The Coalition of Finance Ministers for Climate Action

# Analytical and policy approaches to the climate and economy

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## Climate policy in policy mixes for different policy "domains"

Successful climate policy needs to influence the actions and behaviors of a wide range of stakeholders, from whole industrial sectors to the firms that they comprise, and to households and individuals. It is now generally accepted that there are no "single bullet" policies that will be effective across these diverse actors, and the most effective policy approach will likely combine a number of policies into a "policy mix" (Rogge and Reichardt, 2016; Alt et al., 2024). Fu & Wang (2022) find that to reduce emissions in the context of economic growth ("decoupling"), "taxation is vital, and regulations, information instruments, and public goods and services are important factors." For China, their recommendation is that it "should organise its tax, trading system, economic incentives, and regulations on the decarbonisation of equal policy intensity to accomplish strong decoupling early."

Grubb et al. (2015) identify "three domains" of energy-climate transitions that require different policy emphases, although these are not exclusive of other policy instruments. Thus, the first domain, of market-based decision-making seeking optimization, tends to be responsive to price signals (i.e., has a relatively high price elasticity of demand). In this domain, therefore, market-based instruments, such as carbon taxes or emissions trading (discussed further below), will likely be relatively effective, though this effectiveness can be enhanced by policy instruments such as regulation and strategic investment, which are most associated with the two other domains (discussed next).

A second domain is where decisions are less influenced by markets and more by other behavioral traits, such as habits, social norms, inertia, transaction costs, or split incentives. Optimization in such circumstances may seem too difficult or impossible, leading to satisficing behaviors that attain outcomes that are "good enough." In such cases, price-based instruments will likely be relatively ineffective (i.e., price elasticity will be low) and better outcomes will likely be achieved by regulation. Mandating minimum levels of energy efficiency, for example, in buildings or energy-using products, is a common policy response in such circumstances. Saunders et al. (2021) discuss the wide range of policies that have been used to seek to increase energy efficiency and find that the most effective (in terms of the reduction in energy demand) and cost-effective (in terms of the lowest cost per unit of energy saved) are energy efficiency labels and efficiency standards for buildings, lighting, vehicles and household appliances.

The third domain is associated with innovation and technological change, which have been crucial in developing and bringing down the cost of low-carbon technologies, and which will doubtless need to continue to do so. The competitiveness of low-carbon technologies will be helped by carbon prices, which reduce these technologies' relative prices compared with high-carbon alternatives, but innovation and technology development also require strategic investment. Most of this in the energy context will need to come from the private sector, which requires an acceptable risk/return ratio. Policy can seek to both reduce the risk and increase the return.

On the risk side, policymakers need to reduce low-carbon risks by coinvesting or providing assurance of future markets and prices (e.g., through Contracts for Difference), while making clear the risks of high-carbon investment by having a credible decarbonization roadmap. On the return side, policy needs to provide incentives where necessary, so low-carbon technologies can compete against high-carbon incumbents. Polzin (2017) provides a long list of policies that have been used for these purposes, including: subsidies[1] (and the removal of subsidies for fossil fuels and technologies based on fossil fuels); taxes on fossil fuel-using products, emissions, or fossil fuels themselves (recognizing that the external costs of burning fuels can be characterized as subsidies to their use, as done by the IMF in Black et al., 2023); stable tax incentives for private innovation, product standards, and demand-generating effects of regulation, as well as an articulation of quality requirements; and, for renewable energy, feed-in tariffs, renewable obligation certificates, or quota models such as renewable portfolio standards.

1 Large-scale, economy-wide subsidies to the full range of low-carbon technologies, such as the U.S. Inflation Reduction Act (IRA) will likely be limited to big economic blocs (e.g., the U.S., China, the EU). Smaller countries will need more targeted industrial strategies to support and develop those technologies and sectors in which they can build comparative advantage.

