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To price or not to price? : making a case for a carbon pricing mechanism for India

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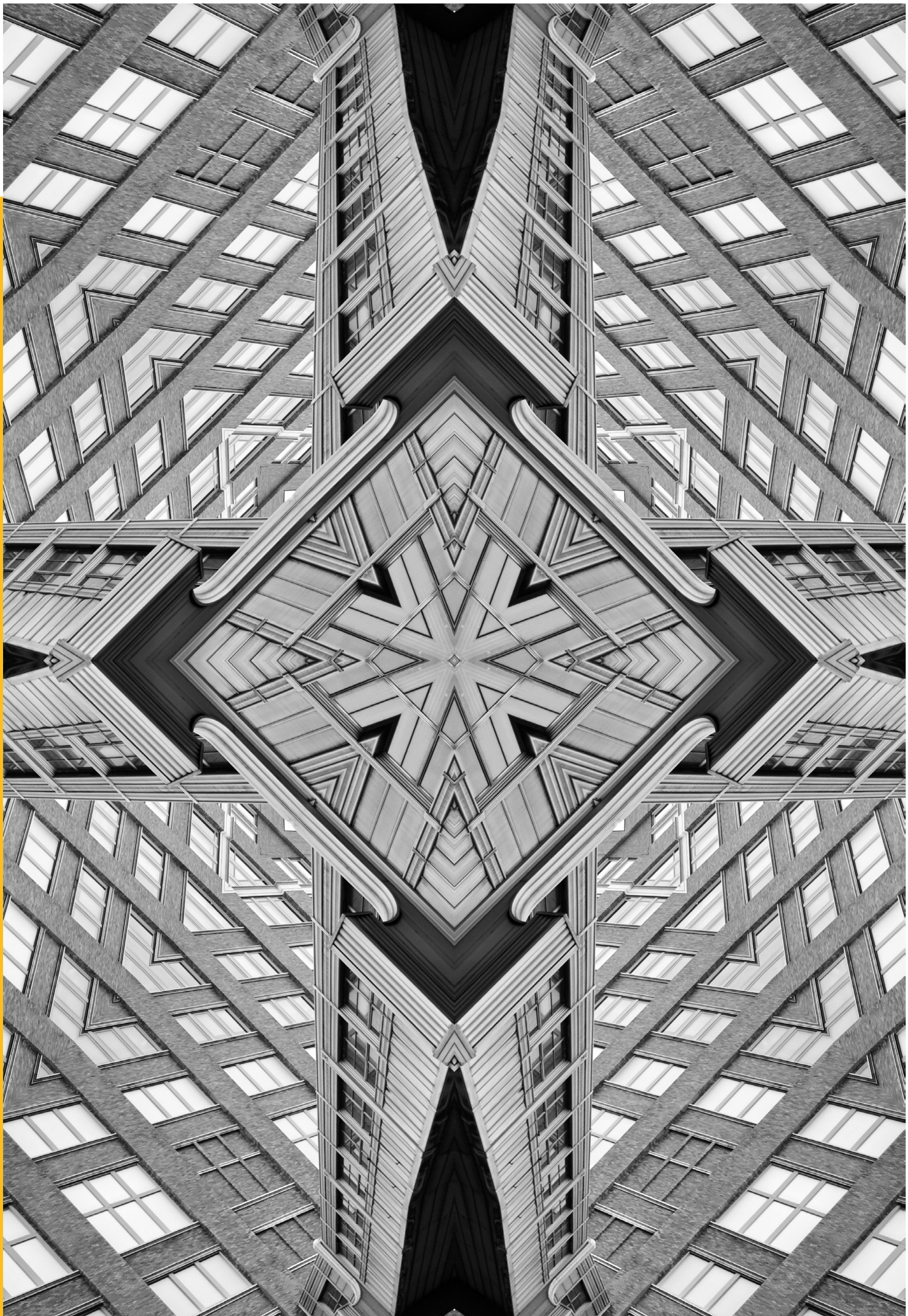

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To Price or not to Price? Making a Case for a Carbon Pricing Mechanism for India

Mannat Jaspal

Abstract

The 2021 Conference of Parties 26 (COP26) propelled nations to ramp up their climate targets and the concomitant Nationally Determined Contributions (NDCs) to reduce global greenhouse gas emissions. However, the updated NDCs and the announced pledges for 2030 remain insufficient and poorly aligned with the targets of the Paris Agreement. The reduction in projected 2030 emissions is estimated to be 7.5 percent—far lower than the 30 percent required to limit warming to 2°C, and the 55 percent which is ideal to remain within the 1.5°C target. Many analysts had posited that the COVID-19 pandemic was a unique opportunity to conflate the recovery process with the green agenda and accelerate the decarbonisation process. Yet, the resulting emission reduction in 2020 was transient in its effects, and the urgency and scale of the impending climate crises demands increased ambition and cooperation to drive the green transition imperative. This paper explores the role of carbon pricing as an effective instrument in the domestic and international climate policy architecture.

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Introduction

There is a broad consensus among economists that climate change is a product of both market and policy failure.[1] That the cost of emitting greenhouse gases (GHGs) is not reflected in the price of goods and services, and allows 'free-riding' on climate as an input for economic activity is indicative of an egregious market failure.[2] It perpetuates the linkage between fossil fuel consumption and economic growth.[3] Further, poor incentives for potential innovators and the inadequacy of public infrastructure, energy networks, and finance have impeded investments in research, development and deployment of clean technology. Among public policy failures, fossil fuel subsidies and a distortionary tax system are most consequential.[4]

Effective climate change policies will be instrumental in reversing the trend. Carbon pricing is considered a cost-effective measure to internalise the externalities associated with CO_2 emissions and maximise emission reduction per dollar at the lowest possible cost to producers, consumers, and taxpayers.[5] Putting a price on carbon internalises the social cost of carbon, and compels companies to adjust their investment portfolio and production methods while encouraging consumers to alter behavioural patterns.[6] It embodies a *laissez faire* ideology offering a market-friendly mechanism that allows firms and consumers the flexibility to choose between the costs of cutting emissions and the benefits accrued from continuing to emit—and this ensures maximisation of environmental benefit at the least cost.[7]

The idea of a price internalising externalities dates back to a century ago when the economist Arthur Pigou argued in 'The Economics of Welfare' (1920), that individuals (and firms) will continue to take actions with little regard to the costs imposed or benefits conferred on others, unless the cost to individuals incorporate a social cost of an act. A Pigouvian tax on carbon, therefore, ensures that the cost of emitting GHGs is reflected in the price of the commodity or service.[8]

A carbon price is deemed as an effective tool to incentivise future investment, consumption and innovation towards sustainable and climate-friendly pathways, and support a sustainable pandemic

Introduction

recovery. In 2021, approximately USD 84 billion was recorded in carbon pricing revenue, almost 60-percent higher than in 2020, as a result of higher carbon prices, increased auctioning from emissions trading, and revenue from new instruments. Moreover, carbon pricing can be a useful fiscal tool and a prominent source of augmenting government revenues.[9] Typical carbon pricing policies allocate government revenues in three ways: investment in climate-related clean technologies, general budget, and income tax cuts or rebates.[10] Estimates suggest that investments in sustainable industries can generate jobs three times of the full-time jobs from government spending in fossil fuels.[11] In the context of developing economies, these investments become particularly critical for supporting vulnerable sectors and communities to adapt to climate change and achieve just transitions.[12] Pre-emptively, designing effective domestic climate policies inclusive of carbon pricing mechanisms—such as the EU Carbon Border Adjustment Mechanism—can also help offset the implications of border tariffs. This idea is increasingly being considered among developed nations as a protectionist strategy to avoid carbon leakage.

