POLICY BRIEF

4i TRACTION
innovation · investment
infrastructure · integration

In Search of Transformative Ambition: EU Climate Policies in 2005–2020

Results of a Quantitative and Qualitative ex-post Assessment

Main findings and recommendations:

1. The EU vastly overachieved the emission reduction target it had set itself for 2020: it reached the 20% mark eight years ahead of time, by 2020 emissions were 35% below 1990 levels. The EU also exceeded its targets for energy efficiency and the expansion of renewables, raising the question if more ambition could have been possible – and would indeed have been warranted.

2. EU climate policy in 2005-2020 was still predominantly of an incremental nature. It sought to promote lower-carbon alternatives, to help climate-friendly solutions to evolve from their niche and become mainstream, and to optimise existing systems. But it did little to change or disrupt existing fossil-based systems.

3. In terms of fostering innovation and stimulating investments, EU policies with a stronger sector- or technology-specific focus were found to have a stronger, more discernible impact, whereas cross-cutting tools remained below expectation.

4. Infrastructure was a neglected element in the EU's climate policy mix. This is a missed opportunity given the centrality of infrastructure for most climate-neutral solutions, the long lead times, the limits to private provision, and the EU's role for infrastructure funding.

Introduction: in search of transformative ambition

In 2009, the European Union set itself three headline targets to direct its climate policy efforts until 2020:

- Reduce greenhouse gas emissions 20% below 1990 levels;
- Raise the share of renewable energy in total final energy consumption to 20%, and that of renewable energy in transport to 10%;
- Improve energy efficiency by 20% compared to the reference scenario.

To achieve these targets, the EU deployed a suite of new policy instruments, and increased the ambition of existing instruments, further expanding its climate policy mix. In response to the 2015 Paris Agreement, the EU increased the ambition of its climate targets – and towards the end of the decade announced its new overarching strategy for climate-neutral economic prosperity, the European Green Deal (EGD). The EGD firmly established the end goal of climate neutrality as a reference point for EU climate policy, but also raised the bar. Compared to pre-2020 climate policies, incremental improvements are no longer sufficient; achieving climate neutrality in the remaining time requires transformative climate policy (Görlach and Martini 2022).

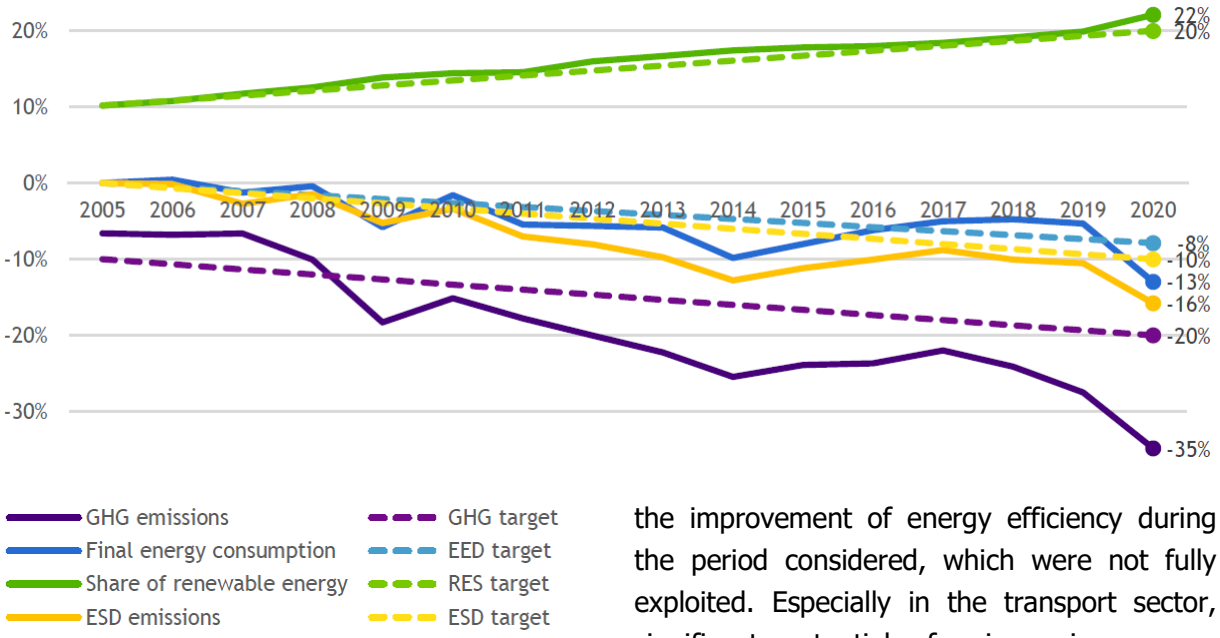
This policy brief draws on work conducted in the 4i-TRACTION project that investigated the implementation of the EU climate policy in the period 2005-2020, both at the EU level and in selected Member States. The analysis was comprised of a quantitative assessment, a qualitative assessment, and a set of seven national case studies. In particular, it sought to distil whether (and in what ways) pre-2020 climate policies already included transformative elements. The analysis was organised around four core cross-cutting challenges, by asking whether EU climate policy managed to

