Futures 129 (2021) 102742

Contents lists available at ScienceDirect

Futures

journal homepage: www.elsevier.com/locate/futures

Embedding imaginaries- electric vehicles in Sweden's fossil fuel free future

Amelia Mutter [a,b]

[a] Department of Thematic Studies - Technology and Social Change, Linköping University, 581 83, Linköping, Sweden
[b] Swedish University of Agricultural Science, Department of Urban and Rural Development, Sweden

ARTICLE INFO

Keywords:
Sociotechnical imaginaries
Electric vehicles
Transport policy
Sweden

ABSTRACT

The purpose of this study is to explore the interaction between visions of the future and policy through the analysis of one Swedish policy document, a 2013 government investigation *Fossil Fuel Freedom on the Road*, and its subsequent policy process. Here, I examine the emergence of a sociotechnical imaginary (Jasanoff & Kim, 2009) that places electric vehicles at the center of a fossil fuel independent future. Analysis centers on textual analysis of this document as well as responses from a formal consultation process and two concrete policy measures showing how this imaginary is stabilized through interaction with additional actors and translation to additional contexts. This electric vehicle imaginary as presented in the policy report focuses on the role of electric vehicles in fighting climate change, as well as the increased energy efficiency and positive impact on city environments these vehicles promise. Additionally, this investigation identifies a specific policy agenda where electric vehicles are introduced first for personal vehicles and urban buses. This imaginary is stabilized in the consultation responses and two policy instruments, showing a process of embedding. Frictions, however, remain as these documents introduce contestations around biofuels versus electric vehicles and which sections of transport should be electrified.

1. Introduction

As a result of growing concern about the effects of human generated climate change, the need for a transformation to a renewable fuel-based transport sector has become evident. If catastrophic global impacts are to be avoided, the deeply entrenched global transport system that relies on fossil fuels needs to be replaced with new renewable fuel systems, calling into question how such a shift can be achieved. As of 2009, the Swedish government has set the ambitious national goal of achieving a fossil fuel independent vehicle fleet by 2030 (Regeringskansliet, 2009). Setting such a goal, however, is only the first step, as achieving it will require significant investment in alternative fuels and infrastructures. Within this vision of a fossil fuel free future, a number of pathways for how this future could be achieved co-exist, backing different measures for reducing fossil fuel independence. Within this transformation, visions and expectations are likely to play a central role, as they can help to drive transition processes by influencing where resources such as policy support and research investments are placed (Borup, Brown, Konrad, & Lente, 2006). Furthermore, these visions are often the first step towards convincing the wider public that such a transformation is necessary. One such vision emphasizes the role of electric vehicles in achieving a transition to non-fossil fueled transport. Electric vehicles have gained international attention in the last several years, as the number of models available have increased and many vehicle companies have placed electric vehicles at the center of their

E-mail address: amelia.mutter@slu.se.

https://doi.org/10.1016/j.futures.2021.102742
Received 27 January 2020; Received in revised form 28 January 2021; Accepted 28 March 2021
Available online 31 March 2021

plans for development. In the Swedish context, these vehicles are often considered as a key sustainable technology because of their efficient engines and the non-fossil sourcing of the Swedish electricity supply. As of 2018, the Swedish electricity mix was generated from 41 % nuclear power, 39 % hydropower, and 10 % wind power (Swedish Energy Agency, 2020). These vision, however, can be somewhat fragmented with some actors questioning the role electric vehicles will play in the future transport system because of the diverse international sourcing of electricity, infrastructural constraints (Wentland, 2016), and sourcing of raw materials for batteries (Sovacool, Kester, Noel, & Rubens, 2019). For example, Sovacool et al. identify one narrative of the electrified future where batteries are controlled by an elite few leading to potential shortages in supply and unethical sourcing of materials. This is only one example of the many potential drawbacks that could be a result of the electrified future.

This article will consider such a vision of electric vehicles in Sweden using the conceptualization of sociotechnical imaginaries to emphasize the way these visions become collectively held and institutionally stabilized (Jasanoff, 2015a; Jasanoff & Kim, 2009). Specifically, I will explain how this imaginary is expressed in one important policy document, Swedish Government Official Report *Fossil fuel freedom on the road - A report of the investigation on fossil free vehicle traffic* (SOU 2013:84) (sometimes called the FFF-investigation or the FFF). Using this document this article will show how the elements of an imaginary are presented in this investigation and become embedded through the subsequent process of consultation and passing of concrete policy measures. The FFF-investigation was written as an exploration into the possible methods of achieving the fossil fuel independent vehicle fleet. In other words, the FFF-investigation can be seen as the first comprehensive attempt to lay out pathways towards achieving the national goal of a fossil fuel vehicle fleet by 2030. This type of report is commonly requested by the executive branch of government, and there are many such investigations carried out each year. This investigation, however, was particularly influential and is often cited as an inspiration in later reports and is used to motivate transport research (Magnusson & Berggren, 2017; Sveriges Riksdags Trafikutskottet, 2018; Swedish Energy Agency et al., 2017; Xylia & Silveira, 2017). Furthermore, the FFF-investigation also has had a lasting impact through its suggestion of many concrete policy measures to facilitate the increased inclusion of renewable fuels in the transport sector.

As a complex investigation into fossil fuel free vehicle traffic, the FFF goes into the opportunities and limitations of many alternative technologies and can be understood as presenting multiple visions of the future transport system. As it emphasizes the goal of achieving fossil fuel independence by 2030, this could be seen as an overarching imaginary that places alternative fuel vehicles at the center of the future transport system. This imaginary is central to Swedish climate policy that seeks to place Sweden at the forefront of the renewable energy transition. In fact, the 2030 goal is only the first step towards the intention of achieving a net zero emissions of greenhouse gases by 2050 (Regeringskansliet, 2009). These targets are significantly more ambitious than the 2009 European Union legislation which aimed for 20 % cut in greenhouse gas emissions, 20 % renewable energy and 20 % improvement of energy efficiency by 2020 (European Commission, 2008).

This imaginary, however, is complicated because there are a number of different methods for achieving fossil fuel independence and net zero greenhouse gas emissions. The FFF, in fact, emphasizes five, namely: planning cities that reduce transport demand and increase transport efficiency, infrastructure measures and change of traffic type, more efficient vehicles, biofuels, and electric vehicles. In my analysis I have chosen to focus more specifically on one of these methods examining imaginaries of electric vehicles. This decision is largely based on the prominent role that electric vehicles play in the scenarios presented by the FFF. The report introduces best case scenarios for different types of road transport where the share of electric vehicles becomes increasingly dominant, eventually accounting for 25 %, 60 % and 100 % of transport trucks, personal vehicles, and city buses respectively (Regeringskansliet, 2013). This prominent role raises questions about what aspects of electric vehicles make them seem so desirable as a part of the fossil fuel free future. The emphasis on electric vehicles is particularly interesting considering the prevalence of biofuels in the Swedish context, where they already accounted for 12 percent of energy use in domestic transport in 2013, a 21 % increase from the previous year (Energimyndigheten, 2015). Compressed biogas, specifically, has developed as a popular fuel including in city buses where a number of municipalities have invested in developing local biogas systems using municipal waste and fueling public transport. Despite their role in the current system, biofuels are framed as interim fuels within the FFF scenarios replacing fossil fuels only to be eventually phased out by electric vehicles. This proposed interaction between biofuels and electric vehicles implies a competition between these two alternative energy carriers, however the FFF-investigation justifies this role by suggesting the biofuels will be used elsewhere.

This study, thus, follows this imaginary from the FFF-investigation to subsequent processes of consultation and regulation, seeking to answer questions such as:

1 What vision of the electric vehicle future is expressed in the FFF-investigation?
2 How is this vision reflected in a subsequent consultation process and concrete policy instruments?
3 How does this process show contestation or stabilization of the imaginary of electric vehicles?

To answer these questions, I will use a textual analysis of the FFF-investigation and other relevant documents including the response letters solicited in the consultation process. Additionally, I have interviewed five key policy actors to augment my understanding of the investigation and the Swedish policy making process in general.

