PLOS Climate

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From petro transition ethics to pragmatic energy efficient transition ethics in Norway

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OPEN ACCESS

Citation: Sareen S, Inderberg THJ, High M, Rosenow J, DellaValle N, Niderehe S, et al. (2026) From petro transition ethics to pragmatic energy efficient transition ethics in Norway. PLOS Clim 5(3): e0000880. https://doi.org/10.1371/journal.pclm.0000880

Editor: Lily Hsueh, Arizona State University, UNITED STATES OF AMERICA

Published: March 26, 2026

Funding: This work was supported by the Research Council of Norway (331790 Empowered Futures Research School to SS; 344206 SOLNOR to TI and SS to cover research time). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

Abstract

Despite the urgency of climate change mitigation, the political economy of fossil fuel lock-in in petroleum-exporting states such as Norway makes the policy underpinnings perpetuating fossil fuel production intractable. This can have a chilling effect on low-carbon energy transition measures, such as renewable energy sources and energy efficiency solutions, due to capital, interests, and values being tied up in influential and attractive fossil fuel activities. Academic critique typically argues for a shift in extant political economic relations, yet lacks the teeth to bring this about. In this essay, a wide range of energy transition experts embrace a pragmatic approach that identifies several energy efficiency solutions that are not tied to nor serve to only cement the interests of the petroleum sector. We elucidate feasible and desirable energy efficiency initiatives to advance low-carbon transitions that, while not particularly transformative in isolation, can collectively mitigate emissions and begin to shift underpinning sociotechnical practices, political economic interests, and moral values in petroleum-exporting states. We also underscore the importance of inclusive governance and participatory mechanisms, such as citizens' assemblies, to overcome political gridlock, foster trust, and ensure that pragmatic energy efficiency measures are socially legitimate and equitable. By identifying relatively uncontroversial pathways for rapid action at scale, an emphasis on such initiatives can drive investment towards and support for low-carbon transitions by engaging with complex political economic relations. Over time, this approach may unlock a greater shift in energy systems and even inflect states' policy priorities more than the current normative deadlock.

1. Introduction

Norway is a modern welfare state with an open market and a well-functioning economy. Although it is not a classic ‘petrostate’--an established academic concept typically invoked to describe countries that rely heavily on petroleum export in the context of the resource curse and paradox of plenty [1] – Norway confronts the paradox of aspiring to be an international climate policy frontrunner while also being a major petroleum exporter [2,3]. As a major petroleum exporter with considerable state ownership in oil and gas exploration and production activities, petroleum activities figure heavily in its national income, and petroleum interests dominate national political strategies [4]. The Norwegian political economy exhibits divergent forces with regard to rapidly transforming to low-carbon energy systems: significant parts of the national economy are heavily influenced by fossil fuel production and exports, while land-based energy systems are characterised by low-carbon electricity based on renewable energy generation. These energy systems have traditionally existed in almost complete separation, but recent plans for offshore wind energy and electrification of offshore petroleum platforms on the Norwegian continental shelf couple them. The resulting challenge for an electricity system already under pressure to meet demand at affordable costs, combined with the interests of the petroleum lobby, shapes domestic decarbonisation processes. What has been missing up to now in the political discourse in Norway is a consistent, cross-party political consensus on how to deal with both climate change and mitigation policies. Such a consensus could encourage more long-term policy decisions that are anchored within the electorate as well.

The Norwegian case is instructive for understanding energy transition dynamics of states where specific industrial sectors dominate policy paradigms around energy and climate policy. Norway’s petroleum export income is transferred to its national sovereign wealth fund, commonly referred to as “the petroleum fund”, with up to three percent of its annual profits being channelled into the domestic economy. Given the size of the petroleum fund today, more revenue now accrues in the fund from global investments than from the production of oil and gas itself, making Norway less exposed to variable petroleum revenues than other petroleum exporting states. Nevertheless, the official stance across the major political parties is to develop rather than scale back the hydrocarbon sector – until a gradual decline in the distant future. It also involves coupling the hydrocarbon sector to domestic energy systems through the electrification of oil and gas platforms in order to meet Norway’s emission mitigation targets and render Norwegian petroleum production less carbon-emitting than production in other petroleum-exporting states. In this way, the Norwegian paradox is mobilised to justify production until the “last drop” of oil. This makes it relevant to consider how petro-exporting states’ transition ethics runs into conflict with pragmatic strategies for low-carbon energy transitions that are far more efficient, pragmatic, and scalable in reducing climate emissions than solutions tied to the petroleum sector. With an electricity system based on 99% renewable energy, such pragmatic pathways include the national greenhouse emissions mitigation strategy to electrify industry and transport. This strategy seeks to reduce Norway’s share of fossil fuels in its primary energy consumption, which is still around 50 percent. However, rather than aggressively pursue such pragmatic strategies, energy transition contingencies are increasingly modulated by petroleum interests, with increased electricity demand from offshore petroleum production likely to comprise over 10 percent of Norway's total electricity demand by 2030 [5].

