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REPORT

Leveraging carbon markets for cost-efficient emissions reductions in India

Practical recommendations for the design and implementation of an effective carbon market

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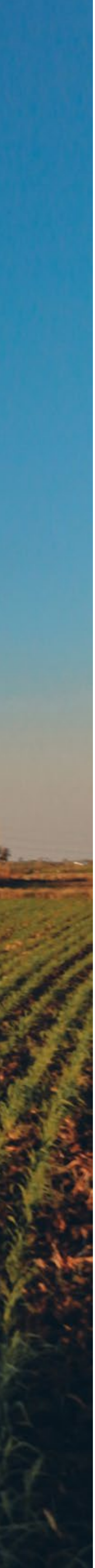

Foreword

Mitigating the threat of climate change requires urgent policy interventions to shift the global economy away from emissions-intensive activities. To be politically feasible, decarbonization policies need to create the right incentives for all stakeholders, particularly businesses and industry, to act early, invest in greener technologies, and avoid locking in high-carbon technologies. This is especially true for emerging economies like India, where climate policies should also bolster economic growth without adversely affecting industrial competitiveness. A carbon market is one such instrument, which if designed well, can deliver emissions reductions at a lower cost.

India has recently announced its plan to implement a domestic carbon market. The timing of India's carbon market development is favourable as it coincides with the Paris Agreement Article 6 rules being finalized. The design of the Indian carbon market presents an opportunity for India to meet its climate commitments and development goals, while also leveraging international markets to channel much-needed finance for low-carbon investments.

This report presents a novel carbon market simulation conducted by WRI India with 21 Indian companies with three cycles of notional emissions trading. The trading in this simulated carbon market led to 28 percent reduction in the cost of reducing emissions, compared to a scenario with no market. If extrapolated to the whole economy, it could save more than a billion tonnes of carbon dioxide in a decade.

Based on this simulation, consultations with Indian industry, learnings from other carbon markets, and India's own experience with market mechanisms, this report presents evidence-based recommendations on the design and implementation choices that Indian policymakers could make. It discusses the details of setting ambitious targets, creating predictable demand, having complementary policies to enhance uptake of cleaner technologies, rolling out a comprehensive capacity building program, and instituting a robust yet simple monitoring, reporting and verification system.

Additionally, the market presents an opportunity to create incentives for decarbonizing the micro, small and medium enterprises (MSME) sector, through well-designed market-linked offset schemes. Sound design and meaningful engagement with industry will be key to unlocking the potential of carbon markets in India.

With over a decade of experience in implementing the Perform, Achieve and Trade (PAT) and Renewable Energy Certificate (REC) schemes, India has already built the foundations of the institutional and regulatory framework needed to implement a successful domestic carbon market. It is now India's moment to build upon these foundations and create a thriving carbon market to efficiently meet its climate targets and development priorities.

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Executive summary

As India readies itself for a carbon market, this report provides practical design and implementation recommendations for an effective carbon market in India, bringing together learnings from international carbon markets, India's experience with market-based mechanisms over the two decades, and insights and industry feedback from a carbon market simulation. A well-designed and well-integrated carbon market can reduce emissions reduction costs for the industry and help India meet its climate goals along with its economic aspirations.

HIGHLIGHTS

- India is developing a national carbon market to reduce greenhouse gas emissions. An ambitious and well-designed carbon market can encourage cost-efficient, low-carbon transformation of the Indian industry, while unlocking financing and technology transfer opportunities for micro, small, and medium enterprises.
- A carbon market, however, is complex to implement and can involve significant transaction costs. Poor design can also lead to inequity, inefficiency, loss of competitiveness, carbon leakage, and a lack of compliance.
- This report provides design and implementation recommendations for an effective carbon market in India. These findings draw from international carbon markets and India's experience with market-based mechanisms, brought together with practical insights and industry feedback from a carbon market simulation.
- A well-designed carbon market can reduce emissions reduction costs for the industry, increase the emissions coverage of India's existing market-based mechanisms, and improve administration and compliance by potentially subsuming the existing market-based mechanisms into a single framework.
- Beyond good design, the critical elements for a successful carbon market include tailored capacity across different stakeholders, evolving design through ongoing simulations and pilots, engagement with industry to build stakeholder buy-in, and complementary policies to minimize competitiveness and distributional impacts of carbon pricing.

CONTEXT

Over the last decade, carbon pricing has emerged as a key economic instrument to help countries achieve their emissions abatement goals and drive low-carbon investments. Carbon markets in particular have been more popular than carbon taxes. In fact, with China's emissions trading scheme (ETS) coming into effect, carbon markets now cover 16 percent of global emissions (World Bank 2021), compared to 5.5 percent covered by carbon taxes.

A carbon market puts a cap on total emissions[1] on each regulated entity but allows flexibility to achieve that cap through internal emissions abatement or trade among regulated entities. By doing so, carbon markets bring down the overall costs of reduction by incentivizing reductions where it costs the least. This is particularly important in the Indian context, as it can help bring down the costs of emissions reductions and allow India to meet its current and future climate goals while fulfilling its economic and developmental ambitions.

Through the implementation of domestic market-based mechanisms (MBMs) to promote energy efficiency and renewable energy over the last decade—namely, the Perform, Achieve, Trade (PAT) and Renewable Energy Certificate (REC) schemes, respectively—India has been able to create some institutional capacity for operationalizing MBMs. This provides a good starting point for implementing a carbon market. The Energy Conservation Bill passed by the Indian parliament in 2022 lays the foundation for establishing a carbon market in India, an effort that is currently spearheaded by the government agencies Bureau of Energy Efficiency (BEE) and the Ministry of Environment, Forest, and Climate Change (MOEFCC) (MoP 2022).

Specifically, a carbon market can help India by:

- **Lowering the aggregate cost of achieving Nationally Determined Contribution (NDC) targets.** By creating a common market space for emissions with a robust cap, a carbon market can lower the costs of reductions by utilizing the different abatement costs of regulated entities that can trade allowances/reductions to meet their targets. A carbon market can also create avenues for including a wider range of emissions sources beyond energy intensive facilities, thus encouraging reductions in untapped sectors such as micro, small, and medium enterprises (MSMEs), thus bringing down the overall cost of meeting the NDC targets.

