



Mapping the financial and organizational interdependencies between the Dutch State and the fossil fuel industry

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Abstract

In this thesis I mapped the financial, and related organizational, interdependencies between the Dutch government and the fossil fuel industry. I used a transitions theory lens to assess the importance of these relations for, and their effect on, the Dutch energy transition. To do this I developed a practical framework based on the value chain of the fossil fuels oil, coal, and gas. The Dutch government, at the local, regional, and national level, was found to be heavily involved in the energy regime, having financial links with the industry throughout the chain. Most interdependencies were found in the production, trade, and transport phases of the gas value chain and the use phase of the gas and oil value chain. Finally, I reflected on the dynamics of these relationships, with as main conclusion that the Dutch government is facing a significant drop in fossil fuel related income, from around 18 percent of total revenues in 2013 to around 12 percent in 2015. As the energy transition advances, further revenue losses for the government can be expected. In the case of serious commitment by the government to further decarbonisation, and a connected drop in the use of fossil fuels, the Dutch government should prepare to replace these tax revenues and include such plans in its transition approach. Moreover, it could use the found financial linkages as a lever in the energy transition.

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Unit conversion

- Gas units are converted using the 'Gasunie Unit Converter'¹
- Electricity units are converted using the 'IEA Unit Converter'²

List of Abbreviations

Bcm – billion cubic meters (used to denote Nm³)
 CBM – coal bed methane
 CCUS – Carbon Capture, Utilization, and Storage
 CEPS – Central European Pipeline System
 DPO – Defensie Pijpleidingen organisatie (Military pipeline organization)
 DSO – Distribution System Operator
 EBN – Energie Beheer Nederland
 EBRD – European Bank for Reconstruction and Development
 EIB – European Investment Bank

¹ "Gasunie Unit Converter."

² IEA, "IEA - Unit Converter."

ET – Energy Transition
 ETP – Energy Transition Project
 GHG – Greenhouse Gas
 GTS – GasUnie Transport Services
 IEA – International Energy Agency
 IOC – International Oil Company
 Mcm – million cubic metre
 M kg – million kilograms
 MLP – Multi-level perspective
 Mt – Million Ton (metric)
 NATO – North Atlantic Treaty Organization
 NEA – Netherlands Energy Agreement
 NPM4 – Fourth Dutch National Environmental Policy Plan
 OECD – Organization for Economic Cooperation and Development
 Pj – Petajoule
 RE – Renewable Energy
 SOE – State owned enterprise
 Sm³ – Standard cubic metre
 SME's – Small and Medium-sized Enterprise
 TPES – Total Primary Energy Supply
 TKI – Topsector Kennis en Innovatie
 TSE – Topsector Energie
 TSO – Transport System Operator
 Twh – Terawatt-hour
 VAT – Value Added Tax

1 Introduction

1.1 Introduction

In 2016 the Netherlands signed the Paris Agreement and agreed to put in place measures to limit the rise of global temperatures to well below 2 degrees Celcius, and preferably increase efforts to limit temperature increase to 1.5 degrees. In the decades prior to the Paris Agreement the Netherlands committed to the United Nations Framework Convention on Climate Change, its extension the Kyoto protocol, and put in place a plethora of national agreements and plans to limit greenhouse gas (GHG) emissions of which the newest is the Netherlands Energy Agreement (NEA). On top of this, a landmark ruling by the Court of The Hague in 2015 in the 'Urgenda Climate case', arguing that the government has a duty of care, forced the government to adopt stricter GHG reduction goals³. Moreover, for a multiplicity of reasons, the Netherlands started as early as the 1960's and 1970's with something that could be called an 'energy transition'⁴. In the early 2000's, with the fourth National Environmental Policy Plan (NMP4), the government officially adopted a strategy of 'transition management' in order to transform the dominant energy regime and accelerate the uptake of renewable energy⁵.

Despite these strong commitments to curb GHG emissions, the Netherlands remains a fossil fuel and thus GHG emissions intensive economy, with over 90% of the total primary energy supply (TPES) coming from oil, coal, and gas⁶. The country is a producer and exporter of oil and gas, and functions as a major transport hub for other (European) countries supplying natural gas, coal, and refined petroleum products⁷. Moreover, the Netherlands has been a slow mover in the energy transition ranking third-last in the European Union when it comes to deployment of renewable energy⁸. In 2015 the share of renewable energy (RE) in the energy mix was around 6% and around 11% of the electricity mix⁹. Although new off-shore wind capacity is in the pipeline and the government aims to increase RE capacity in general, current policy puts the country on track for around 12.5 percent of RE in 2020 instead of the 14 percent set as goal under the NEA¹⁰.

Fossil fuels and related activities are not only important for the general economy and energy system but also for the Dutch State. In the past the national government has received a significant income from the production of natural gas and oil through, for example, dividends from State owned enterprises (SOE's), production concessions, VAT on electricity and fuel products, corporate tax, and environmental taxes¹¹. Also, the oil and gas reserves present a significant share of the total equity of the Dutch state, and a 2013 study estimated that energy intensive activities in general contributed around 50 billion annually to the national budget¹². On the other hand, the State, or state-owned enterprises, invest in infrastructure, R&D, and other projects related to fossil fuels. Moreover, past

³ Urgenda, "Climate Case - Urgenda - Samen Sneller Duurzaam."

⁴ Verbong and Geels, "The Ongoing Energy Transition."

⁵ Verbong and Loorbach, *Governing the Energy Transition*, 221 & 222.

⁶ World Resources Institute, "CAIT."

⁷ IEA, "The Netherlands 2014 Review."

⁸ Eurostat, "Energy from Renewable Sources - Statistics Explained."

⁹ CBS Statline, "CBS StatLine - Hernieuwbare Energie; Verbruik Naar Energiebron, Techniek En Toepassing"; CBS Statline, "CBS StatLine - Hernieuwbare Elektriciteit; Productie En Vermogen."

¹⁰ ECN et al., "Nationale Energie Verkenning 2016," 12.

¹¹ Van Rossum and Swertz, "De Nederlandse aardgaswinning."

¹² CBS, "Waardevermindering gasreserve maakt overheid armer"; Weterings et al., "Towards a future proof energy system for the Netherlands/Naar een toekomstbestendig energiesysteem voor Nederland."

estimates of annual subsidies on the consumption of fossil fuels in the Netherlands have been as high as 4.4 billion and subsidies on the production of energy from fossil fuels and nuclear at 1.2 billion¹³. Although these numbers have been contested they provide strong evidence that, at least in the past, there were considerable financial relations between the government and the fossil fuel industry in the Netherlands.

Within transitions literature, which provides the theoretical backdrop to this thesis (see chapter 2), this laggard position of the Netherlands when it comes to the energy transition has been attributed to the strong position of fossil fuels, and the power of incumbents, in the energy system¹⁴. Moreover, in addition to the existence of a strong fossil based energy regime¹⁵ there is also evidence that the Dutch government, or part of it, exhibits incumbent behavior: protecting the status quo in the energy system¹⁶. In the past, the Dutch government has taken up an active role in the energy regime. For example, by taking on a leading role in the introduction of gas and nuclear into the energy mix¹⁷. However, at the same time as being an active part of the energy regime, governments also have a leading role in enacting policy measures to reach sustainability goals and provide input for the regime to change¹⁸. Direction from government through policy is needed because sustainability transitions serve a collective, in some cases long-term good, e.g. that of averting dangerous climate change, which means that individual actors in the system have little incentive to change their ways without policy direction¹⁹.

There is thus an inherent friction between the two ‘roles’ of the government in the energy transition, on the one hand the government is part of the fossil based regime and has contributed to its build up through policy and regulation, yet on the other hand it needs to initiate a transition away from this system. Here, it should of course be added that the government cannot be seen as single entity but is an organization with its own internal dynamics and with departments having different roles and positions, with, for example, possibly conflicting policy goals or visions regarding the energy system²⁰. This view of a conflicting position for the government, and the role of power, politics, and interests in this respect, is increasingly being incorporated into energy transition studies²¹. For example, based on insights from political economy, it has been found that policy makers and industry can form an unconscious ‘alliance’ aimed at protecting the status quo²². For the fossil fuel industry this can be captured by the concept of a ‘fossil fuel historical bloc’, an implicit cooperation between the fossil fuel

¹³ de Visser et al., “Overheidsingrepen in de Energiemarkt: Onderzoek Naar Het Nederlandse Speelveld Voor Fossiele Brandstoffen, Hernieuwbare Bronnen, Kernenergie En Energiebesparing.”

¹⁴ Bosman et al., “Discursive Regime Dynamics in the Dutch Energy Transition,” 2; Kern and Smith, “Restructuring Energy Systems for Sustainability?”; Verbong and Loorbach, *Governing the Energy Transition*, 233.

¹⁵ In transition studies the incumbents, in this case the fossil fuel industry, and other key actors such as the government, together with established practices and rules, make up a socio-technical regime. When applied to the energy sector this is called an ‘energy regime’. See chapter 2.1

¹⁶ Bosman et al., “Discursive Regime Dynamics in the Dutch Energy Transition”; Verbong and Loorbach, *Governing the Energy Transition*, 220–21.

¹⁷ Verbong and Geels, “The Ongoing Energy Transition,” 1027.

¹⁸ Geels, “The Multi-Level Perspective on Sustainability Transitions”; Verbong and Loorbach, *Governing the Energy Transition*; van den Bergh, “Policies to Enhance Economic Feasibility of a Sustainable Energy Transition”; Meadowcroft, “What about the Politics?”; Rotmans, Kemp, and Van Asselt, “More Evolution than Revolution.”

¹⁹ Geels, “The Multi-Level Perspective on Sustainability Transitions”; Markard, Raven, and Truffer, “Sustainability Transitions.”

²⁰ Bosman et al., “Discursive Regime Dynamics in the Dutch Energy Transition.”

²¹ Baker, Newell, and Phillips, “The Political Economy of Energy Transitions”; Smink, “Incumbents and Institutions in Sustainability Transitions”; Moe, “Energy, Industry and Politics”; Moe, *Renewable Energy Transformation or Fossil Fuel Backlash: Vested Interests in the Political Economy*; Van de Graaf et al., *The Palgrave Handbook of the International Political Economy of Energy*; Avelino and Wittmayer, “Shifting Power Relations in Sustainability Transitions.”

²² Geels, “Regime Resistance against Low-Carbon Transitions.”

corporations, trade bodies, and government based on existing, underlying, interdependencies; e.g. governments need fossil fuel producers to develop their resources while producers need governments to gain access to these resources²³. It has been argued that such dynamics might be at play in the Netherlands²⁴.

Given the slow development of the energy transition in the Netherlands, the importance of fossil fuels in the Dutch economy, and possible evidence of incumbent behavior of (parts of) the government, the following questions arise: might there be a ‘fossil fuel historical bloc’ in the Netherlands? And if so, what is the extent of such interdependencies between industry and government, and what is its effect on the energy transition in the Netherlands? Although it has been argued that the national government has no incentive to push for a rapid energy transition due to its large stakes in the fossil based energy regime, both financially and politically, and some empirical research supports this claim, these financial relations have not been studied in detail²⁵. This leads this thesis to undertake a structural mapping exercise of where, and to what extent, such financial relations between the government and the fossil fuel industry can be found.

1.2 Hypothesis and research question

This leads to the starting hypothesis of this thesis, namely: *the historical and continued (perceived) financial interdependencies between the fossil fuel industry and the government, have the effect of slowing the energy transition in the Netherlands.*

A first attempt, however, to test this hypothesis would be to explore the extent of the mutual dependencies that are supposed to underly an implicit ‘alliance’ between the government and industry. Thus, before being able to test the above posed hypothesis this thesis would need to test another, more simple, hypothesis: *“interdependencies between the Dutch government and the fossil fuel industry exist”*.

In order to test this hypothesis this thesis asks the following research question: *what financial interdependencies exist between the Dutch Government and the fossil fuel industry in the Netherlands?*

1.3 Research objective

The objective of this research is twofold (1) to structurally map the financial interdependencies between the government and the fossil fuel industry in the Netherlands and (2) in order to do this develop a practical research framework for the step-wise analysis of such interdependencies.

1.4 The need for a practical framework

In order to answer the research question, this thesis will use the extent of financial flows between government and industry to depict these interdependencies. Financial flows, the exchange of money between two entities, are used because they allow for a quantification of the dependency, and its (relative) importance. Different frameworks to guide research in the relations between government and industry exist. However, to the author’s knowledge, no framework to structurally map financial

²³ Phelan, Henderson-Sellers, and Taplin, “The Political Economy of Addressing the Climate Crisis in the Earth System”; Geels, “Regime Resistance against Low-Carbon Transitions.”

²⁴ Verbong and Loorbach, *Governing the Energy Transition*, 243.

²⁵ Ibid.

flows between the government and industry, and specifically aimed at the fossil fuel industry, exists. There is, however, a need for a structured guide to support the research process of this thesis and report on the process and results in a systematic manner that enables repetition.

The framework to be developed by this thesis has as goal to provide more insight in the financial flows between the fossil fuel industry and the government. This would be achieved if it fulfils the following criteria: (1) it provides an overview of the different stages in the supply chain where such relations can exist; (2) it explores the different types of relations that can exist and equips the research with some of the tools to locate them; (3) it provides an overview of their magnitude and relative size, for example in relation to government or company revenue; (4) it brings to light (financial) linkages to be studied more closely.

1.5 Chapter structure

This thesis will be structured as follows, chapter 2 sets out the theoretical framework used in this thesis. Chapter 3 discusses the methodology and data used and develops the practical framework. Chapters 4 until 9 are structured according to the stages of the framework, as developed in chapter 3, which is: chapter 4. Initial Scoping; chapter 5. Production and Exploration; chapter 6. Transport and Storage; chapter 7. Sales and Distribution; chapter 8. Use; and chapter 9. R&D. Chapter 10 presents a summary of the results, discusses the effects of the found interdependencies, analyzes the possible barriers to the transition posed by these relationships, and identifies how the found interdependencies be used in a productive manner to accelerate the energy transition in the Netherlands.

2 Theoretical Framework

2.1 Transitions literature and the MLP

This thesis makes use of two key frameworks from transition studies, the multi-level perspective (MLP), and the concept of the ‘energy transition’ and its governance. The MLP was developed to explain the dynamics of technological transitions that societies undergo. It sees society as a “nested hierarchy” of multiple-levels: *niches*, *regimes*, and the *landscape*²⁶. New technologies emerge in protected niches and attempt to enter, from the bottom up, into the existing regime of technologies and actors, governed by a “semi-coherent set of rules”. These three dimensions combined form a socio-technical regime. On the other hand, top-down, the regimes are influenced by developments at the landscape level, the “deep structural trends” in society that change through time²⁷.

Applied to the energy sector such a socio-technical regime is called an ‘energy regime’. The energy regime consists of a network of actors and social groups, such as the government, the incumbent fossil based energy suppliers, and users of energy, combined with established practices and rules that guide the activities of these actors, e.g. laws, regulations, and societal norms, and the material and technical elements such as the electricity grid or powerplants²⁸. These entities and the structural relations between them thus make up the energy regime. Regimes have a large historical aspect, are path dependent, and characterized by a degree of lock-in. On the three dimensions, this is caused by the

²⁶ Verbong and Loorbach, *Governing the Energy Transition*, 220–21; Bosman et al., “Discursive Regime Dynamics in the Dutch Energy Transition.”

²⁷ Geels, “Technological Transitions as Evolutionary Reconfiguration Processes,” 1261.

²⁸ Verbong and Geels, “The Ongoing Energy Transition,” 1026.

fact that incumbents have vested interests in the status quo and social capital has been built up around this status quo; the 'rules' have a stabilizing effect and habit behavior might block-off actors sensitivity to other ways of doing; and existing investments in technology, and connected sunk costs, and the complementary nature of these technologies, stabilizes existing infrastructure²⁹. All in all, the energy regime thus refers to the dominant structure, institutions, practices, paradigms, and economics that govern how the function energy, and the required technology, is provided to society³⁰.

In transitions literature the 'energy transition' is seen as a non-linear shift in regimes, going from the current centralized fossil fuel based system with large energy consumption to an alternative system³¹. One of the options for such a new system would be a system, largely, based on (de-centralized) renewable energy. This shift in regimes can be described using the multi-phase concept. Transitions follow an S-shaped pathway, moving from the predevelopment phase, where the regime is stable but has problems with adapting to niche and landscape level changes, through a reconfiguration or acceleration phase leading to a new dominant regime, which includes the niche and landscape developments, in the stabilization phase. This involves the challenging of incumbents by new entrants, the development of new technologies, or exogenous (landscape level) shocks. The governance of energy transitions is then concerned with managing this process by attempting to break through the path dependency and lock-in of the energy regime and accelerating the emergence of a new, dominant, sustainable energy regime³². The deconstruction of the incumbent fossil fuel based energy regime can be depicted by an inversed S-pathway moving from optimisation of the current system, through destabilization, and breakdown to a phase-out. Combined these two lines form the so called 'X-curve' that describes transition patterns³³ (see Appendix 1). The transition, as described above, has a type of autonomous dynamic between the regime players attempting to optimize and expand the existing system while alternatives continue to grow, leading to tensions in the system.

A transition is thus not only concerned with the build-up of a new system but also with the (partial) breakdown of the status quo. An important mechanism in this respect is the destabilization of the current regime and related existing industries. Main determinants of destabilization are a reduction in available resources, declining public acceptance, or a disintegration of commitment to the regime by its main actors³⁴. However, although it is likely that existing structures, interests, and routines will be broken down, atleast in part, during a transition, incumbent regime actors do not necessarily resist the energy transition but can also be a source of change, albeit often in an incremental and structure preserving manner³⁵.

Through the initiation of the Energy Transition Project (ETP), under the NMP4 introduced above, the Dutch government attempted to steer the energy regime and initiate the transition by establishing stakeholder platforms. Although this project successfully integrated energy transition goals into government policy it failed to bring about a fundamental shift in energy policy³⁶. Partial to this failure was cooptment by regime players and, related to this, the lack of radical policy alternatives. Such drastic alternatives are needed to provide a way out of the prevailing modes of thinking and policy making; i.e. to move away from the 'way of' policy making that established the current regime³⁷.

²⁹ Ibid.

³⁰ Verbong and Loorbach, *Governing the Energy Transition*, 9.

³¹ Ibid., 319.

³² Ibid., 10.

³³ Loorbach, "To Transition! Governance Penarchy in the New Transformation."

³⁴ Turnheim and Geels, "Regime Destabilisation as the Flipside of Energy Transitions," 36.

³⁵ Verbong and Loorbach, *Governing the Energy Transition*, 320 & 321.

³⁶ Ibid., 233.

³⁷ Smink, "Incumbents and Institutions in Sustainability Transitions"; Verbong and Loorbach, *Governing the Energy Transition*, 234.

Previous experience has however showed that just a bold move by the government or the market is not enough actors from all levels need to be included in the process to gradually build a shared-understanding of what the energy transition should look like³⁸. Some of these, for example, the incumbents, will only move along slowly, trying to protect their investments in the fossil based regime, but, on the other hand, have large institutional, political, and financial power that could aid in mainstreaming new energy innovations. The government must thus find a balance between including regime actors and innovative front-runners. However, as the case of the Netherlands illustrates, a government, and connected actors, with the ambition to change the system is not enough, with significant barriers standing in the way of realizing such ambitions. Disruptions to the system, for example external shocks such as low oil and gas prices, or production related earthquakes, provide the opportunity overcome such barriers and thus provide an opportunity to accelerate the transition.

These barriers can be of a technical, political, cultural, or economic nature. Within the scope of this thesis it is relevant to note that financial interdependencies that might function as a barrier to ET also have an institutional form. Connected to the financial flows there are networks of people, routines, implicit rules, and built up beliefs. These further add to the stability of the interdependency and underscore the need for a shock to the system to break through ET barriers.

In terms of the theories set out above this thesis is thus concerned mostly with the structural aspects of the energy regime. Instead of looking at the actors or the discourse in the regime it looks at the financial relationships that underly the regime and tie together the different actors, government and industry.

2.2 Research justification

Traditionally research on energy transitions, and energy regimes in specific, has focused mainly on the historical transformations that energy systems have gone through³⁹ or on the actors and the discourse in the regime⁴⁰. Although the importance of the structural aspects in steering the energy regime, embeddedness, lock-in, and path-dependency, have been clearly shown, there is limited research on what such structural aspects of the regime, and the economic and financial aspects of structures in specific, look like. In mapping economic interdependencies in detail for the Dutch energy regime, looking at where and how financial streams occur, and what their strength is, this thesis hopes to contribute to filling this gap. In addition, as mentioned in the introduction, in doing this this thesis hopes to add to the existing evidence of strong government- fossil fuel industry relations in the Netherlands. The scientific contribution of this thesis thus lies not so much in advancing theory on energy regimes and the energy transition but rather on presenting an empirical study of the economic relations that hold together the regime with as goal to see how these interdependencies might impact the ability of the system to undergo a transition.

2.3 Frameworks for sector analysis

In order to test the hypothesis laid out in section 1.2 an operationalization of the theoretical framework is needed. This thesis will attempt to do this through the development of a framework for the analysis of government and fossil fuel industry interdependencies. A good source of inspiration for this are the sector and country level political economy approaches and frameworks found in the

³⁸ Verbong and Loorbach, *Governing the Energy Transition*, 237.

³⁹ Verbong and Loorbach, *Governing the Energy Transition*; Turnheim and Geels, "Regime Destabilisation as the Flipside of Energy Transitions"; Verbong and Geels, "The Ongoing Energy Transition"; Rip and Kemp, "Technological Change"; etc. .

⁴⁰ Bosman et al., "Discursive Regime Dynamics in the Dutch Energy Transition"; Verbong and Loorbach, *Governing the Energy Transition*.

realm of development cooperation⁴¹. Although these frameworks are designed for use within the area of developmental cooperation, and take a political economy lens, they do provide valuable insights on how to structurally map a sector.

However, to my knowledge none of these frameworks are geared specifically to researching the fossil fuel sector. Moreover, since this thesis will not look at the entire sector, which includes a variety of actors, but is only interested in the industry and governmental actors, it will be required to deviate from these frameworks.

An example of such a framework, which will be the starting point for the development of the framework for the analysis of the fossil fuel industry, is the “analytical framework for understanding the political economy of sectors and policy arenas” by Moncrieffe and Luttrell (2005). By combining methods from economics, sociology, and political science political economy tries to understand how a policy program is managed and performs and comprehend the relationships between social institutions, economical processes, and politics⁴². This specific framework has multiple aims including: to understand how and why sectors differ between countries; to support the (comparative) analysis of sectors and the relations between national and sub-national levels within a sector; to analyze how actors work within different institutional contexts and how they affect policy making⁴³. See Appendix 2 for an overview. Chapter 3 will explain in more detail how the operational framework will be developed and how the Moncrieffe and Luttrell framework is used as a point of departure.

3 Methods & Data: building a government-industry relations framework

3.1 Framework for the analysis of the fossil fuel sector and government relations

In order to operationalize the theoretical framework of transitions theory, and the notion of an energy regime in specific and study the posed hypothesis this thesis develops a step-wise framework for the analysis of the financial interdependencies between the government and the fossil fuel industry. This is done by combining insights from a schematic representation of the fossil fuel supply chains with the way in which the frameworks for sectoral analysis by Moncrieffe and Luttrell (2005) approach and structure such an analysis. For this thesis the relevance of this framework is not so much what the aims of the framework are, and what questions they ask in reaching them, but more how they operationalize their research questions using the framework; i.e. what practical steps are involved in performing the study of a sectoral analysis.

Divided into three stages they guide researchers in doing a political analysis of a sector by providing distinct steps and relevant themes and subsequent questions to be answered (Appendix 2). Within each stage or sub-stage topics and questions that could be of relevance for each topic are presented using textboxes in the form of tables. In addition, it provides guidance on methodological considerations, for example on the available research time, and desired depth of the study, and possible data sources.

⁴¹ For an overview see: Edelmann, *Analysing and Managing the Political Dynamics of Sector Reforms*.

⁴² Moncrieffe and Luttrell, “An Analytical Framework for Understanding the Political Economy of Sectors and Policy Arenas,” 3.

⁴³ Ibid.

This thesis will take a similar set-up as a method to document the research process which will result in a framework for the analysis of government and fossil fuel industry relations. The framework will be developed step-wise during the research process; going back and forth between the data and the framework. While looking at the empirical data questions will be developed that help guide the research in the right direction, using the fossil fuel value chain as a guideline.

3.2 Aim of the framework

The aim of the framework is to present a guideline to researchers in analyzing the interdependencies between the government and the fossil fuel industry in an area of study and reporting on those relations in a structured way. It is not of a prescriptive nature; rather it presents questions that were found useful in analyzing these relations within the Dutch context. Although it will be attempted to make the framework applicable to different areas of study it will, inevitably, be geared more towards the issues at hand in a 'rich' country and the particularities of the Dutch fossil industry. This framework does not claim to be able to present an exhaustive overview but rather aims to identify the different ways in which government can be (financially) related to industry and vice versa.

3.3 Presentation of the framework

The framework will make use of the way in which Moncrieffe and Lutrell (2005) present their framework using tables and textboxes with questions grouped according to the topic they address. In light of the aim of this thesis to present a guideline to researchers, tables with questions grouped according to topic and research stage will be presented for each chapter, based on the blocks in the value chain (see 3.5).

3.4 Overview of the framework

This section provides an overview of the framework by (1) defining the boundaries of the research object, (2) surveying the fossil fuel value chains, and (3) setting out the different stages of the framework, which the chapter division of this thesis will follow. In addition, (4) an overview of possible data sources will be given. The text boxes can be found in the appendix.

3.4.1 Defining the research object boundaries

Since a sector or an industry is not a pre-defined static entity it is necessary to start with determining the boundaries of the industry/sector to be researched. This thesis focuses on the corporate actors active in the value chain of fossil fuels. Since this could be seen as a sub-set of the energy sector it will be referred to as the 'fossil fuel industry' and not the 'fossil fuel sector'. The 'fossil fuel industry' and the 'fossil industry' can be taken as a synonym when used in this thesis.

Table 1 Research object boundaries: The fossil fuel industry

Defining the boundaries of the fossil fuel industry
Fossil fuel industry: the fossil fuel industry is taken to include all the (corporate) entities involved in one of the building blocks of the fossil fuel chain (see section 3.2.3.3).
Comment
Although users are involved in the fossil fuel chain this group is often too large to study by looking at individual actors. Therefore, it might be that these have to be analysed in aggregate; e.g. identifying total consumer or industry subsidies on fossil fuels.

Table 2 Research object boundaries: The Government

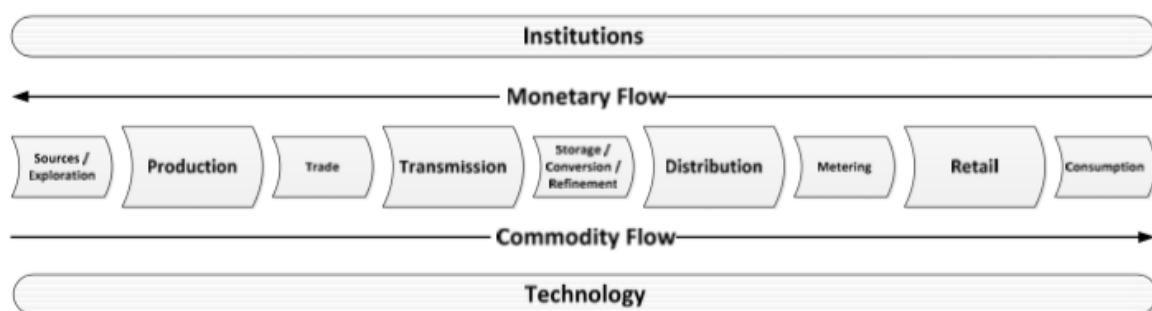
Defining the boundaries of the 'government'
Government: This thesis takes government to include all levels of government within the Netherlands from the local to the national level. This includes subsidiaries (state-owned enterprises) and other public bodies.
Comment
Public institutions at the European and International level will not be included as a research object. However, for reasons of completeness and to provide input for future research, it will be mentioned if a financial relationship with such an institution is found.

3.4.2 The fossil fuel value chains

The basis for the classification of the fossil fuel industry part of the framework is the energy value chain, and, more specifically, the coal, oil, and gas value chains. They provide a systematic overview of all activities within the fossil fuel industry and each link in the chain provides a good reference point for possible relations with government. At each step value is added to the product, this means that there will be a financial flow; i.e. either the company delivering the product wants to harness some of this added value, and/or the government wants to capture a part of the added value. For example, companies try to capture rent from the extraction of state-owned, or controlled, minerals and governments try to capture added value through tax⁴⁴. This makes it likely that at these points a financial relationship emerges between the government and industry.

3.4.2.1 Energy value chain

Scholten and Kunneke (2016) provide a schematic overview of how energy infrastructures can be reimagined as socio-technical systems in which they combine the engineering and economic dimension of energy infrastructure (Figure 1). Their schematic provides a good starting point for classifying the energy system into different segments in which government-industry relations could occur. They distinguish (1) sources and exploration, (2) production, (3) trade, (4) Transmissions, (5) storage, conversion, refinement, (6) distribution, (7) metering, (8) Retail, and (9) Consumption. Combining these with the specifics of the fossil fuel value chains a denser set of segments can be created.

Figure 1 Energy infrastructure STS⁴⁵

⁴⁴ Tordo, *National Oil Companies and Value Creation*, 5–11.

⁴⁵ Scholten and Künneke, "Towards the Comprehensive Design of Energy Infrastructures."

3.4.2.2 *The coal value chain*

Although the coal value chain is not always classified in the same manner it is roughly made up of the following three chains: exploration and production, transport, and use. As an example, Appendix 3 summarizes the steps in the coal supply chain according to the South African National Energy Development Institute (SANEDI). Each stage could be further specified by including, for example, all the specific activities undertaken during the exploration or mining phase. However, since this framework aims at identifying interlinkages between corporations and government, and corporations usually oversee multiple activities, a broader grouping of activities suffices. This should however be reviewed during the research process. It might be that a specific break out of activities could be helpful in identifying corporations in the chain. Appendix 4 presents another view on the coal supply chain and includes the chains 'inputs', 'Production', 'Transport', and 'End Market'. Combining these two views of the coal value chain the following four segments emerge: production and exploration, transport, storage, consumption.

3.4.2.3 *The oil and gas value chain*

The value chain for petroleum products can be divided into an upstream, midstream, and downstream segment. Production and exploration (E&P) make up the upstream section, transport and storage midstream, and processing, distribution, and sales downstream⁴⁶. Within each segment a variety of companies is active. In the value chain E&P companies require a variety of auxiliary companies to perform services such as seismic surveys, drilling, and supplying equipment. While transmission companies operate in the midstream, and distribution companies in the downstream⁴⁷. If a country has larger endowments of oil and gas to extract, there will be more activity in the upstream section and likely more 'horizontal consolidation'; i.e. one company controls a larger share of the resource extraction market. The same goes for the midstream and downstream markets, depending on the market size in those segments⁴⁸.

As can be seen in Appendix 5 the oil and gas value chains follow roughly the same pattern as the coal value chain: Exploration and production, Transport and Storage, Processing and Refining, Marketing and distribution.

3.4.3 *Other approaches to the analysis of the fossil fuel industry*

In addition to the fossil fuel value chains other studies on the industry can provide valuable information on possible ways to structure an analysis of the industry. Here I list two studies that are relevant to the Dutch situation, the 2014 country study of the Netherlands by the International Energy Agency (IEA)⁴⁹, and the 2016 annual report on oil and gas production by Energie Beheer Nederland (EBN)⁵⁰. In addition, the 2009 study by Alba and March, although directed to resource rich developing countries and not designed solely for the fossil fuel value chains, provides more insight on the revenue side of the value chain. It focusses on revenue management, transparency, and accountability⁵¹. Such studies are also a good source of data, especially for the scoping stage (see 3.5.8).

The 2014 IEA study is a good starting point for analysing the fossil fuel industry since it gives a complete breakdown of all activities taking place in the Netherlands. Also it includes topics that are not

⁴⁶ Wolf, "The Petroleum Sector Value Chain," 7.

⁴⁷ Weijermars, "Value Chain Analysis of the Natural Gas Industry," 87; Wolf, "The Petroleum Sector Value Chain," 7.

⁴⁸ Wolf, "The Petroleum Sector Value Chain," 7.

⁴⁹ IEA, "The Netherlands 2014 Review."

⁵⁰ Energie Beheer Nederland (EBN), "Focus on Dutch Oil & Gas 2016."

⁵¹ Alba and March, "Extractive Industries Value Chain."

necessarily related to the physical processes involved such as markets and pricing, taxation, and energy policies and relevant institutions⁵². See Appendix 6

EBN (Energie Beheer Nederland) divides its yearly overview of oil and gas production in the Netherlands using the following chapter headlines: Exploration; Production, Reserves, and Resources; Infrastructure; Decommissioning; Research and Innovation. This gives a more detailed breakdown of the different stages within exploration and production and could be of help in analysing this stage of the chain.

Alba and March, with a focus on management of the chain, depict the extractives industries value chain as follows: award of contracts and licenses; regulation and monitoring of operations; collection of taxes and royalties; revenue management and allocation; implementation of sustainable development policies and projects⁵³.

Although only a small sample of the ways in which a sectoral overview of the oil and gas industry could be structured these three studies provide more insight in the different aspects of the sector that are of importance.

3.4.4 Blocks in the fossil fuel chain

Combining the three value chains, and taking in the energy infrastructure STS (Figure 1, leads to the following ‘blocks’ in the fossil fuel chain: exploration and production, transport and storage, processing and refining, sales and distribution, Use, and R&D (see Table 3). Although storage is grouped together with processing and refining in the energy infrastructure STS it has been decided to merge this with transport since, for gas, these activities are usually handled by the transport company (GTS), and for oil, since it takes place in the same geographic location as transport (ports). This division does not imply that these activities necessarily happen in this order, for example, as can be seen in Appendix 5, transport takes place at several points within the value chain. This division groups together the different activities that take place in each step of the chain. It will need to be evaluated throughout the research whether this division works and whether blocks should be added or removed.

Table 3 Blocks in the fossil fuel value chain

Government- Industry relation blocks in the fossil fuel chain
<i>Exploration and Production</i>
<i>Transport and Storage</i>
<i>Processing and Refining</i>
<i>Sales and distribution</i>
<i>Use</i>
<i>Research and Development (R&D)</i>

3.4.5 Stages in the framework

The chapters in this thesis will be structured according to the above mentioned blocks in the fossil fuel chain. For reasons of clarity, and due to the small differences that exist in the chain between the fuels each chapter will contain a sub-chapter for each of the three fuels. In addition, topic specific sub-chapters have been added. A sub-chapter on ports has been added to the ‘transport and storage’

⁵² IEA, “The Netherlands 2014 Review.”

⁵³ Alba and March, “Extractive Industries Value Chain,” 3.

chapter due to the high importance of the import and export of fossil fuels in the Netherlands⁵⁴. Moreover, since each fuel is in some form imported or exported through ports, for example, the Port of Rotterdam imports oil, coal, and LNG⁵⁵, it makes sense to study these movements at once instead of separated over three sub-chapters. Similarly, a sub-chapter on electricity will be added to the 'Use' chapter since power plant operators in the Netherlands usually operate both coal and gas plants, making it impractical to discuss this in separate sub-chapters.

Due to the high degree of horizontal concentration and vertical integration – due to economies of scale and reduction of transaction costs - in the oil and gas sector the same companies will probably be found to be active in different parts of the chain⁵⁶. This could provide grounds, together with the results from the scoping stage, to merge certain sub-chapters if this represents more accurately the situation in the country of study; for example, those on oil and gas production. Due to the interconnections within the value chain the activities in stages will inextricably be linked, and might sometimes difficult to disentangle and place within a certain stage. In this framework it has been attempted to group activities based on how close they lie to that specific stage. In addition, activities might be discussed in a certain stage due to pragmatic reasons, for example, the use of road fuels is part of the 'use' stage, but a result of distribution through petrol stations, which falls in the 'sales and distribution' stage. However, discussing the distribution of road fuels, e.g. volumes, revenue, also means discussing the use of these fuels. In addition, data concerning an activity falling in a different stage may be discovered while studying another stage. For example, looking at bunker fuels in the 'sales and distribution' stage led to the discovery of excise tax exemptions for this fuel class. However, since this is a tax paid by final users it belongs in the 'use' stage. This interconnectedness also means that stages need not necessarily be research in the given order. For example, thinking about where refining and processing occurs, can help identify possible transport links. In an attempt to pre-empt this the initial scoping stage has been added to inform the later stages.

3.5 Core questions for the analysis of government- fossil industry relations

This section sets out the questions that were developed to guide the research on a stage by stage basis. Since each stage makes up a chapter both terms can be used interchangeably. The questions in the different stages are of a repetitive nature, following a similar pattern, and, depending on the characteristics of that specific stage and/or fuel, can be the same for different stages/fuels. For reasons of readability the actual topics and questions can be found in the appendix.

3.5.1 Initial scoping

The first stage in the framework exists of a brief survey of the energy sector and provides insight in the role of energy in the economy, and in localizing where and how streams of fossil fuels 'move' through the economy. The goal of this stage is to inform the later stages by providing a starting point for the research. This stage could be shortened or lengthened depending on the amount of research already available on the situation in the area of study. Therefore, it is important to include a brief overview of existing analyses of the fossil fuel industry and the energy sector in your country of study. The textbox below presents some of the topics and related questions that could be used in this stage. Depending on the findings during the scoping stage the later stages of the research can be refocused. See Appendix 7 for an overview of the core questions.

⁵⁴ IEA, "The Netherlands 2014 Review," 18.

⁵⁵ Port of Rotterdam, "Port of Rotterdam: Annual Report 2015."

⁵⁶ Tordo, *National Oil Companies and Value Creation*, 3.

3.5.2 Production and exploration

The questions in this stage are aimed at analysing the exploration and production segment of the fossil fuel chain. They have been designed to get a clear picture of the size of the production segment, ownership structures, entities involved, and the financial streams between the government and the producers. In doing this it intends to show where and how interdependencies between the two can emerge. See Appendix 8 for an overview of the core questions

3.5.3 Transport and storage

The transport and storage section analyses port authorities and the transport and storage of coal, oil, and gas. It looks at coal shipping by waterways, road, and rail, oil and gas transport through pipelines, and the storage of these fuels in terminals, tanks, and underground storages. In addition, it takes a closer look at the activities of the SOE 'Gasunie', which owns the large distance gas transmission network. See Appendix 9 for an overview of the core questions

3.5.4 Processing and Refining core questions

Due to the limited size of this stage in the Netherlands, and the similarity between fuels, oil and gas have the same core questions. Coal is not discussed since coal transformation activities are limited and completely privatized. The topics/questions used for oil and gas processing could also be used to study coal processing. See Appendix 10 for an overview of the core questions.

3.5.5 Sales and distribution core questions

The sales and distribution chapter explores how coal, oil, and gas is distributed and traded through local and regional transport networks, wholesalers, retailers, and exchanges. Use Given the difficulty of looking at different fuels individually in the use stage, for example, because taxes apply to different fuels, or uses such as electricity generation are not limited to a single fuel, this stage is not organized according to the division coal, oil, and gas. Instead it has been opted to analyze the interdependencies of this stage by looking at the production of electricity, tax income from and expenditure on the use of fossil fuels, and government participations with fossil fuel use related activities. See Appendix 11 for an overview of the core questions

3.5.6 Use

See Appendix 12 for an overview of the core questions for the use section.

3.5.7 R&D

The R&D chapter looks at research and development activities for fossil fuels as a group. Specifically, it looks at government support for these activities through policy, direct and indirect support or subsidy measures, government funded R&D organizations, and the R&D activities of SOE's. See appendix Appendix 13.

3.5.8 Data sources

For an overview of data sources used see Appendix 14

4 Initial scoping

The goal of the initial scoping stage is twofold (1) to provide an overview of the role of energy in the economy of the area of study to get a rough picture of where government industry interdependencies could occur (2) a first insight in the involvement of the government in the energy regime. The role of energy in the economy is analysed by looking at energy flows (section 4.1), the trade of fossil fuels (section 4.2), energy and economic indicators (section 4.3), and through previous analyses of the Dutch energy system. The role of the government in the energy regime is assessed by looking at tax revenue from energy related activities, government participations, energy/fossil fuel policies specific to the Dutch situation, and other government activities that have a relation to fossil fuels.

The second goal was added to the initial scoping stage after it appeared to be difficult to study this relationship when approaching the relationship from the fossil fuel value chain, as is done in stages 5-9. Although many of the governments participations in fossil fuel related companies are discussed in those chapters, the initial scoping stage aided in identifying these companies by looking from the perspective of the government; i.e. by taking the government as a point of departure instead of the fossil fuel supply chain.

4.1 Energy Flows

This section uses a Sankey diagram of the Netherlands⁵⁷ and 2015 data from CBS, the Central Bureau for Statistics, to analyze how energy flows through the Dutch economy. Looking at the Sankey diagrams from 1973 to 2014 it becomes apparent that the Netherlands is a producer of oil and gas, and a big importer and exporter of oil, oil products, and coal⁵⁸. In addition, types of uses stay relatively constant, but quantities increase drastically. Almost all of the crude oil imported is refined and then exported, and most of the imported oil products are re-exported. In addition, around 50 to 60 percent of the gas production is exported and most imported coal is exported again. This makes the Netherlands, in 2015, the world's 7th largest coal exporter (36.2 Mt) and the world 6th largest coal importer (56.8 Mt)⁵⁹ according to the IEA⁶⁰. Going back to the Sankey diagram, of the gas that was not exported in 2014 390Pj was used for power plants and the remaining 815Pj for other uses, of which the biggest are residential heating and cooking (268Pj) and industry (190Pj), with most going to the chemical and petrochemical industry (66.5Pj). The biggest domestic users of oil are the transport sector (408Pj) and non-energy uses in industry (498Pj). Oil export accounted for 4220 Pj and Bunkers for 679Pj.

Figure 2 shows the development of fossil fuel supply⁶¹, production, imports and exports between 2000 and 2015. This reveals that although overall production and supply are declining, with an especially steep decline in gas production, imports and exports are increasing. Also it shows that coal is destined

⁵⁷ See Appendix 2, or for an interactive version: <http://www.iea.org/sankey/#?c=Netherlands&s=Balance>

⁵⁸ Although oil, coal, and gas are not homogeneous groups of products, i.e. having different grades and types, they will be treated as such in this thesis.

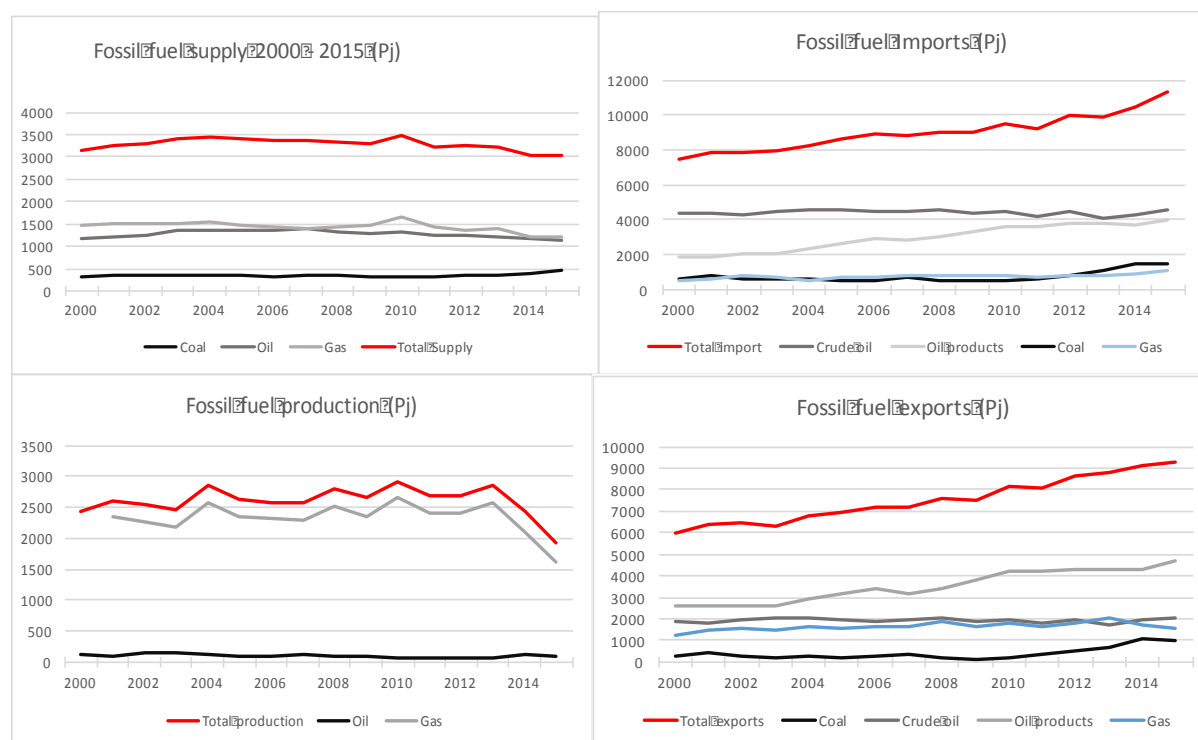
⁵⁹ There appear to be differences between CBS and IEA data, even though the IEA gets its data from CBS; e.g. according to CBS the 2014 coal export was higher than the 2015 export and vice versa according to IEA. As mentioned by the IEA (2014 review) this might be due to changes/differences in the measuring methods. For international comparisons IEA data will be used, in all other cases CBS data will be used. See for example, CBS, "CBS StatLine - Steenkoolbalans; Aanbod En Verbruik." and International Energy Agency (IEA), "Coal Information 2016."

⁶⁰ International Energy Agency (IEA), "Coal Information 2016," 51.

⁶¹ Total Primary Energy Supply (TPES) roughly equals consumption; TPES: import + production + stock withdrawal - export - bunkers.

mainly for export, gas is exported but also used for heating and in industry, and transport, oil as an input, and bunkering are important destinations for oil (and oil products).

Figure 2 Fossil fuel supply, production, imports, and exports 2000-2015 (adapted from CBS, 2016)⁶²



4.2 Fossil fuel trade

As became apparent in the previous section, the Netherlands functions as a trade hub for other (European) countries. In 2015 the biggest export destinations were Germany, with 87.5 percent of coal and 20 percent of oil exports, and Belgium, with around 20 percent of oil exports and 8 percent of coal exports⁶³. Gas is exported to Germany, Belgium, France, and Italy. In 2015 the Netherlands exported 9.68 bcm to Belgium, 6.97 bcm to France, 20.46 to Germany, and 8.21 to Italy⁶⁴.

In 2015 most coal was imported from countries such as the United States (13550Mt), Australia (2418Mt), Colombia (16726Mt), South Africa (12728Mt), and Russia (9769Mt). Very small amounts of coal (around 100Mt) are imported from Germany⁶⁵. Crude oil and oil products are imported from all over the world. Crude oil is imported mainly from Norway, United Kingdom, Russia, Kuwait, Saudi-Arabia, and Nigeria. Oil products come mainly from OECD countries (55 percent), with Russia being the largest non-OECD supplier (25 percent)⁶⁶. This means that most coal and oil enters the Netherlands through seaports. Seaports are thus an integral part of the transport and storage segment (see section 6.1). In addition, gas is imported by pipelines from Russia, Norway, and the United Kingdom and in small quantities by ship (LNG) from Algeria, Norway, and Qatar⁶⁷.

⁶² CBS, "CBS StatLine - Energiebalans; Kerncijfers."

⁶³ International Energy Agency (IEA), "Coal Information 2016," 197; IEA, "Oil Information 2016," 375.

⁶⁴ IEA, "Natural Gas Information 2016," 52.

⁶⁵ International Energy Agency (IEA), "Coal Information 2016," 195.

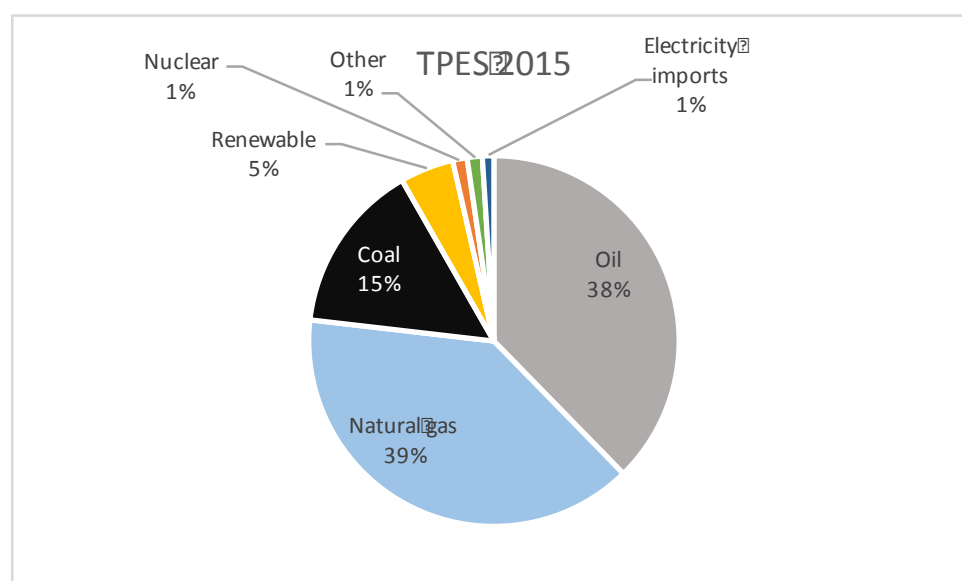
⁶⁶ IEA, "Oil Information 2016," 371-73.

⁶⁷ GIIGNL, "The LNG Industry: GIIGNL Annual Report 2015 Edition," 14.

4.3 Key energy and economic indicators

As mentioned in the introduction, the total primary energy supply (TPES) of the Netherlands is largely fossil. Of the total 3094 PJ (supplied in 2015 around 38 percent comes from oil, 39 percent from gas, and 15 percent from coal (Figure 3). For international comparison the IEA calculates a host of 'key indicators' (see Appendix 18). For 2014 the Netherlands had a TPES/capita of 4.33 (Toe) and a TPES/GDP of 0.09 (toe/thousand 2010 USD). These values are higher than the EU-28 averages (3.08;0.09), and roughly similar to OECD averages (4.16;0.11). Electricity consumption per capita amounted to 6.71 MWh and CO₂ emissions per capita to 8.8 t CO₂. This is higher than the EU average (5.91;6.22). Compared to other EU countries people in the Netherlands use more energy and electricity and emit more CO₂. The economy has an average energy intensity.

Figure 3 Total primary energy supply (TPES) in the Netherlands (adapted from CBS, 2016)⁶⁸



The contribution of the energy sector and energy related activities to the economy can be calculated as a share of GDP. As can be seen in Appendix 16 the value of energy related activities in the Dutch economy has decreased from 5.68 percent in 2008 to 4.45 percent in 2015 and is expected to drop to 3.43 percent in 2016. This decrease is caused mainly by a reduction in the value of oil and gas production (see chapter 5). Moreover, the added value of oil refineries as share of GDP has dropped from 0.37 percent in 2008 to 0.03 in 2015 and is expected to remain low in the future. On the other hand, the added value of renewable energy production has increased from 0.17 percent in 2008 to 0.26 percent in 2015 and is expected to rise further up to almost 0.5 percent in 2020.

The energy related activities accounted for 1.8 percent of total employment in 2015, rising from 1.5 percent in 2010 and 1.3 in 2008 (see Appendix 17). Fossil fuel related activities accounted for 0.9 percent of total employment in 2015. The increase of employment in this sector came mainly from increased investments in conventional electricity generation, networks, and renewable energy. This data shows that the economic importance of the energy sector in the Netherlands lies more in the contribution to added value than to employment. However, employment in the energy sector is expected to increase in the future, mainly due to investments in renewable energy, networks, and energy efficiency. The relative importance of fossil fuel activities within the sector are thus expected to decline.

⁶⁸ CBS, "CBS StatLine - Energiebalans; Kerncijfers."

4.3.1 Existing analyses of the Dutch energy system

Another important starting point in exploring the importance of energy in the (Dutch) economy and the importance of specific parts of the industry for the energy systems are existing analyses of this system. Relevant research done in the previous years include studies on natural gas production and its governance, natural gas trade strategies, such as the so called ‘natural gas roundabout’, the fossil dependence of the port of Rotterdam, and possible strategies for the transition to a climate neutral economy⁶⁹. A full review of these studies does not fall within the scope of this research, but their conclusions further underline the reliance of the Dutch economy on fossil fuels and energy intensive industries and point in the direction of segments in the chain where financial relations could exist. Since the governance of gas production in the Netherlands is complicated, but well studied, the next section will provide a short description, preempting the need to discuss this in later stages of the research.

A complete review of the Dutch energy system, with as goal to identify barriers and opportunities in future pathways to a sustainable energy supply, was undertaken in 2013 by the research institutes TNO, ECN, and the University of Utrecht. They concluded that the Dutch energy system was highly fossil, that a quarter of all energy was used by energy-intensive industries (which contribute 12.4 percent of GDP), that oil and gas revenues were a significant contributor to the budget, and estimated that the total contribution of the energy system to the government’s budget amounted to 49 billion euro in 2010, or around 20 percent of the annual budget⁷⁰. Moreover, they concluded that economically important sectors such as the chemical industry, transport, horticulture, and the food industry were dependent on stable and low energy prices to sustain themselves. And that, due to heavy investments in the existing, centralized, energy infrastructure, a certain degree of lock-in in the fossil system exists. Their overall conclusion was that, unlike other EU states such as Germany, Sweden, and Denmark, investing in the transition to renewable energy might not, economically, be the best way forward for the country⁷¹. Although some of its conclusions were controversial, and the situation has clearly changed since then (e.g. recent developments in offshore wind) the report clearly underlined the large fossil, and energy, dependency of the Dutch economy. Moreover, its analysis of tax data provides a good starting point for analyzing the financial relationship between the government and the fossil fuel industry.

As became apparent at the beginning of the initial scoping stage ports take up an important role in the energy system: they are the main nodes for import and export and house a variety of energy related activities, such as refining and power plants. This conclusion is supported by the TNO/ECN/UU report quoted above⁷². That the ports activities have a strong fossil aspect has been shown for the port of Rotterdam⁷³. Based on these insights this thesis included a section focusing specifically on Dutch seaports, their fossil aspects, and their relationship with the government (see section 6.1).

4.4 Government involvement in the energy regime

⁶⁹ e.g. van Gastel, van Maanen, and Kuijken, “Onderzoek toekomst governance gasgebouw”; TNO, “Beefst de Grond Onder de Voeten van de Gasrotonde”; TNO, “Het Fossiele Dilemma van Rotterdam”; Schotten et al., “Time for Transition: An Exploratory Study of the Transition to a Carbon-Neutral Economy.”

⁷⁰ Weterings et al., “Towards a future proof energy system for the Netherlands/Naar een toekomstbestendig energiesysteem voor Nederland,” 8.

⁷¹ Ibid., 11.

⁷² Ibid., 21.

⁷³ TNO, “Het Fossiele Dilemma van Rotterdam.”

This section attempts to provide a first overview of the role of the Dutch government in the energy regime by looking at government policy on natural gas (production), tax income related to fossil fuels, and government participations and state-owned enterprises (SOE's).

4.4.1 Management of gas production, distribution, and sales

The production of natural gas in the Netherlands is governed through a complex structure called the 'gas building'. As can be seen in Figure 4 this public-private cooperation brings together the government, through state owned organizations, and multinational oil companies. EBN (Energie Beheer Nederland) participates in all fossil fuel projects on behalf of the government⁷⁴, and functions as a policy instrument for the government with as main goal to maximize public gains; i.e. a clean, reliable, and affordable energy supply⁷⁵. Usually EBN takes a 40 percent stake in projects, but this differs per project and sometimes goes up to 50 percent⁷⁶. EBN's (indirect) share of the gas reserves amounts to 340 bcm⁷⁷. The NAM (Nederlandse Aardolie Maatschappij) which is owned by Shell and Exxonmobil operates the Groningen gas field and is connected to the government, sharing the proceeds from Groningen, through a partnership (the 'Maatschap Groningen'). EBN, which has a share in the Maatschap, transfers its proceeds to the government through yearly dividend payments. GasTerra is the gas trader, and has a duty to buy all gas it is offered (see section 5.1.8 and chapter 8) while Gasunie is the transporting and distributing entity (see section 6.4). GasTerra is partly state-owned and Gasunie completely. GasTerra buys and sells all the gas from the Groningen field and around 75 percent of the gas coming from small fields⁷⁸.

4.4.1.1 The 'Gas hub' strategy

In 2005 the government started implementing its 'gas-hub', or 'gas roundabout', policy to transform the Netherlands into a hub for natural gas, providing the northwest of Europe with gas import, transport, storage, and quality conversion services. The goal was to create security of supply for the Netherlands, which is expected to become a net-importer of natural gas in the coming decade, and Europe, but also to promote economic growth and ensure a prominent position of the Netherlands in the gas market after domestic production declines⁷⁹. This policy was implemented through the state-owned enterprises (SOE's) Gasunie and EBN, which already invested 8.2 billion of the planned 9.6 billion between 2005 and 2014 in infrastructure⁸⁰. The government supported the implementation by, among other things: promoting investments in pipelines and storage and LNG facilities; continuing support for the development of marginal gas fields; actively supporting the further liberalization of the (European) gas market; undertaking 'gas diplomacy'; and promoting innovation in and economic competitiveness of the Dutch gas industry through support policies⁸¹. However, a report by the Dutch court of auditors showed that, prior to implementation of the policy, no supporting evidence existed of how the policy would contribute to the set objectives of security of supply and economic growth. The policy making process was deemed to be opaque, with essential documents only being published after the decision had been made⁸². Moreover, social costs and benefits were not assessed, and the effects of long-term changes in the gas market, such as the possible rise of shale gas in the U.S, were

⁷⁴ EBN does not participate in four older NAM concessions (Staten-Generaal, "Beschrijving van de Opzet van Het Huidige Gasgebouw.")

⁷⁵ Algemene Rekenkamer, "A Gas Hub: Benefits, Needs, and Risks," 5.

⁷⁶ Energie Beheer Nederland (EBN), "Jaarverslag 2015," 90.

⁷⁷ Ibid., 125.

⁷⁸ van Gastel, van Maanen, and Kuijken, "Onderzoek toekomst governance gasgebouw," 12–14.

⁷⁹ Algemene Rekenkamer, "Rapport Besteding van Aardgasbaten Feiten Cijfers En Scenario's," 2.

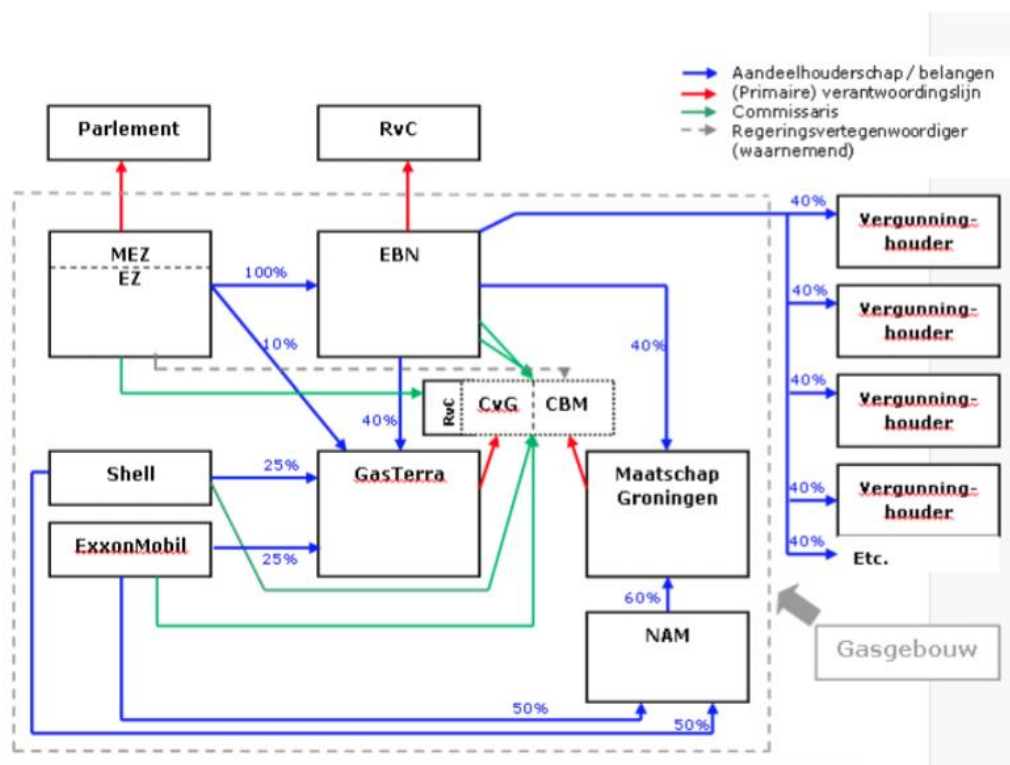
⁸⁰ TNO, "Beeft de Grond Onder de Voeten van de Gasrotonde," 3.

⁸¹ Algemene Rekenkamer, "A Gas Hub: Benefits, Needs, and Risks," 3; TNO, "Beeft de Grond Onder de Voeten van de Gasrotonde," 5.

⁸² Algemene Rekenkamer, "A Gas Hub: Benefits, Needs, and Risks," 44.

not taken into account⁸³. Moreover, the infrastructural investments done are not without risk. As set-out by TNO in a report in October 2015 an accelerated reduction in gas extraction, for example under public (or legal) pressure to prevent further earthquakes and combat climate change, could reduce the need for the build infrastructure, and undermine the strategy by, for example, taking away public support for gas storage and CCS. Part of this scenario has become reality, the production of the Groningen field is now capped at 24 bcm (30 bcm in cold years) annually⁸⁴, with some actors arguing that it should go down to 12bcm annually⁸⁵. In addition, other European countries chase similar aims, for example when it comes to LNG, and there is a high degree of geopolitical uncertainty involved when it comes to importing gas (Russia) and LNG (Qatar)⁸⁶.

Figure 4 The Dutch 'Gas building'⁸⁷



4.4.2 Government dependence on energy tax revenue

As mentioned above the total contribution of the energy sector and energy intensive activities to the government budget has been estimated to be around 50 billion annually, based on 2010 data. This estimation included looking at the direct gas revenues, excise tax levied on fuels, wage tax and profit tax coming from the production and transmission of energy and, to include the use of energy, the wage and profit tax coming from energy intensive activities⁸⁸. The data excludes VAT paid and collective insurance premiums. Within this estimation the gas revenue, excise tax, and the wage and profit tax on the energy supply are directly related to fossil fuels. This analysis shows the (potential) importance of tax revenue related to fossil fuels for the Dutch budget. For this reason, each stage will

⁸³ Ibid., 45.

⁸⁴ Ministry of Economic Affairs, "Instemmingsbesluit Winningsplan Groningenveld."

⁸⁵ Fluxenergie, "FluxEnergie."

⁸⁶ TNO, "Beeft de Grond Onder de Voeten van de Gasrotonde," 8&9.

⁸⁷

⁸⁸ Energy intensive activities were taken to be activities that use more than 0.1 euro in energy per euro in added value.

include a section on taxation, which attempts to provide insight in the tax revenue coming from that specific stage. Unfortunately, almost no data is available on wage, profit, and corporate tax per sector. Also it was not possible, within the scope of this thesis, to redo the estimations by Weterings et al (2014) looking only at fossil fuels and not energy as a whole. This limits the possibility to analyze the dependency of the Dutch national budget on fossil fuel related tax revenue.

Table 4 Contribution of energy production, transmission, and use to the government budget in 2010 (translated from Weterings et al., 2013)⁸⁹

Mln €	
Gas revenue (aardgasbaten)	15,882
Excise tax	12,008
Wage tax energy supply	777
Profit tax energy supply	4,883
Wage tax energy intensive activities	9,067
Wage tax energy intensive activities	6,306
Total	48,923

4.4.3 State-owned enterprises and government participations

In 2015 the Dutch Court of Auditors published a review of the governments participations in companies. It showed that dividends coming from these participations have been an important source of revenue for the government, with the total dividends amounting to between 3 and 5 billion annually in the period of 2007-2013⁹⁰. In addition, they concluded that the government, as of yet, does not have enough decision-making power within its participations, for example, when it comes to giving permission for large investments, and that the decision making process surrounding such investments has not always been transparent and done with the utmost care. This is in line with the analysis quoted above regarding the Gas hub strategy. Moreover, they found that the information provided regarding such investment decisions, for example through the annual report on the management of the governments participations, to the parliament was inadequate, lacking key financial information such as benchmarks and the costs and risks of investments⁹¹. Given the importance of the governments participations, this section will briefly look at the fossil aspect of these participations.

In 2015 the national government held direct participations in 30 different entities, excluding temporary participations in financial institutions as a result of the financial crisis, of which it owned 14 completely. Of the 30 companies, 8 have a direct link to fossil fuels: EBN, GasTerra, Gasunie, KLM, the Port of Rotterdam, Schiphol Airport, and Sababank Resources and Winair located, respectively, in the Caribbean islands of Saba and Sint Maarten⁹². In addition the government holds a share in the 'Maatschap Groningen' through EBN (see section 4.4.1). Appendix 20 provides an overview of the ownership structure of these companies. It includes the fossil fuel related holdings of the municipalities: the port of Rotterdam and the port of Amsterdam⁹³. The relationships with ports are discussed in section 6.1.

⁸⁹ Weterings et al., "Towards a future proof energy system for the Netherlands/Naar een toekomstbestendig energiesysteem voor Nederland," 61.

⁹⁰ Rekenkamer, "De Staat Als Aandeelhouder," 8.

⁹¹ Ibid., 11.

⁹² Ministry of Finance, "Jaarverslag Beheer Staatsdeelnemingen 2015."

⁹³ As becomes apparent in this research, there are more municipalities that hold shares in fossil fuel related entities. The municipality of Amsterdam and Rotterdam were included because they hold shares in companies that the national government also owns a part of.

The government publishes an annual overview of its participations, providing some insight in the financial relation between the government and these entities (see Appendix 20) In total the fossil fuel related participations of the government represented a capital value of 33.3 billion euro in 2015, with around half coming from GasTerra alone. This is around 10 percent of the total asset value, 300 billion in 2015 of the governments participations⁹⁴. In the same year these companies paid the State 944 million euro in dividends, with a major share coming from EBN and Gasunie. The SOE's EBN, Gasunie, and GasTerra will be discussed in detail in the appropriate stages. The national government's participations in KLM, Schiphol, and Winair will be discussed in the use stage (chapter 9).

4.5 Discussion

The initial scoping has provided a good basis on which the later stages can be build. It showed the importance of the Netherlands as an energy hub and indicated the existence of possible interdependencies between the government and the fossil fuel industry through, among others, gas production, ports, state-owned enterprises, taxation, refining, and in the use stage.

5 Exploration and Production

5.1 Oil and gas

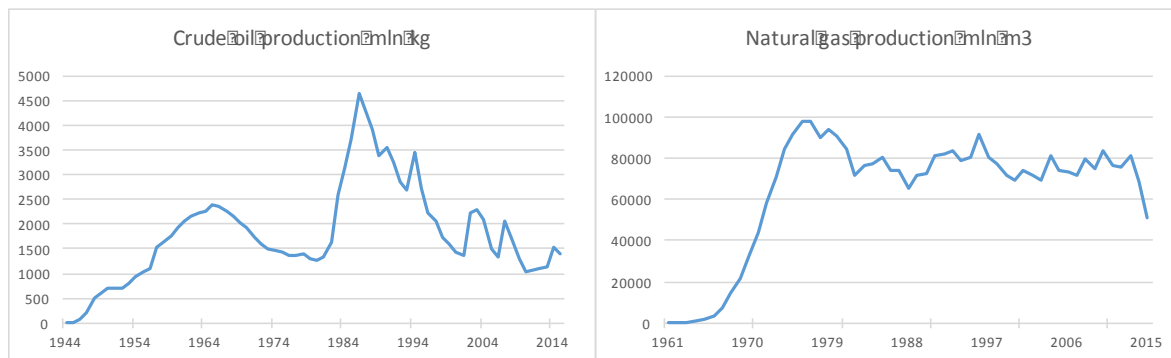
This chapter focusses on the government-industry relations in the production and exploration phase of the fossil fuel supply chain. Historically the Netherlands has been a large producer of gas, with a total of 3582 billion cubic meters (bcm) of natural gas extracted since its first discovery in 1959. Production peaked in the 1970's at around 90 bcm a year and is currently declining rapidly, with production dropping around 25 percent between 2014 and 2015⁹⁵. This is mainly due to production caps on the Groningen field in an attempt to reduce seismic activity. Oil production has always been limited and peaked in the mid 80's around 4600 million kg extracted annually shrinking to around 1500 million kg today⁹⁶. Coal production was halted in 1974 and will thus be excluded from this analysis. Although it would be useful to develop a core questions template for the production part of the coal value chain it is not possible to do this using the Dutch energy regime as a case study. In addition, given the limited amounts of oil being produced in the Netherlands it will be difficult to develop an approach to analysing the specificities of the oil production industry. However, given the similar value chains of oil and gas the insights gained through analysing the production of gas could also apply to the production of oil. Given the limited production of oil in the Netherlands, and since, in the Netherlands, this is done by companies that also produce gas, the oil and gas sections will be combined in this chapter.

