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Transforming socio-technical configurations through creative destruction: Local policy, electric vehicle diffusion, and city governance in Norway

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ABSTRACT

Transforming mobility systems in sustainable directions will likely rely on several niche-innovations outperforming incumbent regimes that support non-sustainable ways of upholding personal mobility. One prominent driver in these developments is policy, which through creative destruction could serve to destabilise regimes surrounding internal combustion engine vehicles (ICEVs) while also promoting regimes surrounding battery-electric vehicles (EVs). The diffusion of EVs receive substantial attention in policymaking and research, and EV policies are studied extensively in a range of scholarly disciplines. Most studies, however, tend to focus on the role of national-level policy. In contrast, this study explores how local policy can promote the diffusion of EVs. Specifically, we discuss how creative and destructive elements of local policy in two Norwegian cities might have enhanced the relative advantage of EVs through shaping socio-technical configurations that surround the EV niche and the ICEV regime. We find that local policy can enhance the relative advantage of EVs in many ways, especially through shaping infrastructure, user practices, and normative rules. The latter could in particular take research on EV diffusion further, by increasing our understanding of the controversy of EVs even in markets with high diffusion.

1. Introduction

Policy is widely recognised as a potential driver in socio-technical transition [1–3], as "replac[ing] existing systems without changes in economic frame conditions (e.g., taxes, subsidies, regulatory frameworks)" is unlikely [4:25]. Defining effective policy mixes that drive transitions forward is thus a focal point of transition scholars [e.g. 2,5–9], as they might protect and nurture emerging niche-technologies while also destabilising established (unsustainable) technologies. This is what Kivimaa and Kern [10] have labelled *creative destruction* [1–3].

The role of policy has also been prominent in studies addressing sustainability transitions in mobility systems [e.g. 11,12–14]. Globally, the transport sector accounts for around 24 percent of greenhouse gas emissions [15]. In urban areas, mobility is also a main contributor to air pollution, energy consumption and negative environmental impacts. Concerns about the climate crisis, coupled with increasing urbanisation, call for transitioning mobility regimes towards low-carbon systems [16], leading policy and research to centre their attention on the adoption of electric vehicles (EVs) [17]. EV is a broad term that among other includes electric trucks, vans and passenger cars. In this article, EV denotes battery electric passenger cars.

To encourage transitions towards electric mobility, a range of policies that target development and use of EVs has therefore been introduced [18,19]. EV policy has received substantial interest among scholars of sustainability transitions and EV diffusion [13,14,19–21]. As a pioneer in EV diffusion, with 54 % of new car sales in 2020 [22], scholars have also paid particular attention to Norwegian EV markets. Giving a thorough review of policies that supported EV diffusion in Norway, Figenbaum [17] studied how political frameworks, stakeholder activities and international developments collectively produced circumstances from which diffusion of EVs could effectively grow. Skjølsvold and Ryghaug [12] have illustrated how EV visions and policies evolved over decades, while other studies have provided contemporary checks on the significance of Norwegian EV policy for EV diffusion [e.g. 23,24,25].

Despite significant research on how policy can progress diffusion of EVs, in Norway and elsewhere, studies tend to focus on the role of national-level regulations. Although Norwegian national policies have been a major contributor to the diffusion of EVs, policies are particularly successful when they are tailored to local conditions [26]. Some policies,

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such as exemption from registration fee and VAT, and reduced annual vehicle licence fee, are set nationally, and impact all EV purchases equally. Other policies, such as access to bus lanes, and discounts on road tolls, ferry tickets and parking fees, are anchored in national legislation, but specified and enacted locally. As such, these policies might differ from one city to another. Fig. 1 illustrates annual sales of new EVs per 100,000 population in selected Norwegian cities. Though sales have been generally increasing in all cities, the figure shows how the pace and timing of EV diffusion has differed between regions.

This underscores the significant role also played by local policy and that tending to local policies could provide a more complete and nuanced understanding of policy. Research shows that the impact of policies for EV diffusion differs between regions, due to local and regional variation in traffic conditions, travel patterns, and consumer preferences [21]. However, despite being recognised as prominent drivers in EV diffusion, differences in local policies have not received substantial interest from transition scholars. To fill this void, this study seeks to understand how local policy might contribute to EV diffusion. Recalibrating towards local policy is particularly acute because of the increasing political controversy around local EV policies in Norway, which we will see might bring strong normative connotations and symbolic value into policymaking.

More specifically, we rely on Kivimaa and Kern's [10] idea of creative destruction to analyse how local policy can both strengthen the EV niche and destabilise internal combustion engine (ICEV) regime. We further discuss policies with regard to their possible impact on socio-technical configurations surrounding the ICEV regime and the EV niche, which we understand as collections of socio-technical elements that might support incumbent as well as emergent technologies. The purpose of this paper is therefore to *explore how creative and destructive dimensions of local policy might shape socio-technical configurations surrounding incumbent and emergent technologies, thereby influencing local technology diffusion*.

We analyse local policies that emerged during two specific periods in time when diffusion of EVs increased dramatically in Norway's two largest cities, Oslo and Bergen. We consider such analyses pressing because of increasing controversy and public debate on whether EV policies are still needed. However, we do not aim for a cause-and-effect study that determines whether policy changes are followed by technology diffusion. As energy transitions are complex and irreducible to a single cause [28], demonstrating such causality would require far more detailed and time sensitive data on the many different diffusion drivers relevant to these cases. Rather, we seek to add to our understanding of policy drivers by qualitatively exploring policy changes that emerge in periods with particularly strong diffusion.

The remainder of this paper is structured as follows. Section 2 establishes our understanding of the core concepts applied in this study, and presents existing research on the role of policy in technology

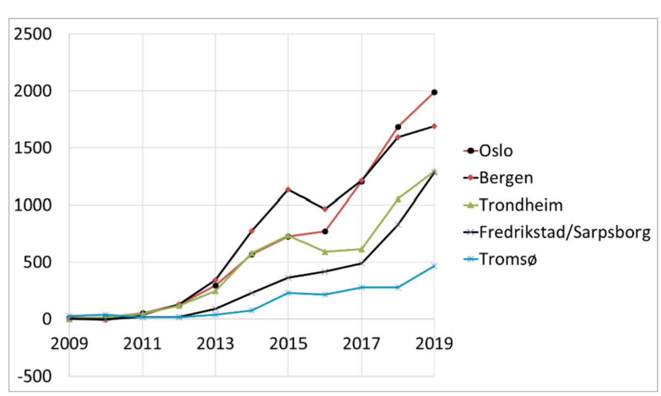

Fig. 1. Annual sales of new EVs per 100,000 population in selected cities in Norway in 2009–2019 [27].

diffusion, with particular emphasis on creative destruction and EV policies. Section 3 accounts for case selection, methods, and data, while Section 4 briefly presents the empirical outset. Then, Section 5 analyses and discusses creative and destructive dimensions in local policies, and how these could contribute to strengthen the EV niche and/or destabilise the ICEV regime through influencing elements in their respective socio-technical configurations. Finally, Section 6 presents our concluding comments.

