The Coalition of Finance Ministers for Climate Action

It takes two to tango: the role of Ministries of Finance in pricing and non-pricing policies for a low-carbon economy

Council on Economic Policies

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Key messages

- **Carbon pricing has long been viewed by policymakers as a primary policy tool to unlock a low-carbon economy and advance climate action.** Economic analysis and modeling in Ministries of Finance has thus often focused on the optimal calibration of carbon pricing.
- **Non-pricing measures are moving up policy agendas.** Policymakers are increasingly focusing on obstacles hindering low-carbon investments, such as regulatory uncertainties, slow technology adoption, financing constraints, workforce shortages, and bottlenecks in networks. Removing these obstacles needs more than just putting a price on carbon emissions.
- **Against this background, governments are adopting packages that combine pricing and non-pricing policies.** It is increasingly understood that unlocking the low-carbon economy requires comprehensive changes in markets, behaviors, and expectations. Recent packages combine a variety of instruments to achieve this, including carbon pricing, Government subsidies, public investment, and regulations. Examples include the EU's Fit-for-55 package, the UK's Net Zero Strategy, the U.S. Inflation Reduction Act (IRA), and China's decarbonization plans.
- **Cross-country comparisons of policy packages for a low-carbon economy are useful to identify best practices.** While carbon pricing is well tracked globally, there is a lack of information on non-pricing actions. The multiplicity of policy instruments and their complex design make their monitoring challenging, but progress is being made in international organizations. The Coalition of Finance Ministers for Climate Action (CFMCA) could establish a workstream to support these efforts and learn from the experience across jurisdictions with implementing packages of multiple provisions.
- **Models that combine macroeconomic, fiscal, energy and climate dimensions are useful to project the impact of packages of various climate actions**. For instance, the impact of the IRA has been explored using these models. In France, long-term electricity market decisions are informed by simulations of large models. However, these models have struggled to predict turning points, such as the surge in renewable investment.
- **An emerging literature is taking advantage of available micro-data to evaluate the effects of non-pricing policies.** Using empirical evidence from banking information, tax statements, administrative records, and novel experiments, researchers are evaluating whether Government initiatives are effective in unlocking a low-carbon economy. As an illustration, research has shown that policies intended to improve homes' energy efficiency can have poor cost-effectiveness. The CFMCA could establish a workstream to support the development of these micro evaluations, including by creating a repository of relevant research.

Governments increasingly deploy policy packages for climate action

Carbon pricing has long been a key policy tool to unlock a low-carbon economy and advance climate action. When fossil fuels are available at a lower cost than cleaner energy sources, putting a price on the greenhouse gas emissions they generate encourages a shift to low-carbon alternatives. Through carbon taxes, emission permits, and fuel excise duties, policymakers have increased the cost of fossil fuels relative to cleaner options. MoFs have led efforts to calibrate such carbon-pricing policies as optimally as possible.

At the same time, non-pricing measures are moving up policy agendas. As the cost gap between fossil fuels and clean energy narrows—and in some cases inverts—further instruments beyond carbon pricing are receiving growing attention. Policymakers are therefore increasingly focusing on other obstacles to the low-carbon economy, such as slow technology adoption, financing constraints, workforce shortages, bottlenecks in networks, and hindrances in the supply chains of green materials. Putting a price on carbon emissions will not suffice to remove these obstacles. Other policies, referred to in this paper as "non-pricing policies," are equally critical.

A first category of non-pricing policies is based on fiscal tools. This category includes direct Government subsidies, tax expenditures, public investment, public procurement, and concessional financing to make it cheaper to adopt clean energies. The U.S. IRA is the latest illustration of a package of non-pricing policies. Like carbon pricing, these policies seek to make using clean energy more attractive than using fossil fuels, but they work differently. Because they lower the cost of using clean energy, they do not encourage energy conservation and may even increase energy demand through a rebound effect (the "Jevons Paradox"). In addition, these policies increase Government budget deficits and therefore act like a fiscal stimulus for output, investment, and wages (Bistline et al., 2023). Because of this fiscal impact, these policies are often placed under the leadership of MoFs. For instance, the U.S. Department of the Treasury has established the Inflation Reduction Act Program Office to serve as a hub of the IRA implementation.[1]

A second category of non-pricing policies is based on regulations. This category involves, *inter alia*, renewable energy targets for electric utilities, emission limits for coal-fired power plants, fuel efficiency standards for cars, bans of the sale of new fossil fuel-powered cars, and bans on the installation of new gas boilers. These policies do not have an explicit price tag, but the required abatement of emissions comes at a cost for energy users and has a broad impact on output, employment, and prices. Although MoFs do not have the leadership in this category, they cannot ignore their economic consequences.

Packages of self-reinforcing measures can be "good economics." When designed effectively, pricing and non-pricing policies are mutually reinforcing and make good policy packages (Anadon et al., 2022; Blanchard et al., 2022; Fries, 2021). Carbon pricing sends a broad market signal to all carbon emitters, while non-pricing policies can be tailored to achieve deep decarbonization within specific sectors and through specific technologies. As an illustration, high car fuel taxes encourage reduced use of fossil fuel-powered vehicles, while scrapping incentives promote their replacement, and electric vehicle (EV) incentives encourage the adoption of cleaner cars. Working together, these measures can effectively promote the decarbonization of national car fleets.