2. Theory

When policy documents such as the FFF-investigation set concrete ambitions for the future, these can influence normative perceptions of which future is preferred. One way of conceptualizing these normative visions is by using the theoretical perspective of "sociotechnical imaginaries", defined as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in

science and technology" (Jasanoff, 2015a, 4). This is just one perspective within a wider study of imaginaries within the social sciences, where the term 'imaginary' is used to denote the social aspects of the collective imagination (McNeil, Arribas-Ayllon, Haran, Mackenzie, & Tutton, 2017). Sociotechnical imaginaries, however, tend to refer more specifically to the visions that are grounded in science and technological development and how they contribute to ideas about what type of society we want to live in. In other words imaginaries are "imbued with implicit understandings of what is good or desirable in the social world writ large" (Jasanoff & Kim, 2009, 122−23). This means that by choosing a technology of the future, actors are not only influenced by their expectations of what technology will succeed but also on their opinions about what kind of future they want based on the values and potentials connected to this technology. These kinds of normative visions are considered especially relevant when considering the fossil fuel free future, as there are many different potential alternatives.

The concept of sociotechnical imaginaries has been widely used in the study of sustainability technologies, including the transition to a renewable energy and transport system (Ballo, 2015; Eaton, Gasteyer, & Busch, 2014; Kuchler, 2014; Smith & Tidwell, 2016). One reason for this usage is the way that these technologies are often imbued with hope that they can help overcome a myriad of modern sustainability challenges (Lunde, Ropke, & Heiskanen, 2016). Electric vehicles and other renewable transport alternatives have been explored in a number of cases (Bergman, 2017; Ryghaug & Toftaker, 2016; Wentland, 2016). Furthermore, the contested natures of these imaginaries have been recognized for example by Sovacool et al. (2019), who identify the emergence of eight different visions of electric vehicles among a group of Nordic experts and Eames, McDowall, Hodson, and Marvin (2006) who conclude that the wide variety of visions around hydrogen vehicles is a result of the interpretive flexibility of the hydrogen economy. This previous literature indicates that multiple imaginaries can co-exist depicting different futures for the same technology.

This study builds on previous understandings of contested imaginaries with a focus on imaginary formation and how this process interacts with policymaking. This interchange has also been identified in the imaginaries literature, including how these dynamics can be complex and contested (Delina & Janetos, 2018). Contested imaginaries have been especially identified in cases where different political scales are considered. Trencher and Heijden (2019) conclude that top-down influence of national imaginaries can lead to mixed results including the use of national energy visions to promote local goals. Karhunmaa (2018), in contrast, shows how shared imaginaries can be used by different actors to promote diverse pathways to the same goal. This article fills a gap in the research by attending more directly to the development of imaginaries. This article builds on these understandings of the role of interpretation in national imaginaries while considering the development of an imaginary through multiple stages of a policy process (investigation, consultation, and incentivization). This process has not been evaluated, in part because of the challenge inherent in studying the development of ideas. As Delina explains, "the discursive practices, their framings, and the resultant imaginaries continue to undergo messy, complex, and heterogeneous processes suggesting that there is actually no singular reality" (Delina, 2018, p. 53). Despite this challenge, I attempt to consider the development of the imaginary of electric vehicles using the method laid out by Jasanoff in *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*.

Jasanoff (2015b) suggests a four stage framework for imaginary development that includes: origin, embedding, resistance, and extension. In the origin phase an imaginary comes into being, however, this can be hard to pinpoint in many cases with the exception of imaginaries that originate in individual ideas sometimes referred to as 'vanguard visions' (Barker, 2015; Moon, 2015; Storey, 2015). The second phase is 'embedding' where "ideas of scientific and technological future need to gain assent outside such bounded communities in order to become full-fledged imaginaries" (Jasanoff, 2015b, p. 326). In the resistance phase, imaginaries are challenged, and tensions are highlighted resulting either in one imaginary replacing another or in the imaginary adapting. Finally, the extension phase "calls for a situated re-embedding in order for translated imaginaries to take root and flourish in new soil" (Ibid., 333). Taken together, these phases make up a process by which an imaginary is taken from the realm of imagination to a stabilized force embedded in everyday praxis. This study uses these stages of development to describe the stabilization of the electric vehicle imaginary that emerges from the FFF-investigation. In doing so, it contributes to the literature by utilizing this framework to examine the emergence and embedding of imaginaries.

In the subsequent processes of consultation and passing of concrete policy measures, a process of embedding occurs as the imaginary is adopted by additional actors. To some extent, a limited amount of resistance can also be determined from the tensions that emerge within these processes. This process, however, is not entirely straightforward. Rather:

> It is through embedding, whether material as in objects or psychosocial as in memories and habits of social interaction, that imaginaries are effectively translated into new contexts. Embedding thus performs an important part of the work of extension that allows imaginaries to spread across cultures, time, and space; but it is not friction free (Jasanoff, 2015b, p. 329).

This study will attend to this process, including its related frictions in the policy arena by examining how the adoption of an imaginary of electric vehicles in the FFF-investigation contributes to the process of embedding. With this focus, I engage with the imaginaries literature where policy is recognized as one of the ways that imaginaries can become embedded or stabilized. Jasanoff and Kim (2009, p. 123) note how political actors are particularly empowered with setting imaginaries through "active exercises of state power such as the selection of development priorities, the allocation of funds, the investment in material infrastructures, and the acceptance or suppression of political dissent." These actors are capable of using the influence of their platform to impact how the public at large views technology futures.

By studying the embedding of sociotechnical imaginaries within policy, we can come to understand how they are "coproduced (Jasanoff, 2004), emerging from policy discourses, state administration, and established institutions and are backed up by technical routines and material infrastructures" (Yang, Szerszynski, & Wynne, 2018, p. 281). In this manner, policy is entangled with the iterative processes of imaginary formation. Kuchler and Bridge (2018, p. 145), for example, show how imaginaries of coal are influenced by policy, going so far as to suggest that:

because coal's materialities are inherently ambiguous, what is important to understand is how they become stabilised in ways that do long-term cultural and political work: so that, for example, a lowly combustible rock is able to underwrite far reaching socio-technical imaginaries, such as the idea of nationhood or national destiny.

This is just one example of how imaginaries become embedded in a process of alignment with national goals. These imaginaries can also work to project collective ideas of what constitutes a desirable future as in the case of Rwandan ICT policy, which presented these technologies as central to achieving development and modernization (Bowman, 2015).

Specifically, this article examines this process through a practice of policy setting including investigation, consultation, and regulation. By following this process, I intent to improve understanding about the role that policy processes can play in the stabilization of imaginaries. This type of policy document can influence the embedding of imaginaries through "processes of issue framing and agenda setting"(Jasanoff, 2015a, p. 25). This process, however, can have drawbacks including overemphasizing the role of certain actors in power. Rather, in some cases imaginaries can overemphasize the role of elite actors such as policymakers and scientific experts (Smallman, 2020). By examining an imaginary during multiple stages of the policy process, including consultation, this article considers whether interests of these additional actors influence the development of the electric vehicle imaginary.

Table 1
Primary documents for analysis.

Year	Title	Author	Relation to FFF
2012	Committee Directive: Fossil Fuel Independent Vehicle Fleet – A Step on the Road to Zero-emissions of Greenhouse Gases	The Ministry of Enterprise and Innovation	This directive called for the FFF-investigation to be carried out
2013	Fossil fuel freedom on the road – A report of the investigation on fossil free vehicle traffic	Government offices	This is the FFF-investigation
2014	Response letters submitted during the consultation process	Submitted by interested parties including municipalities and regions, private companies, interest groups, universities and individuals	This was a formal consultation process following the publication of the FFF.
2014	Compilation of position papers by Actor A-Ö	2030 Secretariat (M. Goldman & T. Persson)	This provides a helpful overview of the position papers.
2015	Regulation on support to promote sustainable city environments	Ministry of the environment	This is one legislation that is proposed in the FFF.
2016	Regulation on the electric bus premium	Ministry of the environment	This is a second legislation that is proposed in the FFF

3. Methods and materials

Imaginaries can be hard to study because of their ideational nature. Language and discourse, however, are common arenas for studying imaginaries, particularly within policy. As Jasanoff (2015a, p. 27) explains, "Policy documents, no less than judicial opinions, can be mined for insights into the framing of desirable futures…as well as for specific verbal tropes and analogies that help identify the elements of the imaginary." To examine the development of an imaginary of electrification of transport, I have focused on textual analysis as a method of gleaning expectations and values from a number of key texts during the policy making process. This analysis focuses on the FFF-investigation, a 2013 Swedish Government Official Report called *Fossil fuel freedom on the road - A report of the investigation on fossil free vehicle traffic* (Fossilfrihet på väg - betänkande av Utredningen om fossilfri fordonstrafik - SOU 2013:84). This document, however, represents only one point in the process of imaginary formation. To contextualize this within a wider policy making and imaginary setting process I also included documents that precede and follow the publication of the FFF-investigation. Table 1 provides an overview of the texts that were analyzed in this study, including the year they were published and their relationship to the FFF-investigation.

