A dissertation submitted to the Department of Environmental Sciences and Policy of Central European University in part fulfilment of the Degree of Doctor of Philosophy

Climate Change's Role in Shaping the European Union's Natural Gas Markets

John SZABO

May, 2022

Budapest

Author's declaration

No portion of the work referred to in this dissertation has been submitted in support of an application for another degree of qualification of this or any other university of other institute of learning.

Furthermore, this dissertation contains no materials previously written and/or published by another person, except where appropriate acknowledgement is made inf the form of bibliographical reference, etc.

John SZABO

THE CENTRAL EUROPEAN UNIVERSITY

ABSTRACT OF DISSERTATION submitted by:
John SZABO
for the degree of Doctor of Philosophy and entitled: Climate Change's Role in Shaping the European Union's Natural Gas Markets
Month and Year of submission: May, 2022.

This dissertation examines the interaction of the European Commission's climate strategies and natural gas policies between 1992–2018. The Commission responded to the threat of climate change by introducing increasingly ambitious measures. The effect of these has varied from source fuel to source fuel. Many presumed that natural gas and the established interests of the sector would benefit from the transition. They posited that the fuel's low emissions upon combustion would lead consumers to shift towards it, allowing it to play the role of a transition fuel. The Commission's energy policy also adhered to a narrative of decarbonisation in which switching to natural gas on the path to a renewable-dominated energy system is permissible. This changed during the 2010s, when it began to withdraw support for respective infrastructure projects and then questioned whether it was indeed the transition fuel.

To theorise findings, this thesis introduces a Greening Institutionalism analytical framework, which proposes how political institutions change over time in response to climate-driven policy. The framework, broadly speaking, draws on institutionalism and energy transition theories. It shows how discourse plays an essential role in shifting the actions of political institutions, such as the Commission. Moreover, it builds on neo-Gramscian green transition theory that underscores the politics of transitions and the resistance of various actors to change through their use of material, organisation, and discursive power. They use this to influence EU governance, shaping the actions and policies of the Commission. As the political momentum to decarbonise unfolded and the Commission's policies became more effective, the dominance of established interests withered, forcing them to adapt and find an alternative role to play in the EU's low carbon economy. With these measures, the Commission moved to becoming a post-carbon institution, but it still remained confined to a number of pre-existing practices.

As the effect of the Commission's climate policies increased, natural gas sectoral actors adopted a relatively unified position in suggesting that they could provide low carbon gases to meet energy demand. From a technical and economic standpoint this is necessary to decarbonise the EU, while enabling for the re-utilisation of natural gas infrastructure and allowing respective interests to continue to play a role in the EU's energy system as the energy transition unfolds. The case underscores that political institutions change gradually and even though discourse-driven critical junctures lead to larger ruptures in historical continuities, the power actors wield through governance combined with political and socio-technical lock-ins allows for them to shape governance regimes to maintain their relevance.

Keywords: climate change, natural gas, European Commission, greening institutionalism

---

Acknowledgements

Five years ago I embarked on a journey that was driven by a curiosity to develop a deeper understanding on the role of energy in society. I was told by many PhDs that this would be a lonely endeavour, but it soon became clear just how little I would have accomplished without the community that surrounded me.

I would first like to thank Michael C. LaBelle for supervising my PhD. Without his warm welcome, support, and feedback this project would not have been possible. Accordingly, I am deeply grateful towards Central European University's Department of Environmental Sciences and Policy for providing me with the institutional framework necessary to carry out this work, despite the challenges during this period. I am also deeply indebted to the other members of my dissertation committee, namely, Nick Sitter and Brent Kaup, for their guidance and insights.

My PhD would not have been possible without all the professional support I received from a plethora of institutions and the people that welcomed me to these. I am eternally grateful to András Deák, who welcomed me to the Institute of World Economics as a colleague, but would become a friend. I appreciate Kacper Szulecki's invitation to the University of Oslo, which led to a fruitful and memorable fellowship in Norway. I am also deeply appreciative of Imre Szeman's warm welcome to the University of Waterloo, his unrelenting support in my professional advancement, and, most importantly, the insightful discussions we had.

I would like to thank Mónika Zsigri at the European Commission without who's recommendations and insights my fieldwork would have been much more challenging and meagre. Thank you to Steffen Bettin for his comments on my work and Margarita Balmaceda for her recommendations and excellent questions. I also appreciate the support offered by Foundation EDF's History of Electricity and Energy Grant 2018/2019. Beyond these, there are the countless colleagues who provided feedback on chapters, papers, and presentations—I appreciate your time, advice, and input!

Many of the colleagues I mention above have become my close friends during this period, but fortunately the list goes on. Discussions with Dániel Czégel, Márton Fabók, Robert Brückmann, and Balázs Sipos were key to developing the ideas, for which I am thankful. The unrelenting support of those at CEU's Environmental Sciences and Policy department have been crucial, which include my peers Olea, Balsa, Masa, and Ana, as well as those who continuously offered me a helping hand, Györgyi, Tünde, and Krisztina. And, without the support of my friends Bálint, Gergő, Dóri, Mara, Zsófi, Judit, Kriszti, Márk, Martina, and Michi, I certainly would not have managed this trying and formative period of my life.

It is difficult to express my gratitude toward my family, my parents, Judith and Ioan, as well as my sister, Andrea, without who's love and care none of this would have been possible.

And, I cannot even begin to articulate my deep gratitude to Anna, my intellectual partner and bastion of support.

The list is surely incomplete, for this I apologies to those I did not include, but THANK YOU!

Table of contents

List of figures

List of tables

List of terms and abbreviations

ACER	Agency for the Cooperation of Energy
bcm	billion cubic metres (The measure of 1 bcm differs. According to the IEA 1 bcm = 38.2 PJ at 15 °C; Russia: 1 bcm = 41.4 PJ at 20 °C; BP: 1 bcm = 41.87 PJ; Cedigaz: 1 bcm = 40 PJ.)
CCGT	combined cycle gas turbine
CDA	critical discourse analysis
CH_4	methane
CMEA	Council for Mutual Economic Assistance
CO_2	carbon-dioxide
Commission	European Commission
CRM	capacity reserve mechanism
CCS	carbon capture and storage/sequestration
DSO	distribution system operator
ECSC	European Coal and Steal Community Treaty
EEC	European Economic Community
ENTSOE	European Network of Transmission System Operators for Electricity
ENTSOG	European Network of Transmission System Operators for Gas
EU	European Union
Euratom	European Atomic Energy Community
GHG	greenhouse gases
GJ	gigajoule (10^9 joules)
IPCC	Intergovernmental Panel on Climate Change

Joule (J)	joule (derived unit of energy in International System of Units)
LNG	liquified natural gas
MJ	megajoule (10^6 joules)
Mtoe	million tonnes of oil equivalent (41.868 GJ)
NOx	nitrous oxides
OCGT	open cycle gas turbine
PJ	petajoule (10^15 joules)
PM	particulate matter
TJ	terajoule (10^12 joules)
TSO	transmission system operator
SEA	Single European Act
SOx	sulphur oxides
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

1.1 Introduction

Natural gas has become one of the European Union's (EU) most important sources of energy. EU institutions have supported its uptake by developing an infrastructure system and regulatory framework necessary for its consumption. It is frequently discussed as a "cleaner" alternative to other fossil fuels from an environmental and climate standpoint, but it is nonetheless an emitting, non-renewable source of energy (Smil, 2015). The EU grew its reliance on natural gas alongside a commitment to "achieve [the] stabilization of greenhouse gas[1] concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"[2]. Various bodies of the EU articulated the contours of an ambitious climate agenda since the global ambition to tackle climate change emerged with the 1992 Rio Conference. The European Commission[3] would go on to develop the EU's climate agenda in subsequent years, but alongside this it also introduced policy that supported the uptake of natural gas. This dissertation explores how the climate action of the European shaped its natural gas market policies and *vice versa*.

The Commission's natural gas policy supported the expansion of the fuel's demand, partly because of the common understanding that it is a "clean(er)" or the "cleanest" fossil fuel. It became the "transition" or "bridge" fuel (Howarth, 2014; Stern, 2019), which facilitates the shift from more polluting fossil fuels to low carbon or carbon free sources of energy. This characterisation is justified to a certain extent, but it has its caveats. Natural gas yields the least amount of carbon-dioxide (CO_2) emissions upon combustion, but methane—the prime

[1] GHG emissions include: carbon dioxide (CO_2); methane (CH_4); nitrous Oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); sulphur hexafluoride (SF_6).

[2] COM(92) 508 final, 15.12.1992, p. 1.

[3] Unless noted otherwise, I will refer to the European Commission simply as the Commission throughout this dissertation.

component of natural gas—itself is a potent greenhouse gas which leaks into the atmosphere throughout natural gas' supply chain, exacerbating global warming. Moreover, its uptake to substitute other fossil fuels could prolong the EU's reliance on emitting fossil fuels. Despite these shortcomings, many experts, established interests from within the natural gas sector, and policy-makers tended to emphasise the fuel's relative climate benefits, while downplaying the problems its consumption raises. Only with greater climate ambition did this approach change. This dissertation explores how the Commission's approach to the fuel shifted, explicating how political institutions policies change amidst the energy transition.

The EU offers an insightful case on how climate and natural gas policy impacted one-another, given its reliance on the fuel and ambitious climate policy (Stern, 2017b). This is why I have chosen to analyse how the Commission's natural gas policies were impacted by its climate initiatives, what role climate policy allocated to natural gas, and how infrastructure shaped the climate-natural gas policy nexus. This dissertation explores how the EU moved from a combination of weak climate policies and a deep reliance on natural gas to gradually question the future role of the fuel in the EU's energy mix. To this end, it traces policies and discourses that emerged over the course of the more than twenty-five years since the launch of the Rio Agenda in 1992. The EU's case, and thereby this dissertation, offers insights into the politics of an energy transition. It explores how the role of a source of energy is shaped by the way in which it is discussed and how this changes as increasingly ambitious climate policy is implemented. The dissertation thus theorises how and why the Commission's energy policy changed in relation to climate action. With this, it also takes to the normative goal of providing a deeper understanding on how to address the pressing issue of global warming.

The objective of this first chapter is to introduce the topic and relevance of this dissertation. It begins with a problem statement in section 1.2, which highlights the problematic of sustained natural gas consumption, given the EU's ambitious climate agenda. Then, section 1.3 provides a broad sketch of the dissertation's contribution to the scholarly literature. This chapter then introduces the dissertation's research questions in section 1.4, which it follows with a succinct summary of the research design in section 1.5. In the final section, it provides an overview of the dissertation's structure through snapshots of its chapters.

1.2 Problem statement: the contradiction of natural gas consumption and climate action

From an environmental standpoint, natural gas seems to be the ideal fossil fuel. This is predicated on its physical properties (i.e. primary characteristics) as well as how it is harnessed and consumed (i.e. secondary characteristics). Its characteristics underpin its role as a convenient source of energy with a relatively limited environmental impact (see table 1.1). It is convenient because it provides a continuous flow of energy, when the necessary infrastructure is in place. This is paired with relatively low emissions upon combustion. The rise in EU demand for the fuel was instrumental in reducing SOx and NOx emissions between 1990–2018 (EEA, 2020), given the comparatively higher emissions to which coal consumption would have led. Its particulate matter (PM) emissions—a significant contributor to air pollution—are also relatively low when compared to other combustible fuels (US EPA, 2008); although, these are not negligible and pose a risk to human health (Buonocore *et al.*, 2021). Its carbon-dioxide emissions are also relatively low: approximately half of coal's when considering its effective CO_2 factor[4] (IPCC, 2006). On

[4] This takes the differences in the efficiency of power plants and other combustion units into account when comparing CO_2-intensity.

the face of it, natural gas offers relative alleviation from most emissions when compared to alternative fossil fuels.

Table 1.1: Primary and secondary qualities of natural gas

Primary qualities	
Physical state	- Gaseous
Energy density	- Volumetric: low compared to coal or oil - Mass-based: relatively high compared to coal or oil - Can be increased through pressurisation and liquefaction: compressed natural gas (CNG) and liquified natural gas (LNG)
Emissions throughout its supply chain	- Potentially high due to risks of methane leakage
Emissions upon combustion	- Relatively low compared to coal or oil: ○ Low SOx and NOx ○ Low PM ○ Low CO_2 ○ Risk of methane leaks
Secondary qualities	

Infrastructure-intensity	- High: comprised of production and processing facilities, transit and distribution pipelines, compressor stations, end-user appliances. Additionally, LNG or CNG-specific infrastructure.
Applications	- Electricity generation, space heating, industrial applications - Power plants feature high efficiency
Environmental compatibility	- Presumed to be relatively high (not accounting for methane leakage)

Source: Author's compilation based on Smil (2015), *Bradshaw & Boersma* (2020), *and Balmaceda* (2018)

The EU consumes natural gas for a number of applications. It is a popular source-fuel for electricity generation, which stems from both the high thermal efficiency rates of turbines and their relatively flexible output. Natural gas also offers an effective source of heat, frequently consumed by end-users to heat households and commercial spaces in addition to which industrial actors use it in furnaces. Moreover, it is a feedstock in industrial processes, such as fertiliser production or oil refining—although, this dissertation will focus on its energy-related applications. To enable its consumption, energy companies—predominantly transmission system operators (TSOs) and distribution system operators (DSOs)—have developed an extensive infrastructure network (Smil, 2010, 2015). This has also been the case in the EU, where an enormous infrastructure system is in place to allow consumers to meet a quarter of their energy demand with natural gas (Eurostat, 2020). They use close to a third of this for transformation input (i.e. electricity generation and heat production), households and industry consume quarter apiece, and commercial and public services burn just under an eighth of total demand.

Natural gas has come to play a sizeable role in the EU's energy system since the 1960s, when its large-scale uptake began. It has grown from a fuel that was locally produced and consumed in small quantities during the first half of the 20th century to a source of energy that infrastructure operators transit over thousands of kilometres to meet energy needs (Smil, 2015; Eurostat, 2020). The increase in its consumption has outpaced both coal's and oil's since producers first began to exploit it at scale (BP, 2020). This was possible due to its availability in the Netherlands, the North Sea, and the Soviet Union (now Russia), which was met with ample demand in a number of European countries (P. Högselius, 2013; Ryggvik, 2015; Honoré, 2017; Gustafson, 2020). To enable its uptake, governments and enterprises constructed and installed the network of transit and distribution pipelines, compressor stations, liquified natural gas (LNG) terminals, consumer appliances, etc. that would become the backbone of the European natural gas system.

A number of European countries increased the role of natural gas partially due to the fuel's environmental benefits. The United Kingdom (UK) was the first of these, where the government introduced measures to substitute coal for natural gas and town gas to reduce air pollution in the wake of the 1952 Great Smog of London (Turnheim and Geels, 2012; Arapostathis *et al.*, 2013). Later, "the natural gas industry was [also] remarkably successful in exploiting the oil crisis of 1973/74 to its advantage" (Per Högselius, 2013, p. 5). This was primarily based on the fuel's competitive advantage, but it was also supported by its environmental benefits, which became prominent on the global political agenda with rising environmentalism boosted by Rachel Carlson's (2002) *Silent Spring*, the Club of Rome's 'Limits to Growth' report (Meadows, Rome and Associates, 1972), or the 1972 United Nations Conference on the Human Environment. EU institutions, such as the European Council, also supported the fuel's uptake on environmental grounds[5]. This became especially pertinent with the Single European Act (SEA) which "introduced the environment as an area of EU policy" (Matlary, 1997, p. 66) in 1987. The rising importance of environmentally conscious EU policy favoured the consumption of natural gas, even if this was not the dominant factor driving the fuel's demand.

Following in the tracks of environmentalism, climate policy also positively differentiated natural gas. The United Nation's (UN) influential 'Our Common Future report'[6], published in 1987, argued that "[i]n terms of pollution risks, gas is by far the cleanest fuel, with oil next and coal a poor third" (UN, 1987, p. 147). The report notes that consuming natural gas is still problematic, but less so than alternative fossil fuels. The Commission's positions[7] also reflected this approach to natural gas. The Intergovernmental Panel on Climate Change (IPCC) (1990b) took a similar stance in its First Assessment Report, noting that natural gas was "lower carbon fuel" and a shift from more polluting fossil fuels to natural gas would yield climate benefits. Such positions of institutions engaged with climate policy—the UN or the IPCC—underpinned a general attitude towards natural gas that would later be reflected in the Commission's energy policy as well. They cemented a general understanding that it is more acceptable to consume natural gas than other fossil fuels.

The Commission's energy policies generally supported the uptake of natural gas until relatively recently, as climate policy only had a minor impact on energy consumption patterns. If anything, policy tended to support a shift to natural gas, as opposed to away from it (Stern, 2017b). The

[5] Council Directive 75/404/EEC, 13.02.1975, p. 1.
[6] Also frequently referred to as the Brundtland Report (UN, 1987).
[7] COM (81) 540 final, 2.10.1981; COM/1982/0653 final, 15.10.1982; and COM (86) 518 final, 11.12.1986.

Commission, like most of the energy sector, framed natural gas as the cleanest fossil fuel and an essential component of the energy mix. These presumptions shielded the natural gas sector from the negative ramifications of climate policy, in contrast to coal, for instance, which was widely expected to be the first target of the Commission's measures. As the Commission's climate policy became more influential and more ambitious, this relation began to change. The ratification of the Paris Agreement suggests that "fossil fuels, including natural gas, can have no substantial role in an EU 2°C energy system beyond 2035" (Anderson and Broderick, 2017, p. 43). The contradiction between support for natural gas and climate goals came to the fore, leading the Commission to question whether natural gas could play the role of the transition fuel.

1.3 Theoretical questions and contributions

Most scholarship on the Commission's role in natural gas affairs focuses on the creation of a single EU market and the fuel's geopolitics (see e.g. Boersma, 2015; Grigas, 2017). Climate and sustainability considerations were largely absent from these discussions, since this was effectively deemed to be a non-issue. Khrushcheva and Maltby (2016), for instance, suggest that "[e]ven in the context of decarbonisation, natural gas will remain a core component of the EU-Russia energy relationship" (p. 819). With this, they indicate the deep entrenchment of natural gas-based geopolitical ties and the common understanding that phasing natural gas out of the region's energy mix is still a distant goal. Gustafson's (2020) book on the matter shows how natural gas has played the role of the "bridge" between Europe and Russia, but does not detail how this is changing in response to climate change. He limits his engagement to underscoring the energy carrier's importance for political stability.

Scholars have begun to respond to this gap by leading inquiries that explore what climate policy may mean for natural gas markets and the fuel in general (Delborne *et al.*, 2020; Brauers, Braunger and Jewell, 2021). Jonathan Stern (2017b, 2017a, 2019) published a string of insightful papers on natural gas' role in (EU) decarbonisation that this dissertation draws upon. These go beyond the strong geopolitical/market regulatory aspects frequently discussed by scholars and engage with the politics of the energy transition. Stern, however, focuses on how markets change in response to policy, to which this dissertation adds by conducting an in-depth analysis of how the Commission's policies change. Moreover, Stern's work consists of policy papers, to which this dissertation adds by more explicitly drawing on and further developing number of a theories and concepts. This dissertation builds on two broad streams of literature connected to (1) institutionalism and (2) green transition theory. It is especially animated by how path dependencies confine action and the role discourse plays in shaping events. Drawing on these strands of theory, I introduce the *greening institutionalism* analytical framework to theorise how political institutions and their policies change over time in response to climate change.

Chapter two develops the dissertation's analytical framework in-depth, but in a nutshell, its point of departure is that a carbon lock-in is a deeply political process. In contrast to Unruh's (2000) position, it focuses on how fossil fuel-based social relations are reproduced and encoded in institutions (Andrews-Speed, 2016; Szabo and Fabok, 2020). That is, how fossil energy plays a role in mediating interactions and practices between social agents, which, over time, were institutionalised. The actions of political institutions emerge within these confines and follow path dependencies (Mahoney, 2000; Pierson, 2000a; Rosenbloom, Meadowcroft and Cashore, 2019). Their actions reproduce fossil fuel consumption practices, given the overwhelming dominance of fossil fuels in the EU's energy system—political institutions in this setting take on the role of carbon institutions. They nonetheless change, but only gradually. The Commission has also begun to *green* its practices in response to the mounting issue of climate change. The form and direction of this is an outcome of governance, shaped by actors that wield material, organisation, and discursive power to influence the actions of political institutions (Turnheim and Geels, 2012; Bieling, Jäger and Ryner, 2016; Newell and Johnstone, 2018).

Greening institutionalism draws on discursive institutionalism for tools to theorise how change is prompted by discourse and how it takes effect (Schmidt, 2008, 2010). Institutions are not solely discursively constituted and thus the material factors that confine (e.g. lock-ins) or stimulate (e.g. climate change) change also play key roles, but the approach developed in this dissertation suggests that discourse is central to determining outcomes. Discourses are based on the physical qualities of energy carriers (Balmaceda, 2018), which are then used by actors to influence EU energy governance. The case of natural gas shows how discourse influences the role actors assign to an energy carrier, because positively framing it as a "cleaner" source of energy and including it into a narrative of the energy transition allows for it to continue to play a role in the energy system (Delborne *et al.*, 2020; Szabo, 2020b, 2022). Greater climate action severs the legitimacy of these discourses and leads the Commission to withdraw its support and move towards becoming a *post-carbon institution* (LaBelle, 2012).

The theoretical problem this dissertation tackles is to understand how institutions change, specifically how the Commission's approach to natural gas changed with increasingly stringent climate policy. It develops and uses this analytical framework to explore how an institution greens its policies, moving from a supportive role toward an emitting, non-renewable source of energy and its industry to gradually impeding its consumption and questioning its long-term role in the energy system.

1.4 Research questions

Given the issues with the continued consumption of natural gas and the urgent need to decarbonise, I find it pertinent to ask how the Commission has reconciled the fuel's role with climate ambitions. It seems paradoxical that the Commission's climate strategies and its development of natural gas markets existed on what were effectively parallel tracks. Climate action had a limited impact on natural gas policy and the role the fuel played in meeting energy demand. If anything, many expected the fuel's role to increase in the EU's energy system. Accordingly, its consumption has been on the rise, despite increasingly ambitious goals to decarbonise the EU's energy mix. The Commission enabled this by developing its regulatory framework and an extensive infrastructure network. It only beginning to question the compatibility of these diverging goals relatively recently. Answering how "climate" and "natural gas" were reconciled in EU policy-making can provide insights on how narratives paired with fuels shape the role policy-makers assign to them in respective policy and how political institutions change the role they allocate to fuels as the impact of their climate measures increase. This inquiry also shows how actors of a sector behave amidst a threat of decline and how their actions shape supranational energy policy.

I explore the above mentioned topic by asking the following core research question:

How does the European Commission reconcile its climate strategies and natural gas policies?

To structure my work, this dissertation breaks this overarching question into the following sub-questions:

i. *How does the Commission address climate change in its natural gas policy?*

ii. *How is natural gas addressed in the European Commission's climate initiatives?*

iii. *How did the European Commission change its natural gas infrastructure policy in response to climate considerations?*

iv. *What is the role of the EU in reproducing fossil fuel-based social relations?*

These questions will guide the research of this dissertation. The objective of the background chapter (chapter four), the three analytical chapters (five, six, and seven) as well as the final, eighth, is to answer them. Such answers contribute to a more nuanced understanding of the *climate strategy–natural gas policy nexus* in the EU. Through this, it offers theoretical insights on how—at a more abstract level—political institutions, discourse, infrastructure, and energy relate to one-another. This informs how actors within a dominant sector respond to change threatening their operations and what tools they utilise to shape outcomes. Given the threat of climate change and the need to decarbonise the global energy system, this dissertation's objective is to provide a humble contribution to a scholarly understanding of change (or lack thereof) which can also be the basis of further climate action.

1.5 Overview of the research design

The EU offers an insightful case to explore the intersection of EU climate and natural gas policy, because it is amongst the first areas where these two streams of policy have clashed. As this chapter has already shown and subsequent chapters further elaborate, the EU has a long-standing, extensive reliance on natural gas. In addition, it has positioned itself as a leader climate action. To explore how these dynamics have related to one-another, this dissertation focuses on the Commission's natural gas and climate policies between 1992–2018. Albeit, it discusses relevant preceding and ensuing events to provide context and further nuance to the analysis. The starting point for the inquiry is 1992 because this is when an EU climate policy was effectively launched following the Rio Conference. This also marked the beginning of the Commission's larger role in EU climate and, subsequently, energy affairs. This dissertation shows how climate initiatives played a growing role with the turn of the millennium and became especially influential following the Paris Agreement in 2015. The end date of the inquiry is slightly prior to the conclusion of my fieldwork, providing perspective for interviewees to reflect upon events and incorporating the natural gas sector's response to the Clean Energy Package which became pronounced between 2016–2019 (Szabo, 2022).

The research design draws on a number of disciplinary insights that go beyond that of mathematicised economics or geopolitics frequently deployed to interpret energy-related matters (Sovacool, 2014). It draws on political economics, political science, environmental studies, the humanities, as reflected in the theoretical framework (see chapter three). Accordingly, it develops a research design that is compatible with this interdisciplinarity. It is based on qualitative data analysis, based on two streams of data: (1) a number of documents and (2) interviews. Documents analysed were generally policy documents and communiqués issued primarily by the Commission and relevant stakeholders (see chapter four). The dissertation directly draws upon 124 documents, in addition to which I had scrutinised additional documents that were ultimately excluded from the analysis due to their limited relevance. Interviews were conducted between 2018–2020 with forty-eight experts affiliated with relevant actors or long-time observers of the EU's natural gas affairs (e.g. academic scholars). This trove of data comprised the basis of the inquiry, which I subjected to discourse tracing (LeGreco and Tracy, 2009).

The research design is primarily guided by critical discourse analysis, but the dissertation takes a multimethodological approach to validate findings (Feyerabend, 1993). This entails that it focuses on the relation between text and context, with the latter informed by a number of sources ranging from statistical databases through studies to news articles. This allows for the triangulation between data gathered, existing interpretations, and other primary sources. Since the dissertation focuses on how the Commission's natural gas policies are influenced by its climate strategies and the fuel's discourses, it applies the "within-case" method of process tracing. This allows the analyses to identify causal links that prompted observed and analysed developments within the case. It thus allows one to test the theory proposed despite the limitations of exploring a single case (Bennett, 2008). With this, the dissertation identifies the causal impact of climate strategies on natural gas policies.

1.6 Structure of the dissertation

This dissertation is composed of eight chapters. Having introduced the problem statement and the research questions in this first chapter, it provides an overview of pertinent literature and develops the greening institutionalism analytical framework in the second. This provides the tools to theorise the subject matter and thereby functions as the scaffolding that guides the inquiry. It introduces and critically discusses relevant literature, developing a framework, which draws on institutionalism and green transition theory. Chapter three introduces the research design. It articulates the rationale behind the case selection, which is limited to the Commission's natural gas and climate policies between 1992–2018. It then introduces the choice of methodology, discourse tracing, before providing a detailed description on how I gathered and analysed data for the project.

Chapters four through seven comprise the analytical chapters of the dissertation. These begin to answer the research questions. Chapter four both provides a background chapter that contextualises this inquiry, while it is also an analytical chapter that already draws on empirical findings. It discusses the physical qualities of natural gas that shaped its historical role in the EU and the discourses that actors link to it. Moreover, it introduces and explores the role of the most influential stakeholders involved in the governance of the EU's natural gas sector. Chapter five scrutinises how the Commission's natural gas policies reflect its climate strategies. It shows how the transition fuel discourse changed over time, how this was imprinted in policy, and what response it provoked from established interests. Chapter six is effectively the inverse of chapter five: it traces the role the Commission's climate strategies allocate to natural gas and how the fuel is discursively framed in respective documents. It shows how these (e.g. the EU emission trading system) generally favoured a shift to natural gas and the Commission only gradually withdrew its support for natural gas projects on climate grounds relatively recently.

Chapter seven assesses the role natural gas infrastructure and the Commission's respective policy played in shaping the climate action–natural gas nexus. It shows how the Commission's support for infrastructure projects on supply security grounds grew the fuel's market and further entrenched the sector's role in the EU, making a transition away from it difficult. As the impact of climate policy increased, the Commission was much more careful in supporting respective projects and pushed infrastructure owners and other established interests to explore they can support the energy transition. The final, eighth, chapter discusses the contributions of the dissertation and draws conclusions. It suggests that the Commission's, like most actors involved in the energy sector, accepted the dominant discourse that natural gas would be the transition fuel, until the impact of climate policy made it question this position. It shows that political institutions decarbonise along the path dependences and carbon lock-ins that confine their actions, which are upheld by interests that benefit from the dominant energy regime.

2 Greening institutionalism : An analytical framework

2.1 Introduction

The objective of this chapter is to develop an analytical framework on how political institutions move from supporting fossil fuel-based social relations to favouring green policies. It introduces the novel *Greening Institutionalism* framework to theorise how climate policy shapes the energy policy. This primarily draws on two strands of theory: new institutionalism and energy transitions (Scoones, Leach and Newell, 2015; Andrews-Speed, 2016; Lockwood *et al.*, 2017). By building on institutionalism and theory pertinent to political institutions, specifically, the European Union and the European Commission, it shows how the actions of political institutions are shaped by dominant practices. It seeks to offer a framework to capture these institution's changing energy policy, which they are slowly decarbonising. The chapter complements new institutionalist scholarship with *green transition theory* (Bulmer, 1997; Lowndes and Roberts, 2013; Scoones, Leach and Newell, 2015). It places emphasis on the role of governance, power relations, and discourse in change. Greening institutionalism argues that discourse deeply influences the direction in which institutions evolve. As the transition unfolds, actors support narratives that assign specific roles to various sources of energy. As this dissertation shows, natural gas has been widely understood to play the role of the transition fuel, but as political institutions become greener this role comes under scrutiny.

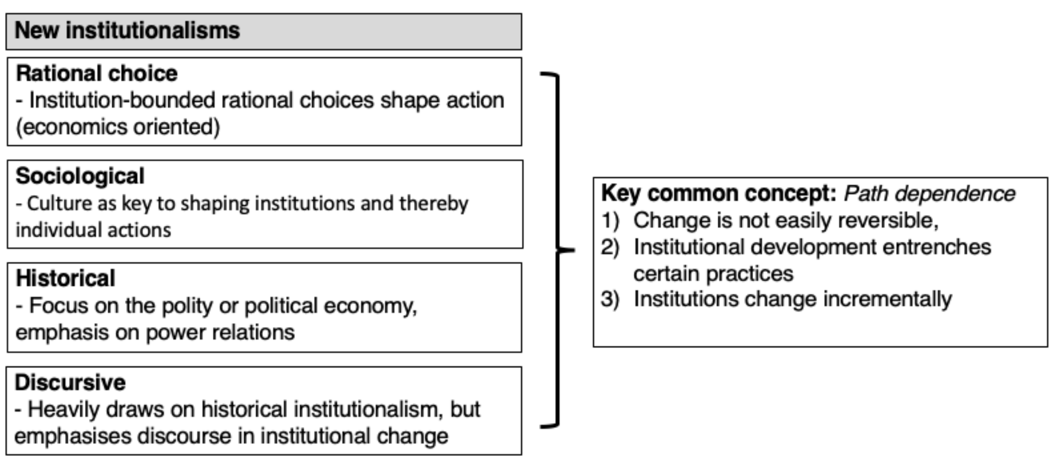
This chapter and, more broadly, the dissertation contributes to the ongoing debate within energy scholarship on the politics of an energy transition (Lockwood *et al.,* 2017; Newell, 2019a). It proposes a theory to explain the changing behaviour of the Commission and offers analytical insights on how political institutions and their policies disrupt fossil fuel-reliance. Moreover, it explores how this changes with increasingly ambitious climate policy. It develops the greening institutionalism framework to analyse the relation of political institutions to fossil fuel and climate policy, which it bases on an exploration of the Commission's role in natural gas and climate affairs between 1992–2018. This analytical framework provides the scaffolding for the case study conveyed in the empirical chapters of this dissertation—chapters four through seven. Chapter eight discusses the theoretical contributions of the dissertation based on a synthesis of the theoretical propositions conveyed in this chapter and the empirical data I had gathered for the project. These all contribute to a deeper understanding of how political institutions change as an energy transition unfolds.

The chapter is structured as follows: section 2.2 introduces institutional theory and how these conceptualise political institutions, including the European Commission. Section 2.3 discusses the role of governance in shaping institutions and, specifically, the EU and the Commission. Section 2.4 connects the path dependence of political institutions to socio-technical inertia, introducing the concept of a carbon lock-in and its relevance for the dissertation. This chapter then turns to discuss power and its forms in section 2.5, before moving on to explore the Commission's powers and the role of narratives in the energy transition in section 2.6. Section 2.7 ties the aforementioned strands of theory together to detail the greening institutionalism analytical framework, based on which section 2.8 draws conclusions.

2.2 Institutions, political institutions and their change

The greening institutionalism framework draws on new institutionalist theory, which "connotes a general approach to the study of political institutions, a set of theoretical ideas and hypotheses concerning the relations between institutional characteristics and political agency, performance, and change" (March and Olsen, 2011, n.p.). An institution is a set of relatively enduring rules and organised practices that shapes the actions and behaviour of various actors in specific situations (March and Olsen, 2010). In-turn, these institutions underpin a political order that supports a more or less "coherent system" (March and Olsen, 2011), structurally shaping the way in which actors behave and the decisions they take. A key quality of pre-existing "older institutional structures" (LaBelle, 2012, p. 393) is that they overwhelmingly perpetuate a fossil fuel-based system, given the dominance of such energy carriers in many geographies (Scoones, Leach and Newell, 2015). However, their perpetuation of fossil fuel-based energy systems is changing in response to a number of factors ranging from social pressure to economic incentives (Cherp *et al.*, 2018; Sovacool *et al.*, 2020). Greening institutionalism offers a toolkit to explore how such practices change over time through a focus on the role of political institutions.

Figure 2.1: New institutionalism

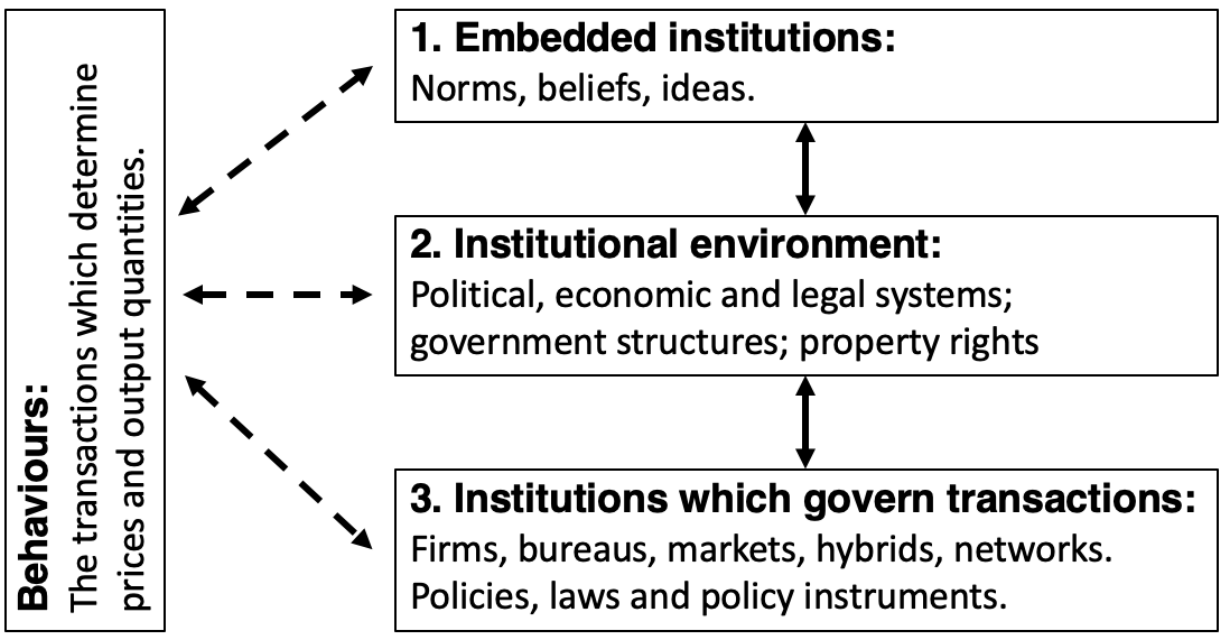


Source: Based on (Andrews-Speed, 2016; Lockwood *et al.*, 2017)

The dominant streams of new institutionalism—rational choice, historical, and sociological (see figure 2.1)—all underscore the propensity of institutions to resist change, whilst reinforcing existing practices, producing positive feedbacks, or delivering increasing returns (Pierson, 2011). The greening institutionalism framework draws on *historical institutionalism*, which builds on the presumption that “history matters” (Steinmo, 2008) due to the *path dependence* of institutional action and the focal role power relations play in shaping the course of events (Hall and Taylor, 1996). This entails that (1) change is not easily reversible, (2) institutional development entrenches certain practices, and (3) institutions change incrementally (Pierson, 2011; Andrews-Speed, 2016). Thus, the concept of path dependency proposes that actors sustain pre-existing practices or only change in a gradual manner (David, 1985; Mahoney, 2000; Pierson, 2000b, 2000a; Schwartz, 2004). These can be linked to the high costs of change as well as established interests taking action to avert change. The “status quo bias” (Pierson, 2000a) political institutions perpetuate is linked to deliberate interventions of established interests and the broader structural setting in which they are embedded, leading to the reproduction of specific social relations (Barrow, 1993).

Despite their propensity to reproduce pre-existing social relations, institutions change, which can emerge on four levels (Williamson, 2000; Andrews-Speed, 2016). The norms, beliefs, and ideas constituting the so-called “embedded institutions” are essentially the most abstract, most slowly changing, and, thereby, more enduring components of institutions (see figure 2.2). At the second level is an institutional environment composed of “political, economic and legal systems government structures; property rights” “which has a pre-ponderance of formal institutions consciously designed by humans” (Andrews-Speed, 2016, p. 219). Firms, bureaus, markets, hybrids, networks are the institutions which govern transactions and constitute the third level. Policies, laws and policy instruments, while all forms of change rely on behaviours of actors i.e. “the actual transactions which determine prices and output quantities” (Andrews-Speed, 2016, p. 219). Tracing how actors initiate or impede change from the third or fourth levels, which then ripples through more abstract levels and effects respective institutions helps trace how institutional change emerges. Through its focus on the Commission, EU policies, and their relation to a general discourse, greening institutionalism is concerned with how practices are perpetuated and change emerges from the second level and impacts more abstract levels, including the EU's policy framework as well as a discourse and practices pertinent to a specific source of energy.

Figure 2.2: Levels of institutions



Source: Based on (Andrews-Speed, 2016, p. 219)

By choosing the Commission as its prime object of study, this dissertation speaks to the literature on who governs the EU (Skjærseth and Eikeland, 2017). Already twenty-five years ago, Pollack (1997) wrote that "[n]early four decades into its existence, the precise causal role of the European Commission in the processes of European policy-making and European integration remains theoretically contested and empirically unmapped" (p. 109). Scholars continue to contentiously debate its role in policy-making and how this has changed over time (Nugent, 2000; Nugent and

Rhinard, 2016; Hooghe and Marks, 2019). Theorisations are based on underlying conceptions of the EU, generally split along *intergovernmentalist* and *neo-functionalist* lines (Anderson, 2009; Wallace, Pollack and Young, 2015), which offer grand theories on the "teleology of integration" (Bulmer, 1998, p. 368). In contrast, new institutionalism can complement such theories through an agnostic take on the end goal of integration and offering a middle range theory that explores how *institutions matter*.

Bulmer (1997) suggests that "[n]ew institutionalism places the analytical focus on the polity. We can understand politics as comprising three separate components: politics, polity and policy. The presumption is that the polity structures the inputs of social, economic and political forces and has a consequential impact on the policy outcome" (n.p.). With the creation of the European Union and the decisions of member states to delegate executive, legislative, and judiciary powers to EU-level institutions it underpinned the formation of a new polity (Hix, 2007). Embedded in this polity is the Commission, which is a political institution i.e. an organisation that scholars have both seen as "arenas" for social forces and "transformative" actors in and of themselves (Polsby, 1975). Political institutions are "more than simple mirrors of social force" (March and Olsen, 1984, p. 739), but their actions are shaped by the institutional landscape in which they are embedded. Thus, greening institutionalism, too, explores how the structural landscape alongside social, economic, and political forces impact policy outcomes taken by political institutions (Weaver and Rockman, 2010). More specifically, it primarily focuses on the socio-political and socio-technical systems in which institutions are embedded and the discourses that are perpetuated by actors to shape policy outcomes and alter institutions.

The Commission's ability to enact change—such as lead an energy transition—is confined by institutions, shaping the form and limiting the impact of its policies. It can only gradually alter practices as historical trajectories restrict its interventions (Jupille and Caporaso, 1999). Its agency is limited by path dependencies given the “constraints […] created by […] predecessors” (Pierson, 1996, p. 148), leading its policy-making to be “iterative and incremental” (Bulmer, 1998, p. 373) with change emerging when historical continuities are punctured at “critical junctures” (Krasner, 1984; Collier and Collier, 1991). Hall and Taylor (1996) remark that “[t]he principal problem here, of course, is to explain what precipitates such critical junctures, and, although historical institutionalists generally stress the impact of economic crisis and military conflict, many do not have a well-developed response to this question” (p. 942). Earlier scholarship tended to focus on “punctuated equilibrium” (Kingston and Caballero, 2009), which traces how exogenous shocks or crises lead to the reconfiguration of institutions or the emergence of new ones. In contrast, Lockwood (2017) notes that “more recent research in HI [historical institutionalism] has focused on more gradual change, arising from endogenous sources of instability” (p. 324).

Mahoney and Thelen (2009) begin to explore “why particular types of change tend to happen in specific political contexts and in institutions with particular characteristics” (Lockwood *et al.*, 2017, p. 325). While the impact of climate change is a driving force in reconfiguring institutions the specific manner in which it is translated into institutional change remains to be explored. That is, historical forces shape the trajectory of the energy transition, but the specific path pursued by actors and thus coded into institutions emerges from a plethora of options (Hermwille, 2016; Cherp *et al.*, 2017; Lockwood *et al.*, 2017). Schmidt (2008) proposes that “institutional action can also be predicated on what I call foreground discursive abilities, through which agents may change (or maintain) their institutions” (p. 314). Schmidt proposes a theory of *discursive institutionalism* to complement new institutionalisms and offer a more robust theory of institutional change. According to her, agents think, speak, and act both within and outside their institutions, leading to a communicative deliberation with institution-altering effects. Thus, discourses and the ideas they manifest shape the trajectory of institutions.

Greening institutionalism underscores the importance of discourse in shaping the energy transition, by focusing on how political institutions reinforce or severe existing path dependencies (Buschmann and Oels, 2019). Through this it explores and theorises how institutions change, because it explores a process during which institutions shift to less polluting practices. Thus, in-line with historical and discursive institutionalism, its focus is on how institutions evolve. A focus on discourse and the material context allows one to capture a state in which that given institution is in. This offers a point of departure for an analysis of how it relates to its broader structural setting as well as capture how internal and external factors shape its specific characteristics. Moreover, dominant discourses are also indicative of the anticipated direction of change, as suggested by discursive institutionalist. Greening institutionalism focuses on how institutions relate to climate and other environmental objectives not only in the present, but what role they plan to allocate to the given resource. This, in-turn, shapes the way institutional change unfolds.

2.3 The role of governance in institutional change

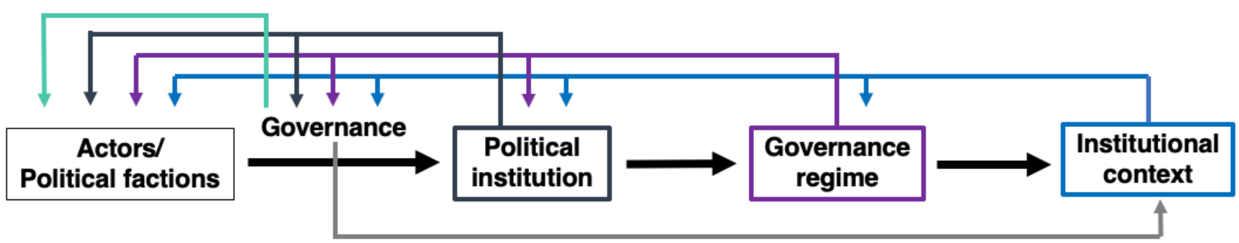
The combination of historical and discursive institutionalism offers an analytical toolkit to show "how different institutional configurations – between political systems or between policy subsystems – can impact upon governance capacity" (Bulmer, 1998, p. 372) and how, in-turn, the outcomes of governance shapes these institutions. Governance is a complex, tangled, and interwoven network of political relations through which actors shape institutions (Jessop, 2006), or, simply, an "interplay […] of social forces" (Bieling, Jäger and Ryner, 2016, p. 58). It is the process through which actors engage with the objective of shaping institutions (see figures 2.2 and 2.3). Greening institutionalism draws upon is state-centric interpretation of governance (Majone, 1997), because it is primarily concerned with how the interplay of social forces in a specific institutional setting shape policy which, in-turn, shapes institutions. This allows one "to avoid the risk of taking at face value the appropriate object of study as well as distorting or biasing our understanding of where power lies" (Johnstone and Newell, 2018, p. 8) (e.g. the government) by exploring how power is dispersed between a number of actors and they relate to institutions.

The state-centricity of governance is based on the state's asymmetrical ability—based on its role as a political institution—to shape the institutional environment and, thereby, embedded institutions (figure 2.2). It can reify and amplify the positions of those actors which dominate the space of governance (Dunleavy and O'Leary, 1987), which harks back to the understanding that political institutions are arenas of social forces (Polsby, 1975; Jessop, 2015). Marks (1992) proposes that this governance framework can be used to theorise the actions of the EU as well, where power is diffused amongst actors and institutions, constituting a "a complex, multilayered, decision-making process stretching beneath the state as well as above it" (p. 221). This refers to multi-level governance, which incorporates the interactions that unfold at the micro-, meso-, and macro-levels to trace the emergence of institutional change. This offers "descriptive neutrality and thus, 'putative compatibility with virtually any of the institutional theories […]'" (Stephenson, 2013, p. 825) and a tool to theorise the Commission's behaviour as well.

The Commission has the ability to "influence the interpretation of the problem, thereby pre-determining possible answers" (Bauer, 2002, p. 386) through which it "behave[s] as a 'leader', a 'political entrepreneur' or an 'informal agenda-setter'" (Pollack, 1997, p. 121). In this role, the

Commission introduces "governance regimes" (Campbell and Lindberg, 1991), which "[f]rom the modest beginnings of the first Commission initiative in an illustrative (EC pillar) policy area, perhaps reflected in a 'mere' recommendation and itself preceded by a phase of agenda-setting, interest groups establish their claims to consultation. National officials are also engaged in many meetings before the first piece of legislation is agreed. Gradually a governance regime is established" (Bulmer, 1998, p. 373) (figure 2.3). This engagement relies on a process of deliberation, in which a number of actors directly participate, but also indirectly influence the actions and approach of the Commission by taking action that sustain certain institutions or seeks their change. Schmidt (2010) suggests that discursive institutionalism "infuse[s] these 'structures' [i.e. collection of institutions] with 'agency', by focusing on the ideas of real actors that help explain changes or continuities in institutions, at critical moments or incrementally over time" (p. 13). That is, by considering how actors support ideas and discourses in governance, one can explicate the emergence of specific governance regimes and institutional change.

Figure 2.3: The governance–institution nexus



Source: Author's design

Ideas and discourses matter in greening institutions. That is, the ideas and discourses supportive of a transition to renewables shaped a governance regime that supports the gradual move away from fossil fuels (Hermwille, 2016; Stern, 2019). This is based on an increasingly influential meso-level climate policy governance led by the Commission at the EU-level (Barnes, 2011;

Skjærseth, 2017; Szulecki and Claes, 2019), which has carried institution altering ramifications and propelled the energy transition (Woerdman, 2004; Lee and Gloaguen, 2015; Aghion *et al.*, 2019; Szabo, 2020a). Objectives to "green" policies has expanded in its scope and reach, reducing the current and future role of fossil fuels in the EU's energy system (section 2.4). Climate initiatives trickled into various policy realms, which changed the governance regime by altering the relative power relations. For instance, it reduces the power of fossil fuel entities over the long-term, given their presumed decline. It has also led to "a steady, if surreptitious, growth of the powers of the Commission" (Majone, 2002, p. 380), given that the EU's executive arm positioned itself as a "policy entrepreneur" (Maltby, 2013) leading an increasingly ambitious climate action (Oberthür, 2019).

2.4 A carbon lock-in

Institutional path dependence is frequently confined to a focus on social relations, neglecting a broader socio-ecological system (Newell, 2019a) where *inter alia* natural resources, technology, and related infrastructure mediate social relations. A socio-ecological system is composed of biophyiscal and social factors that interrelate and shape one-another (Malm, 2016). Societies rely on the exploitation of natural resources to sustain themselves and subsequently pollute the environment when consuming these resources. As Karl Marx paraphrased William Petty: "labour is its [material wealth's] father and the earth its mother" (Marx, 1887, n.p.). Fossil fuels have been especially important resources, as 80% of global energy demand is met with fossil fuels and most of the Global North relies on them in effectively all dimensions of life (Huber, 2012; Smil, 2017). However, their combustion yields greenhouse gas emissions which have instigated climate change (IPCC, 2018) and, if these are left unabated, they will render the Globe uninhabitable (Wallace-Wells, 2019). There is an urgent need to decarbonise energy consumption, but the politics that enable this shift are only in their infancy given the propensity of institutional path dependency to reproduce fossil fuel-based social relations (Unruh, 2000; Altvater, 2007). Simply put, institutions are predominantly *carbon institutions* and societies will only gradually supplant them (Smil, 2016a; Sovacool, 2016).

The EU also perpetuates the greenhouse gas emitting socio-ecological system based on the exploitation of emitting, non-renewable sources of energy. Unruh (2000) asks why, despite the looming threat of climate change, societies continue to rely on fossil fuels? To explain the matter, his paper introduces the concept of a *carbon lock-in*. This "arises through a combination of systematic forces that perpetuate fossil fuel-based infrastructures in spite of their known environmental externalities and the apparent existence of cost-neutral, or even cost-elective, remedies" (Unruh, 2000, p. 817). Unruh's theory suggests that the proponents of a social practice or technology will seek to profit from their investments until this is technically possible. They are reluctant to shift to alternatives because the prevalent economic rationale engrained in institutions supports profit maximisation and thereby the sustained use of existing assets. Simply put, a shift to an alternative source of energy is costly and leads to unrealized potential income or profits. For instance, investors will look to capitalise on a pipeline or power plant for as long as it is economically viable and technically possible. They are reluctant to shift to alternative modes of energy production and risk stranded assets (Caldecott and McDaniels, 2014), despite the environmental costs of their actions.

Unruh's (2000) theory underscores the role of infrastructure in a carbon lock-in and the economics involved, but with this it also depoliticises and, thereby, overlooks the power relations that perpetuate the dominance of fossil fuels' role in the energy system. A lock-in is not only sustained by rational economic calculations, but by established interests that participate in the governance of resources and shape the actions of political institutions (Wilson, Carlson and Szeman, 2017; Lockwood, Mitchell and Hoggett, 2019). Thus, "institutions matter" (Lowndes and Roberts, 2013) and weaving the politics of institutionalist theory more closely to Unruh's conception of a carbon lock-in offers a richer mid-range theory on social change. It offers insights on the politics of transitions, complementing socio-technical-oriented analyses (Andrews-Speed, 2016; Kuzemko *et al.*, 2016; Lockwood *et al.*, 2017). To understand the actions of political institutions, one has to dive even deeper and explore how actors—through the process of governance—are able to shape the actions of political institutions. This leads this chapter to explore the "economic, social, political, and normative conditions" (Seto *et al.*, 2016, p. 447) as well as the bases of power (Ford and Newell, 2021) that reproduce lock-ins.

2.5 Power in energy transitions

A carbon lock-in emerges in relation to an *energy regime*, which is "the network of industrial sectors that evolves around a particular energy resource, as well as the political, commercial, and social interactions that foster the expanded production and consumption of a given energy resource" (Podobnik, 1999, p. 155). Established interests play an especially prominent role in maintaining the lock-in that perpetuates the energy regime from which they benefit. Their ability to perpetuate path dependencies relies on the recognition that "institutions distribute power unevenly across social groups" (Hall and Taylor, 1996, p. 941). A number of scholars have shown how established interests support and shape regimes through their participation in governance (Lauber and Sarasini, 2014; Berggren, Magnusson and Sushandoyo, 2015; Kungl and Geels, 2018; Lockwood, Mitchell and Hoggett, 2019; Curran, 2020), allowing them to both benefit from institutions favourable for their practices and implement strategies that sustain these institutions. Path dependence is therefore not a teleologically determined trajectory; instead, it is the inability of actors initiating change to puncture existing practices combined with the lack of a historical rupture that allows for such change to unfold.

Power is thus central to theorise how institutions develop and the practices they reproduce. Stirling (2019) conceptualises power as “structuring agency”, which allows certain actors to asymmetrically shape events compared to others. Greening institutionalism focuses on the power relations that lead political institutions to withdraw their support for carbon-intensive practices in support of low carbon technologies. That is, how do they influence the form of the energy transition and how does their respective position change over time? They, too, have structuring agency, which, as discussed above, is shaped by governance and determines prevalent institutional configurations. It is worthwhile to consider various forms of power for analytical clarity. Schmidt (2010) suggests that “[t]he problem with RI [rational institutionalism] and HI [historical institutionalism] is that they tend to reify questions of power and position by assuming that power is a function of position and that agents’ strategic interests derive primarily from their power and position. DI [discursive institutionalism] holds instead that power cannot be defined by (objective) position alone, since ideas and values infuse the exercise of power and (subjective) perceptions of position” (p. 18). Greening institutionalism also accepts the centrality of discourse and ideas as sources of power, but it links this with the three bases of power identified in green transition scholarship (Scoones, Newell and Leach, 2015; Johnstone and Newell, 2018).

Greening institutionalism draws on a neo-Gramscian green transition framework to conceptualise the sources of power upon which actors draw in governance shaping the actions of institutions (Johnstone and Newell, 2018; Newell, 2019b; Ford and Newell, 2021). This approach is rooted in Antonio Gramsci’s (1971) work on how actors and political factions establish social dominance. Gramsci’s most frequently deployed concept is *hegemony*, which is the act of power-wielding over society through a combination of coercion and consent. It is reliant on “[a] hegemonic social structure, or an ‘historical bloc’ [… i.e.] the alliances among various social groupings and also to the specific alignment of material, organizational, and discursive formations which stabilize and reproduce relations of production and meaning” (Scoones, Leach and Newell, 2015, p. 87). Thus, there are three bases of power in this framework: material, discursive, and institutional (see table 2.1). First, material power pertains to the relations of production i.e. the economic power that actors possess. Second, discourses are “structured collections of meaningful texts” (Phillips, Lawrence and Hardy, 2004, p. 636) and thereby “manifestations of power” (Harvey, 1996, p. 78). And third, institutional or organisational power is when “[i]nstitutions reproduce themselves by establishing routines, disciplining deviance, and constructing agents’ identities and interests” (Levy and Scully, 2007, p. 975). Actors and political factions use their bases of power to shape institutions, driving their change or maintaining path dependencies.

Table 2.1: Natural gas regime incumbents and power

Base of power	**Form of power**
Material	- Control over the resource (production, trade) (e.g. Gazprom’s control over natural gas production and trade in Russia) - Infrastructure (transit, storage, and distribution systems) (e.g. TSOs control over pipeline systems)
Discursive	- Securitisation (e.g. concerns over a strong reliance on imported natural gas)

	- Sustainability-related (e.g. the proliferation of a transition/bridge fuel discourse)
Organisational/institutional	- Consumption practices (e.g. the extensive reliance on natural gas-based heating in many EU households) - Policy-making (e.g. the role of certain actors in providing policy input)

Source: Author's compilation

The physical properties of a resource and its historical context shape the forms of power actors participating in the resource's governance wield (table 2.1). Material power pertains to the control of natural gas' production and trade as well as its infrastructure. This is often discussed by scholars, since it shapes the geopolitical relations between suppliers and consumers of the fuel—consider e.g. discussion on Russia's use of the "gas weapon" (Balmaceda, 2013; Overland, 2017). Control over infrastructure is also a key source of material power, given its role in supplying consumers, but also in it underpinning the lock-in of fuels (Unruh, 2000; Ingwersen, 2021). Discursive power has generally taken the form of securitisation and transition fuel discourses (Natorski and Surrallés, 2008; Delborne *et al.*, 2020). The former underscores the vital role of the fuel and its link to energy security, while the latter emphasises necessity of natural gas in the energy transition. The third base of power manifests in consumption practices and the role of actors in policy-making, including consumption practices that rely on the fuel and developing the political-legal framework of the resource, respectively (Arapostathis *et al.*, 2013; Klauser and Shavlak, 2017). These are all specific forms of power that those involved in the sectoral governance of natural gas draw upon to both ensure the fuel's role in the energy transition and thereby their role in the energy system as well as a response to institutional change that may occur during the greening of institutions and their policies.

2.6 The Commission's powers and the narratives of energy carriers

Haas (2019) suggests that the EU's energy regime has been dominated by fossil fuel and nuclear actors in the past, given the bloc's reliance on these sources of energy. However, he underscores that the relative influence of green—predominantly renewable energy—interests is increasingly contesting the power of grey interests. These shifting political relations have also influenced the actions of the Commission as well and how it deployed its powers. Historically, it reproduced fossil fuel-based relations, which primarily materialised as policy and, by extension, regulation (Maltby, 2013; Andersen, Goldthau and Sitter, 2017). It does not have direct control over material resources, such as the production of natural gas or the vast infrastructure system traversing the continent, but its power derives from its ability to develop the policy and regulations that shapes a broader political-legal institutional framework in which the actors that control such resources operate. Its prime objective has been to establish a single natural gas market by developing the infrastructure and the regulations necessary for the operation of a single market that ensures competitive supplies in a sustainable manner (Crisan and Kuhn, 2017; Klauser and Shavlak, 2017)—although, the sustainability element is frequently overshadowed by the other considerations (Szabo, 2020b).

The Commission also wields organisational power. A number of sectors rely on natural gas as a source of energy or a feedstock in industrial processes (Smil, 2015). Given the dissertation's focus on political institutions, it will not look in-depth at consumption practices, but rather how the EU and the Commission have institutionalised policy-making processes. In the realms of climate and energy policy it undertakes sectoral governance, which "denotes policymaking by private and/or public actors in sectorally delineated areas outside the legislative arena of democratic politics" (Eberlein, 2008, p. 74). These interventions reflect a bias towards established fossil fuel interests as "[t]he Commission has delegated power to 'sectoral governance actors' for two reasons. First, it is a politically expedient method that works around cumbersome political decision making, and second, benefits from the expertise of sectoral actors" (LaBelle, 2012, p. 394). The sheer complexity of the energy sector lead the Commission to rely on established interests, which can also cause it to adapt specific discourses and objectives that favour those in support of such positions.

The Commission delegated a number of powers to actors that are equipped with the know-how to streamline natural gas markets, but, in-turn, they are also biased in the presumption that the fuel has a role to play in the EU's energy transition. This "empowered the EU-level associations of national transmission system operator(s) (TSOs) for electricity and natural gas (European Network of Transmission System Operators for Electricity and Gas, ENTSO-E and ENTSO-G, respectively) to prepare transmission codes for their respective sectors. These are then assessed by the European quasi-regulator (Agency for the Cooperation of Energy Regulators, ACER) and promoted by the European Commission to be implemented on the national level" (Szabo and Fabok, 2020, p. 4). The Commission's policy-making and regulatory processes are deeply influenced by associations, advocacy groups, and corporations that convey a deep interest in perpetuating the use of the fuels they trade (Szabo, 2020a). Policy, regulations, and guidelines reflects the preferences of these actors, embodying a pro-natural gas bias and perpetuating existing path dependencies.

The Commission also wields discursive power by discussing certain resources and their role in the energy transition through "discourse framing" (Bauer, 2002). It adopts specific narratives generally originating or backed by incumbents, which shapes the envisioned role of certain energy carriers. These are based on the physical characteristics of the resource in question as well as the specific historical and institutional setting (Johnstone and Newell, 2018; Balmaceda, 2021). Political institutions reproduce the discourses that underpin narratives which are instrumental to entrenching or severing carbon lock-ins by impacting the pace of material change (Buschmann and Oels, 2019). Such discourses are central to the "politics around knowledge production in debates about green transformations" (Scoones, Newell and Leach, 2015, p. 4) and serve particular views, values, or interests (Leach, 2015). As an articulatory social practice, they reproduce and alter practices and social relations (Laclau and Mouffe, 2001; Fairclough, 2013); thereby, also reconfiguring institutions (Schmidt, 2010). Actors wield their discursive power to "stabilize and reproduce relations of production and meaning" (Scoones, Newell and Leach, 2015, p. 87) and align institutions with their interests. This allows for the formation of "'discourse coalitions' that can contest a particular form of rule, practice or policy" (Howarth, 2010, p. 318) that reflect a consensus through a narrative, which may, for instance, embody the trajectory of the energy transition and the role various energy carriers can play.

The EU's goal to decarbonise has amplified the role of discourse as a medium through which actors seek to influence the transition's trajectory (Hermwille, 2016; Roberts, 2017; Buschmann and Oels, 2019; Delborne *et al.*, 2020). It has also become a key tool used by various actors to reconcile the contradictions between climate goals and certain forms of energy consumption. Their discourses become a part of *story-lines* or *narratives*, which are "symbolic references that imply a common understanding of an issue […] By uttering a specific word or phrase […] a whole story-line is in effect re-invoked […] They can thus act to define policy problems while obscuring underpinning interests, values and beliefs" (Scrase and Ockwell, 2010, p. 2228).

Actors deploy narratives to "'provide both a diagnosis and a set of measures and interventions' (Jessop, 1999). They define a problem, explain how it comes about, and show what needs to be done to avert disaster or bring about a happy ending" (IDS, 2006, p. 10). Discourses such as "clean coal" (see e.g. Fitzgerald, 2012) or "bridge fuel" (Howarth, 2014) identify the problem of needing to meet energy demand while decarbonising. They then offer a solution to these issues based on the characteristics of the resource and available technologies. The discourses greening institutions deploy reflect these subtle changes, as they move from supporting fossil fuels to gradually withdrawing this as they shift to greener policies.

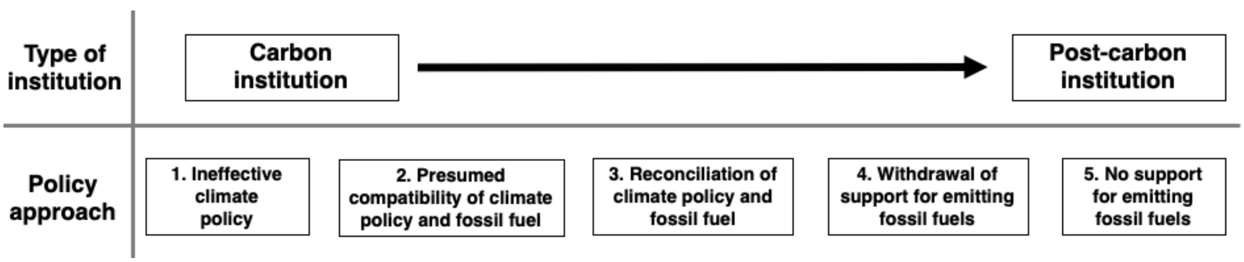
Narratives are then reflected in forms of mediation that aim for neutrality, such as policy language (Hajer, 1995). The way policies frame specific topics reflect the values of the institution and the influence of those actors participating in EU energy and climate governance. Thus, while the Commission can undertake "discourse framing", a "subtle and […] successful strategy to influence the interpretation of the problem, thereby pre-determining possible answers" (Bauer, 2002, p. 386), its positions and framing reflects the engrained positions of a carbon institution. This maintains an energy policy favourable towards fossil interests, since "[p]olicy actors therefore expend considerable effort on influencing the design and evolution of institutions in order to ensure problems and solutions are framed in ways they favour" (Scrase and Ockwell, 2010, p. 2226). By doing this, the Commission reinforces institutions, perpetuating path dependencies. Haas (2019) observes that the germ of change towards the dominance of green interests is emerging, leading to a changing status quo and forcing fossil fuel interests to alter dominant discourses they support. The Commission has been "greening" objectives and policies as it moves to become a "post-carbon institution" (LaBelle, 2012) that withdraws its support for fossil fuel-reproducing relations and backs greener policies.

