ICE transport discontinuation in the Netherlands: what is the Dutch government doing about it?

A Bachelor's Thesis of Public Administration student Evert Swarts at Twente University

ABSTRACT

This thesis explores the role of the Dutch government in the discontinuation of ICE transport. It summarizes Dutch policy concerning ICE transport since 2001. It uses the Multi Level Perspective from Geels and Schot (2007), the Streams of Governance of Discontinuation of Stegmaier et al. (2015) and the three Pillars of Governance of Change from Borrás and Edler (2014) to describe the place of the Dutch government in the socio-technical regime of the ICE and the role of its governance in changing the socio-technical system. The research concludes that the Dutch government is actively trying to facilitate a transition from ICE transport to transport with other fuels. It is visible that the socio-technical system of transport starts to adopt niches. The Dutch government facilitates the opportunities for Dutch industries to gain from the socio-technical change by creating a supportive structure based on broad agreement and market initiative.

Author
E.J. Swarts
Student Public Administration
Twente University

Evaluation Committee
Dr. P. Stegmaier
Prof. Dr. A. Need

29-8-2016

CONTENTS

INTRODUCTION

When did you last drive a car? When is the next time you will drive a car? What if you were not allowed to drive a car for a year? Chances are that you are using it often. For some the car is a convenience they would not like to miss, others rely on it for their living. What if the car would be forbidden by law by tomorrow?

Obviously, this will not happen. But it does show our reliance on the car. The main part of a car is the internal combustion engine (ICE), which propels the car. An ICE needs fuel in the form of petrol or diesel, allows for a car to have a range of up to 1000 kilometres and can be used for transport of groups of passengers or freight. These characteristics of a car with an ICE may seem self-evident, but if the ICE would disappear and be replaced, they may not be the same. Our transport, be it of passengers in passenger cars or busses, or freight in trucks, is reliant on the characteristics of the ICE. The ICE has shaped current transport.

The car will not be forbidden anytime soon, but what about the ICE? Electric vehicles (EVs) are now sold as well and it has become widely accepted that the car with an ICE has environmental disadvantages. Is the ICE going to disappear from our transport? Will it even be forbidden?

This research will explore this question for transport in the Netherlands. It will look for evidence that the Dutch government is helping the discontinuation of ICE transport in the Netherlands. The first chapter will introduce the subject, relevant theory, methods and research questions. Chapter two presents the hints of ICE discontinuation by the Dutch government from the data. Chapters three and four will analyse this data and answer the research question. I will end with a conclusion that reflects on the results and places them in context. What follows now is chapter one, starting with further explanation of the research subject.

1 CHANGE IN MOBILITY IN THE NETHERLANDS: DEFINING AND DESCRIBING THE SUBJECT

Although electric vehicles (EVs) are part of the car industry since its very start (Schmid, 2014), the modern car as invented by Carl Benz (McRae, 2012) with the internal combustion engine (ICE), has led to the ICE being at the centre of mobility for more than a hundred years. The ICE has been incrementally improved during that time and cities and infrastructures are built to accommodate this type of mobility. Reliance on ICE mobility in Western society is characterized by the hesitance of people to adopt electric vehicles, as pointed out by Bonges and Lusk (2016: 63-5), who identify lower range and complex refuelling of EVs as common obstacles for customers not to choose an EV. Incremental development, investments in ICE technology, an infrastructure that supports ICE mobility and people's reliance on mobility with the use of the ICE, identify the ICE as a locked in feature of the mobility regime.

However, during the past decade there has been an increase in hybrid and electric cars on Dutch roads. The total of electric vehicles[1] on Dutch roads, including passenger cars, buses, trucks and motorcycles, was 97,036 on the 31st of July 2016 (RvO, 2016) on a fleet of 9,786,227 on the 1st of January 2016 (CBS, 2016), approximating a 1% of electric vehicles on the total fleet. Sales rates of electric cars comprise 3,9% in 2014, 9,7% in 2015 and 2,9% up to the 31st of July 2016 of total car registrations (RvO, 2016). Charge points for electric cars are becoming more common in Dutch city streets as they total 24,135 by the 31st of July 2016 (RvO, 2016). Looking abroad, Norway is even setting up a bill to ban gasoline powered cars by 2025 (electrek.com, 2016), while at a rate of 24% EVs. These numbers suggest that the socio-technical system of the ICE mobility is challenged and changing. Therefore, the case of the ICE is one of the studied cases of the *Governance of Discontinuation of Socio-Technical Systems* (DiscGo) project (Stegmaier, Kuhlmann, Stirling, & Weyer, 2016), which explores the governance of discontinuation of technology reliant systems that have an important role in society (Stegmaier, 2016). The ICE is, among the DDT insecticide, nuclear power and the incandescent light bulb, one of the studied socio-technical systems. Whereas the DDT and light bulb cases are reflections on systems that are already discontinued, the nuclear and ICE cases are discontinuations in progress. The ICE case is considered discontinuation "in the making" by Weyer, Longen, and Hoffmann (2015: 2), who conducted a case study looking at signs of ICE discontinuation in Europe as part of the DiscGo project. The results[2] of Weyer et al. (2015) suggest that the landscape that may create the right conditions for ICE discontinuation is mainly created by the European Union on a supranational level. National governments find themselves between enacting EU agreements and acting in the interest of car manufacturers, which drive the national economy. On the local level, a lot of different, but uncoordinated initiatives are observed. In the Netherlands, the research of Weyer et al. (2015) did not find national discontinuation

[1] Including BEV, E-REV, PHEV and FCEV. See Appendix 1 for definitions.

[2] Hoffmann, Longen, and Weyer (2014) looked into ICE abandonment on EU level and in the United Kingdom, Germany, France and the Netherlands. This research uses the theoretical background of the Multi Level Perspective (Geels & Schot, 2007), supplemented by an actor-centered approach, and the Multi Level Governance perspective (Bache & Flinders, 2004). Using these as a heuristic, Hoffmann et al. (2014) analyze activities relating to ICE discontinuation on the supranational, national and local level.

governance after the SVV policy in 1990 and VERDI in 1996, suggesting no discontinuation governance took place since then on the Dutch national level.

In a recent effort and with an explorative approach I found reports that actually hint at how the Dutch government currently is recognising problems with ICE mobility, like CO_2 emissions, air quality and future oil depletion (NOS.nl, 2014), and utterances of Dutch governmental officials suggest an agenda on promotion of alternatively fuelled transport (NOS.nl, 2015). Therefore, this thesis looks into governance activities of the Dutch government concerning early ICE transport discontinuation, adding data to the DiscGo project and the research of Hoffmann et al. (2014). These governmental activities are set against a theoretical background that enables me to name them and create an up to date picture of Dutch ICE discontinuation governance. I will now show the theoretical tools I used to look at the socio-technical context of the ICE, explain the used view on the discontinuation process and the angle at which I look at governmental activities.

THEORETICAL HEURISTIC

I use three theoretical tools to look at ICE transport discontinuation governance in the Netherlands: 1) the Multi Level Perspective (MLP), 2) the DiscGo governance streams and 3) the 3 pillars of governance of change. I use specific elements of these theories that help me in my research. Firstly, the Multi-level perspective (MLP) as developed by Geels (2002) is useful for modelling the socio-technical (ST) configuration of the ICE and regime change. The MLP presents regimes as part of a nested hierarchy. Figure 1 represents a socio-technical configuration of several regimes. The ICE is a socio-technical regime that is maintained by a socio-technical regime. As is visible in Figure 1, the regime of the ICE is part of a socio-technical landscape. The socio-technical landscape represents the slow development of several external factors. For each regime, there are niches. These niches are small scale developments that may influence the regime in some way, for example by being adopted by or changing the regime. Thus, the MLP depicts an ST-configuration consisting of three levels: the landscape, regime and niche level. In the DiscGo project the notion of a socio-technical system is also used. Stegmaier, Kuhlmann, Joly, et al. (2016) tell us that the notions of system and regime are often used without much specification, but generally "'system' is used to refer to the idea of a complex functional relationship of interaction and interdependency, whereas 'regime' is used to point at sets of complex relationships, practices, principles, rules, and decision-making procedures" (Stegmaier, Kuhlmann, Joly, et al., 2016, fn. 1). In this thesis, the notion of system is used for an existing and functioning ST-configuration, whereas the notion of regime is used for the framework that maintains a socio-technical system:

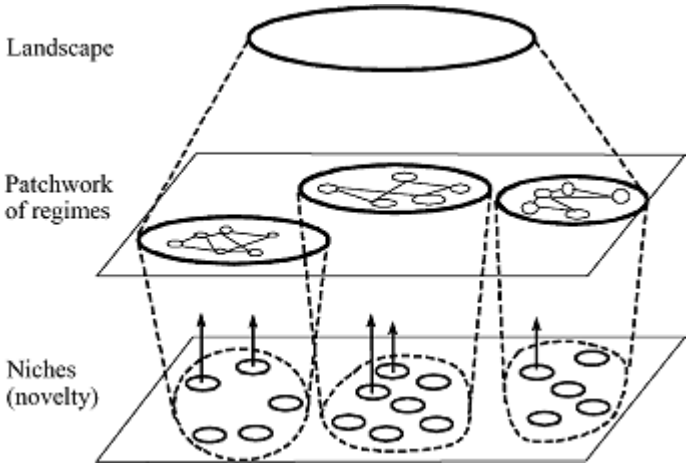


Figure 1. A socio-technical configuration (adopted from (Geels, 2002).

"ST-regimes (socio-technical regimes, Ed.) account for the *stability* of ST-configurations. This stability is of a dynamic kind, meaning that innovation still occurs but is of an incremental nature" (Geels, 2002: 1260, italic formatting from source). For a ST-system to change, the regime needs to be destabilized. Whereas Weyer et al. (2015) look at personal transport and locate the ICE "at the centre of the regime of automobility" (Weyer et al., 2015), I consider the ICE in all mobility and therefore locate the ICE at the centre of the socio-technical regime of mobility. The regime of mobility is a stable one with the ICE having a central role in this stability. Looking at the place of governments in this model, the Dutch government is part of the regime of mobility in the Netherlands. The EU is, at least from the Dutch perspective, part of the mobility landscape.

For the discontinuation of the ICE to come about, the regime of mobility needs to destabilise and change. The model in figure 1 does only acknowledge the influence of niches on a regime but says nothing about how a change may happen. Therefore Geels (2002) expands the model to the one depicted in figure 2. The model consists of the same three levels but acknowledges mutual influences and the change of a socio-technical system by

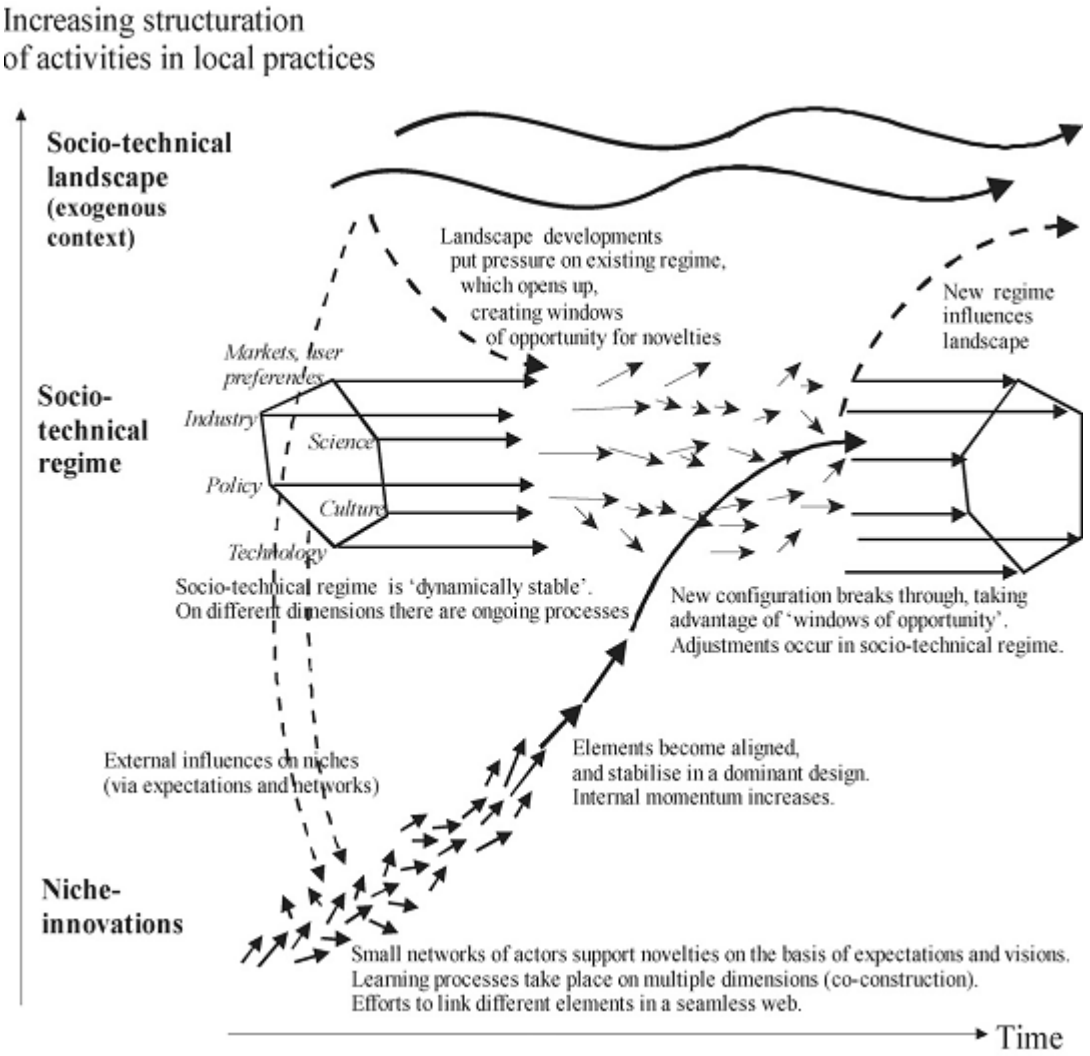


Figure 2. Interactions in the Multi-level perspective (adopted from Geels and Schot (2007)

inserting a time dimension. The landscape is a slowly evolving stream of i.e. "cultural changes, demographic trends, broad political changes" (Geels, 2002: 1262). The socio-technical regime becomes a bundle of "regular

incremental processes" (Geels, 2002: 1262) consisting of "seven dimensions in the sociotechnical regime: technology, user practices and application domains (markets), symbolic meaning of technology, infrastructure, industry structure, policy and techno-scientific knowledge" (Geels, 2002: 1262). On the influence of niches on the regime he adds: "Changes in the landscape level (…) may put pressure on the regime, and create openings for new technologies" (Geels, 2002: 1261), thus creating a window of opportunity for regime transition. This model provides us a more complex perception of the socio-technical regime, with the seven dimensions of a regime that is proposes. With the time dimension and interactions, the MLP provides a model of how the socio-technical regime of mobility may change: mobility niches develop, sometimes fail, or sometimes get adopted by the mobility regime. Change of the mobility regime can take place when a window of opportunity is created by tensions within the mobility regime and pressure from the mobility landscape. If we look at the socio-technical regime itself (figure 2), we see that the dimensions of the regime proposed by Geels include, apart from the policy dimension, little emphasis on the governance dimensions of a socio-technical system. The other dimensions are focus of the Science, Technology and Innovation research field. To add emphasis on the governance perspective of regime change, I use the concept of discontinuation governance streams (Stegmaier et al., 2015) from the DiscGo project. The authors created a heuristic for socio-technical regime change that uses the policy concept of streams of the agenda setting theory by Kingdon (2014). His theory is based on the idea that there are three streams of processes that have to coincide for a policy subject to gain a high position on the policy agenda. These

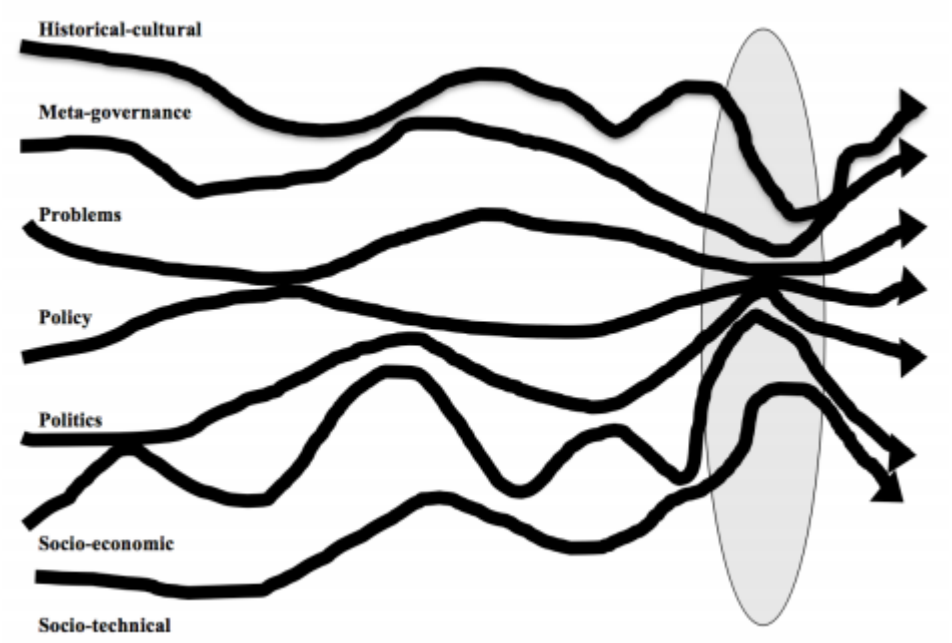


Figure 3. The discontinuation governance streams as independent processes, that may open a window of opportunity (grey area) when configured in the right way (depicted by streams being closer together) (adopted from Stegmaier et al., 2015).

are the 1) problems, 2) proposals and 3) politics stream. When at least two of these streams coincide, a window of opportunity is opened and, if acted upon, policy can be made. The DiscGo Heuristic adds four more streams, the 4) socio-technical, 5) socio-economic, 6) historical-cultural and 7) meta-governance stream. The idea of these streams remains the same as in Kingdon (2014) policy stream theory and is similar to the regime dimensions of Geels (2002): the streams are different processes. The governance of discontinuation streams heuristic also uses

the idea of windows of opportunity that both Kingdon and Geels use. However, where Geels sees tensions between the dimensions and landscape pressure creating a window of opportunity, the DiscGo heuristic adopts Kingdon's idea of coinciding streams that create the window of opportunity. Furthermore, the window of opportunity is defined as an opportunity for "a group of governance actors (…) to undertake discontinuation governance" (Stegmaier et al., 2015), shifting focus to the governance of discontinuation. The heuristic doesn't specify the number of streams that need to intersect for a window of opportunity to open[3]. Figure 3 represents the discontinuation governance streams. When the streams get close together, a window of opportunity is opened, depicted by the grey area.

Because I aim to describe the role of the Dutch government in the change of the mobility regime, I primarily use the problem, policy and politics streams. These streams refer directly to the "three streams of processes: problems, policies and politics" (Kingdon, 2014: 197). The problem stream is "the increasing and dynamic perception by wider engaged publics and stakeholders of 'critical issues' with socio-technical regime characteristics" (Stegmaier et al., 2015: 7). I determine to what extent the ICE is seen as a problem by the Dutch government. The problem the government defines helps understand the motivation of possible ICE discontinuation policy and politics. The policy stream consists of the "opening up, formulation and negotiation, and closing down of policy alternatives" and the "sphere in which policy proposals are formulated and refined" (Stegmaier et al., 2015: 7). Therefore I look at the activities of governmental policy makers, proposing certain policies that may lead to discontinuing ICE mobility. The policy may succeed or fail. The politics stream is "the intentional politics of discontinuation of technologies and regimes, motivated by organized actors' desire to address one or more particular societal or economic 'issues'" (Stegmaier et al., 2015: 7). When discontinuation is seen as the solution to a problem by the Dutch government, it is possible to speak of intentional discontinuation. Actors can be actual politicians, but also different actors from inside or outside the mobility regime. The other streams couple the policy process to the socio-technical, socio-economic, historical-cultural and meta-governance aspect of socio-technical regime change. By doing so, the complexity of the socio-technical regime is fully appreciated. Focussing on ICE discontinuation of the Dutch government as I do, I use the problem, policy and politics stream from the DiscGo heuristic for the analysis of my data. I sort findings in the data within these three streams and determine the current state of affairs on the problem, policy and politics, from the viewpoint of the Dutch government. This gives a view on the problem perception of ICE usage in mobility, give a view on the proposals in mobility and the political direction in mobility. It enables me to see the alignment or de-alignment of these streams and the possibility of a window of opportunity to open.

[3] It is important to emphasize that this concerns a heuristic, meaning that it is an unfinished, work in progress theory that represents a current view on the governance of discontinuation. For example, how this interaction and conjunction of streams takes place, or how many streams need to coincide, is not answered by this heuristic, but will have to be determined by empirical research. The heuristic provides a way to look at the complex problem of discontinuation.

Until now I described the structure of a socio-technical configuration using the MLP and zoomed in on the governmental processes within the socio-technical regime with the governance streams. However, this remains a rather passive view on the governance of discontinuation. As I am looking at specific governmental activities to discontinue the ICE system, I will be looking at a government that takes the opportunities that occur and at governmental instruments being used. Therefore I use theory of Borras & Edler (2014). They present three pillars to understand the governance of change in STI systems. The pillars are 1) agents and opportunity structures, 2) instrumentation and 3) legitimacy (figure 4). "(…) the three pillars together provide a comprehensive view of the key 'governance'-related research question about how system change is coordinated in complex contexts, that is, what are the modes and actors of coordination" (Borrás & Edler, 2014: 24). This means that these pillars give us with a way to look at the governance that drives the change of STI-systems: "(…) the 'governance' of change is the way in which societal and state actors intentionally and deliberatively interact in order to transform socio-technical systems. Intention and deliberation are crucial notions here" (Borrás & Edler, 2014: 25). This is very important for the research we want to do: we want to know what the Dutch government is doing to deliberately discontinue the ICE or to transition to something else. Therefore we need to be able to define their actions in the context of governance. These pillars of Borrás and Edler (2014) provide us with the governance view to look at STI transitions. The first pillar concerns the drivers of change: "(…) opportunity structures refer to the co-evolution of technology and social institutions, which sequentially or simultaneously generate opportunities for change that agents might take" (Borrás & Edler, 2014: 26). The authors add once more that agency is crucial, the co-evolution of technology and social institutions does not have to bring change by itself, it may create a window of opportunity. This fits very well with the DiscGo governance streams. The opportunity structures are aligned DiscGo streams that open a window of opportunity. Agents may take this opportunity to change the regime. In our case, the focus is on the Dutch government as an agent that drives change. The instrumentation pillar refers to "the specific ways and mechanism by which agents induce change in the socio-technical system and are able to design and give direction to that change" (Borrás & Edler, 2014: 31). This can cover policy and actions of non-government actors, but again, I focus on the Dutch government as change agent. That means the instruments pillar consists of governmental instruments to govern the studied regime change. The third pillar is about legitimacy: "(…) socio-technical systems are legitimate if they enjoy wide social acceptance and support" (Borrás & Edler, 2014) and therefore a change of system needs a new type of legitimacy. For this research this is connected to the sense of problem definition by the Dutch government: what is stated by the Dutch government as a problem legitimising ICE discontinuation, says something about the de-legitimisation of the old and the legitimisation of the new system. Together, the three pillars of governance of change provide a governance focused view on the change of socio-technical systems. For the

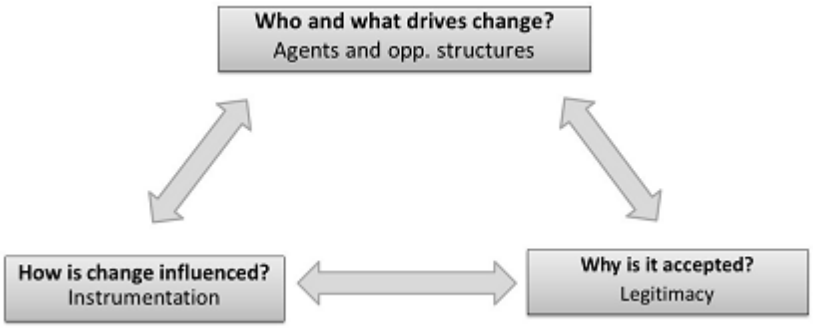


Figure 4. Three pillars to understand the governance of change in STI-systems (adopted from Borras & Edler, 2014)

purpose of this research, I will use the pillar of agents and opportunity structures and the pillar of instrumentation to identify the agents of change that make use of a window of opportunity and to describe the instruments they use to bring about the change.

I described how I will look into the role of the Dutch government in the discontinuation of the ICE in the Netherlands. Even with the focused view on the governmental role, this research provides new data that gives insight in the discontinuation of the ICE in the Netherlands. To say something about the state and type of ICE discontinuation in the Netherlands, I will use the transition pathways of Geels and Schot (2007) and the Ladder of Discon-

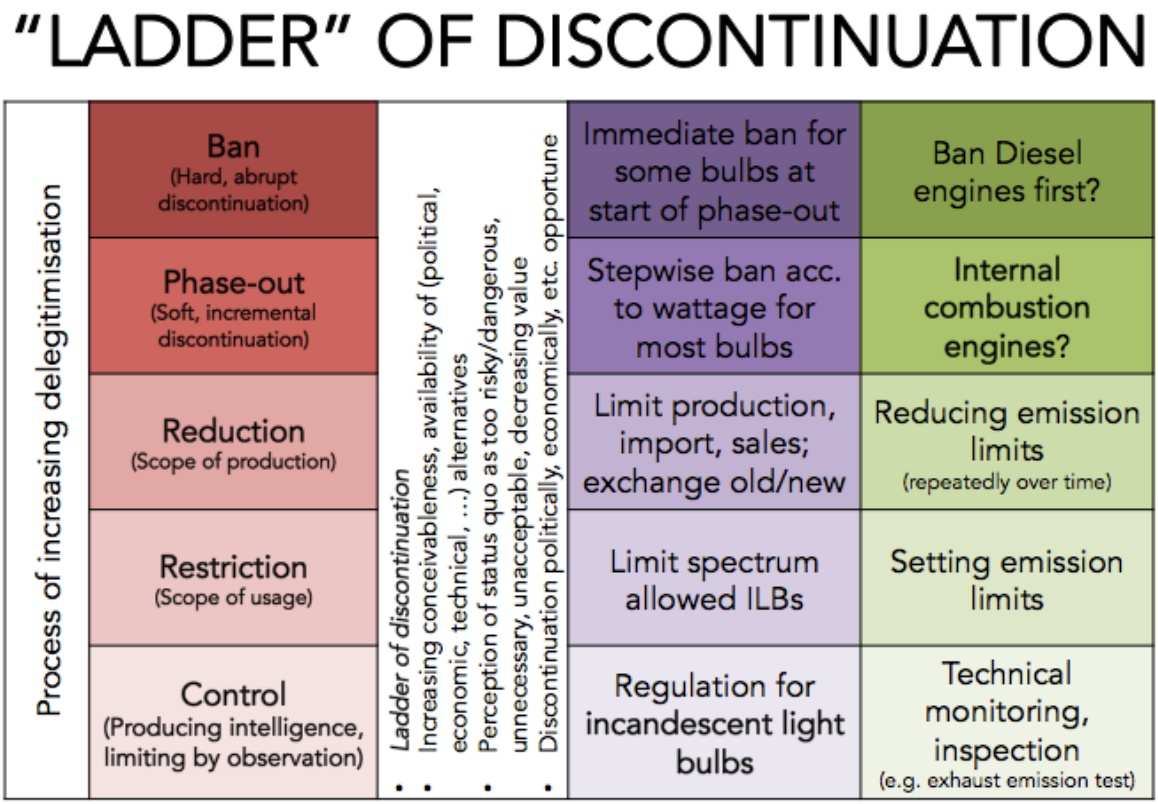


Figure 5. The Ladder of Discontinuation from the DiscGo project. It depicts several stages of discontinuation and corresponding stages of the ILB and ICE cases.

tinuation from the DiscGo project.

Figure 5 shows the Ladder of Discontinuation from the DiscGo project. It is created based on findings in the Incandescent Light Bulb (ILB) case and findings and expectations of the early stage ICE discontinuation. The five steps are 1) control, 2) restriction, 3) reduction, 4) phase-out and 5) ban. It is assumed that a discontinuation of a socio-technical system goes through these phases in a discontinuation process. The corresponding findings for the ILB case are shown on the right side in blue. For the ICE case the corresponding phases are shown in green. The current state of ICE discontinuation can be placed on this ladder in one, or maybe more phases. For ICE discontinuation in the Netherlands, I will reflect on the phase of discontinuation that I observed after the data analysis.

Geels and Schot (2007) developed different transition pathways which are based on different interactions between the levels of the MLP. These pathways result from taking timing and nature of interactions between the

different levels into account. The different pathways are the 1) transformation, 2) de-alignment and re-alignment, 3) technological substitution and 4) reconfiguration pathways. The pathways provide a way to look at the process of discontinuation based on the interactions between the socio-technical system and niches on one side, and the socio-technical landscape on the other. The transition pathways can be described as scenarios of transition. The transformation pathway depicts a regime transformation to another regime as a result of changes within the regime. There is moderate landscape pressure which leads to regime actors making changes to the regime from within. Niche innovations are not sufficiently developed to take the opportunity to really change the regime, but innovations may be adopted by the regime if they are close enough to regime practices. The basic structure of the regime remains the same. The de-alignment and re-alignment pathway assumes the regime breaks down because of large and sudden landscape changes. Niche innovations are not sufficiently developed to provide an immediate replacement. Multiple niches develop alongside each other until a new regime is formed from their innovations. The technological substitution pathway is visible when innovations in niches have developed enough to replace a regime when landscape pressure is high enough to disrupt it. The niches are, as it were, ready and waiting for the stable regime to destabilize. When this window of opportunity opens, innovations will enter increasingly bigger markets. Reconfiguration of a regime is when niche innovations are used to solve local problems, but start reconfiguration and replacement of other regime elements as well. In the end, the regime's basic structure has changed. After the analysis I will reflect on the transition pathways to say something about the pathway that is visible from the data I found.

I put forward the MLP, DiscGo streams and pillars of governance of change to look at activities of the Dutch government in discontinuing the ICE in the Netherlands. Furthermore, the ladder of discontinuation and transition pathways will be used to reflect on the state of ICE discontinuation in the Netherlands. These lenses to look at the data are put into research questions as a guideline throughout the data analysis and provide an answer afterwards. The research question and sub questions are formulated as follows:

What ICE discontinuation activities are performed by the Dutch government?

- How is the ICE identified as a governance problem by the Dutch government?
- What (proposed) policy in the Netherlands helps discontinuing the ICE?
- Is there political will in the Netherlands to discontinue the ICE?

As stated, the goal of this research is to see what the Dutch government does to discontinue the ICE in the Netherlands. The DiscGo streams of problems, policy and politics are used to describe the Dutch governmental activities in the mobility regime chronologically. This is translated directly into the sub questions. The MLP and pillars provide context in these four questions. The MLP shows the configuration of the socio-technical ICE system, consisting of the mobility regime, the landscape it is in and niches. It introduces the notion of landscape pressure on a socio-technical regime and niche developments changing the regime. The pillars of agents and opportunity structures and instrumentation help to describe the agency of the Dutch government in changing the mobility regime and the instruments it uses in doing so.

I will now first shed some light on the relevance of this research and the way the data was collected. The analysis is done in chapter two, three and four and I will end with a conclusion in which the research questions are answered.

Social Relevance

The area of science, technology and innovation (STI) policy research has recently been facing the emergence of attention for the so called *Grand Challenges*, i.e. health, environment, climate, transportation and security (Geels, 2013). In an interview by Kallerud (2016), Kuhlman says that the *Grand Challenges* "may be seen to reflect perceptions within the system about urgent and important issues at a historical intersection of two major trends." The first trend is the growing perception of uncertainty and welfare at risk shared between the issues marked as Grand Challenges. The second is the shrunken confidence in unbounded market forces, which makes companies wanting governments to take some responsibility if something goes wrong. Kuhlmann goes on by telling Kallerud (2016, capitalization from source): "We need ideas of governance which allow us to think of New ways of coping with these concerns and hopes, this uncertainty and precariousness."

So the notion of *Grand Challenges* refers to large issues, defined by uncertainty and shared responsibility between market and government actors. Also, the governance to deal with these *Grand Challenges* needs new ideas.

Discontinuation of, or transition to other transport solutions than the ICE, is closely related to the *Grand Challenges*, which include environment, climate and transportation. For instance, the issue of reduction of greenhouse gasses and transport efficiency have been set as goals in the Europe 2020 (European EC, 2010). Therefore, this research into the governance of ICE discontinuation contributes to finding new ideas to cope with the *Grand Challenges*, including environment, climate and transportation.

Scientific Relevance

Governance of discontinuation is a thus far mostly overlooked field of research, for the disappearance of socio-technical systems has in the past been mostly researched in terms of innovation (Stegmaier et al., 2015: 2-3). This research adds to the relatively small governance of discontinuation portfolio, adding to a research subject in development.

Furthermore, the DiscGo project is on the intersection of STI and policy research, because governance of discontinuation and socio-technical systems are combined. This is reflected in the DiscGo heuristic that uses elements from the policy streams of Kingdon (2014) and the MLP on socio-technical regime transition of Geels (2002), as well as the choice of theory in this research, adding the governance of change theory. Therefore, the DiscGo project and this research contribute to the development of a research field between these two more classical research fields.