As Table 1 shows, I used textual analysis to examine a number of documents relating to three stages of policy setting and imaginary formation. While the documents highlighted in yellow relate to the FFF-investigation itself, the documents highlight in blue relate to the open consultation process following the publication of the FFF in 2013. This type of consultation is very common in the Swedish policy making process and is intended to allow all interested parties to read and respond to policy documents such as Government Official Reports. In this case, the Ministry of Enterprise and Innovation (the government ministry responsible for overseeing the-FFF) sent out the report requesting responses from many actor groups that were considered stakeholders in the renewable transportation debate. However, in this process anyone interested in the question can also submit such a response unsolicited. This resulted in 107 different response letters submitted during the first half of 2014. Finally, the documents highlighted in green are government regulations outlining two policy instruments in support of electric vehicles approved in 2015 and 2016. These regulations were chosen to provide insight into the concrete policy outcomes that can be traced back to the FFF, with the intention of showing how the electrification imaginary is stabilized following its publication.

Textual analysis is a well-established method for interpreting how other actors understand and make sense of the world around them (McKee, 2003). Textual analysis can take a number of forms, however in this case I have taken a generalist approach trying to identify the narratives and themes that contribute to an imaginary of electric vehicles. Analysis was inspired by grounded theory where researchers are encouraged to continuously interact with both data and analysis (Bryant & Charmaz, 2007). For this reason, my analysis of the texts included a process of inductive coding in atlas.ti to draw out themes and narratives around electric vehicles and their potential role in the future. The materiality of these texts, however, led to a number of challenges to this analysis process. The FFF itself is over 1000 pages long, so to allow a more in-depth analysis I focused on certain sections that discussed the overview of the fossil fuel free future (the introduction, aims, and scenario proposals) and the chapter on electrification. To ensure I did not miss text that discussed electrification I also did a key-word search for "electric vehicles", "electric driven", and "electrification" to find other sections where this topic was discussed. This process was intended to focus analysis on the electric vehicle imaginary; however, codes were taken from the way that electric vehicles were discussed drawing recurring themes and rhetoric from these areas of text.

In order to access the response letters submitted during the consultation process, I visited the Government archives in February and March 2019 (since the collection of these was no longer available online). I read each response, took notes, and acquired copies of the responses where electric vehicles were most widely discussed. In an attempt to create an overarching understanding of the opinions presented in these 107 response letters, I categorized these based on their response to the report, generally, as well as the support of specific measures supporting electric vehicles and biofuels. Although the analysis focuses on the imaginary of electric vehicles, attitudes to biofuels were also considered relevant because of the relationships between these two fuels. As discussed in the introduction, Sweden has a strong biofuel history which in some cases can lead to tensions between these two fossil fuel alternatives. Each response was placed in one of the five following categories: generally pro-FFF, pro-electric vehicles, pro-biofuels, pro-electric vehicles and biofuels, and critical or questioning. These categories, however, are a subjective simplification of the complex reflections included in the multiple page responses. For example, many of the “generally pro-FFF” responses include some kind of criticism or commentary on aspects of the renewable transport future which are under developed, however if they do so within a response letter that also praises the document or supports the goal of a fossil fuel free future it is placed in this category. These responses are further discussed in the analysis section. Additionally, I utilized a compiled summary of all of the responses from an organization called ’The 2030 secretariat’, an organization formed after the release of the FFF-investigation to follow up on the fossil fuel free targets. This document provided a helpful overview that I could return to in the months following my initial analysis.

In addition to textual analysis, I also performed five interviews with the aim of obtaining additional context for the policy making process and the debates that emerged from the FFF. These interviews allowed me to ask key actors more specifically about the investigation and following policy process. These actors included: the principle investigator in the investigation, representatives of Swedish vehicle manufacturers Volvo and Scania, a representative of the Swedish Gas Association, and a researcher with extensive experience in this subject. The interviews were carried out from March to September 2019, were between 45 and 90 min long, and with one exception were carried out in person. The interviews were semi-structured, following an interview guide.

4. Imaginaries of electric vehicles

This section acts as an analysis of the imaginary of electric vehicles which is expressed in the FFF-investigation and subsequently reflected in the actor responses and in two concrete policy instruments. Here I include an in-depth explanation of the imaginary of

electric vehicles, including the frictions that arise during its extension to new actors and arenas.

4.1. Electrification and the FFF-investigation

The following section introduces four aspects of the electric vehicle imaginary as embedded in the FFF-investigation.

4.1.1. Electric vehicles against climate change

Climate change is one underlying theme of the FFF-investigation which has the aim to "map possible actions and identify measures for reduced transport sector emissions and dependence of fossil fuels in line with the vision for 2050" (Näringsdepartementet, 2012, p. 78). The aim of combating climate change is central throughout the investigation, where the information presented is intended to help achieve a future where the climate crisis has been abated. As a response to this climate framing, support for electric vehicles is largely motivated by the properties of these vehicles that counteract climate change. Specifically, electric vehicles have no-in place emissions and dramatically reduce the carbon dioxide emissions compared to similar trips with traditional fossil fuel vehicles. This is particularly the case in the Swedish context where the electricity mix is composed of mostly nuclear, hydro, and wind power. As the investigation elaborates:

> Electrification means that the energy consumption per vehicle kilometer is cut in half, which in 2030 according to WSP [a Swedish consultancy firm, my note], would reduce energy usage by around 10 TW h... The effect would be the reduction of in place emissions of carbon dioxide of around 3.9 million tons (Regeringskansliet, 2013, p. 517)

Here, the potential of electric vehicles is presented as a measurable reduction in carbon dioxide emissions at 3.9 million tons, specifying exactly how electrification can work to reduce the climate impact of the transport sector. This explanation connects electrification to the fossil fuel free future by referencing measurable ways that electric vehicles can contribute to substantial reductions of greenhouse gas emissions.

4.1.2. Efficiency of electric vehicles

The second motivation for the electric vehicles imaginary in the FFF-investigation is the argument that electric vehicles can improve the overall efficiency of the transport sector. Electric vehicles use energy much more efficiently than internal combustion vehicles. This efficiency has the possibility to greatly reduce the amount of energy needed in the transport system, helping to achieve the fossil fuel independent future. As the investigation explains, "due to the fact that electric motors have a significantly higher efficiency than combustion motors, an increased electrification of road traffic will reduce the transport sector's energy use" (Regeringskansliet, 2013, p. 502). This motivation is central to the imaginary of electric vehicles, because it articulates how replacing fossil fuels with electric vehicles has a greater impact than replacing fossil fuels with renewable fuels. Here it is not only fossil fuels that are being reduced, but also the general demand for energy within the system. Thus, by switching more vehicles to electricity the same amount of energy can be used to drive more vehicles. The argument is essential to the FFF-investigation which introduces "increased efficiency" as one of the five types of measures for achieving the fossil fuel free future (electrification is another). While this is not entirely about the electricity imaginary, because the efficiency of combustion engines can also be improved, it makes a case for why electric vehicles are considered so important. Electric vehicles play an important role in this future because they are one of the most efficient means to reduce energy demand.

4.1.3. Improved city environments

A third theme within the electric vehicle imaginary as presented by the FFF investigation is the way that electric vehicles are viewed as key components for improving city environments. Within this theme, electric vehicles are emphasized because of the way they can contribute to more desirable, cleaner and quieter urban areas. Here, the FFF-investigation connects electric vehicles to wider assumptions about how cities will develop in the future, as city populations grow and densification is necessary to cater to residents. This urban future poses additional challenges for the transportation sector by concentrating transportation demand resulting in negative impacts such as air pollution. The electric vehicle imaginary as presented by the FFF investigation merges with this expectation, suggesting that electric vehicles can help mitigate the negative impacts of condensed urban transportation. As the investigation explains, "battery power also offers advantages such as the absence of local emissions, low noise levels and ease of operation" (Regeringskansliet, 2013, p. 506). This comment explains how electric vehicles go beyond reducing energy demand to also offer benefits that improve the local environment by reducing local noise and air pollution. By introducing this motivation, the FFF-investigation links electric vehicles to cleaner air in a way that goes beyond climate change mitigation. While reduced CO_2 emissions can help reduce global warming and the many negative impacts associated with this (sea level rise, drought, and dramatic weather events for example), electric vehicles can also have positive implications for air quality closer to home. Furthermore, as this impact is most relevant in urban areas where traffic is heaviest, this aspect of the imaginary can also be seen as an agenda setting practice, emphasizing the way that electric vehicles are beneficial for urban areas and de-emphasizing rural areas.