Accounting for such petro-exporter state interests and dynamics, this essay identifies and discusses some key energy efficient transition solutions. A pragmatic focus on such solutions is crucial for enabling feasible pathways to rapidly scale action towards low-carbon energy transitions. Such action is an important part of the requisite response to the climate crisis, which extends beyond decarbonisation to other domains like biodiversity. Like many other countries, Norway is a signatory to important global treaties, such as the United Nations' Framework Convention on Climate Change's with its Paris Agreement of 2015, and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services with its notable transformative change assessment report of 2024. It also champions the United Nations Sustainable Development Goals running until 2030. This wider policy context – which includes numerous ambitious and time-bound targets at supra-national, national and sub-national scales – provides the backdrop for our argument. As authors with wide expertise on energy transitions, our primary focus is to address the main domestic decarbonisation arena – the electricity system – linked to energy transition ethics. While a more transformative approach to decarbonisation would necessarily direct attention to scaling down and phasing out petroleum activities, as this is unavoidable in a net-zero world [6], the intractable nature of this issue in a petro-exporter political economy does imply that other decarbonisation elements should not be put on hold.

Our basis for exploring energy efficient transition solutions is their demonstrated and potential impact in emergent low-carbon energy systems in Norway and beyond. While no context is free of incumbent interests, we aim to draw insights from instances where such action is not stalled by a petro-intensive political economy, and to identify scope for their application in petro-relevant contexts as well. This research design holds the promise of transferring learning across contexts, with solutions reviewed and referenced based on our collective wide experience with concrete decarbonisation transition solutions, and diverse critical positionality in jointly evaluating applicability to the Norwegian context.

Our motivation for doing this is threefold: First, petro-exporter states' emissions reduction strategies often rest on techno-optimist future fixes (such as carbon capture and storage (CCS) and blue hydrogen), while framing transformative demand-side cuts in the use of petroleum products (such as oil and gas) as a way to avoid supply-side responsibility. This paralysis, however, does not exclude the need to transition other energy system elements. Second, exploring complementary decarbonisation processes, such as energy efficient transition solutions, can over time trigger systemic openings and impetus for transformative shifts. Third, we stress that technical and economic considerations must be coupled with attention to energy ethics and inclusive, participatory, and value-oriented approaches, for example, through citizens' assemblies. As we later discuss, such assemblies can help overcome political gridlock, reduce polarization, and build trust between the citizenry and policymakers.

In the following sections we review key literature on petro-exporter state ethics and energy efficient transition solutions, followed by elaboration of numerous energy efficient transition solutions applicable to Norway. We then reflect on the payoffs and limitations associated with such a pragmatic approach to energy transition solutions, before concluding with reflections on how to accelerate their implementation.

2. Petro-exporter state ethics and energy efficient transition solutions

Energy systems are not just about technology and infrastructure – they are also productive of and underpinned by cultural practices, socioeconomic relations, political structures, and ethical sensibilities [7,8]. As dense sociotechnical matters, visions of energy transitions thus involve fundamental questions about equity, access, and responsibility. Who benefits from energy transitions? Who bears the cost? What future is envisioned? And whose flourishing is prioritised? Confronted with greater permeability of risks [9], declining trust in institutions [10,11], and the rise in 'ethical capitalism' [12, cf. 13], governments, corporations, industries, and citizens are entangled in ethical concerns that are often rendered explicit and visible. Ethics has come to figure prominently in contested and performative spaces where diverse persuasions are enacted, negotiated, and commodified. While this shift towards the language and performance of ethics does not necessarily imply that deeper, more profound moral imperatives are now embraced, it does have implications for how energy transitions are perceived, endorsed, and, not least, challenged.

Recognising energy projects as also ethical(isation) projects is crucial for a pragmatic approach to energy transitions. The values people lean towards, hold, or reject form part of their understanding of what matters to them and why. Without attending to these values, there is a major risk of misapprehending and simplifying what is at stake for others in energy projects. As trust erodes and conflicts arise, positions become defensive and entrenched, making dialogue and engagement increasingly fraught and unlikely. Deliberative consultations with 'mini publics', inclusive and attentive governance along with early meaningful engagement that attends to ethical sensibilities and commitments are particularly important in high-stakes transitions like societal visions for 'net zero' futures (see, e.g.,[14,15]).