ACQUIREMENT OF DATA AND METHOD OF ANALYSIS

This case study is a qualitative empirical research using a theoretical heuristic basis for identifying empirical findings. The data consists of documents and interviews. Three interviews were conducted: one with a civil servant from the Ministry of Infrastructure and Environment (IenM), one with a policy researcher at the Ministry of IenM and one with a Dutch member of parliament (MP). After early orientation in the research field, which consisted of looking up news articles and looking through governmental websites to find leads to relevant documents and identify the relevant actors, the three interviewees were contacted early in the research. The ministry of Infrastructure and Environment (IenM) was soon identified as the current key ministry in sustainability in transport. The civil servant was selected by contacting the ministry of IenM and asking for a connection with someone working on mobility sustainability. This quickly led to the person in question. The policy researcher was found by looking at the organogram of the ministry of IenM and contacting the relevant department. The MP was found when his name was mentioned in the media and, looking through parliament documents, the name of the MP came up on relevant topic debates. Contacting the MP was done with contact details on the MP's web page. The interview with the civil servant provided a historic overview of environmental transport policy over the years since about 2002 and an insight in the pivotal and managerial role with a lot of agency of the civil servant. The overview helped to see documents in a broader picture and identify trends. The interview with the policy researcher gave an insight in the way the ministry works: the research institute incorporated within the ministry translates scientific data to policy options that are usable for civil servants. The interview with the member of parliament gave an insight in the views of an MP that is very engaged in environmental plans. The documents gathered are governmental reports and agreements that address the ICE and mobility. Finding these documents was initially done via governmental websites and internet search engines. The governmental websites provide the tools to find documents related to others. The documents often refer to other governmental documents, which helped to find them using the search engines and governmental websites. Also, using internet search engines to search for key words found in documents proved to work well in finding further documents. Only a small selection of documents was identified as being at the core of the research issue and therefore analysed in a more extensive way. Table 1 provides an overview of the types of data used in this research.

WHAT	WHERE
INTERVIEW CIVIL SERVANT	Ministry of Infrastructuur en Milieu
INTERVIEW POLICY RESEARCHER	Ministry of Infrastructuur en Milieu
INTERVIEW WITH MP	Dutch political party
GOVERNMENTAL DOCUMENTS	Dutch national government websites
SEMI-GOVERNMENTAL DOCUMENTS	Dutch governmental websites and semi-governmental websites

Table 1. Overview of data sources used in this research.

The main data source consists of documents. To provide an overview of the documental data, I divide them into categories according to the problem, policy and politics stream, as well as sorted on the involvement of the Dutch national government as public agent, or the involvement of private parties or semi-governmental organisations as private agents, along public agents. This produces the data framework of Table 2.

	PUBLIC AGENTS	PUBLIC AND PRIVATE AGENTS
PROBLEM	Documents in which the Dutch government states problems related to ICE transport discontinuation.	Documents in which the Dutch government and non-governmental agents state problems related to ICE transport.
POLITICS	Dutch political decisions related to ICE transport discontinuation.	Platforms of private parties acting in their shared interest.
POLICY	National policy instruments, like legislation and agreements with sectors.	

Table 2. Framework for data by type according to the DiscGo streams and the author being governmental or semi-governmental.

The data that is used in the analysis can be sorted within this framework. Some data is mentioned multiple times, when it is applicable to more than one category. This produces the data overview in Table 3.

	PUBLIC AGENTS	PUBLIC AND PRIVATE AGENTS
PROBLEM	National Policy Plan Environment 4 Energy Agreement for Sustainable Growth Vision on Fuels	Energy Agreement for Sustainable Growth Vision on Fuels
POLICY	*Kilometerheffing* Car Letter Car Letter II Green Deals	Platforms Green Deals More with Energy! Chances for the Netherlands
POLITICS	Balkendende II coaltion agreement Balkenende IV coalition agreement Rutte I coalition agreement Rutte II coalition agreement Energy Report 2011 Energy Agenda Energy Agreement for Sustainable Growth Vision on Fuels	Vision on Fuels Energy Agreement for Sustainable Growth

Table 3. Arrangement of data by type according to the DiscGo streams and the author being governmental or semi-governmental.

After transcription of the interviews, all data was in written form. The data was sorted in the Atlas.ti software. This software was also used to highlight interesting parts of documents. Coding was used sometimes to link certain findings to each other. The data is from sources since 2001. Current and recent policy are the focus of this research, but for some historical context I start the chronological analysis in 2001.

The research process has been one of going back to the drawing board more than once. At the start of the research, the research subject was defined very broadly as 'ICE discontinuation in the Netherlands'. Already when writing the proposal this proved a rather vague subject that was hard to fetch in clear and limiting research question. The questions posed in the proposal also differ greatly from the questions in this thesis now. It was in several steps narrowed to the Dutch government and Data gathering and processing and reading relevant literature often proved the need to rethink the research and change the questions and with that the subject, which

in turn meant the data needed new assessment[4]. The subject has gone from rather vague and broad wordings to what I hope is a more limited and clear research.

The next chapter will give a description of the pieces of data found and highlight the political, problem and policy aspects found. After that I will dedicate a chapter on putting these pieces together and describe the activities of the Dutch government in ICE transport discontinuation.

[4] An example of data processing is provided in appendix 6, which contains interesting parts from the Energy Agreement and Vision on Fuels.

2 THE DATA: A CHRONOLOGIC RECONSTRUCTION OF THE GOVERNMENTAL SITUATION SINCE 2001

In this chapter I describe in chronological order the traces of governmental ICE discontinuation that were identified in the data. This is done by discussing documents in chronological order. The first step in interpreting these traces is done by naming the problem, political and policy aspects from the DiscGo streams, the agents, opportunity structures and instruments from the pillars of governance of change and the landscape and niches from the MLP. These are discussed and listened when they are found in the data. The historical context of current policy is seen as relevant for the interpretation of current governance of ICE discontinuation. Therefore the chronological overview starts in 2001.

The *'Nationaal Milieubeleidsplan 4'* (National Policy Plan on Environment 4) was introduced by the former VROM[5] ministry in 2001. This plan spoke of bringing about an energy transition, including a transition to sustainable mobility. The National Policy Plan on Environment labelled the energy sector as unsustainable and saw greenhouse gasses and particulates as the problem (VROM, 2001: 131). It set a long term vision to reduce emission of greenhouse gasses and particulates (VROM, 2001: 146-7). This was in line with goals set on the European level and cooperation on that level was seen as an important driver. However, it was stated that, even without the EU, the Netherlands would try to reach set goals, when possible in agreement with other coalitions countries (VROM, 2001: 148). The Dutch government spoke directly of future scenarios of energy transition. Three possible visions they had of 2030 (VROM, 2001: 152-3) were 1) keeping the current energy infrastructure and moving to renewable sources, 2) fully committing to hydrogen as final energy carrier and 3) fully committing to electricity as final energy carrier. VROM (2001) referred to research by RIVM and ECN (2000), which showed that a transition with 30% CO_2 reduction in 2030 was possible with changes including efficiency gains, behavioural change, using renewable sources and using clean fossil fuels (VROM, 2001: 154-5). In bringing about the transition, the government saw its task in "creating the right conditions for the transition" (VROM, 2001: 161) by supporting the investment phase, creating institutions and instruments that "engage at the system level and operate at the scale at which solutions present themselves" (VROM, 2001: 162). In mobility, VROM (2001: 169-73) mentioned the hydrogen fuel cell as a promising zero emission solution for transport. Possible actions in mobility were mentioned, including fiscal stimulation of economic cars, payment per kilometre in road transport and contributing to regulate CO_2 emissions on the EU level. The government wanted to stimulate research and demonstration of fuel cell technology and look for obstacles in infrastructure (VROM, 2001: 182). It was expected that this wide portfolio of stimulating on different fronts would accelerate the introduction of zero and near zero emission transport solutions.

Summarising, the National Policy Plan on Environment directly spoke of problems with the energy system and related these to transport as well. In terms of political decision making, there was a choice to support a transition. Instruments were chosen, but note that I only found them planned in this document and not solidified into policy

[5] Housing, Spatial Planning and Environment

instruments. The planned instruments consisted of supporting the niche developments that may bring about a transition and lobbying for stricter EU regulations, as these are seen as necessary to have a faster national transition. The opportunity for this transition planning as mentioned in the plans was provided by the landscape developments of EU regulations and the development of the niche of hydrogen fuel cell technology. The aspects are listed in table 4.

Agent	Ministry of VROM
Niches	Hydrogen fuel cell technology
Landscape	EU regulations
Problem	Unsustainable energy system High CO_2 and NO_x emissions Mobility has a role in the above problems
Opp. structure	EU regulations on CO_2 Hydrogen fuel cell development
Political decision making	Energy system towards sustainability with an energy transition Reduce CO_2 and NO_x emissions Mobility needs to move towards zero emission, hydrogen most promising
Instruments (proposed)	Creating the right conditions for a transition Supporting the investment phase Create institutions for a transition Stimulate research Support demonstrations Remove infrastructure obstacles Lobby for stricter EU regulations

Table 4. Table with the applicable aspects found in the National Plan on Environment by the VROM ministry in 2001.

In the governmental agreement of the second Balkenende government (Kabinet Balkenende II, 2002), the focus was on trying to enforce stricter rules on EU level. The Netherlands didn't want to set norms that are more strict than those on EU level. The Balkenende IV government also spoke (Kabinet Balkenende IV, 2007a) of the negative effects of mobility on welfare in its governmental agreement. In solving this, fossil fuels were seen as a problem, because the envisioned solutions included a transition to renewable energy sources. However, also efficiency gains and clean fossil fuels were seen as viable options that don't problematize the ICE or fossil fuels in ICE transport. The Balkenende IV government aimed to set up the *'kilometerheffing'* (variable road taxation) and governmental and interest groups agreed (Rijksoverheid, 2008) on aiming for a transition to zero emission, not choosing one specific transition path or fuel. The intended taxation is an important part of national mobility policy: as the KiM (2008: 77-9) argues, besides expected EU policy, the taxation per kilometre is important in reaching the set goals.

We see here that by the Dutch governments of Balkenende II and IV, welfare problems were blamed on ICE transport and fossil fuels. A transition is still in focus, but efficiency gains and clean fossil fuels suggest that a more pragmatic approach is chosen, according to the documents. The EU landscape may provide the opportunity to set these goals, but is not mentioned as such and therefore not included. The goals are to be met by, once more, urging at EU level for stricter norms and by implementing fiscal policy. A concrete policy plan is launched with the variable road taxation.

Agents	Balkenende II and IV governments
Landscape	EU regulations
Niches	Clean fossil fuels
Problem	Mobility negatively affects welfare Fossil fuels are a problem in mobility
Politics	Energy transition Clean fossil fuels Efficiency gains
Instruments	Enforce stricter EU norms Fiscal policy planning
Policy	Plan variable road taxation

Table 5. Table with the applicable aspects found in the Balkenende II and IV government agreements, from 2002 and 2007 respectively.

During the governments of Balkenende II, III and IV[6], the energy transition agenda was mainly enforced by the taskforce energy transition, that had the task of exploring realisation of the plans from the environment plan we just mentioned. The taskforce was founded in 2004 and in 2006 they published the report *'Meer met energie! – Kansen voor Nederland'* (More with Energy – Opportunities for the Netherlands, TFE, 2006), with more concrete plans on the energy transition. The report focused on development paths to reach the set goals on CO_2 reduction and energy usage reduction and emphasized the chances for Dutch industries, implying a possible problem of missing changes in the imminent energy transition, which would hurt Dutch industry. On transport, clean fossil fuels and supporting hydrogen initiatives still had focus. Fuel for transport was seen as an integral part of the energy sector, and thus was integrated in the general energy transition. The task force was criticised for consisting largely of representatives of the fossil fuel industry (milieudefensie, 2006; Rotmans, 2012: 144), which was said to obstruct the transition. Also, CO_2 targets were set lower than the EU standards for 2050 (Kabinet Balkenende IV, 2007b; milieudefensie, 2006).

Agents	Task Force Energy Transition Dutch government
Landscape	Energy transition
Niches	Clean fossil fuel technology Hydrogen fuel cell technology
Problem	Energy usage and CO_2 emission Dutch industries may miss out on transition
Opp. Structure	The task force gets the opportunity to give form to a transition by the government
Politics	An public-private task force is given the task of giving form to a transition Industries need to take chances
Instruments	Exploring different development paths

Table 6. Table with the applicable aspects found in the Task Force Energy Transition, 2006.

A few things are remarkable: first, the fiscal policy of variable road taxation was not realised during this governmental period, while it was planned and deemed important when the government was presenting its plans. Secondly, the exploration of policy options for an energy transition was assigned to a task force consisting of largely industry players, which explores possible transition pathways. Although I could not find detailed data on the

[6] 2nd, 3rd and 4th government with J.P. Balkenende as prime minister (2003-2006, 2006-2007 and 2007-2010)

activities of the task force as to their motivations and explorations, this situation implies a more restrained approach by the Dutch government. Also, technological niche developments may be slower than expected. Lastly, the motivation of industry opportunity in a transition implies that it may be assumed that a transition is happening anyway, making an energy transition a landscape development that puts pressure on the system of automobility.

With the appointment of the government of Rutte I[7], environmental policy was "out of the picture" (Civil Servant Interviewee, 2016: r. 26): the governmental parties didn't see environmental issues as their priorities and focussed more on the economic and accessibility aspects of mobility. This might be due to the economic crisis of 2008. The agreement of the governmental coalition (Kabinet Rutte I, 2010: 28-9) scrapped the planned taxation per kilometre. The possibility of variable taxation in the form of fuel taxes was said to be an international subject. In transport policy, there is an extra investment in roads.

Agent	Rutte I government
Landscape	2008 financial crisis
Problem	Focus on non-environmental transport problems
Politics	No new environmental transition plans Scrap variable road taxation plans Invest in roads

Table 7. Table with the applicable aspects found in the Rutte I government, 2010.

A new approach to energy transition was presented in the *'Energierapport 2011'* (Energy Report 2011, EZ, 2011) and in the *'Duurzaamheidsagenda'* by the I&M[8] ministry (Sustainability Agenda, I&M, 2011a). The focus was more on the economic aspects of the energy transition. The aim for a low carbon economy in 2050 still stood, but the focus was on the economic perspective and reliability of energy supply, which suggests the possibility of an unreliable and economically uncompetitive energy sector was seen as a possible problem. The Sustainability Agenda presented a 'green growth' strategy for the Netherlands, focussing on an economy that grows in a sustainable way: "After a phase of a government using goals and frames as controls, now industries and organisations pick up the gauntlet themselves"; "The government will mainly support the societal parties and help create the conditions that enable innovation and sustainable business to blossom" (I&M, 2011b: 3). However, policy was formulated specifically for the transport sector, maintaining the idea of a transition. EU regulations were seen as crucial in reducing CO_2 in road transport. On fiscal policy, the *'Autobrief'* (Car Letter, Financiën, 2011) proposed that taxes would still be variable on a CO_2 emission basis. Fewer cars were to be exempt and the thresholds for tax benefits were lowered. For the subsequent years, it was stated that electric driving and a charging infrastructure would be focus. The *"Lokale Klimaatagenda 2011-2014"* (Local Climate Agenda 2011-2014) bundled some local municipal initiatives on sustainable transport (I&M, 2011b: 9-12) with national goals, encouraging pilots by municipalities for a bottom up approach.

[7] First government with M. Rutte as prime minister (2010-2012)
[8] Ministry of Infrastructure and Environment

The focus on private initiative was instrumentalised with the presentation of the green deal approach. This approach, presented by three ministries[9] (EL&I, I&M, & BZK, 2011a) was aimed at giving private parties like interest groups and industries the ability to seek opportunities in the green economy. They can initiate "sustainable initiatives in the fields of energy, water, resources and mobility" and the government would be "removing obstacles for concrete, sustainable projects" (EL&I et al., 2011a: 3). The approach was a tool for more specific initiatives of NGOs or industries in which the government is needed to remove obstacles, but also more general green deals were agreed on. Along with the introduction of this approach, 50 green deals were presented that had been agreed on (EL&I, I&M, & BZK, 2011b) between governmental and non-governmental parties.

One of the first green deals concerned a concrete plan for electric driving: *'Elektrisch rijden in de versnelling'* (accelerating electric driving, EL&I, I&M, & BZK, 2011c), signed by three different ministries and private partners. It was a dedicated plan on the development of EV's for the period 2011-2015. As its motivations it mentioned economic advantages and contributing to reducing CO_2 emissions. Goals were to reach 20.000 EV's in 2015, stimulate innovations and develop potential gains from EV's. This plan was evaluated in a report by KWINK (2016), which concluded (KWINK, 2016: 3-7) that the action plan, in addition to fiscal policy and the dedication of public-private partnerships, contributed to reaching the set goals. On stimulating EV's the goal was easily reached. On the development of a public charge infrastructure there was still much to be gained.

Reflecting on this year of 2011, we see that there is less focus on the problems of ICE transport and solving them, but more on changes that industries can take in an energy transition in transport. With the Green Deal instrument, a situation is created in which policy niches are created: private actors can initiate ideas that may rise and influence the system of ICE transport. Fiscal policy is, with the Car Letter, used to bring pressure to the ICE regime.

Agent	Dutch government Rutte I
Landscape	Liberal climate in Dutch politics
Niches	Local and private policy initiatives
Problem	Energy may lose economic competitiveness Energy supply may become unreliable CO_2 emissions
Opp. Structure	Liberal climate gives opportunity to private and local change agents
Politics	Industry initiative, governmental support Energy transition is still the vision Future car is thought to be battery electric
Instruments	Green Growth policy for sustainable economy growth Fiscal policy favouring CO_2 low cars becomes stricter Green Deal approach EV planning 2011-2015
Policy	Car Letter Green Deals

Table 8. Table with the applicable aspects found in documents from the Rutte I government, 2011.

[9] BZK: Ministry of Home Affairs and Kingdom Relations, EL&I: Ministry of Economic Affairs, Agriculture and Innovation, I&M: Ministry of Infrastructure and Environment

Following the proposed industry initiative and the start of the Green Deal way of making policy, more public-private agreements followed. In June 2012, the Minister of Economic Affairs and Agriculture asked for advice (EL&I, 2012) of the SER[10] on how to go through with the challenges that environmental energy policy faced. How to anticipate on growing energy problems, on what governmental level and who to involve? The SER considered energy and climate policy at the time lacking continuity and consistency (SER, 2012c). The SER argued that the transition to sustainable energy provided opportunities and saw the need for an *'Energieakkoord'* (Energy Agreement) that was broadly supported by public and private actors (SER, 2012b). The new government of Rutte II[11], appointed in November 2012, soon showed support for making such an Energy Agreement (SER, 2012a). In 2013, the SER took the initiative (SER, 2012c) for the *'Energieakkoord voor duurzame groei'* (Energy Agreement for Sustainable Growth, SER, 2013). It was signed by a broad spectrum of NGOs, governments and industries. The agreement included long and short term goals in terms of CO_2 reduction and energy usage reduction and addressed them on the subject of transport directly. The goals (SER, 2013: 99-104) in the Energy agreement for the transport sector included, among specific CO_2 and energy reduction goals, aims for zero emission passenger vehicles. For 2035, the goals was set that all new vehicles sold must be zero emission capable and in 2050, all vehicles must be zero emission capable[12]. This means that a target was set for large CO_2 and energy usage reductions as well as a clear goal for passenger cars. There was a cautious mention of future exploration of the possibility to let users pay for their transport usage. It was noted that the Rutte government would not take action on this and that future action would depend on political developments. Furthermore, it was agreed to make further plans on alternative fuels and a supporting infrastructure. On modalities, parties agreed to make plans for promoting more travel by bike.

Agent	SER	National government
Problem	Energy usage CO_2 emissions	Environmental energy policy faces challenges
Opp. Structures	More market initiative	
Politics	Energy reduction targets CO_2 reduction targets Zero emission capable passenger vehicle targets Plan modality change to bike Make further plans on fuels	More market initiative
Instruments	Agreement created, signed by governmental and private parties	Support SER initiative and agreement

Table 9. Table with the applicable aspects found in the Energy Agreement, 2013.

It's notable that this is the first time we see this amount of parties agreeing on such specific goals for sustainable transport. The government grants initiative to the SER, which is known for bringing together private and public parties to one table. In the agreement, little is said about landscape or niche development in sustainable

[10] Social and Economic Council
[11] 2nd government with M. Rutte as prime minister (2012-present)
[12] Being zero emission capable is not the same as being a zero emission car. HEVs, PHEVs and E-REVs are zero emission capable, but only BEVs and hydrogen EVs are fully zero emission.

transport. Specific CO_2 and energy usage targets are agreed on, also for transport. Parties agree to strive for these goals, but no visible policy directly follows.

In 2014, transition policy for transport got more concrete than ever before. Building on the foundations of the Energy Agreement, a joint vision of public and private partners on a sustainable fuel mix was published by I&M ministry: *'Een duurzame brandstofvisie met LEF',* also published in English as "*A* vision on sustainable fuels for transport: Towards a sustainable fuel mix for transport in the Netherlands" (I&M, 2014). Like the Energy Agreement, this vision is agreed on by broad spectrum of governmental, NGO and industry parties. The authors stated that there is a need for a vision for reaching climate goals and that a transition provides opportunities for the Netherlands: "Such a vision is necessary because the transition from fossil fuels – mainly petrol and diesel – to new sustainable energy carriers will entail major changes, without which the objectives (from the Energy Agreement, Ed.) will not be attainable. The changes will also provide opportunities for green growth, as the Netherlands focuses on promising fields and innovations" (I&M, 2014: 1). Furthermore, "certain aspects of our mobility system have an adverse impact on people, the economy and the environment. Examples include persistent congestion, the emission of particulates, NO_x, SO_2 and CO_2 oxides, increasing noise problems and, of course, the cost of increasingly scarce fossil fuels and the resulting geopolitical tensions" (I&M, 2014: 1). The ambition to take a leading role in the transition was characterized by the sentence: "What matters is not only the formal targets, but also in particular a clear ambition to achieve a sustainable and renewable fuel mix" (I&M, 2014: 11).

Going towards something else than the ICE and fossil fuel was important: "Central to all initiatives concerned with vehicles, vessels and fuels are clean energy carriers and drive train technologies" (I&M, 2014: 1). The call for a more radical transition is clear: "Although the energy-efficiency of vehicles and combustion engines can and must be increased further and the penetration of renewable gas and sustainable biofuels can be increased, the realisation of long-term climate and energy targets depends on opening a second trend-breaking transition path, towards a fundamental change in the energy sources used for vehicular transport" (I&M, 2014: 5). However, there was no clear chosen path for a direction of transition. The idea was to support more possible solutions, because it is probable that more are needed to meet the set energy targets (I&M, 2014: 12) and if a technology fails, it is good to have back-ups (I&M, 2014: 12): "It is desirable to take an adaptive approach in order to secure the Energy Agreement targets, partly because no single fuel or technology provides the so-called silver bullet in any given sector" (I&M, 2014: 13).

Apart from a general vision, there were also more detailed views of the authors of the Energy Agreement on different sections of transport: road transport, shipping, aviation and rail. On the section of road transport, a distinction was made between passenger car, buses and different types of goods transport. The authors looked at different renewable fuel sources: liquid, gaseous, hydrogen and electric (I&M, 2014: 2). Electric vehicles were seen (I&M, 2014) as the best alternative to current mobility in road transport: they were needed to achieve the targeted CO_2 reductions. A transition via hybrid cars to full electric vehicles seemed most viable, taking into account the expected technological progress of fuel cells and batteries. "For road transport, various solutions are possible, but the most promising solution differs from one market segment to the next. Fully battery-electric vehicles are appropriate for personal mobility in urban areas, but do not yet appear promising for long-range bus

or freight transport or for heavy goods transport. In the latter segments, hydrogen, renewable gas and biofuels, including (bio-)LNG are likely to prove better solutions" (I&M, 2014: 12). Generally, we see that a choice was made to go for battery-electric solutions. Whenever this proves to be unrealistic or technically not feasible in certain sectors, biofuels were thought to be at least an intermediate solution. Hydrogen had high hopes as well, but was further away.

The authors of the Vision on Fuels wanted to be in the vanguard of countries that try to achieve sustainable mobility. In certain niches, it is thought that the Netherlands may take the lead. A leading role in all sectors was deemed too ambitious (I&M, 2014: 13). The Vision on Fuels defined niches with high 'green growth potential' for the Netherlands. These niches were 1) gas, 2) biofuels, 3) electricity and 4) hydrogen. The Vision on Fuels argued that the Netherlands has the chance to attain a leading role in these niches[13]. These were the niches that would have the focus in support programs (I&M, 2014: 38-40).

Agent	Dutch government
Landscape	Energy transition
Niches	Gas, Biofuels, Electricity, Hydrogen technological niches
Problem	Transport needs to change to reach climate goals The Netherlands needs to take changes in energy transition Mobility has adverse effects in its current form on people, economy and environment: • Congestion • Noise • Emissions • Fuel scarcity
Opp. structures	Energy Agreement
Politics	A clear ambition to achieve a sustainable and renewable fuel mix Opening a trend breaking transition path A fundamental change in energy sources for vehicular transport Focus on niches with high 'green growth' potential An adaptive approach, no single fuel technology is the 'silver bullet' The aim is towards electric drivetrains with battery or hydrogen as energy carrier Renewable gas and biofuels are intermediate solutions Attain a leading role in the gas, biofuels, electricity and hydrogen niches
Instruments	An agreement between governmental and private parties on achieving a sustainable fuel mix The aim is towards electric drivetrains with battery or hydrogen as energy carrier Renewable gas and biofuels are intermediate solutions Attain a leading role in the gas, biofuels, electricity and hydrogen niches

Table 10. Table with the applicable aspects found in the Vision on Fuels, 2014.

The vision on fuels was followed by an action agenda (I&M, 2015), that described the situation in 2015 and built on the Vision on Fuels with goals for the period of 2015-2020. It was a rolling agenda (I&M, 2015: 7), emphasizing that this was not a plan with actions that have to be carried out as stated, but as a range of actions that, given developments during the next years, may have to be changed. It stated per product-market combination (PMC) the 1) ambitions, 2) market phase and obstacles, 3) actions and investments and 4) policies.

[13] A description of these niches from the Vision on Fuels can be found in Appendix 4

It seems that in the Energy Agreement, transport and the fuels related to the ICE are addressed as being a problem: they need to be replaced. This agreement is formed in the context of the Energy Agreement that was agreed on in 2012 and called for a dedicated agreement on transport. The fuel of the future is explicitly not completely clear, because things may change, but 4 niches are chosen for economic competitiveness. As with the Energy Agreement, this is a consensus between a large number of actors, but no direct governmental policy can be derived from this agreement.

TOWARDS ZERO EMISSION

Current policy is based on the agreements I just discussed. The implementation of these agreements is distinguishable in various green deals and fiscal policy. An important role is for a wide range of platforms, representing different market segments. I will discuss the recent governmental activities.

Fiscal policy is changed to focus more on the move towards zero emission. Current fiscal policy already provides tax benefits to zero emission and hybrid cars and has a tax rate based on CO_2 emission. In the *"Autobrief II"* (Car Letter II, Financiën, 2015) the plans for fiscal car policy in relation to environmental issues for the period 2017-2020 are explained. The plans led to a bill (Rijksoverheid, 2016a) that is currently in review by parliament. The main points are that zero emission vehicles will keep their mayor fiscal advantages tax wise. Plug in hybrids, already in an advantage, will be "treated more and more as regular cars" (Financiën, 2015: 2), which is in line with the vision of the stakeholders in I&M (2014) of plug in hybrids as an intermediate solution. Focus on CO_2 emissions will be reduced in favour of focus on air quality, leading to changes in CO_2 taxes. In the tax for passenger cars and motorcycles (BPM), the CO_2 thresholds are lowered and it is proposed to add special tariffs for PHEV's, to get them in line with ICE cars (Rijksoverheid, 2016b: 10-2). On the motorized vehicle tax (MRB), zero emission cars will remain exempt from and PHEV's will see their tax benefits further reduced in 2019. For the *bijtelling* (a tax system for private use of company cars), the system is reduced to two categories: zero emission vehicles and other vehicles. Only zero emission vehicles get tax benefits. In the fiscal plans, a move towards promoting fully zero emission transport is clearly visible.

Agent	Dutch government
Niches	Different EVs
Problem	Air quality Less focus on CO_2
Opp. Structures	Vision on Fuels which calls for working towards zero emission
Politics	Towards zero emission vehicles
Instruments	Fiscal policy
Policy	Zero emission vehicles maintain tax advantages PHEVs lose tax advantages over the coming years Taxes less CO_2 dependent

Table 11. Table with the applicable aspects found in the Car Letter II and related documents, 2015-2016.

There are currently over 200 Green Deals (RvO, I&M, EZ, & BiZa, 2016). According to the progress report (EZ, I&M, BZK, & RvO, 2016) on Green Deals, which measured up to October 2015, there are 34 Green Deals on mobility with a total of 222 participating parties. 21 of the Deals are about EV, 12 about biofuels and green gas.

In the Energy Agreement, the Green Deal Public Electric Charging Infrastructure was planned for 2013, but the involved parties, including national and local governments and several private parties, didn't complete this Green Deal (Rijksoverheid et al., 2015) until April 2015. The aim is to boost the development of a public infrastructure for charging EVs. The cost of a charge point has to be reduced by 70% in 2017 compared to 2013. The *Nationaal Kennisplatform Laadinfrastructuur* (National Knowledge Platform Charging Infrastructure, NKL), will supervise the cost reductions and monitor innovations (Rijksoverheid et al., 2015: 4-5). The rollout of charging stations (Rijksoverheid et al., 2015: 5-7) will follow the demand: a charge point is realized if an EV owner asks for one. The market for charging points is very much in development and there will be room for other parties to take the initiative for placing charging stations, like car dealers. For every charging station, the national government provides a portion of the cost, if also the local government and a private party and private party contribute to the price (VNG, 2015).

Agent	Government, Industries and NGOs
Problem	EVs need charge points which are scarce
Opp. Structures	The Emergence of EVs Green Deal policy
Politics	Boost development of public charging infrastructure Reduce cost of charge points by 70% in 2017 Rollout will follow demand Initiative for placing a station variable Costs are divided between national and local government and a private party
Instruments	NKL manages and supervises targets

Table 12. Table with the applicable aspects found in the Green Deal Public Electric Charging Infrastructure and related documents, 2013-2015.

The Green Deal Zero Emission City Distribution (Rijksoverheid et al., 2014) has the aim to reach zero emission city distribution by 2025. This is done by trying different options in the period up to 2020, under the name Living Labs. This means that the involved parties set up pilots to see what works best technologically, financially and legally. In 2020 the results will be reported and in the period 2020-2025, scaling up has the focus. See table 13.

Agent	Government, Industries and NGOs
Niches	Living Labs
Opp. Structures	Green Deal policy
Politics	Reach zero emission city distribution by 2025 Organise Living Labs in the period up to 2020 Report results in 2020 Scale up working solutions in 2025
Instruments	Let niches develop on local level

Table 13. Table with the applicable aspects found in the Green Deal Zero Emission City Distribution, 2014.

After a successful Green Deal about electric driving (EL&I et al., 2011c), which led to the start of a charge infrastructure and saw the market introduction of electric driving in the Netherlands (EZ et al., 2016: 30), in April 2016 a new Green Deal for electric transport was created: the Green Deal Electric Transport 2016-2020. This Green Deal aims (ANWB et al., 2016: 3-4) to bundle all efforts by the government and the *Formule E-Team*[14]. The goals

[14] A semi-governmental platform promoting EV transport.

are that in 2025, 50% of all new cars has an electrical traction system and a plug and 15% of all new cars is fully electric. For 2020, 10% of all new sold cars has an electric traction system. The Netherlands want to remain in the top 5 of EV countries. Currently most EV's are part of a corporate fleet. These cars need to enter the consumer market as second hands. There is focus on the development of the charge infrastructure and making sure it has a viable business case. Also, innovation is to be supported: "Parties acknowledge that 'disruptive innovation' benefits from the existence of frontrunners, who can speed op transition and bring about change" (ANWB et al., 2016: 4). The *Formule-E Team* (ANWB et al., 2016: 5) is the primary platform, making an action agenda based on this Green Deal and monitoring progress, that is responsible for the execution of made agreements.

Agent	Governments, Industries, NGOs
Niches	EVs
Problem	Reaching Energy Agreement and Vision on Fuel goals Bundle efforts of government and Formula E-Team
Opp. Structure	Green Deal policy More developed EV technology
Politics	Specific EV targets for 2020 and 2025 Remain in top 5 EV countries Focus on charge infrastructure development Support innovation
Instruments	Formula-E Team supervises this deal

Table 14. Table with the applicable aspects found in the Green Deal Electric Transport 2016-2020 from 2016.

A Green Deal for hydrogen is in the making and it is due to be signed in the fall of 2016, as reported by the NWP[15] (NWP, 2016b). The NWP, which includes the Ministry of Infrastructure and Environment, also reports on the ambition of the ministry to have 20 hydrogen refuelling stations in the Netherlands in 2020 and in 2025, 1500 passenger cars and 100 buses will use hydrogen as their fuel (NWP, 2016a). Furthermore, the platform has stated its ambitions for 2020 including 2000 passenger cars, 20 refuelling stations, 100 buses and 20-50 trucks on hydrogen. The NWP being an important public-private platform in the Netherlands on hydrogen, these goals have high chances of ending up in the Green Deal on hydrogen.

Agent	Governments, Industries, NGOs
Niches	Hydrogen technology
Opp. Structures	Development of hydrogen technology Green Deal Policy
Politics	Specific hydrogen targets for 2020 and 2025
Instruments	Making a green deal on hydrogen

Table 15. Table with the applicable aspects found in the planned Green Deal on hydrogen, planned fall 2016.

FUTURE: A BAN ON THE ICE?