4.1.4. Electricity as a niche technology

Finally, the imaginary of electric vehicles in the FFF-investigation presents a rather specific path towards electrification starting with certain niches or sections of transportation. Despite the fact that the imaginary provides multiple motivations for why electric vehicles contribute to a better fossil fuel independent future, it combines these with plans for measured introduction by stating that "battery vehicles in the coming years are only expected to be niche vehicles, for the most part, used in local public and private service

such as in car pool and rental fleets" (Regeringskansliet, 2013, p. 501). All sociotechnical transformations take time, and the FFF-investigation includes this limitation in the way it presents an electrified future. However, the niches that the FFF-investigation suggests should be electrified first play a central role in the imaginary because they help to create a specific policy agenda for the renewable fuel transition to follow. By identifying which sections of transport are better or worse for the use of electric vehicles, the FFF-investigation stabilizes an imaginary where electrification begins with certain niches. One example of this kind of pathway emerges from a section of the report that introduces potential scenarios to achieve the fossil fuel independent future. This section considers the availability and cost of different technologies to present two potential scenarios for the future: one (Scenario A) which achieves the 2030 and 2050 targets and a second (Scenario B) which indicates a much slower phase out of fossil fuels. As Scenario A indicates a more desirable future which aligns with previously established government policies (namely the 2050-vision), it also incorporates elements of the electric vehicle imaginary describing how much electrification is feasible in the different sections of the transport sector. Electrification as presented in scenario A is outlined in Fig. 1.

As Fig. 1 clearly shows, the FFF-investigation suggests a future where electrification occurs most rapidly in city buses and personal

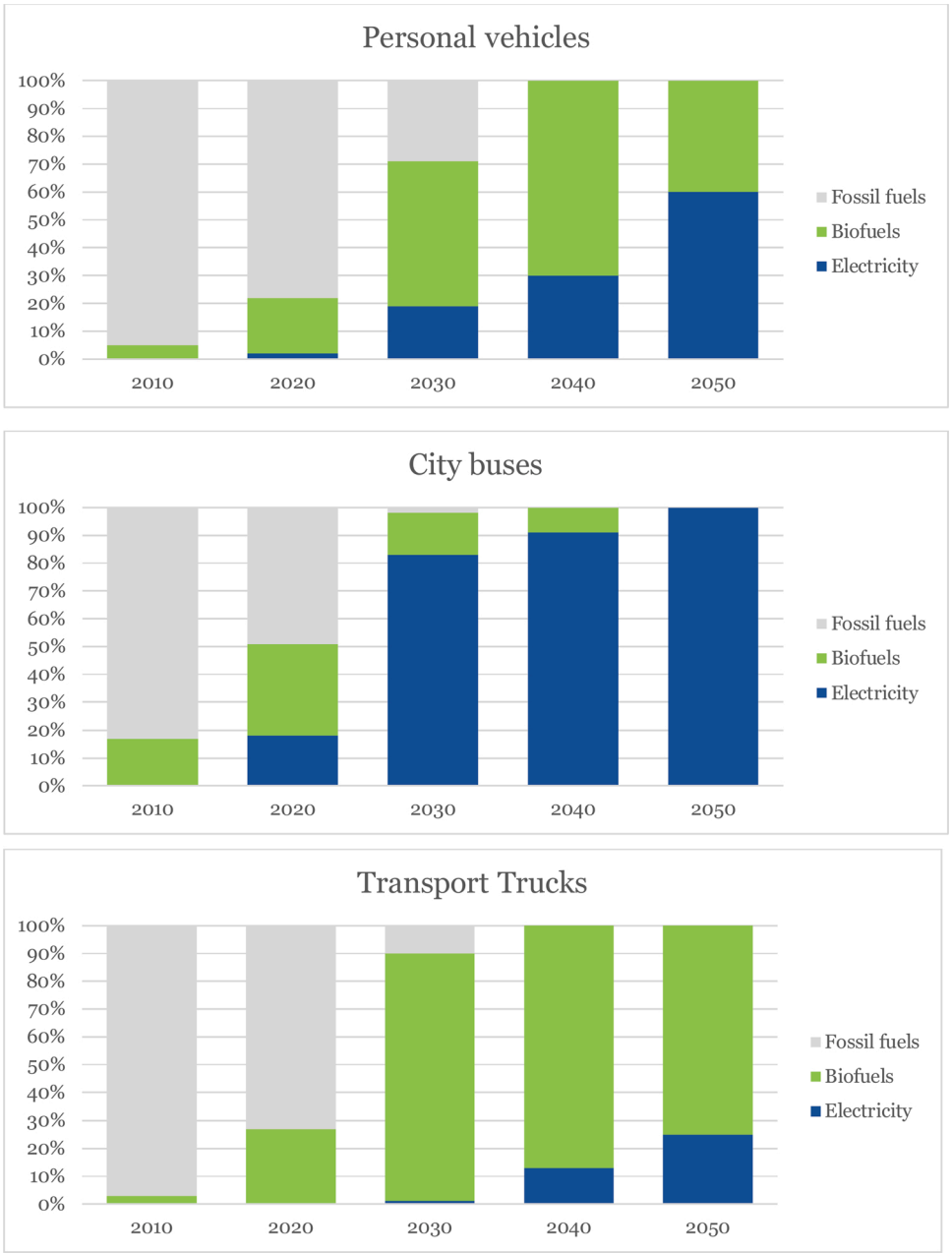

Fig. 1. A–C Percentage of renewable fuels by area of transport from Scenario A.

vehicles. While electrification of personal vehicles is projected at around 20 % by 2030 and transport trucks only 1 % by 2030, city buses are projected as heavily electrified (up to 83 %) already by 2030 and 100 % electrified by 2050. Additionally, the investigation states that distribution trucks used in cities are projected to follow the same trend of electrification as city buses, while rural buses are expected to achieve no electrification by 2030 and similar levels as transport trucks by 2050 (Regeringkansliet, 2013, 574). This outlines an imaginary of the future where electrification of city buses and distribution trucks will occur at the fastest rate, followed by personal vehicles with rural buses and long-distance transport trucks lagging behind. The investigation motivates this scenario by explaining:

> City buses are one type of vehicle which have relatively favorable conditions to work with battery power. The utilization rate by driving hours is high which reduces the depreciation costs. The area of motion is measurable. Routes are set providing conditions for access to charging (Ibid., 512).

As this statement shows, there are some aspects of this type of transportation that would make electrification relatively easier. With this scenario, a specific policy agenda is embedded within the FFF-investigation and included within the electric vehicle imaginary. In this manner, the imaginary of electric vehicles goes beyond the just presenting a desirable vision of the future to propose concrete steps that could help achieve this vision.

4.2. Fossil free imaginaries in the consultation process

As described in the methods chapter, the consultation process following the publication of the FFF-investigation opened up the imaginary of electrification to feedback from over 100 different actor groups, asking for responses on the report and its version of the future. Table 2 outlines the five different overarching positions that arose from the analysis of these responses, including the number of responses that were placed in that category, an overview of the actors/actor groups whose responses fit here, and examples of the type of commentary or arguments that fit within this category. As the response letters were often long and complex these are just some samples to give an idea of different themes in the responses. Some of these categories also overlap, with categories 2, 3 and 4 also including language that was generally supportive of the FFF and its goals.

The vast majority of responses (101 of 107) were generally supportive of the FFF-investigation, sharing the ambitions of a fossil fuel free future. The Swedish Society for Nature Conservation, for example, writes that "it is good that the investigation establishes that it is possible to reduce the carbon dioxide emissions from road traffic by at least 80 % by 2030"(Response letter). Many responses shared similar statements that supported the vision of a fossil fuel free future, however as the table describes, these responses often had caveats that indicated a more complex understanding of this document. One common stipulation was the wish for more concrete recommendations from the investigation. This weakness was also discussed in the interviews, for example where the representative of

Table 2
Summary of positions in consultation response letters.