2.7 Greening the energy policy of political institutions

Greening institutionalism offers a framework to theorise how political institutions change. Social pressure to take climate action alongside the rising influence of green interests and respective policy assert power that drives the reconfiguration of the EU's energy system (Piggot, 2018; Haas, 2019). The push to change alters the scene of governance from one that is dominated by fossil fuel interests to one where green actors are increasingly influential. Social movements that drive environmentalism based on the sheer risk of making the World uninhabitable paired with actors which back new technologies that challenge fossil fuel reliance are driving change (Geels *et al.*, 2017; IPCC, 2018). This force is intertwined with the reconfiguration of political institutions, as the entrenchment of prevalent institutions that perpetuate fossil fuel-based relations is severed. Changes in institutions are driven by a combination of material and discursive factors, as underscored by discursive institutionalist. Actors involved in the governance of the climate and energy scene draw on material, discursive, and organisational bases of power to meet their strategic objectives (Jessop, 2015; Ford and Newell, 2021), which gradually overturn dominant fossil fuel relations. This provides the impetus to the formation of green governance regimes, underpinning the greening of institutions.

A rising renewable energy regime and the social pressure to combat climate change materialises in the EU's governance, which leads political institutions to adapt as well. The Commission is a greening political institution, which is evolving from a carbon into a post-carbon institution (figure 2.4). Change is reflected and driven by the discourse that it promulgates. When broken down, one can identify five stages in the process during which a political institution greens its policies. Initially, it effectively ignores the relatively weak influence of green discourse and—limited by path dependence and a carbon lock-in—either does not respond or introduces marginal measures (phase one, figure 2.4). As green actors accrue greater power and influence in EU governance, they instigate a *snowballing effect*, where technological and political path dependencies are increasingly challenged by newly emerging forces. The economic competitiveness of low carbon technologies increase due to the policy support they receive, which then underpins the political influence of respective actors, allowing them to exert greater influence in the governance space which they can translate into greater policy support. Their role is still limited at this stage, given the immense size of the fossil fuel energy regime (Smil, 2016a), but their technology offers an increasingly competitive alternative to fossil fuels. These shifts are reflected in the discourses emanating from political institutions and seep into policy language as well.

Figure 2.4: The policies of carbon and post-carbon institutions



Source: Author's compilation

The Commission uses its ability to identify problems, frame them in a specific manner, shape a respective discourse, and ultimately propose policy solutions to increasingly support non-established interests (e.g. renewable technologies and respective companies). How it approaches the energy transition is elemental in shaping subsequent action and the relative influence various actors wield in EU governance. The discourse framing it undertakes begins to reflect green interests, but it is still also shaped by the path dependencies sustained by the fossil fuel sectors. Actors "respond strategically" (Turnheim and Geels, 2012, p. 37) to avert their decline by drawing on their bases of power to shape the actions of an institution that has begun to green its policies but is still forced to support some fossil fuel interest. The discursive hegemony of fossil fuel interests continues to support a narrative of the energy transition that is inclusive of the fuel they provide (Hermwille, 2016; Winskel, 2018; von Hirschhausen, Kemfert and Praeger, 2020) (phase two, figure 2.4). Thus, their primary concern is what ideas and discourses the Commission develops and shares with regard to the energy transition. In the case of natural gas, this entails that incumbents underscore that natural gas is the transition fuel (Delborne *et al.*, 2020). They frame the energy carrier as elemental to a successful energy transition.

The discourse supported by a greening—but not yet green institution—that reconciles the contradiction between climate goals and the continued consumption of a fossil fuel diffuses to shape the energy transition's narrative (phase three, figure 2.4). The relative influence of this narrative is initially minor since climate policy's reach and impact is limited (Skjærseth and Eikeland, 2017), while the space governed continues to overwhelmingly rely on fossil fuels. Nonetheless, there is a gradual shift to support low carbon technologies and adapt increasingly ambitious climate goals by political institutions. This signals a rupture in the path dependencies of a political institution, but its incremental character derives from the force for change clashing with a resistance to it. This leads to a cacophony of discourses emanating from political institutions that simultaneously support fossil fuel-based social relations and measures that sever these. Policies are an outcome of these two opposing forces. As an outcome, a political institution, such as the Commission, seeks to reconcile path dependencies and forces of change by emphasising their compatibility. The transition fuel discourse does precisely this: it allows for natural gas' continued consumption and the development of an energy transition. The

Commission's policies reflect that the continued consumption of fossil fuels and decarbonisation can be compatible.

The gradual change of institutions emerged in a setting where there are socio-technical limitations to shifting from one energy regime to another (Smil, 2010, 2016a; Fouquet, 2016). As noted above, the path dependencies of political institutions are intertwined with technological lock-ins. This poses a further constraint on the pace of the energy transition. The ability of the transition to unfold is politically and technologically limited. A period of *interregnum* unfolds. Gramsci (1971) described this as a period when the pre-existing order is destabilising, but the new one is not powerful enough to take its place (Bauman, 2012). This is unfolding in the EU as fossil fuel interests are yet to relinquish their dominance, while proponents of low carbon alternatives are not yet in a position to provide a full substitute to existing energy regimes (IEA, 2020). During this interim period political institutions continue to reconcile policy objectives and sustain climate goals, while still limited by the path dependencies of a fossil fuel energy regime. A greening institutionalism framework thus allows for these two forms of energy regimes (fossil fuel and non-fossil fuel) to co-exist in the discourses supported by political institutions and the policies it publishes.

Despite technological or political limitations, political institutions shift the support they lend to energy regimes already during the interregnum; albeit, within pre-existing confines. As their support wavers for fossil fuels, so does the relative weight of matters they address in their policies, which can be reflected via their absence as well as measures that dismantle mechanisms supportive of fossil fuel consumption. Thus, the Commission changes the discursive framing of the issues it tackles. It shifts its emphasis towards decarbonisation, altering the questions and policy agenda items that it prioritises. These change as the political institution *greens its policies*.

Table 2.2 illustrates how the policy framing changes with regard to natural gas during this period. The questions policy-makers ask and the objectives of their actions differ, since the decarbonisation process leads them to consider the climate facet of their measures more thoroughly against the need to ensure secure and competitive access to the fuel. Initially some of these may be reconcilable with the objectives of fossil fuel interests, but this gradually withers away as green discourse proliferates, respective action is taken, and institutions become greener.

Table 2.2: Political institutions' changing policy priorities during decarbonisation

Base of power	Form	The objective of a carbon institution	During decarbonisation
Material	Production/ trade	Develop market policies	How does the energy carrier's production and trade relate to climate goals?
	Infrastructure	Address bottlenecks	Can infrastructure support decarbonisation? Or, how can it be altered to support decarbonisation?
Discursive	Securitisation	Ensure supply security	For how long is there a need to ensure supply security of the energy carrier?
	Transition fuel	It is the transition fuel	Is it the transition fuel? And, if so, when and how does one phase it out?

Organisational	Consumption practices	Ensure broad access to the fuel	Where do we absolutely need to gasify?
	Policy-making	Develop effective policy	How to reduce the influence and bias of advocacy associations?

Source: Author’s compilation

The contradiction that a political institution’s bid to discursively reconcile decarbonisation and fossil fuel reliance become untenable after a certain point. Thereby, fossil fuels are no longer compatible with long-term objectives and their role has to be reconciled with forces of change (phase four, figure 2.4). As a green transition unfolds, a political institution needs to adapt its narrative to address the rising contradiction. This, yet again, is based on the materialities of the fuel, but also the pre-existing discourse. The advancement of the transition and the governance regime that is supportive of renewables in the long-term forces actors within the natural gas sector, for instance, to discursively articulate their compatibility with the newly emerging energy regime and ability to support the transition towards a green energy system. The discourse of natural gas becomes more relational, meaning that the rationale driving its consumption hinges on how it can complement renewables. Actors from within the natural gas sector augment their discourse, shifting it to emphasise how the fuel they control is supportive of renewables. Political institutions reach a tipping point, where, discursively, their efforts are to fully green their activities.

The path to a critical juncture of a political institution is thus slow to unfold, but this emerges as it adapts practices reflective of “post-carbon institutions” (LaBelle, 2012) (phase 5, figure 2.4). Its policies phase out support for carbon emitting forms of fossil fuel consumption, but this does not outright rupture the EU’s supportive stance towards these energy carriers. They are *greening* *institutions*, not green institutions. The interregnum and the path dependencies lead the Commission to explore how the EU could rely on decarbonised fossil fuels (Szabo, 2020a). Its actions may reflect the governance outcomes of a new, green transition focused governance regime, but, if decarbonisation is materially reconcilable with fossil fuel consumption, it may also be willing to support these. The narrative promulgated by such a greening institution withdraws its support for emitting fossil fuels, but suggests that technological solutions that limit emissions (e.g. CCS) paired with fossil fuels makes their continued consumption permissible (Anderson, 2015; Vettese, 2019). Path dependencies and incumbents' proposals to develop technological solutions limit the rupture in the practices of political institutions, given the deep entrenchment of fossil interests.

2.8 Conclusion: towards a greening institutionalism framework

This chapter developed a framework to theorise the empirical findings of this dissertation and help answer the dissertation's overarching research question of *how does the European Commission reconcile its climate strategies and natural gas policies?* The question points to an inquiry focused on the interaction between two streams of the Commission's policy: climate and natural gas. Institutional change has been at the fore of this framework, as it effectively proposes a theory on how institutions change their approach to energy policy as climate action's impact increases. This chapter draws on new institutional and energy transition-oriented strands of scholarship to propose a novel greening institutions analytical framework, which theorises how climate action has altered the Commission's fossil fuel-related path dependence.

The greening institutionalism framework offers the tools to theorise how the actions of political institutions change over time in response to climate change. By drawing on historical institutionalism, it underscores that institutions and political institutions tend to reproduce pre-existing power relations. Actors involved in the governance of a sector and, more broadly, a polity seek to wield their influence to shape the actions taken by such institutions. Those involved in the governance of a polity wield various forms of power to reinforce or sever existing practices. These bases of power—drawing on neo-Gramscian green transition theory—are material, organisational, and discursive. By deploying them, actors shape the behaviour of political institutions, the governance regime, and, ultimately, the institutional context. Power relations have hitherto favoured fossil fuel interests, given the overwhelming reliance on fossil fuels, but this is changing as actors respond to climate change.

Institutions are reconfigured in response to external and internal forces, prominent amongst which is discourse. Greening institutionalism explores the form of institutional change by examining the relation between material and discursive factors to identify how they interact and impact the form of change. Drawing on discursive institutionalism, the approach posits that discourses have institution-altering effects, due to their ability to influence practices by, for instance, framing certain energy carriers in a specific manner. That is, the discourse of an energy carrier shapes the role that actors allocate it in an energy system. As political institutions green their policies, the discursive hegemonies that maintain a certain framing of an energy carrier can shift. As it greens its policies, a carbon institution evolves from supporting the reproduction of fossil fuel-based social relations to increasingly questioning those. This leads it to initially reconcile the contradictions between the sustained consumption fossil fuels and climate or sustainability ambitions, but as it moves to become a post-carbon institution their incompatibility emerges and strengthens leading greening institutions to reconsider or withdraw their support for carbon relations.

3 Research design

3.1 Introduction

This chapter introduces the research design of the dissertation. It develops a framework to gather and analyse the empirical evidence necessary to answer the research question and thereby explore the validity of the generative mechanisms proposed as a part of the green institutionalism framework (see chapter two). To map how structures, institutions, and discourses change over time in response to the power relations and actions of actors it uses *discourse tracing*, which "analyzes the formation, interpretation, and appropriation of discursive practices across micro, meso, and macro levels of analysis" (LeGreco and Tracy, 2009, p. 1518). As a part of this, it first defines the case, which covers the Commission's policies at the intersection of natural gas and climate affairs between 1992–2018. After this, it introduces how I gathered data, organised it, and identified emergent themes. The analysis was based on a dataset comprised of texts produced by the Commission and other actors involved in relevant governance as well as forty-eight interviews. It then details the structuring questions that provided the arch for the analysis and, subsequently, the structure of the dissertation. To substantiate findings, the research design also incorporates triangulation to introduce multiple perspectives and data sources that increase the validity of findings. The final part of the research design briefly considers how theoretical implications will be drawn.

In-line with the analytical framework of this dissertation (chapter two), the research design focuses on developing a framework to analyse discourses and how these have maintained path dependencies or facilitated change. Its objective is to identify how "power becomes a question of the representation of problems (and solutions) and competition over which representations (discourses) constitute reality, or viable alternative realities" (Smith, Stirling and Berkhout, 2005,

p. 1503) in a scientifically rigorous manner. To this end, it develops a methodological framework that guides further research by drawing on scholarly approaches that have explored how perception is rooted in subject positions, shaped by social and historical factors, with communication shaping knowledge and identity (Deetz, 2009). Thus, it mobilises ideas from a broad range of scholars, including the post-structuralist thought of Michel Foucault (1971, 2012a, 2012b) to the critical discourse analysis proposed by Norman Fairclough (2001, 2013). With these, it enables one to explore how the Commission's discourses, positions, and, thereby, actions evolved over the course of the analysed period.

This chapter describes the research design guiding this research project, providing the foundations for a scientifically rigorous analysis. It develops a methodological framework which complements the preceding chapter's theoretical approach and one that can help answer the research questions posed in chapter one. This guided the data I gathered, assessed, and conveyed in chapters four through seven of this PhD. This chapter is structured as follows, it first introduces the general research philosophy of the dissertation, which is followed by the conceptual underpinnings of discourse tracing. Section 3.4 turns to operationalising discourse tracing, which it breaks down into four phases (the case, gathering and organising data, analyses, implications), after which the chapter draws conclusions in section 3.5.

3.2 Research philosophy

Sayer (2000) proposes that "material structure of society—its institutions, social relations and artefacts—are dependent on social meanings in various ways" (p. 29). Consequently, "social phenomena are socially constructed" (Fairclough, 2005, p. 915) establishing a central role for concepts in determining the way we, as human members of society, interpret our object(s) of observation. This also allows for ideas and discourses to alter social practices and social institutions (see chapter two). The mode of one's interpretation of events is shaped by their predispositions, leading different observer's interpretations of the same ontological reality through these different conceptual frameworks to yield different social constructions i.e. create different readings of the generative mechanisms producing events (Danermark, 2002). This drives a need for a critical consideration of one's positionality in their research, the continuous need to evaluate text-context dynamics, and triangulate between various data sources, theories, and methods (Fairclough, 2013; Carter *et al.*, 2014). Moreover, one needs to critically evaluate how research is informed by concepts and theories, and by leading an inquiry into how these relate to prevalent power relations (Fairclough, Jessop and Sayer, 2007). This dissertation does this by conducting a thorough literature review when developing its analytical framework in chapter two.

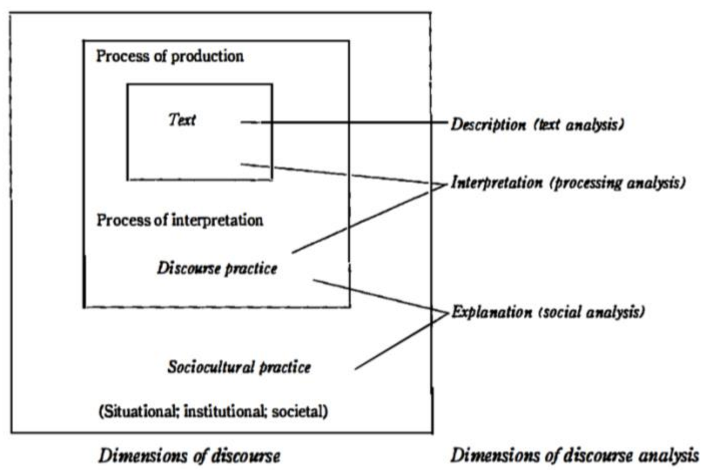
The green institutionalism framework provides an *initial theory* (Bhaskar, 1998), which can be used to theorise generative mechanisms. It lays the foundations for an inquiry, which can only be confirmed following corroboration with the empirical evidence that validates the proposed generative mechanisms. Note that this approach closely reflects the frequently invoked hypothetic-deductive method, which suggests that inquiries are theory-driven with findings testing the propositions (Popper, 2002). Theory informs and refines pre-defined research questions, which is then followed by data collection as determined in the research design. Given the "messiness" of social science, Feyerabend (1993) proposes that "anything goes" when such research is conducted. This entails that a multimethodological approach where a hodgepodge of quantitative and qualitative methods can be deployed that span disciplines. Energy studies also relies on such an approach, given that the object of its study is frequently at the boundaries of a number of disciplines (Sovacool, 2014; Sovacool *et al.*, 2015).

3.3 The conceptual underpinnings of discourse tracing

Before moving on to the step-by-step description of the discourse tracing undertaken as a part of this PhD project, it is worthwhile to briefly consider its conceptual underpinnings and compatibility with the greening institutionalism analytical framework (see chapter two). While scholars have defined approaches to the critical analysis of discourse in a number of manners (Broadfoot, Deetz and Anderson, 2004), as point of departure this thesis accepts that discourse "is an *articulatory practice* [italics in original] which constitutes and organizes social relations" (Laclau and Mouffe, 2001, p. 96). Discursive institutionalism used in the greening institutionalism analytical framework suggests that "discourses are integral causal factors in institutional change and stasis" (Becker, Beveridge and Röhring, 2016, p. 28). Greening institutionalism suggests that actors' behaviour are confined by path dependencies, but discourses can both reify the paths or offer ruptures leading to institutional change. Accordingly, the dissertation's point of departure is to analyse discourses in specific historical contexts, how those relate to specific interests, and how they evolve over time. Foucault "outlined specific conditions for concepts, statements, and ruptures that give form to a discourse" (LeGreco and Tracy, 2009, p. 1519), providing the analytical tools used by discursive institutionalists necessary to assess how discourses normalise certain practices or rupture others.

The other intellectual pillar of discourse tracing is critical discourse analysis (CDA), which focuses on the linguistic properties of texts and text-context dynamics (Fairclough, 2003, 2013). This suggests that discourse mediates between the text and the sociocultural practice, leading actors to institutionalise practices (Chouliaraki and Fairclough, 1999). Accordingly, CDA focuses on text-context relations which it explores through three interrelated processes: (1) text analysis (including verbal, visual or verbal and visual texts); (2) processing analysis (writing/speaking/designing and reading/listening/viewing); and (3) social analysis (see figure 3.1) (Janks, 1997, p. 329). Thus, when discourse is analysed by an observer, a close reading of the text itself, who produced the text, who the readership is presumed to be, and who the text is directed at are all essential considerations. The social setting in which the text was produced is crucial to decipher the role it plays in perpetuating social relations. For instance, the position papers produced by natural gas advocacy associations are incumbent responses to policy consultations that aim to perpetuate their dominant role in the EU's energy system by shaping Commission policy.

Figure 3.1: The three dimensions of CDA



Source: (Fairclough, 2013, p. 98)

The object of this dissertation is primarily the analysis of Commission policy texts. This is frequently presumed to offer a power-neutral medium, but CDA provides the tools to "explain language use in a way that helps to reveal the underlying interests, value judgements and beliefs that are often disguised by policy actors' factual claims" (Scrase and Ockwell, 2010, p. 2226). That is, "linguistic features and structures are not arbitrary […but] power relations are produced, exercised, and reproduced through discourse […and] texts acquire their meanings by being situated in specific social, cultural and ideological contexts, and time and space" (Sheyholislami, 2017, p. 13). This is also the case with regard to policy language. CDA analyses how actors establish and reproduce *discursive hegemony* (Hajer, 1995), which is a key source of power as understood by neo-Gramscian green transition theory incorporated into green institutionalism as well (see chapter two). Consequently, the critical analysis of language through discourse tracing allows for the analysis of how power-wielding through discourse materialises and shapes events.

A hallmark of discourse tracing is its focus on micro, meso, and macro discourses, but it is worthwhile to consider what these mean and how they relate to one-another. Micro level discourses refer to the "local uses of texts within a specific context" (LeGreco and Tracy, 2009, p. 1519), such as the positions developed by actors (e.g. advocacy association, NGOs, or natural gas firms) or the discussions had during interviews. Micro discourses connected across contexts constitute meso discourses. Policy, for instance, coordinates discourses along multiple sites and fields, thereby, serving as a meso discourse. Meso discourses are especially pronounced in discourse tracing, given its overall orientation to exploring and mapping institutional change. Lastly, macro discourses are broad and enduring social narratives that are shaped by and shape meso and micro discourses. The interaction of these three levels of discourse reflects the diverse strategies deployed by actors to wield their power and maintain the dominance of an energy regime, for instance. As actors wield their power to shape the actions of supranational policy, they use micro discourses to influence policy, which then materialises in policy issued by the Commission, shaping the overarching narrative and framework of a transition.

3.4 Operationalising discourse tracing

Discourse tracing marries grounded theory, case study analysis, process tracing, and qualitative content analysis to explore "how various levels of discourse interacted with one another to create or transform a certain phenomenon, policy, or action over time" (LeGreco and Tracy, 2009, p. 1522). Grounded theory ensures that discourse tracing is firmly rooted in empirical findings (Glaser and Strauss, 1967), while case study methodologies enrich it by providing context-dependent knowledge by supporting case selection and how to establish the boundaries of an analysis (Yin, 1994; Stake, 1995; Flyvbjerg, 2006). Process tracing offers an in-case language and toolkit to explore causal processes across space and time in a structured manner (Bennett, 2008; Bennett and Checkel, 2014). Lastly, the approach draws on qualitative content analysis, which focuses on the emergent themes, codes, and patterns that seek to answer how discourses change and why. Table 3.1 summarises the four phases of discourse tracing: research design, data management, data analysis, and evaluation. These can be broken down into further tasks with research design composed of defining the case coupled with a literature review. The second phase involves gathering and organising data. The third phase comprises of data analysis, where the scholar applying the method poses questions and identifies themes to structure the data. Finally, the fourth phase consists of data evaluation, which narrows in on the practical and theoretical conclusions and contributions of the project.

Table 3.1: Discourse tracing overview

Phase	**Tasks**
1: Research design	- Define case - Review literate
2: Data Management	- Gather data (variety of sources and levels of discourse) - Order data chronologically

	- Identify emergent themes
3: Data Analysis	- Organised based on questions and issues - Write case study by answering questions and issues
4: Evaluation	- Address theoretical conclusion - Explore broader applicability

Source: Authors compilation based on (LeGreco and Tracy, 2009, p. 1523)

3.4.1 Phase 1: the case study and a literature review

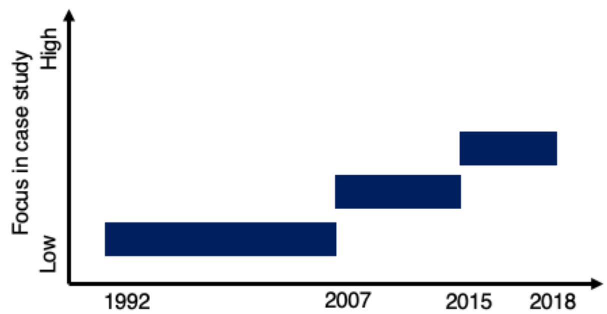
Discourse tracing begins with the definition of a case, which typically links to a turning point or a rupture in a discourse or institutional configuration. Simons (2009) suggests that a "[c]ase study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution or system in a 'real-life' context" (p. 21). The case this dissertation explores is the impact of climate change on the Commission's natural gas policies, which brought about a gradual shift in the role the Commission assigned to natural gas. The idea for developing the case was loosely based on participatory observation (Guest, Namey and Mitchell, 2013), in the sense that I had worked with natural gas affairs for years and had become aware of the positive framing the fuel enjoyed, despite its role in exacerbating climate change. There was a general consensus amongst policy-makers, commodity traders, analysts, and many other experts I interacted with that it would play a prominent role in the energy transition and be a part of the EU's energy system for years to come. Few were critical about its role, leading this dissertation's inquiry.

Jonathan Stern's (2017b) paper helped define this case, since it was amongst the first studies to undertake an in-depth critical assessment of the role of natural gas in the EU's energy transition.

This case revolves around the actions of the Commission. This is for two reasons, first, the Commission has become increasingly influential in developing policy within the EU and because the objective of this dissertation was to assess how a political institutions changes (see chapter two). Second, the EU is the most prominent geography where natural gas and climate policy has come into conflict. James Henderson, the Director of the Natural Gas Programme at the Oxford Institute for Energy Studies, notes that Stern's (2017b) study on climate change's impact on EU natural gas markets "is deliberately Euro-centric, because this is the region where gas appears under greatest threat" (p. iii). The EU's climate leadership coupled with its extensive reliance on natural gas drives a conflict between the two realms of policy. The EU is thus the first and the largest natural gas-reliant region where its executive arm—backed by a number of other actors—are questioning the future role of the fuel. One can look at the EU as a petri dish that allows for the assessment of how climate and natural gas policy collide.

The dissertation asks the overarching question of *how does the European Commission reconcile its climate strategies and natural gas policies?*, which corresponds to Yin's (1994) proposal whereby a case study should be invoked as tool for research when one asks "how" and "why" questions. Such an inquiry is explanatory, focusing on how and why the Commission acted in a particular manner within the pre-defined 1992–2018 period. The temporal boundaries of this case are based on the launch of EU climate policy in 1992 with the Rio Conference, shortly after which the Commission began to develop a common energy policy and the proposals necessary for the creation of a single natural gas market (Matlary, 1997). The case explores events between this twenty-seven year period, but the analysis becomes richer over time as the two domains of policy increasingly interact. Climate action had a very limited impact until the late-2000s, but events in the 1990s and early-2000s are included because they are elemental to understanding and explaining subsequent outcomes. Early measures had a limited impact on natural gas consumption patterns, but they shaped discourses that would later be formative in the role the Commission assigned to the energy carrier. The effect of climate action then increased, especially beginning in the early-2010s and following the Paris Agreement in 2015, offering the basis for a richer analysis (see figure 3.2).

Figure 3.2: Temporal boundaries of the case study



Source: Authors design

Identifying a case allows one to approximate the boundaries of their research and deep-dive into the specific factors and generative mechanisms shaping outcomes. However, as Yin (1994) points out: "[a] case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 13). Thus, the boundaries discussed above are indicative, but given the embeddedness of the EU's actions in a broader spatial and historical context, the dissertation introduces and explores mechanisms that are key to identifying causal factors shaping identified outcomes. To address this, for instance, chapter four provides a historical snapshot of natural gas' relation to environmental policy, allowing for the analysis to be embedded in a broader context. Another risk with case studies is "[t]he over-extension commonly associated with concrete research consists in the illegitimate extrapolation (or generalization) of specific findings about a particular (contingent) conjuncture of a system to the rest of the system, when in fact it may be unrepresentative" (Sayer, 2000, p. 240). To address this, not only are the findings "research based, inclusive of different methods and […] evidence-led" (Simons, 2009, p. 21), but, as discussed below, the dissertation triangulates findings.

The second component of phase 1 pertains to reviewing relevant literature. This was a key element in developing the dissertation and was the basis for the analytical framework discussed in chapter two. Given the in-depth presentation of the literature in chapter two, this chapter will forego the further discussion of this matter.

3.4.2 Phase 2: gathering and organising data

The second phase of this PhD project comprised of collecting data, which included gathering texts from micro, meso, and macro discourses (LeGreco and Tracy, 2009). Micro discourses refer to the "everyday talk" for which this dissertation relied on interviews with forty-eight individuals. They answered interview questions during these sessions, providing input on how experts from within the field discuss the natural gas–climate nexus. Additionally, news articles, reports, presentations, communications, and studies, were also used as primary sources that reflected micro discourses. This project relied on policy papers as material for meso discourses, which included archival documents and relevant policy-papers generally issued by the Commission. Thirdly, macro discourses were traced in broader policy frameworks and long-term strategies that embody narratives and ideologies supported by institutions. Frameworks, such as Energy Packages[8] or the Clean Energy for All Europeans[9] embodied such macro discourses. Such a

[8] Directive 98/30/EC, 22.06.1998; Directive 2003/55/EC, 26.06.2003; Directive 2009/EC/73, 14.08.2009.
[9] COM(2016) 860, 30.11.2016.

selection of sources allows this dissertation to explore how these three realms of discourse interact with one-another and drive institutional change.

Identifying the boundaries of the case and conducting the literature review led to an understanding of which actors may be prominent in shaping policy and respective discourses at the intersection of natural gas and climate affairs. Chapter four details this, since the selection of actors was not only based on a literature review but also the project's empirical work. The reason for this was that scholarship does not discuss which actors are the most prominent and how they take action to shape policy in the analysed realm. Based on this, six broad groups of actors were identified: (1) the Commission, (2) EU-level advocacy groups , (3) companies, (4) NGOs, (5) national governments and authorities, and (6) observers (see figure 4.1). I sought to gather texts issued by actors from within these groups and conduct interviews with experts affiliated with them to have their variegated positions represented in this dissertation.

The Commission's texts were at the core of this inquiry, given its central role in developing EU natural gas and climate policy. Since it is a complex bureaucratic ensemble—composed of 27 cabinets, whose work is supported by a number of Directorates-General (DGs), and 32,000 European civil servants (European Commission, 2020c, 2020a)—this project narrowed its focus to DG Energy (DG Ener)[10], DG Competition (DG Comp), DG Environment (DG Env), and DG Climate (DG Clima)[11], which play the largest role in developing relevant policy. Numerous actors participate in respective governance, the role and influence of which became clear as the project progressed (see chapter four), but initially the texts produced by the European Network of

[10] During the assessed period DG Ener was under the oversight of Miguel Arias Cañete, European Commissioner for Energy and Climate Action and to Vice President of the Commission Maroš Šefčovič, responsible for Energy Union. DG Ener was led by Klaus-Dieter Borchardt between 2013–2018.

[11] DG Clima branched off from DG Env in 2010 (Hustedt and Seyfried, 2016).

Transmission System Operators for Gas (ENTSOG) and advocacy groups, such as Eurogas or Gas Infrastructure Europe (GIE), offered key points of departure to understand the position of the natural gas industry. This was expanded with the positions of the EU's two largest suppliers, Gazprom and Equinor, but it did not include additional key private stakeholders, such as E.ON or Engie, given the limited scope of the endeavour. The project also assessed the texts of NGOs, most prominently, Greenpeace and Friends of the Earth Europe, especially since the latter has dedicated increasing attention to natural gas (FotEE, 2017). Texts published by national stakeholders were not thoroughly assessed, because this went beyond the scope of this project.

This research project analysed 124 texts issued by relevant stakeholders from the 1992–2018 interval (for a full list of relevant documents, see annex 1). Influential natural gas policy packages constituted core texts, including the First[12], Second[13], and Third Energy Packages[14], and the Energy Union[15]. Moreover, where relevant, energy policy packages were also considered even if this did not directly relate to natural gas, but carried ramifications for the EU's energy system, such is the Clean Energy for All Europeans[16]. Additional texts, including communications, green papers, studies, consultations were analysed that pertained to energy affairs. A number of pivotal climate policy documents were also assessed, including those focused on energy efficiency, renewables, CO_2 monitoring, the EU ETS, and so on. These policy documents have been the cornerstone of EU climate action, encoding goals, trajectories, and indicating how the Commission thought about certain fuels and the role it would allocate to them. They were accessed primarily from three databases: 'EUR-lex – Access to European Law', the 'Archive of

[12] Directive 98/30/EC, 22.06.1998.
[13] Directive 2003/55/EC, 26.06.2003.
[14] Directive 2009/EC/73, 14.08.2009.
[15] COM(2015) 080 final, 25.02.2015.
[16] COM(2016) 860, 30.11.2016.

European Integration' maintained by the University of Pittsburgh, and the 'Historical Archive of the European Union' maintained by the European University Institute. Beyond the Commission documents, the public statements, presentations, press releases, and studies of the actors included in the study were included in the analysis. These were accessed from their respective websites.

Interviews conducted with forty-eight experts were a key source of data for this dissertation (see table 3.2). Their selection was based on the relevance of the actors with which they were affiliated (see chapter four) or because they were involved with analysing the EU's natural gas or climate scene(s). Furthermore, six interviews were conducted with experts affiliated with national energy organisations, but they had been involved with EU energy and climate affairs. With this, they presented a perspective on EU affairs as an outsider from the 'Brussels Bubble' (Georgakakis, 2011). Table 3.2 lists interviewees and indicates which group of actors they were affiliated with at the time of the interview. Accordingly, I conducted six interviews with EU policy-makers, six with experts at advocacy groups, fourteen with professionals affiliated with companies, two NGO experts, six government officials, and fourteen external observers, most of which were either scholars or researchers at think tanks that had expertise on the subject matter.

Table 3.2: Affiliations of interviewees

Type	Actors	Number of interviews
The Commission	DG Ener, DG Comp, ACER	Six
EU-level advocacy groups	ENTSOG, Eurogas, IOGP, Hydrogen Europe, Gas Infrastructure Europe	Six

Companies	Equinor, Gazprom, Aurora Energy, Tellurian, Hungarian Gas Storage, ABN Amro, PGNiG, PSE Innovacije, MVM	Fourteen
NGOs	Friends of the Earth, Greenpeace	Two
National governments	Ministry of Foreign Affairs Germany, Ministry of Foreign Affairs Poland, Hungarian Energy & Utilities Regulatory Agency	Six
Observers	International Energy Agency, Oxford Institute for Energy Studies, PWC, Hertie School of Governance, WiseEurope, University of Oslo, University of Warwick, The Fridtjof Nansen Institute, Harvard University	Fourteen

Source: Author's compilation

The project's fieldwork was composed of a number of trips to conduct in-person interviews where possible. This included a lengthier stay in Brussels in January 2019, when I interviewed thirteen EU-level officials, experts at advocacy groups, as well as company and NGO affiliates with offices in the city. I travelled to Ljubljana to speak to two ACER officers in January 2019 as well. Moreover, during a trip to Warsaw in the January of 2019, I was able to speak to seven government officials, industry representatives, and other analysts who were involved with EU energy affairs. During a trip to Berlin in the summer of 2018, I was able to interview five experts, who were involved with EU energy and climate affairs, two of whom were representatives of the German government. I conducted a further two interviews during a trip to Paris in January 2019, seven interviews during a research stay in Oslo during March 2019, and a further four interviews while I was a Visiting Fellow at the University of Waterloo during the fall of 2019. These were complemented with a further six interviews with experts based in Budapest or travelling through the city during my fieldwork. In addition, I conducted two interviews with UK-based experts online and follow ups to all the interviews via email, telephone, or videoconferencing.

Table 3.3: List of interviewees

Code	Position/description	First interview
COM_1	Commission officer involved with natural gas affairs and methane emissions	22-Jan-19
COM_2	Commission officer involved with developing the internal energy market	22-Jan-19
COM_3	Commission infrastructure expert	23-Jan-19
EU_Ex _1	Senior expert from a natural gas industry infrastructure advocacy group	22-Jan-19
EU_Ex_2	Executive from natural gas infrastructure advocacy group	22-Jan-19
EU_Ind_1	Senior executive affiliated with major EU natural gas supplier	22-Jan-19
EU_Ind_2	Policy expert affiliated with major EU natural gas supplier	22-Jan-19
EU_Ex_3	Executive of hydrogen advocacy group	25-Jan-19
NGO_Ex_1	Energy expert at Greenpeace (Brussels-based)	25-Jan-19

NGO_Ex_2	Energy expert at Friends of the Earth (Brussels-based)	24-Jan-19
EU_Ind_3	Policy and legal expert affiliated with major EU natural gas supplier	24-Jan-19
EU_Ex_4	Expert affiliated with natural gas industry advocacy group	25-Jan-19
COM_4	Commission officer formerly affiliated with DG COMP and DG Ener	29-Aug-19
G_Ex_1	Senior expert at a global energy think tank	28-Jan-19
G_Ex_2	Natural gas analyst at a global energy think tank	28-Jan-19
COM_5	Senior expert at ACER	11-Jan-19
COM_6	Senior expert at ACER	11-Jan-19
D_Gov_1	German energy diplomat	26-Jul-19
D_Gov_2	German energy diplomat	26-Jul-19
EU_Ind_4	Policy expert affiliated with major EU natural gas supplier (Berlin office)	26-Jul-19
Ind_1	Head of energy trading and analyst firm	27-Jul-19
D_A_1	Academic focused on EU natural gas affairs (Berlin-based)	31-Jul-18
HU_Ex_1	Head of Department at the Hungarian Energy & Utilities Regulatory Agency	21-Aug-19
HU_Ind_1	CEO of a Hungarian natural gas infrastructure firm	03-Jul-19
HU_Ind_2	Expert affiliated with Hungarian natural gas firm	22-Jul-19
HU_An_1	Natural gas analyst from Hungary working mostly on EU affairs	12-Jul-19
US_Ind_1	Senior executive of US-based LNG firm	03-Sep-19

PL_Gov_1	Polish energy diplomat	14-Jan-19
PL_Gov_2	Polish energy diplomat	14-Jan-19
PL_Gov_3	Senior Polish government official working on EU energy affairs	15-Jan-19
PL_An_1	Energy analyst (Warsaw-based)	15-Jan-19
EU_Ex_5	Former EU energy expert (Brussels-based), currently senior executive at natural gas firm (Warsaw-based)	15-Jan-19
PL_An_2	Energy analyst (Warsaw-based)	17-Jan-19
EU_Ex_6	Senior expert involved with EU energy affairs (Warsaw-based)	17-Jan-19
NO_A_1	EU energy affairs expert in academia (Oslo-based)	13-Mar-19
NO_Ind_1	Industry expert affiliated with gas advocacy (primarily biogas)	18-Mar-19
NO_An_1	Energy analyst focused on global affairs (Oslo-based)	18-Mar-19
NO_An_2	Energy analyst focused on electricity (Oslo-based)	19-Mar-19
NO_An_3	Energy analyst focused on EU-Russia relations (Oslo-based)	19-Mar-19
NO_An_4	Energy analyst focused on oil and natural gas (Oslo-based)	22-Mar-19
EU_An_1	Consultant focused on EU energy affairs	23-Mar-19
NO_Ex_1	Expert focused on EU climate and energy policy (Oslo-based)	11-Aug-20
G_Fi_1	Natural gas expert at global bank	26-Sep-19
US_A_1	Academic focused on environmental policy (Boston-based)	24-Sep-19

US_A_2	Academic focused on Russia-EU energy relations (US-based)	24-Sep-19
EU_Ex_7	Expert from oil and natural gas advocacy association	27-Jan-19
UK_Ex_1	Prominent EU natural gas affairs expert at UK think tank	13-Aug-20
UK_A_1	Academic focused on EU energy affairs (UK-based)	10-Sep-20

Source: Author's compilation

I arranged interviews by drawing on my (1) existing professional network, (2) by attending conferences and talking to potential interviewees, (3) requesting that my mentors and colleagues refer me to relevant experts, and (4) sending cold emails and initiating cold calls. These provided a point of departure for my fieldwork, but I also relied on the snowball/chain-referral sampling technique (Tansey, 2007). I conducted semi-structured interviews to both address specific questions, whilst providing the interviewee the freedom to introduce and elaborate on pertinent matters that I may have not included in my questions (Legard, Keegand and Ward, 2003; Silverman, 2011). Annex 2 provides a list of interview questions that were developed based on this dissertation's Prospectus, which I further refined based on the input of the Dissertation Committee's feedback and input from initial interviews. Most interviewees did not wish to be recorded and were only willing to participate in the research under the condition of anonymity. This allowed for them to speak more freely, of which I took detailed notes. Recorded interviews were transcribed. I generally conducted interviews in the offices of interviewees or cafés in some cases. Their length typically ranged between 45–60 minutes.

Given the precondition of anonymity in most cases, descriptors were adopted that refer to the interviewees based on the countries they are based in and the type of organisation with which they are affiliated. Their descriptors' first letters refer to the country (e.g. 'D' for Deutschland i.e.

Germany and 'NO' for Norway) in which they are based or in some cases it indicates the institution (e.g. 'COM' for the European Commission). The second part of these descriptors refers to the type of stakeholder the interviewee was affiliated with: 'gov' refers to government, 'ind' to industry, 'a' to academic, 'an' to analyst, 'ex' to expert, 'fi' to finance.

The second step in the second phase of discourse tracing is chronological ordering. This is necessary to trace how discourses evolved over time, since it "helps researchers to detect the emergence of social processes across time and context" (LeGreco and Tracy, 2009, p. 1526). The approach draws on process tracing, which relies on chronology to identify causal factors driving events (Bennett and Checkel, 2014). Most discussions were "event centred", meaning that interviewees themselves discussed events in a chronological manner, frequently introducing what led to certain decisions or actions and what implications these had in their opinion. Thereby, chronological ordering was easy to execute, since the dates, events, policies, etc. noted by interviewees provided anchor points to discuss events sequentially. Based on these, after being cross-checked against other primary sources and the literature, data was organised chronologically. This led to a chronology that centred around a sequence of formative events which would later provide the structure for the chapters as well—for the main events see table 3.4.

Table 3.4: Chronology of EU natural gas and climate affairs

Date	**Event**
1992	Rio Conference
1995	COP1 – Berlin

1997	Kyoto Protocol
1998	First Natural Gas Directive
2003	Second Natural Gas Directive; EU ETS
2004	Eastern Enlargement
2006	First natural gas supply crisis
2007	EU2020 Agenda; Treaty of Lisbon
2009	COP15 – Copenhagen; Third Energy Package; Second natural gas supply crisis; EU ETS Phase 2
2011	German *Energiewende*; oil and natural gas price decline begins; EU 2050 decarbonisation
2013	EU ETS Phase 3; First PCI list
2014	2030 goals
2015	Paris Agreement; Energy Union
2016	Clean Energy Package

Source: Author's compilation

3.4.3 Analysis and writing

The third phase of discourse tracing begins with asking structured questions that help structure the data and develop thematic clusters of information to answer research questions. Structuring questions and the identification of key themes in the answers forces a "comparison of somewhat parallel situations, policies, or cases" (LeGreco and Tracy, 2009, p. 1531) allowing for one to pinpoint how and when change occurred. Structuring questions emerge from the literature review, theoretical presuppositions, research questions, a close reading of the data, and the factors that shape the context of the data. When developing these, "discourse tracers should word these questions in order to systematically 'lift out' patterns and arguments from the qualitative data set" (LeGreco and Tracy, 2009, p. 1532) and to help identify how discourses evolved. In the case of this dissertation, I developed questions based on the themes that emerged from the close reading of the data gathered (Nowell *et al.*, 2017; Brummett, 2018) and the consideration of the literature review conducted (see table 3.5). Three broad groups of questions took shape, one focused on climate affairs, one on natural gas policy, and one on infrastructure. These would provide the structure for the main empirical chapters of the dissertation.

Table 3.5: Structuring questions

<u>Climate action-related structuring questions</u> - How are EU climate affairs governed? - Has the Commission had the power to lead climate initiatives? - Is climate policy incorporated into EU energy policy? - What role does the EU ETS play in EU climate policy? - What impact did the Paris Climate Agreement have? - Were there turning points for EU climate policy apart from the Paris Agreement?

- What sort of problem do methane emissions pose?
- Does the Commission take a technology neutral approach to the energy transition? What does this mean?
- How do renewables shape the natural gas–climate nexus?

Natural gas-related structuring questions

- What physical qualities of natural gas are important from an environmental/climate standpoint?
- What role has natural gas played historically in the EU?
- Which interests are represented in the governance of EU natural gas affairs?
- Which actors design the EU's natural gas agenda? Do others influence this?
- What are the most prominent power relations in EU natural gas governance? (That is, who has power?)
- What is a transition fuel?
- Which actors support the EU in adopting natural gas as a transition fuel?
- What role is natural gas assumed to play in the energy transition?
- Is the supply security of natural gas an issue in the EU?
- Is the phase out of natural gas discussed in the EU?
- How is the path dependence of natural gas perceived?
- What role can natural gas play in the future?
- Is there a different role for natural gas in newly joined EU member states?
- Does it matter where natural gas is sourced from?

Infrastructure-related structuring questions

- What role will natural gas play in electricity generation?
- What is the role of capacity mechanisms in the EU's energy market going forward? How does this relate to natural gas?
- How are natural gas infrastructure matters governed?
- Are stranded natural gas assets an issue?
- What is the future of natural gas infrastructure?
- What role can carbon capture and storage paired with natural gas play in the EU's energy transition?

Source: Author's compilation

While not included in discourse tracing as proposed by LeGreco and Tracy (2009), I triangulated findings between data gathered (primary sources and interviews), the scholarly literature, the grey literature (e.g. reports, policy papers, etc.) (Bonato, 2018), and newspaper articles to verify findings on a continuous basis. Triangulation overcomes observer biases and introduces a number of perspectives, approaches, or theories into the analysis to offer robust results (Punch, 2013). This dissertation primarily relies on data source triangulation, which "involves the collection of data from different types of people, including individuals, groups, families, and communities, to gain multiple perspectives and validation of data" (Carter *et al.*, 2014, p. 545). As noted above, this entailed a reliance on a number of primary sources issued by various actors and interviews conducted with individuals affiliated with a multitude of organisations. This offered a multi-perspective approach and allowed for the biases of some perspectives to counterbalance those of others, allowing for the scholar to weigh their positions and reduce biases.

Primary sources may be reliable, but to enrich the perspectives and to complement their limited availability this dissertation also drew on a number of additional resources. These include the aforementioned studies and literature as well as media accounts. The latter include reporting from a large number of news outlets, including Bloomberg, Platts, Euractive, Politico, and Natural Gas World. Since such non-academic sources are neither subject to rigorous review processes and may be susceptible to biases, I sought to carefully consider where, for instance, pro-natural gas or pro-environmentalism biases may have skewed the given assessment. Lastly, my understanding of events shaping the EU's climate and natural gas scene was enabled by my participation at related industry events and conferences. The proliferation of online events amidst the COVID-19 global pandemic enabled me to participate in an even larger number of pertinent discussions. This dissertation also draws on quantitative sources, expanding the scope of data source triangulation. Quantitative data on energy consumption patterns (IEA, 2019b, 2020d, 2020c; BP, 2020; Eurostat, 2020), natural gas trade (Eurostat, 2020; IEA, 2020c, 2020f), infrastructure capacities (GIIGNL, 2018; GIE, 2019a; ENTSOG, 2020b), as well as various prices (BP, 2020; Sandbag, 2020; Lazard, 2021) were all drawn upon to verify findings. The values and descriptive statistics extracted from these sources offered points of reference against which other sources, claims, interpretations, and narratives could be tested.

After structuring the data in a chronological and thematic manner around the questions as well as cross-checking and enriching findings with triangulation that allowed for a deeper understand of text-context relations, I took to writing the case. This entailed critically reflecting on findings, evaluating the results, organising them along a presentable narrative, while taking the time to clearly articulate these in writing. A key component of the writing process was seeking feedback, which not only originated from those directly commenting on the dissertation, but by presenting parts of the project at various scientific and industry conferences, workshops, and seminars. These provided constant feedback and valuable guidance in this work.

3.4.4 Evaluating research

The last phase of discourse tracing comprises of evaluating the research by drawing theoretical and practical implications. As a case study, this dissertation focuses on the “transferability” of findings. That is, it is evaluated against its ability to provide insights that are theoretically applicable to theorising other cases (Lincoln and Guba, 1986, 1990; Polit and Beck, 2010). This is presented in the final discussion chapter, which discusses the validity of the theoretical framework against the case assessed. “Because discourse tracing is interested in examining change, power, and transformation, the implications generated by case studies could be transferred to other participants” (LeGreco and Tracy, 2009, p. 1536), which is especially pertinent given the all-encompassing change necessary to tackle climate change. Although, discourse tracing offers the tools necessary to identify generative change prompted by discourses (Deetz and McClellan, 2011), this dissertation does not set out to articulate recommendations to enact change. Developing practical recommendations are seen as a next step in this project, given that the findings of this dissertation offer a solid foundation on which one can base policy recommendations.

3.5 Conclusion

This chapter discussed the dissertation’s research design. Its point of departure is an *initial theory* which is the greening institutionalism analytical framework articulated in chapter two. The methodology developed above provides a rigorous framework for empirical evidence to be gathered and assessed to corroborate or discard the generative mechanisms proposed by the initial theory. The choice of methodology is discourse tracing, which draws on critical discourse analysis and Foucauldian thought to explore how different levels (micro, meso, macro) of discourse change phenomena, policy, or action over a certain period of time. In the case of the dissertation, the objective is to answer how the Commission has reconciled climate strategies and natural gas policies, to which end the green institutionalism proposes that discourses are essential to shaping the role the Commission allocated to natural gas in the energy transition. Moreover, actors sought to use discourses—in addition to material and organisational forms of power—to maintain the fuel's role in the energy system and thereby their dominant position in the energy sector. The Commission gradually greened its positions and moved towards becoming a post-carbon institution, but its scope of action was continuously by lock-ins.

To guide the inquiry, discourse tracing draws on grounded theory, case study analysis, process tracing, and qualitative content analysis. Accordingly, the inquiry is grounded in empirical data gathered for a case which is identified as the intersection of EU natural gas and climate affairs between 1992–2018 with a focus on policies issued by the Commission and texts published by actors involved in respective governance. Data for the inquiry comprised policy documents, reports, communications, etc., which were complemented with forty-eight expert interviews. After organising data chronologically and clustering input around key events (e.g. the introduction of the EU ETS or the Paris Agreement) based on content analysis, structuring questions were posed to organise the data. This provided an arch for the dissertation, leading to the current division of content between the three main empirical chapters (five, six, seven) and their sub-sections. Primary sources were triangulated against additional input, including the scholarly literature, reports, media publications, and quantitative data. Finally, the analysis led to causal relations to be drawn between events, which would then provide the basis for theoretical propositions.

4 The bases of a natural gas regime

4.1 Introduction

This chapter explores the conditions that led the EU to integrate natural gas into its energy mix. It begins by sketching the history of the European natural gas sector with a focus on how its uptake related to environmental considerations. It suggests that the common perception of natural gas' environmental-friendliness was pertinent to consumers accepting it as a source of energy and, thereby, also supported the growing role of its respective sector. It discusses the physical qualities of natural gas to show why the Commission and other actors framed it as the transition fuel, but also underscore those qualities that led to a gradual change in this perception. Its relatively low emissions upon combustion and an already broad role in the EU led it to become ideal to meet energy demand during the energy transition. Nonetheless, it is a non-renewable, emitting source of energy, which exacerbates climate change through methane leaks, making it incompatible with long-term decarbonisation goals. Finally, the chapter introduces the main actors involved in the governance of the EU's natural gas regime and discusses how they play a role in perpetuating path dependencies. This shows the close linkages between policy-making and industry interests, indicating how those involved in the governance of a resource can shape policy directly and indirectly.

This dissertation explores the natural gas–climate policy nexus in the EU to which end this chapter primarily provides context. It lays the foundation for subsequent empirical chapters (five, six, and seven), by sketching the basics of the EU's natural gas regime i.e. "the network of industrial sectors that evolves around a particular energy resource, as well as the political, commercial, and social interactions that foster the expanded production and consumption of a given energy resource" (Podobnik, 1999, p. 155). This is the basis of the fuel's and respective interests institutionalisation in EU policy-making. It sketches the premises of a carbon institution by exploring the historical roots of natural gas' uptake, the materialities of the fuel, and the relations of power that shape its governance. This is a key point of departure for greening institutionalism (see chapter two), which, as subsequent chapters will further illustrate, theorises that with rising pressure to take climate action, institutions move away from reproducing fossil fuel relations to become post-carbon institutions. This chapter begins to discuss why the Commission supported the consumption of natural gas and what were the factors the it subsequently drew upon to reconcile demand for the energy carrier with environmental or climate policy.

The dissertation's focus may be on the recent past (1992–2018) (see chapter three), but the institutional setup centred around natural gas is shaped by the fuel's deep historical role. Hence, this chapter focuses on the material, organisational, and discursive bases of power that emerged and empowered some actors through natural gas' uptake. It shows how a specific governance regime formed and shaped the actions of political institutions. Subsequent chapters focus on how climate action changed natural gas governance, but this one narrows in on the point from which this change began. To convey this, the chapter is composed of three broad sections, the first, section 4.1, explores how a natural gas regime formed in Europe. Section 4.2 discusses the material qualities of the fuel, while section 4.3 introduces the key actors that participate in its governance, before section 4.4 draws conclusions.

4.2 A brief environmental history of natural gas in Europe

The environment-related physical characteristics of natural gas shaped its European uptake, even if this was not the prime driver of its rising consumption. Initially, consumers took to it due to their pre-existing reliance on town gas (Arapostathis *et al.*, 2013; Arapostathis, Pearson and

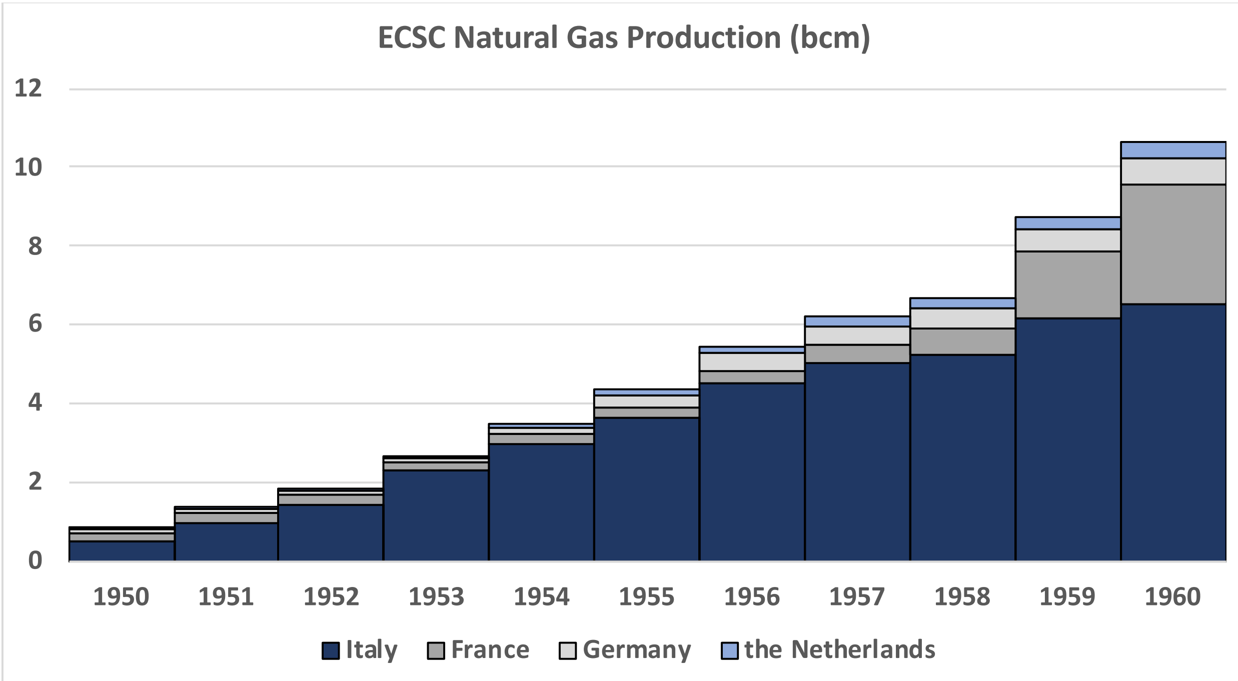
Foxon, 2014). Town gas is a coal-based source of energy adopted throughout Europe during the 1800s, “when the gigantic laboratories known as gasworks, sending their products through endless subterranean pipes, began to illuminate the factories and soon after the cities of Europe” (Hobsbawm, 2010, p. 360). It required an extensive infrastructure system and by the “[19]30’s–[19]40’s there was a gas distribution system in almost every town all over Europe” (NO_Ind_1), since it offered both a convenient source of energy and also eased urban pollution (Smil, 2015; Thomas, 2018). Society began to frame and understand gas—town gas in this case—as a source of energy that is accompanied by limited air pollution and emissions (Williams, 1981; Arapostathis *et al.*, 2013; Thomas, 2018).

Town gas became the basis of natural gas’ uptake in the 1950s (Podobnik, 2006; Smil, 2015; Bradshaw and Boersma, 2020). Coal became problematic in the UK as its availability declined, miners’ strikes led to substantial price increases, and urban air pollution culminated in lethal events such as the 1952 Great Smog of London (Turnheim and Geels, 2012; Arapostathis *et al.*, 2013). These forces prompted the UK government to seek alternatives, one of which was natural gas. Shifting to natural gas became a viable energy strategy when companies made substantial discoveries in the Netherlands and, later, in the North Sea (British Gas, 1980; Ryggvik, 2015; Honoré, 2017; Craig *et al.*, 2018). The UK led Europe in converting its town gas infrastructure to support the transit and distribution of natural gas (Williams, 1981). Natural gas also became a popular source of energy in the Union of Soviet Socialist Republics or the Soviet Union (USSR) and Warsaw Pact countries during the 20th century. Production in the Ukrainian Soviet Socialist Republic dates back to the late-1940s, which was followed by a push from Soviet leaders to supply the Bloc’s largest cities (Moscow, Kyiv, etc.) with natural gas (Högselius, 2013). To this end, the USSR constructed vast infrastructure to deliver what consumers saw as a modern source of energy that was both convenient and clean (Hoffman and Dienes, 1985; P. Högselius, 2013).

The rising role of natural gas led European governments and private enterprises to cooperate in establishing the politico-legal framework of natural gas markets. Initially, these were national endeavours (P. Högselius, 2013), but governments also supported discussions on a common energy policy amongst European Coal and Steel Community Treaty (ECSC) members[17]. This became more pronounced when member states created the European Economic Community and Euratom in 1957—suggesting that further European integration would follow (Haas, 1958)—when government officials and European policy-makers called to develop a free oil market and common energy policy (Leemans, 1960; European Community, 1962; ECSC, Commission of the European Economic Community and Commission of the European Atomic Energy Community, 1964). Creating an oil market was at the heart of decision-makers' agendas, leading them to formulate specific long-term steps to reduce trade barriers and "[w]here practicable, similar arrangements should be made for natural gas" (Inter-Executive Energy Committee, 1962, p. 11). Policy-makers began to discuss the need for a European framework to support its international trade, even though it only played a minuscule role in meeting energy demand at the time (see figure 4.1). The Commission nonetheless anticipated that it role in the European energy mix[18] would increase, warranting the development of a respective policy agenda.

Figure 4.1: ECSC natural gas production

[17] Consultative Assembly on the activities of the Common Assembly from 1st July 1956 to 30th June 1957, 30.09.1957.
[18] P-1/63, 10.01.1963.



Source: (Office Statistique des Communautés Européennes, 1962)

The rapid expansion of natural gas' role continued in the 1970s. The Council adopted the Commission's proposal[19] to limit the sulphur content of liquid fuels in response to the acid rain-related concerns governments raised at the Stockholm conference in 1972, providing a boost for natural gas demand (Per Högselius, 2013). In subsequent years, the 1973 and 1978 oil crises led to surging oil prices (Yergin, 2011) and "the natural gas industry was remarkably successful in exploiting the oil crisis of 1973/74 to its advantage" (Per Högselius, 2013, p. 5) by offering an economically competitive and increasingly available source of energy[20]. EEC natural gas consumption climbed to 200 mtoe by 1985[21] from 144 mtoe in 1974 (BP, 2019b). This reflected a growth of 39% during the elapsed eleven years—a 4% average yearly increase—far outpacing

[19] Council Directive 75/716/EEC, 24.11.1975.
[20] "Whereas, for example, in 1970 imported oil was cheaper than imported gas and coal in Western Europe by 13 and 80 percent, in 1980 oil was more expensive by 35 and 147 percent respectively" (Hoffman and Dienes, 1985, p. 6).
[21] Figures do not include Greece, which joined the EEC in 1981.

oil's and coal's contraction of 2% and 1.2% average per annum, respectively[22]. Natural gas' relative share in EEC and CMEA countries' fuel mixes grew from 1974's 14.3% and 13.8% to 17.8% and 17.4% by 1982, respectively (Hoffman and Dienes, 1985). European consumers developed an appetite for natural gas, as it offered an alternative to European oil imports and it "increasingly [was] linked with its favorable environmental characteristics" (P. Högselius, 2013, p. 195) in policy and common discourse. It became an integral component of the EU's hydrocarbon economy.

The fuel's momentum continued in the 1980s and the narrative the Commission paired with it was overwhelmingly positive. In 1981, it suggested that "[t]he considerable existing infrastructure this network represents is one of the advantages of natural gas. It is also transported unobtrusively and is environmentally attractive because of its cleanliness during use. It is a flexible and convenient fuel to use which also helps to explain its popularity in the domestic sector and in certain specialised industrial uses"[23]. Policy discourse framed the fuel's role in a positive manner, while demand for it continued to rise leading to a growing natural gas sector as well (P. Högselius, 2013; Gustafson, 2020). Increasing demand was paired with an infrastructure build-out undertaken by Russian and European industry actors. Projects included the *Siyanie severa* [Northern Light] (1969-1985), Soyuz (1978), *Bratstvo* [Brotherhood] (1984), and Yamal-Europe (1983) pipelines (P. Högselius, 2013; Vermaat, 2015). In addition, the first phase of the Trans-Mediterranean Pipeline was also completed in 1984, allowing Italy to import natural gas from Algeria (Hayes, 2004). Soviet imports alone increased from 3.4 bcm in 1970 to 26 bcm

[22] This was partially due to the lacklustre economic performance of EEC members weighing on their overall energy consumption during this period (IMF, 2019).
[23] COM (81) 540 final, 02.10.1981, p. 8.

by 1980, and they continued to rise to 109 bcm by 1990 (Stern, 2004), while total demand climbed from 225 bcm to 291 bcm between 1980–1990 (BP, 2019b).

The role of natural gas expanded in the 1970s and 1980s, but the 1990s was when the fuel's role became comparable to coal's or oil's in the EU. Its role increased from 16.8% of total energy supply in 1990 to 21.4% by 2003 (BP, 2019b)—prior to the Eastern Enlargement of the EU. Its growth was underpinned by a favourable environmental perception, which the Commission consolidated in its policy discourse during the 1980s[24]. The dominant narrative was that natural gas is *clean*; however, the main factor driving the sector's growth was governments' and the Commission's drive to liberalise natural gas markets (Stern, 1998; Winskel, 2002). This originated from the UK, but seeing that success and the influence of neoliberal policies the Commission soon led a similar venture (Gustafson, 2020). With this, the EU not only supported the uptake of the fuel by constructing an expansive infrastructure network, but it also developed a politico-legal framework that enabled its trade. Between the onset of natural gas' consumption and the early-2000s, the sector—supported by policy and regulations—grew from providing a marginal source of energy to become a key pillar of the energy system.

4.3 Natural gas is a convenient, but emitting energy carrier

Natural gas is a gaseous, relatively homogenous energy carrier that is overwhelmingly composed of methane (CH_4) (Smil, 2015). It has a low volumetric energy density (0.036 MJ/l) when compared to oil (37 MJ/l) and coal (34–43 MJ/l), due to its gaseousness. However, its net calorific value per mass is a relatively high 48 TJ/tonne[25] compared to crude oil (42.3 TJ/tonne)

[24] COM (81) 540 final, 02.10.1981; COM/1982/0653 final, 15.10.1982; and COM (86) 518 final, 11.12.1986.

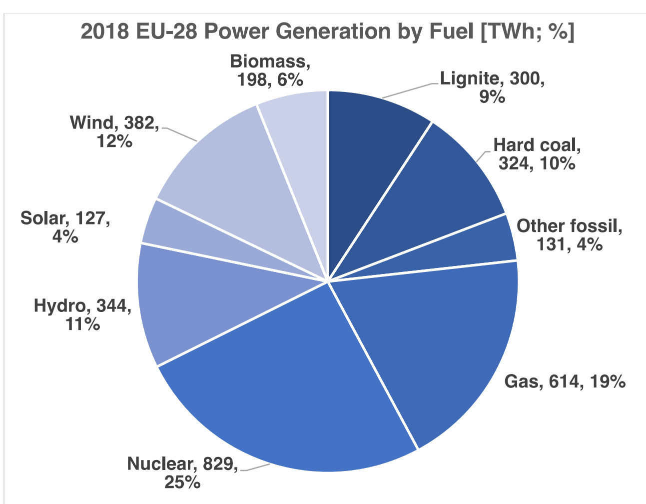
[25] Energy density varies based on where the fuel is produced, leading to variants such as low calorific natural gas (L-gas) in the Netherlands or high calorific gas (H-gas) in Russia. The energy density of natural gas varies based on the region of production, and can range from 33.3 MJ/m^3 (Dutch Groningen field) to 42 MJ/m^3 (Algerian Hasi R'Mel field).

or hard coal (26.7 TJ/tonne) (IPCC, 2006). Natural gas is an infrastructure-intensive source of energy, given the need to construct capital-intensive pipelines or establish LNG infrastructure systems—composed of liquefaction and regasification plants as well as LNG carriers—to connect production wells with end-users. The “types of energy characterized by being both high volume but low value per volume and gaseous in form (e.g., natural gas) tend to have high transportation and storage infrastructure costs relative to the value of the goods making them especially prone to risks related to stranded assets and sunk costs” (Balmaceda, 2021, p. 70). Thus, the natural gas sector has a stranded asset issue if the infrastructures it constructs are not utilised until the end of their economic life (as presumed when investors took the investment decision) (IEA, 2013).