- **Addressing gaps in existing MBMs**. A carbon market can synthesize existing MBMs through a common carbon currency or emissions reduction units; provide greater coverage of emissions beyond just energy-use emissions; enhance flexibility in reducing emissions, making it more cost-effective; reduce the total administrative and transaction costs associated with the different markets; and potentially improve enforcement and compliance outcomes.
- **Opening opportunities for carbon finance**. A national carbon market in India linked to well-established markets, such as the European Union Emissions Trading System (EU ETS), where marginal emissions abatement costs could be higher, can create international demand for emissions reduction units from the Indian market. This would then channel international finance for emissions reduction investments in India and create financial incentives for more ambitious emissions cuts.
- **Protecting export-oriented sectors**. Jurisdictions that price carbon, including the EU, are in the process of implementing carbon border adjustment mechanisms, which aim to protect the competitiveness of domestic industry by imposing an equivalent carbon price on emissions-intensive imports. A carbon market in India would put a price on carbon domestically, which would mitigate the severity of the impact of such mechanisms on export-oriented sectors. It would also incentivize businesses to shift to low-carbon technologies, thus decarbonizing India's industry and export portfolio over time and safeguarding the country's trading position with Europe and other economies that price carbon.
- **Offering economic and social co-benefits.** As demonstrated by international carbon markets like the EU ETS and California's Cap-and-Trade Program, by increasing low-carbon investments and efficiencies and reducing fossil fuel use and generating revenues, a carbon market could also deliver important co-benefits. Possible co-benefits include generating jobs, reducing particulate matter emissions and therefore improving health outcomes, and supporting further decarbonization in other sectors and redistribution of finances to vulnerable groups (Breslow 2020).
- However, carbon markets involve many design and implementation decisions that can influence the demand and supply and price of allowances, transaction costs and inefficiencies, compliance, and integrity of reductions. They may also have negative implications on competitiveness for businesses in the jurisdiction, leading to capital flight (outflow of capital from a country due to adverse or unfavorable policies) and carbon leakage (European Commission 2020). These implications can disproportionately and unfairly impact small businesses and poorer sections of the society or informal labor as a result of job losses due to the increased cost of operations or shift to more efficient technologies. However, well thought out and locally relevant design and complementary policies can avoid these pitfalls while helping achieve the climate objectives of reducing emissions that come with industry growth, improving resource efficiency and air quality, and pivoting to cleaner, more affordable energy.

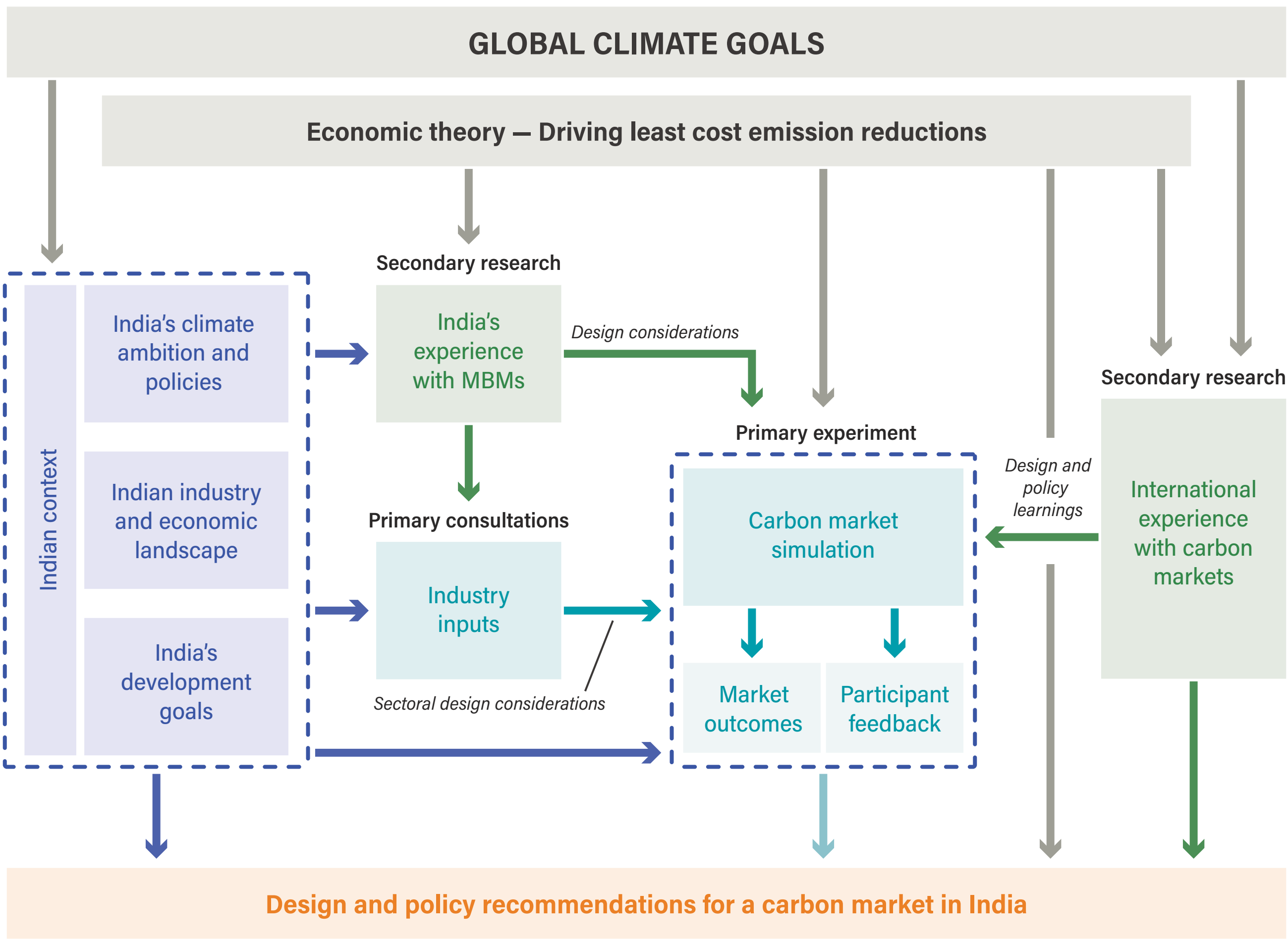
ABOUT THIS STUDY

This study is aimed at informing the development of a successful and effective carbon market in India which drives real emissions reductions, encourages deeper decarbonization and early action, and is cost effective, locally relevant, resilient to external shocks, and internationally compatible. Specifically, this report studies the design and implementation choices to be made and provides

- recommendations on market design;
- policy and implementation recommendations; and
- capacity building needs.

To do this, as presented in Figure ES-1, we use a combination of primary and secondary research. This study draws from 15 years of international experience with carbon markets and 10 years of domestic experience with MBMs; consultations with large Indian businesses to understand the needs, challenges, and perspectives of the Indian industry; and a first-of-its kind simulation of a carbon market. This carbon market simulation, implemented in 2020, encompassed 21 large Indian businesses (representing approximately 10 percent of India's industry emissions) and addressed all elements of a carbon market—including baseline and target setting and monitoring, reporting, and verification (MRV) and trading—using real company data combined with notional emissions trading. The evidence collected from the market outcomes and participant feedback was then contextualized within the Indian economic, developmental, and climate priorities and challenges; international and domestic learnings from previous MBMs; and

FIGURE ES-1 | Approach of the study



Source: WRI authors.

economic theory to inform a set of robust design, policy, and capacity building recommendations for a carbon market in India.