Recently a majority of the Dutch parliament accepted (J. Vos, 2016) the resolution by political party *Partij van de Arbeid* (Vos et al., 2016) to strive for the selling of zero emission cars only in 2025, but the Minister of Economic Affairs rejected it (EZ, 2016b), saying it is in conflict with existing policy and not realistic. This would mean that

[15] National Hydrogen Platform

existing policy does not allow for a ban on cars with emissions in 2025, despite the Netherlands performing well in Europe, with the most registered EVs by the end of 2015 (ACEA, 2016). What then is different in the Netherlands? Why is a ban on ICE cars not possible?

The Minister of Economic Affairs first pointed at (EZ, 2016b) the Energy Agreement. The goals of the agreement concern CO_2 and energy usage reduction, but also set a concrete goal for zero emission capable cars. The Energy Agreement being an agreement between the government and private parties, the minister argues (EZ, 2016b) that changing the rules during the duration of this agreement would compromise the reliability of the government as a partner. Secondly, he argues that the goal of selling only zero emission cars in 2025 is not feasible. The Netherlands was at a quite steady 0.6% of zero emission EVs sold as part of total cars sold over 2015 (RvO, 2016). In 2025 this would have to be 100% to reach the proposed goal. Thirdly, the minister argues that there are legal difficulties caused by European legislation: when a car passes tests and gets accepted to the market in one EU country, it is accepted EU wide. Furthermore, CO_2 norms in the EU are designed in such a way that having stricter rules on a national level doesn't provide environmental benefits, for car manufacturers would be able to i.e. sell EVs in the Netherlands and uneconomic diesel cars in another country.

Agent	MPs	Dutch government
Problem	Transition not going fast enough	Agreements are in place that need to be kept Not to be too ambitious EU regulations are not to be exceeded
Opp. Structures	Parliament majority	Agreements that are in place
Politics	Resolution to strive for zero emission cars in 2025	No further action
Instruments	Carrot and stick	Keep agreements Lobby for stricter EU rules

Table 16. Table with the applicable aspects found in the recent parliamentary and governmental positions on the progress of ICE transition.

This chapter has given an overview of the information found in the data that I use to answer my research questions. Tables take the aspects from the data that refer to the problem, policy and politics stream from the DiscGo streams heuristic. That first layer of interpretation is used to reconstruct the three streams in the next chapter.

3 SEEING TRENDS: THE PROBLEM, POLITICS AND POLICY STREAMS

Using the data that I found, I want to see how we can describe discontinuation of the ICE in the Netherlands at this moment. What is the role of the Dutch government in the governance of ICE discontinuation? I introduced three pieces of theory to answer this question. The MLP and DiscGo streams (Stegmaier et al., 2015) provide the larger context on discontinuation, while the three pillars of governance of change (Borrás & Edler, 2014) provide a view on the actions of the Dutch government. I posed the questions 1) how the ICE is identified as a governance problem by the Dutch government, 2) what (proposed) policy in the Netherlands helps discontinuing the ICE and 3) if there is political will in the Netherlands to discontinue the ICE. In the previous chapter I presented in chronological order governmental data on the subject of ICE transport discontinuation and highlighted the parts relevant to the three streams related to the three research questions. In this chapter I will continue the interpretation by describing the three DiscGo streams in focus: the problem, politics and policy stream.

DEFINING ICE TRANSPORT AS A PROBLEM

In the previous chapter I filtered the problem definitions of governmental actors from the data. In discontinuation theory by Stegmaier et al. (2015: 7), the problem stream represents "the increasing and dynamic perception by wider engaged publics and stakeholders of 'critical issues' with socio-technical regime characteristics". In my case that means I look at the problem perception of the Dutch government on ICE transport. Problem definitions change in time, as the stream characteristic of the DiscGo problem stream (Stegmaier et al., 2015: 7) underlines. For discontinuation of ICE transport to happen, ICE transport has to be seen as a problem and for the Dutch government to take part in ICE transport discontinuation, the Dutch government needs to address ICE transport as a problem. Therefore, I give an overview of the development of problem definitions by Dutch governmental actors, directly taken form the tables in the previous chapter in Table 17. Then I describe the trend in ICE transport problem perception since 2001 and conclude on the current problem perception.

Starting in 2001, the VROM ministry speaks (VROM, 2001) about concerns on the emission of greenhouse gassed and particulates and their effect on health. Mobility is identified as a factor these negative effects. This means the government recognizes the adverse health effects of the current energy system and mobility and directly addresses them as a problem. During the successive years, the Balkenende II and IV governments underline (Kabinet Balkenende II, 2002; Kabinet Balkenende IV, 2007a) this problem and see fossil fuels as a problem in mobility. During the execution of plans by the Task Force Energy Transition, emphasis is also added (Kabinet Balkenende IV, 2007b) to the chances for Dutch industries, implying a possible problem of missing changes is the imminent energy transition, which would hurt Dutch industry. In 2010, when the Rutte I government is installed, it intends not to focus on environmental problems in transport, but on accessibility and economic aspects of mobility (Kabinet Rutte I, 2010). In new energy policy (EZ, 2011), the emphasis is fully on a reliable and competitive energy supply, seeing problems in reliability and competitiveness. In EV plans (EL&I et al., 2011c) there is a mention of the problem of CO_2 in transport still being in focus. The Rutte I government sees acknowledges that environmental energy policy faces challenges in 2012 and passes this problem on to the SER (EL&I, 2012), which

emphasizes the economic dimension that the Rutte government sees in the energy problem. The SER answers (SER, 2012b) in the same way by seeing the need to take the chances provided by an energy transition. In the agreement (SER, 2013), CO_2 and energy usage are problems that need to be addressed. In the successive vision on fuels (I&M, 2014), climate problems and the need to take opportunities are once more emphasised. Problems with transport are said to include congestion, emissions, noise, scarcity and geopolitical tensions. In recent years, no new problems definition emerge.

Time	Agent	Problem definition
2001	VROM Ministry	Unsustainable energy system High CO_2 and NO_x emissions Mobility has a role in the above problems
2002-2007	Balkenende II and IV governments	Mobility negatively affects welfare Fossil fuels are a problem in mobility
2006	Task Force Energy Transition	Energy usage and CO_2 emission Dutch industries may miss out on transition
2010	Rutte I government	Focus on non-environmental transport problems Energy may lose economic competitiveness Energy supply may become unreliable CO_2 emissions
2012-2013	Social and Economic Council Public-private coalition	Energy usage CO_2 emissions
	Rutte I government	Environmental energy policy faces challenges
2014	Public-private coalition led by I&M Ministry	Transport needs to change to reach climate goals The Netherlands needs to take changes in energy transition Mobility has adverse effects in its current form on people, economy and environment: Congestion Noise Emissions Fuel scarcity
2015	Dutch government	Air quality Less focus on CO_2
2015	Public-private coalition	EVs charge points are scarce
2015	Dutch parliament	Transition not going fast enough
2016	Public-private coalition	Reaching Energy Agreement and Vision on Fuel goals Bundle efforts of government and Formula E-Team

Table 17. Problem definitions on ICE transport of (semi-)governmental actors taken from data since 2001 as described in chapter 2.

Summarising, we see that from 2001 environmental issues concerning energy and transport found their resemblance in problem definition. During the Balkenende period up to 2010, energy problems were also addressed to transport and fossil fuels are also directly addressed. After 2010, taking changes in a transition became the focal problem to solve, while the original problems of CO_2 and reducing energy usage are not addressed as problems in governmental documents. We see however that, when the energy problem is given to the SER, environmental problems still play a role. It is as if the Rutte government does not want to stipulate the problem itself.

The liberal Rutte governments focus more on taking economic problems and chances from their political background. However, once very clear transport transition plans are elaborated with a wide field of organisations in the vision on fuel, we see that environmental and public health problems are still recognised as problems in transport: they are directly mentioned by the public-private coalition, which stipulates the wide acceptance of these problems in recent years.

POLITICAL DECISIONS

The politics stream is the "the intentional politics of discontinuation of technologies and regimes, motivated by organized actors' desire to address one or more particular societal or economic 'issues'" (Stegmaier et al., 2015: 7). Is there evidence in the data that the Dutch government addresses ICE transport issues by publicly stating that it intends to do something about them? Again, in Table 18, I take the politics stream related data pieces directly from chapter 2 in and present them here in chronological order.

Looking at the 2002-2016 period form a politics perspective, the 2002-2010 period is characterized by the intention of the governmental ministry of VROM (VROM, 2001) and the Balkenende governments (Kabinet Balkenende II, 2002; Kabinet Balkenende IV, 2007a) to bring about an energy transition. The political intentions connect directly to the problem recognition discussed in the previous paragraph and we see that hydrogen was

Time	Agent	Political decision
2001	VROM	Energy system towards sustainability with an energy transition Reduce CO_2 and NO_x emissions Mobility needs to move towards zero emission, hydrogen most promising
2002-2007	Balkenende II and IV governments	Energy transition Clean fossil fuels Efficiency gains
2006	Task Force Energy Transition	An public-private task force is given the task of giving form to a transition Industries need to take chances
2010	Rutte I government	Political intention to: • Scrap variable road taxation plans • Invest in roads Industry initiative, governmental support Energy transition is still the vision Future car is thought to be battery electric
2011	Social and Economic Council (SER)	Advice to: • Energy reduction targets • CO_2 reduction targets • Zero emission capable passenger vehicle targets • Plan modality change to bike • Make further plans on fuels
2011	Rutte I government	Initiative is granted to the SER

2014	Public-private coalition led by I&M Ministry	A clear ambition to achieve a sustainable and renewable fuel mix Opening a trend breaking transition path A fundamental change in energy sources for vehicular transport Focus on niches with high 'green growth' potential An adaptive approach, no single fuel technology is the 'silver bullet' The aim is towards electric drivetrains with battery or hydrogen as energy carrier Renewable gas and biofuels are intermediate solutions Attain a leading role in the gas, biofuels, electricity and hydrogen niches
2014	Public-private coalition	Reach zero emission city distribution by 2025
2015	Dutch Government	Towards zero emission vehicles
2015	Public-private coalition	Boost development of public charging infrastructure Reduce cost of charge points by 70% in 2017
2016	Public-private coalition	Specific EV targets for 2020 and 2025 Remain in top 5 EV countries Focus on charge infrastructure development Support innovation
2016	Sustainability MPs	Transition not going fast enough
2016	Dutch government	Agreements are in place that need to be kept Not to be too ambitious EU regulations are not to be exceeded
2016 (planned)	Public-private coalition	Specific hydrogen targets for 2020 and 2025

Table 18. Political intentions and decisions on ICE transport of (semi-)governmental actors taken from data since 2001 as described in chapter 2.

seen as the most promising candidate to replace ICE in transport. There is also an intention to lobby at EU level for stricter norms: the Dutch government wants to get on with a transition, but needs to be in pace with EU norms. Also there is the intention to plan variable road taxations. The following Rutte governments, however choosing to focus less on environmental issues, chose continue the transition in another way: the attitude of leaving the initiative to the market is inspired by the liberal government. The idea of energy transition is not abandoned, but the role of the government is seen differently (Kabinet Rutte I, 2010), demonstrated by the purposeful move of initiative to the SER (EL&I, 2012). The following agreements make it more difficult to speak about political agency of the Dutch government, because the agreements are set up by large public-private coalitions. The government takes part, but the shift of initiative makes the Dutch government more of a facilitator than the driver of change. This shift of initiative itself however, is a politically motivated choice. In the agreements (I&M, 2014; SER, 2013) and several green deals, the differing coalitions set specific targets that directly challenge ICE transport. Transition has to come about one way or another, with Hydrogen and EV being the most obvious replacements of the ICE. This leads to plans for an electric charge infrastructure as well as hydrogen fuel stations. The loss of governmental initiative is accentuated by recent MP calls (Vos et al., 2016) for a faster transition,

which is refused by the government. Reaching already set goals is focus and the EU regulations are not to be exceeded.

POLICY

Lastly, I will focus on the policy and policy proposals on ICE transport that have been initiated or put in place. The discontinuation theory by Stegmaier et al. (2015: 7) defines the policy stream as the "opening up, formulation and negotiation, and closing down of policy alternatives". What now follows is an overview of policy and policy plans taken directly from the data summary in chapter 2, see Table 19, and an elaboration on the policy stream.

In 2001 the ministry of VROM (2001) stated problems with energy and mobility, as we have seen, and opted for a transition towards a sustainable energy system. In policy, it had some ideas about the way to accomplish this: creating the right conditions and stimulate the investments, research and demonstrations. Thus policy ideas are aimed at focussing on creating the right environment and institutions in the socio technical system and supporting niches. The instrument chosen is granting further implementation to a taskforce. The taskforce fails in implementing the plans for an energy transition (Rotmans, 2011) because of the incumbent private actors involved. After initiative was granted to the SER, it was chosen to go for a broad agreement between private and public parties, both in the Energy Agreement (SER, 2013) in 2011 and the Vision on Fuels (I&M, 2014) in 2014. These agreements set goals for a transition to sustainable fuels, but do not incorporate specific policy implementations. Apart from fiscal policy (Financiën, 2015) to stimulate a move from ICE transport to other fuels, the Dutch government moves to a facilitating role in policy: the initiative for plans and ideas is moved to private or local agents with the Green Deal approach (EZ, 2016a). The Green Deals provide opportunities for niche initiatives as smaller and larger deals are made. Focus is definitely towards a new fuel mix in the agreements and an important notion is that no one fuel is selected as the most promising replacement. However, focal niches are selected by the public-private coalition of the Vision on Fuels (I&M, 2014). The move towards zero emission vehicles in recent years is seen in the fiscal policy (Financiën, 2015). Platforms play an important role. Consisting of experts and actor representatives they initiate and supervise Green Deals.

In this chapter the data was sorted according to the problem, politics and policy stream of the DiscGo heuristic (Stegmaier et al., 2015). This helps to see the streams as evolving processes with interactions. In the next chapter I will describe the interactions and focus on what the Dutch government does in ICE transport discontinuation in the Netherlands.

Time	Agent	Policy and instruments
2001	VROM	Creating the right conditions for a transition Supporting the investment phase Create institutions for a transition Stimulate research Demonstrations Remove infrastructure obstacles
2006	Task Force Energy Transition	Development paths
2011	Social and Economic Council (SER)	Agreement created, signed by governmental and private parties
2011	Rutte I government	Green Growth policy for sustainable economy growth Fiscal policy favouring CO_2 low cars becomes stricter Green Deal approach EV planning 2011-2015 Support SER initiative and agreement
2014	Public-private coalition led by I&M Ministry	An agreement between governmental and private parties on achieving a sustainable fuel mix An adaptive approach, no single fuel technology is the 'silver bullet' The aim is towards electric drivetrains with battery or hydrogen as energy carrier Renewable gas and biofuels are intermediate solutions Attain a leading role in the gas, biofuels, electricity and hydrogen niches
2014	Public-private coalition	Organise Living Labs fore zero emission city distribution in the period up to 2020 Report results in 2020 Scale up working solutions in 2025
2015	Dutch Government	Zero emission vehicles maintain tax advantages PHEVs lose tax advantages over the coming years Taxes less CO_2 dependent
2015	Public-private coalition	NKL manages and supervises charge infrastructure targets Rollout of charge infrastructure will follow demand Initiative for placing a charge station may differ Costs are divided between national and local government and a private party
2016	Public-private coalition	Supervision of plans by platforms
2016	Sustainability MPs	Resolution to strive for zero emission cars in 2025 Carrot and stick
2016	Dutch government	Keep agreements Lobby for stricter EU rules

Table 19. Policy (plans) on ICE transport of (semi-)governmental actors taken from data since 2001 as described in chapter 2.

4 ICE DISCONTINUATION: THE DUTCH GOVERNMENT AS CHANGE AGENT?

In the last two chapters I have shown the data sources in a chronological way and took out the problem, policy and politics related data from them and showed their relevance. What do they mean? Is there a purposeful ICE transport discontinuation visible by the Dutch government? What is it made of? Throughout this chapter, I implicitly reference to the MLP (Geels & Schot, 2007), DiscGo streams heuristic (Stegmaier et al., 2015) and the pillars of Borrás and Edler (2014) to make sense of the data. References to the data are based on the previous chapters two and three.

As early as 2001 there was a transition policy in energy, including transport (VROM, 2001). In the plans there was a clear visionary aspect, with views of future energy and the things that need to change in the system to bring about a transition. In the plans a choice was made to highlight one transition path for transport, namely towards hydrogen fuel carriers. To reach these goals the government stated that it wants to provide the right environment and invest in possible solutions. With the MLP of Geels and Schot (2007) in mind, we see that policy was aimed at supporting niches to influence the system and at creating the right institutional environment with the direct goal of changing the energy system. The government was using the increasing environmental concerns and EU pressure in the field of energy and took the opportunity to articulate and plan an energy transition, seeming to know what it took to change a system like this. As with the first pillar of Borrás and Edler (2014), the environment provided the opportunity structure for the government to use its agency in trying to bring about change. Instruments that were used include fiscal policy to influence market behaviour and lobbying to influence the EU environment, because the Netherlands wanted stricter goals than were set at that moment. Supporting niches was done by stimulating research and demonstrations. To create the right environment, obstacles would be identified and taken away. This means the government wanted to work on all three MLP levels: influencing the environment by lobbying at EU level, changing the system from within by creating the right environment for change, and supporting niches. It was a broad plan to bring about a transition to sustainable transport. The further elaboration of these plans by the Task Force Energy Transition, a semi-governmental player, was a form of governance that placed the national government more on an environmental level. The work and governance from within is done by the taskforce. As we have seen (Rotmans, 2011), the task force consists for too large a part of important industry parties, because of which the transition fails to take off. The policy path chosen led to a dead end, not because of the arrangement of the transition, but because of the chosen instrument of a taskforce with large existing players. Leaving the transition to incumbent players proved impossible. I argue that this was also due to the lack of opportunity structures for market agents to engage in a transition. The development of EV or Hydrogen technology was not marketable yet.

On top of the failing transition, changes in policy occur because of a political change in 2010. In problem identification, environmental problems for transport seemed of less concern. However, from a policy perspective, change is not as imminent as it seems on problem formulation. A reform of road taxation was scrapped and investments in roads were part of the governmental plans (Kabinet Rutte I, 2010), but the different formulation of problems did not lead to abandonment of goals towards zero emission transport. With the focus on economy,

'green growth' was now the label for sustainable economy growth. Also initiative shifted to industries. The government provided the institutional environment and opportunities, the industries had to take the changes to gain from a transition to electrical transport. The new Green Deals approach embodied this: Green Deals support not only technical niches but also policy niches, encouraging a bottom up approach. This approach is based on agency, however the agency in taking the opportunities to a transition are left to other players that need to take opportunities that are partially created by the government. The national government wanted to be institutionalising, to be part of the environment rather than of the system itself.

With asking the SER what should be the focus in environmental energy policy, initiative was further transferred to market players, because the SER consists for two thirds of employer and employee representatives (SER, 2016). It also emphasized the economic interests of environmental policy. The SER seems to have learned from the failed setup with the Task Force Energy Transition and wanted a broadly accepted agreement, that made sure Dutch industries didn't miss the boat on transition. The SER also consists of expert members appointed by the government, meaning that the national government does play a role in SER activities. Prioritising economic interests, making initiative something for the market and involving more than incumbent transport players is an outcome that is in line with the governmental intentions of the Rutte government at the time. The following Energy Agreement and the Vision on Fuels were successful in reaching agreement by a large number of governments, NGOs and industries on profound transport transition plans. When we look at the direction of the transition, in the Vision on Fuels it was agreed that the Netherlands will focus on the niches that it is good at and that transition will go mainly towards battery-powered and hydrogen electric transport. The goals set are broadly supported, providing the needed legitimacy that was missing with the task force. Green Deals and platforms involved in the agreement make sure that goals are further worked out and that money spent arrives where it needs to. The national government has with these agreements and the Green Deal framework, provided the needed institutional background for the market to work on the transition themselves. The national government being the one with the power of fiscal measures, uses these to encourage the change by changing taxes, making stricter rules for emissions of ICE vehicles. Also, in Green Deals on public charge infrastructures, it is agreed that the national government supports the infrastructure financially. The number of Green Deals currently agreed on, shows that the instrument appears successful. Being a facilitator of change, giving some direction, but focussing on the opportunity for industries and leaving the agency to take opportunities to the market, has at least resulted in just that: many decentralized initiatives. Some are more successful than others and how the system will change and if it will be because of these initiatives is at this moment impossible to say. However, the Dutch government has created a niche landscape of technological, regulative and economic niches in the Netherlands, of which at least some will end up in a transformed socio-technical system.

CONCLUSION AND OUTLOOK

I started out by asking the question what ICE discontinuation activities are performed by the Dutch government. This was divided in to the sub questions 1) how the ICE is identified as a governance problem by the Dutch government, 2) what (proposed) policy in the Netherlands helps discontinuing the ICE and 3) if there is political will in the Netherlands to discontinue the ICE. To find out, I described what the Dutch government did in the field of ICE mobility since 2001.

As to the first question, we have seen that from the start of the analysis in 2001, environmental problems were recognized that were attributed to ICE transport. These problems are repeated later, when the large Energy Agreement and Vision on Fuel are created. Also, after 2010, the possibility of the Netherlands missing out on the opportunities that an energy transition brings is seen as a problem. In recent years, environmental problems in ICE transport are not subject of governmental documents anymore, suggesting they are widely accepted. Part of parliament sees the transition to sustainable transport as going too slow.

The second sub question asks whether political will in the Netherlands exists to end the ICE. The answer is yes, the Dutch government has a clear vision to make a transition to zero emission transport. In 2001 governmental documents stated that an energy transition was needed, but in implementation this failed. After 2010 the Dutch government, as decision maker with agency, is not in the foreground in energy and transport sustainability. The Energy Agreement and Vision on Fuels are not orchestrated by the Dutch government as such, the Dutch government is one of the partners. These agreements do have clear targets for a transition towards sustainability in transport. The recent collaboration with differing coalitions in green deals and the fiscal policy also prove that the government is steering towards zero emission vehicles.

The third sub question asks whether policy was implemented to end ICE transport. If we look at governmental policy, we have two clear examples. The first Car Letter provides fiscal policy that favours cars with less CO_2 emissions and the second moves the advantages more to zero emission cars with the accompanying letter stating this trend will continue. Failed however, are plans by the Balkenende governments to introduce a variable road tax. This was scrapped by the Rutte governments. As for the governance of ICE transport, the first attempt to create a coalition with the Task Force Energy Transition failed. The second attempt granted initiative to the SER and the formation of coalitions started from there. Also the Green Deal method and the accompanying platforms, have proven to be a successful governance instrument.

Summarizing the three sub questions and answering the main question, the Dutch government sees ICE transport as a problem for sustainability reasons. There is political will to end the ICE and this has recently been implemented by governance programs to have large public-private coalitions agree on the transition to sustainable transport and to stimulate private initiative in reaching these goals.

OUTLOOK

Going slightly beyond the research questions, do we see the end of the ICE soon in the Netherlands? The transition pathways of Geels and Schot (2007) provide us with a blueprint for common transition pathways. Can we see a trend in the transition away from the ICE that fits on one of the pathways? Or is a combination observable, or something entirely different? Growing environmental pressure is visible from attention for environmental issues in general, and EU regulations. In 2002, niches weren't developed enough to make it to the streets, but now, in 2016, alternative fuels are visible and start to become viable alternatives for ICE transport. The system starts to adopt niches. From within, governments and other parties have agreed to make changes to the system. This means not stopping personal transport, but adapting personal transport to the environmental needs of the future. This is a fit for the transformation pathway. With moderate environmental pressure and increasingly developing niches, the system transforms by activities within the regime. The DiscGo Ladder of Discontinuation I presented with the theory starts at the bottom and ends at the top with a ban. Placing the current ICE discontinuation in the Netherlands on this ladder, we see that there are emission limits and that they are periodically reduced. This places the current state of discontinuation at the reduction step of this ladder. The next step is a phase out. We have seen that goals are set to only allow zero emission capable cars to be sold in 2025 and only allow zero emission capable cars at all in 2050. These plans are part of agreements, and not yet solidified.

LIMITATIONS AND FURTHER RESEARCH

This research only scratches the surface of ICE transport discontinuation in the Netherlands. I hope to have given a broad overview of the most significant data from the discussed period, but it is still possible that the picture is not complete. Also, with the data found, more analysis is possible. Unexplored aspects are the social agents that take part in governance, the type of governance instruments of different public and social agents (Borrás & Edler, 2014: 32-3) and into the embeddedness of Dutch policy in EU regulations. Also, the stage of ICE discontinuation in the Netherlands and the possibility for a window of opportunity for ICE discontinuation to come about in the Netherlands, are aspects that were not within the reach of this research and provide promising entrance points for further research to continue on the basis that I hope to have provided.

CONTRIBUTION TO THE DISCGO PROJECT

For the DiscGo project, this work hopes to provide Dutch data to the ICE discontinuation portfolio and hints are given as to the placement of the evidence of ICE transport discontinuation in the Netherlands within the project heuristic. This thesis research has greatly benefited from the work of Weyer et al. (2015) from the DiscGo project. Their work featured ICE transport discontinuation policy on European and the national level of several countries including the Netherlands. I hope to have provided new insight into the ICE transport discontinuation policy in the Netherlands that may help the project to shape a picture of ICE transport discontinuation on the national and international level.

REFERENCES

ACEA (2016). *New Passenger Car Registrations by Alternative Fuel Type in the European Union - Quarter 4 2015*. Retrieved 28-8-2016 from http://www.acea.be/uploads/press_releases_files/AFV_registrations_Q4_2015_FINAL.PDF

ANWB, AutomotiveNL, BOVAG, RAI Vereniging, NBNL, Natuur & Milieu, De Groene Zaak, Vereniging DOET, Vereniging Energie-Nederland, VNA, VNG, 3TU, NVDE, MRA, provincie Noord-Brabant, & FET (2016). *Green Deal Elektrisch Vervoer 2016-2020 (C-198)*. Retrieved 28-8-2016 from http://www.greendeals.nl/wp-content/uploads/2016/04/GD198-Elektrisch-Rijden-2016-2020.pdf.

Bache, I., & Flinders, M. (2004). Multilevel Governance: Conclusions and Implications. *Multi-level governance*.

Bonges, H. A., & Lusk, A. C. (2016). Addressing electric vehicle (EV) sales and range anxiety through parking layout, policy and regulation. *Transportation Research Part a-Policy and Practice, 83*, 63-73. doi:10.1016/j.tra.2015.09.011

Borrás, S., & Edler, J. (2014). *The Governance of Socio-technical Systems: Explaining Change*: Edward Elgar Publishing.

CBS (2016). Motorvoertuigenpark. Retrieved 28-8-2016 from http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=82044ned&D1=0-1,3,12&D2=a&D3=12-16&HDR=T&STB=G1,G2&VW=T

Civil Servant Interviewee (2016, 22-3-2016) *Interview with Dutch Public Servant on mobility transition in the Netherlands/Interviewer: P. Stegmaier & E. Swarts*.

EC (2010). *Europe 2020 - A strategy for smart, sustainable and inclusive growth*. Brussels Retrieved 28-8-2016 from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF.

EL&I (2012). Adviesaanvraag Energie en Economie.

EL&I, I&M, & BZK (2011a). *Green Deal*. Retrieved 13-6-2016 from https://www.rijksoverheid.nl/documenten/kamerstukken/2011/10/03/green-deal.

EL&I, I&M, & BZK (2011b). *Green Deal Bijlage 1 - Overzicht op hoofdlijnen van (binnenkort af te sluiten) Green Deals*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/vergaderstukken/2011/10/03/bijlage-1-overzicht-op-hoofdlijnen-van-binnenkort-af-te-sluiten-green-deals.

EL&I, I&M, & BZK (2011c). *Green Deal Bijlage 2 - Elektrisch Rijden in de versnelling - Plan van Aanpak Elektrisch Vervoer 2011-2015*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/richtlijnen/2011/10/03/bijlage-2-plan-van-aanpak-elektrisch-vervoer-elektrisch-rijden-in-de-versnelling.

electrek.com (2016). Norway reportedly agrees on banning new sales of gas-powered cars by 2025. Retrieved 18-6-2016 from http://electrek.co/2016/06/03/norway-gasoline-powered-car-ban-2025/

EZ (2011). *Energierapport 2011*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/rapporten/2011/06/10/energierapport-2011

EZ (2016a). Green Deal aanpak. Retrieved 16-6-2016 from https://www.rijksoverheid.nl/onderwerpen/duurzame-economie/inhoud/green-deal

EZ (2016b). *Kamerbrief betreffende motie Jan Vos c.s. inzake het louter verkopen van (nieuwe) emissieloze auto's in 2025*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/kamerstukken/2016/04/15/kamerbrief-met-reactie-op-motie-over-emissieloze-auto-s.

EZ, I&M, BZK, & RvO (2016). *Green Deals in beeld - Voortgangsrapportage Green Deals 2011-2015*. Retrieved 28-8-2016 from http://www.greendeals.nl/wp-content/uploads/2016/03/Green-Deals-in-Beeld-2011-2015.pdf

Financiën (2011). *Autobrief*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/rapporten/2011/06/01/autobrief.

Financiën (2015). *Autobrief II*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/kamerstukken/2015/06/19/autobrief-ii.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy, 31*, 1257-74.

Geels, F. W. (2013). Reconceptualizing the co-evolution of firms-in-industries and their environments: Developing an inter-disciplinary Triple Embeddedness Framework. *Research Policy, 43*, 261-77.

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy, 36*, 399-417.

Hoffmann, Longen, & Weyer (2014). *Achieving sustainable mobility - The discontinuation of socio-technical regimes*. Unpublished working paper.

I&M (2011a). *Agenda duurzaamheid: een groene groei-strategie voor Nederland*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/rapporten/2011/10/03/agenda-duurzaamheid-een-groene-groei-strategie-voor-nederland.

I&M (2011b). *Lokale Klimaat Agenda 2011-2014 Werk maken van Klimaat*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/rapporten/2011/11/02/lokale-klimaat-agenda-2011-2014-werk-maken-van-klimaat.

I&M (2014). *A vision on sustainable fuels for transport*. Retrieved 28-8-2016 from http://www.energieakkoordser.nl/nieuws/brandstofvisie.aspx.

I&M (2015). *Actie-agenda duurzame brandstoffen - Inventarisatie van mogelijke acties per marktsegment voor de periode 2015-2020*. Retrieved 28-8-2016 from http://www.energieakkoordser.nl/~/media/files/energieakkoord/nieuwsberichten/2015/20150710-ministerraad-duurzame-brandstofvisie/actie-agenda-duurzame-brandstoffen.ashx.

Kabinet Balkenende II (2002). *Meedoen, Meer Werk, Minder Regels*. Retrieved 28-8-2016 from http://www.parlement.com/id/vj4dcdwqk0r3/meedoen_meer_werk_minder_regels.

Kabinet Balkenende IV (2007a). *Coalitieakkoord tussen de Tweede Kamerfracties van CDA, PvdA en ChristenUnie*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/rapporten/2007/02/07/coalitieakkoord-balkenende-iv.

Kabinet Balkenende IV (2007b). *Kabinetsreactie op de Tussenrapportage Taskforce Energietransitie + SER advies - Samenvatting*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/kamerstukken/2007/04/16/kabinetsreactie-op-de-tussenrapportage-taskforce-energietransitie-ser-advies-samenvatting.

Kabinet Rutte I (2010). *Vrijheid en verantwoordelijkheid - Concept Regeerakkoord VVD-CDA*. Retrieved 28-8-2016 from http://www.parlement.com/9291000/d/pdfs/regeer2010.pdf.

Kallerud, E. (2016). EU research and innovation policy deserves more credit than it gets. Interview with Stefan Kuhlmann and Jakob Edler. *Forskningspolitikk*.

KiM (2008). *Doelen en daden. Herijking van de Nota Mobiliteit*. Retrieved 28-8-2016 from https://www.rijksoverheid.nl/documenten/rapporten/2008/10/22/doelen-en-daden

Kingdon, J. W. (2014). *Agendas, Alternatives, and Public Policies* (Second Edition ed.): Pearson Education Limited.

KWINK (2016). *Terugblik en vooruitblik op het beleid voor elektrisch vervoer - Een analyse van het 'Plan van aanpak: Elektrisch rijden in de versnelling'*. Retrieved 13-6-2016 from https://www.rijksoverheid.nl/documenten/rapporten/2016/02/10/terugblik-en-vooruitblik-op-het-beleid-voor-elektrisch-vervoer

McRae, M. (2012). Karl Benz biography. Retrieved 24-3-2016 from https://www.asme.org/engineering-topics/articles/automotive/karl-benz

milieudefensie (2006). Taskforce Energietransitie maakt verkeerde keuzes. Retrieved 21-6-2016 from

NOS.nl (2014). Bijtelling 'schone' auto's omhoog. *NOS.nl* Retrieved 14-3-2016 from http://nos.nl/artikel/2000514-bijtelling-schone-auto-s-omhoog.html

NOS.nl (Producer). (2015, 14-3-2016). Kamp over de toekomst van elektrisch vervoer. Retrieved from http://nos.nl/video/2074107-kamp-over-de-toekomst-van-elektrisch-vervoer.html

NWP (2016a). Ministerie I&M wil naar 20 waterstoftankstations in 2020. Retrieved 18-6-2016 from http://www.nationaalwaterstofplatform.nl/nieuws?news_id=392

NWP (2016b). Van Branstofvisie en Green Deal tot marktontwikkeling. Retrieved 18-6-2016 from http://www.nationaalwaterstofplatform.nl/nieuws/van-brandstofvisie-en-green-deal-tot-marktontwikkeling?news_id=421

Rijksoverheid (2008). *Duurzaamheid in Beweging, sectorakkoord mobiliteit, logistiek en infrastructuur 2008-2020, hoofdlijnenakkoord*. Retrieved 28-8-2016 from https://www.rvo.nl/sites/default/files/bijlagen/sectorakkoord_mobiliteit_logistiek_infrastructuur_2008-2020.pdf.