Once a piece of infrastructure is constructed, owners tend to argue that these should be used until the end of their technical life so they can capitalise on their investment and avoid economic inefficiencies. This underscores the general arguments that stranded assets should be avoided to enable a cost-efficient energy transition (Mercure *et al.*, 2018; Ingwersen, 2021). The lifetimes of natural gas infrastructures, pipeline systems in particularly, can reach a lengthy 30–50 years (IEA, 2011a). Although, even these can be surpassed or extended. For instance, the Ukrainian natural gas transit infrastructure—delivering supplies from Russia through Ukraine to Europe—has been in operation since the 1970s–1980s (40+ years), despite a lifetime expectance of 33 years at the time of its construction (Gnedina and Emerson, 2009). It may be in need of refurbishments (Deák, 2012)., but it is still up and running. Thus, natural gas is especially prone to perpetuating a carbon lock-in, given the long economic and technical lifetimes of infrastructure that composes its value chain (Balmaceda, 2021; Brauers, Braunger and Jewell, 2021).

Natural gas’ physical properties make it an ideal fuel for a number of applications. The EU-27 (excluding the UK) consumed 13.6 exajoules (EJ) of natural gas in 2018, most of which it used for transformation input (i.e. electricity generation and heat production) (29.4%), industry (23.2%), households (24.3%), as well as commercial and public services (12.3%) (Eurostat, 2020). It has especially been an important source of energy to generate electricity, provided that 19% (614 TWh) of the EU-28's 2018 power generation was based on natural gas (see figure 1). The popularity of electricity generating gas turbines in the sector stems from both their high thermal efficiency rates and relatively flexible output. There are two main types of natural gas power plants: open cycle gas turbines (OCGT) and combined cycle gas turbines (CCGT). OCGTs can ramp up electricity generation from zero relatively quickly (so-called black start) without the process damaging the plant (unlike coal plants, for instance). CCGTs are flexible to increase and decrease output when already running, but their black starts can be more challenging. The flexibility of these power plants is why the electricity industry sees natural gas as an important source fuel that can help meet peak demand, given that coal and nuclear are substantially less flexible. This is an especially valued quality in the context of the energy transition, where there is a rising need to balance the intermittent generation of renewables.

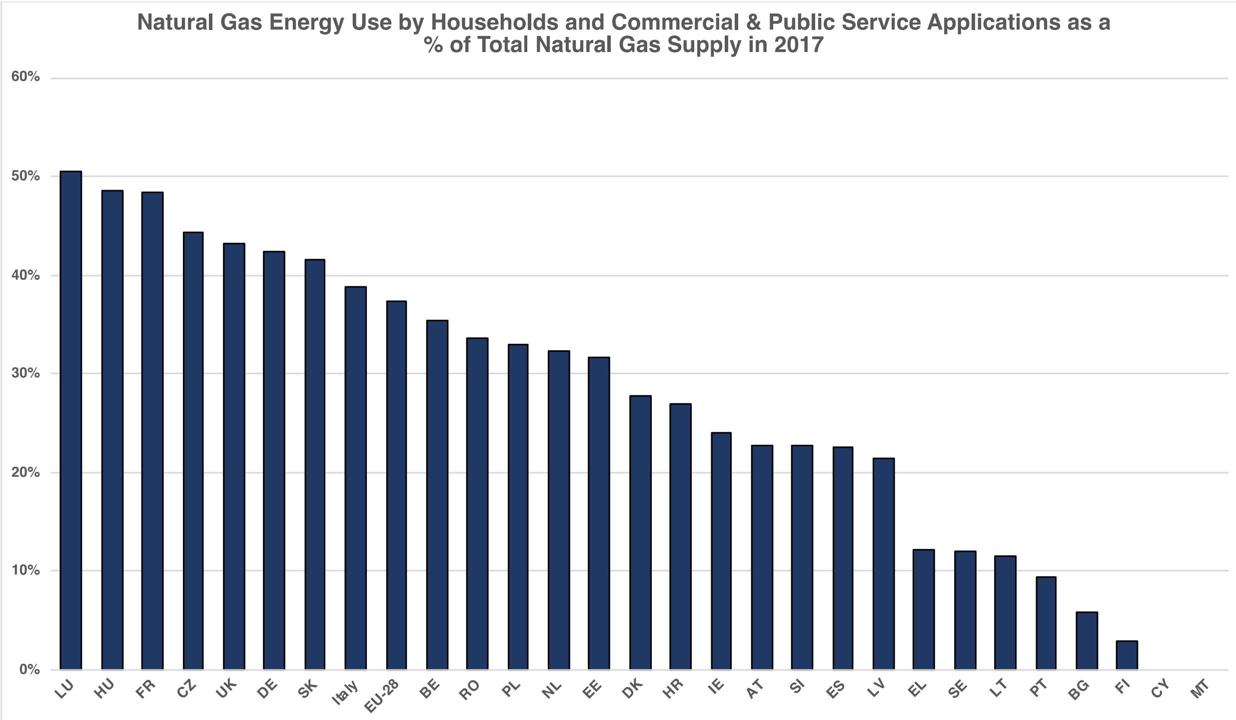
Figure 4.2: EU-28 Power Generation by Fuel



Source: (Agora Energiewende and Sandbag, 2019)

Natural gas is also a convenient fuel for heat production, leading households and other buildings to widely adopt natural gas-based heating systems throughout the EU (Smil, 2015; Bradshaw and Boersma, 2020). This is predicated on the buildout of an expansive transit and distribution network as well as end-users installing the appliances that allow for the combustion of the fuel (e.g. boilers or furnaces). Access ranges from cases like the Hungarian or the Dutch, where 90%+ of settlements are connected to the grid, to countries like Finland, where infrastructure for the fuel's consumption remains negligible (CEER, 2018a; KSH, 2020). In-turn, this shapes the natural gas-intensity of respective countries (see figure 2). The capital intensity of these infrastructure system leads transmission system operators (TSO), distribution system operators (DSO), and consumers to take decisions that shape their energy consumption practices for years to come. The industrial sector also uses natural gas for both energy and non-energy applications. Energy-related applications pertain to the production of hot water and steam generation as well as providing direct heat for preheating, melting, or materials and dehumidification (Smil, 2015). These domains of natural gas consumption are difficult to substitute in an economically feasible manner, since electricity-based alternatives are costly. Substituting methane in non-energy applications may be even more challenging, given that it is a feedstock for industrial processes (e.g. fertiliser production or hydrogen production in oil refining).

Figure 4.3: EU natural gas use



Source: (Eurostat, 2017)

Natural gas is widely regarded for its favourable environmental qualities, simply put "it burns cleanly" (Gustafson, 2020, p. 29) and effectively only emits carbon-dioxide. To achieve this, processing facilities strip sulphur and nitrogen compounds after producers extract it to inhibit the risk of SO_2 or NOx emissions that can otherwise induce acid rains (US EPA, 2019). The EEA (2020) suggests that the EU's switch to natural gas helped reduce SOx and NOx emissions between 1990–2018. In addition, it yields lower particulate matter emissions than other fossil fuels (US EPA, 2008), which played an especially prominent role in the UK's shift to natural gas following the Great Smog (see above). Its environmental appeal thus stems from its ability to burn cleanly in contrast to other fossil fuels, supporting its uptake during the 20th century.

Natural gas' carbon-dioxide emissions upon combustion are also low when compared to oil or coal. Its default carbon content is 15.3 kg/GJ, while this is 26.8 kg/GJ in the case of hard coal or 20.0 kg/GJ for crude oil, so as a rule of thumb the carbon content of coal, oil, and natural gas is

5:4:3 (IPCC, 2006). The effective CO_2 factor shows an even larger difference at a ratio of 2:3:4 for natural gas, oil, and coal, respectively. Thus, the CO_2 emissions of natural gas can be half that of coal's. The issue is that climate change is not only induced by carbon-dioxide, but a group of greenhouse gases, including methane (the prime component of natural gas). And, "[m]ethane emissions also constitute a problem" (EU_Ind_1) in addressing climate change. This was noted by nine experts and has been widely acknowledged in the literature (Smil, 2015; Stern, 2020), but has only recently become a topic of discussion amongst policy-makers (see subsequent chapters). Methane slips into the atmosphere along the natural gas value chain and, because it is 86-times more potent during a twenty year timespan, its climate impact is worrying (IPCC, 2018).

Methane emissions increased as global oil and natural gas production expanded. Total atmospheric methane levels are disputed, but experts have generally observed increasing concentrations (Nisbet *et al.*, 2016; Turner *et al.*, 2017). The causes of the rise are still contested and seem to be linked to a number of factors, but scholars argue that there is a strong link between heightened natural gas output and rising methane levels (Hausmann, Sussmann and Smale, 2016; Alvarez *et al.*, 2018; IEA, 2018b). Generally speaking, if methane slips amount to more than approximately 2% of production, natural gas is a greater contributor to climate change than coal, which undermines the popular argument that natural gas is a relatively climate-friendly source of energy (Howarth, 2014). Scholars are still exploring the precise dynamics and implications of methane emissions and natural gas production, but the high potency of methane has led many to question whether it is indeed a less emission-intensive source of energy (Vorgang *et al.*, 2009; Stephenson, Doukas and Shaw, 2012; Abrahams *et al.*, 2015; Anderson, Salo and Fridell, 2015; Kawa, 2015; Bledsoe, 2018; Jacobson, 2019).

Oil and gas producers have begun to address methane emissions, but the effect of these endeavours are still contested. A Commission expert remarked that Russian Gazprom, despite signing the Guiding Principles on Reducing Methane Emissions across the Natural Gas Value Chain[26], "[w]on't care about EU's rules and regulations. The methane leakage numbers are a case in point, where the company reported a 90% improvement year-on-year in 2018, by changing calculations coefficients and not changing a single thing in the material configurations" (COM_5). Other interviewees were more optimistic that the companies will fall in-line with more stringent requirements (D_Gov_2), but this also requires the continued and clear leadership of the Commission (COM_1; EU_Ind_3) and member states. Experts have meanwhile begun to estimate *inter alia* Gazprom's methane emissions to be as high as 5%–7% of output (Piebalgs and Olczak, 2019), while Gazprom has claimed that these figures are as low as 0.34% (Romanov, 2020). Efficiency and technology may continue to improve these figures, but the validity of data continues to pose a problem which also inhibits natural gas' ability to play the role of a transition fuel (Stephenson, Doukas and Shaw, 2012; Stern, 2020).

An interviewee summed up the natural gas industry's relation to emissions when suggesting that "natural gas is still deemed the cleanest [fossil fuel], but […] we need to continue to monitor methane; while NOx and SOx have been reduced with it significantly. Nonetheless, the industry has done a masterful job at instating and consolidating this [cleanest fossil fuel] discourse" (G_Fi_1). These remarks point to the ability of the natural gas industry to push for the consolidation of a discourse in which natural gas' favourable qualities overshadow the negative implications of its consumption—subsequent chapters will explore this in detail. Its combustion

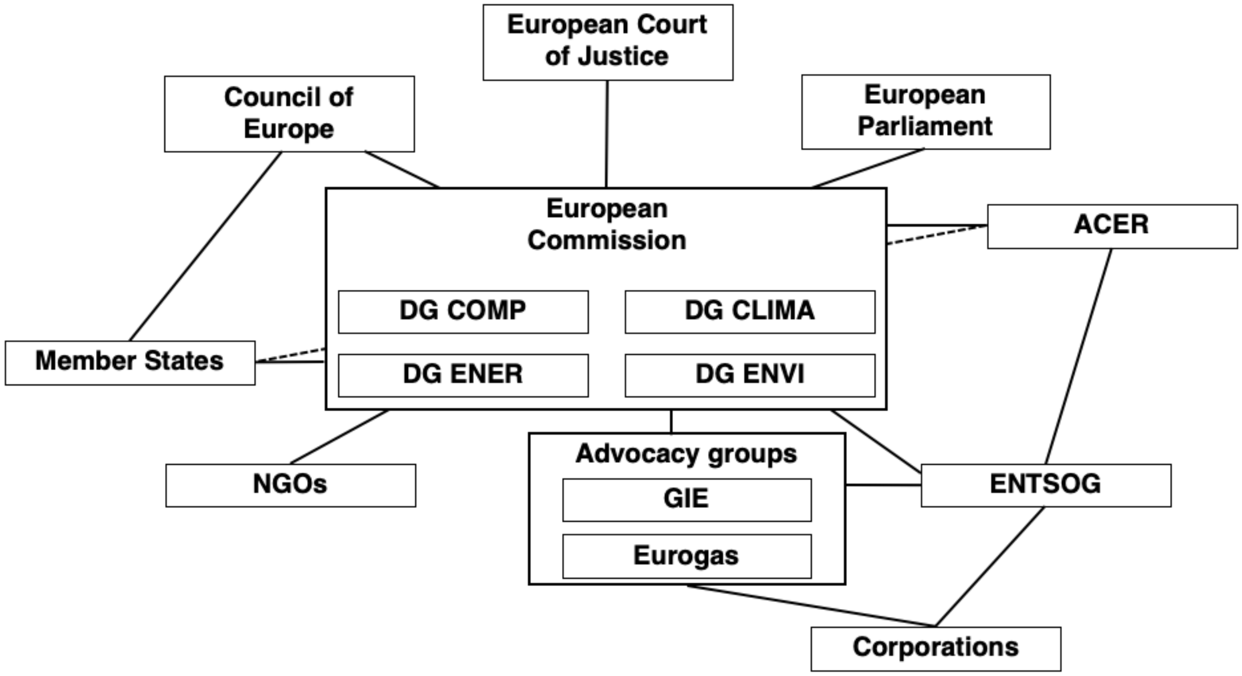
[26] This is an agreement initially signed by eight oil and gas majors in 2017 to reflect their commitment to reduce "reduce methane emissions […] advance strong performance across gas value chains […] improve accuracy of methane emissions data […] advocate sound policies and regulations on methane emissions […] and increase transparency" (CCAC, 2017). Gazprom joined the coalition in 2018 (Gazprom, 2018b).

offers clear benefits in terms of various emissions and particulate matter, but methane leaks and the fact that it is a non-renewable emitting source of energy undermines its climate- and environmental-compatibility even if, as this dissertation argues, the policy discourse emphasising that it is a transition fuel masks these caveats.

4.4 Actors governing the intersection of climate and natural gas policy

A number of actors participate in the governance of the EU's natural gas market and thereby shape the Commission's positions and policies (see figure 4.1). Based on my empirical research and literature review, the following section introduces the Commission, which is the EU's arm responsible for proposing policy. It briefly looks at its role in climate and natural gas policies. Then, it turns to discusses the role of industry associations and private corporations, as well as their roles in EU governance. They have been essential in consolidating a natural gas regime as well as establishing a loosely knit political faction that is heavily supportive towards the continued consumption of natural gas. Thereby, discussing these actors' positions and their role in EU natural gas and climate policy-making is central to exploring why the Commission took certain policy positions at the intersections of these two domains. The *greening institutionalism framework* (see chapter 2) suggests that they play a focal role in perpetuating path dependencies, which this section and subsequent chapters explore in detail.

Figure 4.4: Actors involved in shaping the EU's natural gas and climate policy



Source: Author's compilation

4.4.1 The Commission

The Commission is the EU's policy-making body. Effectively all interviewees underscored its central role in developing natural gas and climate policy, which then shapes laws, regulations, and guidelines both at the EU and national levels. It proposes the policy that is the basis of the EU's single market, but, given its role in regulating the market an expert from an international natural gas firm simply said that it has become the "*de facto* regulator" (EU_Ind_4). This has been reflected in the literature as well, where scholars have hypothesised that the EU has developed into a regulatory state at the core of which is the Commission's ability to propose policy and regulations (Andersen, Goldthau and Sitter, 2016). In contrast, interviewees scarcely spoke about other EU institutions, such as the Council of Europe, the European Parliament, or the European Court of Justice. This is not to say that they are unimportant (Szulecki and Claes, 2019; Bocquillon and Maltby, 2020), but interviewee consensus suggested that "natural gas' role [is] heavily dependent on the Commission's positions" (EU_Ex_4). This is especially true in relation to the natural gas–climate policy nexus, given its central role in developing climate policy as well (see chapter six).

Interviewees described the Commission's role in policy-making as the result of two intertwined dynamics: a push to "grab power" (EU_Ind_4) and the need to coordinate supranational energy policy (Barnes, 2011; Glachant, Hallack and Vazquez, 2013; Maltby, 2013). An EU policy-maker described this as "they [those working within the Commission] have a pretty strong self-consciousness, which is not necessarily integrationist, so there is a self-interest. Sometimes integrationist, sometimes self-interest—how do we benefit the most [people]?—they essentially move between these two forces" (COM_6). Government representatives and company executives underscored the Commission's "power grab" (EU_Ind_4), since it has acquired some powers of member states (HU_Ind_2, PL_Ind_1; D_Gov_1). It is "much better equipped with the know-how and technical skills that it needs to govern according to its wants" (EU_Ex_4), granting it influence in developing governance regimes—a point confirmed by German, Hungarian, and Polish government officials (D_Gov_1; D_Gov_2; PL_Gov_1; PL_Gov_2; HU_Ex_1). EU policy-makers also suggested that there has been a shift in competences to the supranational level (EU_Ex_1; EU_Ex_4; COM_6), given the complexity and interconnectedness of markets (Glachant, Hallack and Vazquez, 2013; Klauser and Shavlak, 2017).

The Commission's policy positions are not homogenous and emerge following internal debates between DGs. Matlary (1997) shows that DGs had variegated roles and relative influence in shaping energy policy during the 1990s, but this continues to date as "[h]ierarchy and competition between DGs [sustain]" (US_Ind_1). DG Energy, DG Competition, DG Environment, DG Climate are key bodies within the Commission that govern the EU's energy and thereby natural gas markets. How their powers relate to one-another varies on a case-by-case basis, but "[DG] Comp is usually at the top of the hierarchy since it provides the legal tools to implement the political will that frequently cannot be achieved at the EU-level otherwise" (US_Ind_1). A key testament to this was the development of policy for the First Energy Package (Matlary, 1997), but has sustained since, leading a government official who participated in the liberalisation of the Polish market to remark that "the real power resides in DG Comp" (PL_Gov_3). This allocation of power is in-line with the general objectives, tools, and accomplishments of the Commission, which have emphasised the creation of a single competitive market (Glachant, Hallac and Vazquez, 2013; González-Díaz *et al.*, 2017).

DG Comp may provide the legal tools and the push to develop a single market, but DG Ener has been the driver of EU natural gas policy. In its approach, it "has always been supportive of natural gas […and] frequently praises the resource's importance" (NGO_Ex_1). It has been focused on developing a single market and ensuring secure supplies, which have regularly overshadowed climate-considerations (HU_An_1). These priorities can be traced in its policies as well (see chapter six), as it continuously sought to ensure: competitive, secure, and sustainable energy. The Third Energy Package directly takes note of this, calling for "a competitive, secure and environmentally sustainable internal market in natural gas" (European Commission, 2009, art. 3 and 40). This statement in itself is a contradiction, because a natural gas-based energy system is not sustainable per definition, but it aptly reflects the priorities of DG Energy in 2009, since its orientation had been to establish a competitive and secure market, while sustainability considerations were secondary.

DG Environment and DG Climate are relative newcomers to the governance of the EU's energy markets and had limited powers until recently, but had a clear orientation to fortify the environmental aspect of EU policy. DG Envi's competences stem from the Single European Act and generally remained marginal despite some growth in its influence (NO_Ex_1; Selin and VanDeveer, 2015). This pressured it to align objectives "with other goals of other DGs or national governments/agencies, otherwise it doesn't have the political power to execute its will" (US_A_1). In principle, this is true for all DGs, since they need to find support from other DGs for their policies to be introduced. However, DG Envi and DG Clima's influence was especially limited, leading them to make greater compromises than other, more influential DGs. This changed with the rise of the climate agenda: the Commission established DG Clima in 2010 and "under the Barroso Commission [between 2004–2014] […] climate change got up the agenda as the most important energy issue" (NO_Ex_1). Climate increased on the Commission's agenda as climate governance took form and became institutionalised, forcing DG Ener, DG Envi, and DG Clima to cooperate and pursue goals that were acceptable to all of them (NO_Ex_1). This aligned their agendas (PL_Ind_2) (Delbeke and Vis, 2015).

DG Envi and DG Clima conveyed a favourable stance towards natural gas. As noted by a policy-maker, "even in the previous Commission [the Barroso Commission, 2004–2014] the Climate DG remained quite rational, everyone thought in a way—decision-makers and influential people—everyone thought that gas should stay [in the energy mix]" (Com_4). This is the period when the Commission introduced a governance regime on the back of the 2020 targets, the EU ETS, long-term climate plans, and preparations for COP21 in Paris (see chapter six). Despite the emergence of a more robust climate agenda, natural gas had a favourable standing even with the environment-oriented DGs. The latter tended to focus on phasing out coal and other more polluting fossil fuels. DG Clima's favourable position on the matter has begun to change recently as "[c]limate policy didn't take natural gas into consideration [since] it was under the purview of

DG Ener, but DG Clima has strengthened, so it can push for reductions" (HU_An_1). Thus, natural gas was effectively outside the jurisdiction of the DG tasked to take climate action, while DG Energy, which was responsible to develop its markets reflected upon it as a resource for which it could establish a "environmentally sustainable internal market".

An influential institution closely linked to the Commission is the Agency for the Cooperation of Energy Regulators (ACER). Its "role is crucial for projects creating an Energy Union" (Maher and Stefan, 2019, p. 87), because "[i]t can issue recommendations and opinions (non-binding soft laws that are influential)" (ibid.). The Commission established ACER to support the harmonisation of network codes that allow for the functioning of a single market. With this it has taken on an increasingly influential role in technical questions, while avoiding to have to take a position in socially or politically charged issues (LaBelle, 2017). An expert at ACER remarked that "[t]he Council provides the political direction. When taking decisions over technical matters, the Council effectively approves the directives proposed by the Commission" (COM_6) based on the recommendations of ACER. Its focal role hinges on the "complex" (Groenleer, 2016; Maher and Stefan, 2019) nature of the EU's energy system, where many national government and regulatory officials do not have the competencies to take decisions (EU_Ind_4). A German government official remarked that "ACER [actions for] grabbing power is clear" (D_Gov_1), but the need for supranational governance and expertise is also evident given the rising Europeanisation and complexity of the EU's natural gas market.

4.4.2 Industry associations and corporations

A second group of prominent actors in EU natural gas policy-making are industry associations. Most prominently the European Network of Transmission System Operators for Gas (ENTSOG) has become central in developing the EU's natural gas markets by proposing network codes

(ACER, 2021b). It is an organisation the Commission (2009) established with the Third Energy Package "to facilitate and enhance cooperation between national gas transmission system operators (TSOs) across Europe, to ensure the development of a pan-European transmission system in line with European Union energy goals" (ENTSOG, 2020, n.p.). It proposes regulations, codes, and guidelines to develop and refine the operation of the single market through which it has taken on an increasingly influential role in shaping the structure of the EU's natural gas market and the fuel's future (COM_6; EU_Ind_3) (Szabo and Fabok, 2020).

An expert well-versed in ENTSOG's operations noted that it is "not a lobby" (EU_Ex_1), but it certainly behaves similarly to one. It cannot directly push for policy to support the uptake of natural gas, but its stakeholders are incumbent TSOs that all have an interest in maintaining the EU's natural gas grid and the consumption of gas that underpins the rationale of operating a grid. ENTSOG also designs network codes and guidelines that allow for a more efficiently functioning market, which increases the competitiveness of natural gas vis-à-vis alternative fuels. A Commission official acknowledged the bias towards gas baked into governance when stating that "ENTSOG should provide technical guidance for the Commission and should not lobby, although in reality [it] is geared to develop the gas market" (COM_1). This was confirmed by another policy-maker (COM_2). Others reiterated this point in various forms as well (UK_Ex_1; G_Ex_2) and noted that that ENTSOG and TSOs are a very powerful group in the EU, given their role in developing the market and control of a vast infrastructure system traversing the continent (Stern, 2019).

Industry actors and associations are embedded in EU natural gas policy-making (Klauser and Shavlak, 2017; Maher and Stefan, 2019). A Commission Officer remarked that "[p]olicy-making [is] dependent on a strong voice for TSOs, LNG, storage operators" (COM_2), which was corroborated by another expert from the Commission, noting that “DG Ener’s ideas and policy heavily rely on the input and studies commissioned, by them and other associations, including lobby groups” (COM_1). This has also been recognised by industry association experts, who claimed that “[t]hrough these [studies and meetings] ENTSOG is being heard” (EU_Ex_1), “[c]ommon positions [of the industry] can be pushed [to shape policy]” (EU_Ex_4), and publicly by leaders from within the Commission (Borchardt, 2019, 2020). The influence of the natural gas lobby groups—most prominently Eurogas—has been limited until recently compared to coal’s or electricity’s (COM_6), since natural gas was a non-issue, but also because stakeholders of these groups frequently had interests in other fields of energy (US_Ind_1). For example, Eurogas had stakeholders with investments in the coal industry as well, which curbed the group’s ability to lobby for coal-to-gas switching (US_Ind_1). Nonetheless, lobby watchdog, Corporate Europe Observatory, has also highlighted that incumbents have invested vast capital into lobbying directly or through industry associations (CEO, 2017).

The European natural gas industry has not formed a single monolithic bloc with aligned interests; instead, it has been a “fragmented community” (UK_A_1). This may have not been articulated by all interviewees explicitly, but most of them described European natural gas market actors as an atomised group of entities—chapter five will show this in greater depth and argue that its fragmentation has declined over time. There has historically been a strong divide between upstream, midstream, and downstream actors, within which there are further diverging interests (Stern, 2017b). Upstream actors produce and sell their natural gas, majors—such as Gazprom, Equinor, Royal Dutch Shell, etc. —have a deep interest in maintaining the role of natural gas in the EU’s energy mix, which they have balanced with some diversification attempts in their portfolios, by including renewables or seeking alternative markets (e.g. via new pipelines or LNG terminals). Midstream actors control infrastructure and focus on capitalising on transit fees that ships gas between countries, similarly to downstream actors which are involved in the final sales of natural gas and profiting from the distribution network they own. Midstream and downstream actors are more limited in their ability to pursue alternative export markets in contrast to upstream actors, but, in-principle, they can also transit and distribute gases other than natural gas, such as biomethane or hydrogen—albeit, such experiments remain in their infancy (chapter seven).

Interests are further divided within sub-sectors. Consider Gazprom and Equinor. Their impact is strongly felt on the EU-level with an industry expert noting that "Gazprom interests have generally been taken into account by the EC [European Commission]" (EU_Ind_3), even though the Commission—and the EU more broadly—has invested substantial political capital to curtail the influence of Gazprom (Overland, 2017). Interviewees also understood Equinor to have a close working relation with the Commission on a number of projects directly related to natural gas, hydrogen, or CCS (COM_3; COM_4; EU_Ind_1; EU_Ind_2)—e.g. H21, H-vision, Magnum, and the Net Zero UK partnership (European Commission, 2017b; Equinor, 2020b)—which underpin the firms' ability to influence the policy-making process. Thus, they are not only the largest, but also the most influential upstream actors in the EU. However, their roles and strategies have heavily varied based on ownership structures and geopolitics.

Gazprom is frequently considered an arm of the Kremlin, a political economic tool that leads to the boundaries between political and economic objectives becoming obscured (Balmaceda, 2013; Overland, 2017). This was demonstrated during the 2006 and 2009 gas crises, when the Kremlin used Gazprom to coerce Ukraine to take political decisions favourable to Russian strategic interests. Meanwhile, Norwegian Equinor may also be predominantly state-owned, but the closer geopolitical alignment of Norway and the EU have led to substantially less geopolitical confrontation that influenced corporate objectives in an adverse manner (Waerness, Gjeset and Syversen, 2017). Thus, ownership structures, geopolitics, market and strategic objectives, economics of production, and a plethora of other factors all shape the respective positions of natural gas companies involved in sectoral governance, which have all splintered the natural gas industry and led to actors forming misaligned interests (UK_Ex_1). While these are important considerations, this dissertation is primarily occupied with broad, EU-level institutional change and discourses. By focusing on factors of change directly related to the Commission's climate agenda, its scope to explore these diverging interests and their root causes remains limited.

4.4.3 NGOs

Interviewee positions on the influence of NGOs in governing natural gas governance varied. According to a Polish industry executive who had been involved with EU policy-making, "NGOs punch above their weight" (PL_Ind_1) given their ability to gather public support and because in his reading they have "valid" agendas. What he could have meant by this is that they stand for legitimate decarbonisation and environmental goals that increase the well-being of the population, but these may not be achievable within the confines of the current socio-ecological system. Greenwood (2018) shows that EU-level NGOs have been key in conveying messages between civil society and policy-makers, but their influence has limitations. An expert at an NGO noted that "NGOs have no seat at the table" (NGO_1) and that their "objections [with regards to natural gas were] noted, but not necessarily agreed upon", or as noted by an industry executive "NGOs talked, but the industry was slow to react" (EU_Ex_1). NGOs facilitate change, but their impact is limited, which is worsened by their exclusion from decision-making platforms, such as the Madrid or the Copenhagen forums (EU_Ex_1) (European Commission, 2018a), as subsequent chapters will explore in greater detail.

4.4.4 Member states

Despite the rising influence of supranational institutions, many EU-level and national policy-makers I interviewed underscored the influential role member states continue to play. As succinctly noted by a Norwegian expert surveying events from an external standpoint: “at the end the member states make a legislation” (NO_Ex_1) (Eikeland and Skjaerseth, 2016). This was reiterated in some shape or form by multiple interviewees, including a German government official highlighting that “member states’ consent remains crucial with qualified majority or unanimity determining most outcomes” (D_Gov_1). And, indeed, the Council of Europe remains vital in both setting the political direction of action and ultimately approving the Commission’s proposals (Ringel and Knodt, 2018; Lindberg, Markard and Andersen, 2019). It seems that there is “no readiness from member states to surrender powers to the EC [European Commission]” (EU_Ind_1). This is not only acknowledged by those working outside the bubble of EU bodies, but those inside as well, as a policy-maker noted that “the real competencies and hence the decision of the fuel’s role remain in the hands of member states” (COM_1)—also see (Lindberg, Markard and Andersen, 2019; Bocquillon and Maltby, 2020). Member states play an influential role in the governance of the EU’s energy and climate policy, but this dissertation does not explore their role at depth. Hence, the limited focus on these actors in this section as well.

4.5 Conclusion

This chapter introduced the environmental characteristics of natural gas and explored how these related to its historically uptake. It showed that natural gas is the least emitting fossil fuel upon combustion, but it is non-renewable and the methane from which it is composed is a potent greenhouse gas emission that exacerbates climate change by leaking into the atmosphere throughout its supply chain. Nonetheless, its materiality was an influential factor in shaping its role in the European energy system and its low SOx, NOx, particulate matter, and CO_2 emissions led to the formation of a favourable common discourse that also materialised in policy language. This framed the fuel as "clean" or "sustainable", which became especially pronounced when compared to other fossil fuels. Consumption practices institutionalised alongside a common, favourable discourse pertinent to the fuel, as consumers increased their consumption of natural gas, producers expanded their output, and infrastructure links were added. EU member states and the Commission introduce a policy and regulatory framework, leading the governance of the sector to become reliant on the technical expertise of those within it. A natural gas regime took shape.

The Commission supported the uptake of natural gas with its policies, streamlining its consumption. It reproduced carbon relations by introducing measures that perpetuated demand for the fuel, which was partially predicated on the general supply and demand, but also the widely accepted positive discourse surrounding it and the gradual involvement of industry interests in the governance of the sector. The latter allowed for the institutionalisation of policy-making processes that relied on a complex sectoral governance reliant on sectoral interests' knowledge. During this period, as suggest by the greening institutionalism framework (see chapter two, figure 2.4), the Commission did not introduce effective climate policy and it also presumed that natural gas was compatible with its climate objectives given its low emissions upon combustion. There was little force to alter institutionalised practices, actions it took only further entrenched the consumption of the fuel fortifying a carbon institution. This chapter only provided a brief introduction to allow for the reader to see the basis of a carbon institution, from which subsequent chapters will explore how the Commission changed its behaviour. With time it came to lead an increasingly ambitious climate agenda and forced change upon natural gas interests, but this is the point of departure for it greening into a post-carbon institution.

5 Climate considerations in the European Commission's natural gas policy

5.1 Introduction

The Commission reshaped the EU's natural gas markets in the past three decades. It introduced pivotal policy packages to support an efficient, secure, and competitive market. This chapter explores how climate considerations are reflected in its interventions by answering the research sub-question *how does the Commission address climate change in its natural gas policy?* The question is prompted by a contradiction in the Commission's behaviour: it supported the expansion of natural gas markets, which deepened the fossil fuel reliance of the EU, even though, it pursued increasingly ambitious climate policies from 1992 onwards. In the following, I show that the Commission reconciled natural gas and climate policy by accepting and reproducing a discourse that natural gas *will be* the transition fuel. This was a part of a narrative that underscored the need for a natural gas-intensive energy transition, which was broadly supported by the energy industry and other actors involved in the governance of the EU's natural gas markets. The rising influence of climate policy shifted the Commission's position: as climate considerations became more influential in energy policy, it withdrew its support for natural gas and began to explore how to phase the fuel out of the EU's energy mix.

This dissertation explores how political institutions change in response to climate action. To this end, it uses the greening institutionalism analytical framework introduced in chapter two to theorise how such change emerges. This chapter turns to analyse how, with time, the Commission shifted from supporting a fossil fuel regime to dismantling it. Initially, natural gas policy did not contradict climate ambitions, because the fuel was widely understood to be the transition fuel, making it climate-compatible (Stern, 2019; Delborne *et al.*, 2020; Szabo, 2020b).

Accordingly, respective governance focused on developing a single competitive market and ensuring secure supplies (Glachant, Hallack and Vazquez, 2013; Gustafson, 2020). The Commission reproduced fossil fuel-based relations and path dependencies, which impeded its ability to radically break with consumption practices (Unruh, 2000; Johnstone and Newell, 2018; Rosenbloom, Meadowcroft and Cashore, 2019). Policy language reflected this orientation and reproduced the dominant transition fuel discourse (Hajer, 1995). The rising influence of climate policy spurred institutional change as the narrative supportive of a natural gas-intensive energy transition came to be questioned by a number of actors, including the Commission. Thus, the Commission gradually evolved from reproducing fossil fuel based consumption practices to become a post-carbon institution (LaBelle, 2012)—it *greened* its policies.

This chapter explores how the Commission's natural gas policies reflect climate-related considerations during the dissertation's period of inquiry between 1992–2018. It is the first analytical chapter of the three that constitute the core of the dissertation. It uses the analytical framework introduced in chapter two to analyse the selected case and explore how climate considerations are reflected in the Commission's natural gas policy. In this sense, it mirrors chapter six, which will explore how natural gas is reflected in the Commission's climate policy. This chapter builds on the background discussion in chapter four, which introduced how a natural gas regime formed in the EU and who its key actors are, but moves beyond this by showing how the role the Commission assigned to the fuel changed over time. Through this, it contributes to the discussion on the dissertations empirical and theoretical contributions drawn in chapter eight.

This chapter is structured as follows, after this introduction, it discusses how a transition fuel discourse emerged and shaped the Commission's policies, while section 5.3 shows that actors adapted this discourse as the prominence of renewables increased. Section 5.4 explores how those involved with the governance of natural gas responded to the EU's initial climate ambitions in the 2000s and early-2010s. Section 5.5 argues that the Clean Energy Package brought a turning point in the Commission's behaviour, when it shifted its focus to renewables and clearly signalled the withdrawal of its support for fossil fuels. This is followed by a discussion on how the natural gas industry responded in section 5.6, before the chapter draws conclusions.

5.2 The transition fuel discourse

Natural gas' *bridge fuel*[27] and *transition fuel* discourses originated in the mid-1990s (Delborne *et al.*, 2020). Scholars proposed that natural gas could help transition coal and oil-reliant societies to renewable-based ones without substantially disrupting energy consumption patterns (Nakićenović, 1993, 1994), in response to rising concerns over climate change (Paterson and Grubb, 1992; Buchan, 2009). The IPCC's (1990b, 1995) first and second assessment reports also supported this position, underpinning the scientific consensus that natural gas could play the role of a bridge in the energy transition from a carbon-intensive to low carbon energy system. A scholar working on environmental policy issues remarked that "[n]atural gas as a transition fuel shares multiple similarities with other 'greenwashed'[28] environmental discourses […] It too originated from an academic institution, which has been a frequent phenomenon, but it has been pushed by powerful actors along the way" (US_A_1). Indeed, the transition fuel narrative originates from scientists, but as this chapter will explore was gradually adapted and institutionalised by a number of actors, including the Commission.

[27] Note that leaders in the Soviet Union had already used the term *bridging fuel* for natural gas, since they considered it as the fuel „carrying the Soviet economy from the era of oil toward the coal-and-nuclear future of the next century" (Gustafson, 2014, p. 137).
[28] For a discussion on 'greenwashing' see (Lippert, 2011).

Chapter four introduced the two main dynamics shaping the intersection of energy and climate policy in the EU during the 1990s: a boom in natural gas demand and the launch of a climate agenda. EU natural gas demand grew dynamically in the 1980s, which further accelerated in the 1990s with the liberalisation of respective markets. The UK was the first to liberalise its market, but seeing the success of these measures (D_A_1) and EU institution's push to develop a single competitive market, other countries followed suit (Gustafson, 2020). The Commission developed policy that allowed consumers to burn natural gas for electricity generation[29] and it devised a framework for an internal energy market and a common energy policy[30], culminating in the First Energy Package[31] (Matlary, 1997). "[T]he first IEM [internal energy market] initiatives, […] merely focused on liberalisation and competitiveness, and not on environmental protection" (Fiedler, 2015, p. 5). Despite some environmental benefits to burning natural gas, an interviewed scholar remarked that "I don't think at that time that was explicitly an environmental policy" (UK_A_1) when discussing the UK's case. The same applies for EU policy, where "the establishment of a competitive natural gas market" (European Commission, 1998) was at the heart of the natural gas directive. Climate considerations were still marginal, even if the reduction in air pollution "was a benefit" (UK_A_1).

Despite the limited weight of environmental and climate considerations in energy policy-making, the Commission underscored the relative benefits natural gas offered. For instance, it emphasised the "economic and environmental advantages of natural gas"[32] during the development of the First Energy Package. It discursively distinguish natural gas from other fossil fuels from a

[29] COM(95) 478 final, 18.10.1995.
[30] COM(94) 659 final, 11.1.1995 and (European Commission, 1995).
[31] Directive 98/30/EC, 22.06.1998.
[32] COM(95) 478 final, 18.10.1995, p. 13.

climate standpoint. The interview data I collected supports this as well. When analysing how interviewees "framed natural gas" (see table 5.1), I categorised how they discussed natural gas in relation to other fossil fuels. Broadly speaking, three groups emerged: "natural gas is one of the fossil fuels", "it is the cleanest fossil fuel", and "it is the fossil fuel that still has to be addressed". The first category suggests that it was "lumped" or "boxed" with other fossil fuels. This was quite scarce, since the physical qualities of the fuel led many to differentiate it from coal or oil—Balmaceda (2018, 2021) also explores this in depth. One expert working in the sector noted "natural gas industry got boxed in by NGOs and utilities as a fossil fuel" (EU_Ind_1), which may reflect that fossil fuels were targeted by NGOs in general, but, in practice, NGO experts (NGO_1; NGO_2) suggested that they had payed limited attention to natural gas specifically, since most of their efforts were dedicated to phasing out coal—campaigns, such as Greenpeace's, tend to reflect this orientation.

Nine interviewees suggested that natural gas was differentiated from other fossil fuels based on its environmental characteristics. These positions indicate that it is the "cleaner" (EU_Ex_4) source of energy or, in its extreme, it was not considered a polluting fossil fuel, but something relatively green (UK_Ex_1). This false per definition, but reflects the common perception of the fuel. The third way in which interviewees framed natural gas was by suggesting that it was an issue that would have to be addressed. The low carbon-dioxide-intensity of natural gas upon combustion and other low emissions was reflected in the way key actors, including the Commission, distinguished it from other fossil fuels according to their view. According to this cluster, policy would have to address this "question" which became a part of the "problem" that decarbonisation posed. This suggests that the position of those governing EU's energy transition are shifting their stance on natural gas. The general positive framing in which it is seen as the "cleanest" fossil fuel may have prolonged the Commission's actions, but would force it to intervene eventually—something a number of interviewees noted.

Table 5.1: The framing of natural gas

One of the fossil fuels	**The cleanest fossil fuel**	**The fossil fuel that still has to be addressed**
"Natural gas industry got boxed in by NGOs and utilities as a fossil fuel" (EU_Ind_1)	"debate is turning: nat[ural] gas is taken out of the fossil fuel label" (EU_Ind_1)	"post-2035 molecules still pose a question" (EU_Ind_1)
"Natural gas has always been the little brother of oil" (HU_Ex_1)	"Nat[ural] gas has thus been decoupled from other fossil fuels" (NGO_2)	"Redesigning communication is necessary to lump fossil fuels together once again" (NGO_1)
"There's a push to move nat[ural] gas from the lump of fossil fuels, to a separate category" (EU_Ind_3)		"now seems that the labels are going to fall" (NO_An_1)
	"Gas will always be the cleanest of the three [fossil fuels i.e. coal, oil, natural gas]" (US_Ind_1)	"EC [European Commission] saw that natural gas can be a useful transition fuel" (HU_An_1)
	"Nat[ural] gas a cleaner alternative" (EU_Ex_4)	"EC's pragmatism: it didn't want any more fossil fuel projects [post-2015]" (HU_An_1)
	"as climates became more important on the European agenda, it was like, you know, gas is fantastic, gas is clean fuel" (UK_Ex_1)	"Gas instead of being part of the solution became the problem itself" (US_Ind_1)

	"I guess it's a realization when we started up first with the focus on the lowest hanging fruit [coal]" (NO_Ex_1)	"the whole dispute over shell tarnish the green image of natural gas" (UK_A_1)
	"I think prior to shale gas the idea that natural gas was clean that was its unique selling point" (UK_A_1)	"so the more radical view is that the natural gas has also to go little bit later but has to go" (NO_An_3)
"As for civil society, there are environmental NGOs that see the value of gas, but often times they call for a phase out of all fossil fuels without distinction, and we regret that given the difference and uses there is between oil & gas on one side, and coal on the other." (EU_Ex_5)		

Source: author's compilation based on interviews

The Commission introduced the Second Energy Package[33] in 2003 to continue developing a single competitive market (Haase, 2008). The key objective of this intervention was *unbundling*, meaning that it sought to separate the production and trading activities of (formerly) vertically integrated energy companies and their transit businesses. Its goal was to open transit capacities for competition and reduce rent-seeking. In contrast to the First Energy Package, the Second one takes note of the environment-natural gas market nexus, when stating that "Member states shall ensure […] natural gas undertakings are operated in accordance with the principles of this Directive with a view to achieving a competitive, secure and environmentally sustainable market in natural gas"[34]. Thus, environmental sustainability became more pronounced, but the Commission introduced an "oxymoron" (UK_A_1) into a key piece of legislation by suggesting

[33] For electricity: Directive 2003/54/EC, 26.06.2003 and for natural gas: Directive 2003/55/EC, 26.06.2003.
[34] In this same document, the Commission includes climate change under the umbrella of environmental protection.

that a natural gas market is environmentally sustainable. It attempts to discursively reconcile the expansion of a fossil fuel's markets and greater sustainability, through a false presumption woven into the fuel's general discourse.

The Commission's position towards natural gas was based on academic research that underscored the fuel's ability to meet the EU's energy demand, while allowing the bloc to reduce emissions (Delborne *et al.*, 2020). Actors had begun to think about the fuel as "clean" (UK_A_1), quickly leading them to discursively classify it as "sustainable". According to an expert working within DG Comp and DG Ener in the 1990s and early-2000s, the Commission had "fooled itself into believing natural gas is a transition fuel" (COM_4). A broader scientific and expert-base supported such a discourse that transpired into policy language, alongside industry actors that were poised to benefit from the fuel taking on a growing role (UK_Ex_1; NO_Ind_1; COM_4), For instance, the Second Energy Package incorporates a push to develop a single competitive market as "EU demand for gas and electricity is expected to increase considerably over the coming twenty years"[35]. This was possible since natural gas was presumed to be compatible with initial, relatively modest climate ambitions. Climate-based action "lack[ed] teeth" (EU_Ind_1)—i.e. it did not provide sufficient pressure or incentives to curtail the demand for fossil fuels (see chapter six). There was limited pushback against natural gas, because it was still cleaner than alternatives and thereby climate compatible, supporting to the consolidation of a natural gas regime. Actors involved in the governance of the sector expanded infrastructure and influenced the development of a regulatory framework (Glachant, Hallack and Vazquez, 2013; Gustafson, 2020), on the back of a generally favourable discourse conveyed towards the resource.

[35] COM(2002) 488 final — 2002/0220(COD) 11.09.2002, p. 1.

The Commission's (2009) third step to develop a single market was the Third Energy Package[36], which called for "a competitive, secure and environmentally sustainable internal market in natural gas" (articles 3 and 40). Once again, it reinforces the idea that it is possible to establish an *environmentally sustainable internal market in natural gas*. It further institutionalised the fuel as something that was "environmentally sustainable". This was based on the "cleanest fuel narrative [which] was substantial and pushed by the industry—[the] Commission, amongst others, properly accepted it and that's how it could incorporate such positions into its policies which enable natural gas to be labeled as sustainable" (G_F_1). The framing of the fuel in policy discourse reflects this interpretation and indicates that it would be the ideal transition fuel that would curtail coal and oil consumption, while the EU expanded renewable energy capacities. This allowed natural gas to avoid being "scrutinised on environmental grounds" (US_A_1) by policy-makers, while they developed energy policy that would rely on it in the future. In the meantime, the Commission prioritised security and competition over sustainability (HU_An_1; COM_5) (Klauser and Shavlak, 2017).

Twenty-two interviewees explicitly noted that the Commission and—more broadly—the energy sector presumed that natural gas would play the role of a transition fuel. Even those that did not directly mention this term, suggested that it would the source of energy that can help shift the energy system from coal to renewables. Interviewees suggested that the transition fuel narrative proliferated during the second half of the 2000s in EU policy-making circles, around the time the Commission (2008) introduced the 2020 Agenda. The Commission began to introduce measures to reduce the carbon-intensity of the EU—it began to green its practices—but the effects of its interventions were slow to follow. Climate action began to have an impact on energy policy (see

[36] Directive 2009/EC/73, 14.08.2009.

chapter six), but natural gas' low emissions made it climate-compatible and did not lead policy-makers to question its role. Path dependencies limited the pace of change with regard to a fuel that was deeply entrenched in the EU's energy system. The Commission's actions aligned with the consensus that the transition fuel would provide consumers with a secure and competitive source of energy that also reduced the EU's carbon intensity; thus, it focused on ensuring consumers had competitive access to it.

5.3 A changing transition fuel discourse

2009 was a turbulent year for the EU from an energy standpoint. Not only did the Commission introduce the Third Energy Package, but it was preparing further climate measures with the 2020 Agenda (European Commission, 2008) (see chapter six) and faced the suspension of natural gas supplies from Russia (Balmaceda, 2013). National and supranational officials were confronted with a supply security threat which kindled "the skepticism towards Russian gas" (NO_An_3). This damaged the image of the fuel more generally (EU_Ind_3)—given the dominance of Russian supplies in imports (BP, 2019b). This worsened an already "tarnished" (US_A_2) image and led many politicians to "demonise" (EU_Ind_3) the resource. EU policy-makers underscored the security threat import-reliance entailed and urged a concerted European response (McGowan, 2011). This was led by the Commission[37], which introduced new provisions such as the Gas Coordination Group[38] and the Projects of Common Interest[39] (PCI) to mitigate risks. It took measures to streamline the flows of natural gas and ensure consumers access to the fuel,

[37] Regulation (EU) No 994/2010, 12.11.2010 and Commission Decision 2011/C 236/09, 11.08.2011 were key in these endeavours. Neither included any reference to sustainability or climate change related concerns.
[38] Commission Decision 2011/C 236/09, 11.08.2011.
[39] Prompted by European Parliament resolution 2011/2034(INI) [P7_TA(2011)0318], 05.07.2011; followed by Commission notice no. 2013/C 33 E/06, 05.02.2013; followed by Regulation (EU) No. 347/2013, 17.04.2013 and Regulation (EU) No. 1391/2013, 14.10.2013.

suggesting that “[g]as has an important role as a transition fuel in the move towards a high-efficiency, low-carbon energy system”[40]. Interviewees noted that, in hindsight, the Commission’s actions ambitions to develop a single market overshadowed climate risks (NO_An_3; EU_Ind_1; EU_Ind_2; EU_Ind_3; PL_Ind_2). However, at the time, the general understanding that an efficient market could overcome supply security *and* yield emission reductions prevailed.

Industry actors widely popularised the transition fuel narrative between 2009–2011. Numerous reports and analyses identified that the only feasible energy transition would be a natural gas-dependent one. Gasterra—a Royal Dutch Shell, ExxonMobil, and Dutch government joint venture which trades natural gas—was amongst the first that explored the long-term role of natural gas. It asserted that “natural gas is relatively benign to use, with the least impact on the environment” (GasTerra, 2009, p. 6) and envisioned a natural gas-intensive energy transition in its influential report. The Gas Advocacy Forum also suggested in its forward looking report that “by increasing utilisation of existing gas-fired plants (currently at just 60% in Europe) and by replacing old coal-fired plants with new gas-fired ones, Europe can move faster and more cheaply towards its CO2 reduction targets” (European Gas Advocacy Forum, 2011, p. 17) in addition to which natural gas would be a “good match with renewables” (European Gas Advocacy Forum, 2011, p. 18). Others made similar arguments (IGU, 2010), while this narrative also surfaced in Russian positions (Sharples, 2013) as well as public campaigns, such as Statoil’s (2012b) ‘Fuelling the UK with the telegraph and Statoil’. Incumbents thus fortified the transition fuel discourse and a narrative of the energy transition that would ensure they continued dominant role in the energy system. They complemented their material power with discursive power that

[40] SEC(2009) 979 final, 16.07.2009.

emphasised the positive aspects of the resource they provided to consumers, consolidating institutionalised practices.

Roadmaps published by various organisations also supported that natural gas become the transition fuel (BP, 2011; Shell, 2011). The European Climate Foundation (ECF) suggested that "[n]atural gas in particular plays a large and critical role through the transition" (ECF, 2010, p. 13), while Shell proposed that "natural gas will give the world an early opportunity to reduce overall CO2 emissions from energy by displacing coal with gas. At the same time, a continued strong focus on energy efficiency and market based CO2 pricing will keep demand growth in check" (Shell, 2011, p. 23). Shell, as an oil and natural gas company, has a clear interest to support a natural gas-intensive energy transition, but ECF (2010) and Heaps et al. (2009)—both commissioned by organisations that are considered more "environmentalist"—take a similar position. What is more, even the report developed by Greenpeace and European Renewable Energy Council (EREC) (2010)—a notoriously anti-fossil fuel NGO and a renewable lobby, respectively—assumed that natural gas would substitute other fossil fuels through 2030 after which its relative role would decline. Thus, the general discourse in support of positioning natural gas as the transition fuel was widespread.

Authoritative research institutions also backed the transition fuel discourse. This included the MIT Energy Initiative (MITEI, 2011) and the IEA (2011b). The latter's 2011 flagship report even heralded the *golden age of gas* and assumed that global natural gas markets would thrive in subsequent years; although, it was much more cautious regarding the prospects of the EU's natural gas market. Stakeholders did not necessarily differentiate between the messages and their respective geographies, given the momentum the industry could gather through the positive framing of the fuel (COM_2; HU_Ind_1). These narratives were reflected in the Commission's climate policy planning as well. An expert working on related matters noted that “there was that first 2050 document [Energy Roadmap 2050 (European Commission, 2011)], I think we wrote it around 2010–2011, and in that it was asked […] whether gas is a bridge fuel?” (COM_4). The Commission’s Roadmap affirmed that natural gas could be the transition fuel, suggesting that the policies were influenced by the dominant discourse supported by research institutions and industry actors alike. General discourse and the push from these various organisations transpired into policy.

The transition fuel narrative reinforced by sectoral actors was incorporated into policy-planning and a broader understanding of how the EU could execute an energy transition, but according to an EU policy-maker this narrative was “effing boring” (COM_4). The basis of this claim was that the policy-maker did not see the natural gas industry actors engaging in a constructive dialogue on the direction of the EU’s energy transition. Actors merely continued to reproduce the same line of argument rooted in the materiality of their fuel. This, however, did not respond to the pace of the unfolding energy transition and the EU’s long-term plans, which the Commission first articulated in 2011 (see chapter six). The natural gas industry did not offer answers on the role their fuel would play in a low carbon economy and how it would be phased out. This prompted the question of “what the heck is a bridge fuel?” (COM_4). This question became especially prominent as Germany’s *Energiewende* (BMWI and BMU, 2010) reconfigured the objectives of the EU’s climate policy and required natural gas interests to convey their role in relation to renewables and long-term climate goals. In response, sectoral actors changed what they understood as a transition fuel by underscoring that natural gas could not only bridge the gap between coal and renewables, but could also complement intermittent renewable energy production (see table 5.2 and chapter four). Thus, material changes forced natural gas interests and the energy sector more broadly to revisit the pre-existing narrative and develop one that would drive institutional change but this would be limited to the confines of existing path dependencies.

Table 5.2: Transition fuel

Bridge the gap between more polluting fossil fuels and renewables	**Complement to renewables**
"Switching coal for nat[ural] gas is already a step […] its transition fuel role holds up in this sense" (EU_Ex_1)	"but a bigger role can be expected [for natural gas], since it works well with renewables" (PL_An_2)
"Gas is a part of the solution, transition" (EU_Ex_2)	"natural gas should be seen as a complement to renewables" (PL_Ind_1)
"Nat[ural] gas has always had a bridge fuel role, because of its cleanliness" (COM_3)	"Renewables and nat[ural] gas a good alliance" (PL_Ind_2)
"large-scale decarbonisation is taking place through a switch from coal to natural gas [underpinning its transition fuel role]" (EU_Ind_3)	"Gas seen as the best backup of complimentary for renewables" (PL_Gov_3)
"There was and still is a recognition that natural gas is a cleaner energy source than coal, and that a switch from coal to gas is beneficial in the power production sector from a CO2 reduction perspective" (EU_Ex_5)	"intermittency is still not overcome […] backup needed" (EU_Ex_4)
"They [Russians] constantly find positive aspects of gas and shamelessly the point to the climate benefits	"Opinions range on a wide spectrum, one end of the scale emphasises the strong need for gas backup, and it is a very common opinion that gas is an ideal backup

[…] they believe that gas has a great future” (NO_An_3).	for renewables. At the other end of the scale there are those who say that the electric system […] can substitute gas power plants. [Our institution] takes a position between the two. […] We think that gas capacity utilisation rates will decrease […] but will continue to play a key role in approximately 1000 hours per year […] to balance the grid” (G_Ex_1).
“and somebody in the audience from the company kept coming out with this like: ‘Look, all you need to do is shut down all the coal, replace it with gas and you’ll [meet climate targets]’” (UK_Ex_1)	“Gas plus renewables could work […] since the EU backed renewables, it implicitly provided backwind for natural gas” (HU_An_1)
“Gas was a cleaner alternative to coal and oil [was recited as a] mantra” (HU_Ind_1)	“but what an amazing complement this is to intermittent renewables and this is the winning combination” (COM_4)
“there is a lot that can be done than simply replacing coal with natural gas” (UK_A_1)	“The buildup, the rapid expansion of renewable power generations certainly in the UK, is a road to gas demand. I mean the gas is now relegated to playing a backup role.” (UK_A_1)
	“gas people said that gas will always be needed when the temperature hits lows, because that is when the gas infrastructure can provide a solution. Then, these electricity people [said] that the wind will stop and there won’t be renewable energy, thus there will be a bunch of problems, we’ll need gas backups to provide heating and for us to be able to operate” (COM_6)

“switch from coal to gas, get as much renewables in the grid as you can and back it up with gas” (UK_Ex_1)

Source: author’s compilation based on interviews

Two broad themes emerged in the interview data as to what interviewees understood as a transition fuel (see table 5.2). Ten interviewees suggested that natural gas can be the transition fuel due to its “cleanliness” i.e. the relatively lower emissions it emits upon combustion. This is the concept used since the 1990s, as discussed above. Another interpretation emerged in the early-2010s, according to which natural gas provides an ideal pairing with renewables in the EU’s energy system. This links to the EU’s decarbonisation, which is based on intermittent renewables (e.g. wind and solar power). In this reading, natural gas is a transition fuel because it can be the basis of electricity that can ramp up quickly to help meet demand when renewable energy-based output recedes. Moreover, it offers a mode to meet energy demand in sectors that are difficult or costly to electrify, such as household heating or the industry (see chapter four). Thus, it is a “complement” to renewables, which became increasingly important as the penetration of renewables rapidly increased with Germany’s reinvigoration of its *Energiewende* (Beveridge and Kern, 2013).

Industry interests, such as the European Gas Advocacy Forum (2011) had already indicated that natural gas offers a complement to renewables, but this came to be underscored by a number of experts. Interviews suggest that experts equally consider natural gas to be a transition fuel that can substitute coal during the shift to renewables *and* it can complement the shortcomings of renewables (see table 5.2). This was a prominent theme articulated by research institutions, such as the IEA’s (2011b, 2012, 2013) annual reports as well. It was also reflected in the Commission’s positions, which suggested that “[p]rovided the supply is stable, natural gas will continue to play a key role in the EU’s energy mix in the coming years and gas can gain importance as the back-up fuel for variable electricity generation"[41]. Accordingly, the Commission's emphasis continued to be on ensuring supply security through policy measures as opposed to tapering the fuel's consumption in response to climate targets[42]. At the time, there was a general consensus that natural gas would be a key component of the energy transition. Climate action was thus forcing the Commission to green its policies, but its scope of action remained limited as ensuring competitively priced energy continued to dominate agendas.

5.4 The inertia of natural gas sectoral actors

The Commission introduced a number of mechanisms to mitigate supply risks following the 2006 and 2009 events (Balmaceda, 2013; Glachant, Hallack and Vazquez, 2013), but curtailing the EU's reliance on the fuel was mostly limited to measures the Energy Efficiency Directive[43] introduced (COM_4). These may have been effective to a certain extent (Filippini, Hunt and Zorić, 2014; Ó Broin, Nässén and Johnsson, 2015), but natural gas demand rose in absolute terms from 2011 onwards (Eurostat, 2020). A policy officer working at DG Ener at the time posed and answered the rhetorical question: "why was a strong reaction [to phase out natural gas] absent […] if we [already] have supply security issues and gas is a toxic fuel? I believe that its penetration was too large and its was still being developed in certain areas" (COM_4). This was spelt out by another analyst, who noted that "the EU couldn't get rid of it [natural gas], since it still played a vital role" (HU_Ind_1). The fuel was entrenched in the EU's energy system and policy did not aim to support a pivot away from it. Reducing its role was further inhibited by The Treaty of Lisbon, which limited the Commission's ability to shape the energy mixes of member

[41] COM(2010) 639 final, 10.11.2010, p. 10. Also see COM(2011) 0885 final, 15.12.2011.
[42] COM(2011) 539 final, 07.09.2011.
[43] Directive 2012/27/EU, 25.10.2012.

states[44]. A robust natural gas regime remained in-tact and governance away from it was limited by institutional inertia.

Incumbents anticipated a natural gas-dependent transition so they presumed that they were in a "comfort zone" (EU_Ex_1). Their "blindness" and "denial" (Turnheim and Geels, 2012) to how the energy transition would impact their operations was based on two factors: (1) the transition fuel discourse and (2) policy focus on building markets. The transition fuel narrative remained dominant in the early-2010s, as shown above, even if, as a policy-maker noted, it was unconstructive in reaching zero carbon goals (COM_4) and a tool with which actors justified their lack of constructive contribution to the transition. In parallel, the Commission focused on developing the EU's natural gas market following the 2009 crisis. This was renewed following Russia's illegal annexation of Eastern Ukraine and Gazprom's abuse of market power in Central and Eastern European markets[45] (Boersma, 2015; Grigas, 2017). European Council President Donald Tusk (2014) proposed to form an Energy Union to safeguard energy supplies, leading to the Communication on the Energy Union[46]. This underscored the need to address energy security and competition to ensure the EU's access to the resource, overshadowing climate concerns. It anticipated that natural gas demand would continue to play a prominent role in the EU's energy mix in forthcoming decades, only noting that "[g]iven the EU's import dependence and global climate change challenges, we need to take additional measures to reduce its oil consumption"[47].

[44] Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, signed at Lisbon, 13.12.2007. The Lisbon Treaty formally established the energy-related jurisdiction of the European Commission and the governments of member states.
[45] 39816 Upstream gas supplies in Central and Eastern Europe, which was launched with MEMO/11/641, 27.09.2011 and Final Commitments were published on 24.05.2018.
[46] COM(2015) 080 final, 25.02.2015.
[47] COM(2015) 080 final, 25.02.2015, p. 5.

Those within the natural gas industry did not expect natural gas' role to be curtailed by EU policy and market developments that emerged between 2010–2015 (table 5.3). They considered themselves to be a key element of the energy transition, while they were a sort of "lost child" (PL_Ind_1) in energy policy. Their focal role and the Commission's policies did not indicate that their operations would be disrupted. The energy scene was changing, but not disrupting the role of natural gas in a substantial manner. The Commission's focus on developing the regulatory framework for the EU, the US shale revolution adding additional supplies, and the continued emphasis on its transition fuel role suggested that the energy carrier had a bright outlook (Sernovitz, 2016; Stern, 2017b; Szulecki, 2017). This was further supported by infrastructural developments (see chapter seven), as the Commission backed developments through the Projects of Common Interest and ENTSOG's (2009, 2011) Ten Year Network Development Plans (TYNDP); both anticipated a need for the EU to expand infrastructural capacities. Thus, those within the sector did not perceive any signs that suggested that their operations were at risk.

Table 5.3: Perceptions of natural gas and industry incumbents

Comments on natural gas stakeholders' self-perception	
Inertia	**Gas industry was taking action**
"[G]as is somewhat of a forgotten child" (PL_Ind_1)	"The push to change Gazprom's strategy has come a few people in the company's European offices […] decarbonisation strategies have been developed, despite the good results of the
"Gas business has been in a comfort zone" (EU_Ex_1)	
"Formerly gas didn't have a clear role" (COM_2)	

“and if the natural gas industry simply drifts without any strategy than electrify may not be everything, but will lead to extensive electrification” (G_Ex_1)	company, which could lend support to a comfortable position” (EU_Ind_3)
“[N]at[ural] gas industry had to take a position, but didn’t say much” (HU_Ind_2)	
“The industry laid back and assumed that the renaissance of natural gas was nearing” (US_Ind_1)	
“The industry reinforced the message that natural gas was the cleanest fossil fuel, but its proactive measures to diffuse the positive narrative framing of the fuel still lagged. It did not see itself in a particularly vulnerable situation until the Paris Agreement, before which its primary concern was cheap coal hampering coal-to-gas substitution (HU_Ex_1)”	
“Industry already considered to have contributed to bringing down emissions, since natural gas was the lowest emitting fossil fuel” (EU_Ind_1)	

Source: author’s compilation based on interviews

Interviewees overwhelmingly indicated that industry actors did not respond to a rapidly changing energy scene (see table 5.3). Actors “laid back” and did not take further measures that indicated their role in a low carbon economy. “Inertia” was a commonality between the actors, as they all anticipated business-as-usual to continue, which was warranted on the grounds that there was little policy pressure to reduce the consumption of their fuel. A common, industry-wide, response was lagging. This is partially because “it’s [the natural gas sector] not an industry, it’s a community of stakeholders" (UK_Ex_1). While in the 1990s the industry was dominated by vertically integrated monopolies that formed an industry, the Commission's energy packages unbundled production, transmission, and distribution activities, leading to a much more splintered sector (Gustafson, 2020). This favoured consumers through competition, but inhibited actors' ability to align their long-term strategies and develop visions on how natural gas can play a role in a low carbon economy.

The commonality among sectoral actors was their general push to support the uptake of natural gas, for which there was ample demand through 2005. After the blip in demand during the Great Recession and its aftermath consumption rebounded in the early-2010s. Climate action may have become increasingly topical, but actors did not deploy concerted or aligned strategies that suggested how their role in the EU's energy system would be maintained. Policy responses that curtailed natural gas demand were lagging, limiting the responses of those within the sector. Some actors proposed piecemeal solutions with which they sought to limit emissions from their own operations—the latter is recurring part of suppliers' Annual Reports (Gazprom, 2012; Statoil, 2012a)—but these did not respond to a changing environment. With this, they presumed that the natural gas energy regime was insulated from disruption and the only form of action was discursive in their push to underscore that natural gas is the transition fuel.