Category	Number of responses	Summary of actors with this position	Sample arguments
1. Generally pro-FFF	49	Many universities and government agencies, private companies such as Preem and Sunfleet, industry organizations such as the Swedish Transport Workers' Union and Gothenburg region municipal workers' union, several cities and regions, and vehicle companies Scania and Volvo Cars.	• Support for the 2030 and 2050 goals • Requests for additional information on specific solutions • Supportive of the goal but not specific suggestions • Concerns that the FFF does not make more concrete suggestion on how to achieve the 2030 and 2050 goals.
2. Pro-electric vehicles	19	Several energy companies including E. ON and Vattenfall, cities and regions from southern and western Sweden, interest groups such as National Electric Vehicles Sweden, The Swedish Association of Green Motorists, and Power Circle.	Shared points from 1 and: • Specific requests for support of electric charging infrastructure • Specific mention of the benefits of electrification • Additional targets for electrification
3. Pro-biofuels	25	Chemical and biofuel companies, companies and interest groups related to agriculture and forestry, the Swedish Gas Association, associations related to waste and energy and Volvo group.	Shared points from 1 and a: • Specific mentions of the benefits of biofuels • Requests for additional support for biofuel production or use • Additional targets for biofuel production
4. Pro-electric vehicles and biofuels	8	2030 secretariat, organizations for nature conservation, transport interest groups, one city administrative board and one region and the Swedish Association of Local Authorities and Regions.	Shared points from 1 and a: • Additional arguments or mentions relating to both 2 and 3.
5. Critical or questioning	6	Vehicle interest groups, the Swedish Air Transport Society, Confederation of Swedish Enterprise, National Institute of Economic Research and The Swedish Petroleum and Biofuel Institute	• Need to remain economically competitive • The future will require more transportation, not less

Scania states that “this was maybe the disadvantage with the investigation was that it did not become a clear enough action plan” (Interview 2). This perspective indicates a desire to already start working towards achieving the fossil free future.

Despite the widespread support for the 2030 goal, a handful of criticisms of the FFF-investigation emerge from the responses (6 total). These were primarily critical of the economic implications of committing to renewable fuels prior to the rest of the world, calling into question what the fossil fuel free future could mean for Swedish business. The confederation of Swedish enterprise explains this concern writing, "On the other hand, the study suffers from an overly narrow national perspective, where some measures aimed at "taking the lead" within the EU and globally risk making transport more expensive and could result in a loss of competitiveness for Swedish business"(Response letter). As this point indicates there could be negative implications of setting goals that are far ahead of the international community. According to the chief investigator for the FFF, this concern also emerged during the preparation of the report and one actor left the team as a result of this difference of opinion (Interview 1). As a result, the FFF-investigation retained its pro-transition stance, but met with additional concern once the report was released. The chief investigator for the FFF describes:

> We received an unbelievable volume of critic when it came out, the investigation recommended to reduce travel, to reduce petrol and diesel and it was absolutely nonononono…but then it went out for consultation and the responses were almost all very positive which was not what we heard when it went to debate.

This quote indicates that the chief investigator actually expected this criticism to be wider spread. The limited number of critical responses, however, indicate that this perspective was overshadowed by positive responses to the fossil fuel free future.

Twenty-seven of the consultation responses include rhetoric that supports electric vehicles and initiatives to encourage their use, sharing in the electric vehicle imaginary as embedded in the FFF-investigation. These responses, for example, also frame the need for electrification to combat climate change. This body of responses also seem to agree with the use of energy efficiency and improved city environments as motivations for the electric vehicle imaginary. For example, as one comment from the interest group within the Swedish electricity industry (Power Circle) explains, "it should be emphasized that electricity’s biggest advantage is the possibility for a significant reduction in emissions in parallel with an advantageous energy efficiency. No other alternative comes close to electricity on the question of energy efficiency" (Response letter). Here, the imaginary of electric vehicles is presented even more concisely, as Power Circle places extra emphasis on electricity as compared with other alternatives. This explanation highlights how important efficiency is for reducing energy demand and places full support behind electric vehicles’ ability to help achieve the fossil fuel free future. The emphasis on efficiency is also mirrored in the interviews with key actors, as exemplified by a quote from a representative of Scania who states, “Energy efficiency is the alpha and the omega here, we often say it is part of our DNA. Our motors must be as efficient as possible regardless of if they use fossil fuels or renewable fuels” (Interview 2). Here, this informant is emphasizing how this has become an essential question for the vehicle industry as well indicating that they are constantly working to create more efficient vehicles across the board. Another aspect of this imaginary is emphasized by the response of National Electric Vehicle Sweden who explain "a transition to electric vehicles in cities even improves the air quality and noticeably reduces the noise level from traffic"(Response letter). This quotation reiterates that another aspect of electric vehicles that makes them desirable is their contribution to more desirable city environments.

Tensions do exist, however, when it comes to opinions about which sections of the transport sector should be electrified and how quickly this can be achieved. While Scenario A implies that electrification could happen in city buses and personal vehicles first, not all actors agree with this proposition. For example, two actors specifically suggest more aggressive targets for electric cars, deviating from the pathway in Scenario A. The response by the interest group National Electric Vehicle Sweden suggests that there should already be the appropriate conditions for electric vehicles to replace 33 % of the car fleet, indicating space for a more rapid introduction of electric cars than in scenario A, and electrification of buses is not mentioned. This response mirrors the electric vehicle imaginary in terms of the desirability of electric vehicles for achieving the fossil fuel free future, but not on the pathway for how this transformation will take place prioritizing the electrification of personal cars over other vehicles. In contrast, the Swedish Public Transport Authority largely agrees with the target for urban buses, "We also support the investigations proposal for increased electrification of bus traffic in bigger cities…An increased electrification of city buses would support both energy and climate goals and should be stimulated"(Response letter). Elsewhere other actors suggest electrification in different areas than the FFF. One example is the interest group Swedish Association of Green Motorist which suggests that electrification could actually be a solution for rural areas (contradicting the "urban" aspect of the imaginary). In this case they suggest that investment in charging stations in rural areas could help to counteract some places where access to traditional fueling stations has become scarce.

Another interesting conclusion from the responses was that none of them were directly critical to electrification of the vehicle fleet. Not one of the responses questioned the value of electric vehicles in the fossil fuel free future (although a few questioned the use of electric vehicles in certain applications). In fact, many of the responses didn’t mention electric vehicles at all. One contrasting opinion, however, could be found in responses from biofuel producers and supporters who called for increased support for biofuels without explicitly questioning the electric vehicle imaginary. One example of this type of contrasting imaginary comes from the response submitted by the Swedish Gas Association, which represents many Swedish biogas producers. In this response they suggest that a shift to biofuels could have the biggest impact in the short term and call for more institutional support for biogas production and infrastructures (Goldman & Persson, 2014). While this position is not very surprising coming from an actor in the biofuel branch, it counteracts the impression that electric vehicles are the most important measure for reducing fossil fuel independence. As the table suggests, however, there are some response letters that include text in line with both the pro-electricity and pro-biofuel position. However, there are much fewer of these letters (only 8 compared to 19 and 25 of pro-electricity and pro-biofuel letters).

4.3. Embedding in two policy initiatives

In addition to providing an abundance of information about the opportunities and challenges of reducing fossil fuel dependence, the investigation also suggests a number of concrete policy measures to help facilitate the transition. This section introduces two policy initiatives introduced by the FFF and subsequently passed into law that directly draw on the imaginary of electric vehicles.

4.3.1. The city environmental contract

The "city environmental contract" was launched in 2015 as an initiative to financially support initiatives to improve Swedish cities. In 2018 the amount of funding for this initiative was increased and in the current policy, cities can apply for a piece of this 95 million Euros each year up until 2029. The stated objective is that measures should "lead to energy effective solutions with low emissions of greenhouse gases and contribute to successfully fulfilling the environmental quality goal 'Good built environment'" (Trafikverket, 2019). Specifically, funded projects should contribute to either "increased transport of individuals with public transportation or cycling" or "sustainable goods transport solutions" (Finansdepartementet, 2015). A number of municipalities have used this initiative as a source of funding for charging infrastructure for electric buses. One example is an electric bus initiative in the city of Östersund in northern Sweden. In this case, the city was granted nearly half of the 7.5 million Swedish crown expected cost for electrifying one bus line (Östersunds Kommun, 2018).