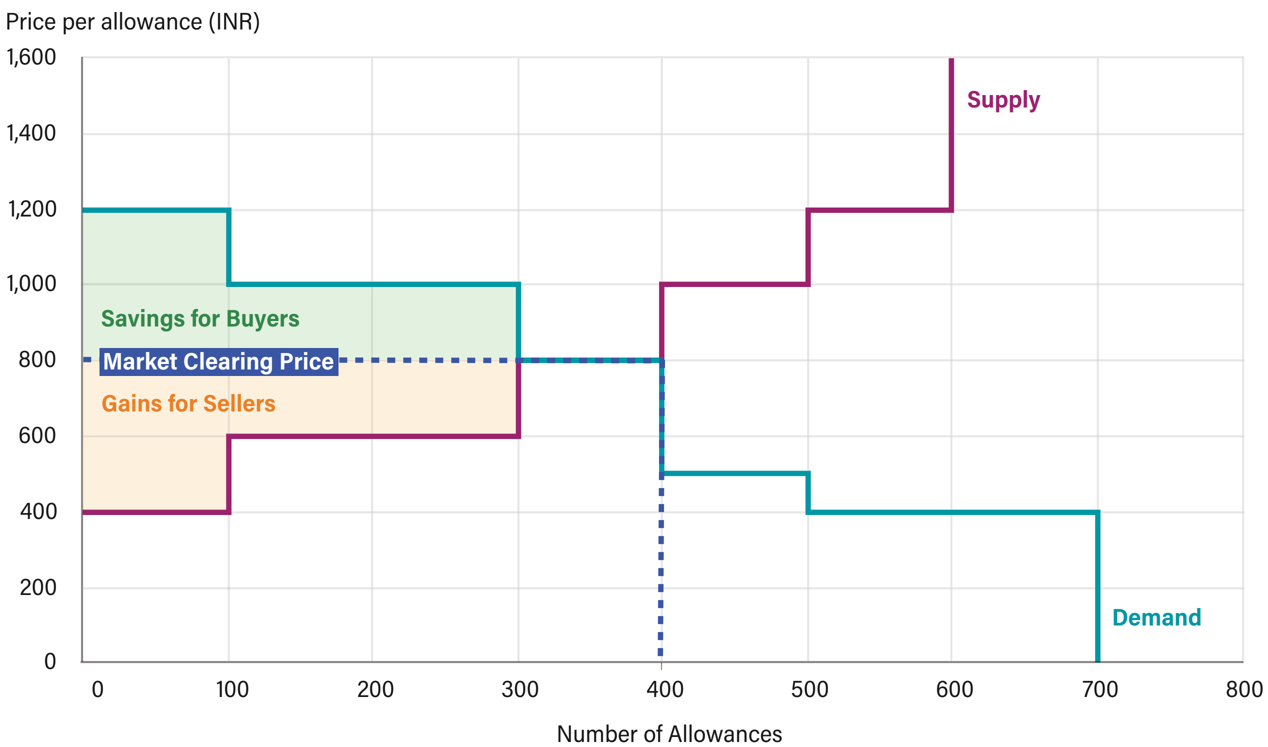
WHAT OUR RESEARCH SHOWS

- A carbon market can encourage cost-effective decarbonization of Indian industry while helping India play a key role in the global carbon market landscape. In fact, **carbon markets can cover emissions sources beyond energy-related emissions** (which PAT and REC schemes currently target), such as process emissions from industries, **which comprise approximately 36 percent of the emissions from the industrial sector and 8 percent of total national emissions** (MoEFCC 2021).
- The industrial and power sectors comprise approximately 66 percent of India's greenhouse gas (GHG) emissions and are most amenable to regulation through a carbon market. A carbon market that covers India's industrial sector and sets targets aligned to the average ambition level of existing voluntary commitments by the Indian corporate sector **has the potential to reduce the emissions intensity of India's gross domestic product (GDP) by an additional 5.6 percent in 2030, compared to a current policy scenario** (Hingne et al. 2021). Such a carbon market could also enable a cumulative reduction of 1,370 million metric tonnes of carbon dioxide equivalent (MMT CO_2e) between 2022 and 2030.
- The carbon market simulation demonstrated a **28 percent reduction in the total cost of emissions reduction due to trade in the market** (see Figure

ES-2). A well-designed carbon market in India can harness such cost efficiencies to lower the cost of meeting India's climate goals.

- Synthesizing existing MBMs in India into a common, **carbon currency-based framework will bring down emissions reduction costs** by providing more flexibility in the choice of reduction options. It will also reduce administrative and transaction costs and improve compliance.
- A domestic carbon market aligning with global best practices, as opposed to the existing MBMs, can **make India's market more linking-ready** with major international carbon markets or the newer marketplace under Article 6, thus creating a channel for international finance for emissions reduction investments in India.
- **Trading rules and methods** can play an important role in minimizing transaction costs and maximizing efficiency. The PAT scheme in India, like most global markets, uses a "call auction with uniform pricing" for allowance trading: trading occurs at predetermined time intervals and all bids that meet the market clearance criteria are bought and sold at one market-determined price. By bringing all participants to the market within a predetermined time window, this method can reduce transaction costs, as compared to the alternative of continuous trading.
- **Flexibility measures** such as "banking" of excess allowances for the future incentivizes early action but poses the risk of the accumulation of surplus allowances. A longer compliance period can reduce compliance costs by addressing the issue of a lag between emissions reduction investments and results, effects of seasonal variation or temporary economic shocks on business activity.
- **Allowing for the use of "offsets"** or emissions reduction outcomes from entities infeasible to regulate directly in the market—such as MSMEs, which currently represent 30 percent of India's energy use (FMC 2012)—can help incentivize emissions reductions outside the market jurisdiction, reduce the overall cost of meeting the market cap, and enhance the overall emissions reduction ambition of the

FIGURE ES-2 | Cost efficiency gains through savings for buyers and sellers



Source: WRI authors.

market. However, challenges around double counting and additionality must be addressed to maintain the environmental integrity of the market.

- Carbon markets also allow for **price stability measures** such as minimum or maximum limits (price collars) that provide a stable price signal to the regulated entities, allowing them to plan for longer term investments, and provide resilience to external shocks. However, business stakeholders and participants did not prefer this provision, despite the COVID-19-induced volatility in the notional market, since it would increase the level of regulation in the market and reduce the potential cost efficiency gains from trading in a free market.
- In order to ensure **real, accountable emissions reductions and avoid double counting**, it is important to implement a simple yet robust MRV protocol to enable streamlined, transparent, consistent, and accurate data collection at the minimum cost.
- India's renewable purchase obligation (RPO) market has witnessed poor compliance due to low penalties and lack of enforcement. As a result, more than 20 states consistently achieved less than 60 percent of their mandated targets, leading to low demand and trade volumes in the REC market (Prayas n.d.). To prevent this, **compliance should be incentivized** through the market design.
- **Market design must evolve over time** and incorporate "learning by doing." Important changes to market design to consider over time include, for example, transitioning from an emissions intensity cap to moving to an absolute cap, in line with global markets. Market design should also transition from free allocation to auctioning of allowances, which would raise public revenues that can be redistributed to manage the impacts of carbon pricing on vulnerable industrial sectors, workers, and communities. These changes will need to be balanced with India's developmental needs and the feasibility of setting an absolute emissions reduction target for Indian industry.
- **An ongoing stakeholder engagement plan,** along with a comprehensive capacity building program based on different levels of existing capacity amongst Indian industry, is key to a successful carbon market. As the first step, an emissions reporting program for the corporate sector is necessary, which will build capacity and consistency in emissions accounting practices across companies. This in turn will enable market simulation exercises (such as this one) or market pilots to be conducted with larger samples and better sectoral representation.
- Finally, **complementary policies to enable sustained reductions and ensure compliance**, safeguard competitiveness, and avoid leakage are key to a successful market that also helps meet India's economic and developmental goals. Significantly, these policies must also serve to minimize any adverse or inequitable impacts on vulnerable sectors, smaller companies, or lower income households.