In petro-intensive economies such as Norway, oil and natural gas have formed the "lifeblood" of the nation for decades [16]. And with the ongoing exploration and production in the Norwegian North Sea and Barents Sea, coupled with the petroleum-income based national pension fund and controversies surrounding onshore wind developments, this carbon lifeblood is set to continue pulsating. While subject to strong critique and challenge, the fossil fuel lock-in runs deep, extending through Norwegian society and across multiple and varied regimes of ethics [17,18,3]. Recognising how ethics has become a battlefield where actors and critics uphold the kind of flourishing that they believe should be brought into being, incremental and inclusive pathways for energy transitions at scale are less likely to appear on the front page than the latest national energy controversy. It is precisely therefore that such pragmatic pathways merit articulation and attention.

Petroleum interests should not be caricatured or expected to unfold similarly for all aspects of possible transition elements. Rather, like other vested interests [19], we hold that they are likely to play out differently depending on the context and the interests of the involved and influential actors. As pointed out by the International Energy Agency, in a global perspective, the three most important energy efficient transition solutions include *(i) the rollout of renewable electricity technologies, (ii) the low-carbon electrification of buildings, industry and transport, and (iii) traditional energy efficiency* [20]. We use these three general transition policy areas to discuss how petroleum ethics, through their informed but assumed interests, are likely to influence policy developments, and use them in the discussion to explore the space for pragmatic decarbonisation policies to develop.

The *widespread deployment of renewable electricity technologies*, such as solar, wind, and hydro power, is central to decarbonising the electricity sector efficiently. These technologies generate electricity directly without combustion, avoiding large conversion losses entirely. Indeed, analysis shows that global final energy demand could be 40 percent lower if the full electrification potential is deployed [21]. This means that even by simply switching from fossil fuel generation technologies to wind, solar, and hydro power, vast amounts of primary energy can be saved. As these technologies mature, their costs have plummeted, making them increasingly competitive with fossil fuels. Solar photovoltaic (PV) and wind energy are now the fastest-growing sources of electricity globally. The rollout includes not only the installation of these technologies, but also the necessary grid upgrades and the development of energy storage solutions, like batteries or enhanced pumped storage hydropower capacity.

Electrification is the process of switching from direct fossil fuel use to electricity for energy consumption in key sectors. This is crucial for the energy transition because as the power grid becomes cleaner with more renewables, these sectors can also decarbonise. In buildings, this means replacing natural gas furnaces with electric heat pumps for heating and cooling. For transport, it involves the mass adoption of electric vehicles (EVs) for personal and public transport. In industry, it includes using electric boilers, heat batteries, and heat pumps for various processes. Additionally, electrification implies some energy efficiency, as electric systems often convert energy into useful work more effectively than combustion-based systems, thereby reducing wasted energy.

Finally, although often overlooked, *energy efficiency* remains often the most cost-effective and immediate solution for the energy transition. It involves using less energy to achieve the same or a better level of service, e.g., replacing traditional light bulbs with light-emitting diode (LED) bulbs or optimising industrial processes. The goal is to reduce overall energy demand, which in turn lessens the need for new power generation and infrastructure. Implementing efficiency measures, such as better insulation in buildings, more efficient industrial processes, and smarter energy management, not only cuts carbon emissions but also lowers energy bills and enhances energy security. Importantly, future energy efficiency solutions need to be net zero compatible, meaning that rather than making existing fossil fuel technologies marginally more efficient, they must be elements of a fully decarbonised package of solutions [22].

Recognising the interplay between the ethical considerations and technical fixes allows us to consider how the design and implementation of pragmatic energy transitions are entangled with social values, governance structures, and political interests. It also allows us to frame the following discussion not simply as a catalogue of technical measures, but as an exploration of how such measures can be mobilised in ways that are both feasible and socially legitimate within petro-exporter contexts like Norway.

3. Energy efficient transition solutions and their implementation in the Norwegian context

In this section, we briefly unpack some key elements of energy efficiency, renewable energy technology deployment, and electrification as key energy efficient transition solutions in the Norwegian context. This is not a comprehensive overview, but necessarily selective both given space constraints as well as our ambition to identify key pathways to advance energy transitions along lines that are relatively uncontroversial in Norway, and globally recognised as being economically desirable in a long-term perspective based on state-of-the-art scholarship, which we indicatively cite.

