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RESEARCH ARTICLE



Mainstreaming decarbonization through local climate budgets in Norwegian municipalities

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ABSTRACT

Climate budgets are increasingly being used in local climate governance, but it is not clear whether they have the potential to drive systemic change toward decarbonization. This study uses a political dynamics of decarbonization framework to assess the transformative potential of municipal climate budgets to catalyze changes across cultural, economic, political, and technological systems to overcome carbon lock-in. Document analysis and interviews with climate budget experts from Oslo, Fredrikstad, Hamar, Bergen, Arendal, Bærum, Asker and the county of Agder in Norway were employed in this study to identify and discuss transformative conditions for decarbonization. Climate budgets are used to integrate climate change mitigation as a core element of municipal governance. This approach aims to integrate climate change mitigation into existing decision-making mechanisms and expand the mandates of municipal departments and agencies in executing and overseeing climate actions. Local climate budgets are also being used to catalyze changes across cultural, economic, political, and technological systems through the alignment of new laws, regulations, financial and institutional capacities, inter-municipal coalitions, and cooperation with the private sector. However, climate budgeting in cities and local governments faces multiple barriers. These include a lack of jurisdiction over emissions accounted for in climate budgets; inadequate legal frameworks to support municipal climate actions; and competition for financial and institutional resources with other public services expected by city residents. These findings deepen our understanding of the transformative change potential in local climate action experiments by emphasizing the role of political dynamics in overcoming carbon lock-in.

KEY POLICY INSIGHTS

- Cities and local governments should reorient decision-making through climate budgeting to prioritize climate change and broaden the roles of municipal departments and agencies. This approach can ensure that climate is integrated into municipal governance, from urban planning to public service delivery.
- Establishing monitoring and reporting mechanisms within the climate budgeting process enhances accountability and transparency by requiring municipal departments and agencies to regularly report their progress and the impact of their climate initiatives.
- Municipal programmes, urban planning, legislation, financial streams, and institutional capacity should be leveraged to drive systemic changes across cultural, economic, political, and technological systems towards city-wide decarbonization.

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1. Introduction

Cities and municipal governments have been at the forefront of climate actions over recent decades (Hofstad & Vedeld, 2021; Jordan et al., 2015; Pattberg et al., 2022). Notably, many local governments have set ambitious greenhouse gas (GHG) emission reduction targets (Reckien et al., 2013) and sought to act independently of national governments (Gordon, 2016). Local experimentation has also become a defining feature of urban climate action, with many cities bringing new forms of policy design and implementation (Bernstein & Hoffmann, 2018a; Hofstad et al., 2021; Jordan et al., 2015).

In this context, the Oslo local government took a pioneering step by introducing its first climate budget in 2016 (Petersen, 2020), aiming to align municipal decision-making with climate change mitigation and facilitate city-wide reductions in GHG emissions. This approach involved tracking resource allocation to climate change mitigation against emission reduction targets (City of Oslo, 2022). However, despite more Norwegian municipalities adopting climate budgets, there is limited research on how climate budgets have driven decision-making in municipalities (Petersen, 2020; Vedeld et al., 2021) and the potential of these climate budgets to support decarbonization has not been assessed. Local governments are also increasingly using the term ‘climate budgets’ to distinguish the approach from ‘carbon budgets’ (Garfield, 2021; Gunnarsson, 2021). The latter refers to the allowable quantity of carbon dioxide emissions associated with a global climate target and has been largely considered by other studies (Lahn, 2020; Matthews et al., 2017; Millar et al., 2016). As municipalities increasingly prioritize climate action, gaining a nuanced understanding of how Norwegian local government climate budgets enable decarbonization is critically important for advancing urban climate policy.

To contribute to these discussions, this study examines climate budgets in Norwegian municipalities and one county by analysing their potential to catalyze systemic changes that influence local cultural, economic, political, and technological systems that sustain the use of fossil fuels. To build this analysis, Section 2 introduces the political dynamics of decarbonization framework, which is used to identify evidence of decarbonization in municipal climate budgets. Section 3 outlines the research methods employed to gather data from Oslo, Fredrikstad, Hamar, Bergen, Arendal, Bærum, Asker, and the county of Agder. The results, presented in Section 4, detail how these municipalities are implementing their climate budgets and the resulting changes in local decision-making. Evidence of political dynamics is then presented to assess their potential for systemic change. Finally, Section 5 explores the transformative potential of municipal climate budgets to harness political dynamics and catalyze changes across cultural, economic, political, and technological systems. It also examines opportunities and challenges involved in integrating decarbonization into municipal decision-making processes. Additionally, this section critically evaluates the application of the political dynamics of decarbonization framework in analyzing municipal climate budgets, offering reflections on its potential to deepen our understanding of how urban climate actions can drive transformative change across various contexts.