This paper seeks to explore the increasing role of carbon pricing as an effective instrument in climate policy. Carbon pricing, within an integrated policy mix, has been propounded as a cost-effective and efficient tool to achieve both economic and environmental benefits. In the case of India, the relevance of carbon markets has been underlined by the recent Energy Conservation (Amendment) Bill, 2022 which is momentous in its scope, empowering the government to establish a carbon credit trading scheme and laying the ground for a formal carbon market that can be instrumental in India's pathway towards a net-zero economy by 2070.[13]

The paper aims to understand the landscape of global carbon pricing mechanisms, primarily carbon tax and emission trading systems, and draw on the global knowledge and experience to arrive at a suitable decarbonisation strategy for India using national carbon markets. The rest of the paper delineates the different approaches to pricing carbon; reviews the current global carbon pricing landscape; and outlines the measures undertaken by India to put an implicit price on carbon. It concludes with a proposed approach to a carbon pricing framework that would be most favourable to India.

Approaches to Carbon Pricing

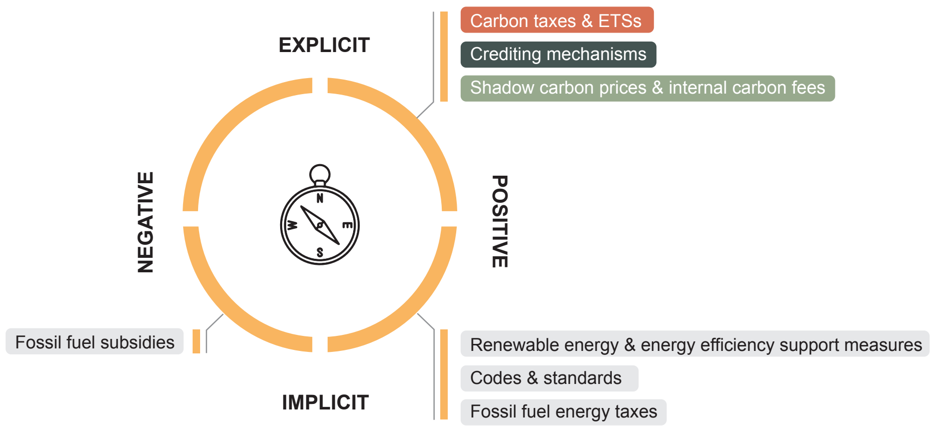
There are different approaches to determine the most appropriate rate of carbon tax and is often based on the policy objectives and goals of the tax regime in a given jurisdiction. The tax rate could be determined using an *abatement approach*—which is the level of carbon emission reduction the country hopes to achieve—or the *social cost of carbon* approach which translates into the dollar value of damages incurred from emitting each additional metric ton of greenhouse gases. It could also be determined using the *revenue approach,* where the tax rate is based on the revenue considerations of the regulating authority or by simply following a *benchmarking approach* where the tax rate is linked with the rate in neighbouring jurisdictions, among trading partners or competitors.[14]

Carbon pricing mechanisms are predicated on the basis that profit-making firms will continue to cut emissions to the point where the marginal abatement cost is lower than the social cost of carbon. To put this into perspective, the marginal abatement cost for an entity is the marginal cost of reducing each additional unit of emission and is contingent on various factors including the pace of low carbon technological innovation, cost of compliance, as well as the ability of firms and consumers to substitute low-carbon products for high-carbon ones.[15] The social cost of carbon for an entity is the marginal damage cost of a unit of emissions and presents the economic value associated with one extra unit of greenhouse gas in the atmosphere.[16]

A range of policy instruments, market or valuation based, can be leveraged to price carbon which can effectively lead to a carbon reduction pathway. These can be classified as an explicit or an implicit carbon pricing strategy, and include carbon tax, cap-and-trade scheme, emission reduction credits, clean energy standards, and fossil fuel subsidy reduction.

Approaches to Carbon Pricing

Figure 1.[17]



This graphic is not meant to be an entirely exhaustive list. Other policies could also be added, particularly on the implicit side, from which a carbon price could be derived. The placement of the instruments in the graphic also does not indicate any ranking or hierarchy within the quadrant.

Source: The World Bank: State and Trends of Carbon Pricing 2021

Explicit Carbon Pricing

Explicit carbon pricing is usually mandated by the government and imposes a price on the carbon content. It acts as a market signal for producers and consumers to move towards cleaner sources of production and consumption and encourage a more cost-effective carbon mitigation pathway. These can be achieved through carbon taxes and/or an ETS (emission trading system or cap-and-trade) which holds emitters responsible for their actions; carbon credits which creates a reward-like system for reducing carbon emissions; or via internal shadow pricing leveraged by companies to guide decision-making on investment. Contingent on the design, they render various benefits such as augmenting government revenues, creating green industries and jobs, encouraging low-carbon investment, enhancing energy efficiency and security, and improving air quality. [18]

Approaches to Carbon Pricing

a. Carbon Tax

A carbon tax imposes a fixed price on carbon (CO_2 equivalent on GHG emissions) while the quantity of emission reduction is left to the market forces. The objective is to increase the cost of fossil fuel and provide an incentive for investments in fuel-switching strategies and energy-efficient technologies.[19] It can be applied at different points in the product cycle of fossil fuels, upstream (point of production/ extraction), mid-stream (point of distribution), or downstream (point of consumption).[20]

Considerations across price, emission coverage, point of taxation, allocation of revenue generated from the tax towards general public spending or specific emissions-reducing activities, and harmonisation across boundaries beyond the jurisdiction of the tax should be built into the design and reviewed periodically.[21] However, it is important to note that the market response to the price signal in the form of emission reductions is difficult to determine and estimate.[22]

Carbon taxes have the potential to generate substantial fiscal revenues and the effectiveness of the instrument depends on the amount and use of the tax revenue. By reducing the existing distortionary taxes on labour and capital, it can help cushion the blow for low-income households and offset some of the policy's social costs. Part of the revenue should also be channelled to fund research and development of climate-friendly technologies and desirable sustainability-linked programs. [23]

b. Emission Trading System (ETS)

In a cap-and-trade model, the government sets a limit (cap) on permissible emissions for different sectors in a particular compliance period and allowances are either auctioned or allocated as per criteria.[24] A hybrid approach of freely allocating emission allowances and auctioning is common in ETS markets. While the quantity/volume of emissions is regulated, the price is determined by the market supply and demand. During the compliance period, firms with lower abatement costs can sell their allowances in secondary markets to firms with higher abatement costs.[25] This allows emissions reductions at the least possible cost. Eventually, at the end of the compliance period, the allowances are to be surrendered to the government. Various factors should be considered in the design: the size and level of the emission cap, sectoral coverage, the scope of the cap's coverage, point of taxation, whether to freely distribute or sell (auction) allowances, revenue distribution and management, monitoring, measurement and verification of emissions and allowances, cost containment measures, and impact on international competitiveness.[26]

Similar to the carbon tax, the revenues generated from selling allowance certificates will augment fiscal revenues and can be used to reduce distortionary taxes or finance investments in clean-tech programs. Free allocation of allowances, on the other hand, allows the risk of potential "grandfathering" i.e., transferring the wealth, equivalent to the value of the allowance, to existing firms instead.[27] In an ETS, high or volatile allowance prices can undermine the efficacy of the policy. Therefore, certain cost containment measures are often undertaken by the government to prevent emission costs from overshooting or dipping beyond a threshold to avoid cost uncertainly and ensure economic stability and the competitiveness of firms. These include: offsets, allowance banking (reserve units to use in a future compliance period) and borrowing (using units allocated for a future compliance period), safety valves, price collars, and market stability reserves.

An offset provision allows regulated entities to offset their own emission reduction with credits from emission reduction measures outside the scope of ETS coverage and can link the cap-and-trade system with an emission-reduction-credit system. Banking and Borrowing allows firms to trade their emissions across time horizons by allowing transfer of allowances to a future period (banking) or permitting future period allowances to be utilised pre-maturely. This allows firms the flexibility to prioritise across time frames to create the most cost-effective path to carbon reduction. Banking and borrowing define caps on cumulative emissions rather than on an annual basis. A safety valve is a price ceiling that puts an upper limit on the cost of tradable allowance with the government offering additional allowance at a predetermined trigger price.