2. Core concepts and existing knowledge

2.1. Regimes, niches, and socio-technical configurations

Different strands of transition studies take different approaches to understand how socio-technical transformations move societies in more sustainable directions. By referring to regimes and niches, this study lends ear to core concepts in the Multi-level Perspective (MLP), which is prominently placed in transition literature. The MLP was originally introduced and theorised through the works of Geels [29–31], and has later been criticised, revised, and expanded through a substantial amount of publications [e.g. 4,32–34]. The core component in the MLP framework is the *regime* concept, which refers to a set of semi-coherent normative, regulative and cognitive rules that uphold certain ways of maintaining societal functions, by guiding actor behaviours and perceptions [4:27]. The societal function under study in this paper is personal mobility, which serves to enable social, cultural, political, and economic activities [35]. Currently, the technology still most associated with upholding personal mobility is internal combustion engine vehicles (ICEVs), which are a major cause of greenhouse gas emissions. Within the European Union, transport is responsible for 30 % of CO_2 emissions, while cars alone are responsible for 13 % of emissions [36]. Following the MLP, ICEVs continue to uphold the societal function of personal mobility so long they are supported by the rules that constitute socio-technical regimes and sub-regimes related to for instance policy, markets, science, and technology.

According to the MLP, technologies that uphold societal functions in a more sustainable manner gain traction when rule-sets (i.e. regimes) surrounding emerging technologies become predominant guides for actor behaviour and perceptions [4:28]. Thus, ICEVs come under pressure when facing competition from alternative solutions for upholding personal mobility, referred to by the MLP as *niche-innovations,* which are nurtured and protected from market competition [37]. When introducing the MLP to the transport domain, Geels [11] describes a range of niche developments that could eventually challenge the incumbent ICEV regime, whereof one is the emergence of green propulsion technologies such as EVs.

To understand the role of local policy in transitions, we have in this study set out to explore how local policy might strengthen the EV niche or destabilise the ICEV regime. Although the regime and niche concepts are heavily associated with the MLP, we will not rely explicitly on the MLP as an analytical tool in this study. Rather, we discuss the EV niche and ICEV regime by reference to the socio-technical configurations surrounding them. As elaborated below, we do so because we sought an analytic approach that could be applied to regimes as well as niches, and to bypass challenges with empirically operationalising the regime concept.

In providing an analytic for studying "shifts from one socio-technical system to another and the co-evolution of technology and society", Geels [29:897] understands shifts to come about through interaction between three analytic dimensions: rules, actors and socio-technical systems. As noted above, normative, regulative, and cognitive (regime) rules contribute to guide the perceptions and interactions of actors, who in turn contribute to carry and (re)produce these rules. The involvement of actors, and the rules that guide them, are also shaped by socio-technical systems, which in road transport are typically comprised of regulation and policies, maintenance and distribution networks, production systems, industry structure, road infrastructure, traffic systems, fuel infrastructure, market, user practices, culture, and symbolic meaning [30:446]. Thus, upholding personal mobility is conditioned by how rules and the many aspects of socio-technical systems engage with actors, and with each other.

However, a challenge in transition studies has been to empirically operationalise these concepts. The MLP has been criticised for inadequately conceptualising regimes and for blurred, theoretical distinctions between socio-technical regimes and socio-technical systems [4,34,38]. We also perceive of another challenge in the MLP universe, pertaining to potential confusion surrounding the regime concept. Regimes could be understood as "semi-coherent sets of rules, which are linked together" [29:904]. In this sense, *regime* refers to the deep structure and grammar that uphold particular ways of maintaining for instance personal mobility. However, in the transition literature, *regime* also typically denotes the wider status-quo, i.e. existing ways of upholding societal functions, that face competition from emerging niche innovations. These inconsistencies in the use of the regime concept are also pointed to be Smith et al [34:441]. They argue that tensions between institutional and material interpretations of the regime concept implies that it sometimes refers to the simple rules and institutions which guide developments, and while other times referring to a broader analytical approach which includes guiding principles, technologies and infrastructure, industrial structure, user relations and markets, policy and regulations, knowledge bases, and culture.

In our study, one particular challenge deriving from the regime concept referring to rule-sets as well as the wider status-quo, is that rule-sets also guide behaviours and actions in niches. The three analytic dimensions that Geels suggest to rely on, "also apply to niches" [29:912], and working to specify rules is cardinal to increase the competitiveness of niche-innovations. Although rules in niches are less articulated and might overlap with rules supporting the status quo, they might also deviate from rules on the regime level, suggesting that niches could be connected to rules of their own.

This implies a muddy distinction between regimes understood as the dominant way of upholding societal function (e.g. the ICEV regime upholding personal mobility), and regimes understood as rule-sets that could support incumbent technologies as well as emergent niche-technologies. In conducting this study, where the ICEV regime is juxtaposed with the EV niche, we saw a need for bypassing this conceptual confusion around regimes (and subsequent challenges with empirical operationalisation), and we sought a terminology that allowed us to study the mass of socio-technical influences that might impact the strength and position of regimes (i.e. incumbent technologies) as well as competing niches (i.e. emergent technologies). Thus, we have in this study explored the role of policy with reference to potential impacts on socio-technical configurations.

The term socio-technical configuration has previously been used to denote both the socio-technical system [39,40] as well as regimes [34], so we consider configuration to explicitly encompass the mass and width of socio-technical elements that might influence the strength and position of (incumbent and emergent) technologies. In an early study, Geels [39:1257–1258] interprets socio-technical configurations as the alignment of different heterogeneous elements that fulfil a particular function, and refer to the same elements as those pertaining to socio-technical systems. Similarly, Smith et al [34:440] talk about socio-technical configurations as "the stable and dominant way of realising a particular societal function". These studies, and a scan among selected dictionary definitions [41–43], encourage us to apply the following definition of socio-technical configurations:

"A socio-technical configuration refers to the arrangement of socio-technical elements that condition the maintaining of societal functions".

According to Geels [39:1258], transforming socio-technical configurations is challenging "because the elements in a sociotechnical configuration are linked and aligned to each other". By tending to local policy, this study therefore also delves into how changes in one particular element might produce changes in others, thereby impact the whole configuration's ability to maintain societal function. Moreover, under the above definition, we assume that the strength and position of incumbent and emergent technologies derive from the same sets of socio-technical influences. Based on the many discussions in theoretical and empirical studies in the transition literature, Fig. 2 presents a selection of socio-technical elements that we consider prominent. In this study, we thus assume that the ability of both ICEVs and EVs to uphold personal mobility depend on the support provided by the range of socio-technical elements listed. We also assume that a transition from ICEV-based personal mobility to EV-based personal mobility depends on reducing the support provided by socio-technical elements surrounding ICEVs, while increasing the support provided by socio-technical elements surrounding EVs. In the following, we will revisit the role of policy in ushering such changes in relative advantage.