3.1 Energy efficiency and heat pump development

While energy efficiency or savings are often intrinsically linked to less advanced technologies like insulation and improved windows, heat pumps represent a key technology for using less energy for heating. This is true both for space heating, as well as industrial heat. Norway has excellent preconditions for a rollout of heat pumps in general. While they represent key energy efficiencies, they are also a cornerstone in the electrification of heat. Most homes have experience with electric panel ovens, therefore the distribution network in the housing areas is already dimensioned for this inefficient technology. While the Norwegian heat pump coverage is already high in a European context, a further transition to heat pumps is easily feasible, as both the necessary grid capacity as well as overall consumption is reduced. Much of current heating systems use air-to-air heat pumps, which can have sub-par performance in cold winters. The alternative, air-to-water heat pumps, or the even more efficient ground source-to-water heat pumps, can be costly to overlay on existing structures. These types are used less often, due to a lack of incentives combined with relatively low energy costs. Industrial heat pumps have an even smaller spread, but are starting to be deployed more often. Heat pumps catering for the 150–200°C range will enable electrification of a sizable part of heat-intensive industrial processes. District grid heating systems are another potential field for heat pump application. Electrification of industry and transport requires upgrades to transmission and distribution systems, as well as new generation assets.

Demand-side energy flexibility is a major requirement for a successful energy transition. To achieve this, it is sufficient to control the energy use of heating and mobility (independent of whether this is located in a family home, or at an industrial site), as well as of some industrial processes. All other electricity use (such as for lighting, home appliances or computers) pales in comparison to demand associated with electrified heat and mobility, with data centres being an exception due to the high concentration of energy-intensive computing processes. In family homes, control of space heating (by heat pump or panel ovens), hot water (if not part of a heat pump system), as well as automobile charging can render about two-thirds of installed demand flexible in a Norwegian setting. Additionally, both solar systems as well as battery storage installations can be controlled, but these are underdeveloped in Norway. This control can be established either within the home itself, or via aggregators such as the electricity provider Tibber. This is already being done at a small scale. Industrial companies are also using their flexibility, primarily in direct contracts with the distribution system operator (DSO). Alternatively, they can market their flexibility in market structures such as Euroflex (a national flexibility market platform), together with aggregators like Tibber, with DSOs being the main flexibility off-takers.

Despite the promise energy flexibility solutions hold, incentives remain insufficient, and often countered by measures such as '*norgespris*', namely a subsidised household electricity tariff that has now come into force. The adage '*the technology is not the problem; the policies are missing*' holds true for Norway. It used to be the country of cheap electricity prices, and compared to many European countries it still is. Norwegians, however, have experienced substantial electricity price increments in the 2020s, due to a combination of major new grid connections to Germany and the UK, and the fossil fuel energy crisis after the Russian invasion of Ukraine in 2022. Due to a major public outcry, the Norwegian government has reacted with subsidies to electricity costs for private households. These have been implemented in three waves, from December 2021 and until today, with specified tariffs excluding value added tax and grid access fees. The specific design is less important here, although announced from October 2025 onwards there is a key policy where households can choose a fixed energy price of 0.50 NOK/kWh. Apart from bracketed grid charges linked to peak demand volumes per user, this means that few incentives for demand response remain.

The last two iterations of this subsidy are controversial among energy transition professionals and have been the subject of extensive critique, as losing incentives for flexibility and lower energy consumption will reduce capital investments in energy transition solutions. This is already evident, as the market for solar energy installations on households has all but collapsed, and the private heat pump market has also shrunk. There are other possible ways of organising this subsidy that would both keep incentives in place and support social equity. One notable proposal suggests subsidy allocation per person as an equal sum [23]. The mechanism has resonance with 'climate fee and dividend' systems and incentivises less energy use as well as demand flexibility. Alongside energy efficiency measures, it is equally critical to accelerate the displacement of fossil fuels with lower-carbon alternatives, an issue that we will now turn to.

3.2 Renewable electricity technology deployment and flexibility solutions

Despite a history of hydropower generation to meet its domestic electricity demand, Norway's future electrification requires the rapid addition of energy capacity, largely from other renewable energy sources such as wind and solar energy. After a slow start around 2000, electricity production from onshore wind turbines increased steeply from around 1 TWh (less than 1% of annual electricity production) by the end of 2010 to about 15 TWh or some 10% of total annual electricity production by the end of 2021 [24]. In 2019, however, the wind power permitting system was put on hold when the government decided to stop any processing of wind power permits until a new and improved permit system had been developed. This decision was the result of escalating conflicts and widespread protests about the wind power licensing system in Norwegian municipalities [25,26]. About four years later, in July 2023, legal reforms granting planning authority to the municipalities in wind power siting decisions were implemented, and the processing of licensing applications by the Norwegian energy agency was resumed [26]. However, the development of new wind power projects has been slow, partly due to the veto power of the municipalities in the new licensing system and partly due to tensions between their development and indigenous Sámi self-determination, especially in the Arctic and subarctic regions of Norway [27]. Similarly, the development of rooftop and ground mounted solar power has been slow in Norway.