Low-carbon innovation policy needs to have a dual focus: the deployment of existing low-carbon technologies at scale, which, as with photovoltaics and wind, will reduce their unit cost; and research and development (R&D) targeted at the next generation of technologies (for example, hydrogen or carbon removal). There is strong evidence from China that its early trials of emissions trading have increased low-carbon innovation (Zhu et al., 2019; Pan et al., 2022). However, Dechezleprêtre et al. (2016) make the point that "price-based instruments, such as carbon markets, and quantity-based instruments, such as renewable energy targets, tend to favour innovation in technologies that are closest to the market." Therefore, direct support to emerging technologies (e.g., public funding for R&D or feed-in tariffs) will be necessary to meet future emissions reduction targets that rely on technologies at an earlier level of development. Essentially, when a low-carbon technology is already broadly competitive with high-carbon incumbents (and therefore its price elasticity of demand tends to be high), market/carbon taxation measures can be effective. When those technologies are further from market competitiveness, with relatively low price elasticities, other, complementary, measures may be needed.

What follows is a discussion of those instruments that will likely be of greatest interest and potential for MoFs.

## Carbon pricing

Carbon pricing may be implemented through two different instruments: carbon taxes, which normally tax carbon emissions per unit of carbon dioxide (or carbon dioxide equivalent) emitted; and carbon emissions trading systems (ETSs), which issue emission allowances to covered firms or sectors, with the allowances matching the emissions of these entities needing to be surrendered at the end of the relevant period. Entities may trade surplus allowances (creating a carbon price), and the number of allowances issued may decline over time, to deliver emission reduction. Recent empirical evidence on carbon taxation is reviewed by Köppl and Schratzenstaller (2022), while the 2024 report from the International Carbon Action Partnership (ICAP) (ICAP, 2024) gives a comprehensive review of the world's ETSs.

Although the World Bank considers that "Carbon pricing can be one of the most powerful tools available to policymakers to incentivize reducing emissions as part of an integrated policy mix." (World Bank, 2024, Foreword), the extent of carbon pricing has only grown slowly (from 7% to 24% of global emissions covered over 2013–2024). There are now 75 carbon pricing schemes, of which 39 are carbon taxes and 36 are emission trading systems, almost exclusively among high and upper-middle income countries. Carbon prices generally remain low: only 7 of the tax and trading schemes have prices above the US\$63/$tCO_2$ 2030 price range considered necessary to comply with the "well below $2^oC$" target of the Paris Agreement, and 24 of them have prices below US\$10/$tCO_2$. In addition, many of the schemes cover a relatively small proportion of a country's greenhouse gas emissions (World Bank, 2024). For example, although Uruguay has the highest carbon tax (US\$167/$tCO_2$), it covers only around 5% of the country's total greenhouse gas emissions.[2]

Carbon taxes always raise revenue, and ETSs do so when the emission allowances are auctioned. In 2023, revenues from carbon pricing exceeded US\$100 billion for the first time. The use of these revenues can be critically important for gaining political acceptance of carbon pricing from the affected population and maximizing the benefits from the carbon pricing policy (Cárdenas Monar, 2024). How they will be used should be announced before the carbon pricing is implemented: whether they are to be used to compensate low-income households, to prevent the pricing measure being regressive, to invest in low-carbon technologies, or to substitute for other taxes, or whether they are simply to become part of the general budget. Of these options, the political acceptability of carbon taxes is increased by the spending of revenues on climate projects and on increasing perceptions of fairness by mitigating negative impacts on low-income or vulnerable social groups (Maestre-Andrés et al., 2021). The macroeconomic impact of the pricing measure will depend on the treatment of energy-

2 https://www.statista.com/statistics/483590/prices-of-implemented-carbon-pricing-instruments-worldwide-by-select-country/ .

and trade-intensive sectors (EITIs) and on the use of revenues, with the best macroeconomic outcomes deriving from the reduction in taxes on employment (Goulder and Hafstead, 2013).

Finally, if, as is suggested above, carbon prices are most effective if they are introduced as part of a policy mix, the question of sequencing arises: does the order in which the various policies comprising the mix are introduced matter? Now, the effect of carbon pricing depends on the elasticity of demand for fossil fuels. It is known that this elasticity is higher in the long term than in the short run because the long term gives time for investments to be made in low-carbon substitutes for fossil fuels, or for fossil fuel-using products. If these investments can be accelerated by policies complementary to carbon pricing, this would enhance the effectiveness of the carbon pricing in increasing the price elasticity of demand (i.e., making it more negative) for fossil fuels and products that use them. D'Arcangelo et al. (2022) are explicit about the desirability of these complementary policies, stressing "the importance of additional policies—such as green technology support measures, regulations, standards—to complement emissions pricing measures. Indeed, these policies can reduce abatement costs and ease the substitution of clean energy sources for fossil fuels, increasing emission responsiveness to carbon prices." Putting these complementary policies in place before the implementation of carbon pricing will, therefore, increase its effectiveness.