2. Politics of decarbonization

Cities and local governments are entrenched in economic, political, technological, and cultural systems that rely on and perpetuate fossil fuel use. This entanglement arises from interconnected dependencies and reinforcements of fossil fuels in economic activities, urban planning, institutional settings, cultural practices, regulations, and technologies that enable lifestyles and livelihoods (Seto et al., 2016). As a result, decarbonization pathways cannot be constructed only through economically efficient policy mixes or changes to specific technologies and energy production practices (Bernstein & Hoffmann, 2018a). Instead, decarbonization requires disrupting and reconfiguring the intricately interwoven political dynamics embedded in society through norms, institutions, policies, financial streams, and coalitions that perpetuate the use of fossil fuels (Seto et al., 2016). On this basis, fundamental shifts in political and economic systems are necessary to catalyze decarbonization pathways (Bernstein & Hoffmann, 2018b; Vedeld et al., 2021; Wolfram et al., 2018) although ‘what these pathways look like in reality remains in question’ (van der Heijden, 2019, p. 7). Moreover, empirical evidence has exposed a gap between ambitious municipal climate mitigation targets and decarbonization outcomes of local climate actions, highlighting the limited capacity and political resistance experienced by cities and local governments (van der Heijden, 2019; Vedeld et al., 2021). With municipal climate budgets growing as a governance approach

to local climate change mitigation (Johansen, 2022; Marlowe & Clarke, 2022), we turn to scholarship on the politics of decarbonization to understand the potential of this approach in practice to enable decarbonization.

2.1. Assessing decarbonization through a political dynamics framework

Informed by the literature on the politics of systemic change, Bernstein and Hoffmann (2018b) argue that decarbonization is driven by political dynamics of norm change, capacity building, and coalition building, which scholars have suggested drive changes in economic, political, technological, and cultural systems (Geels, 2014; Meadowcroft, 2011; Seto et al., 2016; Shove, 2010; Shove & Walker, 2007). To offer a conceptualization of systemic transformation, the authors propose a framework that explores how local climate action experiments can harness these political dynamics to produce systemic changes and catalyze decarbonization (Bernstein & Hoffmann, 2018a, 2018b).

In the framework, *norm change* is a political dynamic that can enable decarbonization to the extent that it shifts ‘what is held to be in the public interest, which affects public policies and political expectations’ (Tozer, 2020, p. 3). For instance, local climate actions leading to changes in public services and work practices can be an influential driver of change across what is expected from public and private organizations. *Capacity building* is a political dynamic supporting material and institutional capacities that enable decarbonization. Local climate actions, for example, can increase direct funding for fossil-free urban infrastructures and services. New forms of institutional capacity and expertise can also be built into organizations to lead local climate action and enable decisions aligned with climate change mitigation efforts. *Coalition building* is a political dynamic leading to new forms of cooperation to support decarbonization. For instance, local climate actions can include city networks and public-private partnerships that reinforce change opportunities in political, technological, and societal choices (Gordon, 2016). The framework also assesses two systemic effects – scaling and entrenchment – capturing the potential of transformative influence of political dynamics supporting decarbonization in cultural, economic, political, and technological systems (Bernstein & Hoffmann, 2019; Tozer, 2020). Political dynamics can *scale up* local climate actions to expand decarbonization in new contexts, sectors, and jurisdictions. The *entrenchment* of local climate actions can also result from political dynamics’ effects to achieve long-lasting or irreversible changes in cultural, economic, political, and technological systems. For instance, increasing the social benefits issued from climate actions and raising the costs for those who choose not to participate in them can result in the entrenchment of new forms of working and living (Bernstein & Hoffmann, 2019).

While these political dynamics and systemic effects are considered separately in this framework for analytical purposes, they frequently interact and overlap (Bernstein & Hoffmann, 2018b). For example, climate actions supporting norm change can be an influential driver of change across what is expected from public and private services and may be accompanied by substantial changes in institutional and financial capacity toward decarbonization. Stronger institutional and financial capacities can scale up local climate actions by reproducing successful approaches in new jurisdictions and across sectors that were not originally contemplated by the local government. Coalitions of local governments can advocate for laws supporting fossil-free systems with the potential to entrench changes into regional and national legal and regulatory frameworks and further strengthen decarbonization opportunities through norm change and new legal capacity.

2.2. Using the political dynamics framework to investigate climate budgets

This study uses the political dynamics of decarbonization framework to identify evidence of norm change, capacity building, and coalition building in Norwegian local government climate budgets and considers the extent to which activities related to the climate budget are catalyzing (or have the potential to catalyze) changes in cultural, economic, political, and technological systems in ways that enable decarbonization (Bernstein & Hoffmann, 2018a; Tozer, 2020). The adoption of this framework is motivated by two key considerations. Firstly, the framework provides a methodological approach to assess the transformative potential of emerging municipal climate budgets. We argue that we would know if climate budgets had the potential to produce decarbonization if we could see evidence of the three political dynamics catalyzing systemic change. Crucially, the

political dynamics of the decarbonization framework allow us to analyze the forward-looking potential of municipal climate budgets to catalyze decarbonization. We can look for the seeds of systemic change while it is in process. Secondly, a focus on decarbonization rather than GHG emission reductions necessitates keen attention to the political dimensions of systemic change. While many analyses of decarbonization predominantly emphasize technological or economic dynamics, it is essential to recognize that carbon lock-in is rooted in political foundations encompassing norms, institutions, financial streams, and coalitions that uphold systems dependent on fossil energy (Geels, 2014; Seto et al., 2016). Relatedly, adding up progress in units of GHG emission reduction does not tell us enough about whether we are on the right track since there is a significant lag in GHG inventory processes and emissions trajectories do not convey enough nuance to understand whether carbon lock-in is being overcome (Bernstein & Hoffmann, 2019). For example, GHG reductions can come from more efficient fossil fuel use (e.g. more efficient fossil gas furnaces/boilers) that further entrenches fossil fuels into systems, or they could result from short-term contexts like the COVID-19 pandemic.