⁹⁴ Ministry of Finance, "Jaarverslag Beheer Staatsdeelnemingen 2015," 27.

⁹⁵ TNO, "Delfstoffen En Aardwarmte in Nederland: Jaarverslag 2015," 10.

⁹⁶ CBS, "CBS StatLine - Aardoliegrondstoffenbalans; Aanbod, Verbruik En Voorraad."

Figure 5 Oil and gas production in the Netherlands (adapted from CBS, 2016)⁹⁷



This chapter is structured as follows: section 5.2 looks at the Dutch fossil fuel reserves; 5.3 at ownership of these reserves; 5.4 at the value of these reserves; 5.5 at producers of fossil fuels⁹⁸; 5.7 at exploration and other upstream activities; 5.8 at producer income from production; 5.9 at State income from production; 5.10 at State investment in production; 5.11 at subsidies and support measures for production; 5.12 at decommissioning of production infrastructure; and section 5.13 at costs related to external effects of production.

5.2 Fossil fuel reserves

As of January 1st 2016 the Dutch proven oil reserves⁹⁹ are estimated to be 31.6 Sm3 of which 20.5 Sm3 onshore and 11.1 Sm3 offshore. The estimated proven gas reserves amount to 891 bcm (940 Sm3), of which 665 bcm in the Groningen field, 109 bcm in the onshore small fields, and 117 bcm in offshore small fields. Although sources of shale gas have been found the commercial exploration and extraction of shale gas using fracking methods is banned in the Netherlands until, at least, 2020. One, non-commercial, exploration project has been granted permission¹⁰⁰. Five permits, held by DSM N.V., for the extraction of coal are still active. Even though coal production is (and will not be) economically viable there might be interest in the future for the extraction of coal bed methane (CBM). A total of 570 Mt of coal has been delved in the past and there are possibly large amounts of CBM to be found in the remaining coal beds.¹⁰¹

5.3 Ownership of reserves and resources

According to the Dutch Mining Act (2003) all minerals, which includes oil, coal, and gas, on, and below, Dutch territory and the Dutch continental shelf are owned by the government¹⁰². However, once an entity holds a production license for a certain field, and makes use of this license, the property rights are de facto transferred to the licensee¹⁰³.

⁹⁷ Ibid.; CBS, "CBS StatLine - Aardgasbalans; Aanbod En Verbruik."

⁹⁸ Technically speaking fossil fuels are not 'produced' but extracted; In this thesis produced and extracted will be used interchangeably

⁹⁹ Includes Reserves and Contingent resources of which the development is pending (see appendix 3)

¹⁰⁰ TNO, "Delfstoffen En Aardwarmte in Nederland: Jaarverslag 2015," 9.

¹⁰¹ Ibid., 61.

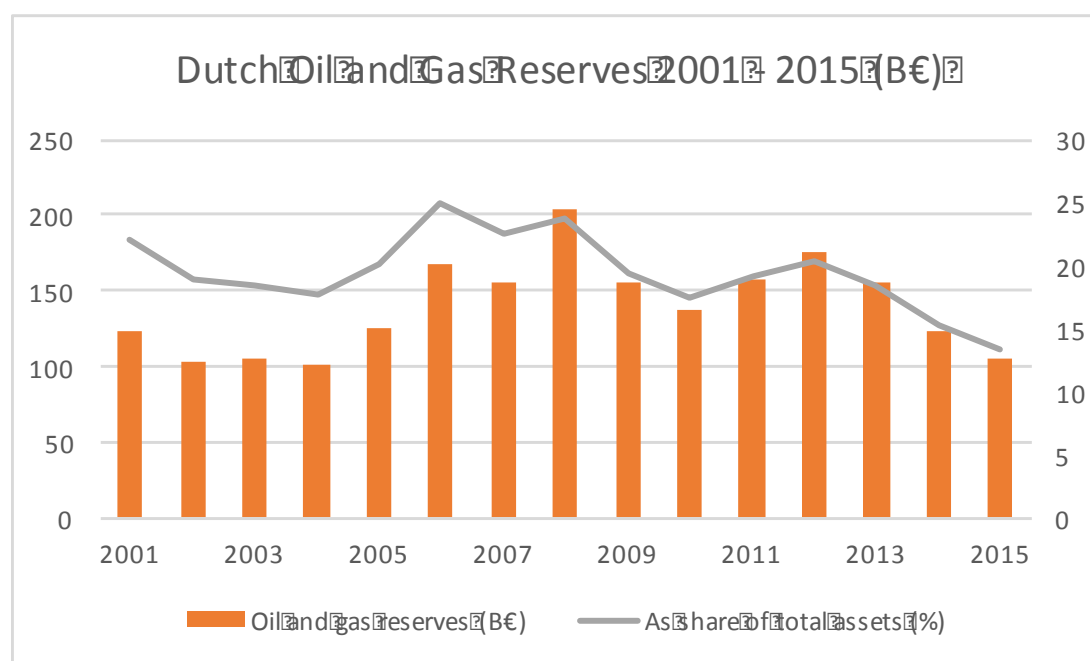
¹⁰² Ministry of the Interior and Kingdom Relations, "Mijnbouwwet."

¹⁰³ Ibid.; Chapter 1, article 3.

5.4 Value of reserves and resources

The oil and gas reserves item on the balance sheet of the Dutch government comprises the extracted, and extracted but not yet sold, oil and gas. The value of the reserves depends on its volume and the gas price, but is also influenced by the extraction rate. Since future revenues are discounted the current value of the reserves decrease when extraction rates are lower (as is, for example, currently the case due to production caps). A devaluation of the oil and gas reserves decreases the net worth of the government thus reducing its position to take up debt¹⁰⁴. Due to ageing infrastructure and maturing fields up to 100 bcm of natural gas located in marginal offshore fields is at risk of being permanently lost in the current low price environment¹⁰⁵. This would reduce the natural gas reserves by about a tenth. The possibility of this loss might be an incentive for the government to enact policy to reduce costs of producers in order to prevent premature decommissioning of off-shore infrastructure. The IEA suggesting that the government might need to review its taxation scheme and ownership structure, and the government itself hinting at a 'level-playing field' with, the heavily subsidized, UK offshore sector indicates that this incentive is real¹⁰⁶. This is relevant because it would constitute a dependency of the oil and gas producers on the government to be able to increase production, and by the government on the producers in order to maintain revenue from marginal fields and prevent a loss in assets.

Figure 6 Value of the Dutch oil and gas reserves 2001-2015 (adapted from CBS, 2016)¹⁰⁷



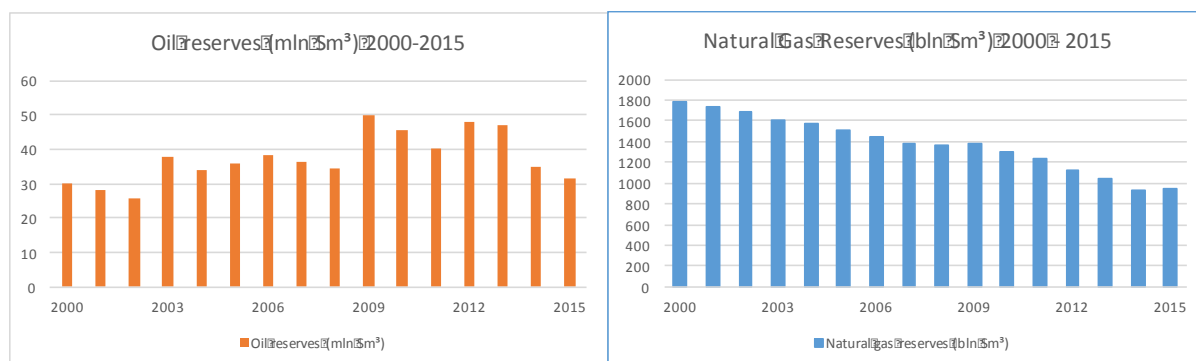
¹⁰⁴ CBS, "Waardevermindering gasreserve maakt overheid armer."

¹⁰⁵ Energie Beheer Nederland (EBN), "Focus on Dutch Oil & Gas 2016," 14.

¹⁰⁶ IEA, "The Netherlands 2014 Review," 135; Ministry of Economic Affairs, "Energie Agenda 2016," 71; Pickard and van der Burg, "G20 Subsidies to Oil, Gas and Coal Production."

¹⁰⁷ CBS, "CBS StatLine - Overheidsbalans; Activa En Passiva."

Figure 7 Dutch Oil and Gas reserves 2000-2015 (adapted from CBS, 2016)¹⁰⁸



5.5 Producers of fossil fuels

By looking at all the licenses granted for the operation of oil and gas fields a list can be compiled of all the oil and gas producers in the Netherlands. Also, the state owned entity EBN takes a 40 percent share in all oil and gas projects in the Netherlands (see Figure 4). This means that the licensees, who are often also the operators, have to cooperate with EBN in order to extract hydrocarbons. The biggest of such partnerships is between the NAM and EBN, formalized in the ‘Maatschap Groningen’, which holds the Groningen gas field (although NAM is the concession holder and operator)¹⁰⁹. Appendix 22 provides an overview of the companies currently holding oil and gas concessions on Dutch territory (on-shore) and the Dutch continental shelf (off-shore). NAM is by far the largest permit and concession holder (around 50 percent of all fields) and producer, because it holds the Groningen field concession and several small fields¹¹⁰. See the NLOG website for a complete overview of Dutch oil and gas fields¹¹¹

5.6 Ownership of producing entities

Most licensees are publicly traded on the stock market; some are privately owned (e.g. Petrogas and ONE). None of the exploration and production companies are owned by the Dutch government, the production segment (upstream) is completely privatized and liberalized¹¹². Although not falling within the scope of this research, Dana petroleum is a subsidiary of the Korea National Oil Company (KNOC) which is owned by the South-Korean Government¹¹³. Although not a license holder the SOE EBN is thus involved in (almost) all oil and gas production.

5.7 Exploration and other non-producing upstream activities

Given that the entire upstream segment is privatized and liberalized exploration companies are not included in the analysis. However, EBN supports exploration of oil and gas through its research efforts and knowledge sharing and makes policy to stimulate and support exploration and decommissioning efforts (see section 5.10 and 5.12). For example, through its project ‘exploration motor’ and geo-

¹⁰⁸ CBS, “CBS StatLine - Aardgas- En Aardoliereserves; Nationale Rekeningen.”

¹⁰⁹ van Gastel, van Maanen, and Kuijken, “Onderzoek toekomst governance gasgebouw,” 13.

¹¹⁰ TNO, “Delfstoffen En Aardwarmte in Nederland: Jaarverslag 2015,” 107–18.

¹¹¹ NLOG, “Kaart Velden | NLOG.”

¹¹² OECD, “Fossil Fuel Support Country Note: The Netherlands.”

¹¹³ Dana Petroleum, “At a Glance.”

drilling knowledge sharing events. In addition, it participates in R&D for new exploration and production techniques (10.5.1) and invests in natural gas infrastructure¹¹⁴.

5.8 Producer income from production

It proved to be very difficult to get an estimation of producer income from oil and gas production in the Netherlands. Publicly listed companies publish annual reports but do not break down their revenue in enough detail to distinguish the parts coming from their Dutch oil and gas activities and privately owned companies do not publish yearly reports at all. A very crude estimation could be made by using EBN's 2015 revenues as a guide line. Assuming an equal division of revenues over the field owners, and knowing that EBN has a 40 percent share in most fossil fuel projects, total revenue from upstream gas and oil in the Netherlands would have to be around 12 billion euro in 2015.

In 2015 EBN realized a revenue of 4.77 billion euro, of which 0.45 billion in net profits. EBN's share in gas production was 21.8 billion bcm, of which 9.7 bcm from small fields (43 percent share in total small fields production), and the remainder from the Groningen field (45 percent of total Groningen production¹¹⁵)¹¹⁶. When using a 44 percent share in production (average of EBN's share in the small fields and the Groningen field) the revenue of the production segment would amount to 10.9 billion. This estimation would however exclude EBN's share in oil production and thus slightly underestimate the total revenues from fossil fuel production. Incidentally, some information on NAM's revenues from the Groningen field between 2006 and 2013 have been released by the Ministry of Economic Affairs. In these years NAM earned 8.95 billion euro from the Groningen field, and the State 68.85 billion. Over this period NAM thus received 11.5 percent of total profits from the Groningen field.

Table 5 Groningen Gas Revenues (adapted from Ministry of Economic Affairs, 2014)¹¹⁷

Year	Groningen Volume (B m3)	Profit (B €)	To State (B €)	To NAM (B €)
2006	32.2	7.15	6.3	0.85
2007	29.9	6.75	5.85	0.9
2008	38.9	10.65	9.45	1.20
2009	37.8	8.10	7.05	1.05
2010	50.1	9.15	8.00	1.15
2011	44.7	9.95	8.90	1.05
2012	47.2	12.85	11.40	1.45
2013	53.2	13.2	11.90	1.30

5.9 State income from fossil fuel production

The government receives income from the production of natural gas and oil in different ways. The government itself counts the direct income through concessions plus the dividends received, from EBN and GasTerra, and the corporation tax paid by gas producers towards its total gas revenues¹¹⁸. EBN channels 67 percent of its profits to the government through its dividends¹¹⁹. In total the government receives around 90 percent of the revenues coming from the Groningen field and around

¹¹⁴ TNO, "Delfstoffen En Aardwarmte in Nederland: Jaarverslag 2015," 107–18.

¹¹⁵ NAM, "Gas- En Oliewinning | NAM."

¹¹⁶ Energie Beheer Nederland (EBN), "Jaarverslag 2015," 25.

¹¹⁷ Ministry of Economic Affairs, "Kamerbrief 'Inkomsten Uit Groningen Gas.'"

¹¹⁸ CBS, "Aardgas voor bijna 80 procent op."

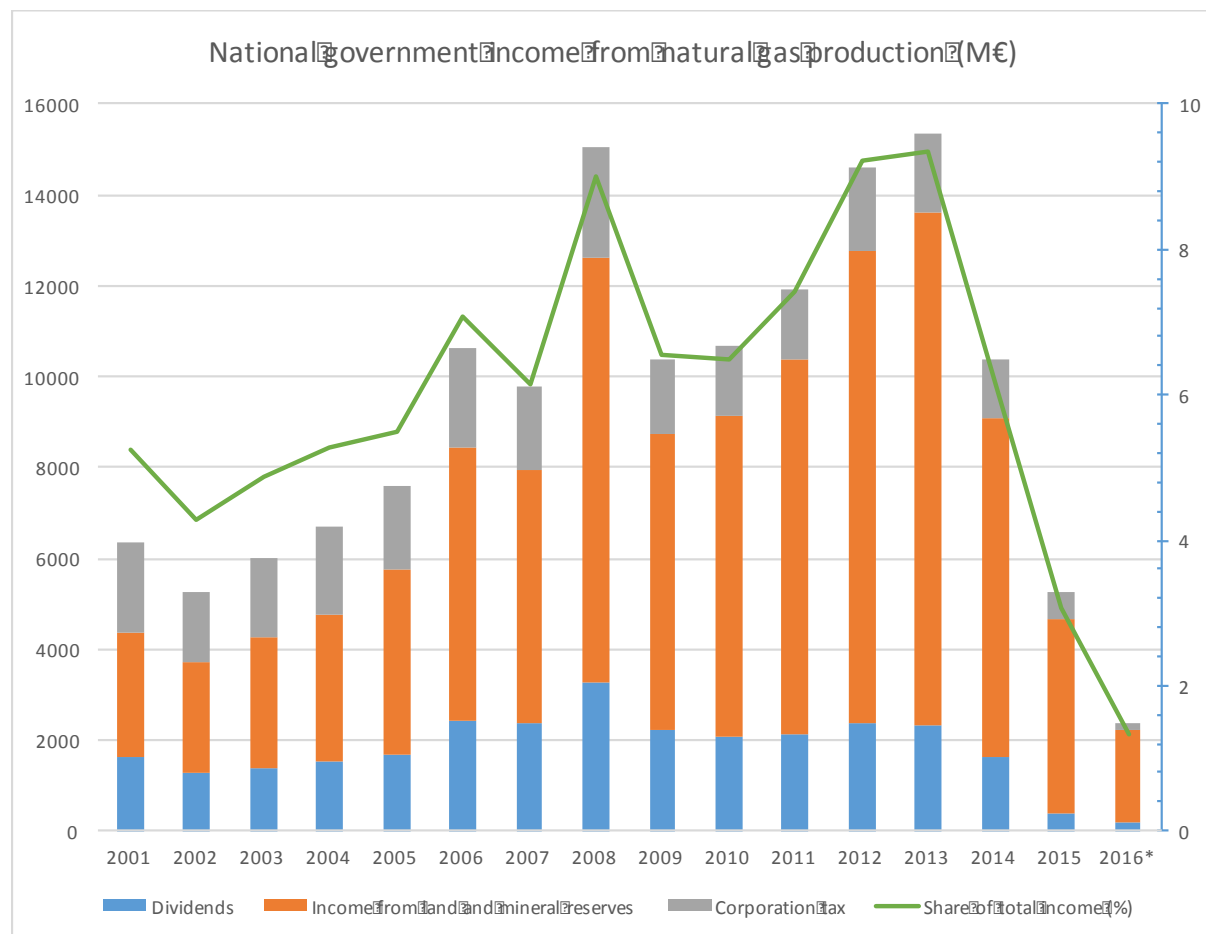
¹¹⁹ Energie Beheer Nederland (EBN), "Jaarverslag 2015," 54.

64 percent of the revenues coming from the small-fields¹²⁰. Unfortunately, the income from oil production, probably because it is so small, is not reported separately by CBS.

Figure 8 below provides an overview of the gas and oil production revenue of the national government. It clearly shows the large effect of Groningen output reduction on government gas earnings. From a decade high record of around 15 billion euro, 8.5 percent of national government income, to around 2 billion in 2016, 1.1 percent of national government income. National government income refers all the earnings of the national government excluding income from social security premiums (which are not freely spendable). The figure in Appendix 23, which goes back until 1966, shows that the last decade has been the most profitable for the Dutch government. Although gas revenue made up a larger share of government income in the past, almost reaching 20 percent in the 1980's. Over the years the dependency of the government on natural gas income has thus been very strong. Only in 2016, with gas revenue as share of income starting to approach 1 percent of government income is this dependency starting to become less strong.

The national government receives income from the production of natural gas through royalties, taxes, and dividends. The next sections analyze this in more detail.

Figure 8 Government income from gas production 2001-2016 (adapted from CBS, 2016)¹²¹



¹²⁰ van Gastel, van Maanen, and Kuijken, "Onderzoek toekomst governance gasgebouw," 49.

¹²¹ CBS, "CBS StatLine - Overheid; Inkomsten En Uitgaven"; CBS, "Bijna 3 miljard euro begrotingsoverschot in 2016."

5.9.1 Income through EBN

As mentioned in the initial scoping EBN partakes in oil and gas production for the Dutch government. EBN's dividends, together with GasTerra's fixed dividend of 3.6 million per year, make up the dividend section in the graph above. Some of EBN's dividend comes from dividends paid out by GasTerra (in which EBN has a 40 percent share). In total the national government receives around 37.5 percent of the GasTerra dividends that EBN receives¹²². In addition, EBN contributes to the gas production revenues through its corporate tax payments and special levies¹²³. According to EBN it contributed around 1.2 billion to the total natural gas income in 2016, down from 6.9 billion in 2012. In addition to production, EBN is active in the exploration, transport, and storage of oil and gas. As Table 6 show only a very minor share of its revenues thus come from transport and storage activities (Nogat B.V and NGT-Extension, see section 6.3.1.1). These activities are discussed further in the relevant sections.

Table 6 Contribution of associated firms to EBN revenue

M€	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GasTerra	14	14	14	14	14	14	14	14	14	14	14
NOGAT B.V	27	29	29	30	33	32	26	23	17	16	15
NGT-Extension	7	8	8	8	7	7	8	7	7	7	6
Total	48	51	51	52	54	53	48	44	38	37	35

5.9.2 Upstream taxation

The 2003 Mining act, updated in 2016, sets-out the fiscal regime that applies to upstream oil and gas activities. Offshore exploration permit holders pay a general fee, which increases over time, per square kilometer of land involved and production license holders pay a fixed annual fee¹²⁴. Companies are subject to the regular corporation tax (25 percent) and a State Profit Share (SPS) (50 percent), in addition, onshore extraction is subject to royalties between 0 and 7 percent (the royalties are upped 25 percent when the price of imported crude oil rises above 25€ per barrel). The SPS is deductible for income tax purposes and companies can deduct an extra 10 percent of their costs from their taxable income. In addition, exploration expenses can be written off in the year they occur¹²⁵. According to the IEA the average onshore marginal tax rate (small-fields) amounted to 72 percent and the average offshore marginal tax rate to 71 percent, which they deemed a 'favorable' rate¹²⁶. For the Groningen this amounted to around 90 percent between 2006 and 2013, consisting of tax paid by the Maatschap Groningen and the royalties (see Table 5). In

Figure 8 the different fees royalties are grouped in the 'income from land and mineral reserves' data series. No data was found on revenue from the individual taxes.

In addition, provinces receive a one-time fee of 4.5 euro per square meter of terrain licensed within their boundaries¹²⁷. Unfortunately, it is not possible to distinguish between income related to permits for the extraction of hydrocarbons and permits for salt and geothermal heat using the CBS data available. This makes it impossible to determine how much provinces earned through gas and oil permit fees.

¹²² Energie Beheer Nederland (EBN), "Jaarverslag 2015," 115.

¹²³ Energie Beheer Nederland (EBN), "Jaarverslag 2016," 46.

¹²⁴ Ministry of the Interior and Kingdom Relations, "Mijnbouwwet"; Chapter 5, Article 58.

¹²⁵ OECD, "Fossil Fuel Support - NLD."

¹²⁶ IEA, "The Netherlands 2014 Review," 134.

¹²⁷ Ministry of the Interior and Kingdom Relations, "Mijnbouwwet"; Chapter 4, article 77.

5.10 State costs related to production

As described in section 4.4.1 the State does not participate in the production of fossil fuels directly, but the state owned enterprise EBN does. Since it holds a 40 percent share in fossil fuel projects it also has a 40 percent share in the costs. According to its annual report EBN finances its activities independently from the government on the capital markets, mainly using (long-term) bonds¹²⁸. In 2001 the State bought the certificates of ownership of EBN, still held by DSM N.V, which used to be a state-owned enterprise and wholly owned EBN, for 1.243 billion euros. This purchase led to an increase in the national debt and increased the yearly interest payments of the national government by between 61.3 and 63.5 million euro¹²⁹.

EBN's participation in gas and oil production may have other effects on the market. Given that EBN is a wholly state-owned entity it might be able to borrow under more favorable conditions than private entities, under the assumption that a state-owned enterprise has less chance of reneging on its debt. This would thus reduce the costs of fossil fuel projects in which EBN participates. In addition, EBN's participation in exploration and research activities improves the production and exploration climate. Moreover, it supports operators in periods of low gas prices by taking over some of the preliminary research activities¹³⁰. Thus, even though the government does not invest directly in gas and oil production, its indirect involvement may have a cost reducing impact on fossil fuel production. This could benefit both the government and the industry, and indicates that there is a two-way dependency; the State needs the industry to extract the gas and provide technical expertise, while the industry needs the government to set the right conditions to reduce operating costs.

5.11 Government subsidies and support measures

Analysing subsidies for the production of fossil fuels is difficult since different definitions and methodologies are used and data is often scarce¹³¹. Nevertheless, some analyses of fossil fuel production subsidies in the Netherlands exist. The OECD takes a broad approach and looks at 'support' for the industry in the form of policies that can induce changes in the relative prices of fossil fuels¹³². For the Netherlands the OECD identified two production support measures (extraction stage): the small-fields policy and the related marginal fields and prospect incentive. It does however not provide an estimate of the tax expenditure related to these measures, since this data is not (publicly) available¹³³.

The small-fields policy was started in 1974 to encourage the production from small natural gas fields in order to maximize domestic resources and to reduce pressure on the Groningen field, which henceforth acted as a swing producer to balance supply and demand. The policy consists of: a duty by GasTerra to buy the gas coming from the small-fields; the duty for GasUnie Transport Services (GTS) to transport the gas; and the 40 percent participation by EBN in exploration and production. A total of 420 small fields (on - and offshore) have been identified up to now, of which 234 have been

¹²⁸ Energie Beheer Nederland (EBN), "Jaarverslag 2015," 52.

¹²⁹ Staten-Generaal, "Herstructurering Gasgebouw; Brief minister over de uitgangspunten en perspectieven voor de toekomstige structuur van het Gasgebouw."

¹³⁰ Energie Beheer Nederland (EBN), "Jaarverslag 2015," 8.

¹³¹ The Global Subsidies Initiative (GSI), "A How-to Guide: Measuring Subsidies to Fossil-Fuel Producers"; Kojima and Koplow, "Fossil Fuel Subsidies."

¹³² OECD, *OECD Companion to the Inventory of Support Measures for Fossil Fuels 2015*, 26.

¹³³ OECD, "Fossil Fuel Support - NLD."

developed, with a combined volume of over a third of the Groningen field¹³⁴. Although GasTerra is obliged to buy the gas coming from small-fields at market prices, the operators are not obliged to sell the gas to GasTerra but can also sell to others. This removes uncertainty related to demand, and thus, according to the OECD, constitutes a support measure promoting the exploration and production of natural gas¹³⁵. Unfortunately, no estimates, in monetary terms, exist of the effects of this policy on gas production.

In order to further incentivize off-shore production, by increasing profitability for operators, the marginal fields and prospect incentive has been introduced in 2010. This allows operators of ‘marginal fields’, meeting criteria for well productivity, reservoir volume, and distance from existing infrastructure, to deduct 25 percent of their investment costs from their taxable profit. In addition, the fallow area measure has been introduced that allows licensees to reduce the size of the area under licence (de-licencing areas that are not being used), which reduces certain legal obligations for the operators regarding liability¹³⁶. The OECD reports that, based on information provided by EBN, that around 50 percent of the off-shore fields developed between 2010 and 2013 have made use of this incentive¹³⁷. In 2014 the IEA reported that a total of 13 projects have been approved to make use of the mechanism, which covers 22bcm of natural gas¹³⁸. Unfortunately, there is no data (publicly) available on the height of this measure and the effect on government gas revenues. However, with more knowledge of the cost structure of off-shore operators it should be possible to arrive at a rough estimate of the financial streams involved in this measure.

In 2015 the Dutch Court of Audit published a short review of environmentally harmful subsidies in the Netherlands. They did not identify any fossil fuel producer related subsidies, but estimated that up to 18 billion euro was spend annually on energy use related subsidies. This will be discussed in chapter 9

5.12 Decommissioning of production infrastructure

The responsibility for decommissioning of production related infrastructure lies with the (former) production license holders, with the Minister of Economic Affairs having the power to set a deadline for removal¹³⁹. EBN participates in the production of oil and gas and thus shares in the decommissioning responsibility. EBN estimates that it will need to contribute around 40 percent, corresponding to its 40 percent ownership share, of the decommissioning costs in its projects. However, for reasons unknown to the author, they estimate that the final costs for the government will amount to 70 percent of total decommissioning costs¹⁴⁰. Current estimates would put these costs 6.7 billion euro, of which the government would need to contribute around 5 billion. This equals a 75 percent share in the total decommissioning costs in the Netherlands for the government. Around 40 percent of these costs would be covered from EBN’s budget and the remainder from reduced government income from natural gas production. EBN, however, notes that these cost estimates could increase considerably citing that, for example, in 2014 alone the total decommissioning costs already amounted to 4.3 billion euro¹⁴¹.

¹³⁴ van Gastel, van Maanen, and Kuijken, “Onderzoek toekomst governance gasgebouw,” 53.

¹³⁵ OECD, “Fossil Fuel Support - NLD”; description of measures.

¹³⁶ van Gastel, van Maanen, and Kuijken, “Onderzoek toekomst governance gasgebouw,” 54.

¹³⁷ OECD, “Fossil Fuel Support - NLD”; description of measures.

¹³⁸ IEA, “The Netherlands 2014 Review,” 134.

¹³⁹ van Gastel, van Maanen, and Kuijken, “Onderzoek toekomst governance gasgebouw,” 47.

¹⁴⁰ Energie Beheer Nederland (EBN), “Focus on Dutch Oil & Gas 2016,” 58.

¹⁴¹ EBN, “Netherlands Masterplan for Decommissioning and Re-Use,” 11.

If the abovementioned division of costs would become reality the share in decommissioning costs the government bears will not be proportional to its share in the profits from small-fields production, which lies around 65 percent, and would be far more than the share it is responsible for through its EBN participations. This would clearly lower production costs for operators and would thus amount to government support for oil and gas production. Moreover, it further strengthens the view that producers might be dependent on the government to take care of the boundary conditions in order to make production (more) profitable.

5.13 Government expenditure on production related damages

Since 2012 seismic activity around the Groningen field has become increasingly strong and has led to increased damage to buildings in the area¹⁴². This leads to costs related to research on seismic activity, safety inspections, and payments for building retrofitting, reparations on damaged buildings, extra safety measures in new construction projects and compensation payments. NAM, the operator of the Groningen field, is responsible for the safe operating of the field and thus liable for the damages caused by production¹⁴³. The NCG (national coordinator Groningen) has been established by 12 municipalities, the province of Groningen, and the national government to manage the damage repair and retrofitting process¹⁴⁴. Between 2016 and 2024 their budget amounts to 430.1 million, in addition, NAM and the province of Groningen will contribute 1.23 billion and 57.5 million euro respectively between 2014 and 2018¹⁴⁵. The NCG budget comes from the governments gas revenues. The government, both national and provincial, with 487.6 million, will thus contribute (directly) around 40 percent of the costs related to seismic activity. However, indirectly, this percentage will be higher. Through its participation in the Maatschap Groningen the national government will pay for 64 percent of the costs made by the NAM through reduced gas revenue¹⁴⁶. Combining the costs for the NCG and the indirect costs through the Maatschap the bill for the government will thus be around 1.2 billion. Moreover, the actual costs are very likely to be higher than currently budgeted. For example, the NAM and the province have already spent over 90 percent, and the NCG over 25 percent, of their budgets before the end of 2016¹⁴⁷. Moreover, municipalities in the region might face an increased workload due to earthquake related issues, leading to extra costs¹⁴⁸.

Even though the government is thus not directly liable for the damages it does share considerably in the costs. This, again, could hint at a dependency of the producing industry on the government to take care of boundary conditions and could constitute government support to gas production.

5.14 Discussion

Having reviewed the fossil fuel production segment using the topics and core questions set-out in the framework a clearer picture of the relationships between the government and the entities in this segment has emerged. It shows that the Dutch government has a large financial stake in the production of gas, with gas revenues consistently lying between 5 and 10 percent of the national budget. This provides a clear incentive for the national government to maximize gas production. Due to external shocks to the regime, earthquake induced production limits and price declines, gas

¹⁴² Onderzoeksraad voor Veiligheid, "Aardbevingsrisico's in Groningen: Onderzoek Naar de Rol van Veiligheid van Burgers in de Besluitvorming over Gaswinning (1959 -2014)."

¹⁴³ Ministry of the Interior and Kingdom Relations, "Mijnbouwwet"; Chapter 4, Article 33.

¹⁴⁴ Ministerie van Economische Zaken, "Over ons - Nationaal Coördinator Groningen."

¹⁴⁵ NCG, "Kwartaalrapportage Juli- September 2016," 27 & 28.

¹⁴⁶ Ministry of Economic Affairs, "Kamerbrief 'Gaswinning In Groningen,'" 9.

¹⁴⁷ NCG, "Kwartaalrapportage Juli- September 2016," 29.

¹⁴⁸ Groninger Krant, "Gemeente Loppersum Stelt Voor Belastingen Te Verhogen."

revenues have dropped to around 1 percent of government income in 2016, could decline even further in 2017. In addition, to maximize gas production and revenues, especially from the small-fields, the government is reliant on operators willing to invest in marginal fields. This has led to the introduction of support measures for such operators, reducing their costs of production. Unfortunately, it proved to be impossible to quantify the effects of the government support measures for production. It would have been very interesting to get a crude estimation of the effects of, for example, the marginal investment incentive, on the profitability of small-field operators.

Moreover, given the significant value of the oil and gas reserves on the ‘Dutch’ balance sheet there could be an incentive for the national government to maximize the size of these reserves since this would increase the wealth of the government. As EBN has stated, around a tenth of the total gas reserves is at risk of being permanently lost due to low-gas prices which has reduced the economic viability of off-shore infrastructure. There is thus a clear incentive for the government and EBN to attempt to ‘save’ these reserves, and the related revenue and value on the governments balance sheet. This might lead to further policies aimed at cost reductions for producers, and thus government support for the industry.

On a side note, this type of thinking by EBN and the government, together with an existing lock-in in gas due to the infrastructure already on the ground, could have contributed to EBN’s current interest in ‘green gas’ and carbon-capture and storage, and its offshore-wind to gas proposals¹⁴⁹.

Other forms of interdependency arise when it comes to the ‘boundary conditions’ of gas and oil production. From cradle to grave the government, at all levels, (indirectly) supports the production of fossil fuels through preliminary exploration research, and financial and policy support for decommissioning and the damaging effects of production.

6 Transport and Storage

The third block in the fossil fuel value chain is ‘Transport and Storage’. As the initial scoping revealed the Netherlands is an important importer and exporter of fossil fuels and has a well-developed oil and gas (transport) infrastructure including storage. The major transport hub is the ‘energy port’ of Rotterdam, with the Port of Amsterdam being strong in coal and petrol. Given the high importance of ports in the transport of fossil fuels in the Netherlands the first part of this chapter (section 6.1) will focus on Ports while section 6.2, 6.3, and 6.4 will provide an overview of the transport and storage activities of coal, oil, and gas in the Netherlands and the interdependencies that exist in this realm.

6.1 Ports

The Netherlands is a large importer and exporter of coal, oil and gas. Coal and oil enters the country mainly through sea or inland water transport, while gas is imported mainly through pipelines (see section 6.4). Small quantities of LNG, 2.3 Mt in 2015, enter the country through the GATE terminal in Rotterdam¹⁵⁰. This section will go further into how fossil fuels enter the Netherlands through ports and identify financial linkages with the government that occur in this part of the fossil fuel value chain.

¹⁴⁹ Energie Beheer Nederland (EBN), “Focus on Dutch Oil & Gas 2016,” 11.

¹⁵⁰ Port of Rotterdam, “Port of Rotterdam: Annual Report 2015,” 33.

The Netherlands has a total of 17 seaports, of which the largest are grouped into the port authorities 'Port of Rotterdam' (HbR), 'Port of Amsterdam' (HbA), 'Groningen Seaports' (GSP)¹⁵¹, 'Zeeland Seaports' (ZSP), and the Port of Moerdijk. After landing in port fossil fuels are transported further by inland waterways, rail, and pipelines¹⁵². Some oil and gas is also imported through pipelines, for example through the Antwerp-Rotterdam oil pipeline¹⁵³ or the gas interconnectors with Belgium, Germany, the U.K, or Norway¹⁵⁴ (see section 6.3 and 6.4).

In addition to facilitating the trade and transport of fossil fuels ports often host a variety of activities on its grounds such as storage, processing, electricity generation, maintenance of off-shore equipment, and different industries. All the activities in the ports are overseen by the port authorities. This section will look at the port authorities in specific since, being publicly owned, they are the prime link between the government and the fossil fuel industry in this block of the value chain¹⁵⁵. In addition, they hold the economic ownership over the ports lands and generate revenue through land leases and various shipping fees (see e.g. section 6.1.1.1). Activities taking place within port bounds, such as refining, will not be addressed specifically in this section, but will be addressed in the appropriate chapter.

Most ports are no longer an agency falling under the municipality in which they lie but instead a (indirectly) publicly owned firm¹⁵⁶. This means that the ports pay dividend to their shareholders and thus generate revenue for the municipalities, provinces, and the national government. For example, the national government expects a return on investment of around 10 percent a year for HbR and a pay-out rate of at least 40%¹⁵⁷.

The following sections will report on the financial relations between the ports and their public owners following the set of themes and questions as outlined in chapter 3. These questions are based on financial relationships found while surveying the annual reports of the port authorities and their shareholders.

6.1.1 Port of Rotterdam

6.1.1.1 Fossil fuel dependency

The Port of Rotterdam is very dependent on fossil fuels. It houses oil refineries and storage facilities, large coal import and storage terminals, the GATE LNG terminal, and power plants and industry that use oil, oil products, natural gas, and coal as an input¹⁵⁸. Almost 54 percent of the goods, based on tonnage, coming into the port are fossil fuels of which 30 percentage points crude oil, 9.5 coal, 0.2 LNG, and 13.5 mineral oil products. The terminals for the on- and offloading of fossil fuels, refineries, coal fired power plants, and the related movements by ship constitute a large part of the revenue generating activities in the port. In addition, the end products of the refineries are in its turn important

¹⁵¹ Coal import through the Zuidkade Terminal, direct use for the RWE Essent Eemshaven coal fired power plant (see section 8.1)

¹⁵² Drijver et al., "Annexes for: 'Nederland Duurzaam Distributieland': de Nederlandse Zeehavens En Hun Mogelijke Bijdragen Aan Verduurzaming van Productieketens," 4.

¹⁵³ Port of Rotterdam, "Pijpleidingen."

¹⁵⁴ IEA, "The Netherlands 2014 Review," 136.

¹⁵⁵ Port of IJmuiden N.V is the only private port in the Netherlands. It mainly hosts fishing and leisure crafts, but also provides services to the offshore (oil and wind) industry and harbours a steelmaking facility (which imports coking coal).

¹⁵⁶ The 'Naamloze Vennootschap' (N.V) is a public limited liability company, the shares in the port authorities are however not freely tradable since they can only be sold to Dutch public bodies.

¹⁵⁷ Ministry of Finance, "Jaarverslag Beheer Staatsdeelnemingen 2015," 32–33.

¹⁵⁸ IEA, "The Netherlands 2014 Review," 129.

inputs to the chemical and transport industries in the surrounding region¹⁵⁹. Many of the value adding activities that take place in the area of the port are thus fossil fuel based (see Appendix 27). The direct and indirect value generated by port activities amount to 3.3 percent of Dutch GDP and 2.1 percent of employment (2014 and 2015 data respectively). Around 10.000 of the 94.000 jobs in the port, and around 12.5 billion euro of the added value, are directly related to oil refining, the chemical industries, or the fossil power plants found there (2013 and 2014 data respectively)¹⁶⁰.

In 2015 the Port of Rotterdam generated 657,3 million euro in revenue, coming from port dues and rental – and leasehold contracts. In addition, the port received 19,6 million for managing the traffic guidance system, which is also used by the Port of Amsterdam¹⁶¹. HbR does not breakdown its revenues according to product group. However, given the 54 percent share of fossil fuels in the total tonnage, and when assuming an equal division of fees over the goods throughput, around half of all revenue could be attributed to the trade of fossil fuels and related activities. Calculated in this way ‘fossil’ income amounted to 355 million in 2015. It could ofcourse be that leasehold payments from fossil fuel related users contributed more, or less, but no data is available on this subject. Incidentally, it was found that GasUnie will pay HbR around 42 million in leaseholds over a period of 12 year following the opening of the LNG GATE terminal (see section 6.4.1.1.2).

6.1.1.2 Dividend payments

The Port of Rotterdam pays dividend to its shareholders on a yearly basis (see ome.

Figure 9). This amount has varied throughout the years depending on the realised revenue and special payments or deductions; for example, in 2004 the dividend paid to the municipality of Rotterdam was lowered in exchange for services rendered by the port in the establishment of the traffic guidance system¹⁶². In 2015 the dividend amounted to 91 million euro, of which 26.50 went to the national government and 64.50 to the municipality of Rotterdam. Again, it is impossible to determine exactly the share of fossil fuels in generating the dividend, it could however be assumed that this also lies around 54 percent.

For the national government the dividends paid by the port of Rotterdam represent only a very small share of the yearly income. With an income of 171 billion in 2015, excluding social premiums, this was about 0.015 percent¹⁶³. Compared to all the dividend that the government received from its participations and state owned enterprises in 2015, 977 million, this is 2.7 percent¹⁶⁴. For the municipality of Rotterdam, the 2015 dividend was about 1.8 percent of the city’s budget, or around 4 percent of total freely spendable income¹⁶⁵. For the national government Hbr’s dividends are thus not

¹⁵⁹ TNO, “Het Fossiele Dilemma van Rotterdam.”

¹⁶⁰ Ibid., 3.

¹⁶¹ Port of Rotterdam, “Port of Rotterdam: Annual Report 2015.”

¹⁶² Port of Rotterdam, “Port of Rotterdam: Annual Report 2004.”

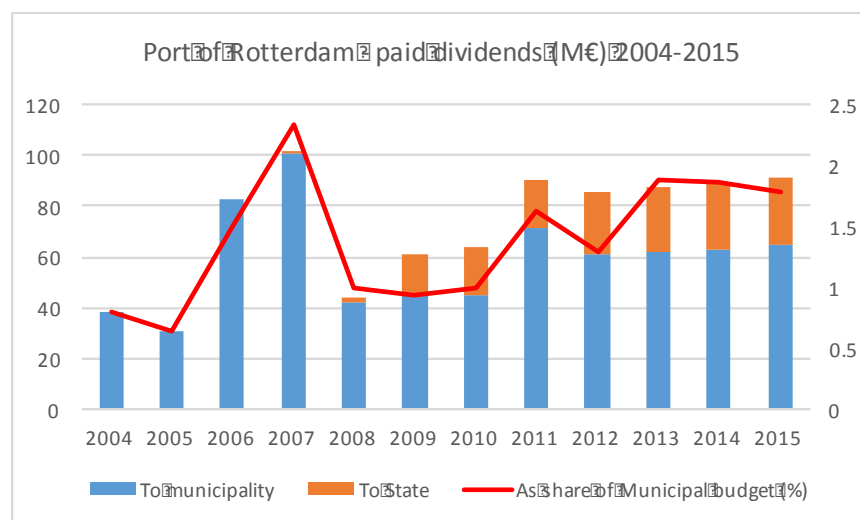
¹⁶³ Rijksoverheid, “Financieel Jaarverslag van Het Rijk 2015.”

¹⁶⁴ Ministry of Finance, “Jaarverslag Beheer Staatsdeelnemingen 2015.”

¹⁶⁵ Municipality of Rotterdam, “Algemene Dekkingsmiddelen • Jaarstukken 2015 Rotterdam.”

of any importance, however, for the municipality of Rotterdam, the dividend payments represent a substantial amount of freely spendable income.

Figure 9 Port of Rotterdam dividend payments (based on own analysis)¹⁶⁶



6.1.1.3 Capital value

In 2015 the municipalities share in the port in was in the books for 327.1 million, which is 24.1 percent of city's financial fixed assets and 7.7 percent of its total assets¹⁶⁷. Since the Government stopped publishing a yearly balance focussed just on the national government ('Staatsbalans') in 2012 and instead publishes a balance sheet for the entire government ('Overheidsbalans'), and since it does not publish the book value of the state-owned enterprises in its yearly report on the management of state holdings, it is not possible to determine the current value of the governments share in HbR as a share of its total assets. However, when it became a shareholder in 2007 it deposited 50 million in equity in exchange for its 29.17 percent share¹⁶⁸. In 2009 an extra 450 million was added to this, bringing the total deposited share capital to 500 million¹⁶⁹. This could be assumed to be the book value of their shares, this would however conflict with value of Rotterdam's shares, since they hold a larger share yet valued it lower. It is thus not possible to say with certainty what the value of Hbr is on the governments balance sheet. otter

6.1.1.4 Loans and guarantees

As part of the restructuring of the ownership structure of HbR in 2004 it received 12 subordinated loans, with a term of 10 years, to the height of 920 million and 256 million in other loans from the

¹⁶⁶ Before 2004 this were direct payments to the Municipality of Rotterdam. The state only became a shareholder in 2007. Sources: Port of Rotterdam, Annual reports 2002 – 2015

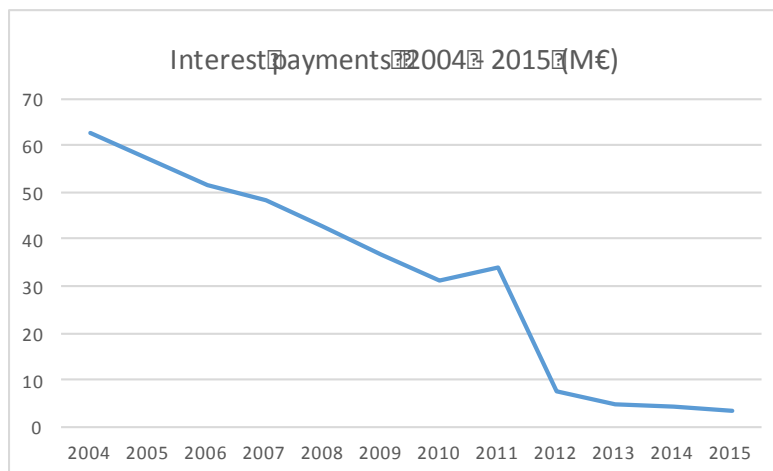
¹⁶⁷ Port of Rotterdam, "Port of Rotterdam: Annual Report 2015."

¹⁶⁸ Port of Rotterdam, "Port of Rotterdam: Annual Report 2007," 100.

¹⁶⁹ Port of Rotterdam, "Port of Rotterdam: Annual Report 2009," 104.

municipality¹⁷⁰. As of 2015 62.1 million remained of the initial loans which is currently being repaid at a rate of around 10 million a year¹⁷¹. HbR pays 5.72 percent interest over its long term loans and an average of 5.37 percent interest over its other loans with the municipality (bandwidth 4.81 percent to 6.14 percent)¹⁷². Figure 10 provides an overview of its annual interest payments between 2004 and 2015. Especially in the early years of the loan these interest payments have been a considerable source of income for the municipality of Rotterdam and, in those years, contributed more to their budget than the HbR dividends they received. In total the municipality received 384.4 million euro in interest in the years 2004-2015. No guarantees for loans to HbR given by the municipality or other financial streams between the two entities have been identified. Although not part of the scope of this thesis, HbR also receives, or has received, loans from the European Investment Bank (EIB). For example, HbR received 180 million in 2010¹⁷³.

Figure 10 HbR interest payments to Municipality of Rotterdam (based on own analysis)¹⁷⁴



6.1.1.5 Taxes

Currently the publicly owned Dutch ports do not pay corporation tax. This will however change from the first of January 2017 onwards. The national government expects that this will amount to 35 million a year for all ports. The port of Rotterdam however expects that they alone will have to pay about 60 million a year, meaning that the amount the national government will raise will be considerably higher¹⁷⁵. Taxes on activities in other parts of the chain will be treated in the relevant chapters, if possible.

6.1.1.6 Subsidies and other State contributions

The Port of Rotterdam regularly receives subsidies, usually related to a government policy project. For example, in 2014 it received a subsidy from the European Union to convert a ship to be able to use LNG as a fuel. Although EU subsidies are not part of this research it was the only subsidy that could be directly linked to a project and has therefore been used as an example.

¹⁷⁰ Port of Rotterdam, "Port of Rotterdam: Annual Report 2004," 34.

¹⁷¹ Municipality of Rotterdam, "Leningverstrekking • Jaarstukken 2015 Rotterdam."

¹⁷² Port of Rotterdam, "Port of Rotterdam: Annual Report 2015," 119 & 124.

¹⁷³ Port of Rotterdam, "Port of Rotterdam: Annual Report 2010," 96.

¹⁷⁴ Numbers for 2005-2007 are based on a calculation by the author. Actual amount could differ. Sources: Port of Rotterdam, Annual reports 2004-2015.

¹⁷⁵ de Jong et al., "Analyse Invoering Vpb-Plicht Nederlandse Zeehavens."

It is difficult to create a complete overview of the received subsidies since they are often not explicitly named in the yearly accounts or other company documents. The 2004 to 2009 Annual reports do report on the total amount of government and EU subsidies received but not which projects this entailed. From 2009 onwards government subsidies and contributions to investments are grouped together. Table 7 provides an overview of the, identifiable, subsidies and contributions received between 2004 and 2015. As can be seen in the table the subsidies represent a very small share of yearly investments.

Table 7 Port of Rotterdam subsidies + contributions received 2004 – 2015 (based on own analysis)

Year	Amount (M€)	As % of investments that year	Type
2004	3.5	3.6	Subsidy
2005	n/d	n/d	n/d
2006	6	2.6	Subsidy
2007	1.5	0.64	Subsidy
2008	6	3.1	Subsidy
2009	1.8	0.5	Subsidy
2010	n/d	n/d	n/d
2011	4.8	1	Subsidy + contributions
2012	11.9	2	Subsidy + contributions
2013	2	0.8	Subsidy + contributions
2014	5.9	3	Subsidy + contributions
2015	6.2	4	Subsidy + contributions
49.6			

The only fossil fuel related subsidy that is directly named is the above mentioned subsidy the port received for its participation in the project “LNG-Masterplan Rhine-Main-Danube” to promote the use of LNG as fuel for ships and as cargo. The total EU subsidy for this project amounts to 40 million euro, through the TEN-T program, however, it is unclear how much of this went to HbR¹⁷⁶.

6.1.1.7 Government investments

The State and municipality also contribute to investments in the Port of Rotterdam, especially for large infrastructural projects. For example, in the recent expansion “Maasvlakte 2”. Again, these investments cannot be linked directly to fossil fuel activity, however, investments in port expansion do contribute to the trade and use of fossil fuels. The Maasvlakte 2 houses a variety of activities ranging from container- to offshore wind terminals, but, as of yet, no fossil fuel related activity, it does however free up space in other parts of the port. Maasvlakte 1 – an earlier port expansion – houses a variety of fossil fuel related activities such as coal terminals¹⁷⁷. Moreover, an extra capital injection by the national government leaves the port more space to invest its own capital into other projects, which again could have a fossil character.

Other investments done by the government, or by the government and port authority together, in hinterland connections, will benefit the port but will be very difficult to attribute to benefiting the trade or transport in fossil fuels. For example, in the coming years HbR will contribute to the diversion of a part of the rail way line leading towards the port (Theemswegtrace)¹⁷⁸. In the past large infrastructural projects, such as a train connection with Germany (‘Betuweroute’), have been paid by the national government. Such projects have not been included in this analysis due to the difficulty of quantifying their ‘fossil aspect’; e.g. to what extent they are used for the transport of fossil fuels. But

¹⁷⁶ Port of Rotterdam, “Port of Rotterdam: Annual Report 2015,” 70.

¹⁷⁷ Port of Rotterdam, “Facts and Figures on the Rotterdam Energy Port and Petrochemical Cluster.”

¹⁷⁸ Port of Rotterdam, “Port of Rotterdam: Annual Report 2015,” 49.

do contribute to the interdependency of the government and the fossil fuel industry when it comes to the transport of fossil fuels.

Figure 11 Port of Rotterdam – Government Investments 2004 – 2015 (based on own analysis)¹⁷⁹

Year	Investor	Investment (M€)	Note
2007	National Government	50	Nat. Gov. enters as share holder
2009	National Government and Municipality of Rotterdam	450	Criteria for 2 nd share capital deposit by Nat. Gov. fulfilled
2011	National Government	363	Nat. Gov. contribution to 'Maasvlakte 2'
2012	National Government	363	Nat. Gov. contribution to 'Maasvlakte 2'
2013	Port of Rotterdam	-290	Part restitution of Nat. Gov. contribution to 'Maasvlakte 2'
Total		936	

6.1.1.8 Discussion

On the whole, it can be said that the Port of Rotterdam is highly fossil, and strongly connected to both the municipality of Rotterdam and the national government through ownership, dividend payments, loans and interest payments, and through operational subsidies and investment contributions from the government. This clearly shows that, especially for large infrastructural projects, such as port expansion, the port is dependent on government contributions. Although hard to quantify, these contributions definitely support the transshipment of fossil fuels.

6.1.2 Port of Amsterdam

6.1.2.1 Fossil fuel dependency

Similar to Rotterdam the Port of Amsterdam (HbA) is very fossil fuel dependent. It is the world's largest petrol port and Europe's second coal port (after the Port of Rotterdam)¹⁸⁰. In 2015 coal and amounted to 77.4 percent of total tonnage transhipped (only seaport of Amsterdam)¹⁸¹. Figure 12 provides an overview of the fossil fuel transshipment of the Port of Amsterdam for the years 2001-2016.

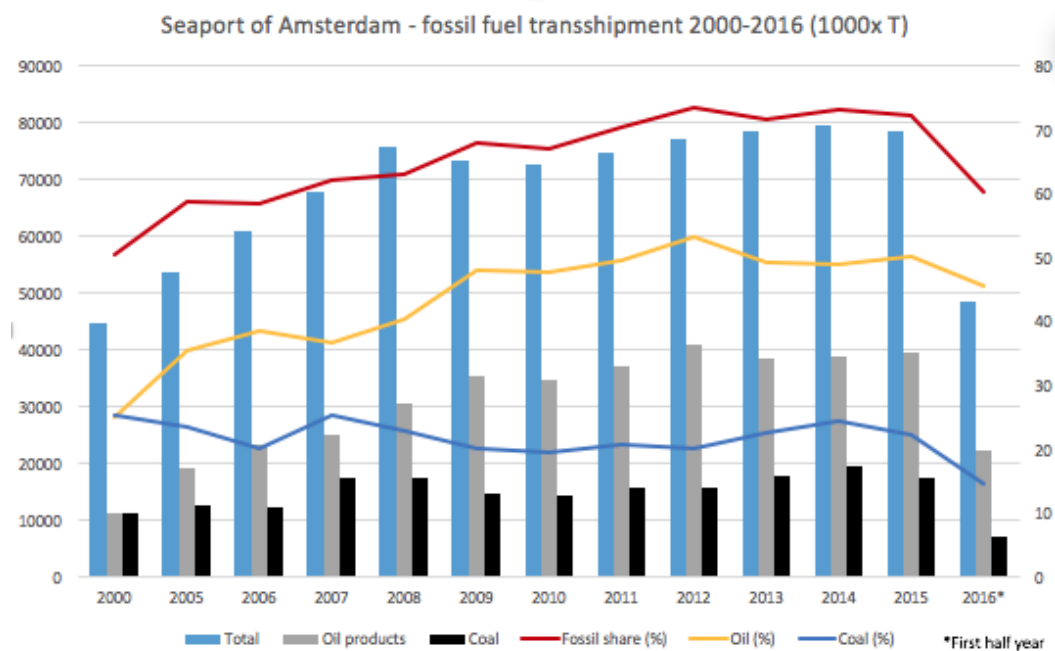
Figure 12 Port of Amsterdam - fossil fuel transshipment 2001-2016 (based on Port of Amsterdam 2012 -2015)¹⁸²

¹⁷⁹ Port of Rotterdam, "Port of Rotterdam: Annual Report 2007"; Port of Rotterdam, "Port of Rotterdam: Annual Report 2009"; Port of Rotterdam, "Port of Rotterdam: Annual Report 2011"; Port of Rotterdam, "Port of Rotterdam: Annual Report 2012"; Port of Rotterdam, "Port of Rotterdam: Annual Report 2013."

¹⁸⁰ Port of Amsterdam, "Port of Amsterdam: Annual Report 2012," 2.

¹⁸¹ Port of Amsterdam, "Port of Amsterdam: Annual Report 2015," 28&29.

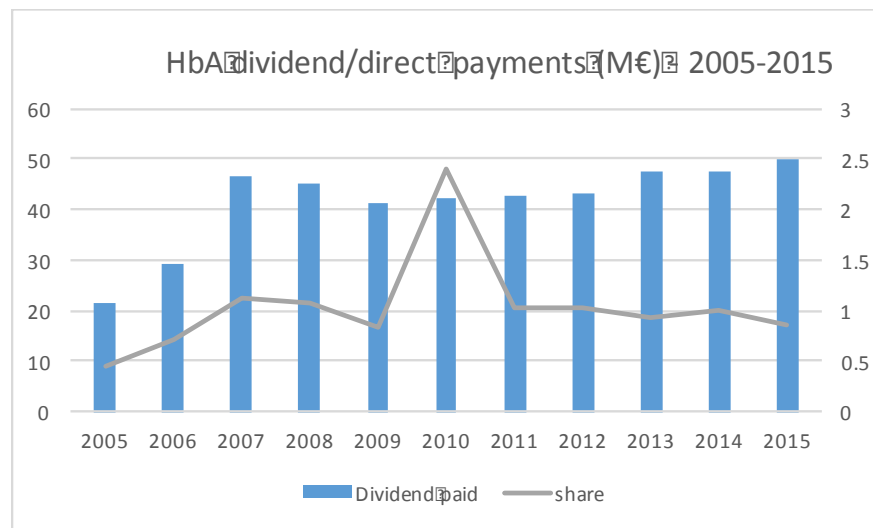
¹⁸² Port of Amsterdam, "Port of Amsterdam: Annual Report 2012"; Port of Amsterdam, "Port of Amsterdam: Annual Report 2014"; Port of Amsterdam, "Port of Amsterdam: Annual Report 2015."



6.1.2.2 Dividend payments

HbA only separated from the city in 2013, with the city becoming its sole shareholder, and has paid dividends since then. In 2015 this amounted to 50 million (see Figure 13). Although a non-negligible contribution to the city's budget in absolute terms, HbA contributes on average only 1 percent to the city's budget. However, since revenues from the city's participations are not bound to a certain policy program they provide source of income for the city that can be freely spend¹⁸³. As share of the cities freely spendable income HbA dividend amounted to 1.85 percent in 2015¹⁸⁴.

Figure 13 Port of Amsterdam - Dividends 2005-2015 (based on own analysis)¹⁸⁵



¹⁸³ Municipality of Amsterdam, "Municipality of Amsterdam: Annual Report 2015," 215.

¹⁸⁴ Ibid., 271.

¹⁸⁵ Source: Port of Amsterdam: Annual Reports 2005-2015.

6.1.2.3 Capital value

Amsterdam values its participations based on the historical purchase price of the shares¹⁸⁶. In 2015 the HbA was in its books for 304,9 million, making it by far the most valuable participation in the cities portfolio¹⁸⁷. The port represents 22.5 percent of the city's total financial assets and 2.4 percent of its total assets¹⁸⁸.

6.1.2.4 Loans and guarantees

Upon restructuring the ports ownership in 2013 HbA received a 3-year loan to the amount of 147.1 million from the municipality on which it pays 5.01 percent interest a year. In addition, it can make use of a credit facility with the municipality to the height of 50 million. However, from 31 December 2014 onwards HbA has not made use of this facility and it is supposed to be externally refinanced in 2016¹⁸⁹. HbA paid 7.2 million in interest in 2013, 6.2 million in 2014, and 5.2 million in 2015. Again this represents a very small share of the cities revenues (e.g. compare with Figure 13).

In 2015 the remaining 105 million in loans was repaid. The HbA refinanced 60 million of the loan with the Dutch Rabobank and Bank Nederlandse Gemeente¹⁹⁰(BNG)¹⁹¹. Coincidentally the municipality of Amsterdam has a 1.1 percent share (with a book value of 1.4 million) in the BNG it is thus still (very) indirectly involved in the loan¹⁹². The city of Amsterdam did not provide any guarantees to HbA.

6.1.2.5 Subsidies and contributions

Similar to HbR, HbA does not break down the (investment and operational) subsidies it receives in its reporting. Moreover, HbA does not explicitly report on if, and if so, on the amount of, subsidies it received in a specific year. For 2014 and 2015 subsidy amounts could be identified by combining the following items found in the annual accounts: "subsidies received in advance" and "subsidies to be received". In 2014 this amounts to 1 million and in 2015 to 2.3 million. It is however unclear what type of subsidies this entails and whether this covers all subsidies received. Unfortunately, the older annual accounts do not contain these items.

In addition, it could be identified that HbA received 1.5 million euro in contributions from third parties in 2014, and 780 thousand in 2015. It is however not possible to determine who these third parties were and thus if there are any links with government parties¹⁹³.

6.1.2.6 Government investments

The most recent investment by the government in the Port is the planned construction of a new sea lock in IJmuiden. The new 500m long lock will allow larger ships to enter the port of Amsterdam. According to the current budget Amsterdam will contribute 101.25 million euro, the province of North-Holland 56 million, and the national government, through the Ministry of Infrastructure and the Environment 600 million to its construction¹⁹⁴. In addition, it has received 4.45 million in EU subsidies through the TEN-T program and further 11 million in EU subsidies is expected for the construction phase¹⁹⁵. The investment decision was based on increased demand for coal, agricultural

¹⁸⁶ Municipality of Amsterdam, "Municipality of Amsterdam: Annual Report 2015," 407.

¹⁸⁷ Ibid., 396.

¹⁸⁸ Ibid., 460.

¹⁸⁹ Port of Amsterdam, "Port of Amsterdam: Annual Report 2014," 100.

¹⁹⁰ BNG is also a state-owned enterprise. See initial scoping

¹⁹¹ Port of Rotterdam, "Port of Rotterdam: Annual Report 2015," 92.

¹⁹² Municipality of Amsterdam, "Municipality of Amsterdam: Annual Report 2015," 396.

¹⁹³ Port of Amsterdam, "Port of Amsterdam: Annual Report 2015," 113.

¹⁹⁴ Stil, "Zeesluis Kost Amsterdam Miljoenen Meer - Binnenland - PAROOL."

¹⁹⁵ Rijkswaterstaat, "Fase 2 Planuitwerking Zeesluis."

bulk, container transshipment and increasing cruise ship activity¹⁹⁶. This assumption case can, however, already be questioned since HbA announced in March 2017 to phase-out coal in the port by 2030¹⁹⁷. Similar to hinterland connections, as discussed in the previous section, it is not possible to determine to what extent such a lock enlargement benefits the transshipment of fossil fuels. However, being explicitly mentioned as a driver for doing this investment it is likely that the new lock will benefit the transit of coal.

No other large investments in which the national government or the city of Amsterdam participated were found. Technically all investments done by the port before its increased independence through the N.V structure in 2013 could be seen as investments done by the city.

6.1.2.7 Discussion

In conclusion, HbA is heavily reliant on the fossil fuels coal and oil, and the relationship between the city and the port is strong. Until 2013 the port was part of the city itself, and has paid between 20 and 50 million in contributions or dividends between 2005 and 2015. Although a small percentage of freely spendable income, around 1.85 percent in 2015, this presents a non-negligible revenue for the city. Similar to Rotterdam, there is a strong interdependency between the port and the city.

6.1.3 Zeeland Seaports

6.1.3.1 Fossil fuel dependency

Similar to the HbR and HbA, ZSP has a large dependency on fossil fuels when it comes to throughput (see Figure 14). Assuming an equal division of shipping fees over the tonnage, around 25 percent of ZSP's revenues are derived from shipments of fossil fuels. If an equal division would be assumed in its revenues coming from rents and leaseholds around 60 percent, using the share of fossil fuel in throughput, of ZSP's total revenues would be fossil fuel related. This would amount to 30.7 million euro in 2015 (see Table 8). Fossil fuel related activities in ZSP include oil refining, oil and coal storage, and chemical production.

Figure 14 Zeeland Seaports Fossil fuel imports and exports (Based on own analysis)¹⁹⁸

¹⁹⁶ Amelung, "'Nieuwe Megasluis IJmuiden Is Groot Risico Voor Amsterdam' - Opinie - PAROOL."

¹⁹⁷ Port of Amsterdam, "Port of Amsterdam: Strategic Plan 2017-2021," 4.

¹⁹⁸ Municipality of Amsterdam, "Annual Report: 2003"; Municipality of Amsterdam, "Annual Report: 2004"; Municipality of Amsterdam, "Annual Report: 2005"; Municipality of Amsterdam, "Annual Report: 2006"; Municipality of Amsterdam, "Annual Report: 2007"; Municipality of Amsterdam, "Annual Report: 2008"; Municipality of Amsterdam, "Annual Report: 2009"; Municipality of Amsterdam, "Annual Report: 2010"; Municipality of Amsterdam, "Annual Report: 2011"; Municipality of Amsterdam, "Annual Report: 2012"; Zeeland Seaports, "Zeeland Seaports: Annual Report 2013"; Zeeland Seaports, "Zeeland Seaports: Annual Report 2014"; Zeeland Seaports, "Zeeland Seaports: Annual Report 2015."

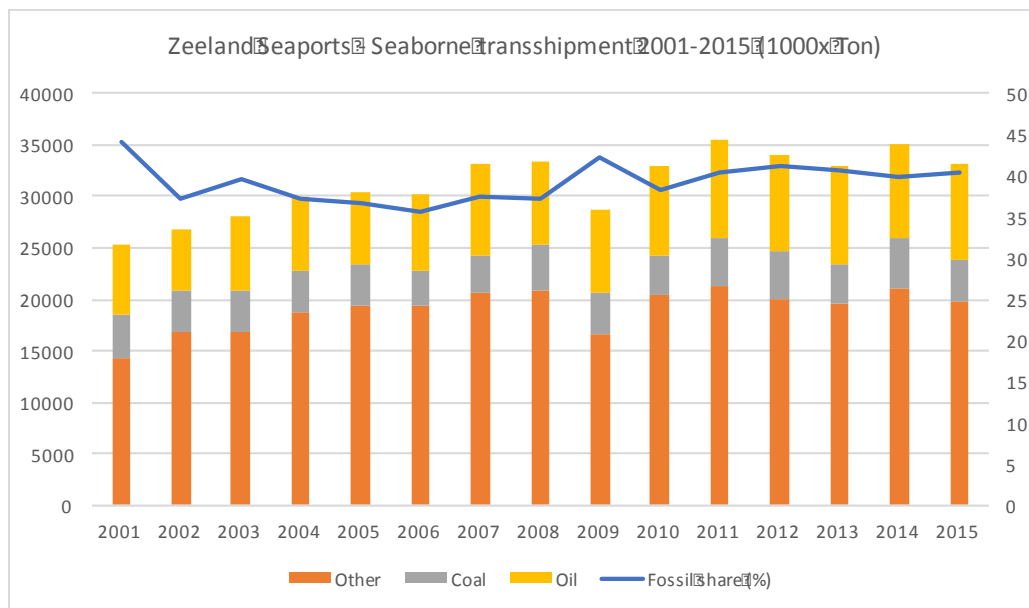


Table 8 ZSP Revenue 2012 – 2015 (based on own analysis)¹⁹⁹

M€	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Shipping related	14.0	14.1	15.4	14.7	15.6	15.7	16.1	17.4	16.8	17.1	19.7	21.5	20.9	20.1	20.9
Leasehold/rent	23.9	28.6	56.1	7.0	16.9	11.3	13.5	15.0	18.8	24.1	25.2	26.0	24.5	26.2	27.2
Other	2.1	2.3	75.9	25.3	2.5	2.4	2.5	8.7	3.9	6.1	6.8	1.7	1.8	2.4	4.6
Total	39.9	45.0	147.4	47.0	35.1	29.4	32.1	41.1	39.5	47.3	51.7	49.1	47.2	48.7	52.7
Profit	5.4	6.3	7.8	6.2	9.8	7.8	12.7	8.4	11.4	-9.6	-3.7	-15.7	-15.1	0.0	8.0
Fossil share of revenue	17.6	16.8	58.5	17.4	12.9	10.5	12.1	15.3	16.7	18.1	20.8	20.2	19.2	19.4	21.3

6.1.3.2 Dividend payment

Due to its financial situation, ZSP made a profit for the first time in five years in 2015, and the wish of the shareholders to invest in the port, ZSP does not currently pay dividends²⁰⁰. However, ZSP paid a total of 60 million to different municipalities since its autonomisation in 2006 as a contribution to different (infrastructural) projects²⁰¹. Assuming a 40 percent fossil share, around 24 million euro in fossil payments was done over the years to different municipalities. This does not mean much in terms of interdependencies.

6.1.3.3 Capital value

Due to the indirect ownership of ZSP N.V through the GR ZSP the province and municipality do not directly own any shares, there has thus not been a grant of capital by the shareholders of the GR and consequently no mention in the books of the shareholders of the ZSP. When becoming independent in 2011 ZSP was valued at 160 million and it is in GR ZSP's books for this amount²⁰². In 2015 the Province of Zeeland's assets were valued at 328 million²⁰³, those of Vlissingen at 190 million²⁰⁴, Borsele

¹⁹⁹ Ibid.