Recent government packages favor the combination of policies. Across the world, governments are combining a variety of pricing and non-pricing policies to promote transformations that will lead to deep decarbonization pathways. The EU Fit-for-55 package combines carbon pricing through the EU Emissions Trading System (EU ETS) with non-pricing measures, such as state aid for batteries and hydrogen and the 2035 clean vehicle mandate. The UK Net Zero Strategy also mixes pricing (UK ETS and carbon tax) with fiscal support (e.g., aid to replace gas boilers with heat pumps) and regulation (the 2035 zero emission vehicle mandate). China is developing an ETS that adds a carbon price to its traditional tools. The U.S. IRA is almost entirely based on non-pricing measures (apart from a methane emissions charge), but at the subnational level several U.S. states, including California, combine non-pricing measures with a cap-and-trade program.

Experience shows that policy packages can be effective when they are well designed. Research suggests that combinations of policies, rather than single policies, have contributed most effectively to the uptake of green technologies. Successful policy packages have combined market pricing, R&D support, concessional finance, norms and standards, information campaigns, Government procurement, and public investment. Working together these policies supported the emergence of efficient solar photovoltaics, cost-effective wind energy, high-capacity lithium batteries, energy efficient LED bulbs, and electric cars with extended mileage (Anadon et al., 2022). The successful rollout of wind energy has been found to stem from both supply-pushed and demand-driven policies leading to "learning-by-deployment" and rapid cost reduction (Elia et al., 2020). Not only have policy packages helped put these technologies on the market, but they have also contributed to their plummeting in price, making them competitive and affordable.

Implementing multi-year energy transformation packages is becoming a priority for MoFs. The surge of low-carbon investments provides hope for the way forward. However, previously announced

1 https://home.treasury.gov/about/offices/the-inflation-reduction-act-program-office

policies will not be enough to reach the worldwide decarbonization ambitions and keep the rise of global temperature within agreed limits (IEA, 2023). Following Russia's invasion of Ukraine and the surge in energy prices, policymakers need also to focus on energy security. In addition, ensuring affordable access to energy is a priority in both advanced and developing countries. As the main Government Agencies in charge of delivering sustainable and inclusive economic growth, MoFs must play a central role in the design and implementation of effective energy transformation packages.

Affordability is key in the energy transformation

Affordable access to energy for all citizens is critical. Research shows that carbon pricing policies can have regressive or progressive effects, depending on their specific designs (Shang, 2021; D'Arcangelo et al., 2022). Nevertheless, the perception of adverse distributional impacts often discourages policymakers and lawmakers from approving significant increases in carbon prices. Comprehensive policy packages that provide subsidies for the uptake of green technologies by vulnerable households can deliver significant social benefits and thus increase political acceptance. Well-designed packages also pay attention to local communities that are adversely affected by transformational changes, such as workers in the coal and oil sectors. Countries such as Denmark have built consensus among social partners and stakeholders to support such measures, and they have introduced means-tested support to facilitate the transition to low-carbon transportation and heating.

Non-pricing policies can also be regressive. Because non-pricing measures often take the form of explicit subsidies to consumers, they are often perceived as not being regressive. As such, they receive more political support than policies that raise energy prices. Fiscal support for renewable electricity, home improvements, and fuel-efficient vehicles frequently receive widespread approval in parliaments. Notwithstanding this support, the overall impact of non-pricing measures can be regressive if they are funded, for example, by higher indirect taxes paid by consumers, such as higher excise duties or increased VAT rates. Regulations can also be detrimental to affordability, for example, when automakers pass on upfront costs of fuel efficiency standards to consumers, potentially making the purchase of clean cars more difficult for low-income households.

As with any policy, MoFs must account for the social impacts of climate action. Experience shows that policy packages disregarding social aspects face strong resistance in parliament and on the street. Examples of climate reforms with poor regard for social repercussions include France's 2019 planned increase in carbon taxes, which led to the "gilets jaunes" social unrest and the annulment of the planned tax rise. Learning from this experience, subsequent policy packages for climate action have featured prominent non-pricing measures to offset adverse distributional effects. These include, for example, the French means-tested energy cheques, "chéques énergie," to help 5.6 million households pay their home energy bills, thus addressing potential vulnerabilities from rising energy taxes (Lenain, 2024). Additionally, France has established a "social leasing" scheme to help low-wage commuters acquire electric cars, making them more resilient to car fuel price hikes. Such policies have a fiscal cost, which needs to be funded, but they can be important to safeguard affordability and security as countries advance their energy transformation.