The variable nature of these sources over time makes energy flexibility solutions increasingly relevant. In light of the above politically-inflected trajectory of electricity pricing, we argue that dynamic tariffs and digitalisation-enabled automation represent important domains where pragmatic energy efficiency solutions must be assessed not only for their technical performance but also for their *efficacy*, or ability to function effectively. In Norway, where political and economic structures may limit rapid transformation, measures can only succeed if they are designed to address equity and the capacities of those who will ultimately interface with these solutions. Dynamic tariffs – which expose households to time-varying electricity prices – and automation technologies – such as smart controls for heat pumps, hot water, or EV charging – are widely promoted as solutions for demand-side flexibility. Together, they can reduce peak demand, facilitate renewable integration, and lower system costs. Yet their effects are not neutral [28]. Distributionally, households with limited adaptive capacity – such as tenants unable to invest in equipment, elderly people with limited digital skills, families with rigid routines, or those with limited incomes – may face higher risks of exclusion or cost burdens. Procedurally, tariff and automation design has largely been confined to expert and regulatory circles, limiting the possibility for public involvement. Moreover, prevalent regulatory, market, and technological frameworks tend to assume uniform, rationally responsive consumers. Such assumptions overlook the heterogeneous practices, vulnerabilities, and values of different social groups, thereby reproducing inequalities and undermining legitimacy. Recognising the diversity in energy needs and capacities is thus key when designing and implementing these measures.

In the Norwegian context, recognising diversity in energy needs and capacities also requires acknowledging that different groups may understand justice in energy decision-making in fundamentally different ways [29]. As noted by Valkenburg (2024) [30], a considerable number of Sámi people are rallying against the Norwegian government, arguing that cultural and traditional interests have been insufficiently considered in decisions regarding the siting of wind energy projects. Research on Sámi perspectives helps explain why this can occur even when policies formally address distribution, participation, and recognition [31]. These insights are directly relevant for flexibility governance. Dynamic tariffs and automation can be experienced as unjust where they are disconnected from place-based livelihoods and longer temporal horizons that shape how energy interventions are valued.

Responding to these legitimacy challenges thus requires an equity-oriented approach that actively reshapes how flexibility measures are designed, governed, and justified. This entails widening participation and equipping all groups with competences and tools that expand their adaptive capacity, such as accessible digital literacy programmes, transparent automation interfaces, and inclusive support schemes [32]. At the same time, safeguards are needed to protect consumers from exploitation or manipulation, since automation and tariffs rely on personal data [33]. Ensuring data justice – through secure governance, transparency, and accountability – is not merely a technical safeguard, but a precondition for social legitimacy. Without such protections, citizens may resist automation schemes, undermining flexibility potential; with them, trust can be built and sustained, enabling households to actively participate and exercise agency in shaping energy transitions [34]. Applied consistently, these measures become opportunities to foster energy citizenship, where citizens move beyond the role of passive consumers to become informed, capable, and empowered actors in shaping the energy system [35]. This may include consultation on tariff design, co-development of automation programs, or participation in community aggregation schemes that pool resources and decision-making.

3.3 Electrifying transport

Sectoral coupling between electricity and transport constitutes an especially notable domain of pragmatic efficiency measures with high technical potential. Norway's rapid adoption of EVs provides a world-leading basis for integrating mobility into the energy system. Smart charging and vehicle-to-grid (V2G) technologies can transform EVs from individual mobility devices into distributed storage assets, enhancing system flexibility, accommodating variable renewables, and reducing the need for costly grid reinforcements. In purely technical terms, EVs therefore represent a scalable and attractive solution. Yet, as with other flexibility measures, their broader value depends on how well they address citizens' needs, mitigate vulnerabilities, and expand opportunities for agency and participation.

From a distributive justice perspective, access to EVs and home charging infrastructure is concentrated among households with higher adaptive capacity: those with sufficient income, private parking, or flexibility in daily schedules [36]. Others – including tenants, households in dense urban areas, and those with limited resources – risk exclusion from benefits such as participation in V2G services. These inequalities are also spatial: in peripheral and rural regions, limited charging infrastructure, long travel distances, and harsh climatic conditions can further constrain the feasibility and affordability of EV adoption.