²⁰⁰ Municipality of Borsele, "Municipality of Borsele: Annual Report 2015," 108.

²⁰¹ Zeeland Seaports, "Zeeland Seaports: Annual Report 2013," 4.

²⁰² GR ZSP, "GR Zeeland Seaports: Annual Report 2014," 3.

²⁰³ Province of Zeeland, "Province of Zeeland: Annual Report 2015," 167.

²⁰⁴ Municipality of Vlissingen, "Municipality of Vlissingen: Annual Report 2015," 138.

at 48 million²⁰⁵, and Terneuzen at 236 million²⁰⁶. According to their share in the GR ZSP, this represents, respectively, a share of 24 percent, 14 percent, 55 percent, and 11.3 percent of their current total assets (in which the ZSP is not included).

6.1.3.4 *Loans and Guarantees*

The GR ZSP currently guarantees loans held by the ZSP up to the total of 500 million, of which 358 is currently being used²⁰⁷. The Province of Zeeland guarantees up to 250 million and the other 250 million is shared by the municipalities²⁰⁸. These guarantees will be slowly brought back to zero in 2028, after which the GR can be dissolved and the province and municipality become direct shareholders of ZSP. In addition, the GR is the final guarantor for a 65 million guarantee that ZSP has given to its subsidiary 'WarmCo2'. For these guarantees not to be earmarked as state support ZSP has paid a fee in exchange at market rates in 2011. This amounted to 36 million, of which 26 million was paid in cash and 10 million in services delivered by the ZSP to the GR free of charge²⁰⁹. In 2015 the province of Zeeland's budget (income) amounted to 233 million euro and its freely spendable revenue to 128 million euro ('algemene dekkingsmiddelen')²¹⁰. This means that the guarantees by the province to ZSP are larger than its entire budget and almost twice their annual freely spendable revenue. Moreover, Zeeland's reserves amounted to 23.6 million in 2015 this means that the guarantees given are more than ten times larger than the financial reserves of the province²¹¹.

6.1.3.5 *Subsidies and contributions*

Similar to other ports investment and operational subsidies are not mentioned explicitly in the reports but are deducted from the reported assets²¹². This means that no subsidies or contributions from the government side could be identified for ZSP. On the other hand ZSP paid the municipality of Borsele 1.4 million which will be used to plant a new forest in the municipality²¹³.

6.1.3.6 *Government Investment*

One large investment project for which ZSP received government support has been identified. In 2012 it was decided that ZSP will receive 6 million from the GR the construction of a new lock in Terneuzen, payment is expected in 2017²¹⁴.

6.1.3.7 *Discussion*

Similar to HbA and HbR ZSP is also very dependent on the transshipment of fossil fuels and related activities such as refining or storage. Moreover, given its poor financial performance, the port is dependent on its public shareholders to provide loans and guarantees. In this case there is thus a clear dependency of the industry on the government to keep the port afloat in order to continue their business.

6.1.4 *Groningen Seaports*

²⁰⁵ Municipality of Borsele, "Municipality of Borsele: Annual Report 2015," 121.

²⁰⁶ Municipality of Terneuzen, "Municipality of Terneuzen: Annual Report 2015," 121.

²⁰⁷ Zeeland Seaports, "Zeeland Seaports: Annual Report 2015," 22.

²⁰⁸ Blommaert, van Galen, and Bruin, "Deelnemingen: Overzicht En Inzicht," 7.

²⁰⁹ GR ZSP, "GR Zeeland Seaports: Annual Report 2014," 3.

²¹⁰ Province of Zeeland, "Province of Zeeland: Annual Report 2015," 132.

²¹¹ Ibid., 84.

²¹² Zeeland Seaports, "Zeeland Seaports: Annual Report 2015," 59.

²¹³ GR ZSP, "GR Zeeland Seaports: Annual Report 2014," 8.

²¹⁴ Zeeland Seaports, "Zeeland Seaports: Annual Report 2015," 85.

6.1.4.1 Fossil fuel dependency

Historically Groningen seaports is less dependent on fossil fuels than other Dutch ports. In 2015 oil products represented 2 percent of total throughput and fuel products, which could include non-fossil products, 24 percent²¹⁵. Its main land-based activities include chemicals, electricity production (coal, gas, wind), agribusiness, and datacentres²¹⁶. Gas and coal are used to run the power plants located in the Eemshaven, it is likely that natural gas arrives directly by pipeline from the Groningen production sites. It is however unsure if the coal for the RWE Eemshaven plant²¹⁷ is included in the ports figures. According to the author's own (rough) estimations these imports should amount to around 2.6 Mt of coal a year (based on installed capacity and full load hours)²¹⁸. However, if it is included in the figures this could explain the rise in solid fuels throughput between 2013 and 2015.

Table 9 Groningen Seaports throughput 2010 – 2011 (based on own analysis)²¹⁹

Mt	2010	2011	2012	2013	2014	2015
Coal	0.1	0.1	0.1	0.1	1.4	2.7
Oil	1.1	0.7	1.2	0.6	0.5	0.2
Total fossil	1.1	0.8	1.3	0.7	1.9	2.9
Total throughput	7.6	8.1	8.7	7.3	10.1	11.3
Fossil share (%)	15	9.9	15	10	19	26

Table 10 Groningen Seaports revenue, profit, and dividend 2006-2007 (based on own analysis)²²⁰

M€	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	14.4	19.2	42.5	25.5	36.9	23.8	27.7	31.5	48.3	32.6
Profit	2	5.9	25.6	5.5	14.5	0.1	1.6	1.4	2.7	3.5
Dividend/payment	0	0	0	0	0	0	0	0	0	0.6

6.1.4.2 Dividend payments

GSP became an independent entity in 2013 with all shares being held by the GR GSP. Its first dividend payment was done in 2015 and amounted to 673.000 euro²²¹. Given limited availability of data it is unsure whether payments have been done in the past, when the port was still part of the municipalities/province.

6.1.4.3 Capital value

GSP is valued at 198 million. The GR GSP total assets are valued at 220 million, this includes the initial contribution in share capital of 198 million to GSP and 22 million in loans (long-term receivable) by

²¹⁵ Groningen Seaports, "Groningen Seaports: Facts & Figures 2015."

²¹⁶ Groningen Seaports, "Business - Groningen Seaports."

²¹⁷ RWE AG, "RWE AG - EEMSHAVENCENTRALE."

²¹⁸ Groninger Internet Courant, "Eerste Kolenschip Meert Aan in Eemshaven."

²¹⁹ Groningen Seaports, "Groningen Seaports: Facts & Figures 2010"; Groningen Seaports, "Groningen Seaports: Facts & Figures 2012"; Groningen Seaports, "Groningen Seaports: Facts & Figures 2014"; Groningen Seaports, "Groningen Seaports: Facts & Figures 2015"; Groningen Seaports, "Groningen Seaports: Facts & Figures 2013."

²²⁰ Groningen Seaports, "Groningen Seaports: Annual Report 2011"; Groningen Seaports, "Groningen Seaports: Annual Report 2012"; Groningen Seaports, "Groningen Seaports: Annual Report 2013"; Groningen Seaports, "Groningen Seaports: Annual Report 2014"; Groningen Seaports, "Groningen Seaports: Annual Report 2015," 2016.

²²¹ Groningen Seaports, "Groningen Seaports: Annual Report 2015," 2016, 15.

the GR GSP to the GSP²²². The 220 million in capital provided by the GR equals 9 percent of the province of Groningen's 2015 total assets²²³, 51 percent of the municipality of Eemshaven's 2014 total assets²²⁴, and 40 percent of the municipality of Delfzijl's 2015 total assets²²⁵.

6.1.4.4 Loans and Guarantees

The GR GSP guarantees 100 percent of GSP's finance needs up to a maximum of 269 million. This was increased from up to 80 percent guaranteed before 01/01/2016 because the GSP was unable to raise the remaining 20 percent without a public guarantee²²⁶. This means that the Province of Groningen guarantees up to 161,4 million, and municipalities of Eemshaven and Delfzijl both up to 67 million²²⁷. This guarantee is supposed to be slowly reduced, reaching zero in 2034.

6.1.4.5 Subsidies and contributions

No subsidies and contributions were identified.

6.1.4.6 Discussion

In conclusion, similar to ZSP Groningen Seaports is dependent on guarantees by its public owners to receive financing. Also, for its municipal owners the port presents a considerable capital investment both in the form of asset value and guarantees given. There is thus a clear incentive for the municipalities to support GSP, e.g. in financially rough times, to prevent financial losses. GSP is less dependent on fossil fuel related throughput than other ports, but, with the share of fossil fuels rising from 19 to 26 percent of total throughput between 2014 and 2015 this dependency is increasing.

6.1.5 Port of Moerdijk

The smaller port of Moerdijk will be discussed shortly due to a limited amount of available data. The port only became an independent entity in 2017, being directly part of the municipality of Moerdijk before. Although the port houses a variety of fossil fuel intensive activities, such as a large chemical cluster, the share of fossil fuels in goods transshipped is limited (Table 11). The fossil dependency of the port is thus limited. Moreover, although the port runs a profit, no payments to the owners could be identified.

Table 11 Port of Moerdijk goods throughput²²⁸

1000 Tons	2009	2010	2011	2012	2013	2014	2015
Coal	116	214	191	203	23	0	2
Oil (products)	1509	1875	1913	1623	752	627	641
Crude oil	0	0	0	0	0	0	0
LNG	0	0	0	0	0	0	1
Total	13653	18732	21767	20291	18497	16781	16589
Fossil share (%)	11.9	11.2	9.7	9	4.8	4.5	5.6

²²² GR GSP, "Programmaverantwoording En Jaarstukken 2014 GR Havenschap Groningen Seaports."

²²³ Province of Groningen, "Province of Groningen: Annual Report 2015," 334.

²²⁴ Municipality of Eemshaven, "Municipality of Eemshaven: Annual Report 2014," 103.

²²⁵ Municipality of Delfzijl, "Municipality of Delfzijl: Annual Report 2015," 124.

²²⁶ Province of Groningen, "Province of Groningen: Annual Report 2015," 247.

²²⁷ Ibid.

²²⁸ Port of Moerdijk, "Port of Moerdijk: Annual Report 2011"; BMD Advies, "Monitoringrapport Haven-En Industrierrein Moerdijk: 2012"; Port of Moerdijk, "Port of Moerdijk: Annual Report 2013"; Port of Moerdijk, "Port of Moerdijk: Annual Report 2014"; Port of Moerdijk, "Port of Moerdijk: Annual Report 2015."

Table 12 Port of Moerdijk revenue, profit, dividends²²⁹

M€	2010	2011	2012	2013	2014	2015
Revenue	18.7	20.6	21.6	20.4	20.7	20.4
Profit	14.3	11.6	5.1	4.1	4.9	8.2
Dividends	0	0	0	0	0	0

6.1.6 Infrastructure investment

The government is the main investor in infrastructure surrounding the ports and in port-hinterland connections. Although such investments benefit not only port throughput, they do have a cost reductive effect on the transport of goods, including fossil fuels. Table 13 gives some examples of planned infrastructural projects surrounding ports (some of these were mentioned in the sections above). Although it is not possible to determine to what extent they benefit the trade in fossil fuels, which would also depend on the fossil share of port throughput, they do constitute an interdependency between the government and industry. Given the limited dependency of the port on fossil fuels no further analysis of financial ties between the public owners and the port has been undertaken since even strong financial ties in this respect would not indicate an interdependency between the government and the fossil fuel industry.

Table 13 National government investments in infrastructure in port regions (adapted from Ministry of Infrastructure and Environment, 2016)²³⁰

State investment in infrastructure surrounding ports		
Project	Budget (M €)	Completion date
Deepening Eemshaven channel	30	2017
Railway to Vlissingen (Zeeuwse Lijn)	27	2017
Port of Amsterdam lock expansion (Zeetoeegang IJmond)	604	2019
Caland bridge/Theemsweg trace (Port of Rotterdam)	158	2020
New sluice Terneuzen (ZSP)	174	2021
Road expansion near port of Rotterdam (Blankenburgverbinding)	857	2022-2024
Channel adaptation Gent – Terneuzen (ZSP)	165 (Maximum)	n/d
Rail connection Maasvlakte 2	217	n/d
Total	2.232	

²²⁹ Port of Moerdijk, "Port of Moerdijk: Annual Report 2011"; Port of Moerdijk, "Port of Moerdijk: Annual Report 2013"; Port of Moerdijk, "Port of Moerdijk: Annual Report 2014"; Port of Moerdijk, "Port of Moerdijk: Annual Report 2015."

²³⁰ "Rijksbijdrage infrastructurele projecten rondom zeehavens"; Ministerie van Infrastructuur en Milieu, "Reactie Op de Moties Naar Aanleiding van Het Debat over Het Vervallen van de Vrijstelling van Vennootschaps- Belasting Voor de Nederlandse Zeehavens (TK 34003, Nrs. 18, 19 En 23)."

6.1.7 Discussion

This section analyzed the financial links between the port authorities of the Netherlands' main sea ports, and fossil fuel handling ports, and the government. It attempted to determine the fossil dependency of the port authority's revenues and looked at the capital value of government shares in the port authorities, the dividend and interest payments from the authority to the public bodies, subsidies and contributions given by the government, and investments done by the public bodies in the port authorities or related infrastructure.

It was found that the bigger ports, HbR and HbA, pay, or have paid in the past, considerable amounts to their shareholders in interest on loans and dividend. Constituting up to 4 percent of annual freely spendable income for the municipality of Rotterdam, and up to around 2 percent for the municipality of Amsterdam. All port authorities are depended on their public shareholders in some way. Smaller ports, such as GSP and ZSP, have been given guarantees on loans, and in the case of ZSP a fee was paid by the port in exchange for the guarantee. Ports need such guarantees to attract capital on the private market. Especially GSP had difficulties in attracting finance from private bodies, the shareholders had to increase the share of loans guaranteed up to 100 percent due to a failure of GSP to get a loan under market conditions. In addition, all ports need financial support from their public shareholders for large infrastructural investments such as port expansions (e.g. Maasvlakte 1 & 2), maintaining or expanding waterways (e.g. dredging the Eemshaven channel), or railway connections.

Given the large fossil dependency of these ports, especially HbR, HbA, and ZSP, between 50 and 70 percent of their revenue could be ascribed to fossil fuel related activities. This means that dividends and interest payments that the public shareholders receive are strongly related (between 50 and 70 percent) to fossil fuels. Moreover, any investments done or contributions given by the public shareholders benefit fossil fuel related activities in this proportion. In addition, especially for port expansion investments, these are investments that are likely to not have been possible without the support of the public owners/. It can thus be concluded that the port authorities are dependent on government support when it comes to doing large investments, which benefit the throughput of fossil fuels.

On the other hand, especially for the municipality of Rotterdam, with the combined interest payments and dividends presented a considerable share of their yearly income (3-5 percent), there is also a dependency from the government on the, largely fossil fuel driven, ports. For the HbA and the municipality this dependency is less strong since the dividend payments account to around 1-2 percent of the city's revenue on average. For GSP and ZSP the dependency mainly runs one way, from the port to the public shareholder, since no (ZSP), or only very small (GSP) dividends are paid. These dependencies mean that there is an indirect linkage between the trade and processing of fossil fuels within the ports boundaries and the government which could have a positive effect on the fossil fuels industry to operate. In addition, the large amount of fossil fuel related activities, such as petrochemical and chemical industries, especially in the case of HbR, adds to the fossil aspect of these interdependencies.

6.2 Coal

6.2.1 Transport and Storage

Coal is transported in the Netherlands over sea, inland waterways, and rail²³¹. After arriving at one of the ports discussed in section 6.1 the coal is either stored, used directly by power plants or for steel production, or transported. Coal is offloaded by stevedores, many of which also offer storage services

²³¹ IEA, "The Netherlands 2014 Review," 164.

(see Appendix 26). These stevedores pay fees and leases to the ports in which they are located, as discussed in the previous section, and pay the regular corporate taxes.

The only company that transports coal by rail is 'DB Cargo Netherlands N.V', a subsidiary of the 'Deutsche Bahn', which is wholly owned by the German Federal Government²³². The Dutch state-owned railways, 'NS', are no longer involved in cargo transport having sold 'NS cargo' to 'DB Cargo' in 2000. However, the Dutch railways are managed by a government organization, 'Prorail', and the government invests in railway expansions. For example, the 'Betuweroute', a rail connection between the Netherlands and Germany, which is used for coal transports, was paid by the government through a 4.5 billion investment coming from the gas revenues (through the 'Economic Structure Enhancement Fund' (FES))²³³. Although this train connection is not used solely for the transport of coal, and it is not known to what extent it is used for coal – or other fossil fuels –, the transport of fossil fuels is thus indirectly supported by government investments in infrastructure.

Transport over inland water ways is done by barging companies. This sector is completely privatized. However, 'DB Cargo' offers coal transport services between the ports of Rotterdam and Amsterdam and Germany through its subsidiary 'DAB Barging B.V'. Again, transport over water also benefits from general infrastructure investments and waterway maintenance from and by the government. There are however no clear direct dependencies between the Dutch government and coal transports over inland waterways.

Given that the road transport sector is completely privatized, again, except for the construction and maintenance of roads, it is not likely that there is a relation with government in this respect. Moreover, it is not very likely that coal is transported by road within the Netherlands, given the existence of better modes of transport such as rail and water.

6.3 Oil

This section provides an analysis of the transport and storage of oil and related products. The findings of this section will be discussed together with the natural gas storage and transport section (see 6.4.3).

6.3.1 Transport

Similar to coal, oil and oil products usually arrive by ship from overseas, as discussed in section 6.1. After having landed in the Netherlands they are processed or refined (see chapter 7) and then transported by pipeline, road, rail, or inland water ways.

6.3.1.1 Pipelines

Around 35 percent of all oil, oil products, and chemical products are transported through pipelines²³⁴. For example, the port of Rotterdam alone has a network of around 1500 km of pipelines and is connected to different ports and processing plants by pipeline (see Appendix 28 and Appendix 29)²³⁵.

Velin (the association of pipeline owners in the Netherlands) counts 26 members of which 21 operate oil or gas pipelines. Most of them also own storage and/or processing facilities. Table 14 below provides an overview of the long distance pipelines in the Netherlands. In addition, storage and processing facilities usually also operate (short-distance) pipelines.

²³² DB Cargo AG, "Connecting Europe to the World | DB Cargo AG."

²³³ Algemene Rekenkamer, "Rapport Besteding van Aardgasbaten Feiten Cijfers En Scenario's," 22 & 23.

²³⁴ IEA, "The Netherlands 2014 Review," 154.

²³⁵ Port of Rotterdam, "Pijpleidingen."

A 'pipeline corridor', operated and owned by 'LSNed', runs from Rotterdam, through Moerdijk and Vlissingen, to Antwerp. It facilitates the easy addition of pipelines on the track between these two ports houses different types of pipelines (and cables), both fossil fuel and non-fossil fuel related ²³⁶. LSNed was set-up by the Dutch government in the 1970's and now functions as a special type of independent organization²³⁷. Its board includes members from the national government, provinces, and private parties. The initial investment for the construction of the corridor was done by the government and whether this constitutes a gift or a loan to the organization is currently unclear²³⁸. To lay a new pipeline through the corridor the company has to pay a fee to LSNed. This entrance fee is passed on to the government, in addition users pay regular maintenance fees to LSNed. In 2014 LSNed had a revenue of 3.1 million²³⁹.

The Central European Pipeline System (CEPS) includes a connection between the port of Rotterdam and Schiphol airport and is owned by the NATO and operated by a branch of the Dutch military (DPO)²⁴⁰. Through this pipeline the Dutch military supplies Schiphol airport with jet fuel. The pipeline has a maximum technical capacity of 2.9 mcm annually and the oil companies operating on Schiphol have the obligation to purchase at least 1.8 mcm of kerosene annually to make sure operation remains profitable for the pipeline operator²⁴¹. In 2013 CEPS DPO signed a 25-year contract with the company 'Aircraft Fuel Supply' (AFS) to deliver around 50 percent of the airports annual fuel needs. Most of the oil will come from Rotterdam, but can now be supplemented with oil from the Antwerp or Gent ports²⁴². The rest of the required kerosene is provided by the Amsterdam Schiphol Pipeline (ASP), in which the KLM airline is a shareholder. The national government holds a 5.92 percent share in KLM²⁴³. The government is thus directly involved in transporting kerosene destined for commercial use at Schiphol through its defense ministry, and other (Eindhoven airport is also connected to CEPS) airports, and is indirectly involved through its stake in KLM. Moreover, the maintenance costs of the Dutch part of the CEPS pipeline are paid for by the Dutch state. Income from commercial (civil) allows the government to recoupate part of these costs²⁴⁴. All other oil pipelines in the Netherlands are owned by privately or publicly traded companies. There is thus a clear dependency of the commercial aviation industry on government transported fuels and vice versa, since the government needs the commercial activities to reduce CEPS maintenance costs.

Table 14 Oil pipeline operators and owners (based on own analysis)

Pipelines	Owner	Comments
Central European Pipeline system (CEPS)	NATO - operated in the Netherlands by DPO (Defensie Pijpleidingen Organisatie)	Minimum purchase requirement for consumers (i.e. oil companies) on Schiphol Airport
Rotterdam Rhine Pipeline	Shell (45,6%), Shell Deutschland (10%), RUHR OEL (22,2%), BP Olex (22,2%)	
Petrochemical Pipeline services	Petrochemical Pipeline Services B.V	

²³⁶ LSNed, "Facts & Figures."

²³⁷ RWT: rechtspersoon met wettelijke taak

²³⁸ Based on a phone interview with an LSNed employee

²³⁹ Tweede Kamer der Staten Generaal, "Jaarverslag En Slotwet Ministerie van Infrastructuur En Milieu 2015," 218.

²⁴⁰ DPO, "Pipeline Network - DPO – Defensie Pijpleiding Organisatie."

²⁴¹ ACM, "Besluit Besluit ontheffing kartelverbod Amsterdam Schiphol Pijpleiding | ACM.nl."

²⁴² NATO, "Central Europe Pipeline System (CEPS)."

²⁴³ Ministry of Finance, "Jaarverslag Beheer Staatsdeelnemingen 2015," 64.

²⁴⁴ NATO, "Central Europe Pipeline System (CEPS)."

Total (Zeeland refinery)	Total and Lukoil	
RAPL	Total and Exxonmobil	
Rhein Main	Shell (63%), BP (35%), Exxon Mobil (2%)	
Amsterdam Schiphol Pipeline (ASP)	KLM, Shell, Total, BP, Statoil, Q8 petroleum, Navires Fuels (Morgan Stanley)	Operated by Aircraft Fuel supply B.V

Similar interdependencies to the rail transport of coal, based on the government ownership of the railway network, exists in the transport of oil. Also, similar to the situation with coal, 'DB cargo' is a major player in the transport of oil (and chemicals) in the Netherlands. But their relations with the German federal government fall outside the scope of this research.

6.3.2 Storage

The storage of oil (and gas) takes place at different phases in the chain: between production and processing facilities and between processing and the final customer. Storage also occurs for reasons of security of supply and price hedging/speculation²⁴⁵. Large-scale oil storage is done by oil importers, refineries, specialized oil storage companies, and IOC's. Small-scale storage occurs in the distribution chain and is included in the analysis in section 7.4. Storage usually occurs near large refineries and points of entry (ports). Appendix 30 provides an overview of oil storage locations in the Netherlands. In total the Netherlands, according to 2014 data, has 30 mcm of oil storage, which the IEA describes as 'vast', with most capacity being concentrated around the Rotterdam, Amsterdam, and Vlissingen (Zeeland Seaports) ports²⁴⁶.

6.3.2.1 Underground storage

The underground storage of minerals, including oil and gas, requires a storage permit from the Dutch government. As of 2015 a single permit for the underground storage of oil, in this case diesel, has been granted (to Akzo Nobel Salt B.V)²⁴⁷. Similar to the production of oil and gas a one-time fee needs to be paid by the license holder to the province in which the storage terrain is located, in so far that this terrain has not yet been used for the extraction of oil or gas²⁴⁸. In addition the government, when determined in the conditions of a specific permit, can request an extra fee²⁴⁹.

6.3.2.2 Tank storage

Aside from strategic stockpiling, the market for oil storage in the Netherlands is completely privatized. However, as has been discussed in section 6.1, oil storage contributes to the revenue of port authorities and thus of their municipal and governmental shareholders. Even though it proved impossible to determine how much revenue was generated with different fossil activities within the port's bounds it is clear that oil storage is very profitable for the ports of Amsterdam and Rotterdam, both being some of the largest oil and fuel ports in the world. For example, a recently cancelled crude oil storage project in Rotterdam would have generated 700 million euro in revenue for the port

²⁴⁵ Wolf, "The Petroleum Sector Value Chain," 16.

²⁴⁶ IEA, "The Netherlands 2014 Review," 154.

²⁴⁷ Although not yet fully operating this storage site is already under heightened supervision by the Dutch regulator (SodM) due to the large amount of leakages detected. Some of those leakages are related to the diesel storage site (Ministry of Economic Affairs, "Akzo Nobel in Twente onder verscherpt toezicht SodM - Nieuwsbericht - Staatstoezicht op de Mijnen.")

²⁴⁸ Ministry of Economic Affairs, "Opslagvergunning Bergermeer."

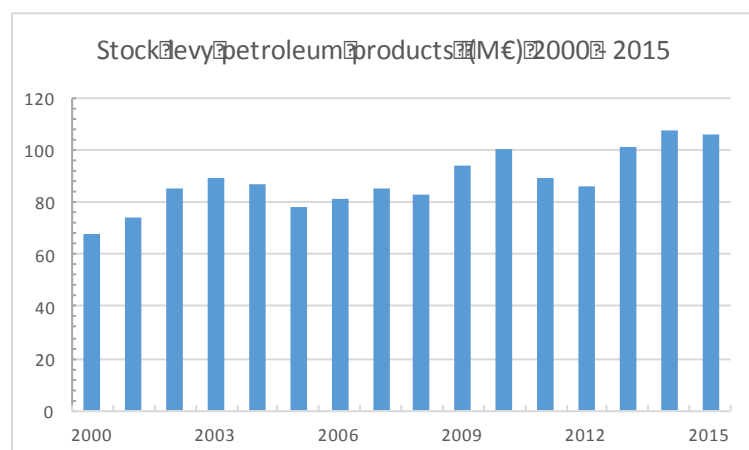
²⁴⁹ Ministry of the Interior and Kingdom Relations, "Mijnbouwwet"; Article 98.

authority in the coming 30 years (120m in land lease plus 22 annual port fees)²⁵⁰. Given that the normal, non-strategic, storage of oil and oil products is completely privatized this will not be analyzed further.

6.3.2.3 Strategic storage

As a member of the IEA and the EU the Netherlands is required to hold strategic stockpiles of oil²⁵¹. These strategic oil stocks are managed by the Netherlands Stockpiling Agency (COVA)²⁵². In this manner the government maintains a reserve of 90 days of net imports; i.e. imports destined for domestic consumption. In 2013 this amounted to 4 Mt of oil. 20 percent of this reserve is maintained by companies selling more than 100.000 tons of oil and petroleum products annually in the Netherlands and the remaining 80 percent by the COVA²⁵³. The COVA is an independent foundation but operates in order of the ministry of economic affairs. It receives a fee of 8 €/m³ from the ministry of economic affairs for storage giving them a revenue of 108 million euro and a net result of 19 million euro in 2015. This is financed through the 'stock levy' payable by consumers on petrol, diesel, and LPG and then passed on to the COVA by the ministry of economic affairs. In 2015 its reserves amounted to 869 million euro, and, given that COVA holds 20 percent, the total strategic reserves thus had a worth of 1.08 billion. COVA has 953 million in loans, mostly financed through the ministry of finance but from private capital providers and under guarantee from the ministry of economic affairs. Making use of the governments financing instruments allows COVA to borrow at low costs²⁵⁴. Since the COVA does not have its own storage facilities, and since 20 percent of the strategic reserve is held by companies, the government is dependent on commercial storage providers for its storage needs. Increase in revenues between 2012 and 2013 is due to an increase in the stock levy.

Figure 15 Stock levy petroleum products/COVA revenue (CBS, 2016)²⁵⁵



6.4 Gas

As a large producer of natural gas the Netherlands has an extensive transport and distribution network and related infrastructure such as storage and processing facilities. In addition, the governments 'gas roundabout' policy is aimed specifically at improving gas import, export, and storage facilities²⁵⁶. A considerable part of this section will be dedicated to the SOE Gasunie.

²⁵⁰ "Massive Russian Rotterdam Oil Storage Project Cancelled."

²⁵¹ Ministry of the Interior and Kingdom Relations, "Wet voorraadvorming aardolieproducten 2012."

²⁵² COVA, "About COVA | Cova."

²⁵³ Ministry of Economic Affairs, "Oil - Energy Policy - Government.nl."

²⁵⁴ COVA, "About COVA | Cova."

²⁵⁵ "CBS StatLine - Overheid; Ontvangen Belastingen."

²⁵⁶ TNO, "Beeft de Grond Onder de Voeten van de Gasrotonde," 5.

6.4.1 Transport

6.4.1.1 Gasunie

Transport and distribution networks in the Netherlands, for both electricity and gas, have been separated from utilities and producing entities and are managed by transport system operators (TSO's). The main national transmission system (HTL) for natural gas is managed by the TSO 'Gasunie Transport Services' – which includes the international connections – while the regional high-pressure transmission system (RTL) is managed by the TSO 'Gasunie Grid Services' (see Appendix 32). Both are complete subsidiaries of the SOE Gasunie (see

Appendix 31 for an overview of Gasunie's value chain). Before the split up in 2005, as part of the liberalization of the gas market, of Gasunie in a transport (Gasunie) and sales entity (GasTerra), Shell and Exxon also held shares in the transport network, which were taken over by the Dutch government²⁵⁷. Upon separation of the trade and transport branches in the national government compensated the other shareholders, EBN, Shell, and Exxonmobil, which consisted of a capital deposit into Gasunie to the amount of 2.4 billion²⁵⁸.

GTS and GGS generate revenue through tariffs, controlled by the Dutch regulatory authority (ACM), that they charge their customers for transporting their gas. For example, GasTerra, the Dutch gas retailer, buys transport capacity from GTS. They are also responsible for investments in network expansion and processing facilities (see section 7.3). In total Gasunie manages around 15,500 km of pipelines in the Netherlands and Germany, transporting 1.179 Twh of gas in 2015.

6.4.1.1.1 Gasunie subsidiaries

As a gas infrastructure company Gasunie is active in the transport, processing, trade, and storage of gas. Appendix 33 provides an overview of Gasunie's subsidiaries and participations in the Netherlands and abroad, as far as could be identified.

6.4.1.1.2 Gasunie revenue, profit, investments, dividend payments and debt.

Gasunie pays a yearly dividend to its only shareholder, the Dutch government. In 2015 this amounted to 330 million euro. Figure 16 gives an overview of Gasunie's revenue, profit, and dividend payments between 2004 and 2015. No data prior to 2004 could be found. As becomes apparent from the graph its dividends have averaged between 300 and 500 million euro annually over the years, with 2010, 2011, and 2012 being notable exceptions. Consistently around 75 percent of Gasunie's revenue comes from GTS, the Dutch transport branch, with the German transport branch, GUD, and Gasunie's other activities providing the remaining 25 percent²⁵⁹ (see Figure 18).

Between 2007 and 2012 Gasunie has been investing heavily in expanding its transport network, including interconnections with neighboring countries, and processing facilities as part of the government's 'gas roundabout strategy' (see section 4.4.1.1). For example, Gasunie invested 2.1 billion to buy part of the German gas network – now called 'Gasunie Deutschland' (GUD). On which it had to write off 1.8 billion write off due to a lowering of the transmission tariffs by the German regulatory authority (causing the above mentioned losses in 2011). In addition, Gasunie expects to continue to invest 300 to 500 million euros annually to maintain the transmission network.

²⁵⁷ Gasunie, "Nederlandse Gasunie Gesplitst » N.V. Nederlandse Gasunie."

²⁵⁸ Gasunie, "Gasunie: Annual Report 2005," 103.

²⁵⁹ Gasunie, "Gasunie: Annual Report 2013."

In 2015 Gasunie's total net debt position amounted to 4.5 billion euro²⁶⁰. This debt is mostly held by private parties. However, 657.1 million euro of this debt is held by the European Investment Bank (EIB)²⁶¹. Although relationships with institutions of the European Union lie outside the scope of this research, EIB is funded and owned by the European Member states, among which the Netherlands. Indirectly the Dutch government thus provided part of the funding for this loan²⁶². Gasunie mentions that the EIB will increase the interest rates it asks on its loans if Gasunie is no longer a 100 percent state-owned enterprise to reflect the increased risk as holder of the loan for EIB²⁶³. This means that government ownership of an enterprise reduces the costs of borrowing for that enterprise. It could thus be the case that the Dutch gas (and oil) industry can borrow at a lower cost due to the involvement of the SOE's EBN and Gasunie.

Part of this net debt consists of guarantees made by Gasunie to its subsidiaries. In 2015 Gasunie had a total 540 million in outstanding guarantees. For its share in the GATE Terminal Gasunie guarantees 42 million in leasehold payments to HbR, with a remaining duration of 12 years, and 30 million euro in sureties to shippers, with a remaining duration of 18 years. Between 2012 and 2014, Gasunie guaranteed, corresponding to its share in the project, up to 570 million to the loan capital providers of Nord Stream 1 during its construction. These guarantees expired upon completion of Nordstream in 2014. In addition, Gasunie guarantees up to 438.2 million to compensate for the possible negative effects (on the Nordstream project) of changes in applicable regulations. This guarantee runs up to 2026 and decreases as Nord Streams debts are paid off. In addition, Gasunie guarantees up to 7 million annually, until 2026, in operating expenses for Nord Stream 1²⁶⁴. This means that, indirectly, the government provides guarantees to the construction and future revenue of natural gas infrastructure projects in the Netherlands and abroad.

*Figure 16 Gasunie - Financial results 2004-2015 (Based on own analysis)*²⁶⁵

²⁶⁰ Net debt is the total of the liabilities and debts of a company minus cash and other liquid assets. See: Gasunie, "Gasunie: Annual Report 2015," 18.

²⁶¹ Ibid., 101.

²⁶² European Investment Bank, "Shareholders."

²⁶³ Gasunie, "Gasunie: Annual Report 2015," 101.

²⁶⁴ Ibid., 122 & 113.

²⁶⁵ Gasunie and GasTerra were part of the same company until 2005, the 2004 numbers in this graph only apply to the transport branch of this old company (also called Gasunie). (Gasunie: Annual reports 2004 – 2015)

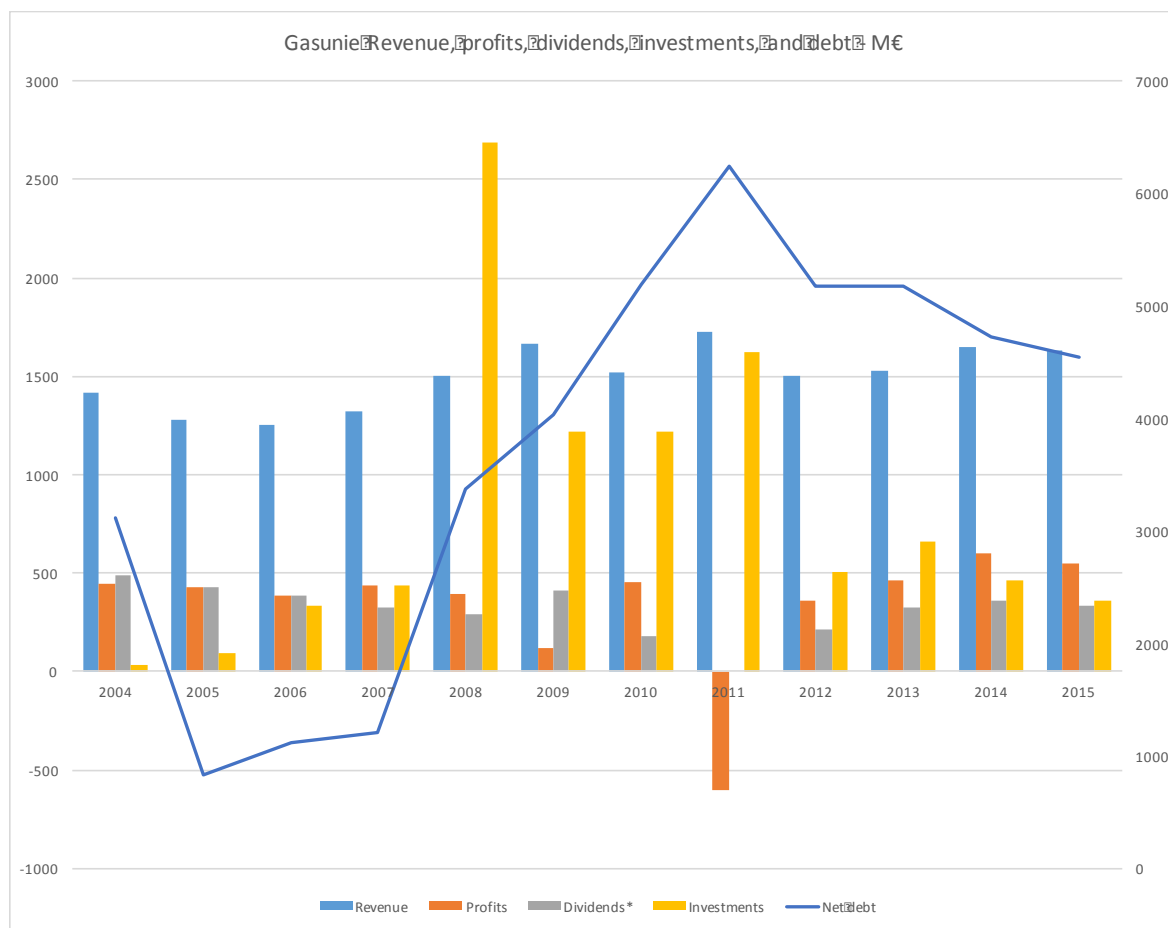


Figure 17 Gasunie - natural gas transmissions 2000 – 2015 (based on Gasunie, 2000-2015)²⁶⁶

²⁶⁶ Gasunie, "Gasunie: Annual Report 2004"; Gasunie, "Gasunie: Annual Report 2005"; Gasunie, "Gasunie: Annual Report 2006"; Gasunie, "Gasunie: Annual Report 2008"; Gasunie, "Gasunie: Annual Report 2009"; Gasunie, "Gasunie: Annual Report 2010"; Gasunie, "Gasunie: Annual Report 2011"; Gasunie, "Gasunie: Annual Report 2012"; Gasunie, "Gasunie: Annual Report 2013"; Gasunie, "Gasunie: Annual Report 2014"; Gasunie, "Gasunie: Annual Report 2015."

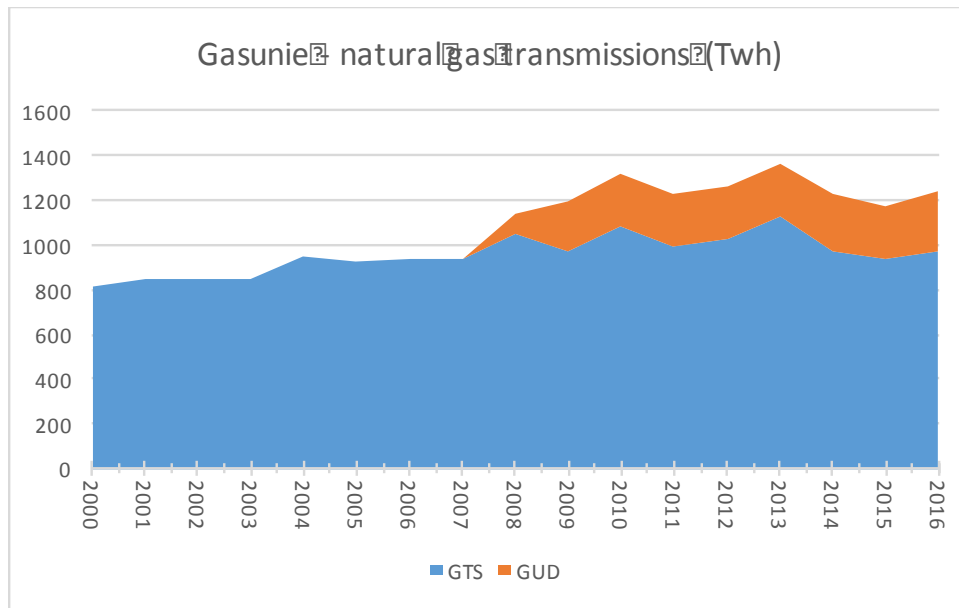
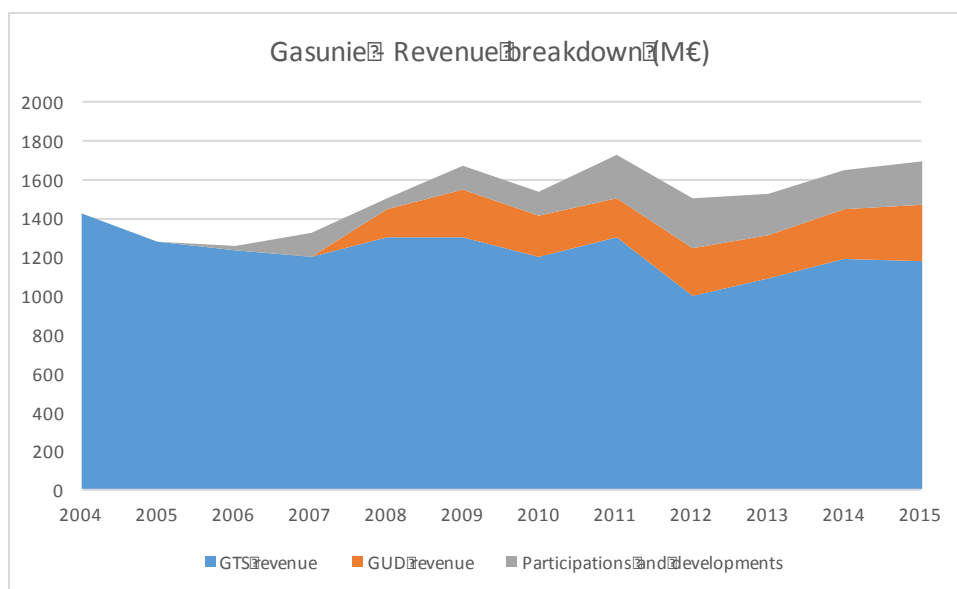


Figure 18 Gasunie revenue breakdown 2004 – 2015 (based on Gasunie, 2005-2015)²⁶⁷



6.4.1.2 Offshore-pipelines

In addition to the land network Gasunie manages several offshore pipelines, built by gas field operators, that connect offshore platforms to the Dutch mainland and neighboring countries (see Appendix 34). Table 15 gives an overview of the three main offshore pipeline networks. These pipelines connect 119 out of the 133 offshore platforms²⁶⁸. These so called ‘trunk lines’ are owned and operated by the respective platform owner/operator. In addition, several pipelines run directly from platforms to land based processing stations. As a participant in gas production EBN has a 45 percent share in the NOGAT pipeline, and, an effective stake of 12% in the NGT pipeline; it does not

²⁶⁷ Ibid.

²⁶⁸ Energie Beheer Nederland (EBN), “Focus on Dutch Oil & Gas 2016,” 41.

actually own a share but receives 12% of the proceeds²⁶⁹. In 2015 EBN received 16 million and 7 million euro in revenue from, respectively, NOGAT B.V and the NGT-Extension²⁷⁰.

Due to decreasing offshore production, related to the maturity of the fields, pipelines are operating below their capacity²⁷¹. Industry is looking to reduce operating expenditures and has started a project to improve cooperation and reduce the number of pipelines. Decommissioning may thus become relevant in the near future, and it may very well be that one of the three main trunks is closed down²⁷².

Table 15 Off-shore gas pipelines (based on own analysis)

Pipeline ('trunk')	Operator	Owner
NOGAT (Northern Offshore Gas Transport)	ENGIE (before 2008 NAM)	ENGIE, Centrica Production Nederland, EBN (45%)
NGT-Extension (Noordgastransport)	ENGIE and NAM	ENGIE Global Gas Holding Nederland B.V, PD Alternative Investments NL ApS, XTO Netherlands LTD, Rosewood Exploration Ltd, InfraVia Gas Transportation S.a.r.l.; EBN has an effective stake of 12%
WTG (West Gas transport)	Wintershall and NAM	n/d

6.4.2 Storage

Five facilities for the underground storage of natural gas are currently operating in the Netherlands with a total capacity of 13.8 bcm. As can be seen in Table 16 the SOE EBN participates for 40% in two of these storage facilities.

Table 16 Underground gas storage facilities (based on own analysis)²⁷³

Facility	Capacity	Operator	Owner
Peak storage 'Zuidwending'	200 million m3	EnergyStock B.V	Gasunie
Peak storage 'Alkmaar'	500 million m3	TAQA	
'Gas Storage Bergermeer'	46 TWH/4.1 billion m3	TAQA	TAQA (60%), EBN (40%)
UGS 'Grijpskerk'	2 billion m3	NAM	NAM (100%)
UGS 'Norg'	7 billion m3	NAM	NAM (60%), EBN (40%)

6.4.3 Discussion

This section provides a short review of the findings on oil and gas transport and storage in the Netherlands. It can be concluded that the Dutch government is heavily involved in the transport and storage of natural gas through its SOE Gasunie. However, when it comes to transport and storage of

²⁶⁹ Energie Beheer Nederland (EBN), "Jaarverslag 2015," 90.

²⁷⁰ Ibid., 106.

²⁷¹ Energie Beheer Nederland (EBN), "Focus on Dutch Oil & Gas 2016"; Janssen, "Dutch Offshore Infrastructure Optimization Project (DOMINO)."

²⁷² Janssen, "Dutch Offshore Infrastructure Optimization Project (DOMINO)."

²⁷³ TNO, "Delfstoffen En Aardwarmte in Nederland: Jaarverslag 2015," 87.

gas it is hard to evaluate what financial relations constitute and interdependency between industry and government since the whole system is interrelated. It would be impossible for each gas producer to create its own pipeline/storage network, they are thus dependent on the existence of a single, open-access, network, which Gasunie offers. On the other hand, the government wants to offer this network to allow the extraction of its resources; e.g. perhaps the entire system can only exist through these interdependencies.

In addition, EBN, as an SOE, has a share in two major gas storage projects and two off-shore pipelines. This is in line with its policy to take a 40 percent stake in most oil and gas production projects. Possibly EBN's participation the storage of gas in depleted gas fields is also related to the fact that it already participated in the field when it was still producing. EBN does, however, not participate in oil storage and transport, even though it does participate in oil production. It could be that this has to do with how the Dutch 'Gasbuilding' has grown historically, with considerable government involvement throughout the chain. The government, through the ministry of defense and the COVA, is however involved in the storage and transport of oil. Stemming from cold war times, and being set up before the liberalization of the energy market, the Dutch military manages an extensive oil pipeline system that also supplies commercial airports (Amsterdam and Eindhoven), with jet fuel. Even though networks for electricity and gas have been put under the management of 'independent', but usually state owned, TSO's, due to the natural monopoly characteristics of networks, this does not apply to oil pipelines and offshore gas pipelines. Similarly, the government maintains, directly and through companies, a strategic stock of oil for which it has instated a specific 'tax' the fuel stockage levy.

In terms of interdependencies there are thus strong links between government and industry when it comes to the transport and storage of natural gas and the transport of oil (jet fuel). On the other hand, possibly related to a lack of domestic production, the government has no direct involvement in the transport and storage of coal, although it does take place within government owned port areas.

7 Processing and Refining

The fourth stage of the framework looks at the processing and refining of oil, coal, and gas. From the initial scoping it became clear that the Netherlands is a major refiner of oil and oil products, mainly for export. In addition, earlier stages showed that gas in the Dutch gas system needs to be converted between different caloric values and that the use of LNG is taking off. This chapter will first look at coal preparation, then at oil refining, and finally at gas processing.

7.1 Coal preparation

Processing is not a large part of the coal value chain. After mining coal needs to be prepared – also called cleaning, processing, or beneficiation – as to remove impurities improving energy content and calorific value²⁷⁴. This is done in the production and exploration stage of the coal value chain. Since the Netherlands does not have any coal production, the preparation of coal is not a relevant activity to look at in this research. Although not really qualifying as processing, coal is sometimes also washed, sorted, and/or blended. The EMO coal terminal in the port of Rotterdam, for example, offers such services²⁷⁵. As discussed before it is not possible to determine the share of port income coming from specific activities, e.g. through land-leases, within its bounds. Also, as discussed in the initial scoping, it is not possible to determine the share of tax revenue coming from specific fossil fuel activities.

²⁷⁴ South African National Energy Development Institute (SANEDI), "Overview of the South African Coal Value Chain: Prepared as a Basis for the Development of the South African Coal Roadmap," 43.

²⁷⁵ Acemoglu and Robinson, "Economics versus Politics."

7.2 Oil refining

Oil refining is needed to turn the extracted, and in the Dutch case, imported, oil into usable products. Such as, for example, fuel oil, gas oil (diesel), kerosene (jet fuel), gasoline, naphtha, and liquefied petroleum gasses (LPG). During refinement - the separation, conversion, and treatment of oil - the hydrocarbon molecules in the crude oil are separated and turned into one of the above products²⁷⁶. Refineries are usually located near major import and export hubs to limit transportation costs and to be close to where the demand is²⁷⁷.

The Netherlands houses six large refineries (see Appendix 35). The five refineries based in Rotterdam have a combined distillation capacity of 58 million tons, combined with the Zeeland Refinery's capacity of 9 million tons, the total distillation capacity of refineries in the Netherlands amounts to 67 Mt, or around 1.3 million barrels per day²⁷⁸. In 2015 refinery output was around 60 Mt, almost 10 percent of OECD Europe, and around 1.5 percent of global production (using 2014 data)²⁷⁹. Most refineries are owned by IOC's, while the GPR is owned by Gunvor Group, a global (energy) commodity trader. The refining segment of the oil value chain is completely privatized. The only (indirect) relation with the government is through the ports of Rotterdam and Vlissingen in which the refineries are located. Unfortunately, it has not been possible to determine the share of refinement activities in the ports revenues. Corporate and profit tax on refining activities are included in the tax levied on 'energy intensive activities', as discussed in the initial scoping (4.4.2). For reasons described there a similar calculation has not been attempted in this research.

7.2.1 Excise tax exemption

Based on EU regulation to protect the competitiveness of the European refinery industry, and to prevent double taxation within the EU, the Dutch government, and other Member States, exempt(s) oil used as an input for the production of oil products destined for export from excise tax²⁸⁰. Fuel used during the refining process, and which is produced within the refinery itself, is also included in the tax exemption. There is the option to also include the use of fuel produced outside the facility in the exemption²⁸¹. The Dutch government has opted to do this. The cost of this exemption amounts to around 40 million euro a year, as the government reported in its 2010 budget. In 2011 the government decided that this exemption should no longer be seen as a tax expenditure and removed the item from its budget reports²⁸².

Table 17 Refinery excise tax exemption 2004 – 2014 (based on own analysis)²⁸³

²⁷⁶ Wolf, "The Petroleum Sector Value Chain," 17.

²⁷⁷ Ibid., 16.

²⁷⁸ Port of Rotterdam, "Facts and Figures on the Rotterdam Energy Port and Petrochemical Cluster"; Zeeland Refinery, "Zeeland Refinery | Zuinig Met Olie."

²⁷⁹ IEA, "Oil Information 2016," 9 & 365.

²⁸⁰ Algemene Rekenkamer, "Evaluatierapport Belastinguitgaven Op Het Terrein van de Accijnzen," 6.

²⁸¹ Council Directive 2003/96/EC of 27 October 2003 on restructuring the Community framework for the taxation of energy products and electricity European Commission, "37420 51..51 - LexUriServ.do."

²⁸² Tweede Kamer der Staten Generaal, "Miljoenennota 2011 (Nota over de toestand van 's Rijks Financiën)."

²⁸³ 2010-2014 are estimations; Tweede Kamer der Staten Generaal, "Miljoenennota 2007 (Nota over de toestand van 's Rijks Financiën)," 130; Tweede Kamer der Staten Generaal, "Miljoenennota 2008 (Nota over de toestand van 's Rijks Financiën); Tweede Kamer der Staten Generaal, "Miljoenennota 2009 (Nota over de toestand van 's Rijks Financiën); Tweede Kamer der Staten Generaal, "Miljoenennota 2010 (Nota over de toestand van 's Rijks Financiën)."

M€	2001	2002	2003	2004	2005	2006	2007	2008	2009	* 2010	* 2011	* 2012	* 2013	* 2014
Refinery exemption	12	39	39	39	41	41	42	42	43	44	45	46	47	48
*Budget estimations														

7.3 Gas processing

Two forms of natural gas processing exist. First, it needs to be processed after extraction to take out excessive hydrocarbons, called natural gas liquids (NGL's), such as ethane, propane, butane, iso-butane, and natural gasoline, but also water and carbon dioxide²⁸⁴. In this framework this type of processing is taken to be part of the production process, since it is done directly by the producer to make the gas fit for pipeline transport. It is thus seen as part of the E&P stage and is represented in the figures presented for E&P. Other types of gas processing includes transforming it to liquefied natural gas (LNG), changing the calorific content, and gas-to-liquids (GTL) conversion²⁸⁵.

In the Netherlands 'quality conversion' from high caloric gas (H-gas) to low caloric 'Groningen' gas (G-gas²⁸⁶), by adding nitrogen, is undertaken by Gasunie. Gasunie converted 16.9 bcm of H-gas to G-gas in 2015 and 4.8 bcm in 2014²⁸⁷. In addition, to a lesser extent, other low calorific gas (L-gas) is mixed with H-gas to create G-gas, and G-gas is mixed with H-gas to make the caloric value as high as possible within the use boundaries of the Dutch system or for export²⁸⁸. Due to reduced production from the Groningen field H- to G conversion has increased considerably. Gasunie thus expects to expand its conversion facilities²⁸⁹. No other types of natural gas processing in this stage takes place in the Netherlands.

The production caps of the Groningen field, and the future natural production decline due to field maturity, mean that the amount of G-gas available will decrease. And, since the conversion from H- to G-gas is expensive, the Netherlands and the countries to which it delivers G-gas, Germany, Belgium, and France, will need to prepare their markets for H-gas to prevent the need for large scale conversion in the future. It has been agreed that Germany will implement a conversion of its system to make it suitable for other gas qualities such as gas coming from Norway and Russia, or LNG, between 2020 and 2030. France and Belgium will implement this transition between 2024 and 2030. The current expectation of the industry is that the Netherlands will need to start the conversion process in 2030 the latest. As of yet, the government does not have a policy plan in place to address this issue and it is unclear how much this would cost the government, TSO's, and Gasunie, although the costs are expected to be limited since the end of technical life of most appliances in residential properties is expected to be reached before 2030 anyway²⁹⁰.

²⁸⁴ Wolf, "The Petroleum Sector Value Chain," 14.

²⁸⁵ Ibid., 18.

²⁸⁶ G-gas: the type of gas coming from the Groningen field with a low calorific value. Gas equipment in the Netherlands and neighbouring countries can, for a large part, only run on G-gas. However, gas coming from the small fields is H-gas, hence a conversion is necessary.

²⁸⁷ Gasunie, "Gasunie: Annual Report 2015," 2.

²⁸⁸ van der Wal, "The Technological Infrastructure of the Gas Chain - National Reforms in European Gas - Chapter 2."

²⁸⁹ Gasunie, "Gasunie: Annual Report 2015," 31.

²⁹⁰ EBN, "Ombouw Nederlandse Gasmarkt Vanaf 2030"; GasTerra, "From L-Gas to H-Gas."

7.4 Discussion

Having reviewed the processing of oil and gas it can be concluded that the government is involved in gas conversion through its SOE Gasunie. The financial interdependencies between the government and Gasunie have been discussed in the previous chapter. When it comes to processing specifically, the producers of marginal fields are dependent on the quality conversion undertaken by Gasunie to be able to sell their gas.

Oil refineries are dependent on the availability of space within a port area or a pipeline connection to a port. This makes them dependent on the government owned port authorities providing this space. The financial situation of ports, including their (financial) connection with government has been discussed in section 6.1.

8 Sales and distribution

This chapter looks at the ‘sales and distribution’ stage of the framework. This includes: regional distribution, wholesalers and retailers, and energy exchanges (e.g. ICE Endex and the Title Transfer Facility (TTF)). The gas section takes a closer look at the regional gas transmission grids, distribution system operators (DSO’s), and GasTerra’s, a partly state owned gas wholesaler, activities in the Dutch gas market. Coal will be briefly mentioned, and in the oil section distribution of transport fuel and oil as an industrial input will be analyzed. Being the final stage before the end-user, and describing the actors that deliver to the end-user, the activities described in this stage are closely linked to, and touch upon, those that will be described in the ‘Use’ chapter.

8.1 Coal

The sale and distribution of coal does not constitute a large part of the coal value chain in the Netherlands. Coal is used mainly by large users, such as a steel mill and powerplants (see chapter 9), and is usually shipped there directly from overseas. Nevertheless, companies that produce coal products, e.g. bio-coal or ballast coal, and sell and distribute these exist²⁹¹. This industry is completely privatized.

The companies involved do however pay tax, but, as has been mentioned before, due to the aggregated nature of tax data it is not possible to report on the taxes paid by companies involved in the sale and distribution of coal.

8.2 Oil

In general oil is distributed and sold through wholesalers or retailers or directly by the producer. Fuels for road transportation are distributed at petrol stations, oil for heating is delivered directly to customers, airlines and airports purchase oil directly from refineries, and residual fuels are usually sold to shipping companies, utilities, and industrial users²⁹². In addition, for the Netherlands, the bunkering of oil both for inland waterways and overseas shipping is an important part of this segment of the value chain²⁹³. Finally, fossil fuels used as an input for industrial processes are sold directly by producing entities or through wholesalers. As became apparent during the initial scoping stage there

²⁹¹ For example, Rijnen Brandstoffen, “Rijnen Brandstoffen | Kolen, Gas, Olie En Hout Producten.”

²⁹² Wolf, “The Petroleum Sector Value Chain,” 18.

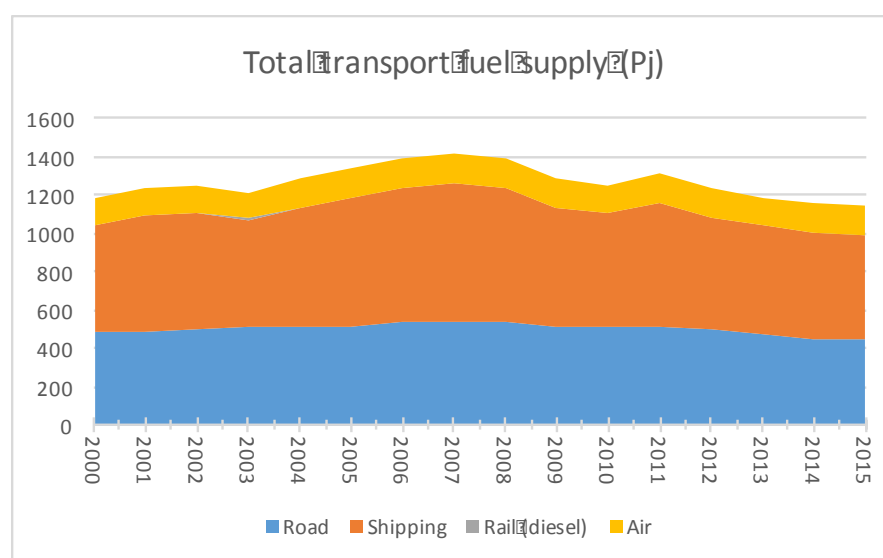
²⁹³ IEA, “The Netherlands 2014 Review,” 153 & 154.

are no SOE's active in the trade and distribution of oil. However, the transport of oil by DPO could also be seen as a type of distribution. Moreover, the government is indirectly involved in the distribution of aviation fuel through its participations in KLM, which participates in the Amsterdam – Schiphol pipeline, as has been discussed in the previous chapter

8.2.1 Sector trade association.

The NOVE represents independent companies that are active in the trade, retail, transport, stockholding, and wholesale of oil and gas based fuels and lubricants and those that provide bunker services to inland waterway shippers, fishers, and overseas shippers. Around 75% of all independent companies in this segment are a member of NOVE. These 185 members own a quarter of all petrol stations, provide around 50 percent of the fuels used for road transport, own the majority of the 145 bunker boats for inland waterways, and 80 percent of all tank trucks, and provide half of all fuel bunkered in the Netherlands by sea-going vessels²⁹⁴. As can be seen in Figure 19, a total of 1152.2 PJ in transport fuels was supplied in the Netherlands in 2015 for road, rail, water, and air transport.

Figure 19 Transport fuel supply in the Netherlands (adapted from CBS, 2016)²⁹⁵



8.2.2 Wholesalers and IOC's

Wholesalers of oil and oil products and IOC's, sell and distribute both fuel products and products that function as an input for industrial processes. In the oil segment these entities are completely privatized.

8.2.3 Bunkering

The bunkering of fuels refers to the sales of fuels destined for international shipping and aviation. Due to differences in taxation, and to be able to differentiate between fuels sold for domestic and non-domestic use, marine and aviation bunkers are analyzed separately from other fuel sales and distribution channels. Bunkering companies can supply fuel but also offer trading and brokerage services. These companies are completely privatized in the Netherlands. In 2011 an analysis of the marine bunker supply chain in the Netherlands counted 17 suppliers, 15 traders, and 16 brokers. In

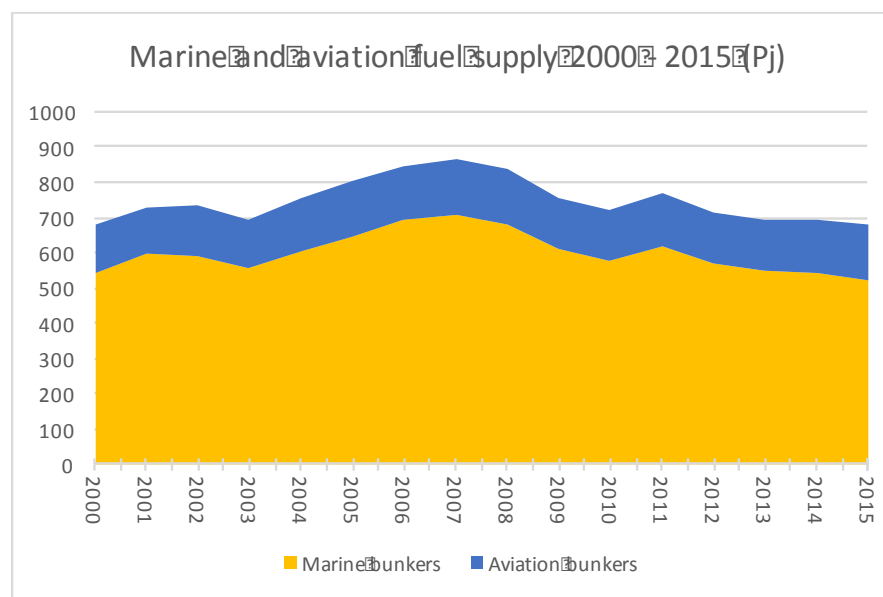
²⁹⁴ NOVE, "Feiten En Cijfers."

²⁹⁵ CBS, "CBS StatLine - Motorbrandstoffen; Afzet in Petajoule, Gewicht En Volume."

addition it counted 6 storage terminals and 8 waste processors²⁹⁶. These companies are situated in the major ports, mainly Rotterdam and Amsterdam, and along major inland shipping routes.

Aviation bunkers are found at airports. The fuel supply of Schiphol has been discussed in section 6.3.1.1. Appendix 39 provides an overview of the biggest publicly owned airports in the Netherlands. Distribution of fuel to these airports is done by dedicated companies, wholesalers, and IOC's²⁹⁷. In 2015 marine bunkers supplied 523 PJ in fuel and aviation bunkers 160 PJ (see Figure 20).

Figure 20 Marine and Aviation fuel supply (adapted from CBS, 2016)²⁹⁸



8.2.3.1 Taxation

Both marine and aviation bunker fuel, based on international treaties, used for international transport are exempt from excise tax and VAT in the Netherlands²⁹⁹. There is the possibility to tax intra-European flights and waterway transport using bilateral agreements, but no EU member state has made use of this possibility³⁰⁰. Both fuels are also exempt from excise tax. Leisure crafts and domestic flights are not included in the exemptions. According to the Dutch government the excise tax exemptions cost them between 3 and 4 billion in foregone revenue annually (see Table 18). In 2011 the way in which this exemption was calculated changed which resulted in the large increase in foregone revenue between 2008 and 2009. However, as the government notes, this new method of calculation means that the numbers currently reported are higher than the actual revenue that would be earned if the exemptions were abolished³⁰¹. A very rough estimation would put the amount of foregone revenue due to the VAT exemption for aviation at between 1.1 and 1.6 billion in 2016³⁰². See Table 28 for a timeseries going back to 2001.

²⁹⁶ de Buck et al., "CE Delft - Blends in Beeld: Een Analyse van de Bunkerolieketen."

²⁹⁷ E.g. Skytanking (dedicated company) at Schiphol airport, Schenk tanktransport (wholesaler) at Rotterdam and Eindhoven, and Shell Aviation (IOC) at all airports

²⁹⁸ CBS, "CBS StatLine - Motorbrandstoffen; Afzet in Petajoule, Gewicht En Volume."

²⁹⁹ Belastingdienst, "Levering en bevoorrading van zeeschepen en vliegtuigen."

³⁰⁰ Algemene Rekenkamer, "Evaluatierapport Belastinguitgaven Op Het Terrein van de Accijnzen."

³⁰¹ Tweede Kamer der Staten Generaal, "Miljoenennota 2011 (Nota over de toestand van 's Rijks Financiën)."

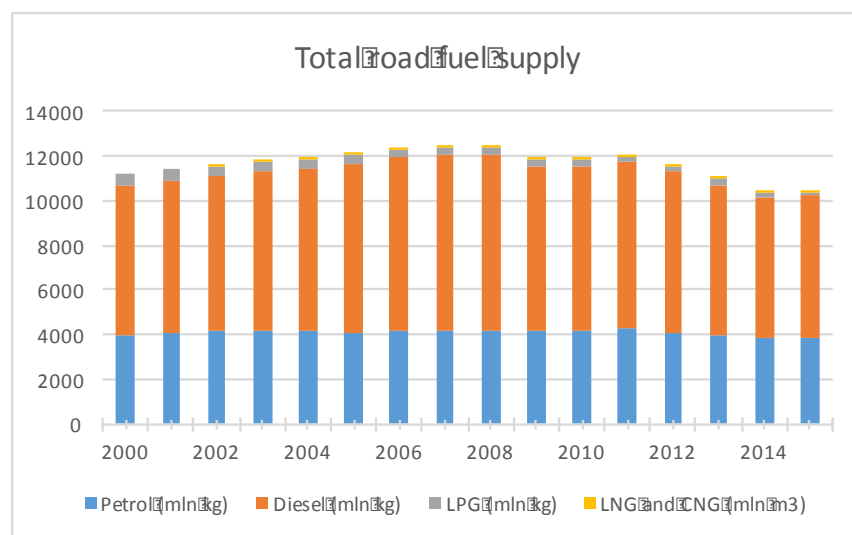
³⁰² Using 2015 fuel data (figure 2015), and an average 2016 jet fuel price (jet fuel kerosine based) of 65.68 dollar/bbl, an average dollar/euro exchange rate of 0.851 for 2016. Lower number is without including excise tax in the fuel price over which VAT is calculated. Using the methodology of: Korteland and Faber, "Estimated Revenues of VAT and Fuel Tax on Aviation."

Table 18 Excise tax exemptions aviation and marine bunkers (based on own analysis)³⁰³

Foregone revenue due to marine and aviation exemptions							
M€	2011	2012	2013	2014	2015*	2016*	2017*
Exemption marine	1348	1298	1169	1220	1604	1284	1293
Exemption aviation	1831	1794	1869	2105	2233	2123	2145
Total	3179	3092	3038	3325	3837	3407	3438
*Budget estimates							

8.2.4 Petrol stations

The Netherlands has around 4200 petrol stations. Around 40 percent is owned by an IOC, 25 percent by NOVE members, and the remaining 35 percent by other independent companies³⁰⁴. In 2015, 452.4 Pj was supplied in the Netherlands for road transport³⁰⁵. Figure 21 gives an overview of the types and quantities of fuel sold/distributed by, publicly accessible and private petrol stations. Gas used as a fuel for road transport has been included in this figure.