Voorstel van Wet Uitwerking Autobrief II, (2016a) Retrieved 13-6-2016 from https://www.eerstekamer.nl/behandeling/20160121/voorstel_van_wet_2/document3/f=/vk10k6f576ya.pdf.

Rijksoverheid (2016b). *Wetsvoorstel Uitwerking Autobrief II - Memorie van Toelichting*. Retrieved 13-6-2016 from https://www.eerstekamer.nl/behandeling/20160121/memorie_van_toelichting_2/document3/f=/vk10k6f578yc.pdf.

Rijksoverheid, Lokale Overheden, Ondernemingsorganisaties, Brancheorganisaties, Belangenorganisaties, Voertuigproducenten, Brandstofleveranciers, Logistieke Dienstverleners, Verlanders en ontvangers, & Overige partijen (2014). *Green Deal Zero Emission Stadslogistiek*. Retrieved 28-8-2016 from http://greendealzes.connekt.nl/wp-content/uploads/2016/02/Tekst-ondertekenaars-Green-Deal-ZES.pdf.

Rijksoverheid, NBNL, E-laadNL, EVnetNL, NKL, RAI, Decentrale overheden, & Marktpartijen (2015). *Green Deal Publiek Toegankelijke Laadinfrastructuur*. Retrieved 28-8-2016 from https://vng.nl/files/vng/brieven/2015/attachments/20150508_green-deal_openbaar-toegankelijke-elektrische-laadinfrastructuur.pdf.

RIVM, & ECN (2000). *Synergie in de aanpak van klimaatverandering en verzuring*. Retrieved 28-8-2016 from http://www.ecn.nl/docs/library/report/2000/c00074.pdf

Rotmans, J. (2011). Staat van de Energietransitie in Nederland. Retrieved 28-8-2016 from http://janrotmans.blogspot.nl/2011/08/staat-van-de-energietransitie-in.html

Rotmans, J. (2012). *In het oog van de orkaan*.

RvO. Innovatieagenda Energie. Retrieved 7-6-2016 from http://www.rvo.nl/subsidies-regelingen/innovatieagenda-energie

RvO (2016). Cijfers Elektrisch Vervoer. Retrieved 14-3-2016 from http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/energie-en-milieu-innovaties/elektrisch-rijden/stand-van-zaken/cijfers

RvO, I&M, EZ, & BiZa (2016). 200ste Green Deal is een feit. Retrieved 16-6-2016 from http://www.greendeals.nl/200ste-green-deal-is-een-feit/

Schmid, B. (2014, 28-1-2014). Der erste Porsche war ein Elektroauto. *Frankfurter Allgemeine*

SER (2012a). Kabinet steunt SER-initiatief voor energieakkoord. Retrieved 20-6-2016 from https://www.ser.nl/nl/actueel/nieuws/2010-2019/2012/20121128-kabinet-steunt-ser-initiatief-voor-energieakkoord.aspx

SER (2012b). *Naar een energieakkoord voor duurzame groei*. Retrieved 28-8-2016 from https://www.ser.nl/~/media/db_adviezen/2010_2019/2012/energie-economie.ashx

SER (2012c). SER: Nederland heeft een Energieakkoord voor duurzame groei nodig. Retrieved 20-6-2016 from https://www.ser.nl/nl/actueel/nieuws/2010-2019/2012/20121026-energie-economie.aspx

SER (2013). *Energieakkoord voor duurzame groei*. Retrieved 28-8-2016 from http://www.energieakkoordser.nl/energieakkoord.aspx.

SER (2016). Samenstelling Sociaal-Economische Raad, 34e zittingsperiode. Retrieved 26-8-2016 from https://www.ser.nl/nl/raad/raadsleden.aspx

Stegmaier, P. (2016). Governance of Discontinuation of Sociotechnical Systems. Retrieved 25-2-2016 from https://www.utwente.nl/bms/steps/research/projects/bestanden/DiscGo/

Stegmaier, P., Kuhlmann, S., Joly, P.-B., Barbier, M., Stirling, A., Weyer, J., & Geels, F. W. (2015). *On Governing the Disengagement from Socio-technical Trajectories- The Discontinuation Governance Streams Heuristic*. Unpublished working paper.

Stegmaier, P., Kuhlmann, S., Joly, P.-B., Barbier, M., Stirling, A., Weyer, J., & Geels, F. W. (2016). *Streams and Critical Junctures - a Strategic Research Perspective*. Unpublished book chapter.

Stegmaier, P., Kuhlmann, S., Stirling, A., & Weyer (2016). discontinuation-governance.net. Retrieved 11-7-2016 from http://discontinuation-governance.net/

TFE (2006). *Meer met Energie*. Retrieved 28-8-2016 from http://www.gezen.nl/archief/Meer-met-Energie-tcm24-187512-2.pdf

VNG (2015). *Brief aan de leden betreffende Green Deal Openbaar Toegankelijke Elektrische Laadinfrastructuur*. Retrieved 28-8-2016 from https://vng.nl/files/vng/brieven/2015/20150508_ledenbrief_green-deal-openbaar-toegankelijke-elektrische-laadinfrastructuur.pdf.

Vos, Veldhoven, V., Tongeren, V., Dik-Faber, Wassenberg, & Klein (2016). *Motie over de verkoop van emissieloze auto's in 2025*. Retrieved 28-8-2016 from https://zoek.officielebekendmakingen.nl/kst-30196-441.html.

Vos, J. (2016). Motie van het lid Jan Vos c.s. over de verkoop van emissieloze auto's in 2025 - stemmingsuitslag. Retrieved 19-6-2016 from https://www.tweedekamer.nl/kamerstukken/moties/detail?id=2016Z06335&did=2016D13030

VROM (2001). *Nationaal Milieubeleidsplan 4*. Retrieved 28-8-2016 from http://www.rivm.nl/bibliotheek/digitaaldepot/VROM2001NMP4.pdf.

Weyer, Longen, & Hoffmann (2015). *Multi-level governance of socio-technical systems- Modelling the discontinuation of the regime of automobility*. Unpublished working paper.

LIST OF ABBREVIATIONS

ACEA	European Automobile Manufacturers Association
BiZa	Ministry of Home Affairs (Ministerie van Binnenlandse Zaken)
BZK	Ministry of Home Affairs and Kingdom Relations (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties)
CO_2	Carbon Dioxide, an atmospheric gas on earth
DDT	Chemical insecticide
EC	European Commission
ECN	Energy Research Centre of the Netherlands (Energieonderzoek Centrum Nederland)
EL&I	Ministry of Economic Affairs, Agriculture and Innovation (Ministerie van Economische Zaken, Landbouw en Innovatie
EV	Electric Vehicle
EZ	Ministry of Economic Affairs (Ministerie van Economische Zaken)
I&M	Ministry of Infrastructure and Environment (Ministerie van Infrastructuur en Milieu)
KiM	Knowledge Institute for Mobility Policy (Kennisinstituut voor Mobiliteitsbeleid)
NO_x	A generic term for the mono-nitrogen oxides NO and NO_2, gasses
NWP	National Hydrogen Platform (Nationaal Waterstofplatform)
PHEV	Plug-in Hybrid Electric Vehicle
RIVM	National Institute for Public Health and Environment (Rijksinstituut voor Volksgezondheid en Milieu)
RvO	Civil Service for Dutch Entrepreneurs (Rijksdienst voor Ondernemend Nederland)
SER	Social and Economic Council (Sociaal-Economische Raad)
SER BE	Social and Economic Council, Assurance Committee Energy Agreement (Sociaal-Economische Raad, Commissie Borging Energieakkoord)
SO_2	Sulphur Dioxide, a gas
ST	Socio-Technical
STI	The research field of Science, Technology and Innovation
TFE	Task Force Energy Transition
VNG	United Dutch Municipalities (Vereniging Nederlandse Gemeenten)
VROM	Ministry of Housing, Spatial Planning and Environment (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieu)

LIST OF FIGURES

APPENDIX 1: FUEL DEFINITIONS IN VISION ON SUSTAINABLE FUELS

These definitions of biofuels, renewable gas and electric vehicles were taken from I&M (2014).

SUSTAINABLE BIOFUELS

This vision is based on the following definitions and views of sustainable biofuels taken from I&M (2014: 3):

"In order to be counted in the context of Renewable Energy Directive (RED) obligations for 2020, biofuels must fulfil the following three sustainability criteria:

- Up to and including 2016, the greenhouse gas emission saving from the use of any such biofuel (relative to the use of fossil fuel) must be at least 35 per cent. From 2017, the saving must be at least 50 per cent. Moreover, from 2018, the saving associated with fuel from new installations taken into production on or after 1 January 2017 must be at least 60 per cent.
- The raw material from which biofuel is made must not come from regions with high carbon stock or high biodiversity value. A region with high biodiversity value is defined as land that in or after January 2008 acquired the status of primary forest, nature conservation area or highly biodiverse grassland. Land with high carbon stock is defined as land that in January 2008 had the status of (but no longer has the status of) wetlands, continuously forested areas or areas of woodland measuring more than one hectare. Nor may a qualifying biofuel be produced from raw materials originating from land that was peatland in January 2008. Agricultural raw materials cultivated in the Community and used for the production of biofuels must fulfil the requirements of the regulation for direct support schemes for farmers.
- It is likely that, from 2020, no more than 70 per cent of the 10 per cent may be accounted for by conventional biofuels (ILUC). It is also probable that a non-binding sub-target of 0.5 per cent will be introduced for extremely advanced biofuels (lingo cellulose).

With a view to facilitating the use of sustainable biofuels in aviation and shipping, it will be necessary to develop policies that allow the biofuels used in those sectors to be counted in the context of the RED. The biofuels under consideration are biokerosene for use in aviation and biodiesel blends or bio-LNG for use in shipping."

RENEWABLE GAS

"Renewable gas comes from the following sources and takes the following forms:

1. Biogas: methane gas extracted from renewable sources such as manure, by means of fermentation. The quality of such gas is not sufficient for it to be used in its original form for transport, but it can be used as a raw material for the production of green gas, bio-CNG or bio-LNG.
2. Green gas: a general name applied to various types of renewable methane refined to the quality of the natural gas used in the Dutch system and fed into the natural gas network. Green gas can be used for transport in the form of renewable CNG, supported by bio-tickets.

3. Power to gas (P-t-G) methane: synthetic methane gas produced using sustainably generated electricity by the electrolysis ofwater and reaction with CO2. The storage characteristics of P-t-G are similar to those of bio-CNG.
4. Bio-LNG: liquid methane (almost 100 per cent pure) made from biogas (stored at -163 degrees Celsius, max 2 bar).
5. Bio-CNG: compressed methane gas made from biogas (stored in gaseous form at ambient temperature, 200 bar, approximately 82 per cent methane).
6. Bio-LPG: liquid propane gas made from the by-products of liquid biofuel production (stored in liquid form at ambient temperature, 8 bar).
7. Bio-DME: fuel produced synthetically from the by-products of process industries, which has properties similar to LPG.
8. SNG: synthetic natural gas produced by the gasification of organic (waste) material. Storage and aggregation conditions depend on the process parameters. SNG is notyet available on any significant scale" (I&M, 2014: 5).

ELECTRIC VEHICLES

"Electric vehicles come in four basic types (although numerous variations are possible):

An electric vehicle is a vehicle with a drive system powered wholly or partly by electricity. The electricity may come from a battery or from a fuel cell system.

1. Battery-electric vehicles (BEVs): fully electric vehicles whose only drive power source is an electric motor, powered by a battery charged from an external electricity source.
2. Fuel cell-electric vehicles (FCEVs): fully electric vehicles that have no combustion engine, but carry a supply of hydrogen, from which electricity is generated on board by means of a fuel cell.
3. Plug-in hybrid vehicles (PHEVs): vehicles which have a combustion engine and a battery-powered electric motor, both of which serve as drive power sources. The vehicles may run on either power source, or a combination of the two. The electric motor is powered by a battery charged from the public grid, or by the combustion engine.
4. Electric range-extended vehicles (E-REVs): vehicles that use an electric motor as their primary source of drive power, supported by a combustion engine, which extends vehicle range by driving the electric motor when the battery has insufficient power to drive the electric motor unassisted.

Electric vehicles are currently developing rapidly, meaning that new types will undoubtedly reach the market in the years ahead. Possibilities include battery-powered electric vehicles with fuel cell range-extenders, or renewable gas-powered range extenders. In this vision, PHEVs and E-REVs are referred to collectively as plug-in vehicles" (I&M, 2014: 5-6).

APPENDIX 2: THE FOCAL NICHES OF THE DUTCH GOVERNMENT

The Dutch government, together with private parties, has chosen (I&M, 2014: 38-9) to focus on the niches of gas, biofuels, electricity and hydrogen. The niche boxes below were taken from the Vision on Fuels of I&M (2014: 38-9).

GAS

Leader on R&D and pilots in the fields of distribution, regulation, production of renewable gas for light vehicles and (bio-)LNG for heavy road transport and shipping. This niche builds on:

- The strong position that the Netherlands has because of mainports Rotterdam and Amsterdam as hubs for transfer between maritime shipping, inland shipping and road transport and as bunkering locations.
- Renewable gas (bio-LNG) is the most promising sustainable fuel for articulated HGVs and shipping.
- Expertise in the fields of distribution, regulation, production of renewable gas from sustainable biomass and power-to-gas as a possible sustainable energy buffer.

BIOFUELS

Leader on the development of sustainable biofuels for all modalities. The niche dovetails with:

- Ambitions and position of aviation sector.
- Ambitions of Amsterdam and Rotterdam.
- The strong position of the Netherlands in chemicals and agriculture.
- Position and capacity of refineries.

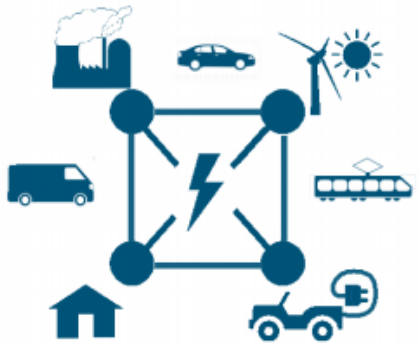
The size of the latter opportunity depends on the extent to which co-production and biorefinery are realised on the basis of the current position and on the extent to which existing capital investments act as impediments to change.

ELECTRICITY

Products and services linked to the charging infrastructure, transport concepts, smart grids, production of vehicles for particular applications, the bus sector, electric pleasure boats and ferries, components, parts and materials. Ties in with:

- Leading role on electric transport due to e.g. urbanisation.
- Battery-electric vehicles can play a role in energy transition and energy buffering. Buffering-related services are globally applicable.
- Expertise and the Dutch service economy.
- Opportunity for linkage with the development of (local and regional) sustainable generating capacity.

Smart-grids, charging infrastructure, services



HYDROGEN

Development, pilots and market introduction projects with fuel cell-electric buses and passenger vehicles and the simultaneous realisation of a basic hydrogen refuelling infrastructure, capable of supporting daily bulk users and incoming minor users.

- Buses are one of the first markets to which hydrogen could be rolled out.
- The Netherlands has its own bus manufacturing industry.
- The government is the biggest customer and can facilitate rollout.
- The Netherlands has a refuelling infrastructure industry with several niche players.
- Sustainably produced hydrogen from established production processes is available for the pilots and market introduction of hydrogen-powered vehicles.

Hydrogen-powered PT buses

- The energy requirement of the public transport bus fleet is relatively small, so the absolute reduction in CO_2 emissions will be relatively small, but the bus sector can serve as a good test environment for the use of new technologies in heavy vehicles.
- Public transport buses are very visible to the general public and public transport buses make a significant contribution to local air and noise pollution.

APPENDIX 3: EXAMPLE OF DATA PROCESSING

1.1.1 Energy agreement

Current activities are all based on the Energy Agreement for Sustainable Growth (SER, 2013), which was established by the Social and Economic Council of the Netherlands (SER) in collaboration with industry and environmentalist parties. The agreement includes long and short term goals in terms of CO_2 reduction and energy usage reduction and addresses them on the subject of transport directly (SER, 2013: 99-104). I will point out the relevant transport goals that were set by this agreement.

1.1.1.1 Goals for the transport sector

1. In 2050 the emission of greenhouse gasses is reduced by 60 percent compared to 1990.
2. In 2030 the emission of greenhouse gasses is reduced by 25 megaton CO_2 or equivalent, which is 17% reduction compared to 1990.
3. In 2020 the transport sector is expected to contribute to the total reduction of energy usage of 100 petajoule with a reduction of 15 to 20 petajoule.
4. New vehicles zero emission capable in 2035, all in 2050.

These goals are directly derived from the overarching goal of the energy agreement and specified to the portion that the transport sector has to contribute to those goals. How to achieve the goals, is elaborated in some long and short term plans.

1.1.1.2 Long term transport plans

On the subject of transport, some long term activities to reach the set goals are elaborated on. These long term perspectives are indicated with the term *Green Growth*, emphasizing the goal of a growing green economy. Some interesting points are:

5. The intention to create a common vision in 2014 with, private and public partners, on a sustainable fuel mix. This vision was created in 2014 and is explained in 4.2.2.
6. Intensions regarding zero emission transport: in 2035 all new sold passenger cars should be zero emission (capable(!?)) and in 2050 all passenger cars should be zero emission. Also a Green Deal concerning zero emission city distribution is in the planning. This will be mentioned in the paragraph on Green Deals.
7. There is a cautious mention of future exploration of the possibility to let users pay for their transport usage. It is noted that the current government will not take action on this and that future action will depend on political developments.
8. Mobility sustainability will be elaborated in spatial policy.

Most notable here are clear goals for the sector of passenger cars and the intention to create a vision on a sustainable fuel mix, which will be elaborated on later.

1.1.1.3 Short term transport plans

Also, some short term actions are planned in the agreement concerning the transport sector. This includes some intentional goals and more specific actions. The most important ones are listed below.

9. The partners support the set goals and will commit to ensure that on the EU level, norms will be set or made stricter.
10. For the sake of public-private market preparation there will be a program in 2014 to provide a framework for products and technologies for a transition to sustainable mobility.
11. To be in the vanguard of new technology, the public-private project for electric driving will continue, it will be made possible to start new projects and an agreement will be made in 2013 about public recharge infrastructure. Also LNG and biogas solutions will be researched.
12. There will be fiscal support for the most economical vehicles. This is further elaborated in the Car Letter II, which will be explained in 4.2.3.
13. For the sake of mobility management and fuel saving, a several plans are elaborated:
    - There will be a pilot in 2014 to fiscally encourage commuters to travel more sustainable and outside of rush hour. The pilot will be evaluated in 2014.
    - Large companies will make plans to reduce CO_2 emissions by 20% in five years' time.
    - In 2015, 1 million mobility cards will be in use.
    - In 2020 there will be 100,000 low emission cars.
    - The New Driving and The New Turning will be promoted.
    - A long term campaign will be started to change the mobility culture that we want.
14. On public transport and clean bikes,
    - An agreement will be made to make public transport more sustainable,
    - Before the end of 2014 the *Vereniging Nederlandse Gemeenten* and some private partners will make agreements to heighten the portion of bikes in movements to 35% in 2030, compared to 26% in 2011.
15. On the logistics sector,
    - There will be a uniform measurement method by 2015,
    - A portion of transport companies has made a 20% CO_2 reduction plan by 2020.
    - In 2025, 25% of goods transport will be done by companies that are registered in a CO_2 database, up to 75% in 2035.

What we see here, overall, is the intention to create an environment for transport that is more economic and emits less greenhouse gasses. In one case it is specifically noted that the goal is to make a transition to sustainable transport. Also, goals are set for the corporate sector to reduce greenhouse gasses. We also see that there are plans for fiscal support for more economical vehicles.

1.1.1.4 Execution, progress and evaluation of the Energy Agreement

There are documents about the execution and evaluation of the energy agreement. Can mention and elaborate here.

16. SER Commissie borging energieakkoord
    - Uitvoeringsagenda's
    - Uitvoeringsrepresentative (zie filmpje energieakkoord, er zou een representative moeten zijn per onderdeel die zorgt voor de uitvoering.)
17. Agenda mobiliteit en transport n.a.v. energieakkoord
18. Energieverkenningen
19. Voortgangsrapportage 2015
20. Resultaatmeter
21. Evaluatie rond oktober 2016, gedaan door KWINK

1.1.1.5 ICE-discontinuation in the Energy Agreement

The goals of the Energy Agreement are to reduce emission of greenhouse gasses and reduce energy consumption. On the subject of transport, specific goals are set on these two targets. If this may lead to discontinuation of the ICE is not visible in these goals.

However, the partners also have set up some specific actions and, in the name of *Green Growth* shared their vision on future transport. It is specifically mentioned that passenger cars should be zero emission in 2050 and that the road should be cleared for a transition to sustainable transport. While most plans concern more economical transport and reduced greenhouse gasses, the few mentions of zero emission and transition to sustainable transport cannot be overlooked. Things are set in motion to achieve these goals.

With current technology, zero emission cars using an ICE are not feasible. This means that we can describe some of the plans as explicit intentions to end the ICE and the fuel that we use with it. The Energy Agreement is a starting point for numerous activities of the Dutch government in reducing CO_2 and energy usage. As we already see a call for transition away from the ICE here, it will be interesting to see what we find in activities that follow this agreement. The plans for a shared vision on a sustainable fuel mix is the most interesting plan, and we will cover it now.

1.1.1.5.1 Problem

What we see here is a government that wants to address problems: CO_2 emissions and energy consumption. This problem is linked to the transport sector by setting specific goals for it in achieving these overarching goals. CO_2 reduction, and specifically the wish for zero emission vehicles, address the ICE directly as being a problem, for the ICE is not zero emission capable.

In the agreement, little is said about what are the underpinnings of the identification of these problems. It is stated that "the wish to make our energy supplies sustainable is broadly supported" (SER, 2013: 5). Despite European goals set for CO_2 reduction, it emphasizes the will of all involved parties to do something about energy sustainability.

1.1.1.5.2 Transition

To reach the goals, something else than the ICE is needed. The Energy Agreement doesn't get very specific on how to reach its goals, but working on a charge infrastructure and research into LNG is mentioned. LNG is gas that also uses an ICE to propel a car. A charge infrastructure points at setting goals for EVs.

Partly a transition will be needed, to reach the goal for zero emission cars. However CO_2 emission and energy usage reduction can also be reached by making transport more efficient. This would mean developing the ICE further to be more efficient or use different fuels in combination with the ICE.

A clear course is not yet visible. The Dutch government may try to go on with the existing socio-technical system by improving it, possible by adapting niche innovations like the mentioned LNG. A change or ending of the existing system is possible when the ICE is to be replaced by EVs.

1.1.2 Fuel Vision

In June 2014, following the Energy Agreement of 2013, a joint vision of public and private partners on a sustainable fuel mix was published by the Social and Economic Council of the Netherlands (SER): A vision on sustainable fuels for transport: Towards a sustainable fuel mix for transport in the Netherlands (I&M, 2014). The vision is also grounded in the EU call for alternative fuel infrastructure by the Clean Power for Transport Directive (source). Predecessors of this vision are the Sustainable Mobility Sector Agreement (Rijksoverheid, 2008) and the Energy Innovation Agenda (RvO)

There is a piece in the vision (p. 10) about EU regulations it takes into account. Possible to add.

"This document sets out a vision developed by a process in which more than a hundred organisations were intensively involved. Representatives of fuel producers, vehicle manufacturers, energy companies, transport companies and shipping companies, community umbrella groups and NGOs, knowledge centres and local, regional and national government entities all participated in the collective effort to define an integrated development path. Many of the stakeholders in question were representing a constituency of trade organisations or NGOs, so that the circle of stakeholders that had input to the vision actually included far more than the hundred or so bodies that were directly involved" (I&M, 2014: 1).

Apart from a general vision, there are also more detailed views on different sections of transport: road transport, shipping, aviation and rail. On the section of road transport, a distinction was made between passenger cars and, buses and different types of goods transport. The authors look at different renewable fuel sources: liquid, gaseous, hydrogen and electric (I&M, 2014: 2).

1.1.2.1 Why is a vision on sustainable fuels needed?

For our research it is very important what the reasons are to get to something as visionary and this close to a transition strategy as the vision on sustainable fuels. It can tell us much about the intentions of the government and other organizations involved, and helps us to recognize an discontinuation agenda. Why do we need a vision on fuels?

The authors state that we need a vision for reaching climate goals and that a transition provides opportunities for the Netherlands: "Such a vision is necessary because the transition from fossil fuels – mainly petrol and diesel – to new sustainable energy carriers will entail major changes, without which the objectives (form the Energy Agreement, Ed.) will not be attainable. The changes will also provide opportunities for green growth, as the Netherlands focuses on promising fields and innovations" (I&M, 2014: 1).

1.1.2.1.1 Problems with current mobility

So what are the problems identified in relation to our current mobility? The Vision on Fuel states that "certain aspects of our mobility system have an adverse impact on people, the economy and the environment. Examples include persistent congestion, the emission of particulates, NO_x, SO_2 and CO_2, increasing noise problems and, of course, the cost of increasingly scarce fossil fuels and the resulting geopolitical tensions" (I&M, 2014: 1).

The problems we can identify are:

1. The emission of greenhouse gasses NO_x, SO_2 and CO_2: "Mobility is one of the main drivers of greenhouse gas emissions in the Netherlands" (I&M, 2014: 1);
2. Pollution in the form of particulates and noise;
3. Dependency on oil and gas: "The use of sustainable energy sources makes the Netherlands less dependent on oil and gas and the nations that produce them, thereby directly contributing to our targets for energy security and security of supply" (I&M, 2014: 8);
4. The Netherlands has a strong position in the oil and gas sector, which is lost if the Netherlands does not take a leading role in the imminent transition: "The oil and gas sector is currently one of the mainstays of the Dutch economy. The transition to sustainability constitutes an opportunity, as long as the Netherlands takes a lead role. Conservatism on the question of the sustainability of the oil and gas sector represents a risk to the Dutch economy, government finances and pensions" (I&M, 2014: 8);
5. Because of the increasing demand for energy and a growing global population, "The pursuit of a sustainable mix of energy carriers for mobility and transport is necessary in relation to our mobility wishes in the long(er) term" (I&M, 2014: 4).

The Dutch government and the involved private parties agree on the need for a transition to sustainable transport. The problems mentioned are related to the fuel based on oil and gas that is used in ICEs. A transition to other fuels, as 4) above proves, is seen as unavoidable. It will happen, and the Netherlands needs to take the opportunity to gain from it and keep a strong position in the fuels for transport market.

The ambition to take a leading role in the transition is characterized by the sentence: "What matters is not only the formal targets, but also in particular a clear ambition to achieve a sustainable and renewable fuel mix" (I&M, 2014: 11).

1.1.2.2 How to reach a sustainable fuel mix

The authors see a very important role for fuels and drive train technologies in the realization of sustainable mobility: "Central to all initiatives concerned with vehicles, vessels and fuels are clean energy carriers and drive

train technologies, together with a focus on new mobility concepts, behavioural change, better infrastructure utilisation, intelligent transport systems and logistic innovations geared to increasing the efficiency of transport capacity utilisation. It is through the application of those levers that sustainable mobility can be realized" (I&M, 2014: 1).

"The mobility and transport sector can stimulate demand for sustainable alternatives within the existing energy mix" (I&M, 2014: 4).

"The energy supply system of the future (2050) will to a large extent be based on sustainable energy sources, such as the sun, the wind, water power and sustainably produced biomass. The energy supply for transport will change accordingly" (I&M, 2014: 4).

"The electrification of vehicle drive systems reduces the use of fossil fuels. (…) Although the energy-efficiency of vehicles and combustion engines can and must be increased further and the penetration of renewable gas and sustainable biofuels can be increased, the realisation of long-term climate and energy targets depends on opening a second trend-breaking transition path, towards a fundamental change in the energy sources used for vehicular transport" (I&M, 2014: 5).

"The adoption of electric drive systems, whether battery-powered or powered by fuel cells, implies not only migration to a different drive technology, but also migration to a different fuel and supporting infrastructure. The realisation of such profound change is complex, time consuming and expensive, and depends partly on factors that the Netherlands cannot control independently" (I&M, 2014: 6).

This summarizes the overall plans in the different sectors: "At the tank-to-wheel level, the targeted use of sustainable biofuels and renewable gas would yield significant short-term emission reductions for the road transport sector as a whole, and possibly longer term reductions for aviation, shipping and long-distance road freight and bus transport. A number of market sectors are strongly dependent on such fuels, due to the current lack of adequate alternatives. In sectors that are able to make the transition to the electric drivetrain systems, liquid and gaseous biofuels can serve a bridging function in the short term, which in the longer term serves as 'insurance' against the possibility of electrification failing to take off" (I&M, 2014: 6).

"Biofuel tracks (gaseous and liquid) can serve as 'insurance' against the possibility that the market introduction of electric vehicles proceeds more slowly than anticipated. In that scenario, the use of biofuels can assure a certain level of climate and green growth benefit" (I&M, 2014: 6).

"Sustainable biofuels (liquid and gaseous) should in principle be used only in sectors where there is no alternative to the combustion engine. As the penetration of battery-powered and hydrogen-powered electric mobility increases, the use of renewable gas and sustainable biofuels should be concentrated within the heavier transport modes, such as long-distance road freight, aviation and shipping. In the meantime, the use of biofuels can support the upscaling and development of biorefining expertise and technologies" (I&M, 2014: 6).

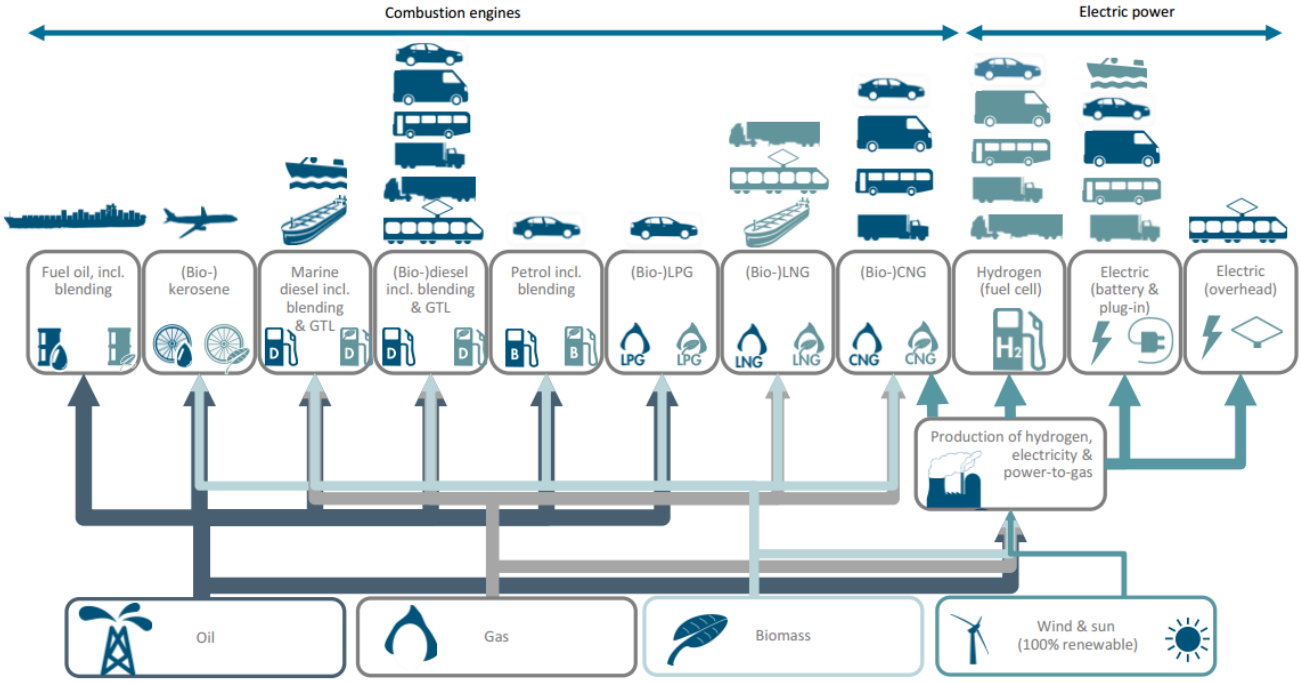
The targeted use of renewable gas, bio-kerosene, and biodiesel can expedite the transition to a low-carbon fuel mix, while also contributing to CO2 emission reduction targets and green growth. Battery-electric and hydrogen-based mobility will consequently have the time needed to mature and, where possible, take over from biofuels. However, it is important to ensure that the renewable gas and biofuel tracks do not unnecessarily delay or impede the transition to electrification (particularly gas and hybrid). Any potential for such undesirable lock-in effects need to be identified and addressed in the context of periodic updating of the vision" (I&M, 2014: 6).

However: "The market players are seeking ways of realising the transition to a sustainable future on a cost-effective basis. Furthermore, fossil, hybrid and/or biofuel tracks will remain relevant for a considerable time to come" (I&M, 2014: 8).

"Important levers for realising sustainable mobility are clean fuels and clean and energy-efficientdrivetrain technologies, together with new mobility concepts, better infrastructure utilisation, intelligent transport systems and logistic innovations" (I&M, 2014: 10).

1.1.2.3 How to achieve

"The targets can be achieved through a combination of various sustainable fuels and technologies. Calculations by the expertise consortium on the basis of the highest realistic estimates from the various round tables on fuels, indicate that neither the target for 2030 nor that for 2050 can be achieved by the adoption of any single



"Interrelationship between raw materials, energy carriers (light green = low carbon variant) and market sectors (light green = not yet developed)" (adopted from SER, 2014, p. 12)

fuel or technology" (I&M, 2014: 12).