Of the large suppliers, Gazprom had taken some action to devise decarbonisation strategies, but this fell outside its core business, limiting their impact (see table 5.3). The firm's reports show that it generally began to pursue more environmentally friendly practices, but this did not lead it to reconsider how its main source of revenue—natural gas sales—related to climate change, apart from a larger focus on carbon-dioxide emission accounting and efforts to tackle methane emissions (Gazprom, 2011, 2012). One shift, which first surfaces in its 2013 Environmental

Report states that "[t]he pilot project of hydrogen reception from water via electrolysis by means of the energy received from renewable energy sources, with further hydrogen supply to the gas transmission network was discussed […] Moreover, a project of hydrogen production from natural gas by means of adiabatic conversion was presented" (Gazprom, 2013, p. 46). Thus, Gazprom explored what would later become a key component of prolonging methane's role in the energy system—hydrogen—but this was only a marginal part of its strategy at the time (for a further discussion see below).

Statoil-turned-Equinor "continue[d] to take a positive long-term view of gas as an energy source" (Statoil, 2011, p. 123). It continues by noting that the "[d]omestic production of gas in the EU continues to decline, while demand for gas is expected to increase in the long term, particularly due to the lower carbon footprint of natural gas compared with oil and coal" (ibid.). Its 2011 and 2012 Annual Reports suggest that European natural gas demand will continue to grow through 2020 (Statoil, 2011, 2012a). These also note that "Statoil is also participating in projects that focus on other forms of energy, such as offshore wind and carbon capture and storage, in anticipation of the need to expand energy production, strengthen energy security and combat adverse climate change" (Statoil, 2012a, p. 5), but this remained a small part of its business. The Norwegian company also underlined that "natural gas is an attractive source of energy from an environmental perspective since it emits far less carbon dioxide than coal and oil" (Statoil, 2011, p. 61). This narrative continued in subsequent years; for instance, in 2014 the company continued to argue that it "expects oil, and in particular gas, to be less impacted than coal in a carbon constrained world" (Statoil, 2014, p. 98).

TSOs also paid little attention to the climate-compatibility of the fuel they transited and simply reiterating the transition fuel argument. ENTSOG's (2012) Annual Report, for instance, notes that “I [Stephan Kamphues, ENTSOG President at the time] believe that the role of gas and the gas sector will be increasingly important in the decarbonization process and in obtaining green growth objectives of the EU. […] New innovative technologies like power-to-gas and green gas, as well as carbon capture and storage are the best means to foster green power generation and decrease CO2 emissions” (p. 6). There was some discussion gravitating to the larger inclusion of biomethane into the grid, but its impact also remained insignificant in most of Europe (NO_Ind_1). The 2015 Annual Report begins to place greater emphasis on the challenge that “ENTSOG will have to deal with the integration of renewable energy sources” (ENTSOG, 2015, p. 5); thus, at this point, there is still a clear signalling that natural gas is a key industry that will complement emerging renewables and that the energy governance regime is still dominated by fossil fuel interests. But even in subsequent years ENTSOG continued to advocate for the completion of a competitive market and only gradually suggesting how it would take measures to facilitate the transition by decarbonising the fuel it provided (ENTSOG, 2016, 2017).

As the Commission articulated its increasingly stringent climate plans, the natural gas industry was confronted with its precarious position. Despite the prevalence of the transition fuel narrative, natural gas demand did not increase on the back of a large-scale switch away from coal. The latter’s competitiveness was underpinned by government support, “low CO_2 prices [on the EU ETS] and the collapse of coal and oil prices” (HU_Ex_1). As the US shale revolution ramped up, US coal became widely available in Europe, which entailed that it was not only a social issue to maintain coal mining regions, but it was also difficult to compete with imports given low carbon prices (Kuchler and Bridge, 2018; Balmaceda, 2021). In parallel, natural gas’ competitiveness was curbed as the nuclear disaster at “Fukushima, pushed natural gas prices up” (HU_Ex_1). Multiple analysts noted that the high prices of the fuel reduced the prospects of coal-to-gas switching (NO_Ind_1; NO_Ex_1; G_Ex_1), which was further impeded by low quota prices on the ETS (Stern, 2017b). Statoil (2013), for instance, remarks in its Annual Report that "[t]he ETS can have a positive or negative impact on us, depending on the price of carbon, which will consequently have an impact on the development of gas-fired power generation in the EU. Until now, the carbon price has been too low to replace coal with gas fired generation capacity" (p. 100). Despite these headwinds, the EU's natural gas demand rose during the early-2010s. However, this was rather a rebound from the lows following the Great Recession as opposed to fuel-switching. To make matters worse for natural gas industry actors, the *Energiewende's* contribution to enhance the availability of "cheap renewables" (HU_Ind_1) introduced a technology that was increasingly competitive and enjoyed wide political support (Sivaram, 2018).

5.5 A pivotal shift in energy policy: the Clean Energy Package

The Paris Agreement not only raised climate action on the global agenda and signalled the commitment of the EU on the matter (see chapter six), but prompted the Commission to devise policy that would facilitate the EU's decarbonisation. It based this on the Energy Union[48], which it revisited prior to Paris when publishing the State of the Energy Union[49]. This "looks at progress over the last nine months and identifies key issues that require specific political attention in 2016, a key year for implementation of the Energy Union"[50] and was the culmination of the Commission's Work Programme 2016 which emphasised the need to take action and continue building "A Resilient Energy Union with a Forward-Looking Climate Change Policy"[51]. When

[48] COM(2015) 080 final, 25.02.2015, p. 5.
[49] COM(2015) 572 final, 18.11.2015.
[50] COM(2015) 572 final, 18.11.2015, p. 1.
[51] COM(2015) 610 final, 27.07.2015, p.16.

discussing natural gas in the State of the Energy Union, the Commission underscored that the EU had made progress in developing a single market and "worked intensively with Member States to remove existing regulatory obstacles to cross-border trade of electricity and gas"[52]. Thus, it continued to underscore the implementation of the Third Energy Package and the free market principles that were to benefit consumers through heightened competition. It also suggested that "[i]n 2016, all actors need to step up their work on infrastructure projects"[53]. The policies outlined a continued support for the development of a single competitive natural gas market and it does not mention that these objectives may contradict climate goals.

Following the Paris Agreement, the Commission's approach to energy policy changed. It introduced the 'Clean Energy for All Europeans Communication'[54], which looked to "boost the clean energy transition" as remarked by Maroš Šefčovič (2016, n.p.) the Commission's Vice-President for the Energy Union and EU Space Policy. An expert working on EU-level energy matters remarked that it was the "first EC [European Commission] policy intervention based on climate change" (EU_Ex_4). It signalled that climate policy would carry greater weight in shaping the EU's energy policy, which included the push to phase fossil fuels out of its energy system (Meeus and Nouicer, 2018). The Commission also increasingly had the tools to shape the governance of the transition. In the final section of the State of the Energy Union, it suggests that "[i]ntegrated national energy and climate plans [NECPs], addressing all five dimensions of the Energy Union, are necessary tools to have more strategic planning"[55]. NECPs wold prompt member states to devise plans on how they will decarbonise their energy system and decrease

[52] COM(2015) 572 final, 18.11.2015, p. 7.
[53] COM(2015) 572 final, 18.11.2015, p. 7.
[54] COM(2016) 860, 30.11.2016. Also frequently referred to as the Clean Energy Package, CEP, or the Winter Package.
[55] COM(2015) 572 final, 18.11.2015, p. 15.

their reliance on fossil fuels. With this, the energy governance regime of the EU shifted from developing a single competitive markets to "strategic planning" in support of decarbonisation and the factors that could enable it (Szulecki and Claes, 2019).

Natural gas is notably absent from the Clean Energy Package, even though the Commission introduced new regulations to ensure the secure supplies of the fuel earlier that year[56]. In the latter, there is no discussion on whether natural gas can be consumed in-light of climate policy, but only on how to ensure secure supplies. Meanwhile, by late-2016 an enthusiasm from the Commission towards renewables and electrification limited their focus towards natural gas (COM_6; PL_Ind_1; HU_An_1). The Commission took major steps to withdraw its support for natural gas and, more generally, fossil fuels. It introduced a pivotal forward-looking energy policy package that did not allocate a role to natural gas, if anything, it questioned it, when noting that "[c]urrent low oil and gas prices provide a window of opportunity for phasing out fossil fuel subsidies"[57]. With this, it began to withdrew its support for natural gas to take the role of a transition fuel, since it shifted the narrative of the transition to emphasise accelerating renewable deployment and electrification.

An EU policy-maker noted that leaving natural gas out of the Package was a "big mistake" (COM_4), because the long-term strategy for the EU's decarbonisation was not possible solely based on renewables and electrification. Eurelectric (2018), the electricity lobby, suggested in a presentation widely cited by interviewees, that anything above an 80% electrification was technologically not possible or economically extremely costly. In principle, this entailed that natural gas had a role to play in the energy mix, but industry actors had also supported natural

[56] COM(2016) 52 final, 16.02.2016.
[57] COM(2016) 860, 30.11.2016, p. 6.

gas' omission from the Clean Energy Package. An EU policy-maker asserted that "when the development of the Package began, the gas people said: "um, this is too early for us, we would like to first establish the rules of the internal market, we do not want to engage with these innovative ideas" (COM_6). ENTSOG Annual Reports clearly testify the body's push to focus on finalising a single market as opposed to explore long-term decarbonisation (ENTSOG, 2016, 2017). The discourse emanating from the sector indicate the continued assumption that their fuel was indispensable in the transition. This led actors to resist engagement in climate policy-making, which had, however, turned a corner and began to focus on meeting the EU's 2030 and 2050 decarbonisation goals. An industry expert noted that the "2016 package was a missed opportunity" (EU_Ex_4) for the sector, but it was also a missed opportunity for the Commission, which could not carry out its long-term plans and would have to revisit its long-term objectives (COM_6) (Stern, 2017b).

5.6 The natural gas industry springs into action

Despite Commission policy shifting to focus on renewables and electrifications, the technological and economic hurdles would force it to reconsider its narrative of the transition. The issue policy-makers faced was that decarbonising via renewables and electrification had limitations, which were underscored by those within the natural gas sector and energy affairs more broadly (CEER, 2018b; IEA, 2018b). Discourse promulgated by actors from the natural gas sector contested the emerging renewable-dominated governance regime and attempted to reposition themselves to maintain their relevance. The Clean Energy Package signalled that the natural gas sector would have to align its activities with EU decarbonisation goals. The fuel's omission from the Package was deemed a mistake by both the sector and policy-makers, but was indicative that consuming emitting natural gas and decarbonisation goals were irreconcilable. The transition fuel narrative no longer sufficed to ensure that policy included natural gas into long-term planning, because the sector had to indicate how it could not only lower emissions—a feat in itself questionable, given the rising concerns over methane emissions (IEA, 2018b; Stern, 2020)—but play a role in a decarbonised energy system.

The contradiction between consuming natural gas and meeting climate targets became evident in the EU around 2017–2018, when scientific research commissioned and popularised by NGOs underscored the fact of the matter (NGO_1; NGO_2; EU_Ex_1; EU_Ex_5; COM_1) (CEO, 2017; FotEE, 2017). Anderson and Broderick (2017) conclude their scientific inquiry noting that "*[b]y 2035 the substantial use of fossil fuels, including natural gas, within the EU's energy system will be incompatible with the temperature commitments enshrined in the Paris Agreement* [italics in original]" (p. 2). This forced the sector and policy-makers to consider how they would phase the fuel out of the energy system and what source of energy can take its place, given the limitations of electrification. Eulectric (2018) suggested that gaseous energy had a role to play in the EU's energy system, but the question became how it could do so without leading to emissions. Essentially all interviewees noted that this would be the key to the industry's long-term survival and was the prime policy objective discussed by experts when I pursued my fieldwork. The sector's emphasis on this became evident when during interviews in 2018: I raised questions about natural gas and interviewees overwhelmingly spoke about how it could be decarbonised.

Table 5.4 gathers what interviewees said about how natural gas should be phased out by the EU. Three approaches emerged, one of which argued for a relatively quick phase out to avoid any further lock-ins and move towards renewables as quickly as possible. The second position suggests that the pace of a phase out is contingent, because of a need to set priorities (e.g. focus on the coal phase out) and the difficulty of severing lock-ins. The third group, which was the most populous, argued that natural gas' phase out should be a gradual, carefully designed process. This is in-line with a general understanding that energy transitions are slow to unfold (Smil, 2016a), but also reflects the deep reluctance and inability of policy-makers and experts to undertake radical change to reconfigure the energy system. A key question that emerged in interviews was what is "realistic" (UK_Ex_1). Sweeping change in the energy system was deemed by most as something that is not feasible, given the deep entrenchment of consumption practices. Such lock-ins and related path dependencies, in-turn, shape the pace at which political institutions themselves can seek to implement change. Institutions only green their policies in a gradual manner, given the limitations as to what is "realist" and the confines that limit their action within a specific institutional context.

The Commission's shift in its energy policies may have been gradual, but it was noticeable. Building on the Clean Energy Package, it developed policy that focused on the energy performance of buildings, renewable energy, energy efficiency, governance, and electricity market design. These did not take an anti-natural gas stance, but left the role of the fuel unclear and, in some cases, it supported action that underpinned a natural gas-to-renewables shift. For instance, the Recast Renewable Energy Directive states that "Member States shall ensure that their competent authorities at national, regional and local level include provisions for the integration and deployment of renewable energy […] and energy infrastructure, including electricity, district heating and cooling, natural gas and alternative fuel networks"[58]. Policies thus began to provide the support for the enhanced expansion of renewables to the detriment of fossil fuels, indicating a marked shift in EU policy.

[58] Renewable Energy Directive (EU) 2018/2001, 21.12.2018, article 15.

Table 5.4: The phase out of natural gas

Natural gas phase out		
Should be executed quickly	**Pace contingent**	**Should be a prolonged matter**
"because we need to produce things from renewables anyway and by wasting time, we will add to the sum of costs, making it [the energy transition] more expensive than if we would have undertaken the construction of a renewable system" (COM_6)	"Coal phase out will be followed by questions around gas, although this will depend on the political party in power as well (e.g. Greens' role in Germany)" (D_Gov_1)	"Gazprom and Equinor projects are showcases of technology, but they will surely look to export inexpensive natural gas unchanged for as long as possible [… they seek to erect a] smokescreen for climate and to remain relevant and be considered in the EU's energy future" (HU_Ind_1)
"Green Peace blue eyed in the past decade on the need to phase out fossil fuels, not just coal which has been emphasised" (NGO_2)	"Path dependency is very much up in the air [but] Industry-infrastructure-political power clearly perceived" (D_Gov_2)	"the Comission fully agreed that [to] fully electrify the energy sector is not realistic or rather it is not realistic technically, but even if it was it would be far more expensive than an electric and gas EU balance. So that's a big step forward! They've accepted that we need gas molecules in the energy balance." (UK_Ex_1)
"politicians have accepted the green position that backing further fossil	"It is still a question of nuance if it can be phased out, or to what	"we really have to keep natural gas as a bulk market of natural gases,

fuel can create strong path dependence" (PL_Gov_3)	extent, and what is realistic" (COM_4)	actually for the heating sector" (NO_Ex_1)
		"gas people said that gas will always be needed" (COM_6)
		"Borchard [DG Energy] has made it clear that natural gas will continue to play a role in the next 20-30 years in the EU" (EU_Ind_1)
		"Today, the Commission sees natural gas as a way to get us to our 2030 GHG targets" (EU_Ex_5)

Source: author's compilation based on interviews

Those within the natural gas sector responded to ensure their "survival" (COM_4), which was challenged by the EU's push to decarbonise. Their response was two-pronged: (1) promulgating the transition fuel narrative and (2) exploring options to supply low carbon gases. The transition fuel discourse proliferated in policy discussions. Producer Statoil-turned-Equinor (2017) argued that such fuel-switching was focal to underpin the credibility of the EU's climate strategy, while Gazprom (2018a) also suggested that "[w]hen developing the EU strategy for long-term GHG [greenhouse gas]emissions reduction it is important to take into account the potential of natural gas as a low-emission energy source for the following reasons. The existing advanced gas infrastructure allows reducing emissions in an efficient way at no significant cost by switching coal-fired installations to gas" (n.p.). Natural gas stakeholders articulated similar positions in their responses to the Commission's (2018c) initiative on the 'EU long-term greenhouse gas emissions reduction strategy'. A formerly scattered natural gas industry forged a "new alliance" (NO_Ex_1) in which their strategies converged. They did not pursue formalised or institutionalised cooperation, but their long-term interests aligned more clearly in a structural setting where the climate policy-driven governance regime drove the dislodgement of their dominance.

An EU policy-maker observed that "[t]he industry began to actively promote its interests post-COP21 to influence consumers that the resource is a viable option in the long-run" (COM_2). They also pursued this through a close dialogue with policy-makers in an attempt to wield their organisational power given their involvement in policy-making processes. The preeminent platforms where they shaped long-term strategy and policy was the yearly Madrid Gas Forum and, to a lesser extent, the Copenhagen Infrastructure Forum. The Madrid Forum had historically been a platform the Commission convened to discuss network codes and technical regulations governing the EU's natural gas market. However, debates began to noticeably shift in 2017 to tackle the challenge of decarbonisation and natural gas' role in it (European Commission, 2017a, 2018a). Policy-makers, experts affiliated with incumbents, and a limited number of academics participated in these discussions, while experts affiliated with NGOs were not invited to the proverbial table (EU_Ex_1; NGO_Ex_1), even though they had become more engaged in challenging the role of natural gas in the EU's energy transition (NGO_1; NGO_2; EU_Ex_1; EU_Ex_5; COM_1).

Presentations by the European Commission, Eurogas, the European Federation of Local Energy Companies (CEDEC), Gas for Climate[59], and ENTSOG all emphasised the need for gas in the

[59] A group of seven EU gas transit firms: Enagás, Fluxys, Gasunie, GRTgaz, Open Grid Europe, Snam, and Teréga, in addition to two renewable gas industry associations: the European Biogas Association and Consorzio Italiano Biogas.

EU's decarbonised energy future (European Commission, 2017a, 2018a). Eurogas, for instance, showed that coal-to-gas switching can curtail emissions by up to 5 percentage points in the near future (Braaksma, 2018), which was a common position reflected in presentations. This was reinforced in policy as well[60], which suggested that natural gas would continue to play a declining, albeit important, role in the EU's energy mix. Presentations also began to explore the role renewable or decarbonised gases could play in meeting energy demand (Ecofys, 2018; Lopez-Nicolas, 2018). Table 5.5 summarises how interviewees reflected on the future role of gas, with responses suggesting that a rising focus on gases—plural, which included biogas or hydrogen (see below)—was emerging in these future-oriented discussions. A group of interviewees reflected that the foreseeable future of natural gas was ensured, since it "offers a way" to meet 2030 targets and pave the way to further decarbonisation. On the other hand, a number of experts already discussed gases, as opposed to (natural) gas, which would help meet EU demand.

The shift amongst interviewees and Madrid Forum discussions to discussing the future of a broader admixture of gaseous energy carriers responds to the expectation that there will be a continued demand in the EU for gaseous energy carriers. It also allows for natural gas interests to maintain their operations by leading them to explore how low carbon gases may be fed into the pipelines they control or complement the natural gas they provide. The common external threat converged the interests of had been a "community of stakeholders" (UK_Ex_1) to argue a relatively unified position that they could decarbonise their fuel. This external shock was the basis of them forming a closer coalition united around a common goal to maintain the role of the fuel in the long-term. TSOs were the first to introduce a strategy (EU_Ex_1; EU_Ex_4;

[60] SWD(2019) final, Part 4/11, 09.01.2019.

UK_Ex_1; UK_A_1) in which they argued that the EU's vast gas pipeline system offered an efficient mode to transit energy and would underpin an efficient transition—in principle, this is true (Bradshaw and Boersma, 2020). They emphasised that their ability to transit low carbon gases (e.g. biomethane) and decarbonised gases (e.g. hydrogen) instead of emitting natural gas to help meet energy demand. They drew on their power linked to the infrastructure at their control and argued that the EU should pursue a gas-based transition (Ingwersen, 2017a; ENTSOG, 2018; GIE, 2019c, 2019b).

Table 5.5: The future of gas

<table>
<tr><th colspan="2">Gas' future</th></tr>
<tr><td>The future of natural gas</td><td>The future of natural gas and other gases</td></tr>
<tr><td>"Borchard (DG Energy) has made it clear that natural gas will continue to play a role in the next 20-30 years in the EU" (EU_Ind_1)</td><td>"supply side companies are lobbying for hydrogen" (COM_6)</td></tr>
<tr><td colspan="2">"The acknowledgement that natural gas is here to play a focal role through 2030 is being done […] after that this should be reduced to other forms of gas" (COM_2)</td></tr>
<tr><td>"Today, the Commission sees natural gas as a way to get us to our 2030 GHG targets" (EU_Ex_5)</td><td>"Natural gas industry finally comes up with an answer: green gas […] numerous questions sustained around this" (HU_Ind_2)</td></tr>
<tr><td>"It is a paradoxical stance and highlights the ambiguity towards natgas and the inability of players to plan and devise strategies that facilitate the energy transition, but instead prolong the status quo" (US_An_2)</td><td>"2019 brought a strong shift in narratives as the green gas and future alternatives were at the center of everyone' attention who is remotely involved with</td></tr>
</table>

	natural gas […] the industry seemed to be legitimately concerned over its future" (HU_Ex_1)
"Well, there are 50% lower emissions in a power plant compared to coal but lots of other ways are generating power than coal, coal is going, you know.'' You then have to compare the lifecycle emissions of natural gas to the new killer the renewables but of course it's a problem now and so what's the answer decarbonize natural gas, so that's what when we get into this next discussion which initially is basically attach CCS to a gas power station, problem solved." (UK_An_1)	"colleagues are working on this—something called the Gas Strategy—that is should not only be a single natural gas, but that it can be gas, which can have carious forms, with hydrogen, and biogas, and so on" (COM_4)
	"natural gas is not valid anymore, but just gas. […] And within gas it [the Commission] includes blue gas green gas, biogas, etc." (US_Ind_1)
	"I had to look at this new alliance that has been made as part of the strategy and it struck me that there are a lot of natural gas companies and they all kind of taking the lead in this alliance [in pro-hydrogen group]." (NO_Ex_1)

Source: author's compilation based on interviews

To explore the future of natural gas, the Commission requested "a few assessments by researchers […] which reflected this new thinking" (COM_6) about the energy system and could provide input on the trajectory of the transition. A case-in-point was 'The role of Trans-European gas infrastructure in the light of the 2050 decarbonisation targets' report, which found that the availability of infrastructure warranted the inclusion of gas in the energy transition (Trinomics, 2018). The Commission led further inquiries and requested various industry incumbents to conduct studies following the 2019 Madrid Forum. Most of the reports were undertaken or supported by industry associations. For example, the International Association of Oil & Gas

Producers (IOGP) was tasked to explore CCS, the infrastructure lobby group Gas Infrastructure Europe (GIE) focused on methane emissions, and ENTSOG was requested to explore how the gas and electricity grid can be integrated with European Network of Transmission System Operators (ENTSOE) (COM_6; EU_Ex_1) (Borchardt, 2019). Incumbents thus played an essential role in producing the ideas and promulgating the discourses that indicated the direction of the transition.

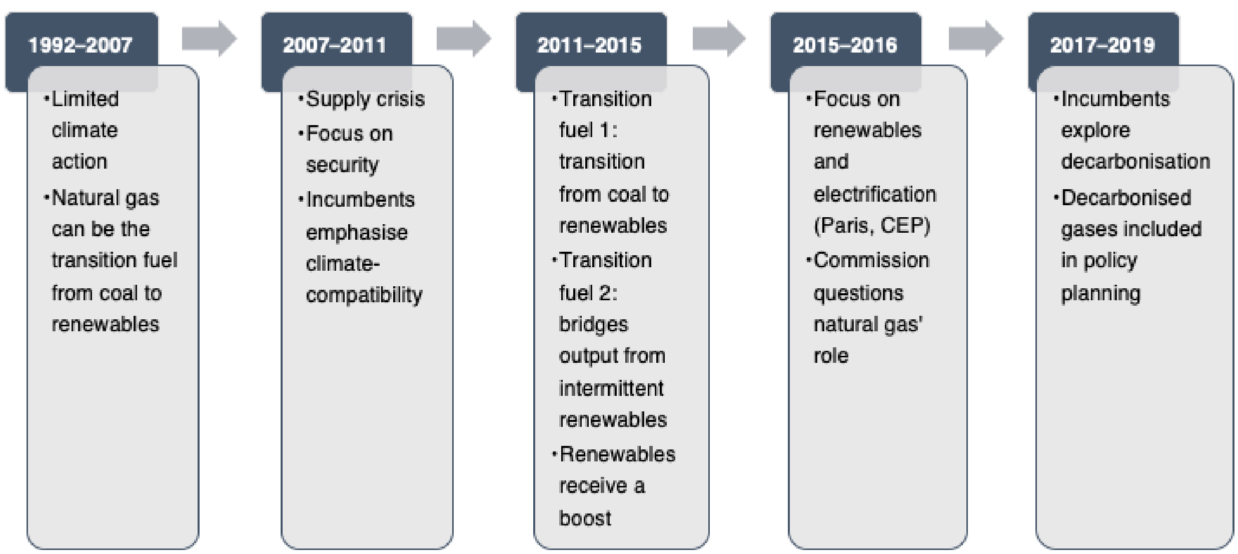
Producers also pledged to develop technologies that allowed for the decarbonisation of natural gas (Stern, 2019). A key element of their strategy is to draw on the long-standing utopia of a society reliant on emission free hydrogen, but maintain society's consumption of natural gas (Szabo, 2020a). Hydrogen offers a convenient, non-emitting energy carrier that functions similarly to natural gas in many senses: it is gaseous with a relatively high energy density that can be used for similar applications and store energy. However, it is an energy carrier which can be produced in multiple ways. Currently, it is mostly produced by oil and gas corporations as well as ammonia producers with a process called steam reforming methane—where the methane originates from natural gas (IEA, 2017a, 2019a). This yields emissions and is referred to as grey hydrogen. If hydrogen is produced from methane, but does not yield emissions, it is called blue hydrogen. Equinor is experimenting with pairing steam methane reforming with carbon capture and storage (CCS) to offer the EU a low carbon source of gaseous energy (European Commission, 2017b; Equinor, 2020b). Accordingly, it leads multiple hydrogen projects in Europe (e.g. H21, H-vision, Magnum, and the Net Zero UK partnership). Gazprom is also exploring hydrogen's potential by developing methane pyrolysis, which allows it to produce hydrogen without combusting methane (Shiryaevskaya, 2018)—this allows it to forego the problem of storing CO_2.

Both Equinor and Gazprom argue that the hydrogen they provide is a key element of the EU's energy transition (Statoil, 2017; Szalai, 2017; Shiryaevskaya, 2018; Kuhn, 2019, 2021), which has already been included into EU policy as well (European Commission, 2018b, 2020b). Grey and blue hydrogen are both permissible sources of energy according to the EU's Hydrogen Strategy, if producers and TSOs limit methane emissions and until the panacea of hydrogen—green hydrogen—scales. Green hydrogen is the electrolyses of water from renewable-based electricity. This is what underpins the excitement around the fuel, since many presume that renewable-based hydrogen can offer a sustainable source of energy. Even though green hydrogen and other sustainable gases face capacity limitations and their scaling has been slow to unfold (IRENA, 2018; IEA, 2020e). This has allowed the natural gas industry to capture the momentum and carve out a role for its methane. Infrastructure-owners also tend to be supportive of hydrogen (GIE, 2019d), irrespective of how it is produced and the questions of whether natural gas infrastructure is fit to transit and distribute hydrogen (ACER, 2020b; ENTSOG, GIE and Hydrogen Europe, 2020). Thus, natural gas' discourse is shifting once again, since it is not only a transition fuel, but also an *end fuel* (Szabo, 2020b). Consumers can rely on it indefinitely, since blue hydrogen is climate-compatible, but with this it perpetuates the EU's fossil fuel reliance.

5.7 Conclusion

This chapter set out to answer a research sub-question of this dissertation, namely *how does the Commission address climate change in its natural gas policy?* The short answer, as argued above, is that it did so gradually. For years, effectively between the launch of EU market liberalisation (1998) and the Clean Energy Package (2016), the Commission focused on developing the EU's single competitive market (see figure 5.1). It proposed a policy framework that allowed for the more efficient and secure allocation of the resource, which it presumed would benefit consumers. Climate change is barely reflected in the governance regime the Commission developed with regard to natural gas and thereby in the policies it issued until 2016. The matter was mostly absent or, if mentioned, policies positioned natural gas as the cleanest fossil fuel that could be the basis of a "sustainable" energy market. The Commission saw natural gas as the source of energy that not only benefitted consumers, but would help mitigate climate change; a position which was largely in-line with the energy industry consensus and discourses prevalent at the time. This framing of the fuel is rooted in its widely accepted materialities—it emits the least greenhouse gases upon combustion—and the discourse that positioned it as the transition fuel.

Figure 5.1: The Commission's changing approach to natural gas



Source: author's design

Based on an expert consensus, sectoral interests actively promulgated a transition fuel discourse which emphasised the climate-compatibility of natural gas. This became especially pronounced following the supply crisis of 2009, which tarnished the fuel's image. Their discursive strategies substantiated a natural gas-intensive narrative of the energy transition—the fuel could substitute more polluting coal and was also assumed to complement intermittent renewables. Such a role of natural gas was also based on the availability of the resource and its respective infrastructure, which was further complemented by the reliance of policy-makers on sectoral actors to develop the resource's complex legal-technical framework (also see chapter four). These factors led the Commission to explore a natural gas-intensive energy transition. It perpetuated fossil fuel-based relations through its support for natural gas in its policies; although, this was coupled with a gradual shift to supporting energy efficiency and renewable source of energy beginning in the early-2010s. While climate policy's influence increased in subsequent years, the presumption of incumbents and the energy sector, more broadly, paired with the Commission's focus on resolving natural gas supply security issues suggested that natural gas would remain to be a key component of the energy system's transformation.

Following the Paris Agreement, there was a noticeable shift in the Commission's energy policy, which became evident with the Clean Energy Package. Natural gas policy declined in its prominence and urgency, as electrification and renewables came to dominate the EU's policy-making agenda. This threatened natural gas' transition fuel role, since focus shifted to eliminate all emitting energy sources. This was a juncture in the Commission's behaviour, when it markedly pivoted away from supporting fossil fuels to focus on decarbonisation. It began to question whether natural gas can be a transition fuel and how it would phase this fuel out. Technological and economic limitations of electrification forced the Commission to revisit the role of gas in the energy system and explore the opportunity low carbon gases offered. Producers and TSOs responded by suggesting that not only could natural gas be a transition fuel, but methane could be decarbonised and the EU's extensive natural gas infrastructure can be repurposed to transit and distribute low carbon gases. TSOs were the first to articulate their ability to provide consumers with biogas and other low carbon gases, while major suppliers soon proposed to explore how they could provide methane-based hydrogen as a substitute to natural gas. The Commission natural gas policies incorporated these positions, leading its natural gas polices to be overwhelmingly subjugated to climate considerations.

The Commission's natural gas policy was thus shaped by climate action, but in a very gradual manner. Greening institutionalism underscores that the immense inertia of a complex institutional ensemble that the EU's energy system embodies leads to gradual change, which the case explored above also reflects. This chapter has shown that the carbon lock-in of the resource was not only infrastructure- or economics-dependent, but fortified by institutionalised practices, dominant discourses, and the involvement of key powerful actors in policy-making processes. These, coupled with dominant consumption practices, limit the scope and pace of institutional change. The force to take climate action led the Commission to move from supporting natural gas to having to reconcile it with climate goals to eventually considering how to phase it out of the energy system in its emitting form. The Commission greened its natural gas policies between 1992–2018 in a gradual manner, the specific form of which was shaped by the material qualities of the fuel, its role in the energy system, related discourse, and the forms of power deployed by actors which participated in the governance of the sector.

6 EU climate policy: a boon for natural gas?

6.1 Introduction

The European Commission’s climate policies substantially changed during the course of the past three decades. This chapter shows how they evolved from a marginal field of policy into an impactful, energy consumption altering force. By exploring how the Commission’s climate action changed, it conveys the role it relegated to natural gas in such policy and how this also changed over time. It does so to answer the research sub-question of *how is natural gas addressed in the European Commission's climate initiatives?* Natural gas has been widely understood to be the fossil fuel which emits the least upon combustion. Climate-led intervention was by-and-large anticipated to be a boon for natural gas demand and established interests in the sector, because the Commission was presumed to pursue an energy transition pathway where the EU would substitute more carbon-intensive fossil fuels with less emitting alternatives. This favoured natural gas. Industry interests and actors involved in the EU’s energy governance more broadly suggested that expanding the role of the so-called transition fuel would further support climate targets. The Commission’s climate policy initially reflected this, but, as it increased the stringency of climate-led intervention, the role natural gas could play declined. This chapter explores how the climate policy tools developed by the Commission moved from having very little impact on natural gas to supporting the switch to natural gas before finally dampening future prospects.

This chapter explores how the rising stringency of the Commission’s climate policy gradually impeded the shift to the least emitting fossil fuel, natural gas. The greening institutionalism framework proposes that EU climate policy became increasingly impactful over the course of three decades (Barnes, 2011; Eikeland and Skjaerseth, 2016; Oberthür, 2019). Its impact accrued gradually and its ramifications were confined by path dependencies that limited the Commission's ability to undertake a rapid transition. This was shaped by techno-economic lock-ins as well as influential actors wielding their powers to shape the actions of the Commission (Pierson, 2000a, 2000b; Unruh, 2000; Schwartz, 2004; Johnstone and Newell, 2018). The particular physical characteristics of natural gas led sectoral incumbents to underscore the climate-compatibility of the fuel they fuel they provided, promulgating the transition fuel discourse and, thereby, perpetuating institutional practices that limited climate-based intervention (Turnheim and Geels, 2012; Balmaceda, 2018; Buschmann and Oels, 2019). This was imprinted in the Commission's climate policy and shaped general EU-level discourse on what sort of energy transition was possible. Only gradually did the governance regime shift to one in support of green solutions as the Commission began to pursue a more ambitious path to become a post-carbon institution and introduce climate policy that increasingly questioned the role of natural gas.

To answer this dissertation's overarching research question, namely, *how does the European Commission reconcile its climate strategies and natural gas policies?*, it looks at two sides of the same coin: how climate policy relates to natural gas and how natural gas policy incorporates climate considerations. This chapter focuses on the former and, thereby, directly mirrors chapter five. Chapter seven will then complement these two chapters by offering an in-depth discussion on the infrastructural dimension of this inquiry. This chapter, much like the other empirical chapter, is structured by the greening institutionalism analytical framework chapter two introduced. Its findings are based on the research design conveyed in chapter three and, along with the other empirical chapters (four through seven), will inform the discussion in chapter eight that articulates the empirical and theoretical contributions of this dissertation.

This chapter discusses EU climate policy in a more-or-less chronological manner, but it narrows in on a few pivotal policy tools or pertinent formative developments. It continues with a brief background on the onset of the EU's climate policy in section 6.2, after which it turns to introduce the Commission's most impactful tool, the emission trading system which it designed to meet the requirements set out in the Kyoto Protocol in section 6.3. Section 6.4 follows with targets which are the other main leg of EU climate policy, before section 6.5 turns to renewable source of energy that offered an alternative to fossil fuel dependence. The chapter then turns to the Paris Agreement and the Clean Energy Package that it prompted, in sections 6.6 and 6.7, respectively, both of which were major turning points in EU climate affairs. Section 6.8 discusses how the Commission turned the Emission Trading System (ETS) into a more impactful mechanism. And, finally, section 6.9 draws conclusions.

6.2 The onset of EU climate action

The Commission first became involved with climate affairs in the mid-1980s (Rayner and Jordan, 2016). It began by observing scientific discussions that focused on the effect of greenhouse gas emissions on the warming of the atmosphere. It was "well aware of the conclusions"[61] that participants reached at the 1985 Villach climate conference, which was a focal meeting that led to raising broader awareness to the "warming issue" (Selin and VanDeveer, 2015). The Commission planned to organise further symposia on the impact of emissions to "shed light on some particularly serious general problems in order to establish the scientific principles on which Community policies should be based" [62]. Its decision to organise climate conferences emerged

[61] No 87/C 72/66, 20.03.1987, Written Question no. 1138/86 by Mr Francois Roelants du Vivier (ARC-B) to the Commission of the European Communities, 02.09.1986 and Answer given by Mr Narjes on behalf of the Commission, 29.10.1986 and the Commission hosted the Changes in Climate and the Environment to be Expected due to the Atmospheric Increase of Carbon Dioxide and other "Greenhouse" Gases, Brussels, 3-5 November 1986.
[62] Ibid.

alongside the launch of the United Nation's World Climate Programme, which raised general awareness that greenhouse gas emissions could destabilise the Earth's climate[63]. The Commission's early involvement reflect its acceptance of the scientific consensus on the "greenhouse issue"[64], according to which "[m]an is modifying at an unprecedented rate the composition of the Atmosphere"[65]. It may have become aware of the issue early on, but it being able to take effective action was slow to unfold.

The impact of greenhouse gases were mostly relegated to the realm of academic debates until it became a "major political issue in 1988" (Paterson and Grubb, 1992, p. 293). Similarly, Bulkeley and Newell (2010) suggest that "the governance of climate change as a global political issue has progressed from being a cause for concern among a growing number of scientists to gaining recognition as an issue deserving of a collective global effort orchestrated by the United Nations" (p. 19). The turning point was the UN's 1988 'World Conference on the Changing Atmosphere' held in Toronto[66], when governments vowed to take steps to limit emissions. The Commission also participated in the Conference and subsequently proposed to "elaborate by mid-November 1988 preliminary ideas on possible Community action in respect of the 'Greenhouse issue'"[67]. It suggested to "take the initiative to launch a substantial policy-options study programme to evaluate the feasibility, costs and likely results of possible measures to limit greenhouse gases emissions" [68]. Member states supported the Commission's endeavours and the Council stated that it "INVITES [sic!] the Commission to reconsider, as soon as possible, existing Community

[63] See e.g. (World Climate Programme, 1986).
[64] COM(88) 656 final, 16.11.1988.
[65] Ibid, p. 5.
[66] See: (WMO and UNEP, 1989).
[67] COM(88) 656 final, 16.11.1988, p. 4.
[68] COM(88) 656 final, 16.11.1988, p. 51.

policies and orientations which may no longer be appropriate in the light of the need to combat the greenhouse effect”[69]. This was the point from when onward the Commission began to consider the climate dimension of its policies. This did not necessarily lead to targeted action to limit emissions initially, but global action was also very much in its infancy.

EU climate policies required “high-level coordination” (EU_Ind_2) to align the multifold positions of member states and other stakeholders involved in the multi-level governance of the EU. Given the expanse of the fossil fuel-based economy (Altvater, 2007), addressing the emissions that led to the greenhouse issue required coordination between a plethora of European stakeholders throughout the energy value chains ranging from energy producers to end-users (Newell and Paterson, 1998; Barnes, 2011; Bäckstrand and Elgström, 2013). Environmental policy was a related field in which the Commission had led EU governance in the past (Rhodes, 1997). The EU formalised this with the Single European Act (SEA) signed by member states in 1986, which included “articles formally acknowledging environmental issues as a Community task” (Selin and S. D. VanDeveer, 2015, p. 19). The Commission had pursued policies in-line with the UN’s (1987) ‘Our Common Future’ report, which urged the international community to shift to more sustainable modes of living and a need to harmonise environmental standards that ensure the functioning of the single market (Lyons, 1992; Hanf and Jansen, 1998; Selin and S. D. VanDeveer, 2015). Its role in environmental and energy governance (see chapter four) provided the basis for its role in climate policy coordination (Cini, 1997).

The ambition of the Commission’s climate policy was limited by its mandate in the 1990s (Matlary, 1997). The main jurisdiction of the Commission was the development of a single market (PL_Gov_3; EU_Ex_4) that led it to primarily focus on competition policy (COM_4),

[69] Council Resolution 89/C 183/03, 20.07.1989, paragraph 5.

despite its competences in environmental policy. Such a ranking of its priorities has been acknowledged in the literature (see e.g. Glachant, Hallack and Vazquez, 2013) and is one of the reasons climate policy did not have too much “bite” (NO_Ind_1) initially. This was noted by an observer promoting renewables’ uptake, reflecting a bias towards more transformative action to mitigate emissions. However, scholars have also taken note of the EU member states’ reluctance to accept and implement ambitious climate goals (Eikeland and Skjaerseth, 2016; Rayner and Jordan, 2016). Most prominently at the time, the Commission was unable to pass the “controversial” (Matlary, 1997, p. 68) carbon tax. The Commission’s powers to intervene and propose ambitious climate goals were limited by the interests of a plethora of actors ranging from the member states to the “fossil fuel companies […that] have actively lobbied” (Newell and Paterson, 1998, p. 682) against the global climate agenda since 1988, perpetuating path dependencies.

In the 1990s, developing a single market, expanding EU membership, and gaining access to fossil fuels to meet energy demand were the top priorities of the Commission and the EU’s member states (Matlary, 1997; Drake, 2000) (EU_Ind_1). It behaved as a carbon institution given the energy regime to which it was confined. Emission reductions were not a priority for most Directorate-Generals (DG). DG Environment (DG ENVI) provided impetus for climate action, but it was considered a small, powerless unit consisting of “ecological freaks” who could not adapt to the *modus operandi* of supranational bureaucracy and had limited sway over policy (Cini, 1997). Despite its limited influence it led the Commission to launch programmes to reduce greenhouse gas emissions: it extended the Environment Action Programme and introduced measures supporting energy efficiency[70], renewable diffusion[71], CO_2 monitoring[72], an EU carbon/energy tax programmes, etc.[73] (Barnes, 2011) (see table 4.1). These programmes reflected a commitment to climate action, but their impact was limited.

Table 6.1: Key global and EU climate action-related events

	Global	EU-specific			Global	EU-specific		
1985	Villach conference			2002			Sixth Environmental Action Programme	
1986		Single European Act		2003				EU ETS Phase I
1987	Brundtland report		Fourth Environment Action Programme	2004		Eastern Enlargement		
1988	The Changing Atmosphere Conference			2005				
1989		EPOCH and Joule		2006				
1990	IPCC 1st AR	SAVE programme		2007	IPCC 4th AR; Stern Review; COP13 Bali	EU 2020; Treaty of Lisbon		
1991				2008				EU ETS Phase II
1992	Rio Summit	Altener programme; Maastricht Treaty		2009		Renewable Energy Directive		
1993		CO2 monitoring programme	Fifth Environment Action Programme	2010				
1994				2011		2050 Roadmap; Energiewende		
1995	COP1 Berlin; IPCC 2nd AR			2012		Energy Efficiency Directive		
1996				2013		Green Paper	Seventh Environmental Action Programme	EU ETS Phase III
1997	COP3 Kyoto			2014	IPCC 5th AR	2030 Strategy		
1998				2015	COP21 Paris			
1999				2016		Clean Energy Package		
2000		Climate Change Programme						
2001	IPCC 3rd AR	Renewable Electricity Directive						

Source: Author's design

The Commission's role in developing the EU's climate agenda increased with the United Nations Framework Convention on Climate Change (UNFCCC)[74] at the Rio Summit in 1992. The UNFCCC established the Conference of the Parties (COP), a decision-making body of the treaty

[70] COM(90) 365 final, 30.11.1990.
[71] COM(92) 180 final, 20.05.1992; Council Decision 89/236/EEC, 14.03.1989.; See: (Commission of the European Communities, 1988).
[72] Council Decision 93/389/EEC9, 24.06.1993, no. L 167/31.
[73] Council Resolution 87/C 328/01, 19.10.1987; Council Decision 89/625/EEC, 20.11.1989.
[74] A/CONF.151/26/Rev.1 (Vol. I), 3-14.06.1992.

composed of signatory states. Significant lobbying efforts allowed experts of the European Economic Community to attain *full participant status* at COP, establishing the representation of the Commission in climate negotiations (Vogler, 1999). It became involved with ensuring the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNFCCC, 1992, p. 9). Its role in developing EU policy led the Council to task it to "establish the procedures and methods for the evaluation of national programmes"[75] monitoring greenhouse gas emissions and measures member states could take to reduce them. Henceforth, the Commission oversaw emission data and the policies member states introduced to curtail emissions. It could not introduce policy that would limit emissions just yet, but it came to play a role in monitoring EU emissions, further establishing itself as a key actor in EU climate governance.

These early years of climate policy reflect discussions on how to tackle global warming, but few practical measures were taken by UNFCCC signatories (IPCC, 1990b, 1995). The EU was no exception: already in 1994 "it was becoming increasingly clear that the EU could not meet its CO2 reduction targets [it had committed itself to] through the proposed policy measures" (Matlary, 1997, p. 70). Policy did not curtail the consumption of fossil fuels, given their deep-seated carbon lock-in. Discussions focused on the need to reduce greenhouse gas emissions broadly speaking, but specifics were lacking and they did not address the role different kinds of fossil fuels could play in forthcoming years. Experts had, however, begun to reflect upon natural gas as the transition fuel (see chapter five). Influential climate policy reports, such as the UN's (1987) 'Our Common Future' report and the IPCC's (1990b) First Assessment Report[76],

[75] Council Decision 93/389/EEC9, 24.06.1993, no. L 167/31, article 5.

[76] The presumption is incorporated into Scenario B of the Emissions Scenarios From Working Group III Of The Intergovernmental Panel On Climate Change (IPCC, 1990b Appendix 1). The IPCC's (1990a, 1990c) *Response Strategies* and *Impacts Assessment* both highlight that fuel switching from coal/oil to natural gas can help reduce

underscored that natural gas is a “lower carbon fuel” and thus substituting more polluting alternatives (e.g. coal) can help reduce greenhouse gas emissions. The Commission also planned to use natural gas to meet growing EU energy demand while reducing emissions. Its only concern was linked to methane slips, which could exacerbate the greenhouse effect[77], but it took little action to mitigate these.

6.3 A major step with little initial impact: the EU ETS

Enthusiasm toward EU climate action remained limited after Rio, in-part due to the ongoing economic recession (Grant, Matthews and Newell, 2000). COP1 hosted by Germany provided renewed momentum for the cause in 1995, which was underscored by the urgency to take action articulated by the IPCC’s (1995)[78] Second Assessment Report. The Commission participated in negotiations, but its competences remained “limited” (Oberthür and Ott, 1999, p. 14). This was partially because “Member State governments have also been hesitant to adopt common policies and measures because this would imply shifting competences to the EU” (ibid., p. 16) and “Europhilic politicians seized on the (then relatively unknown) informal norm of subsidiarity to allay fears that the EU was becoming too large and too involved in ‘national’ affairs” (Jordan and Rayner, 2010, p. 62). This materialised when the Council did not grant the Commission a formal mandate to coordinate the EU’s position in COP3 negotiations in Kyoto (Jordan and Rayner, 2010). It operated within the constraints imposed by member states and their energy systems,

emissions while maintaining economic competitiveness. Although, they also note that methane venting from oil and natural gas well as well as pipeline leakages can accelerate global warming.

77 COM (88) 656 final, 16.11.1988.

78 The IPCC’s Second Assessment Report, yet again, argued for the benefits that switching from coal and oil to natural gas carries in terms of greenhouse gas emissions; although, it notes that methane emissions have to be limited.

leading it to propose energy efficiency enhancing measures[79], which did not impinge on member state sovereignty over energy mixes

When considering the relative role of various fuels at the time, the Commission suggested that "[a]dditional [greenhouse gas emission] reductions will result from switching from coal to natural gas as planned as planned in several Member States" [80]. An interviewee affiliated with an EU-level oil and natural gas advocacy group noted that "[s]ince Kyoto, the Commission has been quite pragmatic when it comes to natural gas. There was and still is a recognition that natural gas is a cleaner energy source than coal, and that a switch from coal to gas is beneficial in the power production sector from a CO2 reduction perspective. The UK was often quoted as an example of a country which used gas to lower its emissions in the late [19]90's" (EU_Ex_5). The reasoning that this is a "pragmatic" choice is based on the positions of influential organisations (UN, 1987; IPCC, 1990a, 1990c), scholarly work (Flavin, 1992; Nakićenović, 1993, 1994; Flavin and Lenssen, 1994), and a general push from the hydrocarbon industry to avoid a reduction in the consumption of oil and natural gas (Paterson and Grubb, 1992; Newell and Paterson, 1998).

EU climate leadership raised the Kyoto Protocol's goals, but greater supranational coordination could have led to even greater ambition (Macrory and Hession, 1996; Collier, 1997; Oberthür and Ott, 1999; Grubb, Vrolijk and Brack, 2019). Diverging interests and path dependencies made this difficult, which underscored the EU's "credibility gap" between what it promised and what it could deliver (Oberthür and Kelly, 2008). The EU's emission reductions it achieved were based on unification of Germany and the UK's coal-to-gas switch (see chapter five) as institutional inertia limited substantive change in the composition of the energy system, while it did not signal

[79] COM(97) 481 final, 01.10.1997.
[80] COM(97) 481 final, 01.10.1997, p. 6.

how it would meet long-term goals. The Kyoto Protocol required the EU to reduce emissions by "8% from 1990 levels in the period 2008-2012 […] In addition, demonstrable progress has to be made by the year 2005"[81], but EU bureaucracy was "slow" (HU_Ex_1) to introduce measures according to an external observer in the energy sector. This was not due to a lack of initiative but the gridlocks between EU institutions, member states, and other actors as well as the sheer complexity of the Kyoto Protocol (Oberthür and Ott, 1999), something which the Commission also noted[82].

The Commission remarked that "[t]he Community's commitment to limit greenhouse gas emissions cannot be achieved by continuing 'business as usual' without making changes in energy policy" [83]. To this end, it announced a dual-pronged programme[84] to decarbonise the energy regime in-place consisting of the European Climate Change Programme and the EU Emission Trading System (ETS). The former initiated a multi-stakeholder dialogue to reduce emissions (Pallemaerts and Williams, 2006), while the latter introduced the foundations for an EU-wide emission trading system [85]. The ETS offered a mechanism to penalise more CO_2-intensive fossil fuels (Lohman, 2006), which the Commission asserted would support the transition from more to less emitting sources of energy[86]. Therefore, "[w]ith the demise of the carbon/energy tax fresh in mind, DG Environment saw tradable CO2 emission permits as an alternative, harmonized instrument compatible with the philosophy of the internal energy market"

[81] COM(1998) 353 final, 03.06.1998, p. 5.
[82] COM(1998) 353 final, 03.06.1998, p. 5.
[83] Ibid.
[84] COM(2000) 88 final, 08.03.2000.
[85] Directive 2003/87/EC, 13.10.2013.
[86] COM(2000) 0769 final, 29.11.2000 and IP/00/1368, 29.11.2000.

(Eikeland and Skjaerseth, 2016, p. 38). With the ETS, the EU took a major step in developing a tool that it presumed could support the decarbonisation of its energy system.

Interviewee positions on the efficacy of the EU ETS were mixed. A number of national policy-makers and those working in the Commission saw it as the best tool to reduce emissions. A German government official noted that it is “the best way to deal with the emissions” (D_Gov_2), while a Commission expert remarked that “DG CLIMA is still on the strong opinion that we have an excellent ETS, we need to let it function, and we do not need CO_2 or carbon taxes” (COM_4). These comments reflect a commitment to the system that they developed and presumed would have a gradual impact. Others dispute whether this is the most effective and “best” tool to reduce emissions, since it commodifies emissions, subjecting them to speculative trading, while allowing for emitters to buy the permissions to pollute (Spash, 2010; Bryant, 2019). A Commission expert noted that “emission trading was not successful” (COM_6), which she argued was because shifting from more to less emitting fossil fuels did not allow for decarbonisation at the pace necessary to meet goals. Specifically, she noted that “natural gas does not offer a substantial improvement over coal, just because it offers a slight benefit in terms of emissions” (COM_6). Thus, even those close to the Commission see the ETS critically, since it induces relative improvements but not a permanent fix. Moreover, the Commission did not have control over this complex mechanism and overestimated the quota needs of emitters, inhibiting its impact (UK_Ex_1)—a point sections below will return to.

The EU made “astonishingly quick progress” (Jordan and Rayner, 2010, p. 69) to introduce the ETS, a tool which also embodied a deep anomaly in EU energy governance. An expert working on EU energy affairs noted that the “EU ETS—article 192 [of the TFEU[87]] in particular—had a

[87] Official Journal C 326, 26.10.2012.

structure-altering impact on the EU energy market, while article 194 [of the TFEU] left the energy sector in the hands of member states…the two mechanisms contradict one-another!" (EU_Ind_1). Article 192 allows the Commission to take action to protect the environment and curtail emissions, while article 194 ensures that "[s]uch measures shall not affect a Member State's right to determine the conditions for exploiting its energy resources, its choice between different energy sources and the general structure of its energy supply". Member states thus retained sovereignty over the structure of their energy mixes, but they developed a supranational mechanism—the ETS—that could fundamentally shape this very structure. The Commission reconciled the contradiction by underscoring that the EU ETS is technology neutral—noted by multiple Commission experts (COM_1; COM_2), observers (NO_An_2; EU_Ex_1), and policy documents—meaning that it could not force member states to adhere to specific mixes, but the price of carbon would allow those within the energy sector to take decisions over which fuel was deemed most economic.

The ETS could not directly mandate member states to opt for certain sources of energy, but it reinforced the differentiation between sources of energy based on their emissions. The "explicit backing of natural gas could not be included into policies" (COM_2), but it was implicitly favoured since EU policy favoured energy sources that yield lower greenhouse gas emissions. The Commission thus began to withdraw its support for the reproduction of fossil fuel relations, as the ETS was to penalise the most carbon-intensive sources of energy, mostly coal. It began to introduce policies that aimed to green EU institutions. The infancy of renewables led it to promote a shift to what were then understood to be less carbon-intensive fossil fuels (IPCC, 1990b, 1995; EIA, 1998; IEA, 1998; Aaheim and Müller, 2000), most prominently, natural gas (Stern, 2017b). In retrospect, the issue emerged that this system that "we've inherited from

Kyoto", does not look at the "lifecycle" emissions of goods, products, and fuels (UK_A_1). It ignores fugitive methane emissions (Stern, 2020), an issue the Commission was aware of, but only responded to relatively recently[88]. The complexity of such calculations impeded their consideration (Curran, 2012; IEA, 2018b), as an academic I interviewed elaborated, "[l]ife cycle emissions are highly context and setting-specific and very complex to calculate, this made it easy to identify the 'good' and 'bad' resources. This allowed natural gas to avoid scrutiny, while blame on coal was more evident" (US_A_1): coal was CO_2-intensive, while natural gas was not.

The Commission thus sought to steer the EU to become a post-carbon bloc, but its main policy tool supported the shift to natural gas in-line with the expert consensus and the available alternatives at the time. An expert deeply opposed to all forms of fossil fuels remarked, the "EU ETS has also been a tool directed against coal, […] when will it [natural gas] be transitioned out?" (NGO_Ex_2). By design it was to first limit the consumption of coal only after which would it begin to substantially impact other fossil fuels. In the meantime, natural gas demand climbed until 2005 only to be reduced by the high oil price environment and the economic crisis of 2007. Meanwhile, the ETS in-itself remained an ineffective tool as governments were able to secure exceptions and free quotas for their emitting activities (EU_Ind_2), which ultimately prompted very little fuel-switching (Neuhoff, Martinez and Sato, 2006; Marcu *et al.*, 2019). Even this marginal impact would decline as the 2007/2008 economic crisis suppressed demand for quotas (Ellerman and McGuinness, 2008; Hintermann, Peterson and Rickels, 2016). Even as a "tool directed against coal" (NO_Ex_2), the ETS played a limited role in fuel-switching, leading "to accusations from the gas community that the EU commitment to decarbonisation has lacked

[88] Historically, the Commission as acknowledged the problematic of methane slips, see e.g. COM (88) 656 final, 16.11.1988. However, it only began to address the issue in a comprehensive manner in COM(2020) 663 final, 14.10.2020.

seriousness" (Stern, 2017b, p. 20). The Commission introduced a key tools with which the EU could decarbonise, but its impact remained limited until it would increase its stringency (see section 6.7 below).

6.4 The other leg of climate policy: targets

A Commission official remarked that climate action "at the time [2004–2005] […] was much-much weaker" (COM_4) than what the Commission would lead a decade later. The ETS' and other climate policies' impact on energy demand patterns remained subdued (Ellerman and Buchner, 2007), sustaining the fossil fuel dependence of the EU. The Commission responded with further proposals in a 2005 memo[89] and received political support from the Environment Council, which called for the EU to accept emission reduction pathways (Pallemaerts and Williams, 2006). These prompted further discussions on limiting emissions. Including further sectors (e.g. transportation) in the ECCP II were considered by policy-makers (Damro and Mackenzie, 2008), while there was a continued support to decarbonise electricity generation by *inter alia* "substituting natural gas for coal"[90]. The urgency of action was underscored by the forewarnings of the Stern Review and the IPCC's Fourth Assessment Report's (IPCC, 2007; Stern, 2007). Climate discussions were bolstered by high oil prices and the 2006 natural gas supply crisis, which pushed the EU to consider the reduction of its dependence on imported energy carriers[91]. The Commission received political support from the European Council[92] to explore how climate and energy policy could address the mounting challenges.

[89] MEMO/05/42, 09.02.2005.
[90] Ibid., n.p.
[91] COM(2006) 105 final, 08.02.2006.
[92] 7224/1/07 REV 1, 02.05.2007.

Introducing climate policy that had a tangible impact on energy consumption patterns was a "very gradual process" (NO_Ind_1) (McGowan, 2008; Jordan and Rayner, 2010; Eikeland and Skjaerseth, 2016; Eikeland, Skjærseth and Gulbrandsen, 2016). The EU was falling short of meeting its Kyoto goals[93], which, combined with its attempt to reduce dependence on energy imports, prompted the EU to launch "a new climate strategy, which sought to push internal policy making into an even more energetic phase" (Jordan and Rayner, 2010, p. 73). The Commission proposed its 2020 Agenda[94], which included further emission reduction measures for the 2011–2020 period. It developed this in tandem with 'An Energy Policy for Europe'[95], which introduced a "more integrated European energy policy" (Langsdorf, 2011, p. 6). Both policy documents reflected a greater focus on developing energy and climate policy in an interrelated manner (Eikeland, Skjærseth and Gulbrandsen, 2016), which was also generally anticipated to enhance their impact and allow for the EU to sever its carbon lock-in. The 2020 Agenda[96] used the ETS as a "centralised" instrument that became "integrated into wider energy and climate policy" (Skjærseth and Wettestad, 2010, p. 101). With this, the Commission's greater climate ambitions built on the approach that supported the coal-to-gas switch that a number of experts had already anticipated (NGO_Ex_2) (Stern, 2017b).

The 2020 Agenda introduced targets to support the diffusion of renewables, reduce energy consumption through efficiency measures, and reduce greenhouse gases. This signalled the emergence of governance regime that would lead the EU's decarbonisation efforts which was intertwined with the Commission taking on a greater role to lead the bloc's climate ambitions. A

[93] COM(2007) 757 final, 27.11.2007.
[94] COM(2007) 2, 10.01.2007.
[95] COM (2007) 1, 10.01.2007.
[96] COM(2008) 30 final, 23.01.2008 and DIRECTIVE 2009/29/EC, 05.06.2009.

Commission expert suggested that the "2020 targets were derived from the Lisbon Treaty[97]" (COM_1), because it expanded the Commission's competencies *de jure*—a point noted by other interviewees as well (UK_Ex_1; EU_Ind_4) (Barnes, 2011; Hix and Høyland, 2011; da Graça Carvalho, 2012). This led the EU institution to pursue policy that would underpin "smart, sustainable and inclusive growth"[98], but the impact of its climate policy, while increasing, was still minuscule and pushed action into the future. Member states had a decade to reach 2020 goals and even if they did not, whether the Commission would impose sanctions remained an open question. Nonetheless, the momentum of climate action prompted the Commission to develop an increasingly ambitious agenda[99] for COP15 in Copenhagen[100] and the near future[101], but as Energy Commissioner at the time Andris Piebalgs remarked the EU's climate action "is by no means anti-fossil fuel"[102]. This was especially pronounced with regard to natural gas, which the Commission continued to frame as a key component of decarbonisation.

6.5 Maturing conditions for decarbonisation

The 2020 agenda "brought more coherent climate policies" and "decarbonis[ation] [became a] critical part of EU energy policy" (EU_Ex_1). The Commission began to develop energy policy while bearing climate considerations in mind, even though climate policy decelerated to a "snail's pace" (Dupont and Oberthür, 2015, p. 4) due to the 2007/2008 and euro crises. Path dependencies prevailed, even though in the meantime, the Council tasked the Commission to launch an inquiry into how the EU could decarbonise in the long-term[103] in accordance with the

[97] The Treaty on the Functioning of the European Union, 09.05.2008.
[98] COM(2010) 2020, 03.03.2010.
[99] COM(2009) 39 final, 28.01.2009, p.2.
[100] FCCC/CP/2009/L.7, 18.12.2009.
[101] COM(2010) 639, 10.11.2010.
[102] SPEECH/09/102, 11.03.2009.
[103] EUCO 2/1/11 REV 1, 08.03.2011.

Bali Road Map (UNFCCC, 2007). It assessed[104] the energy infrastructure of the bloc, and indicated that there is a need to support the diffusion of renewables and auxiliary infrastructure (e.g. electricity grids). The prohibitively high costs of renewables at the time impeded their expansion, which also entailed that the EU could not do away with its carbon lock-in, since it did not have an alternative energy regime to shift towards. In-line with this, the Commission found that "[n]atural gas will continue, provided its supply is secure, to play a key role in the EU's energy mix in the coming decades and will gain importance as the back-up fuel for variable electricity generation" [105]. This led the Commission to continue to support the development of natural gas infrastructure as a part of climate *and* natural gas policy.

The Commission proposed that the EU reduce emissions by 80%–95% by the middle of the century in its 2050 Roadmap[106]. To reach this, the EU had to substantially increase the role of renewables, enhance energy efficiency, while decreasing oil and solid fossil fuel (primarily coal) consumption or developing carbon capture and storage (CCS) technologies. The Commission also continued to argue that "[g]as will be critical for the transformation of the energy system"[107] and "might play an increasing role in the future" [108]. The Roadmap generally supported natural gas in alignment with the common position that framed natural gas as a "climate-compatible" fossil fuel (IPCC, 2006) (see chapter five). It nonetheless indicated that it may only be used for flexible back-up and balancing renewables unless it is paired with CCS from 2030 onwards—even though the prospects of CCS remained highly uncertain (see chapter seven). The Roadmap simultaneously suggested that member states should substitute more CO_2-intensive fossil fuels

[104] COM(2010) 677 final, 17.11.2011.
[105] Ibid, p. 6.
[106] COM(2011) 112 final, 08.03.2011 and COM(2011) 885 final, 15.12.2011.
[107] COM(2011) 885 final, 15.12.2011, p. 11.
[108] Ibid., p. 11.

with natural gas (NGO_Ex_2), but its positions became somewhat more cautious when considering the long-term role of the fuel. This reflects the gradual change in the Commission's discourse. However, this had little tangible impact on energy consumption practices at the time, as natural gas demand remained low given the EU's economic slump.

The Commission introduced the Roadmap around the time German government reinvigorated the *Energiewende* (BMWI and BMU, 2010). This indicated that the EU's largest country (per population and GDP, amongst others) will phase out nuclear and undertake a transition to a low carbon energy system (Jacobs, 2012; Beveridge and Kern, 2013; Von Hirschhausen, 2014). The *Energiewende* would profoundly shape EU climate policy (Szulecki *et al.*, 2016; Gawel *et al.*, 2019) in two major ways: it provided political support for further climate action and it would increase the competitiveness of low carbon energy production (Ind_1; D_Gov_1) (Schreurs, 2016). It channeled vast investments into the German wind and solar photovoltaic sectors leading to "cheap" renewables (HU_Ind_1). These technologies had been available for decades, but their large-scale commercialisation was pending since fossil fuels offered cheaper sources of energy that were compatible with well-established consumption practices (Smil, 2016b; Sivaram, 2018; Mulvaney, 2019). As investment flowed into the renewable sector, costs declined (Lazard, 2021) and they became palatable alternatives to fossil fuels. They offered a tool to disrupt path dependencies by offering the techno-economic means that could complement political-institutional change.

6.6 A turning point: Paris

The EU made limited progress on climate action between 2009–2015 (Dupont and Oberthür, 2015), even though the Commission's focus was noticeably shifting to implementing measures. By then, it had developed a number of strategies and policy tools that would support decarbonisation, but the EU would only reinvigorate global and, thereby, domestic climate action at 2015's COP21 in Paris (Oberthür and Groen, 2018). The EU established itself as a "leadiator" (Bäckstrand and Elgström, 2013)—a leader and mediator—in international climate talks. A role premised on the Commission's 2030 Framework[109] and a sense of urgency to reduce emissions (IPCC, 2014; IEA, 2018a; Oberthür and Groen, 2018). The Commission launched a consultative communication[110] for COP21, emphasising the need for the Paris Agreement[111] to be inclusive, ambitious, effective, fair, and legally binding. Accordingly, the Communication included a number of policy proposals that would support emission reductions. The Commission then refined its positions[112], leading it to develop what essentially became a blueprint for the Paris Agreement (Oberthür and Dupont, 2021). COP participants signing the Paris Agreement prompted a wave of enthusiasm, which many saw as a "turning point" (Waskow and Morgan, 2015) for climate affairs and the Commission called a "historically significant landmark in the global fight against climate change"[113].