A CARBON MARKET FOR INDIA

Recommendations for design, policy, and capacity building

Setting the right goals: Scope and ambition

- **Regulate emissions of the industrial and power sectors (typically referred to as large point sources), beginning with carbon dioxide (CO_2) emissions**, which comprise over 90 percent of total GHG emissions from the sector. This will simplify monitoring and reporting requirements without significantly compromising on emissions coverage. Expand coverage to non-CO_2 GHGs over time, given the anticipated rise in the share of non-CO_2 emissions such as fluorinated gases (F-gas) in the future.
- **Include the power sector in the short term by regulating indirect emissions from purchased electricity** at point of use (Scope 2 emissions) in other industrial sectors. Build political feasibility for a transition to direct coverage in the medium to long terms by amending or deregulating electricity tariffs, allowing the power sector to reflect compliance costs in prices.
- **Provide all industrial sectors with the choice to opt into the market**, even if coverage is limited to emissions-intensive sectors. Allow for flexibility in aggregation of regulated entities (for example, participation at a group or a sectoral level, facilitated by industry associations) to include less emissions-intensive sectors, without significantly increasing transaction costs.

TABLE ES-1 | Summary of recommendations on scope, targets, and allocation

SCOPE AND AMBITION		
Parameter	**Recommendation**	**Rationale**
Scope and Coverage		
Geographical boundary	National	▪ Avoid the risk of carbon leakage and competitiveness impacts across subnational regions ▪ Based on domestic and international experience with MBMs and stakeholder interviews
Sector	Industry with downstream power sector emissions (Scope2)	▪ Feasibility of regulation of industrial sector ▪ Based on literature review, domestic and international experience with MBMs, and stakeholder interviews
Sub-sectors	All	▪ Potential for greater cost-efficiency in a cross-sectoral market and to reduce participation costs for less emissions-intensive sectors ▪ Based on economic theory and stakeholder interviews
Level of aggregation of regulated entity	Company level (with flexibility provisions for different sub-sectors)	
Gases	CO_2 (with inclusion of other GHGs over time)	▪ Higher emissions coverage while keeping transaction costs low ▪ Based on emissions profiles of participating companies and validated by a literature review
Target Setting and Allocation		
Nature of cap	Intensity-based for short to medium term	▪ Projected growth in output (and emissions) in the short to medium term ▪ Based on literature, experience of domestic MBMs, analysis of voluntary targets of participating companies, and stakeholder interviews
Intensity metric	Physical intensity metric preferred	▪ Increase resilience to market shocks ▪ Based on market outcomes of the simulation
Method	Grandparenting, with a transition to benchmarking over time	▪ Simplicity and stakeholder acceptability of grandparenting and the absence of appropriate sectoral emissions performance benchmarks ▪ Based on market outcomes of the simulation and stakeholder interviews
Allocation	Free in the short to medium term, transitioning to auctioning as the market matures	
Allowance distribution	Ex-ante	▪ Provide a market price signal for allowances to inform participants' compliance strategies during the compliance period ▪ Based on market outcomes of the simulation and stakeholder interviews
Compliance period	Three years	▪ Ensure greater market stability and give regulated entities more flexibility in compliance ▪ Based on experience of domestic MBMs and stakeholder interviews

Source: WRI authors.

- **Wherever feasible, set individual emissions intensity targets for regulated entities** that allow for a rise in emissions with growth using physical intensity metrics (for example, production), which are more closely coupled with emissions. Develop sectoral performance benchmarks over time from the information collected in this process.
- **Allocate free allowance quotas to regulated entities,** to begin with, to build political feasibility for the market. Assess the feasibility of auctioning on a sectoral basis and phase it in over time.
- **Announce the ambition of the targeted emissions reduction** from the market over medium to long term timeframes—a minimum of five to ten years. This will give businesses a clear policy signal to shift investments toward low-carbon technology.

Ensuring sustained and efficient reductions

- **Mandate reporting of GHG emissions by identified sectors in the short run, streamline processes, and align reporting timelines with the financial year.** Even in the absence of a market, MRV mandates can build necessary capacity within the industry. Mandates should simplify and standardize the data requirements, and also provide electronic reporting formats and standard emission factors and processes for emissions measurement. Specify the required frequency of MRV and eligible authorities for third-party verification.

- **Employ a call auction with a uniform pricing trading scheme, with interim trading cycles and intermediate compliance requirements**. This would help enhance cost efficiency gains at minimal transaction costs, enhance price discovery, and ensure timely reductions.

- **Identify qualitative and quantitative criteria to determine offsets that ensure environmental integrity and explore the potential for the MSME sector to become a source of offsets for a carbon market in India.** This would encourage and finance deeper reductions without a mandate in the economy.

TABLE ES-2 | Recommendations on trading, market flexibility and stability, and MRV

ENSURING SUSTAINED AND EFFICIENT REDUCTIONS		
Parameter	**Recommendation**	**Rationale**
Trading		
Trading methodology	Uniform price call auctioning	▪ Lower transaction costs and increase allocative efficiency ▪ Based on experience of domestic and international MBMs and stakeholder interviews
Trading frequency	Quarterly	▪ Maintain a clear signal of the market price ▪ Based on market outcomes of the simulation and stakeholder interviews
Flexibility and Stability		
Banking	Allowed, but to be decided based on initial pilots	▪ Encourage early action while mitigating the risk of accumulation of large, banked surpluses ▪ Based on experience of domestic MBMs and stakeholder interviews
Borrowing	Not recommended	▪ Mitigate risks of disincentivizing early action, depressing early market prices and future defaults ▪ Based on international experience with MBMs
Offsets	Domestic offsets may be phased-in as market matures	▪ Reduce compliance costs and facilitate emissions reductions in sectors infeasible for direct regulation like MSMEs ▪ Based on international experience with MBMs and stakeholder interviews
Price stability	Market reserves can be considered (in case of external shocks)	▪ Improve price predictability and resilience market to shocks ▪ Based on international experience with MBMs and stakeholder interviews
Monitoring, Reporting, and Verification		
Monitoring	Minimize data points, establish default emissions factors, and adopt standardized tools	▪ Reduce transaction costs, increase transparency, and improve compliance ▪ Based on international experience with MBMs and stakeholder interviews
Reporting	Piggyback on existing reporting channels, through standardized electronic/digital reporting formats	
Verification	Develop standards for verification and build capacity across verification agencies	
Frequency	Annual, aligned with financial year	

Source: WRI authors.