## Case study on carbon pricing in Indonesia[3]

The development of carbon pricing in Indonesia began with the Partnership for Market Readiness (PMR) project, funded by the World Bank from 2017 to 2020. This project, implemented by UNDP Indonesia in collaboration with various relevant ministries, technical agencies, and industry associations, achieved several milestones. These included the development of a comprehensive greenhouse gas emissions profile, the creation of an online greenhouse gas emissions reporting system for the power generation and industrial sectors, the establishment of a framework for market-based instruments in Indonesia, and collaboration with the private sector. In early 2020 a consultancy funded by the German development agency GIZ provided training in carbon pricing to officials in the Indonesian Ministry of Finance (IMOF).

The PMR and subsequent work laid the groundwork for further carbon pricing development in Indonesia. The Ministry of Environment and Forestry (MoEF) and the Coordinating Ministry for Maritime and Investment Affairs began preparing for the implementation of carbon pricing. MoEF has focused on carbon pricing as a means to fulfill the Nationally Determined Contribution (NDC) and domestic trading, while the Coordinating Ministry for Maritime and Investment Affairs has concentrated on investment and international carbon trade aspects. In 2021, the enactment of Law No. 7/2021 and Presidential Regulation No. 98/2021 marked significant progress. Law No. 7/2021 includes provisions for a carbon tax, divided into three phases, and explicitly introduces the cap-and-tax mechanism, but the mechanism is actually cap-and-trade-and-tax. Meanwhile, Presidential Regulation No. 98/2021 outlines the governance of carbon pricing. This was followed by the issuance of a derivative regulation, Ministerial Regulation of the Environment and Forestry No. 21/2022.

Regarding the implementation of carbon trading in Indonesia, the first phase is within the power sector. Prior to the implementation, there was a pilot phase in 2020–2021. The 2020 pilot project included a total of 84 participants, comprising 54 units from the PLN group (the state electricity company) and 30 units from Independent Power Producers (IPPs). In this project, 45 participants exceeded the emission cap, while 39 participants operated below it. The project resulted in a potential trade of 1.67 million $tCO_2e$ from those with a surplus to those with a deficit. Meanwhile, the 2021 pilot phase was participated in by 32 coal-fired power plant units, with the majority acting as sellers. At least 28 carbon trading transactions were recorded among these power plants, with a total carbon transaction volume of 42,455.42 $tCO_2$ and an average carbon price of 2 US$/$tCO_2$.

3 The information in this section comes from the Indonesia case study in ICAP (2024), and contacts at the University of Indonesia. A range of issues related to carbon taxation in Asia are discussed in Ekins et al. (2023), published by the Asian Bank Development Institute.

The implementation is divided into three phases: Phase I (2023–2024), Phase II (2025–2027), and Phase III (2028–2030). In Phase I of 2023, implementation applied to coal-fired power plants (CFPPs) with a capacity of 100 MW or more, and in 2024, it extended to CFPPs with a capacity of 25 MW or more (42 entities covering 99 installations in 2023, 63 entities covering 146 installations in 2024). The cap was set by the Ministry of Energy and Mineral Resources (MEMR) on the basis of emission intensity benchmarks, with free allowances granted to the power sector in 2023, based on installations' average emissions of the previous year, with an absolute cap of 238.2 $MtCO_2e$ (about 40% of greenhouse gas emissions from Indonesia's energy sector). Allowances corresponding to the covered emissions must be submitted annually, and these allowances may include certified offsets. Penalties are applied for a shortfall in allowances, and eventually it is envisaged that this shortfall will be subject to a carbon tax.

Auctioning in the future may take place through the newly established Indonesian Carbon Exchange (IDXCarbon), but so far there has not been any allowance trading; the focus has been more on trading Certified Emission Reductions (CERs). As of July 2024, statistics indicated no transactions in the carbon exchange using the auction mechanism, with regular market mechanisms dominating in terms of total frequency.