Procedural justice concerns arise because decisions about charging infrastructure, tariff structures, and market integration are often dominated by central policymakers, utilities, and car manufacturers, with little space for citizen or local involvement. Recognition justice concerns arise because the mobility needs and practices of those without access to private EVs, including public transport users and residents of peripheral regions, are often marginalised in policy design. In Norway, this includes Sámi communities in non-metropolitan regions, where mobility is closely connected to land use, seasonal activities, and livelihoods that depend on sustained relationships with nature [31]. In such contexts, mobility is not only about daily commuting, but about accessing seasonal work sites and dispersed settlements, often under conditions that may challenge standard EV assumptions regarding range, charging access, and infrastructure availability. As a result, transport electrification may unevenly benefit those whose mobility practices align with urban and suburban norms, while offering fewer advantages for place-based livelihoods beyond metropolitan areas, unless place-based policy approaches incorporate Sámi perspectives and other non-metropolitan mobility needs.

At the same time, sectoral coupling carries important potential to address both energy poverty and transport poverty [37]. EV integration into electricity markets could lower household energy costs, expand affordable access to mobility services, and enable participation in local flexibility markets. However, this potential is not automatically unlocked. It requires a justice-centred policy package that simultaneously targets system structures (infrastructure, regulation, pricing incentives) and social conditions (capacity-building, affordability measures, and inclusion schemes). Only through such comprehensive design can EV coupling contribute to social as well as technical goals.

Such design can also create the conditions to foster energy citizenship. For example, public charging hubs designed with municipalities, cooperative ownership of charging infrastructure, and participatory consultations on V2G integration can allow citizens to influence how EV infrastructures are deployed and governed in line with citizens' needs. Such arrangements can also foster relational values, e.g., solidarity, reciprocity, and trust, that reinforce legitimacy in the energy transition process [38].

4. Discussion: Potential payoffs and limitations of pragmatic energy transition approaches

We have outlined the viability of pragmatic solutions that can reduce Norway's climate emissions. There is some state support for some of these solutions through subsidy programmes such as Enova and research and innovation investments such as the Research Centres for Environmentally Friendly Energy. Overall, however, financial and political support for pragmatic solutions to energy and environmental challenges is lacklustre compared to other Norwegian governmental interventions in technologies linked to the petroleum industry such as CCS and blue hydrogen. While in specific cases such technologies may be necessary due to the lack of present alternatives (such as CCS in waste-to-heat and cement manufacture, and hydrogen in fertilizers and chemicals), there are also significant hurdles in quickly and effectively implementing these technologies [39,40].

The push for uncertain technologies over actually-existing pragmatic solutions points to the limits of petro-exporter states in promoting technological innovation. The challenges lie in how the lines between energy policy, industrial policy, and climate policy in petrostates becomes blurred, and how the policy preferences of certain business and labour interests become promoted by the state contra others [41]. Over the half-century since the advent of its petroleum industry, Norway has established an extensive offshore supply sector as a major employer in the petroleum sector [42]. Companies and labour unions in this sector have collaborated to form powerful lobby organisations such as Konkraft to extract political support and tax benefits for the industry [43]. Today, Norway's oil resources are becoming increasingly mature and more costly to extract, and even in the best-case scenarios, oil production is expected to drop [44]. Both companies and labour unions in the sector envision that the future of the industry depends both on maintaining current levels of oil production as long as possible and on developing alternative businesses centred on petroleum industry expertise. A primary challenge for these technologies, however, is that markets are immature, often reliant on significant subsidies, and with much lower profit margins than the petroleum sector. In response, the Norwegian state deploys industrial policy intended to support the industry, in the form of energy and climate policy to reduce hard to abate industrial emissions, through extensively subsidised programmes such as a 22 billion NOK investment in the Longship CCS Project. This ironically shortchanges the already available and scalable pragmatic solutions outlined above of adequate support.

Given the three transition policy areas discussed here – *electrification of fossil energy use, renewable energy diffusion,* and *traditional energy efficiency* – we argue that petro ethics and interests are likely to unfold in very different ways. *First*, the most controversial area is likely to be found in the electrification of energy use. As shown by Larsen & Dupuy [45], petroleum electrification projects have been politically granted while other companies seeking connection approvals from the Transmission System Operator (TSO) are increasingly competing for the same electricity – electricity that is increasingly limited both by grid availability and a potentially more constrained national electricity balance. This competition is currently rather strong and implies that there is a limited ground for pragmatic collaboration, and that interests are likely to seek ways of influencing framework conditions in a competitive way. This situation resembles a zero-sum game with little room for synergistic solutions, where non-petroleum industry electrification runs counter to petroleum interests when there is shortage of grid capacity and electricity generation and is deprioritised.