Meeting the fiscal cost of energy transformations

While carbon pricing raises fiscal revenue, other fiscal measures can come at a budgetary cost. World Bank (2024) estimates that direct carbon pricing generated Government revenue of US$104 billion in 2023, an amount likely to increase as countries phase in higher carbon taxes and more ambitious ETSs. No comprehensive data is available globally on the budgetary resources allocated to non-pricing policies, but partial data suggests that their fiscal costs have far exceeded these carbon pricing receipts. The Oxford Global Recovery Observatory and International Energy Agency estimate global fiscal commitments on green measures were between US$1 trillion and US$1.2 trillion during 2020 and 2021. The OECD Green Recovery Database estimates a roughly similar amount of €1.1 trillion in Government spending allocated to environmentally positive measures during the period January 2020 to April 2022. The IEA estimates that Governments spent about US$40 billion worldwide just to promote EV sales in 2022.[2]

In times of limited fiscal space, Government spending of this magnitude needs to be financed. Apart from funding from general Government revenue, several financing channels are used to cover the cost of fiscal support measures:

- **Carbon pricing** revenue can pay for fiscal support measures. As an illustration, the EU ETS Directive requires that 50% of the revenue generated by the EU ETS auctioning of emission allowances is to be used to support the achievement of climate and energy objectives.
- Revenue generated from the removal of **fossil fuel subsidies** can be earmarked to support the transition to green energy. This approach also helps prevent the shift to other polluting energy sources, such as households replacing natural gas with coal or wood fires. For instance, Bassi et al. (2024) report that emissions in China can be reduced by an additional 15%–19% when the proceeds from fossil fuel subsidy removal are recycled to support green energy initiatives.
- **Feebates** are another financing option: they consist in imposing a fee (or tax) on activities producing high levels of pollution and using the revenue collected to fund rebates for activities that are environmentally friendly. For instance, France taxes high-emission vehicles ("malus automobile")[3] and use the proceed to subsize low-emission vehicles ("bonus écologique").[4]
- **Dedicated excise duties** can be levied to channel funding to low-carbon activities. For instance, France established the "*Contribution au Service Public de l'Électricité"* to cover the cost of feed-in tariffs paid to renewable energy providers.
- Further fiscal measures can be used to fund policy packages. For example, the U.S. IRA includes a mix of tax increases that fund support for energy-related investments through, *inter alia*, reforms of the corporate minimum tax and a tax on stock buybacks, as well as a reform to reduce drug spending by the Federal Government.

MoFs need strong analytical capabilities to project the fiscal impact of climate action and inaction. Recent experience shows the uncertainty in projecting the budgetary impact of complex policy packages. The climate-related provisions of the U.S. IRA were estimated by the U.S. Congressional Budget Office to cost US$392 billion over 10 years. However, Goldman Sachs projected that the fiscal costs could reach US$1 trillion, with a variety of other estimates falling in between (Bistline et al., 2022). The large range of estimates reflects the design of several of the IRA's provisions, in particular the uncapped tax credits offered to renewable energy producers and to buyers of EVs. Tax and spending provisions written in law without a budget cap mean that the fiscal costs will ultimately depend on the uptake of these provisions, e.g., the magnitude of new renewable energy capacity and the interest of car buyers for new EVs. When climate-related provisions are subject to a budget cap, they can be projected with more certainty, but this may unduly restrain the switch to low-carbon technologies, as happened in France when the "social leasing" 2024 budget allowance was exhausted after only two months, thus preventing many low-income households from making the transition to clean surface transportation.

Making the low-carbon economy more bankable

Low-carbon projects often require relatively more upfront financing compared with fossil fuel-based technologies. The bulk of costs for wind farms and solar photovoltaic panels, for example, is the initial

2 https://iea.blob.core.windows.net/assets/dacf14d2-eabc-498a-8263-9f97fd5dc327/GEVO2023.pdf
3 https://www.service-public.fr/particuliers/actualites/A17079
4 https://www.economie.gouv.fr/particuliers/bonus-ecologique

capital expenditure. The costs to operate and maintain them are relatively small. Long-term financing is thus critical for low-carbon investments. However, the future earnings of renewable electricity investments are subject to uncertainties such as unpredictable regulatory approvals, legal challenges, policy reversals, intermittent weather, and volatile spot electricity markets. Hence, these earnings may not be considered as sufficiently steady by financial institutions. With uncertainties about the long-term income stream and the commitment of future governments to green policies, such projects are scrutinized by creditors.

Predictable Government support makes low-carbon projects more "bankable." To reduce uncertainties about debt service sustainability, creditors often look for Government backing to consider green investments as "viable investment propositions with an acceptable level of risk," in short, to make them bankable (Christophers, 2024). Credible long-term policies can be critical to improve the predictability of future income streams from clean energy projects, and therefore their bankability. Feed-in-tariffs set the price of future electricity sales and thus provide guaranteed returns; contracts for difference (CfDs) reduce the uncertainties resulting from electricity spot market volatility; investment tax credits and production tax credits reduce the total costs of renewable investments and secure future earnings. All these non-pricing policies can play a key role in improving the bankability of green projects and unlock the low-carbon economy.