- Foster breakthrough innovation;
- Shift investment and financial flows;
- Roll out the infrastructure for a climate-neutral and resilient economy; and
- integrate solutions across sectors and policy instruments.

The EU over-achieved its 2020 climate targets

The EU vastly overachieved the emission reduction target it had set itself for 2020: the 20% mark had been reached eight years ahead of time, and by 2020 emissions were 35% lower than they had been in 1990. The EU also exceeded its targets for energy efficiency and the expansion of renewables, albeit later and with a smaller margin. While this is a positive achievement, it raises the question whether the EU could have been – or should have been – more ambitious in setting its targets.

The emission reductions observed in 2005-2020 are mostly attributable to the effect of climate policies, both at EU and member state level. Other drivers such as economic development, population growth and structural change would have resulted in growing emissions.



For two main drivers of emission reductions – energy efficiency and the expansion of renewable energy – a contradictory picture emerges:

Regarding **energy efficiency**, the positive finding is that the EU economy used energy much more efficiently in 2020 than it had in 2005, in terms of the energy required to produce one unit of GDP. Yet the contribution of energy efficiency policies to this trend is less clear: in several sectors, more could have been possible, and energy efficiency policies became a bottleneck, leaving untapped potential.

A national case study from Finland shows that the integration of energy efficiency targets and measures into local decision making (climate policy integration) has been a practical way to achieve the energy efficiency standards set by EU legislation (Varis 2023). This example also shows that there were significant reserves for the improvement of energy efficiency during the period considered, which were not fully exploited. Especially in the transport sector, significant potentials for improving energy efficiency remain untapped. While some policies targeted vehicle efficiency, other potentials were not addressed – the reduction of transport intensity, better organisation of transport services, development of transport infrastructure, and changed mobility patterns.

The contribution of **renewable energies** to emission reductions was modest in the 2005-2020 period, as these technologies were still emerging out of the niche and approaching market maturity. Yet in terms of policy, the development of renewables is a success story combining faster than expected roll-out at lower-than-expected costs, reflected in increasingly ambitious targets for renewables. Thus, the EU originally set out with a 20% target by 2020, this was increased in 2018 to 32.5% by 2030, to be increased yet again to 42.5% by 2030 as part of the FIT for 55% package adopted in 2023.

EU climate policy from 2005 to 2020: Rapid evolution, but still short of transformation

EU Climate policy in 2005-2020 was still predominantly of an incremental nature. It sought to promote lower-carbon alternatives, to help climate-friendly solutions to evolve from their niche and grow into the mainstream, and to optimise existing systems. But it did little to change or disrupt these (fossil-based) systems.