The Netherlands wants to be in the vanguard of countries that try to achieve sustainable mobility. In certain niches, the Netherlands may take the lead. A leading role in all sectors is too ambitious. (I&M, 2014: 13)

It is imperative that the Netherlands tries to be in the vanguard, both to meet the set targets and to not loose its good position in the field of electric vehicle usage. The Netherlands needs other countries. When too passive, the Netherlands will lose its voice in Europe (I&M, 2014: 13)

1.1.2.4 Plans for different sectors

"The focus of the sustainable fuel mix is road transport. Passenger vehicles, light goods vehicles and heavy goods vehicles together account for more than 80 per cent of all CO2 emissions attributable to the mobility sector (excluding international aviation and maritime shipping). Hence, major changes need to be realised in these subsectors" (I&M, 2014: 10).

"The prospects for realisation of the targets and security-of-supply objectives are improved by having a back-up alternative for each market sector" (I&M, 2014: 12).

"It is desirable to take an adaptive approach in order to secure the Energy Agreement targets, partly because no single fuel or technology provides the so-called silver bullet in any given sector and partly because the course of many of the developments will be determined outside the Netherlands" (I&M, 2014: 13): A lot of zero emission vehicles are needed to meet the set targets, but in their current state they are not ready for mass usage; The scalability of biomass is still uncertain; New innovations may emerge in the period up to 2050, calling for regual revision of this vision. Therefore, adaptive programming is used.

Road transport

"For road transport, various solutions are possible, but the most promising solution differs from one market segment to the next. Fully battery-electric vehicles are appropriate for personal mobility in urban areas, but do not yet appear promising for long-range bus or freight transport or for heavy goods transport. In the latter segments, hydrogen, renewable gas and biofuels, including (bio-)LNG are likely to prove better solutions" (I&M, 2014: 12).

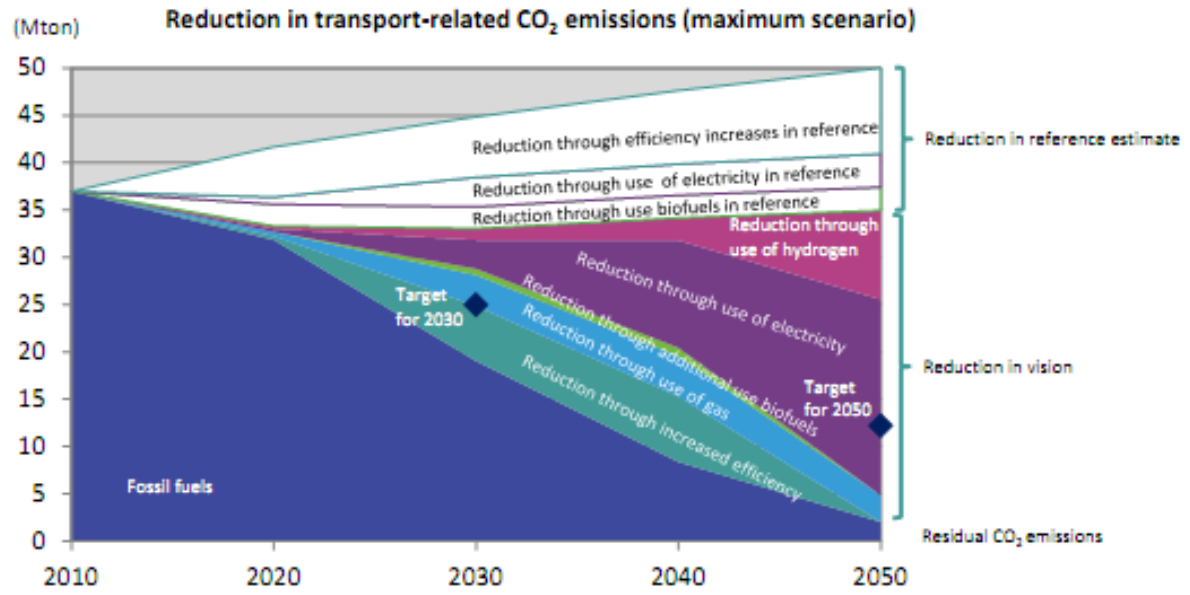
Electric vehicles are seen as the best alternative to current mobility in road transport: they are needed to achieve the targeted CO_2 reductions. A track via hybrid cars to full electric vehicles seems most viable, taking into account the expected technological progress of fuel cells and batteries. (I&M, 2014)

If fuel cell and battery technology is insufficient to meet the targets, use of biofuels and hybrids can play a supportive role in light vehicles. In heavy vehicles, these fuels will heavily contribute, for electric drive trains are not expected to be suitable for heavy vehicles within the given time. Furthermore, gas and biofuels are easy to implement and provide short term CO_2 reduction benefits.(I&M, 2014: 15-6)

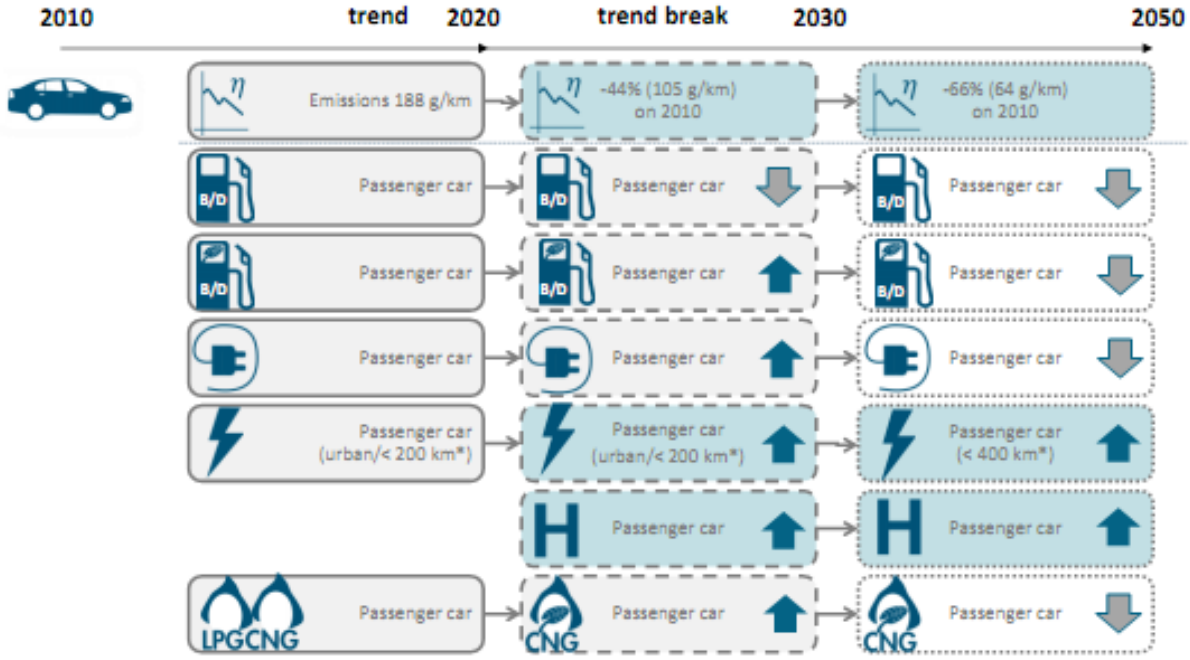
Efficiency improvements are important for all drive systems and fuels.

Market penetration of battery-electric and fuel cell-electric vehicles is expected in the period up to 2050 and is dependent on the infrastructure rollout. This needs short term policy action.

As a fallback and possible between step, is the use of gas and biofuel.

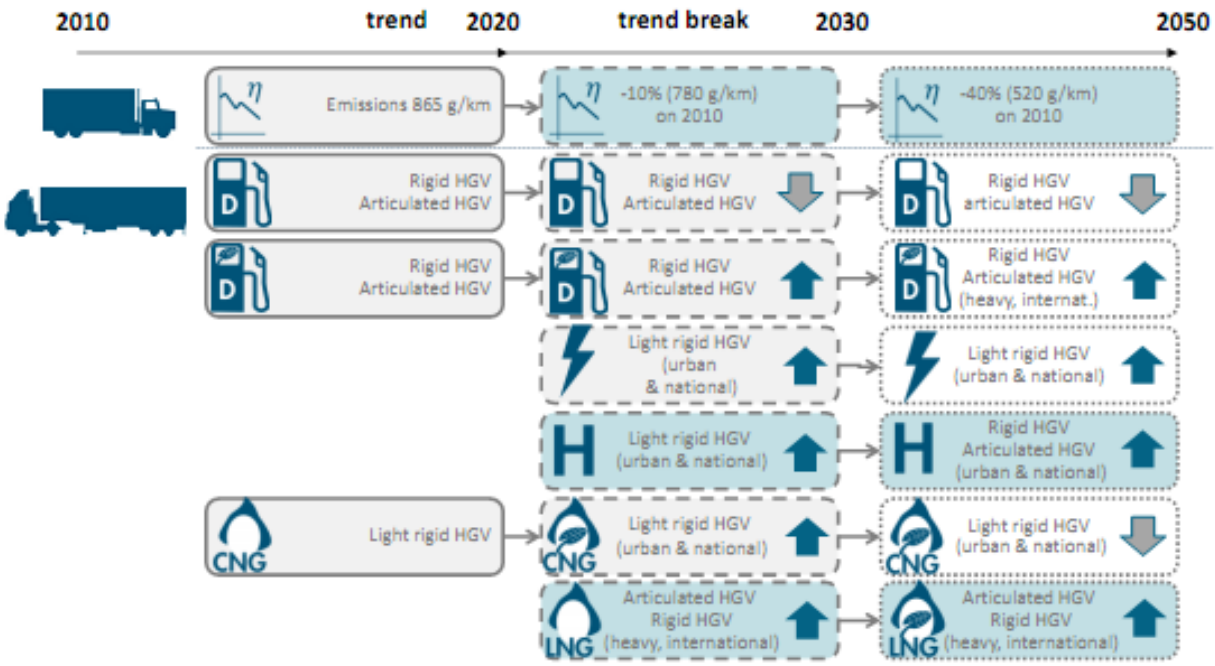


Estimated reduction in CO_2 emissions from road transport (maximum scenario) (adopted from SER, 2014, p. 17)



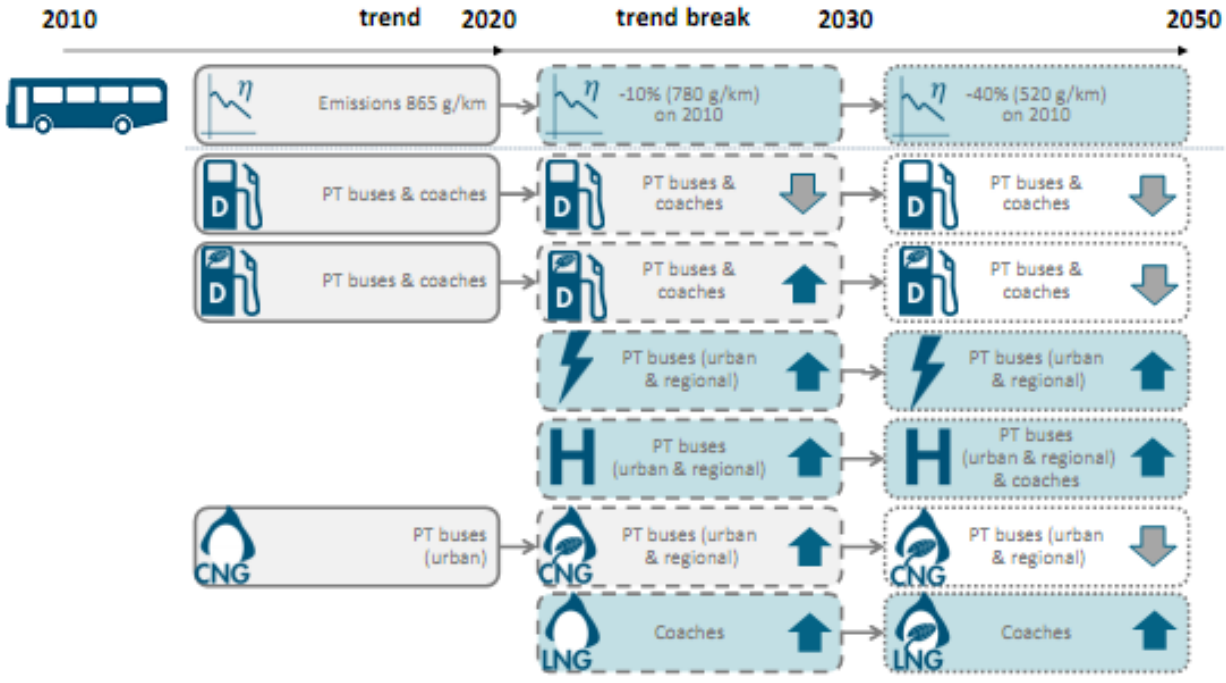
The intended development path for passenger vehicles. Notice the arrows for planned trends. PHV, gas and biofuels are intermediate solutions, full battery-electric and fuel cell-electric transport in 2050 (figure adopted from SER, 2014, p. 18)

For light goods vehicles, the plan is similar to the development plan of passenger vehicles (I&M, 2014: 19).



Development in the heavy goods vehicles road transport. Notice the arrows for trends. (Adopted from SER, 2014, p. 20)

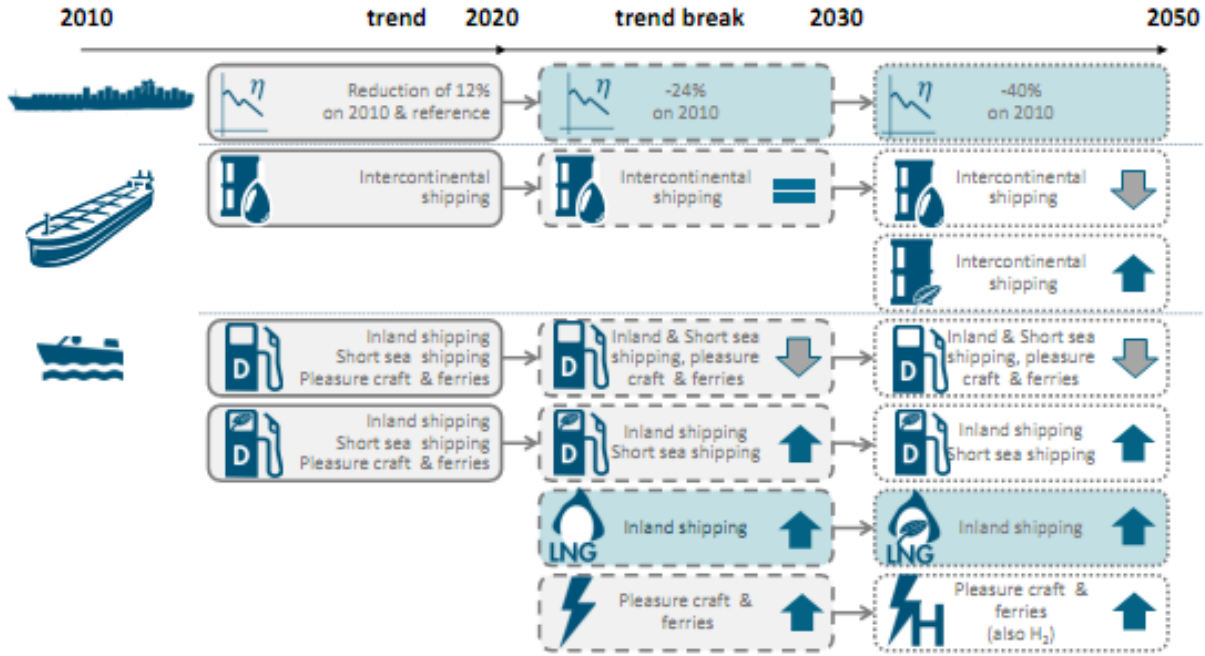
The focus in heavy transport is on efficiency gains, because it is expected that conventional diesel will be predominant, also in the long term. The alternatives in 2050 visible in figure 6 are expected in certain suitable market segments. In the long term, fuel cell-electric may be a viable alternative. (I&M, 2014: 20)



Development plan for buses. The image is similar to the plan for heavy transport, however, full electrification is seen as a viable goal for 2050.

1.1.2.4.1 Shipping

Efficiency. LNG long term. That is also in line with European Clean Power Directive. Electrification for short term efficiency gains. In the long term Hydrogen can replace LNG. Battery-electric in niche segments. Biofuels also option.



Development paths in shipping (adopted from SER, 2014, p. 24)

The figure shows the intended shift to LNG and biofuels. The overall focus is on efficiency. In inland shipping, electric propulsion is an option with efficiency gains which also benefits from transition to LNG or even hydrogen. (I&M, 2014: 23-4)

This is to be reached by encouraging early adaptors and promoting the use of LNG and biofuels (I&M, 2014: 25)

1.1.2.4.2 Aviation

In aviation, efficiency improvements and the use of bio-kerosene have to contribute to CO_2 reduction. Fuel cells and electrification are not an option in aviation. (I&M, 2014: 27-8)

1.1.2.4.3 Rail

The rail sector strives for further efficiency gains and energy carrier sustainability. Most rail is electrified, but diesel is also still widely used. Use of LNG and bio-LNG is an option. Dutch Railways intends to move to green power, considering the well-to-wheel problem. (I&M, 2014: 30)

1.1.2.5 Policy options

Where the business case for a product is already strong, investment will come from the market. In other situations, the government can provide temporary support. For a successful transition to sustainable fuels, policy must address products in various fields: infrastructure, vehicles and the fuels itself. (I&M, 2014: 31)

Policy options (I&M, 2014: 31):

1. Sutandardisation and regulations
2. Subsidisation of R&D and innovation
3. Additional measures, such as privileges that promote sustainable transport
4. Fiscal incentives

It is further elaborated that these policy options need to be in pace with the state of development of the product-marked combination (PMC). Less developed PMC's should get funding for lower numbers, for it is more expensive, and more developed PMC's can get funding for larger numbers. Also, "there must be a prospect of a product ultimately being available at a competitive price (…) if they are to win over consumers" (I&M, 2014: 32).

In terms of taxation and fiscal policy, the Fuel Vision provides some considerations on changes that need to be made for sustainable tax revenue generation, and to create a total cost calculation (TCO) that, besides proportional CO_2 reduction contribution, takes social cost into account (I&M, 2014: 32).

1.1.2.6 Policy levels

The Vision on Fuels stresses that different policy measures need to be carried out on different level, and that coordination is important. Worldwide, European, national and local levels are considered.

Innovation policy is said to be located at various levels, ranging from the local to the European level.

It is suggested that the rollout of alternative fuels is best started at the regional level, to be scaled up to the national level. Charging infrastructure needs to be nationally coordinated.

(I&M, 2014: 34)

1.1.2.7 Green Growth

"A transition to a more sustainable economy and energy supply is inevitable and essential; to remain competitive one must 'go green', not only for the sake of the environment but also for the economy for competitiveness and energy security" (I&M, 2014: 36). Green Growth captures the idea of increasing the competitiveness of the Netherlands by taking a position in the vanguard of green innovations.

"Switching to hydrogen fuel cells, batteries or renewable gas can make an important contribution to breaking the link between mobility development and environmental impact" (I&M, 2014: 36). When a transition to full sustainable fuels is made, there is no environmental restrain on the growth of mobility, with high impact on economy. There are costs, but the benefits are great.

Current leaders in Europe are Denmark, Germany, UK, France, Norway and Sweden. The Netherlands could gain a strong position on:

6. Biofuels and gas in transport and the production and transfer of non-fossil fuels.
7. Creating solutions for short-range and urban travel.
8. Pioneering innovative vehicle technologies, charging and refueling infrastructures and energy transition and buffering.

The Vision on Fuels defines niches with high 'green growth potential' for the Netherlands. These niches are 1) gas, 2) biofuels, 3) electricity and 4) hydrogen. The Vision on Fuels argues that the Netherlands has the chance to attain a leading role in these niches. These are the niches that will have the focus in support programs (I&M, 2014: 38-40).

APPENDIX 3: INTERVIEW WITH CIVIL SERVANT

Date	March 22nd, 2016
Duration	84 minutes
Medium	Face to face
Speakers	Interviewer1 (I1)
	Interviewer2 (I2)
	Interviewee (PO)
Language	English

[Informal Talk]

PO: Please start and introduce yourself, because-

I1: Yeah! Yeah! Yeah! It's very much in short notice that we got this appointment. First of all, thank you very much that you found time in the calendar for us at such short notice. Maybe I start. I'm an assistant professor at the Faculty1 of a ScienceField1 university, in Place1. University1. You know this university?

PO: Yeah, know, Place2, yes.

I1: Place2, *precies* (exactly, Ed.). And there we, understandably, study innovation, technological innovation, but also policies that are necessary to foster innovation or to make transitions, your portfolio, possible. We have running an international project where French, British, German, us colleagues are working together on the specific aspects of transitions. Where something drops off, technology that has so far been incumbent, is questioned more and more and it's decided to be abandoned. It's all very specific focus. Against the background of transitions, all kinds of transitions.

But we have chosen things that are -really have been abandoned, like DDT, the light bulbs on a European level, or the nuclear power plants in Germany. And we have deliberately chosen something -an area where nothing or only the slightest efforts are beginning and you don't know whether it will be a transition to something else, or whether something like a discontinuation goes on. Termination of a policy, is maybe not a question, but a transition is actually the question.

That's car engines, because you see, of course, there are electric and all kinds of other drive engines coming up, and here and there we hear that somebody… some government cabinet try to establish a policy that supports replacement technologies, or rather stop supporting the old technology, and that's actually your topic. You are *afstudeerstudent* (graduate student, Ed.) [Crosstalk].

I2: Yeah, I'm doing my bachelor thesis now. So the subject that I chose within this project, that includes more subjects, the case of the internal combustion engine, and want to look for signs of… maybe it's a transition to something else in the future, so we may be in the early stages of this transition, and what's happening in these early stages and what kind of governance is going on in these stages.

I1: Especially in the Netherlands. Because this was under studied. We've compared things in the other countries – the German car industry is, of course, the focus - but then the Netherlands. We thought it would be a crucial thing to speak with somebody who's very close to these policy processes and making them, actually, like you, and can tell us about strategies and trends and sensitivities also, maybe, from a Dutch perspective.

PO: Good. How come you get your name, from whom, my name? Who-

I2: I first called to the ministry.

I1: The press office, or what?

I2: I first I was at the press office, but it didn't really work. I called some general number and I think I asked for the secretariat of this department, and then I got an email address and I emailed the secretariat of this department, and then they gave me your number. Because I kind of explained what I was doing – [Crostalk]

PO: Yeah, if you look at my business card: Occupation1, so eh..

I1: Yeah!

PO: What I mean, I try to facilitate transition processes for the sake of better environment friendly vehicles. Of co-mobility. I think that's in short what I do, because the transition theory is vested in the former ministry – department of Environment in the Netherlands - Ministerie van VROM. They started with- we have severe problems on the climate, and we need transitions,

both for mobility and for the energy production for the sustainable agriculture and for the sustainable bio-diversity. That was NMP – National Environment Plan (*Nationaal Milieuplan*, Ed.) number 4, in 2002. Then they started with the concept, and they get the concepts for instance for professor Jan Rotmans, [unintelligible] transition, and also later from the University of Utrecht. Those ideas.

And the Netherlands, I think we were on that topic frontrunner on that moment, but especially [the way] the Netherlands is, we have brilliant ideas, but other countries walk away with them. Denmark. Germany – *Energiewende* (Energy revolution, Ed.). Was this German word for energy transition. And we also have an energy transition agenda in the years 2004, 2008, 2009, I think, yes. And then came in another policy from the *gedoogkabinet* (tolerance cabinet, Ed.)- from the VVD and the PVV. And then it was out of the picture a little bit. Out of the attention of the government and more in the picture of the market parties, and the government was more directed from the Ministry of Economic Affairs. But our ministry was taken off.

But we had contracts, associations, with private partners, and they said, "we have an agreement with you" - that is the right word, agreements – and "hold on, please." And that's why… because transition needs a long time period, over cabinets. And it walks a little bit like this, and in the past years, in the past cabinet we have a new transition agenda – "Energieakkoord" (energy agreement, Ed.). And transition is also, especially the mobility transition as a part of it, especially put on the agenda during this last period of our government. So in the SER "Energieakkoord" (energy agreement, Ed.) mobility is also now vested. But yes, we call it a leapfrog. We were leapfrogging, walking by. But the ideas of the former transition, energy transition in 2002, 2003, are almost the same.

Also, there are situations that this comes up further, but now it is… we have the mobility vision about future fuel in vehicles and future engines and the transition parts, defined in 2004, 2003, are still alive. And we have a transition [part] -strategy that will say: no charge for one technology, but the need to change the old technologies because of the severe environmental problems, especially for climate. But the timeframes are put further in time, because in 2002 we said that the transition needed to be completed in 2030, and now we said the transition has to be completed in 2050. But nevertheless there is a long-term lead about the climate, as Paris was appointed, there is now European and worldwide vested. But the ideas of transition is a concept that was also born, I think - also in other countries, but also in the Netherlands. So we have good concepts, but we are not so, is my opinion, so good in implementing it. Other parties go further. Because then the means, the financial means, we had for transition for 2004-2008, was kept back and fell down. Now we have to start from 0 again, that makes it a little bit [unintelligible].

I1: Can you shed light on some of the anecdotes that you encountered during this period? Where you say they kept the money back, you had to start from scratch again, how come? I mean if there's a plan, if there's a clear dedicated policy and people installed as managers -

PO: Political priority. The managers, the top managers of the ministry said: there's no priority on it. And we have to cut money. So they cut money where? Where because there [Crosstalk]

I1: [German word] –

PO: Ja.

I1: Necessity… out of sheer necessity.

PO: And the energy policy is not a key player… What was the credo, the Dutch credo? *Uhm… Wat was het…* (Eh, what was it…, Ed.) What the cabinet vested. *Ik ben even de naam… Hou je – hou je bij je eigen leest.* (What's the name, keep to your own profession, Ed.) (meaning: stick to what you're good at, Ed.) Our policy was confined to accessibility – *bereikbaarheid* (accessibility, Ed.). And not any longer sustain – *duurzaamheid* (sustainability, Ed.). Because that was left politics. It was a by PVV supported cabinet, so both the VVD and CDA stopped also with giving priority to this subject.

I1: With the first Balkenende cabinet? (Rutte 1, in fact, Ed.)

PO: *Ja ja* (Yes, yes, Ed.) And our… and it was also the time that the two ministries of Environment and Traffic & Transport merged, and our secretary-general… Former; he is now secretary-general in the Ministry of *Justitie* (Justice, Ed.) – Siebe Riedstra. He has to fight to get the environmental department here. That was the situation 6 years ago. You can't believe it, but it was. I can't still believe it, but our secretary… current secretary-general said "Yeah, it's coming back, that time." And the time has come back. So it is more… culture of ministry is who has… ja, *dienstbaar* (service role, Ed.)- supportive for the political choices they made. Political is the boss. If the politics say that environment no longer is possible, then we do that. In the former ministries it is more a long time strategy, and what we'll do is that we'll have made agreements with the societal partners for longer periods than one cabinet. To vest interests or losses is another way to get things done that need to be done. Especially for the introduction for new and alternative technologies, fuels and vehicles for the sake of the environment, we needed that. And it's an institutional point. Problem. And rather angry, still I am - doesn't matter - but it's so… but it's not, I said it's not the ministries worst point, because the ministries are… But it is the politics. That's the politics.

I1: [The structure of the ministries and institutions and] -

PO: I said this to the political partners. Also for instance politicians of the CDA or… "We don't understand you. Why do we need to stop with this? You started with it and next cabinet you stop with this. Are you mad or something like that?" And they said "Yes, it's true." But it was the struggle within.

I1: What did they say? What did they say?

PO: It was an internal struggle. Especially in the CDA party – *Christen-Democratische* (Christian democrats, Ed.) party. At one side Maxime Verhagen en Camiel Eurlings on the other side. And it was a schism in this party.

I1: You really wonder how was it possible, because they would have… they discredited their prior policies.

PO: Yeah yeah yeah.

I1: So this is where the questions are coming up: not just from the general public, but also inside the party. So how do they bring themselves in a position to defend the decision which is against the policies they have themselves made? How does a politician come into such a situation? Is that only the pressure of the budget?

PO: No, no, it was the -

I1: Or why do they say "Okay, we have to go through that"?

PO: It was out of picture in the *samenleving* (society, Ed.). In our society. Because it was out. It was left. It was 6 years ago – 5, 6 years ago.

I1: Had a change of mindsets be necessary -

PO: But what happened, it was the political context, the context within the *bedrijfsleven* (industry, Ed.). The… in the industries. They would have to choose - they chose for sustainability. And then the cabinet, "If you choose and you see business in it, okay then we can hold back." That is exactly what happened.

I1: So originally it was against the ideology, but when the industries themselves embarked on it, invested in it, "Please don't take it away."

PO: And the cabinet okay that we make green deals. We had a green deal policy, but a green deal is just making the barriers invest – what were the barriers and how to overcome the barriers with no budget? And Netherlands has no investing budgets any longer, because they stop also with the *aardgasbaten* (natural gas profits of the Dutch government, Ed.). With the gas…

I1: Gas fields money, yes.

PO: Yes. And they put it not any longer in new technology because it wasn't very successful. You have a little bit right, but because… And they had, and this is the story of the department, the Ministry of Infrastructure & Environment, and the Ministery of Economic Affairs, they started, well, they'd do it. But with *Topsectoren* (prime sectors, Ed.) policy. So they have [a lot of/no/an old] policy, but… But we had a working together policy before. 60 partners working together, and now they're left - 3 partners went away. Environment was gone, Agriculture was gone, [and now]… Agriculture merged with Economic Affairs, and Environment merged with Infrastructure. And we kept on our core business, and there was less room for that.

But nevertheless, because of the agreement with our *omgeving* (environment, Ed.) - our environment - it was… *dus* (so, Ed.), the political context of transition management. And then we started - we started… that was also one of mine, but also our group. We had a group, a policy group within the Ministry of Infrastructure – the former Ministry of Transport. A group, Transport & Environment. And within the group of the Ministry of Environment, we had a group Environment & Transport, and they merged. And in that period the merge process was that the policies of the former Ministry of Transport and the policy of the former Ministry of Environment also merged to the vision of the future: fueling mobility. Among other things. And that is what's going on now.

And the vision has now been vested in a policy paper and in public/private partnerships. So we are now in a rather good situation, but: Germany is further, Denmark is further, I think - this is my opinion, with exemption of electric driving. Electric driving is interesting, it was moved from the former Ministry of Transport to the Ministry of Economic Affairs, and that was going up in 2008, 2009 period. It started in our Ministry of Transport and then it went, it was going slowly away to the Ministry of Economic affairs. As an outcome of those new policy, because do what your own… *Ja de… ik ben de kreet vergeten hoe dat heette. Dus: milieu is uit en richt je tot transport en bereikbaarheid. Het Ministerie I&M. En EZ doet de energietransitie, daar kwam het op neer. Dus ook elektrisch rijden.* (Ed.: Yes the… I forgot the motto, what it was called like. So: the environment is out of fashion and move to transport and accessibility. The Ministry of Infrastructure and Environment. And Economic Affairs

takes on the energy transition, that's what it boiled down to. So electric driving as well, Ed.) But I think because of the transition policy, we not only were involved with battery electric driving, but also with LNG and LPG -

I2: You say the transitions are needed, but now are postponed to 2050?

PO: *Ja* (Yes, Ed.)?

I2: What transitions are these transitions?

PO: What we need is for the mobility, we have now future fueling and… ja, "Brandstofvisie" (Fuel Vision, Ed.). Fueling vision. About fueling, refueling, future mobility. Both for passenger cars and trucks and for trains and for shipping and for aviation. So we have brought [unintelligible] and we said, together we worked it out together with the industrial partners – with 100, 120 partners we have had sessions, the past years, to get the vision in the paper, [and we have] organized among special product market combinations.

And we said for instance for buses, public buses, the policy is 0 *emissie* (emission, Ed.) bus in 2025. In 2030, every public bus has to be 0 emission. And 0 emission is also defined as a goal, there is an electric drive train - or battery eclectic or with opportunity charging buses, or fuel cell electric buses. And the biogas buses and so is only a step if we don't will be successful in electrification. If electrification is the mainstream.

I1: Interim solution, or..

PO: Yes. And if there comes hiccups with electrification options then we go for… are we [aiming? maybe?] too high? And we made a green deal about that. I've prepared a green deal about that part of the market. And we *herhalen* (repeat, Ed.) - repeated those kinds of philosophies for the city… distribution trucks and cars. Also city distribution has to 2025, a point in the future as transition management, that all will be 0 emission. We made it together with private and public partners. [unintelligible] They see also chances. But you need a support program, both financial and in ruling, to realize that.

And besides that, we have 2 or 3 sustainable transition paths for special policy affairs. The one is for passenger cars, is electrification for short trucks - also electrification, but also bio LNG for long haul trucks, more LNG. And perhaps for the future hydrogen, but that's not the solution, we think, at this moment. And for shipping LNG. And for aviation bio kerosene. So that the need for for instance bio fuels is not over all parties, because there's not enough bio fuels prognosed…

I1: Available, yeah.

PO: …available, we think, just for 20 or 30% of the total market. And the other part of the market has to be… with electrification. So the transition is to electrification, but we don't know exactly what the kind of electrification will be. So we don't choose, for instance, for battery electric cars, or for smart electric plug in cars or for fuel cell electric cars, because, interesting, fuel cells seemed to be THE solution eight or ten years ago and then it fell down, and then came up battery electric. That seems to be the solution. But also, for all cars all battery electric is quite a job to realize that, and the battery is not good enough and too pricy at this moment. So we said: don't choose. Because the choice is not for the government but also for the market parties and for the customers. They choose what they want, and it depends on the price, the technology, and the availability of enough infrastructure, and that's the policy we have. So we don't choose. So we have a platform for battery electric cars and we have a platform for fuel cells. And we also have a platform for 0 emission buses and a platform for 0 emission truckings… for [unintelligible] solution. So that's a solution, it is in a matrix you can understand –

I1: Yeah yeah.

