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South African Reserve Bank Special Economic Notes are a collection of descriptive and critical economic analyses with recommendations written for internal SARB discussion. They are written by staff members or fellows of the Economic Research Department and, on occasion, by consultants under the auspices of the SARB. They are released publicly on an occasional basis. This series features summaries of discussions that took place at the 2023 SARB's Biennial Conference.

Authorised for publication by:

Chris Loewald

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Enquiries

Head: Research Department
South African Reserve Bank
P O Box 427
Pretoria 0001

Tel. no.: +27 12 313-3911
0861 12 SARB (0861 12 7272)

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Meeting the climate change challenges: Instruments for climate change mitigation

*Luiz de Mello*¹

Abstract

Climate change is among the most significant challenges facing humanity. Achieving the 2015 Paris Agreement goal of limiting the rise in world temperature to below 2°C compared to pre-industrial levels will require ambitious action to decarbonise economies and societies. Policymakers have several price and non-price instruments at their disposal to achieve decarbonisation goals. These instruments have different abatement potential and associated costs that need to be quantified to inform policy choices. Policy strategies also need to cushion vulnerable social groups from adverse effects on jobs and livelihoods, so that the transition is cost-effective and socially acceptable. Private sector involvement is crucial, given the large investment needs associated with decarbonisation, as well as international cooperation on policies to achieve common climate change goals while reflecting the specific conditions of different countries.

1. Introduction

Climate change is among the most significant challenges facing economies and societies. In 2023, several climate-related records were broken, surprising climate science experts, while extreme weather events have heightened awareness about the risks of climate feedback loops and damaging tipping points.² These developments are drawing the attention of policymakers to the need for action to achieve agreed climate change goals.

Achieving the goal – enshrined in the 2015 Paris Agreement – of keeping the rise in world temperature well below 2°C, and preferably below 1.5°C, compared to pre-industrial levels, requires a sizeable reduction in emissions of greenhouse gases (GHGs). Countries have made ambitious pledges and announced climate change mitigation policies to honour those commitments. One hundred and thirty of the 196 countries that signed the Paris Agreement, accounting for 90% of global GHG emissions, have committed to achieving carbon neutrality by mid-century. However, policy action has so far been insufficient to put emissions on track to reach medium-term (2030) and mid-century targets, although estimates of the gap vary significantly both globally and by country depending on policy scenarios (Figure 1).

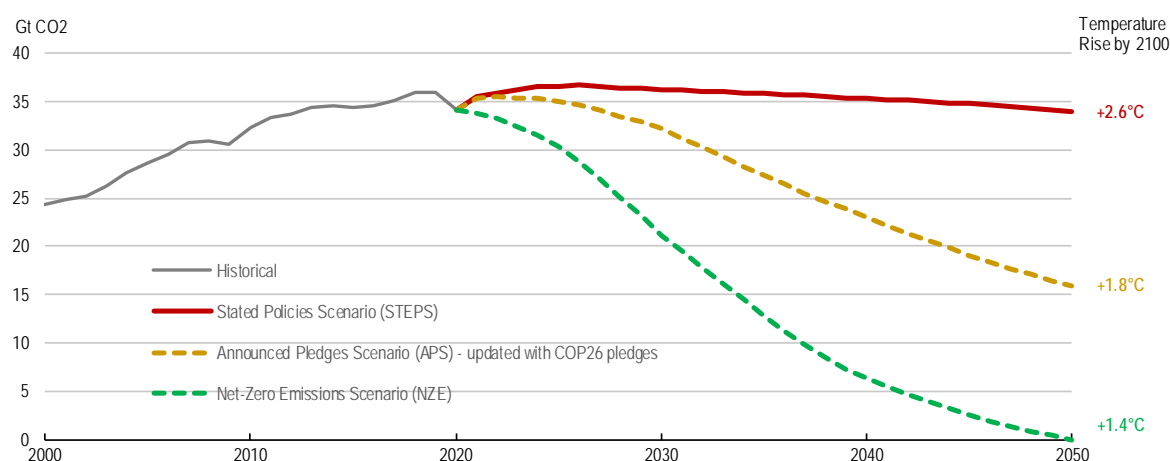
¹ Luiz de Mello is a Director of the Policy Studies Branch of the Economics at the Organisation for Economic Cooperation and Development (OECD).

² See, for example, Ripple et al. (2023).