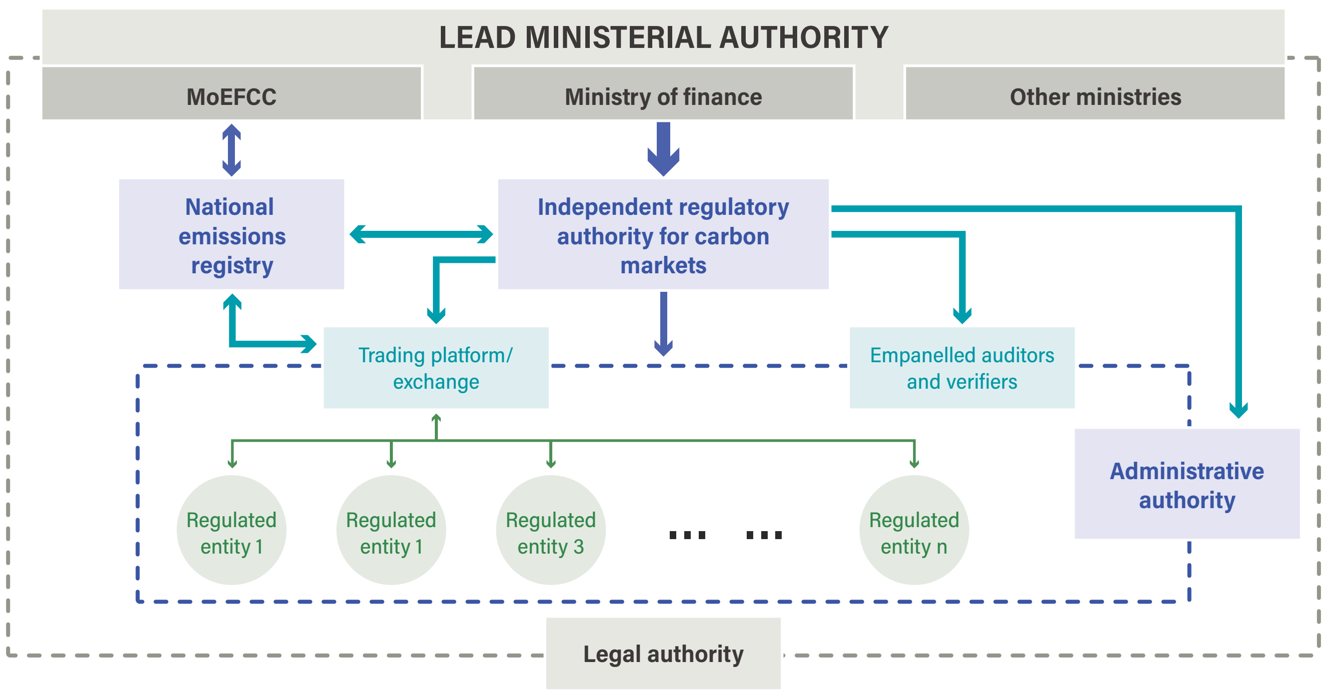
Important considerations to be explored are cost efficiency, compliance costs, technical feasibility and reduction options, and readiness.

- **Use provisions of banking, offsets, and a three-year compliance period as flexibility measures. Do not impose price collars. Gather evidence on their design through pilots or simulations prior to implementation**. This would help assess their impact vis-à-vis feasibility, efficiency gains, and environmental integrity, while building preparedness and capacity and providing resilience to economic shocks. Offsets, procured domestically, can be introduced in the medium term, as the easy-to-abate emissions or "low hanging fruit" of regulated entities decrease.
- **Enforce a financial penalty two to three times that of the market price of an allowance on per tonne of shortfall in meeting the target, along with an obligation to submit the shortfall in allowances, supported by a legal framework.** Also explore the potential for non-financial penalties such as the public disclosure of non-complying companies. In cases of misrepresentation of data or fraudulent behavior, the penalties can be higher (five times the market price) along with revocation of the license to operate, depending on the severity of the case.

Toward successful, enduring, and inclusive markets

- **Integrate current MBMs within the national carbon market in the medium to long term**. This would help minimize transaction and compliance costs and increase cost efficiency and the feasibility of linking with international markets. To facilitate a smooth transition, introduce the carbon market in parallel with the MBMs, with targets in the former as additional to the latter, then slowly phase them into one market.
- Establish a **robust institutional structure and governance mechanism** with an independent regulatory authority. The role of the MoEFCC is critical to ensuring that pricing mechanisms and the resulting implications to sectors, revenues, and spending are aligned with national goals, and that emissions are robustly accounted for under the international emissions reporting and tracking regime. The institutional mechanism must allow for coordination amongst line ministries, including but not limited to Corporate Affairs, Power, and MSMEs. The proposed structure is shown in Figure ES-3.

FIGURE ES-3 | Proposed institutional structure for a carbon market in India



Source: WRI authors.

- **Provide long-term and clearly articulated goals** to send a clear policy signal to investors, businesses, and other stakeholders in ensuring effective and sustained emissions reductions.
- Introduce complementary policies that enable the uptake of green technologies; this may include **market incentives for nascent or innovative technologies, easing of regulations for renewables procurement, and financing instruments for technology upgradation.** Such policies contribute to the necessary ecosystem to support the carbon market in facilitating deep decarbonization of the industry sector.
- **Devise and roll out targeted capacity building programs** to build capacity of businesses in emissions accounting and reporting. Similarly, build capacity in trading through market pilots or mock emissions trading exercises.
- **Implement complementary policies to mitigate competitiveness and other impacts of carbon pricing**. These may include the following:
    - Support the achievement of emissions reduction targets through the creation of **financing mechanisms or incentives** to enable the adoption of green technologies and development of supporting infrastructure.

TABLE ES-3 | Recommendations on allied policies

TOWARD SUCCESSFUL, ENDURING, AND INCLUSIVE MARKETS		
Objective	**Recommendation**	**Rationale**
Create a common carbon currency	Short term: Carbon market in parallel with existing MBMs, with additional targets	Build on existing capacity until the market matures to ensure political feasibility and ensure continued reductions through well-established MBMs Based on current policy landscape and stakeholder interviews
	Medium to long term: Subsume existing MBMs into the carbon market	Increase efficiency of reductions, reduction in administrative and transactional costs Based on experience of domestic and international MBMs and stakeholder interviews
Build capacity	Devise and roll out targeted capacity building programs	Create capacity across industry based on their relative level of awareness and existing capacity to build readiness for a carbon market and facilitate better emissions management Based on current industry capacity and feedback from participants
Ensure compliance	Interim targets Penalties Policy incentives	Encourage early action, and create financial incentives to comply and course-correct Based on international MBM experience
Minimize competitiveness impacts	Conduct stakeholder consultations	Inform policy and design based on stakeholder priorities and challenges, create buy-in, identify vulnerable actors/sectors, and integrate learnings in subsequent compliance periods Based on experience of domestic and international MBMs and stakeholder interviews
	Financing mechanisms /incentives	Support vulnerable sectors through target rationalization, financing to enable low-carbon interventions, and incentives to adopt low-carbon technologies
	Tax breaks or border carbon adjustment mechanisms	Based on experience of domestic and international MBMs and stakeholder interviews
Manage distributional impacts	Alternate employment opportunities Training and skill development programs Direct cash transfers	Compensate for regressive or inequitable impacts of carbon pricing on vulnerable sectors and groups Based on international MBM experience

Source: WRI authors.