PO: And we worked in those programs too. Not only national, but also international and local alliances, local parties together. It's a story, but you asked the question. I've given a whole college, but…

I1: Very interesting to follow.

PO: Is it clear, yeah?

I1: It's good.

PO: We also have this in papers.

I2: These platforms; you have platforms for different kinds of…

PO: Solutions, ja.

I2: What do these platforms do? Do they promote these solutions?

PO: Ja. They asked for help, for the government, for the rulings, for the fiscal systems and for finance. Financial support. And we decided some solutions are ready for market and others are not at this moment ready for market. We made the portfolio of… and in an innovation process. R&D, research, development, demonstrations of early market introduction, later market introduction and growing up. We use innovations graphs for it, if you don't know. You have those in mind, I think, hè? *Innovatiecurve waarbij je dus verschillende stadia van de markt als het ware support* (innovation curve with which you support different stages of the market, Ed.). For electrical it's further in the market than for instance hydrogen. And LNG's in the market already. And this, just support, financial incentives. But for the new technologies you need European R&D programs and demonstration programs. So they are in several stages, and you have to manage the portfolios of those innovations in combinations with each other, that is what we do.

I1: That is maybe an important keyword, because what you describe is partially in the papers, but how you describe it is, of course, not in the papers. Because you have knowledge of how to do it on a practice level. So I would be interested how to keep it – how do you keep these things together? It's a highly differentiated set of portfolios. How to make sure that they go on, politically? That the overarching idea or the different ideas are not somehow lost, or somebody cuts it down again. How do you as a manager of these policies actually keep them alive, even against all the odds of the political, ecological and trends and fashions and so on?

PO: I'm not responsible, I'm more an innovation guy than a manager. We have our head of unit and they are our program managers. They have the overall program. I vested the ideas [crosstalk] because I was the pioneer in it, and I take for my own the new ones. I started with the transition agenda in 2002, and now it is… and now there are more parties, colleagues involved. Then I started with… electric driving came out, and I so we made an action plan for that. And then it was vested and I give it to my colleagues and they just go on. And I said – or not I said, but the industry said: don't forget hydrogen. It was in a fell down, you say. It was going up and everybody said "Hydrogen? Oh, that is old-fashioned. Electricity, that is" -

I1: So many promises and never fulfilled, yeah.

PO: Because the industry gave the promise themselves.

I1: Yeah, exactly.

PO: What would I say - not the industries themselves, but the bosses in the industries. So they said "Ha, we are ready to market" –

I1: The engineers always saw it a bit more realistically.

PO: Yeah yeah. "No, it's far too early. Take time." But if you don't keep it high on the agenda, you don't get the needed public money. If it's not important, you get no money, and it seems to be important, but in fact it isn't. You get the money… that is irrational. But you have to convince, with a good story, the politicians to give money. Support money. And that is what has done for fuel cells, years and years ago in Germany - they started in 2006 with this program. And they spent millions, billions in it. The European Commission as well. We spent 200 million.

We started in 2004, '5, '6, but then came up electric driving and we went "Oh." and we get all our money and we stopped with hydrogen. That's typically Dutch. So the policy, because we have no strategic industrial policy like the Germans have, or the Japanese have. We haven't. The Germans stay very long on that topic. Also in Europe. And the Japanese as well. Because they have more… Ja, *wetenschappelijk* (scientific, Ed.). Wissenschaftliche… *cultuur* (culture, Ed.) in Germany. And they have more money because they are a bigger country.

I1: Also more organized interest of industries. I mean, Germany lives off car industry.

PO: Yes. No wonder. If -

I1: How could you cut their stream of policy or funding?

PO: How come - why it started in Germany, and why not – we had also a starting car industry in the Netherlands, but we did it so silly with the DAF. It was a brilliant technical idea, but the marketing it was so… *suffig* (dull, Ed.). There was no design… That's typical Dutch: we have brilliant ideas –

I1: Looked like a Lada.

PO: Yeah, the Dutch Lada.

I1: [unintelligible] Lada.

PO: Yes, and with Germans, they spend more money, perhaps less smart, I think, but more money, and they give *Deutsche schwung* (German swing, Ed.). Yes, they make it more… ja, thick, I don't know. But they are succeeding where we failed. That's typical Dutch, I think. But it's the culture. I'm a ScienceField3 hè, I'm also thinking about culture aspects of this, why we have-

I1: You're a ScienceField3?

PO: Ja.

I1: Okay, interesting, me too. We do ScienceField2 also in a very ScienceField3 way, actually. That's why I'm asking, what are your strategies, both as these platform managers and as a transition manager and so on, to put these things on the agenda, or keep them there, or let them develop there? So that you keep, whatever the ball is, keep the balls, however labeled or what color they have, but keep the balls somehow in the air, what are your strategies?

PO: What we did - what I did, what we did: we started round tables, in 2002. We started round tables with front runners. And this was also a little bit my idea, but… you do the study: what is the future, what is going on what are promising technologies you read in the papers, you read… if you talk with the industries, if you talk with universities, if you talk with fueling… Shell, or if you talk with Toyota if you talk with a little one. And then they have also together reports (I think he means some kind of meeting groups), and we… we met the reports of the World Business Council for sustainable Development. A report was starting in 2003, 2004, and the chair was Shell, and the co-chair was Toyota and partners were all big industries, like BMW and BP and so. So that was an international report, and I think: "That is interesting. Can't we start a group, talks together the big industries and also the environmentalists." We had a *stichting* (foundation, Ed.) [name intelligible] round table, we talked, you make a year discussion, a round table to figure out the policy, also with some professors, Bert van Wee for instance, and Wim Hafkamp – I don't know if you know the name, an environmentalist was it.

I1: Bit before my time.

PO: Yes yes, and we talked with them. Wim Hafkamp was the chair of *nota Economie en… Milieu & Economie* (annotation Economy and… Environment and Economy, Ed.).

I1: Where was he?

PO: Erasmus University. He was also the boss of Jacqueline Kramer, the former minister. So we talked with them and with the industry, and we had a dialogue together with my bosses. With my director-general. And in the first day we were enthusiastic and he wasn't. We have to convince him. And step by step he was convinced, and then we were chair in 2004 as the ministry of the European Commission – twelve years ago - and he had the idea: let's organize a congress. [And there was a] partner of mine and so it started. So he started with talk, and we formed a transition agenda and then we made part – that was for the mobility transition, and then we made partnership in the Ministry of Economic Affairs, there was also a group about energy affairs.

And we succeeded, and also our partners of the industries, he talked with our directors, directors-general, and put together 3 director-generals, because it's the future, [we see] the steps, and so it started. We started with the vision, this public-private vision, public-private university. That was also transition theory, it was not… And then he made agreements about it, and after those agreements, who were voluntary, but it were agreements still, came more agreements. And in the Netherlands we are very good in making agreements, that is our nature. And those agreements helped to vest… make new policy. So there was a fiscal policy started from the former minister of Finance – Jan-Kees de Jager. He made the policy for the electric cars. And it was so successful, now screwing back – *teruggeschoefd* (rolled back, Ed.), I don't know how you –

I2: Reverted.

PO: Ja. Because it was too successful, it cost too much money. But it helps very… for the Dutch market we have all public… how do you call the cars… the plug-in. hybrids. The Mitsubishis *en dergelijke* (and such, Ed.). The Netherlands is the leading market for that type of car. Because the finance. And Norway is the leading market for electric and hydrogen cars, because of the policy program. And the industries looked together, and what we say, that's great. Because for the whole industry and for the whole society, for the time [unintelligible] we work integral together with our colleagues of Germany and Poland and Greece, Finland... So that was the next step in the strategy. So, first, national strategy; next step is working together with international… and further step is getting European money to those programs, and getting to support electric driving, to support fuel cell electric driving, and so it's a broader idea and so it started.

I1: And how can you keep people who have been sharing ideas and commitment, or at least promised commitment, how can you keep them up to the stakes? How can you keep them involved? How can you keep them committed?

PO: Yeah, because they have also the… we have the same vision about the future. The hydrogen group-

I1: What has there been shared? Has come to a… shared sort of…

PO: Yes, we've talked intensely, for instance, not from… in 2008 with the project manager of Renault-Nissan, because they had a vision about electric cars. We talked in 2007, 2008, '9, '10 intensely with Hyundai, with the Koreans, with the R&D people, with the strategic people, we talked with Toyota International - not with the market owners here I the Netherlands, because they sell what… [crosstalk] yeah, what the concern said, they have to do. We know that you have to talk with them and not with our group, and after that we have the context, we invited the *importeurs* (importers, Ed.). And "Oh, that is very important, because our boss told" – ja, of course, and we said it the same, so then the connection is made. Is a complete other way of handling the industry and the *belangenorganisaties* (interest groups, Ed.). We did it together with them and with the… and if you have the big car industries in mind, they have a research unit, very big and very intellectual, and they know every single… because they have to make big and big decisions. Have to choose for battery, electric, for hydrogen, or for both? And for which cars? And they have to invest billions, and for Shell it's the same.

And besides that, we also talked to the game changers, potential game changers. And then came up, for instance Tesla, or other… we had Better Place for… we heard about them. They are now *failliet* (bankrupt, Ed.), but they started with changing battery systems. Or we talked with the Netherlands with e-Traction, a little [unintelligible] drive innovation company. So we had not only the big OEMs, but also the front runner's policies. The potential gain -but you don't know who the game changers are, you cannot *voorspel* (predict, Ed.) it. And the game change, that is interesting in this policy, that the game changers, we are not only searching for them, but they are also looking for us. They are coming to us to talk with us about their new system, because mostly the rules are not enabling their technology. The rules are against it. You see it with car sharing, with… Airbnb: every transition is against the common rules.

I1: Is somehow revolutionary, against the established set of rules.

PO: Yeah, and you have to be sensitive about it. That's my role, I'm rather sensitive about those things, and I'm easy to contact with them, so that I play a special role within the ministry in the policy making an area, to get things done like this. That's what -

I1: You're a sort of a facilitator, as you describe it.

PO: Facilitator, but also *verkenner* (scout, Ed.). How you call that, vision…

I1: You recognize actually that-

PO: I recognize, I have a feeling, more a gut feeling. If I read this -

I1: Personalized sensor.

PO: Yes, that is correct. And a little bit unconventional, a little bit chaotic, I think. "Ah, he is always a little bit chaotic. But he has every context and..."

I1: I guess it justified for the creativity.

PO: Yes.

I1: Creativity needs to be -

PO: Yes, that's what it is. It's my gut feeling, my father is entrepreneur. So I think that is – and trust me, and that is -

I1: How do you make them trust? How do you make these things you suggest stick?

PO: To organize the external world internal.

I1: OK, that the [intelligible] you have been describing.

PO: Yeah, and in trust. Invite them. And we had also discussion with - we had a discussion with the environmentalists, with Stichting Natuur & Milieu (Nature and Environment Foundation, Ed.). Who has in 2006 or '7, were against passenger cars. They were fond of public transport as THE solution of all environmental problems. That is a stupid idea, because you don't go with the train to the front door, you need to combine individualized and collective transport. So we had to start with a dialogue. And then on the RAI Vereniging they merged a little bit like that. So that is the transition processes within those organizations, and the transition processes within our organization. By organizing those things. And that is what I do, what I my whole life I do - I'm now 65, but in the organization, this is my thing. And recognized.

I1: You bring all this together, all these knowledges, all these interests and everything people trust -

PO: Some topics hè. Specialized -

I1: Exactly. On the other hand, can it sometimes happen that the cabinet simply doesn't want, doesn't follow? You have brought, arranged everything, in a sense, presented on a silver tablet, and they don't pick it, they don't use it. What does it – doesn't that happen?

PO: It doesn't, never. It's never happened. In my experience. Because what I did is… for instance, how the electric car was introduced on the market in the Netherlands, there were local groups of car manufacturers and we had the conversation with Stichting Natuur & Milieu (Nature and Environment Foundation, Ed.). And we had a group. And then they came together and they get involved, and the Stichting Natuur & Milieu (Nature and Environment Foundation, Ed.) is closely related to GroenLinks and Kees Vendrik, "That's a good idea." So it came from outside in. Politic.

And for hydrogen, 6 years later, the industry, Rotterdam industry, the big industry, asked, "We have so many hydrogen in our industry, please help us to realize." And Toyota, "Please don't only… *omhelzen* (embrace, Ed.)- support electric drive cars, but also – battery electric, but also hydrogen. We are ready." So there was this chance that our minister has to open the Ecomobiel Beurs (Ecomobile Exhibition, Ed.). Our minister. And I was asked to prepare her speech. And it was just in the time that our ministries merged. And I dared to advise her, "if you would like to have a *primeur* (scoop, Ed.), if you would like to have a political statement, then I advise not only to get started about electric cars. They are more or less common. And also not about bio fuels and the whole… but focus on hydrogen fuel cars." And I asked industry to come with those cars. And she opened it and announced a transition program also for… And it was on television. She was with Pauw & Witteman (a talkshow, Ed.).

So it came from outside in. The industry, I made a kind of coalition with the industry partners, a coalition with the speech writer of the ministry, I said "This is interesting, you have to do that", and so we started and it happened. And so we have – and that was the start of the transition program for hydrogen. And then you started the fight in the organization. "Hydrogen?", they say, "Hydrogen is old-fashioned. Electric, that's it!" I said "No. We talked with Renault and we talked with Toyota." But I had to - after it was done, I had to convince my colleagues about the chances of that technology.

I1: Did you become some sort of lobbyist for Toyota and for the Rotterdam's… It's not a critical statement, but did you not take over a role as a sort of lobbyist for the interests then?

PO: A little bit like that, I think, yes. It is also a role. Not for the –

I1: You can make it broader: what's the role of the government?

PO: And I'm not a lobbyist for Toyota or for Mercedes; I'm a lobbyist for hydrogen. It's a little bit technology driven, but also [unintelligible] market driven solution. I'm a lobbyist for new solutions. And I did it before, for instance, this was in 1996, '97, for what we then called *ketenmobiliteit* (chain of mobility, Ed.) – I don't know if you know it.

I2: Chain mobility?

I1: Ah, okay. Yeah yeah. Like the Aramis project in Paris. Aramis in Paris, you remember?

PO: We had in the Netherlands, in the sixties we have, of course, Rutger Schimmelpenninck (he means Luud Schimmelpennink, Ed.), with the Witkar (shared electrical car initiative in the Netherlands in the sixties, Ed.). And I was asked for the lease *auto's* (cars, Ed.) – is a long time ago for the lease auto's - why do you have to sell lease auto's? You have to get them out of the market. It has to be public transport. That was the dominant vision in 1995. I said: "what the hell is this? A train does not come from door to door; you need to have door-to-door solutions. The combination of public transport and individual. And you can also use public transport in individual forms", that's what I said. And then came an idea in the… It's called the OV-fiets (public transport bicycle, Ed.). A public transport in an individual form. That came up. If you have that, then we give you financial support of that program, and they get, and so it started. It was another way of thinking about… to the future. And why… and now you see it. In France, you see the Snapcar, and also the electrification combination, in Amsterdam, with Renault – what is… Cow to go? Car to Go. Car to Go was the answer of Mercedes. They proposed in Paris, but they lost. Because a friend of Mr. Sarkozy, he won. That was the founder of that. And then they came to Amsterdam, I know that. Because Amsterdam will so. And so it started.

This was the OEMs starting with public transport solutions. And the public transport… PTO – the public transport operators – has to start with individual options. And to merge them. That's the solution for the future. Especially in dense cities. And it's a mindset. "And now we have public transport and individual transport. What the hell?" It was a mindset. And so was our ministry structured. "What are you doing? It's complete mad!" But that is my astonishment. And all my change agent mode. Drive. Ja, and I'm of course too enthusiastic, so that came to resistance: "Listen to what we say and what they say." "You're 10 steps too far. Yeah, it's none of your business, you are mad." So that is what I heard, but that's the way you as a person, as a public officer, operating in the environment of a ministry and in combination and co-makership with the private partners, and then in the early stages, Renault and Nissan and BMW were working together, to get a new market started, and [unintelligible] after that. But in this time they need to work together. And this is also what is going on with hydrogen. Fuel cost is

the same. So that's the way to handle such future solutions. But we don't know exactly how that's going to go. If the rich technology will win. You can't *voorspel* (predict, Ed.) it, that's impossible.

I1: Is it not relatively new that you have a broader portfolio of alternatives kept warm, somehow, where –

PO: Some people say: you have to choose. I say: we can't choose.

I1: Exactly. In the old times I thought – you thought you could steer through, you're set on one horse you set on one horse and that must be winning. And now you have a portfolio of options.

PO: Yeah. No no. there is no silver bullet. But that is also the transition strategy you learn in books. Jan Rotmans is -

I1: Rotmans, yeah sure, little arrows flowing through the machine, yes?

PO: Yes. And then a discussion: you can't- once give your money. What an idiocy, we have so many policies. So don't choose for one, but have policy, and learning policies. Because it may happen that battery will be the solution, but it nevertheless it may happen that the fuel cell may be the solution, because the battery has problems with loading time, problem with sustainability, that if you load it many, many times that it goes down, or something like that. And those technical solutions are not *opgelost* (solved, Ed.) yet. So you need to have in every - you have to know enough, not too deep but also not too [superficial], what the strengths of the possible solutions are. That means that you have to be top-down, from top, and have high abstract level to… yeah, low floor. *Dicht bij de grond. Voeten op de grond*. (close to the floor, feet on the ground, Ed.).

I2: One of these will be the solution and we don't know which yet, but what exactly is the problem that needs this solution? How would you describe the problem?

PO: We have a problem of climate, that's a problem. We have a problem we are running out of fossil fuels. In the future. There are enough, but… We have an air quality problem, and we have… a space problem, but that is not the solution for compression [conventional? –Ed.] drives [replacing combustion engine is not a solution for the space problem? –Ed.], not for the space problem, you need more integrated public merged transport system solution. But for the air quality and for the climate problem - climate problem is so that you have to run out for fossil fuels [stop using fossil fuels? –Ed.]. In the future. Otherwise we don't get the Paris norms for 1,5 to be… And that is also a little bit in discussion. Now it is it, and 5 years [later/back] it wasn't, and 10 years it was. And what will it be in 5 years? Is Mr. Trump and the… the *sceptici* (sceptics, Ed.), the climate *sceptici* (sceptics, Ed.), now they have no floor, but 5 years ago they had the floor. So that makes [unintelligible]

I1: Think of Copenhagen summit, yeah. In the winter, about climate change, warming.

PO: Yeah. And if there's a study in 5 or 10 years that it is not the CO2 that is the problem, it is something else what's the problem, then you have to change. But nevertheless, it doesn't matter, because then we have the solution that we have a prepared market for electric cars and that is the solution not for [unintelligible] new market ideas. That is the better technology: it's silent, its clean, comfortable, it's smart and it gives… if there is not a problem, there is not a solution. Something we have to live with. Solutions to have a better life for us. And electric - both electric cars hybrid fuel cell electric cars have a lot of possibility, to have intelligence on board. Because you can use more intelligence and more software systems with an electric drive train than with combustion, because… and you can also combine it better. So it has also *voordelen* (advantages, Ed.) – advantages. Above conventional energy solutions with the battery systems. So a smart car is an electric car. The automatic driving car is an electric car, because the technology is more suitable for those solutions than the combustion car. You need so much electricity for the computer smart cars. So if there's no problem any longer with climate, the solution can help also to solve space problems. A little bit philosophical, but it is not… Ja, zo gaat dat toch? (Well, that's how it goes, right?, Ed.)

I1: I liked that question about the problem that needs to be solved. I guess you have even more problems you say you would solve with such a solution. You mentioned now the grand challenges, or whatever they are called, the big highlighted topics, but an industry company is not necessarily interested in cleaner air, or something, if they can't make a profit out of it. If we have them around the table, I guess there are more reasons that you have to bring together a range, as you described in your strategy of getting [unintelligible] and giving drive through, bringing all interested parties together and letting them share mindsets, and let come up something from there. But I think the economic interests, since it's a very economically oriented country and government, culture, still neo-liberal, the companies are strong, they don't contribute, even under CO2 production or "children shall live in a good environment level", if there's not something profitable in for them, I guess.

PO: There must be. It has to be.

I1: You must mobilize also the- direct the original interests of industry, of NGO's, of political… other players, whoever they are.

PO: That's correct.

I1: So what are the problems there in terms of car or mobility? It's difficult to say on which level - is it the engine, is it the concept of mobility, is it the concept of the car -

PO: We call it green growth. Groene groei (green growth, Ed.).

I1: So the marrying of ecology and economy, so to say.

PO: Ja (yes, Ed.), and that is also in-

I1: It's quite a green concept. A German green concept.

PO: Yeah, but we have… there's also a discussion in the University of Wageningen. Louise Fresco, who said you need to intensify *landbouw* (agriculture, Ed.) and you need not *afbouwen vlees* (reduce meat, Ed.) production. But you do it in a sustainable manner. Sustainable way. And that's the combination of technology growth and environmental solutions. There's another *paradigma* (paradigm, Ed.), that some environmentalists said "Nee (no), you have to put down the consumption patterns and you have to get off of the *fleisch* (meat, Ed.) production, and get off the mobility. Because it is…" But why? Why in the hell? If it is sustainable and you can use it- for instance in the mobility, we have now the fossil fuels, but they are endless [means not endless –Ed.]. They have an end. But if you use the power of the sun, and the power of the wind, and you do it smart, and if you sun panels or wind, and you make, for instance, hydrogen from it, a solution, for instance, in the desert, you need to dig in the ground and put in the sand sun…

I1: Collectors.

PO: Collectors, and then you make hydrogen, and you ship the hydrogen from Arab states to the Netherlands, or to Rotterdam. That's also a solution that Shell is thinking about. Why not that? And there's plenty of that energy, why do we have to *onze aarde uitputten* (exhaust our Earth, Ed.) with less complex technology? That is the point, perhaps.

I1: It's a technology they know to use. It's simple for them, it's paid for already. It's still costly, but you can calculate it.

PO: And you need ships and you need cables and you need *grote velden* (large fields, Ed.), you need safety. Many work can be vested from that situation, and that's why-

I1: But it would mean that one change area would cause other changes as well, so you would need a cascade of changes and that may horrify some industry players or banks or policy makers. Where does it start where does it end?

PO: Perhaps, but if you asked for the big companies, and if you asked for the Arab companies also, in Oman or something, they are thinking about those solutions. Shell talks together with the Arab states. Because there is *droogte* (drought, Ed.), but there is plenty of sun, there's plenty of room. So if you change your industry from fossil fuels to solar fuels, or wind fuels, and the fuel is the hydrogen or the electricity, *dat zijn de dragers* (those are the carriers, Ed.) for the future, then you can give work to your people in your country. You can then make deals with other countries, and you can lose… labor problems, which now are the problem, and that is also the kind of the safety *nu* (now, Ed.), *zeggen* (to say, Ed.): we have to be less dependent of the Arab states. But it's not- for the long future it is not good, I think. You can better have chances so that- and you have a new solution. And of hydrogen you can also make all kinds of industrial products. Other products.

And for CO2 as well. I am a believer in technology solutions, to combine it and to let intelligence with… the industry or organizations, I'm a believer on it. I think we are so smart as a human – and I know I'm optimistic - that we can manage it. If we arranged good arrangements. And don't make too much enemies of enemies. Or potential enemies. Because working together will help – is a better way of working together than make war. That's a little bit optimistic and a little bit philosophical, but I think that is the part of the solution in the next coming 20, 30 years. If we'll succeed in that, then we can have more peace than we have now at this moment, because this is also an economic problem.

I1: We are listening and understanding how you communicate, actually, your ideas. Or the ideas that you want to share, I guess. The optimism and the enthusiasm, the knowledge of technologic possibilities, all that - sometimes you call it lobbying, you call it this or that, but policy making is communication and being convinced - being able to not only being trusted, but also win the interest of people, and that's the way you communicate. So I think you're just you, in what you're doing. That's very interesting for us.

PO: Sometimes… I'm sometimes impatient with my colleagues, "Don't you? Why can't you understand, why you have to talk and talk?" But of course it's that, because if you have this mindset, there is another mindset… other people have, is more analytic, more logical, more… less intuitive, something like that [Crosstalk]

I1: I guess they also have people they have to follow up with, and they have to convince them. It's a chain of convincing and counter speak and so on.

PO: True. But nevertheless I was asked from my bosses to stay here a little longer than till my 65th year, and I'm 65, and they said "Stay here in a few years." -

I1: That's a good sign, I think.

PO: That's a good sign, yes. And they say, "But you have… some colleagues don't have this moment. You are younger than some colleagues." Nice to hear. But it's me. The people, the men of the professional, in the organization, in the culture, and that's nice in this department, that my bosses give me the room. And I ask my bosses to give me room, so there is an interaction, and I get the room. I get the room and the space, literally, to get organized. And it's interesting to work in a ministry, because if you have the good this like this, you get support of the head of the department, and I get.

I1: It is actually exactly 1:1 the description a person who has for decades been working with Philips, as a person who developed lots of devices there. An inventor. Happened to be employed for Philips. Gave exactly the same description of his position and his environment, in which he could be so creative. So, interesting to see. It was an engineer, a chemical engineer.

PO: Yeah, yeah.

I1: Developed lots of lamps and I don't know what systems. Gave the same description, exactly, of his work, actually. May I choose another topic, quickly, if you have another five minutes?

PO: Yeah yeah.

I1: Towards the end.

PO: Doesn't matter. I have to get home, but it doesn't matter.

I1: If you have to, we can stop.

PO: No, no, no.

I1: You mentioned earlier that at certain periods the attention and policy for hydrogen fosterings was stopped. So I wonder whether it occurs sometimes that you observe that policies are stopped, or that, second part of the question, that you yourself have the idea, if you want to set through, push for certain things, have maybe to make sure that other things get less attention, because there's not place for all. You see that others stopped things and that you don't want it? But it's topped politically, with political will? Or that you say: well, there needs to be made space for something new, and therefor other things should fade out, somehow. You see, I'm trying to come back to our other topic of policy termination, or however you want to call it, that new things replace old things, that policies sometimes have to stop in order to really make the change. You can't just transition everything, transform everything, sometimes you have to stop something. Think of nuclear power plants, think of the light bulb, cases where there were dedicated policies of stopping a technology, does it in your area also occur from time to time, this putting an end, a hold or phasing down, somehow? As a purposeful strategy.

PO: Yeah, but this is of my own experience, because I started myself with public… multi modeled passenger transport, and after 5, 6, years I was out to stop it, because it was so on my person, you needed to another person, group. It didn't stop, but it merged in other parts of the organization.

I1: It grew in the organization into a different form? From person to group.

PO: Yeah, it didn't stop. But what we had -

I1: But it stopped as an issue for you.

PO: Yeah, but not in the organization. Because the whole… I have not much experience with stopping old technology.

I1: So it doesn't occur very often?

PO: No, not very often but I am now in a situation -

I1: Or policy?

PO: No. For instance we have a policy that is ongoing with hydrogen: wireless electric trains. And we have a policy here in the Netherlands as well to electrificate diesel trains. And there is now… the rail lobby, as we say, "electrification is the solution." But it is so expensive. Too expensive. You have no money. So I say: stop with those paradigms, and start with another paradigm. With wireless electric train, because the fuel cell's coming up. And it is no coincidence that for instance Alstom,

the biggest TGV train maker, started with hydrogen [stakes]. He comes with the solution of the problem because… not especially in the Netherlands, but for instance in Germany 40% of the total rail is diesel trains. And they have now - and also the local trains. The solution of in the same train set you make now a hydrogen solution, they started this - That is to stop with going on in the old path. Other way was -

I1: Exactly, breaking paths, it actually even means sometimes.

PO: And that was also in the thinking about the… the [alternative] for the car was the public transport, to stop that paradigm. That was so what I started to do. Stop with just… if you talked with the NS or if you talk with the rail planners, they talked about the rail system from *stadhart* (heart of the city, Ed.) to *stadhart* - or city heart to city heart. Say yes. And then in less than 20 minutes you are there. Yes, but if you start here you need half an hour, and if you start here it's also 2 hours. You can better take the car. Think about door to door instead of *stadhart* to *stadhart*. And those changes are really happened. Because also -

I1: There are specific models, [rationalist] models that have bracketed out certain aspects, and to change these mindsets is -

PO: But what you see, and that is so strange, NS, our big train company in the Netherland, has problems with bus… [concessions], so: shoemaker, keep making shoes, not other stuff. So the strategy from NS is just now rail transport on the main transport rails. And I don't understand it, because if you have to be a service door to door, you need to also have local solutions. And NS, 10 years ago, started to work together with Green Wheels. They made an agreement. Green Wheel Trains. I hope that NS will do that. And not only with Green Wheels, but also with Big Wheels and other wheels, so you can… They are, of course, a monopolist on the rail. That is okay. You can't have 2 rails, 4 rails apart. But for the *vierde* (fourth, Ed) ring, here and there, you need more suppliers. Cars and bikes. So you need a multi model policy to work for your [unintelligible] and we started those discussions with NS in 1995/1996, and they start with "Yeah, but cars are our competitors."

I1: That was the rule by then, yeah.

PO: That was the rules, and the car maker said, the leasing company, "Competitor? You are too tiny. Because you have 12% of the mobility market and we have 88, so what are you talking about? If you have one passenger of ours once at a time in a car and [unintelligible] you have twice as much passengers as you have now." So that is another way of looking at the markets and so, like that. And that is what discussions I had, severe discussions, with those… I think that is [unintelligible] other way of looking at the reality of the thing. I was learned with different *referentiekaders* (reference frameworks, Ed.) My study helps with that. To be critical at any moment. And that helps.

I1: And look for the cognitive patterns, so to say, that stand behind the industrial or the institutional or political buildings.

PO: Ja. But this is a little bit background. Is that what you're asking for, a little bit?

I1: Very much, I would say.

PO: Okay. But what do you do with the results of this?

I1: It will go mainly into the work of Interviewer2, who writes about all the traces he can find about transition in the car-related, car engine related policy in the Netherlands, and how difficult it is to set it up. And I think you gave a very – and especially in the beginning a very clear picture of how complex this situation is. And for me it's interesting for the greater project, simply to understand from the policymaker's perspective, how you work about putting things in transition, transforming them. And what you look at and how you organize it these days. What the criteria are, how you make arguments, understand how policies are made. Simply because in the textbooks there's so much about the rules and how it should be; but I'm interested in how on the work floor level, how on mundane level it's happening, and how exactly. ScienceField3 of knowledge, how the thinking and the perceptions and the definition of a situation has to be changed in order to be able to change other things then. If there doesn't happen a catastrophe then you usually first think about it, and then you do…

PO: Yeah, I understand. I said, of course, you have… how you call it, the study, the change agent studies, the… Roger Shoemaker and those, interventionists, and also the reflective [pressure] – no, the… how it…

I1: Did you study with Rotmans?

PO: No. No no, I started before, from 1969 to 1980, so it was… Ja, Arend Buitendam in Groningen.

I1: So you rather co-developed actually the transition management thing from the practitioner's – from the ministerial side.

PO: Yes I did COs. CO ScienceField4. It was a pre-MBA study in 1987.

I1: Did you have connections with Rotmans at certain points?

PO: We had.

I1: Did you deliberately - because it's [crosstalk] Occupation1.

PO: Now, it looks like, and I know him, but our ways… In the beginning in 2004, 2006, 2008, he was involved with the ministries, very. But in the period after it, when the transition came less high on the agenda, he moved away from the ministries a little bit, and he was also critical about the policy maker. And he merged with the Urgenda group. With Marianne Minnesma and something like that. And I… Ja, I know them and I know me, but… they also went in other transitional stages for other policies, so-

I1: So it was a general idea, it came to life in different places and different variations.

PO: Yeah. But nevertheless, especially the electric car is more the… icon, how to call that… icon

I1: The iconic, yeah.

PO: The iconic, and especially also Tesla, for those new movements, and also the… the new taxi - not Airbnb but the other..

I1: Ja, Uber.

PO: Uber, that kind of things. Nevertheless, Uber was predicted ten years ago by us. Why not, it is normal step further if you combine the ICT technology and the demand with the car… of course, it was clear that it will happen. But we were not so smart that we can organize it in such a big way as the Americans do. But yeah, of course, it was a clear step. And we have also trials with that, with Snapcar and with Car to Go. Because they combine smartly the Google… *omgeving* (environment, Ed.).

I1: Could you recommend us other colleagues who are also into car or… [Crosstalk]

PO: Of the industries, or… universities?

I1: No, here. Here, at the ministry.

I1: Oh yes, of course. Not from a transition perspective, but maybe from other perspectives, where they deal with the fact that in some way the combustion engine may not end tomorrow but in 20 years, but it's something… it has a target on its back. So there's something to happen, they deal with it politically. They set out "there must be so and so many electric cars." Bans for cars in cities are promoted -

PO: What will be interesting, to talk with Person1. A colleague of mine. And to Person2. Because Person1 is dealing with the negotiations with the car industry. About norms. And that is totally another issue that I do. Because he is looking at the industry in another way than I look. But also other partners. They have the negotiations, they went to the lobbyists who have to stand for keeping the vested industry alive, and that is also a part of the deal. Person1 is interesting to talk with him, because then you have now another way – and Person2.

I1: A more completed picture, then perhaps.

PO: Yes.

I1: Person2 or Peerson2?

PO: Person2. He is coordinator, so you can talk with one of them or both of them. He is also…

I1: And the family name of Person2?