However, this measure can lead to aggregate emissions overshooting the emission cap. A price collar combines the ceiling of the safety valve with the price floor which sets minimum price for auctions or with the government agreeing to purchase allowance at a predetermined price. Cost Containment Reserve (CCR), a volume-based measure, transfers unallocated allowances to a reserve and these are removed or injected into the market if the number of total allowances in circulation is over or under a predetermined threshold. However, without careful planning, increasing certainty of mitigation cost through these containment measures can reduce certainty of the quantity of emissions abated.[28]

Table 1: Carbon tax Vs. the ETS

	Carbon Tax	Emissions Trading System (ETS)
Format	Sets a fixed price on carbon, and volume/level of GHG emissions is determined by market forces.	Sets a maximum cap/limit on GHG emissions within a jurisdiction, and the price is determined by market forces.
Baseline	The natural baseline for a tax is a zero tax.	The baseline for a cap-and-trade system is usually emissions in a particular year.
Point of certainty	Delivers certainty over the price of carbon but the outcome in terms of emission reductions is not known.	Delivers greater certainty about the emission reduction and environmental benefit but the costs of achieving the amount of abatement is not known.

Approaches to Carbon Pricing

	Carbon Tax	Emissions Trading System (ETS)
Point of Application	Usually applied at the national level but can target specific goods or sectors. It can be applied at various points in the product cycle of fossil fuels: upstream (point of production/extraction), mid-stream (point of distribution), or downstream (point of consumption).	Can be implemented at level of regions (such as the European Union) or nations (such as the Republic of Korea), or else sub-national (state based ETS in the United States). It can target specific sectors and be applied either upstream (based on carbon content of fuels) or downstream (based on monitored emissions).
Emission coverage	Can be imposed on the total emissions, certain fuel sources depending on the carbon content, specific sectors, or fuel products.	Cap's coverage must identify the types of greenhouse gas emissions and sources covered.
Allocation of Revenue	Revenue generated from the tax can be allocated towards general public spending, specific emissions-reducing activities, reductions in existing distortionary taxes on labour and capital.	If the allowances are auctioned or sold at a fixed price (as opposed to free allocation), revenues could be used to reduce distortionary taxes or finance other programs.
Price containment measures	N/A	Includes offsets, allowance banking and borrowing, safety valves, price collars, and cost-containment reserves (CCR).
Challenge	1. Market response to the price signal in the form of emission reductions cannot be determined when adopting the policy. It is still necessary to consider revising the carbon price path if the emissions path deviates persistently from the expected one. 2. Abatement costs should be lower than the tax burden to incentivise emitters to invest in more sustainable technologies. However, abatement costs are hard to quantify and therefore setting the right carbon tax is challenging.	1. As the abatement costs are difficult to determine pre-emptively, a sharp increase in the price of certificates is possible when the demand for emission certificates are high. This could lead to a disproportionately higher burden for emitters. 2. Increasing certainty about mitigation cost—through a carbon tax, safety valve, or price collar—reduces certainty about the quantity of emissions allowed.

	Carbon Tax	Emissions Trading System (ETS)
Complementarity	Carbon taxes can be designed with the flexibility to assure certain emissions goals. For example, policymakers can tie the level of the tax to emissions, so it adjusts automatically to keep the long-run trajectory of emissions within a pre-specified range.	A cap-and-trade system transitions to a tax in the presence of unexpectedly high mitigation costs using price collars. The volatility can be mitigated by allowing 'banking and borrowing' of quotas across time periods and/or by introducing a change in the authorities' supply of quotas.

Note: Both systems internalise the cost of carbon by setting a price on emissions but differ in their approaches.

Source: Author's own.

c. International Crediting Mechanisms/ Baseline and Credit system

According to Article 6 of the Paris Agreement (Article 12 of the Kyoto Protocol), industrialised countries with emission reduction targets (Annex B Party) can purchase certified emission reduction (CER) credits from developing countries, each credit equivalent to one tonne of CO_2, to provide offsets if they are unable to comply with their Kyoto targets.[29] Emission credits are available to emitters who successfully reduce emissions below the designated limit; they can then trade and sell these credits in the international market. This is also referred to as the baseline and credit system which offers flexibility for an international cap-and-trade mechanism. [30]

The Clean Development Mechanism is the international standardised emissions offset instrument governed by the United Nations Framework Convention on Climate Change (UNFCCC) to facilitate the trade on the global scale. However, given the growing popularity of the carbon credit market, many independent (such as the Gold Standard, Verified Carbon Standard) and domestic standards (California Compliance Offset Program, Australia Emissions Reduction Fund, Republic of Korea Offset Credit Mechanism) have gained prominence and are dominating the market. [31]

d. Internal Carbon Prices

Corporations worldwide have started to acknowledge the critical role of incorporating climate risks and opportunities in their risk assessment frameworks and consider carbon price to be an effective instrument in guiding capital allocation and investment decision-making. Therefore, internal carbon pricing is being used voluntarily by companies and organisations as a pre-emptive move to safeguard against future shocks, measure exposure associated with climate related physical and transition risks, as well as prospective government regulations pertaining to carbon pricing. It is commonly done via shadow carbon pricing where a hypothetical carbon cost is associated with each ton of CO_2 emissions. This helps identify and integrate climate-related risks and opportunities in the broad long-term strategies of a company and dictate capital allocation and investment decision-making processes by relying on an implicit price which is based on the offsets required to achieve internal carbon neutrality objectives. [32]

Implicit Carbon Pricing

There are certain mandates or government policies that do not directly put a price on emitting carbon but set uniform performance standards for GHG abatement. They seek to address climate objectives of reducing GHG emissions by setting technology and performance-based standards as well as gradually eliminating fossil fuel subsidies to make energy-intensive products more expensive compared to their sustainable/renewable counterparts.

a. Command-and-Control Regulations

Conventional environmental policy employs technology and performance-based standards to control emission levels and protect environment quality. Technology-based standards require firms to use certain energy-efficient processes, equipment or procedures with no fixed targets on the volume of emission reduction. Meanwhile, performance-based standards specify permissible levels of pollutant emissions or allowable emission rates and leave the processes of emission reduction at the discretion of regulated entities.[33] By the very nature of such standard-based policy, given higher costs as well as poor incentives for the development and adoption of environmentally and economically superior technologies, the approach is limiting in its scope and impact. Incorporating market-based instruments within its fold can thus help overcome non-cost-effective outcomes.

b. Clean Energy Standards

A clean energy standard (CES) is a market-based and technology-neutral approach to encourage the power sector to switch to non- or low-emitting sources of energy. The industrial and commercial power consumers are mandated to meet a certain percentage of their power requirements from clean energy sources as a means to phase down dependence on fossil fuels. Given the challenging politics around pricing carbon, clean energy standards are often viewed as a cost-effective and politically palatable alternative to pricing carbon in the electricity sector. Firms that overachieve the clean energy standard targets or thresholds can receive energy saving certificates which can be traded in the energy exchange. This system is analogous to an ETS and relies on the market principles to reduce the energy intensity of high-carbon-emitting sectors in the most cost-effective and efficient manner. [34]

c. Eliminating Fossil Fuel Subsidies

Many countries provide heavy subsidies to fossil fuels to support their growth and development objectives. This becomes particularly critical for nations where innovation and growth in the renewable sector has yet to pick up pace. However, gradual elimination of fossil fuel subsidies can be an effective way to achieve an optimal price for the fuel as well as provide incentives for energy efficiency and fuel-switching technologies (comparable to implementing an explicit carbon price).[35] Fossil fuel subsidies are often termed as a “government failure”, exacerbating the conditions of a market failure. For some years now there has been a significant degree of agreement on phasing out these subsidies, while targeting support for the poor. A G20 Leaders’ summit in 2009 noted, “The economic and climate benefits of fossil fuel subsidy reform could be significant. Inefficient fossil fuel subsidies encourage wasteful consumption, reduce our energy security, impede investment in clean energy sources and undermine efforts to deal with the threat of climate change.”[36]

Global Carbon Pricing Mechanisms: A Review

Globally, 68 carbon pricing instruments (CPIs), including taxes and emissions trading systems (ETSs), are operating while three more are scheduled for implementation in the short term.[37] As this paper's objective is to inform a national carbon pricing mechanism for India, the scope is limited to reviewing only carbon tax and ETS mechanisms. The selection of global carbon pricing mechanisms for review is purposeful to ensure representation from diverse geographies and varying timeframes of implementation to help identify best practices and learning opportunities.