Figure 21 Fuel sold by petrol stations (adapted from CBS, 2016)³⁰⁶

Since 2002 the petrol stations located on land owned by the state and located next to state-run public highways are leased out for periods of 15 years³⁰⁷. Every year leaseholds that are up for renewal are auctioned by the state real-estate agency (Rijksvastgoedbedrijf)³⁰⁸. Since 2002 119 out of the 250 petrol stations have been auctioned, the other 130 will be auctioned before 2030. Yearly the state receives around 16 million in rent from these 250 retail outlets³⁰⁹. Between 2002 and 2016 the state

³⁰³ Tweede Kamer der Staten Generaal, "Miljoenennota 2017 (Nota over de toestand van 's Rijks Financien)."

³⁰⁴ Rabobank, "Tankstations, Rabobank Cijfers & Trends"; BOVAG, "6.3 Aantal En Marktaandeel Nederlandse Tankstations."

³⁰⁵ This excludes the 0.7Pj in electricity provided for electric vehicles.

³⁰⁶ CBS, "CBS StatLine - Motorbrandstoffen; Afzet in Petajoule, Gewicht En Volume."

³⁰⁷ Ministry of the Interior and Kingdom Relations, "Wet tot veiling van bepaalde verkooppunten van motorbrandstoffen."

³⁰⁸ Rijksvastgoedbedrijf, "Veiling locaties benzinestations langs rijkswegen - Verhuren en in gebruik geven - Rijksvastgoedbedrijf."

³⁰⁹ Rijksvastgoedbedrijf, "Verhuurd," September 7, 2016.

earned at least 100 million through leasehold auctions, plus another 240 million in rent. Excluding the years for which there is no data this means that the government earns 26.15 on average each year through rent and leasehold auctioning of petrol stations. See Appendix 36 for a complete overview.

8.2.5 Discussion

The oil sales and distribution segment of the supply chain is largely privatized in the Netherlands. Hence there are limited interdependencies between government and industry in this segment. As discussed in section 6.3.1.1 the government is indirectly involved in supplying Schiphol and Eindhoven airport with fuel. Although the tax exemptions for aviation and marine bunkering apply to the distribution stage, they benefit the end-user since non-end users get their excise and VAT paid reimbursed. VAT and excise tax exemptions for these activities could amount to around 5 billion euro in 2015. Finally, the government, through the petrol stations leaseholds, is involved in the retailing of road fuel with which it earns around 26.15 million yearly on average. On the other hand, road fuel retailers are thus also partly dependent on government auctions of petrol station locations to sell their goods.

8.3 Gas

In general, natural gas is sold to households and commercial customers by utilities. IOC's can be involved through long-distance transmission and direct delivery to large (industrial) users. NGL's, such as LPG, are sold to industrial users, wholesalers, and retailers³¹⁰. As part of the liberalization of the gas market in the European Union the gas distribution networks were split-off from the utilities to form distribution system operators (DSO's) in the Netherlands from 2007 onwards. In addition, natural gas is used as a transport fuel (CNG, LNG) in the Netherlands and is distributed through petrol stations (see Figure 21) and the GATE breakbulk terminal or bunkering facilities that are starting to emerge in other ports.

The trade and sale of natural gas extracted in the Netherlands is handled mainly by the fifty percent state owned entity GasTerra, while gas can be traded (internationally) through the Title Transfer Facility (TTF) hosted by the ICE Endex; a gas hub partly owned by Gasunie. This section will look at the regional gas distributors, natural gas as a transport fuel, and gas trade by GasTerra and TTF.

8.3.1 Regional DSO's

The regional DSO's are owned by municipalities and provinces since they used to be part of the publicly owned utilities. They operate in different geographical regions and (usually) manage a gas and an electricity network. For this thesis only the gas network is of importance, since electricity can also be generated from non-fossil sources. Appendix 36 provides an overview of the 7 DSO's in the Netherlands and their shareholders. Table 19 gives an overview of their revenue and paid dividends in 2015. In general, the distribution of gas contributes between 20 and 30 percent of the DSO's revenue. This has been declining slowly over the past years due to a reduction in the government regulated transport fees.

In addition to the regional distributors, ZEBRA gasnetwerk B.V. manages a 130km high pressure network to supply chemical companies, such as DOW, in Moerdijk with high caloric gas coming from

³¹⁰ Wolf, "The Petroleum Sector Value Chain," 18 & 19.

the Bacton-Zeebrugge Interconnector³¹¹. Most DSO's are a member of the Dutch gas trade association 'KVG' and/or the distribution working group of the International Gas Union.

Table 19 DSO's revenue, profit, and dividends in 2015 (based on own analysis)³¹²

M€	Revenue	Share of gas related revenue ³¹³	Profit	Dividend	Fossil share of dividend
Stedin	1069	n/d	175.9	175.9	n/d
Cogas	36	58.9%	-2.3	No dividend	No dividend
Enduris	112	28.6%	26.6	13.3 (To Delta N.V)	3.5
Enexis	1353.4	19.8%	231.1	231.1	45.8
Liander	1681.1	17.8%	390	85	15.3
Rendo	36.3	n/d	11	7.5	No data
Westland Infra	70	21.4%	16.8	13	2.8
ZEBRA	9.3	100%	1.95	1.95	1.95

As becomes apparent from Table 19 especially the larger DSO's Stedin, Enexis, and Liander have high profits and thus pay considerable dividends to their shareholders. Of these Enexis has the highest share of fossil revenue, around 46 million euro in 2015. This means that the provinces of Noord-Brabant, Overijssel, Limburg, and Groningen will receive considerable dividend payments. On the whole, given the large amount of shareholders, it is not likely that the dividend payments, and their fossil parts, by DSO will constitute a strong financial dependency. Unfortunately, no data is available on the fossil share of Stedin's revenue, since, with the municipalities of Rotterdam and The Hague as major shareholders, their dividend could be a significant source of income for these cities. However, given that Stedin was part of Eneco until 2017 its financial relations can be approached by looking at Eneco, a utility. This is done in section 9.1.2.2.

8.3.2 Distribution of gas as a transport fuel

Gas as a fuel for transport is distributed through petrol stations (LPG and CNG, see 8.2.4), and at LNG stations, such as the breakbulk terminal in Rotterdam. LPG and CNG are used mainly for passenger vehicles and busses. LNG is relatively new as a fuel for transport in the Netherlands and is used by inland vessels, seagoing vessels, and trucks. In 2016 the Port of Rotterdam opened a bunker for ships, providing a 10 to 30 percent discount, based on the environmental certifications of the ship, on port dues for ships bunkering LNG³¹⁴. Opened in 2011, the GATE terminal currently contains three tanks with a total storage capacity of 540000 liquid m3 and eight vaporizers with a capacity to re-gasify 12 bcm of LNG per year³¹⁵. The amount of LNG tankers unloaded in 2015 has increased to 21, up from 14 in 2014, the amount of loaded tankers from 20 to 28, and the amount of trucks and containers supplied with LNG from 174 to 788³¹⁶. In total, in 2015, the Netherlands had a net LNG import of

³¹¹ "ZEBRA Gasnetwerk B.V.: Annual Report 2015"; Frontier Economics, "Pricing of Wholesale Gas in the Netherlands: A Final Report Prepared for NMA," 9.

³¹² Cogas Infra en Beheer, "Cogas Infra En Beheer: Annual Report 2015"; Enduris, "Enduris: Annual Report 2015"; Enexis, "Enexis Annual Report: 2015"; Alliander, "Alliander: Annual Report 2015"; RENDO, "REND: Annual Report 2015"; Stedin, "Stedin: Annual Report 2015"; Westland Infra, "Westland Infra: Annual Report 2015."

³¹³ Based on reported revenue related to the supply of gas. The actual share will be higher, since a part of the 'metering-services' related revenue also relates to the gas network. It is however impossible to determine to what extent.

³¹⁴ Port of Rotterdam, "LNG as a Fuel for Vessels and Trucks."

³¹⁵ GIIGNL, "The LNG Industry: GIIGNL Annual Report 2016 Edition," 31.

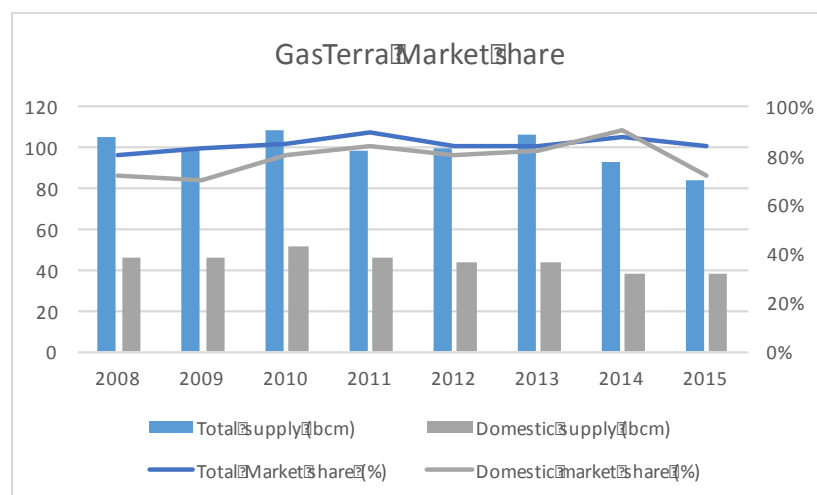
³¹⁶ Gasunie, "Gasunie: Annual Report 2015," 181.

0.63Mt, or around 0.3 percent of global imports, and re-exported 0.84Mt, which amounted to 19 percent of global LNG re-exporting³¹⁷.

8.3.3 GasTerra

GasTerra is the main buyer and seller of natural gas produced in the Netherlands and offers related services. In 2015 GasTerra handled around 70 percent of the gas supply for domestic use and around 85 percent of total supply (see Figure 22). In addition, GasTerra, as a partly government owned entity, has a policy function, which is to execute the small fields policy, sell Groningen gas, and support GTS. GasTerra sells its gas on the Dutch wholesale market, where prices are determined by the TTF. Additionally, GasTerra sells through long-term export contracts where prices are negotiated roughly every three years. They also import gas from Russia, around 5 percent of total gas procured, and Norway through long-term contracts. To execute these import and export contracts, and to supply the TTF, GasTerra buys transmission capacity from GTS, BBL, the British National Grid, and various German operators. Currently, no new long-term export contracts are being accepted to preserve a larger share of the remaining reserves for domestic use (due to the decreased output from the Groningen field). In addition to natural gas, GasTerra is actively involved in developing the market and supply for 'green gas' derived from plant-based biomass and manure³¹⁸. For example, in 2015 GasTerra installed a high pressure digester and concluded contracts to deliver 54 mcm of green gas³¹⁹.

Figure 22 GasTerra market share (based on own analysis)³²⁰



8.3.4 GasTerra revenue, profits, and dividend

Over the past years GasTerra has seen a strong reduction in revenue, 40 percent between 2013 and 2015, due to production reduction from both the Groningen and the marginal fields, and the low gas prices (see Table 20). This reduction is expected to continue due to stricter production ceilings on the Groningen field in 2016, and a year on year decline of small-fields production of around 2 billion m³³²¹. GasTerra's profit, which is paid out as dividend in its entirety, is fixed by its shareholders at 36 million annually independent of revenue. On a yearly basis the NAM calculates in retrospect what price GasTerra needs to pay for the Groningen gas the NAM delivered, to keep GasTerra's profits at the set

³¹⁷ GIIGNL, "The LNG Industry: GIIGNL Annual Report 2016 Edition."

³¹⁸ GasTerra, "GasTerra: Annual Report 2015."

³¹⁹ Ibid., 29.

³²⁰ CBS, "CBS StatLine - Aardgasbalans; Aanbod En Verbruik"; GasTerra: annual reports 2008-2015.

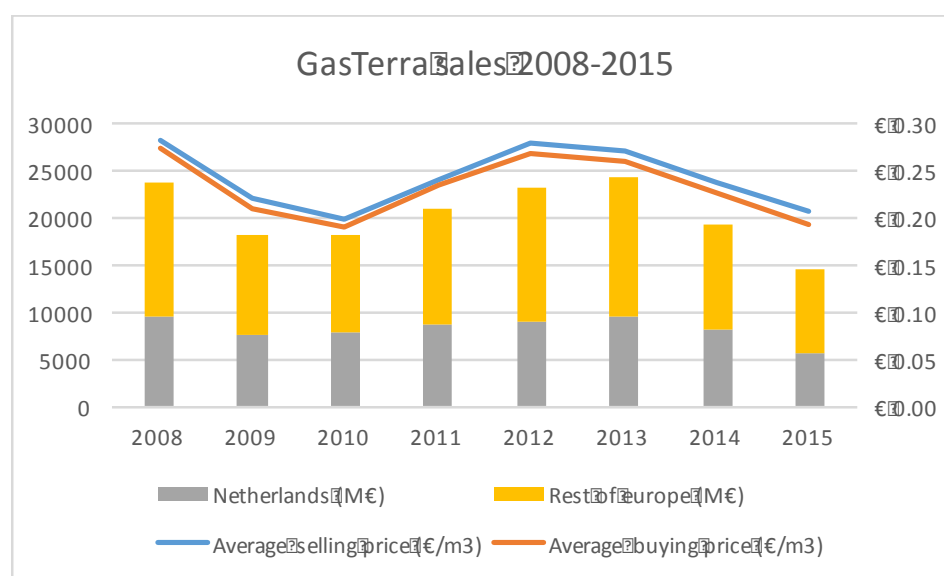
³²¹ GasTerra, "GasTerra: Annual Report 2015," 51.

level³²². The majority of the added value thus stays within the NAM, which transfers a large part of these profits to the government (see chapter 4) The government, based on its share in GasTerra, thus receives 3.6 million in dividends directly and 14.4 million through EBN annually (the government owns 10 percent and EBN 40 percent of the shares). Unfortunately, no annual reports prior to 2008 were available, limiting the analysis to the period between 2008 and 2015.

Table 20 GasTerra revenue, profit, and dividend 2008-2015 (based on own analysis)³²³

Mln €	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	23,953	18,310	18,357	21,095	23,381	24,300	19,501	14,740
Profit	36	36	36	36	36	36	36	36
Dividend	36	36	36	36	36	36	36	36

Figure 23 GasTerra gas sales 2008 – 2015 (in revenue and volume) (based on own analysis)³²⁴



³²² Ibid., 13.

³²³ GasTerra, "GasTerra: Annual Report 2009"; GasTerra, "GasTerra: Annual Report 2011"; GasTerra, "GasTerra: Annual Report 2012"; GasTerra, "GasTerra: Annual Report 2013"; GasTerra, "GasTerra: Annual Report 2014"; GasTerra, "GasTerra: Annual Report 2015."

³²⁴ Ibid.

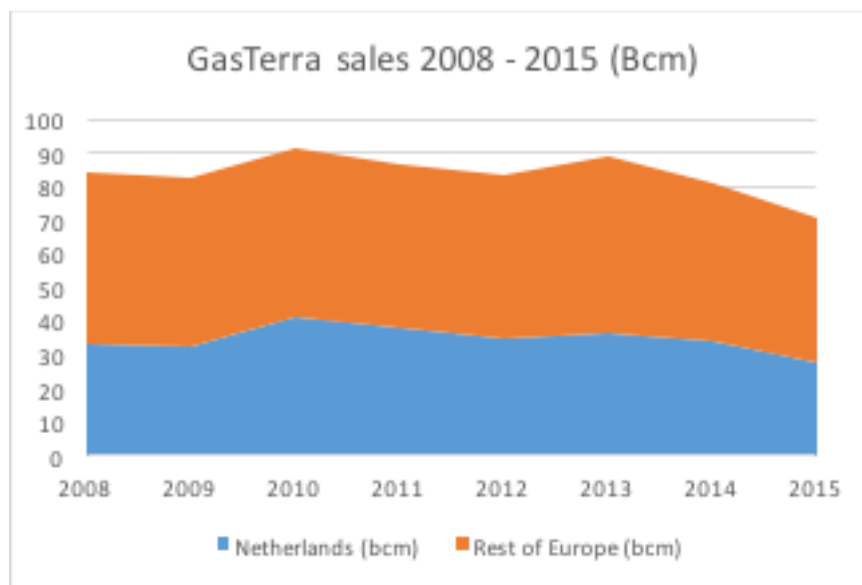
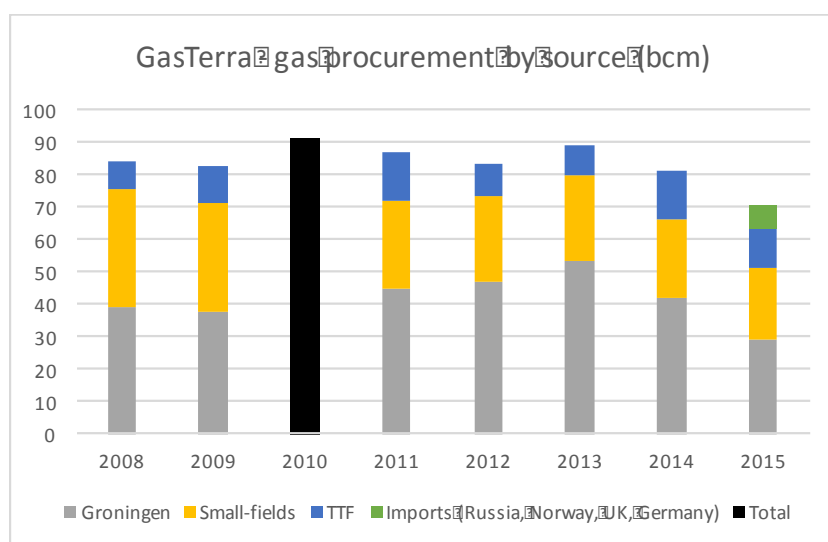


Figure 24 GasTerra - gas procurement by source 2008 – 2015 (based on own analysis)³²⁵



8.3.5 GasTerra as a policy instrument and policy influencer

In addition to being the Netherlands's prime gas wholesaler GasTerra is also being used by the government as a policy instrument in enacting the small-fields policy (see 5.11). In order to promote the production from small-fields GasTerra is obliged to buy all the gas coming from these fields if offered to them by the producer. Producers do however have to possibility to sell to other shippers. In the past it has been estimated that GasTerra takes in around 85 percent of the small field's production³²⁶.

GasTerra also has a role in facilitate production from small-fields through optimizing its systems and conditions. For example, it shifted from a 'buyers request regime' to a 'sellers nomination regime'

³²⁵ No split-out data for 2010; before 2015 imports are included in the TTF number. Source: GasTerra: annual reports 2009-2015

³²⁶ Frontier Economics, "Scenarios for the Dutch Electricity Supply System: A Report Prepared for the Dutch Ministry of Economic Affairs," 7.

meaning that supply is no longer demand but production driven³²⁷. This aids in optimizing production since the producers can better adapt to the technical possibilities of the field³²⁸. Also, GasTerra has been actively involved in developing further methods to support exploration and production of small-field gas reserves through a state-industry consultation platform. As a result, for example, it improved the purchasing conditions by creating more flexible procurement contracts, providing long-term guarantees to producers while at the same time allowing (temporary) deliveries to other parties (than GasTerra)³²⁹. All of these measures had as goal to increase profitability for producers as to maximize their (gas) output.

GasTerra is also an active promotor of the natural gas sector in general. They hold the position that gas has a 'system function' in the energy supply and that natural gas is the ideal 'bridge' fuel in the energy transition. Through its participation in trade associations such as the Dutch Energy Association (VEN), Eurogas, and the International Gas Union (IGU) it attempts to push these ideas and influence regulation and policy making. With the IGU they engage in knowledge exchange and 'gas advocacy', with Eurogas in research, opinion-forming, monitoring, and also gas advocacy. Through VEN they hope to promote the benefits of gas in the energy transition with the Dutch government and influence regulation³³⁰.

Also, GasTerra acknowledges in its annual report of 2015 that a reduction in tax on small-fields would make investment in gas production more attractive and could prevent early decommissioning of infrastructure. The trade association of the producing industry, NOGEPA, then also urged the government to enact such a reduction³³¹.

Although partly government owned itself GasTerra is thus actively lobbying the government, also at the EU level, and acting as an industry partner.

8.3.6 Gas trade: TTF

Gas in the Netherlands can be delivered directly to customers, for example through GasTerra, or can be procured using the Title Transfer Facility. This is a major virtual gas-trading hub for North-west Europe where gas, already in the transport system of Gasunie, can be 'virtually' traded between parties such as gas producers, storage companies, network operators, and distributors. The TTF is facilitated by the gas exchange ICE Endex, in which Gasunie holds a share 20.1 percent share (see Appendix 33). In providing a liquid market for natural gas it allows futures trading and can help balance the system through 'balancing agreements'³³². The TTF has grown considerably in the previous years. In 2015 16,686 Twh of gas was traded virtually and 450 Twh was physically delivered through the exchange. In 2016 this has risen to 21.468 Twh. Also, the churn factor, the ratio between virtually traded and physically delivered gas, which is a representation of liquidity, has been rising steadily. Moreover, the amount of daily active traders has risen from 127 in 2014 to 138 in 2015 and gas is increasingly being traded internationally³³³. These developments further strengthen the position of the Netherlands as a prime gas (trading) hub. As of 2016 TTF is the largest gas trading facility in Europe, surpassing the British National Balancing Point (NBP) for the first time³³⁴. Moreover, this increased

³²⁷ GasTerra, "GasTerra: Annual Report 2015," 52.

³²⁸ GasTerra, "GasTerra: Annual Report 2013," 27.

³²⁹ GasTerra, "GasTerra: Annual Report 2011," 23.

³³⁰ Gasunie, "Gasunie: Annual Report 2015," 30.

³³¹ GasTerra, "GasTerra: Annual Report 2015," 51.

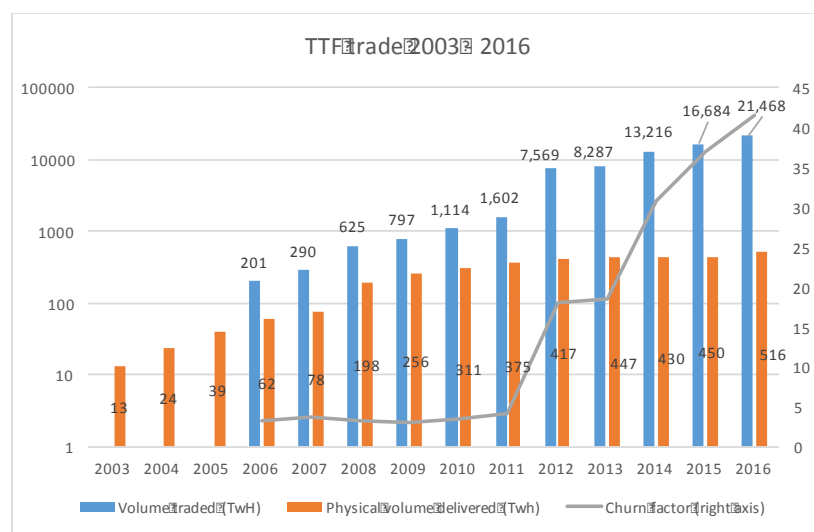
³³² Gasunie, "TTF > Gasunie Transport Services."

³³³ Gasunie, "Gasunie: Annual Report 2015," 178.

³³⁴ Gasunie, "Gasunie: Annual Report 2016," 58.

liquidity allows the TTF to, increasingly, act as a price setter. In this respect it appears that the governments 'gas roundabout' strategy is having the desired effect.

Figure 25 TTF gas traded 2003 -2016 (based on own analysis)³³⁵



8.3.7 Discussion

In the sales and distribution stage of the fossil fuel chain interdependencies occur mainly through the governments participation in the regional distribution of gas and through the wholesaler GasTerra. When it comes to oil, as has been discussed in previous stages, the government is involved in supplying jet-fuel to airports, and, although applying to the use stage, an excise tax exemption for marine transport and the aviation industry costs the government over 3 billion annually in lost tax receipts. Moreover, it earns an average of 26.15 million euro annually through petrol station leaseholds. The distribution of coal in the Netherlands is completely privatized and involves mainly direct transmission to large industrial customers and power plants.

The involvement of lower-governments such as provinces and municipalities in regional distribution networks reduces financial risks for the networks and, especially for the major shareholders, gives them an interest in continuing the network to maintain dividend revenue. However, this need not necessarily pose a barrier to a (future) dismantling of the gas distribution networks the decrease of revenue from gas networks could perhaps be recuperated via the electricity networks (especially given the high costs of gas network maintenance).

Although production is not part of this stage, it has become apparent by looking at the role of GasTerra in the gas chain that the production industry needs the government as a partner in producing gas from small fields to manage production costs. The government is willing to provide this support in order to maximize production of their reserves and thus their revenues. This mutual dependency runs mainly through GasTerra and EBN, as prime partners for the industry in this respect due to their intertwinement with the gas producers, through their shareholders and suppliers (GasTerra) and through the participations in gas production (EBN). For a discussion of EBN see chapter 5.

The trading of gas through TTF, which created an international liquid gas market, has been a key part of the governments gas hub strategy. This strategy has been implemented mainly by Gasunie and GasTerra. The success of the TTF improved the position of the Netherlands as a gas trading hub,

³³⁵ Gasunie, "Gasunie: Annual Report 2005"- 2015.

strengthening the economic importance of natural gas for the Netherlands. This could potentially lead to a further lock-in of the Dutch economy, and the energy system, in using natural gas.

Through its policy activities, its political engagement, and lobbying through trade associations GasTerra is actively promoting the role of natural gas in the Dutch energy system. Indirectly the government is thus lobbying itself, and the European Union, to push natural gas production and investment. Moreover, the government, indirectly, joins calls by the production industry for tax reductions on small fields production through GasTerra's implicit support of such measures. The government hinted at further supporting such measures, and other stimulating measures, in its 2016 'energy agenda' by mentioning the importance of a level playing-field in the offshore production sector between the Netherlands and the United Kingdom³³⁶. Given the large amount of tax breaks, in different forms, in the UK a 'level-playing field' insinuates the intention to adopt similar measures in the Netherlands³³⁷. Although this relation applies to the production stage it has become apparent through analyzing GasTerra's activities in the sales and distribution stage.

9 Use

This stage of the framework looks at the final step of the fossil fuel value chain, the use phase. In total final energy use in the Netherlands amounted to 2586PJ. With industry using 46 percent, transport 19 percent, households 17 percent, agriculture 5 percent, and other uses 13 percent (See Figure 26). This includes both energetic, e.g. the use of fuel to generate electricity, and non-energetic uses, e.g. oil as an input for the (petro)chemical industry. In 2015 the sector industry used 625PJ for energetic uses and 562PJ, of which 85 percent oil and 15 percent gas, for non-energetic uses³³⁸. Around 15 percent of the total final energy use in 2015 was in the form of electricity, which is used mainly by industry and households.

In the Netherlands coal is used exclusively for fuel purposes in power plants and for metallurgical uses; according to CBS the non-energetic use of coal in 2015 was non-existent³³⁹. Non-energetic use of oil and oil products amounted to 455PJ and that of natural gas to 87PJ³⁴⁰. This includes, for example, the production of artificial fertilizers (natural gas), and refineries (oil). Although refineries are the main non-energetic 'users' of oil these activities have already been discussed in the previous chapter and will thus not be part of this chapter. This stage is not organized along the lines of the different fuels but instead looks at the production of electricity, the fiscal side of fossil fuel use, and government participations that are related to the use of fossil fuels. Given that taxes and subsidies often apply to different fuels, and that electricity is generated using different sources this structure was chosen over a structure based on the different fuels.

Figure 26 Final energy use by sector in the Netherlands (adapted from EBN, 2016)³⁴¹

³³⁶ Ministry of Economic Affairs, "Energie Agenda 2016," 71.

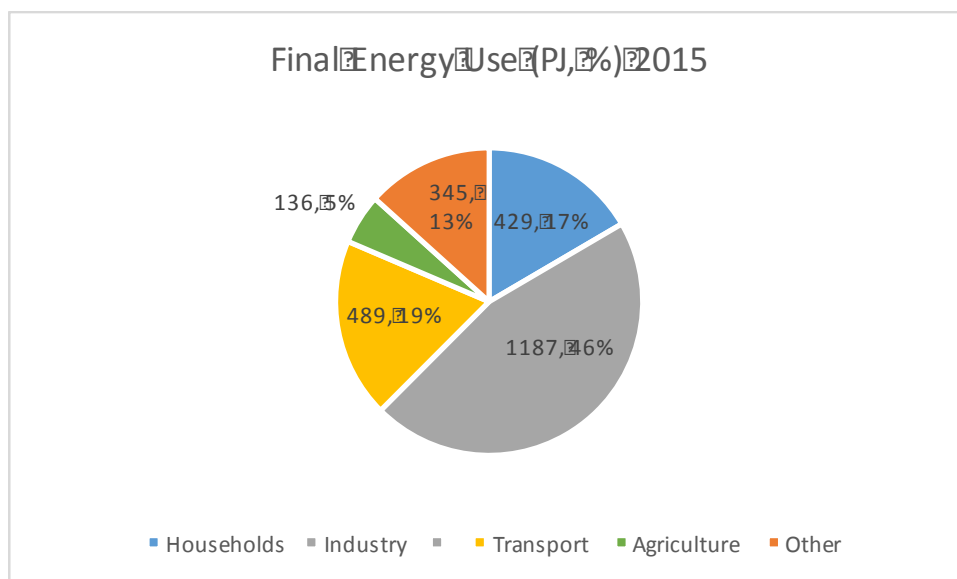
³³⁷ Pickard and van der Burg, "G20 Subsidies to Oil, Gas and Coal Production."

³³⁸ EBN, "EBN Energie Infographic 2016."

³³⁹ CBS, "CBS StatLine - Energiebalans; Kerncijfers."

³⁴⁰ Ibid.

³⁴¹ EBN, "EBN Energie Infographic 2016."



9.1 Electricity

Accounting for 15 % of total final energy use electricity, and its production, is an important fossil fuel user, mainly gas and coal. This section looks at the fossil dependency of the Dutch electricity supply, public ownership of electricity production assets, and government expenditure on (fossil based) electricity production. The latter is important because it can be regarded as a subsidy on the use of fossil fuels.

9.1.1 Fossil dependency of the electricity supply

As became apparent during the initial scoping the Dutch primary energy supply is mainly fossil based. For electricity the situation is similar. In 2015 around 42 percent of electricity was generated using gas, 35 percent using coal, 12 percent using biomass, wind, solar, and hydro, 7 percent with nuclear, and 4 percent using other fossil fuels (see Figure 27 and Figure 28). However, the total share of fossil fuels in the electricity mix has been on the decline, from 84.4 percent in 2010 to 80.9 percent in 2015. This downward trend is, however, being slowed by an increase in coal fired electricity generation in the previous two years (2014 and 2015). Electricity (and heat) in the Netherlands is produced in both a centralized and decentralized manner: by large thermal or nuclear power plants and fed to the high-voltage grid; or using wind, solar, hydro, or biomass plants or thermal installations (e.g. combined heat and power (CHP)) which deliver to a company or middle/low-voltage grid³⁴². Central and decentral production both account for around 50 percent of total electricity production. Of the 295pj produced through decentral production in 2015 around 204pj was generated using fossil fuels. Of this 192pj was generated using gas. This suggests that gas fired CHP installations, which are, for example, used frequently in horticulture, are an important source of electricity production in the Netherlands. This is further underlined by the fact that the horticultural sector as a whole was a net producer of electricity in 2015³⁴³.

The electricity mix clearly shows that there is still a large fossil dependency, with over 80 percent being generated using fossil fuels. Even though the importance of gas is declining, this is partly being offset by a recent increase in coal.

³⁴² CLO, "Inzet Energiedragers En Bruto Elektriciteitsproductie, 1995-2014 | Compendium Voor de Leefomgeving."

³⁴³ EBN, "EBN Energie Infographic 2016."

Figure 27 Electricity production in the Netherlands by source 1990 – 2015 (adapted from CBS, 2017)³⁴⁴

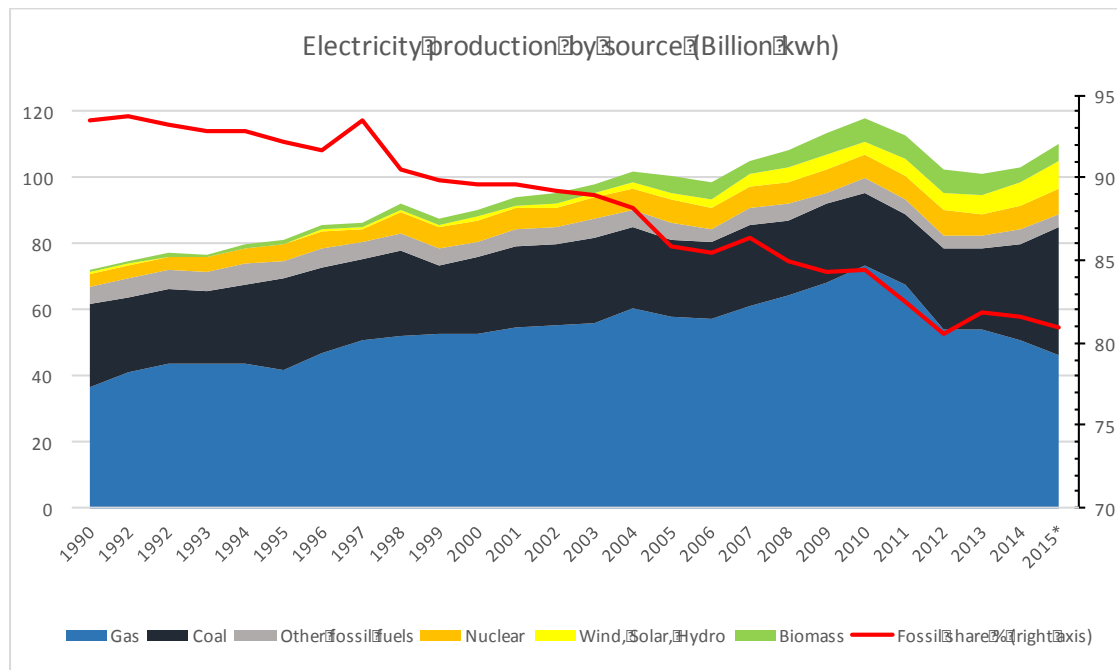
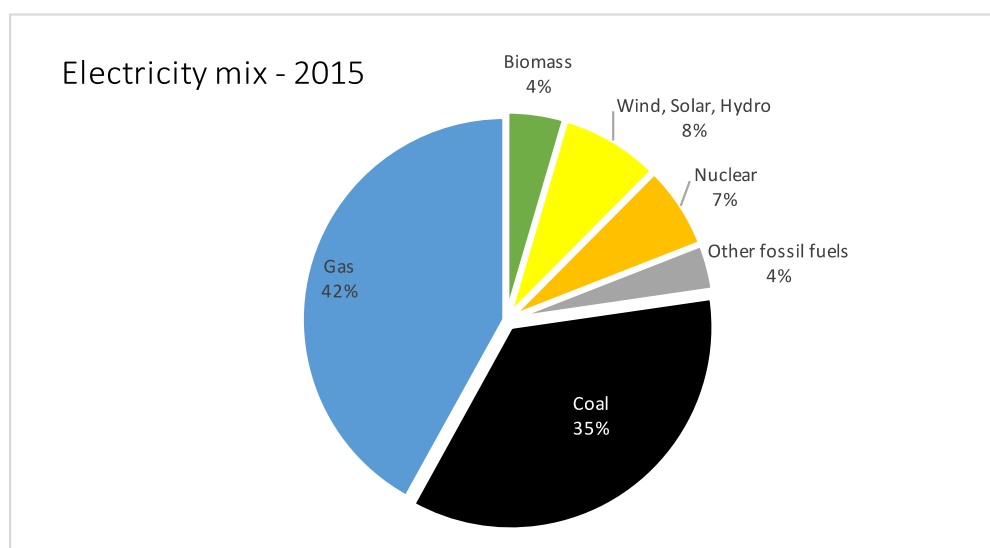


Figure 28 Electricity mix in the Netherlands 2015 (adapted from CBS, 2017)³⁴⁵



9.1.2 Government ownership in the electricity supply

Since the 1990's municipalities and provinces have been gradually selling their shares in the (former) municipal electricity companies. In 2009 the two biggest producers, Nuon and Essent, were sold to, respectively, Vattenfall (owned by the Swedish State) and RWE (owned for a large share by German

³⁴⁴ "CBS StatLine - Elektriciteit En Warmte; Productie En Inzet Naar Energiedrager."

³⁴⁵ Ibid.

municipalities)³⁴⁶. Municipalities and provinces received around 29 billion in total through the sale of Essent and Nuon, which were, and still are, largely fossil (see Appendix 38). In addition, as calculated by 'Investico', a platform for investigative journalism, they received up to 8 billion in dividends from these utilities between the early 80's and the sale in 2009, however, most of the revenue was generated after the year 2000. In addition, Investico estimated that the former owners earned around 3 billion in interest on the payments resulting from the sale and investments done with these sales proceeds³⁴⁷. Since these financial relations between government and industry no longer exist a full analysis of these will not be undertaken. It is good to note, however, that a complete sale of fossil fuel assets reduces the interdependencies between the government and the industry. Perhaps making it easier, for example, to steer towards a coal phase-out, since these assets are no longer owned by the government (who would need to instigate such a phase-out).

Appendix 38 provides an overview of the electricity producers in the Netherlands, giving insight in capacity, their dependency on fossil fuels, and their shareholders. Delta and Eneco are the only producers with the government as a shareholder. EPZ, Sloecentrale, and ELSTA are included in Delta's numbers as provided in the next section. In addition, the national government owns the high-voltage electricity grid, and its operator, TenneT, however, since this transports both fossil and non-fossil generated electricity this ownership relation has not been included in this analysis.

9.1.2.1 DELTA

DELTA is a state-owned 'multi-utility'; In addition to producing electricity DELTA also trades in electricity and gas, owns the DSO Enduris and water utility Evides, and, until recently, owned and managed data networks in the Zeeland region, and a waste treatment company³⁴⁸. In order to reduce its debts and compensate for losses on its electricity producing units DELTA has had to sell part of its activities in the previous years. In 2015 DELTA sold its waste treatment activities and a wind turbine unit and, after a decision by its shareholders early 2016 to not extend financial support, its production and retail units will also be sold. As mentioned above, it also needs to sell its network activities in 2017. The retail section, which includes electricity and non-electricity related activities has been sold in 2016 for 488 million³⁴⁹.

In 2015 DELTA had a revenue of 1.3 billion euro, of with around 1.17 billion coming from electricity production and the supply of gas, and posted a loss of 111 million euro. The loss was caused mainly by lower gas and electricity sales and a reduction in expected future revenue from already contracted gas storage and transport services³⁵⁰. In 2010 DELTA had similarly bad results but then caused by renewables; both its solar cell and biofuel producing branches went bankrupt³⁵¹.

Table 21 DELTA revenue, profits, and dividends paid 2005 - 2015 (based on own analysis)³⁵²

M €	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Revenue	1034.4	1311.8	1453.7	2210.8	1870	2073.1	2185.1	2171.8	2103.6	1930.8	1299	

³⁴⁶ Boots, "The Dutch Electricity Value Chain."

³⁴⁷ Investico, "Overzicht."

³⁴⁸ Delta, "DELTA Annual Report 2015," 10.

³⁴⁹ Financieel Dagblad, "Delta Verkoopt Retailtak Aan Private Equity."

³⁵⁰ Delta, "DELTA Annual Report 2015," 6–7.

³⁵¹ DELTA, "DELTA Annual Report 2010," 6.

³⁵² DELTA, "DELTA Annual Report 2006"; DELTA, "DELTA Annual Report 2007"; DELTA, "DELTA Annual Report 2008"; DELTA, "DELTA Annual Report 2009"; DELTA, "DELTA Annual Report 2010"; DELTA, "DELTA Annual Report 2011"; DELTA, "DELTA Annual Report 2012"; DELTA, "DELTA Annual Report 2013"; DELTA, "DELTA Annual Report 2014"; Delta, "DELTA Annual Report 2015."

Profit	126.7	169.1	114.5	100.9	7.1	-177.8	82.7	81.1	74.8	3.8	-110.7	
Dividend	50	52.5	57.3	50.5	50	50	50	40	40	20	15	455.3

On average, between the years 2005 and 2015, 57 percent of DELTA's revenue was fossil fuel related (Table 22). For 2015 this amounted to 810 million euro. This share fluctuated between 45 percent and 72 percent over the years, based on both the renewable share of production and the overall share of energy in revenue in that year. For example, the sale of its waste treatment branch led to an increase in the share of fossil revenue from 45 to 62 percent between 2014 and 2015. On average, around 57 percent of the generated dividends can thus be seen as fossil fuel related. For example, the province of Zeeland, which has a 50 percent share in DELTA, received 3.35 million euro in fossil dividends in 2014 (44.6 percent of its 7.5 million share in the 2014 dividends). Between 2005 and 2015 the shareholders of DELTA thus received around 260 million euro in fossil dividends, of which 130 million went to the province of Zeeland.

Table 22 DELTA: revenue by activity (based on own analysis)³⁵³

DELTA revenue by activity											
(Mln €)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Supply of electricity	513.9	622.6	712.3	994.9	875	1073	1000	1046	970	882	810
Supply of gas	331.6	490.1	145.4	375.8	300	312	415	332	344	268	257
Transport gas and electricity			116.3	110.5	125	101	113	112	118	106	107
Cable, internet, telecommunications	49.1	50.9	72.7	66.3	69	83	83	75	79	81	81
Waste management	103.8	103.2	276.2	397.9	446	462	509	519	514	517	
Other	36	45	130.8	265.3	55	42	63	84	79	77	44
Total net revenue	1034.4	1311.8	1453.7	2210.8	1870	2073	2185.8	2168	2104	1931	1299
Energy share of total revenue (%)	81.7	84.8	67.0	67.0	69.5	71.7	69.9	68.7	68.1	65.0	90.4
Fossil share of electricity mix (%)	n/d	74.0	74.6	75.9	n/d	n/d	69.2	n/d	61.1	55.2	55.0
Fossil share of electricity related revenue	n/d	461	531	755	n/d	n/d	692	n/d	593	487	446
Fossil share of total revenue (%)	n/d	72	55	56	n/d	n/d	56	n/d	50	45	62
Fossil revenue	n/d	951	793	1241	n/d	n/d	1220	n/d	1055	861	810

For the province of Zeeland DELTA's dividend comprises a considerable share of their freely spendable income. Dividends flow into the provinces current accounts and are not bound to certain structural expenses. As can be seen in Table 23 DELTA's dividend amounted to between 15 and 20 percent of total non-programme bound revenue.. The actual percentage is even higher since most of the other dividends received are not freely spendable (e.g. receipts from Westerschelde Tunnel N.V. are earmarked for tunnel reparation/replacement)³⁵⁴. The fossil share of the provinces revenues then ranges between 10 and 15 percent in the years 2005-2012, and diminishes as DELTA's dividend payments diminish. In the past there has thus been a strong fossil dependency of the province of

³⁵³ DELTA, "DELTA Annual Report 2006"; DELTA, "DELTA Annual Report 2007"; DELTA, "DELTA Annual Report 2008"; DELTA, "DELTA Annual Report 2009"; DELTA, "DELTA Annual Report 2011"; DELTA, "DELTA Annual Report 2010"; DELTA, "DELTA Annual Report 2012"; DELTA, "DELTA Annual Report 2013"; DELTA, "DELTA Annual Report 2014"; DELTA, "DELTA Annual Report 2015."

³⁵⁴ Province of Zeeland, "Province of Zeeland: Annual Report 2015," 106.

Zeeland on fossil fuel revenue coming from its participation in DELTA. In addition, Zeeland also holds a share in DELTA to protect regional and local employment³⁵⁵. The province is thus partly dependend on the fossil fuel industry for the creation of jobs. With the loss of profitability of DELTA and the sell-off of many of its activities both of these dependencies will come to an end. However, attesting to the strength of this interdependency, the shareholders considered financial support to keep DELTA afloat through a guaranteed loan to the height of 200 million euro³⁵⁶. Ultimately, the loan was not granted and DELTA will be split up. Due to the small ownership shares of the other municipalities and provinces it is not very likely that the fossil share of DELTA's dividends represents a major stream of income for these owners. Hence, an analysis of their financial relationship with DELTA is not undertaken. For unknown reasons the dividend received from DELTA in 2005 and 2006 is higher than the total reported dividend received by Zeeland in those years. It could be that the dividends received from DELTA were not classified as such in these years due to a different ownership structure, and thus fall under a different item on the balance sheet.

Table 23 Dependency of Zeeland (province) on fossil dividends (based on own analysis)³⁵⁷

Fossil revenue dependency of Zeeland											
M €	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Non-programme bound revenue	113	130	145	133	124	165	124	141	138	140	127
o/w dividend	22	25	35	29	25	62	30	25	22	17	17
o/w from DELTA	25	26.3	28.6	25.3	25	25	25	20	20	7.5	0
As share of revenue (%)	22.1	20.2	19.7	19.0	20.2	15.2	20.2	14.2	14.5	5.4	0.0
Fossil DELTA dividend (based on Table 22)	n/d	19.1	15.6	14.2	n/d	n/d	14	n/d	10	3.4	
Fossil dividend as share of revenue (%)	n/d	14.7	10.8	10.7	n/d	n/d	11.3	n/d	7.3	2.4	0

9.1.2.2 Eneco

The other electricity producing company still in public hands, which also, until 1-1-2017, held on to its DSO, is Eneco. As can be seen in Appendix 38 Eneco has a relatively low share of fossil fuel fired capacity (46%), but based on actual electricity production its fossil share of production amounted to 75 percent in 2015. Eneco generated around 4 billion euro in revenue in 2015 with its energy related activities, which, at that time, still included the DSO branch revenue, and 208 million euro in profits. Of this, 103 million was paid out in dividends. Using the electricity mix of Eneco's own production, they also buy electricity, as a crude measure of the share of fossil in generating this dividend around 77 million could be marked as 'fossil dividend'. Eneco has 56 municipal shareholders with the biggest being Rotterdam (31.69%) and The Hague (16.55%). Based on their share they received, respectively, 24.5 million and 12.8 million euro in fossil dividend in 2015. For Rotterdam this makes up 21.5 percent of total dividends it receives on an annual basis, and 1.5 percent of the total freely spendable

³⁵⁵ Ibid., 102.

³⁵⁶ Provinciale Staten, "Brief GS van 29 Januari 2016 Inzake Vraag En Antwoord Met Betrekking Tot Herstructurering En Herfinanciering DELTA N.V."

³⁵⁷ Province of Zeeland, "Province of Zeeland: Annual Report 2005"; Province of Zeeland, "Province of Zeeland: Annual Report 2006"; Province of Zeeland, "Province of Zeeland: Annual Report 2007"; Province of Zeeland, "Province of Zeeland: Annual Report 2008"; Province of Zeeland, "Province of Zeeland: Annual Report 2009"; Province of Zeeland, "Province of Zeeland: Annual Report 2010"; Province of Zeeland, "Province of Zeeland: Annual Report 2012"; Province of Zeeland, "Province of Zeeland: Annual Report 2014"; Province of Zeeland, "Province of Zeeland: Annual Report 2015."

income³⁵⁸ it receives³⁵⁹. For the Hague this makes up around 50 percent of total dividend and 1.6 percent of total freely spendable income received in 2015³⁶⁰. For both municipalities the fossil dividend from Eneco is thus only a very minor source of income. In March 2017 Rotterdam announced that it wishes to sell its stake in Eneco due to the break-off of the DSO Stedin³⁶¹. Again, financial relationships with owners of a smaller share in Eneco are not analyzed.

Table 24 Eneco revenue, dividends, and fossil dependency³⁶²

M €	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue (energy related)	3361	3943	4542	4635	5018	4722	4839	5082	5026	4343	4054
Profit	302	311	426	272	177	141	204	233	242	206	208
Dividend	151	166	171	212	136	89	71	201	117	121	103
Fossil share of electricity production (%) ³⁶³	90.1	90.1	90.1	90.1	90.1	90.1	90.1	85.7	83.9	80	75
Fossil dividend	136.1	149.6	154.1	191	122.5	80.2	64	172.3	98.2	96.8	77.3

9.1.3 Government support for electricity production

Apart from municipalities and provinces holding shares in DELTA or Eneco, government income from electricity generation is limited. There is a general energy tax, which is due on both gas and electricity supply and consumption, which is discussed in section 9.2 (see Figure 29)³⁶⁴. In addition, there is a fee (“Opslag Duurzame Energie”, ODE) due, on both electricity and gas, to pay for subsidies given to renewable energy (the ‘SDE+’ policy). Both measures are analyzed in more detail below.

The government provides, and has provided for years, subsidies for the generation of electricity using renewable sources. Currently this policy is called the ‘SDE+’ policy, previously it was called ‘MEP’, ‘OV-MEP’, and ‘SDE’ and is financed by a fee due on electricity and gas consumption. The policy includes subsidies for different types of renewable energy, but this section limits itself to analyzing the subsidies for the co-firing of biomass in coal power plants. The subsidy given is equal to the difference between the cost price of a renewable energy project and the market value of the electricity/heat supplied, and is contracted in a certain year with a fixed running period. Through this program the government hopes to attain 25PJ of energy delivered through biomass co-firing annually. Biomass co-firing in coal power plants was added to the SDE+ policy in 2015, based on the ‘Energieakkoord’. In 2016 the government committed itself to 3.6 billion euro in co-firing subsidies to three different thermal coal power plants for a period of 8 years amounting to 24.84PJ/annum³⁶⁵. In 2017 subsidy requests can be filed for the remaining 0.16PJ/year.

³⁵⁸ Freely spendable income: ‘algemene dekkingsmiddelen’ minus ‘algemene uitkering sociaal deelfonds’

³⁵⁹ Municipality of Rotterdam, “Algemene Dekkingsmiddelen • Jaarstukken 2015 Rotterdam.”

³⁶⁰ Municipality of the Hague, “The Hague Annual Report 2015,” 214.

³⁶¹ Financieel Dagblad, “Gemeente Rotterdam Wil Belang in Eneco Verkopen.”

³⁶² Eneco, “Jaarverslag 2005”; Eneco, “Jaarverslag 2006”; Eneco, “Eneco Annual Report 2007”; Eneco, “Eneco Annual Report 2008”; Eneco, “Eneco Annual Report 2009”; Eneco, “Eneco Annual Report 2011”; Eneco, “Eneco Annual Report 2010”; Eneco, “Eneco Annual Report 2012”; Eneco, “Eneco Annual Report 2014”; Eneco, “Eneco Annual Report 2015.”

³⁶³ Before 2010 Eneco only reported the fuel mix of the power it delivered (e.g. including certificates), not of the power it generated. Hence the 2011 percentage is used for 2005-2010

³⁶⁴ Ministry of General Affairs, “Energiebelasting - Milieubelastingen - Rijksoverheid.nl.”

³⁶⁵ RVO, “Brochure SDE Voorjaar 2017”; “Feiten En Cijfers SDE(+) | RVO.nl.”

Payments committed to under the older policies SDE, OV-MEP, and MEP still occur, since these policies paid out subsidies over the period of 10 (MEP) or 12-15 (SDE) years. Between 2003 and 2006 a total of 1456 million euro was paid out in MEP subsidies, of which 591 million to biomass co-firing ('biomassagroot >50Mw'), and 320 million to gas fired CHP. This amounts to, respectively, 40.6 and 22 percent of the total MEP subsidies given out. Table 25 below lists the payments done between 2008 and 2015 plus the expected maximum pay outs that the government has committed to under the MEP until 2020. Since subsidies are only paid over delivered energy the actual amounts to be paid by the government could end up lower. Originally the MEP was financed through a levy on electricity grid connections for consumers, however, in 2007 the levy was scrapped and the MEP was paid directly from the State budget³⁶⁶. With implementation of the SDE and SDE+ the MEP received financial contributions from the fee introduced for these policies. It appeared impossible to determine what share of the payments came directly from the state coffers or through the SDE/SDE+ levy.

Between 2008 and 2014 the national government has paid out 826.1 million euro in subsidies for biomass co-firing. No payments occurred in 2007. In total 24 biomass co-firing projects received a subsidy under the (OV) MEP, of which 22 ran until 2012/2013. The two remaining co-firing subsidies ended in 2014. However, at the same time, the government reports that between 2009 and 2014 60 new co-firing projects were accepted with a total maximum budget of 8868.8 million euro. It is however unclear whether these accepted projects were effectuated since the amount of payments reported by the executing organization, RVO and its predecessor Agentschap NL, are significantly lower than the 8.8 billion budget cited above (see Table 26)

Although the co-firing of biomass counts as renewable energy, the subsidy for its support can also be seen as support for coal fired power plants. First of all, the subsidy could lead to a postponement of decommissioning of older plants, for example, after NUON did not manage to get co-firing subsidy for its Hemweg plant in 2016 it decided to sell off the plant or decommission it (for which NUON wants government support)³⁶⁷. Also the subsidy could increase profitability of current plants since the subsidy includes compensation for the 'cost components': capital expenditure, maintenance, amortization, and electricity costs³⁶⁸. This is especially relevant since coal power plants are currently in financial dire straits, with the three major plants being uneconomic in terms of meeting their original valuation and investment return targets³⁶⁹. This argument is supported by NUON's decision of selling or discontinuing the power plant after failing to secure subsidy for biomass co-firing. For the MEP biomass subsidies it was calculated that the subsidies given in 2004 were too high and led to excess profits for the power plant owners³⁷⁰.

In addition, the argument could be made that also subsidies for 'greengas' under the MEP/SDE policies are indirect support for fossil gas since both use the same (transport and storage) infrastructure. According to RVO the sharing of infrastructure leads to advantages of scale, benefiting both types of gas³⁷¹. In addition, on the long term, investments in 'green gas' could have a lock-in effect on gas based infrastructure possibly leading to a prolonged use of natural gas (e.g. delaying or preventing the transition to other energy carriers such as electricity). For example, in 2014 alone 658 million euro went to biomass based gas projects³⁷². A similar lock-in effect could occur with residual heat projects.

³⁶⁶ Algemene Rekenkamer, "Subsidie Regelingen Duurzame Energieproductie (MEP En SDE): Terugblik 2010 Op Subsidieregeling 'Milieukwaliteit Elektriciteitsproductie' (MEP)," 12.

³⁶⁷ Voogt, "Nuon Gaat Eigen Kolencentrale Vervroegd Sluiten of Verkopen."

³⁶⁸ Ministry of Economic Affairs, "Kamerbrief Bij-En Meestook van Biomassa in Kolencentrales," 4.

³⁶⁹ Wynn, "The Dutch Coal Mistake: How Three Brand-New Power Plants in the Netherlands Are at Risk Already of Becoming Standed Assets," 1.

³⁷⁰ Mulder, Korteland, and Blom, "Overwinsten Bij de Subsidieregeling Milieukwaliteit Elektriciteits Productie (MEP)," 45.

³⁷¹ Ministry of Economic Affairs, "Annual Report SDE+ SDE and MEP: 2011," 11.

³⁷² Rijksdienst voor Ondernemend Nederland (RVO), "Annual Report 2014 SDE+, SDE, and MEP," 7.

Table 25 (OV) MEP payments 2008-2020 (based on own analysis)³⁷³

M€	2008	2009	2010	2011	2012	2013	2014	2015*	2016*	2017*	2018*	2019*	2020*
MEP payments	539.5	521	671.1	659	619.6	505	432	362.1	278	187.8	55	47	40
o/w to biomass co-firing	n/d	166.1	186.7	192.8	159.5	85.5	35.5	-	-	-	-	-	-
*Estimations from the 2016/2017 budgets of the ministry of economic affairs													

Table 26 OV-MEP Co-firing projects approved and committed budget 2009 – 2014 (based on own analysis)³⁷⁴

M€	2009	2010	2011	2012	2013	2014	Total
Committed co-firing budget	2980	2359.9	1789	906.3	420.6	413.0	8868.8
Number of projects accepted	24	16	10	6	2	2	60

9.2 Tax income and expenditure on fossil fuel use

In all stages of the research tax expenditure and income has been a major financial relationship between the government and industry. This has, however, been difficult to study. Especially since, with the methodology applied in this thesis, and the available data, it is impossible to explore the profit and wage taxes and VAT coming from fossil fuel related activities. The sections below will provide an overview of the government's tax income from, and expenditure on, fossil fuel use, or consumption. Specifically, it looks at the energy tax, fuel excise, fuel and electricity VAT, the coal and fuel levy, fiscal stimuli for (fossil) investments, wage tax reductions for operators of sea-going vessels, EU-ETS compensation subsidy, and the indirect support of energy intensive activities through emissions grandfathering, and windfall profits, under the EU-ETS. Although the EU-ETS

9.2.1 Energy tax

The government levies an energy tax payable by suppliers and consumers of natural gas and electricity. The tax does not apply to electricity produced from renewable sources or emergency systems, self-produced 'green gas', or using a CHP plant³⁷⁵. The energy tax on gas is regressive with the normal rate for small consumers (0.25244€/m³; 0 to 5000 m³/year) being more than 22 times higher than the rate for large industrial users (> 10 million m³ annually). The energy tax on electricity also has a regressive rate with small users (0.1013€/kwh; 0-10,000 Kwh/year) paying around 190 times as much as large

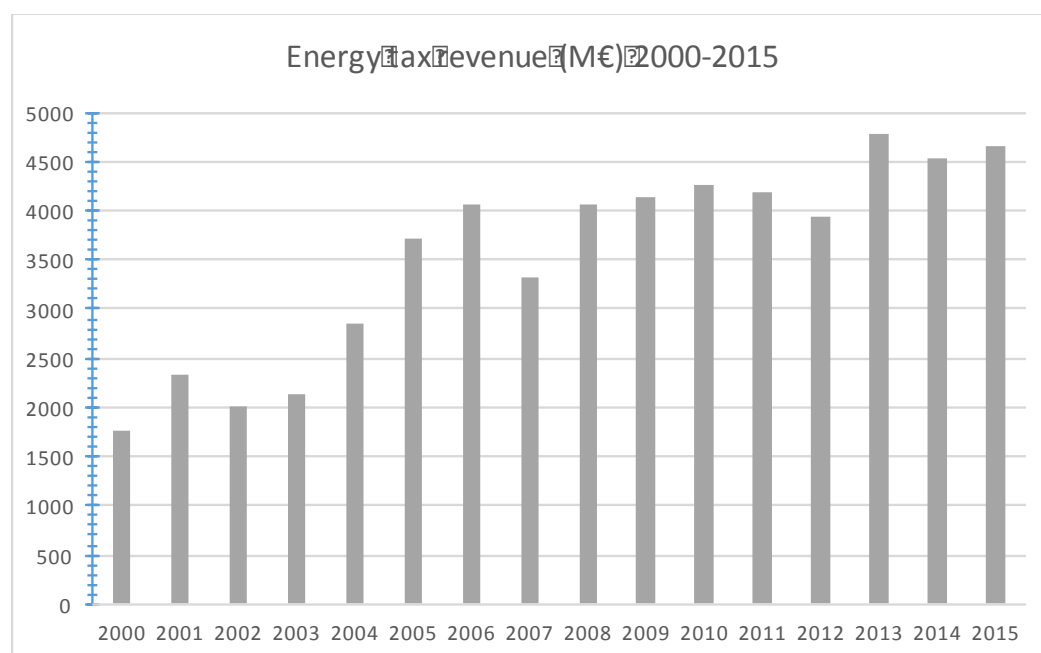
³⁷³ Tweede Kamer der Staten Generaal, "Vaststelling begroting Ministerie van Economische Zaken en Diergezondheidsfonds 2016"; Tweede Kamer der Staten Generaal, "Vaststelling begroting Ministerie van Economische Zaken en Diergezondheidsfonds 2017"; Ministry of Economic Affairs, "Kamerbrief: Stand van Zaken-Hernieuwbare Energieproductie"; Agentschap NL, "Annual Report 2009 SDE and MEP"; Agentschap NL, "Annual Report 2010 SDE and MEP"; Agentschap NL, "Annual Report 2011 SDE+ SDE and MEP"; Agentschap NL, "Annual Report 2012 SDE+, SDE and MEP"; Rijksdienst voor Ondernemend Nederland (RVO), "Annual Report 2014 SDE+, SDE, and MEP."

³⁷⁴ Agentschap NL, "Annual Report 2009 SDE and MEP"; Agentschap NL, "Annual Report 2010 SDE and MEP"; Agentschap NL, "Annual Report 2011 SDE+ SDE and MEP"; Agentschap NL, "Annual Report 2012 SDE+, SDE and MEP"; Rijksdienst voor Ondernemend Nederland (RVO), "Annual Report 2013 SDE+, SDE, and MEP"; Rijksdienst voor Ondernemend Nederland (RVO), "Annual Report 2014 SDE+, SDE, and MEP."

³⁷⁵ Ministry of General Affairs, "Energiebelasting - Milieubelastingen - Rijksoverheid.nl."

industrial users (0.00053€/kwh; > 10 million kwh/year)³⁷⁶. In addition, the horticultural sector enjoys a reduced rate for both small and large consumers of gas. This means that the horticultural sector receives a double benefit since almost half of all CHP installed capacity, which is exempt from the energy tax on electricity, is found in this industry³⁷⁷. Refineries, which had 2.8Mwe of installed CHP capacity in 2014, also benefit from this exemption³⁷⁸. In 2015 the national government earned 4648 billion euro in revenue through the energy tax. As becomes apparent from Figure 31 income from this tax has been rising steadily since 2000 and has now stabilized around 4500.

Figure 29 Energy tax revenue 2000-2015 (based on CBS, 2016)³⁷⁹



On the other hand, the government also uses the energy tax to provide fiscal stimulus to certain industries. In 2015 a total of 133 million was spend, in foregone revenue, on a lowered energy tax rate for the horticultural industry, a reimbursement for churches, not-for-profits, and large consumers. Up to 2003 entities with a CHP plant could deduct the energy tax from their general tax bill, resulting in lower tax income for the government (see Table 27³⁸⁰).

Table 27 Energy tax lowered rates, reimbursement, and deductions 2001 - 2017 (Based on own analysis)³⁸¹

³⁷⁶ Belastingdienst, "Tabellen tarieven milieubelastingen."

³⁷⁷ de Buck et al., "Toekomst Warmtekrachtkoppeling En Warmtevoorziening Industrie En Glastuinbouw," 11.

³⁷⁸ Ibid.

³⁷⁹ CBS, "Heffingen op energiedragers."

³⁸⁰ For 2011-2017 the 'Miljoenennota 2017' was used as a source. For other years the number was taken from the most recent 'miljoenennota' that still included that specific year in its tables.

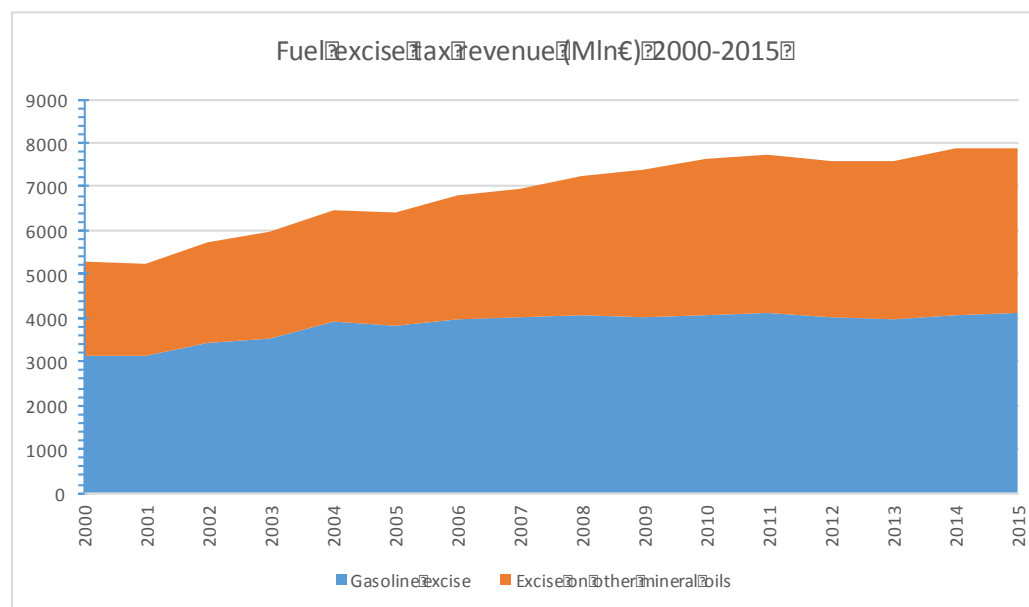
³⁸¹ Tweede Kamer der Staten Generaal, "Miljoenennota 2002"; Tweede Kamer der Staten Generaal, "Miljoenennota 2003"; Tweede Kamer der Staten Generaal, "Miljoenennota 2004"; Tweede Kamer der Staten Generaal, "Miljoenennota 2005"; Tweede Kamer der Staten Generaal, "Miljoenennota 2006 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2007 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2008 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2009 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2010 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2017 (Nota over de toestand van 's Rijks Financiën)."

M€	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*	2017*
Reduced rate in horticulture	65	113	100	103	131	149	156	169	86	83	80	68	83	81	102	116	113
Rebate for religious institutions	4	4	3	3	5	5	5	5	6	7	7	7	7	9	7	8	8
Rebate for Non Profit Organizations	19	19	21	5	5	5	6	15	20	27	25	28	27	22	19	23	23
Reimbursement large consumers	-	-	-	-	-	-	-	-	-	8	8	8	7	3	5	5	5
Reduction for CHP plants	118	118	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	206	254	183	111	141	159	167	189	112	125	120	111	124	115	133	152	149

9.2.2 Excise tax on gasoline and other mineral fuels

An excise tax is levied on gasoline, petroleum, diesel, heavy fuels, LPG, and methane. In addition, vegetable oils used as motor fuel or for heating purposes are also subject to excise tax. Mineral oils not destined for use as motor fuels, fuel for heating, or as an additive to motor fuels are exempt from excise. In 2015 total excise tax on gasoline and other mineral fuels amounted to around 8 billion euro (see Figure 30). The obligatory percentage of vegetable oil admixture amounted to 6.25 percent in 2015³⁸². This means that not all excise tax paid comes from fossil sources. However, under certain circumstances the paid excise on fuels derived from biomass can be reimbursed. This makes it impossible, with the tax data available, to determine the actual contribution of bio-fuels to the excise tax revenue. Also, given that the admixture share was even lower in the past (5.5% in 2014, 5% in 2013, 4.5% in 2012, etc.), the excise tax will be treated, in its entirety, as fossil income.

Figure 30 Fuel excise tax revenue 2000 -2015 (based on CBS, 2016)³⁸³



³⁸² Nederlandse Emissieautoriteit, "Verplichtingen HEV - Onderwerp - Nederlandse Emissieautoriteit."

³⁸³ "CBS StatLine - Overheid; Ontvangen Belastingen."

On the other hand, the government also exempts certain industries or types of fuels from, or reimburses, the excise tax, or has done so in the past. As has been discussed in the distribution stage international aviation and marine activities are exempt from fuel excise and VAT, with a total fiscal cost to the government of around 3 billion annually (see section 8.2.3). Until 2012 agricultural machines enjoyed a lower excise rate, up to 2008 busses and waste collection vehicles using LPG as a fuel also enjoyed a lower rate, and up to 2003 a rate differentiation based on the Sulphur content of fuel existed. Appendix 41 lists further exemptions or reductions that the Dutch tax authority lists but that do not appear in the government budget.

In addition to excise tax it could be argued that vehicle tax (“BPM” and “Motorrijtuigenbelasting”) is a form of taxation on the use of fossil fuels since cars and motorcycles are mainly fossil fuel powered, and electric vehicles are exempt from this tax. However, officially, the tax is on the vehicle and not the fuel. For example, cars that are not or barely used also pay the vehicle taxes. For this reason, vehicle taxes will not be included in this analysis. However, to put this in perspective, in 2015 vehicle taxes raised around 7 billion euro in revenue, roughly similar to the amount raised through excise tax³⁸⁴.

Table 28 Foregone revenue due to excise tax exemptions and rate differentiation 2001 - 2017 (based on own analysis)³⁸⁵

M€	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017*
Exemption marine	58	73	73	73	76	76	77	110	802	878	1348	1298	1169	1220	1604	1284	1293
Exemption aviation	155	122	122	122	127	129	131	133	922	917	1831	1794	1869	2105	2233	2123	2145
Reduced rate diesel fuel for heating or agricultural machinery	127	130	130	130	130	130	132	120	208	241	210	213	-	-	-	-	-
Rate differentiation based on Sulphur content	100	105	177	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reduced rate public busses and waste collection vehicles using LPG as fuel	0	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-
Total	440	431	503	326	334	336	341	364	1932	2036	3389	3305	3038	3325	3837	3407	3438

However, as the government notes in its budgets, abolishing the exemptions or reimbursements would not lead to a complete recoupment of the listed government expenditure. For example, due to changes in fuel use as a result of the changed tax incentives.

9.2.3 VAT on fuel and electricity

³⁸⁴ Ibid.