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Figure 1: Global emissions of GHGs are out of step with the net-zero target by 2050

Scenarios of CO₂ emissions during 2000–2050 and associated expected temperature rise by 2100



Notes: The Announced Pledges Scenario is updated with COP26 pledges as of 3 November 2021; the Net-zero Emissions Scenario shows the global energy-related emission pathway developed by the IEA where technology, investments and policies are deployed in line with the objective of reaching net-zero emissions by 2050. Expected temperature rises by 2100 are relative to pre-industrial levels, and are subject to an upward risk due to uncertainties in the estimate and possible future changes in policy.

Sources: IEA (2021a, 2021b and 2021c)

According to the International Energy Agency (IEA),³ achieving net-zero emissions by 2050 will require global annual investment in the energy sector to rise from about US\$2.3 trillion in recent years to close to US\$5 trillion by 2030. Infrastructure, buildings and transport account for sizeable shares of the required investment to achieve net-zero emissions by mid-century. This is a tall order, but there have been a few encouraging developments. These include the increase in global clean energy investment in 2023, in part due to the recovery of the global economy from the COVID-19 pandemic and the response to the global energy crisis triggered by the war in Ukraine. This is important, because the energy sector is responsible for around three-quarters of GHG emissions globally.

Beyond energy generation, comprehensive decarbonisation will require efforts in other areas as well. More efficient use of energy across all economic sectors, behavioural changes to reduce demand for fossil fuels among firms and households, and continued innovation to speed up the development and deployment of green technologies will all be part of the transition. At the same time, beyond climate change mitigation efforts, countries are already having to adapt to climate change, including by investing in new and upgrading existing infrastructure.

2. Policy instruments to achieve the low-carbon transition

There is no shortage of policy tools to deliver a successful low-carbon transition. These tools need to be deployed in line with effective transition strategies to address the specific needs of different countries, which vary depending on economic structure, social preferences and political circumstances. Transition strategies in turn need to credibly identify gaps in abatement trajectories relative to targets and provide sound evidence on the expected effects of specific policy actions.

³ For more information and discussion, see the IEA (2023a and b).

Equally important is the need to identify and manage the risks of the transition, so that corrective measures can be considered where and when needed. Policy strategies also need to cushion vulnerable social groups from adverse effects on jobs and livelihoods, so that the transition is cost-effective and socially acceptable.⁴

In short, the decarbonisation toolkit includes price and non-price instruments. Among price-based instruments, there are those whose primary objective is to reduce emissions, such as explicit carbon prices and emissions trading schemes, as well as other instruments, such as emissions-based vehicle taxes, feed-in tariffs and tax incentives for businesses. Price-based instruments also include taxes, excises and subsidies on the use/consumption of fossil fuels or electricity, which are relevant for climate change mitigation, even though their primary objective is not to reduce emissions.

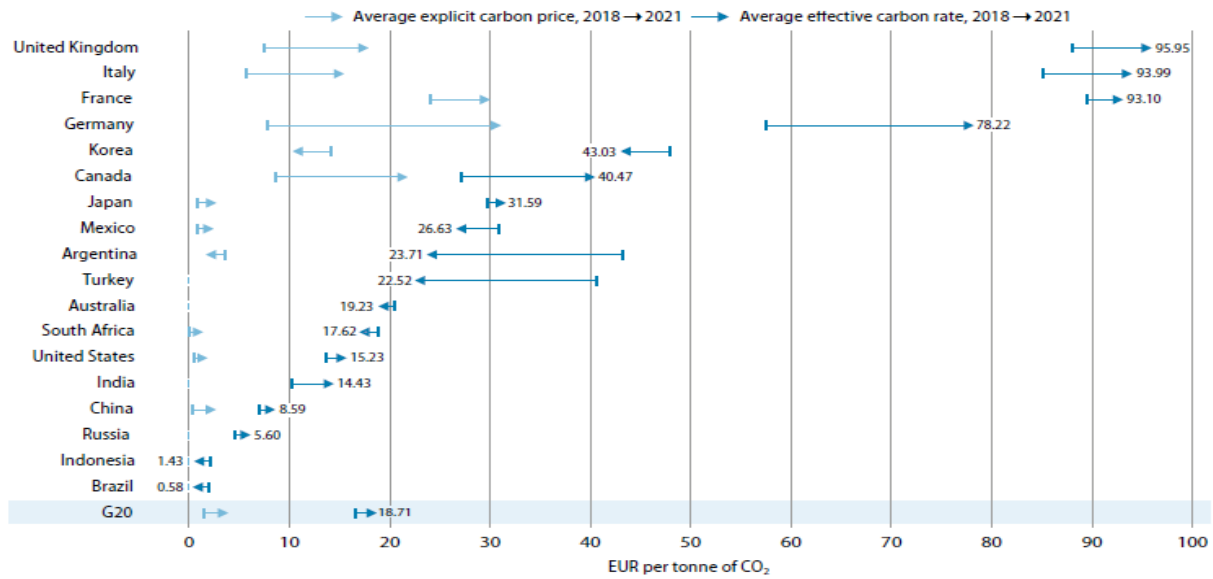
As for non-price levers, emissions intensity standards, technology adoption subsidies and technology mandates are among the instruments primarily aimed at reducing emissions. Other instruments, such as fuel efficiency regulations and air pollution standards, are relevant for climate change mitigation but their main use is not directly aimed at reducing emissions. These non-price instruments can help to overcome coordination failures, split incentives and other market failures. In general, they can be used instead of price instruments in situations where firms and households do not respond strongly to explicit price signals. The costs associated with these instruments can be seen as implicit prices on emissions and need to be quantified. They also need to be designed appropriately to avoid blurring price signals, blunting economy-wide incentives and complicating performance monitoring.