Tables 2 and 3 present a tabular comparison of supranational, national, and subnational level ETS systems of the European Union, China, New Zealand, Republic of Korea, Switzerland, United Kingdom, Regional Greenhouse Gas Initiative and China's seven provinces-Beijing, Shanghai, Tianjin, Chongqing, Shenzhen, Guangdong, and Hubei. Table 4 presents a tabular comparison of international carbon tax systems of Argentina, Canada, Chile, Columbia, Ireland, Japan, Singapore, South Africa, Mexico and Norway.

Countries were selected to cover carbon pricing policies that varied in their sectoral coverage, point of taxation, allocation approaches, price containment measures, revenue redistribution and exemption mandates. Data for all three tables were sourced from the *World Bank Carbon Pricing Dashboard*.

Table 2:
Review of Global Emission Trading Systems (Supranational and National)[38]

Country (Year of Introduction)	Allocation	Sectoral/Fuels Coverage	Price Level (tCO_2e)	Cap on Total Emission Units	Revenue Generated (million)	Share of Jurisdiction's GHG Emissions Covered	Price Containment Measures	Coverage Overlap with Carbon Taxes
EU ETS (EU-member states, plus Iceland, Liechtenstein, and Norway) **(2005)**	Emission allowances under the cap are distributed via a combination of free allocation and auctioning. The free allocation to industry sectors depends on EU-wide benchmarks, historical activity data, emission and/or trade intensity. The power sector does not receive any free allocation.	The system covers activities from the power sector, manufacturing industry, and aviation (including flights from the EEA to the United Kingdom). Some small emitters are exempt from the EU ETS. It applies to CO_2, N_2O, PFCs emissions (individual states may add more GHG emissions).	US$87	1572 $MtCO_2e$ (2021) The total amount of emission allowances is determined top-down and decreases annually by 2.2%.	US$34326	41%	The market stability reserve (MSR) started shaping the supply of allowances to provide greater price stability and predictability in the EU ETS. The MSR achieves this goal by removing or injecting allowances in the market if the number of total allowances in circulation is over or under a predetermined threshold.	Carbon taxes from Finland, Ireland, Netherlands, Norway, Denmark, Estonia, Latvia, Slovenia, Sweden, Poland, Switzerland, France
China National ETS **(2021)**	Builds on the subnational pilot carbon markets implemented in eight regions. Allocation currently takes place through free allocation.	The ETS applies to CO_2 emissions from the power sector, including combined heat and power and captive power plants from other sectors. Exceptions to be determined.	US$9	Entities received allowances at 70% of their 2018 output multiplied by a corresponding benchmark factor.	Not available	33%	The necessary triggers and specifics of a market-regulating and protection mechanism are yet to be defined.	No carbon taxes exist in China

Country (Year of Introduction)	Allocation	Sectoral/Fuels Coverage	Price Level (tCO_2e)	Cap on Total Emission Units	Revenue Generated (million)	Share of Jurisdiction's GHG Emissions Covered	Price Containment Measures	Coverage Overlap with Carbon Taxes
New Zealand ETS **(2008)**	Emission allowances under the cap are distributed via a combination of free allocation and auctioning. Emissions-intensive and trade-exposed sectors at risk of carbon leakage receive free allowances of between 60 - 90% of the benchmark level. The government has decided to phase-out free allocations for the industrial sector, at a rate of 1% per year between 2021 and 2030.	The NZ ETS applies to GHG emissions (CO_2, CH_4, N_2O, SF_6, HFCs and PFCs) from the industry, power, waste, transport and forestry sectors and includes industrial process emissions. The agriculture sector needs to report its emissions but has no allowance surrendering obligations.	US$53	35 $MtCO_2e$ (2022)	US$1648	49%	The ETS provides a price ceiling and an auction reserve price as a price floor, thereby setting up a price corridor for the auctioning of units. If a predetermined trigger price is reached at auction, a specified number of allowances from the CCR is additionally released for sale.	No carbon taxes exist in New Zealand.
Republic of Korea ETS **(2015)**	In the most recent Phase III, 90% or less allowances will be freely allocated to entities in sub-sectors that are subject to auctioning; 100% for EITE sectors. At least 10% of allocation to entities in sub-sectors subject to auctioning. Entities from 41 sub-sectors, which excludes EITE sectors, can participate in auctions. Emission-intensive and/or trade-intensive sectors at risk of carbon leakage receive free allowances up to 100% of the benchmark or historical emission level.	The Korea ETS applies to GHG emissions (CO_2, CH_4, N_2O, PFCs, HFCs and SF_6) from the industry, power, buildings, domestic aviation, public sector and waste sectors. Some small emitters are exempt from the Korea ETS.	US$19	589 $MtCO_2e$ (2022)	US$243	73%	Measures include auctioning of allowances from the reserve, imposing banking limitations, changing the borrowing limits, changing the offset restrictions and temporarily setting a price floor or ceiling. Auctions for market stability will be subject to an auction reserve price.	No carbon taxes exist in South Korea.

Country (Year of Introduction)	Allocation	Sectoral/Fuels Coverage	Price Level (tCO_2e)	Cap on Total Emission Units	Revenue Generated (million)	Share of Jurisdiction's GHG Emissions Covered	Price Containment Measures	Coverage Overlap with Carbon Taxes
Switzerland ETS **(2013)**	Emission allowances under the cap are distributed via a combination of free allocation and auctioning. Industry sectors receive free allocation based on the same benchmarks as the EU ETS and historical activity data. Emission-intensive and/or trade-intensive sectors at risk of carbon leakage receive free allowances up to 100% of the benchmark level. Also, small emitters are exempt from the Switzerland ETS.	The Switzerland ETS applies to GHG emissions (CO_2, NO_2, CH_4, HFCs, NF_3, SF_6 and PFCs) from the industry and power sectors and includes industrial process emissions. Small emitters are exempt from the Switzerland ETS.	US$64	5 $MtCO_2e$ (2020)	US$18	11%	As of 2022, a market stability mechanism reduces auction volumes if the number of allowances in circulation exceed a certain threshold. The Swiss ETS is not subject to the EU ETS Market Stability Reserve.	Switzerland has a carbon levy that covers some entities if they are not covered under the Swiss ETS.
UK ETS **(2021)**	Auctioning is the primary means of allowance allocation under the UK ETS. A share of allowances will be distributed freely to Emissions Intensive Trade Exposed (EITE) sectors at risk of carbon leakage.	The UK ETS covers energy-intensive industries, the power sector, and aviation within the UK and European Economic Area. Hospitals and small emitters with emissions lower than 25 kt CO_2e annually can opt out of the ETS.	US$99	Not available	US$5664	28%	To avoid instability in allowance prices Cost Containment Mechanism (CCM) allows auctioning of additional allowances. Auctions have a transitional Auction Reserve Price (ARP) which will be withdrawn as the UK ETS matures. The UK ETS Authority has set out the possibility of establishing a supply adjustment mechanism (SAM) similar to the EU ETS Market Stability Reserve (MSR).	No carbon taxes exist in UK.