Interviewees generally noted that the Paris Agreement was a turning point for EU climate affairs (see table 6.2). Their reasons for supporting this position varied, but linked to the "credibility" (EU_Ex_3) of the agenda and the "backing" (HU_Ind_2) this would provide for renewables. Some suggested that it was not Paris *per se*, but a chain of events that led "continuous" (US_Ind_1) change. Indeed, the steps the EU and other countries had taken fed into the success of the Agreement (Parker, Karlsson and Hjerpe, 2017), but it reinvigorated government support for climate action, which was further underpinned by the availability of increasingly competitive

[109] COM(2014) 15 final, 22.01.2014.
[110] COM(2013) 167 final, 26.03.2013.
[111] Paris Agreement, United Nations 2015.
[112] COM(2015) 81 final, 04.03.2015.
[113] COM(2016) 110 final, 02.03.2016, p. 2.

renewables (Kinley, 2017). As Stern (2017b) writes, "it was an important declaratory statement signalling a time-limited future for fossil fuels without carbon capture and storage (CCS) capability" (p. 5). The Agreement may have included inconsistencies and lack binding targets (Anderson, 2015; Spash, 2016; Höhne *et al.*, 2017), but it provided global support for emission reductions. Even in the EU, where "many European countries already have 'carbon budgets'" (Stern, 2017b, p. 4), it prompted further action which would lead to the Clean Energy Package (see below). It offered a rupture in the path dependencies of political institutions, prompting the Commission, for instance, to introduce even more stringent measures that could help the bloc reach the targets it accepted.

Interviewees remarked that "COP21 was a pivotal moment for the [natural gas] industry" (EU_Ex_2) not only for climate affairs in general (see table 6.2). They agreed that this is when climate policy began to affect the natural gas sector—Stern's (2017b, 2019) research also underscores this. Only an NGO expert (NGO_1) noted that substantive change in the sector would only follow later, when the IPCC (2018) published its 'Global Warming of 1.5°C' report. Indeed, material change only began to take effect after the Paris Agreement as consumption was still rising from its 2014 lows during the second half of the 2010s (BP, 2020), but the role it could play in the EU's energy transition was reconfigured as those involved in the resource's governance responded to a shifting governance regime that prioritised decarbonisation. Most interviewees suggested that the Commission shifted its approach to natural gas with the Paris Agreement: "instead of being part of the solution [it] became the problem itself" (US_Ind_1). The Commission began to acknowledge its "fossil fuelness" (COM_3) and shifting to natural gas could no longer "lend credibility to the climate agenda" (EU_Ex_3). This was reflected in the authoritative IEA's (2015) work as well, where it no longer considered it as a part of a "Bridge

Strategy"—the research institute still suggested that it can substitute coal and to reduce emissions, but did not argue for consumers to adapt it as a bridge fuel.

Table 6.2: EU climate policy's turning point

<table>
<tr><th colspan="3">Turning point for EU climate policy</th></tr>
<tr><th>Prior to COP21</th><th>COP21</th><th>After COP21</th></tr>
<tr><td>"I think this [change] was continuous. I don't think there is a single policy package" (US_Ind_1)</td><td>"COP21 [provided] push: 2°C need to be reached according to member states" (EU_Ex_4)</td><td>"COP21: not shifted the official view of nat[ural] gas. 1.5°C report could produce push" (NGO_1)</td></tr>
<tr><td>"COP21 has had little impact on their practices…Russia is not a signatory. The deal itself has broad-ranging implications, but Gazprom was also working on related process of decarbonisation, hence the little impact on their positions" (EU_Ind_3)</td><td>"COP21 was a pivotal moment for the [natural gas] industry […] COP21 driving decarbonisation and those decision-makers that came to the agreement are the key drivers of actions taken" (EU_Ex_2)</td><td></td></tr>
<tr><td colspan="2">"COP21: made the journey we were on very visible. Has not fundamentally altered our course of action, because most EU companies and states were already leaders in climate change combat" (EU_Ind_1)</td><td></td></tr>
<tr><td></td><td>"COP21 lent credibility to the climate agenda" (EU_Ex_3)</td><td></td></tr>
<tr><td></td><td colspan="2">"the Paris [Agreement] and most recently the IPCC 1.5°C was very successful in the sense that it redefined the rules of the game" (G_Ex_1)</td></tr>
</table>

	“I think [change came] around Paris” (COM_4)	
	“Paris Agreement provided backing for renewable” (HU_Ind_2)	
	“Climate policy has re-asserted its focal role again in the past 5 years [i.e. around 2014–2015]” (COM_2)	
	“Paris was a key driver […] furthered by commitments in Katowice. COP21’s targets were highly indicative that change needs to be enacted” (EU_Ex_1)	

Source: Author’s compilation based on interviews

Multiple interviewees from within the energy sector suggested that by COP21 most actors had accepted that the sector—including the natural gas industry—would have to gradually meet the requirements posed by climate policy (EU_Ind_1; EU_Ind_2; EU_Ind_3). The policy toolkit to this end was already in place at the EU-level even though the stringency of measures was not yet aligned with long-term objectives. An expert remarked that “decision-makers that came to the agreement [in Paris] are the key drivers of actions taken, not necessarily the EC [European Commission]” (EU_Ex_2), but this is somewhat skewed, since the Commission’s relentless push for greater ambition in the EU’s climate agenda was essential to raise climate ambitions. Scholars have widely recognised its leadership (Barnes, 2011; Maltby, 2013; Dreger, 2014; Parker, Karlsson and Hjerpe, 2017) and Commission officials I interviewed also took note of their leadership (COM_1; COM_2). The latter may have a propensity to overstate their own role, but the Commission’s endeavours certainly played a focal role in driving the policy agenda considering developments. However, these were intertwined with the a multi-stakeholder dialogue as well as other factors (e.g. the competitiveness of renewables) (Kinley, 2017; Oberthür and Groen, 2018) that contributed to a gradually unfolding green governance regime.

The turning point Paris brought in climate policy aligned with the introduction of Energy Union[114] (see chapter five). The Commission initiated the latter to address the supply security of natural gas, but it also became "the most significant policy idea that seeks to reform European energy governance, policy and regional cooperation, streamlining these with long-term climate protection goals" (Szulecki *et al.*, 2016, p. 548). This articulated "[t]he goal of a resilient Energy Union with an ambitious climate policy at its core is to give EU consumers - households and businesses - secure, sustainable, competitive and affordable energy" [115]. Thus, the Energy Union established the foundations for a governance framework that coordinated between climate goals and the measures necessary to achieve them (PL_Ind_1; EU_Ex_4). On the face of it, "[c]limate […] offered the opportunity to launch a power grab game" (EU_Ind_1) favouring the Commission, but it was also clear that climate intervention "needed high-level coordination" (EU_Ind_1). To meet the pre-set targets, the EU would have to take further action to dismantle its carbon-dependence, which the Commission—as the body responsible for EU climate and energy policy—was in a position to propose and enforce (Johnstone and Newell, 2018; Haas, 2019). It was not only a leadiator (Bäckstrand and Elgström, 2013) of global climate action, but also within the EU.

The Commission's actions depended on continuous political support from a plethora of actors, which also shaped the policies it introduced. Prominent of these were member states, which came

[114] COM(2015) 80 final, 25.02.2015.
[115] COM(2015) 80 final, 25.02.2015, p. 2.

to support its decarbonisation agenda. For instance, Germany backed intervention, because its own "climate targets are more ambitious than EU commitments" (Ind_1). A point underscored by German government officials (D_Gov_1; D_Gov_2) and scholars as well (Haas, 2019; Rechsteiner, 2021). This political support was essential for the continued legitimacy of the Commission's actions, as a number newly joined member states and other climate laggards were reluctant to decarbonise (Buzogány and Ćetković, 2021; Szabo and Deak, 2021)—a point also reflected in a number of interviews, especially with German (D_Gov_1; D_Gov_2), Hungarian (HU_Ind_1; HU_Ind_2), and Polish (PL_Gov_3; PL_An_1) experts. This fueled a rupture between member states, but it did not undermine the Commission's push for more stringent climate policy, which would materialise in post-Paris EU policy.

6.7 The Commission turns its attention to electrification: The Winter Package

The Commission translated the Paris Agreement into policy in the Clean Energy Package[116], which focused on "[p]utting energy efficiency first; [a]chieving global leadership in renewable energies; and [p]roviding a fair deal for consumers" [117]. It based long-term priorities on five pillars: energy performance in buildings[118], renewable energy[119], energy efficiency[120], governance regulation[121], and electricity market design[122]. An interviewee working in the natural gas sector remarked in relation to the Package that it was the "first EC [European Commission] policy intervention based on climate change [but it was] [l]imited to redesigning the electricity

[116] COM(2016) 860 final, 30.11.2016. Also frequently referred to as the Winter Package.
[117] Ibid., p. 3.
[118] Directive (EU) 2018/844, 30.05.2018.
[119] Directive (EU) 2018/2001, 11.12.2018.
[120] Directive (EU) 2018/2002, 11.12.2018.
[121] Regulation (EU) 2018/1999, 11.12.2018.
[122] Regulation (EU) 2019/943, 05.06.2019; Directive (EU) 2019/944, 05.06.2019; Regulation (EU) 2019/941, 05.06.2019; Regulation (EU) 2019/942, 05.06.2019.

market" (EU_Ex_4). This was not entirely true, since it addressed other forms of energy to some extent, but the statement captured a key shortcoming of the Package: the supply side of energy is heavily oriented towards renewables and electrification (Meeus and Nouicer, 2018). The Commission articulated that the future of energy in the EU was to be one based on *green electricity*. This brought a marked shift in the Commission's climate policy, which had supported the switch to less carbon-intensive fossil fuels and renewables, but the Package presented a long-term vision of a renewable-based energy system.

The Package did not articulate a role for natural gas. What is more, the Commission committed to "stepping up EU's action in removing inefficient fossil fuel subsidies"[123], from which natural gas infrastructure had benefitted in the past (see chapter seven). The omission led Eurogas (2017) to argue that "[t]he market design parts of the package rightly focus on addressing the electricity market […] [s]ome amendments, however, should be introduced. The energy efficiency and renewables proposals should be more strongly amended to recognise more explicitly the benefits of an holistic approach to a future-proofed energy system, accommodate the potential complementarity of developing gas technologies in the system and realise the energy efficiency potential of gas-fired applications" (p. 3). It supported a holistic reconfiguration of the energy system, but, possibly more importantly, one that would continue to include natural gas. Its argument was still underpinned by the assumption that "[q]uick and efficient climate gains [could] only [be made] with gas" (Eurogas, 2016, n.p.); however, this was now missing from the Commission's climate policy.

The Commission did not focus on the relative emission gains from a coal-to-gas switch that it had emphasised in previous policy documents. Multiple interviewees working in the natural gas

[123] COM(2016) 860 final, 30.11.2016, p. 12.

industry noted that this was the moment, when they comprehended the precarious position of their industry. This was when other actors critical of fossil fuels also began to question whether the energy transition could be based on consuming more natural gas, even if only in the short- to mid-term (Polder, Gilbertson and Tricarico, 2014; EEA, 2016; Anderson and Broderick, 2017; CEO, 2017). Their general answer was "no"—natural gas cannot play much of a role in its emitting form. A natural gas industry expert remarked that the industry had been in a "comfort zone" (EU_Ex_1), insulated from the negative impact of climate policy until the Commission published the Package. It was years in the making, but the Commission began to firmly articulate that its climate policies would reduce demand for fossil fuels. Natural gas interests found themselves in a precarious position. Providing the least emitting fossil fuel did not suffice as the EU's focus turned towards carbon neutral technologies. Despite the focus to limit the role of the fuel, a Commission expert remarked that the Package's focus on electrification and renewables led it to "miss an opportunity" (COM_4) to develop a comprehensive long-term energy transition strategy. It focused on clean sources of energy, but overlooked areas consumers could not yet phase natural gas out (Smil, 2015).

6.8 Changes in the EU ETS

As this chapter discusses above, reforming the EU ETS to support higher climate ambitious has been a continuous issue since the EU instated the system. Only gradually was the Commission able to hone the ETS to support higher carbon prices that would lead to fuel-switching. The first phase of the ETS—the pilot phase (2005–2007)—had little effect on emissions, but allowed the EU to develop necessary rules and regulations (Ellerman and Buchner, 2007). Phase 2 (2008–2012) also had a limited impact, because "by the time it could have impacted markets demand plummeted due to the [2007–2008] economic crisis" (HU_Ind_1). The oversupply of quotas limited the price of carbon (de Perthuis and Trotignon, 2014; Koch *et al.*, 2014). The Commission was aware of the issue[124], with Climate Action Commissioner Connie Hedegaard stating that "[t]he EU ETS has a growing surplus of allowances built up over the last few years. It is not wise to deliberately continue to flood a market that is already oversupplied" [125]. The Commission reduced quotas in Phase 3 (2012–2020), which initially had "little impact" (HU_Ind_2), but gradually grew to levels that increasingly supported decarbonisation.

The Commission governed the ETS by introducing a market stability reserve (MSR)[126] in 2014 that could be adjusted to taper available allowances, increase carbon prices, and support emission reductions by consumers[127]. It introduced this because "too large a surplus affects the stability of the carbon market and impedes the effectiveness of the system in incentivising both short-term abatement, such as fuel switching from coal to natural gas, as well as mid- and long-term investments in low carbon technology"[128]. Interviewees and experts alike noted that establishing a market stability reserve would support coal-to-gas switching (Ind_1; PL_Ind_1; PL_Gov_3) (Eurelectric, 2020), which the Commission—in accordance with the dominant discourse and approach at the time (see chapter five)—deemed desirable. Eurogas (2014) advocated for even greater ambition and the acceleration of back-loading i.e. adding quotas to the MSR, which, in principle, would reduce available quotas, leading to an increase in carbon prices, ultimately increasing the competitiveness of natural gas vis-à-vis coal.

[124] COM(2012) 652 final, 14.11.2012.
[125] IP/12/850, 25.07.2012, n.p.
[126] COM(2014) 20 final, 22.01.2014; Decision (EU) 2015/1814 of the European Parliament and of the Council, 06.10.2015.
[127] IP/12/850, 25.07.2012; IP/12/1208, 12.11.2014.
[128] SWD(2014) 17 final, 22.01.2014, p. 18.

Actors within the natural gas sector saw the EU ETS as a boon for natural gas demand. Multiple interviewees (EU_Ex_4; UK_Ex_1) noted that companies within the sector had already supported a “strengthened ETS” (Eurogas, 2013, n.p.) in their policy positions. They argued that “higher CO2 prices are needed to recognise the environmental friendliness of gas over higher CO2 emitting fuels” (Eurogas, 2012). As Equinor-turned Statoil (2017) articulated somewhat later “[n]atural gas as a replacement for coal in power generation is a critical part of a credible low carbon strategy” (p. 5). In parallel, natural gas industry advocacy groups[129] launched public relations campaigns emphasising the favourable environmental and climate characteristics of their fuel (Stern, 2017b; Szabo, 2020b). Despite these, the ETS-induced rise in natural gas demand envisioned by many did not materialise between 2012–2019 (Stern, 2017b; Eurelectric, 2020). Fuel prices did not support the shift: coal remained too cheap and natural gas too expensive. In addition, renewables became competitive further impeding the shift by attracting investment (Sivaram, 2018). The EU ETS’ design may have favoured natural gas in principle, but price dynamics and its gradual impact (HU_Ind_1) did not allow for it to prompt fuel-switching.

The Commission further reduced the number of available allowances from 2019 onwards to support climate goals (De Clara and Mayr Kordula, 2018; Perino, 2018). German government interviewees had expected such intervention, noting in 2018 that “intervention will also need to be introduced [to the ETS]”, adding that the “ETS is not being discussed at all, [there is] basically no progress [happening]” (D_Gov_2). Progress only took place when the MSR was implemented in Phase 3 and the Commission developed Phase 4 (2021–2028)[130]. Evidence suggests that the ETS gradually contributed to reducing emissions even if only slightly (Bayer and Aklin, 2020) by

[129] The International Gas Union, Gas Naturally, the European Gas Advocacy Forum, and the Oil and Gas Initiative.
[130] COM(2015) 337, 15.07.2015.

"affecting the costs of fossil fuels, nuclear and renewables differently" (Eikeland and Skjaerseth, 2016, p. 43). The Commission's intervention drove allowance prices to the EUR 25–30 interval by late-2018, up from the EUR 5–10 band they had moved within between 2012–2018 (Sandbag, 2020). However, this still did not meet price levels that would induce large-scale coal-to-gas switching[131] and most forecasts did not seem to suggest that fuel-switching would occur, given the competitiveness of renewables (Lewis, 2018; Marcu *et al.*, 2019). This gradually changed, as renewables became more competitive and the high carbon prices coupled with relatively high fossil fuel prices prompted some consumers to make the transition (Eurelectric, 2020; Crellin, 2021).

6.9 Conclusion

This chapter surveyed how the Commission's climate initiatives evolved between 1992–2018 and what role these assigned to natural gas to answer the research sub-question: *how is natural gas addressed in the European Commission's climate initiatives?* 1992 marked the beginning of concerted global climate action with the Rio Conference, in parallel to which the Commission also began to coordinate EU climate policy among member states. Initially, its interventions were limited both in their scope and impact. During the 1990s, these were marginal, relatively small-scale programmes, as the EU and thereby the Commission overwhelmingly reproduced fossil fuel-based social relations. That is, the energy regime was dominated by fossil fuels and respective policy was designed to provide competitively-sourced, secure supplies of these sources of energy, which overshadowed sustainability considerations. Climate policy was an insignificant realm of policy that carried little weight in the EU. The pervasiveness of emitting sources of

[131] Estimated at approximately EUR 35–EUR 40 per tonne of CO_2 (Watson, 2019; Rene, 2021).

energy, impeded the Commission's ability to introduced measures that disrupted the existing energy regime, allowing the energy system to develop along its path dependencies.

In the early-2000s, the Commission introduced a growing number of climate tools and programmes necessary to lead an energy transition. The contours of the Commission's approach to green its policies took shape with the EU ETS it introduced in 2003, which focused on emissions upon combustion and supported a shift to less carbon-intensive energy carriers. In principle, this is a technology neutral mechanisms, but, in principle, it favoured a shift to natural gas allowing it to play the role of a transition fuel. The stringency of such policy tools was lacking and these had little influence on the EU's overall energy mix and, thereby, emissions at the time. Their design, however, allowed their effect to increase with sufficient political will. They offered the basis for a greening institutionalism. The higher ambitions that emerged from a changing governance regime allowed the Commission to gradually shift its practices and move to support a low carbon energy system. Germany's *Energiewende* and subsequent long-term planning would provide the basis for the Commission's further intervention and the support it needed to introduce greater ambitions rupturing carbon lock-ins.

The Commission's climate interventions gradually reduced the role natural gas could play in the long-term as well. The room for natural gas to play a higher role in the EU's energy system declined with net zero goals materialising and interim targets requiring stringent action. In theory, natural gas' uptake could offer alleviation from high coal-based emissions, but the general price environment impeded this shift. With the Paris Agreement and the subsequent Clean Energy Package, the Commission began to withdraw its support for the fuel in climate policy. It focused on essential components of a low carbon energy system: renewables and electrification. Both of these were now economically competitive and, as the Commission indicated the acceleration of its shift to become a post-carbon institution, it was decarbonising its policies and thereby withdrawing its support for natural gas. Relying on fossil fuels without a clear indication of how it would phase those out was not a viable option after the political mandate to decarbonise was accepted by the EU. Climate policy's effect on energy policy became increasingly felt, as the Commission aligned the objectives of the two realms and greened its energy policy.

The Commission already introduced the framework to implement climate action, but it could tweak the tools at its disposal to facilitate decarbonisation with the political support of member states. The ETS offers a case in point: the Commission introduced it in 2003, but only in 2019 would it begin have a tangible impact on energy consumption patterns. The Commission's decision to reduce the number of carbon allowances to prompt this reflected a step toward more ambitious decarbonisation. The design of the ETS continued to support a shift towards natural gas, but with the rising competitiveness of renewables and the Commission's decision to withdraw support for natural gas infrastructure (see chapter seven) the timeframe and the extent to which it could play the role of the transition fuel declined. The Clean Energy Package reflected this by focusing on renewables and electrification. Such climate policy increasingly forcefully ruptured the EU's path dependencies and deterred actors from pursuing fossil fuel dependent practices, forcing a broader reconfiguration of fossil fuel-based social relations to greener practices.

7 Decarbonisation and Natural Gas Infrastructure

7.1 Introduction

The European Commission gradually shifted its approach to natural gas infrastructure. After supporting the construction of pipelines, interconnections, and liquified natural gas (LNG) import terminals to establish a single competitive market, it began to acknowledge the risks these posed to achieve climate goals in recent years. Popov (2020) remarks that "all this frenetic activity is simply creating gas import infrastructure that Europe doesn't need" (n.p.). There are, however, changes in the Commission's policies. This chapter explores how this shift emerged and what implications it had by answering the research sub-question: *how did the European Commission change its natural gas infrastructure policy in response to climate considerations?* The general presumption that natural gas would be the transition fuel led the Commission to pursue the development of natural gas infrastructure and decarbonisation. Emitting natural gas could be a part of the transition, but its long-term prospects diminished as the EU set out to explore how to achieve a zero carbon energy system leading infrastructure owners to explore how they could play a role in the EU's low carbon energy future.

This chapter is animated by the theoretical question of how infrastructures and the lock-ins these produce empower certain actors, shape energy governance, and thereby impact institutional change (Unruh, 2000; Bergek *et al.*, 2013; Bouzarovski, Bradshaw and Wochnik, 2015; Scoones, Newell and Leach, 2015). It builds on the greening institutionalism framework (see chapter two), which explores how the behaviour of political institutions change over time. This framework posits that a key factor in influencing the direction of change stems from infrastructural constraints and associated economic incentives (Unruh, 2000; Seto *et al.*, 2016). Actors' control over energy infrastructures translates into significant power in the EU's governance regime, through material power with their control over key energy assets, organisational power given their integral role in EU energy policy-making, as well as discursive power since they shape the general discourse that pertains to fuels and their respective role in the energy transition (see chapters two, four, and five) (LaBelle, 2012; Johnstone and Newell, 2018). The analytical framework proposes that political institutions can initially resolve contradictions between fossil fuel infrastructure expansion and decarbonisation goals, but this became increasingly challenging as the stringency of climate action rises and they move to become post-carbon institutions.

This chapter explores how the Commission's approach to natural gas infrastructure policy changed as it developed its climate agenda. With this, it explores the role infrastructure plays in the dissertation's overarching research question introduced in chapter one, namely, *how does the European Commission reconcile its climate strategies and natural gas policies?* It directly builds on the findings of chapter four, by further explicating how the fuel's characteristics shaped infrastructure policy and which actors are influential in EU policy-making. It draws on the findings presented in chapter five that discuss how climate considerations are included in the Commission's natural gas policy, but explores the climate-infrastructure nexus in detail. Chapter six informs this chapter by providing a reference on how the Commission's climate policy gained momentum and would alter the role it allocates to natural gas in the transition. The final, eighth chapter will then tie the empirical chapters—four, five, six, and seven—together and discuss how findings relate to the theoretical propositions developed in chapter two.

This chapter is structured as follows, section 7.2 provides a brief historical overview of the Commission's natural gas infrastructural policy, showing how the EU body had focused on facilitating integration and enhancing supply security. Then, the chapter turns to introducing the Projects of Common List in section 7.3, a key tool with which the Commission can shape infrastructure developments. Section 7.4 explores the risk of stranded infrastructure and assets, after which sections 7.5 and 7.6 introduce how natural gas infrastructure can continue to play a role in the EU, by discussing the role of carbon capture and storage (CCS) and how existing infrastructure can be adapted to a low carbon future, respectively. Section 7.7 discusses capacity remuneration mechanisms that incumbents and the Commission are considering as vital to the energy transition. The final section draws conclusions.

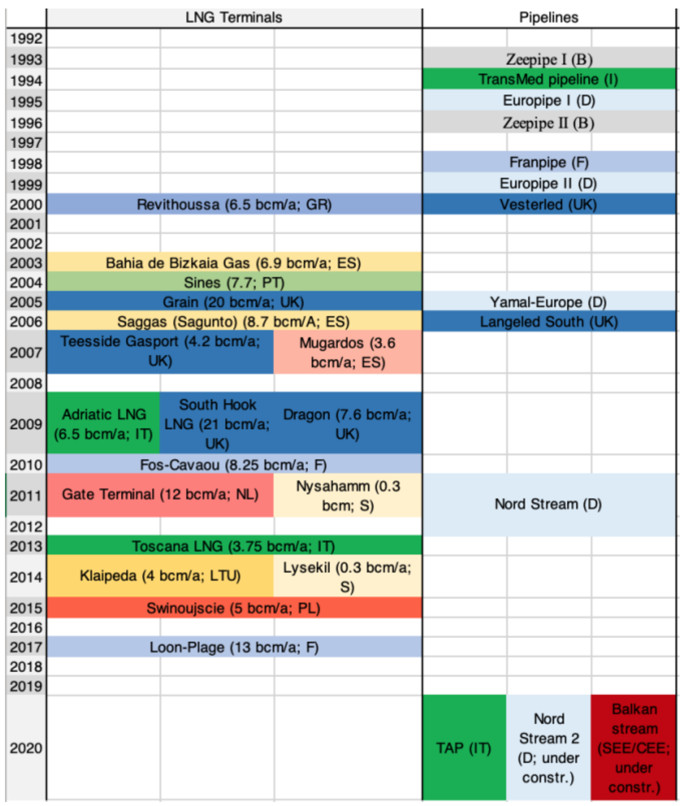
7.2 The EU's natural gas infrastructure policy

EU natural gas infrastructure policy emerged hand-in-hand with its natural gas policy, given the fuel's infrastructure intensity (see chapter four). Its transit, trade, and consumption requires a complex network of pipelines, compressor and metering stations, as well as liquefaction and regasification terminals (Smil, 2015; Bradshaw and Boersma, 2020). European countries launched the large-scale build-out of natural gas infrastructure during the 1970s and 1980s (P. Högselius, 2013; Gustafson, 2020). At the time, natural gas was deemed a favourable source of energy, given its ability to meet rising energy demand, decrease countries' reliance on oil, and lead to relatively limited incremental emissions in comparison to coal (see chapters four and five). The construction of respective infrastructure began with the pipelines connecting Dutch natural gas fields to Western European buyers (Honoré, 2017). This was followed by connections between North Sea fields with the mainland (Arapostathis, Pearson and Foxon, 2014; Waerness, Gjeset and Syversen, 2017; Gassco, 2020). Investors developed these projects with the long-term in mind, since they typically recuperate large up-front costs of massive pipeline systems through the high utilisation rates of infrastructure in subsequent decades (EU_Ind_4; HU_Ind_1; UK_An_1) (P. Högselius, 2013; Balmaceda, 2018).

Rising natural gas demand and limited production prospects led Western Europe to seek imports from the Eastern bloc during the Cold War. The Soviet Union and, later, Russia constructed high capacity pipelines with an initially anticipated lifetime of thirty-three years (Gnedina and Emerson, 2009) that continue to remain operational today, close to fifty years later, and can continue to operate for years to come with minor tweaks (Deák, 2012). Like pipelines that comprise the backbone of Western Europe's natural gas grid, these offer stable "capital returns for the next 30–40 years" (NO_An_1) or even 50+ years (IEA, 2011a), which underpins the long time horizon against which such investments are made. Even when investors recuperate their investments, such infrastructures become "cash cows" (COM_5) i.e. highly lucrative ventures. If backed by revenue prospects both producers and consumers of the fuel were willing to invest in pipeline capacity expansions, leading Russian Gazprom and other companies to complement export capacities with additional connections, including the Yamal-Europe, Nord Stream, Nord Stream 2, and Balkan Stream (Gustafson, 2020). With these measures, companies and governments established the foundations of a European natural gas grid that would enable the consumption of the fuel for decades.

The EU's growing reliance on natural gas was intertwined with a dependency on Russian imports. The volatile relations between the EU and Russia led member states to raise concerns over Russian piped natural gas' supply security (Natorski and Surrallés, 2008). They addressed this by supporting infrastructure expansions that could diversify import sources and routes (Maltby, 2013; Boersma, 2015). Experts working with Gazprom emphasised that the firm had been a stable supplier of natural gas (EU_Ind_3; EU_Ind_4), something which competitors conceded (EU_Ind_1; EU_Ind_2), but the animosity and, thereby, the caution towards Russian piped gas lingered. EU-15 countries paired their rising demand with a build out of infrastructure and the diversification of import sources during the 1990s and 2000s (see figure 7.1), which included the trebling of total LNG import capacities between 2000–2017 (see figure 7.2). This mitigated their reliance on Russian imports or offered the technical capabilities to import from alternative sources in times of crisis or when the economics of imports justified such decisions. The Commission supported these endeavours, as they aligned with its goal to liberalise EU markets.

Figure 7.1: Major natural gas import infrastructure developments



Source: Authors compilation based on (IGU, 2019; Gassco, 2020; Gazprom, 2020)

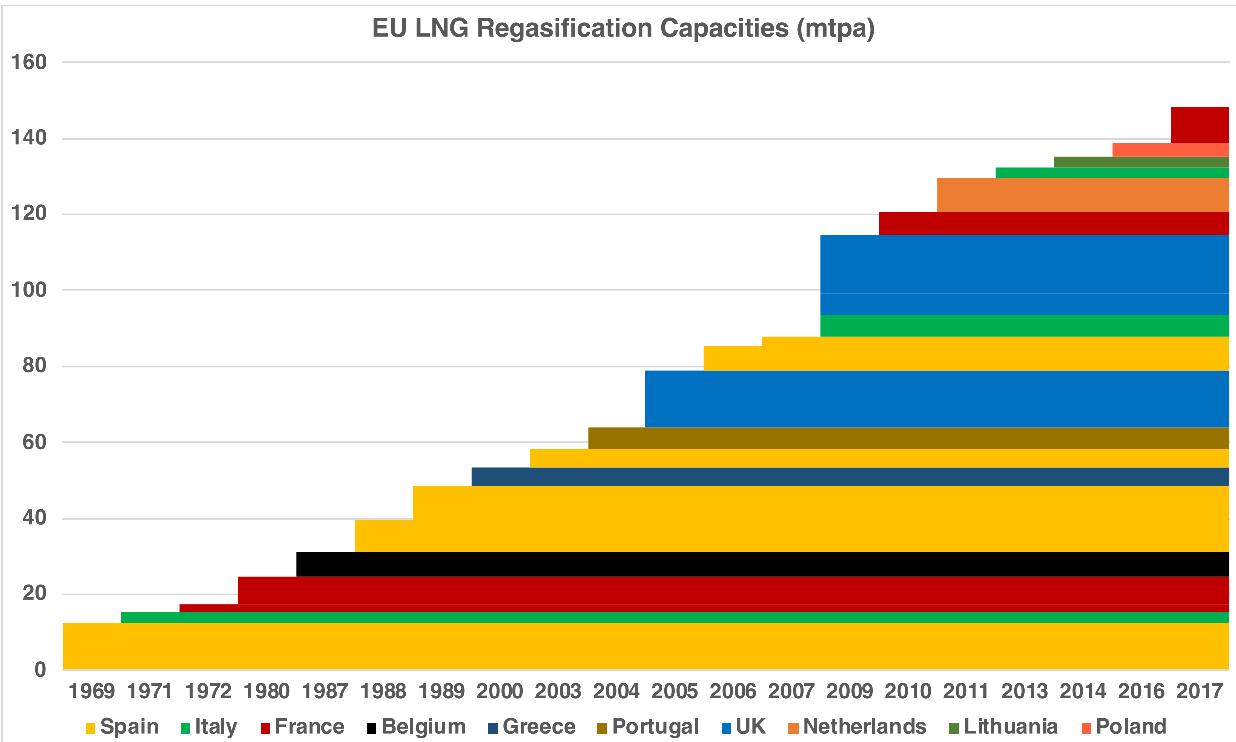
The Eastern Enlargement of the EU welcomed eight—mostly former eastern bloc—countries to the EU. A divide emerged between Western and Eastern member states: the former's infrastructure allowed it to import natural gas from multiple sources, while the latter frequently relied on importing the fuel from Russia through a single pipeline (COM_1; COM_2; EU_Ex_1; EU_Ex_2; EU_Ex_5; PL_Ind_1; HU_An_1; HU_An_2) (Hoffman and Dienes, 1985; Szulecki, 2017; Gustafson, 2020). Both groups of countries heavily relied on imports, but their supply security situation was quite different. Western EU countries were typically more resilient to shocks, since they had developed alternative import channels, such as LNG that alleviated them from the "energy weapon". Moreover, these states had taken decisions to diversify and develop infrastructure in a context where climate policy did not affect their decisions. In contrast, Gazprom frequently dominated Central and Eastern European (CEE) markets[132] (Stern and Yafimava, 2017). The effect of this became evident during the 2009 supply crisis (Balmaceda, 2013), when Russia halted flows and CEE consumers could not turn to alternative sources.

The Commission designed policies to limit the market power of single actors, which implicitly targeted Gazprom's monopoly position (HU_Ex_1; US_A_2; COM_5; D_Gov_2; PL_Ind_2) (Balmaceda, 2013; Overland, 2017). It supported coordination between transmission system operators (TSOs) with the introduction of the Third Energy Package[133] which established ENTSOG (Jones, 2016). The EU took a more systemic approach to develop the infrastructure for a single market, which was "lacking" (Crisan and Kuhn, 2017, p. 169) at the time. It began to address that "the density of infrastructure and the number of [import] sources [of natural gas] available [as] the Eastern bloc's problems lingered from the Soviet era" (HU_Ind_1). The sheer scale of the endeavour would take time, with member states only gradually altering market structures and companies constructing infrastructures. Nonetheless, the approach was generally welcomed, since a coordinated approach could increase the resilience and streamline the

[132] Case '39816 Upstream gas supplies in Central and Eastern Europe' is quite emblematic of Gazprom's market dominance.
[133] Directive 2009/73/EC, 13.07.2009.

functioning of a single market—a point acknowledge in Commission documents and scholarly inquiries (Rodríguez-Gómez, Zaccarelli and Bolado-Lavín, 2015; Correljé, 2016; Osička and Ocelík, 2017; Trinomics, 2018). Thus, security and market-building considerations led the Commission to support the expansion of the grid, which did not yet contradict marginal climate ambitions (see chapter six).

Figure 7.2: EU LNG regasification capacities



Source: (IGU, 2019)

In 2011, the European Council provided the political support to "modernise and expand Europe's energy infrastructure and to interconnect networks"[134], including natural gas'. This aligned with the general understanding that natural gas could play the role of a transition fuel for which

[134] COM/2011/0658 final, 19.10.2011, p. 10.

member states would have to develop respective infrastructure. ENTSOG also supported this ambition, since it not only controlled “a very strong [infrastructural] system” (COM_5) but has a “self-interest” (COM_5) to pursue transit fee revenues. Thus, it uses its key role in sectoral governance to acquire political and financial support from EU institutions and national governments to develop infrastructure. This streamlined the integration of national markets, but its also facilitated the infrastructural lock-in of natural gas. This generally aligned with Commission policy[135], which was supportive of a single competitive market (Szabo and Fabok, 2020) and backed on the grounds that “the further diversification of the EU's natural gas supply remains a key objective”[136] to ensure “security” and “resilience”, while it did not conflict with climate ambitions.

Between 2009–2013 EU natural gas infrastructure policy focused on the diversification of import sources and supporting the development of a competitive markets, which aligned with the transition fuel narrative that it and the energy sector more broadly assigned to natural gas (see chapter five). For instance, it communicated that “LNG has the potential in some cases to reduce environmental impacts, and hence support the EU's <u>sustainability</u> [underline in original] objective” [137]. The policy text reflects the transition fuel discourse prominent at the time, without questioning the long-term implications of investing in respective infrastructure. It supported the reproduction of fossil fuel based social relations, but contradictions and disagreements were mounting within the Commission following the 2009 supply crisis. With the introduction of the 2020 goals, the rising focus on climate change, and increasing pressure from social movements, a number of experts I interviewed—both within the Commission (COM_2; COM_4) and those

[135] Regulation (EU) No 347/2013, 17.04.2013; Regulation (EU) 2018/1999, 11.12.2018; Directive 2009/73/EC, 13.07.2009.
[136] COM(2016) 49 final, 16.02.2016, p. 2.
[137] COM(2016) 49 final, 16.02.2016, p. 3.

offering an external perspective (HU_An_1; PL_Ind_1; PL_Ind_2; EU_Ind_2)—noted that the Commission began to ponder how its backing of natural gas infrastructure may lead to stranded assets or perpetuate a carbon lock-in. Thus, while the Commission's official positions supported the general view that natural gas infrastructure should still be developed, experts from within the institution had begun to discuss what the fuel's future would be.

7.3 Projects of Common Interest

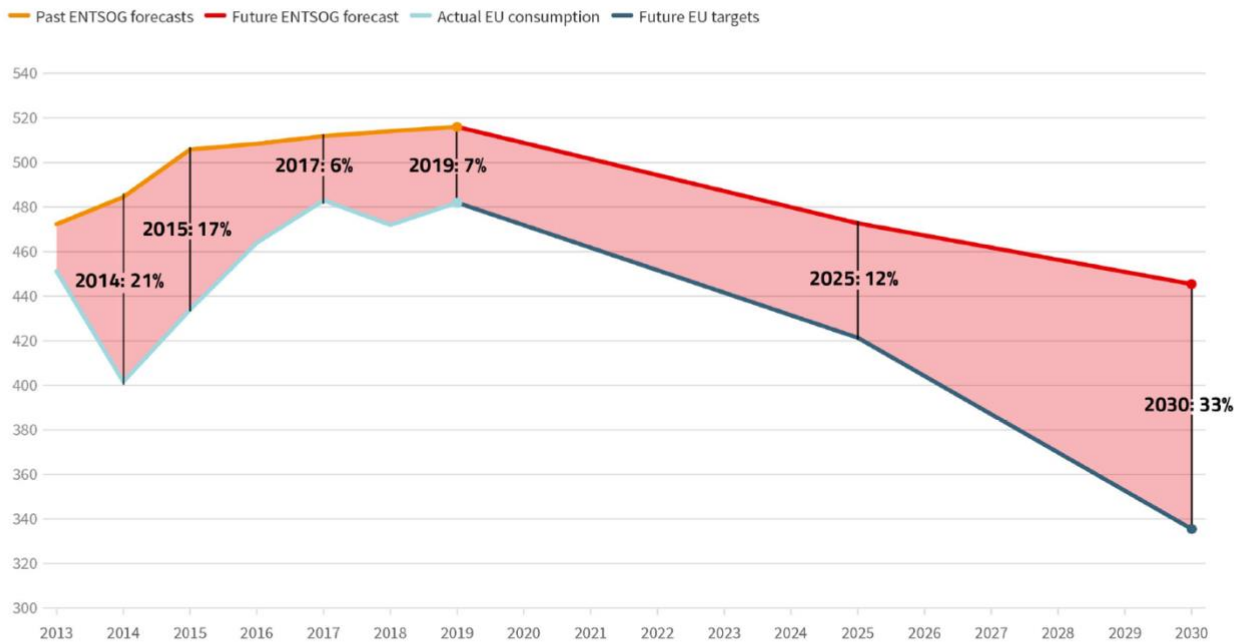
The Commission can develop the EU's natural gas infrastructure system by providing political and financial support for projects. Its main vehicle for this is the Projects of Common Interest (PCI)[138] list, which grants selected projects "priority status"[139] from EU institutions and its member states, which entails that they are *inter alia* subject to streamlined and accelerated permitting procedures as well as receive greater visibility in public and political discourse. They are also eligible for financing from the Connecting Europe Facility (CEF). That is, projects the Commission includes on the PCI list receive substantial support and their selection indicates energy infrastructure agenda priorities. The Commission considers PCI projects to be those which have "a significant impact on energy markets and market integration in at least two EU countries, boost competition on energy markets and help the EU's energy security by diversifying sources as well as contribute to the EU's climate and energy goals by integrating renewables" (European Commission, 2020, n.p.). It uses this mechanism to support the "hardware" (Crisan and Kuhn, 2017) for a single competitive electricity and natural gas market and, more recently, other energy-related projects, such as cross-border carbon-dioxide networks or energy storage installations.

[138] First PCI list: Regulation (EU) 1391/2013, 13.10.2013; Second PCI list: Regulation (EU) 2016/89, 18.11.2015; Third PCI list: 2018/540, 23.11.2017; Fourth PCI list: Regulation (EU) 2019/7772, 31.10.2019.
[139] Regulation (EU) 1391/2013, 13.10.2013, p. 4.

The Commission adopts[140] the PCI list based on the proposals made by companies. The "pool for PCI selection in the field of electricity and gas is based on the Ten Year Network Development Plans (TYNDP) developed by the European Networks of Transmission System Operators (ENTSOs)" (Crisan and Kuhn, 2017, p. 170), which is then discussed "between Member States, national regulatory authorities, project promoters and relevant stakeholders"[141] on a regional basis before the Commission adopts the list. This process reflects that, while the Commission has the final say, it is heavily reliant on the input and expertise of incumbents, indicating the key role they play in sectoral governance. This materialises through the advice articulated by the ENTSOs (COM_2; EU_EXP1). An expert at an NGO critical of PCIs also remarked that established interests are "very successful" (NGO_2) in persuading member states and the Commission to invest in infrastructures irrespective of their needs. Moreover, a German government official noted that the demand forecasts issued by industry bodies, such as ENTSOG, heavily shape the Commission's positions and policy decisions (D_GOV_1). However, these have tended to systematically overshoot actual consumption (see figure 7.3), implying that forecasts enabled greater support for natural gas infrastructure projects than what may be warranted.

Figure 7.3: ENTSOG natural gas demand forecasts

[140] Regulation (EU) No 347/2013, 17.04.2013.
[141] Regulation (EU) No 347/2013, 17.04.2013, paragraph 22.



Source: (Global Witness, 2020, p. 6)

The Commission's decisions regarding natural gas infrastructure were underpinned by its assumption that demand for the fuel would increase as it took on the role of the transition fuel (see chapter five). This led it to include 107 natural gas projects—43% of total projects—on its first PCI list in 2013 (see table 7.1). It prioritised developing missing links in the EU's infrastructure, especially among newly joined EU member states, over long-term climate considerations. As pointed out by an environmental NGO, Friends of the Earth Europe (FoTEE) (2017), "[i]n just three years [between 2014–2016], the EU has granted more than €1 billion in finance to gas Projects of Common Interest (PCIs) through its Connecting Europe Facility programme" (p. 9), even though the Commission had articulated its 2050 decarbonisation targets by then. Furthermore, "the EIB and EBRD have lent to 27 gas projects between 2014 and 2016, while the European Fund for Strategic Investments spent €1.2 billion backing gas projects in 2015 and 2016 alone. EU member states have also used their export credit agencies to support gas projects, including power stations, LNG facilities and pipelines" (FotEE, 2017, p. 9). Thus, the Commission and other institutions working closely with it provided a wave of funding for natural gas infrastructure projects they deemed critical for the functioning of a single market and to ensure the secure supplies of member states, which they still saw compatible with the relatively modest climate ambitions introduced at the time.

The Commission's support for natural gas infrastructure projects began to gradually decline around 2014–2015. In principle, PCIs had to "contribute significantly to at least one of the following specific criteria: […] market integration […] security of supply […] competition […or] sustainability, inter alia through reducing emissions, supporting intermittent renewable generation and enhancing deployment of renewable gas"[142], but sustainability considerations came to the fore. Interviewed policy-makers suggested that support within the Commission was declining for natural gas projects on climate grounds (COM_1; COM_2; COM_3; COM_4). An interviewee from the Commission remarked that "I had been long stressing—and it continues to be my conviction—that these sorts of gas infrastructures need to be seen as cautious rambunctious undertaking […] due to the sunk costs, lock-ins, and others […] even if this—from a certain perspective—increases energy security or opens new market opportunities" (COM_4). Commission experts became more cautious in supporting such infrastructure, which was both an extension of the internal debate on the fuel's future and began to respond to the scepticism of some experts whether natural gas can become the bridge fuel (Howarth, 2014).

The Commission withdrew support for a number of PCIs following the publication of the first list in 2013. A Hungary-based analyst remarked that this decision was climate driven and first materialised when it suspended support for PCI-listed projects in Annex 2 of the 2014 European

[142] Regulation (EU) No. 347/2013, 17.04.2013, Chapter II., article 4, section 2/b, p. 6.

Energy Security Strategy[143] (HU_An_1). While the analyst posited that climate was the driver for the suspension of these projects, Gaventa (2014) suggests that "[t]here is no transparency on [how] this list was developed […] or even whether the identified projects have been assessed against the EU's decarbonisation, security and competitiveness objectives" (p. 9). Thus, it scrutinised the proposed projects in greater detail from list-to-list gradually excluding a number of them (table 7.1). The reasoning is not available publicly and some scholars linked it to the lack of well-prepared projects in an advanced state (Červinková and Jirušek, 2021), but the strong relative decline of natural gas projects and the rise of electricity, smart grid, and CO_2 projects suggests that climate considerations drove the change and the Commission's priorities were shifting. In 2013, the PCI list featured 107 natural gas infrastructure projects, which equaled 42.6% of all projects, but this declined to 32 projects or 21.5% of the total by 2019. The Commission's shift in support for natural gas projects was noted by a number of interviewees as well and they all identified climate action as the leading cause (HU_An_1; PL_Ind_1; PL_Ind_2; EU_Ind_2).

Table 7.1: Number of projects on PCI lists

PCI list/cause	Electricity	Natural gas	Other
First[144] (2013)	132	104 (42.6%)	6 (oil) + 2 (smart grid)
Second[145] (2015)	108	77 (39.5%)	7 (oil) + 3 (smart grid)

[143] COM(2014) 330 final, 28.05.2014.
[144] Regulation (EU) 1391/2013, 14.10.2013.
[145] Regulation (EU) 2016/89, 18.11.2015.

Third[146] (2017)	104	53 (30.1%)	5 (oil) + 4 (smart grid) + 4 (CO_2)
Fourth[147] (2019)	100	32 (21.5%)	6 (oil) + 6 (smart grid) + 5 (CO_2)

Source: Author's compilation (PCI list references indicated in respective footnotes)

Agency for the Cooperation of Energy Regulators (ACER) also took note of the declining number of PCIs. It regularly observed that the number of natural gas projects on the PCI list declined in the 2015–2019 versions of the 'Consolidated report on the progress of electricity and gas Projects of Common Interest' (ACER, 2015, 2016, 2017, 2018, 2019), while those that remained on the list frequently faced delays due to permitting issues. ACER did not explore how climate policy impacted the development of such endeavours and did not take a normative stance on whether these should be developed in-light of EU climate policy. This indicates the limitations to its scope of actions. This was underscored by an ACER interviewee, who remarked that "I do not think climate change things are currently included in-depth in [network] codes. But the plan is that the new natural gas package will be published by 2020 and that will include these" (COM_6). Internally, climate considerations were discussed by ACER experts after the 2016 Clean Energy Package, but these were not formally reflected in how the Agency approached infrastructure development, regulations, and network codes (COM_5; COM_6).

Climate first surfaces in ACER's (2020a) 2020 PCI report, underscoring how slowly the Agency's scope of action shifted. The report notes that "[p]romoters of gas PCIs should take due note of the sea change that EU gas sector is facing […] Project promoters should expect that regulators and other decision-makers may wish to insist upon meeting certain preconditions in

[146] Regulation (EU) 2018/540, 23.11.2017.
[147] Regulation (EU) 2020/389, 31.10.2019.

terms of project maturity and proper risk mitigation, including long-term climate goals compliance, in order to seriously consider a given project. […] ACER intends to closely monitor the issue of contribution of the concerned projects to sustainability, energy systems integration, and will consider evaluating the progress of projects in the light of such issues" (ACER, 2020a, p. 8) (ACER, 2021a, p. 5). Thus, following the publication of the Clean Energy Package that emphasised the need to move towards renewables and electrification in late-2016, ACER's mid-2020 publication reflects that developers should take infrastructure decisions after carefully considering long-term EU climate goals. Three to four years after the Commission's pivot, its regulatory body also began to apply an explicitly climate-considerate approach to natural gas infrastructure—indicating a shift in the governance regime.

Discussions about whether natural gas infrastructure can be supported by EU institutions emerged in the Commission effectively after the 2009 supply crisis, while experts at ACER were also aware of the matter. The influence of these would only increase in the run up to the Paris Agreement and afterwards. An expert from an NGO remarked that the Commission may have recognised the infrastructural "lock-in, but did not act upon it" (NGO_Ex_2). The evidence suggests that it did act on it, but this took years to unfold. Its ability to avoid lock-ins were prevented by existing path dependencies. Global Witness (2020) shows that ENTSOG members have acquired over EUR 4 billion in subsidies for natural gas PCI projects. This has created "European gas infrastructure […that] is well-developed and robust in most of Europe" (ENTSOG, 2018, p. 2). The Commission channeled substantial investments into natural gas infrastructure through this vehicle, but it decreased these and subjected its decisions to greater scrutiny. Experts at NGOs (NGO_1; NGO_2) and independent analysts (HU_An_1; UK_A_1) suggested that these investments had been excessive considering that many began to question the future of the fuel at the time, but they were nonetheless in-line with the general consensus that suggested natural gas is the transition fuel (see chapter five).

7.4 The risk of stranded infrastructure

The Commission and EU member states provided backwind for the growth of renewables while withdrawing support for natural gas projects (ENTSO-E, 2018, 2019). The former's role in electricity generation—where they are natural gas' key competitor—increased from 20% in 2010 to 25% in 2018, while the role of fossil fuels declined from 53% to 42% (Eurelectric, 2019). This was substantial, because it was based on the rapid diffusion of solar photovoltaics (solar PV) and wind power, which offered renewable and scalable sources of electricity that overcame the capacity limitations of hydropower or biomass. The boom in renewables was paired with a climb in natural gas demand (Eurostat, 2020). Rising demand was not driven by large-scale coal-to-gas switching many had anticipated, but rather Europe's climbing energy need amidst its economic recovery (Honoré, 2014; IEA, 2016b; Stern, 2017b). Rising levels of consumption led EU institutions to introduce policies that support infrastructure expansion that increased supply security—a measures that became especially pronounced with Russia's illegal annexation of Ukraine in 2014 (Van de Graaf and Colgan, 2016). The Commission launched the Energy Union and further measures to ensure supply security[148], but it had to increasingly balance these with climate action.

The Commission's shift to focus on renewables and electrification became clear with the Clean Energy Package, which sent shockwaves through the natural gas sector. The Package indicated that the EU may take on an energy transition with no clear role assigned to natural gas. TSOs

[148] COM(2016) 52 final, 16.02.2016, p. 24.

were the first to respond (Stern, 2017b). They "push[ed]" (EU_Ex_4) for the EU to incorporate natural gas into the energy transition, because they "feared that their transit fees may be lost" (EU_Ex_3). As the Commission signaled a pivot towards renewables and electricity, it was unclear what would "become of the pipelines by, say, 2045" (G_Ex_2). An expert affiliated with an industry association bluntly noted that "we're only as valuable as our pipes and the resources that they transit" (EU_Ex_3). Infrastructure owners understood the precarious position in which they were and developed a relatively united front in suggesting that the EU should pursue a decarbonisation pathway that draws on the gas grid. Their revenues stemmed from the continued utilisation of infrastructure and these actors underscored the need to "[f]ind optimum between 3rd package framework, Clean Package-proposals and alternative solutions" (Ingwersen, 2017, n.p.) to ensure an energy transition that would not result in stranded assets[149]. The ability of gas pipeline's to carry energy much more efficiently than electricity also supported their inclusion in the energy transition (Bradshaw and Boersma, 2020).

Actors from within the natural gas sector were animated by the future of the assets they controlled (Ingwersen, 2021). The Commission's withdrawing support for natural gas infrastructure made it unclear what role the fuel would play in the EU's transition and whether its low carbon energy system would include decarbonised gases. There was a "[m]assive change in depreciation, which was formerly 50 years [but is] now much shorter, 20ish, which raises costs for end-users" (EU_Ex_1). Phasing natural gas out of the energy mix would mean that suppliers would distribute the cost of infrastructure use over lower quantities of natural gas they transit, raising the fuel's overall price to the disadvantage of consumers that rely on the fuel. This

[149] Stranded assets are "those investments which have already been made but which, at some time prior to the end of their economic life (as assumed at the investment decision point), are no longer able to earn an economic return" (IEA, 2013, p. 98).

perpetuates a cycle, as it reduces natural gas' competitiveness, decreasing demand and thereby increasing its price (Mete, 2020). Ultimately, natural gas becomes uncompetitive rendering its infrastructure redundant before the end of its economic or technical lifetime. This was also noted in a Commission-ordered report, which found that "[t]he expected decrease in natural gas demand and transported volumes could lead to gas assets becoming devalued or stranded before the end of their depreciation period" (Trinomics, 2018, p. viii). The Commission's policy pivot substantially increased the risks that the transition would lead to stranded assets—the path of institutional change was confined by infrastructure.

Not all interviewees were convinced that stranded assets were a legitimate concern or would be a problem of the magnitude that infrastructure owners discursively emphasised (COM_3; HU_Ind_1; NO_Ind_1; NO_An_3). They suggested that infrastructure owners already recuperated most of their investments and their response was largely driven by an unwillingness to forego the profits from investments. Moreover, these experts suggested that these companies should be able to maintain operations even with lower throughput. A Commission official bluntly remarked that the "stranded costs issue not too large, as natural gas consumption is growing [and] allowing everyone to make money" (COM_3). She argued that assets would be utilised at rates high enough for a period of time long enough that would allow companies to break even and adapt to subsequent lower throughput, since the Commission's policies would only gradually force actors to limit natural gas consumption within the EU. Other interviewees disagreed (D_Gov_1; G_Fi_1), suggesting that infrastructure owners would simply suspend transmission and distribution activities, seek alternative investments, or hike the prices of their services, if revenue-generating flows substantially declined. An expert envisioned that a "a risk premium for stranded [natural gas] assets [can] surface" (G_Fi_1). This divide reflects the broader, unsettled debate on the matter (Kotek *et al.*, 2019; Ingwersen, 2021).

It is unclear whether fears over stranded assets will materialise, but the lengthy phase out of natural gas from the EU's energy system suggested by a number of forecasts offers investors ample time to recuperate their investments (Trinomics, 2018; IEA, 2020f). A Commission expert summarised this when noting that "it's probably difficult to think that gas, especially in 2019, will cease from one moment to another. This seems improbable, I would be a huge fan of this, but this will take 10-20-30 years and [investors] have recuperated these projects, so I don't think these problems are really present" (COM_4). In addition, infrastructure owners have proposed to keep using natural gas as the transition fuel and include low carbon gases (e.g. biomethane) and decarbonised gases (e.g. hydrogen) into the mix of the gas they transit and distribute to help meet energy demand and decarbonise the fuel they would provide consumers (see below). This strategy to avoid stranded assets is reflected in various position papers and statements issued by infrastructure owners between 2017–2019 (Ingwersen, 2017a; ENTSOG, 2018; GIE, 2019c, 2019b) as well as Madrid Forum presentations (European Commission, 2017a, 2018a), but it shows the lock-ins that policy has to overcome to force the shift in the consumption of source fuels.

7.5 Carbon capture and storage

In 2018, the Commission indicated that emitting natural gas will play a very limited role in meeting energy supply in forthcoming decades[150]. The natural gas that the EU consumes will have to be decarbonised or phased out. One way to square the circle of consuming fossil fuels

[150] COM (2018) 773 final, 28.11.2018.

and reducing emissions is to develop carbon capture and storage (CCS) (Herzog, 2018). Climate treaties (Anderson, 2015) and "most international organizations now recognize the need for CCS" (EU_Ex_5), including the IPCC (2018) and the IEA (2020f). A number of interviewees noted that the EU also needs CCS to meet its climate commitments (see table 7.2), to which end the Commission has backed the development of necessary technology and infrastructure. It launched a discussion about such endeavours in 2007[151], which it followed with a Directive[152] and a consultative communication in 2013[153]. It has also established a number of funding mechanisms to support the development and diffusion of the technology[154] and has begun to add CO_2 pipelines to the PCI list (see table 7.1). These reflect the Commission's general openness to explore the potential of the technology and its bid to reconcile fossil fuel consumption and emissions.

CCS may receive ample political and financial support from the EU and other actors—reflecting the path dependencies of a fossil fuel-based energy system—but "the global portfolio of CCS projects is not expanding at anything like the rate that would be needed to meet long-term climate goals" (IEA, 2017b, p. 61). CCS projects' commercial viability has been slow to materialise (IEA, 2016a), as the total number of operating CCS facilities has climbed from eight to twenty-one between 2010–2020, while the combined number of 'operating', 'under construction', 'advanced development', and 'early development' installations has declined from seventy-seven to sixty-five during this period (IEA, 2020a). The IEA found that "[c]arbon capture, utilisation and storage (CCUS) so far has not lived up to its promise" (IEA, 2020b, p. 17), which has been

[151] COM (2006) 843 final, 10.07.2007.
[152] Directive 2009/31/EC, 23.04.2009.
[153] COM(2013) 180 final, 27.03.2013.
[154] Through vehicles such as the European Energy Programme for Recovery (EEPR), New Entrants' Reserve 300 (NER300) and its successor the Innovation Fund, as well as the Strategic Energy Technology-plan (SET-plan), amongst others.

true on the EU-level as well, where, "[d]espite a ramping up of political interest, CCS deployment remains in its infancy" (Dutton, Lehne and Littlecott, 2020, p. 3) and has not developed as planned (European Court of Auditors, 2018). Interviewee comments were also mixed, but conveyed a scepticism whether it could scale (see table 7.2). Of the eighteen interviewees who spoke at length about CCS, thirteen assumed that CCS will not play a role or that its role is highly contingent. This has not discouraged the Commission from closely following policy implementation[155] and continuing to support it.

Table 7.2: The role of CCS

The role of CCS		
Will play a role	**Contingent**	**Will play a minor role**
"CCS may have been unsuccessful, is sought to be promoted by producers which are also asking for financing." (COM_1)	"the question is: what sort of support can be drummed up?" (COM_6)	"This [CCS] is an intelligent, reasonable option, but the problem is that in the European context it is very limited" (G_Ex_1)
"Madrid Forum provided a push to scrutinise CCS, which is a proven technology" (EU_Ex_2)	"A lot of questions loom around CCS" (EU_Ind_1)	"I'm not too optimistic about CCS, given storage limitations and scale-related issued" (HU_Ind_1).
"The natgas industry acknowledges that it will need CCU down the road" (COM_2)	"CCS used for EOR until now, but we do not know how safe it is and it also continues the status quo" (COM_3)	"But we don't have CCS… […] That's not possible right across Europe because in certainty in the interior it's going to be problems with where you put the CO2" (UK_A_1)

[155] COM(2014) 99, 25.02.2014; COM(2019) 566; 31.10.2019.

"The oil & gas sector is the main investor in CCS projects around the world, and we hope to see many more with the help of other sectors, governments, and international organizations. The good news is that most international organizations now recognize the need for CCS as well" (EU_Ex_5)	"The question is how this will be reconciled in the mid- to long-term, since the lifetime of natural gas projects will go beyond 2050, the problem being that they [industry players] need CCUS […] CCUS [is] one element of the exit strategy. The tech may be there, but economics and scalability is not. […] Some form of use, for instance, EOR has underpinned the few existing projects, but other areas remain scarce and these need to be kick-started." (G_F_1)	"If you look at the CCS policy that you had in the Commission and in the EU, well it was kind of hard part, an expensive way of decarbonizing and then they actually managed to come up with the funds on the large scale projects but anyways in the start when it was coal that was in the focus, not natural gas because it's more expensive actually to decarbonize by CCS natural gas, simply because it's less carbon to catch, so you have that question and also when they came to CCS actually it was the coal on focus" (NO_Ex_1)
"Norway is supportive of CCS" (NO_Ind_1)	"CCS discussed, but little progress" (HU_Ind_2)	"CCS faces problems […] the long-term is not figured out." (COM_5)
		"Gazprom: no CCS ambitions" (EU_Ind_3)
		"CCS questionable, unlikely at this point" (EU_Ind_4)
		"CCS-CCUS: serious doubts" (PL_Ind_1)

Source: Author's compilation based on interview data

Despite the looming questions, many interviewees assumed that CCS would play a role, even if a minor one, in the EU's energy system. A Commission official suggested that "[t]he natural gas industry acknowledges that it will need CCU down the road" (COM_2), while another official noted that "the natural gas industry incumbents will take a stab at it [CCS] […] there is a lot of pressure on natural gas producers to uphold carbon capture and storage—this is in their interest" (COM_6). The Commission's climate action has led incumbents to explore CCS, with Borchardt (2019) delegating the inquiry on the potential use of CCS to the International Association of Oil & Gas Producers (IOGP). Meanwhile, other hydrocarbon producers have also become active in this space. Norwegian Equinor is the leader in developing the technology necessary for CCS, based on its involvement with enhanced oil recovery (EOR) since the mid-1970s (Awan, Teigland and Kleppe, 2008). This led the firm to launch its industrial-scale CCS project, Sleipner, already in 1996 (Ringrose, 2018), which it has followed with further projects more recently (Equinor, 2020a). An expert from within the natural gas sector noted that "Norway is supportive of CCS, which partially comes from the responsibility towards solving climate change" (EU_Ind_1), but CCS also allows for Norwegian oil and gas firms to continue exploiting the country's vast natural gas reserves.

The Commission has continued to back CCS, despite the setbacks and the looming questions about the technology's deployment at scale. It began to support related infrastructure projects by including CO_2 pipeline systems on its Third PCI list (see table 7.1), making these eligible for EU funding. It introduced a directive[156] for CCS in 2009 and has been monitoring its implementation since. In 2019, it suggested that "[d]espite the continuous lack of positive assessment for technical and economic feasibility for CCS retrofitting, power plants are nevertheless setting aside land should the conditions change in the future"[157]. In another report it suggests that CCS "was previously seen as a major decarbonisation option for the power sector and energy intensive

[156] Directive 2009/31/EC, 23.04.2019.
[157] COM(2019) 566 final, 31.10.2019, p. 4.

industries. Today this potential appears lower, considering the rapid deployment of renewable energy technologies, other options to reduce emissions in industrial sectors and issues concerning social acceptance of the technology itself. However, CCS deployment is still necessary, especially in energy intensive industries and – in the transitional phase – for the production of carbon-free hydrogen"[158]. Thus, while articulating some scepticism towards the viability of CCS, the Commission continues to offer support for the technology which extends current fossil fuel-based consumers practices and allowing for established interests to play some role in the EU's future energy system.

7.6 Adapting infrastructure to low carbon gases

Developing infrastructure necessary to decarbonise has become an increasingly pressing matter for natural gas actors, which must "replace the idea of just talking about coal and gas switching and backing up renewables with how is gas going to be decarbonised? Talk about hydrogen. Talk about biomethane. And talk about projects" (Ledesma, 2020). TSOs underscore that their assets can play a central role in the EU's cost efficient energy transition, because the natural gas grid is readily available to transit energy in a gaseous form (Eurogas, 2019; GIE, 2019b, 2019a). What sort of gas(es) this may be is not clear yet. And, infrastructure owners are still exploring what measures they need to take to inject non-natural gas into the grid. The Commission has also requested studies that explore what policy it should introduce to facilitate the adoption of non-emitting gases and what sort of infrastructural prerequisites these actions have (Trinomics, 2018; Borchardt, 2019). Established interests and the Commission envision biogas and hydrogen to play a central role in meeting energy demand by utilising existing infrastructure (Szabo, 2020a).

[158] COM(2018) 773 final, 28.11.2018, p. 15.

Biogas can be produced from organic waste with net zero lifecycle emissions and—with adequate infrastructure—it can be processed into biomethane (Tabatabaei and Ghanavati, 2018; Valijanian *et al.*, 2018; IEA, 2020e). Biomethane's appeal lies in that it is composed of methane, like natural gas and can be fed it into the existing grid. In some countries (e.g. Sweden) this is already taking place (Swedegas, 2014; Scarlat, Dallemand and Fahl, 2018). However, its scalability and the high costs of facilities that process biogas into biomethane pose impediments to its wide-scale adoption (Sehgal, 2018; IEA, 2020e). To put its role into perspective, the EU's total biogas output is currently 18 bcm per annum, half of this is CO_2, while the other half, a mere 9 bcm is predominantly methane (COM_5)—this equates to approximately 2% of the EU's methane consumption, which amounted 458.5 bcm in 2018 (BP, 2019a). High costs of the technology also weigh on its expansion, with levelized costs of energy approximately four- to five-fold to that of natural gas (G_Fi_1; G_Ex_1). A further limitation pertains to the debates over how sustainable scaling it would be. These considerations lead experts (NGO_2) (Lambert and Oluleye, 2019) to question the optimistic scenarios for the scaling of biogas in a recent Commission-ordered study (Trinomics, 2018). Despite these barriers, the Commission continues to support the development of biogas and necessary infrastructure[159].