These price and non-price instruments have different abatement potential and associated costs that need to be quantified to the extent possible to inform policy choices. For example, effective carbon rates (the combination of explicit carbon taxes, emissions trading scheme permit prices and fossil fuel excises) remain low around the world and tend to be dominated by fossil fuel excises, rather than explicit carbon prices or emissions trading schemes (Figure 2). There is also a large share of emissions – nearly one-half from energy use – that are not priced at all. This is in part due to concerns about their distributional implications, which motivates public resistance to explicit carbon pricing. In particular, the risk of joblessness for those adversely affected by the transition limits public support for policy change. Consistent with reliance on excises on fossil fuels, effective carbon rates on energy-related emissions are highest in the road transport sector, followed by agriculture and fisheries. The real estate, electricity and manufacturing sectors are taxed comparatively lightly (Organisation for Economic Co-operation and Development, or OECD, 2021).

⁴ For more information, see D’Arcangelo, Levin, Pagani, Pisu and Johansson (2022).

Figure 2: Carbon pricing remains low worldwide

Effective carbon rates, 2018–2021

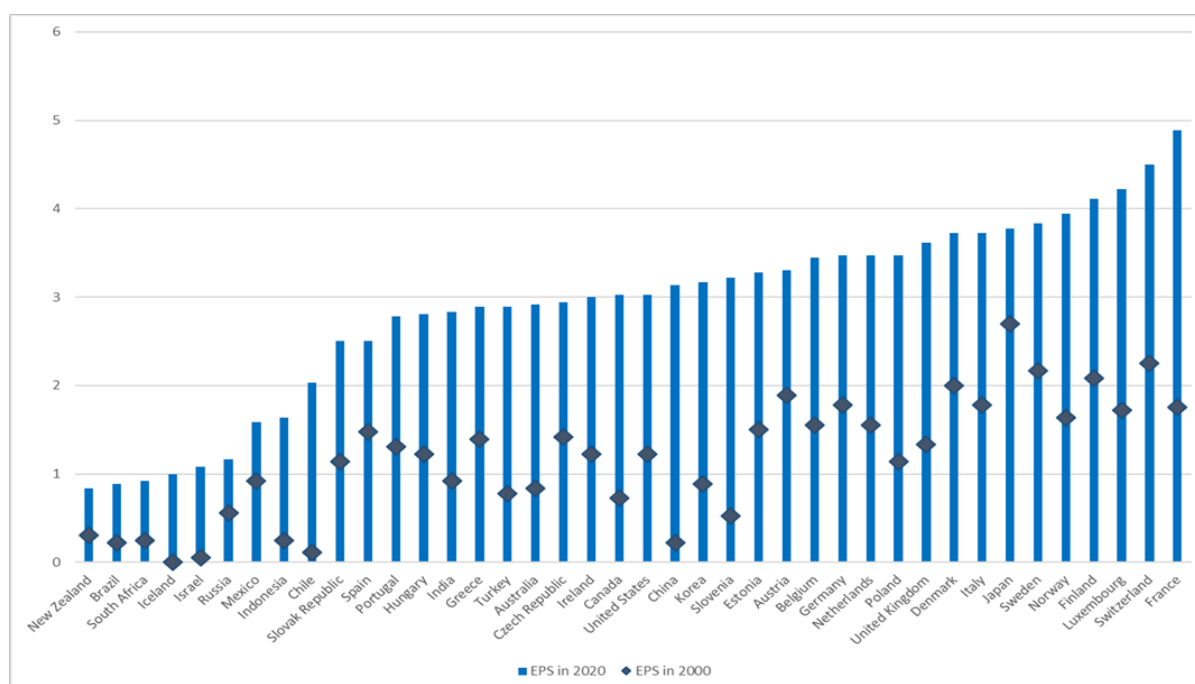


Source: OECD (2021)