- Support vulnerable or internationally competitive industrial sectors through **tax breaks or border carbon adjustment mechanisms**.
- Support workers and communities (particularly low-income groups) affected by carbon pricing through the creation of **alternate employment opportunities, training and skill development programs, and direct cash transfers**.

- **Conduct stakeholder consultations** with representation from relevant line ministries, industry sector associations, consumer associations, and labor unions to identify potential impacts of carbon pricing on different stakeholder groups.

The dynamic ratchet mechanism under the Paris Agreement requires countries to submit new commitments, with higher ambition, every five years (Denchak 2021). A carbon market can help India meet such progressive ambitions by complementing and supporting reductions in a cost-efficient manner. Article 6 of the Paris Agreement can unlock domestic and international market mechanisms to meet the NDCs, drive climate finance, transfer low-carbon technology, and enhance global ambition on mitigating emissions.

Given the limitations of this study—which only included a subset of the Indian industry, most of whom have a relatively mature understanding of carbon markets—the research presented in this report and the suggested recommendations must be complemented by extensive consultations with the rest of the industry, relevant governmental agencies, and ministries. To begin with, any efforts toward enabling a low-carbon industry transition must begin with building capacities as well as improving upon and streamlining better emissions data reporting and verification processes. Simulations and pilots can strengthen the design choices and help identify key policies to then scale up and roll out a potential national carbon market that can support cost efficient achievement of India's climate and developmental goals.

CHAPTER 1

Introduction

Carbon pricing can be one of the key levers to support decarbonisation. In this chapter we compare two main pricing instruments: a tax and a market and discuss the economic case for a carbon market in enabling more cost-efficient decarbonization in the Indian context and the growing popularity of carbon markets in emerging economies to reduce emissions while meeting economic objectives.

Shortly after the COVID-19 pandemic exposed the vulnerability of countries, communities, and businesses to global catastrophes, Working Group II of the Intergovernmental Panel on Climate Change (IPCC) confirmed in its sixth Assessment Report that climate change will have increasingly adverse impacts on infectious diseases, heat, malnutrition, mental health, and displacement in Asia (IPCC 2022). India is particularly vulnerable to the impacts of climate change, facing threats to food, water, energy, and health security (World Bank 2013)—and despite its low historical contribution, India is now the world's third largest emitter of greenhouse gases (GHGs) (Climate Watch 2023) and must therefore play a crucial role in achieving the Paris Agreement's goals of limiting global temperature rise to 1.5°C or well below 2°C. As India is set to experience rapid growth in its population, economy, and energy consumption (IEA 2021b), a sustainable path to development that decouples emissions from economic growth is imperative to both limit anthropogenic global warming and reduce the severity of the domestic impacts of climate change over the coming decades. Since GHG emissions (and the resulting climate damages) are placed in economic theory as a negative externality, pricing carbon emissions can help a growing country like India embed the cost of climate damages within its growth paradigm and achieve more sustainable development.

CARBON PRICING TO DRIVE DEEP DECARBONIZATION

Empirical evidence from around the globe shows that carbon pricing, as part of a policy package, can play a significant role in driving deep emissions reductions compared to business-as-usual (BAU) scenarios (Tvinnereim and Mehling 2018). By providing a sustained policy signal on the price of carbon emissions, carbon pricing can encourage structural shifts in the ways of doing business by making low carbon investments more cost competitive, leading to investments in new technologies and products. Carbon pricing is recognized as a key tool to achieve net zero commitments, and as of May 2021, 21.5 percent of GHG emissions were covered by carbon pricing instruments (World Bank 2021).

There are two primary types of carbon pricing, encompassing a variety of carbon pricing instruments. **Explicit carbon pricing** directly imposes a price on each unit of GHG emissions, including, for instance, carbon tax, carbon market, results-based climate finance (RBCF), and project-based offsets. **Implicit carbon pricing** emerges because of other regulations without direct imposition, such as renewable and energy efficiency support, removal of fossil fuel subsidies, and fossil fuel taxes.

Within explicit carbon pricing instruments, RBCF frameworks involve the crediting of climate finance to regulated entities, contingent upon their driving verified emissions reductions. Project-based offsets allow the sale of emissions reductions from specific projects by unregulated entities to external regulated entities. However, the two most important instruments to price carbon are carbon taxes and carbon markets. Table 1, below, provides a comparative assessment of the two.

CARBON MARKETS AS A MODE OF CARBON PRICING

A carbon market, also known as an emissions trading scheme (ETS), is based on the principle of "cap-and-trade," an economic mechanism that caps aggregate carbon emissions to a target level (an emissions cap) over a defined time period (the compliance period). The emissions cap is then allocated among the entities regulated in the market in the form of tradable certificates or permits (emissions allowances), wherein one allowance typically represents the emission of one tonne of carbon dioxide equivalent (CO_2e). If the individual cap is lower or higher than the firm's needs, a market among the regulated entities allows them to either buy allowances to cover reductions not undertaken internally, or sell allowances that cover any surplus reductions undertaken internally. The trade in allowances, driven by differing emissions abatement costs across the regulated entities, would allow more emission reductions to take place where they are more cost effective, thereby lowering the aggregate cost of achieving the overall target (Figure 1). Moreover, the market-determined price of emissions provides an economic signal to regulated enti-

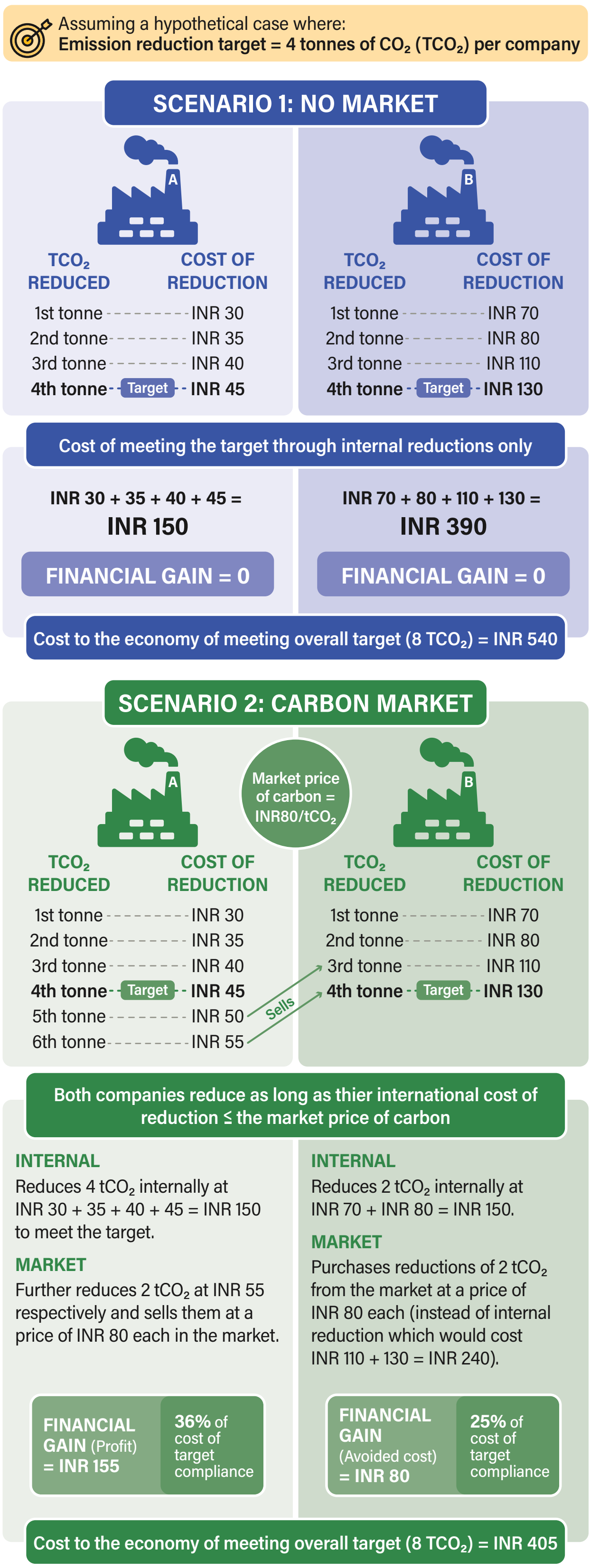
TABLE 1 | Comparative assessment of a carbon tax and a carbon market