The city environmental contract incorporates several of the motivations for the electric vehicle imaginary by emphasizing the role of sustainable public transportation including electric buses as central to improved city environments. It connects the goal of a 'good built environment' directly to energy efficiency and reduced greenhouse gas emissions. Thus, by supporting electric vehicles in a measure that mirrors the motivations of the electric vehicle imaginary presented in the FFF-investigation, this policy extends the imaginary to this concrete policy measure and supports the policy agenda that identifies urban buses as a prioritized section for electrification. Following its mention in the FFF-investigation, this initiative gained significant support in the consultation process where 17 responses specifically voiced support for its realization. This indicates the opinion that this type of infrastructural support would be beneficial for many actors, including municipalities and regions. Support for this initiative is also often connected to the specific need for infrastructure for electrification, as investment in charging stations is requested by many of the pro-electrification response letters. This connection is re-iterated in the interviews, where a representative of Volvo describes the interaction between electric vehicles and infrastructure as a "chicken and egg" problem. Here he elaborates that consumers are unlikely to choose electric vehicles while they are unsure there is sufficient charging infrastructure, while municipalities are unlikely to invest in charging infrastructure before the demand is present (Interview S4). One interpretation of the city environmental contract initiative is that it can be seen as addressing this very real concern and contributing to the realization of the imaginary of electric vehicles.

4.3.2. The electric bus premium

The "electric bus premium" was another initiative stemming from the FFF-investigation. According to the regulation, the aim of this initiative is to "contribute to environmental quality goals 'limited climate impact', 'Fresh air', and 'Good build environment' through an electric bus premium to promote the introduction of electric buses to the market" (Miljödepartementet, 2016). This initiative offsets the cost of investment in electric buses (which are currently still more expensive than traditional fuel vehicles). In its current form the electric bus premium is awarded to municipalities, public transport authorities, or other companies that are contracted for public transport provision to reduce the risk of investing in electric buses. With this initiative, buyers could get up to 20 % of the purchase price back. This policy initiative, like the city environmental contract, solidifies the imaginary of electric vehicles by providing financial support for their introduction. These two initiatives together can be seen as addressing both the "chicken" and "egg" aspects of this problem presented in the previous section. While one supports infrastructures for charging the other subsidizes the purchase of buses that will utilize these charging infrastructures. Furthermore, the stated aim of the electric bus premium ties the introduction of electric buses to other aspects of the electric vehicle imaginary, namely by connecting these buses with clean air, better city environments, and reduced climate impact. By connecting electric buses to these ideals, the premium solidifies the position that electric vehicles and particularly buses can help achieve this version of a better future.

One interesting aspect with relation to the electric bus premium, is that in the FFF-investigation this initiative was originally introduced as a technologically neutral policy that was called the "environmental bus premium" implying that equal support would be available for biofuel buses as well. Despite the fact that numerous actors specifically mentioned support for technologically neutral policies in their consultation letters, the final initiative provides support for only electric vehicles. The reasoning for this shift is not clear, however one explanation is that the government coalition in power pushed for this regulation. One of the parties in this coalition was the Green Party (who wanted to push through environmentally friendly legislations) and the other was the Social Democrats who typically push for industry friendly policies. As both major Swedish heavy vehicle manufacturers had already begun developing electric alternatives, the electric bus premium could be viewed as beneficial to Swedish industry (Interview 1, FFF Special Investigator).

It is worth noting that many of the organizations that highlight the importance of technology neutral policies are those from the biofuel industry. This could be perceived as evidence of concern that electrification will be favored at the cost of support for biofuels. One remittance letter from a biofuel company SEKAB, goes a step further by emphasizing that electrification cannot be the only solution and that biofuels also need support. This response makes sense when examining the actual text that lays out the environmental bus premium in the FFF-investigation. It explains:

> The investigation makes the assessment that there are already strong incentives for choosing energy efficient buses that can be driven by electricity or biofuels. At the same time, there is a big potential to electrify bus traffic and therefore achieve traffic that has both low carbon dioxide emissions and lower noise levels, contributing to a more comfortable experience (Regeringskansliet, 2013, p. 704).

This text specifies the need for specific support for electric buses, even though this sends mixed messages within the greater text which also mentions biofuels. This quotation, as well as the electric bus premium support the electric vehicle imaginary, namely that electric vehicles can lead to cleaner air and better cities.

5. Discussion

The responses from the consultation process and the policy measures show how the imaginary of electric vehicles is translated to these contexts with limited friction, providing evidence of a consistent imaginary. As discussed in an earlier section, the vast majority of responses shared the support for the fossil fuel free future and were either positive or neutral to the electrification imaginary. Of the responses that did specifically support electrification, many of them shared the same motivations as embedded in the FFF, namely that electric vehicles had lower climate impact, were more energy efficient, and contributed to improved city environments. This process can be further understood by returning to the imaginaries literature, and particularly through Jasanoff's four phases of imaginary development: origin, embedding, resistance, and extension (Jasanoff, 2015b). Jasanoff clarifies, however, that these phases do not necessarily occur one after another in a clear progression. I would argue that the discussion of electric vehicles in the consultation process shows both embedding and resistance. The 19 response letters in support of electrification show embedding by showing assent and support for the electric vehicle future among a wide range of actors. These responses tend to reiterate the need for electric vehicles as a crucial tool in the fossil fuel free future because of their energy efficiency and contributions to a better city environment.

At the same time, other responses provide some resistance to the imaginary presented in the FFF. One example of this is through the 25 responses that call for support for biofuel production and utilization. Although these responses do not directly contradict the electric vehicle imaginary they suggest an alternative view of the future where biofuels will have a larger role and request additional governmental support for achieving this future. A second type of tension arose from frictions surrounding the specific policy agenda the FFF-investigation proposes with regards to which vehicles should be electrified first. A handful of the responses agree with the arguments for electrification but suggest that the transition would look differently with a faster adoption of electric cars (National Electric Vehicles Sweden) or electrification of rural systems (Swedish Association of Green Motorists) indicating a slight variation in the electric vehicle imaginary. Although these two types of responses show some different interpretations of the electric vehicle imaginary, these do not fit the mold of 'resistance' used by Jasanoff which includes a much more revolutionary response to incumbent imaginaries. They do however show how the imaginary is opened up for different interpretations during the consultation process. However, once this reaches the policy process it is closed down again and confined to the originally proposed aspects when written into policy. The 'city environmental contract' reinforces the notion that electric vehicles improve city environments. The choice of name for this subsidy for urban transport projects including electric vehicle charging infrastructure underscores the emphasis of this initiative on the improvement of city environments. Meanwhile, the electric bus premium pushes forward the scenario for electrification presented in the FFF by subsidizing electric vehicles in one of the identified niches: urban public transport. One way of interpreting this reinforcement is that this is an act of extension by helping the imaginary of electric vehicles "gain traction, acquire strength, and cross scales" (Jasanoff, 2015b, p. 323). Jasanoff even notes that government institutions can be very successful "agents of extension" because of their power to influence the realization of certain imaginaries. This power includes issue framing and agenda setting as well as financial support.

This process calls into question how actors have different levels of influence when it comes to the phases of imaginary development. While previous research has indicated that policy actors are particularly privileged in this arena, this case study invites the inclusion of all types of actors in the consultation process. However, I believe this case shows that just because these actors are let in, it does not mean that their opinions have a strong influence on the resulting imaginary. For example, 25 of the response letters call for wider support for biofuels often calling for the use of technologically neutral policies. Despite this desire, neither of the policy instruments introduced in this article provide support for biofuel vehicles or infrastructures. In the case of the electric bus premium, this was originally introduced as a technologically neutral policy in the "environmental bus premium" which would have provided the same kind of subsidy for other renewable fuel and low emission vehicles. Ultimately, however, this call for neutrality was ignored, and electric vehicles alone were supported in these two policy instruments indicating that these actors' opinion on this matter were disregarded. No similar policies were implemented supporting biofuels. This conclusion mirrors previous work by Smallman (2020) who comes to similar conclusions in the UK policy-making climate, showing how elite sociotechnical imaginaries are perpetuated and public perspectives are not always heard. In this case, the imaginary is driven by national policy actors with the multiple perspectives assembled through the consultation process are not given equal sway.