Carbon pricing has made overall environmental policies more stringent, despite variations across countries. According to the OECD Environmental Policy Stringency (EPS) indicator, which aims to measure the stringency of price, non-price and technology support policies, there has been a gradual increase in the use of these instruments over time (Figure 3). According to the indicator, price and non-price-based instruments have become more stringent since the mid-2000s, even though progress has been slower in research and development (R&D) subsidies and support for the adoption of green technologies in the countries covered by the indicator. Recent policies and measures, including the Inflation Reduction Act of 2022 in the United States and the European Union’s Green Deal Industrial Plan, may help strengthen technology support policies and reverse this trend.

Figure 3: OECD Environmental Policy Stringency

(0–6 scale, increasing order of stringency)



Source: Kruse et al. (2022)

Policy instruments differ in their impact on government budgets. A simulation carried out by the OECD shows that introduction of a price floor at €60 per ton of CO₂ would significantly reduce emissions, while raising revenue for the government budget.⁵ Of course, these revenue gains would be temporary to the extent that carbon pricing leads to a shift away from the use/consumption of fossil fuels. More importantly, the associated revenues can be used, at least in part, to finance spending on training/retraining programmes for affected workers, support for the development and adoption of green technologies, and investment in climate change mitigation and adaptation, which are needed to support the transition and could make carbon pricing more socially acceptable. Indeed, opinion surveys suggest that public support depends on how the associated revenue is used: there is an increase in support for carbon pricing if revenues are channelled to fund green infrastructure and low-carbon technologies and to compensate low-income households via lower taxes or cash transfers.⁶

3. Addressing the costs of the transition

Related to the above is the need to acknowledge the adverse effects of mitigation policies. Even where aggregate effects are small, there may be heterogeneous effects across firms and workers. OECD work shows that stricter environmental policies explain small shares of economy-wide variations in manufacturing employment, trade and investment.⁷ However, firms operating in energy-intensive and trade-exposed industries tend to be more adversely affected by stricter

⁵ For empirical evidence, see D’Arcangelo, Pisu, Raj and van Dender (2022).

⁶ For more information and discussion, see Dechezleprêtre et al. (2022).

⁷ For empirical evidence, see Dechezleprêtre, Nachtigall and Stadler (2020).

environmental policies than their peers in other sectors. Firms that are on, or close to, the technological frontier are better equipped for the green transition than productivity laggards.

Using climate change mitigation instruments effectively therefore requires action in other policy areas to lower the economic and social costs of the transition. For example, new technologies may reduce the costs of abatement and can be supported through incentives for R&D and innovation incentives. These incentives can take the form of grants, tax credits or innovation prizes. Policies to accelerate the adoption of clean technologies by firms and households are also important. They can be delivered through demand-side policies such as public procurement. Appropriate regulation of product markets is essential to create a competitive environment that is, in turn, crucial for business dynamism and the diffusion of innovation.

At the same time, safety nets and labour market policies will have to respond to the specific needs of those adversely affected by the transition. Low-income households are the most exposed to price hikes in 'polluting' goods, and policymakers need to devise strategies to support them. In addition, workers in declining 'brown' sectors may face persistent joblessness and earnings losses, whereas firms in expanding 'green' activities may have to deal with shortages of workers with the necessary skills.

To achieve a just transition, policymakers will need to invest in education and training/retraining programmes, as well as making sure that labour mobility and market competition are not thwarted by ill-conceived regulation and other policy-related impediments. The same is true for active labour market policies and appropriate social safety nets for the most vulnerable. By emphasising protection for workers, rather than jobs, these interventions have the additional merit of helping to muster public support for climate change mitigation initiatives.

4. The role of the private sector

The investments required for the transition cannot be funded solely by governments. There are indeed many investment opportunities that could support a low-carbon transition, including in power system flexibility, public transport infrastructure, energy-efficient retrofitting of buildings, carbon capture facilities and renewable energy deployment. The private sector has an important role to play and policies will be needed to promote its involvement.