³⁸⁵ Tweede Kamer der Staten Generaal, “Miljoenennota 2003”; Tweede Kamer der Staten Generaal, “Miljoenennota 2004”; Tweede Kamer der Staten Generaal, “Miljoenennota 2005”; Tweede Kamer der Staten Generaal, “Miljoenennota 2006 (Nota over de toestand van ’s Rijks Financiën)”; Tweede Kamer der Staten Generaal, “Miljoenennota 2007 (Nota over de toestand van ’s Rijks Financiën)”; Tweede Kamer der Staten Generaal, “Miljoenennota 2008 (Nota over de toestand van ’s Rijks Financiën)”; Tweede Kamer der Staten Generaal, “Miljoenennota 2009 (Nota over de toestand van ’s Rijks Financiën)”; Tweede Kamer der Staten Generaal, “Miljoenennota 2010 (Nota over de toestand van ’s Rijks Financiën)”; Tweede Kamer der Staten Generaal, “Miljoenennota 2011 (Nota over de toestand van ’s Rijks Financiën)”; Tweede Kamer der Staten Generaal, “Miljoenennota 2017 (Nota over de toestand van ’s Rijks Financiën).”

Final (domestic) users of fuels and electricity have to pay the regular value added tax (VAT) rate of 21 percent over the purchase of such products. The VAT is added after the inclusion of excise/energy tax in the price³⁸⁶. Unfortunately, the government does not publish disaggregated data on the VAT receipts. Some data is, however, available. The car lobby group 'BOVAG-RAI' publishes a yearly estimate of the total VAT paid on gasoline, diesel, and LPG by domestic users. In 2015 this amounted to around 1.6 billion euro, around 1 percent of total tax receipts in that year³⁸⁷. An estimation of the VAT on the electricity 'consumed' by households can be made, for companies this is more difficult since these can, at least partially, get a VAT rebate. In 2015 households used 81.66PJ of electricity³⁸⁸. Combining this with an average of the electricity price for households this leads to a rough estimation of the amount of VAT paid by households on their electricity use³⁸⁹. In 2015 this amounted to 476.3 million euro. With a 81.3 share of fossil fuels in the electricity mix this means that around 387.3 million euro of 'fossil VAT' was paid on electricity in 2015. This is however a very crude estimate since use within the different rate categories might differ largely; meaning that this number provides an underestimation if more use falls within the higher tax brackets and an overestimation if more use falls within the lower tax brackets. Combining VAT on transport and household electricity gives a total of 1889.3 million euro in 'fossil VAT' in 2015. The actual VAT received on fossil fuels by the national government is likely to be a lot higher since non-household users of electricity, and fuel not used for transport are excluded from these estimations.

Table 29 Gasoline, Diesel, and LPG VAT revenue 2010-2016 (based on BOVAG-RAI, 2014/2015/2016)³⁹⁰

M€	2010	2011	2012	2013	2014	2015	2016*
VAT on Gasoline	1200	1286	1414	1410	1445	1350	1245
VAT Diesel and LPG	272	314	359	385	346	291	257
Total	1472	1600	1773	1795	1791	1641	1502

Table 30 Total VAT receipts from household electricity use 2007-2015 (Based on own analysis)³⁹¹

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Use (Kwh)	2.23E+10	2.25E+10	2.29E+10	2.30E+10	2.30E+10	2.34E+10	2.35E+10	2.29E+10	2.27E+10
Average price (€/Kwh)	0.1025	0.10025	0.09175	0.139	0.08125	0.083	0.0865	0.0705	0.1
Total amount due (Mln €)	2282.3	2255.6	2098.5	3196.2	1872.4	1944.0	2028.7	1614.3	2268.3
21 % VAT (Mln €)	479.3	473.7	440.7	671.2	393.2	408.2	426.0	339.0	476.3
Fossil share of electricity	86.3%	85.0%	84.2%	84.5%	82.5%	80.5%	82.0%	81.5%	81.3%
Fossil VAT (Mln €)	413.6	402.6	371.1	567.2	324.4	328.6	349.3	276.3	387.3

³⁸⁶ Ministry of Finance, "Welke belastingen heft de overheid over benzine en diesel?"; Ministry of General Affairs, "Betaal ik btw over mijn energiebelasting?"

³⁸⁷ CBS, "CBS StatLine - Overheid; Inkomsten En Uitgaven."

³⁸⁸ CBS, "CBS StatLine - Energieverbruik Huishoudens; Energiedragers."

³⁸⁹ Given the existence of four different rate categories the average price is also averaged over the different rates this gives in 2015 (including tax since VAT is also paid over the energy tax): -0.049€/kwh up to 1Mwh; 0.121€/kwh between 1-2.5 Mwh; 0.159€/Kwh between 2.5-5Mwh; 0.169€/Kwh between 5-15Mwh; average price of 0.1€/kwh.

³⁹⁰ BOVAG-RAI Mobiliteit, "Mobiliteit in Cijfers Auto's 2013 - 2014"; BOVAG-RAI Mobiliteit, "Mobility in Figuers Car's 2015-2016: 7.2 Central Government Revenue from Vehicle-Related Duties"; BOVAG-RAI Mobiliteit, "Mobiliteit in Cijfers Auto's 2016-2017: 7.2 Rijksinkomsten Aan Verkeersbelastingen."

³⁹¹ CBS, "CBS StatLine - Energieverbruik Huishoudens; Energiedragers"; CBS, "CBS StatLine - Aardgas En Elektriciteit, Gemiddelde Prijzen van Eindverbruikers"; *ibid*.

9.2.4 EIA fiscal stimulus for energy related investments

In addition to direct subsidies the government also provides tax exemptions for renewable energy production and energy efficiency. The ‘Energie Investerings Aftrek’, EIA, introduced in 1997 allows companies to deduct up to 58 percent of investment costs in certain renewable production and energy efficiency technologies from their fiscal profits. Although a large part of the projects that apply for the EIA are not fossil fuel related, gas based projects can also receive fiscal stimulus under the EIA. For example, systems such as gas-fired boilers, ovens, or CHP. Data on the EIA is reported by technology or by sector. In 2015 a total of 29 million in investments in gas related applications could be identified. With a total of 1369 million this makes up around 2 percent of the total investments. Although, there is no data on the actual share of fossil investments that was approved, and thus received government support, an estimation can be made. The total tax expenditure for the government amounted to 107 million euro in 2015. Based on a two percent share of fossil fuel use related investments this would amount to a fiscal stimulus of around 2.2 million in 2015 for these investments (see Table 31). However, due to the generic nature of data reporting it could very well be that the actual natural gas related investments are higher than the 29 million reported here. For example, one of the largest ‘investment classes’ is ‘technical measures for energy savings at existing processes’, which could include gas-fired equipment. The table in Appendix 40 provides a complete overview of the amounts invested, and the fiscal benefit provided, under the EIA between 1997 and 2015. Between 2011 and 2015, 158 million in gas related investments applied to make use of the EIA, of which, using the general acceptance rate for each year, 123.3 million in investments was accepted leading to a fiscal expenditure by the government of 12.3 million. Using averages based on the 2011 - 2015 data, and the actual total investments done under the EIA between 1997 and 2010, an estimation could be made for the years 1997-2010 (see Appendix 40). This puts the total amount of gas related investments between 1997 and 2015 at 522 million with a tax expenditure by the government of 40.5 million. It can thus be concluded that, although on a minor scale, the EIA provides a fiscal stimulus to the consumption of natural gas.

Table 31 Fossil EIA investments and fiscal expenditure 2011-2015³⁹²

M€	2011	2012	2013	2014	2015	Total
Total EIA investments applied	1599	1256	1779	1608	1369	7611
Total EIA investments accepted	1279.2	942	1396	1239	1069	5925
Total tax expenditure	116	94	139	124	107	580
Acceptance percentage	80	75	78	77	77	-
Net fiscal advantage (%)	10	10	10	10	10	-
Fossil investments applied	63.3	23.8	17.1	24.8	29	158
Fossil investments accepted	50.64	17.85	13.338	19.096	22.33	123
Fossil as share of total	4.0	1.9	1.0	1.5	2.1	
Fossil fiscal expenditure	5.1	1.8	1.3	1.9	2.2	12.3

Looking at the EIA investments grouped by industry, it becomes visible that, although perhaps not related to fossil fuel consumption, companies from fossil fuel related sectors also use the stimulus measure. For example, in 2015 the sector “production, distribution, and trade of electricity, natural gas, steam, and cooled air applied with 215 projects corresponding to a total of 169.5 million euro in investments. However, the generic nature of this category makes it to determine to what extent there actually is a relation with fossil fuels in these investments. The only directly fossil fuel related industry

³⁹² Agentschap NL, “Annual Report 2009 SDE and MEP”; Agentschap NL, “Annual Report 2010 SDE and MEP”; Agentschap NL, “Annual Report 2011 SDE+ SDE and MEP”; Agentschap NL, “Annual Report 2012 SDE+, SDE and MEP”; Rijksdienst voor Ondernemend Nederland (RVO), “Annual Report 2013 SDE+, SDE, and MEP”; Rijksdienst voor Ondernemend Nederland (RVO), “Annual Report 2014 SDE+, SDE, and MEP.”

category that could be identified was “production of coking coal products and oil refining”. In 2015 two projects applied with a total investment of 0.1 million. This would put the estimated fiscal costs for these projects at a negligible 8000 euro.

On a side note, a major share of the EIA investments goes to energy efficiency measures. Although such measures reduce the consumption of fossil fuels a certain amount of investments in these measures would also have occurred without the existence of fiscal stimulus. A 2011 evaluation of the EIA estimated that such free-rider behavior could amount to between 44 and 64 percent of all investments³⁹³. Since investments in this category also involve energy efficient appliances this means that there could be an indirect support to the consumption of electricity or other fuels (by those appliances).

9.2.5 Fuel levy/ Coal tax

In the Netherlands the use of coal and coal derived solid fuels is subject to a ‘coal tax’. In 2017 the rate amounted to 14.51 euro per ton³⁹⁴. The use of coal for other uses than fuel, to generate electricity, or coal that is used both as fuel and for other purposes is exempt from this tax³⁹⁵. In 2015 this tax brought in 195 million euro (Figure 31). Up to 2003 a broader fuel levy existed, which was due on different types of fuels. These levies were replaced by the energy tax, with only the coal tax remaining. Given the exemptions given on the coal tax the tax brought in almost nothing in the years 2005-2012, with, for unknown reasons, a negative result occurring in 2006. With the repeal of the exemption for the use of coal in electricity production in 2013 the coal tax revenue increased again. As of 2016, as part of the energy agreement (‘energieakkoord’), the exemption for coal power plants was reinstated. According to the government this presents a tax loss of 189 million annually, which is compensated by an increase in the energy tax of which 50 percent will be borne by households and 50 percent by industry³⁹⁶. Although government tax income thus stays the same it does mean that energy production from coal receives a fiscal stimulus; the same amount of tax will now be raised from a wider tax base. Although their electricity is subject to the, now higher, energy tax costs for owners of coal fired power plants are lower than without the exemption. A 2016 report estimates the total financial advantage for coal power plant owners at 125 million euro annually³⁹⁷.

Figure 31 Fuel levy 2000 – 2015 (based on CBS, 2016)³⁹⁸

³⁹³ Volkerink et al., “Evaluatie Energie Investeringsaftrek: Ex Post Evaluatie 2006-2011,” 7.

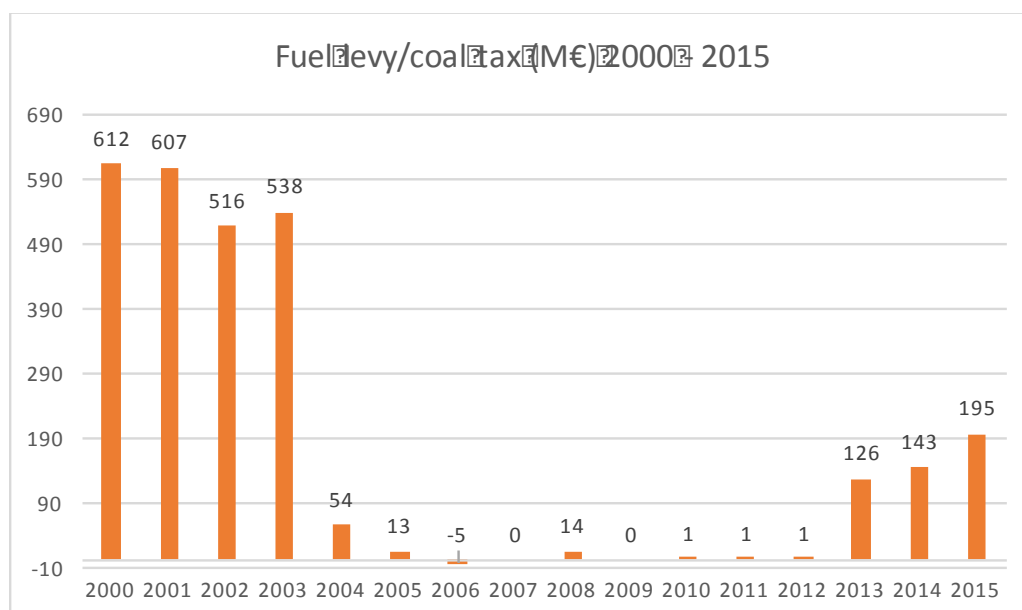
³⁹⁴ Belastingdienst, “Kolenbelasting.”

³⁹⁵ Belastingdienst, “Vrijstelling van Kolenbelasting.”

³⁹⁶ Rijksoverheid, “Financieel Jaarverslag van Het Rijk 2015,” 34.

³⁹⁷ Spring Associates, “Sluiting van de Nederlandse Kolencentrales: Maatschappelijke En Economische Effecten,” 4.

³⁹⁸ “CBS StatLine - Milieubelastingen En -Heffingen; Nationale Rekeningen.”



9.2.6 Wage and corporate tax and social premiums deductions for sea-going vessel operators

The Dutch government gives owners of sea-going vessels the possibility to pay less wage tax and social premiums. In 2016 this amounted to 116 million euro in foregone revenue (see Table 32). This tax rebate thus supports the use of sea-going ships, which are powered by fossil fuels. For ship owners the rebate in its entirety can be seen as support to their operations, while for the government only the wage tax part should be seen as foregone revenue. The social premiums that would have been received without the rebate would not have been freely spendable income for the government and should thus not be counted as an interdependency. Unfortunately, it is not possible to distinguish between the two elements.

In addition, the government provides companies that operate sea-going vessels with the possibility to either pay regular corporate taxes, or to opt for a system based on the amount of goods transported. Often this results in a fiscal benefit for the shippers. In 2016 this amounted to 120 million euro in foregone tax revenue for the government. Another, modest, fiscal stimulus is provided by the possibility for sea-going vessel owners to do extra amortizations on their ships. In 2016 this amounted to 3 million euro in foregone tax revenue. Indirectly these measures promote the use of fossil fuels.

Table 32 Fiscal stimuli for owners of sea-going vessels 2000-2017 (own analysis)³⁹⁹

³⁹⁹ Tweede Kamer der Staten Generaal, "Miljoenennota 2002"; Tweede Kamer der Staten Generaal, "Miljoenennota 2003"; Tweede Kamer der Staten Generaal, "Miljoenennota 2004"; Tweede Kamer der Staten Generaal, "Miljoenennota 2005"; Tweede Kamer der Staten Generaal, "Miljoenennota 2006 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2007 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2008 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2009 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2010 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2011 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2012 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2013 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2014 (Nota over de Toestand van 's Rijks Financiën: 2014)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2015 (Nota over de Toestand van 's Rijks Financiën: 2015)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2016 (Nota over de Toestand van 's Rijks Financiën: 2016)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2017 (Nota over de toestand van 's Rijks Financiën)."

M€	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Tax rebate sea-going vessels	82	81	89	89	83	88	82	83	82	100	105	102	106	110	112	114	116	119
Opt-in profit tax regime	11	11	50	40	50	51	81	70	71	73	81	81	82	120	120	120	120	120
Extra amortizations	0	0	0	0	0	0	1	1	3	3	3	4	4	0	3	3	3	3

9.2.7 EU-ETS permit grandfathering and windfall profits

In 2015 450 Dutch companies, with 94.1 Mton Co2 emissions, around 45 percent of total Dutch emissions, were part of the EU ETS. Under the grandfathering system in the EU ETS Dutch companies received 46.8 million free emission rights, which amounts to around half of the total Co2 emissions of the Dutch ETS participants⁴⁰⁰. The emission of Co2 is primarily connected to the use of fossil fuels. Given a free pass to pollute these companies thus de facto receive a subsidy for the use of fossil fuels. Although the EU-ETS is a European system it is the Dutch government that foregoes revenue from free permit allocation⁴⁰¹. As of 2013, the third phase of the EU ETS, utilities no longer receive free emissions, other energy intensive industries such as the chemical, metallurgical, and petroleum industries still receive free emission rights. Combined these four sectors are responsible for around 85 percent of Dutch co2 emissions covered by the EU ETS. The national government raised 187.3 million euro through the auctioning of the remaining emission rights. Given that around half of the emission rights was auctioned this makes it reasonable to assume that the other half, given away for free, also has a value of around 187.3 million. Although the free allocation of permits clearly has an impact on the auction price. For 2015 the grandfathering of emission rights could thus be seen as a support for the consumption of energy, which is mostly fossil in the Netherlands, to the height of 187.3 million euro. Since companies have received the right to emit Co2, which, for these industries, comes mostly from the burning of fossil fuels, for free.

In addition, the EU-ETS system leads to windfall profits for participating companies through: the over allocation of free emission allowances, which can then be sold by these companies on the carbon market; the possibility to use international offsets, which are cheaper than EU-ETS allowances. The allowances saved in this way can then be sold, the difference in price between the two then being additional profits; and the passing through of non-existent carbon costs to consumers⁴⁰². Between 2008 and 2015 energy intensive companies made 1.2 billion euro in windfall profits in this manner. An estimated 224 million in direct profits was made through the over allocation of allowances, 36 million in additional profits was made through the use of international offsets, and a minimum of 904 million in profits was made through passing on the costs of carbon emission allowances that have been received for free⁴⁰³.

This benefitted both producers, processors, and consumers of fossil fuels. The oil and gas production industry generated a minimum of around 5.2 million in windfall profits, refineries around 397.7 million, and the petrochemical and iron and steel industry around 224.5 and 332.5 million euro respectively⁴⁰⁴.

⁴⁰⁰ CLO, "CO2-Uitstoot Nederlandse Deelnemers EU ETS | Compendium Voor de Leefomgeving."

⁴⁰¹ European Commission, "Auctioning."

⁴⁰² de Bruyn, Schep, and Cherif, "Calculation of Additional Profits of Sectors and Firms from the EU ETS," 2.

⁴⁰³ Carbon Market Watch, "Industry Windfall Profits from EUs Carbon Market 2008-2015: How Energy Intensive Companies Cash in on Their Pollution at Taxpayers Expense," 19.

⁴⁰⁴ de Bruyn et al., "Calculation of Additional Profits of Sectors and Firms from the EU ETS 2008-2015," 27.

Although these profits are not related to government expenditure it shows how industry can benefit from government policy and regulation. In this case there is thus a clear dependency of industry on governments to set-up the permit system in such a manner that it benefits them.

9.2.8 EU-ETS compensation subsidies

The government expected that the EU-ETS could lead to higher electricity prices, which could harm the competitiveness of energy intensive industries. To compensate companies for this the Dutch government gave, from 1-1-2014 onwards, a subsidy to both companies participating in the permit system and those outside of the system. In order to receive the subsidy companies must participate in existing long-term agreements between the government and industry on the improvement of energy efficiency (the MEE and MJA3 agreements)⁴⁰⁵. In 2015 the government spend 31.8 million on this subsidy (see Table 33).

Table 33 Government EU ETS compensation subsidy 2014-2017 (based on own analysis)⁴⁰⁶

M€	2014	2015	2016*	2017*
EU ETS compensation	56.9	31.8	61	62
*Budget estimates				

Given that the subsidy incentivizes the use of electricity, and given the 81 percent share of fossil fuels in the electricity mix (see Figure 28), this subsidy mainly benefits the use of fossil fuels. In addition, the subsidy does not actually compensate for anything since the expected price increases in electricity did not materialize; the electricity price for non-households decreased by between 6 and 14 percent between 2013 and 2015 depending on the amount consumed⁴⁰⁷. The companies thus receive a subsidy to implement an energy efficiency plan that leads to costs reductions within their company, for which they can also make use of the EIA (see 9.2.4) and other fiscal stimuli for investments⁴⁰⁸. Indirectly this subsidy thus supports the use of fossil fuels through the production of energy intensive goods. What does this mean?

9.3 Government participations

As discussed during the initial scoping the Dutch government also holds shares of companies that are related to the use of fossil fuels the airlines KLM and Winair, and the Dutch international airport Schiphol.

9.3.1 Schiphol

The Royal Schiphol Group owns and operates the international airport Schiphol, the three regional airports Rotterdam the Hague, Eindhoven, and Lelystad, and has shares in the Groupe ADP, Brisbane,

⁴⁰⁵ Ministry of Economic Affairs, "Regeling van de Minister van Economische Zaken van 17 Oktober 2013, Nr. WJZ / 13047307, Tot Wijziging van de Subsidieregeling Energie En Innovatie in Verband Met Energiebesparing Door Ondernemingen Die Worden Blootgesteld Aan Een CO2-Weglekrisico Als Gevolg van Doorberekende EU-ETS-Kosten."

⁴⁰⁶ Tweede Kamer der Staten Generaal, "Vaststelling begroting Ministerie van Economische Zaken en Diergezondheidsfonds 2017"; Tweede Kamer der Staten Generaal, "Jaarverslag en slotwet ministerie van Economische Zaken en Diergezondheidsfonds 2015."

⁴⁰⁷ CBS, "CBS StatLine - Aardgas En Elektriciteit, Gemiddelde Prijzen van Eindverbruikers."

⁴⁰⁸ RVO, "Financiële Ondersteuning MJA3/MEE | RVO.nl."

and JFK airports⁴⁰⁹. Yearly it processes around 70 million passengers, of which 63.6 million in Schiphol airport. In 2016 it had a revenue of 1.4 billion euro resulting in a profit of 306 million. Roughly 70 percent of Schiphol's revenue is directly related to aviation - port dues, security, and income from affiliated airports - with the other 40 percent coming from retail, parking, offices, and business locations. However, although generating less revenue, the non-aviation activities contribute more to the overall result. See Appendix 43 for a complete overview of Schiphol's revenue. While in 2014 the share of direct aviation related activities in the results before interest and tax (EBIT) still amounted to 35 percent this has dropped to around 18 percent in 2016. The fossil share of Schiphol's group direct profit is thus relatively low. This is however obfuscated by the fact that the consumer products & services and real estate divisions can only generate this profit because of the core aviation activities at the airport. This however makes it difficult to assess the fossil aspect of this participation.

Figure 32 gives an overview of the dividends paid by the Schiphol Group. From 2008 onwards, as part of the merger of KLM and Air France, Groupe ADP became a shareholder of Schiphol group, diluting the shares of the other shareholders. In that year Schiphol paid out an extra dividend of 500 million euro to its initial shareholders. Interestingly, the government does not mention this in its 2009 annual report on its participations, but only lists its share in the normal dividends (no annual report was published in 2008). The dividends are reported by the year in which they are paid; the dividend paid over 2015 is thus reported in 2016. Interestingly the city of Amsterdam reported in 2015 to have received 27.7 million euro in dividend, yet according to its share in Schiphol it should have received 30 million euro⁴¹⁰. According to share in EBIT only 26.7 million euro of the 2016 dividends can be labeled as fossil, however, when using fossil share of revenue as a reference this rises to around 104 million euro for that year.

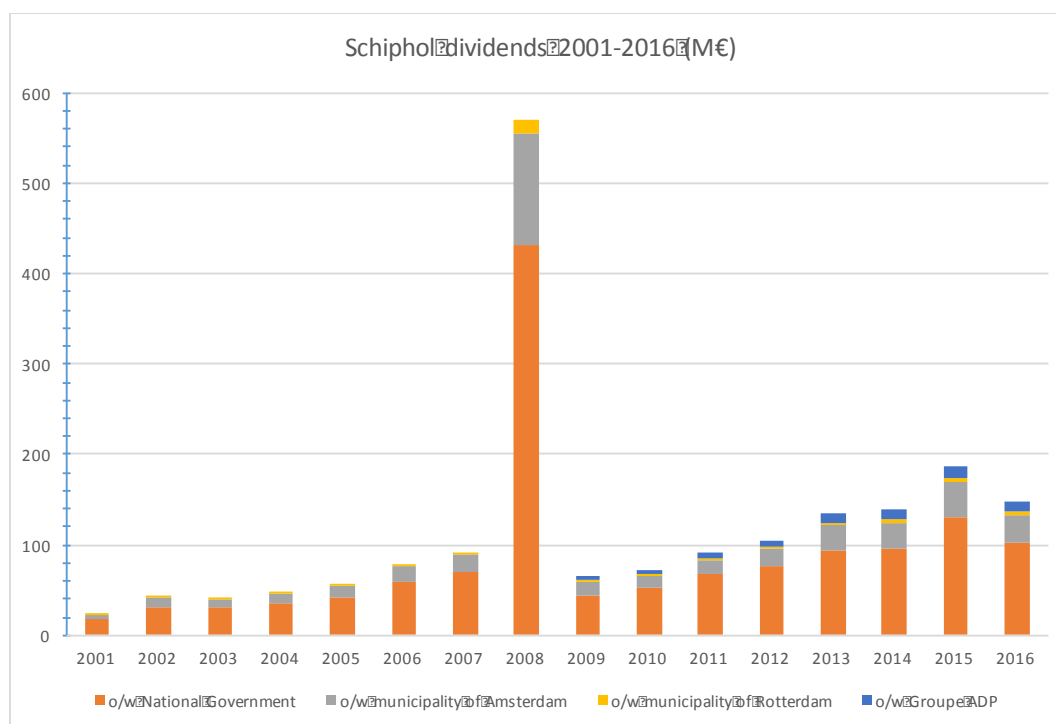
Schiphol does not have any debt with the government and the government did not provide any guarantees to Schiphol.

Figure 32 Schiphol dividends 2001-2016 (based on own analysis)⁴¹¹

⁴⁰⁹ Royal Schiphol Group, "Schiphol Annual Report 2016," 15.

⁴¹⁰ Municipality of Amsterdam, "Municipality of Amsterdam: Annual Report 2015," 286.

⁴¹¹ Schiphol Group, "Schiphol Annual Report 2001"; Schiphol Group, "Schiphol Annual Report 2003"; Schiphol Group, "Schiphol Annual Report 2004"; Schiphol Group, "Schiphol Annual Report 2005"; Schiphol Group, "Schiphol Annual Report 2006"; Schiphol Group, "Schiphol Annual Report 2007"; Schiphol Group, "Schiphol Annual Report 2008"; *ibid.*; Schiphol Group, "Schiphol Annual Report 2010"; Schiphol Group, "Schiphol Annual Report 2012"; Schiphol Group, "Schiphol Annual Report 2013"; Schiphol Group, "Schiphol Annual Report 2014"; *ibid.*; Royal Schiphol Group, "Schiphol Annual Report 2016."



9.3.2 KLM and Winair

The Dutch Government maintains a 5.9 percent economic share in the international airline ‘KLM’, and a 51 percent share in the voting right. In addition, it holds an 8 percent share in the airline ‘Winair’ local to the north-east Caribbean. In both cases the national government finds that it needs to maintain the shares to protect the public interest, it holds that the airlines provide a crucial public service, transport, (Winair) or are of great importance to the Dutch economy (KLM)⁴¹².

As can be seen in Table 34 KLM does not perform very well financially, and paying out very little dividend, even in the years that a profit is made. As such KLM consistently fails to meet the targets that the government expects from its participations such as a 40 percent pay out rate⁴¹³ or a decent solvability (which it does not specify). In 2015 KLM had a solvency of less than 5 percent and a pay-out rate of also around 5 percent⁴¹⁴. Moreover, KLM is one of the only participations that does not have a set ‘expected return on equity’ that it is supposed to achieve⁴¹⁵. Also, there appear to be inconsistencies between the amount of dividend that the national government should receive on the basis of its share in KLM and amounts the government receives according to its own reports. For example, in 2015 KLM reports to have paid out 1 million in dividend, yet the government also reports having received 1 million in dividend, despite the fact that it only holds around 6 percent of the shares. Moreover, the government reports that KLM paid out a total of 3 million euro in dividends in 2015, while KLM reports having paid out 1 million euro. Why these inconsistencies occur is not clear. In dividends the financial relationship with KLM is thus very small. There can however be a dependency of KLM on the Dutch government. It would, for example, be very likely that private shareholders would not accept such a low dividend and would thus demand significant changes be made to the company to increase dividend payments. KLM could thus be dependent on having, partly, a public owner to be able to maintain its current strategy. There is however no obvious way how this dependency could be

⁴¹² Ministry of Finance, “Jaarverslag Beheer Staatsdeelnemingen 2012,” 64 & 153.

⁴¹³ Rekenkamer, “De Staat Als Aandeelhouder,” 33.

⁴¹⁴ Ministry of Finance, “Jaarverslag Beheer Staatsdeelnemingen 2015,” 28&33.

⁴¹⁵ Ibid., 30.

quantified and to what extent it can thus be assumed that there is an interdependency between the government and the fossil industry in this respect. In addition, as the government notes, this participation also serves public interest through safeguarding aviation network connections, market access, and, what they call, ‘aviation politics’ (it is unclear what is meant by this)⁴¹⁶.

Table 34 KLM revenue, profit, dividends 2001-2015 (based on own analysis and Table 34)⁴¹⁷

M€	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	n/d	n/d	n/d	n/d	6442	7201	7698	8028	8182	7469	8651	9473	9688	9643	9905
Profit	n/d	n/d	n/d	n/d	255	276	516	291	-193	-383	147	-44	133	340	53
Dividend	n/d	n/d	n/d	n/d	n/d	14	23	28	0	0	1	0	0	8	1
o/w to Dutch government	n/d	0	1.1	0.2	0	0.4	0.4	0	0	1	1	0	0	0	1

Given Winairs extremely bad financial situation, having a negative equity of between 4 and 10 million euro every year since 2010⁴¹⁸, it is quite clear that Winair is dependent on its public shareholders, the Dutch government (7.95%) and the government of St. Maarten (92.05%) and would probably not survive without them. In 2015 the shareholders approved a ‘Financing and Restructuring plan’ of around 25.7 million euro⁴¹⁹. Unfortunately, they do not report how this plan was financed. Although very small, Winair represents a dependency between a company that is dependent on fossil fuels for its activities and the Dutch government.

9.4 Discussion

This chapter looked at the interdependencies in the ‘use’ stage of the fossil fuel chain through analysing the production of electricity, fiscal relations, and government participations involved in fossil fuel use intensive activities. The overall picture that emerges is that, historically, the government was heavily involved in electricity production, which is still relying heavily on fossil fuels, with two public utilities remaining. Moreover, the use of energy, mainly fossil fuels, is a large source of revenue for the government. With 12.7 billion in reported revenue from excise tax, energy tax, and the coal tax/fuel levy and, estimated, at least, 1.6 billion in VAT on fuels, and 390 from electricity generated with fossil fuels. Totalling around 13.7 billion these tax receipts amount to around 8 percent of the government budget in 2015, and 14.2 percent when excluding income from social premiums (which is not freely spendable). When including vehicle tax as a fossil fuel use related tax another 8 billion could be added to this number. On the other hand, the government also provides fiscal stimulus for the use of fossil fuels. In 2015 fiscal stimulus amounted to 4.17 billion in foregone revenue, with the excise exemption for the aviation and marine industry amounting to 3.8 billion, 237 million for the exemptions on sea-going vessels, 2.2 million through investment deductions, and 133 through exemptions in the energy tax. Also counting the abolished coal tax this number rises to 4.35 billion. It should however be noted that, in case of the abolition of these exemptions, this would not lead to a similar increase in tax revenue. In studying the tax exemptions, it emerged that especially the horticultural industry and refineries benefitted from reduced rates for CHP, and that the horticultural

⁴¹⁶ Ibid., 64.

⁴¹⁷ KLM group, “KLM Annual Report 2008”; KLM group, “KLM Annual Report 2009”; KLM group, “KLM Annual Report 2010”; KLM group, “KLM Annual Report 2011”; KLM group, “KLM Annual Report 2012”; KLM group, “KLM Annual Report 2014”; KLM group, “KLM Annual Report 2015.”

⁴¹⁸ Ministry of Finance, “Jaarverslag Beheer Staatsdeelnemingen 2015,” 155.

⁴¹⁹ 27.5 million US at 2015 average euro/dollar exchange rate of 0.937

industry in general received multiple exemptions or reduced rates. Investment support (EIA) mainly benefits natural gas, while oil use is selectively supported through exemptions and reimbursements of excise and vat. The cancellation coal for electricity production receives support through the cancellation of the coal tax.

When it comes to electricity production large subsidies for renewable energy exist. However, between 2003 and 2014 a total of at least 1.4 billion was spend on the co-firing of biomass in coal power plants, with another 3.6 billion committed for the period 2016-2014, which also could have effects on the profitability of the plant as a whole. Also 320 million in subsidies went to gas fired CHP between 2003-2006. There is however considerable uncertainty over the exact amounts paid to co-firing, since a total of 8.8 billion in co-firing subsidies appears to be unaccounted for. Although it could be that these projects were never realised.

Government participations active in the use stage are limited. Although Schiphol generates a lot of dividend it is not clear to what extend this is related to the use of fossil fuels. However, a strict interpretation, arguing that retail and commercial activities at Schiphol only generate revenue because of its fossil fuel related activities (aviation), would brand all of Schiphol's dividends as fossil fuel related. The two airlines Winair and KLM are involved in fossil fuel intensive activities but generate zero or very little dividend for the Dutch government. On the other hand, KLM and WinAir could benefit from the involvement of the Dutch government in their business. WinAir definitely needs its public shareholders to stay afloat. For KLM the argument is less clear cut, but, historically, there is a close connection between Schiphol and KLM and KLM receives preferential treatment at the airport⁴²⁰. Also, public shareholders might accept lower dividend payments than private parties, and could be inclined to provide financial support if necessary.

Finally, this chapter further underlined the findings of previous stages that industry is also dependent on governments to ensure or increase profits. For example, through the EU-ETS system that leads to windfall profits or the EU ETS compensation subsidy and the aforementioned fiscal stimulus that leads to cost reductions. This further confirms the assumed interdependencies between the government and the fossil fuel industry.

10 Research & Development

The final chapter, and final stage of the framework, explores the involvement of the Dutch government in, and support to, research and development activities in the fossil fuel industry. The Initial Scoping provided some evidence where to start the research for this phase, for example, that there is a wide array of government R&D support programs, such as the 'Topsector' policy. In addition, throughout the research, it became apparent that the SOE's such as GasUnie and EBN also undertake R&D projects, and that the government provides funding to research organizations such as ECN and TNO. This chapter will look at both the (direct) support of the government for fossil fuel related R&D and at R&D activities by SOE's. Section 10.1 provides an overview of government policy and direct spending on energy R&D, section 10.2 will analyze such direct spending programs in more detail, section 10.3 will look at indirect government spending on fossil fuel R&D through, for example, fiscal stimuli, section 10.4 will look at the role of government funded research institutes, and, finally, section 10.5 will look at the R&D activities of (partly) state-owned enterprises such as GasUnie, EBN, and GasTerra. All research and (business) development activities are taken to be part of R&D and government policies labelled 'innovation' will also be taken to pertain to R&D.

⁴²⁰ Financieel Dagblad, "Staat Grijpt in Op Schiphol."

10.1 Government R&D policy and direct spending

In 2012 the Dutch government started the TKI ('Topsectoren Kennis en Innovatie') policy which connects business, research institutes, and the government to support innovation and R&D in nine major industries, or 'top sectors', in the Dutch economy⁴²¹. One of these top sectors is the energy sector. The 'Topsector Energie' (TSE) includes programs focused on renewables, energy efficiency, and (natural) gas. For example, the TKI Gas supports projects in the areas of green gas (through fermentation and gasification), upstream gas, small scale LNG, and CCSUS (carbon capture, utilization, and storage). As part of the TSE up to 100 million in subsidies is given to energy R&D annually (see Appendix 44). In addition to providing financial support the government also organizes "innovation trade missions" in connection with the Dutch embassies and consulates and aids in communication and networking⁴²². In part the TKI policy is executed by government affiliated research organizations such as TNO and ECN⁴²³.

In addition to policies focused specifically on energy R&D a variety of general innovation support measures exists. For example, the 'innovation fund SME's +', with a budget of 500 million euro between 2012 and 2015, provides seed funding for innovative startups, hands out 'innovation loans', or aids companies in securing financing on the capital market⁴²⁴. In total, through such policies, the Dutch government provides on average 40 percent of all financing for R&D in the Netherlands⁴²⁵. Section 10.2 looks at such direct subsidies in more detail.

The RVO publishes an annual report on publicly financed energy research⁴²⁶. The research institutes ECN and TNO are included in the analysis while expenditure through fiscal stimulus measures, loans, and funding coming directly from public universities is excluded. In 2015 the government spend a total of 181 million euro on energy research, of which 121 million being funneled through the RVO subsidy programs (see Appendix 44), 35 million through the Netherlands Organization for Scientific Research (NWO), and the remainder directly to 'users'. Out of the total, 80 million was given to companies, 91 million to universities (in addition to normal university funding) and research institutes, and 11 million to other entities. RVO reported that 17 million went to 'clean' fossil fuels through the TKI Gas (see section 10.2.1) and other programs, and that no subsidies were given to research on coal or oil related projects⁴²⁷.

RVO notes that an additional 50 to 100 million is spend at universities on energy related research annually⁴²⁸. In most of its reports RVO does not provide information on the fossil share of this research expenditure. However, for the years 2009 and 2010 RVO reports that, respectively, 12.7 million and 16 million euros was spend on fossil fuel related research at universities through their direct funding. This amounted to, respectively, 52.5 and 10.3 percent of the total energy research budgets of the universities for those years. For 2009 RVO also reports on the amount of subsidy given to fossil fuel research through the WBSO fiscal policy (see section 10.3), which it estimates at 11.4 million euro, or 24.2 percent of the total subsidy to energy research under the WBSO. Table 35 below gives an

⁴²¹ RVO, "Topsectoren | RVO.nl."

⁴²² Ministry of Economic Affairs, "Rijksoverheid stimuleert innovatie - Ondernemen en innovatie - Rijksoverheid.nl."

⁴²³ Slingerland et al., "Review Topsector Energie: Deelonderzoek 2," 52.

⁴²⁴ RVO, "Innovatiefonds MKB+ | RVO.nl."

⁴²⁵ Rathenau Instituut, "Financiering En Uitvoering van R&D in Nederland."

⁴²⁶ This includes both R&D and the 'demonstration of new technologies'; given that the data cannot always be separated R&D will refer to both.

⁴²⁷ RVO, "Publiek Gefinancierd Energieonderzoek 2015," 5.

⁴²⁸ Ibid., 3.

overview of public spending on energy R&D for the years 2005- 2015. It can be noted that, Co2 related research, such as CCUS, received most support, that coal research was supported up to 2008, and that, overall, the share of support for fossil fuel R&D has been on the decline, with 2015 being a notable exception to this trend.

Table 35 Government expenditure on energy R&D (based on RVO, 2009-2015)⁴²⁹

M€	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014 ⁴³⁰	2015
Total gov. R&D expenditure	3310	n/d	3474	n/d	3648	n/d	4167	4057	4248	4402	4547
Total Energy related expenditure	121	134	208	148	208	350	163	210	185	153	181
o/w fossil fuel related	14	13	43	14	19	31	9	14	12	3	17
o/w oil and gas	3.7	6.8	6.8	7.8	6.5	3	6	11	10	1	n/d
o/w coal	2	2.8	0.8	0.5	0	0	0	0	0	0	n/d
o/w CCUS	7.8	3	35.1	5.8	12.6	29	4	3	2	0	n/d
Fossil share (%)	11.6	9.7	20.7	9.5	9.1	8.9	5.5	6.7	6.5	2.0	9.4

On average 9 percent of the governments energy R&D budget went to fossil fuel related research in the years 2005-2015. Amounting to a total of 189 million euro in the same period. Government support to fossil fuel R&D through direct subsidies is thus limited. A relatively small contribution could however still depict a (strong) interdependency, for example, if R&D in a certain industry/technique would not occur without the subsidy. To get a better perspective on interdependencies in this field a more detailed analysis of the types of programs and research supported is needed. This number does however give a good indication of the overall fossil share in publicly supported R&D funding. The next section will analyze the TKI gas and the, discontinued, 'Energy Research Subsidy' (EOS) programs in more detail.

10.2 Government direct R&D subsidy programs

The government agency in charge of (most) subsidies, RVO, lists a total of 119 different subsidy and finance programs for R&D that it executes, or has executed in the past. 32 of these related to the energy sector. This includes programs in cooperation with the European Union such as Eureka, Horizon 2020, COST, EURIPIDES 2, and Eurostars. EU programs do not fall within the scope of this research and will not be included. In the cases that the Dutch government provides direct funding through an EU program, e.g. Eureka, this will be included. Appendix 44 and Appendix 45 provide an overview of general and energy specific R&D support programs currently in effect. Appendix 46 gives an overview of former government R&D support programs, specifically the EOS measures, that have provided funding to fossil fuel related projects. This section looks at the TKI Gas, EOS, and the 'Innovation Fund MKB +' programs.

⁴²⁹ Decisio, "Monitor Publiek Gefinancierd Energieonderzoek 2009: Zicht Op Bestedingen, Thema's, En Trends"; Decisio, "Monitor Publiek Gefinancierd Energieonderzoek 2010: Zicht Op Bestedingen, Thema's, En Trends"; Agentschap NL, "Monitor Publiek Gefinancierd Energieonderzoek 2012: Zicht Op Bestedingen, Thema's, En Trends"; RVO, "Monitor Publiek Gefinancierd Energieonderzoek 2013: Zicht Op Bestedingen, Thema's, En Trends"; RVO, "Monitor Publiek Gefinancierd Energieonderzoek 2014: Zicht Op Bestedingen, Thema's, En Trends"; Rathenau Instituut, "Financiering En Uitvoering van R&D in Nederland"; RVO, "Publiek Gefinancierd Energieonderzoek 2015."

⁴³⁰ The 2014 monitor reports a total of 1 million in fossil subsidies for 2014 while the 2015 monitor reports a total of 3 million in fossil subsidies for 2014, but without specifying the type of fossil fuel. The 2015 data is taken to be the correct number.

10.2.1 'TKI Gas' support measures

TKI Gas is the only program of the 'Topsector Energie' policy that provides direct support to fossil fuels. Specifically, it supports R&D projects in the upstream gas, small-scale LNG, and CCUS areas. It also provides funding to bio-based gas. The goal of the program is to: where possible, replace fossil gas with renewable gas and hydrogen; maximize the added value of domestic natural gas; support the take-up of LNG as a transport fuel; and capture, re-use, and store CO₂ emissions from natural gas. Practically this means: 750 mcm of 'green gas' produced in 2020, and at least 3 bcm in 2030; minimize the societal impact of Dutch natural gas in the upstream; realize the production of 1 bcm LNG in 2020 and 3-4 bcm LNG in 2030 for goods-transport on roads and inland-waterways; explorative research and the support of CCUS demonstration projects; and, finally, natural gas should take up a central role in the energy system⁴³¹. In addition, hopes to foster the public acceptance of gas as a 'transition fuel' in the energy transition.

More specifically, the upstream gas track aims to maximize the use of domestic gas by contributing to innovations that help extend the lifetime of matured fields or bring currently uneconomic fields into production, through supporting exploration, and by supporting the development of knowledge to take 'tough gas', such as shale gas or difficult offshore fields, into production⁴³². In addition, for the period 2016-2019 it expects that innovation regarding the safety and environmental aspects of arctic production are required⁴³³. The focal points of TKI gas are thus largely in line with EBN's policy, discussed earlier, to maximize the (offshore) production through, for example, doing exploration research and promoting cost reduction measures. The LNG track is directed at improving LNG provisioning technology, developing LNG-based engines for road and waterway transport, and improve safety and standardization within the chain⁴³⁴. In developing and supporting projects in these areas TKI Gas cooperates with other organizations such as the National LNG platform (a government industry cooperation led by the lobbying organization of companies in the Port of Rotterdam), the Upstream Consortium (a cooperation between government, industry, universities, and research institutes focused on the upstream gas industry), and Energy valley (a similar cooperation focused on renewable gas and smart energy systems in the Province of Groningen).

Between 2012 and 2016 a total of 90 million euro in subsidies was given as part of this program, complemented with 62 million in financing coming from participating companies. The TKI Gas reports that 24.5 million euro was spend on upstream gas and small scale LNG projects⁴³⁵. In addition, TKI Gas participants could have made use of other (fiscal) stimulus measures such as the RDA or WBSO (see 10.3). Looking at RVO's database of supported projects a total of 59 natural gas projects could be identified, receiving 14.4 million euro in subsidies over the years 2012-2015 (Table 36). This included 26 projects on LNG, 18 projects on production, 4 on shale gas, 2 on exploration, 2 on improving the public image of gas, 1 on fracking, 1 on power to gas, and 1 project related to the use of natural gas (see Appendix 47).

The difference between the total amount of subsidies reported by the TKI Gas and through analysis of the RVO database could be explained by the subsidies paid over the year 2016, which RVO has not yet incorporated in its database, and extra support paid out through the 'TKI Toeslag' policy - providing funding to public-private partnerships- on which the RVO does not report in its database. Moreover, additional funding could have been provided through ECN and TNO (see 10.4). In so far as was possible,

⁴³¹ TKI Gas, "Innovatie- En Kennisagenda Gas 2016-2019: Met Gas Naar Een Klimaatneutraal Energiesysteem," 2.

⁴³² TKI Gas, "Jaarverslag TKI Gas Voor Het Jaar 2014," 5.

⁴³³ TKI Gas, "Innovatie- En Kennisagenda Gas 2016-2019: Met Gas Naar Een Klimaatneutraal Energiesysteem," 11.

⁴³⁴ TKI Gas, "Jaarverslag TKI Gas Voor Het Jaar 2014," 11&16.

⁴³⁵ TKI Gas, "TKI GAS 2012-2016: Terugblik Op 4 Jaar TKI Gas," 33&34.

Table 37 provides an overview of the extra subsidies paid out through the 'TKI Toeslag' policy. In 2015 around 1.1 million euro went to directly natural gas related projects through this program. One of the projects that the 'TKI Toeslag' has been supporting is the Computational Science for Energy Research (CSER) project. This project is a cooperation between the Netherlands Organization for Scientific Research (NWO), the Foundation for Fundamental Research on Matter (FOM), and Shell. In total CSER received 10 million in TKI funding. Interestingly, as NWO, reports, Shell primarily joined the project as a means to recruit new employees⁴³⁶. This could indicate that industry players are, in part, dependent on publicly funded research institutes, such as NWO and FOM, to recruit employees within specific (research) fields, in this case in the field of computational science.

For the period 2016-2019 the required budget has been estimated at 300 million euro, or 75 million per year⁴³⁷. In the previous period around 60 percent of the budget came from government sources⁴³⁸. For 2016-2019 this means that around 180 million euro in government subsidy would be required.

Table 36 TKI Gas subsidies for natural gas projects (based on own analysis)⁴³⁹

€	2012	2013	2014	2015	Total
# Projects	40	32	21	19	112
o/w natural gas	26	14	12	7	59
Total subsidies	8,460,582	13,382,863	9,935,221	15,291,190	47,069,856
o/w natural gas	3,963,222	5,976,903	2,194,067	2,218,229	14,352,421
Fossil share of budget (%)	46.8	44.7	22.1	14.5	-
TKI Gas + TKI Gas Toeslag	n/d	n/d	3,549,500	3,326,229	-

Table 37 'TKI Gas Toeslag' subsidies, 2015 (based on TKI Gas, 2016)⁴⁴⁰

€	2012	2013	2014	2015
Upstream gas consortium	n/d	n/d	932,500	1,060,000
LNG	n/d	n/d	422,933	48,000
CCS/CCUS	n/d	n/d	729,469	256,000
System integration	n/d	n/d	-	52,000
CSER (computational Science for Energy Research)	n/d	n/d	190,000	575,000
No information on use	n/d	n/d	1,025,098	546,850
Total	n/d	n/d	3,300,000	2,536,850
Total natural gas	n/d	n/d	1,355,433	1,108,000
Fossil share			41.1%	43.7%

⁴³⁶ TKI Gas, "Jaarrapportage TKI Gas over de TKI-Toeslag over Het Jaar 2015," 10; TKI Gas, "Jaarverslag TKI Gas Voor Het Jaar 2014," 7.

⁴³⁷ TKI Gas, "Innovatie- En Kennisagenda Gas 2016-2019: Met Gas Naar Een Klimaatneutraal Energiesysteem," 3.

⁴³⁸ TKI Gas, "TKI GAS 2012-2016: Terugblik Op 4 Jaar TKI Gas," 33.

⁴³⁹ RVO, "Ondersteunde Projecten Door RVO.nl | RVO.nl."

⁴⁴⁰ TKI Gas, "TKI GAS 2012-2016: Terugblik Op 4 Jaar TKI Gas," 10; TKI Gas, "Jaarverslag TKI Gas Voor Het Jaar 2014," 7.

Combining both TKI Gas subsidies brings the total amount of subsidies for natural gas to 3.5 million in 2014 and 3.3 million in 2015. For 2014 the total amount of subsidies given under TKI Gas is thus higher than the total amount of subsidies as reported by the RVO for that year (see section 10.1). For 2015 the amount reported by RVO, 17 million, is considerably higher. This means that the largest part of the subsidies for fossil fuel research for this year are not channeled through the TKI Gas, or other RVO projects. No explanation was found of why the TKI Gas subsidies for 2014 are higher than the total subsidies for fossil energy research reported by the RVO. Perhaps some of the projects seen as fossil fuel related in the analysis of the RVO database made in this research were not labelled as pertaining to fossil fuels by RVO, or the organizations that provided input to the RVO study.

10.2.2 'EOS' program

The EOS program ran from 2005 – 2010 and had a total budget of around 1140 million euro. An ex-post evaluation based on 255 million in subsidies given, around a fifth of the total budget, shows that 11 percent went to electricity production and grid related projects, 11 percent to 'new gas' or 'clean fossil gas', 22 percent to biomass, 23 percent to energy efficiency in industry and agriculture, and 29 percent to projects in the build environment⁴⁴¹. Unfortunately, it was not possible to analyze the financial contribution to fossil fuel related projects using the RVO database. The grouping of renewable and fossil gas into one category also hinders this. Although the supported projects are in the database, the amount of subsidy given is not reported on. This means there is no way to further analyze the subsidizing of fossil fuel related research under this program. However, the EOS is included in RVO's analysis and is thus accounted for.

10.2.3 'Innovation Fund MKB+' program

The Innovation Fund MKB+ program (Innovation Fund) was introduced in 2011, merging different programs, and contains the measures 'Innovation Credit', 'SEED capital', 'Fund-of-Funds', and 'early phase financing'. Funding for this program comes from a revolving fund, with the initial capital coming from the national government, the European Investment bank, Dutch regional investment banks, and, for the SEED capital program, from private investors. The 'innovation credit' offers a credit to (new) companies that want to develop a technology. Similar prior measures are the TOK (1954 – 2002, 1.7 billion total budget) and the 'Uitdagingskrediet' started in 2006 and merged with the innovation credit in 2008. In 2011 the Innovation Credit was merged with the Innovation Fund. Between 2007 and 2016 nine innovation credits with a relation to fossil fuels were identified totaling 12.27 million euro (see Table 39). No data on loans prior to 2007 was found. This represents around 3 percent of all loans given under the innovation credit program in that period. Most loans went to medical research and technology and biotech. The fossil related credits are mainly for oil and gas related technologies and go to just three different companies. Around 5.6 million in credit, around half of all credit to fossil fuel related developments given, went to a technique that could benefit offshore gas or oil production. This further underscores the connection between the (Dutch) offshore oil and gas sector and the government in the area of R&D. This connection could depict a serious interdependency, as discussed earlier, due to the difficult economic situation this sector is currently in and the high operational costs that it has historically had.

Table 38 Government R&D loans 2008-2015 (based on own analysis)⁴⁴²

⁴⁴¹ de Visser et al., "Ex-Post Evaluatie DEN-A En EOS," 7.

⁴⁴² RVO, "Ondersteunde Projecten Door RVO.nl | RVO.nl"; Tweede Kamer der Staten Generaal, "Jaarverslag en slotwet ministerie van Economische Zaken en Diergezondheidsfonds 2015"; Agentschap NL, "Innovatiekrediet Jaarverslag 2009"; Agentschap NL, "Innovatiekrediet Jaarverslag 2011"; Agentschap NL, "Innovatiekrediet Jaarverslag 2012"; Agentschap NL, "Innovatiekrediet Jaarverslag 2010."

M€	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017*
Total budget	19.3	37.5	56.1	47.5	52.9	52.0	50.0	50.3	55.7	60.0
o/w for technological developments	12.9	25.0	32.0	32.0	28.2	n/d	n/d	n/d	n/d	40.0
Fund to Fund						17	12	n/d	n/d	n/d
Seed capital			14.1	10.5	12.4	16.5	13.4	n/d	n/d	n/d
Early phase finance, Regional investment banks, informal investors						17	3.4	n/d	n/d	n/d
Total			70.2	58	65.3	68.5	63.4	50.3	n/d	n/d

Table 39 Innovation credits - fossil projects 2007-2013 (based on own analysis)⁴⁴³

Company	Description	Year	Credit (M€)
Airborne B.B	High resolution radar system for 3d analysis of soil surrounding a drill head	2016	1.3
Innecs Power Systems B.V	Development of a compact industrial steam turbine	2016	0.06
Innecs Power Systems B.V	Development of a compact industrial steam turbine	2015	0.12
Innecs B.V	flexible gas turbines for the production of steam and electricity	2013	0.25
Airborne B.V	Composite drilling tubes for oil and gas production	2011	4.14
Hygear	Gas to hydrogen system	2011	1.75
Innecs B.V	Flexible gas turbines for the production of steam and electricity	2011	0.55
Hygear	Gas to hydrogen system	2010	2.6
Airborne B.B	Composite drilling tubes for oil and gas production	2007	1.5
Total			12.27

The SEED capital and fund- to –fund programs, started in 2010 and 2013 respectively, are difficult to analyze since these are executed by external investments funds, which means that the projects invested in by the funds are not listed in the RVO database. This makes it impossible to determine the amount invested in certain projects. The SEED capital program currently contains 26 active funds with a total government contribution of 24 million euro. In total the program has 57 funds with more than 175 million in government loans (see Appendix 48).

On the basis of the funds portfolio's presented on their websites no projects with a direct link to fossil fuels could be detected (see Appendix 48). Interestingly, the Mainport Innovation Fund (1 and 2), part of the SEED program, is run by KLM, Schiphol, TU University Delft, NS, and the Port of Amsterdam, which are all (partly) government owned companies. Through these funds, 20 million in total with 10 million in government loans, they invest in technology and IT solutions for the aviation and transport

⁴⁴³ RVO, "Ondersteunde Projecten Door RVO.nl | RVO.nl"; Agentschap NL, "Innovatiekrediet Jaarverslag 2009"; Agentschap NL, "Innovatiekrediet Jaarverslag 2010"; Agentschap NL, "Innovatiekrediet Jaarverslag 2011"; Agentschap NL, "Innovatiekrediet Jaarverslag 2012"; Tweede Kamer der Staten Generaal, "Jaarverslag en slotwet ministerie van Economische Zaken en Diergezondheidsfonds 2015."

industry⁴⁴⁴. Although not directly related to fossil fuels, these loans support R&D for activities related to the fossil fuel intensive sector aviation.

10.3 R&D related tax reductions

In addition to direct R&D support indirect support is given through tax deductions and exemptions for R&D activities. Introduced in 1994 the WBSO has as goal to incentivize private investment in R&D by giving a reduction in wage tax due on employees involved in R&D activities. The measure is a mix between a tax credit and a tax allowance⁴⁴⁵. The RDA tax allowance was introduced in 2012 and merged into the WBSO as of 2016. It allowed for a deduction of all types R&D costs from fiscal profit. The measure had to be used in connection with the WBSO. Finally, companies can make use of a general R&D tax allowance. In 2007 the 'patent' tax bracket was introduced, in 2010 it was replaced by the 'innovation' tax bracket ('innovatiebox'). This measure allowed companies, after consulting with the tax authority, to move the profit they made with R&D activities to a lower tax bracket (5 %, with the option to choose between applying it to actual R&D profits or to 25 percent of total profits). Combined these measures provided a fiscal stimulus of around 2.5 billion euro for R&D activities in 2016. Given that there is evidence that the effectiveness of fiscal stimulus for R&D is limited, and especially that of a reduced corporate income tax rate such as the 'innovatiebox', such measures might, in part, be seen as a government support for companies' regular operational expenses⁴⁴⁶; e.g not leading to added R&D investment but simply reducing costs for R&D investments that would be done regardless of the existence of subsidy programs.

Table 40 Indirect R&D support measures 2000-2017 (based on Tweede Kamer der Staten Generaal, 2002-2016)⁴⁴⁷

M€	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	* 2017
'R&D aftrek'	0.5	0	4	4	6	8	8	10	2	3	4	6	8	9	8	8	8	8
WBSO ('Afdracht vermindering R&D')	275	324	361	323	346	362	391	399	445	701	868	915	729	766	780	794	1143	1205
RDA ('Research and Development aftrek')													130	226	255	238		
Innovatiebox								n/d	n/d	91	361	605	743	811	966*	1167*	1390*	1365*
Total	275.5	324	361	327	352	370	399	409	447	795	1233	1526	1610	1812	2039	2207	2541	2578

⁴⁴⁴ MIF, "Investing in Innovation - Mainport Innovation Fund II."

⁴⁴⁵ Verhoeven, van Stel, and Timmermans, "Evaluatie WBSO 2006-2010: Effecten, Doelgroepbereik, En Uitvoering.," 35.

⁴⁴⁶ CPB and partners, "A Study on R&D Tax Incentives: Final Report," 6.

⁴⁴⁷ Rijksoverheid, "Belastingplan 2016: Lijst van Vragen En Antwoorden"; Tweede Kamer der Staten Generaal, "Miljoenennota 2002"; Tweede Kamer der Staten Generaal, "Miljoenennota 2003"; Tweede Kamer der Staten Generaal, "Miljoenennota 2004"; Tweede Kamer der Staten Generaal, "Miljoenennota 2005"; Tweede Kamer der Staten Generaal, "Miljoenennota 2006 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2008 (Nota over de toestand van 's Rijks Financiën)"; ibid.; Tweede Kamer der Staten Generaal, "Miljoenennota 2009 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2010 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2011 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2012 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2013 (Nota over de toestand van 's Rijks Financiën)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2014 (Nota over de Toestand van 'S Rijks Financiën: 2014)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2015 (Nota over de Toestand van 'S Rijks Financiën: 2015)"; Tweede Kamer der Staten Generaal, "Miljoenennota 2016 (Nota over de Toestand van 'S Rijks Financiën: 2016)."

No data on the individual, or type of, projects that were supported is available. For some years data is available per sector. In 2010, the most recent date for which data is available, 26 percent of the companies using the WBSO measure were from the machine engineering sector, 21 percent IT, 15 percent other services, 8 percent chemical industry, 6 percent agriculture, 4 percent food processing industry, and 19 percent other industry. This level of data aggregation does not provide any possibility to analyze the share of energy, or fossil fuel, related research done under the WBSO. However, as mentioned earlier in this chapter, in 2009 the RVO made an estimation of the share of energy related research, and its fossil aspect, done under the WBSO. It estimated that a total of 47.5 million went to energy related research that year, of which 11.5 million going to fossil fuel related research. Thus, for 2009, around 25 percent of all energy related WBSO payments were related to fossil fuels, amounting to 1.65 percent of the total budget for that year. Although a single data point is not a good basis for extrapolation a share of 1.65 percent in the 2016 expenditure on the WBSO for fossil fuel research would amount to around 19 million euro.

In 2013, again the most recent date for which data could be found, the ‘Innovationbox’ was used mostly by companies from the IT (17 percent), wholesaling (14 percent), machine engineering (8 percent), and engineering and architecture (7 percent) sectors. The oil and gas, or energy sector was not mentioned as a group. Again, this level of detail does not allow for an analysis of the fossil aspects of this fiscal measure. No sector data on the ‘R&D aftrek’ measure was found.

In conclusion, due to a lack of detailed data no analysis can be made of government expenditure through fiscal measures on fossil fuel related research. However, based on the sectors using the fiscal stimulus measures for R&D, and the 2009 estimation of the fossil share of WBSO expenditures, this expenditure is likely to be, relatively, limited. However, with the 2009 data as an indicator, the fossil share of the fiscal stimuli measure could match or be higher than the direct government expenditure on fossil fuel R&D.

10.4 Government funded R&D organizations

Government funded research institutes, such as TNO and ECN, are involved in energy R&D both through own research and through partnerships or subsidiaries. Although such direct funding is accounted for through the RVO data quoted in the beginning of this chapter a more detailed analysis of the type of projects undertaken by such organizations, for example, what fossil fuels or techniques they look at, could shed more light on the government – industry interdependencies in this stage of the chain. In addition, this section will shortly look at public private partnerships, such as university – industry cooperation, around energy research. NWO and KNAW are not analyzed in further detail since they just provide funding and are not R&D organizations themselves. They do however sometimes act as partners in research projects, such as the CSER project (see section 10.2.1). Their share in fossil fuel related R&D funding is included in the analysis by the RVO.

10.4.1 TNO

As an independent, but partly government funded, organization the goal of TNO is to accelerate innovation through connecting research and industry. Within its energy program it focusses on sustainable energy, geo energy, the maritime and offshore sectors, and doing geological surveys. TNO runs different types of projects, in early research and shared innovation projects it works together with the government, industry, and knowledge institutes, in ‘contract research’ it functions as a consultancy for companies, and through spin-off subsidiaries attempts to market TNO knowledge. Although TNO sees itself as independent, it is very dependent on government funding (40 percent of revenue for 2015), and on the R&D policy set by the government since it needs public-private

partnerships and government contracts⁴⁴⁸. For this reason, TNO can be seen as a part of the government when looking at the government – industry interdependency in the R&D stage.

10.4.1.1 Research

Prior to 2008 TNO's energy research focused completely on oil and gas. Its main goal within the oil and gas research theme was to develop new techniques of oil and gas extraction, especially for small and complex fields. In order to do this they worked both with the oil and gas industry as well as with EBN⁴⁴⁹. TNO does not provide an overview of its research projects in its annual reports, but an insight in its natural gas related projects can be gained through its TKI subsidy grants. As Appendix 47 shows most grants TNO received under the TKI Gas relate to production techniques, (offshore) exploration, and LNG. Although not listed in the appendix, most of the production projects were in cooperation with private gas producers and other organizations such as EBN⁴⁵⁰. Most production related projects were aimed at improving the production from small maturing fields, for example on enhanced gas recovery and wellhead compression. This quick scan of TNO's research projects further underlines the involvement of the Dutch government in R&D for gas production, and especially for offshore and marginal fields. This method, since it only looks at TKI Gas projects, does however not give us any information on other fossil fuel related projects. For example, in its 2015 annual report TNO notes that it has partaken in a project on the environmental effects of arctic oil drilling and on CCS off the coast of Rotterdam (ROAD project)⁴⁵¹.

10.4.1.2 Companies

For its spin-offs TNO maintains a separate corporate entity 'TNO Bedrijven B.V'. In 2016 a (undisclosed) majority share in TNO Bedrijven B.V has been sold to a private investor⁴⁵². Three companies with fossil fuel related activities still affiliated to TNO, and four companies that have already been sold have been identified. Unfortunately TNO does not publish any financial details of its participations Appendix 49. Again, most of the fossil fuel related activities are related to offshore oil and gas.

10.4.2 ECN

ECN, formerly 'Energy research Centre the Netherlands', is an energy research institute traditionally focused on nuclear energy. Later 'sustainable' energy was added as a research topic. It frequently partakes in research projects with other parties such as TNO or other institutes, SOE's such as GasUnie or private companies, and universities. ECN performs its own research but also works on a commission basis for companies and governments, or through public-private partnerships. Similar to TNO its expenditure on fossil research has been accounted for in the RVO numbers. A closer survey of ECN's activities shows that most of their research is not fossil fuel related. Its main research themes are wind, solar, biomass, energy efficiency, system integration, engineering and materials, environmental assessment, and policy analysis. The energy efficiency focus area can include natural gas related research, for example, a project on providing gas producers with information on developments in gas separation and treatment techniques was found⁴⁵³. Although not strictly fossil fuel related, ECN is currently involved with Essent in a project, on the co-firing of biomass in coal power plants⁴⁵⁴. Which, as described in the section on subsidies for biomass co-firing, can have an effect on the profitability of

⁴⁴⁸ TNO, "TNO Annual Report: 2015," 29 & 40.

⁴⁴⁹ TNO, "TNO Annual Report: 2005," 19.

⁴⁵⁰ RVO, "Ondersteunde Projecten Door RVO.nl | RVO.nl."

⁴⁵¹ TNO, "TNO Annual Report: 2015," 30 & 31.

⁴⁵² TNO, "TNO Verkoopt Meerderheid van de Aandelen TNO Bedrijven BV Aan First Dutch."

⁴⁵³ ECN, "ECN Energy Efficiency."

⁴⁵⁴ ECN, "Biomassa."

the entire plant, and thus on the use of coal. Also as part of its energy efficiency program, ECN partakes in the EDGaR project described below.

10.4.3 Research consortia

In addition to research institutes several R&D or ‘innovation’ consortia related to natural gas exist in the Netherlands.

10.4.3.1 *Energy Delta Gas Research program*

The Energy Delta Gas Research program (EDGaR) was a research consortium led, mostly, by government affiliated entities that hosted an array of gas research projects between 2009 and 2015. The partners were: the university of Delft and of Groningen; the Hanze university of applied sciences ; ECN and TNO; DTO’s Enexis, Liander, and Stedin; GasUnie and Gasterra; and the private firm Kiwa . It was funded through 10 million euro coming from the ministry of economic affairs, 10 million from the EFRD (European Fund for Regional Development), 2 million from the province of Groningen, and 22 million from the participating parties. It focused its research around the effect of the introduction of new types of gas (e.g. green gas or hydrogen) on the gas infrastructure, the future of energy systems, and changing gas markets⁴⁵⁵. Its overall goal appears to be to study, and secure, the future role of natural gas in the energy system. In addition, it lobbied for the creation of a European gas research institute⁴⁵⁶. Given that the Ministry of Economic Affairs is included in RVO’s analysis of public energy R&D funding, although the EDGaR project is not explicitly mentioned, it is assumed that its 10-million-euro contribution is included in RVO’s analysis. Municipalities are not included in RVO’s analysis, and the 2 million contribution thus adds to the total public fossil fuel R&D expenditure.

10.4.3.2 *Energy Valley, Energy Academy, Energy Systems Transition Centre, and the Energy Transition Centre*

Different research consortia work together in certain projects or through institutions such as the ‘Energy Valley’, and the ‘Energy Academy Europe’ (EAE), or the Entrance research project. ‘Energy Valley’ is a cooperation between firms, research and knowledge institutes, and (local) governments to accelerate R&D and economic development in ‘clean energy’ in the northern regions of the Netherlands. It is engaged in a wide-array of energy projects on, mostly, renewable energy. It also partakes in the ‘Energy Academy’, which is an education and research institute set up by the Hanze university of applied sciences, the university of Groningen, GasUnie, EBN, GasTerra, and NAM. The participation of several gas related entities makes it very likely that natural gas is an important topic in its activities, however, no specific gas related research project could be identified. The Energy Academy is affiliated to ‘The Energy Delta Institute’ (EDI), an energy focused business school founded in 2002 by, a mix of government owned/funded and private parties, GasUnie, GasTerra, OAO Gazprom, Shell, and the University of Groningen. Both EDI and EAE’s educational activities could be used as a vehicle to push ‘gas as a transition fuel’ views, however, this is however not part of the scope of this research. EAE receives funding from all participating parties, from the municipality and province of Groningen, and from the European Union⁴⁵⁷.

Together with TNO and ECN, EAE founded the Energy Systems Transition Centre (ESTRAC). In cooperation with industry partners, such as Nam, EBN, GasTerra, and trade associations it has as goal to accelerate energy innovations. Its first project is on energy infrastructure in the North Sea and includes partners from the fossil fuel as well as renewable industries. ESTRAC received 5 million euro

⁴⁵⁵ EDGaR, “Projects.”

⁴⁵⁶ EDGaR, “A European Research Institute for Gas and Energy Innovation.”