3. Research methods

This study considers climate budgets implemented by Oslo, Fredrikstad, Hamar, Bergen, Arendal, Bærum, Asker, and the county of Agder to analyse their potential to catalyze political dynamics that influence local cultural, economic, political, and technological systems toward decarbonization. To select these municipalities, three key criteria were used: implementation of climate budgets, climate action reporting, and relevance of experiences among the chosen cities. The first criterion was met by examining publicly available documents from municipal websites and gauging community engagement in climate budget activities, such as through workshops (City of Oslo, 2020a) or media coverage (Eide, 2022). At the time of data collection, several Norwegian municipalities had indicated plans to adopt climate budgets, but the study focused on cities that had implemented a climate budget for at least a year to enable an analysis of their reported actions and outcomes. The second criterion, focusing on the availability of climate action reporting, considered cities with consistent climate reporting, verified through a review of public records with information on climate action progress and challenges experienced by the local governments. The third criterion emphasized the need for a relevant range of experiences with climate budgeting. To meet this criterion, we sought recommendations from interviewed municipal employees involved in climate budget experts and asked them to suggest municipalities that had noteworthy climate budget experiences. This approach ensured that our sample included a variety of municipalities with insights into climate budget practices (see description of climate targets adopted by these municipalities in Appendix A). This criterion also encouraged the inclusion of smaller and medium-sized cities alongside larger economic hubs like Oslo, Bergen, and Fredrikstad to provide a comprehensive view of the climate budget landscape across different types of municipalities. Ultimately, the final selection of municipalities considered those meeting the three criteria but included only the municipalities that agreed to participate in data collection through interviews.

This study does not provide a comparative analysis of municipal climate budgets to identify best practices or provide a detailed description of the historical context in which they were proposed. Instead, the study examines how climate budgets have influenced decision-making in municipalities and uses a theoretical framework to understand whether climate budgets are creating opportunities for decarbonization. Two key approaches were used. The first approach consisted of a document analysis to identify evidence of political dynamics and systemic effects in written records and official documentation (Bernstein & Hoffmann, 2018b). Under this approach, we first gathered climate budget reports and climate-related documents authored by the Norwegian municipalities. The choice of documents included in the study (see Table 1) was guided by their relevance to municipal climate budgets, specifically focusing on capturing outcomes of climate budgets, and barriers and changes experienced by the local governments. The authors conducted a close and reflective reading of the texts drawing on a discourse analysis approach employed to analyse climate policies (Tozer & Klenk, 2018). We were particularly interested in climate action descriptions and discursive strategies employed in the texts, as informed by the political dynamics of the decarbonization framework (Bernstein & Hoffmann, 2018b). Evidence on climate actions supporting decarbonization identified in municipal climate budgets

Table 1. Documents included in this study (e.g. climate and energy strategical planning, climate budgets, municipal documents).

Oslo	• Procurement Strategy. City of Oslo Department of Finance (City of Oslo, 2017) • Manual for climate budgets as a governance tool (City of Oslo, 2020a) • Climate strategy for Oslo toward 2030 (City of Oslo, 2020b) • General provisions for drawing up draft budgets. Circular 1/2021 (City of Oslo, 2021) • Climate budget 2022 (City of Oslo, 2022) • Climate budget 2023 (City of Oslo, 2023)
Fredrikstad	• Municipal sub-plan for climate 2019–2030 (City of Fredrikstad, 2019) • The municipal director's proposal for the 2021–2024 financial plan and the 2021 annual budget, Climate Budget 2021 (City of Fredrikstad, 2020)
Hamar	• Municipal Development Plan 2019–2030: Environment and Climate (City of Hamar, 2019) • Climate budget for Hamar municipality 2021–2024 (City of Hamar, 2021)
Bergen	• Green strategy climate strategy for Bergen 2022–2030 (City of Bergen, 2022a) • Climate budget 2022 (City of Bergen, 2022b)
Arendal	• Municipal sub-plan Climate and Energy 2019–2023 (City of Arendal, 2018) • Action and financial plan 2023–2026, Climate Budget 2022 (City of Arendal, 2022)
Bærum	• Municipal Climate Strategy 2030 (City of Bærum, 2021) • Climate budget 2022 (City of Bærum, 2022)
Asker	• Action against climate change 2021–2033 (City of Asker, 2021) • Action programme 2023–2026, Climate Budget 2022 (City of Asker, 2022)
Agder (county)	• Financial plan and Climate Budget 2022–2025, Climate Budget 2022 (County of Agder, 2022)

extracted through this reading was categorized and thematically analyzed related to sectors (i.e. transportation, construction, others) and political dynamics of decarbonization (i.e. coalition building, capacity building, norm change, systemic effects).

In examining the potential of municipal climate budgets to mobilize political dynamics and systemic effects toward decarbonization, information crucial to this investigation was not readily available in written materials. To address this gap, the second approach employed in this study involved conducting interviews with climate budget experts working within municipalities and local governments. These experts were publicly identified in climate budget reports and municipalities' websites and were chosen for their direct involvement in the implementation of municipal climate budgets. The study uses a key informant design that emphasizes the expertise of the interviewees in assessing the impact of climate budgets on municipal decision-making in their municipalities, particularly given their comprehensive view across municipal departments and agencies. The study then analyzes these insights across multiple municipal experiences. Additional studies can be built on this basis to layer additional insights, such as from politicians, other municipal agencies, non-government stakeholders, private sector, since the transformative scope of decarbonization has many stakeholders. Conducted between June and December 2022, online interviews with nine experts provided valuable insights into municipal climate budgets. The semi-structured nature of these interviews provided flexibility, allowing for the exploration of unexpected answers raised by respondents (see the semi-structured interview guide in Appendix B). All participants provided informed consent, and the interviews were recorded for subsequent transcription. This transcription process facilitated a comprehensive analysis and the collection of empirical material for further examination. Direct quotations from interviews are anonymously identified in this study with a letter followed by a number and do not correspond to any specific order of cities mentioned previously.