Even where policies aimed to reduce emissions, they were not necessarily compatible with climate neutrality. For instance, EU funding tools such as the modernisation fund continued to support investments into fossil power generation assets and infrastructure, if these were more efficient than the installations they replaced. But nonetheless, these lock in an energy system based on fossil resources. Meanwhile, funding for trans-European transport networks (TEN-T) has not only benefited climate-friendly transport infrastructure, such as rails and canals, but also supported the development of high-capacity motorway networks that have perpetuated car-centred mobility and incentivised more traffic, thereby fuelling the increase of GHG emissions from this sector.

It was only towards the end of the 2005-2020 period that the goal of climate neutrality was firmly anchored in EU climate policy with the announcement of the European Green Deal (Dupont et al. 2023). Previously, EU climate policy had been oriented at a goal of reducing emissions by 80-95% below 1990 levels by 2050. While this seems to express similar ambition, there is a crucial difference: with the 80-95% target, each sector and each emitter could hope to count themselves towards the 5-20% of emitters that were allowed to continue to emit. With the goal climate neutrality, it was clear that all sectors would need to transform towards (near-) zero emissions sooner or later.

Besides, the urgency of the task has increased. In the 2000s, remaining on track to the climate goals was possible through incremental improvements to existing systems (such as increasing the efficiency of combustion engines), or switching from high- carbon to lower-carbon alternatives (such as replacing coal with gas in power generation). This has changed, as the EU has only three decades left to achieve climate neutrality. Orienting climate policy at the goal of climate neutrality has shifted the goalposts for climate policy: in the remaining decades, the EU needs to move beyond fossil-based solutions and value chains altogether and do so in all sectors.

EU climate policy 2005-2020: More centralised and diverse policy mix, but sectoral imbalance

In the 2005-2020 period, EU climate policy saw both a deepening and broadening – as well as a diversification of the instruments applied. Within the policy mix, those that targeted a

particular solution – such as the Renewable Energy Directive of the Energy Efficiency Directive – were found to have had greater and more discernible impact than cross-cutting and general instruments. In particular, the EU Emissions Trading Systems as the self-proclaimed flagship instrument was unable to send a carbon price signal for much of the period 2005-2020, and assumed its envisaged central role only late in the period.

While the instrument mix of EU climate policy became more diversified, it continues to rely mostly on three elements: (i) overarching frameworks and targets, (ii) market-based instruments and pricing tools, as well as (iii) standards and regulation (Oberthür and von Homeyer 2022). Strategic funding tools only recently began to play a larger role in the mix, such as support for transformative investments, or the redirection of financial flows. In this regard, the EU took first timid steps towards the end of the study period: the NER 300 programme, which led to the establishment of the EU innovation fund in 2019, or the development of the EU Taxonomy for Sustainable Finance (adopted in 2020). One aspect that remains underdeveloped at EU level are instruments and tools to encourage social or behavioural change, as well as deliberative formats that not only seek to create passive acceptance but rather invite active social momentum for change.

Increasing centralisation of EU climate policy

EU climate policy became increasingly centralised over the period from 2005 to 2020: the EU ETS for instance, had started off as a framework that allowed much discrepancy to the Member States to make their own design choices, but became much more unified following the first revision of the EU ETS Directive in 2009. Still, it relies very much relied on establishing frameworks and setting targets, such as with the Effort Sharing Regulation, Renewable Energy Directive (RED) and Energy Efficiency Directive (EED). It thereby allowed the Member States some leeway to implement different approaches, and thus also provided room for experimentation. At the same time, EU climate policy also achieved convergence between Member States – mostly by forcing laggards to speed up their efforts. For instance, before the introduction of the RED and EED, several EU countries had national policies in place to address renewable energy and energy efficiency. Where this was not the case, European legislation was the driver requiring significant efforts to implement. Similarly, some Member States had established their own carbon pricing instruments, later to be succeeded by the EU ETS (Bausch, Görlach, and Mehling 2016).