While the emissions cap is currently being implemented in the power sector, the industrial sector is set to follow. The Ministry of Industry is developing a roadmap for carbon trading in this sector, focusing on four short-term priority subsectors, five medium-term priority subsectors, and other subsectors depending on their readiness. Applying an emissions cap to the forestry sector may not be appropriate, although it is regulated through Regulation of the Minister of Environment and Forestry no. 7/2023. The forestry sector is better suited for implementing offsets due to the nature of its emissions removal or avoidance.

Regarding the imposition of a carbon tax with a hybrid cap-tax-and-trade mechanism in 2025, although the cap-and-tax design has been explicitly outlined and was planned to be implemented for coal-fired power plants during 2022–2024 under Law No. 7/2021, at the time of writing the design that will be applied during the actual implementation remains uncertain: the Ministry of Finance is preparing a roadmap for the implementation of the carbon tax in Indonesia, and no final decision has been made regarding its design.

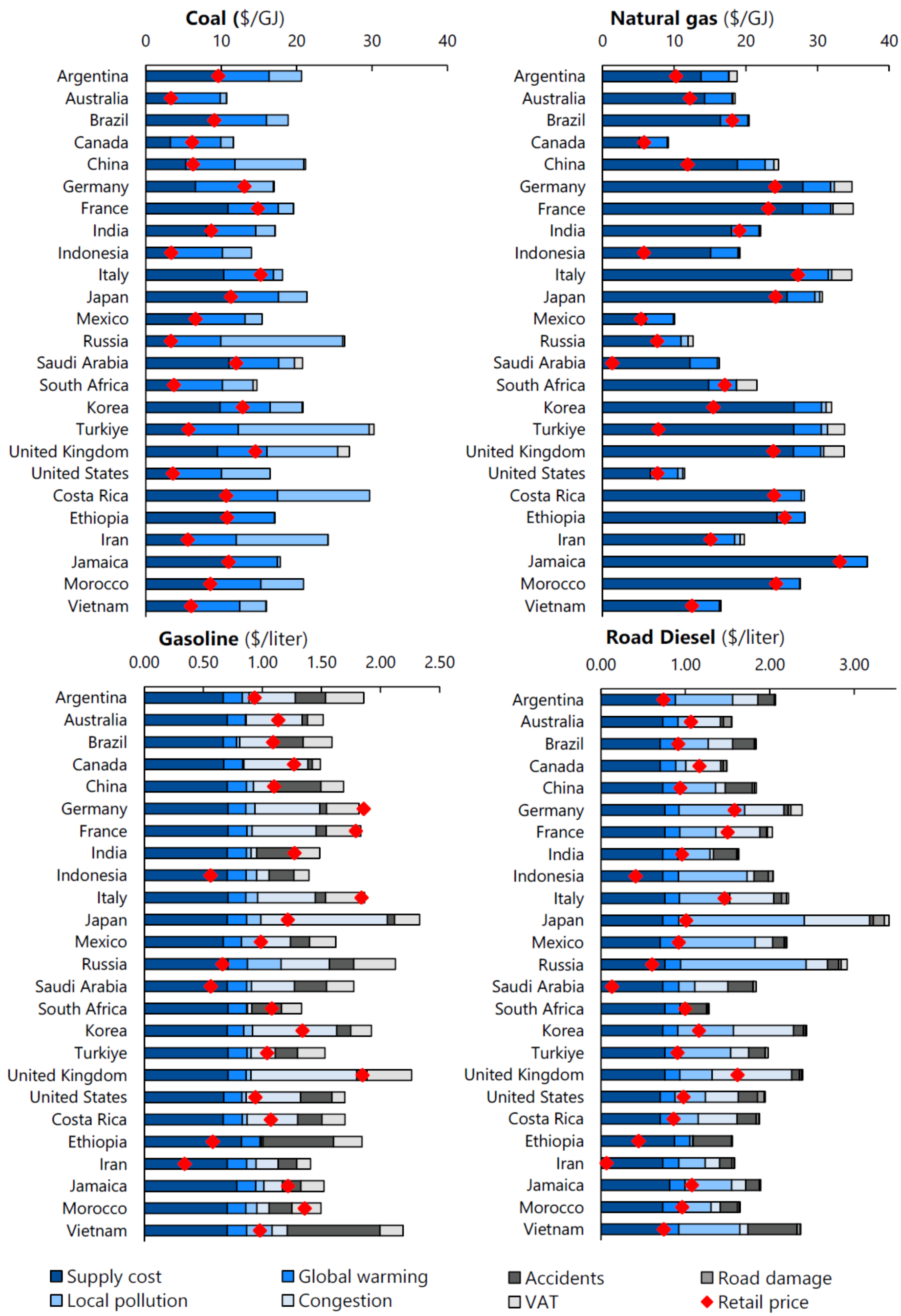
As noted above, eventually the ETS will function as a hybrid "cap-and-trade-and-tax" system. The average trading price of allowances in 2023 was US$0.64, while that of offsets was US$4.45. It is planned to implement emissions caps for four further sectors in the future: forestry, industrial processes and product use, agriculture, and waste management. The analytical methods and modeling approaches that resulted in this novel nearly parallel introduction of carbon emission trading and taxation are not yet public, but the measures adopted suggest a recognition of the central role of the electricity sector in Indonesian decarbonization as well as the need to begin this process without excessive impacts on Indonesian electricity prices and security.