Note: tCO2e = ton (t) of carbon dioxide (CO2) equivalent (e); GHG = Greenhouse gas emissions; N_20 = Nitrous oxide

PFCs = Perfluorochemicals; $MtCO_2e$ = Metric tons of carbon dioxide equivalent; CH_4 = Methane; NF_3 = Nitrogen Trifluoride SF_6 = Sulphur Hexafluoride; HFCs = Hydrofluorocarbons

Source: World Bank Carbon Pricing Dashboard

Table 3:
Emission Trading System (Sub-National)

Country (Year of introduction)	Allocation	Sectoral/Fuels Coverage	Price Level (tCO_2e)	Cap on Total Emission Units	Revenue Generated (million)	Share of Jurisdiction's GHG Emissions Covered	Price Containment Measures	Coverage Overlap with Carbon Taxes
Regional Greenhouse Gas Initiative **(2009)** (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont and Virginia).	It is the first mandatory ETS in the United States. The majority of emission allowances are allocated through quarterly auctions using a 'single-round, sealed-bid uniform-price' format. Auctions are open to all parties with financial security, with a maximum bid of 25% of auctioned allowances per quarterly auction.	The ETS only applies to CO_2 emissions from power sector in the Northeast **and Mid-**Atlantic US states. Small power plants are exempt from RGGI.	US$14	88 $MtCO_2e$ (The total amount of emission allowances is determined top-down and decreases annually).	US$926 million	11%	An auction price floor is set which increases by 2.5% per year to reflect inflation. In addition, there is a Cost Containment Reserve (CCR) creates a fixed additional supply of allowances that are only available for sale if CO_2 allowance prices exceed certain price levels. In addition, Emissions Containment Reserve (ECR) was established in 2021 such that allowances are withheld from auction if the price is below the trigger price.	No carbon taxes exist in RGGI states.

Country (Year of introduction)	Allocation	Sectoral/Fuels Coverage	Price Level (tCO_2e)	Cap on Total Emission Units	Revenue Generated (million)	Share of Jurisdiction's GHG Emissions Covered	Price Containment Measures	Coverage Overlap with Carbon Taxes
China **The earliest pilot ETS was set up in Shenzhen ETS in 2013, and the latest was launched in Chongqing ETS in 2014** (Beijing, Tianjin, Shanghai, Chongqing, Shenzhen, Guangdong, Hubei).	Beijing: Free allocation Tianjin: Mixed, free allocation (major) and small portion of allowances can be auctioned Shanghai: Mixed, free allocation and auction Chongqing: Mixed, free allocation and auction Shenzhen: Mixed, free allocation, Regulations stipulate that 3% of the total allowances should be auctioned Guangdong: Mixed, free allocation with a small portion of allowances can be auctioned Hubei: Mixed, free allocation with a small portion of allowances can be auctioned (The main purpose of auctions is to provide compliance entities with additional supply to meet their compliance demand)	The ETS initially only applies to CO_2 emissions. Beijing: Covers industry, power, transport and buildings sectors. Tianjin: Covers industrial and buildings sectors. Shanghai: Covers industry, buildings and transport sectors. Chongqing: Covers GHG emissions from the industrial sectors. Shenzhen: Covers industry, power, buildings and transport sectors. The Guangdong: Covers industry and domestic aviation sectors. The Hubei : Covers industrial sectors.	Beijing: US$7 Tianjin: US$4 Shanghai: US$9 Chongqing: US$6 Shenzhen: US$0.64 Guangdong: US$13 Hubei: US$7	Beijing: 35 $MtCO_2e$ (2022) Tianjin 165 $MtCO_2e$ (2019) Shanghai: 158 $MtCO_2e$ (2019) Chongqing: 100 $MtCO_2e$ (2018) Shenzhen: 31 $MtCO_2e$ (2015) Guangdong: 465 $MtCO_2e$ (2019) Hubei: 270 $MtCO_2e$ (2019).	Not available	Beijing: 24% Tianjin: 33% Shanghai: 35% Chongqing: 51% Shenzhen: 29% Guangdong: 40% Hubei: 27%	No borrowing but Banking is allowed during pilot phase. Regulating authority can auction extra allowances if average weighted price exceeds the threshold and buy back allowances if price falls below a specified limit. Certain provinces do set up a price floor.	No carbon taxes exist in China.

Note: tCO_2e = ton (t) of carbon dioxide (CO_2) equivalent (e); GHG = Greenhouse gas emissions; $MtCO_2e$ = Metric tons of carbon dioxide equivalent

Source: World Bank Carbon Pricing Dashboard

Table 4:
Review of Global Carbon Tax Mechanisms

Country (Year of introduction)	Point of Taxation	Sectoral/Fuels Coverage	Tax Rate per ton of CO_2e	Revenue Generated	Share of Jurisdiction's GHG Emissions Covered	Revenue Disbursement
Argentina (2018)	Upstream: Producers, distributors, and importers of the fossil fuels covered.	All liquid fuels and some solid products (mineral coal and petroleum coke). Exemptions include international aviation and shipping, export of the fuels covered, the biofuel content of liquid fuels and the use of fossil fuels as raw materials in chemical processes.	Most liquid fuels: US$5/ tCO_2e; Fuel oil, mineral coal and petroleum coke:US$0/ tCO_2e	US$272 million	20%	100% of this revenue is distributed according to the Federal Revenue Distribution System for fuel oil, mineral coal and petroleum coke. For the rest of the products, the revenue is designated to multiple beneficiaries, including the social security system, the Transport Infrastructure Trust, the National Housing Fund (FONAVI), the provinces, among others.
Canada federal fuel charge (2019)	Upstream: Registered distributors and producers of the fossil fuels covered are liable for payment of the charge upon use or delivery of those fuels. Note: The federal backstop system applies in jurisdictions that request it or do not have a provincial system in place that meets minimum national stringency criteria, as set out in the federal benchmark.	The charge covers 21 types of fuel delivered, transferred, used, produced, imported or brought into a province and territory where the federal fuel charge applies. It also applies on combustible waste that is burned for the purpose of producing heat or energy in those jurisdictions. Exemptions include uses of fossil fuels in agriculture and transport and for farmers and remote off-grid communities.	US$40/$tCO_2e$	US$4798 million	22%	All direct proceeds from the federal system are returned to the province or territory of origin.

Country (Year of introduction)	Point of Taxation	Sectoral/Fuels Coverage	Tax Rate per ton of CO_2e	Revenue Generated	Share of Jurisdiction's GHG Emissions Covered	Revenue Disbursement
Chile (2017)	Midstream (power producers): Fixed sources are regulated downstream. Mobile sources are regulated through a purchase tax, calculated based on fuel efficiency and NOx emissions (not an explicit carbon tax).	CO_2 emissions from mainly the power and industry sectors. The tax covers all fossil fuels. Small installations (<25.000 tCO_2) are exempt from tax.	USD5/tCO_2.	US$160 million	29%	Not available
Colombia (2017)	Upstream: Sellers and importers of the fossil fuels covered are liable for payment of the tax. Special Feature: Use of Offsets - Emitters can avoid the payment if they achieve carbon neutrality through the use of offset credits generated from projects in Colombia. Credits have to be verified by auditors accredited by the UNFCCC, Colombia's national accreditation body, or a member of the International Accreditation Forum.	All sectors with some minor exemptions. It is a tax on the carbon content of liquid and gaseous fossil fuels, it does not apply to solid fuels. Tax exemptions apply to natural gas consumers that are not in the petrochemical and refinery sectors, and fossil fuel consumers that are certified to be carbon neutral.	US$5/$tCO_2e$	US$89 million	23%	50% of the revenues from the tax will be used in coastal erosion management, conservation of water sources, and the protection of ecosystems and the other 50% of revenues will be used for financing the Program for the Substitution of Illicit Use Crops
Ireland (2010)	Midstream: Fuel suppliers; The Ireland carbon tax is officially under three names: - Natural Gas Carbon Tax (NGCT), Mineral Oil Tax: Carbon Charge (MOTCC) and Solid Fuel Carbon Tax (SFCT)). The tax serves as a complementary policy measure to the EU ETS.	Applies to CO_2 emissions from all sectors with some exemptions for the power, industrial processes (chemical reduction, electrolytic or metallurgical processes), transport, shipping aviation sectors. The tax covers all fossil fuels. The tax serves as a complementary policy measure to the EU ETS hence, full/partial reliefs are available for fuels used in the ETS sector.	Transport fuels: US$45/$tCO_2e$. Other fossil fuels: US$37/ tCO_2e	US$542 million	40%	The revenues are used to boost energy efficiency, support rural transport, alleviate fuel poverty, and maintain or reduce payroll taxes.