⁴⁵⁷ Energy Academy Europe, “Energy Academy Europe: Annual Report 2015.”

in initial funding, but it is unclear what the different parties contributed and how it is spend⁴⁵⁸. A similar initiative is the Energy Transition Centre (EnTranCe), which was founded by the Hanze university of applied sciences, but has partnered with many of the organizations mentioned in this section⁴⁵⁹. Many of its R&D projects are in partnership with TNO, ECN, AEA, and industry⁴⁶⁰. Since no direct fossil fuel related projects could be identified no attempt at creating a complete financial overview of these partnerships has been made.

There is thus a mix of public-private partnerships when it comes to R&D for, especially, natural gas. Historically, based on the presence of natural gas in the Netherlands, and the governments involvement in its production, these different entities have built up a close relationship. Although relatively small in terms of financing, compare, for example, with annual spending through the WBSO, these partnerships further add to the government – industry interdependency in the area of fossil fuel R&D.

10.5 SOE R&D activities

Since the financial ties between SOE's and the government have been studied throughout this research this section will just briefly describe some of the R&D activities of EBN, GasUnie, GasTerra, and the ports of Amsterdam and Rotterdam, without attempting to create a complete overview of R&D spending by these parties. In the previous section it was already mentioned that EBN, GasUnie, and GasTerra partake in R&D partnerships with institutes such as TNO and ECN.

10.5.1 EBN

EBN's main areas of expertise, and research, are geology, geomechanics, seismicity, and, more recently, the decommissioning and reuse of infrastructure⁴⁶¹. For example, EBN is currently engaged in a project with TNO, Siemens, and Shell on linking-up oil and gas industry in the North Sea with offshore wind parks, with as main goal to find alternative uses for oil and gas rigs that should otherwise be de-commissioned⁴⁶². Most of EBN's research is focused on exploration in the Dutch continental shelf and exploring strategies that lead to a reduction of operating expenses. This exploration research is done, as EBN frequently states in its annual reports, to maximize oil and gas extraction through reducing costs for producers (which no longer need to do this research). This is especially relevant given the rising share of exploration costs in small-fields margins⁴⁶³. EBN thus effectively removes an operational risk for the oil and gas producers. Another topic of great interest for EBN is the extension of field life⁴⁶⁴. All of these research areas contribute to the goal of oil and gas production maximization.

10.5.2 Ports of Rotterdam and Amsterdam

One of the goals of the Port of Rotterdam in achieving its business goals for 2030 – being a global hub and an industrial cluster for Europe - is to create partnerships for 'innovation'⁴⁶⁵. Most of such projects

⁴⁵⁸ Energy Academy Europe, "ESTRAC – Energy Systems Transition Centre | Energy Academy Europe."

⁴⁵⁹ EnTranCe, "Partners | EnTranCe."

⁴⁶⁰ EnTranCe, "Projects | EnTranCe."

⁴⁶¹ EBN, "Technische Kennis & Studies."

⁴⁶² Energie Beheer Nederland (EBN), "Focus on Dutch Oil & Gas 2016," 5.

⁴⁶³ EBN, "Focus on Dutch Oil and Gas: 2015," 12.

⁴⁶⁴ EBN, "Focus on Dutch Oil and Gas: 2013."

⁴⁶⁵ Port of Rotterdam, "Innovation."

focus on optimizing port activities, such as the speed of container transshipment or reducing smell pollution. As part of this program, and its 'sustainability' program, the Port of Rotterdam also pushes LNG as a transport fuel, as has been discussed in section 6.1. This however does not relate to R&D. Within its R&D related projects, such as business hubs, start-up incubators, or innovation labs, no fossil fuel related projects were identified.

In its projects the port also works together with other government related institutes such as ECN. For example, through 'Plant One Rotterdam', a test facility where companies can do research and pursue innovative ideas to develop (more) sustainable technologies and produce at a commercial scale. (improvement of industrial processes). This includes projects on: plastics (pet upcycling); Ocean Thermal Energy Conversion (OTEC); catalyzers with a low environmental impact; or the collection and re-use of waste gas collection. ECN used the facility for the development of a membrane technology that could replace distillation in the process industry⁴⁶⁶.

Although on a smaller scale, The Port of Amsterdam engages in similar partnerships for port related R&D. For example through its start-up incubator 'Prodock', which opened in 2016, or its participation in the Mainport Innovation Fund (see 10.2.3)⁴⁶⁷. No fossil fuel related projects were identified.

10.5.3 Gasunie

As mentioned above Gasunie participates in EDGAR, EAE, EDI, and Energy Valley. It provided 0.5 million euro in funding for the EAE and Entrance programs, and 175 thousand euros for a project with GasTerra, as part of EnTranCe on hydrogen use for power to gas⁴⁶⁸. As part of its participations and business development branch Gasunie aims to facilitate the change to a 'sustainable' energy system through finding 'clean' uses of natural gas, strengthening the interplay between natural gas and other electricity carriers, and by increasing the feed-in of 'sustainable' gasses⁴⁶⁹. This policy however focuses more on implementing market ready/commercial technologies instead of doing R&D.

In 2016 Gasunie invested an extra 0.5 million in EAE and Entrance, and committed another 0.6 million over three years for the newly founded ESTRAC energy innocation centre, and another 0.15 million for a renewable energy production monitoring app. 1.2 million euro was invested in R&D focused on the optimization of Gasunies current assets. This is the only R&D investment that applies to fossil fuels. On the whole, it can be concluded that Gasunie has limited (fossil fuel) R&D activities.

10.5.4 GasTerra

GasTerra participates in the EnTranCe project, for example in biogas projects, but no other R&D activities were found.

10.6 Discussion

This chapter reviewed the public support for fossil fuel R&D and R&D activities by government funded, supported, or owned parties. Between 2005 and 2015 the national government spend a total of at least 189 million euro, around 10 percent of total energy R&D expenditure by the government in that

⁴⁶⁶ Plant One Rotterdam, "Projecten » Plant One Rotterdam."

⁴⁶⁷ Municipality of Amsterdam, "Municipality of Amsterdam: Annual Report 2015," 73–81.

⁴⁶⁸ Gasunie, "Gasunie: Annual Report 2015," 158.

⁴⁶⁹ Ibid., 13.

period, on fossil fuel related R&D, of which around 100 million going to CCUS related projects. Given inconsistencies between the results of the analysis done in this chapter and data reported by other entities this data should be taken as an indication. Considerable fiscal stimuli for R&D exist, amounting to over 17 billion in foregone government tax revenue between 2001 and 2016, it is unknown how much of this went to fossil fuel R&D. However, based on data for 2009, this could be in the same order of magnitude as the direct government expenditure. This would still make up a relatively small amount of total public support for energy R&D. However, given that most direct funding goes to only a few technologies/types of research: CCUS, gas production, and LNG. It becomes apparent that there could be a strong dependency of industry on public financing in these areas. On the other hand, the national government wants to push these specific areas and needs industry in doing this.

In general fossil fuel related R&D activities by SOE's are limited, but, notably EBN and GasUnie, do participate frequently in R&D partnerships and research projects by research institutes TNO and ECN. During this chapter the picture emerges that, although providing limited financial contributions, there is a strong presence of these companies in energy and fossil fuel R&D and 'innovation policy'. The ports of Rotterdam and Amsterdam are involved in R&D activities, but at a very limited scale, and most not related to (fossil) energy.

The findings of this chapter further underline the interdependency between the Dutch government and the offshore oil and gas industry in specific. Most gas production and exploration projects ran by TNO under the TKI Gas pertain to offshore gas, 3 of the 7 (former) TNO subsidiaries operate (mainly) in the field of offshore gas and oil, and EBN's R&D is mostly aimed at maximizing production, and minimizing operational costs, of offshore gas and oil. The dependency of offshore oil and gas production is further underlined. Moreover, this chapter adds to the image of the national government being a staunch supporter of natural gas in general, and wishes to expand the role of gas in the energy system, notably through the further uptake of LNG in transport. A 2014 review of the Topsector policy confirmed that the economically important upstream gas sector had zero emission reduction capacity and the LNG program only a modest reduction potential⁴⁷⁰. Moreover, it concluded that the "additionality of the TKI" was hard assess and impossible to quantify, and that the future of small-fields production is very dependent on successful technological innovation coming from the TKI gas⁴⁷¹.

11 Discussion

This thesis has mapped the financial interdependencies between the Dutch government and the fossil fuel industry in the Netherlands by looking at financial flows between the two. Looking at all parts of the fossil fuel value chain: production and exploration; transport and storage; processing and refining; sales and distribution; use; and, finally, fossil fuel related Research and Development. Having presented results and a short discussion for each stage in the framework in the relevant chapters this discussion focusses on the key interdependencies and take a broader perspective. To do this the first section of this chapter presents the key findings of the research in an aggregated manner. The second section provides a discussion of the found key interdependencies taking a transition studies lens, looking in specific at how these interdependencies constitute a barrier to the ET and what opportunities they provide for accelerating the ET. The final section briefly discusses other possible 'locations' of interdependencies that have not been included in the research, for example, those at

⁴⁷⁰ Blom et al., "Review Topsector Energie: Deelonderzoek 1," 60.

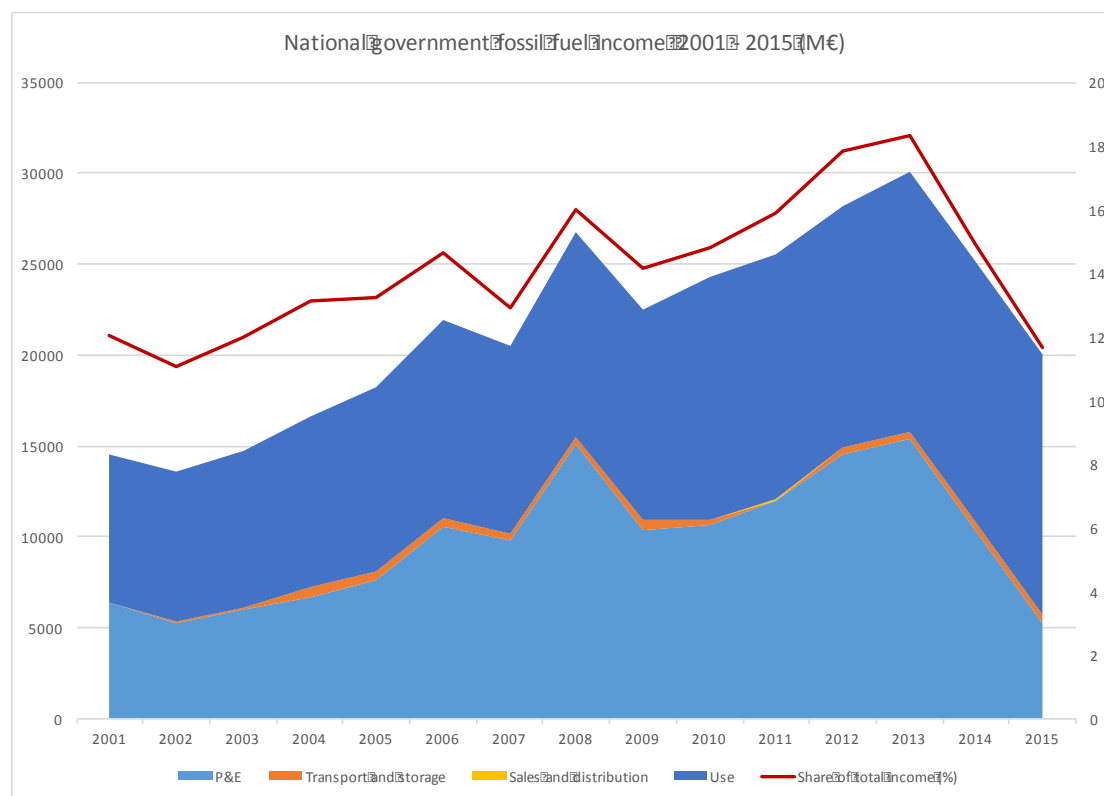
⁴⁷¹ Ibid., 15 & 16.

the European level, and gives a short reflection on the operational framework that was developed during the process of this research and other methodological and data issues.

11.1 Financial interdependencies between government and industry

Figure 33, Figure 34, and Figure 35 below provide an overview of the fossil fuel related income and expenditures of the national government between 2001 and 2015⁴⁷². These figures only include data as provided by the government itself and the statistics agencies, while estimations of missing financial flows made throughout this research, or ambiguous financial flows are presented in Table 41. On the revenue side we see that fossil income peaked in 2013, mostly due to record high revenue from gas production, at 30 billion euro, amounting to 18.3 percent of total government income (excluding social premiums)⁴⁷³. While expenditure amounted to over 4 billion euro in the same year. Due to declining income from production fossil revenue as share of total government revenue has dropped to around 12 percent in 2015, and will come out even lower in 2016 due to the further reduction of production revenue by 2 billion euro (see Figure 8). Historically, there has thus been a large dependency on income from the production of natural gas and oil. With the current collapse of natural gas production revenue, the already growing dependency on government income from the use of fossil fuels has become even stronger.

Figure 33 Total fossil fuel related income of the national government 2001-2015 (based on own analysis)



⁴⁷² Two graphs on fossil fuel related expenditure have been provided, one including and one excluding the exemptions for excise taxes in aviation and marine sectors, to present a clear picture of how expenditures are divided over the different stages of the value chain.

⁴⁷³ As mentioned before, social premiums are not included because they are not freely spendable income. This is common practice when looking at government income, see, for example Rabobank, "Nederlandse Aardgasbaten Nog Steeds Belangrijke Inkomstenbron Overheid."

Figure 34 Total fossil fuel related expenditure of the national government 2001-2015 – including aviation and marine excise tax exemptions (based on own analysis)

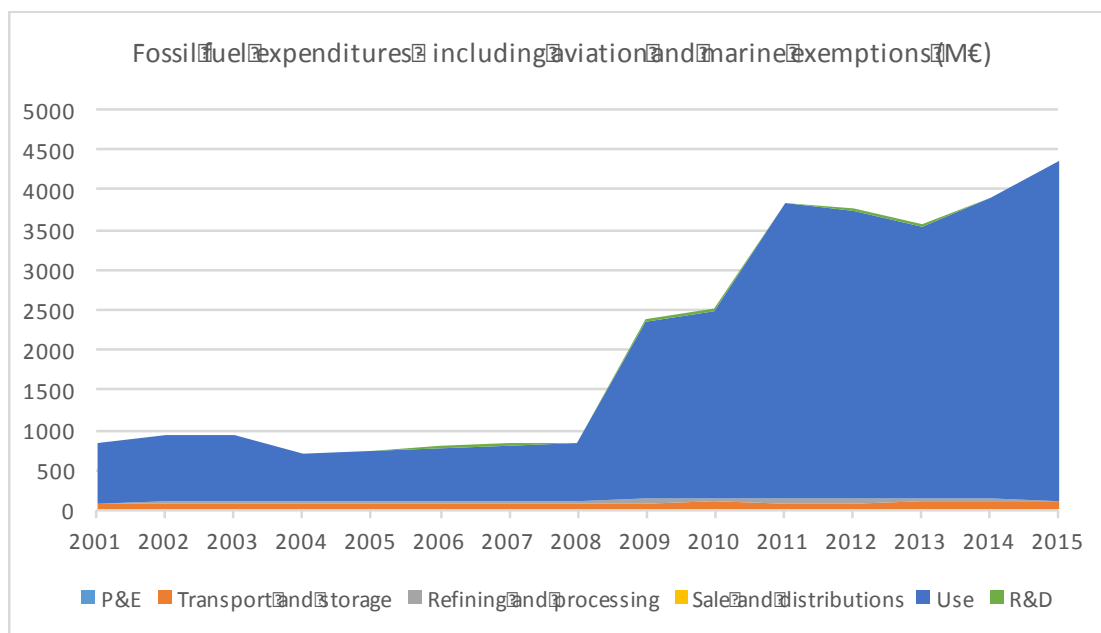
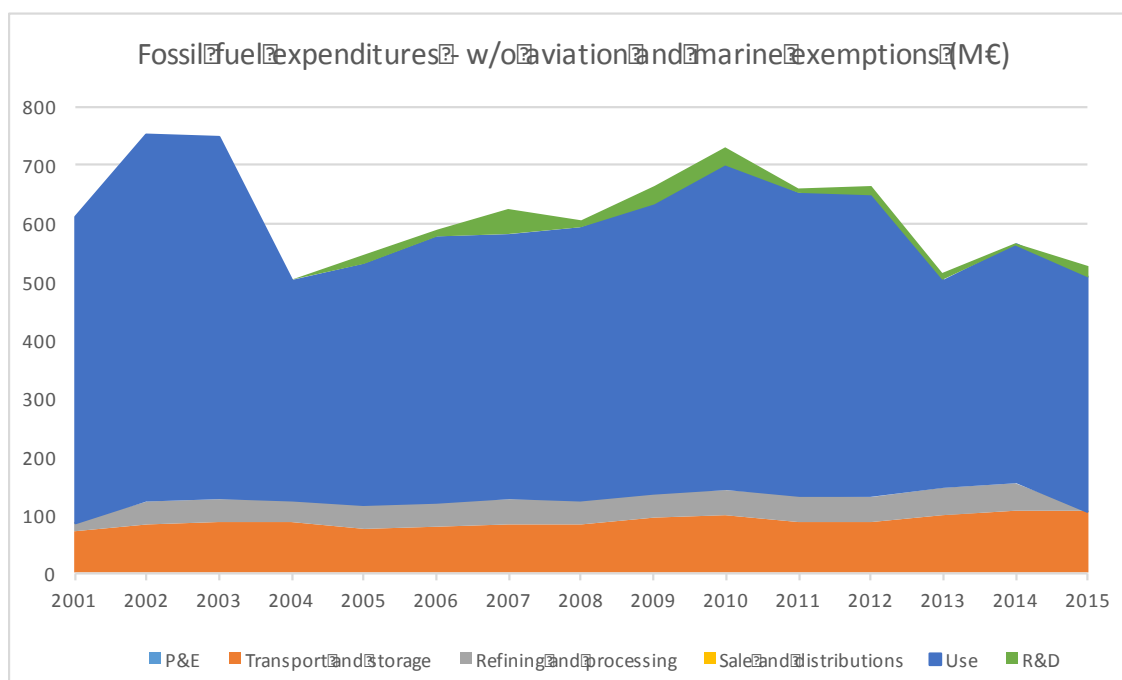


Figure 35 Total fossil fuel related expenses of the government 2001-2015 - excluding aviation and marine excise tax exemptions (based on own analysis)



On the expenditure side, the government spend around 4 billion euro in 2015, mostly in foregone tax revenue, on support for fossil fuels and related activities. The figures clearly show that excise tax exemption for international aviation and marine transport makes up the bulk of the governments costs when it comes to fossil fuels. Due to the difficulties surrounding the figures for this tax exemption (as explained in section 8.2.3.1), and to give a clearer picture of other expenses Figure 35 excludes these tax exemptions from the analysis. In this analysis, expenditure on fossil fuels and related activities amounts to around 500 million in 2015, or around 0.3 percent of total government

expenditure in that year⁴⁷⁴. Again, the biggest costs are in the use fase, comprising the tax exemptions for international shipping, energy tax reimbursements, and other excise tax exemptions or lowered tariffs. All in all, direct payments amount to around 150 million a year, with over 100 million being payments to the COVA for the stockage of oil.

In addition to the above mentioned figures estimations of other financial flows between the government and industry have been made, or financial flows that could not necessarily be linked directly to fossil fuels have been found. Although not enough data was available to provide a complete picture, Table 37 makes clear that, roughly, an extra 500 million euro in income, and around 1.8 billion in expenditures (extrapolating missing data) is not being counted in the numbers quoted above (see Appendix 51 for the complete timeseries). This comes from government VAT receipts on electricity generated using fossil fuels (the 2015 number is a very conservative estimate, see section 9.2.3), and dividends from fossil fuel related participations. On the other hand, the government gives minor amounts in fiscal benefits through investment deductions (and the R&D deductions studied in section 10.3), and R&D loans, although these are potentially a lot larger. While VAT exemption on international aviation, similar to excise tax exemption, presents a major loss of tax revenue. However, apart from the dividend relations, creating a complete overview of these financial relationships appeared to be unfeasible within the bounds of this thesis and would require a different methodological approach to create viable estimations of these figures.

Table 41 Estimations of other government fossil fuel income and expenditure (based on own analysis)

M€	2015	2016
Total income	491.1	72.6
VAT on fossil electricity	387.3	n.d
Dividend	103.8	72.6
o/w Schiphol	89.6	72.6
o/w HbR	13.3	n.d
o/w KLM	1.0	n.d
Expenditure	189.9	1601.4
EIA fossil investments	2.2	n.d
Aviation VAT exemption	n.d	1600.0
Innovation credits	0.1	1.4
Emission credits grandfathering (EU-ETS)	187.5	n.d

The overview of income and expenditure on and of fossil fuels by the government clearly shows the large dependency that the government has on fossil fuel revenue. In comparison the government support for fossil fuels, in so far as it was possible to quantify these here, appears to be limited. With most support being foregone tax revenue from industries that are exempt from these taxes both in other European countries and globally. Moreover, as mentioned before, the actual loss in tax revenue is lower than the quoted figures. Nevertheless, this support could provide a crucial competitive advantage for the aviation industry compared to other modes of transport. To provide more insight in how the financial relations mentioned above, and other relationships that have been found but could not be quantified, or assessed in an unambiguous manner, constitute interdependencies between the government and the industry the next section presents the findings of this research in a stage by stage manner.

⁴⁷⁴ CBS, "CBS StatLine - Overheid; Inkomsten En Uitgaven."

11.2 Interdependencies in the fossil fuel value chain

Going through the 7 stages of the framework this section presents the key locations where interdependencies have been identified and their nature and magnitude and discusses them through a transitions thinking lens; how do these interdependencies constitute a barrier to the ET and how could they productively be leveraged in accelerating the ET? But also, what do they mean for the ET at large and what transition dynamics can be identified?

11.2.1 Production and exploration: natural gas

As quantified above, the government has a large dependency on revenue from natural gas production, with oil production being of minor importance. On the other hand, producers of gas from small-fields, especially offshore, are very dependent on the creation of favourable 'boundary conditions' by the government. Through the marginal fields policy and other supportive policies, exploration research and other support provided by the SOE EBN, the setting of producer favourable being terms and conditions by GasTerra, and R&D supported through heavily government funded research institutes such as TNO and ECN the government provides this. In addition, there is evidence that producers will rely on the government to foot a large part of offshore-decommissioning and earthquake costs.

The interdependencies in the P&E stage of natural gas are strong, rooted in history, and mutual; i.e. both parties need, and want to, cooperate in order to maximize gas production and, for example, prevent loss of resources from small-fields. The Groningenfield is a special case in this respect due to the ease of production, but is currently suffering from earthquake related production limits. This external shock, in combination with low gas prices, has put significant pressure on natural gas production in the Netherlands and the position of the industry in the regime. Moreover, it has caused government income from production to plummet. In this respect the dependency of the government on domestic gas production has been reduced, however, industry dependency on the government has perhaps increased; especially the offshore sector is requesting support, for which there is evidence that the government is willing to provide this, and the Groningen producer, NAM, needs the State in dealing with production induced earthquakes and their (monetary) effects.

These developments are a clear sign of regime destabilization; the existing underlying structures 'the rules of the game' are changing. Although still of great importance, the cardinal position of domestic natural gas is being seriously undermined. This is supported by findings in the later stages of the research, for example, through the increase of gas imports, and with the end of long-term export contracts, and the start of a structural switch to L-gas, expected in the coming decade. However, despite the effects of these external shocks on gas production, the remaining assets in the ground are substantial leaving the strong incentive for the national government to maximize production in place.

11.2.2 Transport and storage

The transport and storage of coal and oil is an important economic driver for the main seaports in the Netherlands, with over 50 percent of the throughput in the Ports of Amsterdam and Rotterdam coming from these fuels. The main seaports have become important energy hubs with storage, refining, power generation, and secondary industries established within their bounds. Being publicly owned, and paying considerable amounts of dividends, the port authorities are a strong link through which industry is connected with the government at this stage. Through loans, guarantees, and investments in port infrastructure and hinterland connections the public shareholders are key

supporters of the ports, and thus of the trade and storage of fossil fuels, especially oil and coal. Moreover, for the municipalities of Amsterdam and Rotterdam, the ports dividends, and/or interest payments, provide a minor but important share of freely spendable revenue. However, based on the size of the interdependencies, this need not necessarily provide an incentive to prevent a phase-out of fossil fuels in ports. It is more likely that employment and network or mainport benefits would pose a restraint to the ET in this respect. Moreover, public ownership provides opportunities for municipalities to steer activities in the ports. For smaller ports the importance of public backing to attract financing further extends the amount of influence the public owners have over these ports. This gives the shareholders further leverage to use ports as a means to enact or accelerate the ET, for example to steering towards replacement of fossil fuel throughput and related activities. Some, minor plans in this respect have been made by the ports of Amsterdam and Rotterdam themselves, for example to phase out coal by 2030 (Amsterdam) or increase biofuel and biomass activities (Rotterdam).

However, at the moment, purely looking at amounts transported, the dependency of the main seaports on fossil fuels does not appear to be under pressure. 2015 saw record levels of oil transshipment for HbA, but falling coal throughput. Moreover, the closure of the coal fired powerplant in the port of Amsterdam could put further pressure on coal transshipment in that port. This natural development means that the 2030 coal phase-out might prove to be mostly a symbolic gesture.

The other main interdependencies between industry and government in this stage of the value chain were found in the pipeline transport of oil and natural gas. The natural gas transport system is indirectly publicly owned through the SOE Gasunie, meaning that the government is the industry in this respect. Although Gasunie does not regard itself as a public body, its public ownership means that there are substantial possibilities for the government to influence activities in this field. However, up to date, this method of influencing the energy regime remains practically un-used. With a decline in domestic production the import of natural gas will become increasingly important, this, together with the strong increases in gas trade through Gasunie's TTF mean that gas transport will become more important in the energy regime. This was actively supported by the government through its gas hub policy.

Although oil transport is mostly privatized, it is strictly coordinated by the government. For example, through the pipeline corridor LSNed, which has been developed and was paid for by the government. Oil transport in the Netherlands clearly shows the historical aspect of current interdependencies. Due to Schiphol's distant military past it was connected to the oil pipeline system established under the NATO. For this reason, the Dutch military still supplies around half of the jet fuel for the now commercial airport. This finding further underlines the role of habits and routines in the energy regime; there is no clear rationale (anymore) for the military to act as a commercial fuel supplier, it just happened to grow that way. This routine was further entrenched by the fact that the military has started to rely on the commercial supply contracts help pay for pipeline costs, which, again, provides a clear incentive to keep this anachronistic interdependency in place.

11.2.3 Processing and refining

Interdependencies in the processing and refining stage are limited, but could be growing. Gasunie undertakes necessary gas quality conversion and is investing in LNG for road and waterway transport, which requires de-lidification. Although currently LNG quantities imported, processed, and used are minor this could mean that Gasunie will be more involved in gas processing in the future. The output drop from the Groningen field will also mean that more quality conversion of imported gas needs to occur. The other main processing activity in the Netherlands is oil refining. As a refining centre for the North-west of Europe the Netherlands has a strong position in this industry. All refineries are located

in publicly owned ports and thus provide revenue for their public shareholders. Although it was not possible to quantify this relationship it does show that oil refining is an important sector for Dutch ports. Looking at the first three segments of the value chain the image emerges that interdependencies are especially strong where physical infrastructure is in place, e.g. pipelines, oil rigs, or ports. This could ofcourse be seen as a natural consequence of the governments strong control over (public) space in the Netherlands.

11.2.4 Sale and distribution

In the sale and distribution segment of the value chain the main interdependencies run through the publicly owned regional gas distribution networks (TSO's) and the semi-government owned gas wholesaler GasTerra. In addition, the bunkering of marine fuel takes places in the publicly owned ports, while, through its participation in KLM, the government partakes in fuel distribution at Schiphol. In the sale of fuels for road transport retailers are partly dependent on the government to provide, and auction, land adjacent to national roads.

Being half government half industry owned the wholesaler GasTerra is a prime example of the close cooperation between industry and government in the gas sector and, as part of the 'Gasbuilding', further underlines the historical dependency of the system. Interestingly, GasTerra, opposed to Gasunie or other participations, is actively being used by the government as a policy tool to enhance production from small-fields. This also shows how activities in different stages of the chain are connected, and interdependencies found in one segment might have ramifications for the whole value chain.

The TSO's are another entity that could be used by regional governments and municipalities to drive change in the energy system. Although an analysis of the financial relationships between the governments and the TSO's does not provide a clear picture of interdependencies between the two parties based on economic relations, the public ownership of these entities does mean that they could be used as a vehicle for change in the energy regime. Although not explicitly studied in this research the importance of grid management in a renewable energy based system further strengthens the possibility to use public ownership of power grids as a leverage tool.

11.2.5 Use

As shown in the first section of this chapter the government is heavily involved in this segment of the chain through consumer taxation. Also, it was found that regional and municipal governments stil own two electricity producers, Eneco and Delta. With more than 80 percent of electricity coming from fossil fuels this provides a clear interdependency with the fossil fuel regime.

For the province of Zeeland the dividends paid by Delta constituted a significant share of freely spendable income in the past. On the other hand, although ultimately unsuccesfull, Delta attempted to secure public backing to attract new financing. This strong relation between the government and electricity producing companies, again, has a large historical aspect, and has diminished only in the past decade through liberalization of the electricity market. Although not included in the overview of government income and expenditure on fossil fuels above, the large amounts of support for the co-firing of biomass in coal power plants can, as explained in section 9.1.3, contribute to the overall economic viability of coal fired powerplants. Especially given the current bad economic situation of these plants such as support measure could have significant effects on the industry. In this respect there is thus evidence of a dependence of coal power plant owners on government support. Within the electricity supply the use of coal is currently under pressure, both for economic and environmental

reasons, which is a clear sign that the destabilization of the fossil energy regime is also starting to occur the electricity sector.

Although the continued public ownership of Delta and Eneco is not certain, these participations could have been, and continue to be, used as a means to accelerate the energy transition. Although Eneco currently already has the highest share of renewable energy in its production mix, its public owners could pressure them or cooperate with them in further expanding their renewables portfolio.

In addition to electricity production the government is also involved in the use segment through its participations in the airlines KLM and Winair. Both interdependencies have a large historic element, with the Dutch government having obtained a stake in KLM after the second world war, while Winair operates in former Dutch colonies in the Caribbean. The short analysis of the financial relations between the government and KLM showed that KLM is barely profitable, paying almost no dividends to the government. As discussed in the relevant section the governments participation in KLM is mainly to safeguard the 'public' interest. This could be taken to underscore the dependency of KLM on government favoritism. Winair is financially dependent on its public shareholders, and thus presents a clear dependency of a fossil fuel user on the government to continue business.

As became visible in Figure 33 the States dependency on use stage taxes has steadily increased, and stands to increase even further, at least as long as production caps on the Groningen field remain in place. However, in the long run, use phase taxes could also come under pressure from reduced fossil fuel use in transport, electricity production, and (home) heating. For example, a complete switch towards electric or hydrogen vehicles would severely impact fuel excise tax revenue. Whereas an increase in renewables could negatively impact the energy tax. Disruption in revenue from the use of fossil fuels, aggravating the already occurring loss of production based revenue, could have a strong impact on the governments finances. In a complete fossil fuel phase out scenario, looking only at direct fossil fuel related tax income, this would amount to at least 20 billion euro annually. Given that the power sector needs to have completely eliminated Co2 emissions by 2050, and transport needs to have reduced it by 60 percent, to reach the EU's 2050 goals the government needs to replace a significant share of these revenues within a similar timeframe⁴⁷⁵. This relation between fossil fuel use and tax revenue could be a clear incentive for the government to, even under an emissions reduction scenario, stick to the use of fossil fuels, but for example in combination with CCS.

11.2.5.1 R&D

The government provides large subsidies for R&D, mostly in the form of tax rebates. However, it appeared that only limited data was available on which industries benefit from these subsidies. Nevertheless, through SOE's, publicly funded research organizations, and its own innovation policies the government can have a significant impact on fossil fuel R&D, specifically when it comes to off-shore gas, techniques for 'difficult gas', and CCS (on which most projects analyzed focused, see chapter 10). The first two would help reduce costs and extent production life-time of (offshore) small-fields whereas CCS could contribute to the continuation of the fossil based regime. Especially given the experimental nature of, for example, CCS projects, government funding could have a significant effect on whether such a project will be undertaken or not. Although the overall support for fossil fuel related R&D project was relatively small, amounting to 17 million euro in 2015, and averaging 9 percent of the governments total R&D budget between 2005 and 2009, the focus on specific techniques or industries means that there could be a dependency in those industries on government funding to successfully launch R&D projects.

⁴⁷⁵ European Commission, "2050 Energy Strategy - Energy - European Commission."

11.2.5.2 Conclusion

Under the pressure of external shocks, a tipping-point in the production of natural gas has appeared with far reaching financial effects for the government. With the government appearing to be caught unprepared for this disruption not having planned for the occurrence of such external shocks as gas production related earthquakes and related societal backlash to natural gas production. The governments dependency on the use of fossil fuels by society is considerable, and, due to its interwovenness with the system, throughout the different segments of the chain, highly complicated. Whereas gas production revenue comes in large chunks from a few entities the use phase revenue streams are comprised of both small and large amounts coming through many different channels. The same applies to the government expenditures on fossil fuels and related activities. Moreover, connected to, and based on, these financial flows, there are organizational relationships that further entrench the financial interdependencies in the regime. This makes that even minor financial flows can have a strong slowing effect on the ET through the facilitation of incumbents; e.g. R&D contributions by the government are low, yet represent a strong policy connection between the government and industry.

The case of natural gas production revenue shows that transition dynamics can be rapid and disruptive leading to an unexpected deconstruction of the regime. In the case of a fossil fuel phase-out, planned or unplanned, the government thus needs a financial exit from fossil fuels. In other words, a strategy to start raising revenue with renewable energy and a plan to deal with possible disruptions. The occurring regime destabilization can thus also be seen as an opportunity to further shape the ET and the governments role in this. The government should not only be focused on replacing its current fossil based income but also use this shift to see how they could use their financial position to enable the ET. In the sections above suggestions have been given on how this could be achieved within each segment of the chain. For example, using publicly owned regional distribution system operators, publicly owned utilities, or the gas focused SOE's.

11.3 Organizational, EU, and not investigated interdependencies

Throughout the research a variety of possible interdependencies were not included in the research because they fell outside of the scope of the research or could not be investigated using the methodology used in this thesis.

11.3.1 Organizational links

In addition to financial links government and industry are also connected through organizational links. Sometimes, as mentioned above these follow the lines of the financial links. For example, it was found that both the ministry of economic affairs and GasTerra seconds employees to industry entities such as oil and gas production companies. Also, evidence of government lobbying for the Dutch gas industry during trade missions to Russia was found. Moreover, as became apparent by looking at financial relations, SOE's, the government, and oil and gas companies cooperate in a host of different projects throughout the value chain. Although the organizational aspect of such projects has not been included in this research these interdependencies based on exchange of knowledge and technical capabilities, personal connections, and other socio-cultural aspects further embeds the financial interdependencies in the system.

11.3.2 EU Links

Through the EIB or EBRD, research programmes such as COST, Europa, Euripides2, Eurostars, or Horizon 2020, and other investment funds or programmes, such as the ‘Connecting Europe Facility’ which invests in natural gas infrastructure, the European Union also invests in fossil fuel related projects⁴⁷⁶. For example, in LNG infrastructure (see section 6.1.1). When it comes to R&D, for example, the European Commission hosts the Research Fund for Coal and Steel (RFCS). Indirectly, given that the Dutch government contributes to the EU budget such programmes are also related to the Dutch government. For example, the Dutch government has a 11 billion euro share in the EIB capital. These possible interdependencies were not researched further because they fall outside the scope of this thesis.

11.3.3 Other possible financial interdependencies

Several possible financial links between the government and industry were identified but not analyzed in more detail because it was not possible to do so using the operational framework developed for this thesis. This includes export credits and export insurance given by the Dutch government, activities of Dutch regional development banks, investment guarantees (e.g. ‘Borgstelling MKB Kredieten’ or ‘Groeifaciliteit’), or investment tax allowance policies such as the MIA and VAMIL. Also, contributions to the World Bank or the Asian Infrastructure Investment Bank could be spent on fossil fuel projects. Moreover, a forthcoming study on Dutch export credits and insurance showed that a large amount of the supported projects are fossil fuel related⁴⁷⁷.

11.4 Reflection on methodology, data, and the operational framework

The initial goal of the framework, as set out in section 3.2 was to provide insight in the financial flows between government and industry and aid in creating a good overview of where and how such interdependencies can occur, what their size is, and how they might pose a barrier to the energy transition. And, in doing this, provide clarity on what relations warrant closer research. All in all, I find that the operational framework developed was useful in guiding, structuring, and documenting the research process and successfully fulfilled its aims. It could however be developed further when it comes to summarizing, presenting, and visualizing the found interdependencies. For example, along the lines of the value chain segments, topics, and core questions used by the framework.

To reflect on the methodology used it appeared that a study of annual reports to identify financial relationships has some drawbacks. Firstly, the data found in the annual reports of most private companies was not detailed enough to allow for an analysis of financial streams related to a certain country or project. This meant that most analysis had to be done from the government side, looking at government policy, annual reports and budgets, department websites, letters to parliament from the different ministries, and existing analyses of government policy. This gave a good view of government involvement in the energy regime, and the dependency of the government on this regime. However, it limited the possibility for the analysis of industry dependency on the government, specifically within certain segments of the value chain. For example, it became apparent that offshore gas production is likely to be dependent on government SOE’s and support measures, but it was not possible to quantify to what extent; e.g. what is the effect of this dependency on producer income or profitability. Secondly, although the methodology used allowed for an effective analysis of the locations within the value chain of financial relationships it could not always be used to arrive at a quantification of the found interdependencies. For example, it was found that most tax data provided by the government and the national statistics agency, both on tax income and tax expenses, is

⁴⁷⁶ EurActiv.com, “The Brief: Beware of White Elephants”; European Commission, “Research Fund for Coal and Steel (RFCS) - Research & Innovation - Key Enabling Technologies - European Commission.”

⁴⁷⁷ Report forthcoming in 2017, based on interview of the reports author Niels Hazekamp (Both ENDS)

presented at such a high level of aggregation that the share going to or coming from specific industries could not be extracted. This was for example the case with VAT, income and corporate tax, or tax deductions and rebates. Reconstructing these tax revenues and expenditures requires a different methodological approach and data⁴⁷⁸.

When it comes to data it was found that public reports or annual reports and accounts of public institutions or SOE's do not always report data in a consistent, accurate, or clear manner. For example, annual reports from different years may give different numbers for the same year (in the past), either due to an update of tax data, a new way of estimating or calculating the figure, or perhaps erroneously. Also it is not always clear what specific items in annual accounts refer to or what is included in the aggregation presented; for example, the government includes 'dividends' in the gas production revenue figure, without specifying which SOE's this applies to (most likely EBN and GasTerra). But also, the government does not mention the super-dividend it received from Schiphol before selling a stake to ADF in 2008. Also, data on subsidies or government expenditure has showed inconsistencies. E.g. differences were found between the MEP subsidy on biomass co-firing as reported by RVO and in the annual reports of the subsidy program. While the annual reports of the subsidy mention 8 billion in committed payments it is not certain that these subsidies were effectuated since they do not show up in the annual accounts of the ministry of economic affairs. Sometimes it was possible to solve such data inconsistencies or unclarities by looking at communication between parliament and the concerning ministry – the need for this extra explanation could be taken to mean that ministries are sometimes purposely vague or unclear in their publications -, requesting extra information from the concerning ministry or organization, or by comparison with figures found in other documents.

⁴⁷⁸ See, for example, the estimates done by Weterings et al. (2013), or Korteland and Faber (2013)

12 Bibliography

- Aardgas-in-nederland.nl. "Aardgasbaten En Economie | Wat Draagt Aardgas Bij Aan de Schatkist? |." *Aardgas-in-Nederland*. Accessed April 5, 2017. <http://aardgas-in-nederland.nl/nederland-aardgasland/aardgas-en-de-economie/>.
- Acemoglu, Daron, and James A Robinson. "Economics versus Politics: Pitfalls of Policy Advice." *Journal of Economic Perspectives* 27, no. 2 (February 2013): 173–92. doi:10.1257/jep.27.2.173.
- ACM. "Besluit ontheffing kartelverbod Amsterdam Schiphol Pijpleiding | ACM.nl." Besluit, March 12, 2003. <https://www.acm.nl/nl/publicaties/publicatie/876/Besluit-ontheffing-kartelverbod-Amsterdam-Schiphol-Pijpleiding/>.
- . "Overzicht regionale netbeheerders." Text. Accessed January 27, 2017. <https://www.acm.nl/nl/onderwerpen/energie/elektriciteit/regulering-regionale-netbeheerders/overzicht-netbeheerders/>.
- Agentschap NL. "Annual Report 2009 SDE and MEP." Ministry of Economic Affairs, 2010.
- . "Annual Report 2010 SDE and MEP." Ministry of Economic Affairs, 2011.
- . "Annual Report 2011 SDE+ SDE and MEP," 2012.
- . "Annual Report 2012 SDE+, SDE and MEP." Ministry of Economic Affairs, 2013.
- . "Innovatiekrediet Jaarverslag 2009," 2010.
- . "Innovatiekrediet Jaarverslag 2010," 2011.
- . "Innovatiekrediet Jaarverslag 2011," 2012.
- . "Innovatiekrediet Jaarverslag 2012," 2013.
- . "Monitor Publiek Gefinancierd Energieonderzoek 2012: Zicht Op Bestedingen, Thema's, En Trends," August 2013.
- Ahmed, Ghada, Ajmal Abdulsamad, and Gary Gereffi. "US Coal and the Technology Innovation Frontier: What Role Does Coal Play in Our Energy Future?" Duke University: Center on Globalization, Governance, & Competitiveness, 2013.
- Alba, Eleodoro Mayorga, and E. March. "Extractive Industries Value Chain." *A Framework for Managing Non-Renewable Resources: Do Local/Subnational Priorities Really Matter*, 2009. <http://www.eisourcebook.org/cms/media/eivaluechain.pdf>.
- Algemene Rekenkamer. "A Gas Hub: Benefits, Needs, and Risks." Algemene Rekenkamer, 2012.
- . "Evaluatierapport Belastinguitgaven Op Het Terrein van de Accijnzen," 2008. http://www.rekenkamer.nl/Publicaties/Onderzoeksrapporten/Introducties/2010/05/Inzicht_in_belastinguitgaven_specifieke_uitkeringen_en_subsidies/Belastinguitgaven/Evaluaties/Evaluatierapport_belastinguitgaven_op_het_terrein_van_de_accijnzen:4710.
- . "Rapport Besteding van Aardgasbaten Feiten Cijfers En Scenario's." Algemene Rekenkamer, 2014.
- . "Subsidie Regelingen Duurzame Energieproductie (MEP En SDE): Terugblik 2010 Op Subsidieregeling 'Milieukwaliteit Elektriciteitsproductie' (MEP)," March 25, 2010.
- Alliander. "Aandeelhouders | Alliander." Accessed January 27, 2017. <https://www.alliander.com/nl/over-alliander/corporate-governance/aandeelhouders>.
- . "Alliander: Annual Report 2015," 2015.
- Amelung, Bas. "'Nieuwe Megasluis IJmuiden Is Groot Risico Voor Amsterdam' - Opinie - PAROOL." *Het Parool*, September 9, 2016. <http://www.parool.nl/opinie/-nieuwe-megasluis-ijmuiden-is-groot-risico-voor-amsterdam~a4373604/>.
- Avelino, Flor, and Julia M. Wittmayer. "Shifting Power Relations in Sustainability Transitions: A Multi-Actor Perspective." *Journal of Environmental Policy & Planning* 18, no. 5 (October 19, 2016): 628–49. doi:10.1080/1523908X.2015.1112259.

- Baker, Lucy, Peter Newell, and Jon Phillips. "The Political Economy of Energy Transitions: The Case of South Africa." *New Political Economy* 19, no. 6 (November 2, 2014): 791–818. doi:10.1080/13563467.2013.849674.
- Belastingdienst. "Kolenbelasting." Algemeen. Accessed December 13, 2016. http://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/kolenbelasting/.
- . "Levering en bevoorrading van zeeschepen en vliegtuigen." Algemeen. Accessed January 25, 2017. http://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/btw/tarieven_en_vrijstellingen/goederen_0_btw/levering_en_bevoorrading_van_zeeschepen_en_vliegtuigen.
- . "Tabellen tarieven milieubelastingen." Tabel. Accessed January 24, 2017. http://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/tarieven_milieubelastingen/tabellen_tarieven_milieubelastingen.
- . "Tarieven Accijns En Verbruiksbelastingen." Accessed March 3, 2017. https://download.belastingdienst.nl/douane/docs/tarievenlijst_accijns_acc0552z74fol.pdf.
- . "Vrijstelling van Kolenbelasting." Accessed March 6, 2017. https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/kolenbelasting/vrijstelling_van_kolenbelasting.
- Bergh, J. C. J. M. van den. "Policies to Enhance Economic Feasibility of a Sustainable Energy Transition." *Proceedings of the National Academy of Sciences* 110, no. 7 (February 12, 2013): 2436–37. doi:10.1073/pnas.1221894110.
- Blom, Martijn, Cor Leguijt, Arno Schroten, Stephan Slingerland, and Koen Rademaekers. "Review Topsector Energie: Deelonderzoek 1," n.d.
- Blommaert, M.F, A.C.F van Galen, and B Bruin. "Deelnemingen: Overzicht En Inzicht." Rekenkamer Zeeland, 2014.
- BMD Advies. "Monitoringrapport Haven-En Industrierrein Moerdijk: 2012," December 2013.
- Boots, Maroeska. "The Dutch Electricity Value Chain." KEMA, 2011.
- Bosman, Rick, Derk Loorbach, Niki Frantzeskaki, and Till Pistorius. "Discursive Regime Dynamics in the Dutch Energy Transition." *Environmental Innovation and Societal Transitions* 13 (December 2014): 45–59. doi:10.1016/j.eist.2014.07.003.
- BOVAG. "6.3 Aantal En Marktaandeelen Nederlandse Tankstations." *Mobiliteit in Cijfers Auto 2015*. Accessed February 6, 2017. <http://bovagrai.info/auto/2015/brandstoffen/6-3-aantal-en-marktaandeelen-nederlandse-tankstations/>.
- BOVAG-RAI Mobiliteit. "Mobiliteit in Cijfers Auto's 2013 - 2014," 2015. <http://www.bovagrai.info/auto/2013/7.2.html>.
- . "Mobiliteit in Cijfers Auto's 2016-2017: 7.2 Rijksinkomsten Aan Verkeersbelastingen." *Mobiliteit in Cijfers Auto 2016*, 2017. <http://bovagrai.info/auto/2016/fiscale-betekenis/7-2-rijksinkomsten-aan-verkeersbelastingen/>.
- . "Mobility in Figures Car's 2015-2016: 7.2 Central Government Revenue from Vehicle-Related Duties." *Mobiliteit in Cijfers Auto 2015*, 2016. <http://bovagrai.info/auto/2015/en/7-fiscal-significance/7-2-central-government-revenue-from-vehicle-related-duties/>.
- Bruyn, Sander de, Ellen Schep, and Sofia Cherif. "Calculation of Additional Profits of Sectors and Firms from the EU ETS." CE Delft, March 2016.
- Bruyn, Sander de, Ellen Schep, Sofia Cherif, and Thomas Huigen. "Calculation of Additional Profits of Sectors and Firms from the EU ETS 2008-2015." CE DELFT, December 2016.
- Buck, Ab de, Sebastiaan Hers, Maarten Afman, Harry Croezen, Frans Rooijers, Wim van der Veen, Pieter van der Wijk, and Thijs Slot. "Toekomst Warmtekrachtkoppeling En Warmtevoorziening Industrie En Glastuinbouw." CE DELFT & DNV GL, October 2014.

- Buck, Ab de, Martine Smit, Jasper Faber, and Anouk van Grinsven. "CE Delft - Blends in Beeld: Een Analyse van de Bunkerolieketen." CE Delft, May 2011.
- Carbon Market Watch. "Industry Windfall Profits from EUs Carbon Market 2008-2015: How Energy Intensive Companies Cash in on Their Pollution at Taxpayers Expense," November 2016.
- CBS. "Aardgas voor bijna 80 procent op." Webpagina. Accessed November 4, 2016.
<https://www.cbs.nl/nl-nl/nieuws/2016/37/aardgas-voor-bijna-80-procent-op>.
- . "Bijna 3 miljard euro begrotingsoverschot in 2016." Webpagina. Accessed April 5, 2017.
<https://www.cbs.nl/nl-nl/nieuws/2017/12/bijna-3-miljard-euro-begrotingsoverschot-in-2016>.
- . "CBS StatLine - Aardgas- En Aardoliereserves; Nationale Rekeningen." Accessed December 1, 2016.
<http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=82539ned&D1=a&D2=a&VW=T>.
- . "CBS StatLine - Aardgas En Elektriciteit, Gemiddelde Prijzen van Eindverbruikers." Accessed March 6, 2017.
<http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=81309NED&D1=10-15&D2=a&D3=l&D4=34,39,44&HDR=T&STB=G2,G3,G1&VW=T>.
- . "CBS StatLine - Aardgasbalans; Aanbod En Verbruik." Accessed November 4, 2016.
<http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=00372&D1=1-2,8-14&D2=0-35,52,69,86,103,120,137,154,171,188,205,222,239,256,273,290,307,324,341,358,375,392,409,426,443,460,477,494,511,528,545,562,579,596,605,613,616,618-620,l&HDR=G1&STB=T&VW=G>.
- . "CBS StatLine - Aardoliegrondstoffenbalans; Aanbod, Verbruik En Voorraad." Accessed November 4, 2016.
<http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=83325ned&D1=1-2,9-10&D2=1,l&D3=0&D4=0-68,85,102,111,119,122,124-126,l&HDR=G1,G2,G3&STB=T&VW=T>.
- . "CBS StatLine - Energiebalans; Kerncijfers," 2016.
<http://statline.cbs.nl/statweb/publication/?dm=slnl&pa=37281>.
- . "CBS StatLine - Energieverbruik Huishoudens; Energiedragers." Accessed March 14, 2017.
<http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=82375NED&D1=0&D2=a&D3=35-40&HDR=T,G1&STB=G2&VW=T>.
- . "CBS StatLine - Motorbrandstoffen; Afzet in Petajoule, Gewicht En Volume." Accessed January 24, 2017.
<http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=83406ned&D1=0-3,8,11-18,21,25-29,34,37-43,46-52,57&D2=a&D3=54-66,83,100,113,117,124,126-128,l&HDR=G1,G2&STB=T&VW=T>.
- . "CBS StatLine - Overheid; Inkomsten En Uitgaven," September 23, 2016.
<http://statline.cbs.nl/statweb/publication/?dm=slnl&pa=82563ned>.
- . "CBS StatLine - Overheidsbalans; Activa En Passiva." Accessed November 29, 2016.
<http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=82790ned>.
- . "CBS StatLine - Steenkoolbalans; Aanbod En Verbruik." Accessed February 7, 2017.
<http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=37621&D1=a&D2=169,186,203,220,237,254,271,288,305,322,339,356,373,390,407,418,420-421,424,435,437-438&HDR=G1&STB=T&CHARTTYPE=1&VW=T>.
- . "Heffingen op energiedragers." Webpagina. Accessed January 25, 2017.
<https://www.cbs.nl/nl-nl/onze-diensten/methoden/onderzoeksomschrijvingen/korte-onderzoeksbeschrijvingen/heffingen-op-energiedragers>.
- . "Waardevermindering gasreserve maakt overheid armer." Webpagina. Accessed September 2, 2016. <https://www.cbs.nl/nl-nl/nieuws/2016/29/waardevermindering-gasreserve-maakt-overheid-armer>.

- CBS Statline. "CBS StatLine - Hernieuwbare Elektriciteit; Productie En Vermogen," February 28, 2017. <http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=82610NED&D1=a&D2=0-2,5-10&D3=a&VW=T>.
- . "CBS StatLine - Hernieuwbare Energie; Verbruik Naar Energiebron, Techniek En Toepassing," December 21, 2016. <http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=83109NED&D1=0-1&D2=0-2,5,11,18-22,28-30,35&D3=a&D4=24-25&HDR=T,G2&STB=G1,G3&VW=T>.
- "CBS StatLine - Elektriciteit En Warmte; Productie En Inzet Naar Energiedrager." Accessed February 14, 2017. <http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=80030NED&D1=a&D2=a&D3=a&D4=14-17&HDR=T&STB=G1,G2,G3&VW=T>.
- "CBS StatLine - Milieubelastingen En -Heffingen; Nationale Rekeningen." Accessed February 9, 2017. <http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=82725NED&D1=0-1,4-5,8-12,14&D2=0-1,4-5,12-14,16-17,26,59-60&D3=5-20&HDR=T&STB=G2,G1&VW=T>.
- "CBS StatLine - Overheid; Ontvangen Belastingen." Accessed February 9, 2017. <http://statline.cbs.nl/statweb/publication/?dm=slnl&pa=82569ned>.
- CLO. "CO₂-Uitstoot Nederlandse Deelnemers EU ETS | Compendium Voor de Leefomgeving." Accessed March 6, 2017. <http://www.clo.nl/indicatoren/nl0584-ets-emissies-kooldioxide>.
- . "Inzet Energiedragers En Bruto Elektriciteitsproductie, 1995-2014 | Compendium Voor de Leefomgeving." Accessed February 14, 2017. <http://www.clo.nl/indicatoren/nl0019-inzet-energiedragers-en-bruto-elektriciteitsproductie>.
- Cogas Infra en Beheer. "Cogas Infra En Beheer: Annual Report 2015," 2015.
- COVA. "About COVA | Cova." Accessed January 6, 2017. <http://www.cova.nl/about-cova/?lang=en>.
- CPB and partners. "A Study on R&D Tax Incentives: Final Report." European Commission, 2014.
- Dana Petroleum. "At a Glance." *Dana Petroleum*. Accessed November 28, 2016. <http://www.dana-petroleum.com/understanding-dana/at-a-glance/>.
- DB Cargo AG. "Connecting Europe to the World | DB Cargo AG." Accessed December 13, 2016. http://www.dbcargo.com/rail-deutschland-en/company/dbcargo-group/DBCargo_group_all/10276704/profilenederland.html?start=0.
- Decisio. "Monitor Publiek Gefinancierd Energieonderzoek 2009: Zicht Op Bestedingen, Thema's, En Trends," October 25, 2010.
- . "Monitor Publiek Gefinancierd Energieonderzoek 2010: Zicht Op Bestedingen, Thema's, En Trends," October 3, 2011.
- DELTA. "Aandeelhouders | DELTA." Accessed January 26, 2017. <https://www.delta.nl/over-delta/bestuur/aandeelhouders>.
- . "DELTA Annual Report 2006," 2007.
- . "DELTA Annual Report 2007," 2008.
- . "DELTA Annual Report 2008," 2009.
- . "DELTA Annual Report 2009," 2010.
- . "DELTA Annual Report 2010," 2011.
- . "DELTA Annual Report 2011," 2012.
- . "DELTA Annual Report 2012," 2013.
- . "DELTA Annual Report 2013," 2014.
- . "DELTA Annual Report 2014," 2015.
- Delta. "DELTA Annual Report 2015," 2016.
- DPO. "Pipeline Network - DPO – Defensie Pijpleiding Organisatie." Accessed December 14, 2016. <https://defensiepijpleidingorganisatie.nl/en/about-dpo/pipeline-network>.
- Drijver, Jeroen, Nathalie van Haren, Remi Kempers, Victor de Lange, Paul Wolvekamp, and Katelijne van Wensen. "Annexes for: 'Nederland Duurzaam Distributieland': de Nederlandse Zeehavens En Hun Mogelijke Bijdragen Aan Verduurzaming van Productieketens." Both ENDS & CREM, 2011.

- EBN. "EBN Energie Infographic 2016." Accessed February 14, 2017. <https://www.ebn.nl/wp-content/uploads/2016/12/EBN-Energie-Infographic-2016.pdf>.
- . "Focus on Dutch Oil and Gas: 2013," 2014.
- . "Focus on Dutch Oil and Gas: 2015," 2016.
- . "Netherlands Masterplan for Decommissioning and Re-Use," 2016.
- . "Ombouw Nederlandse Gasmarkt Vanaf 2030." *EBN*, August 26, 2015. <https://www.ebn.nl/ombouw-nederlandse-gasmarkt-vanaf-2030/>.
- . "Technische Kennis & Studies." *EBN*. Accessed March 30, 2017. <https://www.ebn.nl/technische-kennis-en-studies/>.
- ECN. "Biomassa: Lopende Projecten." *ECN*. Accessed March 29, 2017. <https://www.ecn.nl/nl/expertises/biomassa/lopende-projecten/>.
- . "ECN Energy Efficiency: Current Projects." *ECN*. Accessed March 29, 2017. <https://www.ecn.nl/expertise/energy-efficiency/current-projects/>.
- ECN, PBL, CBS, and RVO. "Nationale Energie Verkenning 2016," 2016.
- Edelmann, David. *Analysing and Managing the Political Dynamics of Sector Reforms: A Sourcebook on Sector-Level Political Economy Approaches*. London: Overseas Development Institute, 2009. <http://www.odi.org.uk/resources/download/4323.pdf>.
- EDGaR. "A European Research Institute for Gas and Energy Innovation." *EDGaR: Energy Delta Gas Research*. Accessed March 29, 2017. <http://www.edgar-program.com/news/a-european-research-institute-for-gas-and-energy-innovation>.
- . "Projects." *EDGaR: Energy Delta Gas Research*. Accessed March 29, 2017. <http://www.edgar-program.com/projects>.
- Enduris. "Enduris: Annual Report 2015," 2015.
- Eneco. "Aandeelhouders - Eneco Over Ons." Accessed January 27, 2017. <https://www.eneco.nl/over-ons/organisatie/aandeelhouders/>.
- . "Eneco Annual Report 2007," 2008.
- . "Eneco Annual Report 2008," 2009.
- . "Eneco Annual Report 2009," 2010.
- . "Eneco Annual Report 2010," 2011.
- . "Eneco Annual Report 2011," 2012.
- . "Eneco Annual Report 2012," 2013.
- . "Eneco Annual Report 2014," 2015.
- . "Eneco Annual Report 2015," 2016.
- . "Jaarverslag 2005." Accessed February 23, 2017. <http://www.shareholder.com/visitors/dynamicdoc/document.cfm?documentid=1096&companyId=Eneco&Pin=534288222>.
- . "Jaarverslag 2006." Accessed February 23, 2017. <http://www.shareholder.com/visitors/dynamicdoc/document.cfm?documentid=1433&companyId=ENECO>.
- Energie Beheer Nederland (EBN). "Focus on Dutch Oil & Gas 2016." *EBN*, 2016.
- . "Jaarverslag 2015," n.d.
- . "Jaarverslag 2016," 2017.
- Energy Academy Europe. "Energy Academy Europe: Annual Report 2015," n.d.
- Energy Academy Europe, Astrid. "ESTRAC – Energy Systems Transition Centre | Energy Academy Europe." Accessed March 29, 2017. <http://www.energyacademy.org/project/estrac/>.
- Enexis. "Enexis Annual Report: 2015," 2015.
- ENGIE E&P Nederland B.V. "Offshore Pipelines." Accessed January 10, 2017. <https://www.engie-ep.nl/en/activities/offshore-pipelines>.
- EnTranCe. "Partners | EnTranCe." Accessed March 29, 2017. <http://en-tran-ce.org/for-partners/>.
- . "Projects | EnTranCe." Accessed March 29, 2017. <http://en-tran-ce.org/ourprojectsandpartners/>.

- EurActiv.com. "The Brief: Beware of White Elephants." *EurActiv.com*, February 17, 2017. <https://www.euractiv.com/section/energy/news/the-brief-beware-of-white-elephants/>.
- European Commission. "2050 Energy Strategy - Energy - European Commission." *Energy*. Accessed April 19, 2017. </energy/en/topics/energy-strategy-and-energy-union/2050-energy-strategy>.
- . "37420 51..51 - LexUriServ.do." Accessed February 3, 2017. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:283:0051:0070:EN:PDF>.
- . "Auctioning." Text. *Climate Action - European Commission*, November 23, 2016. https://ec.europa.eu/clima/policies/ets/auctioning_en.
- . "Research Fund for Coal and Steel (RFCS) - Research & Innovation - Key Enabling Technologies - European Commission." Accessed April 18, 2017. http://ec.europa.eu/research/industrial_technologies/rfcs_en.html.
- European Investment Bank. "Shareholders." Accessed January 23, 2017. <http://www.eib.org/about/governance-and-structure/shareholders/index.htm>.
- Eurostat. "Energy from Renewable Sources - Statistics Explained," 2017. http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_from_renewable_sources.
- "Feiten En Cijfers SDE(+) | RVO.nl." Accessed February 27, 2017. <http://www.rvo.nl/subsidies-regelingen/sde/feiten-en-cijfers>.
- Financieel Dagblad. "Delta Verkoopt Retailtak Aan Private Equity." *Fd.nl*. Accessed February 21, 2017. <https://fd.nl/ondernemen/1178578/delta-verkoopt-retailtak-aan-private-equity>.
- . "Gemeente Rotterdam Wil Belang in Eneco Verkopen." *Fd.nl*. Accessed April 3, 2017. <https://fd.nl/ondernemen/1191770/gemeente-rotterdam-wil-belang-in-eneco-verkopen>.
- . "Staat Grijpt in Op Schiphol." *Fd.nl*. Accessed April 4, 2017. <https://fd.nl/economie-politiek/1104509/staat-grijpt-in-op-schiphol>.
- Fluxenergie. "FluxEnergie: 'Gaswinning Moet Toch Naar 12 Mrd m3 En Niet Naar 24 Mrd m3' -." *FluxEnergie*, July 22, 2016. <http://www.fluxenergie.nl/gaswinning-moet-toch-naar-12-mrd-m3-en-naar-23-mrd-m3/>.
- Frontier Economics. "Pricing of Wholesale Gas in the Netherlands: A Final Report Prepared for NMA," October 2008.
- . "Scenarios for the Dutch Electricity Supply System: A Report Prepared for the Dutch Ministry of Economic Affairs," September 2015.
- Gastel, Marcel van, Geert van Maanen, and Wim Kuijken. "Onderzoek toekomst governance gasgebouw." ABDTOPConsult, August 2014.
- Gasterra. "From L-Gas to H-Gas." *GasTerra*, August 24, 2015. <http://www.gasterra.nl/en/news/from-l-gas-to-h-gas>.
- GasTerra. "GasTerra: Annual Report 2009," 2009.
- . "GasTerra: Annual Report 2011," 2011.
- . "GasTerra: Annual Report 2012," 2012.
- . "GasTerra: Annual Report 2013," 2013.
- . "GasTerra: Annual Report 2014," 2014.
- . "GasTerra: Annual Report 2015," 2015.
- Gasunie. "Gasunie: Annual Report 2004," 2005.
- . "Gasunie: Annual Report 2005," 2006.
- . "Gasunie: Annual Report 2006," 2007.
- . "Gasunie: Annual Report 2008," 2009.
- . "Gasunie: Annual Report 2009," 2010.
- . "Gasunie: Annual Report 2010," 2011.
- . "Gasunie: Annual Report 2011," 2011.
- . "Gasunie: Annual Report 2012," 2013.
- . "Gasunie: Annual Report 2013," 2014.
- . "Gasunie: Annual Report 2014," 2015.

- . “Gasunie: Annual Report 2015,” 2016.
- . “Gasunie: Annual Report 2016,” March 31, 2017.
- . “Nederlandse Gasunie Gesplitst » N.V. Nederlandse Gasunie.” Accessed January 11, 2017. <https://www.gasunie.nl/nieuws/nederlandse-gasunie-gesplitst?page=26>.
- . “TTF › Gasunie Transport Services.” Accessed February 2, 2017. <https://www.gasunietransportservices.nl/en/shippers/products-and-services/ttf>.
- “Gasunie Unit Converter.” Accessed January 18, 2017. <https://unit-converter.gasunie.nl/>.
- Geels, Frank W. “Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective.” *Theory, Culture & Society* 31, no. 5 (September 1, 2014): 21–40. doi:10.1177/0263276414531627.
- . “Technological Transitions as Evolutionary Reconfiguration Processes: A Multi-Level Perspective and a Case-Study.” *Research Policy* 31, no. 8 (2002): 1257–1274.
- . “The Multi-Level Perspective on Sustainability Transitions: Responses to Seven Criticisms.” *Environmental Innovation and Societal Transitions* 1, no. 1 (June 2011): 24–40. doi:10.1016/j.eist.2011.02.002.
- GIIGNL. “The LNG Industry: GIIGNL Annual Report 2015 Edition,” 2015.
- . “The LNG Industry: GIIGNL Annual Report 2016 Edition,” 2016.
- GR GSP. “Programmaverantwoording En Jaarstukken 2014 GR Havenschap Groningen Seaports,” 2014.
- GR ZSP. “GR Zeeland Seaports: Annual Report 2014,” 2014.
- Groningen Seaports. “Business - Groningen Seaports.” Accessed October 31, 2016. <http://www.groningen-seaports.com/en-us/business.aspx>.
- . “Groningen Seaports: Annual Report 2011,” 2012.
- . “Groningen Seaports: Annual Report 2012,” 2013.
- . “Groningen Seaports: Annual Report 2013,” 2014.
- . “Groningen Seaports: Annual Report 2014,” 2015.
- . “Groningen Seaports: Annual Report 2015,” 2016.
- . “Groningen Seaports: Annual Report 2015,” 2016.
- . “Groningen Seaports: Facts & Figures 2010,” 2011.
- . “Groningen Seaports: Facts & Figures 2012,” 2013.
- . “Groningen Seaports: Facts & Figures 2013,” 2014.
- . “Groningen Seaports: Facts & Figures 2014,” 2015.
- . “Groningen Seaports: Facts & Figures 2015,” 2016.
- . “Selectielijst Voor Archiefbescheiden van de Overheids-NV Groningen Seaports En Taakvoorgangers: 1997 - Heden.” *Staatscourant*, July 21, 2015. <http://www.nationaalarchief.nl/waardering-selectie/selectielijsten/selectielijst-archiefbescheiden-overheids-nv-groningen-seaports-taakvoorgangers-peri>.
- Groninger Internet Courant. “Eerste Kolenschip Meert Aan in Eemshaven.” Accessed October 31, 2016. <http://www.gic.nl/economie/eerste-kolenschip-meert-aan-in-eemshaven>.
- Groninger Krant. “Gemeente Loppersum Stelt Voor Belastingen Te Verhogen.” *Groninger Krant*, October 7, 2016. <http://www.groningerkrant.nl/2016/10/gemeente-loppersum-stelt-belastingen-verhogen/>.
- Gunvor group. “GUNVOR ACQUIRES ROTTERDAM REFINERY | Gunvor Group.” Accessed January 12, 2017. <http://gunvorgroup.com/news/gunvor-acquires-rotterdam-refinery/>.
- IEA. “IEA - Unit Converter.” Accessed March 14, 2017. <https://www.iea.org/statistics/resources/unitconverter/>.
- . “IEA Sankey Diagram.” Accessed November 11, 2016. <http://www.iea.org/sankey/#?c=Netherlands&s=Balance>.
- . “Natural Gas Information 2016,” 2016.
- . “Oil Information 2016,” 2016.