Second, for renewable energy diffusion, the situation is somewhat different. A key difference from electrification is that increased renewables production capacity will increase available electricity for decarbonising petroleum installations, as well as for other industry initiatives. There is evidence of both offshore and onshore industry initiating vertically integrated renewables projects, which are directly connected to industry needs through Power Purchase Agreements. However, while these may seem like synergistic initiatives, petroleum and other industry initiatives and developments have to a large degree been separate. While the petroleum sector facilitates and invests in offshore wind power developments, so far land-based industry has either purchased their needed power from traditional external contracts, or developed onshore projects, for example wind power, without being able to develop competitive Power Purchase Agreement agreements. This means that there is *not* a direct conflict in interests, but rather limited space for pragmatic policy solutions.

Finally, within traditional energy efficiency (households, buildings, industry), we argue that this is, in the current energy situation in Norway, aligned with interests of the petroleum sector and therefore not resisted by the petroleum sector. Energy efficiency in an increasingly constrained electricity situation is not helped by the price management policies currently operating in Norway. However, energy efficiency would, given effective implementation, lead to more electricity available with the bonus of less conflict between the petroleum industry and other economic activities. While there are other barriers for these policies to be effective, given a constrained electricity situation there is little by way of direct opposition to such policies (although in a situation with a large annual surplus on the power balance, the situation would be different. Here, electrification would be less of an interest conflict. Notably, in such a situation, one can also argue that energy efficiency is in conflict with large hydropower producers' interests, as it risks undermining their hydropower assets. These are fundamental questions that we do not discuss further, given Norway's increasingly pressured electricity situation). Given the ostensible interest alignments with the petroleum sector, we identify the area of energy efficiency to be open for pragmatic policy solutions, that has some potential to drive the energy transition without running into the challenge of needing to adopt policies that conflict with the dominant interests of the petroleum sector.

See Table 1 for a summary of interest alignment, rationale, and consequence for pragmatic transition policies.

To bolster the rapid emergence and scaling of pragmatic energy transition solutions, it is imperative to move beyond incumbent actor roles and expand scope for a broader constellation of stakeholders and energy industry innovation and enterprise. This includes creating transition pathways for workers and local communities whose livelihoods are tied to petroleum production and related industries, as well as groups historically excluded from decision-making [46]. A globally just yet locally inclusive transition requires attention to these constituencies, both to mitigate risks of social discord and to unlock opportunities for shared prosperity. Industrial clusters and technology providers stand to benefit from market

Table 1. Summary of interest alignment, rationale, and consequence for pragmatic transition policies.

	Non-petroleum industry electrification	*Renewables technologies*	*Energy efficiency*
Alignment with petro interests	*Not* in line with petroleum interests (or effectively quashed by political priority given to petroleum).	*In line* with petroleum interests.	*In line* with petroleum interests.
Rationale	Unlikely to be politically supported beyond rhetoric, with ongoing competition for electricity capacity and supply with other transitional actors and uses. No overt official arguments from the petroleum industry.	Likely to be passively supported, as more renewables, and measures to phase in more renewables in the system, will make electricity more available also for petroleum activities.	Likely to be supported, as it will reduce competition for electricity in a diminishing annual electricity balance.
Consequence for pragmatic transition policies	Limited scope for pragmatic transition policies, as such policies might face both indirect resistance or lack of prioritisation.	Scope for pragmatic transition where policies are not connected to petroleum interests (although this has been difficult for the last five years for other reasons).	Scope for pragmatic transition where policies are not connected to petroleum interests. These include energy saving policies in the industry, households, and other areas, although other obstacles occur.

https://doi.org/10.1371/journal.pclm.0000880.t001

expansion in electrification, flexibility services, and energy efficiency, while municipalities and local governments can leverage these shifts to attract investment and revitalise regional economies, doing so in a way that reflects citizens' priorities due to their proximity to local communities. Financial institutions, educational bodies, and civil society organisations also play critical roles in enabling access to capital, skills development, and accountability mechanisms. Importantly, marginalised groups, such as low-income households, tenants, and digitally excluded populations, must be positioned not only as beneficiaries, whether through affordable energy services or community energy schemes, but also as knowledge contributors, bringing their lived experiences and future visions into the design of these initiatives. Recognising a sense of place and local identity helps anchor these contributions and ensures communities remain able to shape their own futures [47]. Equally important is that benefits, such as jobs and revenues, are localised rather than concentrated among incumbent industries or investors, ensuring that communities can influence how these benefits are allocated. Complementary measures, including targeted support for vulnerable groups, can strengthen people's ability to participate. As Sovacool et al (2025, 15 [48]) argue, in UK's industrial decarbonisation, for example, this requires "careful, inclusive planning at many different sites and levels of decision-making" supported by coordinated efforts from politicians, civil servants, and coalitions that span socio-ecological advocates and communities.