National implementation of climate policy: innovation and leadership, but also missed opportunities

Since EU climate policy was still mostly decentralised in 2005-2020, the member states had flexibility to set their own priorities and try out different approaches in implementing the EU legislation. The national case studies developed in the 4i-TRACTION project showed how member states used these flexibilities more or less successfully. On the positive end, the **Netherlands** developed an innovative

governance approach to rolling out charging infrastructure for electric vehicles, which turned out to be highly effective (Rienks 2023). **Belgium**, through a targeted combination of innovation and industrial policy, succeeded to develop its offshore wind sector to not only supply the domestic market, but also export solutions internationally (Wyns 2023).

Yet there were also some missed opportunities: in **Spain**, the use of environmental and climate taxes was poorly coordinated between the central government and the regions, and generally driven more by political opportunity and the need to raise revenue, than by a strategic decarbonisation objective (Fontanet-Pérez, López Otero, and Labandeira Villot, 2023). In **Germany**, the roll-out of smart meters was bogged down by overly tight regulation and lack of attention for the technological and business model implementation (Faber, Dück, and Reichwein 2023). Finally, **Poland**'s use of funding from the EU Modernisation Fund did deliver incremental improvements by modernising existing (fossil) power plants, but was not aligned with long-term goals, and did not overcome the fossil path dependency in the energy sector (Kobyłka, Miłobędzka, and Sobkiewicz 2023).

Progress across sectors remains uneven

EU climate policy still mostly retains a sectoral focus – and thus falls short of the "all-of-government" effort that would be required for a transformation. In the relevant sectors, progress in the study period has been uneven: the integration of climate and energy policies is fairly advanced, as many of the central and earlier pieces of EU climate legislation had direct impact on the energy sector (RED, Biofuels, EU ETS etc.). For transport and buildings, climate-related policies have had increasing impact, and while the instrument mix remains incomplete (e.g. regarding the absence of pricing tools), key policies such as the EPBD and the system of vehicle emission standards are in place. This is different especially in agriculture or forestry, where the relevant EU policies (in particularly the Common Agricultural Policy) are for the most part not aligned with climate goals.

Likewise, there has been little coordination of climate policies with neighbouring policy areas. It was only with the European Green Deal that social and distributional aspects of climate policy were firmly anchored on the political agenda. But also for environmental objectives other than climate (e.g. nature protection, biodiversity, resource efficiency), and for adaptation to climate change, there was little coordination nor integration in the 2005-2020 period – another deficiency that the European Green Deal is beginning to address (Dupont et al. 2023).

Could – or should – the EU have been more ambitious to begin with?

The fact that the EU overachieved its climate and energy targets, and some with an appreciable margin, could be read to suggest that the targets could have been chosen more ambitiously. And such ambition would have been appropriate: First, since it is cumulative emissions that matter for the climate, so that achieving greater reductions earlier produces a

greater climate benefit. And second, since the next steps towards decarbonisation in the 2020s and 2030s will not be any easier.

A more cautious interpretation would maintain that agreement on greater climate ambition is difficult to achieve in an EU of (at the time) 28 Member States with very different socioeconomic contexts and political priorities; and that governments cautious since key technologies were still costly or not proven at scale, and that the instruments of climate policy had not shown their worth.

It could be argued that the EU was therefore well-advised to started with lower ambition, and then to ratchet up ambition gradually as policies demonstrate their effectiveness and acceptability. While this strategy incurs a lower risk of political infeasibility, it lacks the element of long-term predictability and thinking back from the end. And as the drawn-out process of ramping up the EU ETS has shown, the process of recognising mistakes, learning from them and correcting them is by no means instantaneous.

Innovation for climate neutrality induced by supply-side, demand-side and enabling factors

The 4i-TRACTION research shows that innovation was crucial in reducing CO_2 emissions, improving energy efficiency, and increasing the adoption of renewable energy, and thus in achieving all three headline objectives.

Directing technological change and stimulating innovation has increasingly become a focus of EU climate policy. In the 2005-2020 period, the EU climate policy mix combined policies with a generic approach to innovation (such as the EU ETS or the ESD) with policies that pursue a more targeted approach to influencing the direction of technological development, be it by setting certain standards (Alternative Fuels Infrastructure Directive, Fuel Quality Directive, CO_2 emission standards for cars and light commercial vehicles) or by providing funding (such as NER3000, Horizon, Innovation Fund).