4. Results

In this section, we first offer a description of how Norwegian municipalities pursue their climate budget implementation and its impact on decision-making. Evidence of the political dynamics of norm, coalition building, and capacity building identified in this study is then presented to discuss the potential for systemic change.

4.1. Mainstreaming decarbonization into local decision-making

Climate budgets are used to engage municipal governments in the implementation of climate actions, as well as to monitor the effects of these actions on the city's emissions and financial budget (City of Oslo, 2022). To

support this form of institutional engagement, Norwegian municipalities developed a governance approach in which climate change mitigation becomes ‘part of the [municipality’s action and economic plan] and that the measures in the [climate] budget are reported on in connection with the ordinary reporting’ (City of Oslo, 2020a, p. 21). According to one participant, this approach aims at integrating climate change mitigation into existing financial decision-making mechanisms that were well-established in municipal departments and agencies:

[Before the implementation of the climate budget], they wanted to cut emissions, but we did not have a tool to know how to cut emissions. Where do we do it? And are we sure that we are reaching our goals? So, we needed a steering system. (...) The best way of doing that is to actually incorporate [climate] into the existing budget process in the municipality, not create a completely new system, but have it aligned with the financial process (...) Then for every decision that you make in the municipality, you also make it for the climate, that you think about the climate in every single budget process. (I1)

In this governance approach, ‘all the [municipal] entities are responsible for evaluating and submitting measures to limit climate change’ (City of Oslo, 2020a, p. 22) as they are asked to implement and report on their climate actions. However, while ‘for some sectors, it was more natural to welcome the [climate budget] process since they were already working on climate mitigation’ (I6), the climate budget also aimed to mobilize new institutional resources in various municipal departments and agencies that were not directly engaged in climate actions:

What’s common for all [municipal] entities is the financial budget. Everyone has to do the financial budgets. So that’s the reason why the [city] chose to incorporate [the climate budget] into the financial budget (...) Now the climate is incorporated into every single financial document that is given out to the [municipal] entities, the entities have to report on the climate budget in the same way as a report to the financial budget. (I1)

However, achieving this level of integration between existing financial budgeting mechanisms and the climate budget may require new forms of institutional capacity within municipalities. One participant reported that its municipality ‘established an interdisciplinary project group with key competence within climate accounting, finance, statistics, and three employees from the three departments in the [municipal] organization that contributed the most to the climate emissions’ (I4) to investigate and pilot the adoption of the climate budget, while ‘it [took] time, especially in the first year, to develop and get the whole [municipal] organization with you and make the entire organization responsible for owning and taking responsibility for climate measures within its areas of responsibility’ (I4). Additionally, the integration of climate budgets in municipal decision-making and reporting mechanisms may still face challenges while some aspects of climate budgets remain aspirational. As summarized by one participant, ‘[the] goal is that you always consider a climate effect when you deliver your service or do your job so that it is always something that you take into consideration’ (I6).

4.2. Climate budgets harnessing political dynamics

This section presents political dynamics identified in the climate budgets of Norwegian municipalities. These dynamics, encompassing norm change, capacity building, and coalition building, offer evidence of the forward-looking potential of municipal climate budgets to catalyze decarbonization opportunities. They are distinguished for analytic purposes here, but they frequently intersect and overlap. Table 2 outlines the climate actions led under climate budgets, categorizing them by which political dynamics they leverage and specifying whether they promote substitution (e.g. moving away from fossil fuels) or restriction of fossil fuel use (e.g. banning the use of fossil fuels).

4.1.1. Norm change

To normalize work practices and lifestyle choices that support fossil fuel replacement across multiple sectors, including transportation, construction, and waste management (see summary in Table 2 with further detail in Appendix Table C1), climate budgets have focused on the adoption of new legislation and regulation, incentives, and public support. Climate actions adopted under municipal climate budgets have also attempted to normalize work practices and technologies that support fossil fuel restrictions. These restrictions include the creation of zero-emission urban zones through the adoption of requirements in municipal spatial planning

as well as car-free zones around schools to eliminate traffic in those areas and promote active transportation among students (City of Bærum, 2022; City of Bergen, 2022b).

To influence municipally-owned construction and potentially alter carbon-intensive work practices, climate budgets have largely relied on the adoption of public procurement requirements and regulations to support the adoption of fossil-free and zero-emission construction technologies and services. In 2017, the Oslo municipality came up with new public procurement requirements supporting fossil-free and zero-emission technologies and services in construction activities (City of Oslo, 2017). While these requirements led to the implementation of the first fossil-free construction site in Oslo, extensive work with private companies and service providers was needed to overcome technological barriers and adapt existing work practices in the construction sector, as highlighted by one participant:

The City of Oslo has driven that technology change. So only a couple of years ago [...] they got the first emission-free construction site in Oslo. And then they didn't have the technology. You had to build the machines, like using fossil-fuel machines and replace the engines. But now they actually have [several] machines that are emission-free. (I1)

Table 2. Summary of political dynamics identified in municipal climate actions to enable decarbonization.