Country (Year of introduction)	Point of Taxation	Sectoral/Fuels Coverage	Tax Rate per ton of CO_2e	Revenue Generated	Share of Jurisdiction's GHG Emissions Covered	Revenue Disbursement
Japan (2012)	Upstream: Producers of the fossil fuels covered are liable for payment of the tax.	Applies to CO_2 emissions from fossil fuels across all sectors with some exemptions for the industry, power, agriculture, transport and forestry sectors.	US$2/t$CO_2$e	US$1800 million	75%	Revenue is primarily reserved for climate change mitigation projects.
Singapore (2019)	Upstream: At source, such as power stations and other large direct emitters.	Applies to direct emissions from facilities emitting 25 ktCO_2e or more in a year, covering carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons, and perfluorocarbons. Excise duties are also levied on transport fuels which serves as a carbon price signal for transportation emissions. The carbon tax is applied on all sectors without exemption as long as the facility meets the emissions threshold.	US$4/t$CO_2$e	US$153 million	80%	Revenue supports initiatives to address climate change. Companies can also continue to tap on existing support measures for decarbonisation, such as the Resource Efficiency Grant for Energy (REG(E)), Investment Allowances for Emissions Reduction (IA(ER)) and Energy Efficiency Fund.

Country (Year of introduction)	Point of Taxation	Sectoral/Fuels Coverage	Tax Rate per ton of CO_2e	Revenue Generated	Share of Jurisdiction's GHG Emissions Covered	Revenue Disbursement
South Africa (2019)	Upstream: At source **Use of Offsets:** Companies can use carbon offsets as a flexibility mechanism to increase their tax-free allowances by either 5% or 10% of their emissions. Only domestic emission reduction projects will be credited and the scheme will primarily rely on existing international offset standards including the CDM, Verified Carbon Standard, and Gold Standard.	The Carbon Tax covers all types of fossil fuels combusted by large businesses across industry, power, and transport sectors. The carbon tax does not apply to the residential sector. Tax exemptions range from 60% to 95%, depending on the sector and the level of exemption depends on the presence of fugitive emissions, level of trade exposure, emission performance, offset use, and participation in the carbon budget program. Companies can also claim an energy efficiency tax incentive; and are able to offset payments of the electricity generation tax and additional purchases of renewable energy against their carbon tax liability. This transitional support is available until December 2025.	US$10/t$CO_2e$	US$94 million	80%	Not available

Country (Year of introduction)	Point of Taxation	Sectoral/Fuels Coverage	Tax Rate per ton of CO_2e	Revenue Generated	Share of Jurisdiction's GHG Emissions Covered	Revenue Disbursement
Mexico (2014)	Upstream: Producers and importers of the fossil fuels covered are liable for payment of the tax. Use of Offsets: Companies liable to pay the carbon tax may choose to pay with credits from CDM projects developed in Mexico or CERs that are also eligible for compliance in the EU ETS, equivalent to the market value of the credits at the time of paying the tax.	Mexico's carbon tax is an excise tax under the special tax on production and services. It is not a tax on the full carbon content of fuels, but on the additional CO_2 emission content compared to natural gas. The Mexican carbon tax applies to CO_2 emissions from all sectors. The tax is capped at 3% of the fuel sales price. Natural gas is exempted from this tax.	Upper: US$4/ tCO_2e. Lower: US$0.42/tCO_2e	US$314 million	44%	Revenues will be used on, among others, energy efficiency, technologies, and the improvement of public transportation
Norway (1991)	Upstream: Producers, distributors and importers of the fossil fuels covered are liable for payment of the tax.	Applies to GHG emissions from all sectors with some exemptions. The tax covers liquid and gaseous fossil fuels. Norway does not have any taxes on emissions from LULUCF (Land use, land-use change, and forestry). Operators covered by the EU ETS are in general exempt from the carbon tax. International aviation and international shipping, export of the fuels covered and the share of biofuels in mineral oil are exempted as they are not included in the Norwegian GHG emissions inventory.	General tax rate:US$88/ tCO_2e. Reduced rate for LPG and natural gas in the greenhouse industry: US$9/ tCO_2e	US$1716 million	63%	Not available

Note: tCO_2e = ton (t) of carbon dioxide (CO_2) equivalent (e); GHG = Greenhouse gas emissions; $MtCO_2e$ = Metric tons of carbon dioxide equivalent; $ktCO_2e$ = kilotonnes of carbon dioxide equivalent

Source: World Bank Carbon Pricing Dashboard

Implicit Carbon Pricing in India

India does not impose an explicit carbon pricing mechanism but puts an implicit price on carbon through a series of measures and schemes that will be described in the following paragraphs:

1. Perform, Achieve and Trade (PAT) Scheme

The PAT scheme (Perform, Achieve and Trade), introduced in 2012, is the flagship programme of the Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. The scheme holds some degree of resemblance with the market-based emission trading system (ETS) where certain energy-intensive industrial production units, identified as designated consumers (DC), with threshold energy consumption are allotted Specific Energy Consumption (SEC) reduction targets over a cycle of three years.[39] The units that exceed the targets are awarded Energy Saving Certificates (ESCerts), each equal to one metric tonne of oil (MTOe),[40] as an incentive to implement energy-efficient technologies and overachieve these targets. DCs that are unable to meet these targets can purchase the difference in ESCerts from the units that have exceeded their targets. The ESCerts can be traded on two power exchanges, namely, Power Exchange Indian Limited (PXIL) and Indian Energy Exchange (IEX).

Failure to comply, either by their own actions or by buying the energy saving certificates, would result in the imposition of a prescribed penalty linked to the degree of non-compliance. The BEE has rolled out six PAT cycles as of 31 March, 2020 covering 1,073 DCs across 13 sectors including energy-intensive sectors of Aluminium, Cement, Chlor-Alkali, Fertiliser, Iron and Steel, Paper and Pulp, Thermal Power Plant, Textile, Railways, Refineries, and Electricity Distribution Companies (DISCOMs), Petrochemicals, and Buildings.[41] In the financial year 2018-2019, the PAT scheme was responsible for nearly 63 percent of all energy efficiency savings and is projected to avoid almost 70 million tonnes of CO_2 by March 2023.[42] However, the monitoring, reporting and verification (MRV) framework under PAT is not directly geared towards reducing CO_2 but the potential unit of energy saved (expressed in tonnes of oil equivalent).[43] The ambition and long-term effectiveness of the PAT scheme has been questioned over issues of equity, leniency in targets, high transaction costs, low trading prices of EScerts, and rising energy prices which would have incentivised energy savings even in the absence of the PAT scheme.[44] The Centre for Science and Environment (CSE), in an analysis of the PAT scheme for thermal power plants, noted that the value of one ESCert was approximately INR 700 while INR 4,020 in investment was necessary for reducing energy equal to one TOE.[45]

2. Emission trading scheme on an air pollutant, i.e., respiratory solid particulate matter (RSPM)

This is an innovative emission trading scheme on respiratory solid particulate matter, the first particulate trading system in the world. The scheme has been piloted in industrial clusters of three polluting states of Gujrat, Maharashtra, and Tamil Nadu. It is an attempt to shift away from the conventional command and control regulation. It mimics the EU-ETS model where pollution targets are set for areas based on ambient air quality standards and permits are allocated which can be traded, after verification, based on the gains and shortfalls from compliance. The scheme relies on a continuous emission monitoring system (CEMS) for setting the baseline and verification purposes. CEMs is an intrinsic element in the scheme's design as it provides real-time information and helps avoid issues pertaining to spot checking and/or spurious reporting by third party auditors.[46]

For example, the Surat ETS began with two months of mock-trading, before its official launch in September 2019, to gain stakeholder support and allow capacity building. Eighty percent of the permits were allocated for free and the balance of 20 percent was auctioned via the Gujrat Pollution Control Board (GPCB) through the National

Commodities and Derivatives Exchange Limited e-market.[47] Similar to the PAT Scheme, industries have the financial incentive to invest in pollution-curbing technology. Over-achieving targets provides the opportunity to earn profits through the trading of emission permits at the National Commodities and Derivatives Exchange.[48] A preliminary analysis of the pilot program found a 29-percent reduction in particulate matter from current levels, an increase in average industry profits, and fall in costs of reducing particulate emissions.[49] However, the long-term benefits of the pilot program are yet to be seen.