Case studies show that successful innovation requires policies that tackle the whole innovation chain and create an innovation ecosystem. Policy must not only address the supply of new technologies (through research and development) but also stimulate demand (lead markets, deployment support, standards), and ensure that the enabling conditions are met (in terms of skilled labour, public-private collaboration, industry clusters, physical and digital infrastructure etc.). The case of offshore wind power development in Belgium provides a successful example of how these factors can come together (see textbox).

EU innovation policy is a joint undertaking with member states, where national innovation support and policy complement EU efforts. In the case of the Effort-Sharing Regulation or the Renewable Energy Directive, the innovation impact is less dependent on the EU legislation, which only provides for targets and frameworks. Here, the innovation effect is rather dependent on the national implementation, where measures such as Feed-in-Tariffs have substantially contributed to the development and diffusion of renewable energy technologies.

EU standards have driven innovation and the diffusion of new technologies. For example, the EED and the Ecodesign Directive have had a significant impact on improving energy efficiency generally, but also specifically for the diffusion of (at the time) novel technologies, for example, replacing incandescent lightbulbs with more efficient LEDs.

By contrast, the EU ETS had only limited direct impact on innovation, as carbon prices remained low throughout most of the 2005-2020 period. Yet it did have an indirect effect as revenues from the EU ETS were used to fund innovation activities and technology deployment (initially via the NER 300, later through the Innovation Fund, as well as national initiatives). Given the more recent increase of the price of emission allowances, the EU ETS will play a greater role to promote the uptake of cleaner alternatives, as well as the phase-out of fossil-intensive technologies.

In addition to the EU ETS, several member states have pricing tools in place. The Spanish case study, for instance, showed how environmental taxes have driven technological innovation. By increasing the price of polluting

products and services, environmental taxes were found to encourage the uptake of lower carbon alternatives (Fontanet-Pérez, López Otero, and Labandeira Villot, 2023).

While EU policy has induced innovation towards low-carbon alternatives, a more affirmative role could be taken. The role of governments is important for directing technological change through flexible coordination, setting standards, identifying and removing bottlenecks, and supporting research and development. Ensuring competition and phasing out support in-time are two major challenges for EU innovation policy going forward.

Offshore wind in Belgium: How an innovation ecosystem fostered successful scaling (Wyns 2023)

Belgium was one of the first countries in the world to successfully scale up offshore wind energy[1]. In 2020, the country produced 6.7 terawatt hours of electricity - nearly 10% of the country's annual gross electricity consumption. As a result, it ranked 4th largest offshore wind energy country globally.

This success is supported by an emerging innovation ecosystem consisting of actors from the private sector, public sector, and research organisations. Belgium, as a coastal country with large harbours and ports, had ample experience and the presence of Belgium headquartered (multinational) companies. The Belgian government saw this as an opportunity and built its offshore wind energy upon this strength and experience of companies with distinct but related industries such as the maritime engineering. As such, the Belgian government established coordination centres that connected, coordinated and supported research institutes with companies and other relevant actors in offshore wind (and related or similar activities). This facilitated R&D and innovation through knowledge exchange, the testing or piloting of new technologies and infrastructures, funding opportunities, and ultimately an increase in entrepreneurial activity and a large service industry.

The emergence of an offshore wind market led to incumbent companies changing or innovating their business models. For example, the two biggest multinational companies with headquarters in Belgium, DEME and Jan de Nul, reoriented (part of) their business model towards the development of offshore wind. Funding, however, also came from public entities as most of the offshore wind capacity in Belgium is owned by private and public sector stakeholders. This has the advantage that it increases the chances of revenues and profits of offshore wind are re-invested in the Belgian economy, which in turn supports the scaling up of an emerging market.

[1] With Denmark the pioneer in offshore wind in the 1990s and the UK in the first years of the 21st century, Belgium and Germany were the next EU countries to commercially develop offshore wind starting in 2010.