Political dynamics	Supporting fossil fuel replacement	Supporting fossil fuel restriction
Norm change	- Traffic reduction (e.g. toll rings with emission-based prices, reduction of the number of parking spots), increase in active transportation (e.g. new biking lanes, pedestrian infrastructure), and increase in public transportation ridership (e.g. free public transportation). - Change in work practices and lifestyle choices (e.g. travelling guidelines to reduce the number of business trips by plane made by municipal employees, teaching programmes to increase cycling skills, and winter cycling campaigns with city residents). - Implementation of fossil-free emission construction sites, such as in Oslo, Fredrikstad, Hamar, Bergen, Arendal, and Bærum.	- Adoption of public procurement requirements and regulations for machines used in municipal buildings and construction sites to be fossil-free (e.g. use of specific criteria to reward emission-free technologies). - Adoption of mobility plans to ban the use of fossil-fuel vehicles (e.g. routes dedicated only to fossil-free public transportation) and political support for changes in mobility priorities. - Ban on the use of fossil fuels to operate ships while on board during port leases (e.g. all ships must either be able to be supplied with shore power, use emission-free energy sources or shut down operations completely while in the port).
Capacity building	- Investments in zero-emission and fossil-free public transportation infrastructure and services, (e.g. electric buses, electric ferries, and bicycles), and active transportation infrastructure (e.g. biking lanes, pedestrian infrastructure). - Replacement of the municipality's fleet with electric cars, investment in low-emission heavy transportation for municipal services (e.g. waste transportation) and infrastructure for the electrification of heavy transportation. - Funding for renewable energy projects in municipal buildings (e.g. installation of solar panels in schools), energy-saving projects (e.g. additional insulation, heat recovery) and charging infrastructure. - Investments in biogas stations to extract landfill gas and reduce emissions from waste incineration plants (e.g. Saulekilen plant), and emerging energy sources (e.g. hydrogen).	- Funding for fossil-free and zero-emission technologies and services in municipally-owned construction sites. - Use of public markets to drive up innovation and investments in zero-emission and fossil-free technologies and services (e.g. adoption of a new public procurement policy in Oslo). - Political support for the exclusive use of zero-emission and fossil-free technologies and services by municipal entities and operations (e.g. construction and building sector). - Political support for the creation of zero-emission neighbourhoods/zones in cities, including car-free zones around schools, such as in Bergen, Bærum. - Requirements for fossil-free technologies and services in municipal services (e.g. innovations brought up by Oslo's public procurement requirements used by smaller cities).
Coalition building	- Participation in trans-municipal networks to support local climate action (e.g. Klima Østfold), public-private partnerships, and regional and local authorities (e.g. Klimapartnere Agder). - Support of a National Transport Plan to establish a comprehensive plan for road transportation, public transport, cycling, and walking in large urban areas. - Cooperation agreement with universities on R&D to investigate new technologies (e.g. construction and building sector).	- Collaboration between municipalities and the private sector to come up with solutions for public procurement requirements and regulations. - Political support for changes in the national Planning and Building Act to create zero-emission neighbourhoods/zones in cities. - Inter-municipal support for zero-growth targets for passenger vehicles, such as in Kristiansand region.

Additionally, the Oslo municipality established a system of financial rewards for suppliers that minimize the distances travelled to carry bulk materials to and from construction sites as well as for those using electricity and biogas in these operations. To support this action, a municipal working group was established to instruct suppliers of bulk transport services about the possibility of recycling bulk items, as well as investigating new logistical solutions (City of Oslo, 2022). This form of norm change was summarized by one participant:

The public sector is quite important regarding procurements because the public sector is a big buyer of services and products. So, when the public sector asks for these kinds of climate actions, the market will also change and try to support [the municipality] demands. (I5)

To achieve this goal, municipalities may rely on their capacity to influence market demand. For instance, the Oslo municipality accounts for about a fifth of the city turnover in the construction sector and invests NOK 10 billion annually in infrastructure (Omland, 2022), supporting technological innovation and push the private sector to provide fossil-free and zero-emission technologies and services. Considering that ‘it’s very attractive to build in Oslo, so they can be very strict because they will get what they want in a way and they won’t stop building in Oslo because they are strict’ (I2), public procurement requirements adopted by Oslo have also contributed to accelerating the adoption of fossil-free and zero-emission technologies and services in small and mid-sized Norwegian cities, with fossil-free construction sites being implemented in Fredrikstad, Hamar, Bergen, Arendal, and Bærum. Private suppliers and businesses in Oslo have also announced tighter requirements for procurements, with some of them demanding emission neutrality from their suppliers. However, the adoption of public procurement requirements for municipally-owned construction sites also reveals forms of resistance to decarbonization from the private sector, as described by a participant:

When the municipality said they were going to set this as criteria [for fossil-free construction sites], the private sector was a little bit negative because the technology was not there at that point. And yes, it does have a higher cost to use biofuels instead of fossil fuels. (I1)

Additionally, when reflecting on the technological pathways for fossil-free construction sites, it is important to notice that ‘electrical construction machines are rebuilt after they leave the factory. The manufacturers have not started large-scale production yet, because they do not see it as profitable’ (Omland, 2022), suggesting that the private sector might still face barriers to fulfil emission reduction requirements of municipalities.