## Fossil fuel subsidy reform

In 2021–2022 none of the G20 countries, or of the IMF's selection of other countries in Black et al. (2023), priced their fossil fuels at a level that covered both their supply costs and the other costs that use of these fuels inflicts on society (Figure 1). In terms of explicit subsidies (where the retail price is below the supply cost): no country subsidizes coal; for natural (fossil methane) gas the largest subsidies were given by Indonesia, Saudi Arabia, and Turkey; for gasoline and road diesel the largest subsidies were given by Indonesia, Saudi Arabia, Ethiopia, and Iran.

Commitments to the reduction of fossil fuel subsidies (FFS) are a regular feature of the final statements or communiques of climate COPs and G7 and G20 meetings and yet, as Black et al. (2023) showed, the explicit subsidies have stayed at around US$500 billion per year since 2018, with a pronounced spike in 2022 as energy prices shot up following the Russian invasion of Ukraine. The implicit subsidies arising from unpriced effects such as global warming and local air pollution take the subsidy total in 2023 to US$7 trillion (Black et al., 2023).

**Figure 1. Supply costs and other social costs from the use of fossil fuels in G20 and selected other countries, 2021–2022**

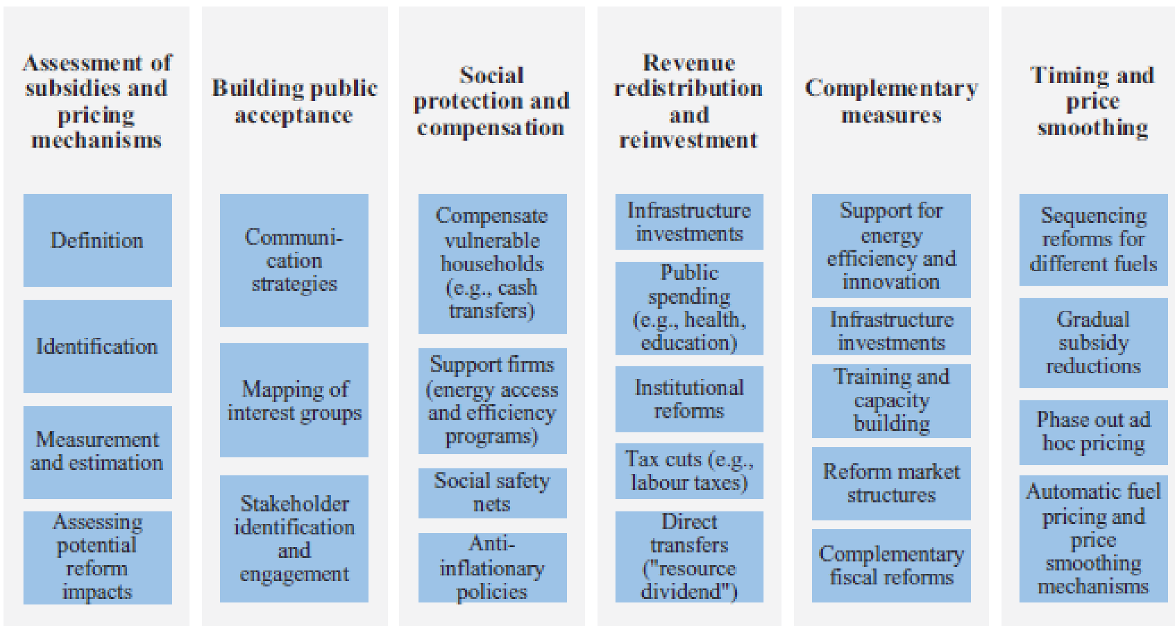



*Source: Black et al. (2023, Figure 3, p. 14) (reproduced with permission)*

However, there have been numerous attempts to remove fossil fuel subsidies in different countries, where the rationale for such reforms, rather than being driven by climate policy, “is determined in a complex environment of political economy challenges, macroeconomic, fiscal and social factors, as well as external drivers such as energy prices” (Rentschler and Bazilian, 2017a).