First and timid steps to redirect investment flows towards climate neutrality

Achieving climate neutrality will also require rebuilding part of Europe's economy and infrastructure, which will require massive public and private investment above all into transport, buildings and the energy sector, as well as the infrastructure to combine them. As many of these investments are long-lived, with an economic lifetime of several decades, foresight and planning are essential. Scaling up investments requires both supply- and demand-side measures: supply-side instruments address the financial sector, in an effort to divert financial flows away from current (often fossil-dominated) assets, and towards investments into clean technologies. Demand-side instruments aim to make such investments more attractive, by increasing their profitability (be it through direct support or by pricing emissions) or otherwise de-risking investments.

On the supply side, the 2005-2020 period saw only modest steps towards increasing financial flows. In particular, the role of the financial sector did not feature prominently in EU climate policy until 2020. As the scale of investment needed exceeds the capacity of the public sector, private capital must be redirected towards investments that are compatible with climate neutrality. This requires a profound change in the way the financial system works and how it appraises investment opportunities.

The EU taxonomy provides a central framework for sustainable financing and is the EU's main tool to shift financial flows towards climate neutrality. By encouraging investment towards the economic activities identified as most critical for transformation, it aligns with the objectives of the European Green Deal. The taxonomy establishes criteria for economic activities in alignment with a trajectory toward zero emissions by 2050 and other environmental objectives beyond climate.

The French national case study suggests steps to better address climate change issues in the banking sector and suggests ways to improve internal procedures, incentives and governance structures (Calipel and Fidel 2023) (see text box below).

On the demand side, some of the strongest drivers were technology support policies that served to de-risk investments into specific technologies, above all into renewable energies. One instrument that did not live up to its expectations regarding the direction of investments was the EU ETS: Throughout the 2010s, it did not generate a price signal, or an expectation of future prices, that would have prevented new investments in fossil technologies and assets. Instead, the low carbon price from the EU ETS merely guided investments into marginal improvements, increasing the efficiency of existing technologies and assets, but fell short of stimulating larger-scale investments required for the transformation to climate neutrality.

Increasingly, the EU ETS also had the function of generating revenue, part of which was used to support investments. These investments, however, were not always aligned with climate neutrality. The Polish national case study highlights how auctioning revenues, which were supposed to be invested into energy transition, were not invested in a forward-

looking way. Instead they consolidated fossil power generation, as the investments reported under the National Investment Plan focused on the modernisation of conventional generation capacity in coal and gas (Kobyłka, Miłobędzka, and Sobkiewicz 2023).

Climate Stress Tests in France: Helpful, but not sufficient for transition financing (Calipel and Fidel 2023)

Climate stress tests encourage banks to integrate climate-related risks into their activities and to carry out an initial assessment of the banks' capacity to deal with these risks. An assessment of how climate stress tests work in France, from the operational processes of their implementation to their impact on banks' strategic decision-making on transition financing, paints a mixed picture of the influence of climate stress tests on transition financing.

Climate stress tests did impact transition funding indirectly, for example by mobilising banks' internal teams and supervisors around climate-related issues. Training of banking teams in France led to more informed decisions and, thus, supported the integration of climate issues into banks' organisational process and governance. However, the tests often result in a fragmented understanding of climate-related issues and fail to offer insights into the actual transition potential or the specific financing needs of banks' clients. Furthermore, the modelling exercises within these tests struggle to capture the real economic impacts of the transition and the intricate channels through which climate risks are transmitted. In this way, they are of limited value for the strategic positioning of banks towards the transition to climate neutrality.

Ultimately, climate stress tests alone are unlikely to bring about a significant shift in transition financing. For such a shift, the tests must be part of a broader suite of tools that allow banks to grasp more fully the complexities of their clients' transition dynamics. The development of banking transition plans, based on detailed transition plans of their clients, emerges as a promising approach to empower banks to provide more effective transition financing and contribute meaningfully to an orderly environmental transition.