3. Carbon Cess

In 2010, India introduced a carbon cess to be levied on coal, lignite, and peat in the form of an excise duty. The revenue from the cess was intended to feed into a National Clean Energy Fund to finance clean-energy projects and research. From 2010–11 to 2017–18, only 35 percent of the money collected from the cess was transferred to the Fund, of which almost half remained unutilised.[50] In 2017, with the introduction of the GST Compensation Cess, the carbon cess was abolished and the money collected through this new mechanism was instead reserved for compensating states for any revenue losses under GST. CO_2 emitting products such as coal, kerosene, naphtha, lubes and LPG are included in GST with exceptions for five petroleum products, i.e., petrol, diesel, natural gas, ATF and crude oil. These are instead subjected to excise duties and VAT. While the cess on the consumption of coal and high level of excise and value added taxes on petrol and diesel are not referred to as carbon taxes, they are considered and expected to perform the role of implicit carbon taxes. However, the tax rates do not correspond with the carbon footprint of the fuels and thus fail to provide the right price signals to producers and consumers to reduce consumption and switch to low carbon-emitting sources of energy. [51]

4. Renewable Purchase Obligations (RPO) and Renewable Energy Certificates (REC)

In India, certain obligated entities such as electricity DISCOMS, open access consumers and captive power producers have to purchase a percentage of their electricity from renewable energy (RE) sources. These are termed as renewable purchase obligations (RPO) and are mandated by the Electricity Act (2003). The State Electricity Regulatory Commission is responsible for fixing the minimum RPO for each state. Due to the variable nature of RE sources, obligated entities may find it difficult to procure green power to meet their RPO targets. They can instead purchase renewable energy certificates (RECs) on the national energy exchanges such as Indian Energy Exchange (IEX) and Power Exchange of India Limited (PXIL) to meet their RPO targets without actual procurement of RE-generated power.[52] The RECs is a useful instrument in overcoming the geographical disparity in renewable energy production and incentivising electricity generation from RE sources beyond the RPO state limits.[53] However, the enforcement and compliance with RPO remains weak and is a persisting obstacle to India's ambitions of expanding renewable energy production and procurement.

5. Excise taxes on Diesel and Petrol

Over the years, India has moved from a carbon subsidisation regime to a significant carbon taxation regime.[54] Even though India does not have an explicit carbon tax on fuels including petrol and diesel, these products are subjected to steep excise duties and VAT. As of May 2020, India had the highest taxes on petrol and diesel in the world which comprised over 69 percent of the pump price for the two fuels.[55] However, the high taxes on petrol and diesel are on account of the Centre's revenue requirements as opposed to environmental considerations and do not account for the carbon footprint of the fuels. As a result, distorted price signals have failed to incentivise users of diesel and petrol to switch to low carbon-emitting sources of energy.[56]

The Case for an Explicit Carbon Pricing Mechanism in India

Despite the ambitious commitments made by India on climate action at COP26, its growing economy will continue to demand higher levels of fossil fuel consumption and, consequently, the country could see a corresponding rise in GHG emissions. India's energy and industry-related CO_2 emissions are projected to more than double from 2020 to 2050, with the share of fossil fuels in primary energy declining from 72 percent to only 69 percent in the same period. Without additional policies and disruptive technological changes, GHG emission intensity will not be reduced relative to their current levels due to growth in output.[57] Well-designed policies, such as carbon pricing, if adapted to suit India's unique emerging and development identity framework, can be a useful lever in the portfolio of instruments and strategies adopted to mitigate and adapt to climate change.

However, its popularity remains weak, given the 'Pigouvian' nature of carbon pricing (as explained in the first section of this paper). There are various challenges in pricing carbon which are a combination of political, economic and cultural dynamics. Given that carbon pricing posits "diffused benefits and concentrated costs", with costs incurred in the short-term and benefits accrued in the longer run, citizens are often sceptical of environmental policies.[58] This makes it difficult to garner the necessary political support essential to engender systemic changes to conventional policy frameworks. In addition, carbon-intensive industries will continue to oppose lest their profits reduce as a result; households will do too, to safeguard their disposable incomes.[59] Policies that are formulated according to specific contexts and are effectively implemented can help offset these challenges, as can a rigorous communication strategy.

India has undertaken various approaches for pricing fuels such as subsidies, and administered and market pricing (as discussed in the previous section). However, weak enforcement and primarily low prices undermine the effectiveness of the policy instruments. Moreover, while the focus has been on energy efficiency, expanding renewable capacity and making coal consumption expensive, none of the instruments are carbon-denominated and do not bear a direct link to CO_2 equivalent. Therefore, carbon pricing can be a useful mechanism to build a common carbon currency for establishing a clear price signal, creating fungibility of credits across schemes, and developing strong incentives for decarbonisation.[60]

In light of the Energy Conservation (Amendment) Bill, 2022, the following section outlines the near-term carbon pricing strategies that India can adopt with regards to a carbon tax and an emission trading mechanism. These strategies can help the country realise its Nationally Determined Contributions (NDC) under the Paris Agreement and the 2030 climate commitments made in Glasgow in 2021.

1. Carbon Taxes

India does not follow a uniform approach in pricing fuels and the tax rate and its coverage under the GST are not determined by the carbon content or emission rate but instead by social, political and revenue considerations. As an example, the price of imported natural gas is different from that prescribed for domestically produced natural gas. The tax rate is lower for fuels such as coal which have a larger carbon footprint in comparison to natural gas, for example, which has a far lower carbon footprint. While coal is included in the GST base, other high-polluting fossil fuels such as petrol, diesel and crude are excluded from its purview.[61] Nearly INR 52,000 crore of GST compensation was due to the states as of September 2021, which is telling of the Centre's tardy disbursement record and states' apprehension to exclude these fuels from the GST base in order to maintain their revenue stream.[62] These fuels are, however, subject to a significantly high excise duty and the VAT, both of which vary across states. However, the taxes are not linked to the degree of carbon emissions nor the carbon content in the fuels.[63]

The Case for an Explicit Carbon Pricing Mechanism in India

India's legislative framework under the GST regime lays a strong ground to address these anomalies and incorporate all fossil fuels under its ambit by setting a uniform tax rate and an additional levy contingent on the quantum of carbon emissions instead of usage. International practice, as discussed in the previous sections, dictates the same premise with certain exemptions depending on the sector and trade exposure. The tax should be upstream, implying an imposition only at source for producers and importers of fossils fuels. Similar to experiences of other countries as depicted in Table 4 exemptions should be granted for fuel usage in the farm/agriculture sector and remote off-grid communities (as done in Japan and Canada), companies or sectors that have a strong trade exposure (such as in South Africa), units with installations below a certain threshold (such as in Chile) and also where carbon-emitting fuels are used as a feedstock for manufacturing, e.g. fertilisers (such as in Argentina).