- . “The Netherlands 2014 Review.” *Energy Policies of IEA Countries*. International Energy Agency (IEA), 2014.
- International Energy Agency (IEA). “Coal Information 2016.” IEA, 2016.
- Investico. “Overzicht: Wat Ontvingen de Overheden?” *Investico*, 2016. <http://www.platform-investico.nl/artikel/hoeveel-geld-werd-er-verdiend/>.
- Janssen, Hans. “Dutch Offshore Infrastructure Optimization Project (DOMINO).” presented at the Loyens & Loeff Oil & Gas seminar, Rotterdam, November 10, 2016.
- Jong, Onno de, Bart Kuipers, Larissa van der Lugt, Marten van den Bossche, Marjan van Schijndel, and Johan Gille. “Analyse Invoering Vpb-Plicht Nederlandse Zeehavens.” Erasmus Universiteit Rotterdam & Ecorys Nederland B.V, 2016.
- Kern, Florian, and Adrian Smith. “Restructuring Energy Systems for Sustainability? Energy Transition Policy in the Netherlands.” *Energy Policy* 36, no. 11 (November 2008): 4093–4103. doi:10.1016/j.enpol.2008.06.018.
- KLM group. “KLM Annual Report 2008,” 2009.
- . “KLM Annual Report 2009,” 2010.
- . “KLM Annual Report 2010,” 2011.
- . “KLM Annual Report 2011,” 2012.
- . “KLM Annual Report 2012,” 2013.
- . “KLM Annual Report 2014,” 2015.
- . “KLM Annual Report 2015,” 2016.
- Kojima, Masami, and Doug Koplow. “Fossil Fuel Subsidies,” 2015. <http://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-7220>.
- Korteland, Marisa, and Jasper Faber. “Estimated Revenues of VAT and Fuel Tax on Aviation.” CE Delft, July 2013.
- Loorbach, Derk. “To Transition! Governance Penarchy in the New Transformation.” presented at the Inaugural Address, Erasmus University Rotterdam, October 31, 2014. http://www.transitiefocus.com/wp-content/uploads/2014/11/To_Transition-Loorbach-2014.pdf.
- LSNed. “Facts & Figures.” *LSNed*. Accessed January 23, 2017. <http://lsned.nl/facts-figures-2/>.
- Markard, Jochen, Rob Raven, and Bernhard Truffer. “Sustainability Transitions: An Emerging Field of Research and Its Prospects.” *Research Policy* 41, no. 6 (July 2012): 955–67. doi:10.1016/j.respol.2012.02.013.
- “Massive Russian Rotterdam Oil Storage Project Cancelled.” *DutchNews.nl*, July 16, 2015. <http://www.dutchnews.nl/news/archives/2015/07/massive-russian-rotterdam-oil-storage-project-cancelled/>.
- Meadowcroft, James. “What about the Politics? Sustainable Development, Transition Management, and Long Term Energy Transitions.” *Policy Sciences* 42, no. 4 (November 2009): 323–40. doi:10.1007/s11077-009-9097-z.
- MIF. “Investing in Innovation - Mainport Innovation Fund II.” Accessed March 27, 2017. <http://www.mainportinnovationfund.nl/>.
- Ministerie van Economische Zaken. “Over ons - Nationaal Coördinator Groningen.” Webpagina, 2017. <https://www.nationaalcoördinatorgroningen.nl/over-ons>.
- Ministerie van Infrastructuur en Milieu. “Reactie Op de Moties Naar Aanleiding van Het Debat over Het Vervallen van de Vrijstelling van Vennootschaps- Belasting Voor de Nederlandse Zeehavens (TK 34003, Nrs. 18, 19 En 23),” September 14, 2016.
- Ministry of Economic Affairs. “Akzo Nobel in Twente onder verscherpt toezicht SodM - Nieuwsbericht - Staatstoezicht op de Mijnen.” Nieuwsbericht, September 9, 2016. <https://www.sodm.nl/actueel/nieuws/2016/09/09/akzo-nobel-in-twente-onder-verscherpt-toezicht-sodm>.
- . “Annual Report SDE+ SDE and MEP: 2011,” 2012.

- . “Instemmingsbesluit Winningsplan Groningenveld,” 2016.
https://www.rvo.nl/sites/default/files/2016/09/Instemmingsbesluit_wipla_Groningen_def_OCR.pdf.
- . “Kamerbrief Bij-En Meestook van Biomassa in Kolencentrales,” January 23, 2015.
- . “Kamerbrief ‘Gaswinning In Groningen,’” January 17, 2014.
<https://www.rijksoverheid.nl/documenten/kamerstukken/2014/01/17/gaswinning-in-groningen>.
- . “Kamerbrief ‘Inkomsten Uit Groningen Gas,’” February 5, 2014.
- . “Kamerbrief: Stand van Zaken-Hernieuwbare Energieproductie,” January 27, 2017.
- . “Oil - Energy Policy - Government.nl.” Onderwerp, November 21, 2011.
<https://www.government.nl/topics/energy-policy/contents/oil>.
- . “Opslagvergunning Bergermeer.” Officiële publicatie. Accessed January 6, 2017.
<https://zoek.officielebekendmakingen.nl/stcrt-2007-7-p9-SC78819.html?zoekcriteria=%3Fzkt%3DEenvoudig%26vrt%3Dstcrt%2B2007%2B7&resultIndex=1&sorttype=1&sortorder=4>.
- . “Regeling van de Minister van Economische Zaken van 17 Oktober 2013, Nr. WJZ / 13047307, Tot Wijziging van de Subsidieregeling Energie En Innovatie in Verband Met Energiebesparing Door Ondernemingen Die Worden Blootgesteld Aan Een CO2-Weglekrisico Als Gevolg van Doorberekende EU-ETS-Kosten,” October 31, 2013.
<https://zoek.officielebekendmakingen.nl/stcrt-2013-29895.html>.
- . “Rijksoverheid stimuleert innovatie - Ondernemen en innovatie - Rijksoverheid.nl.” Onderwerp, February 8, 2011. <https://www.rijksoverheid.nl/onderwerpen/ondernemen-en-innovatie/inhoud/rijksoverheid-stimuleert-innovatie>.
- Ministry of Economic Affairs, Ministerie van Economische. “Energie Agenda 2016,” 2016.
- Ministry of Finance. “Jaarverslag Beheer Staatsdeelnemingen 2012,” 2013.
- . “Jaarverslag Beheer Staatsdeelnemingen 2014,” 2015.
- . “Jaarverslag Beheer Staatsdeelnemingen 2015,” 2016.
- . “Welke belastingen heft de overheid over benzine en diesel? - Vraag en antwoord - Rijksoverheid.nl.” Onderwerp, January 15, 2014.
<https://www.rijksoverheid.nl/onderwerpen/accijns/vraag-en-antwoord/welke-belastingen-heft-de-overheid-over-benzine-en-diesel>.
- Ministry of General Affairs. “Betaal ik btw over mijn energiebelasting? - Vraag en antwoord - Rijksoverheid.nl.” Onderwerp, December 11, 2012.
<https://www.rijksoverheid.nl/onderwerpen/btw-omzetbelasting/vraag-en-antwoord/betaal-ik-btw-over-mijn-energiebelasting>.
- . “Energiebelasting - Milieubelastingen - Rijksoverheid.nl.” Onderwerp, March 23, 2015.
<https://www.rijksoverheid.nl/onderwerpen/milieubelastingen/inhoud/energiebelasting>.
- Ministry of the Interior and Kingdom Relations. “Mijnbouwwet.” Wet. Accessed November 17, 2016.
<http://wetten.overheid.nl/BWBR0014168/2016-05-01#Hoofdstuk1>.
- . “Wet tot veiling van bepaalde verkooppunten van motorbrandstoffen.” Wet. Accessed February 6, 2017. <http://wetten.overheid.nl/BWBR0018447/2005-07-31>.
- . “Wet voorraadvorming aardolieproducten 2012.” Wet. Accessed January 6, 2017.
<http://wetten.overheid.nl/BWBR0032775/2013-04-01>.
- Moe, Espen. “Energy, Industry and Politics: Energy, Vested Interests, and Long-Term Economic Growth and Development.” *Energy* 35, no. 4 (April 2010): 1730–40.
doi:10.1016/j.energy.2009.12.026.
- . *Renewable Energy Transformation or Fossil Fuel Backlash: Vested Interested in the Political Economy*. Energy, climate and environment. Palgrave Macmillan, 2015.
- Moncrieffe, Joy, and Cecilia Luttrell. “An Analytical Framework for Understanding the Political Economy of Sectors and Policy Arenas.” *ODI, London*, 2005.
<http://www.academia.edu/download/32315798/2989.pdf>.

- Mulder, Machiel, Marisa Korteland, and Martijn Blom. "Overwinsten Bij de Subsidieregeling Milieukwaliteit Elektriciteits Productie (MEP)." CE Delft, April 2007.
- Municipality of Amsterdam. "Annual Report: 2003," 2004.
- . "Annual Report: 2004," 2005.
- . "Annual Report: 2005," 2006.
- . "Annual Report: 2006," 2007.
- . "Annual Report: 2007," 2008.
- . "Annual Report: 2008," 2009.
- . "Annual Report: 2009," 2010.
- . "Annual Report: 2010," 2011.
- . "Annual Report: 2011," 2012.
- . "Annual Report: 2012," 2013.
- . "Municipality of Amsterdam: Annual Report 2015," 2015.
- Municipality of Borsele. "Municipality of Borsele: Annual Report 2015," 2015.
- Municipality of Delfzijl. "Municipality of Delfzijl: Annual Report 2015," 2015.
- Municipality of Eemsmond. "Municipality of Eemsmond: Annual Report 2014," 2014.
- Municipality of Rotterdam. "Algemene Dekkingsmiddelen • Jaarstukken 2015 Rotterdam," 2016. <http://jaarstukken2015.rotterdam.nl/p89264/algemene-dekkingsmiddelen>.
- . "Leningverstrekking • Jaarstukken 2015 Rotterdam." Accessed October 24, 2016. <http://jaarstukken2015.rotterdam.nl/p89305/leningverstrekking?search=havenbedrijf>.
- Municipality of Terneuzen. "Municipality of Terneuzen: Annual Report 2015," 2015.
- Municipality of the Hague. "The Hague Annual Report 2015," 2016.
- Municipality of Vlissingen. "Municipality of Vlissingen: Annual Report 2015," 2015.
- NAM. "Gas- En Oliewinning | NAM." Accessed November 25, 2016. <http://www.nam.nl/feiten-en-cijfers/gaswinning.html#iframe-L2VtYmVkl2NvbXBvbmVudC8/aWQ9Z2Fzd2lubmluZw==>.
- NATO. "Central Europe Pipeline System (CEPS)." NATO. Accessed December 15, 2016. http://www.nato.int/cps/en/natohq/topics_49151.htm.
- NCG. "Kwartaalrapportage Juli- September 2016," October 2016.
- Nederlandse Emissieautoriteit. "Verplichtingen HEV - Onderwerp - Nederlandse Emissieautoriteit." Onderwerp, February 5, 2015. <https://www.emissieautoriteit.nl/onderwerpen/verplichting-hev>.
- NLOG. "Kaart Velden | NLOG." Accessed April 5, 2017. <http://www.nlog.nl/kaart-velden>.
- NOVE. "Feiten En Cijfers." Accessed January 24, 2017. <http://www.nove.nl/feiten-en-cijfers>.
- NUON Energy. "NUON Energy N.V Annual Report 2015," 2016.
- OECD. "Fossil Fuel Support - NLD." Accessed November 28, 2016. http://stats.oecd.org/Index.aspx?DataSetCode=FFS_NLD#.
- . "Fossil Fuel Support Country Note: The Netherlands," September 2016. <http://www.oecd.org/site/tadffss/data/>.
- . "OECD - IEA Fossil Fuel Support and Other Analysis - Data." Accessed November 11, 2016. <http://www.oecd.org/site/tadffss/data/>.
- . *OECD Companion to the Inventory of Support Measures for Fossil Fuels 2015*. OECD Publishing, 2015. http://www.oecd-ilibrary.org/energy/oecd-companion-to-the-inventory-of-support-measures-for-fossil-fuels-2015_9789264239616-en.
- Onderzoeksraad voor Veiligheid. "Aardbevingsrisico's in Groningen: Onderzoek Naar de Rol van Veiligheid van Burgers in de Besluitvorming over Gaswinning (1959 -2014)," February 2015.
- Phelan, Liam, Ann Henderson-Sellers, and Ros Taplin. "The Political Economy of Addressing the Climate Crisis in the Earth System: Undermining Perverse Resilience." *New Political Economy* 18, no. 2 (April 2013): 198–226. doi:10.1080/13563467.2012.678820.
- Pickard, Sam, and Laurie van der Burg. "G20 Subsidies to Oil, Gas and Coal Production: United Kingdom," 2015. <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9977.pdf>.

- Plant One Rotterdam. "Projecten » Plant One Rotterdam." Accessed March 30, 2017.
http://www.plantone-rotterdam.nl/nl_NL/gerealiseerde-projecten/.
- Port of Amsterdam. "Port of Amsterdam: Annual Report 2012," 2012.
- . "Port of Amsterdam: Annual Report 2014," 2014.
- . "Port of Amsterdam: Annual Report 2015," 2015.
- . "Port of Amsterdam: Strategic Plan 2017-2021," March 2017.
- Port of Moerdijk. "Port of Moerdijk: Annual Report 2011," 2012.
- . "Port of Moerdijk: Annual Report 2014," 2015.
- . "Port of Moerdijk: Annual Report 2015," 2016.
- . "Port of Moerdijk: Annual Report 2013," 2014.
- Port of Rotterdam. "Facts and Figures on the Rotterdam Energy Port and Petrochemical Cluster," 2016.
- . "Innovation: Smartest Port." *Port of Rotterdam*, June 13, 2015.
<https://www.portofrotterdam.com/en/business-opportunities/innovation-smartest-port>.
- . "LNG as a Fuel for Vessels and Trucks." *Port of Rotterdam*, June 12, 2015.
<https://www.portofrotterdam.com/en/cargo-industry/lng-liquefied-natural-gas/lng-as-a-fuel-for-vessels-and-trucks>.
- . "Pijpleidingen." *Haven van Rotterdam*, April 20, 2015.
<https://www.portofrotterdam.com/nl/verbindingen-logistiek/intermodaal-transport/pijpleidingen>.
- . "Port of Rotterdam: Annual Report 2004," 2005.
- . "Port of Rotterdam: Annual Report 2007," 2007.
- . "Port of Rotterdam: Annual Report 2009," 2010.
- . "Port of Rotterdam: Annual Report 2010," 2011.
- . "Port of Rotterdam: Annual Report 2011," 2012.
- . "Port of Rotterdam: Annual Report 2012," 2013.
- . "Port of Rotterdam: Annual Report 2013," 2014.
- . "Port of Rotterdam: Annual Report 2015," 2015.
- Province of Groningen. "Province of Groningen: Annual Report 2015," 2015.
- Province of Zeeland. "Province of Zeeland: Annual Report 2005," May 19, 2006.
- . "Province of Zeeland: Annual Report 2006," 2007.
- . "Province of Zeeland: Annual Report 2007," May 16, 2008.
- . "Province of Zeeland: Annual Report 2008," 2009.
- . "Province of Zeeland: Annual Report 2009," 2010.
- . "Province of Zeeland: Annual Report 2010," 2011.
- . "Province of Zeeland: Annual Report 2012," 2013.
- . "Province of Zeeland: Annual Report 2014," 2015.
- . "Province of Zeeland: Annual Report 2015," 2016.
- Provinciale Staten. "Brief GS van 29 Januari 2016 Inzake Vraag En Antwoord Met Betrekking Tot Herstructurering En Herfinanciering DELTA N.V.," February 5, 2016.
- Rabobank. "Nederlandse Aardgasbaten Nog Steeds Belangrijke Inkomstenbron Overheid." *Rabobank*. Accessed April 4, 2017.
<https://economie.rabobank.com/publicaties/2015/augustus/nederlandse-aardgasbaten-nog-steeds-belangrijke-inkomstenbron-overheid/>.
- . "Tankstations, Rabobank Cijfers & Trends." Accessed February 6, 2017.
<https://www.rabobankcijfersentrends.nl/index.cfm?action=branche&branche=Tankstations>.
- Rathenau Instituut. "Financiering En Uitvoering van R&D in Nederland." *Rathenau Instituut*. Accessed March 17, 2017. <https://www.rathenau.nl/nl/page/financiering-en-uitvoering-van-rd-nederland>.

- Rekenkamer, Algemene. "De Staat Als Aandeelhouder," 2015.
<http://www.binnenlandsbestuur.nl/Uploads/2015/4/Rapport-De-Staat-als-aandeelhouder.pdf>.
- RENDO. "Aandeelhouders En RvC." *RENDO Netbeheer*. Accessed January 27, 2017.
<https://www.rendo.nl/netbeheer/over-rendo/aandeelhouders-en-rvc/>.
- . "RENDO: Annual Report 2015," 2015.
- Rijksdienst voor Ondernemend Nederland (RVO). "Annual Report 2013 SDE+, SDE, and MEP," 2014.
- . "Annual Report 2014 SDE+, SDE, and MEP," 2015.
- Rijksoverheid. "Belastingplan 2016: Lijst van Vragen En Antwoorden," April 15, 2016.
- . "Financieel Jaarverslag van Het Rijk 2015," 2016.
- Rijksvastgoedbedrijf. "Documenten - Verhuren en in gebruik geven - Rijksvastgoedbedrijf." Onderwerp, January 15, 2014. <https://www.rijksvastgoedbedrijf.nl/expertise-en-diensten/i/in-gebruik-geven-van-rijksvastgoed/documenten>.
- . "Veiling locaties benzinestations langs rijkswegen - Verhuren en in gebruik geven - Rijksvastgoedbedrijf." Onderwerp, April 12, 2016.
<https://www.rijksvastgoedbedrijf.nl/expertise-en-diensten/i/in-gebruik-geven-van-rijksvastgoed/inhoud/veiling-locaties-benzinestations-langs-rijkswegen>.
- . "Verhuurd: tien tankstations langs rijkswegen - Nieuwsbericht - Rijksvastgoedbedrijf." Nieuwsbericht, September 9, 2015.
<https://www.rijksvastgoedbedrijf.nl/actueel/nieuws/2015/09/09/verhuurd-tien-tankstations-langs-rijkswegen>.
- . "Verhuurd: zeven tankstations langs rijkswegen - Nieuwsbericht - Rijksvastgoedbedrijf." Nieuwsbericht, September 7, 2016.
<https://www.rijksvastgoedbedrijf.nl/actueel/nieuws/2016/09/07/verhuurd-zeven-tankstations-langs-rijkswegen>.
- Rijkswaterstaat. "Fase 2 Planuitwerking Zeesluis," 2014.
- Rijnen Brandstoffen. "Rijnen Brandstoffen | Kolen, Gas, Olie En Hout Producten." *Rijnen Brandstoffen*. Accessed February 6, 2017. <http://www.rijnen-brandstoffen.nl/>.
- Rip, Arie, and René Kemp. "Technological Change." In *Human Choice and Climate Change*. Citeseer, 1998.
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.198.567&rep=rep1&type=pdf>.
- Rotmans, Jan, René Kemp, and Marjolein Van Asselt. "More Evolution than Revolution: Transition Management in Public Policy." *Foresight* 3, no. 1 (2001): 15–31.
- Royal Schiphol Group. "Schiphol Annual Report 2016," 2017.
- RVO. "Brochure SDE Voorjaar 2017," 2017.
- . "Energie Onderzoek Subsidie (EOS) | RVO.nl." Accessed March 20, 2017.
<http://www.rvo.nl/subsidies-regelingen/energie-onderzoek-subsidie>.
- . "Financiële Ondersteuning MJA3/MEE | RVO.nl." Accessed March 6, 2017.
<http://www.rvo.nl/subsidies-regelingen/meerjarenafspraken-energie-efficiency/financi%C3%ABle-ondersteuning-mja>.
- . "Innovatiefonds MKB+ | RVO.nl." Accessed March 17, 2017.
<http://www.rvo.nl/onderwerpen/innovatief-ondernehmen/innovatiefinanciering/innovatiefonds-mkb>.
- . "Monitor Publiek Gefinancierd Energieonderzoek 2013: Zicht Op Bestedingen, Thema's, En Trends," 2014.
- . "Monitor Publiek Gefinancierd Energieonderzoek 2014: Zicht Op Bestedingen, Thema's, En Trends," 2015.
- . "Ondersteunde Projecten Door RVO.nl | RVO.nl." Accessed March 21, 2017.
[http://www.rvo.nl/subsidies-regelingen/projecten?f\[0\]=subsidies%3A5565](http://www.rvo.nl/subsidies-regelingen/projecten?f[0]=subsidies%3A5565).
- . "Projecten Toekomstfondskrediet | RVO.nl." Accessed March 21, 2017.
<http://www.rvo.nl/subsidies-regelingen/toekomstfondskrediet-tof/projecten>.

- . “Publiek Gefinancierd Energieonderzoek 2015,” 2016.
- . “Subsidies & Financiering | RVO.nl.” Accessed March 16, 2017. <http://www.rvo.nl/subsidies-regelingen>.
- . “Topsectoren | RVO.nl.” Accessed March 16, 2017. <http://www.rvo.nl/onderwerpen/innovatief-ondernemen/topsectoren>.
- RWE. “RWE Annual Report 2015.” Accessed February 16, 2017. <http://www.rwe.com/web/cms/mediablob/en/2974774/data/0/7/RWE-Annual-Report-2015.pdf>.
- RWE AG. “RWE AG - EEMSHAVENCENTRALE.” Accessed October 31, 2016. <http://www.rwe.com/web/cms/nl/1772148/rwe-generation-se/brandstoffen/overzicht-locaties/nederland/eemshavencentrale/>.
- Schiphol Group. “Schiphol Annual Report 2001,” 2002.
- . “Schiphol Annual Report 2003,” 2004.
- . “Schiphol Annual Report 2004,” 2005.
- . “Schiphol Annual Report 2005,” 2006.
- . “Schiphol Annual Report 2006,” 2007.
- . “Schiphol Annual Report 2007,” 2008.
- . “Schiphol Annual Report 2008,” 2009.
- . “Schiphol Annual Report 2010,” 2011.
- . “Schiphol Annual Report 2011,” 2012.
- . “Schiphol Annual Report 2012,” 2013.
- . “Schiphol Annual Report 2013,” 2014.
- . “Schiphol Annual Report 2014,” 2015.
- Scholten, Daniel, and Rolf Künneke. “Towards the Comprehensive Design of Energy Infrastructures,” 2016.
- Schotten, Guido, Saskia van Ewijk, Martijn Regelink, Diederik Dicou, and Jan Kakes. “Time for Transition: An Exploratory Study of the Transition to a Carbon-Neutral Economy.” De Nederlandsche Bank (DNB), March 2016.
- SeaDarQ. “History of SeaDarQ — Seadarq.” Page. Accessed March 28, 2017. <http://www.seadarq.com/seadarq/about-seadarq/history-of-seadarq>.
- Slingerland, Stephan, Koen Rademaekers, Nick Rothengatter, Janet Heida, Martijn Blom, and Cor Leguijt. “Review Topsector Energie: Deelonderzoek 2.” CE DELFT, December 2014.
- Smink, M. M. “Incumbents and Institutions in Sustainability Transitions,” 2015. <http://dspace.library.uu.nl/handle/1874/322962>.
- South African National Energy Development Institute (SANEDI). “Overview of the South African Coal Value Chain: Prepared as a Basis for the Development of the South African Coal Roadmap,” 2011.
- Spring Associates. “Sluiting van de Nederlandse Kolencentrales: Maatschappelijke En Economische Effecten,” June 2016.
- Staten-Generaal, Tweede Kamer der. “Beschrijving van de Opzet van Het Huidige Gasgebouw.” Officiële publicatie. Accessed November 28, 2016. <https://zoek.officielebekendmakingen.nl/kst-28109-4-b1>.
- . “Herstructurering Gasgebouw; Brief minister over de uitgangspunten en perspectieven voor de toekomstige structuur van het Gasgebouw.” Officiële publicatie. Accessed November 28, 2016. <https://zoek.officielebekendmakingen.nl/dossier/34092/kst-28109-1.html>.
- Stedin. “Stedin: Annual Report 2015,” 2015.
- Stil, Herman. “Zeesluis Kost Amsterdam Miljoenen Meer - Binnenland - PAROOL.” *Het Parool*, July 16, 2015. <http://www.parool.nl/binnenland/zeesluis-kost-amsterdam-miljoenen-meer~a4102108/>.
- The Global Subsidies Initiative (GSI). “A How-to Guide: Measuring Subsidies to Fossil-Fuel Producers.” Global Subsidies Initiative Policy Brief, 2010.

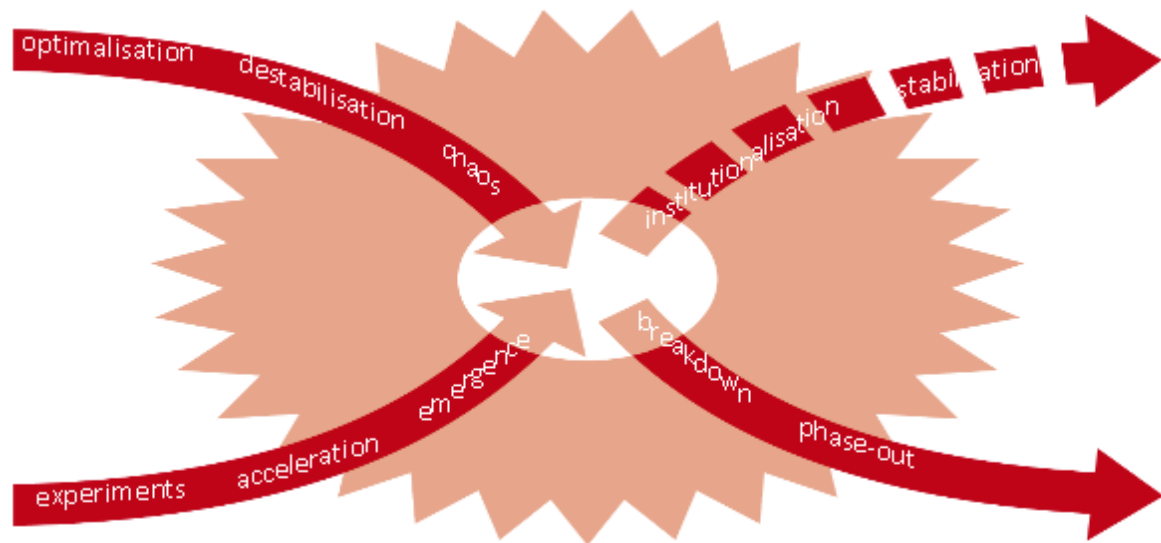
- TKI Gas. "Innovatie- En Kennisagenda Gas 2016-2019: Met Gas Naar Een Klimaatneutraal Energiesysteem," May 2015.
- . "Jaarrapportage TKI Gas over de TKI-Toeslag over Het Jaar 2015," April 2016.
- . "Jaarverslag TKI Gas Voor Het Jaar 2014," April 2014.
- . "TKI GAS 2012-2016: Terugblik Op 4 Jaar TKI Gas," 2016.
- TNO. "Beeft de Grond Onder de Voeten van de Gasrotonde." Position Paper. TNO, Oktober 2015.
- . "Delfstoffen En Aardwarmte in Nederland: Jaarverslag 2015." Ministry of Economic Affairs, July 2016.
- . "Het Fossiele Dilemma van Rotterdam." TNO Discussiepaper. TNO, Maart 2016.
- . "TNO Annual Report: 2005," 2006.
- . "TNO Annual Report: 2006," 2007.
- . "TNO Annual Report: 2007," 2008.
- . "TNO Annual Report 2008," 2009.
- . "TNO Annual Report: 2009," 2010.
- . "TNO Annual Report: 2011," 2012.
- . "TNO Annual Report: 2012," 2013.
- . "TNO Annual Report: 2013," 2014.
- . "TNO Annual Report: 2015," 2016.
- . "TNO Annual Report: 2016," 2017.
- . "TNO Companies." Accessed March 28, 2017. <http://tno-bedrijven.nl/portfolio>.
- . "TNO Verkoopt Meerderheid van de Aandelen TNO Bedrijven BV Aan First Dutch." *TNO*. Accessed December 19, 2016. <https://www.tno.nl/nl/over-tno/nieuws/2016/12/tno-verkoopt-meerderheid-van-de-aandelen-tno-bedrijven-bv-aan-first-dutch/>.
- Tordo, Silvana. *National Oil Companies and Value Creation*. World Bank Working Papers. The World Bank, 2011. <http://elibrary.worldbank.org/doi/book/10.1596/978-0-8213-8831-0>.
- Turnheim, Bruno, and Frank W. Geels. "Regime Destabilisation as the Flipside of Energy Transitions: Lessons from the History of the British Coal Industry (1913–1997)." *Energy Policy* 50 (November 2012): 35–49. doi:10.1016/j.enpol.2012.04.060.
- Tweede Kamer der Staten Generaal. "Jaarverslag en slotwet ministerie van Economische Zaken en Diergezondheidsfonds 2015." Kamerstuk, May 18, 2016. http://www.rijksbegroting.nl/2015/verantwoording/jaarverslag,kst221658_10.html.
- . "Jaarverslag En Slotwet Ministerie van Infrastructuur En Milieu 2015," May 28, 2016.
- . "Miljoenennota 2002," 2001.
- . "Miljoenennota 2003," 2002.
- . "Miljoenennota 2004," 2003.
- . "Miljoenennota 2005," 2004.
- . "Miljoenennota 2006 (Nota over de toestand van 's Rijks Financiën)." Miljoenennota, September 20, 2005. http://www.rijksbegroting.nl/2006/voorbereiding/miljoenennota,kst88447_52.html.
- . "Miljoenennota 2007 (Nota over de toestand van 's Rijks Financiën)." Miljoenennota, September 19, 2006. http://www.rijksbegroting.nl/2007/voorbereiding/miljoenennota,kst99352_55.html.
- . "Miljoenennota 2008 (Nota over de toestand van 's Rijks Financiën)." Miljoenennota, September 20, 2007. http://www.rijksbegroting.nl/2008/voorbereiding/miljoenennota,kst108517_39.html.
- . "Miljoenennota 2009 (Nota over de toestand van 's Rijks Financiën)." Miljoenennota, September 16, 2008. http://www.rijksbegroting.nl/2009/voorbereiding/miljoenennota,kst119632_51.html.
- . "Miljoenennota 2010 (Nota over de toestand van 's Rijks Financiën)." Miljoenennota, September 17, 2009. http://www.rijksbegroting.nl/2010/voorbereiding/miljoenennota,kst132844_43.html.

- . “Miljoenennota 2011 (Nota over de toestand van ’s Rijks Financiën).” Miljoenennota, September 22, 2010.
http://www.rijksbegroting.nl/2011/voorbereiding/miljoenennota,kst148338_15.html.
- . “Miljoenennota 2012 (Nota over de toestand van ’s Rijks Financiën).” Miljoenennota, September 26, 2011.
http://www.rijksbegroting.nl/2012/voorbereiding/miljoenennota,kst160028_14.html.
- . “Miljoenennota 2013 (Nota over de toestand van ’s Rijks Financiën).” Miljoenennota, September 19, 2012.
http://www.rijksbegroting.nl/2013/voorbereiding/miljoenennota,kst173802_14.html.
- . “Miljoenennota 2014 (Nota over de Toestand van ’S Rijks Financiën: 2014),” September 17, 2013.
- . “Miljoenennota 2015 (Nota over de Toestand van ’S Rijks Financiën: 2015),” September 16, 2014.
- . “Miljoenennota 2016 (Nota over de Toestand van ’S Rijks Financiën: 2016),” September 15, 2015.
- . “Miljoenennota 2017 (Nota over de toestand van ’s Rijks Financiën).” Kamerstuk, September 21, 2016. http://www.rijksbegroting.nl/2017/kamerstukken,2016/9/21/kst815004_4.html.
- . “Vaststelling begroting Ministerie van Economische Zaken en Diergezondheidsfonds 2016.” Ontwerpbegroting, September 15, 2015.
http://www.rijksbegroting.nl/2016/voorbereiding/begroting,kst212225_6.html.
- . “Vaststelling begroting Ministerie van Economische Zaken en Diergezondheidsfonds 2017.” Ontwerpbegroting, September 20, 2016.
http://www.rijksbegroting.nl/2017/voorbereiding/begroting,kst225626_14.html.
- Urgenda. “Climate Case - Urgenda - Samen Sneller Duurzaam.” Accessed October 6, 2016.
<http://www.urgenda.nl/en/climate-case/>.
- Van de Graaf, T, Benjamin K. Sovacool, Arunabha Ghosh, Florian Kern, and Michael T. Klare (Eds.). *The Palgrave Handbook of the International Political Economy of Energy*. Palgrave Handbooks in IPE. Palgrave Macmillan, 2016.
<http://www.palgrave.com/it/book/9781137556301>.
- Van Rossum, Maarten, and Otto Swertz. “De Nederlandse aardgaswinning.” CBS, 2010.
- Vattenfall. “About Our Power Plants and the Production – Vattenfall.” Accessed February 20, 2017.
<http://powerplants.vattenfall.nl/#/countries=Netherlands/view=list/sort=name>.
- Verbong, Geert, and Frank Geels. “The Ongoing Energy Transition: Lessons from a Socio-Technical, Multi-Level Analysis of the Dutch Electricity System (1960–2004).” *Energy Policy* 35, no. 2 (February 2007): 1025–37. doi:10.1016/j.enpol.2006.02.010.
- Verbong, Geert, and Derk Loorbach, eds. *Governing the Energy Transition: Reality, Illusion or Necessity?* Routledge Studies in Sustainability Transitions 4. New York: Routledge, 2012.
- Verhoeven, W H J, A.J van Stel, and N G L Timmermans. “Evaluatie WBSO 2006-2010: Effecten, Doelgroepbereik, En Uitvoering,” February 2012.
- Visser, Erika de, Mirjam Harmelink, Thomas Winkel, Paul Noothout, and Kornelis Blok. “Ex-Post Evaluatie DEN-A En EOS.” Ecofys and Harmelink consulting, January 2012.
- Visser, Erika de, Thomas Winkel, David de Jager, Rolf de Vos, Martijn Blom, and Maarten Afman. “Overheidsingrepen in de Energiemarkt: Onderzoek Naar Het Nederlandse Speelveld Voor Fossiele Brandstoffen, Hernieuwbare Bronnen, Kernenergie En Energiebesparing.” CE Delft & Ecofys, July 2011.
- Volkerink, Bjorn, Stephan Slingerland, Sil Boeve, Lars Meindert, Henri de Groot, and Frank van Zutphen. “Evaluatie Energie Investeringsaftrek: Ex Post Evaluatie 2006-2011,” November 1, 2012.
- Voogt, Sam de. “Nuon Gaat Eigen Kolencentrale Vervroegd Sluiten of Verkopen.” *Nrc.nl*. Accessed February 27, 2017. <https://www.nrc.nl/nieuws/2016/12/21/nuon-gaat-laatste-eigen-kolencentrale-sluiten-of-afstoten-a1537796>.

- Wal, Willem van der. "The Technological Infrastructure of the Gas Chain - National Reforms in European Gas - Chapter 2." Accessed January 13, 2017.
<http://www.sciencedirect.com/science/article/pii/B9780080436876500043>.
- Weijermars, Ruud. "Value Chain Analysis of the Natural Gas Industry." *Journal of Natural Gas Science and Engineering* 2, no. 2–3 (July 2010): 86–104. doi:10.1016/j.jngse.2010.04.002.
- Westland Infra. "Westland Infra: Annual Report 2015," 2015.
- Weterings, Rob, Toon van Harmelen, Jonna Gjaltema, Sophie Jongeneel, Walter Manshanden, Evgueni Poliakov, Andre Faaij, et al. "Towards a future proof energy system for the Netherlands/Naar een toekomstbestendig energiesysteem voor Nederland." TNO Reports, March 1, 2013.
- Wolf, Christian OH. "The Petroleum Sector Value Chain." *Available at SSRN 1514593*, 2009.
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1514593.
- World Resources Institute. "CAIT: WRI's Climate Data Explorer." *World Resources Institute*. Accessed January 3, 2017. <http://cait2.wri.org/historical?undefined>.
- Wynn, Gerard. "The Dutch Coal Mistake: How Three Brand-New Power Plants in the Netherlands Are at Risk Already of Becoming Standed Assets." Institute for Energy Economics and Financial Analysis (IEEFA), November 2016.
- "ZEBRA Gasnetwerk B.V: Annual Report 2015," n.d.
- Zeeland Refinery. "Zeeland Refinery | Zuinig Met Olie." Accessed January 12, 2017.
<http://www.zeelandrefinery.nl/raffinaderij/onze-producten/zuinig-met-olie/>.
- Zeeland Seaports. "Zeeland Seaports: Annual Report 2013," 2014.
- . "Zeeland Seaports: Annual Report 2014," 2015.
- . "Zeeland Seaports: Annual Report 2015," 2016.

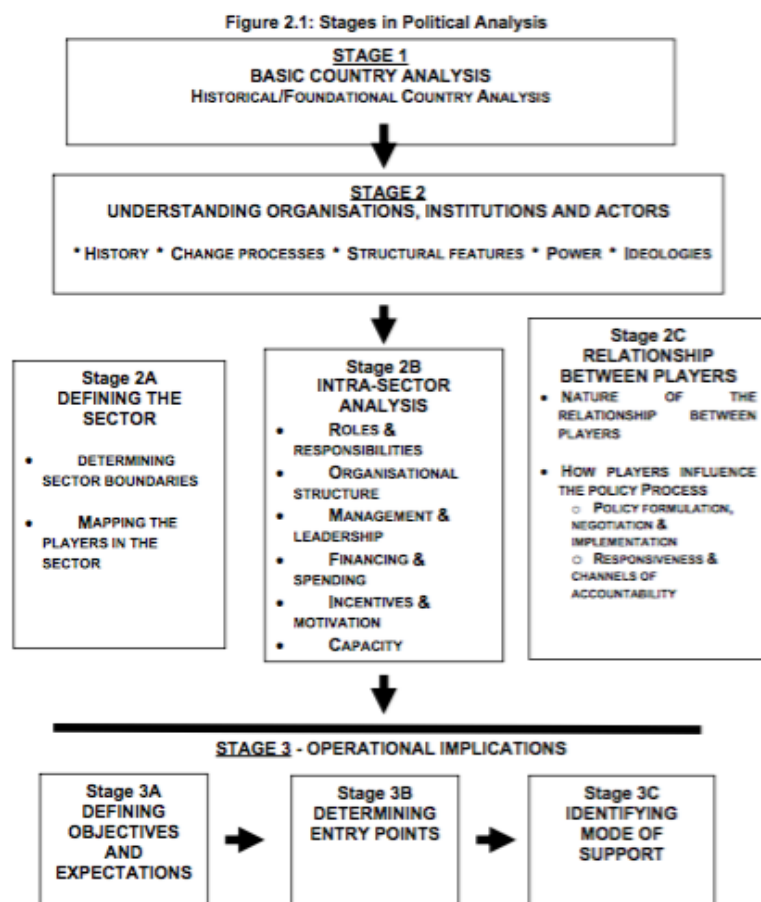
13. Appendices

Appendix 1 Transition patterns - the X-curve⁴⁷⁹



⁴⁷⁹ Loorbach, "To Transition! Governance Penarchy in the New Transformation."

Appendix 2 analytical framework for understanding the political economy of sectors and policy arenas by Moncrieffe and Luttrell (2005)⁴⁸⁰



Appendix 3 The coal value chain according to SANEDI⁴⁸¹

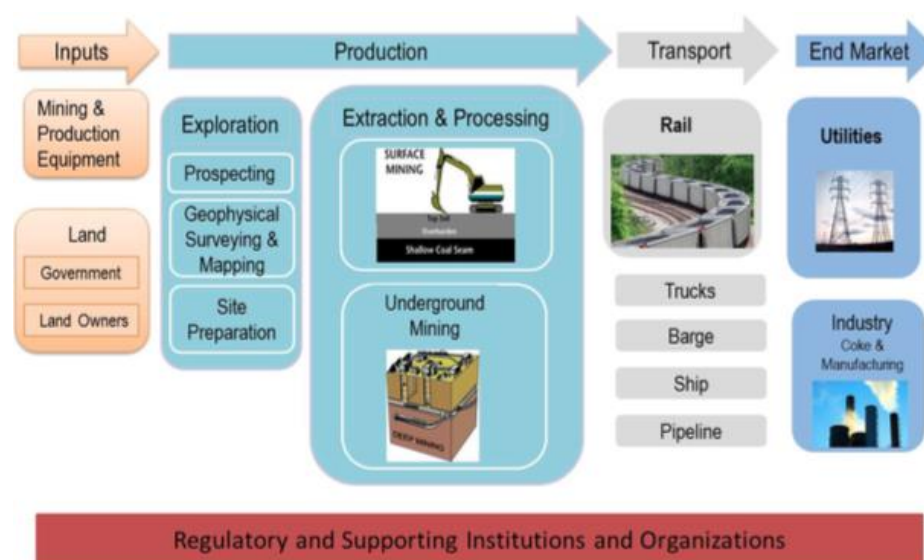
The Coal Value Chain
Production:
Exploration
Mining
Coal Preparation
Trade:
Export
Transport – rail, road, shipping, conveyor systems, and pipelines
Storage
Use:
Electricity generation
Liquid fuels and chemicals production
Metallurgical use
Industrial use
Residential use
Sampling and Characterization

⁴⁸⁰ Moncrieffe and Luttrell, "An Analytical Framework for Understanding the Political Economy of Sectors and Policy Arenas."

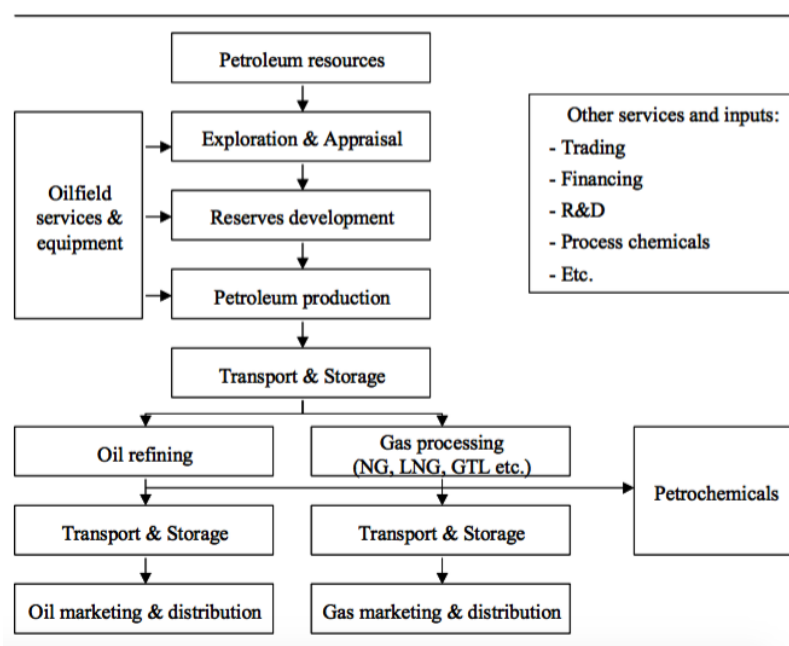
⁴⁸¹ Adapted from: South African National Energy Development Institute (SANEDI), "Overview of the South African Coal Value Chain: Prepared as a Basis for the Development of the South African Coal Roadmap."

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Appendix 4 The coal value chain according to Ahmed, Abdulsamad, & Gereffi⁴⁸²



Appendix 5 The oil and gas (petroleum) value chain⁴⁸³



Appendix 6 IEA Fossil fuel industry overview⁴⁸⁴

IEA natural gas and oil sector description structure

Natural gas

Oil

⁴⁸² Ahmed, Abdulsamad, and Gereffi, "US Coal and the Technology Innovation Frontier: What Role Does Coal Play in Our Energy Future?"

⁴⁸³ Wolf, "The Petroleum Sector Value Chain," 6.

⁴⁸⁴ IEA, 2014.

<ul style="list-style-type: none"> - Natural Gas supply and demand <ul style="list-style-type: none"> o Production and supply o Imports and exports o Upstream licensing and tax regime o Demand 	<ul style="list-style-type: none"> - Production, supply and trade <ul style="list-style-type: none"> o Crude oil o Oil products
<ul style="list-style-type: none"> - Natural gas infrastructure <ul style="list-style-type: none"> o Transmission and distribution o Gas quality o Cross-border interconnections o Liquefied natural gas o Storage o Regional gas grid development 	<ul style="list-style-type: none"> - Demand
<ul style="list-style-type: none"> - Natural gas market structure and regulation <ul style="list-style-type: none"> o Market structure o Regulation o Gas transmission and distribution networks o Gas balancing regime 	<ul style="list-style-type: none"> - Oil Market and infrastructure <ul style="list-style-type: none"> o Storage o Pipelines o Commercial and retail market ports
<ul style="list-style-type: none"> - Natural gas prices <ul style="list-style-type: none"> o Wholesale o Retail 	<ul style="list-style-type: none"> - Oil prices and taxes
<ul style="list-style-type: none"> - Security of gas supply 	<ul style="list-style-type: none"> - Security of supply <ul style="list-style-type: none"> o Stockholding regime o Oil demand restraint

Appendix 7 Initial Scoping Core questions

Initial scoping core questions		
Topics	Core Questions	Comments
Energy flows (Sankey diagram)	What fossil fuels are produced in the area of study?	Provides a good overview of the links between production; imports/exports; stages of transformation; and consumption.
	What fossil fuels are imported and exported?	
	What fuels are used for electricity generation?	
	What sectors are the big energy users?	
	What important transformations occur?	
	What are the biggest streams and end points?	
Import/export data	What are the main origins of fossil fuel imports?	Could be done using IEA data or from the national statistics bureau
	What are the main export destinations?	
	How large are the imports and exports? Also in relation to the total imports/exports.	
	What is the value of these imports/exports?	
	What means of transportation are used?	
Energy and economic indicators	What is the contribution of the energy sector to GDP?	When combining this with the share of renewable energy a rough picture can be created of the importance of fossil fuels in the economy.
	What is the contribution to added value in the economy?	
	What is the employment in the energy sector? What is this in comparison to total employment in the economy?	

	How are energy related activities divided over the country? Is there a local/regional dependency on energy related jobs?	
Quick review of existing analyses on the energy systems	Is there any institute/policy that is unique to the area of study? (e.g. the Gas building in the Dutch case)	Possible sources: OECD, IEA, EIA, national research institutes, relevant ministries.

Appendix 8 Production and Exploration Core Questions

Production and Exploration Core Questions		
Topics	Core Questions	Comments
Size of reserves and resources	What is the size of the oil, coal, and gas reserves and resources in the area of study? How do they develop over time?	
Ownership of resources and reserves	Who owns the reserves and resources?	
Entities involved in production	What entities are involved in extraction?	E.g look into which concession holders the government lists, or what companies have been granted exploration or production licenses.
Ownership of producing entities	Are any of the producing companies (partly) state-owned? Is there involvement from a state-owned/controlled entity in production?	
Producer income from production	Is it possible to determine the income from production?	For the Netherlands this proved to be largely impossible, since companies, and the government, usually do not publish this data.
State income from production	How much does the government earn from production? Through what means? What is the distribution of income between government and companies? Value of mineral reserves on the balance sheet?	Look at the upstream fiscal regime, royalties, fees etc. An agreement where the public party accepts a lower profit margin (e.g than a private entity would) could constitute a dependency. For example, in the Netherlands, EBN stresses that it expects 'commercial' profit margins from its participations
State expenditure on production	Does the government, or state-owned entities invest in fossil fuel production? If so, how? And how much?	
State expenditure through subsidies	Are there any subsidies for fossil fuel production in place?	Look for example at OECD studies on fossil fuel support measures, or studies
Decommissioning of production infrastructure	Who bears the responsibility for decommissioning? What is the fiscal regime for decommissioning? Who bears the cost for decommissioning?	
Effects of production	What negative/positive effects are caused by fossil fuel production? Who is liable for these effects? Who bears the costs of these effects?	In the Dutch case this topic focuses on direct damage caused by seismic activity, it would also be interesting to look at externalities such as impacts on wildlife or greenhouse gas emissions. Or in the case of oil production at oil spills.

Appendix 9 Transport and Storage Core Questions

Transport and Storage Core Questions		
Topics	Core Questions	Comments

Government – Fossil fuel industry relations

<i>Port authorities:</i>		
Fossil fuel dependency	What is the share of fossil fuels in the goods throughput of the Port?; What is the share of fossil fuel related revenue?	
Dividend payments to public owners	Do the ports pay dividends? If so, how much and to whom?	
Capital value of Port authority on public balance sheets	What is the value of the public share as a share of its total assets?	
Loans and guarantees by public owners to port authorities	What loans and guarantees did the public body issue to the port? How much interest is being paid? What amount is guaranteed and till when? Was a fee paid in exchange for the guarantee?	
Subsidies and (governmental) contributions received by port authorities	Did the port receive any subsidies? Did it receive any payments for services or contributions to operational costs? Can any of the subsidies be linked to a project that has a fossil aspect?	
Government investment in port authorities and infrastructure	Does the government contribute to infrastructural investments? Does it do other investments that can be attributed to the functioning of the port?	An example of other investments could be: hinterland connections; port accessibility; etc.
Tax on port activities	Does the port authority pay tax? Are there any specific taxes on port activities?	Since it might impossible to determine the amount of taxes raised with specific activities taking place within the port it might be more useful to only look at this in nation-wide aggregate.
<i>Coal</i>		
Transport	What modes of transport are used? What entities are involved? Are any of these state-owned? (e.g. railways)	For coal this can be over sea, inland waterways, rail, road, pipeline. Take into account the initial scoping; i.e. for the Netherlands most coal transport is expected between the ports and Germany.
	Are there specific taxes on the import/transport/storage/export of coal?	
<i>Oil</i>		
Transport	Is there an overview of pipelines in your area of study? Are there any (indirectly) government owned pipelines?	e.g. European countries maintain a NATO controlled network of oil pipelines.
Storage	Where does storage happen? What type of storage, tank or underground? What entities are involved? Does the government of area of study hold a strategic storage?	
<i>Gas storage and transport</i>		
Storage	Where does storage happen? What type of storage, tank or underground? What entities are involved?	The questions that apply to transport could also apply to storage.
Transport	How is gas transported in your area of study? Who owns the pipeline networks? Who operates the pipeline networks?	
SOE's	If a (partially) state owned enterprise is involved: do, they pay dividends? Do they have debts and with whom? Are the SOE's used as a policy instrument? What financial relationship exists with the government? Do they receive capital injections from the government? (e.g. to do certain investments). Guarantees?	E.g. in the Dutch case the SOE Gasunie, in addition to other activities, manages the long distance transmission network and international interconnectors

Taxes	Are there any special taxes/fees on the transportation of gas? Who needs to pay these and who gets the proceeds?	
Tariffs	How are transportation tariffs determined? Who needs to pay them?	

Appendix 10 Processing and Refining core questions

Processing and Refining core questions		
Topics	Core Questions	Comments
<i>Oil & Gas</i>		
Type and location of processing/refining	What type of oil and gas processing/refining occurs? Where does this take place?	
Entities involved	What entities are involved in the processing/refining? Any SOE's?	
Taxes/fees	Are there any specific taxes/government fees on processing/refining activities?	

Appendix 11 Sales and Distribution core questions

Sales and Distribution core questions		
Topics	Core questions	Comments
<i>Coal</i>		
Coal distribution channels	What types of coal use occur in your AOS? What distribution networks exist?	Often coal is delivered directly to large users
Involved entities	What companies are involved? Are any of these state-owned?	
Taxes	Are there any specific taxes or fees on the trade, sale, and distribution of coal?	e.g. the Netherlands has a tax on the use of coal as fuel, with the exception of power plants. Although levied on the import of coal the tax is paid by the end user.
<i>Oil</i>		
Oil distribution channels	How is oil traded? What distribution networks exist?	Usually two types: wholesale and retail.
Involved entities	What companies are involved? Are any of these state-owned?	
Taxes	How is trade, sale, and distribution of oil taxed?	Usually only end-consumer is taxed
<i>Gas</i>		
Gas distribution channels	How is gas traded? What distribution networks exist? What companies are involved? Are any of these state-owned?	
Regional distribution companies	Who owns the regional distribution companies? How are their fees regulated? How do they invest? Do they pay dividends? Who holds their debt? What other fossil fuel related activities do they engage in?	
Gas as a transport fuel	What types of gas based transport fuels are sold? What transport functions do they serve? How are they distributed?	E.g. in the Netherlands LPG and CNG are sold by petrol stations for road transport, and LNG in the port of Rotterdam for transport over water
Tax	How is the trade, sale, and distribution of gas taxed?	
	Is it possible to determine the amount of corporation/profit tax coming from this segment?	e.g. In the Netherlands tax data is only available at an aggregate level. It is thus not possible to

		determine where in the chain certain tax revenue comes from. Also, due to vertical integration of companies, it would only be possible to due this when knowing how revenue of these companies is divided over the different segments
Trade associations	What trade associations exist in this stage? Do any of the SOE's play a role in them?	
Wholesalers	Is the wholesale sector privatized? Is there SOE involvement? Are there any other 'special' constructions/entities that operate within the market? If so, describe their activities: e.g. profits, dividends, share of public capital invested, loans and guarantees, industry relations, other relevant activities etc.	e.g. GasTerra is a unique public-private partnership that acts as a wholesaler for between 70-80 percent of the gas flowing through the Netherlands.

Appendix 12 Use core questions

Use core questions		
Topics	Core Questions	Comments
<i>Electricity</i>		
Fossil dependency of electricity production	What does the electricity mix look like? What types of generation exist? (e.g. centralized vs. decentralized)	
Government ownership of electricity production assets	What electricity companies operate in the area of study? What type of generation capacity do they own? Who owns these companies? Are any of these owned by (local/regional/national) government(s) Look at government owned utilities: what share of their revenue could be attributed to fossil fuels? How much dividend do they pay, what is the fossil share of this? Do these dividends pose a substantial form of revenue for the shareholders? Is there any (financial) support from the shareholders to the companies?	
Subsidy and support measures for electricity production	Are there any subsidies or support measures for electricity production? Do any of these support fossil fuels? Do they support certain industries?	E.g in the Netherlands biomass co-firing subsidies for coal power plants also support coal.
<i>Tax income from and expenditure on fossil fuel use</i>		
Tax income	What taxes exist in this stage? - Cap and trade system? Carbon tax? - How much is this? How much is this as share of income?	E.g. excise tax, VAT, environmental taxes, energy related taxes etc.
Tax expenditure	Are there any fiscal stimuli?	E.g tax breaks, allowances, credits
Carbon pricing	Is there a carbon tax or cap and trade system? How does the system work? Is there a way in which companies benefit from the system? What is government income/expenditure from/on the system?	E.g the EU-ETS led to windfall profits for companies due to over-issuing emission permits, grandfathering, and other technicalities.
<i>Government participations</i>		
Fossil fuel related activities	Does the government own (a share of) companies with fossil fuel related activities? To what extend are the activities, and revenue, of these firms fossil fuel related? Do they pay dividends? Are these a substantial source of revenue for its owners?	E.g. Airports or airlines.
Government support	Does the government provide support to these companies in any way?	E.g. accepting lower returns or giving favorable treatment.

Appendix 13 R&D core questions

R&D core questions		
Topics	Core questions	Comments
Government R&D Policy	What main policy programs exist? What support measures are connected to these programs?	E.g. a good starting point is the IEA profile of your area of study, especially since they also list discontinued programs
Direct R&D support	How much is given in subsidies to fossil fuel related R&D? Through what channels? How does this compare to funding for other energy related research? What type of research/project topics does most of the funding go to?	E.g. in the Netherlands most R&D funding goes to research on offshore gas and the use of LNG for transport. This is interesting since a certain branch might benefit more from subsidies, meaning that there can be an interdependency, even if the amount is small. As is, for example, the case with offshore gas in the Netherlands
Indirect R&D support	Are there any fiscal stimuli for R&D? What is the annual tax expenditure on these measures? What share of this goes to energy and fossil fuel related research?	E.g. tax deductions for investments in R&D
Government funded R&D organizations	Are there any research institutes related to the government that do energy research? What type of projects do they engage in? How are they funded? Do they engage in partnerships with industry?	E.g. TNO in the Netherlands receives funding from the Dutch government, and partners up with industry, to develop new techniques to extract 'tough' gas such as shale gas.
R&D activities by SOE's or companies in which the government has a stake	What R&D activities do SOE's perform? How much do they spend on this?	E.g. EBN develops new methods to reduce costs of offshore gas production. This could constitute a dependency: industry needs government supported entities to undertake, otherwise, uneconomic research.

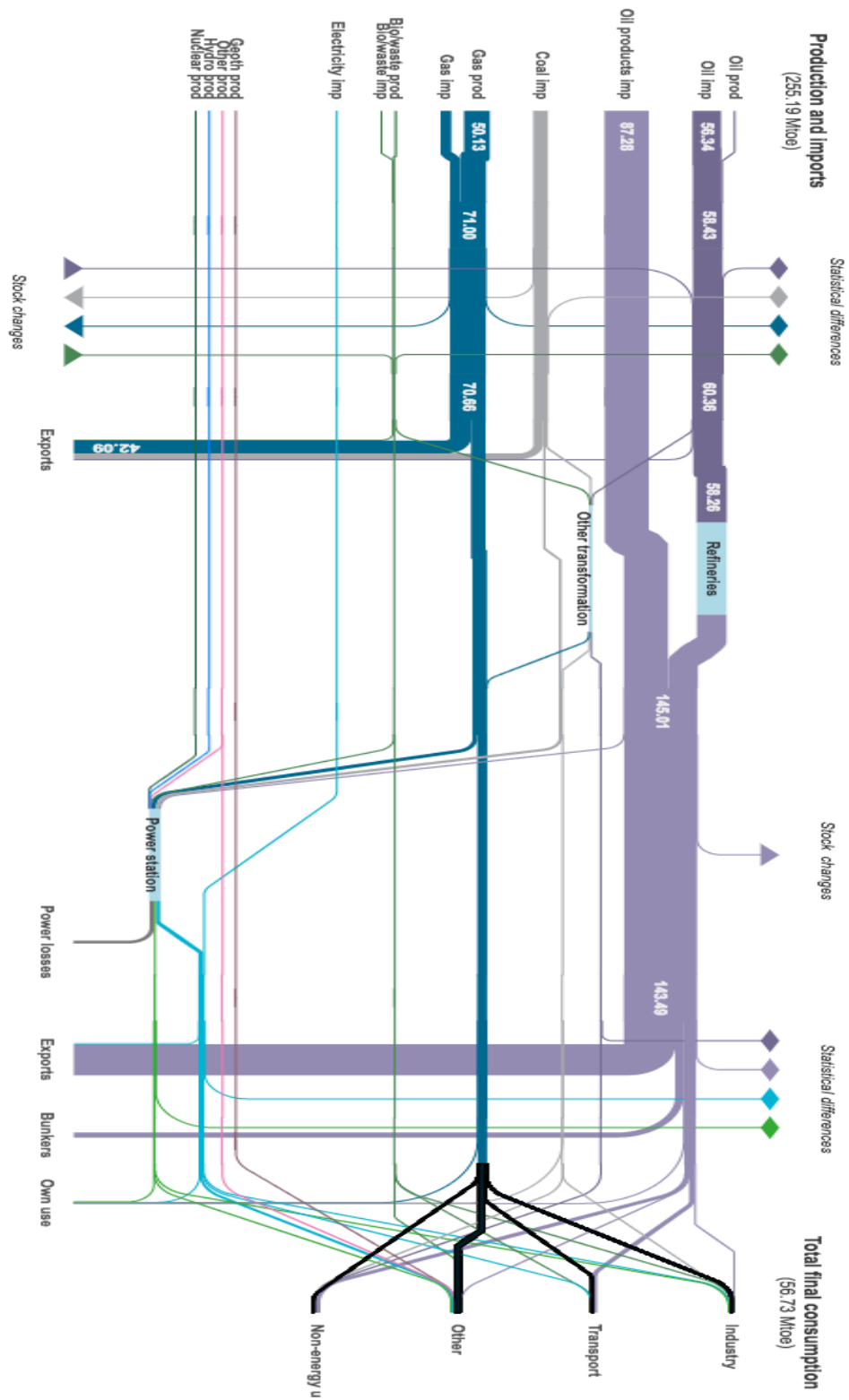
Appendix 14 Data sources used (non-exhaustive)

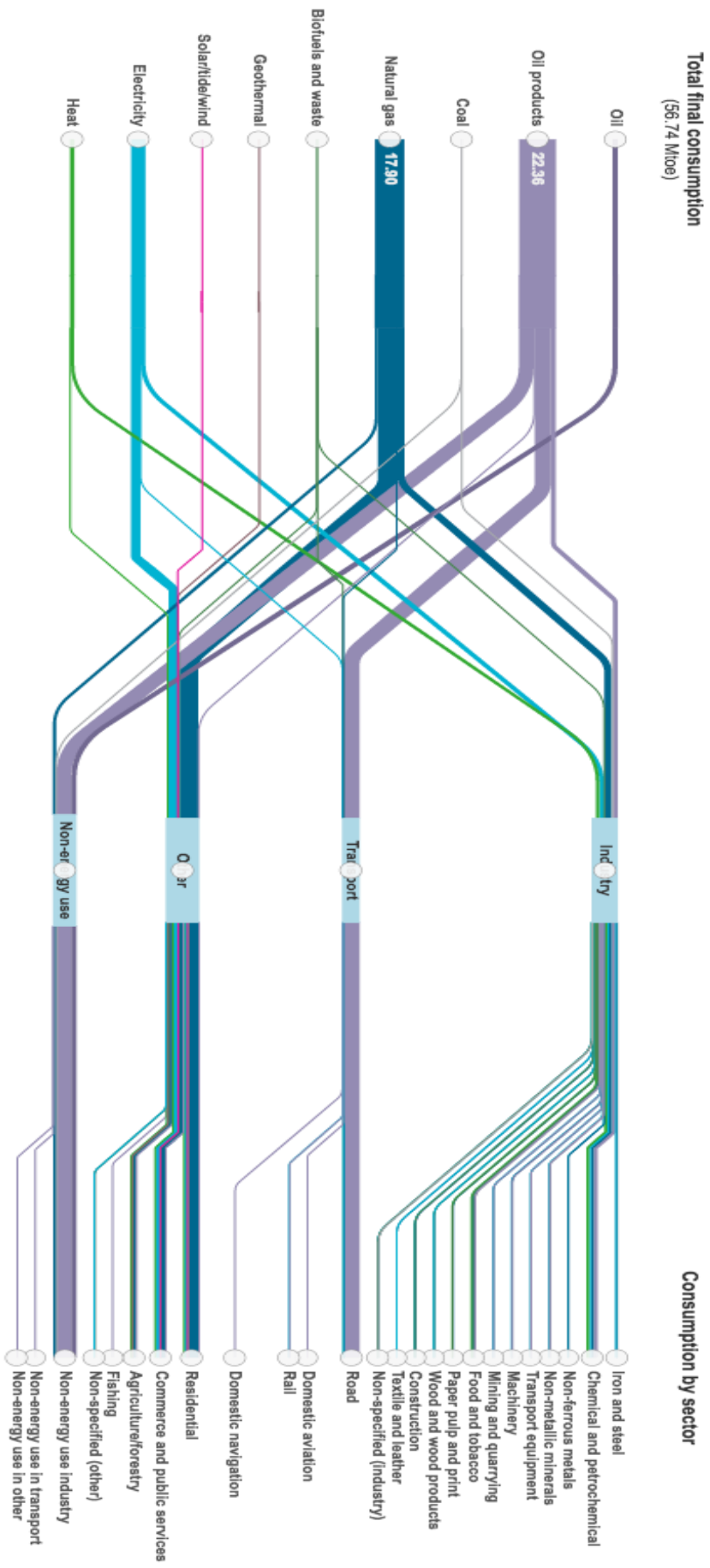
Stage	Data sources	Examples/ccomments
Initial scoping		
	National Statistics Agency	CBS Statline; e.g. Energy balance; crude oil balance; gas balance; coal balance.
	International Energy Agency	IEA (2014) The Netherlands Country report; 2016 Oil, coal, and gas information; Sankey diagrams ⁴⁸⁵ ; database of energy policies and measures.
	OECD Analysis of Budgetary support and tax expenditures	OECD fossil fuel support data for the Netherlands ⁴⁸⁶
	National Energy Research Institutes	
	National Bank/Economic research institutes	
Production and Exploration		
	National budget data	
	Fossil fuel producers annual reports	
	Ministry of Economic Affairs documents	
	Existing analyses of fossil fuel production	
	The Mining Act; The Gas Act;	
	NLOG.nl, data on gas and oil production	
	NCG (quarterly) reports	
	EBN annual reports	

⁴⁸⁵ IEA, "IEA Sankey Diagram."

⁴⁸⁶ OECD, "OECD - IEA Fossil Fuel Support and Other Analysis - Data."

Transport and storage		
	Annual reports of port authorities.	
	Online databases of port companies and activities	
	Municipal and provincial annual reports	
	State budgets ('miljoenennota') and annual accounts	
	Government tax data	e.g through CBS
	Reports from the Ministry of Infrastructure and Environment	
	Gasunie annual accounts, reports, and website	
	Short telephone interview	LSNed (leidingenstraat)
Processing and refining		
	Gasunie/GasTerra reports	
	Trade-association websites and reports	
Sales and distribution		
	Regulator (ACM) reports on energy networks and website	
	Trade- association websites and reports	
	GasTerra annual reports and website	
	Regional distributors annual reports and websites	
Use		
	Data on energy/electricity use and electricity production.	CBS/IEA
	Websites and annual accounts of electricity producers	
	Annual accounts of local and regional governments	
	Tax data	e.g through CBS, annual accounts of the ministry of economic affairs
	Government reports on participations	
	Annual accounts of government owned enterprises	
Research and Development		
	Government website on innovation/R&D policy	
	Dedicated government agencies websites and reports	E.g. RVO
	Ministry of economic affairs annual reports	
	Reports from subsidy giving/receiving organizations/projects	E.g. TKI Gas, Topsector Energie
	RVO Project Databases	Database with all projects that receive subsidies from RVO
	Government funded R&D institute websites and annual reports	
	SOE's Annual reports	
	External evaluations of government innovation policy	E.g. Rathenau institute, CE Delft, Algemene Rekenkamer





Appendix 16 Added value of energy related activities, as percentage of GDP (adapted from ECN et al., 2016))⁴⁸⁷

	Realized				Expected		
%	2008	2010	2015	2016	2017	2018	2020
Total	5.68	5.27	4.45	3.43	3.66	3.85	4.35
Operations							
Oil and gas extraction	3.09	2.56	1.68	0.83	1.02	0.96	1.15
Oil refining	0.37	0.11	0.03	0	0.03	0.02	0.04
Electricity and heat production from fossil sources (central and decentral)	0.19	0.49	0.18	0.15	0.05	0.14	0.16
Networks	0.61	0.6	0.66	0.62	0.62	0.61	0.58
Gasoline stations and storage and wholesale of fossil fuels	0.23	0.31	0.34	0.2	0.2	0.2	0.2
Production renewable energy	0.17	0.18	0.26	0.28	0.31	0.36	0.48
Activities from investments							
Conventional energy (fossil fuels)	0.52	0.5	0.57	0.4	0.38	0.39	0.39
Networks	0.1	0.11	0.19	0.19	0.19	0.21	0.21
Renewable energy	0.15	0.18	0.2	0.41	0.5	0.57	0.47
Energy efficiency	0.25	0.24	0.33	0.35	0.36	0.39	0.47
Total fossil fuel related	4.4	3.97	2.8	1.58	1.68	1.71	1.94

Appendix 17 Total gross employment in energy related activities (adapted from ECN et al., 2016)⁴⁸⁸

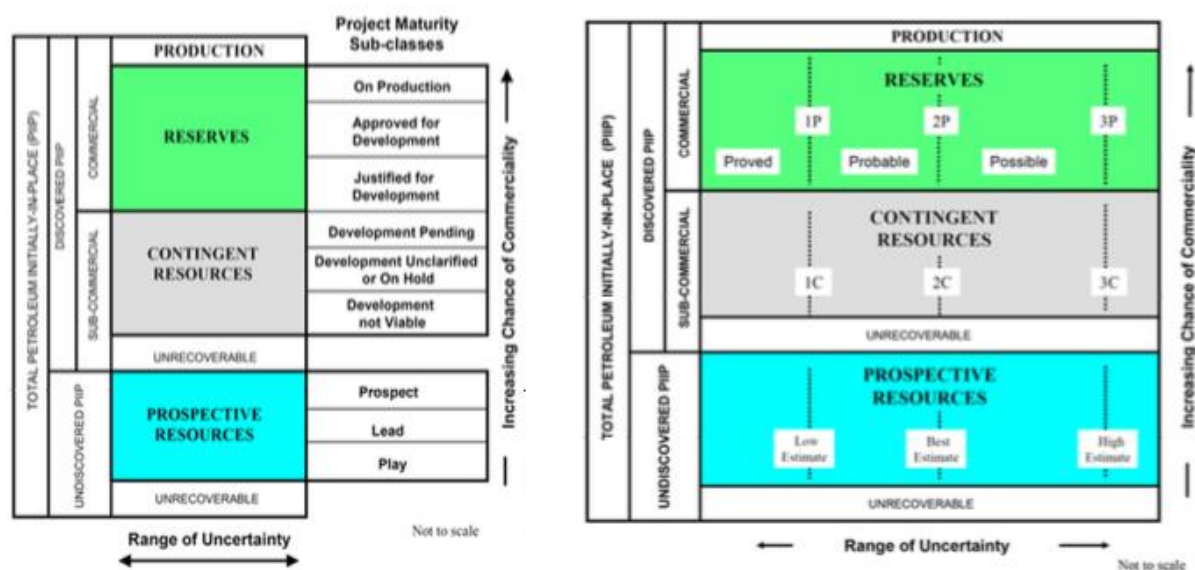
Worked years in FTE	2008	2010	2015	2016	2017	2018	2020
Total Energy related	117.7	127.5	156.2	147.9	153.7	164.4	170.9
As share of total employment (%)	1.3	1.5	1.8	n.d.	n.d.	n.d.	n.d.
Operations							
Oil and gas extraction	2.3	2.6	2.6	2.6	2.5	2.5	2.4
Oil refining	6	5.6	5.5	5.4	5.4	5.3	5.1
Electricity and heat production from fossil sources (central and decentral)	11	11.6	9.7	8.7	8.3	8.1	7.8
Networks	11.3	11	13.8	13.8	13.8	13.8	13.8
Gasoline stations and storage and wholesale of fossil fuels	12.4	13.2	13.2	13.1	13	13	12.8
Renewable energy production	1.8	2.2	2.7	3.5	3.7	4.2	5.1
Activities from investments							
Electricity production from fossil fuels	28.3	33.7	41.6	30.4	30.2	30.9	31.3
Oil and gas exploration	3.3	3.2	5	3.7	3.6	3.7	3.8
Heat, geothermal, and hydropower	1.7	1.9	14.2	4.6	6.1	7.4	7.8
Biomass, -gas, -fuels, and -refinement	3	3.5		2	1.7	2.2	2
Wind	3	3.3		6.1	7.4	9.3	8
Solar	2.3	2.9		4.3	3.7	3.8	3.9
Energy efficiency	23.5	24.5	32.1	33.1	36.3	41.2	47
Total fossil fuel related employment	63.3	69.9	77.6	63.9	63	63.5	63.2
Total fossil related as share of total employment (%)	0.7	0.8	0.9	n.d.	n.d.	n.d.	n.d.