Infrastructure policies that provide the certainty needed and the flexibility required

The development of key low-emission infrastructure has not been a major priority of EU climate and energy policy in the 2005-2020 period. That said, attention for energy infrastructure did increase at EU level, with Projects of Common Interest for key cross-border energy infrastructure, interconnection targets, as well as the Trans-European Networks for Energy (TEN-E).

Interconnection and transnational energy infrastructure are major bottlenecks to integrate growing contributions of renewable energies, and to enable the electrification of end uses in transport, heating and industry. While EU member states so far managed to integrate growing shares of renewables, this will become increasingly difficult without a major increase in interconnection and transnational integration of both electricity markets and the grids that support them.

Infrastructure is a typical chicken-and-egg-problem: many climate-friendly solutions will only be economically viable and practically feasible if the necessary infrastructure is in place. But private investors will only provide the infrastructure if there is certainty that it will be used. Regulation can help to overcome this dilemma by setting infrastructure standard, and the EU plays a key role in this regard. For example, the market and infrastructure for alternative fuels would have been underdeveloped without the Alternative Fuels Infrastructure Directive: coordinated market development and subsequent harmonised adoption of technical specifications for infrastructure and vehicles was only possible via the EU. A unilateral approach by Member States would likely have resulted in fragmented markets with uncertain future.

While the AFID provides a positive example of EU influence on infrastructure development, many gaps remain to be addressed. Overall, infrastructure development in the EU was uneven, not sufficiently specified to the local context, and not targeted at vulnerable regions. District heating is a case in point: more than many other technologies, district heating depends on infrastructure that takes decades to implement. Particularly the Scandinavian countries have shown that district heating can be an important solution for densely populated areas, as it helps to reduce energy dependency, lower costs for households and businesses and achieve significant reductions in greenhouse gas emissions. However, rolling out the infrastructure is a generational project and thus requires a clear, long-term commitment.

Electrification of private transport is another option where infrastructure plays a central role, in this case charging infrastructure. Among the diverse experiences across Europe, an innovative governance approach has placed the Netherlands among the leading countries in Europe, as described in the textbox below.

But while there has been some progress, there remain many instances where infrastructure investments perpetuate past mistakes. Thus, the EU was neither unable to prevent investments in new fossil fuel infrastructure, nor did it assess the compatibility of member state infrastructure development plans with the EU's climate targets. EU support continued to

benefit infrastructure projects that lock-in the continued use of fossil fuels and fossil-based technologies and value chains, such as natural gas pipelines or highways. In the future, the EU must make sure that all new (energy) infrastructure is compatible with climate neutrality, especially where it benefits from EU funding.

The Rollout of public charging infrastructure for electric vehicles in the Netherlands (Rienks 2023)

In 2009 the Netherlands had, like other European countries, virtually no public charging infrastructure. By 2020 the Netherlands was a clear frontrunner. In 2020 nearly one in every three (semi)public charging points in the EU was located in the Netherlands, and these charging points were of a high quality and installed and operated in a cost-effective way. The analysis revealed how smart policies and coordination among different actors helped to bring about this rapid change.

In the first period, 2009-2012, obstacles were removed that had obstructed entrepreneurial activities relating to public charging infrastructure. The most important obstacle was related to overcoming a lock-in effect, in which a lack of public charging infrastructure hindered the adoption of EVs and vice versa. The foundation Elaad was crucial for solving one side of this lock-in, by installing the first 3,000 public charging points in the Netherlands. The policies of the central government were mainly aimed at solving the other side of this lock-in, by stimulating EV adoption, mostly through financial incentives (tax cuts) for EVs.

In 2012-2015, the obstacles for the rollout related to a lack of basic infrastructure and institutions to enable a sufficiently large market for public charging infrastructure. Much of the innovation power came from self-regulation by companies and large metropolitan municipalities.

In 2015-2020, regional variation increased: In some (urban) areas the market for public charging infrastructure became quite mature whereas in other (rural) areas almost no public charging infrastructure was present. In this period the central government facilitated the rollout of public charging infrastructure by (smaller) municipalities, but the main work was done by the municipalities themselves.