MoFs should investigate the levels and most effective types of Government support to enhance bankability. In 2023, total energy investments amounted to just over US$3 trillion, with clean energy accounting for US$2 trillion. The IEA estimates that investments in renewables need to double and energy efficiency investments need to triple by 2030 to meet the goals in its Net Zero Emissions by 2050 scenario.[5] MoFs need to analyze the optimal form of Government intervention to unleash private-sector financing, such as market mechanisms (feed-in tariffs and CfDs), concessional financing (such as subsidized interest rates and development bank lending), public-sector equity participation, or other mechanisms. Financial analysis and cooperation with market participants can help these investigations.

Analytical challenges for MoFs

New analytical frameworks are needed to assess policy packages. The increasing complexity of policy packages—with macroeconomic, energy, fiscal, climate, technological, social, and financial dimensions—requires strengthened research capabilities in MoFs. This research effort is already underway in some jurisdictions. New research units are staffed with experts and provided with analytical resources. Examples of reports testifying to this deployment include:

- The UK Treasury “Net Zero Review”, published in 2021[6]
- France’s Treasury interim report on the “Economic Challenges of the Net Zero Transition”, published in 2023[7]
- Switzerland’s Federal Department of Finance’s fiscal sustainability report, published annually since 2020.[8]

Such reports cover multiple dimensions and draw their analysis from model-based projections and other statistical analyses. Other MoFs are building similar capabilities or considering doing so.

Going forward, three analytical challenges need to be addressed.

5 https://www.iea.org/reports/world-energy-investment-2024.
6 https://www.gov.uk/government/publications/net-zero-review-final-report
7 https://www.tresor.economie.gouv.fr/Articles/ff6787fc-4f79-4b98-b3d4-e6ea0d6c8205/files/453d0c8b-6021-4cee-bf2e-54d3421a5055.
8 https://www.efd.admin.ch/en/fiscal-sustainability-report

International benchmarking

International benchmarking of carbon pricing should be extended to keep track of broad packages of pricing and non-pricing policies. As governments are increasingly focusing on policies for climate actions other than carbon pricing, the international system of benchmarking needs to evolve. Cross-country comparisons of carbon pricing are now widely available thanks to work by the IMF, OECD, and World Bank, and several think-tanks (listed in the annex). Comprehensive information is also available on fossil fuel subsidies. Similar datasets are gradually emerging for non-pricing policies, thanks to the inventories of climate measures maintained by the OECD. To allow comparisons of different non-pricing policies in various institutional contexts, the OECD attributes scores to characterize the potential impact of each policy on climate outcomes. These scores are then aggregated into composite indexes that allow comparisons to be made across countries and monitoring over time. The OECD maintains two sets of such indexes.

- The OECD Environmental Policy Stringency (EPS) index is "an internationally comparable composite index of different environmental policy instruments, focusing primarily on climate change and air pollution policies" (Kruse et al., 2022).[9] It keeps track of 13 policy instruments grouped into market-based policies, non-market-based instruments, and technology support measures. The EPS index covers policies such as carbon taxes, carbon markets, renewable energy certificates, diesel fuel excise duties, emission limit standards, green R&D fiscal support, feed-in tariffs, and renewable energy auctions. The information is organized to identify the stringency of these policies, which is defined as their capacity to deter environmental damages. For this purpose, policies measured in different units, e.g., US$/t$CO_2$ for carbon taxes and US$/kWh for feed-in tariffs, are converted into scores ranging from zero to six, and then aggregated into the composite EPS index. The results are made available and discussed in the framework of OECD committees, including the Economic Policy Committee (EPC) and its Working Party 1, where delegates from MoFs of member countries and key partner countries can exchange views and share information on good practices.
- The OECD Climate Actions and Policies Measurement Framework (CAPMF)[10] is an inventory of 128 climate action variables, grouped into 56 policy instruments and other climate actions, covering 52 countries (Nachtigall et al., 2024). It aims at supporting the efforts made by governments to implement their Nationally Determined Contributions (NDCs) and to advance their paths for deep decarbonization toward carbon neutrality by mid-century. The range of mitigation policies covered is coherent with the UNFCCC and IPCC frameworks, making the CAPMF a useful instrument in intergovernmental discussions. To build its database of CAPMF policies, the OECD interacts closely with experts in national governments, in the framework of OECD committees and its dedicated climate action programme (IPAC).[11] In addition to policies putting a price on air emissions, the CAPMF covers a wide range of regulatory tools (e.g., emission limits, bans, mandates), it takes account of green R&D public expenditure, and it keeps track of international actions such as participation in international climate treaties and climate data reporting. Like the EPS, the CAPMF seeks to characterize the stringency of each mitigation policy, which is defined as "the degree to which climate actions and policies incentivize or enable greenhouse gas emissions mitigation at home or abroad." Each policy variable is normalized, making it possible to categorize the stringency in each country, with a value of zero when no policy is in place, and a value of ten attributed to the most stringent value.

Both the EPS and CAPMF can be used to monitor policy implementation across time and countries. Researchers are using them to assess the responsiveness of greenhouse gas emissions to various

9 https://www.oecd.org/en/publications/measuring-environmental-policy-stringency-in-oecd-countries_90ab82e8-en.html.
10 https://www.oecd.org/en/publications/the-climate-actions-and-policies-measurement-framework_2caa60ce-en.html.
11 https://www.oecd.org/en/about/programmes/international-programme-for-action-on-climate.html.

policies. Boxes 1 and 2 show examples of benchmarking using the CAPMF in Nordic countries and a group of emerging market economies.