The government support for electric vehicles additionally contributes to the tensions between actors in support of biofuels and those in support of electric vehicles. One notable example of this is from the biogas industry, which also offers locally sourced renewable fuels for transport and has historically been closely linked to urban public transport. As a representative of the Swedish Gas Association representative explains:

> We think that in the political debate there has been a much too large focus on just electricity because it has come along as a new solution, how cool, so then we talk only about that and focus only on that. But I think that the risk is distinct that we forget about the other alternatives and create worse conditions for them.

This quotation indicates that even if the actors supporting biofuels (including biogas) think that electric vehicles are promising, they feel as though there is some competition for political support. This interaction could be one explanation for the fact that while 19 responses supported electric vehicles and 25 supported biofuels only 8 mention both. Furthermore, the implementation of electric vehicle specific policies is likely to have an impact on manufacturing and there has been a clear trend among both Swedish heavy vehicle manufacturers (Volvo and Scania) to offer more electric models in the years since the FFF has published. When questioned on this, however, representatives from these companies responded that this trend was largely driven by international demand as much as any national imaginary (Interview 4, Volvo representative). Both Volvo and Scania offer non-electric models as well, and as the representative from Scania explained, they view these as catering to customers that intend to use biofuels instead (Interview 2). These insights indicate that while these manufacturers are influenced by the electric vehicle imaginary, this influence is mitigated by expectations that biofuels will also be a key part of the fossil fuel free future.

The interplay between these two alternative fuels shows how imaginaries of the fossil fuel free future remain contested, even if multiple policy initiatives support electrification. Despite the fact that the FFF covers multiple types of renewable fuel vehicles, the scenarios it suggests depict a specific future where electric vehicles become dominant in certain transport sectors (urban buses and personal vehicles) showing biofuels as an interim solution. This suggests that in many cases where biofuels are used, they will eventually be replaced by electric vehicles. In contrast, actors in support of other renewable fuels are likely to support alternative imaginaries where these fuels have a more prominent space in the fossil fuel free future. The coexistence of these alternative visions within the fossil fuel free future are evidence that this imaginary is somewhat contested. Again, this builds on conclusions drawn in previous imaginaries literature, which has identified the complex ways that sustainability imaginaries are negotiated particularly when multiple actors are involved (Trencher & Heijden, 2019). However, even if these actor groups disagree on how to achieve it, they overwhelmingly support the imaginary of the fossil fuel free future. This mirrors the conclusions drawn by Karhunmaa (2018) who notes a similar phenomenon among Finnish politicians who agree on an imaginary of carbon neutrality but not on the pathway for achieving it. Here, I concur with her conclusion that broad sociotechnical imaginaries can encompass multiple methods for achieving their desired future.

6. Conclusions

In Sweden, an imaginary of electric vehicles is taking hold, placing these vehicles at the center of a fossil fuel free future as shown by my analysis of a key policy document and subsequent responses from relevant transport sector actors. This imaginary emerges from the FFF-investigation which emphasizes four aspects of the electric vehicle future: mitigation of climate change, energy efficiency of electric vehicles, improved city environments, and electrification of certain niches. By emphasizing the role of electrification in combating climate change and even identifying measurable reductions, the investigation identifies electric vehicles as an important technology for achieving a future where the climate crisis has been avoided. The investigation also stresses the energy efficiency of electric vehicles as a crucial step for reducing fossil fuel dependence by decreasing the overall energy demand of the transport sector. Finally, the emphasis on electric vehicles as clean and quiet centers the imaginary on urban environments where replacing combustion engines with clean and quiet alternatives can have the greatest impact. This is one part of the specific agenda for electrification that the imaginary presents identifying the initial niches for electrification as urban buses and personal vehicles. This imaginary, as expressed in the FFF-investigation is stabilized in a process of embedding through its adoption by additional actors and inclusion in concrete policy measures. In the FFF-investigation, this process works by spreading a specific desirable transport future where the climate crisis has been avoided thanks to the introduction of renewable fuels and especially electrification. Furthermore, the use of scenarios aligns this imaginary with a specific policy agenda by identifying potential steps for achieving this desirable future which are then reinforced through concrete policy measures.

The analysis shows how Jasanoff's four phases of imaginary development can be applied to improve our understanding of imaginary formation, with a focus on the role of actor enrollment in this process. In this case, despite an extensive consultation process the imaginary presented in the FFF did not change, showing how the power and privilege to participate in imaginary formation is not universally held and reinforcing the idea that certain actors are empowered with a greater say in this process including experts and policy makers (Smallman, 2020; Yang et al., 2018). This case also demonstrates the complex and heterogeneous understandings that exist within contested ideas of the future, as emphasized in previous research (Delina, 2018; Delina & Janetos, 2018). However, this case is somewhat unique because it examines the contestations that arise when multiple alternative technologies compete for space within a wider vision of the fossil fuel free future.

This study indicates how imaginaries can be written into concrete policy initiatives. In this case, the policy support for electric vehicles favors the electrification of certain vehicle types namely urban buses. These policies also closely link the imaginary of electrification to the material realities of electric vehicles by subsidizing both infrastructures and the vehicles themselves. The two policies under consideration, however, provide focused support for municipalities and do not have the capability of inspiring a wider spread transition to electric vehicles. For this to happen, additional incentives are necessary to inspire investment from other actor groups such as in the electric vehicle subsidy in Norway which encouraged many private persons to invest in electric vehicles. While Sweden has also made some strides towards incentivizing electric personal vehicles through a bonus-malus system that cuts taxes and fees for electric vehicles, this has not led to a similar scale of electrification as in the Norwegian case (Regeringskansliet, 2014).

The analysis of this case is unique to Sweden, where electric vehicles can more easily be defined as sustainable thanks to the low-carbon electricity supply. However, there are lessons that can be applied to other national contexts. As described in the introduction, Sweden has set aggressive targets for achieving fossil fuel independence. While the imaginaries that these targets inspire are somewhat nationally bounded, particularly in their embedding in policy, they mirror an imaginary that exists internationally where electric

vehicles can provide a promising tool towards achieving the fossil fuel free future. In the coming years, more countries are likely to follow suit by proving similar targets and policy to encourage renewable fuels.

Funding

This research is funded by the Biogas Research Center at Linköping University and the Swedish Energy Agency.

Declaration of Competing Interest

None.

Acknowledgements

I would like to thank the editors and two anonymous reviewers for their thoughtful comments on earlier versions of this manuscript. This text has also greatly benefitted from feedback from the STRIPE research group at Tema T, Linköping University, Jane Summerton, and Alexandra Kappeller.

References

Ballo, I. F. (2015). Imagining energy futures: Sociotechnical imaginaries of the future smart grid in Norway. *Energy Research & Social Science, 9*, 9–20.

Barker, J. (2015). Guerilla engineers: The internet and the politics of freedom in Indonesia. In S. Jasanoff, & S.-H. Kim (Eds.), *Dreamscapes of modernity - Sociotechnical imaginaries and the fabrication of power* (pp. 199–218). Chicago and London: The University of Chicago Press.

Bergman, N. (2017). Stories of the future: Personal mobility innovation in the United Kingdom. *Energy Research & Social Science, 31*, 184–193. https://doi.org/10.1016/j.erss.2017.06.028.

Borup, M., Brown, N., Konrad, K., & Lente, H. (2006). The sociology of expectations in science and technology. *Technology Analysis & Strategic Management, 18*(3/4), 285–298.

Bowman, W. (2015). Imagining a modern Rwanda: Sociotechnical imaginaries, information technology, and the postgenocide State. In S. Jasanoff, & S.-H. Kim (Eds.), *Dreamscapes of modernity - Sociotechnical imaginaries and the fabrication of power*. Chicago and London: University of Chicago Press.

Bryant, A., & Charmaz, K. (2007). Introduction - Grounded theory research: Methods and practices. In A. Bryan, & K. Charmaz (Eds.), *The SAGE handbook of grounded theory*. London: SAGE Publications.

Delina, L. L. (2018). Whose and what futures? Navigating the contested coproduction of Thailand's energy sociotechnical imaginaries. *Energy Research & Social Science, 35*, 48–56. https://doi.org/10.1016/j.erss.2017.10.045.