2.2. Relative advantage through creative destruction

Policy might impact socio-technical transition by promoting the diffusion of low-carbon technologies. The Diffusion of Innovation Theory, originally developed by Everett M. Rogers [44], explains how diffusions spread in a social system and describes different traits of innovations that encourage their diffusion. One prominent trait is relative advantage, which refers to the degree to which an innovation is perceived as superior to the idea it supersedes. In our case, this implies the degree to which EVs are perceived as superior to ICEVs. Relative advantage often relates to economic profitability [44:229], and economic advantages of EVs compared to ICEVs are a major component of policies for EV diffusion. The need for introducing policy instruments to promote EV diffusion is above all rooted in cost disadvantages of EVs, as well as their limited driving range and relatively long charging times [45]. While driving range and charging time can improve through technological progress, cost disadvantages can be effectively mitigated by policy. Alternatively, cost disadvantages of could be reduced through disincentives, i.e. policy interventions that make ICEV ownership less attractive [21]. As we will see, however, local policies that promote the relative advantage of EVs also go beyond economic factors.

In studying how local policy might drive diffusion of EVs, this study relies on the work of Kivimaa and Kern [10], revolving around the ability of policy to foster creative destruction. Originally a Schumpeterian notion [46], creative destruction captures the potential of policy to simultaneously impact incumbent regimes (e.g. ICEV) as well as emerging niche innovations (e.g. EV). For instance, policy is equipped to

Fig. 2. Configuration of socio-technical elements surrounding ways of maintaining societal functions [29–31,38,39].

deal with a range of market, structural and transformational failures that sustain regime stability [47]. As such, policy is essential to intervene with the inertia and lock-in of prevailing sociotechnical systems [48:964]. Further, policy could strengthen the push of emerging niche innovations in providing resources to groups that impact the pace and direction of transition, and steer investment rationales [49]. Recognising this, Kivimaa and Kern [10] argue that policy can have creative dimensions that provide support for niches, and destructive dimensions that destabilise regimes. They further suggest that "policy mixes that cover both dimensions (…) are more likely to achieve transitions" [10:214], but emphasise that delivering both dimensions might be politically difficult. When applying creative destruction, we will therefore discuss how creative and destructive dimensions of local policy might enhance the relative advantage of EVs, and will, when relevant, explicitly address potential inhibitors represented by political controversy.

In previous research, creative destruction has been commonly used to investigate emerging innovations [50,51] and to analyse energy policies [52–54]. For instance, Burke and Stephens [52] studied socio-technical transition in the US energy sector, relating creative destruction to 'energy democracy', which provides goals and policy instruments for resisting the dominant energy regime and reclaiming a democratically restructured energy sector. They emphasised the need for applying a *combination* of policies to advance energy democracy. Creative destruction is less prominent in transport studies, and particularly studies on EVs. One exception is Dyerson and Pilkington [55], who studied electric vehicles in California, emphasising the states' profound effect on technological development in particular industries. Further, Ćetković and Skjærseth [56] described the development of electric vehicles in Norway, but without providing in-depth analysis of policy.

2.3. Policy for EV diffusion

In contrast to the limited application of creative destruction to transport studies, electric vehicles (EVs) have received substantial attention in business and research alike, and are gaining momentum in many markets of developed economies. In Norway, EVs have surpassed ICEVs when it comes to new car sales [22]. One prominent driver in the rise of the Norwegian EV niche has been strong and durable policies [21]. In an early study, Geels [11] argued that public climate concerns and public policy for "greening cars" and innovation in the car industry were main drivers in transitioning transport systems. More recently, Docherty et al. [13] have suggested that successful governance approaches to mobility rely on public policy to provide direction, reduce externalities, coordinate and balance policy goals. A range of policies could be implemented to promote EV diffusion [see 57 for useful overview]. Policy instruments might be in form of one-time financial incentives associated with the purchase of EVs, or use-based policy instruments, such as parking incentives, access to bus lanes, access to effective charging infrastructure, road toll fee waivers, and licensing incentives [21,58].

Many studies investigate policy instruments that promote diffusion of EVs in Norway, utilising different research methods including surveys [23,59], statistical analysis [60], case studies [25] and modelling techniques [24]. Findings show that toll exemption, free parking, and access to charging infrastructure, are most effective in promoting EV diffusion, although the causality between EV adoption and charging infrastructure is debated [21]. Further, the effectiveness of access to bus lanes are found to be relatively low in some studies [24,59].

The impacts of policy instruments on EV diffusion have also been studied by transition scholars [61–66]. For instance, in reviewing the full history of EVs in Norway, Skjølsvold and Ryghaug [12] argue that EV policy has become an "institutionalised element", in which policies supported the transition to e-mobility long after implementation. Figenbaum [17] further suggests that Norwegian EV incentives were successful because they were national and included in permanent regulation.

Common to most research on EV diffusion, is its emphasis on national-level regulations and neglect of local enactments. The fact that recursive incentives in Norway are mainly defined at the local level raises the need to thoroughly study the local outset in more detail than has previously been done. In the following, we describe how we set out to explore creative and destructive dimensions of local policies in periods with high technology diffusion.

3. Methods

3.1. Case selection

Our study rests on case studies of two Norwegian cities. Case studies are particularly suited for investigating contemporary phenomena in-depth [67], and allow the researcher to understand a phenomenon's contextual premises [68]. To explore how creative and destructive dimensions of local policy might shape socio-technical configurations, we have identified two periods with particularly high EV diffusion in the Norwegian cities of Oslo and Bergen. Fig. 3 illustrates how annual sales of new private EVs per 100,000 population have evolved in the two cities from 2009 to 2019.

As observed from the Figure, the EV diffusion rates in the cities have similar evolution patterns until 2012. From 2012 to 2015, the EV penetration rate in Bergen increased dramatically, from almost 130 EV per 100,000 residents to over 1,100 EVs. The diffusion rate in Oslo accelerated after 2015, from almost 725 EVs per 100,000 residents to nearly 2000 EV. Thus, to explore creative destruction in local policy, we studied local policy in the City of Bergen in the period 2012 to 2015, during which EV diffusion increased more than 750 percent, and the City of Oslo in the period 2015 to 2019, during which the EV diffusion rate increased by 175 percent. We consider it useful to focus on particularly steep diffusion curves, as this allows us to identify potential success factors in technology diffusion.

3.2. Document studies

In studying the two cases, we have relied on document analysis. According to Bowen [69], document analysis is "a systematic procedure for reviewing or evaluating documents", especially applicable to qualitative case studies. Among other, document studies serve to track change and development, which in this study entails policy developments. Document analysis is also suited for investigating phenomena that exist in documents, thereby studying them "in situ" [70]. In this study, this implied studying documents representing "a field of EV policies" from which we identified dimensions that might transform socio-technical configurations.