Since diesel and petrol already suffer a heavy tax burden, limiting government's ability to impose additional taxes will result in the burden being borne by coal and other fuels. In a study by Shakti Sustainable Energy Foundation and Ernst & Young LLP, the price of carbon tax should reach USD 35 per tonne of CO_2 emissions to achieve 33- to 35-percent reduction in emission intensity by 2030.[64] Given India's COP 26 commitment to reduce the carbon intensity of the nation's economy by 45 percent by 2030, the price on carbon will have to be even higher. Availability of substitute clean fuels and green technologies as well as increase in capacity and deployment of renewable sources of power are critical factors for compliance and effectiveness of the carbon tax. The carbon price will have to be gradually increased and aligned with the maturity of decarbonisation technologies. Indeed, government funding for R&D in India remains weak and investment in technologies like carbon, capture and storage (CCS), and green hydrogen are important to develop viable and economically competitive alternatives.[65]

A carbon tax that is incremental in nature will help augment fiscal revenues, improve the tax-GDP ratio, and generate additional funds which can be utilised for offsetting the burden of the tax on low-income groups as well as facilitate greater investments in green and environmental projects. Revenue recycling is another critical aspect for generating greater acceptability and adoption as well as ensuring effectiveness of the tax mechanism. The following are some examples: Japan reserves its carbon revenues for climate mitigation projects and to boost renewable energy and energy-efficient technologies; Ireland transfers revenues to the general budget to reduce payroll taxes and alleviate fuel poverty; Singapore uses its revenues to support schemes such as the Resource Efficiency Grant for Energy, Investment Allowances for Emissions Reduction and Energy Efficiency Fund; Colombia uses 50 percent of the revenues from the tax towards adaptation projects in coastal erosion management, conservation of water sources, and the protection of ecosystems; Mexico has a strong focus on improving public transportation in addition to boosting energy efficient technology; and Denmark uses its revenues to both subsidise energy efficient investments as well as reduce taxes on labour. In addition, a tier of the revenue transfer from the Centre to the States can be linked to measurable and traceable metrics such as the area expanded under forest cover, share of renewables in the energy mix, fossil fuel replacement strategies including e-mobility, increased ethanol blending, and use of biofuels, amongst others, to ensure greater compliance and enforcement.

With efficiency and equity considerations built into the tax design, political communication becomes an important lever to enhance wider acceptability and drive compliance, the lack of which, as seen in the experience of Australia, led to the abolition of the carbon tax two years after introduction in 2012.[66]

2. Emissions Trading System (ETS)

India's PAT Scheme—given its functional mechanism with DC (designated consumers)-specific targets, issuance, normalisation factor, trading, among other design features—lays a solid foundation to evolve into a full-fledged emissions-based cap-and-trade system. A phased approach to expand its aperture into a more functional ETS market could prove useful using simulations (a mock carbon market) or pilots (a small-scale carbon market). Mexico conducted simulation exercises among certain enterprises before entering the operational phase of its three-year pilot in 2020. China presents a befitting example: it piloted ETS models in eight provinces, allowing learnings and best practices from these programs to inform the design of its national ETS market that was eventually launched in 2021.

In the past, India has demonstrated serious commitment to explore cap-and-trade schemes to achieve its ambitious NDCs and signed up to the World Bank's Partnership for Market Readiness (PMR) to pilot new market-based mechanisms (MBMs) in Waste and MSME sectors. It also set up an integrated data management and registry for GHG emissions.[67] A part of the funding was apportioned to expand and strengthen the scale and scope of existing market-based approaches including the PAT mechanism and the Renewable Energy Certificate (REC) scheme.[68] The World Resource Institute's carbon market simulation covering about 50-60 percent of India's total industry-related emissions across 30 to 40 large businesses as well as the emission trading scheme on RSPM in India are laudable attempts and could set a precedence for scaling and implementing more ambitious ETS pilot programs in India.[69]

India's federal structure provides an ideal framework to develop ETS pilot programs across states with inter-state trading built into its design to enhance cost-competitiveness and efficiency gains. Such pilot projects are ideal to engage with relevant stakeholders and build readiness among industries, develop a bottom-up approach to designing and testing different models, and identifying and understanding operational challenges during the post-pilot phase.[70]

In its current form, the PAT Scheme covers 1,072 designated consumers, consuming 50 percent of primary energy, in 13 sectors.[71] The ETS should aim at a wider coverage, including more sectors and industries above a certain threshold, to maximise potential gains from trade and reduce overall transaction costs. The cap should aim to set reasonably ambitious targets on absolute ambitions or intensity of emissions per unit of GDP, subject to growth rate of the economy.

Defining targets over time frames can be useful for industries to undertake transition planning pre-emptively. As an example, the EU ETS has already declared that its emission cap will decrease annually by 2.2 percent between 2021 and 2030.[72] Emission allowances can be freely allocated with a small portion earmarked for auctioning to set the stage for increasing the latter's percentage over the years. Many emerging economies follow a similar template, such as Korea, where 90 percent or less allowances are freely allocated to entities in sub-sectors that are subject to auctioning and 100 percent for EITE sectors (emission-intensive and/or trade exposed sectors at risk of carbon leakage receive free allowances up to 100% of the benchmark or historical emission level).

For trading purposes, the ESCerts should be converted into carbon-denominated allowances based on carbon intensity benchmarks.[73] Deploying price containment measures in the ETS design can help incorporate greater flexibility and price predictability. These include establishing a price corridor, i.e. introducing a price floor and a price ceiling, as done by countries like the Republic of Korea and New Zealand. Another popular measure to contain price volatility is to have a Cost Containment Reserve (CCR) which allows the regulator to release a fixed additional supply of allowances if the sale of CO_2 allowance prices exceeds a certain price threshold, also called the trigger price, as practiced in the ETS markets of Regional Greenhouse Gas Initiative, Republic of Korea and the European Union. Banking and borrowing unused emissions as well as the use of offsets which allows regulated businesses to buy emissions reduction credits from outside the market, can help provide greater flexibility to business owners, again a measure which finds its place in the Korea ETS with certain control features.[74]

While useful, these cost containment measures can result in trade-offs such as failure to realise the overall carbon emissions targets, lower overall efficiency gains from trade, and reduced predictability in the timing of achievement of emissions reduction targets. Therefore, careful planning is essential using rigorous quantitative modelling and analysis from the data collected via the pilot projects. Establishing a GHG emissions inventory and a strong MRV (Monitoring, Reporting and Verification) system is a pre-requisite for the success of the ETS scheme and therefore capacity building efforts should be deployed by governments for this purpose.[75]

Conclusion

The Energy Conservation (Amendment) Bill, 2022 underscores the willingness of the Indian government to explore the imperative of a formal carbon market to achieve carbon neutrality. Both the GST regime and the PAT scheme provide a well-functioning machinery which India can leverage to build upon a strong carbon pricing framework using a combination of both a carbon tax and an emission trading system.

To be sure, carbon pricing in itself is not a silver bullet; complementary measures along with carbon pricing will help accelerate the path to carbon reduction. An optimal portfolio of policy instruments which includes carbon pricing, fossil fuel taxes, renewable energy subsidies and technology and performance-based standards along with investment in green technologies and revenue recycling to protect vulnerable communities should form the basis of a cost-effective and equitable carbon pricing policy design. [76]

While India should not feel compelled to imitate or adopt western policy frameworks given the country's unique economic and social pre-conditions, carbon pricing has proven to be an effective mechanism for many developing economies, including Republic of Korea, China and South Africa, to achieve significant carbon reduction and realise their national climate targets. In the context of India, it can help meet its ambitious current and future climate goals, offer emission reduction at the lowest possible cost, and accelerate progress on the Sustainable Development Goals (SDGs). [77]

Global climate policy groups have been debating the inception of a Climate Club, popularised by William Nordhaus in his 2015 paper 'Climate Clubs: Overcoming Free-riding in International Climate Policy', seeking to establish an international target carbon price (incremental in nature), amongst other mandates, to which all member countries must comply.[78] While the world is a long way

Conclusion

to institutionalising a framework of such scale and scope, there is broad consensus to include carbon pricing as a prominent tool in the international climate policy architecture. The current G20 Troika, led by three developing countries – Indonesia, India and Brazil, presents a unique and apposite moment to push forward a global carbon pricing framework built with a redistributive mechanism[79] and aligned with the principles of Common but Differentiated responsibilities (CBDR) and the Just Transition Declaration. It is clear that carbon pricing is primed to become and remain the mainstay of the global climate policy architecture and designing domestic carbon policies and pre-emptive strategies that align with global policy trends will hold India in good stead in an increasingly decarbonising future.

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