In the transportation sector, norm change dynamics are mainly directed toward reducing passenger vehicle use as well as increasing active and public transportation modes, as a significant focus in municipal climate budgets is given to ‘reversing the transport hierarchy in all development matters and as a premise for planning matters, so that accessibility for pedestrians, cyclists, and public transport is prioritized ahead of cars’ (City of Arendal, 2018, p. 17). Efforts to normalize new forms for transportation development and planning include higher toll ring rates for passenger vehicles, free public transportation or lower public transportation ticket prices, expansion of municipal cycling services such as bicycle sharing programmes, changes in traffic patterns to prioritize pedestrians and cyclists, and removal of public parking spaces. Work guidelines for municipal employees also aim to reduce the number of business trips by plane. Climate actions adopted under municipal climate budgets also aim to increase the share of fossil-free vehicles, including through the replacement of municipal cars, vans and small trucks with fossil-free or zero-emission options, adoption of requirements in public procurement targeting fossil-free public transportation services, installation of charging stations for electric cars in housing associations, public parking, and municipal buildings, and subsidies and grant programmes for the purchase of electric bicycles.

4.1.2. Capacity building

Building new capacity for decarbonization, mainly through the adoption of new funding streams and institutional mechanisms for implementing and monitoring climate actions, is a key feature of municipal climate budgets. Notably, new financial capacity and funding streams have been produced under municipal climate budgets to support local decarbonization (see summary in Table 2 with further detail in Appendix Table C2).

In the transportation sector, for instance, fossil fuel replacement is supported by investments in public transportation, walking and cycling infrastructure and services, acquisition of bicycles for city residents, subsidies to private companies and municipal entities to support active transportation among employees, and cycling workshops for students and city residents. Transitioning from fossil fuel to fossil-free transportation is also supported by investments in the purchase of electric vehicles by municipalities and the creation of charging infrastructure in public and private areas. In terms of public transportation, the county of Agder allocated resources to support its zero-growth target for passenger vehicles, while Bergen supported public transportation use through increased public transport capacity and Fredrikstad increased public transportation use through free buses available for residents. The Oslo municipality is aiming for zero-emission public transportation, relying on an emission-free bus fleet by the end of 2028 and new tramways (City of Oslo, 2022). Arendal, Asker, Fredrikstad, and the county of Agder also invested in electric ferries to provide emission-free maritime transportation options. Oslo is seeking to accelerate the switch from diesel use in heavy transportation by establishing a subsidy programme for charging infrastructure for trucks.

Despite the creation of new institutional and financial capacities, Norwegian municipalities still face barriers to implementing climate actions. For instance, while '[climate budgets] tell the politicians that if they want to reach a climate goal in 2030 [...] this is how much money it is going to cost' (I1), they do not necessarily create an ideal allocation of financial resources. To address these challenges, political support is another key feature of municipal climate budgets, with one participant declaring that 'one important success factor is that climate budgets are rooted both politically and in administrative management to ensure that the work with climate budgets is prioritized by the entire organization and politically' (I4). The Oslo municipality, for example, aims

to achieve the emissions limit year by year in order to achieve the 2030 target and must therefore actively work to ensure the implementation of both the measures that cannot be quantified with sufficient certainty and the measures that are in process and develop new and strengthen existing instruments. (City of Oslo, 2022, p. 21)

However, political support can also face resistance from other development priorities:

There are several conflicts [in the climate budget]. If you want to build more roads, the politicians want to build more roads. And then, of course, that contributes to lots of time and emissions. [...] So, you have some conflicts of interest there. (I4)

Smaller municipalities may also struggle to allocate their limited resources to support climate budgets, bringing explicit attention to the 'competition for resources [mainly people and human resources] to have enough time allocated to actually ensure that the climate actions are carried out' (I6). Institutional and financial resources needed to implement actions under climate budgets may also create conflicts with traditional municipal services:

[Municipalities] spend almost all money on problems concerning school, health, kindergartens, elder care which is our traditional work in the city. So, we are now introducing a big new concern and that has to get resources. But where should they come from? From the children? From the sick ones? And that is a priority discussion that is very hard. (I3)

Inadequate legal and regulatory capacities are another barrier to local decarbonization identified in the implementation of climate budgets, with one participant arguing that '[municipalities] have a number of quite large barriers against succeeding since [they] do not have jurisdiction over the areas with established goals' (I7). For example, to achieve its emission reduction goals, all cars driving through Oslo will have to be fossil-free by 2030, including those from non-residents who drive in the city only a few times a year. However, these cars cannot be regulated by the municipality and will likely be less affected by the road toll payment system adopted to accelerate fossil fuel replacement. Norwegian municipalities also struggle with insufficient legal power to implement zero-emission zones, as the current National Planning and Building Act does not allow municipalities to set these climate requirements in spatial planning (Eide, 2022). One participant contrasted the lack of legal authority by affirming that 'if [the municipality] spent time with goals only where [it] has legal jurisdiction at the moment, then [it] would not accomplish much at all' (I7). These examples illustrate the extent to which climate budgets may challenge institutional systems to create new legal and regulatory capacities for local decarbonization.

4.1.3. Coalition building

New forms of coalitions facilitated by climate budgets include collaborative approaches with the private sector (see summary in [Table 2](#)). For instance, the Oslo municipality collaborates with suppliers through a Business for Climate network, with several business members from across sectors (City of Oslo, [2022](#)). In this network, the municipality and private suppliers discuss initiatives and solutions in key areas of the climate budget, including transportation, construction, and waste management, to overcome technological and financial barriers. Coalitions between municipalities and private suppliers are also used to provide a pilot environment to experiment, test and develop new solutions and technologies that can meet the challenge of decarbonization, as illustrated in the case of fossil-free construction sites.