Broadening involvement demands procedural innovations that embed justice into the design and governance of transition measures [49]. This entails well-resourced engagement processes that afford communities real influence, moving beyond tokenistic consultation to participatory mechanisms such as citizens' assemblies with suspensive power (referring to the ability to delay or veto policy decisions, see, e.g., [15,50]) thus strengthening the role of energy citizens as core actors in shaping transition pathways [51]. As recommended by the OECD (2025) [52] and EU (2023) [53], and increasingly adopted internationally (ibid), citizens' assemblies can help with long-term, depolarized, and trust-building climate and energy policy. For example, the Norwegian citizen panel "Future Assembly" convened over several months and released a report with 19 recommendations, including an argument in favour of participatory mechanisms becoming a permanent part of the parliamentary decision-making process [54]. In the Norwegian context, where fossil fuel interests wield significant power through lobbying and sponsorship, citizens' assemblies offer a democratic counterweight helping to shift the focus from short-term electoral cycles to intergenerational responsibility [55]. This is also the focus of an ongoing campaign by the "People Against Fossil Power" organisation (see Fig 1), which has received the support of several dozen Norwegian researchers in the form of an Open letter [56]. Results from such a citizen panel could be used as the basis for a cross-party political consensus. Such mechanisms are especially valuable where representative democracy has struggled to curb the influence of special interests. Together, these steps can democratise decision-making and turn pragmatic solutions into socially legitimate pathways for inclusive low-carbon transitions [48].

Fig 1. A campaign at the Oslo Opera House by *folk mot fossilmakta* (people against fossil power) focused on democratic control over the oil fund, as a supplement to current institutions. The 15-metre-long banner reads: "People's Council Now" (13 September 2025). Photo by *folk mot fossilmakta;* used with permission.

https://doi.org/10.1371/journal.pclm.0000880.g001

5. Conclusion: How to accelerate implementation of energy efficient transition solutions

Despite the relatively uncontroversial nature of the solutions we highlight, they face some political barriers to advance in Norway. A central theme in the Norwegian context is the petroleum sector's political clout [4]. Although it is well-established that sectors such as forestry, agriculture, transport, construction, and industry have significant influence in the Norwegian political system, the petroleum sector occupies a special position due to its significance for the economy and employment, and its extraordinary lobbying skills and ability to influence political decisions. One example is the 2020 petroleum tax relief package that was designed to cater to the needs of the petroleum industry and its suppliers during the Covid-19 pandemic. In this and other cases, the industry has emphasised the ripple effects for the supplier industry and employment along the Norwegian coast as arguments to ensure good framework conditions. Indeed, the petroleum industry was central to the emergence of modern lobbying in Norway [57]. Since the 1970s, the Norwegian corporatist system has been dismantled and gradually replaced with more informal lobbying activity wherein various interest groups fight for the ears of decision-makers. The notion of the 'oil worker' has become an important symbolic resource that politicians, public figures, and industry spokespersons use to mobilise sympathy for the petroleum industry in public debate [58]. Although environmental organisations and other actors may have agenda-setting power, the petroleum lobbyists have had the decision-making power needed to get their interests through in parliament. A large and stable political majority in parliament has upheld a petroleum policy that in several ways has served as a barrier to energy efficient transition solutions in Norway.

Compared to other countries, there has been relatively broad political agreement in Norway on climate policy, as shown by the parliamentary climate agreements from 2008 and 2012 and the Norwegian Climate Change Act. Although the larger political parties in parliament and government have exercised the most policy influence, the 'green' Socialist Left

Party and Liberal Party have been able to pressure the major governing parties in different periods – namely the Labour Party and Conservative Party – to agree to a more ambitious climate policy than they would otherwise have pursued on issues such as gas power, CCS, biofuels, restrictions on oil exploration in the Far North, and protection of peatlands [59]. The political clout of smaller parties in climate policy has been strengthened through close ties to the environmental movement. Thus, environmental non-governmental organisations have gained significant support for their positions on several important climate issues, such as the Norwegian Climate and Forest Initiative, CCS, and the ban on cultivating peatlands. While a radical policy shift is unlikely soon, the new government and political majority in parliament may well be able to agree on incremental and practical policy changes that can unlock energy efficient transition solutions. Over time, a less radical, more pragmatic approach to energy efficient transition solutions in petro-exporter political economies like Norway can potentially unlock the action space for transformative systemic shifts based on demonstrating alternative evolution pathways for low-carbon energy systems, while safeguarding against heavy politicisation of climate policy and likely ensuing polarisation as increasingly evident elsewhere.

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