The challenges of subsidy reform bear many similarities to those of carbon pricing, as both entail an increase in the price of fossil fuels. Rentschler and Bazilian’s (2017b) analysis of these challenges and how they can be addressed is set out in Figure 2.

### Figure 2. Important considerations and actions in respect of fossil fuel subsidy reform




*Source: Rentschler and Bazilian (2017b, Figure 1, p. 143)*

It can be seen that FFS reform starts with assessment, then moves to communication with stakeholders and building public acceptance, being clear about the social protection, and compensation using the public revenues saved by the subsidy reduction is envisaged. Following implementation of the FFS reform, these revenues need to be immediately redistributed and reinvested, as envisaged in the *ex-ante* public communication, and supplemented with complementary measures as necessary and appropriate. The implementation needs to be sensitively timed (e.g., when fossil fuel prices are low), and may need to be gradual and smooth to give stakeholders time to adapt. Precisely the same considerations apply to the implementation of a carbon tax.

The challenges to FFS reform (and, by implication, to carbon pricing) set out in Figure 2 suggest the kinds of analysis and modeling that may be necessary in order to get insights into how the challenges might be addressed as well as the economic and social implications for these measures. The initial identification and assessment phase will need fiscal models to assess the revenue impacts of the reforms, distributional models to assess the impacts on household incomes for different income groups, sectoral economic models to see which economic sectors are most exposed to the reforms, and then macroeconomic models to see how the economy as a whole will likely be affected. The second phase involves in-depth consultation with the most affected stakeholders, both stressing the overall benefits of the reform and identifying what kinds of support the most vulnerable groups will need and where these should be focused. The third phase involves the detailed articulation of, and commitment to, that support before the reform is implemented, as well as close consideration of the timing and perhaps a gradual introduction of the reform to allow stakeholder adjustments where necessary. Post-reform, careful consideration needs to be paid to where the public revenues from the reform will be reinvested in the economy. Some will need to go toward compensating vulnerable groups, as identified in the earlier phase, but the economic benefits of the reform will depend on how the rest of the revenue is allocated across infrastructure, efficiency and clean technology investments, public social spending, tax cuts, and institutional reforms.

## Low-carbon technology support measures

It has already been noted that the effectiveness of carbon pricing can be enhanced by the availability of low-carbon substitutes for the taxed fuels or fuel-using products. This availability of substitutes can be much accelerated by public support for their development and early deployment.

The most obvious of these substitutes are the various forms of low-carbon energy, principally renewables. Peñasco et al. (2021) study both the frequency with which 10 different policy instruments have been used to promote renewables (along with other instruments to promote decarbonization more generally) and the evaluated effectiveness of these instruments. After taxes and tax exemptions, the instruments most commonly evaluated are (in declining order) feed-in-tariffs/feed-in-premiums (FITs/FIPs), renewable energy obligations or portfolio standards (RPSs), ETSs, tradable green certificates (TGCs), auctions, white certificates (for energy efficiency), and R&D funding. The criteria used for these evaluations are environmental and technological effectiveness, competitiveness and cost-related outcomes, innovation outcomes, and distributional and other social outcomes. The evaluations cover more than 50 countries.

The evaluations indicated that all the policy instruments had generally positive environmental outcomes (unsurprisingly, perhaps, as this was their purpose). For competitiveness and distributional outcomes, the evidence was more mixed. For competitiveness, 32% of the evaluations reported positive outcomes, and 29% negative outcomes. For distribution there are more negative outcomes, especially for FITs/FIPs, TGCs and RPSs. However, Peñasco et al. (2021) stress that these outcomes are crucially dependent on policy design, and negative effects can be mitigated by the simultaneous adoption of complementary policies (for example, in respect of revenue recycling mechanisms), as noted above.