The purpose of the document analysis was therefore to identify,

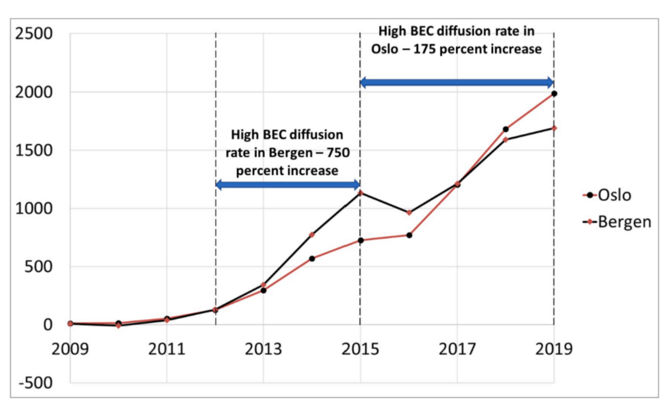

Fig. 3. Annual sales of new private EVs per 100,000 population in Oslo and Bergen [27].

describe and analyse policies that emerged in the two cities during these specific periods of time. To identify relevant documents we relied on an approach similar to Berg's (2001) method for literature reviews: searches should emerge from general topics related to the research question, before continuing with more specific searches when the researcher has gained more insight into relevant topics and issues [71:19–21].

First, documents were found through Google's search engine, in which a variety of searches were conducted related to the study's overall research question, see Table 1 for overview of search words. Here, we particularly searched for governmental and municipal documents such as Propositions to the Storting, white papers or documents and reports from the cities of Oslo and Bergen. After familiarising with these documents and their content, we conducted more targeted searches on topics and issues, such as EVs' exemption from toll fees or EVs' access to bus lanes. Eventually, searches also continued in governmental and municipal databases, on web pages of toll collectors in the two cities, as well as the Norwegian EV Association. Searches also included academic or professional reports and articles, as well as media features and news articles. The search process was iterative but followed a logical order. For instance, many of the governmental or municipal reports led us to discover other documents, producing a snowballing search process.

A total of 24 documents were analysed. In Fig. 4, we present an overview of the material obtained and analysed in this study. The categories are operationalised based on document type and what information they presented. The category "local policy documents" is most prominent in the analysis material, and contains reported effects of policy, municipal strategies, and information from municipal webpages. The second most common document type analysed is "national policy documents", which contain drafts resolutions to the Norwegian Storting. While "research documents" refer to reports and other representation of research material, "Media documents" refer to online news articles from national broadcasters. "Webpages" are online communication articles or articles from encyclopaedia, while "press releases" contains press releases from firms or public organisations. The category "Regulation" contains material from Norwegian legislation.

In analysing the documents, we relied on content analysis as described by Bowen [69:32], referring to the identification of meaningful and relevant passages of text throughout the documents. Each document was analysed by skimming the summary and introduction, which allowed us to examine if the document covered topics relevant to the study. If so, we carefully read the rest of the document to identify and investigate sections that were particularly important, such as the specific policies, their introduction, and their impacts on EV use and adoption. Relevant findings from the document analysis were documented and systematically collected to provide an overview of relevant policies in each of the cases.

As our document study mainly focused on formal and official documents, it was not equipped to capture controversies and discussions associated with the different policies, which is one reason we also included media and news features. This also speaks to how documents are themselves situated, i.e. products of the contexts in which they exist [72]. Further, document studies leave little room for informal, personal deliberations about the policies we have studied, which inclined us to consult studies on Norwegian EV users, which confirmed the

Table 1
Examples of search words used in data collection (translated from Norwegian).

General search words	Targeted search words
EV + history	Oslo/Bergen + EV + policy
National transport plan	Oslo/Bergen + EV + benefits
National transport plan + EV	Oslo/Bergen + toll roads
Norwegian + EV + policy	Oslo/Bergen + EV + free parking
	Oslo/Bergen + EV + charging points
	Oslo/Bergen + expansion + bus lane
	Oslo/Bergen + poor air quality

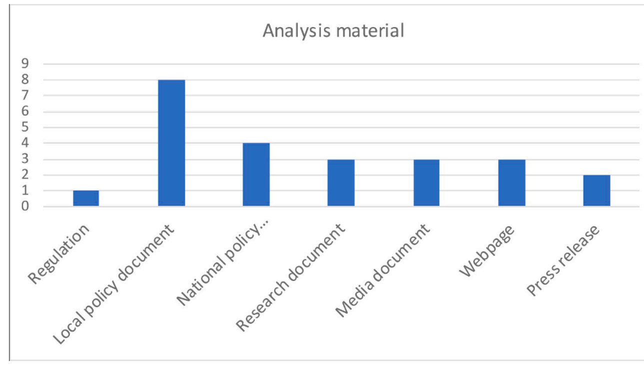

Fig. 4. A graphic presentation of the material analysed in this study.

decisiveness of local policy in technology adoption decision making [e.g. 23]. Although the identification and selection of documents did follow a pre-defined procedure rooted in previous research [69,70,72], any interpretation and qualitative analysis on the side of the researcher represent potentially constitutive aspects of the research process. As knowledge itself is a product of interaction [73], our analytical work could in itself reflect we' relationship with the documents. We do believe, however, that this was less a challenge in this study. Although some documents also provided motivations and intentions behind policies (in which case one should obviously reflect upon the selectiveness and balance of the documents, cfr. [69:33]), our study mainly served to retrieve policy descriptions.

3.3. Statistical data

In addition to document analysis, our examination of policy developments relied on national databases. Statistics on the annual number of registered private cars were collected from Statistics Norway (SSB) and the Information Council for Road Traffic (OFV). Further, the Norwegian National Road Databank (NVDB) was used to extract data on the length of public transport lanes along roads in Oslo and Bergen. To investigate expansions in charging infrastructure we also relied on publicly available datasets from Nobil [74], which collects and disseminates information about charging stations for plug-in vehicles.

4. Empirical outset

Although all Norwegian EV-related policies are legislated in the national parliament, many also allow local authorities to specify and enact the policies in their own ways. Table 2 briefly summarises national policies in Norway and whether they allow local variations. The policies that represent the largest economic benefits and that target EV ownership, such as reduced annual fee and exemptions from VAT and registration taxes, are all bound by national regulation and apply to all EV buyers and owners equally. In contrast, policies that mainly target EV use, such as bus lane access and discounts on toll roads, ferries, and parking, are often subject to extensive local tailoring.

4.1. Local policies in Bergen 2012–2015

Located in western Norway, Bergen is the second largest city in the country with a population of 283,929 [per January 2020, 84] and a population density of 638 persons per km^2 [85]. According to the National Travel Behaviour Survey in 2019, Bergen has the highest rate of EV ownership in Norway, as among 76 percent of respondents who have access to at least one car in their household, 24 percent have stated that their household owns an EV [86]. The main travel mode for daily trips in the city is car. In total, 46 percent of the population use car to go to work, either as driver or passenger, 29 percent use public transport, 14 percent walk to their workplace destinations, and the rest use bicycles or other

Table 2
Overview of national and local policies.