Infrastructure owners have also proposed to blend hydrogen into the existing natural gas admixture, which would allow the decarbonisation of gas and the continued use of the grid. As it reconsiders the role of gas in the EU's energy system, the Commission has accepted that this is a viable and economic way to decarbonise gas, as noted by industry incumbents (EU_Ex_2; EU_Ex_4), Commission experts (COM_1; COM_4), and senior figures in the Commission (Borchardt, 2019). Infrastructure owners supported the approach in publicly available

[159] Directive 2009/28/EC, 23.04.2009; Directive 2018/2001, 21.12.2018.

presentations (European Commission, 2018a) and public statements (GIE, 2019c). The Commission has also supported these endeavours, recently publishing a Hydrogen Strategy, where it emphasises the need for renewable-based hydrogen that allows for the utilisation of existing infrastructure[160]. NGO experts (NGO_1; NGO_2) I interviewed raised concerns over the approach, because hydrogen is not necessarily green. It is still overwhelmingly produced from natural gas and this seems unlikely to change in the near future (IEA, 2019a), maintaining the dominance of incumbents and jeopardising climate targets by betting on CCS (Szabo, 2020a; Howarth and Jacobson, 2021).

Incumbents have only begun to conduct experiments to explore whether natural gas infrastructure is suitable to transit and distribute hydrogen (IEA, 2017a, 2019a; ENTSOG, GIE and Hydrogen Europe, 2020). Interviewees confirmed the contingency of these undertakings as well (EU_Ex_1; EU_Ex_2; HU_Ind_1). Researchers have found that blending 2 vol%–15 vol% of hydrogen into the grid is possible (Altfeld and Pinchbeck, 2013; Ogden *et al.*, 2018; ENTSOG, GIE and Hydrogen Europe, 2020), but this may vary as a hydrogen/methane admixture surpassing 2% can make steel pipelines more brittle or lead to leakage along pipeline fittings (NO_An_1; HU_Ind_1). Meng et al. (2017) also find that "[t]he fatigue life of the X80 steel pipeline [a popular pipeline choice[161]] was dramatically degraded by the added hydrogen" (p. 7411). Other studies indicate that it is still unclear how suitable existing natural gas pipeline infrastructure may be for hydrogen (Baek *et al.*, 2017). ACER suggests that while conversions should be carefully considered, the advantages of repurposing include that "NG [natural gas] pipeline networks are already available and socially accepted […] NG networks can be converted at a cheaper cost to carry hydrogen compared to the cost of building new, dedicated hydrogen pipes. […]

[160] COM(2020) 301 final, 08.07.2020.
[161] See e.g. Nicola (2008) or Qiao et al. (2017).

Technologies for converting the NG infrastructure to hydrogen operation are already largely available and tested" (ACER, 2021c, p. 6). Thus, while a number of questions remain of what can be repurposed and at what cost there was some support for the matter from ACER and the Commission—the latter articulated this in the Hydrogen Strategy[162].

Limitations of hydrogen infrastructure are not relegated to pipelines, but end user appliances (COM_1; NO_An_1) as well as compressor stations and storage facilities (IEA, 2019a; ENTSOG, GIE and Hydrogen Europe, 2021). Adapting end-user appliances to hydrogen or hydrogen-methane admixtures remains a challenge, with burners being a crucial component that have to be re-engineered (de Vries, Mokhov and Levinsky, 2017). Companies and researchers are also exploring how hydrogen can be stored in different geological formations. Salt caverns offer the most promise (COM_3); although, researchers are heavily engaged in understanding how depleted natural gas and oil fields can store hydrogen, since they constitute the bulk of current natural gas storage capacities (Ozarslan, 2012; Tarkowski, 2019; ENTSOG, GIE and Hydrogen Europe, 2020) (HU_Ind_1). The Commission, incumbents, and other actors have conveyed great interest in hydrogen, even if numerous questions and unsolved challenges persists. The only thing that seems certain is a shared understanding that further experiments are necessary (ACER, 2021c). These contingencies may persist, but there is clear support behind the technology in the EU and from within the Commission, as this is at the heart of most discussions (European Commission, 2018a; Borchardt, 2019).

7.7 Capacity remuneration mechanisms: two birds with one stone?

[162] COM(2020) 301 final, 08.07.2020.

Decarbonising natural gas may allow incumbents to supply the EU with energy through existing infrastructure in the long-term, but, in the interim, the EU's electricity sector faces a substantial balancing challenge. The diffusion of renewables increases the need to offset their intermittent generation, but has also caused the overall utilisation of natural gas power plants to decline. That is, natural gas power plants became more vital to the integrity of the energy system, but only for short periods. Consequently, the economic rationale to maintain and operate natural gas power plants has generally been declining and there is a risk that these plants would become unprofitable or stranded assets, much like pipelines. A lack of investment, low utilisation rates, and high CO_2 prices would render them uncompetitive. One possible solution that has gained traction amongst both established interests as well as EU and national policy-makers is the introduction of capacity remuneration mechanisms (CRM). This is an "administrative measure to ensure the achievement of the desired level of security of supply by remunerating generators for the availability of resources" (Erbach, 2017, p. 2). That is, it provides infrastructure owners—electricity generators in this case—with a service fee even when their assets are not in use (Ind_1). They would be compensated to provide backup capacities that are on standby to balance markets when necessary. This would smoothen out the supply curve, allowing for electricity TSOs and DSOs to meet demand, while it also reduces the risk of stranded natural gas assets. What is more, it could even lead to an upswing in investment into OCGTs and CCGTs (Ind_1; PL_An_1; PL_Ind_1; UK_A_1) (Caldecott and McDaniels, 2014).

The Commission[163] and experts have discussed the introduction of CRMs since 2013–2014 (Hancher, Houteclocque and Sadowska, 2015; Zgajewski, 2015), because they could "add a key new layer of depth" (Ind_1) to power markets (European Parliament, 2016). The Commission,

[163] The matter was first addressed at length by the Commission in C(2013) 7243 final, 05.11.2013. Also see: 2014/C 200/01, 28.06.2014.

however, has been slow to support CRMs for two reasons: renewable penetration has only recently reached levels where they need to be considered and the state aid this welcomes "intervenes in the free market" (COM_1) (EU_Ind_4; PL_Ind_1; Ind_1) (Huhta, 2018). Interest has nonetheless sustained towards the mechanism, leading the Commission to perform an inquiry[164] and introduce respective regulations[165]. "[C]apacity markets heavily favour natural gas" (PL_An_1), since "[p]rice signals should also allow for adequate remuneration of flexible resources (including demand-response and storage), as these resources rely on rewards for shorter periods of time (e.g. modern gas plants which are only used for peak hours or the reduction of industrial demand at times of peak demand or system stress)"[166]. The Commission[167] and other actors presume that CRMs would support natural gas power plants, but this has not yet materialised as policy is still to be developed (COM_1; COM_2).

Financing for natural gas projects has declined in recent years and "[g]lobal demand for gas turbines has hit lows" (D_A_1) as risks associate with stranded assets have increased (Sutherland, 2019). There is demand for natural gas infrastructure especially in Eastern Enlargement EU member states, where governments are reluctant to shake their existing reliance on natural gas or are looking for a source of baseload electricity that can substitute coal without the risk of intermittency posed by renewables (see table 7.3). Both those working in the region and at the EU-level seem to support growing the role of natural gas in the region, because in the "east we need to get rid of oil, coal, and burning trash" (HU_Ind_1). The National Energy and Climate Plans (NECPs) (European Commission, 2020e) also reflect an East-West divide in the role they allocate to natural gas, as many NECPs in eastern member states—ranging from

[164] C(2015) 2814 final, 29.04.2015.
[165] COM(2016) 861 final/2, 23.02.2017.
[166] COM(2016) 861 final/2, 23.02.2017, section 1, n.p.
[167] COM(2016) 0752 final, 30.11.2016; 2014/C 200/01, 28.06.2014.

Poland's to Hungary's to Greece's—anticipate a higher role for natural gas through the utilisation of existing power plants and the construction of additional units—a point also noted by interviewees from these countries (PL_Ind_3; HU_Ind_1). The viability of these plans hinge on CRMs making these endeavours profitability for companies, and may lead to a situation where countries invest in heavily underutilised capacities (HU_Ex_1). This difference based on geographicy and history led the Commission to consider a differentiated approach and maintain certain elements of the energy system that actors within the sector argue to be indispensable.

Table 7.3: Geographically differentiated use for natural gas

Geographically differentiated use for natural gas in the EU
"[on the] EU-level less gas is needed […but on the] Polish-level more gas is needed" (PL_An_1)
"Discussions on the role of natural gas kicked into top speed recently, but this is also dependent on the discussed region" (EU_Ex_1)
"Poland could benefit from a gasification, but the element of path dependence is heavily contested and renewable gases would have to grow to play a focal role, which is in limbo just yet" (COM_1)
"Member states' attitudes vary strongly because of national differences. The Netherlands is looking into transitioning away from [natural] gas due to the issues with their Groningen field. Others such as Poland count on gas to replace coal over time." (EU_Ex_5)
"All countries energy mixes and historical circumstances are different, which will determine their respective relation to natural gas [and] plenty will be dependent on natural gas for decades to come […] Getting rid of natural gas is a western discourse, to the east we need to get rid of oil, coal, and burning trash" (HU_Ind_1)
"The East-West divide was crucial in all of this [natural gas dependence], both the density of infrastructure and the number of sources available" (HU_Ind_2)

"I think in many areas gas is a problem because it challenges coal, and the situation in Poland is much like that, but increasingly in other parts of Europe gas is a problem, because it's quickly becoming the most carbon intensive source of energy in the fuel mix." (UK_An_1)

Source: Author's compilation based on interview data

7.8 Conclusion

This chapter set out to answer the research sub-question of *how did the European Commission change its natural gas infrastructure policy in response to climate considerations?* The infrastructure-intensity of natural gas has led the Commission to closely align natural gas and respective infrastructure policies. Both of these were shaped by climate action, leading a gradual shift in policy shift over time. During the 1992–2018 period this chapter analyses, the interval between 1992–2009 feature the buildout of natural gas infrastructure, driven by increasing demand and calls to enhance supply security in largely import-dependent EU member states. The Commission's climate policies had little effect on natural gas infrastructure policy during this period, in-part because many presumed it to be the transition fuel, but, more importantly, the Commission supported the diversification of import routes and the creation of a single interconnected market. The Eastern Enlargement amplified these issues, since the Commission supported newly joined member states in diversifying import routes and integrating into a broader EU gas grid. The Commission bolstered the role of the fuel and its supply security, as its policies led it to behave as a carbon institution, reproducing fossil fuel-based social relations.

The Commission's support for natural gas infrastructure began to internally waver following the development of its 2020 Agenda and the 2009 gas crisis. It continued to support newly joined Eastern Enlargement member states to develop infrastructure critical to reducing Gazprom's market dominance, but it became increasingly circumspect in which projects it backed. The effect of its actions were, however, slow, as the ambitions it would have had to green its policies clashed with supply security considerations that became paramount with Russia's aggression in Ukraine. Nonetheless, the Commission began to reduce the number of natural gas projects it included in PCI lists and it began to consider the risk of stranded assets and the lock-ins that the development of unnecessary capacities may entail. Infrastructure owners had received political and financial backing for their projects, but this declined with the EU's rising focus on renewables and electrification. The Commission had not yet signalled that it would reduce its support for natural gas in the energy transition, but the long-term implications of infrastructure development led it to become much more cautious. Moreover, it could not severe the role of the fuel in an abrupt manner given the rising role it was presumed to play in balancing the volatile electricity generation of renewables.

After the Paris Agreement and the Clean Energy Package, natural gas' future in Europe became much more precarious and infrastructure owners were confronted with the possibility that the utilisation rates and the lifetimes of their assets would decline. They drew on their power to shape the actions of the Commission, since they controlled a vast infrastructure base (e.g. pipelines, LNG terminals, etc.), played a prominent role in the sectoral governance of natural gas (e.g. by developing network codes and guidelines), and were integral to developing the narrative of the energy transition based on their technical expertise (e.g. through public communication and participation in various forums). Infrastructure owners responded to the threat the energy transition posed by exploring how they could extend their role in the EU's energy system. They underscored their ability to efficiently deliver large quantities of energy through pipelines and provide a flexible source of energy that would balance the electricity grid. Meanwhile, infrastructure also became key for producers, which suggested that CCS would be central to the

EU meeting its net zero targets. The Commission's scope to implement sweeping change was confined by pre-existing demand patterns and the way in which the energy sector was structured.

The limitations of full electrification and the push from incumbents led the Commission's support for low carbon gases in the energy transition. It introduced policy supportive of biomethane, CCS, and hydrogen. The Commission's approach to gas infrastructure shifted, but the form of this change was firmly confined by the infrastructural system and related interests perpetuating a gas-based lock-in. This also materialised through its support for CRMs, which can offer a way to overcome underinvestment in natural gas power plant infrastructure crucial for supply security. In the short-term, this could stabilise the grid and the Commission showed an openness to exploring its potential. This offers a mode to reduce the carbon intensity of the EU without a radical rupture. The Commission is evolving into a post-carbon institution, which has influenced its natural gas infrastructure policy. It has begun to severe its support for fossil fuels as it shifts to greener policies. This is still within the confines of an energy system that had been dominated by fossil fuels, but given the long lead times of infrastructure the Commission began to alter this field of policy quite early on. However, the changes still adhere to numerous path dependencies by *inter alia* utilising existing pipeline networks, including hydrogen, or CRMs. This introduces gradual change that unfolds along the lines infrastructural constraints, solutions proposed by established interests, and the ambitions of the Commission.

8 Discussion

8.1 Introduction

This dissertation set out to answer the research question of *how does the European Commission reconcile its climate strategies and natural gas policies?* The four empirical chapters of this thesis have shown how these two realms of Commission policy affected one-another and how their relation changed over time. They show that the Commission changed its approach to natural gas between 1992–2018, but in a very gradual manner, structurally confined by institutions. This final discussion section reviews the main findings of the research I conducted by articulating succinct answers to the research question and sub-questions. Drawing on this, it revisits the greening institutionalism analytical framework introduced in chapter two and discusses respective contributions of the dissertation. Based on these, it then identifies further avenues for research.

8.2 Answers to the research questions

The following section answers the dissertation's overarching research question by first addressing the research sub-questions. It then ties these answers together to develop a comprehensive answer to the broad question posed in the introduction. Chapter five of this dissertation set out to answer *how does the Commission address climate change in its natural gas policy?* The Commission presumed natural gas to play the role of the transition fuel until relatively recently. It only incorporated climate-related considerations to a very limited manner through 2015–2016, discussing it as source of energy that supported decarbonisation goals when it did. Natural gas' physical properties and its extensive role in the EU's energy system substantiated a discourse that emphasised its environmental compatibility. Its institutionalisation as a "clean" source of energy was supported by most actors that participated in the governance of

EU energy affairs, since they presumed that it should be used to substitute more polluting forms of energy consumption (e.g. coal) until renewables become more competitive and available at scale. The Commission's policies were shaped by these forces, leading it to develop policy that streamlined access to fuel, enabling its uptake.

The Commission's pro-natural gas orientation shifted around 2011, as it began to turn its attention to renewables, electrification, and energy efficiency. The energy transition accelerated with Germany's launch of the *Energiewende*, leading established interests to suggest that natural gas cannot only support a shift from coal to renewables, but that it is an ideal complement to renewables by overcoming their intermittency. Thus, it can play a vital role in the energy transition and a low carbon energy system. This had little impact on policy, since the Commission's focus shifted to decarbonisation on the back of greater climate action. Natural gas policy continued to focus on security of supplies, especially given Russia's aggression in Ukraine, but long-term strategies would raise the question of how this emitting source of energy could be phased out or made climate-compatible. The Paris Agreement and the Commission's subsequent prioritisation of renewables, energy efficiency, and electrification, indicated a shift in the policy priorities—the Commission began to green its policies. Using the power at their disposal, TSOs suggested that there is a need to use the EU's gas grid in the transition, while producers underscored the need for natural gas as the bridge fuel. This would shape policy, as natural gas could be a part of the transition, but only for a limited time interval and increasingly in non-emitting form (e.g. biomethane or hydrogen). Following the Clean Energy Package, climate considerations were increasingly reflected in the Commission's natural gas policies as it sought to limit emissions from this energy carrier.

Chapter six tackles the research sub-question *how is natural gas addressed in the European Commission's climate initiatives?* Climate policy moved from favouring natural gas to obstructing its consumption between 1992–2018. This happened gradually and through measures that initially supported a shift to natural gas, especially from coal, to deterring its consumption. Policy tools, such as the EU ETS, for instance, increased the relative costs of more emitting energy sources. In principle, this was to prompt consumers to move towards natural gas, which natural gas industry actors supported. This did not materialise as coal remained inexpensive and carbon-dioxide quota prices low, which impeded natural gas from playing the role of a transition fuel. The lack of fuel substitution can also be connected to the low effect of EU climate policies, which mostly began to have a tangible impact on energy consumption patterns in the second half of the 2010s. Climate policies conveyed a favourable stance towards natural gas, discussing its uptake as key interim step towards decarbonisation, until 2015–2016. As discussed above, more ambitious climate ambitions surfacing after the Paris Agreement led to policies that supported the pivot away from fossil fuels. The Commission questioned the future of natural gas by indicating that renewables and electrification were is priorities in the Clean Energy Package. Thus, climate policy changed from favouring natural gas to questioning its long-term role over the course of the analysed period.

The final empirical chapter, chapter seven, answers the question *how did the European Commission change its natural gas infrastructure policy in response to climate considerations?* The Commission shifted from supporting the build-out of infrastructure to ensure supply security and facilitate the creation of a single, competitive, and integrated market, to much more carefully considering which projects it backed. The EU's executive arm has generally been supportive of developing natural gas infrastructure Since the onset of the EU's uptake of natural gas, leading to its quick build-out in Western Europe during the 1990s and 2000s. The Eastern Enlargement and the 2009 gas crisis led it to support further infrastructure developments given these member states' lopsided reliance on Russian piped gas frequently imported through a single route. When the aftermath of the 2009 crisis blew over, it became much more selective in which projects it supported. It only backed endeavours after careful deliberation, generally opting to back electricity projects that would support the diffusion of renewables.

The Commission also began to support infrastructure that could help decarbonise fossil fuel consumption in the 2010s, especially around and after the Paris Agreement. It provided political and financial support for CCS projects and CO_2 pipelines that it saw as essential to meeting climate ambitions. It also explored the role the natural gas grid could play in a decarbonised energy system, prompted by an understanding that gaseous energy will be necessary due to technological barriers and its ambition to execute an economically efficient energy transition. This also reflected industry actors' general push for the EU to include decarbonised gases in its energy system. Furthermore, the Commission began to consider CRMs as a tool with which it can adapt the use of natural gas power plants to newly arising needs of the energy system. These would help overcome the intermittency of renewables. They could help meet peak demand, to which end CRMs offer a financial model that makes it worthwhile for infrastructure owners to maintain their operations, despite the Commission's push to limit natural gas consumption *in toto*. Thus, the Commission's natural gas policy responded to climate considerations gradually, which drove a change in respective infrastructure policy as well: it swapped general support for targeted interventions.

The fourth research sub-question this dissertation raised is *what is the role of the EU in reproducing fossil fuel-based social relations?* The empirical chapters show that the

Commission's policies play a central role in guiding the fuel choices of consumers by facilitating the institutionalisation of practices. Even, if it cannot formally determine the energy mixes of member states, it's climate-based interventions shape the EU's energy system. Its actions had initially supported the uptake of natural gas by ensuring necessary infrastructure and a regulatory framework, which reproduced fossil fuel-based social relations. It played the role of a carbon institution, as the demand for natural gas increased during the 1990s and 2000s supported by respective policy as well. Thus, at a more abstract level, the Commission plays a central in perpetuating any energy regime, which also provides it with the power to dismantle energy regimes. This is not to say that it can do this on its own, but as the empirical evidence gathered during the interval I analysed, the Commission changed from supporting the reproduction of natural gas-based—and thereby fossil fuel-based—social relations to withdrawing its support and introducing policy—backed by broader social, political, and economic forces—that support renewables and decarbonisation. This shift was heavily reliant on discourse, as the narrative of the energy transition guided action. Its pivot is confined by lock-ins perpetuated by a host of matters ranging from infrastructure to institutionalised processes, but a shifting governance regime led its actions to increasingly reflect post-carbon relations.

The answers to the aforementioned research sub-question all inform the answer to *how does the European Commission reconcile its climate strategies and natural gas policies?* It does so through discourse and gradual change. The empirical chapters above show that the Commission's climate policies only took effect gradually. It was only able to implement actions on a step-by-step basis, multiple years elapsing between the introduction, implementation, and effective impact of measures. For instance, after agreeing to a carbon price in Kyoto, six years passed before the Commission introduced the EU ETS in 2003, two years after which the mechanism's first phase began, with the second launching in 2008, the third in 2013, and the current, fourth, in 2020. During this period, the ETS became a better streamlined mechanism and the EU introduced measures that would underpin its efficacy. These would culminate in the price hikes that allowance prices saw in 2019. Similarly, the Commission developed targets in a gradual manner, articulating 2020 goals in 2008, mid-century decarbonisation ambitions in 2011, and interim 2030 goals in 2030. It took time for climate policy to have an impact on other realms of policy. It was only after these tools were backed by political support articulated as a discourse that the EU will achieve carbon neutrality by mid-century that change began to take effect. Until the Paris Agreement and the discursive shift this brought, climate policy had little effect on energy affairs.

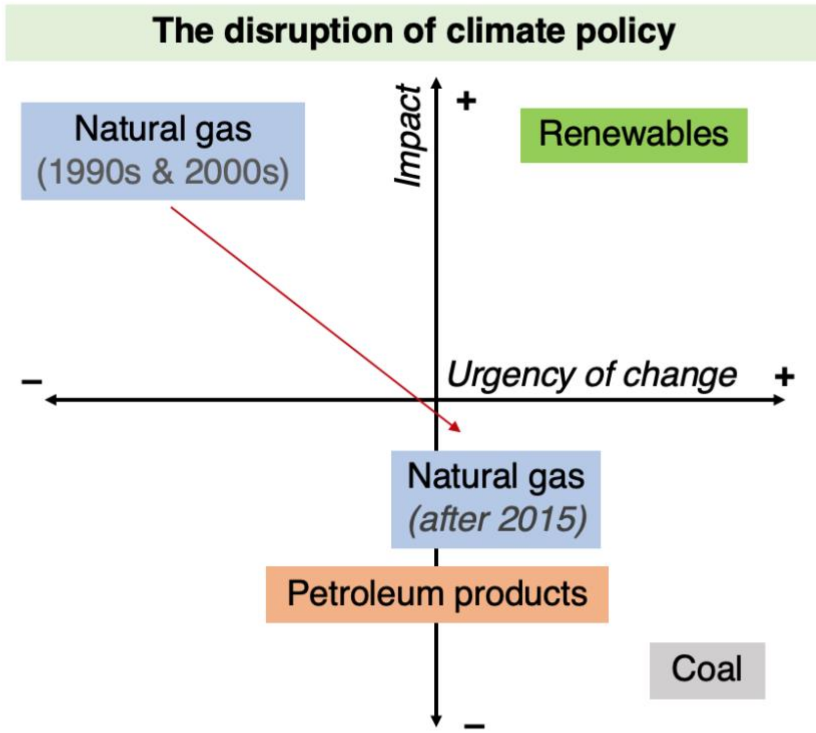
Natural gas and climate policy largely remained on parallel tracks until relatively recently. In the 1990s and 2000s, the Commission accepted and reified the narrative that natural gas is the transition fuel. Its relatively low emissions upon combustion allowed for the proliferation of such discourse, cementing the role EU policy allocated to the fuel. The Commission's focus was on introducing climate policy that taxed the most emitting activities, which was predominantly the consumption of coal. As an interviewee working for the German government summarised: there would be a "[c]oal phase out [which] will be followed by questions around gas" (D_Gov_2). However, these questions were slow to emerge with natural gas demand slumping following the economic crisis of 2007–2008. Instead of curtailing its uptake, the Commission focused on developing its infrastructure and its regulatory framework in the 2000s to ensure the functioning of a single market. The Commission supported the integration of Eastern Enlargement member states by having them implement the natural gas directives, integrate into the EU's grid, and develop alternative import routes. Building a natural gas market did not contradict climate ambitions during this period.

Following the 2009 supply crisis, the Commission and member states became more weary of their reliance on Russian piped natural gas. Although some countries and experts began to propose that the decrease its import reliance, this did not materialise. As the EU climbed out of its economic slump, its demand for the fuel increased and it focused on implementing the regulatory framework designed by the Commission and developing the missing pieces of infrastructure that enabled the functioning of a single market. In parallel, natural gas firms and advocacy associations began to underscore how important the fuel they provided was in the energy transition. This was a response to the supply crisis, which tarnished the fuel's reputation, and the EU's shifting focus to renewables. They emphasised their ability to provide a transition fuel, which was reinforced through the policy language of the Commission. Policy texts discuss it as something necessary to substitute more polluting coal *en route* to a renewable-based energy system and a source of energy that can complement intermittently generating renewables. The EU's executive arm had to do little to reconcile its expansion of the EU's natural gas market framework, since a broader and widely accepted narrative positioned the fuel as compatible, what is more, essential, for a successful transition. In its extreme, the Commission considered natural gas as a sustainable or clean source of energy, reflecting little change in its approach to the fuel.

The EU—led by Germany—accelerated its energy transition in the early-2010s, which led the Commission to reconsider the role of natural gas in its long-term plans. This first influence infrastructure policy, where it applied greater scrutiny to the projects it backed and decreased the number of natural gas infrastructure proposals it included on the PCI list. Moreover, there was a growing debate within the Commission itself whether natural gas could play the role of the transition fuel or if the EU should gradually limit its role. These signaled a change in Commission's behaviour, since it began to reconfigure the practices that sustained the role of natural gas in the EU's energy system. A shift in strategic direction driven by a changing governance regime would only crystallise somewhat later with the Paris Agreement and the Clean Energy Package. The latter focused on electrification and renewables, while natural gas was largely absent from forward looking plans. This sent a shockwave through the industry, which had presumed that it would provide the transition fuel for decades to come. Instead, the Commission questioned natural gas' role: it began to plan for a low carbon economy.

The role of natural gas in the EU conflicted with decarbonisation goals as the discourse to move to a low carbon economy proliferated in the EU. This threatened to dismantle the energy regime from which those in the natural gas sector benefitted. Their relative power in the governance of the EU and in relation to the energy transition's narrative was revisited and overshadowed by a renewable-oriented vision. In 2016, the industry mobilised to offer a narrative in which their fuel could contribute to decarbonisation and shape the transition by drawing on their bases of power—available resources, an extensive infrastructure, the transition fuel narrative, and their central role in the EU's policy-making processes. This mobilisation shaped the Commission's position with regard to the fuel, which was partially a material necessity, since multiple studies demonstrated that full electrification was neither possible nor economically feasible, leaving some room for gas in the energy system. Industry actors and advocacy groups articulated that the sector would help overcome these technological and economic limitations and provide low carbon gases to support the EU execute a cost-effective transition. They made policy propositions in support of natural gas and low carbon gases. Infrastructure owners underscored their ability to transit biomethane or hydrogen, while producers explored the potential to decarbonise natural gas. Commission policy came to support these endeavours, by adapting a gas-inclusive transition narrative.

Figure 8.1: Climate policy's impact on energy policy



Source: Author's design

Between 1992–2018, the Commission's climate policies had increasingly impactful spillover effects on its natural gas policy. As depicted in figure 8.1, climate policy was widely assumed to positively impact natural gas with their being little urgency to change related consumption practices. In contrast, climate action was designed to adversely impact coal, relatively urgently. A similar sense of urgency was present in its effect on renewables, but here the outcome was to be positive. Natural gas policy and, thereby, the role assigned to it in the energy transition was repositioned the most drastically of the energy carriers, since it shifted from this 'positive impact'/'low urgency' to 'negative impact'/'high urgency' category after the Paris Agreement. This did not result in natural gas entirely being ruled out of Commission policy planning, but rather shifted sectoral governance to focus on decarbonising this source of energy by adapting technological innovations. The rising focus and impact of climate strategies substantially changed how the Commission approached the energy carrier and what future it assigned to it, even if this emerged gradually and was met with resistance by a number of actors. During this period, the Commission's positions shifted from not having to reconcile climate goals and natural gas demand to one where it had to reconcile the fuel's role by justifying its role in the transition and developing how it would be phase out.

8.3 Theoretical contributions of the dissertation

Chapter two of this dissertation developed the greening institutionalism analytical framework to theorise how climate action alters institutions. The framework draws on institutionalism and energy transitions theories, by focusing on the role discourse plays in shaping the actions of political institutions. It proposes that institutional change is gradual and can be driven by discourse, while it is limited by path dependencies and the resistance of various actors. The empirics of my research confirm that change is indeed gradual and path dependencies confine the scope and form of change. Political institutions reproduce fossil relations, given the prevalence of a carbon lock-in which spans both the socio-technical and the political economic realms. Fossil fuel-based practices are deeply institutionalised and even if the ambition to change is in place or a cataclysmic event occurs, such as the 2009 supply crisis, a political institution does not pivot from its existing policies instantly. It is confined in its response, with the framework of its action determined by lock-ins and the pushback of various actors. A political institution reproduces the interests of those that are dominant in its governance, which, has reflected a fossil fuel bias in the past—the Commission behaved as a carbon institution. This is shifting as climate policy has become a powerful force for change that led the Commission to alter its agenda.

The impact of climate policies are gradual, but "critical junctures" (Krasner, 1984; Collier and Collier, 1991) emerge and puncture historical continuities. Both played formative roles in the Commission's behaviour, since a gradually unfolding energy transition materialised over the course of the assessed period. This was largely discursively driven. That is, the policies a political institution introduces reflect broader discourses, which came to be supportive of a shift in the form of energy the EU consumed. A general push to renewables and decarbonisation emerged, but overall energy governance remained skewed towards fossil fuels given their overwhelming dominance in the EU's energy system. Moreover, natural gas' physical qualities allowed the Commission to accept the broader narrative that this source of energy is compatible with climate objectives and would play the role of a transition fuel. Established interests and host of other actors reproduced these discourses that transpired into policy, setting the direction for further institutional development which largely adhered to pre-existing practices. This drove gradual change, as the effect of climate action increased and became increasingly formative. The emergent discourse linked to natural gas suggested that it was to benefit from climate action, which established interests and socio-technical limitations in the transition supported.

A rupture emerged in the path dependencies of the Commission with the Paris Agreement and the Clean Energy Package (2015–2016). While these were culminations of preceding events, they reoriented discourses that came to underline a need for quick and effective decarbonisation. The dominant governance regime shifted to one in support of decarbonisation, which also entailed that consuming natural gas became incompatible with the Commission's long-term climate objectives. Climate action began to reconfigure all realms of policy. Forces supportive of green policies became influential, which shaped both the actions of political institutions and the broader institutional context. The seeds for the Commission's action had been in place, as energy security had already prompted the EU's executive arm to question the bloc's reliance on natural gas, but the broader discourse and the energy transition's narrative suggested that natural gas would have to play the role of the transition fuel. It responded to a changing governance regime by seeking to reconcile power relations, which entailed led it to accept that the least emitting fossil fuel was still compatible with the energy transition's trajectory. This was supported by established interests, which drew on their various forms of power to maintain path dependencies and lead political institutions to maintain practices favourable to their interests.

The case shows that the response to climate change largely transpired into action discursively. The need to take action materialised in communicative deliberations, as a part of which the Commission and other political institutions developed goals and strategies. With these, they developed a framework for change, which seeped into policy, but its implementation only unfolded subsequently. Techno-economic and political limitations to execute a swift energy transition were abundant. The resistance from established interests in the energy sector, broadly, and the natural gas sector, in particular, fortified lock-ins, as they deployed their material, organisational, and discursive power to sustain the system in-place. The sheer scale of the EU's reliance on the fuel and the extensive material infrastructure at its disposal confined the way in which the Commission could seek to execute an energy transition. It had to carefully consider socio-technical challenges pertaining to the limits of renewables and electrification as well as stranded assets, alongside the relative power of an immense natural gas industry that is deeply entrenched in the EU's energy system.

The natural gas sector combined its material power with organisational and discursive power. Actors exercised the former by becoming involved in policy-making processes. The highly technical character of the energy system led the Commission to rely on the expertise of industrial associations—sectoral governance was essential in shaping the EU's energy scene. In principle, these need not be advocacy associations to propose solutions and take action that is driven by the ideas that are deeply rooted in how the industry saw its role in the energy transition. That is, those from within the natural gas industry both believed that they offered the transition fuel and that this was essential to a successful energy transition. From one standpoint this was deliberate, as it allowed them to perpetuate their activities, but it also speaks to limitations in tools to execute an energy transition within the specific institutional context. The strong support for CRMs reflects this quite well, as it is a tool that overcomes a technological hurdles to the transition with a mechanism that draws on existing knowledge and practices—it averts radically rupturing historical continuities.

Discursive power is the third form of power incumbents drew upon and came to play an especially pronounced role in shaping the course of the transition. The discursive connotations the Commission attached to energy carriers was crucial in shaping the role it allocated to them in the energy transition. Discourse entrenched natural gas as the transition fuel, allowing it to evade scrutiny pertinent to its sustainability and a phase out. It adapted this position, since relative power relations—still dominated by established interests—forced it to reconcile contradictions between consuming emitting sources of energy and achieving climate targets. It shifts focus from the emitting, non-renewable nature of natural gas that leads to methane leakage along the supply chain to its ability to facilitate an energy transition. With this, discourse sustains existing path dependencies. Actors can discursively resolve contradictions, even if these do not resolve fundamental material contradictions. In the EU, this would only change later, when political pressure led the Commission to *green* its policies and revisit the transition fuel discourse. This would subsequently prompt material change and lead incumbents to explore technological solutions to the contradiction of consuming fossil fuels and reducing greenhouse gas emissions.

The greening institutionalism framework suggests that path dependencies limit carbon institutions from evolving into post-carbon institutions, but political force, shifting governance regimes, and changes in discourses can facilitate such reconfigurations. Impediments to change are nonetheless pernicious in the energy sector, given the deep socio-technical lock-ins posed by infrastructure and consumption practices, but, as this dissertation shows these are linked to deeply political matters that impede the greening of institutions. Resistance from established interests, relative power relations, and dominant discourses all maintain the path dependencies of fossil fuel-based practices, only allowing for their gradual change. These force political institutions to reconcile carbon-based practices and climate goals, and only after critical junctures emerge can watershed moments occur that allow political institutions to realign their pre-existing agendas with new objectives more stringently. These lead to greener institutions, but radical ruptures are still limited, as established interests seek alternative modes to include themselves into the unfolding energy regime. They seek to achieve this through technological and political solutions that maintain their relevance in the broader narrative of the energy transition.

8.4 Future avenues for research

The work I conducted for this PhD has shone light on a number of further research avenues that I consider worthwhile to pursue. These include the future of natural gas, the greening of state and other political institutions' policies, as well as hydrogen's role as an energy carrier. Debates on the future of natural gas have proliferated during the course of my PhD. When I began my work, I had few publications in which I could anchor my work. As discussed in chapter one and two, Robert Howarth's (2014) work, Anderson and Broderick's (2017) paper, as well as a study by

Jonathan Stern (2017b) were the few exceptions that began to explore the natural gas-climate nexus. Experts began to debate the role of the fuel as the energy transition accelerated in recent years. The Commission has also dedicated a number of policy documents to develop the indicate the course of the transition after I completed my fieldwork. These include the ‘Fit for 55 Package’[168], the ‘Gas Package’ [169], and a version of the ‘sustainable finance taxonomy’[170] which someone leaked to the press recently. These begin to develop the framework for natural gas’ role in the EU’s energy system in forthcoming years, but divide experts and the Commission itself: some argue for greater stringency and ambition with a quicker phase out, while others suggest that the technological and economic challenges warrant extending the energy carriers role in the EU.

The greening institutions analytical framework offers a toolkit to theorise how these policies emerged and why they took their specific forms. Exploring newly introduced natural gas policies extends the interval of this dissertation and includes key interventions where the Commission had to reconcile climate and natural gas policy. This framework can also be transposed to other levels of governance, such as the national or the local. Scholars and experts can deploy it to analyse how states and local governments “greened” their policies. A number of cases offer valuable objects of analysis, such as the Netherlands, which has shifted from pursuing a pro-natural gas agenda based on domestic resources to gradually halting consumers in connecting to the grid. Exploring why other states did not pursue this avenue or did so at a much slower pace is also a worthwhile endeavour. Central and Eastern European countries lobbied for natural gas projects to be permissible in the sustainable finance taxonomy, one may ask what sort of path dependencies

[168] COM (2021) 550 final, 14.07.2021.
[169] COM(2021) 803 final, 21.12.2021.
[170] See: (Simon and Taylor, 2022).

facilitated these and how did they wield power to shape Commission policy to be somewhat permissive? By understanding such variegated positions one can both develop a deeper understanding of the politics of an energy transition and inform policy on how to introduce more nuanced and targeted supranational, national, and local policies that facilitate it.

Another path for research is one that explores the role of hydrogen and the role that in can play in the EU's energy system. Szabo (2020a) suggests that the "power relations of fossil capitalism will allow the natural gas industry to appropriate the notion of a hydrogen utopia and substitute a natural gas-based vision for one based on renewables. This ultimately allows natural gas interests to dominate (future) hydrogen markets" (p. 15). This dissertation and other publications (Pflugmann and De Blasio, 2020; Van de Graaf *et al.*, 2020; Szabo, 2022) have begun to explore the socio-political and geopolitical implications of shifting to hydrogen. Including grey and blue hydrogen in the EU's transition has been a key factor reflective of the techno-economic limitations of the shift and the political power of established interests. Nonetheless, the Commission and member states, led by Germany, have emphasised the need to focus on green hydrogen. Exploring the unfolding power struggle between forces in support of fossil fuel and non-fossil fuel based hydrogen can offer further nuance to the theoretical framework proposed in this dissertation. The matter raises questions over how actors innovate and adapt to a changing techno-political context and whether they will be able to influence EU and national governance to allocate a role to fossil fuel-based hydrogen in a low carbon economy. Questions, which also carry crucial geopolitical implications (Szabo, 2021). These avenues of research show the vast number of questions that are still to be answered as the EU decarbonises. I genuinely hope that this dissertation is a humble point of departure for such inquiries.

9 Bibliography

Aaheim, A. and Müller, B. (2000) *Fossil Fuels in a Changing Climate: Impacts of the Kyoto Protocol and Developing Country Participation*. Oxford, UK: Oxford University Press for the Oxford Institute for Energy Studies.

Abrahams, L.S., Samaras, C., Griffin, W.M. and Matthews, H.S. (2015) 'Life cycle greenhouse gas emissions from U.S. liquefied natural gas exports: implications for end uses', *Environmental Science & Technology*, 49(5), pp. 3237–3245. doi:10.1021/es505617p.

ACER (2015) *Consolidated report on the progress of electricity and gas Projects of Common Interest - 2015*. Ljubljana, Slovenia: ACER. Available at: http://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20PROJECTS%20OF%20COMMON%20INTEREST%20for%20the%20year%202015.pdf (Accessed: 5 November 2021).

ACER (2016) *Consolidated report on the progress of electricity and gas Projects of Common Interest - 2016*. Ljubljana, Slovenia: ACER. Available at: http://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20for%20the%20year%202016.pdf (Accessed: 5 November 2021).

ACER (2017) *Consolidated report on the progress of electricity and gas Projects of Common Interest - 2017*. Ljubljana, Slovenia: ACER. Available at:

http://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20for%20the%20year%202017.pdf (Accessed: 5 November 2021).

ACER (2018) *Consolidated report on the progress of electricity and gas Projects of Common Interest - 2018*. Ljubljana, Slovenia: ACER. Available at: http://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20for%20the%20year%202017.pdf (Accessed: 5 November 2021).

ACER (2019) *Consolidated report on the progress of electricity and gas Projects of Common Interest - 2019*. Ljubljana, Slovenia: ACER. Available at: http://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/CONSOLIDATED%20REPORT%20ON%20THE%20PROGRESS%20OF%20ELECTRICITY%20AND%20GAS%20%20PROJECTS%20OF%20COMMON%20INTEREST%20-%202019.pdf (Accessed: 5 November 2021).

ACER (2020a) *Consolidated report on the progress of electricity and gas Projects of Common Interest - 2020*. Ljubljana, Slovenia: ACER. Available at: http://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest%20(2020).pdf (Accessed: 5 November 2021).

ACER (2020b) *Most EU gas transportation networks not yet ready to transport hydrogen*. Ljubljana, Slovenia: ACER. Available at: https://www.acer.europa.eu/Media/News/Pages/Most-EU-gas-transportation-networks-not-yet-ready-to-transport-hydrogen-.aspx (Accessed: 31 July 2020).

ACER (2021a) *Consolidated report on the progress of electricity and gas Projects of Common Interest - 2021*. Ljubljana, Slovenia: ACER. Available at: https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/2021_ACER%20Consolidated%20Report%20on%20the%20progress%20of%20electricity%20and%20gas%20Projects%20of%20Common%20Interest.pdf (Accessed: 5 November 2021).

ACER (2021b) *Network Codes, Network Codes*. Ljubljana, Slovenia: ACER. Available at: https://www.acer.europa.eu/gas/network-codes (Accessed: 22 September 2021).

ACER (2021c) *Transporting Pure Hydrogen by Repurposing Existing Gas Infrastructure: Overview of existing studies and reflections on the conditions for repurposing*. Ljubljana, Slovenia: ACER. Available at: https://extranet.acer.europa.eu/official_documents/acts_of_the_agency/publication/transporting%20pure%20hydrogen%20by%20repurposing%20existing%20gas%20infrastructure_overview%20of%20studies.pdf (Accessed: 6 November 2021).

Aghion, P., Hepburn, C., Teytelboym, A. and Zenghelis, D. (2019) 'Path dependence, innovation and the economics of climate change', *Handbook on Green Growth* [Preprint]. Cheltenham, UK: Edward Elgar Publishing. Available at:

https://www.elgaronline.com/view/edcoll/9781788110679/9781788110679.00011.xml (Accessed: 13 September 2021).

Agora Energiewende and Sandbag (2019) *The European Power Sector in 2018. Up-to-date analysis on the electricity transition*. Available at: https://www.agora-energiewende.de/fileadmin2/Projekte/2018/EU-Jahresauswertung_2019/Agora-Energiewende_European-Power-Sector-2018_WEB.pdf (Accessed: 17 May 2019).

Altfeld, K. and Pinchbeck, D. (2013) *Admissible hydrogen concentrations in natural gas systems*. 03/2013. DIV Deutscher Industrieverlag GmbH. Available at: http://www.gerg.eu/public/uploads/files/publications/GERGpapers/SD_gfe_03_13_Report_Altfeld-Pinchbeck.pdf (Accessed: 22 August 2018).

Altvater, E. (2007) 'The Social and Natural Environment of Fossil Capitalism', *Socialist Register*, 43. Available at: https://socialistregister.com/index.php/srv/article/view/5857 (Accessed: 12 August 2020).

Alvarez, R.A., Zavala-Araiza, D., Lyon, D.R., Allen, D.T., Barkley, Z.R., Brandt, Z.R., Brandt, A.R., Davis, K.J., Herndon, S.C., Jacob, D.J., Karion, A., Kort, E.A., Lamb, B.K., Lauvaux, T., Maasakkers, J.D., Marchese, A.J., Omara, M., Pacala, S.W., Peischl, J., Robinson, A.L., Shepson, P.B., Sweeney, C., Townsend-Small, A., Wofsy, S.C. and Hamburg, S.P. (2018) 'Assessment of methane emissions from the U.S. oil and gas supply chain', *Science*, 361(6398), pp. 186–188. doi:10.1126/science.aar7204.

Andersen, S., Goldthau, A. and Sitter, N. (2017) 'From Low to High Politics? The EU's Regulatory and Economic Power', in Andersen, S., Goldthau, A., and Sitter, N. (eds)

Energy Union: Europe's New Liberal Mercantilism. London, UK: Palgrave MacMillan (International Political Economy Series), pp. 13–26.

Andersen, S.S., Goldthau, A. and Sitter, N. (2016) 'The EU Regulatory State, Commission Leadership and External Energy Governance', in Godzimirski, J.M. (ed.) *EU Leadership in Energy and Environmental Governance: Global and Local Challenges and Responses*. London, UK: Palgrave Macmillan UK (International Political Economy Series), pp. 51–68. doi:10.1057/9781137502766_3.

Anderson, K. (2015) 'Talks in the city of light generate more heat', *Nature News*, 528(7583), p. 437. doi:10.1038/528437a.

Anderson, K. and Broderick, J. (2017) 'Natural gas and climate change'. Friends of the Earth Europe. Available at: http://www.foeeurope.org/sites/default/files/extractive_industries/2017/natural_gas_and_climate_change_anderson_broderick_october2017.pdf (Accessed: 6 December 2017).

Anderson, M., Salo, K. and Fridell, E. (2015) 'Particle- and Gaseous Emissions from an LNG Powered Ship', *Environmental Science & Technology*, 49(20), pp. 12568–12575. doi:10.1021/acs.est.5b02678.

Anderson, P. (2009) *The New Old World*. London, UK and New York, NY, USA: Verso Books.

Andrews-Speed, P. (2016) 'Applying institutional theory to the low-carbon energy transition', *Energy Research & Social Science*, 13, pp. 216–225. doi:10.1016/j.erss.2015.12.011.

Arapostathis, S., Carlsson-Hyslop, A., Pearson, P.J.G., Thornton, J., J., Gradillas, M., Lazcay, S. and Wallis, S. (2013) 'Governing transitions: Cases and insights from two periods in the history of the UK gas industry', *Energy Policy*, 52, pp. 25–44. doi:10.1016/j.enpol.2012.08.016.

Arapostathis, S., Pearson, P.J.G. and Foxon, T.J. (2014) 'UK natural gas system integration in the making, 1960–2010: Complexity, transitional uncertainties and uncertain transitions', *Environmental Innovation and Societal Transitions*, 11, pp. 87–102. doi:10.1016/j.eist.2014.01.004.

Awan, A.R., Teigland, R. and Kleppe, J. (2008) 'A Survey of North Sea Enhanced-Oil-Recovery Projects Initiated During the Years 1975 to 2005', *SPE Reservoir Evaluation & Engineering*, 11(03), pp. 497–512. doi:10.2118/99546-PA.

Bäckstrand, K. and Elgström, O. (2013) 'The EU's role in climate change negotiations: from leader to "leadiator"', *Journal of European Public Policy*, 20(10), pp. 1369–1386. doi:10.1080/13501763.2013.781781.

Baek, U.B., Nahm, S.H., Kim, W.S., Ronevich, J.A. and San Marchi, S. (2017) 'Compatibility and Suitability of Existing Steel Pipelines for Transport of Hydrogen-Natural Gas Blends'. *International Conference on Hydrogen Safety*, Hamburg, Germany. Available at: https://hysafe.info/uploads/2017_presentations/3_Day_130917/1_Floor_Zollhalle/3_Session_StoragePipelines/1_ID228.pdf (Accessed: 6 November 2021).

Balmaceda, M.M. (2013) *The Politics of Energy Dependency: Ukraine, Belarus, and Lithuania Between Domestic Oligarchs and Russian Pressure*. Toronto, ON, Canada: University of Toronto Press.

Balmaceda, M.M. (2018) ‘Differentiation, materiality, and power: Towards a political economy of fossil fuels’, *Energy Research & Social Science*, 39, pp. 130–140. doi:10.1016/j.erss.2017.10.052.

Balmaceda, M.M. (2021) *Russian Energy Chains: The Remaking of Technopolitics from Siberia to Ukraine to the European Union*. New York, NY, USA: Columbia University Press.

Barnes, P. (2011) ‘The role of the Commission of the European Union - Creating external coherence from internal diversity’, in Wurzel, R. and Connelly, J. (eds) *The European Union as a Leader in Climate Change Politics*. Oxon, UK and New York, NY, USA: Routledge (Routledge/UACES Contemporary European Studies), pp. 41–57.

Barrow, C.W. (1993) *Critical Theories of the State: Marxist, Neomarxist, Postmarxist*. Madison, WI, USA: University of Wisconsin Press.

Bauer, M.W. (2002) ‘The Commission and the Poverty Programmes’, *JCMS: Journal of Common Market Studies*, 40(3), pp. 381–400. doi:10.1111/1468-5965.00361.

Bauman, Z. (2012) ‘Times of interregnum’, *Ethics & Global Politics*, 5(1), pp. 49–56. doi:10.3402/egp.v5i1.17200.

Bayer, P. and Aklin, M. (2020) ‘The European Union Emissions Trading System reduced CO2 emissions despite low prices’, *Proceedings of the National Academy of Sciences*, 117(16), pp. 8804–8812. doi:10.1073/pnas.1918128117.

Becker, S., Beveridge, R. and Röhring, A. (2016) ‘Energy Transitions and Institutional Change’, in Gailing, L. and Moss, T. (eds) *Conceptualizing Germany’s Energy Transition—*

Institutions, Materiality, Power, Space. Basingstoke, UK: Palgrave MacMillan, pp. 21–41.

Bennett, A. (2008) ‘Process Tracing: A Bayesian Perspective’, in *The Oxford Handbook of Political Methodology*. Oxford, UK: Oxford University Press, pp. 702–721. doi:10.1093/oxfordhb/9780199286546.003.0030.

Bennett, A. and Checkel, J.T. (eds) (2014) *Process Tracing: From Metaphor to Analytic Tool*. Cambridge, UK: Cambridge University Press (Strategies for Social Inquiry). doi:10.1017/CBO9781139858472.

Bergek, A., Berggren, C., Magnusson, T., and Hobday, M. (2013) ‘Technological discontinuities and the challenge for incumbent firms: Destruction, disruption or creative accumulation?’, *Research Policy*, 42(6), pp. 1210–1224. doi:10.1016/j.respol.2013.02.009.

Berggren, C., Magnusson, T. and Sushandoyo, D. (2015) ‘Transition pathways revisited: Established firms as multi-level actors in the heavy vehicle industry’, *Research Policy*, 44(5), pp. 1017–1028. doi:10.1016/j.respol.2014.11.009.

Beveridge, R. and Kern, K. (2013) ‘The Energiewende in Germany: Background, Developments and Future Challenges’, *Renewable Energy Law and Policy Review (RELP)*, 4, p. 3. Available at: https://heinonline.org/HOL/Page?handle=hein.journals/relp2013&id=5&div=&collection= (Accessed: 29 April 2021).

Bhaskar, R. (1998) *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*. Oxfordshire, UK: Routledge.

Bieling, H.-J., Jäger, J. and Ryner, M. (2016) 'Regulation Theory and the Political Economy of the European Union', *JCMS: Journal of Common Market Studies*, 54(1), pp. 53–69. doi: https://doi.org/10.1111/jcms.12331.

Bledsoe, P. (2018) *Gazprom's 'fugitive emissions' are a problem for Europe*, *Financial Times*. Available at: https://www.ft.com/content/3edd0b08-9bf5-11e8-9702-5946bae86e6d (Accessed: 17 May 2019).

BMWI and BMU (2010) *Energy Concept (Energiewende)*. Available at: https://web.archive.org/web/20161006040920/http://www.bmwi.de/English/Redaktion/Pdf/energy-concept%2Cproperty%3Dpdf%2Cbereich%3Dbmwi%2Csprache%3Den%2Crwb%3Dtrue.pdf (Accessed: 11 November 2019).

Bocquillon, P. and Maltby, T. (2020) 'EU energy policy integration as embedded intergovernmentalism: the case of Energy Union governance', *Journal of European Integration*, 42(1), pp. 39–57. doi:10.1080/07036337.2019.1708339.

Boersma, T. (2015) *Energy Security and Natural Gas Markets in Europe: Lessons from the EU and the United States*. Oxfordshire, UK: Routledge.

Bonato, S. (2018) *Searching the Grey Literature: A Handbook for Searching Reports, Working Papers, and Other Unpublished Research*. Lanham, MA, USA: Rowman & Littlefield.

Borchardt, D. (2019) 'Exclusive! Borchardt (EU Commission) | From the latest Madrid Forum to the next Gas Package'. Florence School of Regulation. Available at: https://www.youtube.com/watch?v=qHCAc_5Yrh4 (Accessed: 29 April 2019).

Borchardt, K.-D. (2020) ‘Klaus-Dieter Borchardt, Deputy Director-General, Energy: “It is not for the Commission to decide anything”’, *Investigate Europe*, 12 October. Available at: https://www.investigate-europe.eu/en/2020/klaus-dieter-borchardt/ (Accessed: 16 November 2020).

Bouzarovski, S., Bradshaw, M. and Wochnik, A. (2015) ‘Making territory through infrastructure: The governance of natural gas transit in Europe’, *Geoforum*, 64, pp. 217–228. doi:10.1016/j.geoforum.2015.06.022.

BP (2011) *BP Energy Outlook 2030*. London, UK: BP. Available at: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2011.pdf (Accessed: 5 October 2020).

BP (2019a) *BP Statistical Review of World Energy*. 68. London, UK: BP. Available at: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf (Accessed: 22 January 2020).

BP (2019b) *Statistical Review of World Energy – all data, 1965-2017*, *BP - Definitions and explanatory notes*. Available at: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html (Accessed: 2 April 2019).

BP (2020) *Statistical Review of World Energy – all data, 1965-2019, BP global*. Available at: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html (Accessed: 17 February 2021).

Braaksma, A. (2018) ‘Session 01.A.03: A study of scenarios to 2050 using Primes’. *Madrid Forum*, Madrid, Spain. Available at: https://ec.europa.eu/energy/en/content/31st-madrid-forum-presentations (Accessed: 14 February 2019).

Bradshaw, M.J. and Boersma, T. (2020) *Natural Gas*. Cambridge, UK: Polity Press.

Brauers, H., Braunger, I. and Jewell, J. (2021) ‘Liquefied natural gas expansion plans in Germany: The risk of gas lock-in under energy transitions’, *Energy Research & Social Science*, 76, p. 102059. doi:10.1016/j.erss.2021.102059.

British Gas (1980) *Gas Chronology: The Development of the British Gas Industry*. UK: British Gas. Available at: http://www.oldflames.org.uk/Gas%20Chronology.pdf (Accessed: 24 June 2019).

Broadfoot, K., Deetz, S. and Anderson, D. (2004) ‘Multi-Levelled, Multi-Method Approaches to Organizational Discourse’, in *The SAGE Handbook of Organizational Discourse*. London, UK: SAGE Publications Ltd, pp. 193–212. doi:10.4135/9781848608122.

Brummett, B. (2018) *Techniques of Close Reading*. Thousand Oaks, CA, USA: SAGE Publications.

Bryant, G. (2019) *Carbon Markets in a Climate-Changing Capitalism*. Cambridge, UK: Cambridge University Press. doi:10.1017/9781108377591.

Buchan, D. (2009) *Energy and Climate Change: Europe at the Crossroads*. Oxford, UK: Oxford University Press for the Oxford Institute for Energy Studies.

Bulkeley, H. and Newell, P.J. (2010) *Governing Climate Change*. Oxfordshire, UK: Routledge.

Bulmer, S.J. (1997) *New Institutionalism, The Single Market and EU Governance*. Working Paper WP 97/25. Oslo, Norway: University of Oslo. Available at: https://www.sv.uio.no/arena/english/research/publications/arena-working-papers/1994-2000/1997/wp97_25.htm#FOOTNOTE_4 (Accessed: 11 March 2022).

Bulmer, S.J. (1998) 'New institutionalism and the governance of the Single European Market', *Journal of European Public Policy*, 5(3), pp. 365–386. doi:10.1080/135017698343875.

Buonocore, J.J., Salimifard, P., Michanowicz, D.R. and Allen, J.G. (2021) 'A decade of the U.S. energy mix transitioning away from coal: historical reconstruction of the reductions in the public health burden of energy', *Environmental Research Letters*, 16(5), p. 054030. doi:10.1088/1748-9326/abe74c.

Buschmann, P. and Oels, A. (2019) 'The overlooked role of discourse in breaking carbon lock-in: the case of the German energy transition', *Wiley Interdisciplinary Reviews-Climate Change*, 10(3), p. e574. doi:10.1002/wcc.574.

Buzogány, A. and Ćetković, S. (2021) 'Fractionalized but ambitious? Voting on energy and climate policy in the European Parliament', *Journal of European Public Policy*, 28(7), pp. 1038–1056. doi:10.1080/13501763.2021.1918220.

Caldecott, B.L. and McDaniels, J. (2014) *Stranded generation assets: Implications for European capacity mechanisms, energy markets and climate policy*. Oxford, UK: University of Oxford. Available at: https://www.smithschool.ox.ac.uk/research/sustainable-finance/publications/Stranded-Generation-Assets.pdf (Accessed: 9 December 2020).

Campbell, J.L. and Lindberg, L.N. (1991) ‘The evolution of governance regimes’, in Hollingsworth, J.R., Campbell, J.L., and Lindberg, L.N. (eds) *Governance of the American Economy*. Cambridge, UK: Cambridge University Press (Structural Analysis in the Social Sciences), pp. 319–355. doi:10.1017/CBO9780511664083.012.

Carson, R. (2002) *Silent Spring*. Anniversary edition. Boston, MA, USA: Houghton Mifflin Company.

Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J. and Neville, A.J. (2014) ‘The use of triangulation in qualitative research’, *Oncology Nursing Forum*, 41(5), pp. 545–547. doi:10.1188/14.ONF.545-547.

CCAC (2017) *Reducing methane emissions across the natural gas value chain - Guiding principles, Climate & Clean Air Coalition*. Available at: https://ccacoalition.org/en/resources/reducing-methane-emissions-across-natural-gas-value-chain-guiding-principles (Accessed: 8 August 2020).

CEER (2018a) *CEER Benchmarking Report 6.1 on the Continuity of Electricity and Gas Supply Data update 2015/2016*. Brussels, Belgium: CEER. Available at: https://www.ceer.eu/documents/104400/-/-/963153e6-2f42-78eb-22a4-06f1552dd34c (Accessed: 24 June 2019).

CEER (2018b) *Study on the Future Role of Gas from a Regulatory Perspective*. Brussels, Belgium: Council of European Energy Regulators. Available at: https://www.ceer.eu/documents/104400/-/-/45c62ea3-86be-c007-e868-28070a0590cd (Accessed: 11 March 2018).

CEO (2017) 'The Great Gas Lock-in: Industry Lobbying behind the EU push for new gas infrastructure'. Corporate Europe Observatory. Available at: https://corporateeurope.org/sites/default/files/the_great_gas_lock_in_english_.pdf (Accessed: 18 November 2017).

Červinková, J. and Jirušek, M. (2021) 'Effective tool or useless list? Projects of Common Interest in the sector of natural gas in Southeastern Europe', *Energy Research & Social Science,* 79, p. 102151. doi:10.1016/j.erss.2021.102151.

Cherp, A., Vinichenko, V., Jewell, J., Masahiro, S. and Antal, M. (2017) 'Comparing electricity transitions: A historical analysis of nuclear, wind and solar power in Germany and Japan', *Energy Policy*, 101, pp. 612–628. doi:10.1016/j.enpol.2016.10.044.

Cherp, A., Vinichenko, V., Jewell, J., Brutshin, E. and Sovacool, B. (2018) 'Integrating techno-economic, socio-technical and political perspectives on national energy transitions: A meta-theoretical framework', *Energy Research & Social Science*, 37, pp. 175–190.

Chouliaraki, L. and Fairclough, N. (1999) *Discourse in Late Modernity: Rethinking Critical Discourse Analysis*. Edinburgh, UK: Edinburgh University Press.

Cini, M. (1997) 'Administrative Culture in the European Commission: The Cases of Competition and Environment', in Nugent, N. (ed.) *At the Heart of the Union: Studies of the European Commission*. London, UK: Palgrave Macmillan UK, pp. 71–88. doi:10.1007/978-1-349-25791-1_4.

Collier, R.B. and Collier, D. (1991) *Critical Junctures and Historical Legacies*. SSRN Scholarly Paper ID 1750509. Rochester, NY, USA: Social Science Research Network. Available at: https://papers.ssrn.com/abstract=1750509 (Accessed: 20 February 2019).

Collier, U. (1997) 'The EU and Climate Change Policy: The Struggle over Policy Competences', in Lofted, R.E. and Collier, U. (eds) *Cases in Climate Change Policy*. London, UK: Routledge, pp. 43–64.

Commission of the European Communities (1988) *Evaluation of the R & D programme in the field of Non-Nuclear Energy (1985-1988) (vol. 1) [EUR 11834 EN/1]*. Research Evaluation 24. Brussels-Luxembourg: Commission of the European Communities. Available at: http://aei.pitt.edu/44933/1/EUR_11834.pdf (Accessed: 9 October 2019).

Correljé, A. (2016) 'The European Natural Gas Market', *Current Sustainable/Renewable Energy Reports*, 3(1), pp. 28–34. doi:10.1007/s40518-016-0048-y.

Craig, J., Gerali, F., MacAulauy, F. and Sorkhabi, R. (2018) 'The history of the European oil and gas industry (1600s-2000s)', in Craig, J. Gerali, F., MacAulauy, F. and Sorkhabi, R. (eds) *History of the European Oil and Gas Industry*. London, UK: The Geological Society of London (Special Publications, 465), pp. 1–24.

Crellin, F. (2021) 'High carbon prices prompt coal-to-gas fuel switching', *Reuters*, 21 April. Available at: https://www.reuters.com/business/energy/high-carbon-prices-prompt-coal-to-gas-fuel-switching-2021-04-21/ (Accessed: 6 December 2021).

Crisan, A. and Kuhn, M. (2017) 'The Energy Network: Infrastructure as the Hardware of the Energy Union', in Andersen, S.S., Goldthau, A., and Sitter, N. (eds) *Energy Union -*

Europe's New Liberal Mercantilism? London, UK: Palgrave MacMillan (International Political Economy Series), pp. 165–182.

Curran, G. (2020) 'Divestment, energy incumbency and the global political economy of energy transition: the case of Adani's Carmichael mine in Australia', *Climate Policy*, 20(8), pp. 949–962. doi:10.1080/14693062.2020.1756731.

Curran, M.A. (2012) *Life Cycle Assessment Handbook: A Guide for Environmentally Sustainable Products*. Hoboken, NJ, USA: John Wiley & Sons.

Damro, C. and Mackenzie, D. (2008) 'The European Union and the Politics of Multi-Level Climate Governance', in Compston, H. and Bailey, I. (eds) *Turning Down the Heat: The Politics of Climate Policy in Affluent Democracies*. London, UK: Palgrave Macmillan UK, pp. 65–84. doi:10.1057/9780230594678_5.

Danermark, B. (2002) *Explaining Society: Critical Realism in the Social Sciences*. Oxfordshire, UK: Routledge.

David, P.A. (1985) 'Clio and the Economics of QWERTY', *American Economic Review*, 75(2), pp. 332–337. Available at: https://ideas.repec.org/a/aea/aecrev/v75y1985i2p332-37.html (Accessed: 25 March 2020).

De Clara, S. and Mayr Kordula (2018) *The EU ETS phase IV reform: implications for system functioning and for the carbon price signal*. Oxford, UK: Oxford Institute of Energy Studies and ewi Energy Research and Scenarios. Available at: https://www.oxfordenergy.org/publications/eu-ets-phase-iv-reform-implications-system-functioning-carbon-price-signal/ (Accessed: 30 October 2019).

Deák, A. (2012) *Jön! Jön! Jön! – a Déli Áramlat*. T-2012/7. Budapest, Hungary: KKI. Available at: https://kki.hu/assets/upload/Tanulmanyok_2012_07_Jen_Jen_Jen_-_a_Deeli_e_.pdf (Accessed: 6 April 2020).

Deetz, S. and McClellan, J.G. (2011) 'Communication', in Alvesson, M., Bridgman, T., and Willmott, H. (eds) *The Oxford Handbook of Critical Management Studies*. Oxford, UK: Oxford University Press. doi:10.1093/oxfordhb/9780199595686.001.0001.

Deetz, W.S. (2009) 'Politically Attentive Relational Constructionism (PARC): Making a Difference in a Pluralistic, Interdependent', in Carbaugh, D. and Buzzanell, P.M. (eds) *Distinctive Qualities in Communication Research*. Abingdon, Oxon, UK and New York, NY, USA: Routledge.

Delbeke, J. and Vis, P. (2015) *EU Climate Policy Explained*. Abingdon, UK: Routledge.

Delborne, J.A., Hasala, D., Wigner, A. and Kinchy, A. (2020) 'Dueling metaphors, fueling futures: "Bridge fuel" visions of coal and natural gas in the United States', *Energy Research & Social Science*, 61, p. 101350. doi:10.1016/j.erss.2019.101350.

Drake, H. (2000) *Jacques Delors: Perspectives on a European Leader*. 1st edition. New York, NY, USA: Routledge.