City networks also contribute to coalition building. Oslo, for example, collaborates with the municipalities of Bærum, Asker, Drammen, the Viken County Council, and the Norwegian Public Roads Administration on the Goods Delivery in the Western Corridor initiative to create solutions for transportation services (City of Oslo, [2022](#)). Hamar works with Gjøvik, Løten and Stange to develop indicators that will make it easier to choose suppliers based on climate requirements (City of Hamar, [2021](#)), while Fredrikstad participates in the Klima Østfold networks to access expertise and increase the quality of the municipality's climate work (City of Fredrikstad, [2019](#)). Coalition opportunities reported by cities to support climate budgets also rely on other forms of exchange and learning, as reported by one participant:

We collaborate with other cities, but not in an institutional way, but more like strengthening each other. We learn from each other. We learn what action points other cities do that we would maybe not be bold enough to do ourselves, but when we see one or two other cities proposing an action point, we dare do the same. (I3)

Trans-municipal coalitions are also forms of collaboration harnessed by climate budgets, both in the form of exchange processes that take place with the implementation of climate budgets and in city networks targeting knowledge creation in specific areas. For instance, coalitions arise from efforts to systematize and facilitate the scale-up of climate budgets to other municipalities, as 'Norwegian municipalities are quite good at talking to each other on the climate field' (I3). The municipalities of Oslo, Hamar, and Trondheim, for example, created a step-by-step guideline for other cities aiming to implement a climate budget (City of Oslo, [2020a](#)), facilitating and expanding the climate budget implementation approach across municipalities.

5. Discussion

In this study, we find that municipal climate budgets in Norway are harnessing political dynamics to catalyze changes in cultural, economic, political, and technological systems. These dynamics, encompassing norm change, capacity building, and coalition building, offer evidence of the potential of climate budgets to produce systemic change toward decarbonization. In the cases observed, this is achieved through the convergence of urban planning, municipal programmes, new legislation and regulations, along with new financial and institutional capacities, and coalitions across municipalities and the private sector. For instance, by utilizing new public procurement policies, municipalities aim to direct financial streams to fund fossil-free and zero-emission innovation. Privately-owned construction sites in Oslo are expected to follow the municipality's initiative to become fossil-free by 2030. Similarly, Asker's requirements and investments in municipal buildings aim to also drive energy efficiency investments in private buildings as well as promote the use of climate-friendly materials in private buildings (City of Asker, [2022](#)). However, climate budgets are not a silver bullet for cities. This study shows that Norwegian municipalities still struggle to allocate limited resources to support decarbonization and inadequate conditions may undermine progress in key sectors, despite the creation of new legal, regulatory, institutional, and financial capacities. In many cases, decarbonization faces barriers as political dynamics and systemic changes unfold in contexts of resistance and uncertainty, including in key partnerships with the private sector and other government levels. Barriers also include the costs and risks associated with fossil-free and zero-emission urban development and a lack of technological implementation pathways to reduce emissions.

The implementation approach of municipal climate budgets is another key mechanism through which political dynamics are being harnessed to mainstream decarbonization into existing decision-making mechanisms

and expand the mandate of municipal accountability structures (see Table 3). Notably, climate budgets are enabling mainstreaming in ways that previous urban climate action approaches did not. Municipal departments and agencies are now requested to initiate, implement, and monitor climate actions in a process aligned with financial budgeting mechanisms to ensure that climate change mitigation becomes a systematic feature of municipal work. Climate budgets are also being used as a new strategy for horizontal coordination across departments and agencies, which is an important enabling factor identified in previous research (van der Heijden, 2019). For instance, in the instructions for drafting sectoral climate budgets, City of Oslo's municipal departments and agencies were asked to 'describe new climate measures that are planned to be implemented within the existing budget framework or are being put forward as additional proposals in the economic plan' (City of Oslo, 2021, p. 1) and assess the effects of their climate budgets on city-wide emissions. While these requirements apply to municipal departments and agencies that contribute to emissions, the climate budget may 'include provisions [...] to ensure that the entire municipality notifies its proposals for measures within its operational areas' (City of Oslo, 2020a, p. 22) including sectors that have not traditionally engaged with climate action. These accountability and reporting requirements aim to redirect the resources of municipal operations to climate change mitigation by layering a climate lens to activities that previously might have been considered unrelated to climate action.

Climate budgets have also supported new discussions on the political and institutional implications of climate change to local governments. Our analysis of the local climate budgets in Norway shows a governance pathway that aims to apply a climate lens to decision-making and redirect municipal expenditures toward climate ends alongside other goals. As a summary representation of this finding, one municipality declared that

climate work must become an integrated part of the municipality's core activities. This means that there must be equality between the economy, the environment and social conditions in the decision-making [...] Economy should no longer be the dominant management objective. (City of Asker, 2021, p. 18)

However, mainstreaming decarbonization into municipal decision-making mechanisms face multiple challenges (see Table 3). These challenges experienced by Norwegian municipalities include the lack of jurisdiction over emissions that are accounted for in climate budgets, inadequate legal frameworks to support municipal climate actions, and the prioritization of traditional municipal services that are expected from city residents, including infrastructure management, education, health and elderly care. Mainstreaming decarbonization into municipal decision-making also faces barriers related to insufficient financial streams to obtain zero-emission and fossil-free technologies and services. These findings support previous research showing that climate

Table 3. Summary of opportunities and challenges for mainstreaming climate actions into municipal decision-making mechanisms.