Policy	National regulation	Local enactment
VAT exemption	All EVs are exempted from VAT since 2001 [17]	No local adjustment. The cost accounts to 25 percent of the vehicle price.
Registration tax exemption	All EVs are exempted from registration tax since 1990 [17]	No local adjustment. The cost is dependent on vehicle's tax group, kerb weight, emission level and cylinder capacity [75]. As an example, the cost for fossil-fuelled Toyota Yaris might account more than 40 percent of the vehicle price.
Reduced/No annual vehicle licence tax	All EVs pay the lowest rate since 1996/2004 [17,23]	No local adjustment. The annual cost is around 300€ for conventional cars. Until 2018, EVs paid around 50€. From 2018 to 2021, EVs were exempted. From mars 2021, they need to pay around 200€ annually.
Discount on toll roads	Introduced in 1997 [17], all EVs were exempted from toll road on national. Since 2016, local authorities can enforce up to 50 percent of full tariffs for EVs [76].	There are significant local variations, from 50 percent of full price to still free driving. Since 2019, EVs must pay around 40 percent of full price in Oslo centre (2.5€ for each passing) per June 2021 [77] and 20 percent of full price in Bergen centre (4.5€ for each passing) per June 2021 [78].
Discount on parking fees	Introduced in 1999 [17], all EVs could access free parking on national level. Since 2016, local authorities can enforce up to 50 percent of full tariffs for EVs [76].	Discounts vary across different municipalities and across different parts within a municipality. In Oslo centre, EVs pay 17 percent of full price (7.5 € for one hour parking) per June 2021 [79], while in Bergen centre, they pay 50 percent of full price (3 € for one hour parking) per June 2021 [80].
Discount on ferry tickets	Introduced in 2009 [17], all EVs could embark ferries without paying the ticket fee on national level. Since 2016, operators can require to 50 percent of full tariffs for EVs [76].	Little local adjustments, EVs pay 50 percent of full price on all national and county roads.
Bus lane access	In 2003 bus lane access was introduced as a pilot incentive for EVs, and in 2005 it was made a permanent national policy. [81:23].	Local authorities can limit EVs access to bus lanes by putting extra requirements, such as carpooling to allow private cars using the bus lane. The Norwegian EV association advises EV drivers check the local regulations due to high variations [82]. Since 2021, it is not allowed to drive in bus lanes within Ring 2 Oslo without having at least one passenger in the car in addition to the driver [83].

forms of transport [86]. According to data from Statistics Norway [85], there are 39,784 commuters to Bergen, and 18,415 commuters from Bergen to other neighbouring municipalities, suggesting that policies in Bergen can also impact residents outside the city.

When reviewing the local policies affecting EV diffusion in Bergen in periods 2012–2015, we observed that the main changes during this period were significant rises in road toll tariffs and improving public transport infrastructure such as bus lanes (see Fig. 5). These policies might not aim at EV diffusion directly, but since EVs were exempted from road tolls and given access to bus lanes, the changes could

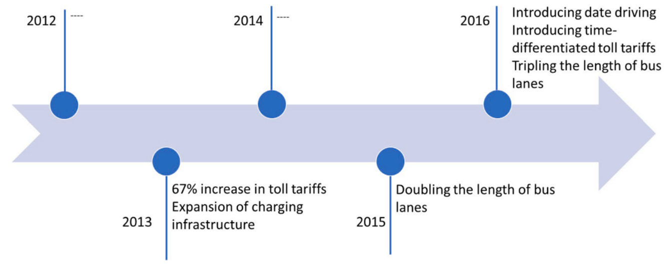

Fig. 5. Simplified timeline for policies in Bergen in period 2012–2015.

potentially benefit EV diffusion in this city. Note that we have included year 2016 in Fig. 5 even though it is not part of our analysis period. The reason is that discussions, debates and decisions surrounding these policies occurred in the years before, i.e. within our analysis period.

A central component in general transport policy in Bergen is the Bergen Programme, and later the Bergen Package. The Bergen Programme was approved by the national government in 2002 [87], after being initiated by the City of Bergen, the Norwegian Public Roads Administration [88], and the county administration [89].

The purpose of the Bergen Program was to abate the city's problems with noise, pollution and environmental damages resulting from traffic. Therefore, the programme sought to curb traffic growth through increasing the use of public transport and through making it attractive for the residents of Bergen to walk and cycle in their daily lives, for example by developing a road map for pedestrians and bicyclists [87,89]. In setting ambitious goals related to this, the national government co-funded investments in transportation and urban development, which provided the city with funding for many important measures.

4.2. Local policies in Oslo in 2015–2019

Oslo, the capital of Norway, is the country's largest city, with a population of 693 494 and a population density of 1628 persons per km^2 [per January 2020, 90]. Oslo has the second highest rate of EV ownership, with 20 percent owning a EV in their households of those who have at least one car in the household (63 percent) [86]. In contrast to Bergen, the car is not a predominant mode of transportation in Oslo. Only 25 percent of travellers in Oslo use car to go to work (either as driver or passenger), while 49 percent use public transport and 15 percent walk to their workplaces. The rest use bicycles and other modes of transport [86]. According to Statistics Norway [90], there are 181,958 commuters to Oslo, and 66,355 commuters from Oslo to neighbouring municipalities, also indicating that EV policies not only impact Oslo residents.

Reviewing the policies in the city of Oslo in periods 2015–2019 reveals several changes in policy and city politics. As illustrated in Fig. 6, charging infrastructure for EVs was significantly improved, bus and taxi with EV access were expanded, and disincentives for use of ICEVs in the form of additional toll stations and increased toll tariffs for ICEVs were launched.

As in Bergen, transport policies in Oslo have revolved around large

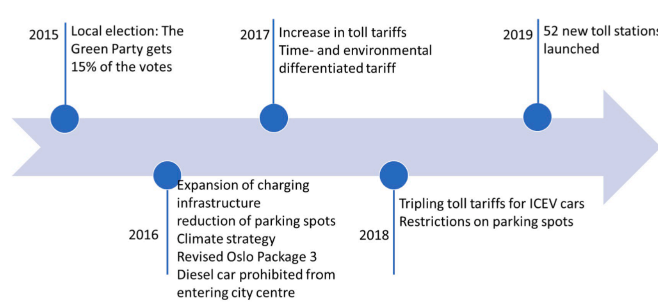

Fig. 6. Simplified timeline for policies in Oslo in 2015–2019.

investment programmes co-funded by the city and the national government, in Oslo named "Oslo packages" [91]. The first Oslo Package, established in 1990, aimed to relieve the city centre and residential areas from traffic noise and pollution, mainly through building an efficient road network financed by road tolls. In the second Oslo Package (2002) the city increased its efforts to strengthen the attractiveness of public transport. Currently, main transport policies are anchored in Oslo Package 3, running from 2008 to 2027. Its main goal has been to develop an efficient, environmentally friendly, safe, and accessible transportation system in the capital region. It also aims to improve accessibility for all traffic groups, prioritising public and commercial traffic, cyclists and pedestrians [92].

5. Creative and destructive dimensions in local policy

The purpose of this paper is to explore how creative and destructive dimensions of local policy might shape socio-technical elements surrounding incumbent and emergent technologies, thereby influencing local technology diffusion. This allows to better understand how local policy can contribute to create a relative advantage for an emergent niche (i.e. EVs) at the expense of the prevailing regime (i.e. ICEVs). In the following, we will present local policies that we in line with Kivimaa and Kern [10] consider to hold creative and destructive dimensions, and discuss how these could contribute to shape socio-technical elements in ways that strengthen the EV niche and/or destabilise the FCC regime.