A credible, predictable policy landscape will be required so that business investment plans are not undermined by policy uncertainty.⁸ Green investments need transparent and consistent disclosure standards, as well as appropriate labels, taxonomies and rating methodologies to come to fruition. Strong and transparent environmental credentials by businesses themselves, including credible transition strategies for those operating in high-emissions sectors, can do much to reduce their costs of borrowing, encourage investment and reduce the risk of greenwashing.⁹ Monetary authorities and regulators also have an important role to play in ensuring that there is a smooth reallocation of capital towards low-carbon investments to avoid a build-up of vulnerabilities and risks to financial stability in the course of the transition.

⁸ For empirical evidence on the effect of policy uncertainty on investment, see Berestycki et al. (2022).

⁹ For empirical evidence, see D'Arcangelo et al. (2023).

5. The importance of international dialogue

Effective strategies for the transition to a low-carbon economy will require international dialogue, as well as efforts to build trust in policies and institutions. International dialogue is crucial for policy cooperation, which is particularly important in this area for at least two main reasons. One is because the climate change mitigation goals are global in nature and scale. The other is to minimise the risk of carbon leakage, which is likely to occur as countries pursue different standards with different levels of ambition and conviction. As for trust in policies and institutions, effective decarbonisation strategies will need to rely on a solid evidence base to inform policy choices. They will also require efforts not only to communicate the benefits and costs of policy alternatives, for example through well-conducted climate education and awareness campaigns, but also to engage relevant stakeholders, combat disinformation and engage with interest groups.

6. Conclusion

Mitigating the effects of climate change on economies and societies requires a gradual and steady transition to a low-carbon global economy. To be successful in this transition, policy strategies will require vision and ambition, international coordination and effective use of all available policy tools. An important step towards this goal is to build a solid evidence base of the decarbonisation potential, associated costs, trade-offs, complementarities and unintended consequences of different policy options. This is essential for transition packages to be designed and implemented to achieve common climate change goals while reflecting the specific conditions of different countries.

References

Berestycki, C, Carattini, S, Dechezleprêtre, A and Kruse, T. 2022. 'Measuring and assessing the effects of climate policy uncertainty'. *OECD Economics Department Working Papers*, No. 1724. Paris: OECD.

D'Arcangelo, F M, Kruse, T, Pisu, M and Tomasi, M. 2023. 'Corporate cost of debt in the low-carbon transition: the effect of climate policies on firm financing and investment through the banking channel'. *OECD Economics Department Working Papers*, No. 1761. Paris: OECD.

D'Arcangelo, F M, Levin, I, Pagani, A, Pisu, M and Johansson, A. 2022. 'A framework to decarbonise the economy'. OECD Economic Policy Paper No. 31. Paris: OECD.

D'Arcangelo, F M, Pisu, M, Raj, A and van Dender, K. 2022. 'Estimating the CO2 emission and revenue effects of carbon pricing: new evidence from a large cross-country dataset'. *OECD Economics Department Working Papers*, No. 1732. Paris: OECD.

Dechezleprêtre, A, Fabre, A, Kruse, T, Planterose, B, Chico, A S and Stantcheva, S. 2022. 'Fighting climate change: international attitudes toward climate policies'. OECD Economics Department Working Paper No. 1714. Paris: OECD.

Dechezleprêtre, A, Nachtigall, D and Stadler, B. 2020. 'The effect of energy prices and environmental policy stringency on manufacturing employment in OECD countries: sector- and firm-level evidence'. *OECD Economics Department Working Papers*, No. 1625. Paris: OECD.

IEA. 2021a. 'CO2 emissions in World Energy Outlook scenarios over time, 2000–2050'. <https://www.iea.org/data-and-statistics/charts/co2-emissions-in-the-weo-2021-scenarios-2000-2050>.

IEA. 2021b. 'Temperature rise in 2100, by scenario'. <https://www.iea.org/data-and-statistics/charts/temperature-rise-in-2100-by-scenario>.

IEA. 2021c. *World energy outlook 2021*. Paris: IEA.

IEA. 2023a. *Global energy and climate model*. Paris: IEA.

IEA. 2023b. *World energy investment*. Paris: IEA.

Kruse, T, Dechezleprêtre, A, Saffar, R and Robert, L. 2022. 'Measuring environmental policy stringency in OECD countries: an update of the OECD composite EPS indicator'. *OECD Economics Department Working Papers*, No. 1703, Paris: OECD.

OECD. 2021. *Effective carbon rates 2021: pricing carbon emissions through taxes and emissions trading*. OECD Series on Carbon Pricing and Energy Taxation. Paris: OECD.

Ripple, W J, Wolf, C, Gregg, J G and Rockström, J. 2023. 'The 2023 state of the climate report: entering uncharted territory'. *BioScience* 1–10.