The case study analysis challenges the conventional wisdom that public sector organisations should refrain from activities that can be performed by the private sector. Instead, the case suggests that in the start-up phase of rolling out a new technology, the public sector should indeed have an role in such activities. In this case, a public sector organization (the Elaad foundation) was heavily involved in rolling out the first 3,000 charging points in the Netherlands. This approach effectively circumvented market failures related to innovation, e.g., relating to fundamental uncertainty and network externalities, by taking risks and setting technological standards.

Working towards coherence across sectors and levels of governance

EU climate policy is a case of multilevel governance, where efforts need to be aligned from the European level down to the national, regional and local level. In the cases analysed, this did not always work out: solutions introduced at the EU level were not always aligned with the efforts pursued at national and regional level. While such divergences may compensate for (perceived or actual) weaknesses of EU regulations, they also create a diverse and partly divergent policy landscape.

While the EU has set itself broad and comprehensive emission reduction targets, the ambition and coherence of the policies to reach these targets differs between sectors.

Climate policy integration with energy policies is most advanced – a suite of instruments cover them both and achieve an overall well integrated policy area (among them the EU ETS, RED, EED etc.). At the other extreme, agriculture and land use is the least integrated area: In particular, there was little alignment between the EU's climate targets and the Common Agricultural Policy. Climate action in the transport sector also remains deficient.

Beyond the key emitting sectors such as energy, transport, buildings, industry and land use, there is also a need for integration with other cross-cutting instruments and strategies, such as funding tools. Thus, for instance, climate aspects ought to be strengthened in the European Union's rural development and cohesion policies. The European Agricultural Fund for Rural Development has not been used significantly to support efforts of the EU to meet renewable energy targets. Moreover, despite the publication of the circular economy action plan in 2015, and despite the crucial role of resource efficiency and circularity for a climate-neutral economy, these policies were not sufficiently reflected in climate policies pertaining to the energy or transport sectors.

Sector coupling is complicated by multilevel governance and fragmented competences create difficulties. For example, the transnational planning and development of energy infrastructure has been challenging. An integrated EU response is needed to reap the potentials of an integrated energy system, building on the Projects of Common Interest but also by a more coordinated and climate-integrated approach to industrial policy.

Energy and environmental taxes in Spain: The necessity, and the difficulties, of achieving a whole-of-government approach (Fontanet-Pérezet al., 2023)

In Spain, environmental taxation has not been effectively leveraged for decarbonisation. Due to limited ambition and flawed design, it has had only modest impact on driving technological change. Challenges include coordination among the central government and the regional and local governments. This led to the existence of a multiplicity of instruments that do not necessarily follow a coordinated strategy, and express different levels of environmental ambition.

The Spanish example sheds light on the unintended consequences arising from poorly aligned policy instruments, such as taxes on wind energy infrastructure that inadvertently favoured fossil-based power generation. This highlights the need for a more coherent policy design and coordination across all levels of government to enhance the environmental impact of taxation.

Overall, the primary role of environmental taxes in Spain continues to be revenue generation, whereas their potential to nudge behaviour toward environmental stewardship remains underutilised. At national level, this represents a missed opportunity to use environmental taxes in a more systematic way to change socioeconomic and technological trends towards decarbonisation. At the regional level, the impetus behind employing these fiscal tools frequently stems from the necessity to supplement revenues, exploiting regulatory gaps left by central governance. A central challenge remains to achieve coherence and coordination among multiple governing bodies. During the period reviewed, there was an apparent lack of resolve from the central government to champion such instruments in a concerted effort with regional authorities, and likewise, a reluctance among the regions to synchronise their efforts.

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Date

20/12/2023

Suggested citation

Krzysztof Krawiec et al. (2023): In Search of Transformative Ambition: EU Climate Policies in 2005-2020. 4i-TRACTION Policy Brief. Warsaw: WiseEuropa

Acknowledgements

The authors would like to thank the colleagues in the 4i-TRACTION consortium on whose research this policy brief is based, in particular those involved with compiling the national case studies.

Project partners

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement **No. 101003884**.