5.1. *Creative policy dimensions*

In both cities we have identified creative dimensions in several local policies. We consider these to be creative because they can strengthen the relative advantage of EVs as an emergent niche by increasing the useability and attractiveness of EVs. This implies that policies succeeded in strengthening and aligning elements in the socio-technical configurations surrounding the EV niche, making it a more competitive alternative to the ICEV regime.

One crucial socio-technical element surrounding EVs is infrastructure, among other because the usability of EVs depends on a sufficient network of charging points. Infrastructure is considered essential in energy transition in general [e.g. [93], but the transition towards electric mobility also depends on EVs being part of a renewed energy infrastructure [94]. Infrastructure policies have therefore been proven to effectively impact EV diffusion [9,57,75], and in both our empirical cases *charging infrastructure* was extensively expanded during the periods of high diffusion. Data from Nobil [74] shows that in Bergen, the number of charging points for EVs increased by 40 percent between 2012 (413 points) and 2015 (580 points), while in Oslo the number of charging points increased by 65 percent between 2015 (1556 points) and 2019 (2585 points). The cases seemed to differ, however, in the degree to which public policy was involved in these expansions.

In Bergen, the expansion did not seem to derive from deliberate public policy. Rather, new charging points were established in cooperation between energy providers and businesses wanting to offer charging infrastructure for their employees and visitors [76]. During the period of high diffusion in Oslo, however, the City of Oslo made substantial investments in charging infrastructure for EVs. Already in 2009, the city municipality had started to offer financial support to housing associations for establishing charging points [95,96]. In 2016, charging infrastructure expanded further, as the electricity company Fortum and the City of Oslo jointly established more than 100 chargers in the city centre. The City also provided residential parking with free charging up to 3,6 kW [97]. Further, the provision of fast chargers continued to rise both in the city and in its neighbouring suburbs, and during 2016 the number of fast chargers increased from 7 to 37 [97].

Hence, although charging infrastructure clearly represents a creative dimension by increasing the relative advantage of EVs, it can do so also without extensive involvement from public policy. In addition to the obvious impacts of infrastructure policies on infrastructure, expansion of charging infrastructure could also shape user practices in expanding operational flexibility and reducing range anxiety, thereby also modifying usability perceptions and alleviating problem perceptions typically associated with EVs [e.g. 98,99]. Publicly mandated expansion of charging infrastructure could further be interpreted as a way to establish a market for power suppliers and charging service providers, which in turn contributes to strengthen the EV niche even further.

Creative dimensions were also identified in policies related to *bus lane access*. As seen in Section 4, bus lane access was originally introduced as national regulation that allowed EVs access to infrastructure initially dedicated to public transport. However, it fell under the mandate of local authorities to define whether and where such access was given. In Norwegian cities, expanding road infrastructure dedicated to public transport has for long been an approach to increase the market shares of public transport, thereby shifting personal mobility from car-based modes. In both Bergen and Oslo, bus lane access was substantially expanded during periods of high diffusion; from less than a kilometre in 2012 in Bergen to more than 4 km in 2015 within the city centre, and from 36 km in 2015 in Oslo to almost 50 km in 2019 [100].

Giving access to bus lanes could serve to increase the relative advantage of EVs through altering several socio-technical elements surrounding them. Bus lane access policy contains an evident change in regulatory conditions for EVs, which are lawfully permitted to use bus lanes, as well as obvious changes in user practices and routines among EV users, as they can plan for more efficient and convenient car travels. Most interestingly, perhaps, bus lane access could bear strongly symbolic and normative connotations around EVs. In urban and highly congested transport systems, bus lane access provides an obvious benefit in terms of travel efficiency and convenience, that is strongly and visibly restricted to a marginal (albeit growing) group. In Oslo in particular, bus lane access for EVs has been subject to substantial, lively public debate over the moral justification for granting EVs such exclusive advantages [101]. There is an obvious political aspect to this, as bus lane access could be interpreted as a redistribution of gains and losses, and it is typically portrayed as favouring wealthy owners of luxurious brands, such as Tesla. This policy could therefore be considered an example of perceived injustices in mobility transitions [e.g. 102]. According to Mullen and Marsden [103:109], policies that shift mobility towards low emission vehicles privilege "those with access to private vehicles and (…) certain sets of activities". They explicitly address how Norwegian EV policies relate to distributive fairness, providing advantages to people with access to EVs and disadvantages to people who rely on fossil-fuel cars. Although this is an element in public debate on EV policies in general [104], bus lane access could also be considered to signal superiority in EV users, making them deserving of extraordinary benefits. Normative interpretations of these policies in Oslo were further substantiated as the growing number of EVs caused congestion also in bus lanes, and in effect delaying public transport [105,106]. Consequently, EVs were disallowed from using bus lanes on the main road past Oslo (E18) during rush hours [88,107]. This not only serves to show how ICEV users themselves perceived EVs to receive a relative advantage, but also how EVs were considered a competitor to other ways of upholding societal functions of personal mobility (i.e. public transport), which were placed on even higher moral grounds and attached to an even stronger relative advantage in public policy.

Parking policies have also become a prominent tool for encouraging the use of EVs in both European and Norwegian cities [57], and parking policies are evident in both our cases. In terms of whether parking policies held dimensions of creative destruction, however, they represented a more ambiguous contribution. Parking policies can mainly increase the relative advantage of EVs in two ways; they can reduce costs associated with parking EVs, and they can ensure parking spaces dedicated to EVs. As such, parking policies touch upon regulatory and infrastructural components of the socio-technical configuration that surrounds EVs. They can further impact costs of use, as well as user practices, for instance by increasing parking flexibility and redistributing urban space in favour of EVs [57]. In Bergen, policies could be considered to strengthen the EV niche precisely by tending to these functions of parking regulation. Here, parking policies reduced costs for EV users, as parking in many cases was free for EVs. In the city centre, EV users during the period under study had access to several parking garages, where they could park for free so long their EV had a registration tag. Whereas EVs represented up to 60 % of users in these garages, they represented as little as 1 % of paying users [108]. Thus, parking policies in Bergen deliberately sought to enhance the advantage of EVs.

5.2. Destructive policy dimensions

Conversely, parking policies in Oslo were also geared to distribute *dis*advantages, thereby displaying more destructive dimensions. We understand destructive policies as measures and incentives contributing to reduce the relative advantage, of and thereby destabilise, the ICEV regime. As in Bergen, EV users in Oslo were during the period under study allowed to park for free on municipal parking spots [81:25]. However, to encourage other travel modes than car travel in the city centre, the City in 2016 started removing parking spots to make space available for other uses. Since then, the City has removed approximately 760 street parking spots [109]. The main purpose of this has been to reduce local pollution and improve air quality. However, to preserve the mobility options of the urban population the city municipality has worked to primarily reduce business travel parking and leisure travel parking [110]. To secure parking for its population, the City of Oslo in 2017 made residential parking in and around the city centre a permanent solution. This could relate to infrastructure, as the space available for parking is significantly reduced, and consequently also user practices when non-usable spaces reduce flexibility and efficiency in car use.