These programs are important advances in building inventories of comprehensive transformation packages and in characterizing the strength of policies both across countries and over time. As Government Agencies with the leadership to steer national economies toward sustainable prosperity and to foster international cooperation, MoFs can leverage indicators to inform their analytical work and feed into national debates. The CFMCA could host regular seminars to benefit from the knowledge generated in this context across its membership.

Modeling tools

Large integrated macroeconomy-fiscal-energy-climate models are useful but face criticisms regarding their forecasting track record. Large-scale models are useful to design multiannual energy transformation strategies supported by comprehensive policy packages. A well-established practice is to use computable general equilibrium (CGE) models to simulate alternative policy scenarios and assess their impact on a set of sector variables (notably energy prices and carbon emissions) and macroeconomic indicators (such as GDP, inflation, employment, fiscal positions). The most advanced models examine the impact not only of carbon pricing, but also of non-pricing policies, though this is often limited to the power sector. Some models cover the tradable sector and investigate possible carbon leakage effects, but the sectors of transportation and buildings are rarely covered. The fiscal aspects are often focused on carbon-pricing receipts and subsidies. The most recent models also investigate the social dimension of the transition. Financial constraints and bankability challenges are rarely addressed. These models make it possible to compare different policy options that policymakers can choose from. Examples of such model-based policy analyses include the following.

- Using the IMF ENV dynamic CGE model, Chateau et al. (2022) explore alternative policy options to decarbonize: carbon taxes, feebates, subsidies, and regulation. They find that, in the electricity sector, the different policy instruments generate similar outcomes because power generation technologies are very substitutable.
- Using the U.S. Regional Economy, Greenhouse Gas, and Energy (US-REGEN) model,[12] Bistline et al. (2023) highlight the very large uncertainties surrounding the fiscal cost of the IRA, as this cost is highly dependent on the demand for new tax credits from renewable energy investors and EV buyers. They also find that the average abatement cost resulting from the IRA is US$83 per tCO_2, which is below recent estimates of the social cost of carbon.
- Using its Global Energy and Climate (GEC) model,[13] in its annual World Energy Outlook publication, the International Energy Agency (IEA) explores three different global energy scenarios based on stated policies (STEPS), announced pledges (APS), and Net Zero Emissions by 2050 (NZE). The GEC is a highly detailed model of energy supply and demand and the corresponding emissions. It covers multiple sectors (power, buildings, transportation, industry, hydrogen, critical materials) as well as employment in various energy activities. The fiscal aspects are taken into account not only through carbon pricing policies, but also through Government funding for clean energy investment support and energy affordability for consumers.
- Using a large-scale model of the European electricity system, with detailed results at hourly intervals over 30 years, Réseau de transport de l'électricité (RTE)[14] explores different electricity mixes, taking into account the transportation, distribution, and flexibility costs in each mix, allowing the results to go beyond those of simpler levelized cost of energy.

12 https://us-regen-docs.epri.com/

13 https://www.iea.org/reports/global-energy-and-climate-model.

14 https://www.rte-france.com/analyses-tendances-et-prospectives/bilan-previsionnel-2050-futurs-energetiques.

The above-mentioned models are most frequently used to analyze the impact of different policy scenarios. Their results are presented as deviations from a baseline projection rather than medium-term forecasts. However, the baseline projection itself is important for policymakers who need to make decisions in terms of economic, fiscal, social, and environmental outcomes. Unfortunately, some of these models have a weak forecasting track record, which undermines their usefulness to guide policymaking.

As an illustration, the IEA's GEC model has been repeatedly criticized for underestimating the sudden surge in renewable investments,[15] notably because it failed to foresee the rapid rate at which renewable costs have declined. Energy-climate models are often not dynamic and therefore do not take account of the long-term impacts of policies supporting innovation, investment, and transformative changes. The IEA updates and improves its models on a regular basis, in a relationship with the global modeling community, with likely benefits in terms of forecasting track record. A good practice for all institutions would be to regularly review and evaluate their forecasts retrospectively, as is done annually by the U.S. Energy Information Administration[16] and is a common practice among macroeconomic forecasters.

Evaluating policy with micro-data

A new strand of evaluation studies using micro-data provides important information to MoFs. A recent strand of the literature takes advantage of available micro-data to conduct ex-post evaluation studies of Government programs seeking to foster changes in energy usage and green technology adoption. These studies seek to provide a rigorous ex-post evaluation of Government incentives such as home retrofit subsidies, EV tax credits, or regulations favoring clean transportation. They can take the form of research evaluating programs already well underway, with researchers getting access to anonymized data from Government subsidies, tax filings, bank statements, electricity bills, energy efficiency administrative records, and vehicle registration records, among other things, to evaluate the effects of Government climate-related initiatives. Another approach takes the form of a randomized controlled trial (RCT), where researchers design experiments akin to Government programs and select a population treated with the experiment, while a control group is not, thus allowing robust inference of the causal effect of the policy intervention on outcomes such as energy consumption.