Opportunities	Challenges
• Alignment of the climate budgeting process with other existing municipal decision-making and reporting processes (e.g. inclusion of climate mitigation planning and monitoring in the annual financial budget). • Use of the climate budgeting process to support systematic participation of municipal departments and agencies in climate mitigation action planning (e.g. engagement of public transportation and traffic planning, municipal infrastructure management, and other municipal services to bring forward and lead climate actions within their areas of responsibility). • Adoption of regular monitoring and reporting mechanisms in the climate budgeting process to strengthen accountability and transparency of climate mitigation actions led by municipal entities and agencies. • Promotion of regular communication of climate mitigation action planning and monitoring efforts with municipal departments and agencies. • Harnessing of political power and institutional capacity to implement climate mitigation actions across municipal departments and agencies.	• Lack of jurisdiction over specific sectoral emissions that are accounted for in the climate budgets, including emissions from industries, city residents, and aerial traffic and marine traffic. • Different political agendas and short-term development priorities (e.g. priority for infrastructure development, such as roads and buildings, that contribute to increasing GHG emissions). • Conflicts between regular municipal services priorities (e.g. health care services, schools, elderly care) and the introduction of climate mitigation planning and monitoring requirements. • Insufficient financial capacity to obtain zero-emission and fossil-free technologies and services, such as new building infrastructure and public transportation, and lack of human resources to lead climate work within municipalities. • Inadequate legal frameworks to support municipal climate actions (e.g. cities lacking legal support to implement zero-emission neighbourhoods in cities). • Lack of technological implementation pathways to reduce emissions (e.g. inexistent zero-emission and fossil-free technologies for construction sites).

change mitigation mainstreaming in existing local governance frameworks is challenging (Klein et al., 2005; Reckien et al., 2019).

To identify and explore political dynamics and systemic changes, this study employs a framework that offers a methodological approach to describe the transformative decarbonization potential of municipal climate budgets. This framework allows for an analysis that goes beyond immediate outcomes, examining the early stages of change. Assessing their impact, however, is complex due to the unpredictability of system interactions and political dynamics as local policy experiments evolve and change (Bernstein & Hoffmann, 2018b; Tozer, 2020). Moreover, using this framework to study municipal climate budgets reveals critical questions about the contested meanings and purposes of decarbonization in local climate action experiments. For example, the study found that implementing climate budgets can generate resistance within municipalities, particularly from other municipal services competing for financial and institutional resources. In this case, the framework allows us to examine potential shifts in norms, policies, and funding streams as climate considerations are woven into decision-making, highlighting how these changes might alter established practices that enable fossil fuel use.

This study is also circumscribed by other methodological aspects. For instance, the selection focused on cities with established climate budgets and climate action reporting and does not represent the full range of municipalities in Norway. The data collection offers only a snapshot of climate budget implementation, although climate actions continue to evolve. The study also partly relied on publicly available documents, such as climate budget reports and municipal strategic plans, which may not capture all relevant activities and decisions. Written records could reflect a more polished perspective, omitting crucial political and systemic elements, thereby constraining our understanding of the potential of climate budgets to produce conditions for decarbonization. The expert interviews, while providing valuable insights into political dynamics and systemic effects, were also limited to nine climate budget experts with insight into how the climate budget was shaping decision-making to draw on multiple municipal experiences. Additional studies can build on this basis by, for example, delving into a case study to examine more historical context and a wider cross-section of stakeholders in a particular place. Further work can also dive deeper into particular cases to understand dimensions beyond or independent of the climate budget influencing the success of climate work in the municipality. Future studies can continue to examine the evolution of local climate action as more cities in Norway and worldwide implement their municipal climate budgets.

6. Conclusions

Our findings show that climate budgets implemented by Norwegian municipalities offer opportunities to harness political dynamics supporting decarbonization. These climate budgets are creating enabling conditions for decarbonization through a combination of political dynamics and systemic changes that produce new financial, institutional, and regulatory capacities and alter public services, urban planning, city-wide work practices, technologies, and livelihoods. The climate budget implementation approach, in which climate budgets are aligned with existing financial budgeting mechanisms, is also contributing to mainstreaming decarbonization into municipal decision-making mechanisms and broadening the mandates of municipal departments and agencies in executing and overseeing climate initiatives. Consequently, climate budgeting serves as a powerful approach for cities and local governments to align their governance structures with climate mitigation goals, integrating municipal programmes, urban planning, legislation, regulations, financial streams, and institutional capacity towards decarbonization. Despite these advancements, barriers persist to consolidating these decarbonization opportunities in Norwegian cities, as cities and local governments still need to address the increased need for institutional and financial resources to implement ambitious climate initiatives alongside traditional municipal services expected by city residents. Additionally, inadequate legal frameworks and a lack of technological implementation pathways may obstruct climate budgeting from effectively supporting city-wide decarbonization. However, these barriers are not insurmountable. The successful integration of climate change mitigation as a central component of municipal operations involves reorienting municipal decision-making to prioritize climate change mitigation, thus reshaping the responsibilities of municipal departments and agencies. Often, this process entails reallocating financial, institutional, and regulatory resources toward

climate actions and finding synergies between climate actions and traditional municipal services. While this process is not without challenges, it steers municipalities toward decarbonization by revealing multiple entry points for urban climate action to foster transformative change. In addition, climate budgeting can contribute to changing legal frameworks and technological implementation pathways. For example, in Oslo, fossil-free and zero-emission municipal construction sites are being developed, where changes in construction norms and practices, new financial and regulatory capacities, and city-private collaboration exemplify political dynamics that could entrench and scale up decarbonization both within and beyond municipal activities. It will also be necessary, however, for other levels of government and actors involved in the multi-level governance of urban climate action to smooth the path for municipal climate budgets by addressing the wider financial, institutional, and regulatory barriers identified through climate budget implementation.

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