These two cases make it difficult to interpret parking policies in light of creative destruction. Whereas parking policies in Bergen clearly displayed creative dimensions in deliberately promoting EVs, widescale removal of parking spaces in Oslo signalled destructive dimensions by destabilising the car-based mobility regime altogether. We do find, however, clearly destructive dimensions in other local policies. A central component in Norwegian EV policies has been the exemption of EVs from toll fees, which since 1997 has given EVs a comparative advantage over ICEVs in areas with extensive tolling. In Bergen, the number of toll stations and the tariff levels have mainly been rooted in the Bergen Programme, which during its first three years established 13 toll stations throughout the city to reduce car travel and environmental problems from transport [87]. When the Bergen programme was revised in 2005 and 2009 [87,111], large infrastructure projects were added, including a ring road and light rail construction, which were expanded again in the 2013 revision of the programme. These expensive constructions were partly funded through the fee collection in the city's toll stations. As spending increased, *tolling policies* became stricter: toll tariffs were raised, available discounts were reduced from 40 % to 20 %, and the maximum payment cap was raised [112,113]. Following debates around challenges with extreme local pollution, time differentiated toll tariffs were introduced early 2016, and later that year toll tariffs increased again in another revision of the Bergen Program [113].

Toll policies were also prominent in the Oslo case. The early phase of Oslo Package 3 involved a restructuring of the toll road system, which included raising tariffs, removing periodic subscriptions, and establishing toll stations along the city border [91:5]. From 2012, the toll policies in Oslo Package 3 were revised several times, placing ever greater costs and inconveniences on ICEV users through raising tariffs, introducing toll roads on municipal roads, and reducing discount levels for registered users. In 2016, even more extensive restructuring of the toll system was introduced [92,114]. First, time differentiated toll tariffs were established, raising tariffs during rush hour. Second, environmentally differentiated tariffs were introduced, raising tariffs for ICEVs. Third, 52 new toll stations were established throughout the city, with the purpose of designing a fairer distribution of toll fees that did not only target the city's suburban population. In consequence, the revised toll road system covered 75 % of car travels in the city, placing substantial disincentives on ICEV use in the population.

Tolling policies could shape several socio-technical elements. Historically, toll policies have been intended to ensure user payment for new, large infrastructure projects. However, with increasing congestion and local pollution they have been applied to change user practices, i.e., travel behaviour. In many cases, tolling is used to divert infrastructure use (travel) away from the busiest hours or discouraging car trips in general. In Norwegian cities, they have also been used to shift user preferences away from car-based modes of transport, towards public transport or soft modes. As such, toll policies can fulfil some of the same functions as parking policies in Oslo; namely to reduce the relative advantage of cars altogether. Use costs associated with travelling from one side of Oslo to another could be more than double when travelling by car than when travelling by public transport [115,116]. However, although toll policies clearly disfavour all car-based travel, they also represent a particular disadvantage for ICEVs. This is rooted in national regulation that allows for differentiating tolling between vehicle types through exempting EVs from tolling. As with bus lane access, these policies might communicate normative and symbolic valuing of different modes of personal mobility, disfavouring ICEVs vis à vis EVs, and particularly vis à vis public transport. This shows how tolling policies could destabilise the ICEV regime by reducing its competitiveness relative to that of public transport, walking and bicycling, as well as EVs.

Another set of local policies we consider to hold destructive dimensions is *air pollution policies*. Both cities have faced substantial challenges with local air pollution. In 2015 Norway was convicted by the European Free Trade Association (EFTA) for having extremely poor air quality in several regions, and Bergen was one of the cities that for a long time struggled to remain within air pollution limits [117]. In response, local authorities introduced "date driving" on days with severe local pollution, which was used for the first time in 2010. Based on the vehicles' registration numbers, the vehicle fleet was divided into two groups. While vehicles ending with an even number could drive on even dates (the 2nd, 4th,6th of the month etc.), vehicles ending with an odd number were allowed to drive on odd dates (1st, 3rd, 5th of the month etc.). In effect, on days with severe local pollution, half the vehicles would have to remain immobile, or the driver would risk a 150€ fine. In addition, the City Council in 2012 [118] decided to increase the toll tariffs on days when the risk of severe air pollution was high [119]. However, EV users were exempted from these policies, which implies that costs and restrictions were placed exclusively on ICEV users.

Air pollution is also a matter of constant consideration in Oslo, especially on cold and still days, when lack of air circulation and low air temperatures cause local emissions to sink towards the ground. Local emissions of nitrogen dioxide (NO_2) and airborne dust have several times exceeded limits set by national pollution regulations, endangering the health and wellbeing of citizens suffering from asthma, bronchitis, and cardiovascular disease [120]. One of the main reasons for this pollution is traffic, and in December 2016 the city municipality prohibited diesel-fuelled cars on days when pollution was expected to be particularly high [118,120]. In a revised action plan for improved air quality in 2018 this prohibition continued, and was supplemented with a tripling of the toll tariffs for ICEVs and possibilities for restricting parking in the city centres on days with high air pollution [119].

The Oslo case in particular shows how destructive dimensions associated with air pollution, parking and tolling were all directed towards reducing ICEV use. All three policies could therefore be considered a threat to the ICEV regime. Perhaps even more than others, air pollution policies could have changed the problem agenda associated with urban transport policies; whereas tolling has for long been an established transport policy and targeting efficiency over sustainability, the introduction of air pollution policies explicitly targeting car-based mobility demonstrated the undesired contribution of ICEV to environmental problems. Again, local policies introduced an element of normative symbolism, with dramatic consequences for user practices (i.e. travel behaviour) among travellers relying on ICEVs.

Local policies with destructive dimensions thus share a prominent trait; by contributing to shift legitimacy, costs and convenience between different ways to uphold personal mobility, they above all sought the destabilise car-based approaches. As such, they did not necessarily target the ICEV regime specifically, but the car regime more generally. This implies that a certain level of destruction might also seep into the EV niche, which might be forced to not only defend its existence vis à vis ICEV, but also other niches for personal mobility. In applying the MLP to discuss the future of transport, Geels [11] lists a handful of other niches that could induce low-carbon transitions in transport, whereof public transport innovations are one. Discussions concerning almost moral justifications of allowing EVs access to bus lanes are thus one example of how the diffusion of EVs is not only about its relative advantage over ICEVs, but also other emerging niche-innovations. Nonetheless, the destructive dimensions identified in this study still favour EVs over ICEVs, as EV users are alleviated from the substantial costs, restrictions and inconveniences placed on ICEV users by tolling and pollution policies. Although these policies promote reductions in car use altogether, they also rank EVs over ICEVs, thereby communicating support to the EV niche at the expense of the ICEV regime.