Dreger, J. (2014) *The European Commission's Energy and Climate Policy - A Climate for Expertise?* London, UK: Palgrave MacMillan.

Dunleavy, P. and O'Leary, B. (1987) *Theories of the state: the politics of liberal democracy*. New York, NY, USA: Macmillan Education.

Dupont, C. and Oberthür, S. (2015) 'Decarbonization in the EU: Setting the Scene', in Dupont, C. and Oberthür, S. (eds) *Decarbonization in the European Union: Internal Policies and External Strategies*. London, UK: Palgrave Macmillan UK (Energy, Climate and the Environment), pp. 1–24. doi:10.1057/9781137406835_1.

Dutton, J., Lehne, J. and Littlecott, C. (2020) *EUROPEAN CCS:: LEARNING FROM FAILURE OR FAILING TO LEARN?* Discussion Paper. E3G. Available at: https://www.jstor.org/stable/resrep24948 (Accessed: 25 November 2020).

Eberlein, B. (2008) 'The Making of the European Energy Market: The Interplay of Governance and Government', *Journal of Public Policy*, 28(1), pp. 73–92. doi:10.1017/S0143814X08000780.

ECF (2010) *Roadmap 2050: A Practical Guide to a Prosperous, Low-Carbon Europe*. The Hague, NL: European Climate Foundation. Available at: https://www.roadmap2050.eu/attachments/files/Volume1_fullreport_PressPack.pdf (Accessed: 5 August 2021).

Ecofys (2018) 'The Role of Renewable Gas in a Decarbonised Energy System'. *Madrid Forum*, Madrid. Available at: https://ec.europa.eu/energy/en/content/31st-madrid-forum-presentations (Accessed: 14 February 2019).

ECSC, Commission of the European Economic Community and Commission of the European Atomic Energy Community (1964) *Study on the Long-Term Energy Outlook for the European Community*. Luxembourg, Luxembourg. Available at: http://aei.pitt.edu/37429/1/A3386.pdf (Accessed: 13 February 2019).

EEA (2016) *Transforming the EU power sector: avoiding a carbon lock-in*. Copenhagen, Denmark: European Environmental Agency. Available at: https://www.eea.europa.eu/publications/transforming-the-eu-power-sector (Accessed: 28 February 2018).

EEA (2020) *European Union emission inventory report 1990-2018 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)*. No 05/2020. Luxembourg, Luxembourg: European Environment Agency. Available at: https://www.eea.europa.eu/publications/european-union-emission-inventory-report-1990-2018 (Accessed: 6 August 2020).

EIA (1998) *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*. Washington DC, USA: EIA. Available at: https://inis.iaea.org/collection/NCLCollectionStore/_Public/30/014/30014223.pdf (Accessed: 6 August 2019).

Eikeland, P.O. and Skjaerseth, J.B. (2016) 'Evolution of EU Climate and energy policies', in Skjaerseth, J.B. et al. (eds) *Linking EU Climate and Energy Policies - Decision-making, Implementation and Reform*. Cheltenham, UK UK and Northampton, MA, USA: Edward Elgar Publishing (New Horizons in Environmental Politics), pp. 31–49.

Eikeland, P.O., Skjærseth, J.B. and Gulbrandsen, L.H. (2016) 'Initiating the package for 2020', in Skjaerseth, J.B. et al. (eds) *Linking EU Climate and Energy Policies: Decision-making, Implementation and Reform*. Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing, pp. 50–70. Available at:

https://www.elgaronline.com/view/9781785361272.00010.xml (Accessed: 4 August 2021).

Ellerman, A.D. and Buchner, B.K. (2007) ‘The European Union Emissions Trading Scheme: Origins, Allocation, and Early Results’, *Review of Environmental Economics and Policy*, 1(1), pp. 66–87. doi:10.1093/reep/rem003.

Ellerman, A.D. and McGuinness, M. (2008) *CO2 Abatement in the UK Power Sector: Evidence from the EU ETS Trial Period*. Working Paper. Available at: https://dspace.mit.edu/handle/1721.1/45654 (Accessed: 3 August 2021).

ENTSO-E (2018) *Electricity in Europe 2017*. Brussels, Belgium: European Network of Transmission System Operators for Electricity. Available at: https://eepublicdownloads.entsoe.eu/clean-documents/Publications/Statistics/electricity_in_europe/entso-e_electricity_in_europe_2017_web.pdf (Accessed: 25 November 2020).

ENTSO-E (2019) *Statistical Factsheet 2018*. Brussels, Belgium: European Network of Transmission System Operators for Electricity. Available at: https://eepublicdownloads.entsoe.eu/clean-documents/Publications/Statistics/Factsheet/entsoe_sfs2018_web.pdf (Accessed: 25 November 2020).

ENTSOG (2009) *European Ten Year Network Development Plan 2010 - 2019*. Brussels, Belgium: ENTSOG. Available at: https://www.entsog.eu/sites/default/files/entsog-migration/publications/TYNDP/2012/ENTSOG_TYNDR_MAIN_23dec2009____.pdf (Accessed: 8 October 2021).

ENTSOG (2011) *Ten-Year Network Development Plan 2011 - 2020*. Brussels, Belgium: ENTSOG. Available at: https://www.entsog.eu/sites/default/files/entsog-migration/publications/TYNDP/2012/TYNDP_Report_110217_MQ_.pdf (Accessed: 8 October 2021).

ENTSOG (2012) *Annual Report 2012*. Brussels, Belgium: ENTSOG. Available at: https://www.entsog.eu/annual-work-programme-annual-reports#entsog-annual-reports (Accessed: 11 October 2021).

ENTSOG (2015) *Annual Report 2015*. Brussels, Belgium: ENTSOG. Available at: https://www.entsog.eu/annual-work-programme-annual-reports#entsog-annual-reports (Accessed: 11 October 2021).

ENTSOG (2016) *Annual Report 2016*. Brussels, Belgium: ENTSOG. Available at: https://www.entsog.eu/annual-work-programme-annual-reports#entsog-annual-reports (Accessed: 11 October 2021).

ENTSOG (2017) *Annual Report 2017*. Brussels, Belgium: ENTSOG. Available at: https://www.entsog.eu/annual-work-programme-annual-reports#entsog-annual-reports (Accessed: 11 October 2021).

ENTSOG (2018) ‘Strategy for Long-Term EU Greenhouse Gas Emissions Reductions (REF: PRE0229-18)’. Available at: https://www.entsog.eu/sites/default/files/2018-11/PRE0229_181108_LET_ENTSOG-EC_Strategy_Long-

Term_EU_Greenhouse_Gas_Emiss._Reduc._T.Baltazar.pdf (Accessed: 7 December 2020).

ENTSOG (2020a) *About ENTSOG | ENTSOG*. Available at: https://www.entsog.eu/about-entsog (Accessed: 12 October 2020).

ENTSOG (2020b) *Transparency Platform*. Available at: https://transparency.entsog.eu/#/map (Accessed: 2 July 2020).

ENTSOG, GIE and Hydrogen Europe (2020) *How to transport and store hydrogen - facts and figures*. Brussels, Belgium. Available at: https://www.entsog.eu/future-gas-infrastructure (Accessed: 21 September 2021).

ENTSOG, GIE and Hydrogen Europe (2021) *How to Transport and Store Hydrogen - Facts and Figures*. Brussels, Belgium. Available at: https://www.hydrogeneurope.eu/wp-content/uploads/2021/05/ENTSOG_GIE_HydrogenEurope_QandA_hydrogen_transport_and_storage_FINAL.pdf (Accessed: 6 November 2021).

Equinor (2020a) *Carbon capture and storage in Equinor - equinor.com, Equinor*. Available at: https://www.equinor.com/en/what-we-do/carbon-capture-and-storage.html (Accessed: 25 November 2020).

Equinor (2020b) *Renewables and low-carbon, Equinor*. Available at: https://www.equinor.com/en/what-we-do/renewables.html (Accessed: 22 January 2020).

Erbach, G. (2017) *Capacity mechanisms for electricity*. PE 603.949. European Parliamentary Research Service. Available at:

https://www.europarl.europa.eu/RegData/etudes/BRIE/2017/603949/EPRS_BRI(2017)603949_EN.pdf (Accessed: 22 February 2020).

Eurelectric (2018) *Decarbonisation Pathways*. Brussels, Belgium: Eurelectric, p. 21. Available at: https://cdn.eurelectric.org/media/3457/decarbonisation-pathways-h-5A25D8D1.pdf (Accessed: 5 February 2019).

Eurelectric (2019) *Annual Report 2019*. Brussels, Belgium: Eurelectric. Available at: https://annualreport2019.eurelectric.org/ (Accessed: 25 November 2020).

Eurelectric (2020) 'ETS evolution and its impact on fuel switching'. Online. Available at: https://www.eurelectric.org/events/ets-evolution-and-its-impact-on-fuel-switching/ (Accessed: 7 August 2021).

Eurogas (2012) *Press release: EU to work harder to make low-carbon energy future a reality*. Brussels, Belgium: Eurogas. Available at: https://eurogas.org/website/wp-content/uploads/2018/03/Climate_environment_-_Press_R_EU_to_work_harder_to_make_low-carbon_energy_future_a_reality_101012_01.pdf (Accessed: 7 August 2021).

Eurogas (2013) *Press release: Eurogas welcomes ETS back-loading Decision*. Brussels, Belgium: Eurogas. Available at: https://eurogas.org/website/wp-content/uploads/2018/03/Climate_environment_Eurogas_Press_Release_Eurogas_welcomes_ETS_back-loading_Decision_190213_01.pdf (Accessed: 7 August 2021).

Eurogas (2014) *Eurogas views on the EU Emissions Trading System and the Market Stability Reserve*. Brussels, Belgium: Eurogas. Available at: https://eurogas.org/website/wp-content/uploads/2018/03/14PP396_Eurogas_views_on_the_ETS_and_Market_Stability_Reserve.pdf (Accessed: 7 August 2021).

Eurogas (2016) *Press release: Clean Energy package: Quick and efficient climate gains only with gas*. Brussels, Belgium: Eurogas. Available at: https://eurogas.org/website/wp-content/uploads/2018/03/Eurogas_Press_release_-_Clean_Energy_for_All_Europeans_package.pdf (Accessed: 7 August 2021).

Eurogas (2017) *Eurogas views on the Clean Energy Package*. Brussels, Belgium: Eurogas. Available at: https://eurogas.org/website/wp-content/uploads/2018/03/17PP087_-_Eurogas_views_on_the_Clean_Energy_Package.pdf (Accessed: 7 August 2021).

Eurogas (2019) *The sustainable credentials of gas*. Brussels, Belgium: Eurogas. Available at: https://eurogas.org/website/wp-content/uploads/2019/02/The-sustainable-credentials-of-gas_A-study-of-scenarios-to-2050-by-using-PRIMES.pdf (Accessed: 22 December 2020).

European Commission (1995) *Green Paper: For a European Union energy policy*. Brussels, Belgium: European Commission. Available at: https://publications.europa.eu/en/publication-detail/-/publication/f3a9af74-f359-4d06-9361-c0b06f0fbe61 (Accessed: 1 August 2019).

European Commission (1998) 'Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the internal market in natural gas', *Official Journal of the European Union*, L204(1). Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31998L0030&from=EN (Accessed: 5 May 2020).

European Commission (2008) 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - 20 20 by 2020 - Europe's climate change opportunity {COM(2008) 13 final} {COM(2008) 16 final} {COM(2008) 17 final} {COM(2008) 18 final} {COM(2008) 19 final}'. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52008DC0030 (Accessed: 7 August 2019).

European Commission (2009) *DIRECTIVE 2009/73/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC*. Brussels, Belgium: European Commission. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32009L0073&from=EN (Accessed: 21 April 2018).

European Commission (2011) 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions A Roadmap for moving to a competitive low carbon economy in 2050'. *Official Journal of the European Communities*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0112&from=en (Accessed: 20 March 2020).

European Commission (2017a) *Madrid Forum*. Available at: https://ec.europa.eu/energy/en/events/madrid-forum (Accessed: 22 February 2019).

European Commission (2017b) *Projects of common interest - Energy - European Commission, Energy*. Brussels, Belgium: European Commission. Available at:

https://ec.europa.eu/energy/en/topics/infrastructure/projects-common-interest (Accessed: 16 November 2017).

European Commission (2018a) *31st Madrid Forum - Presentations*. Available at: https://ec.europa.eu/energy/en/content/31st-madrid-forum-presentations (Accessed: 22 February 2019).

European Commission (2018b) *A Clean Planet for all: A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy*. COM(2018) 773 final. Brussels, Belgium: European Commission. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018DC0773 (Accessed: 14 March 2019).

European Commission (2018c) *Strategy for long-term EU greenhouse gas emissions reductions, Have your say - Published Initiatives - Strategy for long-term EU greenhouse gas emissions reductions*. Brussels, Belgium: European Commission. Available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1853-Strategy-for-long-term-EU-greenhouse-gas-emissions-reductions/feedback_en?p_id=265612 (Accessed: 10 October 2021).

European Commission (2020a) *Commission staff, European Commission*. Available at: https://ec.europa.eu/info/about-european-commission/organisational-structure/commission-staff_en (Accessed: 21 May 2020).

European Commission (2020b) *COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS - A hydrogen* *strategy for a climate-neutral Europe*. COM(2020) 301 final. Brussels, Belgium: European Commission. Available at: https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf (Accessed: 31 July 2020).

European Commission (2020c) *European Commission - Overview*, *European Commission*. Available at: https://europa.eu/european-union/about-eu/institutions-bodies/european-commission_en (Accessed: 21 May 2020).

European Commission (2020d) *Key cross border infrastructure projects*, *Energy - European Commission*. Available at: https://ec.europa.eu/energy/topics/infrastructure/projects-common-interest/key-cross-border-infrastructure-projects_en (Accessed: 7 December 2020).

European Commission (2020e) *National energy and climate plans (NECPs)*, *Energy - European Commission*. Available at: https://ec.europa.eu/energy/topics/energy-strategy/national-energy-climate-plans_en (Accessed: 9 December 2020).

European Community (1962) 'Community Executives Propose Common Energy Policy', *Bulletin from the European Community*, (55), pp. 3–4. Available at: http://aei.pitt.edu/43697/1/A7440.pdf (Accessed: 28 May 2019).

European Court of Auditors (2018) *Special report No 24/2018: Demonstrating carbon capture and storage and innovative renewables at commercial scale in the EU: intended progress not achieved in the past decade*. Available at:

https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=47082 (Accessed: 31 October 2018).

European Gas Advocacy Forum (2011) *The Future Role of Natural Gas*. Available at: http://www.gazpromexport.ru/files/Making_the_green_journey_work_-_web_version395.pdf (Accessed: 14 March 2019).

European Parliament (2016) *Report on EU strategy for liquefied natural gas and gas storage (2016/2059(INI))*. A8-0278/2016. Brussels, Belgium: European Parliament. Available at: https://www.europarl.europa.eu/doceo/document/A-8-2016-0278_EN.pdf (Accessed: 7 December 2020).

Eurostat (2017) *Consumption of energy - Statistics Explained*. Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/Consumption_of_energy (Accessed: 22 November 2017).

Eurostat (2020) *European Commission > Eurostat > Energy > Data > Database > Energy (nrg) > Energy statistics - quantities, annual data (nrg_quanta) > Energy balances (nrg_bal) > Complete energy balances (nrg_bal_c), Eurostat*. Available at: https://ec.europa.eu/eurostat/web/energy/data/database (Accessed: 27 January 2020).

Fairclough, N. (2001) *Language and Power*. London, UK: Pearson Education.

Fairclough, N. (2003) *Analysing Discourse: Textual Analysis for Social Research*. Hove, UK: Psychology Press.

Fairclough, N. (2005) ‘Peripheral Vision: Discourse Analysis in Organization Studies: The Case for Critical Realism’, *Organization Studies*, 26(6), pp. 915–939. doi:10.1177/0170840605054610.

Fairclough, N. (2013) *Critical Discourse Analysis: The Critical Study of Language*. Oxfordshire, UK: Routledge.

Fairclough, N., Jessop, B. and Sayer, A. (2007) ‘Critical Realism and Semiosis’, *Journal of Critical Realism*, 5(1), pp. 2–10.

Feyerabend, P. (1993) *Against Method - Outline of an Anarchistic Theory of Knowledge*. London, UK: Verso. Available at: https://theanarchistlibrary.org/library/paul-feyerabend-against-method (Accessed: 13 September 2018).

Fiedler, M. (2015) *The Making of the EU Internal Energy Market*. Brussels, Belgium: Rosa Luxemburg Stiftung. Available at: https://www.rosalux.eu/fileadmin/user_upload/making-of-eu-internal-energy-market-2015.pdf (Accessed: 21 November 2019).

Filippini, M., Hunt, L.C. and Zorić, J. (2014) ‘Impact of energy policy instruments on the estimated level of underlying energy efficiency in the EU residential sector’, *Energy Policy*, 69, pp. 73–81. doi:10.1016/j.enpol.2014.01.047.

Fitzgerald, J. (2012) ‘The Messy Politics of “Clean Coal”: The Shaping of a Contested Term in Appalachia’s Energy Debate’, *Organization & Environment*, 25(4), pp. 437–451. doi:10.1177/1086026612466091.

Flavin, C. (1992) ‘Building a bridge to sustainable energy’, *Fortnightly; (United States)*, 129:3. Available at: https://www.osti.gov/biblio/7279512 (Accessed: 1 August 2019).

Flavin, C. and Lenssen, N. (1994) *Power Surge: Guide to the Coming Energy Revolution*. New York, NY, USA: W. W. Norton & Company.

Flyvbjerg, B. (2006) ‘Five Misunderstandings About Case-Study Research’, *Qualitative Inquiry*, 12(2), pp. 219–245. doi:10.1177/1077800405284363.

Ford, A. and Newell, P. (2021) ‘Regime resistance and accommodation: Toward a neo-Gramscian perspective on energy transitions’, *Energy Research & Social Science*, 79, p. 102163. doi:10.1016/j.erss.2021.102163.

FotEE (2017) ‘Can the climate afford Europe’s gas addiction?’ Friends of the Earth Europe. Available at: http://www.foeeurope.org/NoRoomForGas (Accessed: 22 November 2017).

Foucault, M. (1971) ‘Orders of discourse’, *Social Science Information*, 10(2), pp. 7–30. doi:10.1177/053901847101000201.

Foucault, M. (2012a) *Discipline and Punish: The Birth of the Prison*. New York, NY, USA: Knopf Doubleday Publishing Group.

Foucault, M. (2012b) *The Archaeology of Knowledge*. New York, NY, USA: Knopf Doubleday Publishing Group.

Fouquet, R. (2016) ‘Historical energy transitions: Speed, prices and system transformation’, *Energy Research & Social Science*, 22(Supplement C), pp. 7–12. doi:10.1016/j.erss.2016.08.014.

Gassco (2020) *History of the Norwegian Gas Pipeline System*. Available at: https://www.gassco.no/static/transport-3/#/timeline (Accessed: 18 February 2020).

GasTerra (2009) *Natural gas as a transitional fuel: For a sustainable energy future*. Groningen, the Netherlands: GasTerra. Available at: https://www.gasterra.nl/uploads/fckconnector/ad10e972-6213-42e7-8063-52b1ffa39f71 (Accessed: 7 February 2019).

Gaventa, J. (2014) *Energy Security and the Connecting Europe Facility: Maximising public value for public money*. London, UK: E3G. Available at: https://www.jstor.org/stable/resrep17818 (Accessed: 8 December 2020).

Gawel, E. *et al.* (2019) *The European Dimension of Germany's Energy Transition: Opportunities and Conflicts*. Cham, Switzerland: Springer.

Gazprom (2011) *Annual Report 2011*. Moscow, Russia: Gazprom. Available at: https://www.gazprom.com/f/posts/60/591327/annual-report-2011-eng.pdf (Accessed: 8 October 2021).

Gazprom (2012) *Annual Report*. Moscow, Russia: Gazprom. Available at: https://www.gazprom.com/f/posts/21/014436/annual-report-2012-eng.pdf (Accessed: 8 October 2021).

Gazprom (2013) *Environmental Report 2013*. Moscow, Russia: Gazprom. Available at: https://www.gazprom.com/f/posts/01/207595/gazprom-environmental-report-2013-en.pdf (Accessed: 8 October 2021).

Gazprom (2018a) *Feedback from: PJSC Gazprom - Strategy for long-term EU greenhouse gas emissions reductions*. Moscow, Russia: Gazprom. Available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1853-Strategy-for-long-term-EU-greenhouse-gas-emissions-reductions/F13767_en (Accessed: 10 October 2021).

Gazprom (2018b) *Gazprom signs Guiding Principles to reduce methane emissions across natural gas value chain*. Moscow, Russia: Gazprom. Available at: http://www.gazprom.com/press/news/2018/march/article412911/ (Accessed: 17 May 2019).

Gazprom (2020) *Projects*, *Gazprom*. Available at: https://www.gazprom.com/projects/ (Accessed: 15 December 2020).

Geels, F.W. *et al.* (2017) 'The Socio-Technical Dynamics of Low-Carbon Transitions', *Joule*, 1(3), pp. 463–479. doi:10.1016/j.joule.2017.09.018.

Georgakakis, D. (2011) 'Don't Throw Out the "Brussels Bubble" with the Bathwater: From EU Institutions to the Field of Eurocracy', *International Political Sociology*, 5(3), pp. 331–334. doi:10.1111/j.1749-5687.2011.00137_2.x.

GIE (2019a) *Aggregated LNG Storage Inventory, GIE - ALSI*. Available at: https://alsi.gie.eu/#/ (Accessed: 11 February 2019).

GIE (2019b) *Energy transition in the European Union*. Brussels, Belgium: Gas Infrastructure Europe. Available at: https://www.gie.eu/index.php/events-diary/workshops/2019-

workshops/energy-transition-in-the-european-union/27907-gie-paper-energy-transition-in-the-european-union/file (Accessed: 22 December 2020).

GIE (2019c) *GIE Vision 2050*. Position Paper. Brussels, Belgium: Gas Infrastructure Europe. Available at: https://www.gie.eu/index.php/gie-publications/position-papers/27537-gie-vision-2050/file (Accessed: 1 February 2020).

GIE (2019d) *GIE Vision 2050*. Brussels, Belgium: Gas Infrastructure Europe. Available at: https://www.gie.eu/index.php/gie-publications/position-papers (Accessed: 22 February 2019).

GIIGNL (2018) *The LNG industry: GIIGNL Annual Report 2018*. International Group of LNG Importers, p. 28. Available at: https://giignl.org/sites/default/files/PUBLIC_AREA/Publications/rapportannuel-2018pdf.pdf (Accessed: 22 May 2018).

Glachant, J.-M., Hallack, M. and Vazquez, M. (2013) *Building Competitive Gas Markets in the EU*. Cheltenham, UK: Edward Elgar Publishing.

Glaser, B.G. and Strauss, A.L. (1967) *The Discovery of Grounded Theory: Strategies for Qualitative Research*. New York, NY, USA: Aldine de Gruyter.

Global Witness (2020) *Pipe Down - How gas companies influence EU policy and have pocketed €4 billion of taxpayers' money*. Brussels, Belgium: Global Witness. Available at: https://www.globalwitness.org/en/campaigns/oil-gas-and-mining/pipe-down/.

Gnedina, E. and Emerson, M. (2009) *The Case for a Gas Transit Consortium in Ukraine: A Cost-Benefit Analysis*. 180. Brussels, Belgium: CEPS. Available at: http://aei.pitt.edu/10766/1/1782.pdf (Accessed: 21 June 2019).

González-Díaz, F.E. *et al.* (2017) 'Competition policy as a tool to complete the EU's internal gas market; recent developments on abuse of a dominant position', in *The of Gas in the EU's Energy Union*. Deventer, Netherlands: Claeys and Casteels Law Publishers (EU Energy Law), pp. 147–172.

da Graça Carvalho, M. (2012) 'EU energy and climate change strategy', *Energy*, 40(1), pp. 19–22. doi:10.1016/j.energy.2012.01.012.

Gramsci, A. (1971) *Selections from the Prison Notebooks of Antonio Gramsci*. New York, NY, USA: International Publishers.

Grant, W., Matthews, D. and Newell, P. (2000) *The Effectiveness of European Union Environmental Policy*. London, UK: Palgrave Macmillan UK. doi:10.1057/9780333981405.

Greenpeace and EREC (2010) *energy [r]evolution: Towards a Fully Renewable Energy Supply in the EU 27*. Greenpeace and the European Renewable Energy Council. Available at: https://wayback.archive-it.org/9650/20200511194431/http://p3-raw.greenpeace.org/eu-unit/Global/eu-unit/reports-briefings/2010/7/EU-Energy-(R)-evolution-scenario.pdf (Accessed: 5 August 2021).

Greenwood, J. (2018) 'NGOs in the European Union', in Kellow, A. and Murphy-Gregory, H. (eds) *Handbook of Research on NGOs*. Cheltenham, UK: Edward Elgar Publishing, pp.

391–403. Available at: https://rgu-repository.worktribe.com/output/242309/ngos-in-the-european-union (Accessed: 22 September 2021).

Grigas, A. (2017) *The New Geopolitics of Natural Gas*. Cambrdige, MA, USA: Harvard University Press.

Groenleer, M.L.P. (2016) *Redundancy in Multilevel Energy Governance: Why (and When) Regulatory Overlap Can Be Valuable*. SSRN Scholarly Paper. Rochester, NY, USA: Social Science Research Network. doi:10.2139/ssrn.2865683.

Grubb, M., Vrolijk, C. and Brack, D. (2019) *Kyoto Protocol (1999): A Guide and Assessment*. 1st edition. Abingdon, UK: Routledge.

Guest, G., Namey, E.E. and Mitchell, M.L. (2013) *Collecting Qualitative Data: A Field Manual for Applied Research*. London, UK: SAGE Publications, Ltd. doi:10.4135/9781506374680.

Gustafson, T. (2014) *Crisis Amid Plenty: The Politics of Soviet Energy Under Brezhnev and Gorbachev*. Princeton, NJ, USA: Princeton University Press.

Gustafson, T. (2020) *The Bridge: Natural Gas in a Redivided Europe*. Cambridge, MA, USA: Harvard University Press.

Haas, E.B. (1958) *The Uniting of Europe: Political, Social, and Economic Forces, 1950-1957*. Stanford, CA, USA: Stanford University Press.

Haas, T. (2019) ‘Struggles in European Union energy politics: A Gramscian perspective on power in energy transitions’, *Energy Research & Social Science*, 48, pp. 66–74. doi:10.1016/j.erss.2018.09.011.

Haase, N. (2008) *European gas market liberalisation: Are regulatory regimes moving towards convergence?* NG 24. Oxford, UK: Oxford Institute of Energy Studies. Available at: https://www.oxfordenergy.org/publications/european-gas-market-liberalisation-are-regulatory-regimes-moving-towards-convergence/ (Accessed: 6 October 2021).

Hajer, M.A. (1995) *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*. Oxford, UK: Oxford University Press.

Hall, P.A. and Taylor, R.C.R. (1996) ‘Political Science and the Three New Institutionalisms*’, *Political Studies*, 44(5), pp. 936–957. doi:10.1111/j.1467-9248.1996.tb00343.x.

Hancher, L., Houteclocque, A. de and Sadowska, M. (2015) *Capacity Mechanisms in the EU Energy Market: Law, Policy, and Economics*. Oxford, UK: Oxford University Press.

Hanf, K. and Jansen, A.-I. (1998) *Governance and Environment in Western Europe: Environmental Politics, Policy and Administration in Western Europe*. Oxfordshire, UK: Routledge.

Harvey, D. (1996) *Justice, Nature and the Geography of Difference*. Oxford, UK: Blackwell.

Hausmann, P., Sussmann, R. and Smale, D. (2016) ‘Contribution of oil and natural gas production to renewed increase in atmospheric methane (2007–2014): top–down estimate from ethane and methane column observations’, *Atmos. Chem. Phys.*, 16(5), pp. 3227–3244. doi:10.5194/acp-16-3227-2016.

Hayes, M. (2004) *ALGERIAN GAS TO EUROPE: THE TRANSMED PIPELINE AND EARLY SPANISH GAS IMPORT PROJECTS*. 27. Stanford, CA, USA: Stanford University. Available at: https://scholarship.rice.edu/bitstream/handle/1911/91495/algerian-gas-to-europe-the-transmed-pipeline-and-early-spanish-gas-import-projects.pdf?sequence=1 (Accessed: 2 July 2019).

Heaps, C. *et al.* (2009) *Europe's Share of the Climate Challenge Domestic Actions and International Obligations to Protect the Planet*. Stockholm, Sweden: Stockholm Environment Institute. Available at: https://www.osti.gov/etdeweb/servlets/purl/971052 (Accessed: 5 August 2021).

Hermwille, L. (2016) 'The role of narratives in socio-technical transitions—Fukushima and the energy regimes of Japan, Germany, and the United Kingdom', *Energy Research & Social Science*, 11, pp. 237–246. doi:10.1016/j.erss.2015.11.001.

Herzog, H. (2018) *Carbon Capture*. Cambridge, MA: The MIT Press.

Hintermann, B., Peterson, S. and Rickels, W. (2016) 'Price and Market Behavior in Phase II of the EU ETS: A Review of the Literature', *Review of Environmental Economics and Policy*, 10(1), pp. 108–128. doi:10.1093/reep/rev015.

von Hirschhausen, C., Kemfert, C. and Praeger, F. (2020) *Fossil Natural Gas Exit – A New Narrative for the European Energy Transformation towards Decarbonization*. Discussion Papers 1892, IV, 46 S. Berlin, Germany: DIW. Available at: https://www.diw.de/de/diw_01.c.798193.de/publikationen/diskussionspapiere/2020_1892/

fossil_natural_gas_exit_____a_new_narrative_for_the_european_energy_transformation_towards_decarbonization.html (Accessed: 16 September 2020).

Hix, S. (2007) 'The European Union as a Polity', in Jørgensen, K.E., Pollack, M., and Rosamond, B. (eds) *The SAGE Handbook of European Union Politics*. London, UK: SAGE, pp. 141–158.

Hix, S. and Høyland, B. (2011) *The Political System of the European Union*. 3rd ed. 2011 edition. Basingstoke, UK: Red Globe Press.

Hobsbawm, E. (2010) *Age Of Revolution: 1789-1848*. London, UK: Orion.

Hoffman, G.W. and Dienes, L. (1985) *The European energy challenge : East and West*. Durham, NC, USA: Duke University Press. Available at: https://trove.nla.gov.au/version/21773416 (Accessed: 27 June 2019).

Högselius, P. (2013) *Red Gas: Russia and the Origins of European Energy Dependence*. New York, USA: Palgrave MacMillan (Palgrave MacMillan Transnational History Series).

Högselius, Per (2013) *The European Natural Gas Industry and the Oil Crisis of 1973/74*. Available at: https://networks.h-net.org/european-natural-gas-industry-and-oil-crisis-197374-hogselius-h-energy-1973-energy-crisis (Accessed: 29 May 2019).

Höhne, N., Kuramochi, T., Warnecke, C., Röser, F., Fekete, H., Hagemann, M., Day, T., Ritika, T., Kurdziel, M., Sterl, S. and Gonzales, S. (2017) 'The Paris Agreement: resolving the inconsistency between global goals and national contributions', *Climate Policy*, 17(1), pp. 16–32. doi:10.1080/14693062.2016.1218320.

Honoré, A. (2014) ‘The Outlook for Natural Gas Demand in Europe’, *OIES Paper* [Preprint], (87). Available at: https://ora.ox.ac.uk/objects/uuid:0548a64f-310d-4500-8eee-9fc651a253fe (Accessed: 5 December 2020).

Honoré, A. (2017) ‘The Dutch Gas Market: trials, tribulations and trends’, *OIES Paper*, (NG 118), pp. 1–63. Available at: https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/05/The-Dutch-Gas-Market-trials-tribulations-and-trends-NG-118.pdf (Accessed: 12 June 2018).

Hooghe, L. and Marks, G. (2019) ‘Grand theories of European integration in the twenty-first century’, *Journal of European Public Policy*, 26(8), pp. 1113–1133. doi:10.1080/13501763.2019.1569711.

Howarth, D. (2010) ‘Power, discourse, and policy: articulating a hegemony approach to critical policy studies’, *Critical Policy Studies*, 3(3–4), pp. 309–335. doi:10.1080/19460171003619725.

Howarth, R.W. (2014) ‘A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas’, *Energy Science & Engineering*, 2(2), pp. 47–60. doi:10.1002/ese3.35.

Howarth, R.W. and Jacobson, M.Z. (2021) ‘How green is blue hydrogen?’, *Energy Science & Engineering*, 9(10), pp. 1676–1687. doi:10.1002/ese3.956.

Huber, M. (2012) ‘Refined Politics: Petroleum Products, Neoliberalism, and the Ecology of Entrepreneurial Life’, *Journal of American Studies*, 46(2), pp. 295–312. Available at: https://www.jstor.org/stable/23259138 (Accessed: 20 January 2020).

Huhta, K. (2018) *Capacity mechanisms in EU Law: A comment on the free movement of goods*. Oxford, UK: OIES. Available at: https://www.oxfordenergy.org/publications/capacity-mechanisms-eu-law-comment-free-movement-goods/ (Accessed: 9 December 2020).

IDS (2006) *Understanding policy processes - A review of IDS research on the environment*. Sussex, UK: Knowledge, Technology and Society Team, Institute of Development Studies, University of Sussex. Available at: http://steps-centre.org/wp-content/uploads/IDS-Understanding-policy-processes.pdf (Accessed: 12 November 2020).

IEA (1998) *World Energy Outlook 1998 Edition*. Paris, France: IEA/OECD. Available at: https://www.iea.org/media/weowebsite/2008-1994/weo1998.pdf (Accessed: 6 August 2019).

IEA (2011a) *Oil and Natural Gas Logistics*. P03. Paris, France: IEA/OECD. Available at: https://iea-etsap.org/E-TechDS/PDF/P03_oilgaslogistics_PS_revised_GSOK2.pdf (Accessed: 21 June 2019).

IEA (2011b) *World Energy Outlook - 2011 Edition*. Paris, France: IEA/OECD (World Energy Outlook).

IEA (2012) *World Energy Outlook 2012*. Paris: IEA/OECD. Available at: https://www.iea.org/publications/freepublications/publication/world-energy-outlook-2012.html (Accessed: 24 October 2017).

IEA (2013) *World Energy Outlook Special Report*. Paris, France: IEA/OECD. Available at: https://www.iea.org/topics/world-energy-outlook (Accessed: 5 December 2020).

IEA (2015) *World Energy Outlook 2015*. Paris, France: IEA/OECD.

IEA (2016a) *20 Years of Carbon Capture and Storage*. Paris, France: IEA/OECD. Available at: https://www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf.

IEA (2016b) *World Energy Outlook 2016*. Paris, France: OECD/IEA.

IEA (2017a) *Global Trends and Outlook for Hydrogen*. Paris, France: IEA/OECD. Available at: http://ieahydrogen.org/pdfs/Global-Outlook-and-Trends-for-Hydrogen_Dec2017_WEB.aspx (Accessed: 22 August 2018).

IEA (2017b) *World Energy Outlook 2017*. Paris, France: IEA/OECD.

IEA (2018a) *Global Energy and CO2 Status Report*. Paris, France: IEA/OECD, p. 15. Available at: http://www.iea.org/publications/freepublications/publication/GECO2017.pdf (Accessed: 6 April 2018).

IEA (2018b) *World Energy Outlook 2018*. Paris, France: OECD/IEA.

IEA (2019a) *The Future of Hydrogen*. Paris, France: IEA/OECD. Available at: https://webstore.iea.org/the-future-of-hydrogen (Accessed: 25 July 2019).

IEA (2019b) *World Energy Oulook - 2019 Edition*. Paris, France: IEA/OECD (World Energy Outlook). Available at: https://www.iea.org/reports/world-energy-outlook-2019 (Accessed: 24 March 2020).

IEA (2020a) *CCUS in Clean Energy Transitions – Analysis*, *IEA*. Paris, France: IEA/OECD. Available at: https://www.iea.org/reports/ccus-in-clean-energy-transitions (Accessed: 25 November 2020).

IEA (2020b) *Energy Technology Perspectives: Special Report on Carbon Capture Utilisation and Storage - CCUS in clean energy transitions*. Paris, France: IEA/OECD. Available at: https://webstore.iea.org/download/direct/4191 (Accessed: 25 November 2020).

IEA (2020c) *Gas Trade Flow in Europe*, *International Energy Agency*. Paris, France: IEA/OECD. Available at: https://www.iea.org/gtf/ (Accessed: 2 July 2020).

IEA (2020d) *IEA Sankey Diagram*. Paris, France: IEA/OECD. Available at: https://www.iea.org/Sankey/ (Accessed: 2 July 2020).

IEA (2020e) *Outlook for biogas and biomethane*. Paris, France: IEA. Available at: https://webstore.iea.org/outlook-for-biogas-and-biomethane (Accessed: 1 May 2020).

IEA (2020f) *World Energy Outlook 2020*. Paris, France: IEA/OECD (World Energy Outlook, 2020). Available at: https://www.iea.org/reports/world-energy-outlook-2020 (Accessed: 17 November 2020).

IGU (2010) *Natural Gas Unlocking the Low Carbon Future*. Barcelona, Spain: International Gas Union. Available at: https://www.igu.org/app/uploads-wp/2010/04/Natural-Gas-Unlocking-the-Low-Carbon-Future-min-1.pdf (Accessed: 5 October 2020).

IGU (2019) *2019 World LNG Report*. Barcelona, Spain: International Gas Union. Available at: https://www.igu.org/publications-page (Accessed: 9 April 2019).

IMF (2019) *World Economic Outlook (April 2019)*, *International Monetary Fund*. Available at: https://www.imf.org/external/datamapper/datasets/WEO (Accessed: 26 April 2019).

Ingwersen, J. (2017a) 'ENTSOG's take on Gas Demand Scenarios for the European Clean Energy Future'. *GIE Annual Conference*, Prague, CZ. Available at: https://www.entsog.eu/sites/default/files/2018-11/22%20June%202017%20ENTSOG%20at%20GIE%20Annual%20Conference__Jan%20Ingwersen.pdf (Accessed: 7 December 2020).

Ingwersen, J. (2017b) 'Updating the Third Package for 2030: the ENTSOs as key delivery partner'. *Dinner-debate jointly hosted by ENTSO-E & ENTSOG*. Available at: https://www.entsog.eu/positions-and-consultation-responses#speaking-notes (Accessed: 22 February 2019).

Ingwersen, J. (2021) 'Stranded gas assets: the dilemma of the energy transition costs'. *FSR*, Online, 21 May. Available at: https://fsr.eui.eu/stranded-gas-assets-the-dilemma-of-the-energy-transition-costs/ (Accessed: 14 September 2021).

Inter-Executive Energy Committee (1962) 'Energy Policy in the European Community (Memorandum on Energy Policy)'. High Authority of the European Coal and Steel Community. Available at: http://aei.pitt.edu/34492/1/A662.pdf (Accessed: 29 May 2019).

IPCC (1990a) *Climate Change - Response Strategies*. IPCC. Available at: https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_III_full_report.pdf (Accessed: 30 July 2019).

IPCC (1990b) *Climate Change - The IPCC Scientific Assessment*. Cambridge, UK: Cambridge University Press. Available at:

https://www.ipcc.ch/ipccreports/far/wg_I/ipcc_far_wg_I_full_report.pdf (Accessed: 30 October 2018).

IPCC (1990c) *Climate Change: The IPCC Impacts Assessment*. International Panel for Climate Change. Available at: https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_II_full_report.pdf (Accessed: 30 July 2019).

IPCC (1995) *IPCC Second Assessment Full Report*. International Panel for Climate Change. Available at: https://www.ipcc.ch/report/ipcc-second-assessment-full-report/ (Accessed: 12 October 2019).

IPCC (2006) *Guidelines for National Greenhouse Gas Inventories*. International Panel for Climate Change. Available at: http://www.ipccnggip. iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf (Accessed: 8 March 2018).

IPCC (2007) 'IPCC Fourth Assessment Report: Climate Change 2007'. Intergovernmental Panel on Climate Change. Available at: : https://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_full_report.pdf (Accessed: 5 November 2017).

IPCC (2014) *Fifth Assessment Report - Mitigation of Climate Change*. International Panel for Climate Change. Available at: https://www.ipcc.ch/report/ar5/wg3/ (Accessed: 7 October 2017).

IPCC (2018) *Global Warming of 1.5 ^{o}C*. Special Report. International Panel for Climate Change. Available at: https://www.ipcc.ch/sr15/ (Accessed: 23 July 2019).

IRENA (2018) *Hydrogen from Renewable Power - Technology Outlook for the Energy Transition*. Abu Dhabi: International Renewable Energy Agency. Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Sep/IRENA_Hydrogen_from_renewable_power_2018.pdf (Accessed: 1 May 2020).

Jacobs, D. (2012) ‘The German Energiewende – History, Targets, Policies and Challenges’, *Renewable Energy Law and Policy Review*, 3(4), pp. 223–233. Available at: https://www.jstor.org/stable/24324660 (Accessed: 11 November 2019).

Jacobson, M.Z. (2019) ‘Evaluation of Coal and Natural Gas With Carbon Capture as Proposed Solutions to Global Warming, Air Pollution, and Energy Security’, in Jacobson, M. Z., *100% Clean, Renewable Energy and Storage for Everything*. Cambridge, UK: Cambridge University Press. Available at: https://web.stanford.edu/group/efmh/jacobson/Articles/I/NatGasVsWWS&coal.pdf (Accessed: 16 May 2019).

Janks, H. (1997) ‘Critical Discourse Analysis as a Research Tool’, *Discourse: Studies in the Cultural Politics of Education*, 18(3), pp. 329–342. doi:10.1080/0159630970180302.

Jessop, B. (1999) ‘Narrating the Future of the National Economy and the National State? Remarks On Remapping Regulation and Reinventing Governance’, *Department of Sociology, Lancaster University, Lancaster* [Preprint]. Available at: http://www.comp.lancs.ac.uk/sociology/papers/Jessop-Narrating-the-Future.pdf (Accessed: 12 November 2020).

Jessop, B. (2006) ‘State- and Regulation-Theoretical Perspectives on the European Union and the Failure of the Lisbon Agenda’, *Bob Jessop*. Available at: https://bobjessop.wordpress.com/2014/12/29/state-and-regulation-theoretical-perspectives-on-the-european-union-and-the-failure-of-the-lisbon-agenda/ (Accessed: 4 October 2020).

Jessop, B. (2015) *The State: Past, Present, Future*. Hoboken, NJ, USA: John Wiley & Sons.

Johnstone, P. and Newell, P. (2018) ‘Sustainability transitions and the state’, *Environmental Innovation and Societal Transitions*, 27, pp. 72–82. doi:10.1016/j.eist.2017.10.006.

Jones, C. (2016) *EU Energy Law Volume I, The Internal Energy Market:* 4th edition. Deventer, Netherlands: Claeys & Casteels Publishing.

Jordan, A. and Rayner, T. (2010) ‘The evolution of climate policy in the European Union: a historical overview’, in Jordan, A., Rayner, T., Huitema, D., van Asselt, H and Berkhout, F. (eds) *Climate Change Policy in the European Union: Confronting the Dilemmas of Mitigation and Adaptation?* Cambridge, UK: Cambridge University Press, pp. 52–80.

Jupille, J. and Caporaso, J.A. (1999) ‘Institutionalism and the European Union: Beyond International Relations and Comparative Politics’, *Annual Review of Political Science*, 2(1), pp. 429–444. doi:10.1146/annurev.polisci.2.1.429.

Kawa, N. (2015) ‘Gas Leaks Can’t Be Tamed’, *The Atlantic*, 18 September. Available at: https://www.theatlantic.com/technology/archive/2015/09/gas-leaks-are-everywhere/405820/ (Accessed: 21 May 2019).

Khrushcheva, O. and Maltby, T. (2016) ‘The Future of EU-Russia Energy Relations in the Context of Decarbonisation’, *Geopolitics*, 21(4), pp. 799–830. doi:10.1080/14650045.2016.1188081.

Kingston, C. and Caballero, G. (2009) ‘Comparing theories of institutional change’, *Journal of Institutional Economics*, 5(2), pp. 151–180. doi:10.1017/S1744137409001283.

Kinley, R. (2017) ‘Climate change after Paris: from turning point to transformation’, *Climate Policy*, 17(1), pp. 9–15. doi:10.1080/14693062.2016.1191009.

Klauser, B. and Shavlak, S. (2017) ‘The Internal gas market: achievments, challenges and the next steps’, in Jones, C. (ed.) *The Role of Gas in the EU’s Energy Union*. Deventer, Netherlands: Claeys and Casteels Law Publishers (EU Energy Law, XI), pp. 173–202.

Koch, N. *et al.* (2014) ‘Causes of the EU ETS price drop: Recession, CDM, renewable policies or a bit of everything?—New evidence’, *Energy Policy*, 73, pp. 676–685. doi:10.1016/j.enpol.2014.06.024.

Kotek, P., Granado, P.C., Egging, R. and Tóth, B. (2019) ‘European Natural Gas Infrastructure in the Energy Transition’, in *2019 16th International Conference on the European Energy Market (EEM)*. *2019 16th International Conference on the European Energy Market (EEM)*, Ljubljana, Slovenia: IEEE, pp. 1–6. doi:10.1109/EEM.2019.8916432.

Krasner, S.D. (1984) ‘Approaches to the State: Alternative Conceptions and Historical Dynamics’, *Comparative Politics*. Edited by Nordlinger, E. Geertz, C., Skowronek, S., Tilly, C., Grew, R. and Trimberger, E.K. 16(2), pp. 223–246. doi:10.2307/421608.

KSH (2020) *STADAT – 2.3.12. Piped gas supply (1990–), Search Results Web result with site links Hungarian Central Statistical Office*. Available at: http://www.ksh.hu/docs/eng/xstadat/xstadat_annual/i_zrk003.html (Accessed: 11 August 2020).

Kuchler, M. and Bridge, G. (2018) 'Down the black hole: Sustaining national socio-technical imaginaries of coal in Poland', *Energy Research & Social Science*, 41, pp. 136–147. doi:10.1016/j.erss.2018.04.014.

Kuhn, M. (2019) 'Gas Pathways to 2050'. *Twenty-eigth session of the Committee on Sustainable Energy*, Geneva, Switzerland. Available at: https://www.unece.org/fileadmin/DAM/energy/se/pp/CSE/2019/EnComm28_Sept.2019/26.Sept/Khun.pdf (Accessed: 1 September 2021).

Kuhn, M. (2021) 'The Role of H2 from Natural Gas'. *Energetika 21*, Moscow, Russia. Available at: http://en.unecon.ru/sites/default/files/en/maximilian_kuhn_the_role_of_h2_from_natural_gas.pdf (Accessed: 1 September 2021).

Kungl, G. and Geels, F.W. (2018) 'Sequence and alignment of external pressures in industry destabilisation: Understanding the downfall of incumbent utilities in the German energy transition (1998–2015)', *Environmental Innovation and Societal Transitions*, 26, pp. 78–100. doi:10.1016/j.eist.2017.05.003.

Kuzemko, C. *et al.* (2016) ‘Governing for sustainable energy system change: Politics, contexts and contingency’, *Energy Research & Social Science*, 12, pp. 96–105. doi:10.1016/j.erss.2015.12.022.

LaBelle, M. (2012) ‘Constructing post-carbon institutions: Assessing EU carbon reduction efforts through an institutional risk governance approach’, *Energy Policy*, 40, pp. 390–403. doi:10.1016/j.enpol.2011.10.024.

LaBelle, M.C. (2017) ‘Regulating for Consumers? The Agency for Cooperation of Energy Regulators’, in Andersen, S., Goldthau, and Sitter, N. (eds) *Energy Union - Europe’s New Libeal Mercantilism*. UK: Palgrave MacMillan, pp. 147–164.

Laclau, E. and Mouffe, C. (2001) *Hegemony and Socialist Strategy: Towards a Radical Democratic Politics*. New York, NY, USA and London, UK: Verso.

Lambert, M. and Oluleye, G. (2019) *A mountain to climb? Tracking progress in scaling up renewable gas production in Europe*. 153. Oxford, UK: Oxford Institute of Energy Studies. Available at: https://www.oxfordenergy.org/publications/a-mountain-to-climb-tracking-progress-in-scaling-up-renewable-gas-production-in-europe/ (Accessed: 19 February 2020).

Langsdorf, S. (2011) *EU Energy Policy: From the ECSC to the Energy Roadmap 2050*. Berlin, Germany: Heinrich Böll Stiftung. Available at: http://archive.gef.eu/uploads/uploads/media/History_of_EU_energy_policy.pdf (Accessed: 5 August 2021).

Lauber, V. and Sarasini, S. (2014) ‘The response of incumbent utilities to the challenge of renewable energy’, *Systems Perspectives on Renewable Power 2014*, pp. 138–148. Available at: https://research.chalmers.se/en/publication/210536 (Accessed: 5 September 2019).

Lazard (2021) *Levelized Cost of Energy and of Storage*, *Lazard.com*. Available at: http://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2020/ (Accessed: 5 August 2021).

Leach, M. (2015) ‘What is green? Transformation imperatives and knowledge politics’, in Scoones, I., Newell, P., and Leach, M. (eds) *The Politics of Green Transformation*. London, UK; New York, NY, USA: Routledge, pp. 25–38.

Ledesma, D. (no date) ‘Oxford Energy Podcast - Methane Emissions from Natural Gas and LNG Imports an increasingly urgent issue for the future of gas in Europe’. Available at: https://www.oxfordenergy.org/publications/oxford-energy-podcast-methane-emissions-from-natural-gas-and-lng-imports-an-increasingly-urgent-issue-for-the-future-of-gas-in-europe/ (Accessed: 15 December 2020).

Lee, R.P. and Gloaguen, S. (2015) ‘Path-dependence, lock-in, and student perceptions of nuclear energy in France: Implications from a pilot study’, *Energy Research & Social Science*, 8, pp. 86–99. doi:10.1016/j.erss.2015.05.001.

Leemans, V. (1960) ‘Rapport Complementaire fait au nom de la Commission pour la politique énergétique sur les problèmes de la coordination dans le domaine de la politique énergétique. 1960-1961 Doc no. 58 = Complementary report drawn up on behalf of the

Commission for Energy Policy on the problems of coordination in the field of energy policy. European Parliamentary Assembly: ordinary session. 1960-1961 Doc 58, June 1960.' European Parliament. Available at: http://aei.pitt.edu/88730/ (Accessed: 28 May 2019).

Legard, R., Keegand, J. and Ward, K. (2003) 'In-depth Interviews', in Ritchie, J. and Lewis, J. (eds) *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. London, UK: SAGE, pp. 139–168.

LeGreco, M. and Tracy, S.J. (2009) 'Discourse Tracing as Qualitative Practice', *Qualitative Inquiry*, 15(9), pp. 1516–1543. doi:10.1177/1077800409343064.

Levy, D. and Scully, M. (2007) 'The Institutional Entrepreneur as Modern Prince: The Strategic Face of Power in Contested Fields', *Organization Studies*, 28(7), pp. 971–991. doi:10.1177/0170840607078109.

Lewis, M.C. (2018) 'Carbon Clampdown: Closing the gap to a Paris-compliant EU-ETS'. *COP-24*, Katowice, 7 December. Available at: https://www.ieta.org/resources/COP24/Misc%20Media%20Files/Dec7/SE16%20(2).pdf (Accessed: 30 October 2019).

Lincoln, Y.S. and Guba, E.E. (1986) 'Research, Evaluation, and Policy Analysis: Heuristics for Disciplined Inquiry', *Review of Policy Research*, 5(3), pp. 546–565. doi:10.1111/j.1541-1338.1986.tb00429.x.

Lincoln, Y.S. and Guba, E.G. (1990) ‘Judging the quality of case study reports’, *International Journal of Qualitative Studies in Education*, 3(1), pp. 53–59. doi:10.1080/0951839900030105.

Lindberg, M.B., Markard, J. and Andersen, A.D. (2019) ‘Policies, actors and sustainability transition pathways: A study of the EU’s energy policy mix’, *Research Policy*, 48(10), p. 103668. doi:10.1016/j.respol.2018.09.003.

Lippert, I. (2011) ‘Greenwashing’, in *Green Culture: An A-to-Z Guide*. Thousand Oaks, CA, USA: SAGE Publications, Inc., pp. 421–429. doi:10.4135/9781412975711.

Lockwood, M., Kuzemko, C., Mitchell, C. and Hoggett, R. (2017) ‘Historical institutionalism and the politics of sustainable energy transitions: A research agenda’, *Environment and Planning C: Politics and Space*, 35(2), pp. 312–333. doi:10.1177/0263774X16660561.

Lockwood, M., Mitchell, C. and Hoggett, R. (2019) ‘Unpacking “regime resistance” in low-carbon transitions: The case of the British Capacity Market’, *Energy Research & Social Science*, 58, p. 101278. doi:10.1016/j.erss.2019.101278.

Lohman, L. (2006) *Carbon Trading*. 48. Sweden: Corner House. Available at: http://courses.washington.edu/pbaf595/Readings/6b%20-%20Carbon%20Markets%20I/Lohmann_2006.pdf (Accessed: 15 August 2018).

Lopez-Nicolas, A. (2018) ‘Renewable Gas in the revised Renewable Energy Directive post-2020’. *Madrid Forum*, Madrid, Spain. Available at: https://ec.europa.eu/energy/en/content/31st-madrid-forum-presentations (Accessed: 14 February 2019).

Lowndes, V. and Roberts, M. (2013) *Why Institutions Matter: The New Institutionalism in Political Science*. 2013th edition. Houndmills, Basingstoke, Hampshire: Red Globe Press.

Lyons, P.K. (1992) *EC Energy Policy: A Detailed Guide to the Community's Impact on the Energy Sector*. London, UK: Financial Times Business Information.

Macrory, R. and Hession, M. (1996) 'The European Community and Climate Change: The role of law and legal competence', in *Politics of Climate Change*. Abingdon, UK: Routledge.

Maher, I. and Stefan, O. (2019) 'Delegation of powers and the rule of law: Energy justice in EU energy regulation', *Energy Policy*, 128, pp. 84–93. doi:10.1016/j.enpol.2018.12.046.

Mahoney, J. (2000) 'Path Dependence in Historical Sociology', *Theory and Society*, 29(4), pp. 507–548. Available at: https://www.jstor.org/stable/3108585 (Accessed: 4 April 2019).

Mahoney, J. and Thelen, K. (eds) (2009) *Explaining Institutional Change: Ambiguity, Agency, and Power*. Cambridge, UK: Cambridge University Press. doi:10.1017/CBO9780511806414.

Majone, G. (1997) 'From the Positive to the Regulatory State: Causes and Consequences of Changes in the Mode of Governance', *Journal of Public Policy*, 17(2), pp. 139–167. doi:10.1017/S0143814X00003524.

Majone, G. (2002) 'The European Commission: The Limits of Centralization and the Perils of Parliamentarization', *Governance*, 15(3), pp. 375–392. doi:10.1111/0952-1895.00193.

Malm, A. (2016) *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming*. London and New York: Verso.

Maltby, T. (2013) ‘European Union energy policy integration: A case of European Commission policy entrepreneurship and increasing supranationalism’, *Energy Policy*, 55, pp. 435–444. doi:10.1016/j.enpol.2012.12.031.

March, J.G. and Olsen, J.P. (1984) ‘The New Institutionalism: Organizational Factors in Political Life’, *The American Political Science Review*, 78(3), pp. 734–749. doi:10.2307/1961840.

March, J.G. and Olsen, J.P. (2010) *Rediscovering Institutions*. New York, NY, USA: Simon and Schuster.

March, J.G. and Olsen, J.P. (2011) ‘Elaborating the “New Institutionalism”’, in Goodin, R.E. (ed.) *The Oxford Handbook of Political Science*. Oxford, UK: Oxford University Press. doi:10.1093/oxfordhb/9780199604456.013.0008.

Marcu, A. *et al.* (2019) *2019 State of the EU ETS Report*. ERCST, Wegener Center, ICIS, I4CE and Ecoact. Available at: https://www.i4ce.org/wp-core/wp-content/uploads/2019/05/2019-State-of-the-EU-ETS-Report.pdf (Accessed: 30 October 2019).

Marks, G. (1992) ‘Structural Policy in the European Community’, in Sbragia, A. (ed.) *Europolitics: Institutions and Policy Making in the ‘New’ European Community*. Washington DC, USA: The Brookings Institution, pp. 191–224. Available at: https://garymarks.web.unc.edu/wp-content/uploads/sites/13018/2016/09/marks-Structural-Policy-in-the-European-Community.pdf (Accessed: 4 July 2021).

Marx, K. (1887) ‘Book One: The Process of Production of Capital, Chapter One: Commodities, Section 2: The Two-fold Character of the Labour Embodied in Commodities’, in *Capital*

– *A Critique of Political Economy, Volume I*. Moscow, USSR: Progress Publishers. Available at: https://www.marxists.org/archive/marx/works/1867-c1/ch01.htm#S2 (Accessed: 5 November 2020).

Matlary, J.H. (1997) *Energy Policy in the European Union*. London, UK: Palgrave Macmillan.

McGowan, F. (2008) 'Can the European Union's Market Liberalism Ensure Energy Security in a Time of "Economic Nationalism"?', *Journal of Contemporary European Research*, 4(2), pp. 90–106. Available at: https://www.jcer.net/index.php/jcer/article/view/92 (Accessed: 4 August 2021).

McGowan, F. (2011) 'Putting Energy Insecurity into Historical Context: European Responses to the Energy Crises of the 1970s and 2000s', *Geopolitics*, 16(3), pp. 486–511. doi:10.1080/14650045.2011.520857.

Meadows, D.H., Rome, C. of and Associates, P. (1972) *The Limits to growth: a report for the Club of Rome's project on the predicament of mankind*. New York, NY, USA: Universe Books.

Meeus, L. and Nouicer, A. (2018) *The EU clean energy package*. Florence, Italy: European University Institute. doi:10.2870/013463.

Meng, B., Gu, C., Zhang, L., Zhou, C., Li, X., Zhao, Y., Zheng, J., Chen, X. and Han, Y. (2017) 'Hydrogen effects on X80 pipeline steel in high-pressure natural gas/hydrogen mixtures', *International Journal of Hydrogen Energy*, 42(11), pp. 7404–7412. doi:10.1016/j.ijhydene.2016.05.145.

Mercure, J.-F., Pollitt, H., Viñuales, J.E., Edwards, N.R., Holden, P.B., Chewpreecha, U., Salas, P., Sognnaes, I., Lam, A. and Knobloch, F. (2018) 'Macroeconomic impact of stranded fossil fuel assets', *Nature Climate Change*, p. 1. doi:10.1038/s41558-018-0182-1.

Mete, G. (2020) *Energy Transitions and the Future of Gas in the EU: Subsidise or Decarbonise*. London, UK: Palgrave Macmillan (Energy, Climate and the Environment). doi:10.1007/978-3-030-32614-2.

MITEI (2011) 'The Future of Natural Gas'. Massachusetts Institute of Technology Energy Initiative. Available at: http://energy.mit.edu/publication/future-natural-gas/ (Accessed: 5 November 2017).

Mulvaney, D. (2019) *Solar Power: Innovation, Sustainability, and Environmental Justice*. First edition. Oakland, CA, USA: University of California Press.

Nakićenović, N. (1993) 'Energy Gases - The Methane Age and Beyond', in Howell, D.G. (ed.) *The Future of Energy Gases*. Washington DC, USA: United States Government Printing Office (US Geological Survey Professional Paper, 1570), pp. 661–676. Available at: https://pubs.usgs.gov/pp/1570/report.pdf (Accessed: 5 May 2020).

Nakićenović, N. (1994) *Energy Gases - The Methane Age and Beyond*. RR-94-8. Laxenburg. Austria: IIASA. Available at: http://pure.iiasa.ac.at/id/eprint/4079/1/RR-94-08.pdf (Accessed: 13 March 2019).

Natorski, M. and Surrallés, A.H. (2008) 'Securitizing Moves To Nowhere? The Framing of the European Union's Energy Policy', *Journal of Contemporary European Research*, 4(2), pp. 70–89. Available at: https://www.jcer.net/index.php/jcer/article/view/88 (Accessed: 7 February 2018).

Neuhoff, K., Martinez, K.K. and Sato, M. (2006) 'Allocation, incentives and distortions: the impact of EU ETS emissions allowance allocations to the electricity sector', *Climate Policy*, 6(1), pp. 73–91. doi:10.1080/14693062.2006.9685589.

Newell, P. (2019a) *Global Green Politics*. Cambridge, UK: Cambridge University Press. doi:10.1017/9781108767224.

Newell, P. (2019b) 'Trasformismo or transformation? The global political economy of energy transitions', *Review of International Political Economy*, 26(1), pp. 25–48. doi:10.1080/09692290.2018.1511448.

Newell, P. and Johnstone, P. (2018) 'The Political Economy of Incumbency: Fossil Fuel Subsidies in Global and Historical Context', in Skovgaard, J. and van Asselt, H. (eds) *The Politics of Fossil Fuel Subsidies and Their Reform*. Cambridge, UK: Cambridge University Press, pp. 66–80.

Newell, P. and Paterson, M. (1998) 'A climate for business: global warming, the state and capital', *Review of International Political Economy*, 5(4), pp. 679–703. doi:10.1080/096922998347426.

Nicola, S. (2008) 'The pipe kings from Germany', *European Energy Review*, (September/October 2008), pp. 16–17. Available at: https://www.elektormagazine.com/files/attachment/3545 (Accessed: 22 August 2018).

Nisbet, E.G., Dlugokencky, E.G., Manning, M.R., Lowry, D., Fisher, E.R., France, J.L., Michel, S.E., Miller, J.B., White, J.W.C., Vaughn, B., Bousquet, P., Pyle, J.A., Warwick, N.J., Cain, M., Brownlow, R., Zazzeri, G., Lanoisellé, M., Manning, A.C., Gloor, E., Worthy, D.E.J., Brunke, E.G., Labuschagne, C., Wolff, E.W. and Ganesan, A.L. (2016) 'Rising atmospheric methane: 2007–2014 growth and isotopic shift', *Global Biogeochemical Cycles*, 30(9), p. 2016GB005406. doi:10.1002/2016GB005406.

Nowell, L.S., Norris, J.M., White, D.E. and Moules, N.J. (2017) 'Thematic Analysis: Striving to Meet the Trustworthiness Criteria', *International Journal of Qualitative Methods*, 16(1), p. 1609406917733847. doi:10.1177/1609406917733847.

Nugent, N. (2000) *At the Heart of the Union: Studies of the European Commission*. 2nd edn. London, UK: Palgrave Macmillan UK. Available at: https://www.palgrave.com/gp/book/9780333918302 (Accessed: 21 June 2021).

Nugent, N. and Rhinard, M. (2016) 'Is the European Commission Really in Decline?', *JCMS: Journal of Common Market Studies*, 54(5), pp. 1199–1215. doi:10.1111/jcms.12358.

Ó Broin, E., Nässén, J. and Johnsson, F. (2015) 'Energy efficiency policies for space heating in EU countries: A panel data analysis for the period 1990–2010', *Applied Energy*, 150, pp. 211–223. doi:10.1016/j.apenergy.2015.03.063.

Oberthür, S. (2019) 'Hard or Soft Governance? The EU's Climate and Energy Policy Framework for 2030', *Politics and Governance*, 7(1), pp. 17–27. doi:10.17645/pag.v7i1.1796.

Oberthür, S. and Dupont, C. (2021) 'The European Union's international climate leadership: towards a grand climate strategy?', *Journal of European Public Policy*, 28(7), pp. 1095–1114. doi:10.1080/13501763.2021.1918218.

Oberthür, S. and Groen, L. (2018) 'Explaining goal achievement in international negotiations: the EU and the Paris Agreement on climate change', *Journal of European Public Policy*, 25(5), pp. 708–727. doi:10.1080/13501763.2017.1291708.

Oberthür, S. and Kelly, C.R. (2008) 'EU Leadership in International Climate Policy: Achievements and Challenges', *The International Spectator*, 43(3), pp. 35–50. doi:10.1080/03932720802280594.

Oberthür, S. and Ott, H.E. (1999) *The Kyoto Protocol: International Climate Policy for the 21st Century*. Cham, Switzerland: Springer Science & Business Media.

Office Statistique des Communautés Européennes (1962) *INFORMATIONS STATISTIQUES CAHIERS TRIMESTRIELS de L'INTEGRATION ECONOMIQUE EUROPEENNE. Statistique d'energie 1950-1960 . 1962 1/2 bis = Statistical Information Quarterly Books on European Union integration. Energy statistics 1950-1960. 1962 1/2 bis*. Brussels, Belgium. Available at: http://aei.pitt.edu/90982/ (Accessed: 26 June 2019).

Ogden, J. *et al.* (2018) 'Natural gas as a bridge to hydrogen transportation fuel: Insights from the literature', *Energy Policy*, 115, pp. 317–329. doi:10.1016/j.enpol.2017.12.049.