PO: Ja eh… (Yes, ehm…, Ed.)

I1: But we can also maybe phone or email…

PO: You sent me a mail hè, or not?

I2: No we only communicated –

[crosstalk]

PO: Give me a mail and I can give you the names, that is simple. I think I have to..

I1: Definitely, we took too much of your time.

PO: No it's just, my wife has to go to dinner early because she has an appointment at 7 and I promised her that I would make the deal, the dinner tonight. And it's ten minutes biking from here to my… so it's not uh… a big problem.

I1: Thank you very much for your time and your inspiring insights. It's very rich, we have to work on it.

PO: Okay, thank you. You as well. I didn't expect these questions, but if you ask me, well…

[Informal talk]

APPENDIX 4: INTERVIEW WITH POLICY RESEARCHER

Date	March 22nd, 2016
Duration	96 minutes
Medium	Face to face
Speakers	Interviewer1 (I1)
	Interviewer2 (I2)
	Interviewee (PR)
Language	English

PR: You're from Place3, are from Place1.

I1: Exactly, *ja* (yes, Ed.).

I2: University1 it's called nowadays.

I1: Yeah, it's a Science Field1 university which still can afford to pay for some social scientists, even studying ScienceField2. That's how we met. We were actually doing an international research project on the discontinuation, on the exit from certain technologies. A very utterly strange topic actually.

Normally you talk about progress and innovation and we turned the thing around and said, "What happens when *beleidsmakers* (policy makers, Ed.), when policy makers suddenly have to exit from nuclear, or organize the phase out of the light bulb as recently happened on European scale; and he somehow fell interested and does now have to do a project on the combustion engines and they're still quite…

PR: How it's phasing out and is it phasing out?

I1: Existence, but is there some efforts to change things, to put this under transition and this is maybe where we can meet. That we say, in principle, we are interested in discontinuation but there are subjects which are subject to early agenda setting work or even drawbacks which maybe we will discuss later.

We found, and you (I2, Ed.) found that here at this Institute1, there could be some competence that could help us understand how this process works in the Netherlands because you (Interviewee, Ed.) are, I guess, it's your job to observe it and to put you strategic intelligence for the *beleidsmakers* (policy makers, Ed.), for policy makers in terms of *mobiliteits* (mobility, Ed.), the mobility policy, or *mobiliteitsbeleid* (mobility policy, Ed.).

Maybe from your position as an observer, as a collaborator, as a co-producer of the policy, from the knowledge side, so to say, from the *onderzoeks*-side (research side, Ed.) or however you would define it, we thought it would be interesting to talk to you how you observe the life of the conventional combustion engine as an object of policy. The life cycle, the career or the possible end of the career of this kind of technology which is so taken for granted in a way and they are not.

PR: How far are you in your research? What is the phase you are in? Is it at the end or at the beginning or…?

I1: Its rather towards the end. We have already investigated a couple of cases since two or three years as is that nuclear, light bulb, DDT as an older story, more taking place in 60s, 70s, 80s and also combustion engine for a couple of countries, but since it was done from our German colleagues mostly for UK, Europe and France and Germany, we found that actually another project could spot some light into the Dutch situation.

The Dutch *mobiliteit* (mobility, Ed.) and if you like, car policy, car engine policy. How deep you go, that's the question maybe we have to discuss whether it's about mobility as the large thing or whether it's about technical device built into a car, like an engine. That's really the trick. How to frame it. How to focus it. I guess also for policy makers.

You, as an expert may have made some observations over the years how car, the engine technology, mobility and everything in that complex actually how that interacts but how it becomes subject to more or less dedicated focused policies or as part of a bigger policy, of bigger policies, larger policies. Our special interest also for your (I2, Ed.) studies, I think is trying to put something in the agenda of policy or keeping it there or developing it further on the agenda because…

I2: Also on the… Is Institute1, is it directly researching things that are kind of ordered by the ministry? Is it like, "We want to know about this or that," and you research into it or are you kind of, do you have your own initiative on what you do?

PR: It's a mix of both but it's mostly that we are asked to do things. We are *vraaggestuurd* (demand driven, Ed.), mostly, but independent…

I1: By direct request, so to say.

PR: Sorry?

I1: On direct request.

PR: On direct request, but we have a work program which we make every year and we do suggestions also, like how about us studying this or that subject? Then we are independent in our answering of the questions so if they ask a question, we can say… They cannot change our answer.

It's not like they dictate and we write so were independent in the answering and we're also moving a little bit towards more trying to be proactive and think: "what might be a subject of the future," of things that policy makers aren't thinking about yet but they should be thinking about it.

I1: *Toekomstverkenning* (long term future exploration, Ed.).

PR: Ja. We're trying to put it on the agenda like, "This is a subject that is coming up and you should be aware of this or that trend." That's what we also do.

We're a part of the ministry but we're apart. We're colleagues but we're still at a certain distance. We do evaluations. Each year we have a publication that's called the Publication1 which looks back at the last year but also mostly at the period of ten years, what happened in the mobility system about… Sometimes, for one year, it tries to decompose certain effects in the different drivers. Like congestion: was it caused by the economic crisis, by women working more, by higher petrol prices? How can you decompose it in different terms?

We're not really a research institute in the kind of like… We don't do measurements. We don't have a laboratory. We don't have… We're more like a… We try to bring together the results of different other research institutes, try to make it accessible for policy makers.

I1: Since we haven't met, it's important, I guess, that we exchange a little bit about what are we making and what are we doing and are you doing? Is it also that you commission then other institutes or agencies or agents, whatever, to do research for you that you…

PR: Sometimes.

I1: That you commission a laboratory to do something if there's not yet something to be found on the knowledge market?

PR: I don't think that we commission laboratories. It's not that kind of work…

I1: Not so technical.

PR: Not so technical. Sometimes colleagues of mine, they commission for instance about this congestion; there's a lot of data about really points at the road. About how the traffic pass at different points, at different times of the day and they can make an analysis of it. They have a model. We commission that they use their model and that they build their model and that they sustain their model and they improve it but for fuel pipe emissions, no. The ministry commissions that by themselves. The policy makers have, pay they own institute to make measurements.

I1: That's the division of labor that you rather use existing data of ongoing processes…

PR: Ja, but not always. In my domain, like sustainability, we are not at the forefront. We try to make it accessible for policy makers but we don't do the pioneering…

I1: Or that you, in a sense, you say you make it accessible, bringing together and making…

PR: Synthesis…

I1: somehow usable…

PR: Ja, usable, readable, applicable like: what do they need? What kind of knowledge is at this moment suitable for them?

I1: Does this actually also include that you look into the new trends? You said "what's going on, what are the current trends or possible future trends," that you look into governance trends or policy trends; so not just the matter of the factors things, the areas infrastructure, *mobiliteit* (mobility, Ed.), or maybe congestion, what you obviously have done recently, but the policy of it. Do you also look into policy making trends?

PR: Trends in policy making. That's an interesting one.

I1: How other countries are approaching same kinds of policy problems. Is that a term that you sometimes…?

PR: As a matter of chance I did a, for one of the *afdelingen* (departments, Ed.), I did a comparison between the policies of different countries in Europe and the United states on the subject of CO2 reduction in traffic or in transport. It was like: "what is their goal, in which year and how do they implement it? What's their policy?" Do they have a law or do they have… What do the municipalities do? What does the central government do? That was a specific question.

I1: On subject matters and on the policies of the subject matters [crosstalk 00:10:48]

PR: Ja, on those policies but it was really a small research so I didn't look at the results of the policies like, if you have a law and it says we want to reduce CO2 by this, even if it's a law, it doesn't mean that it's going to happen. You still need to have the right policies in place. You setting a target is not enough and often it's only setting a target and then nothing happens. It's all too often that it's like this or that it's only one policy paper.

We Sweden or we, Germany, we want to do this or that but it involves so much more than just setting a goal. It applies to the Netherlands as well. The Dutch situation is a bit different from other countries since we have this 'polder-overleg' (polder model based bartering, Ed.). We do it in different ways than in Germany or France or United Kingdom.

I1: So in practice, polder is still active. The polder model is still active.

PR: The polder model is still active. You know the SER?

I1: Politically it has been bye-byed but…

PR: No, I don't think it has ever been really bye-byed. No. You know the SER "Energieakkoord" (Energy Agreement, Ed.)? SER is the "Sociaal Economische Raad" (Social and Economic Counsil, Ed.). "Energieakkoord" is from the summer of 2013, 14? '14, I think. An *akkoord* (agreement, Ed.) between different parties from different parts of the society, employers, NGOs and the government. It has put a target on the CO2 emissions for the economy as a whole and for different sectors within.

It was with many parties involved - and then the transport goal has been elaborated by a large group of stakeholders in a "Brandstofvisie" (Fuel Vision, Ed.). Did you hear about it? "Brandstofvisie"?

I2: I have heard about it, yes but I don't know really much about it.

PR: I think it's a central document in the changing of the technologies with regard to transport. It sets a target of a 60% CO2 reduction in transport by 2050 as compared to 1990. There are a few *maatregelen* (measures, Ed.), no, how do you say it?

I2: Measures…?

PR: Measures or sub-goals. There's one goal about the number of electric vehicles, about the number of car-sharing although it's not really linked to the goal. How can you say car-sharing leads to so much CO2 reduction?

I2: But do you also feel that this kind of a goal setting that isn't really picked up and put into policy, like you said before, that is sometimes the case? Or is it…?

PR: It's difficult to put it in - because the goal is very ambitious, minus 60. How do you get there and what steps do we take now to get there in 20 years or 30 years' time? The big problem is that - the implementation of technologies that are too expensive yet to be fully rolled out. You will need electric cars. You will need fuel cell cars; a bit of everything which is zero emission or nearly zero emission but these cars are not available for the big market yet; only a few niches.

How do you organize a big rollout if you need a transport technology that's not available at a low price yet? They call that sometimes the valley of death. How do you abridge it? How do you get over it? What do governments do mostly, they try to have demonstration projects or start at a low level; a few pilots. With the "Energieakkoord", what happened, there were many parties with all their own interests like the BOVAG RAI, the car manufacturers, or the car sellers in Netherlands, or Shell, or Bio fuel producers, were all at the table and saying, "Well, this technology should be promoted and is it absolutely needed to get to 60%?"

Everybody is there for his own interest. How do you, ja… Maybe it's interesting to show you this report I made in 2013. I have a copy of the English summary (Interviewee hands over some papers, Ed.). It's about the policy options for the CO2 emissions. It has the 2050 goal as a central focus and then we looked at the different kind of policies that you need to get there. I think there are 2 main policy sets. One set of policies is aimed at reducing CO2 now, directly, so you do something and it has a direct effect on CO2, and other policies aim at having CO2 reductions in the future and preparing your technologies so that they are ready to take over, to penetrate in the market in a large scale in the future.

You cannot make them penetrate right now, but you need to prepare and it's what I call the Innovation Pillar. The Innovation Pillar is not aiming at CO2 emission reduction but at innovation and getting the price lower so that CO2 reduction gets cheaper.

I1: That's actually like a first phase where you collect all kinds of drivers that will hopefully lead to a point where then the critical mass is reached that the actual policy can be implemented…

PR: Ja, exactly…

I1: That the actual goals can be started to be targeted.

PR: Ja, sometimes by setting a goal or by saying like - in Europe we have this whole framework of standards. So you took standards and now the next standard is for 2021, but you should go on and make new standards for 2025 so that industry knows what to aim at and then they know that it makes point to have innovation; that we'll need it to reach the goal.

I1: What do you call then the second phase when you say the Innovation Pillar phase is where you try to reach a point where then the extra policy can be started because we need the technologies that replace the ones you want to reduce or the technologies in place that are cleaner than the ones that shall be abandoned. How is then the second part called after the Innovation Pillar?

PR: There is the Innovation Pillar and the other pillar is the Emission Reduction Pillar. It aims- like the ETS system for instance, the Emission Trading System, or a standard that is already in place, or the fuel duties, or everything that already has an effect on CO2 emissions. Many politicians, they always want to have a direct result. If you have a pilot for cleaner trucks, they want immediate effect and then they say, "Oh, it only reduces 1 ton of CO2."

"It's nothing so this policy isn't working." But it depends on what the purpose of your policy is. If you want to learn and if you want parties to collaborate, to exchange knowledge, then it can be a very good policy. You must be aware of the goal of your policy.

I1: Is that a very typical structure of how you make advice to policy makers and politicians that you give so to say, a bit of what is in reach now. What is now in reach? What can now or in near future be reached realistically and what will be then the further steps, the more adventurous or advanced kinds of policies. Do you give them both parts as this pattern describes?

Is that a standard approach of you informing policy makers about what is possible? What is done? What has effects and what not yet? Just give them something they can immediately use to say how this is useful? This is effective?

PR: We try to help them in their… We can't make choices. We can't say you should aim at electrical cars because they are going to be a success. We cannot say that. But we say there are different kind of policies and you should do both to reach a goal in the far future…

I1: You show them a spectrum of possible policies?

PR: Without making a choice or selection. We don't give advices.

I1: Oh, ja. Not advice in that sense. You open up a spectrum of possibilities of… Maybe give of information about conditions under which it's likely that this might happen and obviously it's fun doing so.

PR: It's fun?

I1: Just because of the outside (there's laughter outside, Ed.).

PR: I don't think they're working on anything serious. I also made this (Interviewee hands over some papers, Ed.) for the… It is only to think about different kind of policies. Like this, I had some kind of multiplication. If you want to reduce CO2, you have three directions. You can reduce the volume of the- if you don't drive, there's no pollution, there's no emission. Also, you can make the vehicle cleaner and you can make the fuel cleaner.

There are three different kinds. If this one works completely, you don't need the other two. It applies to all. If you have electrical cars such as this, you have a fuel that is zero emission, no CO2, then okay, you may drive as much as you want. Your vehicle doesn't have to be efficient with, ja, it's a manner of speaking. Still, your emissions will be zero. You have three different directions.

Then I made this where you have one of each one. Then the different kind of policies that you can have. The middle circle is for the decentral, is like Amsterdam or Rotterdam or *gemeente* (municipality, Ed.), then the middle circle is the state, the nation. Then the outer circle is the EU. I have tried to put all the policies that already exist in this spectrum and so you see here, you have policies that aim directly not at one of these three but they choose…

I1: Play into the same…

PR: Ja, each of the same and you may choose if you want these ETS, some Emission Trading Sysem. You can choose what measure you take. All you need to do is reduce your emissions. It's up to you how you do it. The ones that are…

I1: Of course, this needs to be qualified then what has maybe more or less effects, greater or lesser effects. I mean…

PR: It depends also on, ja, what is your ETS target, what is your- and this (Interviewee points sat something in the papers, Ed.) is not in place.

I1: ETS.

PR: *Ja, cursief betekent 'mogelijk' in de toekomst* (Yes, italic means 'possible' in the future, Ed.). This is not in place but this is (Interviewee points at something in the papers, Ed.). But this is not for the transport sector. These in this area, *dus* (so, Ed.) in the vehicle efficiency, you have this, the CO2 norm for the European, and I hope to make policy makers aware that they have the specter of different… they can put in place different policies and they have different effects. Sometimes, you need two or three or four at the same time because they aim at different parts of it.

I1: This looks you have in principle maybe a little bit extended but put on a very visible one page map, the situation. What's there. What the different parameters are, elements where policy can start. I think that refers a lot to the things mentioned in that report, again (I1 puts a report on the table, Ed). I think it was in 2011 or '10.

PR: Which one?

I1: Exactly now, that's the "Elektrisch rijden in de versnelling" (Gearing up electric driving, Ed.). It appears to me that many things that are here come up again. It was a bit more focused on *elektrisch rijden* (electric driving, Ed.), this (the report that was handed over by Interviewee, Ed.) is on CO2 reduction, but obviously, there are for the two different foci, CO2 reduction and *elektrisch rijden* (electric driving, Ed.), there are so many overlaps that I recognize many of the points that you have here also from the list here of possible policies.

I could ask in the next instance, you have done this with a very clear focus on the car where you then can really say if it's totally electric, you can neglect the other aspects. If you would put it in a greater sort of context, say, what is part of the infrastructure technical, socio technical infrastructure which is for *elektrisch* (electric, Ed.), *of* (or, Ed.) conventional *rijden* (driving, Ed.) actually an issue, the infrastructure how you can charge, what energy you charge and then you end up with the *kerncentrale* (nuclear power plant, Ed.), you end up with atomic power plants or other forms of producing energy.

Because the energy goes also in this equation, just that it's here, bracketed somehow (pointing at document handed over by Interviewee, Ed.). My question is, do you have also models or moments where you use such more complex models where you then say, okay, this equation is clear but somehow, it's also reducing the reality to some extent because of course, the reduction is never really null if you add the rest of the technical system to it; the car, yes. But where comes the energy that flows into the electrical [crosstalk 0:27:06]. It comes from the *kerncentrale* (nuclear power plant, Ed.). It comes from the, or wind or gas plants, power plants.

PR: It has to do with the target setting. Target has been set at the level of the car so it's…

I1: That's then automatically your focus and that you stick to.

PR: Ja, in this report, yes, because it was the target the ministry has to deal with. There's also a target for the energy sector but it's not in this transport target. It's only the tank to wheel part and not well to wheel.

I1: Okay, how do these things then come together? When the request comes, put an entire picture together. These things are linked; energy production and mobility, transport and CO2 reduction…

PR: Where they come together in more overall goals which are set at the national level.

I1: Then you would make an equation which is an algorithm which is a bit more inclusive, I guess.

PR: Ja and then for biofuels, it's even more complicated I think, you know, because they are imported or they are not from Europe or from… How do you account for the emissions that happened at the production sites of the biofuels?

I1: And via transport and so on, right. Very interesting. I think we understand a bit better now how you work as a Institute1, a member of a Institute1 that directly contributes…

PR: You aim to make it probably about a whole… You talk about a combustion engine and is it then also connected with the energy system like nuclear power plants or…

I2: Well, if you are looking at the project, it's about the governance of discontinuation of socio technical systems, like the, also the case about nuclear energy, and so it's about systems that are very- we deal with in our lives; technical systems in our lives that are part of society like the internal combustion engine. We use it every day. Our roads are built to use cars with that kind of engines. There are petrol stations every 20 miles or something. You can fill it up in a few minutes. All these kind of things so it's very…

We used to be very reliant on that at least and we still are. We see signs of changes to shift to other means of propelling a car. We see signs of changes in infrastructure like there are charge points in cities. That's all emerging. What we are interested in is: how does the internal combustion engine eventually come to an end? Is it probably coming to an end?

We see signs now that it maybe is coming to an end. In this case, it's very interesting because this end isn't… We are not close to this end. It's far away so we are probably in early stages of maybe seeing an end to the combustion engine. It's very interesting to see how you talk about niches. There are some activities in niches in other fuels.

Is there governance to activate these niches into becoming more mainstream and to push the system somewhere? Is there… Is government working on a transition?

I1: Is there anybody or any instant that brings that threads together that may cause the sort of action that goes in that direction or is it just loosely coupled?

I2: Where do you see the internal combustion engine in say ten years, do you think? What would it look like then?

PR: If you ask my opinion, it's nothing more than my opinion; I think that the combustion engine is still very strong. It has very strong positon. In Europe, you can see now a bit like a fight, or maybe it's not a right word but, between diesel and petrol. What you see now is that diesel engines at least, they cannot comply with the continuation of… Maybe for CO2 emissions but not for the nitrogen oxides and not for particles taken.

Also, they have these particle filters, soot filters. Diesel engines are under threat but they are still going strong. There's such a big industry and so many jobs involved in this industry that if you want to continue, how should we say that, *normen steeds strenger maken* (impose increasingly stricter standards, Ed.), the standards for nitrogen oxide…

I1: OK, that was something I didn't…

PR: Ja, it's not CO2.

I1: Okay, ja, ja.

PR: If you want to continue that, diesel engines cannot adjust. It's part of the technology that they need things that do not- are not compatible with low nitrogen oxide levels. That's why they can't comply. If you ask "Does the combustion engine come to an end," it depends on how willing you are as politicians to prove…

I2: And do you feel that they are willing?

I1: Or under which circumstances would they be willing?

PR: No, would they… The target, there's a European target. There is like with Europe set in Paris with the UN Climate Summit, it's at a European level and then it has to dripple down (ooze out, Ed.) to different countries and to different sectors within. How do you decide what does transport sector has to do, what do households have to do, what do industry have to do. For industry we now have the ETS system for CO2 but that's not an easy going process to put pressure on it and they're talking about leakage, about jobs moving to India, to Brazil.

Ja, maybe you can learn from history what happened up until now. What did really change? What changes did we make in this- ETS is in place for now for ten years or so. It's so difficult to make changes.

I1: Or we can make a structural analysis and look at the socio economic structure of the country, technology infrastructure and everything and see where are opportunities to do something without having too much negative side-effects for the national economy or for companies or for tax returns or whatever aspect you want to mobilize there in the analysis.

I could imagine a German policy maker would have a hard time to legitimize regulations that force diesel engines out of the market because Germany relies, I don't know, two thirds of the gross national product of German car industries and exports and everything.

But this is different in the Netherlands so I guess there are countries, just imagine Norway, how far they are in activating all kinds of positive policies and negative poles in terms of giving allowances, giving help, subsidies or restricting use of these old technologies and helping to produce new ones. They don't depend on car industry in that way as Germany.

That's just one explanation, but one could imagine for the Netherlands I think a similar scenario under which conditions and directions- could one in Netherlands push innovation towards the Innovation Pillar, if I may say so, and be maybe a pioneer in that direction and obviously, you are to some extent because the sales rates, the market shares for all kinds of electric vehicle; plug-in and full electric vehicles, I think you are second, third, under the first five worldwide.

It's one of the biggest markets for electric vehicles. How could then the entire policy around that maybe be at the forefront as well because there are certain independencies of other industries that other countries have? Is that a sort of reasoning that you…?

PR: It's true that we are a pioneering country with the market share of electrical vehicles but the large part of it is plug-in hybrids and there's one type of car that was the Mitsubishi Outlander which was really like- it's not really a zero emission vehicle because it's only running in these electrical modes a very small part of the time.

I1: Your amperes hold just 20, 30, 50 kilometers and then the plug-in engine comes. Still you have the highest sales rates, one of the second highest, actually the second highest sales rates of full electric cars or doesn't that…

PR: I think we have 7000 full electric cars in…

I1: 2 500 full electric cars I saw in 2013…

PR: I think there are about 7000 or 8000…

I1: 7000 now? Okay.

PR: full electric vehicles on a fleet of 8 million.

I1: Ja, there are so different numbers. That's also an interesting thing. How to get the intelligence to know where the trend goes? I just looked up Wikipedia and that has some references and they were…

I2: RDW? I think about all cars in the Netherlands…

I1: We are interested… Ja, ja, you know it then. That actually is a clear source.

For us, it would be interesting to see, is there any imagination around in the policy world in the Netherlands that there could be a point where one would force a certain political direction in which the old drive technologies would have, what the word's to say it, colloquially, bad luck, would be pushed away, would be put in a negative position through all kinds of incentives. Is there any situation imaginable where there is a certain turning point where things go in that direction or do we have to think in different terms, so to say?

You observe technology, *mobiliteits* (mobility, Ed.) policy since many years. Sometimes maybe, it's not deliberately made, a policy that says car engines or other kinds of things should be replaced or CO2 reduction should be reached by this or that measure. Maybe it's sometimes just policy making by occasion because there are certain developments going on. You see "okay, there's a reduction." You enforce certain things and it goes on.

It's not all just wanted, not all just made, but you jump on certain trends in policy making, enforce them and then stabilize a certain direction and that's it. So we are actually coming from the question how much active political will and how much opportunity taking is included in mobility policy and how likely is it for policy makers here that they would make the old conventional engine a target for being replaced these days. As you are looking, it seems unthinkable in foreseeable time.

PR: I think there is this goal about this minus 60 in the SER "Energieakkoord" (Energy Agreement, Ed.) and it is taken seriously but it's still, it is ambitious and they… It's a bit like looking, "How? What do we do now to reach that goal?" and there's not a lot of money that can be put in place so you'd need to be careful. Netherlands is now forerunner for this market share of electrical cars but we made mistakes also.

There's now going back on it because it cost too much money for too little results. We have a large share but what is the CO2 result? What does it mean in terms of innovation? Did it bring innovation to have this large market share? Did it bring CO2 emissions? And you can doubt both. It's not this innovation; we have a European target for…

I1: 2020. 2020 target I guess, you mentioned or…?

PR: No, the CO2 standard for manufacturers. If they sell a lot of electrical cars in the Netherlands they sell less of these cars in other countries. They have a goal for their company, not for a specific country. You know what I mean?

I2: No, not really.

PR: OK, the CO2 standards here in this part of the [inaudible 0:42:58] (speaking about the document on the table, Ed.). CO2 standards for cars and for vans, they're in place. They're European and they apply to manufacturers. For instance, Renault, the fleet of Renault, what Renault sells overall in every European country has to reach a certain level. For now, for 2021 it's put at 95grams of CO2 per kilometer.

This target: if Renault sells a lot of cars that are zero emission in the Netherlands, zero emission, and the average has to be 95, it can sell cars of 160 in other countries and then still it levels out to 95. So if you have a European system with standards that are set at the European level, if one country has a certain policy that makes its fleet in its country less emitting, then that doesn't mean that at the European scale there is a CO2 reduction. That's what I mean with we may be at the forefront but you can ask what is the CO2 effect and you can ask what is the innovative effect?

I1: Or you could also ask what is the policy effect? Giving example that such a policy is possible and that it's thinkable, justifiable against motors, against interest groups in a country.

PR: But the innovation is not measured. It's not measured. What is the innovative effect of this policy? Like this Mitsubishi has made this Outlander car specifically- it's only sold in the Netherlands, this car. Almost, most of the Mitsubishi Outlanders go to the Netherlands and they serve a specific target group of… It's a lease car mostly for lease car drivers. It has very small range so after 20 kilometers or something, or 50, they switch the engine to the petrol status.

In the petrol status, I don't know how you say it, but it's more polluting and it's emitting more CO2 than an average car. It's not like I want to say that we didn't do anything. We tried, but you need to learn from your policy what effect does it have and does it have effect on both pillars or only at one? I think what our job is, is to help policy makers to choose a good policy and learn from the policies that they tried.

I1: I guess the point is that there is a large list of possible policies that you can implement to aim for example at such an aim of production or whatever it is called and then they come the first efforts to use it and you see side-effects and you see all kinds of leveling effects and so on and then you reconsider…

PR: Calculating effects; calculating of the parties…

I1: So if you just think of something really to just focus on the combustion driven car, I think it was Amsterdam, they banned the car from certain inner city streets on a couple of weekends and had many more accidents between pedestrians and bicycle riders. They got less pollution in terms of acoustics and chemical pollution but they got more accidents so they turned back to the old policy and now are looking for something where they can achieve the first aim, actually, without causing more accidents or some problems in the other area.

We're linking by the way to something which is making it even more complex: that people are simply not accustomed to the not presence of cars in the streets because people walk just across, zig zag on the streets when there are just bicycles but when there are cars, they stay on the pedestrian side, you know?

As soon as there's no car anymore, people have to learn to behave in an environment which has totally changed because the car is absent. Even such a cultural, mundane side comes in beyond these levels of emissions and national economy effect and so on, even down to these mundane grounds it goes that you have to test. It's a trial and error, sort of process you're obviously describing here.

PR: The combustion engine is one thing but I don't think it will disappear from the, very soon from now on, but then there will be an electrical car or not a car… The car is not going to disappear in my…

I1: Not the car. And parallel systems of different drives, you said already, as well, are likely. Parallel systems of different alternatives until one wins or one standard wins or…

PR: Electrical cars are now at a disadvantage because their battery is very expensive so when you compare then maybe the fuel cell technology is going to win or…

I1: Or, as this report says ("Elektrisch rijden in de versnelling", Ed.), as soon as there are for the daily job traffic, daily traffic, enough cars are available that can cover these ranges which is not just two or three kilometers to the next supermarket but 20 to 200 kilometers to the next job, workplace; Until then, it's very difficult to change the market but if they available and producers are coming up with smaller cars for exactly that range between 30 and 300 kilometers to an affordable price, then maybe the situation changes again because then you don't need to buy a sports car like Tesla which is good for managers.

They test it. Managing companies, they buy these cars. They test it for very rich people but the average employee can't afford. But in 2017, '18 cars which are small, which are affordable around €30 000 for everybody so to say…

PR: Tesla is announcing that it's going to make a mass market car, Tesla?

I1: Ja, ja. That's then the second next plan that they have. Now the SUV, the next luxury car then the small one, exactly, but also, what's the partner of Opel in the US? The counterpart, so to say.

PR: Daimler?

I1: No the Opel is just a German name but it's Vauxhall and….

I2: Vauxhall is in England...

I1: and in US, how is the main company called who own Opel? The Bolt. Bolt. There's a small car, Bolt and they turned it into an electric car, Volt, to be out next year on the market. A small car like a [inaudible 0:50:30]. This may be another situation then as soon as these small sized cars, affordable come out then you would reconsider, I guess, the situation.

PR: It's still changing. It's not like…

I1: But was also interesting for us to see is that- obviously it's hard to talk about the issue of the engine or the car because the car is not really in the focus of the overarching policy. You do your studies on CO2, on energy and *mobilitieit* (mobility, Ed.) including far more aspects.

I2: The main question that is asked is about CO2 reduction, right (pointing at report, Ed.) or are there also other issues?

PR: But you cannot conclude from this study that the question is not asked.

I1: It's now just a rhetorical question, am I right that to assume into the drive technology at this moment is far too early, is not opportune, is not in the focus of everybody's. There are so many other areas on which they're working related to the same environmental effects…

I2: Do you also present it like this to policy makers or are you also saying, "We think that this or this or this is a good idea?" or do you just say these are possible things and this is the spectrum and you can choose something?

PR: In this study (report on the table, Ed.), we also tried to make a guess about what can be done about each of the sectors also but always with that goal of the minus 60 in mind. For instance, volume. If you want to have the reduction of only volume reduction, then you need a lot of volume reduction and that does not seem very plausible that is going to happen or if that is what you want because it comes at a cost. If you reduce volume, it means you reduce activities.

People don't move for nothing. They have a purpose. Like this vehicle efficiency, if you don't do anything with the fuel or with the different drive system, and it had to come only from efficiency, that means that you have to make your car very small, very aerodynamic, very lightweight and I think there's a limit to that, what you can do and still have a car. It's also about safety, about comfort about…

So maybe this is not for your target. Technically speaking if you want to do it all with this compartment, then you have a hard job. Here are many possibilities in these electrical, hydrogen, biofuels, all kind of… You can still ask questions about what was the upscale production of the electricity and how many emissions were involved, but this part has most of the potential for CO2 reduction.

If you want to have large reductions, then I think you should look in this part and it can be with a combustion engine or with another engine. If you have biofuels, then it can be made possible with a combustion engine even. You don't need to say good-bye to the combustion engine per se.

I2: Do you also say these type of things to policy makers, talking to them? Like: "it's advisable to do- think about biofuels," or "you don't need to end the combustion engine," or…

PR: No, what we tried to in this report is to say what could be achieved by biofuels if all lights are green: if there's availability, If- we used an IEA estimate about the…

I1: International Energy Agency.

PR: Ja, International Energy Agency, I think, what is the potential for biofuels if you don't want to compete with the food market. What is more second generation biofuels- and there's not a very large amount, so it implies- biofuels only is not enough. You need also probably electricity. Electricity can be made from a lot of sources; from renewables, from hydrogen, from all kinds of sources, so that largens your spectrum and your choices, but still you need to have cost reductions to make it compatible with the cheap petrol and diesel options.

It's cheap and it's very handy. It's very compressed. It has a lot of energy in it. There are many advantages to the fossil fuels. That's why they are in such a strong position. And they're developed. A lot of effort has been put into this combustion engine so it's- also what we tried to point out: the other drive strains are at a disadvantage because they are in their infancy. That's

what they need niches for; to grow up and to become adults and to be able to compete with the grown up system that is the combustion engine running on petrol and diesel.

I1: As soon as there would be an alternative available, then policy making could use this as a carrier so to say, for dedicated, for targeted…

PR: But you need to foster it…

I1: But you need to foster it or

PR: and that's the task of the government, I think.

I1: On the other hand, there's so many alternatives and are some are better and less interesting as you have described and there are all the alternatives picked the right alternatives these days.

PR: I think the Dutch government hasn't made a choice. They tried to let that everything…

I1: Still, okay… It's still a kind of a waiting position. See what's realizes, what comes up.

PR: Ja.

I2: You said fostering, it is a task of the government and yes and do you also advise on how that fostering can be done?

PR: Ja, with this Innovation Pillar, for instance, then you acknowledge that it's not going to happen by itself. You need policies. I think that the Innovation Pillar is something like fostering. It says: "grow up, become healthy; become strong so that you can compete with this other, ja, this existing system." It means also like- companies don't want to share their knowledge and you need these knowledge crossovers and there's this knowledge spillover. I mean that if you invent something or you learn and you make mistakes and you pay for these mistakes.

That withholds people from creating knowledge. Governments- they spend a lot of money at helping innovation just because of these knowledge spillovers.

I1: Making formats in which money is only granted if they collaborate on certain targets where they have to exchange the knowledge finding, even against the competitors interest.

PR: Make them, make them exchange, ja, or if you have a demonstration product then you pay for a product that is not really already a good product. It's still at an inferior level. It's not… You rewarded that they have an inferior product, which you rewarded by giving it money for a demonstration project.

I1: The situation is: watch what occurs and help where you can and divisions where you want. Where are the emphasis you put on these days?

PR: Did you hear about Green Deals?

I1: That's exactly what I want to refer to because this has been featured (puts some papers on the table, Ed.). There has been set a number in 2015 that shall be…

PR: You have one Green Deal but there are many…

I1: Just one page from the house here so to say.