Ex-ante assessments of the introduction of these policies will need to shed as much light as possible on their likely impact. Perhaps most important is the identification, in the country context, of the low-carbon technologies that will likely be most cost-effective in their delivery of low-carbon energy, which of those technologies have the most potential for cost reduction through their deployment at scale (Malhotra and Schmidt, 2020). Also not to be overlooked are the skills required for the effective operation of those technologies, and the policies most likely to incentivize the private sector to develop these skills and invest in the technologies. Jagger et al. (2012) identify the most effective policies in this area as "standardisation of funding for training; formalisation of transferable qualifications; legally-binding targets for carbon emissions reductions and low-carbon technology deployment; framework contracts and agreements between actors in key sectors; licensing and accreditation schemes for key technology sectors; Government support for skills academies and training centres; support for first movers in niches; increasing mobility of workers; and providing a clear long-term cross-sectoral framework for a low-carbon transition, including skills training."

Targeted public support for the early deployment of technologies has been shown to be crucial in achieving their subsequent deployment at scale and in befitting from ensuing cost reductions. The results of Iyer et al. (2015a,b), obtained using an integrated assessment model (IAM), emphasize the importance of early, strong, and stable climate policies in reducing long-term abatement costs, and of the relative prices of low- and high-carbon options, and therefore the role of carbon pricing, in low-carbon technology take-up.

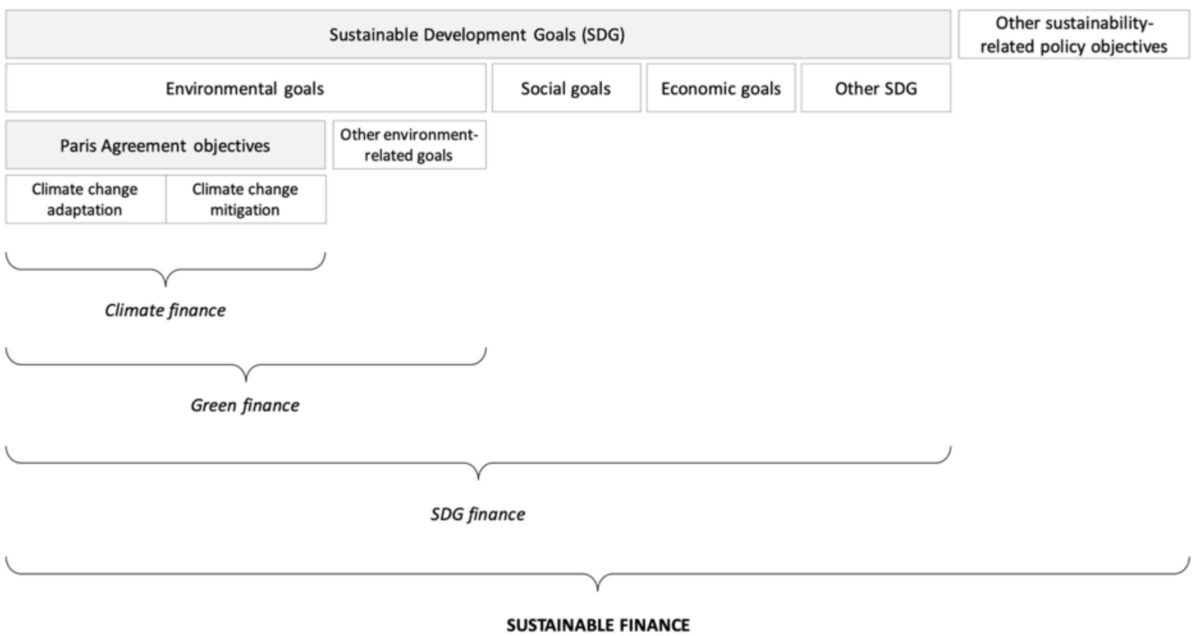
The policies in support of clean energy are having an impact. The International Energy Agency (IEA) reports that clean energy would likely attract nearly two-thirds of the total energy investment in 2024 (IEA, 2024), but this is heavily skewed toward the U.S., Europe, and China. Emerging and developing economies (outside China), with well over 50% of the world's population, are only seeing about 15% of the clean energy investment. One of the reasons for this lack of investment in developing and emerging markets (outside China) can be their relatively high weighted average cost of capital (WACC)

(Egli et al, 2019), which militates particularly against renewables given their relatively high capital intensity. Ameli et al. (2021) identify the reasons for high WACCs as "differences in macroeconomic conditions, business confidence, policy uncertainties and regulatory frameworks" together with immature capital markets and a lack of capital stock, so that "investors apply high-risk premiums to the finance they make available". While there are no easy answers to these barriers to capital investment, it is possible that the growth of "sustainable finance" may provide new capital flows to those emerging and developing countries that most need them.