Researchers conducting these micro studies with fiscal data on budgetary costs can identify the cost-effectiveness of alternative policy options, e.g., in terms of monetary units per tonne of CO_2 abated. With micro-data, it is possible to take into account the heterogeneity among firms and households and thus—through micro simulation models—evaluate the distributional impact of pricing and non-pricing policies. This new strand of research is promising to deliver new findings rich in terms of heterogeneity, causality, and robustness. As an illustration, research using micro-data in China, Norway, and the U.S. finds that EV fiscal incentives tend to encourage the replacement of combustion engine vehicles with cleaner cars, although attention needs to be paid to possible regressive income distribution effects (Sheldon and Dua; 2019; Xing et al., 2021; Lévay et al., 2017). For home retrofitting, research based on French administrative data and randomized experiments in the U.S. find that home improvements supported by Government subsidies result in lower energy consumption, even though the energy saving is often less than predicted (Wald and Glachant, 2023; Fack and Giraudet, 2024; Fowlie et al., 2018).

The CFMCA could create a repository of such micro-data studies and invite researchers to submit their work. This could prompt regular exchanges among policymakers, researchers, regulators, and other stakeholders. Shared knowledge on good practice would be a useful outcome of this initiative.

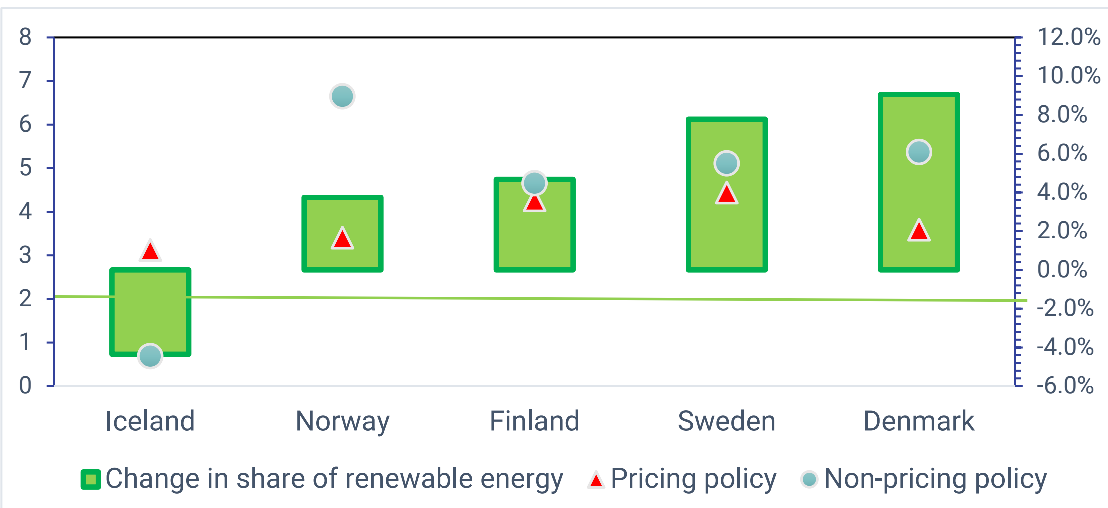
15 https://reclaimfinance.org/site/wp-content/uploads/2022/01/Report-IEA-Net-Zero-2050-RF.pdf.
16 https://www.eia.gov/outlooks/aeo/retrospective/.

Box 1. Pricing and non-pricing policies in Nordic countries

Denmark, Finland, Norway, Sweden, and (to a lesser extent) Iceland are particularly successful in containing their overall energy consumption and increasing the consumption share of renewable energy resources (Grosjean and Duédal, 2021). High taxes on carbon emissions and car fuels are key drivers in their transformation, but not only drivers; these countries also use a variety of non-pricing interventions.

For instance, Denmark has strongly supported the development of offshore wind power with fiscal incentives for innovation and research, as well as feed-in tariffs to encourage investment in the sector (Barker et al., 2022). In Norway, the fast adoption of EVs has been spurred by generous tax incentives, free public parking, and road tolls, as well as regulatory exceptions such as the use of bus lanes (Benoit and Lenain, 2023). Iceland has implemented a narrower and less ambitious mix of policies than the other four countries, which has resulted in less remarkable achievements. However, the policy momentum has accelerated recently; for example, Iceland has decided to ban the sales of new diesel and gasoline car sales by 2030. Figure 1 shows a combination of pricing and non-pricing policies is associated with the unlocking of low-carbon investments (e.g. Sweden), while less stringent policies result in weaker decarbonization (Iceland).