PR: But there are two in the making about…

I1: That's referring to the old one, I guess.

PR: This year, I think in next month or something there will signed two. There will be…

I1: *Vijftien- tot twintigduizend elektrische auto's rijden in Nederland in 2015* (Fifteen to twenty thousand electric cars will drive in the Netherlands by 2015, Ed.) was declared an aim so from your point of view, what function, what role does such a declaration have knowing that you may not even reach it. Obviously, here comes- that's one part of the question: that you set your declaration to stimulate something; to signal something. On the other hand, how is it recorded?

PR: It's also a platform. It's also like people coming together…

I1: But they don't come together just on the fact that it's declared a target. It does not back up through such subsidies that help to share knowledge, to collaborate, or investments in infrastructure development or whatever. All kinds of backup initiatives that make it possible. But what we found striking is that here, the one kind of auto is made target at the expense of the other kind of *auto* (car, Ed.). There's something pushed as an alternative…

PR: With this Green Deal but there are more Green Deals. They are different Green Deals also about hydrogen.

I1: With this Green Deal. Yeah sure, there are more. Sure, sure, OK. I know that it's also directly addressed so to say and through all of these Green Deals so to say, the old technology comes under pressure to some extent. I would say it's more symbolic pressure, still. Partially also when you develop then these formats where people, where the fostering of innovation goes on as you have described it.

It's more than just symbolic but obviously it's part of this trying to put something on agenda, trying to put something in movement also, technically and politically that you call out these, shout out these targets and try to reach them and then see what happens. Is that the function of this one or the other Green Deals? Setting a target number which is more or less realistic.

PR: It should be realistic, though. It should be…

I1: Because it hasn't been reached according to your number.

PR: No, but I know the person who was here in this ministry involved in these Green Deals and this has been, I think it started in about 2008 or something that the first Green Deals… There are many. There are hundreds of Green Deals in different subjects also in agriculture and, *nou ja* (oh well, Ed.). And they try to make them smarter every time.

The first ones that were, and this is an old one. They won't want target that cannot be reached or very ambitious or abstract targets. Also, there has to be things… This party will do this and that party will do that.

I1: What are you saying is they're working of the basis of defining so to say moving targets? The targets are not fixable or you cannot catch them really. You can just announce them and then correct them all the time when you see things develop differently. We are talking about moving targets, actually.

PR: Ja but they are always- have a fairly short…

I1: Lifetime almost.

PR: Lifetime. Like for buses, there was one for zero emission buses. Now there's the second one and then first was the two *provincies* (provinces, Ed.) where they had their conversation and then- now they make a new one where for the whole country but for *stadsdistributie* (city distribution, Ed.), or for the delivery of goods in the inner cities. They have one that is only about demonstrating one or two of these systems with no obligations for the wrong to go on. It depends on the kind of agreement that you make.

The Green Deals are 1) for saying we as a government think this is a very important thing to do; to have commitment of different parties. Companies can say, "We are in this agreement so we are at the forefront. We are a good company. They can put it on their website with a photo with the minister of something.

I1: Get visibility.

PR: It has different kind of…

I1: How does actually the government itself try to become a frontrunner in certain innovative developments? You have been talking about how can government stimulate, how does government stimulate other's action, other's policies, other's technology developments? But the government itself with all the administration, all the cars for example that are in use of the government administration is a factor in itself that could in symbolic ways or in practical ways foster or push a certain direction.

In one of the older reports, there was mentioned, of course, the government could simply start buying for certain purposes electric vehicles or other kinds of vehicles, using them. Like this old Kangoos (Renault car type, Ed.) for all the people that have just 30 kilometers to go and keep the household, so to say. All those who support the infrastructure of the ministries. For Den Haag, they would suffice a car like the Kangoo (Renault car type, Ed.) electric vehicle for example.

Do you see there a trend that the government tries to be one of the frontrunners in that direction to reduce CO2 or whatever on which level we look, change the form of mobility. Set rules that employees have not to take the car but have to take alternative transport means when they travel. Not to take the airplane but take the train or take the bicycle home instead of the car; subsidies for bicycles.

All kinds of things that relate maybe to CO or relate to the use of the old technology combustion engine. Is there anything where the government wants to become frontrunner in its own realm, so to say? As example to society as…

PR: Okay, you say different things like for their own car park, their own car fleet or for older employers to give their employees a bonus…

I1: I'm saying for their own car park and for the employees of the government. In these reports, there's sometimes mentioned the fact that the government itself could play a front running role and do what they expect from the rest of society itself, because there's so many people employed, so many facilities, so many cars in use, so much mobility done every day. They could start to change this themselves and show it works.

Show, we do it so why don't you big company also do it? That has been said as one possibility how to come to this turning point in this report, *electrisch rijden* (electric driving, Ed.). That's something I have taken from here. Do you see this happening or is that just something that is mentioned here because somebody was clever and thought all kinds of possibilities but nobody picks it up?

Is there a trend to CO2 reduction in here, so to say? Or to other kinds of mobility or to other kinds of car uses. You know, I go from all three scales: CO2, meso-level, mobility, micro-level car. Always mention all three. It's just something…

PR: Ja but okay it implies that the government should do something about its own fleet.

I1: No, it implies that they say here, interim report, we could, there's a possibility, it could have an impact if we would do it and I am asking is it happening?

PR: It could but it's not my paper.

I1: It's not yours?

PR: No, it's not mine.

I1: Oh, sure. If it's not yours but you're an observer of this situation so I thought maybe you have an observation or an idea about it.

PR: No.

I1: Okay. I can mark this then…

PR: I think that governments can play a role at showing like for instance, I think that this ministry has two hydrogen fuel cell cars now. It's only two.

I1: For which purposes?

PR: For the minister or the secretary of state to go to appointments…

I1: Appointments in Den Haag itself.

PR: No, or to home. It's symbolic. It's not really a…

I1: But in that line it's a sort of start. It's a sort of…

PR: Ja, I think it does something at this scale but you cannot say it gets seven points out of ten for doing this or that.

I1: Ja, what we are doing is looking for all kinds of traces. Actually, we are talking about something which is actually important, impossible to talk about. Something which is not taking place. Have you realized that in the talk? A transition which is not really yet there. The possibilities are not yet there.

PR: It depends on your definition of when it's happening.

I1: That's another point, yeah.

I2: Well, the… I feel that governance of discontinuation is happening when a government says, "We are doing things so that the combustion engine will not be used anymore."

PR: But that's not the target.

I2: No, exactly.

PR: The target is at an abstract level, it's CO2 reduction. It's not banning the car.

I2: That is why we say, well it isn't happening yet, in that sense.

PR: Is there any government that says there shouldn't be a combustion engine?

I2: Do you know who the countries were that say that?

I1: Well, in Norway they are very close to it, to say we make a policy that actively supports all those who buy cars which are not using the old technology anymore but all kinds of hybrids or fully electrical or fully other sources.

PR: But the Netherlands does that as well.

I1: Yeah, but his is a policy that in a sense does something against, that's how I define it, does something against the existence of the old technology. You promote the new technology that replaces the old one. That's, if you like, not a ban or a phase out, directly organized like for the lightbulbs where there was a law that you wouldn't be able to use and produce lightbulbs after 2013 according to certain wattage. Not such negative ban but positive incentives to opt for alternatives at the expense of the old ones.

It could be active, a sort of indirect active policy towards, against the combustion engine. No longer supporting like German industry, German politics, I guess. I guess you can show in many respects that in all instance where it's about putting limits to the old technology which would cause problems for German car industry, they would try to lighten the weight on the industry. They would try to lift a little bit the limits so that the car producers wouldn't be hurt too much; wouldn't be pushed too quickly to new technology.

That's the opposite of trying to get rid of the old technology. That's how I see the German politics working at the moment. I could imagine other countries… In Norway, it's extremely, it's totally different. That's what we are looking for. I mean we have the examples where there's a very clearly focused policy against this sort of technology. No longer nuclear power plants. Stop. At this time, no one should be left working.

Decision taking in 2010, immediately seven switched off. That's a very clear policy where something like this happens. We try to imagine how does it happen actually with other technologies that are far less ready for it. You have shown us a very interesting way of mapping, so to say, the situation; conditions under which it could work.

PR: I think the targets here are more aimed at the ultimate goal which is CO2 reduction than at the means to reach it. Many options are still left open but everybody sees if you want to reach its goal, it's very difficult with the combustion engine because you are only here (points at document on table, Ed.), only here. Or with biofuels and biofuels has its disadvantages. Probably, you will need the electrical car or the electrical motor but that doesn't say that the government says, "Okay, we choose the electrical car as our target." No, it's still left open.

I2: Do you think that's mainly because they feel the electrical car isn't fast enough yet to place it or, I mean, if in a few years it is advanced enough, do you think their minds may be changed or that that support at which they say well, now we go…

PR: Ja, it could be- if the electrical car has proved itself or if costs have come down then you can say it's a viable alternative for the combustion engine. So from now on… But then still, you have a European market and I don't know if it's possible even to forbid the car with a combustion engine in the free market.

I1: Well, for the bulbs and for other kinds of products it was possible but…

PR: Ja but was it at the European level, the bulbs? It was not in the Netherlands.

I1: And it was so to say, implemented through helping measures like the labeling, which you also have introduced or has been introduced.

PR: Okay but as labeling for cars.

I1: Exactly, labelling starts to set, to distinguish, to discriminate between the good ones and the bad ones.

PR: Yeah, but the level is important. I don't say it's not possible at the European level but I say it's impossible at the member state level. You can have a target, have an amount of electrical cars but then it always has to go with some kind of subsidy or physical incentive but I think, maybe it's your subject more than mine, I think that governments cannot say: "in Europe we ban the combustion engine car," or "we forbid," or we, ja. It's impossible in the European legal context.

I1: It's impossible in the legal context?

I2: Suppose they say: "Now the combustion engine car is twice as expensive." [Inaudible] the same as banning them?

PR: You have your fiscal… This is what you have in place. As a government, you can do these kind of things. Fiscal, but not forbidding…

I1: This is purely national responsibility, so…

PR: and not standards.

I2: Doesn't this mean if you raise the prices of combustion engine cars to ridiculously high then that's kind of the same as forbidding?

PR: Yeah but then if it's only… If it's not a ban in words, but it's a ban in your policy, then it's still considered a ban. If you make it, you say, commission occurs from now on one million euros at least then it's like a ban.

I2: But it's- the *bijtelling* system (a fiscal regulation promoting certain cars based on fuel and efficiency, Ed.) is also a discrimination against certain types of fuel, as is. Is that not kind of the same thing. You are not banning them but you are steering them and discriminating certain cars. You can say that's not a free market anymore as well.

I1: Or certain usages like high speed driving and expense driving…

PR: I think it depends on the scale or on the… If you say that cars with emissions above 80 grams per kilometer will cost €10 000 euros more than cars below, or if you make it too large, the difference, then it's considered to be a ban on a certain car type. I think you cannot do that. They can go to the court of justice and say this is not a free market anymore: We imply with all the laws. We don't pollute. It's CO2, it's not poison."

I1: This is a very interesting argument because I guess; the nuclear exit was only possible because there was such a minimal coordinated EU-wide policy on energy production. This has been really kept very much national for several reasons including the British nuclear arms and underground boat, underseas boat policies and stuff. Not give the energy and related technology a way to Europe, so to say. That's national heritage now, domination of power, so to say.

Whereas the other areas of the market like the bulbs or the cars where we have a very thorough European regulation and policy on it. For the bulbs, there were then a moment reached when the member states came together and said, we do that now for several reasons and then you could make this kind of regulation to phase out the bulbs. Not really hurting many.

For the cars, countries like Italy, France, UK would have to come together and find it convenient, also in relation to the industries that they have in their countries, to something about the old combustion engine, together. That's what I wanted to add here, because it was also with the lightbulb the same situation. Why should a company that wants to produce bulbs and sell bulbs should be interest in banning a old technology which doesn't really cost anything anymore for them, for which they have since decades all their production plans... just sell it, and sell it via the augmentation that the old technology's no longer CO2 efficient. They ecologically discredited it.

Efficiency was related to that. Economically, ecologically. That there would be alternatives soon in place to replace the old lightbulb. The halogens but even more so, the energy saving lamps and not yet on the market, the LEDs. There was a sort of cascade of two expected alternatives coming. That something was… Again, there was a reason why to do it for the European Commission and for the industrialists and for the NGOs to come together.

They had their ecological considerations and they had their market protection considerations, because for both, for the bulbs, the old kind and the energy saving lamps, they expected to be overrun by cheap Chinese products, and to save the lighting industry in Europe and to save the market shares, they had to find a legitimation via efficiency and everything to protect the market and set standards that would force the cheap and not so well developed lamps out of the market. Keep them out of the market.

PR: So there was kind of protective measure?

I1: A protective measure with the side-effect that the industry was so to say, reaching more than they wanted, they would have, they'd actually- the limits were harder than they could cope with because they didn't have the replacement technology in place yet. It went quicker than they expected: within only four years and they would like to have had seven years of transition, phasing out.

So the politics took over, made it even stronger but they could only do it for other reasons but especially because all players played together. There was nearly no opposition anymore. NGOs, environmentalists, industrialists, politics; all wanted and even the member states at some point, in 2008, wanted to have something that they could show, that they could offer something to the World CO2 Summit. [unintelligible].

They needed a target where they could show that they could really do something, we can ban something which is inefficient. Lamps don't hurt. They do something good for our lighting industry…

PR: In this case, the good cars maybe come from Japan and not from Europe.

I1: Exactly. We would have the same situation that the Europeans would have to catch up technologically; in principle, able to do it better or equally good. Then set standards that others cannot easily fulfill with mass products but in principle

are still allowed to sell to the European market if they are good enough. Collaborate maybe even with them to increase perhaps skills, but still be part of the market.

Bring, so to say everybody around the table and agree about it. Then one could set such a measure of banning a certain technology from the market which is just taken for granted and normal and incumbent and are related here. I think, from our observation, this is another political, economical consideration is needed to bring it together. Another element that justifies to combining these things…

PR: Ja, this is only technical.

I1: Okay and then the political, the consensus…

PR: The political is the main thing that comes into considering. Where is space for innovation in Europe? And if we have a large industry which is very good at this, then, ja. You don't want lose something that hurts the European industry.

I1: Ja, that's from EU-level impossible and I also guess nation state level unthinkable.

PR: There are big countries composing… As soon as you touch the diesel industry... The biofuels for instance, was also partly done to help the agriculture farmers…

I1: Partially forgetting about the side-effects in the non-European producing sites [crosstalk 01:25:35]

PR: In the beginning it was only about cold seed and so all these crops that could be grown on wasteland in Europe or Poland or Hungary or… Ja, interesting and when are you going to… Is it your thesis or…

I2: It is my thesis, yes. My bachelors thesis and I will be doing until the end of June so it's kind of at the start of the real, empirical research work which this interview is part of, of course. Also going to look into a lot of documents and well, hopefully answer the question of if there are some signs of governance of discontinuation or yeah, what are the signs?

I1: I think along from that talk we have already got a very deep sense of- when you really look at the complexity of the policy surrounding such a very specific target, how complex it would be to setup a discontinuation policy. What has to come together and how you have to enlarge this equation beyond the technical features.

PR: What is your definition of discontinuation? When is discontinuation happening? Is it a zero one?

I1: As we observed, there's no, so to say, 100% discontinuation…

PR: No, it's a gradient.

I1: It's very often an incremental process. Very often either two very specific targets; very specific products or two product groups, but then with very specific sub-policies. If you imagine a mercury ban, the Minamata Convention, that's really addressing mercury in all its forms of appearance along the entire chain. For all these possible instances, all these possible circumstances in different countries being technologically far advanced or not so far advanced; able to quickly step out of mercury using consumer products or not so quickly be able to do so.

They develop a long variety of steps and instruments that serve all the different purposes along the value chain, different countries, and different forms of consumer products. A highly complex sort of banning instrument is developed there to get rid of mercury in the next, say, 10, 15 years, worldwide.

This is one of the most complex cases. If you look at the lightbulb case, there's also not a 100% discontinuation but the trend is clear. The explicit directive saying: "We phase out." This is a form of defining what discontinuation is; we phase out according to wattage, we phase out in respect to production, to usage, but then European Union's jurisdiction, you observe it's not set through consequentially now there. Nobody really cares whether there are still some Polish or Mongolian lamps come in or something.

PR: Maybe the phasing out of the bulb was only spoken about at the final stage of this phasing out. When will a government say, "We are now on a project of phasing out the combustion engine?" It is… They try to but they cannot say it yet. It's still...

I1: That's a very good example because there was a list of energy using products that the commission had already on the agenda to test for all kinds of purposes; with the labelling. They developed a labelling for all these products…

PR: All preparation for…

I1: efficiency; all kinds of efficiency. Different preparation for all kinds of eco-design issues. That was the large framing thing. Then it turned out that they needed within a short range of time, one target product about which they could do something, for political reasons. It took the least expected one. They thought they could rather use something…

PR: The refrigerator…

I1: The refrigerator or something because they were very far with the labels but then they took the bulb because there was suddenly pressure from industry that they wanted to protect the market. Exactly, and so the one on the lowest part of the list became the first on the list and sent through as a pilot through a dedicated regulation directive that ended by phasing out.

PR: This technology is not so far yet that you can point out a winner and say we are going for that winner and that will be a real replacement of what we have now. They're still worse. They're still inferior.

I1: On the other hand, we have the weird situation that we have also discontinuation that ends half ways; German nuclear phase out.

PR: When there's a switch of government or anything else that happens in the…

I1: Not just the turn back of it which has already happened once but the exit has been decided. It has already started. A third of the power plants have been shut down and there's a clear deadline which may be reached even for the rest of the power plants. But the replacing technology and the entire infrastructure that would allow them to really replace the nuclear market through another; wind or whatever kind of energy market; and infrastructure would lead energy through the country.

Development there has stopped. They are looking, waiting, seeing, and the companies don't know what to invest in whether they should invest in power grids or in smart or in long lines from the coast etc.

PR: Then how is it investing in coal and…

I1: There's so much political- and exactly, they go even back, invest in coal, in gas. It's totally erratic, non-linear, non-consequential policy, testing around, messing around, in a sense, until maybe the pressure becomes very high towards 2022 when the last one should be shut down. Whether then the infrastructure could quickly be brought in place to really come to the end that was planned.

So, decision to exit and then the messing around with the consequences. In principle having the replacement in place but not the infrastructure to really transport the energy then. The energy is there, enough and so on, but not everybody you get it to. That's another interesting example of how discontinuation is politically implemented with a sort of one time chunk and then let's see what happens kind of after-policy, aftermath.

So the very orderly lightbulb, the very disorderly kind of thing of nuclear, or we have another case, the DDT case where it happens in the way there were all kinds of chemical substances already in place to replace DDT in agricultural or in nectar control use. So it was just a question of time until it would have been replaced anyway and it was just opportune at certain points in time to say, "Now we forbid it," because no farmer would cry about it anymore. They would have already other products they would prefer to use.

Waiting until it's somehow the time, the life-cycle's over anyway. How it's itself exnovated by other innovations that replace it more and more. That's another strategy of discontinuation. A laisser-faire, wait and see and then do it. Just give the last kick, so to say, kind of policy. Last kick. Totally well-organized set through like lightbulb, and is just half way, and then let's see whether we really wonder what to do let's see what time brings with the nuclear.

These are the three definitions of discontinuations so far that we have collected and the observation that it's not easy to talk about termination of policies that you have for many decades or years promoted. To turn the perception, to turn the justifications around and say, but now what we have promoted, what we have justified, invested into seems problematic, seems undesirable. We now have to turn around; switch directions suddenly, that discredits the policies that have been advocated before. That's a very risky game for policy makers and politicians.

Sometimes it happens. This is the thing which we tried to trace a little bit in these policies but it's an unconventional look, I must admit.

PR: Okay, I think I have another appointment at…

I1: Yeah, thank you very much that you gave us time to discuss things.

PR: You're welcome. Good Luck.

I1: I think we learned more than we know now because we have to hear this and you gave us a lot of important hints.

PR: I hope so. I point out about the different levels of government in this report so maybe it can help. This European level is really important for the car market. [Intelligible] neglected.

I1: The coordination between the different member states that actually a part of…

PR: It's an internal market.

I1: Ja, I think this is one of the most crucial points. Thank you very much, Interviewee.

PR: Okay, you're welcome. You are going to stay in this building or another appointment?

I1: I think we are staying in this building.

I2: We are staying in this building, yes.

I1: It's just that we are intruders.

I2: Just go downstairs to the reception and…

PR: And you will be picked up..

I2: And shout a name and…

APPENDIX 5: INTERVIEW WITH MP

Date	December 16th, 2015
Duration	15 minutes
Medium	Telephone
Speakers	Interviewer (INT) Dutch MP (MP)
Language	Dutch

MP: Met Dutch MP.

INT: Hallo, met Interviewer.

MP: Hai, je wilde even bellen hè?

INT: Ja, graag.

MP: Zeg het eens.

INT: Heeft u al een beetje gehoord waarom ik contact met u heb gezocht?

MP: Ja, je wilde een aantal vragen stellen over duurzaamheid en energie toch?

INT: Ja, als onderdeel van mijn bachelorscriptie doe ik mee aan een internationaal onderzoek dat onderzoek doet naar het uitfaseren van technische systemen die heel erg verweven zijn met de samenleving. Ik hoorde u op de radio een paar maanden geleden over het uitfaseren van de verbrandingsmotor. Het is voor mij wel interessant, ik ben dus op zoek naar signalen die aangeven dat er hier en daar coalities worden gevormd of iets dergelijks om een einde te maken aan de verbrandingsmotor. Zodoende lijkt het me wel interessant om even met u te praten over waar u mee bezig bent en hoe u daartegenaan kijkt. Dus ik wou daar even een gesprekje met u over hebben, een soort interviewtje eigenlijk.

INT: Hoe bent u eigenlijk bij dit onderwerp terecht gekomen? Bent u hiervoor in de politiek gegaan, om met duurzaamheid bezig te zijn?

MP: Nee hoor, ik ben gewoon in de politiek gegaan omdat ik het interessant vind en belangrijk, en ik heb een portefeuille gekregen die is toegespitst op energie- en klimaatvraagstukken, en dat betekent dat daar ook de verbrandingsmotor onder valt.

INT: Ik zag dat u bijvoorbeeld een motie had ingediend voor een mobiliteitsakkoord. U zei daarbij: er is eigenlijk gebrek aan een lange termijnvisie, want in het klimaatakkoord zou er niet zoveel over de lange termijn gezegd worden. Ik zag wel dat ook daar in staat dat het de bedoeling is dat in 2050 alle auto's emissievrij zijn. Dat lijkt me nog redelijk lange termijn, wat voor lange termijn dingen heeft u het dan over?

MP: Nou ik heb het gewoon over 25 jaar. In 2050 is het zeker zo, maar het moet eigenlijk wat eerder en die termijn van 25 jaar is natuurlijk arbitrair. Maar je moet een stip op de horizon zetten en aangezien we nu elektrische auto's hebben die technisch gezien gewoon uitstekend functioneren en binnen de beperkte hoeveelheid kilometers die je binnen Nederland moet rijden ook voldoende actieradius hebben, denk ik dat het niet heel *far fetched* is om te zeggen: 25 jaar is het doel.

INT: Kijkt u dan alleen naar elektrische auto's of, of gaat het u echt om elektrisch?

MP: Elektrisch, waterstof, het gaat mij meer om *zero emission* dan om elektrisch. Dus de techniek die doet er eigenlijk niet zoveel toe, het gaat er om dat we het CO_2-probleem oplossen.

INT: Kijkt u ook naar de productie van elektrische auto's? Er wordt wel gezegd van accu's: daar zitten veel vervuilende materialen in. Denkt u daar ook aan of gaat het u vooral om de CO_2-uitstoot?

MP: Nou, sowieso hebben wij in ons regeerakkoord staan dat het in 2050 CO_2-neutraal moet zijn op alle vlakken, dus dat gaat ook om de productie van de auto, maar die emissie vanuit de uitlaat die is natuurlijk het makkelijkst te [negeren?] als je elektrisch gaat rijden. En ik weet dat bij de productie ook veel wordt uitgestoten, maar dat gaat natuurlijk om het energie-verbruik bij de productie en dat energieverbruik, dat is weer een heel vraagstuk op zich, hoe dat je dat duurzaam inricht.

INT: Precies, ziet u ook een rol voor de fiets bijvoorbeeld, of het openbaar vervoer?

MP: Dat noemen ze in Den Haag de verschuiving tussen motaliteiten, maar dat vind ik niet zo relevant. Ik denk dat mensen zelf mogen kiezen wat ze willen doen, met de fiets, met de auto of met de trein; maar het moet wel zo zijn dat wat ze doen geen extra emissies veroorzaakt.

INT: Dus het vraagt wel een verandering in het gedrag van mensen?

MP: Nee, het vraagt dat ze niet meer in een auto rijden die CO_2 uit stoot. Of ze met de trein gaan of op de fiets of met de auto, dat maakt mij niet uit.

INT: Dus u ziet het zo: om CO_2 te verminderen is de verbrandingsmotor iets wat moet verdwijnen en die kan het best vervangen worden door iets wat zo goed mogelijk de auto nabootst. Het is niet zo dat u zegt: we moeten heel anders over vervoer gaan denken?

MP: Nee, je kunt er hele fantasieën aan ophangen, maar de meeste mensen stappen wel graag in hun auto.

INT: Dus u zegt: het is het best dat mensen hun gewoontes gewoon kunnen blijven behouden, dat is makkelijker om ze over de drempel te trekken.

MP: Precies.

INT: U heeft ook gezegd: voor zo'n akkoord is het heel interessant als we met heel veel partijen om de tafel gaan zitten, vergelijkbaar met het energieakkoord. Welke partijen ziet u zo voor zich dat daarbij betrokken zouden moeten worden?

MP: Nou ja alle partijen die in de mobiliteitssector een rol spelen, dus de producenten van vervoersmiddelen, de mensen die in de transportsector werken, de taxibranche, de wegenbouwers, je kunt er natuurlijk een heel circus van maken.

INT: En dat is ook hoe u dat voor zich ziet?

MP: Precies.

INT: Bijvoorbeeld de autobranche, die heeft natuurlijk een vrij sterke positie opgebouwd, omdat de auto niet meer is weg te denken uit ons leven, en het kost natuurlijk wel veel investeringen om dat te veranderen. In eerste instantie zullen ze daar zelf misschien niet eens heel veel baat bij hebben, om die drempel over te gaan.

MP: Nee, je ziet altijd dat de partijen die eigenlijk de gevestigde orde zijn het lastigst mee zijn te krijgen

INT: En hoe denkt u dat die dan toch mee te krijgen zijn?

MP: Door ze te betrekken bij zo'n akkoord en dan *stok en wortel*, dus incentives om te veranderen en pressiemiddelen om ze te dwingen om het anders te doen als ze echt niet willen.

INT: Sorry wat zei u precies? Wat bedoelt u met stok en wortel?

MP: *Carrot and stick*, dus aan de ene kant…

INT: Ik begrijp nu wat u bedoelt. En wat moet dan die wortel zijn?

MP: De wortel is geld verdienen in een veranderende markt: innovatie kan meer omzet opleveren en een betere marktpositie. Als wij in Nederland vooroplopen – dat doen we bijvoorbeeld bij windenergie, we investeren heel veel in windenergie op zee – in die sector worden per jaar 15.000 banen gecreëerd. De *offshore*-industrie is dolblij met wat we daar allemaal doen, omdat ze daar heel veel geld mee verdienen. Dat kan ook bij vervoer zo zijn: als je ervoor zorgt dat die automobielfabrikanten in Nederland voorop kunnen lopen met innovatie, dan kun je uiteindelijk in Nederland ook meer geld verdienen, maar dat geld ook gebruiken in andere landen, of de productiemiddelen die je hebt gecreëerd ook gebruiken in andere landen om daar ook meer geld te verdienen. Die offshore windmolens worden in allerlei landen neergezet door onze bedrijven en daar verdienen ze ontzettend veel geld mee. En dat hebben ze in Nederland uitgetest.

INT: En wat betekent dat dan voor mensen die een auto kopen?

MP: Mensen die een auto kopen die moet je het zo gemakkelijk mogelijk maken. Ik kan me voorstellen dat, als je auto's zelfrijdend maakt, wat nu technisch al kan, als we dat toestaan op onze wegen, dan kun je gewoon lekker zitten appen en sms'en en mailen in je auto en dat betekent dat je veel productiever kunt zijn. Als de arbeidsproductiviteit omhoog gaat dan krijg je meer economische groei en meer welvaart, daar is iedereen mee gebaat.

INT: De infrastructuur zal wel moeten worden aangepast als je andere brandstof hebt: je hebt heel veel laadpalen nodig, daar wordt aan gewerkt, je moet waterstof kunnen tanken; wie is er verantwoordelijk daarvoor, dat er bijvoorbeeld laadpalen komen?

MP: De markt en de overheid moeten dat samendoen, maar er moet wel wat gebeuren: het gaat nu allemaal mondjesmaat en gewoon niet snel genoeg.

INT: Op welke manier zou u dat proces willen versnellen?

MP: Het ene uiterste is dat de politiek wetten uitvaardigt dat binnen vijf jaar alle tankstations weg moeten zijn, dat er alleen nog maar elektrische laadpalen zijn. Het andere uiterste is dat we het helemaal aan de markt overlaten en afwachten wat er gebeurt. Ik denk dat een mooie middenweg is dat je een convenant sluit met de sector: dat je gewoon die waterstofstations zo snel mogelijk kunt uitrollen. Shell doet dat al op dit moment in Duitsland, daar hebben ze al een dekkend netwerk en in Nederland moeten we dat ook gaan verzorgen.

INT: Wat zit erin voor die tankhouders als je zo'n convenant sluit?

MP: Dat ze hun vergunning mogen behouden. We moeten alles uitfaseren. En ze kunnen geld verdienen in die nieuwe situatie.

INT: Dus het gaat in feite om het geven van een vergunning?

MP: Uiteindelijk wel ja. Als overheid zijn we daarvoor verantwoordelijk.

INT: En hoe krijg je zo'n partij aan tafel?

MP: Uitnodigen. En uitleggen dat het in hun belang is om mee te werken.

INT: En dat zou ze wel over de drempel kunnen trekken?

MP: Anders zouden we hardere maatregelen nemen waardoor ze uiteindelijk de dupe zijn en geen baan meer hebben.

INT: Ik stel me bijvoorbeeld voor dat autofabrikanten, Shell en pomphouders er allemaal op dit moment belang bij hebben dat ze hun benzine kunnen blijven verkopen. Zou het zo kunnen zijn dat zo'n groep van partijen weigert mee te werken?

MP: Dat kan altijd maar dan verhogen we gewoon de belastingen voor benzine zoveel dat ze het niet meer verkopen en dan is het ook opgelost.

INT: Dus dan zou u zeggen, er worden fiscale maatregelen getroffen.

MP: Precies.

INT: Dat is voor u wel een optie?

MP: Zeker, natuurlijk. Als het niet goedschiks kan dan moet het kwaadschiks. Net wat ik zei: *carrot and stick*.

INT: Dus u ziet niet per se de oplossing bij goed overleg.

MP: Nee, in principe goed overleg, maar als het overleg niet goed genoeg is dan moeten we dát doen waarvoor we zijn aangesteld: het belang van de Nederlandse bevolking dienen; dat belang is dat we minder CO_2 gaan uitstoten en ons vervoer zo inrichten dat onze kinderen geen astma krijgen en dat mensen in Nederland geen longziekte krijgen van alle fijnstof en alle andere vervuilende stoffen die worden uitgestoten.

INT: En de rol van de overheid ziet u dus niet als manager. Het is wel: wij willen dat dit zo gaat gebeuren?

MP: Wat een afschuwelijke term. Toen ik in het bedrijfsleven zat was ik manager, maar de overheid is geen manager, de overheid is de overheid.

INT: Tegenwoordig zie je juist vaak dat een oplossing wordt gezocht in overleg met partijen, maar waarom zouden bijvoorbeeld niet meteen dat soort maatregelen worden getroffen?

MP: **J**e moet eerst proberen om met elkaar te overleggen want als je draagvlak hebt dan werkt het gewoon beter.

MP: Helaas, ik heb niet heel erg lang meer, heb je nog veel vragen?

INT: Ik heb zoveel vragen als u tijd heeft; ik weet niet wat veel tijd is?

MP: 3 minuten?

INT: Ik heb nog wel een andere vraag, het akkoord in Parijs dat net is gesloten, gaat dat nog invloed hebben op hoe u denkt dat dit verder kan worden opgepakt?

MP: Er zal meer urgentie gevoeld worden voor dit soort onderwerpen: een half jaar geleden heb ik gezegd in de media dat we uit het fossiele tijdperk stappen en dat we afscheid moeten nemen van fossiele brandstoffen en toen werd dat becommentarieerd in een aantal dagbladen als een vrij vergaande uitspraak en nu opent het NRC gewoon met “Einde van fossiele tijdperk is nabij”. Ja, dan zie je dat daar in een half jaar tijd gewoon anders over wordt gedacht.

INT: Het voorstel voor een mobiliteitsakkoord, die motie die is aangenomen. Weet u of dat al is opgepakt?

MP: Nee, ik weet niet hoe het daar nu mee staat. Meestal duurt het even in Den Haag voordat dat soort dingen in gang wordt gezet.

INT: Dat zou dus een soort energieakkoord moeten worden maar dan op het gebied van mobiliteit?

MP: Precies.

INT: Als u niet zoveel tijd meer heeft dan is dit misschien wel een moment om het af te ronden. Ik vond het fijn om even met u erover te praten,

MP: Heel graag gedaan en heel veel succes.