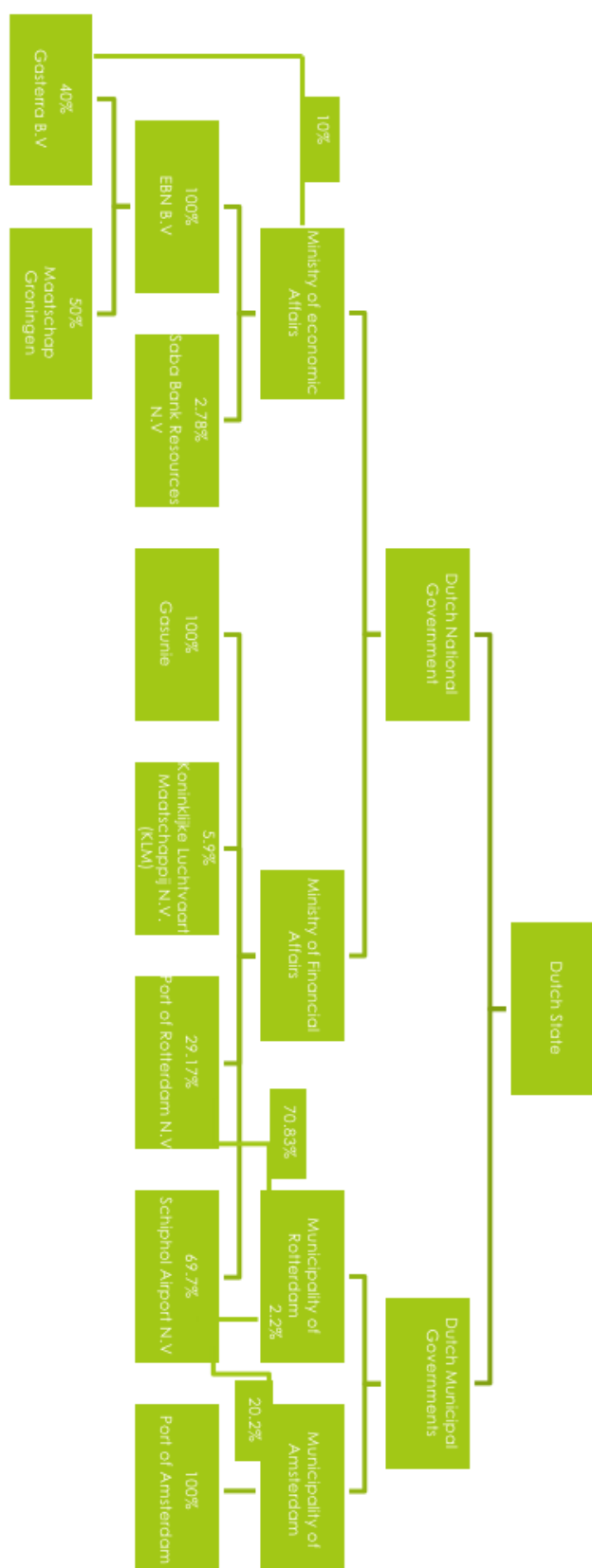
⁴⁸⁷ ECN et al., "Nationale Energie Verkenning 2016," 223.⁴⁸⁸ Ibid., 222.

Appendix 18 IEA Key energy indicators 2014

IEA indicators 2014				
	The Netherlands	EU-28	OECD	World
Population (millions)	16.86	508.13	1266.94	7248.66
GDP (billion 2010 USD)	845.61	17427.02	47107.38	72907.58
GDP PPP (billion 2010 USD)	752.14	17268.23	46238.45	101462.9
Energy production (Mtoe)	58.53	775.03	4143.93	13805.44
Net imports (Mtoe)	30.51	884.38	1321.5	0
TPES (Mtoe)	72.95	1564.97	5273.27	12699.13
Electricity consumption (Twh)	113.21	3002.59	10171.47	21962.54
Co2 Emissions (Mt of Co2)	148.34	3160.02	11855.55	32381.04
TPES/population (toe/capita)	4.33	3.08	4.16	1.89
TPES/GDP (toe thousand 2010 USD)	0.09	0.09	0.11	0.19
TPES/GDP PPP (toe/thousand 2010 USD)	0.1	0.09	0.11	0.14
Electricity consumption /population (MWh/capita)	6.71	5.91	8.03	3.03
Co2/TPES (t Co2/toe)	2.03	2.02	2.25	2.36
Co2/Population (t co2/capita)	8.8	6.22	9.36	4.47
Co2/GDP (kg co2/ 2010 USD)	0.18	0.18	0.25	0.44
Co2/GDP PPP (kg co2/2010 USD)	0.2	0.18	0.26	0.32

Appendix 19 Petroleum Resource Management System (PRMS)



Appendix 20 Overview of government participations (based on own analysis)⁴⁸⁹⁴⁸⁹ Author's own.

Appendix 21 National Government fossil fuel related participation in 2015 (based on own analysis)⁴⁹⁰

Company	Share (%)	Type ⁴⁹¹	Description	Capital share (Mln €)	Dividend (Mln €)	Return on equity (%)
EBN B.V	100	Policy participation	Participates in oil and gas production	4,766	450	240
Gasunie	100	Public participation	Gas transmission, processing, and storage	1,631	332	9.9
GasTerra B.V	10	Policy participation	Gas wholesaling	14,740	3.6	16.7
KLM N.V	5.9	Public participation	International airline	9,905	0.9	26.7
Schiphol Airport N.V	69.7	Public participation	Main international airport	1,540	131	10.4
Port of Rotterdam N.V	29.17	Public participation	Main seaport	677	26.5	8.7
Saba bank resources N.V	2.78	Policy participation	Entity that holds the rights to resource extraction (oil and gas) on the Saba bank	0	0	-1
Winair	7.95	Policy participation	Airline connecting islands in the former Dutch Caribbean	20,5	0	-63.4
Total				33,280	944	

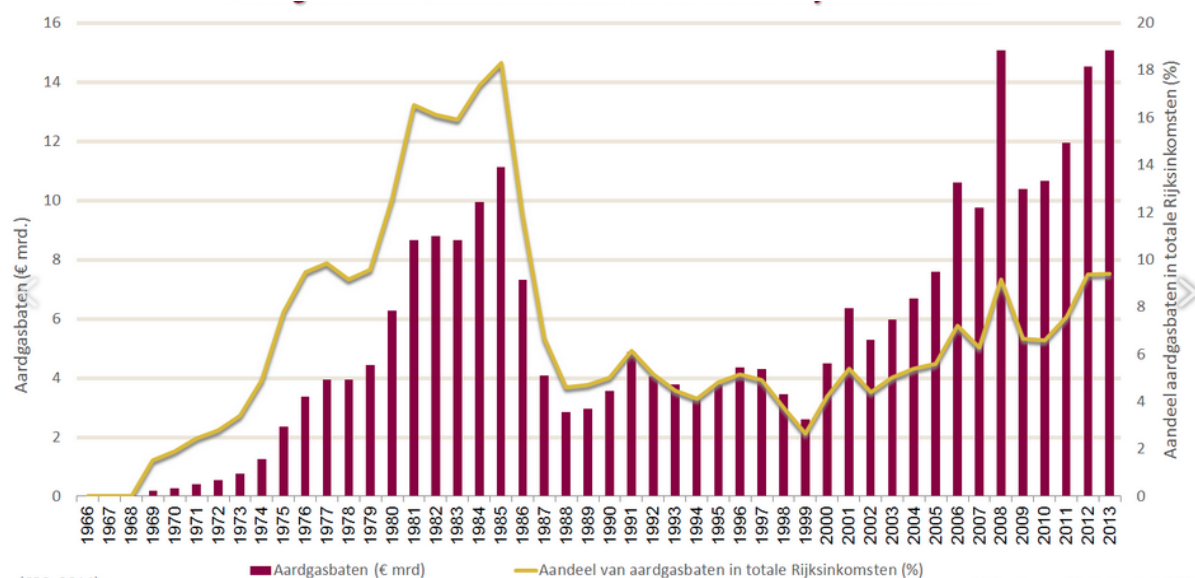
Appendix 22 Dutch Oil and Gas field concession and permit holders⁴⁹²

Gas field owners ⁴⁹³	Oil field owners	Operating permit holders	Exploration permits (hydrocarbons) holders
NAM (Nederlandse Aardolie Maatschappij)	Dana	NAM	Nederlandse Aardolie Maatschappij B.V (NAM)
Dana	Petrogas	ExxonMobil Producing Netherlands	ENGIE E&P Nederland B.V.
Petrogas	TAQA	Oranje Nassau Energie B.V (ONE)	Tulip Oil Netherlands B.V.
TAQA	Engie	Energy06 Investments B.V	PA Resources UK Ltd.
Engie	Wintershall	TAQA Offshore B.V	Vermillion Oil & Gas Netherlands B.V
Wintershall	Vermillion	TAQA Onshore B.V	Lundin Netherlands B.V

⁴⁹⁰ Ministry of Finance, "Jaarverslag Beheer Staatsdeelnemingen 2015."⁴⁹¹ Policy participations (beleidsdeelnemingen) refers to participations that were started to implement certain policy goals; e.g. promote oil and gas production (EBN). Public participations (Staatsdeelnemingen) serve to provide a public good, and usually include (natural) monopolies such as the railways and the powergrid.⁴⁹² TNO, "Delfstoffen En Aardwarmte in Nederland: Jaarverslag 2015," 107–18.⁴⁹³ Some fields produce both gas and oil

Vermillion	Centrica	Dana Petroleum Netherlands B.V.	
Centrica	Sterling	Dyas B.V.	
Total		TAQA Piek Gas B.V.	
ONE		Parkmead (E&P) Ltd.	
Tullow		Total E&P Nederland B.V	
		Gas Storage Ltd.	
		Overseas Gas Storage Ltd.	

Appendix 23 Government gas revenues 1966 - 2013 (In Dutch)⁴⁹⁴



Appendix 24 Dutch Sea Ports

Port name	Port Operator	Fuel handled
Delfzijl	Groningen Seaports	Oil
Eemshaven	Groningen Seaports	Coal (directly to powerplant)
Harlingen	Harlingen Seaport	-
Den Helder	Den Helder Seaport	-
Amsterdam	Amsterdam Seaports	Coal
Zaanstad	Amsterdam Seaports	Coal
Beverwijk	Amsterdam Seaports	Coal
Velsen	Amsterdam Seaports	Coal
IJmuiden	Zeehaven IJmuiden N.V. (Private port)	Coal (directly to Tata Steel)
Scheveningen	Havenbedrijf Scheveningen	-
Rotterdam	Port of Rotterdam	Coal, Oil, LNG
Schiedam	Port of Rotterdam	Coal
Vlaardingen	Port of Rotterdam	Coal
Maassluis	Port of Rotterdam	Coal

⁴⁹⁴ Aardgas-in-nederland.nl, "Aardgasbaten En Economie | Wat Draagt Aardgas Bij Aan de Schatkist?"

Dordrecht	Port of Rotterdam	Coal
Moerdijk	Port of Moerdijk	Petrochemicals, oil, coal, LNG
Vlissingen	Zeeland Seaports	Coal, oil
Terneuzen	Zeeland Seaports	Coal, oil
Borsele	Zeeland Seaports	Coal, oil

Appendix 25 Ownership of major seaports the Netherlands (based on own analysis)

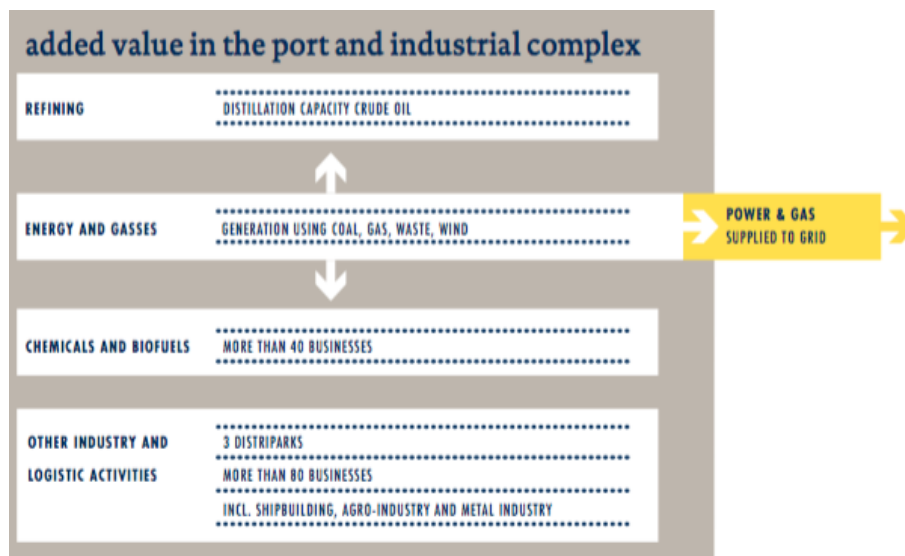
Port	Port Operator	Owner (share in %)
Port of Rotterdam (HbR)	Haven Bedrijf Rotterdam N.V	Municipality of Rotterdam (70,83) National Government (29,17)
Port of Amsterdam (HbA)	Haven Bedrijf Amsterdam N.V	Municipality of Amsterdam (100)
Zeeland Seaports (ZSP)	Zeeland Seaports N.V	Province of Zeeland (50) Municipality of Terneuzen (16,7) Municipality of Vlissingen (16,7) Municipality of Borsele (16,7) (Through 'GR Zeeland Seaports' which has a 100% share in Zeeland Seaports N.V)
Groningen Seaports (GSP)	Groningen Seaports N.V.	Province of Groningen (60) Municipality of Delfzijl (20) Municipality of Eemmond (20) (Through 'GR Groningen Seaports' which has a 100% share in Groningen Seaports N.V) ⁴⁹⁵
Port of Moerdijk	Port of Moerdijk N.V (since 1/1/2017)	Municipality of Moerdijk, Province of Noord-Brabant (Through 'Havenschap Moerdijk')
IJmuiden	IJmuiden N.V	Privately owned

Appendix 26 Stevedores handling coal in the Netherlands

Company	Port
EMO (Europees Massagoed Overslagbedrijf)	Port of Rotterdam
EBS (European Bulk Services)	Port of Rotterdam
RBT (Rotterdam Bulk Terminal)	Port of Rotterdam
Marcor Stevedoring	Port of Rotterdam
ZHD (Zeehaven Bedrijf Dordrecht)	Port of Rotterdam
EECV (Ertsoverslagbedrijf Europoort CV)	Port of Rotterdam
C.D.C (Cooperatieve Duwbakken Centrale)	Port of Rotterdam
BSR Van Uden Stevedoring	Port of Rotterdam
Nieuwe Waterweg Silo	Port of Rotterdam
Ovet	Zeeland Seaports
Verbrugge International B.V	Zeeland Seaports
IGMA	Port of Amsterdam
MAJA	Port of Amsterdam
NUON (direct use in 'Hemweg 8' powerplant)⁴⁹⁶	Port of Amsterdam
OBA	Port of Amsterdam
Rietlanden Terminals/EDf (Energie de France)	Port of Amsterdam

⁴⁹⁵ Groningen Seaports, "Selectielijst Voor Archiefbescheiden van de Overheids-NV Groningen Seaports En Taakvoorgangers: 1997 - Heden," 3.

⁴⁹⁶ This plant will be closed in the near future.

Appendix 27 Value added activities in the Port of Rotterdam⁴⁹⁷Appendix 28 Oil infrastructure in the Netherlands⁴⁹⁸

⁴⁹⁷ Ministry of Finance, "Jaarverslag Beheer Staatsdeelnemingen 2014," 28&33.

⁴⁹⁸ IEA, "The Netherlands 2014 Review," 155.

Appendix 29 Rotterdam pipeline connections

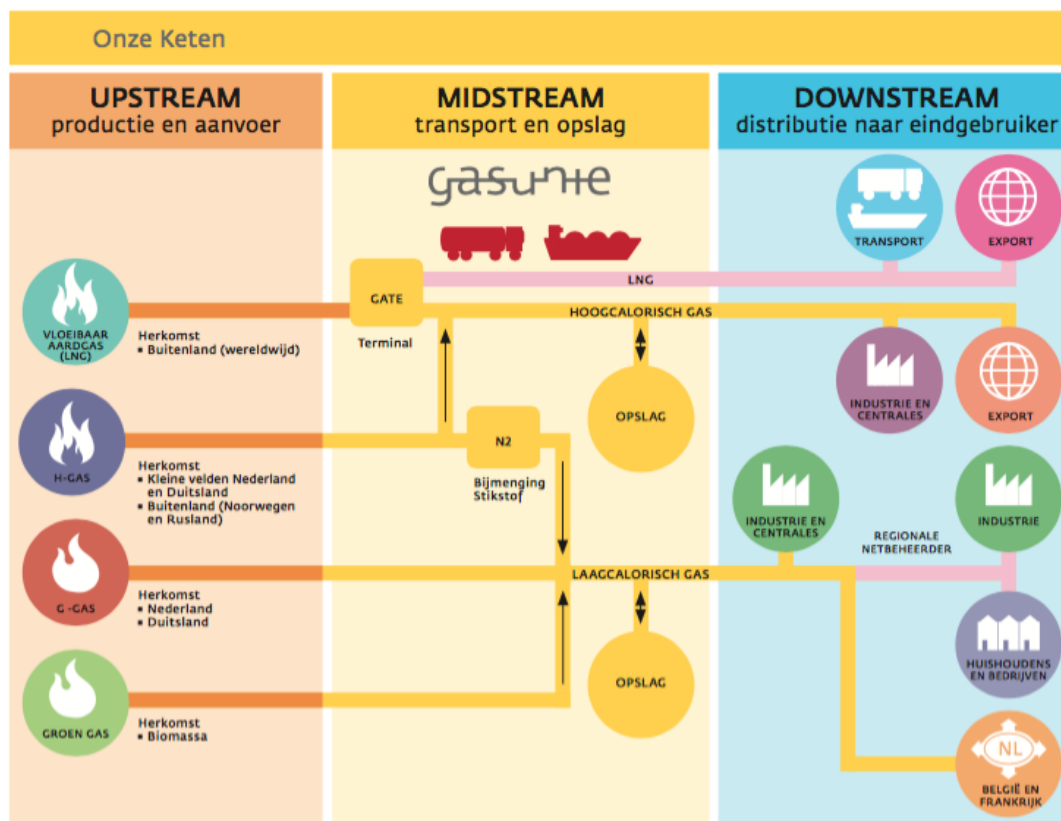


Appendix 30 Oil storage locations (based on own analysis)

Storage site	Owner/operator	Location	Type
Twente-Rijn de Marssteden	Akzo Nobel Salt B.V	Municipality of Enschede	Salt-cavern storage
Vesta Terminal B.V	Mercuria Energy Asset Management B.V and Sinomart KTS development Ltd.	Port of Vlissingen	Tank
Maasvlakte Olie Terminal C.V (MOT)	BP Nederland B.V, Esso Nederland B.V (Exxon), Gunvor Petroleum, Shell Nederland Raffinaderij B.V, Zeeland Refinery (Total and Lukoil), Vopak	Port of Rotterdam	Tank
Maatschap Europoort Terminal	Mafina B.V, Ruhr öl GmbH	Port of Rotterdam	Tank
Odfjell Terminals Rotterdam B.V	Odfjell	Port of Rotterdam	Tank
Rubis Terminal	Rubis Group	Port of Rotterdam	Tank
Vopak Terminal Europoort	Vopak	Port of Rotterdam	Tank
Vopak Terminal Botlek	Vopak	Port of Rotterdam	Tank
Vopak Terminal TTR	Vopak	Port of Rotterdam	Tank
Vopak Terminal Laurens haven	Vopak	Port of Rotterdam	Tank
Vopak Terminal Chemiehaven	Vopak	Port of Rotterdam	Tank
Vopak Terminal Amsterdam Westpoort	Vopak	Port of Amsterdam	Tank

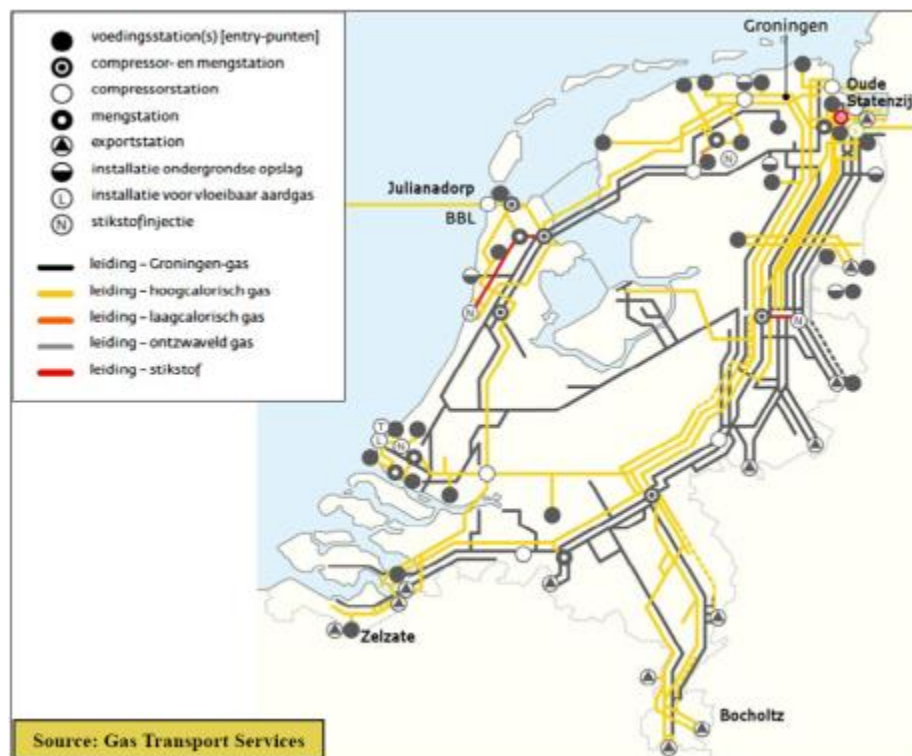
Vopak Terminal Eemshaven	Vopak	Port of Amsterdam	Tank
Oiltanking Amsterdam	Marquard and Bahls AG	Port of Amsterdam	Tank
Alkion Terminal Amsterdam	Finco Fuel Holding B.V	Port of Amsterdam	Tank
Eurotank Amsterdam B.V	VTI	Port of Amsterdam	Tank
Koole Terminals	Koole	Port of Amsterdam/Rotterdam	Tank
Zenith Terminal	Zenith Energy Ltd.	Port of Amsterdam	Tank
Haan Oil Storage	Haan Oil Storage	Port of Rotterdam (Dordrecht)	Tank

Appendix 31 Gasunie transport and distribution chain⁴⁹⁹



⁴⁹⁹ Gasunie, "Gasunie: Annual Report 2015," 158.

Appendix 32 Dutch gas transmission system

Appendix 33 Gasunie - subsidiaries and participations (based on own analysis)⁵⁰⁰

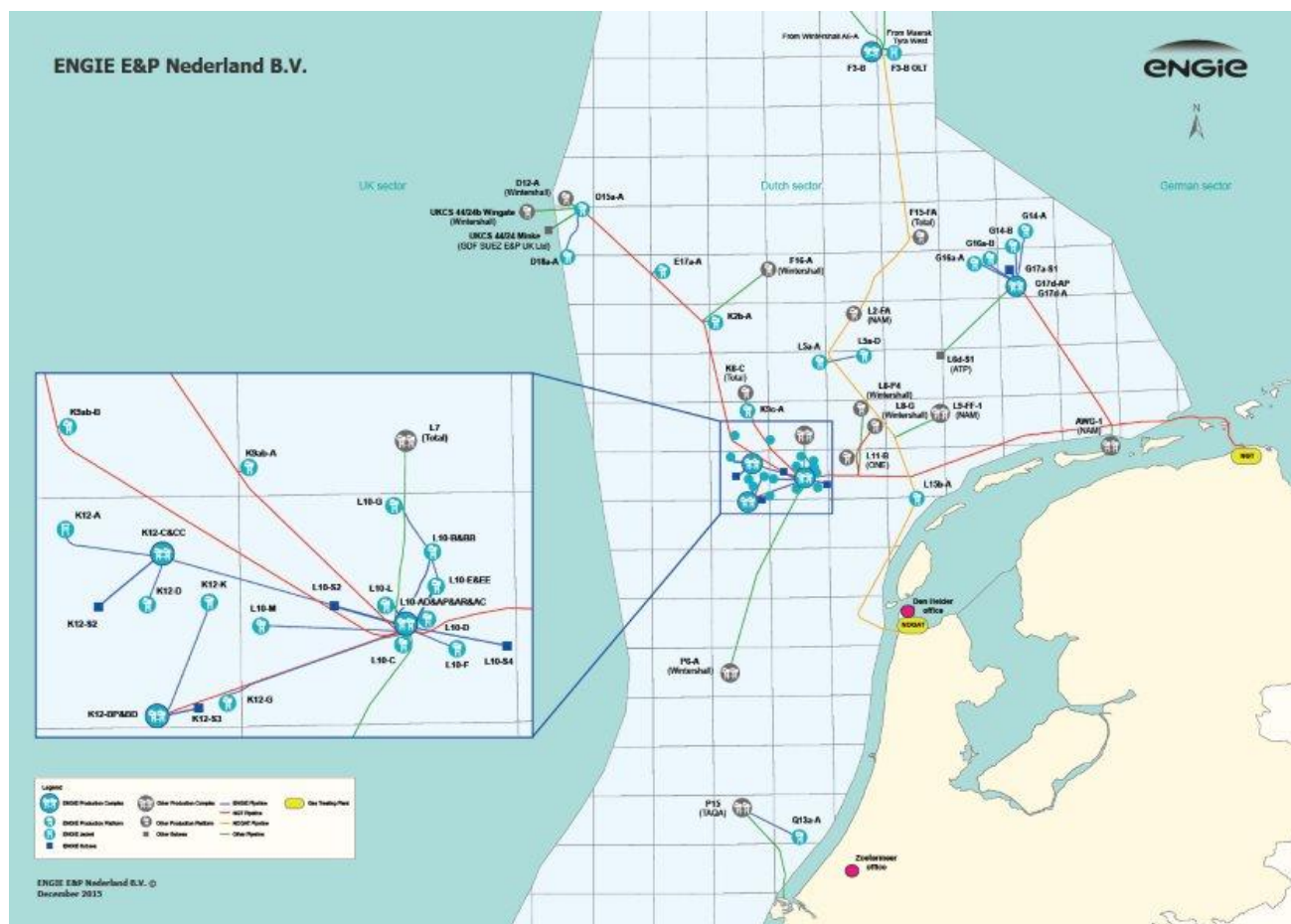
Entity	Description	Owner(s)
Gasunie Transport Services (GTS)	Dutch main transmission network	Gasunie (100%)
Gasunie Grid Services	Regional high-pressure transmission system	Gasunie (100%)
Gasunie Deutschland	Manages part of the German transmission system	Gasunie (100%)
GATE (Gas Access to Europe) terminal C.V	LNG import terminal in the port of Rotterdam	Gasunie (50%), Vopak N.V (50%)
GATE breakbulk terminal	Facility that allows LNG bunkering in the port of Rotterdam	Gasunie (50%), Vopak N.V (50%)
Gasunie Peakshaver B.V	Gas – LNG conversion + tank storage to balance the system during short periods of high-demand	Gasunie (100%)
Energystock B.V	Short-term underground gas storage to match supply and demand	Gasunie (100%)
BBL Company VOF	Connection between the Netherlands and the United Kingdom	Gasunie (60%), Uniper Ruhrgas BBL B.V. (20%), Fluxys BBL B.V (20%).
NEL (Nordeuropäische Erdgas Leitung)	Connection between Nord Stream 1 and Gasunie's German network	Gasunie (25.13%), WIGA Transport Beteiligungs-GmbH & Co. KG (Gazprom & BASF) (46.13%), Fluxys (23.87%), E.ON Ruhrgas (4,87%).

⁵⁰⁰ Gasunie, "Gasunie: Annual Report 2015."

Nord Stream A.G	Connection between Russia and Germany (now called 'Nord Stream 1')	Gasunie (9%), OAO Gasprom (51%), Wintershall Holding GmbH (15.5%), PEG Infrastruktur AG (PEGI/E.ON) (15.5%), ENGIE (9%)
ICE Endex	Gas and power exchange	Gasunie (20,88%), ICE (79,12%)
Vertogas	Official Accreditation body for 'greengas'	Gasunie (100%)
Gasunie New Energy	Helps partner organizations with upscaling new energy solutions such as hybrid-heat pumps, district heating, and 'green gas'	Gasunie (100%)
GASPOOL Balancing services GmbH	Gas network management services in Germany (Operates on the GASPOOL virtual trading facility)	Gasunie (16.7%)
Energie Data Services Nederland B.V (EDSN)	Platform for administrative connections in the Netherlands	Gasunie (12.5%)
PRISMA European Capacity Platform GmbH	European gas capacity trading platform	Gasunie (12,7%)
DEUDAN - Deutsch/Dänische Erdgastransport-GmbH & Co. KG	Gas pipeline from Germany to Denmark	Gasunie (75%)
Eemshaven LNG Terminal B.V	LNG terminal in GSP	Gasunie and Groningen Seaports
Norddeutsche Erdgas Transversale (NETRA) GmbH	Gas pipeline in Germany	Gasunie (33.3%)

Appendix 34 Pipelines in the Dutch part of the North-Sea⁵⁰¹

⁵⁰¹ ENGIE E&P Nederland B.V., "Offshore Pipelines."



Appendix 35 Oil refineries in the Netherlands (based on own analysis)

Refinery	Owner/Operator	Capacity	Location
Shell Pernis	Shell Nederland	404,000 bpd	Rotterdam
Esso Nederland B.V. Rotterdam Refinery	Exxonmobil	190,000 bpd	Rotterdam
Koch HC partnership B.V. refinery	Koch Supply and Trading	85,000 bpd	Rotterdam
BP Europoort Refinery	BP	400,000 bpd	Rotterdam
Gunvor Petroleum Rotterdam (GPR)	Gunvor Group ⁵⁰²	88,000 bpd	Rotterdam
Zeeland Refinery	Total & Lukoil	180,000 bpd	Vlissingen

Appendix 36 State revenue petrol station leasehold auctions 2002-2016 (based on own analysis)⁵⁰³

⁵⁰² The Kuwait Petroleum Europoort refinery was acquired by Gunvor group in 2016. (Gunvor group, "GUNVOR ACQUIRES ROTTERDAM REFINERY | Gunvor Group.")

⁵⁰³ Rijksvastgoedbedrijf, "Documenten - Verhuren en in gebruik geven - Rijksvastgoedbedrijf"; Rijksvastgoedbedrijf, "Verhuurd," September 7, 2016; Rijksvastgoedbedrijf, "Verhuurd," September 9, 2015.

	Total revenue (mln €) ⁵⁰⁴	Government share (mln €)	Number of stations auctioned
2002	29.1	1.5	9
2003	23.6	no data	10
2004	no auction	no auction	no auction
2005	37.4	no data	13
2006	38.8	no data	7
2007	39.5	no data	9
2008	24.2	12.4	10
2009	26.1	18	10
2010	18.2	9.3	7
2011	14.8	10.9	6
2012	6.31	5.5	6
2013	11	10.7	9
2014	12.6	7.1	6
2015	21	10	10
2016	16.1	16.1	7
Total	318.71	101.5	119

Appendix 37 DSO's in the Netherlands (based on own analysis)⁵⁰⁵

DSO	Type	2015 distribution (mcm)	Owner(s)
Cogas Infra & Beheer B.V	Regional distribution of gas and electricity	345.3	Municipalities of Almelo, Borne, Dinkelland, Hardenberg, Hof van Twente, Oldenzaal, Tubbergen, Twenterand, and Wierden
Enduris B.V (part of Delta N.V, legal obligation to be sold before July 2017)	Regional distribution of gas and electricity	434.2	Through Delta N.V: Provinces of Zeeland (50%), Zuid-Holland (0.05%), and Noord-Brabant (0.05%); Municipalities of Goedereede (0.47%), Dirksland (0.32%), Middelharnis (0.68%), Oostflakkee (0.42%), Schouwen- Duiveland (3.91%), Tholen (2.7%), Bergen op Zoom (0.55%), Woensdrecht (0.91%), Reimerswaal (2.54%), Kapelle (1.34%), Goes (4.17%), Borsele (2.64%), Vlissingen (5.76%), Middelburg (5.78%), Veere (2.79%), Sluis (3.25%), Terneuzen (7.35%), Hulst (3.44%) ⁵⁰⁶
Enexis B.V (Edinet merged with Enexis as of 1-1-2017⁵⁰⁷)	Regional distribution of gas and electricity	5,530	Provinces of Noord-brabant (30.83%), Flevoland (0.02%), Groningen (6.01%), Drenthe (2.28%), Overijssel (18.71%), Limburg (16.13%), and around 112 municipalities in these provinces (26%) ⁵⁰⁸
Liander N.V (part of Alliander N.V)	Regional distribution of	6,012	Province of Gelderland (44.68%), Friesland (12.65%), Noord-Holland (9.16%), municipality of Amsterdam (9.16%), the remainder is held by 60+ municipalities ⁵⁰⁹ .

⁵⁰⁴ The 2003 to 2007 numbers probably refer to the summed amount of winning bids; this number is substantially higher than the actual revenue for the government and leaseholders. No other data is available.

⁵⁰⁵ ACM, "Overzicht regionale netbeheerders."

⁵⁰⁶ DELTA, "Aandeelhouders | DELTA."

⁵⁰⁷ Edinet was part of Alliander before 2017. The pre-2017 figures for Alliander thus include Edinets activities.

⁵⁰⁸ Enexis, "Enexis Annual Report: 2015."

⁵⁰⁹ Alliander, "Aandeelhouders | Alliander."

	gas and electricity		
Zebra Gasnetwerk B.V	High-pressure gas pipeline	1,248 (H-gas)	Enexis (67%), Enduris (33%)
RENDO Netbeheer B.V	Regional distribution of gas and electricity	n/d	Municipalities of Coevorden (4.14%), Hardenberg (5.75%), Hoogeveen (33.70%), Meppel (12.01%), Staphorst (4.34%), Steenwijkerland (19.98%), Westerveld (7.97%), De Wolden (10.29%) , Zwartewaterland (1.82%) ⁵¹⁰
Stedin Netbeheer B.V (until 1-1-2017 part of Eneco)	Regional distribution of gas and electricity	4,436	Municipalities of Rotterdam (31.99%), The Hague (16.55%), Dordrecht (9.05%), Leidschendam-Voorburg (3.44%), Lansingerland (3.38%), Delft (2.44%), Zoetermeer (2.34%), Nissewaard (2.14%), Pijnacker-Nootdorp (2.1%), and 44 other municipalities (total 26.87%) ⁵¹¹
Westland Infra Netbeheer B.V	Regional distribution of gas and electricity	1,133	Westland (86.4%), Midden-Delfland (13.6%) ⁵¹²

Appendix 38 Electricity producers in the Netherlands (based on own analysis, using 2015 data)

Electricity producer	Capacity	Fossil share (of capacity, unless otherwise indicated)	Shareholders
Delta	1860.9 Mw; Wind (553), biomass (32), rest through EPZ, ELSTA, and Sloecentrale.	55% ⁵¹³	Province of Zeeland (50%), see Appendix 37 for remaining shareholders
Essent	4442 Mw; Gas (2234 + medium scale CHP plants); coal (2197); water (11).	99.78%	RWE (100%)
Nuon	3086.3Mw; Gas (2061.3), Coal (650), Wind (369), water (6) ⁵¹⁴	87.7% ⁵¹⁵	Vattenfall (100%)
EPZ	900Mw; coal (427), wind (17), nuclear (456). The coal fired plant is decommissioned as of 1-1-2016	47.5%	Delta (70%), RWE (30%) ⁵¹⁶
Intergen (MaasStroom)	428Mw (gas)	100%	Ontario Teachers' Pension plan and China Huaneng Group/Guandong Yudean Group
Sloecentrale	870mw (gas)	100%	Delta (50%), EDF (50%).
ELSTA (Electricity and	Gas; 123Mw electricity, 90Mw steam.	100%	Delta (25%), Essent/RWE (25%), AES (50%)

⁵¹⁰ RENDO, "Aandeelhouders En RvC."

⁵¹¹ Eneco, "Aandeelhouders - Eneco Over Ons."

⁵¹² Westland Infra, "Westland Infra: Annual Report 2015."

⁵¹³ Based on fuel mix in 2015; Delta, "DELTA Annual Report 2015," 12.

⁵¹⁴ Vattenfall, "About Our Power Plants and the Production – Vattenfall."

⁵¹⁵ NUON Energy, "NUON Energy N.V Annual Report 2015," 6.

⁵¹⁶ RWE, "RWE Annual Report 2015," 163.

Steam Association)			
Eneco	2293Mw (in the Netherlands); wind (1101), biomass (132), solar (3), 1057 (gas)	46% (75% based on electricity produced in 2015)	53 municipalities, Rotterdam (31.69%) and The Hague (16.55%), see Appendix 37 for remainder

Appendix 39 Major publicly owned airports in the Netherlands (based on own analysis)

Airport	Owner
Schiphol Airport	Schipholgroup (National government (69.7%), municipalities of Amsterdam (20.2%) and Rotterdam (2.2%))
Rotterdam The Hague airport	Schiphol group (100%)
Lelystad Airport	Schiphol group (100%)
Groningen Airport Eelde	Provinces of Groningen and Drenthe, municipalities of Groingen, Assen, and Tynaarlo
Eindhoven Airport	Schiphol group, province of Noord-Brabant, municipality of Eindhoven
Maastricht Aachen Airport	Province of Limburg

Appendix 40 EIA investments and fiscal benefits 1997 -2015 (Based on own analysis)

M €	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Total EIA investments applied	430	656	587	695	1058	1343	839	1398	1199	3710	2023	1483	890	1065	1599	1256	1779	1608	1369	24987
Total EIA investments accepted	332.8	507.7	454.3	537.9	818.9	1039.5	649.4	1082.1	928.0	2871.5	1565.8	1147.8	688.9	824.3	1279.2	942	1396	1239	1069	19374
Total tax expenditure	33.3	50.8	45.4	53.8	81.9	103.9	64.9	108.2	92.8	287.2	156.6	114.8	68.9	82.4	116	94	139	124	107	1925
Acceptance percentage	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	80	75	78	77	77	77.4
Net fiscal advantage (%)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Fossil investments applied	9.0	13.7	12.3	14.6	22.2	28.1	17.6	29.3	25.1	77.7	42.4	31.1	18.6	22.3	63.3	23.8	17.1	24.8	29	522
Fossil investments accepted	7.0	10.6	9.5	11.3	17.2	21.8	13.6	22.7	19.4	60.2	32.8	24.0	14.4	17.3	50.6	17.9	13.4	19.1	22.3	405
Fossil as share of total	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	4.0	1.9	1.0	1.5	2.1	
Fossil fiscal costs	0.7	1.1	1.0	1.1	1.7	2.2	1.4	2.3	1.9	6.0	3.3	2.4	1.4	1.7	5.1	1.8	1.3	1.9	2.2	40.5

Appendix 41 (Historic) excise tax exemptions as listed by the Dutch tax authority⁵¹⁷

Date	Exemption/reimbursement
As of 1-1-2012	Middle oil and gasoil destined for aircrafts became exempt from excise and the storage levy.
As of 1-1-2013	Middle oil and gasoline with a low taxation became exempt from both excise and the storage fee
As of 1-1-2014	Non-Sulphur free middle oil and gasoline became exempt from both excise and the storage fee
Until 1-1-2017	LPG used as fuel for public busses, waste-collection, drain-suction, and street cleaning vehicles received a reimbursement
Up to 1-1-2013	Large consumers of middle oil (> 159,000 liter/year), gasoline (153,000 liter/year), and LPG (>119,000 kg/year) received a (partial) reimbursement of excise tax.
Up to 1-1-2013	Horticultural companies without a connection to the natural gas grid received a reimbursement of excise paid on middle oil and gasoline. A reimbursement of excise on LPG is still in effect
Up to 1-1-2013	Religious institutions and non-profit organizations received a reimbursement of excise tax paid on middle oil and gasoline. Reimbursement of excise on LPG still in effect.
Up to 1-1-2013	Reimbursement given for 'technical or logistic reasons'
Still in effect	Reimbursement for excise paid on LNG/LPG/biogas

Appendix 42 Windfall profits EU-ETS 2008-2015 (taken from de Bruyn et al, 2016)⁵¹⁸

NACE	Sector	Over-allocation	CERs	CPT Min	Total Min	CPT Avg	Total Avg
06.10	Extraction of crude oil and gas	1,2	0,1	3,9	5,2	6,8	8,1
19.10	Manufacture of coke oven products	-	-	-	-	-	-
19.20	Refineries	7,7	2,2	387,8	397,7	678,7	688,5
20.11	Industrial gasses	8,9	0,5	-	9,5	-	9,5
20.13	Inorganic chemicals	5,3	0,7	5,3	11,3	12,4	18,5
20.14	Petrochemicals	81,7	3,6	139,1	224,5	417,3	502,7
20.15	Fertilizers	20,2	0,1	20,4	40,7	68,1	88,4
20.16	Manufacture of plastics in primary form	2,6	0,7	16,3	19,5	27,2	30,4
23.11	Flat glass	-0,8	0,2	-	-0,5	3,2	2,7
23.13	Hollow glass	-0,4	0,3	10,6	10,5	19,4	19,3
23.14	Other glass	0,5	0,1	1,9	2,5	3,9	4,6
23.32	Manufacturing of bricks	5,6	0,3	11,6	17,5	15,4	21,3
23.51	Cement	14,8	0,2	9,6	24,6	18,7	33,7
23.52	Lime	-0,4	-	-	-0,4	0,3	-0,1
24.10	Iron and steel	15,2	19,5	297,9	332,5	406,2	440,8
	Total	162,2	28,6	904,3	1.095,1	1.677,6	1.868,4

Notes: CERs are Certified Emissions Reductions; CPT Min and CPT Avg refer to the minimum and average cost pass-through; Total Min and Total Avg refer to the total additional profits with minimum cost pass-through and maximum cost pass-through.

⁵¹⁷ Belastingdienst, "Tarieven Accijns En Verbruiksbelastingen."

⁵¹⁸ de Bruyn et al., "Calculation of Additional Profits of Sectors and Firms from the EU ETS 2008-2015."

Appendix 43 Schiphol Airport fossil dividends 2001-2016 (based on own analysis)⁵¹⁹

	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	M€
Net revenue	1435	1423	1474	1364	1353	1278	1180	1154	1154	1146	1037	948	888	860	774	695	
o/w aviation	828	843	839	793	773	733.9	684.4	n/d	639.7	650.4	632.6	568.8	521	484	399	349	
o/w consumer and product services	306	314	366	366	335	310.2	271.4	n/d	301.8	300.5	228.1	199.1	237	252	242	249	
o/w real-estate	206	173	205	145	146	136.1	141.6	n/d	135.7	124.4	114	113.8	95	173	114	73	
o/w Alliances and participations	181	130	178	166	99	98	82.6	n/d	77.2	71	62.22	66.36	57	47	35	35	
Net Profit	306	374	272	227	196.5	196.5	169	132	173	316	527	193	158	191	137	263	
Dividend	148	187	138	135	97.5	76.2	65	69(50) 0)	569.1	91.5	79.1	55.3	46.4	40.9	45	22.7	
Operating result Aviation	75.3	138	143.1	85.3	94.7	83.6	67.5	54.4	61.7	105	79	108.9	95	97	87	74	
Operating result other	345.1	366.9	260.1	211	201.3	220.6	229.2	132.6	232.3	315	237	202.2	177	243	184	160	
Direct fossil share of EBIT	18	27	35	29	32	27	23	29	21	25	25	35	35	29	32	32	

⁵¹⁹ Schiphol Group, "Schiphol Annual Report 2001"; Schiphol Group, "Schiphol Annual Report 2003"; Schiphol Group, "Schiphol Annual Report 2004"; Schiphol Group, "Schiphol Annual Report 2005"; Schiphol Group, "Schiphol Annual Report 2006"; Schiphol Group, "Schiphol Annual Report 2008"; Schiphol Group, "Schiphol Annual Report 2010"; Schiphol Group, "Schiphol Annual Report 2011"; Schiphol Group, "Schiphol Annual Report 2012"; Schiphol Group, "Schiphol Annual Report 2013"; Schiphol Group, "Schiphol Annual Report 2014"; Royal Schiphol Group, "Schiphol Annual Report 2016."

Appendix 44 Energy R&D government support programs (based on own analysis)⁵²⁰

Subsidy	Program	Supports	Amount (€)	Fossil aspect
Biobased Economy and Green Gas (BBEG)	TSE	R&D for “green gas” or other bio-based products.	3.95 million for 2017	No
Demonstration Energy-Innovation (DEI)	TSE	Energy innovations that strengthen the Dutch economy by leading to: higher revenue, more employment, increased export from Dutch-made goods.	20 million for 2017	Possible
Early Adopter Projects – Energy and Industry	TSE	R&D for industrial energy efficient technologies by SME’s and/or research organizations	0.3 million for 2017	Possible
Energy and Industry – Joint industry program	TSE	Energy and process efficiency	6.25 for 2017	Possible
Renewable Energy	TSE	Cost reductions in RE	50 million/year	No
MVI Energy	TSE	Projects on the social acceptance of innovation	1 million for 2017	Possible
System integration studies	TSE	R&D for energy storage and conversion	0.5 million for 2017	Possible
Urban Energy	TSE	R&D for RE, energy-efficiency and energy infrastructure in the build environment	16 million in 2017	Possible
Wind at sea R&D	TSE	R&D for offshore-wind	4.7 million in 2017	No
System Integration on the North Sea	TSE	R&D for cost and CO ₂ reduction through cooperation between offshore-wind and oil and gas.	1 million	Yes
ERA-NET energiecall	TSE	R&D on increasing the European competitiveness of solar	1 million	No

Appendix 45 General R&D support programs (based on own analysis)⁵²¹

Program	Description	Budget	Fossil Aspect
VFF (Vroege Fase Financiering)	Loans for innovative SME’s and startups	7 million for SME’s and 2 million for start-ups in 2017	
TOF (Toekomstonderzoeksfonds)	The Development of research facilities by research institutes	20 million in 2017	No fossil projects ⁵²²

⁵²⁰ RVO, “Ondersteunde Projecten Door RVO.nl | RVO.nl.”⁵²¹ RVO, “Subsidies & Financiering | RVO.nl.”⁵²² RVO, “Projecten Toekomstfondskrediet | RVO.nl.”

	through an interest free loan		
DHI	Support for innovative SME's that want to expand abroad or attract foreign investment	5.75 million in 2017	
SBIR (Small Business Innovation Research)	Competitive program for the development of products that address societal problems by SME's and large companies	No data	
PPS R&D Contribution	R&D funding for public-private partnerships	No data	
Innovation Credit	Loans for innovative clinical/technical development projects	60 million for 2017 o/w 20 for clinical and 60 for technical R&D projects	
Smart Industry Fieldlabs	Development of new (IT based) production technologies	14.55 million	
MIT (MKB Innovatiestimulerend Topsectoren)	Promote SME R&D cooperation between regions	32 million in 2014, 55 million in 2015 o/w 35 from national government and 20 million from the Provinces	

Appendix 46 Former government R&D support programs (based on own analysis)⁵²³

Subsidy	Description	Budget (€)	Period	Fossil aspect
Industrial heat use ('industriële warmtebenutting')	Support the better use of rest-heat and sustainable heat in industry	10.5 million	2010	Possible
EOS (Energie Onderzoek Subsidie)⁵²⁴	Subsidy for R&D on new technologies that contribute to the Energy transition; comprises 6 different subsidy programs	1360 million for all programs listed in the rows below for the entire period	2005 - 2010	Yes
UKR (Unieke Kansen Regeling)	Part of EOS, supported public private cooperation in developing solutions for the energy transition		2005 – 2010	Yes
EOS Long Term ('lange termijn')	Supports research that contributes to a sustainable energy system		2005 – 2010	Yes
EOS Long Term ECN Consortia	Supports research projects that contribute to a sustainable energy		2005 – 2010	Yes

⁵²³ RVO, "Energie Onderzoek Subsidie (EOS) | RVO.nl."

⁵²⁴ Ibid.

	system in which the ECN participates			
EOS KTO ('Korte Termijn onderzoek')	Supports the development of new technologies that contribute to a sustainable energy system		2005 – 2010	Yes
EOS Demo ('demonstratie')	Supports the demonstration of new technologies		2005 – 2010	Yes
UKP VWK ('Unieke Kansen Programma')	Supports heat pump projects		2005 - 2010	Yes

Appendix 47 TKI Gas fossil fuel subsidies 2012-2015 (based on own analysis)⁵²⁵

TKI GAS natural gas subsidies 2012 - 2015 ⁵²⁶				
TKI GAS 2012, 40 projects	Project Nr.	Budget (€)	Applicant/Lead org.	Type
Optimaliseren gasproductie door modelleren zoutafzetting rond productieput	TKIG01001	100,000	TNO	Production
TNO ontwikkelt datasysteem voor veiliger gebruik diepe ondergrond	TKIG01002	175,000	TNO	Production
Zuivering en hergebruik terugspoelwater bij hydraulisch fractureren	TKIG01003	35,000	TNO	Fracking
Langere levensduur gasputten met wellhead compressie	TKIG01004	125,000	TNO	Production
Onderzoek naar effect van kleizwelling op permeabiliteit en gasproductie	TKIG01005	12,500	TNO	Production
Efficiënte technologieën voor hergebruik of lozing proceswater op zee	TKIG01006	125,000	TNO	Production
Aanwezigheid van sweet spots in schaliegas eenvoudiger identificeren	TKIG01008	50,000	TNO	Shale gas
Acceptatie van gas als energiebron voor de toekomst	TKIG01016	50,000	RUG	Societal acceptance
Tough Gas WP1.4 - UU	TKIG01017	80,000	UU	Shale gas
Tough Gas WP1.1 - UU	TKIG01018	80,000	UU	Production
Inzicht in gedrag schaliegasreservoir na opvoeren van vloeistofdruk	TKIG01019	80,000	TU Delft	Shale gas
Ontwikkeling van kennis over scheurgeometrieën in schalies	TKIG01020	80,000	TU Delft	Shale gas
Meer kennis over schuimmiddelen verlengt levensduur gasputten	TKIG01022	500,000	TNO	Production
Enhanced Gas Recovery	TKIG01023	75,000	TNO	Production
Tough gas targeting through high-res. geological char. of fine-grained sed. rock	TKIG01024	28,000	TU Delft	Production
Fracture initiation fracture growth, fluid flow and particle transport	TKIG01025	80,000	TU Eindhoven	Fracking
Ombouw van bestaande dieselscheepsmotor naar LNG	TKIG01027	296,250	Coral Carbonic B.V.	LNG
Advanced LNG Apprentice Training Program	TKIG01028	100,000	Anthony Veder Rederijzaken B.V.	LNG

⁵²⁵ RVO, "Ondersteunde Projecten Door RVO.nl | RVO.nl."

⁵²⁶ Project names mostly in Dutch

LNG Bunker Tank Safety	TKIG01029	255,000	TNO	LNG
Kristallisatiegedrag van onzuiverheden in aardgas bij cryogene temperaturen	TKIG01030	240,000	TU Eindhoven	LNG
Avoiding methane emissions in the small scale LNG supply chain	TKIG01031	180,000	Rolande LNG BV	LNG
A010 Technical Feasibility study for a small-scale LNG composition and level sensor	TKIG01032	47,500	TNO	LNG
LNG applications for Short Sea Shipping	TKIG01034	294,500	Koers & Vaart	LNG
A014 Research program LNG material and construction	TKIG01035	490,000	TNO	LNG
Refitt For All	TKIG01036	103,000	Schipco B.V	LNG
Systeemstudie verkent kansen P2G-route	TKIG01038	281,472	ECN	Power to Gas
	Total fossil gas	3,963,222		
	Total bio gas	4,223,964		
	Total other non-fossil	273,396		
	Fossil share of budget (%)	46.8		
TKI GAS 2013, 32 projects				
Geochemical composition and origin natural gas in onshore and offshore Netherlands	TEG0213001	155,000	TNO	Production
The use of coatings for deliquifying gas wells	TEG0213003	75,000	TNO	Production
Salt precipitation validation	TEG0213004	150,000	TNO	Production
EGR technical and economic feasibility	TEG0213005	120,000	TNO	Production
Alternative Fuels for Fishing Vessels	TEG0313001	171,000	Koers & Vaart	LNG
Validatie van een meetmethodiek voor niveau- en dichtheidmeting in kleinschalige LNG-tanks	TEG0313005	256,799	TNO	LNG
Distributie in Nederland van LNG voor brandstof in vrachtauto, binnenvaart en kustvaart	TEG0313006	330,188	Vopak LNG Holding B.V	LNG
Leren van ervaringen in de gassector	TEG0613001	68,404	ECN	Societal acceptance
Coördinatie en uitvoering van projecten	TKIG01052	2,264,500	Rolande LNG BV	LNG
Coördinatie en uitvoering van projecten	TKIG01056	1,133,389	Technisch Bureau Dahlman B.V	
ISO / CEN- standards voor kleinschalige LNG-tankstations en – bunkering	TKIG01037	80,000	NEN	LNG
Coördinatie en uitvoering van projecten	TKIG01033	687,000	VSL B.V	LNG
Coördinatie en uitvoering van projecten	TKIG01026	208,000	ArenaRed B.V	LNG
TNO kijkt naar condities voor aardgaswinning in relatief onbekend gebied	TKIG01007	277,623	TNO	Exploration
	Total fossil gas	5,976,903		
	Total bio gas	6,964,150		
	Total other non-fossil	441,810		
	Fossil share of budget (%)	44.7		

TKI Gas 2014, 21 projects				
Industrial Research for Improving LNG Flow and Composition Measurements	TEG0214002	397,775	VSL B.V	LNG
CRYOVAT LNG retrofit Tank (voor binnenvaart)	TEG0214003	238,190	Cryovat Internationaal B.V	LNG
Chalk potentieel in de D-, E- en F-kwadranten	TEG0114001	159,067	Amsterdam Petroleum Geoscience B.V	Production
A conceptual diagenetic model for cementation in the Rotliegend sandstones (NL) - targeting reservoir	TEG0114003	150,000	TNO	Production
Ductile Formation Sealing	TEG0114004	125,000	TNO	Production
Unstable flow in liquid loading gas wells	TEG0114005	150,000	TNO	Production
Real Time Production Optimization	TEG0114006	210,000	TNO	Production
Flex-Fuel LNG	TEG0214008	489,375	ArenaRed B.V	LNG
Feasibility study for the application of Composites in LNG equipment	TEG0214009	100,000	TNO	LNG
Industrieel onderzoek naar de betrouwbaarheid van cryogene slangen bij LNG dispensers voor LNG tankstations	TEG0214010	69,660	TNO	LNG
De Groene Trein	TEG0214006	105,000	Stichting Energy Valley	LNG
	Total fossil gas	2,194,067		
	Total bio gas	7,741,154		
	Fossil share of budget (%)	22.1		
TKI Gas 2015, 19 projects				
Primary LNG Mass Flow Standard	TELN115006	170,940	VSL B.V	LNG
CEMS: Continue Emissie Monitoring Systeem	TELN115010	300,945	TNO	Use
Een "correct" octaangetal voor LNG	TELN115013	199,294	KEMA Nederland B.V	LNG
Ontwikkeling, bouw, testen en validatie prototype LNG-Sleephopperzuiger	TELN115014	500,000	IHC Holland B.V	LNG
Ontwikkeling van een LNG overslagsysteem	TELN115016	147,050	TNO	LNG
COMMA Understanding Jurassic Sands of the Terschelling Basin	TEUG115003	150,000	TNO	Exploration
Downhole field lab - Wellbore sealing by rock salt (natural sealing salt plug)	TEUG115005	750,000	TNO	Production
	Total fossil gas	2,218,229		
	Total biogas	13,072,961		
	Fossil share of budget (%)	14.5		

Appendix 48 Government contribution to SEED capital program (based on own analysis)⁵²⁷

Fund name	Focus	Government contribution (M€)	Total fund size (M€)	Fossil investments
TechNano fund B.V	Nano-high tech companies	4	8	No

⁵²⁷ RVO, "Ondersteunde Projecten Door RVO.nl | RVO.nl."

Mainport Innovation Fund 2	Logistics, transport, and aviation	6	12	Only use related, technology for Airport and air travel related services
5square Tech Fund IV B.V	SME's in all sectors	4	8	No
Peak Capital 3	Internet start-ups	6	12	No
Holland Venture Technology Fund	Internet/Tech start-ups	4	16	No
The Hatch Firm Innovation Fund	Information technology	4	8	No
Astor Participaties Technostarters	Tech SME's	2.5	5	No
Percival 2	Tech start-ups	4.5	9	Use: airport baggage handling
Henq 3	Software	6	12	No
Vortex	Software	5	10	No
NextGen Ventures	Healthcare	4	n/d	No
Thuja Capital Healthcare Seed Fund II	Healthcare	4	n/d	No
Orange Growth Fund B	Fintech	4	n/d	No
Enabling Technology Fund	Software	2	n/d	n/d
Tiin Techfund 3 B.V.	High-tech/bio-tech	4	8	No
5square Seed Fund	IT, Financial services, Education, Media, Entertainment	2	n/d	No
Holland Venture Zorg Innovatie Fonds	Healthcare	4	8.25	No
Zeeuws Investeringsfonds B.V.	All sectors	4	8	No
Axivate Capital B.V	All sectors	4	n/d	No
VOC 3	IT, Media, Energy, Medical, Telecommunication	4	8	No
Health Innovation Fund II	Healthcare	4	8	No
Support Seed Fonds	All sectors	4	8	No
Newion Technopartner Fund	IT	4	n/d	No
Start Green Cleantech Venture Fund	Clean tech	3.8	n/d	No
Icos Cleantech Early Stage	Clean tech	4	11.2	No
BioGeneration Ventures II	Biotech	4	8	No
BioGeneration Ventures III	Biotech	6	12	No
5square SEED FUND I	IT, financial services, education, media, and entertainment	n/d	4	No
Aescap Venture I Seed	Biotech	n/d	8	No
Aglaia Oncology Seed Fund	Healthcare	4	8	No
Brabant Life Sciences Seed Fonds	Agro, food, health	4	8	No
Business Angels Technostarters	Tech start-ups	0.6	1.2	No
Business Angels Technostarters II	Tech start-ups	1.5	3	No
Dutch Technology Fund I	Energy, food, and waste technologies	n/d	8	No
E2Cleantech 1	Clean energy / energy efficiency	4	8	No
Fund for Energy, Innovation, Sustainability and Technology – FEIST	Sustainable energy and technology	n/d	8	No
Health Innovation Fund I	Healthcare	4	8	No
HENQ Innovatie Fonds 1	Tech start-ups	4	8	No
HENQ Innovatie Fonds 2	Tech start-ups	4	8	No
Icos Cleantech Early Stage Fund II	Energy, water, materials, recycling, food	n/d	11.2	No
ICT Venture	IT	1.6	3.2	No
Mainport Innovation Fund	Technologies to improve sustainability in the aviation sector	n/d	8	Same as MIF 2

Medsiences Seed Fund	Medical	4	8	No
Newion Investments Capital Early-stage Fund	IT	n/d	8	No
Peak Capital II	Tech start-ups	2	5	No
Percival Participations	Tech start-ups	n/d	8	No
Point-One Starter Fund	Tech start-ups	4	8	Use phase only: car software
Prime Technology Ventures Technostarter	IT	n/d	8	No
Seed Fund III	Life sciences	n/d	8	No
Solid Ventures	IT	4	8	No
Start Green Consumer Products Funds	Clean tech	3.3	6.5	No
Support Seed Fonds	All sectors	4	n/d	n/d
TechFund	IT/tech	n/d	8	No
TIIN TechFund 2	IT/tech	4	8	No
TechnoStars	IT/life sciences/new production methods	4	8.5	No
Thuja Capital Healthcare Seed Fund	Healthcare	4	8	No
Verenigde Innovatie Partners (VIP) Fund	Tech start-ups	0.9	1.8	No
VOC Capital Partner	Tech start-ups	n/d	2	No

Appendix 49 TNO fossil fuel related spin-off companies (based on own analysis)⁵²⁸

Company	Description	Ownership	Start date	Comment
BioIdentify	Patented method to identify 'sweet spots' for oil and gas drilling; especially useful for shale/offshore gas	TNO Bedrijven (44%), JOA (56%)	1-12-2014	Cooperation with the international oil and gas technology supplier JOA
Endures	Company specialized in corrosion prevention; clients include oil and gas and offshore industry	TNO Bedrijven (100%)	1-1-2014	Also has non-oil and gas production related applications.
Euroloop Gas calibration	Test facility for high pressure and high flow gas and liquid (hydrocarbons) meters	Sold	2009	Oil and Gas related
nMi Metrology	Develops Measurement	Sold	n/d	Also specialized in devices for the

⁵²⁸ TNO, "TNO Companies"; TNO, "TNO Annual Report: 2005"; TNO, "TNO Annual Report: 2006"; TNO, "TNO Annual Report: 2007"; TNO, "TNO Annual Report 2008"; TNO, "TNO Annual Report: 2009"; *ibid.*; TNO, "TNO Annual Report: 2011"; TNO, "TNO Annual Report: 2012"; TNO, "TNO Annual Report: 2013"; TNO, "Beeft de Grond Onder de Voeten van de Gasrotonde"; TNO, "TNO Annual Report: 2016"; TNO, "TNO Annual Report: 2015."

	instruments and provides measurement services			oil and gas industry
DIANA FEA	(Geo) Software development	TNO Bedrijven (99 %)	2002	Also specialized in software for oil and gas engineering
Sea DarQ B.V. ⁵²⁹	Oil spill detection radar	Sold in 2009 (TNO had 50 % share)	2003	Also used by non-oil and gas industry
TNO Safety Solutions Consultants	Safety consulting for industry	n/d	n/d	Also serves oil and gas industry

Appendix 50 Government fossil fuel income and expenditure - complete tables (based on own analysis)

⁵²⁹ SeaDarQ, "History of SeaDarQ — Seadarq."

M€	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Production and exploration	6346.4	5278.4	5976.4	6677.4	7575.4	10606.4	9758.4	15067.4	10394.4	10666.4	11937.4	14582.4	15368.4	10383.4	5258.4	2000
Transport and storage	74	85	89	578.4	510.2	463.8	411.4	378.6	509.9	281.5	89	301.2	426.1	469.1	437.7	n.d.
o/w stock levy	74	85	89	87	78	81	85	83	94	100	89	86	101	107	106	
o/w Gasunie dividend	0	0	0	491.4	432.2	382.8	326.4	295.6	415.9	181.5	0	215.2	325.1	362.1	331.7	
Refining and processing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.d.
Sales and distribution	3.6	5.1	3.6	3.6	3.6	3.6	3.6	16	21.6	12.9	14.5	9.1	14.3	10.7	13.6	
o/w gas station auctions	0	1.5	0	0	0	0	0	12.4	18	9.3	10.9	5.5	10.7	7.1	10	
Use	8151	8256	8622	9358	10142	10869	10308	11304	11545	13381	13525	13310	14284	14334	14350	n.d.
o/w excise	5224	5737	5952	6458	6420	6818	6975	7225	7397	7659	7745	7585	7590	7875	7866	
o/w fuel levy	607	516	538	54	13	-5	0	14	0	1	1	1	126	143	195	
o/w road transport fuel VAT	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1472	1600	1773	1795	1791	1641	
o/w energy tax	2320	2003	2132	2846	3709	4056	3333	4065	4148	4249	4179	3951	4773	4525	4648	
Research & Development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.d.
Total fossil fuel earnings	14575	13624.5	14691	16617.4	18231.2	21942.8	20481.4	26766	22470.9	24341.8	25565.9	28202.7	30092.8	25197.2	20059.7	n.d.
As share of total gov. income (%)	12.0	11.1	12.0	13.1	13.2	14.7	12.9	16.0	14.1	14.8	15.9	17.9	18.3	14.9	11.7	n.d.

M€	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*	2017*
Production and exploration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.d.	n.d.
Transport and storage	74	85	89	87	78	81	85	83	94	100	89	86	101	107	106	n.d.	n.d.
o/w COVA payments	74	85	89	87	78	81	85	83	94	100	89	86	101	107	106		
Refining and processing	12	39	39	39	41	41	42	42	43	44	45	46	47	48	n.d.	n.d.	n.d.
o/w refinery exemption	12	39	39	39	41	41	42	42	43	44	45	46	47	48	n.d.		
Sale and distributions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.d.	n.d.
Use	738	824	815	570	614	659	662	709	2220	2350	3696	3608	3392	3731.9	4238.8	3859	3891
o/w marine shipping exemptions	92	139	129	133	139	164	154	156	176	189	187	192	230	235	237	239	242
o/w energy tax reimbursements	206	254	183	111	141	159	167	189	112	125	120	111	124	115	133	152	149
o/w excise tax exemptions/ lowered rates	440	431	503	326	334	336	341	364	1932	2036	3389	3305	3038	3325	3837	3407	3438
o/w EU ETS compensation	0	0	0	0	0	0	0	0	0	0	0	0	0	56.9	31.8	61	62
Research and development	n.d.	n.d.	n.d.	n.d.	14	13	43	14	30.5	31	9	14	12	3	17	n.d.	n.d.
o/w direct payments	n.d.	n.d.	n.d.	n.d.	14	13	43	14	19	31	9	14	12	3	17	n.d.	n.d.
o/w foregone tax revenue	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	11.5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Total fossil fuel related expenditure	824	948	943	696	747	794	832	848	2387.5	2525	3839	3754	3552	3889.9	4361.8	3859	3891
Share of total expenditure (%)	0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.5	1.3	1.3	2.2	2.1	2.1	2.2	2.4	-	-

*Budget estimations

Appendix 51 Estimated fossil fuel income and expenditure by the national government (based on own analysis)

M€	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total income	9.5	17.9	20.3	23.0	28.1	40.6	458.3	671.7	379.3	611.9	379.2	390.1	428.2	356.2	491.1	72.6
VAT on fossil electricity	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	413.6	402.6	371.1	567.2	324.4	328.6	349.3	276.3	387.3	n.d.
Dividend	9.5	17.9	20.3	23.0	28.1	40.6	44.6	269.0	8.3	44.8	54.8	61.5	78.8	79.9	103.8	72.6
o/w Schiphol*	9.5	17.9	19.2	22.9	28.1	40.2	43.6	268.0	0.0	34.5	44.3	49.0	66.1	66.9	89.6	72.6
o/w HbR							0.6	1.05	8.25	9.3	9.5	12.5	12.75	13	13.25	n.d.
o/w KLM	n.d.	0.0	1.1	0.1	0.0	0.4	0.4	0.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0	n.d.
Total expenditure	1.7	2.2	1.4	2.3	1.9	6.0	4.8	2.4	1.4	1.7	5.1	1.8	1.3	1.9	2.2	1601.4
EIA fossil investments	1.7	2.2	1.4	2.3	1.9	6.0	3.3	2.4	1.4	1.7	5.1	1.8	1.3	1.9	2.2	n.d.
Aviation VAT exemption	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	1600
Innovation credits	0	0	0	0	0	0	1.5	0	0	2.6	6.44	0	0.25	0	0.12	1.36

*Conservative estimate using aviation and alliances revenue a share of total revenue for each year to calculate fossil share of dividend

14. Declaration

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