Figure 1. Changes in the share of renewable energy (2019–2023, right axis) is associated with packages of stringent climate policies and actions (averaged over 2019–2022, left axis)

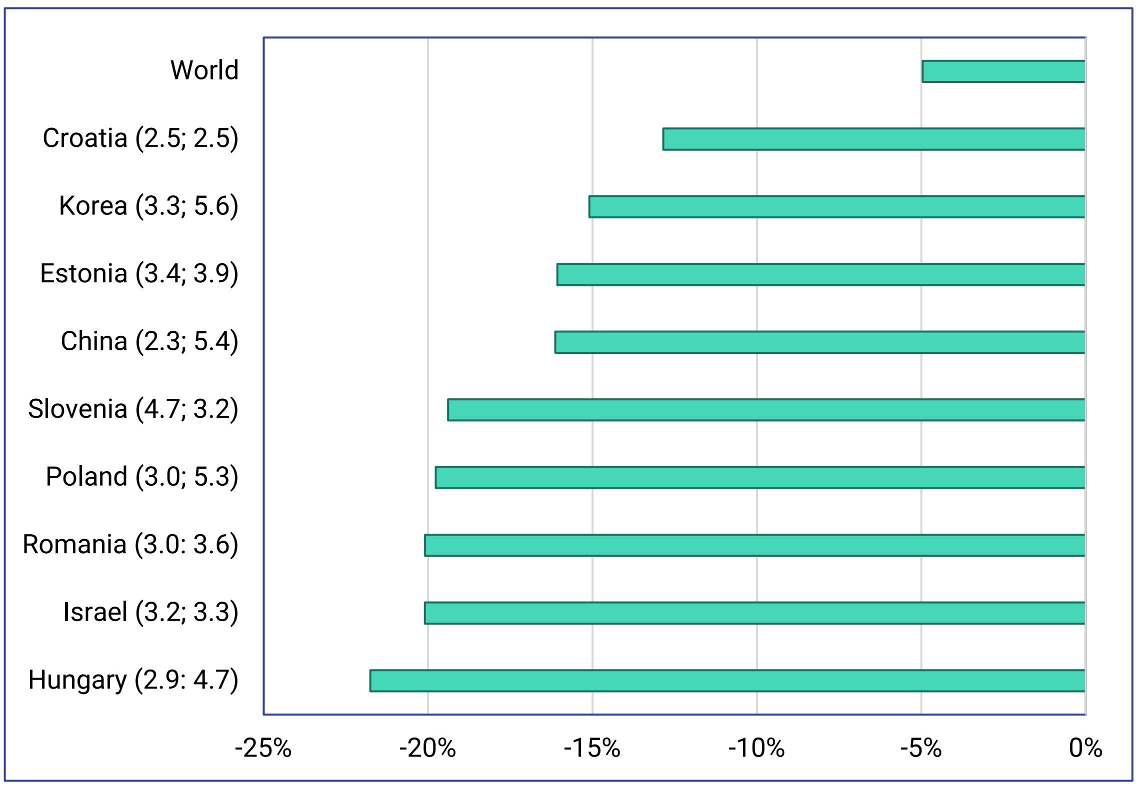


Note: Pricing policy is the unweighted average of carbon taxes, energy excise taxes, and the ETS; non-pricing policies include fossil fuel subsidies, feed-in tariffs, renewables auctions and certificates, and non-market interventions. The policy stringency indicator varies from 0 (no policy) to 10 (most stringent policy).
Sources: Author's analysis, based on Energy Institute (2024) Statistical Review of World Energy; OECD climate actions and policies measurement framework (CAPMF)

Box 2. Pricing and non-pricing policies in emerging market economies

Many emerging market economies have begun to use packages of pricing and non-pricing policies to progress toward a low-carbon economy and to progress their emission abatement targets, in accordance with their Nationally Determined Contributions (NDC) under the Paris Climate Agreement. Several of these countries use non-pricing policies that are more stringent than pricing policies. In many countries, energy consumption is being gradually decarbonized (Figure 2) with the help of subsidies and concessional finance, often by switching from coal to biomass and wind power. Households receive subsidies to retrofit their homes and reduce their demand for heating energy. In China, for example, the Government is actively supporting the development of renewable energy with packages of policy tools including soft loans, subsidies, and tax expenditures exempting investment in wind and solar equipment from VAT and import duties. China has also offered significant tax incentives for the purchase of EVs (Lenain, 2023) and is developing its ETS.

Figure 2. Emission intensity is declining thanks to stringent policies ($MtCO_2$/GDP) during 2000–2023 (in %)



Note: The numbers next to country names correspond to OECD CAPMF stringency index values for 2022, ranked from 0 to 10, with the first index referring to pricing policies and the second to non-pricing policies.
Sources: Same as Figure 1

References

Anadon, L. D., A. Jones and C. Peñasco (2022). *Ten Principles for Policymaking in the Energy Transition: Lessons from Experience*. Report, EEIST. https://eeist.co.uk/eeist-reports/ten-principles-for-policy-making-in-the-energy-transition/.

Barker, A., H. Blake and P. Lenain (2022), *Towards Net Zero Emissions in Denmark*. Working Paper 1705, OECD Economics Department. Paris: OECD Publishing.

Bassi, A. M., G. Pallaske, R. Bridle and K. Bajaj (2023) Emission Reduction via Fossil Fuel Subsidy Removal and Carbon Pricing, Creating Synergies with Revenue Recycling. *World* 4, 225–240.

Benoit, N., and P. Lenain (2023) Advancing Electric Mobility: The Key Role of Fiscal Policy and Regulation. Policy Brief, Council on Economic Policies.