Delina, L. L., & Janetos, A. (2018). Cosmopolitan, dynamic, and contested energy futures: Navicating the pluralities and polarities in the energy systems of tomorrow. *Energy Research & Social Science, 35*, 1–10. https://doi.org/10.1016/j.erss.2017.11.031.

Eames, M., McDowall, W., Hodson, M., & Marvin, S. (2006). Negotiating contested visions and Place-specific expectations of the hydrogen economy. *Technology Analysis & Strategic Management, 18*(3/4). https://doi.org/10.1080/09537320600777127.

Eaton, W. M., Gasteyer, S. P., & Busch, L. (2014). Bioenergy futures: Framing sociotechnical imaginaries in local places. *Rural Sociology, 70*(2), 227–256. https://doi.org/10.1111/ruso.12027.

Energimyndigheten. (2015). *Energy in Sweden 2015*. Retrieved from Stockholm:.

European Commission. (2008). *Communication from the Commission to the European Parliament, the Council, the European Economic and social Committee and the Committee of the Regions - 20 20 by2020 - Europe's Climate Change Opportunity* [Press release].

Finansdepartementet (2015). Förordning (2015:579) om stöd för att främja hållbara stadsmiljöer.

Goldman, M., & Persson, T. (2014). *Fossilfrihet på Väg: Sammanställning av remissvaren per aktör A-Ö*. Retrieved from http://2030-sekretariatet.se/wp-content/uploads/2014/06/FFF-Sammanst%C3%A4llning-A-till-%C3%96.pdf.

Jasanoff, Sheila (2004). The idiom of co-production. *States of knowledge: The co-production of science and the social order*. London and New York: Routledge.

Jasanoff, S. (2015a). Future imperfect: Science, technology, and the imaginations of modernity. In S. Jasanoff, & S.-H. Kim (Eds.), *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power*. University of Chicago.

Jasanoff, S. (2015b). Imagined and invented worlds. In S. Jasanoff, & S.-H. Kim (Eds.), *Dreamscapes of modernity: Sociotechnical IMaginaries and the fabrication of power* (pp. 321–341). Chicago: University of Chicago Press.

Jasanoff, S., & Kim, S.-H. (2009). Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and South Korea. *Minerva, 47*, 118–146.

Karhunmaa, K. (2018). Attaining carbon neutrality in Finnish parliamentary and city council debates. *Futures*. https://doi.org/10.1016/j.futures.2018.10.009.

Kuchler, M. (2014). Sweet dreams (are made of cellulose): Sociotechnical imaginaries of second-generation bioenergy in the global debate. *Ecological Economics, 107*, 431–437. https://doi.org/10.1016/j.ecolecon.2014.09.014.

Kuchler, M., & Bridge, G. (2018). Down the black hole: Sustaining national socio-technical imaginaries of coal in Poland. *Energy Research & Social Science, 41*, 136–147. https://doi.org/10.1016/j.erss.2018.04.014.

Lunde, M., Ropke, I., & Heiskanen, E. (2016). Smart grid: Hope or hype? *Energy Efficiency, 9*, 545–562.

Magnusson, T., & Berggren, C. (2017). Competing innovation systems and the need for redeployment in sustainability transitions. *Technological Forecasting & Social Change, 126*, 217–230. https://doi.org/10.1016/j.techfore.2017.08.014.

McKee, A. (2003). *Textual analysis: A beginner's Guide*. London: SAGE Publications Ltd.

McNeil, M., Arribas-Ayllon, M., Haran, J., Mackenzie, A., & Tutton, R. (2017). Conceptualizing imaginaries of science, technology, and society. In U. Felt, R. Fouché, C. A. Miller, & L. Smith-Doerr (Eds.), *The handbook of science and technology studies* (fourth edition). Cambridge, MA: The MIT Press.

Miljödepartementet (2016). Förordning (2016:836) om elbusspremie.

Moon, S. (2015). Building from the outside in: Sociotechnical imaginaries and civil society in New order Indonesia. In S. Jasanoff, & S.-H. Kim (Eds.), *Dreamscapes of modernity - sociotechnical imaginaries and the fabrication of power*. Chicago and London: The University of Chicago Press.

Näringsdepartementet. (2012). *Kommittédirektiv: Fossiloberoende fordonsflotta - ett steg på vägen mot nettonollutsläpp av växthusgaser* (Dir. 2012:78). Stockholm.

Östersunds Kommun. (2018). *Elbussar*. Retrieved from https://www.ostersund.se/trafik-och-infrastruktur/kollektivtrafik/elbussar.html.

Regerings proposition 2008/09:162 En sammanhållen klimat- och energipolitik - Klimat, (2009).

Regeringskansliet. (2013). *Fossilfrihet på väg: Utredning om fossilfri fordonstrafik SOU*. Retrieved from. Stockholm: Fritzes Offentliga Publikationer.

Regeringskansliet. (2014). *Lag (2014:1502) om ändring i vägtrafikskattelagen (2006:227)*.

Ryghaug, M., & Toftaker, M. (2016). Creating transitions to electric road transport in Norway: The role of user imaginaries. *Energy Research & Social Science, 17*, 119–126. https://doi.org/10.1016/j.erss.04.017.

Smallman, M. (2020). 'Nothing to do with the science': How an elite sociotechnical imaginary cements policy resistance to public perspectives on science and technology through the machinery of government. *Social Studies of Science, 50*(4), 589–608. https://doi.org/10.1177/0306312719879768.

Smith, J. M., & Tidwell, A. S. (2016). The everyday lives of energy transitions: Contested sociotechnical imaginaries in the American West. *Social Studies of Science, 46* (3), 327–350. https://doi.org/10.1177/0306312716644534.

Sovacool, B. J., Kester, J., Noel, L., & Rubens, G. Z. (2019). Contested visions and sociotechnical expectations of electric mobility and vehicle-to-grid innovation in five Nordic countries. *Environmental Innovation and Societal Transitions*. https://doi.org/10.1016/j.eist.2018.11.006.

Storey, W. K. (2015). Cecil rhodes and the making of a sociotechnical imaginary for South Africa. In S. Jasanoff, & S.-H. Kim (Eds.), *Dreamscapes of modernity : Sociotechnical imaginaries and the fabrication of power* (pp. 34–55). Chicago and London: The University of Chicago Press.

Sveriges Riksdags Trafikutskottet. (2018). *Fossilfria drivmedel för att minska transportsektorns klimatpåverkan - flytande, gasformiga och elektriska drivmedel inom vägtrafik, sjöfart, luftfart och spåbunden trafik*. Retrieved from Stockholm:.

Swedish Energy Agency. (2020).). *Energy in Sweden 2020 - An overview*. Retrieved from Eskilstuna:.

Swedish Energy Agency, National Board of Housing, B. a. P, Swedish Environmental Protection Agency, Transport Analysis, Swedish Transport Administration, & Agency, T. S. T. (2017). *Strategisk plan för omställning av transportsektorn till fossilfrihet*. Retrieved from.

Trafikverket. (2019). *Ansök om bidrag för hållbara stadsmiljöer - stadsmiljöavtal*. Retrieved from https://www.trafikverket.se/tjanster/ansok-om/ansok-om-bidrag/statligt-stod-for-hallbara-stadsmiljoer—stadsmiljoavtal/.

Trencher, G., & Heijden, J. (2019). Contradictory but also complementary: National and local imaginaries in Japan and Fukushima around transitions to hydrogen and renewables. *Energy Research & Social Science, 49*, 209–218. https://doi.org/10.1016/j.erss.2018.10.019.

Wentland, A. (2016). Imagining and enacting the future of the German energy transition: Electric vehicles as grid infrastructure. *The European Journal of Social Science Research, 29*(3), 285–302. https://doi.org/10.1080/13511610.2016.1159946.

Xylia, M., & Silveira, S. (2017). On the road to fossil-free public transport: The case of Swedish bus fleets. *Energy Policy, 100*, 397–412. https://doi.org/10.1016/j.enpol.2016.02.024.

Yang, C.-Y., Szerszynski, B., & Wynne, B. (2018). The making of power shortage: The sociotechnical imaginary of nationalist High modernism and its pragmatic rationality in electricity planning in Taiwan. *East Asian Science, Technology and Society: An International Journal, 12*, 277–308. https://doi.org/10.1215/18752160-4386762.