	CARBON TAX	CARBON MARKETS
Price- or quantity-based	Imposes a direct fixed price on each unit of GHG emissions. Thus, it is a price-based instrument: the carbon price is fixed but the emissions reductions caused are variable.	Imposes fixed emissions reduction targets on regulated entities and then provides a marketplace for them to buy and sell reduction units to meet their targets. This leads to a market-based price of carbon. Thus, it is a quantity-based instrument: the quantity of emissions reductions is fixed but the resulting price is variable.
Pros and cons of price- and quantity-based instruments	Price certainty facilitates long-term planning and investment among regulated entities. However, the quantity uncertainty (of emissions reductions) may or may not lead to the achievement of pre-defined targets.	Price uncertainty makes long-term planning and investments more difficult. However, the quantity certainty (of emissions reductions) allows for the market to be aligned with pre-defined targets. This may still be impacted by political decisions on the level of target, which may be higher or lower than the planned targets.
Flexibility of policy to external economic fluctuations	A tax is less flexible in its implementation; it does not self-adjust to fluctuations in the economy and depends on the regulator to do so.	The market price self-adjusts to fluctuations in the economy, ensuring the most cost-efficient investments and reductions occur.
Transaction costs	Implementation of a tax is relatively easier, involving lower transaction costs and capacity building requirements because it can piggyback on existing tax systems.	Development and implementation of a market involves higher transaction costs on behalf of both the regulator and regulated entities. Large-scale capacity building is required for effective implementation and participation.
Political acceptance	A carbon tax may be more susceptible to political resistance and industry lobbying because providing tax breaks to emissions-intensive or trade-exposed sectors is typically harder to justify and sustain.	A market, if designed to do so and with complementary policies, can allow for mechanisms that preserve competitiveness, such as free allocation of allowances for trade-exposed or emissions intensive sectors, to be incorporated more easily into its design. This typically results in greater political feasibility for the system.

Source: Based on C2es 2009; C2es (2009).

FIGURE 1 | The economic case for carbon markets

How carbon markets can lead to cost-effective emission reductions



Source: WRI authors.

ties to reduce their emissions internally. It is a clear metric to evaluate their alternatives in fossil fuel saving or emissions reductions decisions. This incentivizes low-carbon investments and innovation in low-carbon solutions.

In 2022, 25 carbon markets, encompassing 55 percent of global gross domestic product (GDP), covered 17 percent of global GHG emissions. This marked a notable increase in just two years, as compared to 9 percent of global GHG emissions under 21 carbon markets in 2020 (ICAP 2021a). The rise in coverage was the result of three countries—China, Germany, and the United Kingdom—establishing a market in 2021 for meeting their newly-enhanced net zero goals. Seven other carbon markets are currently under development[2] and are expected to be in operation in the next few years, while 14 other jurisdictions are considering it as a potential part of their climate change policy portfolio (ICAP 2021a). Even well-established markets, such as the European Union Emissions Trading System (EU ETS), Korean ETS (K-ETS), New Zealand ETS (NZ ETS), and the Regional Greenhouse Gas Initiative (RGGI) and Western Climate Initiative in the United States are being periodically reviewed and enhanced to align with Nationally Determined Contributions (NDCs) and net zero ambitions.

Of all carbon markets currently in force, under development, or under consideration, emerging economies constitute half of them (ICAP 2021a), highlighting their popularity as a climate policy option for emerging economies that must decarbonize while meeting their development goals. This is the case for India, which must find cost-efficient ways to reduce emissions while safeguarding business competitiveness and sustaining high growth.

Over the last decade, India has gained considerable experience with market-based mechanisms (MBMs), beginning with the participation of the private sector in the Clean Development Mechanism (CDM) in 2005 (the project-based offset program under the Kyoto Protocol) and the domestic MBMs to promote energy efficiency and renewable energy—namely, the Perform, Achieve, Trade (PAT) and Renewable Energy Certificate (REC) schemes, respectively. India also has a subnational ETS on respiratory solid particulate matter, which was piloted in the industrial clusters of three states: Gujarat, Maharashtra, and Tamil Nadu (Greenstone and Sudarshan 2019). In December 2020, the Indian government indicated its intention to expand and strengthen carbon pricing policies by constituting the Apex Committee for the Implementation of the Paris Agreement (AIPA), a high-level inter-

ministerial committee that includes among its key functions the task of formulating guidelines on carbon pricing and MBMs in the country (GoI 2020b).

By providing flexibility in where and how emissions reduction is achieved, a well-designed carbon market can reduce the cost of achieving India's climate targets. It can also create a source of public revenues, which can then be used to support impacted businesses or other needs of climate finance if a share of allowances is auctioned. This makes carbon markets a key instrument to explore in the context of enhancing the scale or ambition of existing climate targets in India, while also realizing its developmental goals.

OVERVIEW OF THIS REPORT

In order to inform an effective and sustainable carbon market in India, this report explores the various design and implementation considerations of a carbon market through secondary research and the simulation of a notional carbon market with 21 Indian companies. In Chapter 2, we set the context by outlining India's policy landscape and its different experiences with MBMs, the prospects for a carbon market in India, and thus, the objectives and approach of this study. Chapter 3 then summarizes the experience and learnings of the key carbon markets around the globe on important design and implementation considerations and contextualizes them to the Indian context. Section 4 explains the methodology used to develop and implement the carbon market simulation and its outcomes. Section 5 discusses recommendations for the design, implementation, and capacity building needs for a carbon market in India, based on international and Indian experience with MBMs, the outcomes of the simulation, and extensive stakeholder consultations. Finally, Section 6 provides the way forward.


CHAPTER 2

Background and about this study

The chapter outlines the climate policy landscape and the evolution of market-based mechanisms in India, summarizing India's experience with its energy efficiency and renewable energy markets. It identifies the gaps a national carbon market can address, the specific opportunities it presents, and outlines our research objective and approach of generating evidence to inform the design and implementation of an effective national carbon market.