## Sustainable finance

There is a growing subset of the financial sector that is interested in sustainable development-related issues as well as financial return. Figure 3 shows various categories of what is collectively coming to be called "sustainable finance".

### Figure 3. A characterization of sustainable finance




*Source: Migliorelli (2021)*

The narrowest category, related to the Paris Agreement goals, is climate finance, whereas green finance includes other environmental goals as well. SDG finance extends this further to investment in achieving the UN Sustainable Development Goals (SDGs), while sustainable finance covers all these and other sustainability-related policy objectives. The overview of sustainable finance provided by the European Commission[4] provides a succinct description of what it is, why governments might wish to use it, and how governments can proceed to implement it in a robust and consistent way.

A wide variety of possible financial instruments can be deployed in the various categories of sustainable finance. Figure 4 shows the main instruments, with brief definitions and applications.

As an example of the increase in the use of these instruments, Bloomberg reports an increase in the issuance of green and other sustainability-related bonds from around $50 billion in 2014 to over $900 billion in 2023 (Bloomberg Professional Services, 2024).

Maltais and Nyqvist (2020) analyze the reasons for investing in sustainability-related (specifically, green) bonds, given there is no consistent evidence they outperform (or indeed underperform) other investments. For example, the financial case includes better financial returns, reduced financial risk

4 https://finance.ec.europa.eu/sustainable-finance/overview-sustainable-finance_en

and lower cost of capital; the business case includes operational efficiency, creating new markets, and reduced business risks; and "legitimacy/institutionally oriented drivers" include the social license to operate and institutional pressures (ibid.).

**Figure 4. Financial instruments for SDG finance**

| Example | Application and description | Special forms of instrument relevant to the SDGs |
|---|---|---|
| Loan | Used when a borrower requires a fixed amount of money, mostly from a commercial bank | Green loan, impact-linked loans (where the interest rate depends on the impact performance) |
| Credit | Used when the borrower requires a more flexible credit e.g. from a commercial bank | Green credit, social credit, impact-linked credit |
| Bond | Used often when the borrower (issuer of the bond) needs a large amount of money and can go to the bond-market to raise money from many investors. The bond has a fixed return to investors (coupon) and a usually fixed repayment date. The investors can often buy and sell these bonds again on the market without affecting the issuer of the bond | Green bonds, blue bonds, social impact bonds, Islamic bonds, diaspora bonds, transition bonds, impact-linked bonds |
| Equity | Often used to raise money for a company or project (e.g. through special purpose vehicles or SPVs), where investor(s) take ownership in the company/SPV. Equity usually does not have a fixed return nor a fixed repayment date. Equity can be tradable (e.g. company stock on stock markets), but also non-tradable (e.g. private equity) | Impact finance, crowdfunding |
| Funds | Used to pool assets (e.g. equity, bonds) to reduce risk of any single asset | Impact funds, crowdfunding, development funds |
| Crypto-based investment | Using digital currencies and contracts with the possibility to integrate a variety of fund-raising and fund-management functions | Integration of smart contracting (e.g. impact requirement) and covenants for the disbursement of funds and the repayment of investments |

*Source: Technical Report for SDG Finance Taxonomy, China (CICETE and UNDP, 2020, p.7)*

MoFs are in a good position to avail themselves of the new opportunities presented by green finance, provided they have clear criteria for the kinds of investments that will qualify as "green" and are in a position to assess whether the investments they are considering have higher than average risks. While most green bonds have been issued by developed economies, Jain et al. (2022) explore their potential role in financing renewable energy in Asia. In China green bond issuance is very well established, but in addition Jain et al. analyze in detail the diverse prospects and conditions for progress in green bonds in India, Indonesia, Malaysia, the Philippines, and Thailand.

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