Bermel, L. et al. (2024) *Clean Investment Monitor: Q1 2024 Update*, Rhodium Group and MIT CEEPR.

Bistline, J., N. R. Mehrotra and C. Wolfram (2023) Economic Implications of the Climate Provisions of the Inflation Reduction Act. *Brookings Papers on Economic Activity* 2023(1), 77–182.

Blanchard, O., C. Gollier and J. Tirole (2022) *The Portfolio of Economic Policies Needed to Fight Climate Change*. Working Paper 22-18, Peterson Institute for International Economics.

Chateau, J., F. Jaumotte and G. Schwerhoff (2022), *Climate Policy Options: A Comparison of Economic Performance.* IMF Working Paper WP/22/242.

Christophers, B. (2024) *The Price is Wrong: Why Capitalism Won't Save the Planet.* London: Verso.

D'Arcangelo, F. et al. (2022) *A Framework to Decarbonise the Economy*. OECD Economic Policy Paper Paris: OECD Publishing.

Elia, A., M. Taylor, B. Ó. Gallachóir and F. Rogan (2020). Wind Turbine Cost Reduction: A Detailed Bottom-Up Analysis of Innovation Drivers. *Energy Policy* 147, Paper 111912.

Fack, G., and L. Gaëtan Giraudet (2024) Efficacité Énergétique des Logements: Rénover L'action Publique. *Les Notes du Conseil D'analyse Économique,* n° 81, Juin.

Fowlie, M., M. Greenstone and C. Wolfram (2018) Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program. *Quarterly Journal of Economics* 133(3), 1597–1644.

Fries, S. (2021). *Transforming Energy Systems: Economics, Policies and Change*. Cheltenham: Edward Elgar Publishing.

Grosjean, J., and É. Duédal (2021) Climate Strategies in the Nordic Countries, *Trésor-Economics* 285.

IEA (2023) *World Energy Outlook 2023*. Paris: IEA. https://www.iea.org/reports/world-energy-outlook-2023.

Lenain, P. (2023) Green Tax Expenditures—A Rising Climate Policy Tool. In *GTED Flagship Report*, Council on Economic Policies and IDOS German Institute of Development and Sustainability.

Lenain, P. (2024) *Economic Policies for Affordable, Secure and Clean Energy: Insights from France*, Policy Brief, Council on Economic Policies.

Lévay, P. Z., Y. Drossinos and C. Thiel (2017) The Effect of Fiscal Incentives on Market Penetration of Electric Vehicles: A Pairwise Comparison of Total Cost of Ownership. *Energy Policy* 105, 524–533.

Shang, B. (2021) *The Poverty and Distributional Impacts of Carbon Pricing: Channels and Policy Implications* IMF Working Paper 2021/172.

Sheldon, T. L., and R. Dua (2019) Measuring the Cost-Effectiveness of Electric Vehicle Subsidies. *Energy Economics* 84, Paper 104545.

Wald, G., and M. Glachant (2023) *The Effect of Energy Efficiency Obligations on Residential Energy Use: Empirical Evidence from France.* Working Paper, CERNA, Mines Paris—PSL.

Watson, J. H. (2021) Driving Deep Decarbonization. *IMF Finance & Development*, September. https://www.imf.org/en/Publications/fandd/issues/2021/09/how-to-drive-deep-decarbonization-stock.

World Bank (2023) *Reality Check: Lessons from 25 Policies Advancing a Low-Carbon Future*. Climate Change and Development Series. Washington, D.C.: World Bank. http://hdl.handle.net/10986/40262.

Xing, J., B. Leard and S. Li (2021) What Does An Electric Vehicle Replace? *Journal of Environmental Economics and Management* 107, Paper 102432.

Datasets of climate policy instruments and energy indicators

Ember (2024) *Global Electricity Review 2024,* https://ember-climate.org/.

Energy Institute (2024) *Statistical Review of World Energy,* https://www.energyinst.org.

Global Tax Expenditure Database (GTED) https://gted.taxexpenditures.org.

IEA (2024) CO_2 *Emissions in 2023*, IEA, Paris. License: CC BY 4.0. https://www.iea.org/reports/CO2-emissions-in-2023.

Kruse, T. et al. (2022) *Measuring environmental policy stringency in OECD countries: An update of the OECD composite EPS indicator.* OECD Economics Department Working Paper 1703. OECD Publishing, Paris, https://doi.org/10.1787/90ab82e8-en.

Nachtigall, D., et al. (2022), *The climate actions and policies measurement framework: A structured and harmonised climate policy database to monitor countries' mitigation action.* OECD Environment Working Paper 203. OECD Publishing, Paris. https://www.oecd.org/en/data/dashboards/climate-action-dashboard.html.

Nachtigall, D., Lutz, L., Cárdenas Rodríguez, M. et al. (2024) The Climate Actions and Policies Measurement Framework: A Database to Monitor and Assess Countries' Mitigation Action. *Environmental and Resource Economics* 87, 191–217.

World Bank (2024) *State and Trends of Carbon Pricing 2024*. World Bank, Washington, DC. https://hdl.handle.net/10986/41544.