Osička, J. and Ocelík, P. (2017) 'Natural gas infrastructure and supply patterns in Eastern Europe: Trends and policies', *Energy Sources, Part B: Economics, Planning, and Policy*, 12(4), pp. 358–364. doi:10.1080/15567249.2015.1136971.

Overland, I. (2017) 'The Hunter Becomes the Hunted: Gazprom Encounters EU Regulation', in Svein, A., Goldthau, A., and Sitter, N. (eds) *Energy Union: Europe's New Liberal Mercantilism?* London, UK: Palgrave MacMillan, pp. 115–130.

Ozarslan, A. (2012) 'Large-scale hydrogen energy storage in salt caverns', *International Journal of Hydrogen Energy*, 37(19), pp. 14265–14277. doi:10.1016/j.ijhydene.2012.07.111.

Pallemaerts, M. and Williams, R. (2006) 'Climate change: The international and European policy framework', in. Semantic Scholar. doi:10.4337/9781847203090.00007.

Parker, C.F., Karlsson, C. and Hjerpe, M. (2017) 'Assessing the European Union's global climate change leadership: from Copenhagen to the Paris Agreement', *Journal of European Integration*, 39(2), pp. 239–252. doi:10.1080/07036337.2016.1275608.

Paterson, M. and Grubb, M. (1992) 'The international politics of climate change', *International Affairs*, 68(2), pp. 293–310. doi:10.2307/2623216.

Perino, G. (2018) 'New EU ETS Phase 4 rules temporarily puncture waterbed', *Nature Climate Change*, 8(4), pp. 262–264. doi:10.1038/s41558-018-0120-2.

de Perthuis, C. and Trotignon, R. (2014) 'Governance of CO2 markets: Lessons from the EU ETS', *Energy Policy*, 75, pp. 100–106. doi:10.1016/j.enpol.2014.05.033.

Pflugmann, F. and De Blasio, N. (2020) 'The Geopolitics of Renewable Hydrogen in Low-Carbon Energy Markets', *Geopolitics, History, and International Relations*, 12(1), pp. 9–44. Available at: https://www.belfercenter.org/publication/geopolitics-renewable-hydrogen-low-carbon-energy-markets (Accessed: 11 June 2020).

Phillips, N., Lawrence, T.B. and Hardy, C. (2004) 'Discourse and Institutions', *The Academy of Management Review*, 29(4), pp. 635–652. doi:10.2307/20159075.

Piebalgs, A. and Olczak, M. (2019) *Industry initiatives - key factors for addressing methane emissions, Florence School of Regulation*. Available at: http://fsr.eui.eu/industry-initiatives-key-factors-for-addressing-methane-emissions/ (Accessed: 17 May 2019).

Pierson, P. (1996) 'The Path to European Integration: A Historical Institutionalist Analysis', *Comparative Political Studies*, 29(2), pp. 123–163. doi:10.1177/0010414096029002001.

Pierson, P. (2000a) 'Increasing Returns, Path Dependence, and the Study of Politics', *The American Political Science Review*, 94(2), pp. 251–267. doi:10.2307/2586011.

Pierson, P. (2000b) 'Not Just What, but Timing and Sequence in Political Processes', *Studies in American Political Development*, 14(1), pp. 72–92. Available at: https://www.cambridge.org/core/journals/studies-in-american-political-development/article/not-just-what-but-when-timing-and-sequence-in-political-processes/E9741EE229E51B3676A062DAA1A608A1 (Accessed: 21 November 2017).

Pierson, P. (2011) *Politics in Time: History, Institutions, and Social Analysis*, *Politics in Time*. Princeton, NJ, USA: Princeton University Press. doi:10.1515/9781400841080.

Piggot, G. (2018) 'The influence of social movements on policies that constrain fossil fuel supply', *Climate Policy*, 18(7), pp. 942–954. doi:10.1080/14693062.2017.1394255.

Podobnik, B. (1999) 'Toward a Sustainable Energy Regime: A Long-Wave Interpretation of Global Energy Shifts', *Technological Forecasting and Social Change*, 62(3), pp. 155–172. doi:10.1016/S0040-1625(99)00042-6.

Podobnik, B. (2006) *Global Energy Shifts*. Philadelphia, PA, USA: Temple University Press.

Polder, P., Gilbertson, T. and Tricarico, A. (2014) 'Natural Gas Lock-In-Current Politics in the European Union'. Rosa Luxemberg Stiftung. Available at: http://www.carbontradewatch.org/downloads/publications/Natural-gas-lock-in.pdf (Accessed: 22 November 2017).

Polit, D.F. and Beck, C.T. (2010) 'Generalization in quantitative and qualitative research: Myths and strategies', *International Journal of Nursing Studies*, 47(11), pp. 1451–1458. doi:10.1016/j.ijnurstu.2010.06.004.

Pollack, M.A. (1997) 'The Commission as an Agent', in Nugent, N. (ed.) *At the Heart of the Union: Studies of the European Commission*. London: Palgrave Macmillan UK, pp. 109–128. doi:10.1007/978-1-349-25791-1_6.

Polsby, N.W. (1975) 'Legislatures', in Greenstein, F.I. and Polsby, N.W. (eds) *Handbook of Political Science*. Reading, MA, USA: Addison-Wesley Publishing Company, pp. 257–319.

Popov, J. (2020) 'US-Russia gas battle is building stranded assets in Europe', *Energy Monitor*, 30 November. Available at: https://energymonitor.ai/policy/us-russia-gas-battle-is-building-stranded-assets-in-europe (Accessed: 3 December 2020).

Popper, K.R. (2002) *The Logic of Scientific Discovery*. Hove, UK: Psychology Press.

Punch, K.F. (2013) *Introduction to Social Research: Quantitative and Qualitative Approaches*. London, UK: SAGE.

Qiao, G. *et al.* (2017) *Mechanical Properties of High-Nb X80 Steel Weld Pipes for the Second West-to-East Gas Transmission Pipeline Project*, *Advances in Materials Science and Engineering*. doi:10.1155/2017/7409873.

Rayner, T. and Jordan, A. (2016) 'Climate Change Policy in the European Union', *Oxford Research Encyclopedia of Climate Science* [Preprint]. doi:10.1093/acrefore/9780190228620.013.47.

Rechsteiner, R. (2021) 'German energy transition (Energiewende) and what politicians can learn for environmental and climate policy', *Clean Technologies and Environmental Policy*, 23(2), pp. 305–342. doi:10.1007/s10098-020-01939-3.

Rene, C. (2021) *Carbon dynamics at forefront of European coal-to-gas switching, ICIS Explore*. Available at: https://www.icis.com/explore/resources/news/2021/02/24/10610141/carbon-dynamics-at-forefront-of-european-coal-to-gas-switching (Accessed: 7 August 2021).

Rhodes, R.A.W. (1997) *Understanding governance: policy networks, governance, reflexivity, and accountability*. Maidenhead, UK: Open University Press.

Ringel, M. and Knodt, M. (2018) 'The governance of the European Energy Union: Efficiency, effectiveness and acceptance of the Winter Package 2016', *Energy Policy*, 112, pp. 209–220. doi:10.1016/j.enpol.2017.09.047.

Ringrose, P.S. (2018) 'The CCS hub in Norway: some insights from 22 years of saline aquifer storage', *Energy Procedia*, 146, pp. 166–172. doi:10.1016/j.egypro.2018.07.021.

Roberts, J.C.D. (2017) ‘Discursive destabilisation of socio-technical regimes: Negative storylines and the discursive vulnerability of historical American railroads’, *Energy Research & Social Science*, 31, pp. 86–99. doi:10.1016/j.erss.2017.05.031.

Rodríguez-Gómez, N., Zaccarelli, N. and Bolado-Lavín (2015) *Improvements in the EU gas transmission network between 2009 and 2014*. Brussels, Belgium: European Commission. Available at: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC93913/eur_27522_en-eu_gas_transmission_network_resilience_improvement_online.pdf (Accessed: 11 December 2020).

Romanov, K. (2020) *Methane emissions management in Russia: Gazprom case study*. Available at: https://ec.europa.eu/info/sites/info/files/energy_climate_change_environment/events/presentations/speaker_intervention_-_gazprom.pdf (Accessed: 8 August 2020).

Rosenbloom, D., Meadowcroft, J. and Cashore, B. (2019) ‘Stability and climate policy? Harnessing insights on path dependence, policy feedback, and transition pathways’, *Energy Research & Social Science*, 50, pp. 168–178. doi:10.1016/j.erss.2018.12.009.

Ryggvik, H. (2015) ‘A Short History of the Norwegian Oil Industry: From Protected National Champions to Internationally Competitive Multinationals’, *Business History Review*, 89(1), pp. 3–41. doi:10.1017/S0007680515000045.

Sandbag (2020) *EUA Prices*. Available at: https://sandbag.org.uk/carbon-price-viewer/ (Accessed: 29 October 2019).

Sayer, A. (2000) *Realism and Social Science*. London, UK: SAGE.

Scarlat, N., Dallemand, J.-F. and Fahl, F. (2018) ‘Biogas: Developments and perspectives in Europe’, *Renewable Energy*, 129, pp. 457–472. doi:10.1016/j.renene.2018.03.006.

Schmidt, V.A. (2008) ‘Discursive Institutionalism: The Explanatory Power of Ideas and Discourse’, *Annual Review of Political Science*, 11(1), pp. 303–326. doi:10.1146/annurev.polisci.11.060606.135342.

Schmidt, V.A. (2010) ‘Taking ideas and discourse seriously: explaining change through discursive institutionalism as the fourth “new institutionalism”’, *European Political Science Review*, 2(1), pp. 1–25. doi:10.1017/S175577390999021X.

Schreurs, M. (2016) ‘Is Germany Really an Environmental Leader?’, *Current history (New York, N.Y.: 1941)*, 115, pp. 114–116.

Schwartz, H. (2004) ‘Down the wrong path: path dependence, increasing returns, and historical institutionalism’, *Unpublished Manuscript (University of Virginia)* [Preprint]. Available at: http://people.virginia.edu/ hms2f/Path.pdf.

Scoones, I., Leach, M. and Newell, P. (eds) (2015) *The Politics of Green Transformations*. New York, NY, USA and London, UK: Routledge.

Scoones, I., Newell, P. and Leach, M. (2015) ‘The Politics of Green Transformations’, in Scoones, I., Leach, M., and Newell, P. (eds) *Pathways to Sustainability*. London-New York: Routledge, pp. 1–24.

Scrase, J.I. and Ockwell, D.G. (2010) 'The role of discourse and linguistic framing effects in sustaining high carbon energy policy—An accessible introduction', *Energy Policy*, 38(5), pp. 2225–2233. doi:10.1016/j.enpol.2009.12.010.

Šefčovič, M. (2016) *Clean Energy for All Europeans – unlocking Europe's growth potential - Press Release, European Commission: Press Release Database*. Available at: http://europa.eu/rapid/press-release_IP-16-4009_en.htm (Accessed: 17 August 2018).

Sehgal, K. (2018) 'Current State and Future Prospects of Global Biogas Industry', in Tabatabaei, M. and Ghanavati, H. (eds) *Biogas: Fundamentals, Process, and Operation*. Cham: Springer International Publishing (Biofuel and Biorefinery Technologies), pp. 449–472. doi:10.1007/978-3-319-77335-3_18.

Selin, H. and VanDeveer, S. (2015) *European Union and Environmental Governance*. Abingdon, Oxon ; New York, NY: Routledge. Available at: https://books.google.hu/books?id=D7zlCAAAQBAJ&printsec=frontcover&dq=stacey+vandeveer&hl=en&sa=X&ved=0ahUKEwivzfPe2vPlAhXjsIsKHct-Au8Q6AEIKzAA#v=onepage&q&f=false (Accessed: 18 November 2019).

Selin, H. and VanDeveer, S.D. (2015) 'EU Environmental Policy Making and Implementation: Changing Processes and Mixed Outcomes', in. *14th Biennial Conference of the European Union Studies Association*, Boston, MA, USA.

Sernovitz, G. (2016) *The Green and the Black: The Complete Story of the Shale Revolution, the Fight over Fracking, and the Future of Energy*. First Edition edition. New York, NY, USA: St. Martin's Press.

Seto, K.C., Davis, S.J., Mitchell, R.B., Stokes, E.C., Unruh, G. and Ürge-Vorsatz, D. (2016) ‘Carbon Lock-In: Types, Causes, and Policy Implications’, *Annual Review of Environment and Resources*, 41(1), pp. 425–452. doi:10.1146/annurev-environ-110615-085934.

Sharples, J.D. (2013) ‘Russian approaches to energy security and climate change: Russian gas exports to the EU’, *Environmental Politics*, 22(4), pp. 683–700. doi:10.1080/09644016.2013.806628.

Shell (2011) *Shell Energy Scenarios to 2050: An era of volatile transitions*. The Hague, NL and London, UK: Royal Dutch Shell. Available at: https://www.shell.com/energy-and-innovation/the-energy-future/scenarios/new-lenses-on-the-future/earlier-scenarios/_jcr_content/par/expandablelist/expandablesection_680706435.stream/1519772516187/787285b3524a8522519a5708558be86cd71a68b2/shell-scenarios-2050signalssignposts.pdf (Accessed: 5 October 2020).

Sheyholislami, J. (2017) ‘Critical discourse analysis’. Available at: https://www.researchgate.net/publication/228921006_Critical_discourse_analysis (Accessed: 1 November 2018).

Shiryaevskaya, A. (2018) ‘Russia Looks to Hydrogen as Way to Make Gas Greener for Europe’, *Bloomberg*, 8 November. Available at: https://www.bloomberg.com/news/articles/2018-11-08/russia-looks-to-hydrogen-as-way-to-make-gas-greener-for-europe (Accessed: 20 December 2018).

Silverman, D. (2011) *Interpreting Qualitative Data*. London, UK: SAGE Publications.

Simon, F. and Taylor, K. (2022) *LEAK: EU drafts plan to label gas and nuclear investments as green*, *www.euractiv.com*. Available at: https://www.euractiv.com/section/energy-environment/news/leak-eu-drafts-plan-to-label-gas-and-nuclear-investments-as-green/ (Accessed: 24 January 2022).

Simons, H. (2009) *Case Study Research in Practice*. London, UK: SAGE.

Sivaram, V. (2018) *Taming the Sun: Innovations to Harness Solar Energy and Power the Planet*. Cambridge, USA: MIT Press.

Skjærseth, J.B. (2017) 'The European Commission's Shifting Climate Leadership', *Global Environmental Politics*, 17(2), pp. 84–104. doi:10.1162/GLEP_a_00402.

Skjærseth, J.B. and Eikeland, P.O. (2017) 'Analytical Framework', in Skjærseth, J.B., Eikeland, P.O., Gulbrandsen, L.H. and Torbjorg, J. (eds) *Linking EU Climate and Energy Policies Decision-making, Implementation and Reform*. Cheltenham, UK: Edward Elgar Publishing Limited, pp. 11–30.

Skjærseth, J.B. and Wettestad, J. (2010) 'Fixing the EU Emissions Trading System? Understanding the Post-2012 Changes', *Global Environmental Politics*, 10(4), pp. 101–123. doi:10.1162/GLEP_a_00033.

Smil, V. (2010) *Energy Transitions: History, Requirements, Prospects*. California, USA: Praeger.

Smil, V. (2015) *Natural Gas: Fuel for the 21st Century*. West Sussex, UK: John Wiley & Sons.

Smil, V. (2016a) ‘Examining energy transitions: A dozen insights based on performance’, *Energy Research & Social Science*, 22(Supplement C), pp. 194–197. doi:10.1016/j.erss.2016.08.017.

Smil, V. (2016b) *Power Density: A Key to Understanding Energy Sources and Uses*. Reprint edition. Cambridge, MA, USA and London, UK: The MIT Press.

Smil, V. (2017) *Energy and Civilization: A History*. Cambridge, MA, USA: MIT Press.

Smith, A., Stirling, A. and Berkhout, F. (2005) ‘The governance of sustainable socio-technical transitions’, *Research Policy*, 34(10), pp. 1491–1510. doi:10.1016/j.respol.2005.07.005.

Sovacool, B.K. (2014) ‘What are we doing here? Analyzing fifteen years of energy scholarship and proposing a social science research agenda’, *Energy Research & Social Science*, 1, pp. 1–29. doi:10.1016/j.erss.2014.02.003.

Sovacool, B.K., Ryan, S.E., Stern, P.C., Janda, K., Rochlin, G., Spreng, D., Pasqualetti, M.J., Wilhite, H. and Lutzenhiser, L. (2015) ‘Integrating social science in energy research’, *Energy Research & Social Science*, 6, pp. 95–99. doi:10.1016/j.erss.2014.12.005.

Sovacool, B.K. (2016) ‘How long will it take? Conceptualizing the temporal dynamics of energy transitions’, *Energy Research & Social Science*, 13(Supplement C), pp. 202–215. doi:10.1016/j.erss.2015.12.020.

Sovacool, B.K. *et al.* (2020) ‘Sociotechnical agendas: reviewing future directions for energy and climate research’, *Energy Research and Social Science*, 70, p. a101617 1-35. doi:10.1016/j.erss.2020.101617.

Spash, C. (2016) ‘This Changes Nothing: The Paris Agreement to Ignore Reality’, *Globalizations*, 13, pp. 1–6. doi:10.1080/14747731.2016.1161119.

Spash, C.L. (2010) ‘The Brave New World of Carbon Trading’, *New Political Economy*, 15(2), pp. 169–195. doi:10.1080/13563460903556049.

Stake, R.E. (1995) *The Art of Case Study Research*. London, UK: SAGE.

Statoil (2011) *Annual Report*. Oslo, Norway: Statoil. Available at: https://www.equinor.com/en/investors/annual-reports.html (Accessed: 8 October 2021).

Statoil (2012a) *Annual Report 2012*. Oslo, Norway: Statoil. Available at: https://www.equinor.com/en/investors/annual-reports.html (Accessed: 8 October 2021).

Statoil (2012b) ‘Fuelling the UK with The Telegraph and Statoil’, *The Telegraph*. Available at: https://www.telegraph.co.uk/sponsored/earth/statoil/ (Accessed: 5 May 2020).

Statoil (2013) *Annual Report 2013*. Oslo, Norway: Statoil. Available at: https://www.equinor.com/en/investors/annual-reports.html (Accessed: 8 October 2021).

Statoil (2014) *Annual Report 2014*. Oslo, Norway: Statoil. Available at: https://www.equinor.com/en/investors/annual-reports.html (Accessed: 8 October 2021).

Statoil (2017) *Statoil’s Climate Roadmap - Creating a low carbon advantage*. Available at: https://www.equinor.com/content/dam/statoil/image/how-and-why/climate/A4-climate-roadmap-digital.pdf (Accessed: 21 August 2018).

Steinmo, S. (2008) ‘Historical Institutionalism’, in Porta, D.D. and Keating, M. (eds) *Approaches and Methodologies in the Social Sciences: A Pluralist Perspective*. Cambridge, UK: Cambridge University Press.

Stephenson, E., Doukas, A. and Shaw, K. (2012) ‘“Greenwashing gas: Might a ‘transition fuel’ label legitimize carbon-intensive natural gas development?”’, *Energy Policy*, 46(Supplement C), pp. 452–459. doi:10.1016/j.enpol.2012.04.010.

Stephenson, P. (2013) ‘Twenty years of multi-level governance: “Where Does It Come From? What Is It? Where Is It Going?”’, *Journal of European Public Policy*, 20(6), pp. 817–837. doi:10.1080/13501763.2013.781818.

Stern, J. (2004) *Natural Gas in Europe - The Importance of Russia*. Oxford: Oxford Institute of Energy Studies and EWI Energy Research and Scenarios. Available at: http://www.centrex.at/en/files/study_stern_e.pdf (Accessed: 2 July 2019).

Stern, J. (2017a) ‘Challenges to the Future of Gas: unburnable or unaffordable?’, Oxford, UK: *Oxford Institute for Energy Studies*, 5 December. Available at: https://www.oxfordenergy.org/publications/challenges-future-gas-unburnable-unaffordable/ (Accessed: 10 March 2018).

Stern, J. (2017b) *The Future of Gas in Decarbonising European Energy Markets: the need for a new approach*. OIES PAPER: NG 116. Oxford, UK: Oxford Institute for Energy Studies. Available at: https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/01/The-Future-of-Gas-in-Decarbonising-European-Energy-Markets-the-need-for-a-new-approach-NG-116.pdf (Accessed: 9 March 2018).

Stern, J. (2019) *Narratives for Natural Gas in Decarbonising European Energy Markets*. Oxford, UK: Oxford Institute for Energy Studies. Available at: https://www.oxfordenergy.org/publications/narratives-natural-gas-decarbonising-european-energy-markets/ (Accessed: 1 March 2019).

Stern, J. (2020) *Methane Emissions from Natural Gas and LNG Imports: an increasingly urgent issue for the future of gas in Europe*. NG 165. Oxford, UK: Oxford Institute of Energy Studies. Available at: https://www.oxfordenergy.org/publications/methane-emissions-from-natural-gas-and-lng-imports-an-increasingly-urgent-issue-for-the-future-of-gas-in-europe/ (Accessed: 20 December 2020).

Stern, J. and Yafimava, K. (2017) *The EU Competition investigation of Gazprom's sales in central and eastern Europe: a detailed analysis of the commitments and the way forward*. NG 121. Oxford, UK: Oxford Institute for Energy Studies. Available at: https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/07/The-EU-Competition-investigation-of-Gazproms-sales-in-central-and-eastern-Europe-a-detailed-analysis-of-the-commitments-and-the-way-forward-NG-121.pdf (Accessed: 24 December 2020).

Stern, J.P. (1998) *Competition and Liberalization in European Gas Markets: A Diversity of Models*. London, UK: Royal Institute for International Affairs/Chatham House.

Stern, N. (2007) *The Economics of Climate Change: The Stern Review*. Cambridge, UK: Cambridge University Press.

Stirling, A. (2019) 'How deep is incumbency? A "configuring fields" approach to redistributing and reorienting power in socio-material change', *Energy Research & Social Science*, 58, p. 101239. doi:10.1016/j.erss.2019.101239.

Sutherland, B. (2019) 'And now, some words on gas turbines', *Bloomberg.com*, 22 November. Available at: https://www.bloomberg.com/news/newsletters/2019-11-22/ge-and-siemens-see-signs-of-life-in-once-core-gas-turbine-units (Accessed: 9 December 2020).

Swedegas (2014) *Historic premiere for biogas in the national grid – Gas pipeline links up biogas plant to the gas grid*. Available at: https://www.swedegas.com/en-GB/Home/News/Premiere_for_gas_in_the_national_grid (Accessed: 12 February 2018).

Szabo, J. (2020a) 'Fossil Capitalism's Lock-ins: The Natural Gas-Hydrogen Nexus', *Capitalism Nature Socialism* [Preprint].

Szabo, J. (2020b) 'Natural Gas' Changing Discourse in European Decarbonisation', in Mišík, M. and Kolundzic, N. (eds) *Energy Humanities: Current State and Future Directions*. Cham, Switzerland: Springer.

Szabo, J. (2021) 'The Bridge – Natural Gas in a Redivided Europe', *Society and Economy*, 43(1), pp. 99–101. doi:10.1556/204.2020.00022.

Szabo, J. (2022) 'Energy transition or transformation? Power and politics in the European natural gas industry's trasformismo', *Energy Research & Social Science*, 84, p. 102391. doi:10.1016/j.erss.2021.102391.

Szabo, J. and Deak, A. (2021) 'The CEE Energy Transition: Recurring Fifty-Year-Old Dynamics?', in Mišík, M. and Oravcová, V. (eds) *From Economic to Energy Transition:*

Three Decades of Transitions in Central and Eastern Europe. Cham: Springer International Publishing (Energy, Climate and the Environment), pp. 63–96. doi:10.1007/978-3-030-55085-1_3.

Szabo, J. and Fabok, M. (2020) 'Infrastructures and state-building: Comparing the energy politics of the European Commission with the governments of Hungary and Poland', *Energy Policy*, 138, p. 111253. doi:10.1016/j.enpol.2020.111253.

Szalai, P. (2017) 'Statoil VP: "Natural gas has a home in the zero-carbon world"', *euractiv.com*, 18 December. Available at: https://www.euractiv.com/section/energy/interview/statoil-vp-natural-gas-has-a-home-in-the-zero-carbon-world/ (Accessed: 21 August 2018).

Szulecki, K. *et al.* (2016) 'Shaping the 'Energy Union': between national positions and governance innovation in EU energy and climate policy', *Climate Policy*, 16(5), pp. 548–567. doi:10.1080/14693062.2015.1135100.

Szulecki, K. (2017) *Energy Security in Europe: Divergent Perceptions and Policy Challenges*. Cham, Switzerland: Springer.

Szulecki, K. and Claes, D.H. (2019) 'Towards Decarbonization: Understanding EU Energy Governance', *Politics and Governance*, 7(1), pp. 1–5. doi:10.17645/pag.v7i1.2029.

Tabatabaei, M. and Ghanavati, H. (2018) *Biogas: Fundamentals, Process, and Operation*. Cham, Switzerland: Springer (Biofuel and Biorefinery Technologies).

Tansey, O. (2007) 'Process Tracing and Elite Interviewing: A Case for Non-probability Sampling', *PS: Political Science & Politics*, 40(4), pp. 765–772. doi:10.1017/S1049096507071211.

Tarkowski, R. (2019) ‘Underground hydrogen storage: Characteristics and prospects’, *Renewable and Sustainable Energy Reviews*, 105, pp. 86–94. doi:10.1016/j.rser.2019.01.051.

Thomas, R. (2018) ‘The development of the manufactured gas industry in Europe’, in Craig, J., Gerali, F., MacAulay, F. and Sorkhabi, R. (eds) *History of the European Oil and Gas Industry*. Bath: Geological Society, pp. 137–164.

Trinomics (2018) *The role of Trans-European gas infrastructure in the light of the 2050 decarbonisation targets*. Rotterdam. Available at: https://publications.europa.eu/en/publication-detail/-/publication/1796ecd6-cb71-11e8-9424-01aa75ed71a1/language-en (Accessed: 15 February 2019).

Turner, A.J., Frankenberg, C., Wennberg, C. and Jacob, D.J. (2017) ‘Ambiguity in the causes for decadal trends in atmospheric methane and hydroxyl’, *Proceedings of the National Academy of Sciences*, 114(21), pp. 5367–5372. doi:10.1073/pnas.1616020114.

Turnheim, B. and Geels, F.W. (2012) ‘Regime destabilisation as the flipside of energy transitions: Lessons from the history of the British coal industry (1913–1997)’, *Energy Policy*, 50(Supplement C), pp. 35–49. doi:10.1016/j.enpol.2012.04.060.

Tusk, D. (2014) ‘A united Europe can end Russia’s energy stranglehold’, *Financial Times*. Available at: https://www.ft.com/content/91508464-c661-11e3-ba0e-00144feabdc0?siteedition=uk#axzz30pcAkBUE (Accessed: 14 April 2018).

UN (1987) *Our Common Future*. Oxford, UK: Oxford University Press. Available at: https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf (Accessed: 2 July 2019).

UNFCCC (1992) ‘UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE’. Available at: http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf (Accessed: 3 July 2019).

UNFCCC (2007) *Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007. Addendum. Part Two: Action taken by the Conference of the Parties at its thirteenth session.* UNFCCC. Available at: https://unfccc.int/documents/5079#beg (Accessed: 19 August 2019).

Unruh, G.C. (2000) ‘Understanding carbon lock-in’, *Energy Policy*, (28), pp. 817–830.

US EPA (2008) *2008 National Emissions Inventory (NEI) Data, US EPA*. Available at: https://www.epa.gov/air-emissions-inventories/2008-national-emissions-inventory-nei-data (Accessed: 14 May 2019).

US EPA (2019) *What is Acid Rain?, US EPA*. Available at: https://www.epa.gov/acidrain/what-acid-rain (Accessed: 14 May 2019).

Valijanian, E., Tabatabaei, M., Aghbashlo, M., Sulaiman, A. and Chisti, Y. (2018) ‘Biogas Production Systems’, in Tabatabaei, M. and Ghanavati, H. (eds) *Biogas: Fundamentals, Process, and Operation*. Cham, Switzerland: Springer International Publishing (Biofuel and Biorefinery Technologies), pp. 95–116. doi:10.1007/978-3-319-77335-3_4.

Van de Graaf, T., Overland, I., Scholten, D. and Westphal, K. (2020) ‘The new oil? The geopolitics and international governance of hydrogen’, *Energy Research & Social Science*, 70, p. 101667. doi:10.1016/j.erss.2020.101667.

Van de Graaf, T. and Colgan, J. (2016) *Russian Gas Games or Well-Oiled Conflict? Energy Security and the 2014 Ukraine Crisis*. SSRN Scholarly Paper ID 2889179. Rochester, NY: Social Science Research Network. Available at: https://papers.ssrn.com/abstract=2889179 (Accessed: 28 February 2018).

Vermaat, S. (2015) *Power in the Global Economy: States versus Firms? An analysis of Eurasian pipeline projects*. Radboud, the Netherlands: Radboud University. Available at: https://theses.ubn.ru.nl/bitstream/handle/123456789/1161/Vermaat%2C_Stefan_1.pdf?sequence=1 (Accessed: 2 July 2019).

Vettese, T. (2019) *Global Warming, Market Opportunity*, *Boston Review*. Available at: https://bostonreview.net/science-nature/troy-vettese-global-warming-market-opportunity (Accessed: 1 October 2021).

Vogler, J. (1999) 'The European Union as an actor in international environmental politics', *Environmental Politics*, 8(3), pp. 24–48. doi:10.1080/09644019908414478.

Von Hirschhausen, C. (2014) 'The German "Energiewende"—An Introduction', *Economics of Energy & Environmental Policy*, 3(2), pp. 1–12. Available at: https://www.jstor.org/stable/26189273 (Accessed: 11 November 2019).

Vorgang, J. *et al.* (2009) 'Reduction of Methane Emissions in the EU natural Gas Industry', p. 8. Available at: http://www.iapg.org.ar/WGC09/admin/archivosNew/Special%20Projects/4.%20IGU%20Best%20Practices/4.%20IGU%20Best%20Practices%20FINAL%20-%20CD%20contents/3.%20Transmission%20-

%20Reduction%20of%20methane%20emissions%20in%20the%20EU%20natural%20gas %20industry.pdf (Accessed: 17 May 2019).

de Vries, H., Mokhov, A.V. and Levinsky, H.B. (2017) 'The impact of natural gas/hydrogen mixtures on the performance of end-use equipment: Interchangeability analysis for domestic appliances', *Applied Energy*, 208, pp. 1007–1019. doi:10.1016/j.apenergy.2017.09.049.

Waerness, E., Gjeset, E. and Syversen, O.A. (2017) 'Norway as a long-term partner in the EU's gas market', in Jones, C. (ed.) *The Role of Gas in the EU's Energy Union*. Deventer, Netherlands: Claeys and Casteels Law Publishers (EU Energy Law), pp. 355–378.

Wallace, H., Pollack, M.A. and Young, A.R. (2015) *Policy-Making in the European Union*. Seventh Edition, Oxford, UK and New York, NY, USA: Oxford University Press (New European Union Series).

Wallace-Wells, D. (2019) *The Uninhabitable Earth: Life After Warming*. 1st Edition edition. New York, NY, USA: Tim Duggan Books.

Waskow, D. and Morgan, J. (2015) 'The Paris Agreement: Turning Point for a Climate Solution', *World Resources Institute*, 12 December. Available at: https://www.wri.org/insights/paris-agreement-turning-point-climate-solution (Accessed: 6 August 2021).

Watson, F. (2019) *EU CO2 fuel switching price of Eur35/mt could arrive before Q2 2020: SocGen, S&P Platts*. Available at: https://www.spglobal.com/platts/en/market-insights/latest-news/coal/072419-eu-co2-fuel-switching-price-of-eur35-mt-could-arrive-before-q2-2020-socgen (Accessed: 7 August 2021).

Weaver, R.K. and Rockman, B.A. (2010) *Do Institutions Matter?: Government Capabilities in the United States and Abroad*. Washington DC, USA: Brookings Institution Press.

Williams, T.I. (1981) *A history of the British gas industry*. Oxford, UK: Oxford University Press.

Williamson, O.E. (2000) 'The New Institutional Economics: Taking Stock, Looking Ahead', *Journal of Economic Literature*, 38(3), pp. 595–613. doi:10.1257/jel.38.3.595.

Wilson, S., Carlson, A. and Szeman, I. (2017) *Petrocultures: Oil, Politics, Culture*. Montreal, Canada: McGill-Queen's Press - MQUP.

Winskel, M. (2002) 'When Systems Are Overthrown: The "Dash for Gas" in the British Electricity Supply Industry', *Social Studies of Science*, 32(4), pp. 563–598. Available at: https://www.jstor.org/stable/3183087 (Accessed: 1 August 2019).

Winskel, M. (2018) 'Beyond the disruption narrative: Varieties and ambiguities of energy system change', *Energy Research & Social Science*, 37, pp. 232–237. doi:10.1016/j.erss.2017.10.046.

WMO and UNEP (1989) *Conference proceedings - The Changing atmosphere, implications for global security*. WMO (Lectures). Available at: https://library.wmo.int/index.php?lvl=author_see&id=5091#.XT_zzpMzYWo (Accessed: 30 July 2019).

Woerdman, E. (2004) 'Path-dependent climate policy: the history and future of emissions trading in Europe', *European Environment*, 14(5), pp. 261–275. doi:10.1002/eet.362.

World Climate Programme (1986) *Report on the International Conference on teh Assessment of the Role of Carbon Dioxide and of Other Greenhouse Gases in Climate Variations and Associated Impacts*. 661. Villach, Austria: UNEP/ICSU/WMO. Available at: https://library.wmo.int/doc_num.php?explnum_id=8512 (Accessed: 9 October 2019).

Yergin, D. (2011) *The Prize: The Epic Quest for Oil, Money & Power*. New York, NY, USA: Simon and Schuster.

Yin, R.K. (1994) *Case study research: design and methods*. London, UK: Sage Publications.

Zgajewski, T. (2015) *The Rise of Capacity Mechanisms: Are They Inevitable in the European Union?* 80. Brussels, Belgium: Egmont – The Royal Institute for International Relations. Available at: http://aei.pitt.edu/70444/1/ep80.pdf (Accessed: 8 December 2020).

10 Annex 1: Archive references

Chapter 1: Introduction (pages 1–15)

Council Directive 75/404/EEC, 13.02.1975. 'Council Directive 75/404/EEC of 13 February 1975 on the restriction of the use of natural gas in power stations'. *Official Journal of the European Union,* L 178/24 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31975L0404. [28.01.2022].

COM (81) 540 final, 2.10.1981. 'The Development of an Energy Strategy for the Community'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:51981DC0540&from=EN. [28.01.2022].

COM/1982/0653 final, 15.10.1982. 'COMMUNICATION FROM THE COMMISSION TO THE COUNCIL ON COMMUNITY NATURAL GAS SUPPLIES'. *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A51982DC0653&qid=1643401749123. [28.01.2022].

COM (86) 518 final, 11.12.1986. 'Commission Decision of 1 October 1986 authorizing Spain to adopt protective measures in respect of imports of certain steel products'. *Official Journal of the European Union,* L 305/46 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31986D0518. [28.01.2022].

COM(92) 508 final, 15.12.1992. 'Proposal for a COUNCIL DECISION concerning the conclusion of the framework Convention on Climate Change'. *Official Journal of the European Union*, L 305/46 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A51992PC0508&qid=1643401995785. [28.01.2022].

Chapter 3: Research design (pages 44–70)

Directive 98/30/EC, 22.06.1998. 'DIRECTIVE 98/30/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 June 1998 concerning common rules for the internal market in natural gas'. *Official Journal of the European Union,* L 204/1via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31998L0030. [28.01.2022].

Directive 2003/55/EC, 26.06.2003. 'DIRECTIVE 2003/55/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC'. *Official Journal of the European Union,* L 76/57 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32003L0055. [28.01.2022].

Directive 2009/EC/73, 14.08.2009. 'DIRECTIVE 2009/73/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC'. *Official Journal of the European Union,* L 211/94 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009L0073. [28.01.2022].

COM(2015) 080 final, 25.02.2015. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0080. [28.01.2022].

COM(2016) 860, 30.11.2016. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND

SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK Clean Energy For All Europeans’. *Register of Commission Documents.* Available at: https://ec.europa.eu/energy/sites/ener/files/documents/com_860_final.pdf. [28.01.2022].

Chapter 4: The bases of a natural gas regime (pages 71–96)

Consultative Assembly on the activities of the Common Assembly from 1st July 1956 to 30th June 1957, 30.09.1957. *Parliamentary Assembly*. Available at: http://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=1025&lang=en. [28.01.2022].

P-1/63, 10.01.1963. ‘The European Community's long-term energy prospects. Information Memo P-1/63’, 10 January 1963. *Archive of European Integration.* Available at: http://aei.pitt.edu/15267/. [28.01.2022].

Council Directive 75/716/EEC, 24.11.1975. ‘COUNCIL DIRECTIVE 75/716/EEC of 24 November 1975 on the approximation of the laws of the Member States relating to the sulphur content of certain liquid fuels’. *Official Journal of the European Union*, L 307/22 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A31975L0716. [28.01.2022].

COM (81) 540 final, 2.10.1981. ‘The Development of an Energy Strategy for the Community’. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:51981DC0540&from=EN. [28.01.2022].

Chapter 5: Climate considerations in the European Commission’s natural gas policy (pages 97–136)

COM(94) 659 final, 23.02.1995. ‘For a European Union Energy Policy - Green Paper. COM (94) 659 final/2, 23 February 1995’. *Archive of European Integration.* Available at: http://aei.pitt.edu/1185/. [28.01.2022].

COM(95) 478 final, 18.10.1995. ‘European Community Gas Supply And Prospects’. *Archive of European Integration.* Available at: http://aei.pitt.edu/4999/1/4999.pdf. [28.01.2022].

Directive 98/30/EC, 22.06.1998. ‘DIRECTIVE 98/30/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 June 1998 concerning common rules for the internal market in natural gas’. *Official Journal of the European Union* via *EUR-Lex*, L 204/1. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31998L0030. [28.01.2022].

COM(2002) 488 final — 2002/0220(COD) 11.09.2002. ‘COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL The internal market in energy: Coordinated measures on the security of energy supply’. *EUR-Lex.* Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2002:0488:FIN:EN:PDF. [28.01.2022].

Directive 2003/54/EC, 26.06.2003. ‘DIRECTIVE 2003/54/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC - Statements made with regard to decommissioning and waste management activities’. *Official Journal of the European Union* via *EUR-Lex*, L 176/37. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32003L0054. [28.01.2022].

Directive 2003/55/EC, 26.06.2003. 'DIRECTIVE 2003/55/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC'. *Official Journal of the European Union,* L 76/57 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32003L0055. [28.01.2022].

Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, signed at Lisbon, 13.12.2007. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A12007L%2FTXT. [28.01.2022].

Directive 2009/EC/73, 14.08.2009. 'DIRECTIVE 2009/73/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC'. *Official Journal of the European Union,* L 211/94 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009L0073. [28.01.2022].

SEC(2009) 979 final, 16.07.2009. 'Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning measures to safeguard security of gas supply and repealing Directive 2004/67/EC'. *Official Journal of the European Union,* L 211/94 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52009PC0363. [28.01.2022].

COM(2010) 639 final, 10.11.2010. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Energy 2020 A strategy for competitive, sustainable and secure energy'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0639:FIN:En:PDF. [28.01.2022].

Regulation (EU) No 994/2010, 12.11.2010. 'REGULATION (EU) NO 994/2010 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC '. *Official Journal of the European Union,* L 295/1 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32010R0994. [28.01.2022].

COM(2011) 0885 final, 15.12.2011. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Energy Roadmap 2050'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52011DC0885. [28.01.2022].

European Parliament resolution 2011/2034(INI) [P7_TA(2011)0318], 05.07.2011. '2011/2034(INI) Energy infrastructure priorities for 2020 and beyond'. *Legislative Observatory – European Parliament.* Available at: https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?reference=2011/2034(INI)&l=en. [28.01.2022].

Commission Decision 2011/C 236/09, 11.08.2011. 'COMMISSION DECISION of 11 August 2011 establishing the composition and the operational provisions of the Gas Coordination Group and repealing Commission Decision 2006/791/EC '. *Official Journal of the European Union,* L 236/10 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.C_.2011.236.01.0010.01.ENG&toc=OJ%3AC%3A2011%3A236%3AFULL. [28.01.2022].

COM(2011) 539 final, 07.09.2011. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS On security of energy supply and international cooperation – "The EU Energy Policy: Engaging with Partners beyond Our Borders"'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52011DC0539. [28.01.2022].

39816 Upstream gas supplies in Central and Eastern Europe (first memo: 27.09.2011). Available at: https://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=1_39816. [28.01.2022].

Directive 2012/27/EU, 25.10.2012. 'DIRECTIVE 2012/27/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC'. *Official Journal of the European Union,* L 315/1 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32012L0027. [28.01.2022].

Commission notice no. 2013/C 33 E/06, 05.02.2013. 'Energy infrastructure priorities for 2020 and beyond European Parliament resolution of 5 July 2011 on energy infrastructure priorities for 2020 and beyond (2011/2034(INI))'. *Official Journal of the European Union,* C 33 E/3 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2013:033E:FULL&from=DA. [28.01.2022].

Regulation (EU) No. 347/2013, 17.04.2013. 'REGULATION (EU) NO 347/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 '. *Official Journal of the European Union,* L 115/39 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=celex%3A32013R0347. [28.01.2022].

Regulation (EU) No. 1391/2013, 14.10.2013. 'COMMISSION DELEGATED REGULATION (EU) No 1391/2013 of 14 October 2013 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure as regards the Union list of projects of common interest'. *Official Journal of the European Union,* L 349/28 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R1391. [28.01.2022].

COM(2015) 080 final, 25.02.2015. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0080. [28.01.2022].

COM(2015) 610 final, 27.07.2015. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Commission Work Programme 2016 No time for business as usual'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0610. [28.01.2022].

COM(2015) 572 final, 18.11.2015. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK State of the Energy Union 2015'. *EUR-Lex.*

Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0572. [28.01.2022].

COM(2016) 52 final, 16.02.2016. 'Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010'. *Register of Commission Documents.* Available at: https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2016)52&lang=en. [28.01.2022].

COM(2016) 860, 30.11.2016. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK Clean Energy For All Europeans'. *Register of Commission Documents.* Available at: https://ec.europa.eu/energy/sites/ener/files/documents/com_860_final.pdf. [28.01.2022].

Renewable Energy Directive (EU) 2018/2001, 21.12.2018. 'DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources '. *Official Journal of the European Union*, L 328/82 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG. [28.01.2022].

SWD(2019) final, Part 4/11, 09.01.2019. 'COMMISSION STAFF WORKING DOCUMENT Accompanying the document REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Energy prices and costs in Europe'. *Register of Commission Documents.* Available at:

https://ec.europa.eu/transparency/documents-register/detail?ref=SWD(2019)1&lang=en. [28.01.2022].

Chapter 6: EU climate policy: a boon for natural gas? (pages 137–168)

No 87/C 72/66, 20.03.1987, Written Question no. 1138/86 by Mr Francois Roelants du Vivier (ARC-B) to the Commission of the European Communities, 02.09.1986 and Answer given by Mr Narjes on behalf of the Commission, 29.10.1986 and the Commission hosted the Changes in Climate and the Environment to be Expected due to the Atmospheric Increase of Carbon Dioxide and other "Greenhouse" Gases, Brussels, 3-5 November 1986. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_1987_072_R_0001_01&qid=1626717486784&from=EN. [28.01.2022].

Council Resolution 87/C 328/01, 19.10.1987. 'Resolution of the Council of the European Communities and of the representatives of the Governments of the Member States, meeting within the Council of 19 October 1987 on the continuation and implementation of a European Community policy and action programme on the environment (1987-1992)'. *Official Journal of the European Union*, C 328/1 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:1987:328:FULL&from=EN. [28.01.2022].

COM(88) 656 final, 16.11.1988. 'COMMUNICATION TO THE COUNCIL "The Greenhouse Effect and the Community" Commission work programme concerning the evaluation of policy options to deal with the "greenhouse effect" and draft COUNCIL RESOLUTION on the greenhouse effect and the Community'. *Archive of European Integration.* Available at: http://aei.pitt.edu/5684/1/5684.pdf. [28.01.2022].

Council Decision 89/236/EEC, 14.03.1989. '89/236/EEC: COUNCIL DECISION of 14 March 1989 on a specific research and technological development programme in the field of energy - non-nuclear energies and rational use of energy - 1989 to 1992 (Joule)'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31989D0236. [28.01.2022].

Council Resolution 89/C 183/03, 20.07.1989. 'COUNCIL RESOLUTION of 21 June 1989 on the greenhouse effect and the Community'. *Official Journal of the European Communities* via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31989Y0720(01)&from=LV. [28.01.2022].

Council Decision 89/625/EEC, 20.11.1989. '89/625/EEC: COUNCIL DECISION of 20 November 1989 on two specific research and development programmes in the field of the environment - step and Epoch (1989 to 1992)'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31989D0625.

COM(90) 365 final, 30.11.1990. 'Proposal for a COUNCIL DECISION concerning the promotion of energy efficiency in the Community.' *Archive of European Integration.* Available at: http://aei.pitt.edu/10771/. [28.01.2022].

COM(92) 180 final, 20.05.1992. 'COMMISSION Proposal for a Council Decision concerning the promotion of renewable energy sources in the Community — (Altener programme).' *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A51992PC0180&qid=1643236946877. [28.01.2022].

A/CONF.151/26/Rev.1 (Vol. I), 3-14.06.1992. 'REPORT OF THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT (Rio de Janeiro, 3-14 June 1992) - Annex I RIO DECLARATION ON ENVIRONMENT AND DEVELOPMENT'. *United Nations General Assembly*. Available at:

https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf. [28.01.2022].

Council Decision 93/389/EEC9, 24.06.1993, no. L 167/31. '93/389/EEC: Council Decision of 24 June 1993 for a monitoring mechanism of Community CO2 and other greenhouse gas emissions'. *Publications Office of the European Union*. Available at: https://op.europa.eu/en/publication-detail/-/publication/57339715-8896-47ed-9ac4-43db30a11ba6. [28.01.2022].

COM(97) 481 final, 01.10.1997. 'COMMUNICATION FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Climate Change -The EU Approach for Kyoto'. *Archive of European Integration.* Available at: http://aei.pitt.edu/6244/1/6244.pdf. [28.01.2022].

COM(1998) 353 final, 03.06.1998. 'COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT CLIMATE CHANGE- TOWARDS AN EU POST-KYOTO STRATEGY'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:51998DC0353&from=DE. [28.01.2022].

COM(1999) 230 final, 19.05.1999. 'COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT – "Preparing for implementation of the Kyoto Protocol"'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/procedure/EN/145198. [28.01.2022].

COM(2000) 88 final, 08.03.2000. 'COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT on EU policies and measures to reduce greenhouse gas emissions: Towards a European Climate Change Programme

(ECCP)’. *EUR-Lex.* Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2000:0088:FIN:EN:PDF. [28.01.2022].

COM(2000) 0769 final, 29.11.2000. ‘Green Paper - Towards a European strategy for the security of energy supply’. *Publications Office of the European Union*. Available at: https://op.europa.eu/en/publication-detail/-/publication/0ef8d03f-7c54-41b6-ab89-6b93e61fd37c/language-en. [28.01.2022].

IP/00/1368, 29.11.2000. ‘The Commission launches an overall debate on a future european energy strategy with a Green Paper on the energy supply security’. *Register of Commission Documents.* Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_00_1368. [28.01.2022].

Directive 2003/87/EC, 13.10.2013. ‘DIRECTIVE 2003/87/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC’. *Official Journal of the European Communities,* L275/32 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32003L0087. [28.01.2022].

MEMO/05/42, 09.02.2005. ‘Winning the Battle Against Global Climate Change’. *Register of Commission Documents.* Available at: https://ec.europa.eu/commission/presscorner/detail/en/MEMO_05_42. [28.01.2022].

COM(2006) 105 final, 08.02.2006. ‘GREEN PAPER A European Strategy for Sustainable, Competitive and Secure Energy’. Available at: https://europa.eu/documents/comm/green_papers/pdf/com2006_105_en.pdf. [28.01.2022].

7224/1/07 REV 1, 02.05.2007. '*Presidency Conclusions – Brussels, 8/9 March 2007*'. Council of the European Union. Available at: https://data.consilium.europa.eu/doc/document/ST-7224-2007-REV-1/en/pdf. [28.01.2022].

COM (2007) 1, 10.01.2007. 'An Energy Policy for Europe'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:l27067&from=EN. [28.01.2022].

COM(2007) 2, 10.01.2007. 'COMMUNICATION FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Limiting Global Climate Change to 2 degrees Celsius The way ahead for 2020 and beyond'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0002:FIN:EN:PDF. [28.01.2022].

COM(2007) 757 final, 27.11.2007. 'COMMUNICATION FROM THE COMMISSION PROGRESS TOWARDS ACHIEVING THE KYOTO OBJECTIVES (required under Decision 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol)'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52007DC0757&from=SL. [28.01.2022].

COM(2008) 30 final, 23.01.2008. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS 20 20 by 2020 Europe's climate change opportunity'. *EUR-Lex.* Available at: http://eur-

lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0030:FIN:en:PDF.
[28.01.2022].

CONSOLIDATED VERSION OF THE TREATY ON THE FUNCTIONING OF THE EUROPEAN UNION, 09.05.2008. *Official Journal of the European Union*, C 115/47 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:41f89a28-1fc6-4c92-b1c8-03327d1b1ecc.0007.02/DOC_1&format=PDF. [28.01.2022].

COM(2009) 39 final, 28.01.2009. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Towards a comprehensive climate change agreement in Copenhagen'. *EUR-Lex.* Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0039:FIN:EN:PDF. [28.01.2022].

SPEECH/09/102, 11.03.2009. 'Andris Piebalgs, Energy Commissioner, EU Energy and Climate Policy, Speech at the 7th Doha Natural Gas Conference, Doha, 11 March 2009'. *Register of Commission Documents.* Available at: https://ec.europa.eu/commission/presscorner/detail/en/speech_09_102. [28.01.2022].

DIRECTIVE 2009/29/EC, 05.06.2009. 'DIRECTIVE 2009/29/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community'. *Official Journal of the European Union,* C 140/63 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0029&from=EN. [28.01.2022].

FCCC/CP/2009/L.7, 18.12.2009. 'Report of the Conference of the Parties on its fifteenth session, held in Copenhagen from 7 to 19 December 2009 Addendum Part Two: Action taken by the Conference of the Parties at its fifteenth session Decisions adopted by the Conference of the Parties'. *UNFCC*. Available at: https://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf. [28.01.2022].

COM(2010) 2020, 03.03.2010. 'COMMUNICATION FROM THE COMMISSION EUROPE 2020 A strategy for smart, sustainable and inclusive growth'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC2020&from=EN. [28.01.2022].

COM(2010) 639, 10.11.2010. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Energy 2020 A strategy for competitive, sustainable and secure energy'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0639:FIN:En:PDF.

EUCO 2/1/11 REV 1, 08.03.2011. 'Conclusions – 4 February 2011'. *European Council*. Available at: https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/119175.pdf. [28.01.2022].

COM(2011) 112 final, 08.03.2011. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A Roadmap for moving to a competitive low carbon economy in 2050'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0112&from=EN. [28.01.2022].

COM(2010) 677 final, 17.11.2011. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND

SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Energy infrastructure priorities for 2020 and beyond - A Blueprint for an integrated European energy network'. *Register of Commission Documents*. Available at: https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2010)677. [28.01.2022].

COM(2011) 0885 final, 15.12.2011. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Energy Roadmap 2050'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52011DC0885. [28.01.2022].

IP/12/850, 25.07.2012. 'Emissions Trading: Commission prepares for change of the timing for auctions of emission allowances'. *Register of Commission Documents.* Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_12_850. [28.01.2022].

Official Journal C 326, 26.10.2012. 'Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union - Consolidated version of the Treaty on the Functioning of the European Union - Protocols - Annexes - Declarations annexed to the Final Act of the Intergovernmental Conference which adopted the Treaty of Lisbon, signed on 13 December 2007 - Tables of equivalences' *Official Journal,* C 326 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:12012E/TXT&from=EN. [28.01.2022].

COM(2012) 652 final, 14.11.2012. 'REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL The state of the European carbon market in 2012'. *Register of Commission Documents*. Available at: https://ec.europa.eu/clima/system/files/2016-11/com_2012_652_en.pdf. [28.01.2022].

COM(2013) 167 final, 26.03.2013. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS The 2015 International Climate Change Agreement: Shaping international climate policy beyond 2020 Consultative Communication'. *EUR-Lex.* Available at: https://ec.europa.eu/clima/document/download/0cf578f5-a3cd-4428-bbcf-f7940fb61ece_en. [28.01.2022].

SWD(2014) 17 final, 22.01.2014, p. 18. 'COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT Accompanying the document Proposal for a Decision of the European Parliament and of the Council concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC'. *EUR-Lex*. Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SWD:2014:0017:FIN:EN:PDF. [28.01.2022].

COM(2014) 15 final, 22.01.2014. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A policy framework for climate and energy in the period from 2020 to 2030'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2014:0015:FIN:EN:PDF. [28.01.2022].

COM(2014) 20 final, 22.01.2014. 'Proposal for a DECISION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014PC0020&from=EN. [28.01.2022].

IP/12/1208, 12.11.2014. 'Emissions trading: Commission presents options to reform the European carbon market'. *Register of Commission Documents.* Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_12_1208. [28.01.2022].

COM(2015) 080 final, 25.02.2015. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0080. [28.01.2022].

COM(2015) 81 final, 04.03.2015. 'ENERGY UNION PACKAGE COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL The Paris Protocol – A blueprint for tackling global climate change beyond 2020'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:e27fdb4d-bdce-11e4-bbe1-01aa75ed71a1.0003.03/DOC_1&format=PDF. [28.01.2022].

COM(2015) 337, 15.07.2015. 'Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments'. *Register of Commission Documents.* Available at: https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2015)337. [28.01.2022].

Decision (EU) 2015/1814 of the European Parliament and of the Council, 06.10.2015. 'DECISION (EU) 2015/1814 OF THE EUROPEAN PARLIAMENT AND OF THE

COUNCIL of 6 October 2015 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015D1814&from=EN#:~:text=(*)%20Decision%20(EU)%202015%2F,(OJ%20L%20264%2C%209.10. [28.01.2022].

Paris Agreement, United Nations 2015. *UNFCC*. https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement. [28.01.2022].

COM(2016) 110 final, 02.03.2016. COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL The Road from Paris: assessing the implications of the Paris Agreement and accompanying the proposal for a Council decision on the signing, on behalf of the European Union, of the Paris agreement adopted under the United Nations Framework Convention on Climate Change. *Register of Commission Documents.* Available at: https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2016)110&lang=en. [28.01.2022].

COM(2016) 860, 30.11.2016. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK Clean Energy For All Europeans'. *Register of Commission Documents.* Available at: https://ec.europa.eu/energy/sites/ener/files/documents/com_860_final.pdf. [28.01.2022].

Directive (EU) 2018/844, 30.05.2018. 'DIRECTIVE (EU) 2018/844 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency '. *Official Journal of the European Union*, L 156/75 via *EUR-Lex*. Available at:

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.156.01.0075.01.ENG. [28.01.2022].

Regulation (EU) 2018/1999, 11.12.2018. 'REGULATION (EU) 2018/1999 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council '. *Official Journal of the European Union,* L 328/1 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ:L:2018:328:TOC&uri=uriserv:OJ.L_.2018.328.01.0001.01.ENG. [28.01.2022].

Directive (EU) 2018/2001, 11.12.2018. 'DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources ' *Official Journal of the European Union,* L 328/82 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG. [28.01.2022].

Directive (EU) 2018/2002, 11.12.2018. 'DIRECTIVE (EU) 2018/2002 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 amending Directive 2012/27/EU on energy efficiency ' *Official Journal of the European Union,* L 328/210 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.328.01.0210.01.ENG. [28.01.2022].

Regulation (EU) 2019/941, 05.06.2019. 'REGULATION (EU) 2019/941 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC '. *Official Journal of the European Union,* L 158/1 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2019.158.01.0001.01.ENG. [28.01.2022].

Regulation (EU) 2019/942, 05.06.2019. 'REGULATION (EU) 2019/942 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators '. *Official Journal of the European Union,* L 158/22 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2019.158.01.0022.01.ENG. [28.01.2022].

Regulation (EU) 2019/943, 05.06.2019. 'REGULATION (EU) 2019/943 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on the internal market for electricity '. *Official Journal of the European Union,* L 158/54 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32019R0943. [28.01.2022].

Directive (EU) 2019/944, 05.06.2019. 'DIRECTIVE (EU) 2019/944 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU '. *Official Journal of the European Union,* L 158/125 via *EUR-Lex*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L0944. [28.01.2022].

COM(2020) 663 final, 14.10.2020. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on an EU strategy to reduce methane emissions". *Register of Commission Documents.* Available at: https://ec.europa.eu/energy/sites/ener/files/eu_methane_strategy.pdf. [28.01.2022].

Chapter 7: Decarbonisation and Natural Gas Infrastructure (pages 169–201)

COM (2006) 843 final, 10.01.2007. 'COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT Sustainable power generation from fossil fuels: aiming for near-zero emissions from coal after 2020'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2006:0843:FIN:EN:PDF. [28.01.2022].

Directive 2009/28/EC, 23.04.2009. 'DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC'. *Official Journal of the European Union* via *EUR-Lex*, L 140/16. Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32009L0028. [28.01.2022].

Directive 2009/EC/73, 14.08.2009. 'DIRECTIVE 2009/73/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC '. *Official Journal of the European Union*, L 211/94 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32009L0073. [28.01.2022].

39816 Upstream gas supplies in Central and Eastern Europe. First Memo: MEMO/2011/641, 27.09.2011. 'Antitrust: Commission confirms unannounced inspections in the natural gas sector'. Competition Policy. *Register of Commission Documents.* Available at: https://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=1_39816. [28.01.2022].

COM/2011/0658 final, 19.10.2011. 'Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52011PC0658. [28.01.2022].

COM(2013) 180 final, 27.03.2013. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on the Future of Carbon Capture and Storage in Europe'. *Register of Commission Documents.* Available at: https://ec.europa.eu/clima/document/download/6c3a4c2f-e4eb-4efa-a0ea-2998d9854664_en. [28.01.2022].

Regulation (EU) No. 347/2013, 17.04.2013. 'REGULATION (EU) No 347/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009'. *Official Journal of the European Union*, L 115/39 via *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex%3A32013R0347. [28.01.2022].

Regulation (EU) 1391/2013, 14.10.2013. 'COMMISSION DELEGATED REGULATION (EU) No 1391/2013 of 14 October 2013 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council on guidelines for trans-European energy infrastructure as regards the Union list of projects of common interest'. *Official Journal of the European Union* via *EUR-Lex*, L 349/28. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R1391. [28.01.2022].

C(2013) 7243 final, 05.11.2013. 'COMMUNICATION FROM THE COMMISSION Delivering the internal electricity market and making the most of public intervention'. *Register of Commission Documents.* Available at: https://ec.europa.eu/energy/sites/default/files/documents/com_2013_public_intervention_en.pdf. [28.01.2022].

COM(2014) 99, 25.02.2014. 'REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on the implementation of Directive 2009/31/EC on the geological storage of carbon dioxide'. *EUR-Lex.* Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0099. [28.01.2022].

COM(2014) 330 final, 28.05.2014. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL European Energy Security Strategy'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52014DC0330. [28.01.2022].

2014/C 200/01, 28.06.2014. 'COMMUNICATION FROM THE COMMISSION Guidelines on State aid for environmental protection and energy 2014-2020'. *Official Journal of the European Union* via *EUR-Lex*, C 200/1. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52014XC0628%2801%29. [28.01.2022].

C(2015) 2814 final, 29.04.2015. 'COMMISSION DECISION of 29.4.2015 initiating an inquiry on capacity mechanisms in the electricity sector pursuant to Article 20a of Council Regulation (EC) No 659/1999 of 22 March 1999'. *Register of Commission Documents.* Available at: https://ec.europa.eu/competition/sectors/energy/decision_on_sector_inquiry_en.pdf. [28.01.2022].

Regulation (EU) 2016/89, 18.11.2015. 'COMMISSION DELEGATED REGULATION (EU) 2016/89 of 18 November 2015 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest'. *Official Journal of the European Union* via *EUR-Lex*, L 19/1. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2016.019.01.0001.01.ENG. [28.01.2022].

COM(2016) 49 final, 16.02.2016. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on an EU strategy for liquefied natural gas and gas storage'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2016%3A49%3AFIN. [28.01.2022].

COM(2016) 52 final, 16.02.2016. 'Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010'. *Register of Commission Documents.* Available at: https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2016)52&lang=en. [28.01.2022].

COM(2016) 0752 final, 30.11.2016. 'REPORT FROM THE COMMISSION Final Report of the Sector Inquiry on Capacity Mechanisms'. *Publications Office of the European Union*. Available at: https://op.europa.eu/en/publication-detail/-/publication/1b732bbb-b6e4-11e6-9e3c-01aa75ed71a1. [28.01.2022].

COM(2016) 861 final/2, 23.02.2017. 'ANNEX to the PROPOSAL FOR A REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the internal market for electricity'. *Register of Commission Documents.* Available at:

https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2016)861&lang=en. [28.01.2022].

Regulation (EU) 2018/540, 23.11.2017. 'COMMISSION DELEGATED REGULATION (EU) 2018/540 of 23 November 2017 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest'. *Official Journal of the European Union* via *EUR-Lex*, L 90/38. Available at: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32018R0540. [28.01.2022].

COM (2018) 773 final, 28.11.2018. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK A Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018DC0773. [28.01.2022].

Regulation (EU) 2018/1999, 11.12.2018. 'REGULATION (EU) 2018/1999 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council '. *Official Journal of the European Union* via *EUR-Lex*, L 328/1. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?toc=OJ:L:2018:328:TOC&uri=uriserv:OJ.L_.2018.328.01.0001.01.ENG. [28.01.2022].

Renewable Energy Directive (EU) 2018/2001, 21.12.2018. 'DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the promotion of the use of energy from renewable sources'. *Official Journal of the European Union* via *EUR-Lex*, L 328/82. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG. [28.01.2022].

Directive 2009/31/EC, 23.04.2019. 'DIRECTIVE 2009/31/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006'. *Official Journal of the European Union* via *EUR-Lex*, L 140/114. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32009L0031. [28.01.2022].

COM(2019) 566 final, 31.10.2019. 'REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL on Implementation of Directive 2009/31/EC on the Geological Storage of Carbon Dioxide'. *Register of Commission Documents*. Available at: https://ec.europa.eu/clima/document/download/311e9e47-49f5-48d5-870a-f816d4a2d5bb_en. [28.01.2022].

Regulation (EU) 2019/7772, 31.10.2019. 'COMMISSION DELEGATED REGULATION (EU) …/... of 31.10.2019 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest {SWD(2019) EN 395 final}'. *Register of Commission Documents*. Available at:

https://ec.europa.eu/energy/sites/ener/files/c_2019_7772_1_commission_delegated_regulation.pdf. [28.01.2022].

Regulation (EU) 2020/389, 31.10.2019. 'COMMISSION DELEGATED REGULATION (EU) 2020/389 of 31 October 2019 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest'. *Official Journal of the European Union* via *EUR-Lex*, L 74/1. Available at: https://eur-lex.europa.eu/eli/reg_del/2020/389/oj. [28.01.2022].

COM(2020) 301 final, 08.07.2020. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A hydrogen strategy for a climate Neutral Europe'. *Register of Commission Documents.* Available at: https://ec.europa.eu/energy/sites/ener/files/hydrogen_strategy.pdf. [28.01.2022].

Chapter 8: Discussion (pages 202–217)

COM (2021) 550 final, 14.07.2021. 'COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2021:550:FIN. [28.01.2022].

COM(2021) 803 final, 21.12.2021. 'Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on common rules for the internal markets in renewable and natural gases and in hydrogen'. *EUR-Lex.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:803:FIN. [28.01.2022].

11 Annex 2: Interview questions

1. What role has the European Commission allocated to natural gas in its climate agenda?
    a. Has this role changed since the natural gas market's liberalisation in 1998?
2. Which policies have been influential in shaping natural gas' role in relation to climate change in the EU?
3. Does the Commission have tools other than policies at its disposal to shape natural gas' role?
4. What impact have the Commission's measures (policies and other means) had on the EU's natural gas markets?
5. How has your organisation's perception of natural gas changed over the past two decades?
6. Has your organisation changed the role allocated to natural gas since 1998?
7. Do your positions on natural gas' role in climate change action align with the Commission's?
8. Do your organisation's vested interests through natural gas infrastructure, for instance, influence strategies adopted in response to climate change?
9. Does natural gas consumption and reaching climate targets go hand-in-hand or are there contradictions in this pairing?
10. Do you think zero carbon modes (e.g. CCS or consumed as hydrogen) of natural gas consumption will proliferate?