6. Concluding discussion

The purpose of this study has been to *explore how creative and destructive dimensions of local policy might shape socio-technical configurations surrounding incumbent and emergent technologies, thereby influencing local technology diffusion*. We have done so by studying local policies in periods with particularly high EV diffusion in the Norwegian cities of Bergen and Oslo, which we analyse with reference to Kivimaa and Kern's [10] conceptualisation of creative destruction. More specifically, we have sought to discuss how these policies might influence socio-technical elements that surround the ICEV regime and the EV niche, respectively. This discussion is summarised in Table 3.

We find that local policy in both cities held creative dimensions that might strengthen EVs as an emergent niche. Policies that expanded charging infrastructure and bus lane accessibility directly aimed to increase the useability and attractiveness of EVs, thereby improving the relative advantage of the EV niche. However, parking policies represented an ambiguous contribution, holding more creative dimensions in one case and more destructive ones in the other.

Table 3
Local policies and the socio-technical components they influence.

Policy	Socio-technical element	Creative	Destructive
Charging infrastructure	Infrastructure User practices Problem agendas Market	X	
Bus lane access	Regulation User practices Normative rules Symbolism	X	
Parking policies	Regulation Infrastructure User practices	X	X
Tolling	Regulation Infrastructure User practices User preferences Normative rules Symbolism		X
Air pollution policies	Problem agenda User practices Normative rules Symbolism		X

We also found that local policy held destructive dimensions that might destabilise the ICEV regime in both cities. This was particularly evident in policies associated with air pollution and road tolls. Although the main motivation behind introducing these policies was to reduce the attractiveness of car-based mobility, they also enabled relative advantage of less polluting modes of transport, thereby solving challenges that impacted the urban population (e.g. low air quality, congestion). Hence, the intent of these policies was not necessarily just to promote the emergent niche (i.e. EVs) but rather to destabilise the ICEV regime by reducing its competitiveness relative to that of public transport, walking and bicycling, as well as EVs.

In their study of policy mixes for transitioning energy sectors in Finland and the UK, Kivimaa and Kern [10] found policies aiming for niche support (i.e. creative dimensions) to be predominant. They suggested that destructive policies are less prominent because they are politically difficult. Among other, this difficulty relates to the traditional purpose of policy to facilitate economic growth, which could be undermined if policy seeks to destabilise incumbent regimes.

In contrast, destructive policies were rather prominent in our study, especially represented by the widescale use of road tolling. Toll policies are an expression of cultural and historic tradition with limiting car use in Norwegian policy, and even during the car boom in post-war years there were pronounced problem-agendas associated with cars and their burden on the national economy [121]. Despite occasionally fierce grassroot opposition against tolling, it remains a core element in funding road transport infrastructure and subject to broad legitimacy, especially if intentions behind tolling are thoroughly communicated to the public in early planning phases [122]. This legitimacy is among other expressed in the co-development of transport policy between local and national policy makers, for instance through co-funded investment programs, such as the Bergen Programme and the Oslo Package, where road tolling is fairly undebated beyond tariffs and duration.

However, political support for policies that enhance the relative advantage of EVs is wavering. There is an increasingly heated national debate around favouritism of EVs, spurred on by assumptions that relative advantage is no longer needed to promote EV adoption [e.g. 123,124] and perceptions of EV policies as favouring wealthy car users because of the entrance of high-end EV models to Norwegian markets [125]. A recent governmental expert committee further advised the removal of road toll exemptions for EVs, as they were considered to reduce governmental revenue and undermine welfare distribution [126]. Bergen was in 2019 the first Norwegian city to remove road toll exemptions for EVs, instead requiring EV owners to pay 35% of ordinary road toll tariffs. Similar arguments have also placed other EV policies on the line, such as ferry ticket discounts, parking fee discounts and bus lane access [25]. As such, EV policies are currently under substantial pressure and maintaining them might require more explicit political justification than before.

This could explain one apparent discrepancy between the two cases that we would like to address, namely the very different political bases for policymaking in the periods of diffusion that we have studied. During the periods of diffusion studied here, the two cities were governed by coalitions on opposite flanks of the left–right axis. The City Council of Bergen had a majority of conservatives, where the right-wing Progress Party was the biggest party and formed the city council with the Conservative Party and the Christian Democratic Party [127]. These parties are known to have a less environmentalist profile than left-wing parties. In Oslo however, the period with highest EV diffusion corresponded with the establishment of a green-left city council following the 2015 local elections, consisting of the Green Party, the Socialist Left Party, the Labour Party, and the Red Party. These parties have substantially more environmentalist profiles, and representatives from the progressive Green Party were placed in strategically important positions in the city council.

Based on this, one could question the relevance of politics in EV diffusion. We would suggest, however, that this rather reflects the increasing politicisation and controversy surrounding EVs. The period with the strongest diffusion in Bergen (2012–2015) could be considered to occur in early phases of the diffusion curve [44], and therefore at a time when incentives for EV diffusion were supported by a fairly broad political consensus[128]. A widely perceived need for policy to enhance the relative advantage of EV could thus have installed these policies with less political controversy. In the period with high diffusion in Oslo, however, controversy around EV policies was increasing [128,129], which could suggest increasing pollicisation of EV policies. In the Oslo case, policies were anchored in the political programs of the ruling parties [e.g., 130], and central in the political foundation of the city council and core strategic policy documents [e.g., 131]. As such, policies were to a greater degree given symbolic meaning to demonstrate the ambition of the political rule, and EV promotion became a key feature of environmental policies in the city council. Further, destructive policies appeared to receive specific political protection in the Oslo case. Although under heavy pressure to alleviate pressures on ICEVs, the political leadership continues to express firm will to uphold their ambition to reduce citywide emissions with 95 % within 2030 [132]. The city council has for instance pushed through massive popular resistance to ensure the removal of parking spaces. This rigour is further expressed through the city counsellor for transport's suggestion to ban all ICEV cars from the city within 2030, facing substantial opposition and debate. Interestingly then, our case does support notions about political controversy around destructive policies but adds to this by indicating that creative policies (e.g. bus lane access) could bear equally prominent political connotations.

Related to this, we have in this study discussed the potential importance of normative symbolism inherent in policies, especially related to perceived justice. Bus lane access, tolling policies and restrictions inherent in air pollution policies all demonstrate obvious consequences for costs and practices associated with use of EVs and ICEVs, thereby laying the basis for political and popular controversy. Cars could be attached to a range of symbolic dimensions that impact whether policy designs are perceived as acceptable [133]. Although our study hints at symbolism and normative assessments being crucial elements in resistance towards local enactment of EV policy, it does not provide in-depth accounts of discourses around EVs. This could be a useful avenue, however, for furthering our knowledge about EV controversies, among other by delving into potential goal conflicts between a strong, national egalitarian culture [e.g. 134,135] and the determined distortion of relative advantage inherent in EV policy. Moreover, we have in this study applied our analytical framework to study how policy might impact individual socio-technical elements, but not delved into how policy could also shape interaction between elements and the workings of entire socio-technical configurations. Both theoretical and empirical dives into this could be a productive way forward. Finally, future research should strive for comparative studies that contrast local policies in markets with high and low EV diffusion. This could increase our understanding of local policy as potential remedy against transition failures [e.g. 47] and the role of (lacking) local policy in cases where EV diffusion is still low.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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