CLIMATE POLICY LANDSCAPE IN INDIA

In its first NDC, India committed to reducing the emissions intensity of its GDP by 33 to 35 percent by 2030, as compared to 2005 levels. India's NDC also set quantitative targets to increase the share of non-fossil sources in installed electric capacity to 40 percent by 2030, and to create an additional carbon sink holding 2.5 billion to 3 billion tonnes of carbon dioxide (CO_2) through tree cover by 2030 (GoI 2016).

In August 2022, India submitted an upward revision in its NDC targets for 2030, committing to reduce the emissions intensity of its GDP by 45 percent from 2005 levels and achieve 50 percent of installed electricity capacity from non-fossil sources (GoI 2022). This revision of the NDC followed the country's November 2021 announcement of a long-term target to reach net-zero emissions by 2070 (GoI 2021).

India has undertaken several policies and targets in relation to energy supply, energy efficiency, and fuel switching in the power, transport, industry, and building sectors that have contributed to reducing its GHG emissions and meeting its NDC targets. In the power sector, the Ministry of New and Renewable Energy (MNRE) set a target of 175 gigawatts (GW) of cumulative renewable energy capacity by 2022, comprised of 100 GW solar, 60 GW wind, 10 GW biomass, and 5 GW small-scale hydro (NITI Aayog 2015). Achieved installed capacity from these sources stood at 117 GW as of August 2022 (CEA 2022). Policies include a *cess* on coal production of INR 400 per tonne (IISD n.d.), various capital and generation-based incentives, and various state-level feed-in tariffs (as determined by the different states) to make adoption of renewable energy financially viable. MNRE has also instituted a renewable purchase obligation (RPO) policy for power distribution companies to source a specified minimum percentage of electricity from renewable sources, which stands at 21 percent by fiscal year 2022 (FY22) (MNRE n.d.), and can be met through the purchase of tradable RECs.

The main policy instrument in the industrial sector is the PAT scheme, an MBM that aims to target energy efficiency improvements in energy-intensive subsectors, power distribution companies, and commercial buildings (discussed further in Section 2.2). In the building sector, the Energy Conservation Building Code (ECBC) aims to promote the design and construction of energy-efficient buildings (BEE n.d.), the Standards and Labelling Scheme lays down minimum energy performance standards and mandates the display of energy performance labels for high energy end-use appliances (BEE n.d.), and the UJALA LED Replacement Scheme promotes the large-scale replacement of inefficient bulbs with LED lighting (EESL 2021).

In the transport sector, the Corporate Average Fuel Efficiency (CAFE) regulation set a fleet average target of 130 grams of CO_2 per kilometer (gCO_2/km) for April 2017, reducing it to 113 gCO_2/km in April 2022 (BEE n.d.) for car manufacturers. The National Biofuels Policy set a target of 10 percent biofuel blending by April 2022, and 20 percent by 2025 (NITI Aayog 2021). The Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME India) scheme focuses on creating a market for electric vehicles in India by providing price subsidies and creating charging infrastructure (Ministry of Heavy Industry n.d.).

Table 2 classifies key climate policies in India by those that aim to reduce GHG emissions by putting a price on carbon, as opposed to those that do so implicitly through incentives and regulations across emissions sources.

PROSPECTS AND CASE FOR A CARBON MARKET IN INDIA

Evolution of MBMs in India

GHG emissions trading was introduced in India in 2005 by the CDM under the Kyoto Protocol. While India did not have an emissions reduction target under the Kyoto Protocol as a non-Annex I country, it participated by supplying offsets—Certified Emission Reduction units (CERs)—generated from emissions reduction projects implemented in India, to Annex I countries to meet their emissions targets. Before the crash of CER prices in 2013 due to large buyers like the European Union placing restrictions on the purchase of CERs based on quantity, type, and origin (emerging from concerns around their environmental integrity), CDM saw immense popularity in the country, and India had the second-largest number of registered CDM projects under the Kyoto Protocol, after China (GIZ 2013). With continued supply-demand imbalance preventing price recovery, the transition of unsold CERs—in the case of India, estimated around 107 million—to the new market regime under Article 6 of the Paris Agreement has been a key issue of contention among countries in climate negotiations.

Nevertheless, the initial success of CDM gave impetus for the introduction of two domestic MBMs for energy in India: the REC and PAT schemes, introduced in 2010 and 2012, respectively. The former introduced tradable electricity attribute certificates for renewable electricity in the country, known as RECs, and allowed for their use in meeting renewable purchase obligations specified to electricity distribution companies (DISCOMs), which presently stands at 21 percent by FY22 (MNRE n.d.), and large industrial consumers of electricity under the Electricity Act 2003 (CERC 2010). From 2010 to February 2022, over 1,000 projects of cumulative installed capacity around 5.0 GW were installed under REC mechanism and 77.3 million RECs issued. The PAT scheme is an energy trading scheme introduced by the Bureau of Energy efficiency (BEE) that specifies energy efficiency (specific energy consumption) targets at the plant-level for energy intensive sectors, and allows the use of tradable permits known as energy saving certificates (ESCerts) to meet these targets. Currently covering over 1,000 entities from across 13 sectors, the scheme is estimated to have resulted in energy savings of 8.67 million tonnes of oil equivalent (MTOe) and 13.28 MTOe in cycle-I (2012–15) and cycle-II (2016–19), respectively (BEE 2020).

In 2012, the Ministry of Environment, Forest, and Climate Change (MoEFCC) also conceptualized an ETS for particulate matter pollution in partnership with three states: Gujarat, Maharashtra, and Tamil Nadu. These three schemes were to then provide a foundation for a future trading program for GHG emissions. In 2019, the Gujarat Pollution Control Board implemented the scheme in Surat, beginning a large-scale pilot covering 158 plants and marking the launch of India's first ETS and the world's first market for particulate matter pollution (Greenstone and Sudarshan 2019). The ETS set a limit on the total pollutant load of the covered plants at 280 tonnes per month from September 2019 onwards, a 29 percent reduction from the baseline value of 362 tonnes per month as of January 2019 (Greenstone and Sudarshan 2019).

TABLE 2 | Key climate policies in India classified as carbon pricing or supporting instruments

PRICING INSTRUMENTS		SUPPORTING INSTRUMENTS	
Tax	**Market Mechanisms**	**Subsidy to low/zero carbon alternatives**	**Regulation**
Coal cess	Perform, Achieve, Trade (PAT) scheme	Feed-in tariffs, viability gap funding, generation-based incentives, and preferential lending norms for renewables	Standards and labelling for appliances
	Renewable Energy Certificate (REC) scheme	Subsidy for electric vehicles	Energy conservation codes for buildings
		Subsidy for LED lighting	Fuel efficiency standards for vehicles

Source: WRI authors.

TABLE 3 | Key moments in the evolution of market-based mechanisms in India

YEAR	EVENT
2005	Registration of the first CDM project in India
2010	Introduction of tradable electricity attribute certificates for renewables (RECs)
2012	Launch of the Perform, Achieve, Trade (PAT) energy trading scheme by the Bureau of Energy Efficiency
2017	India signs up for World Bank's Partnership for Market Readiness program to strengthen existing MBMs and explore new ones for GHG emissions
2019	Launch of the world's first emissions trading scheme for particulate matter pollution in Surat, Gujarat
2020	Formation of the Apex Committee for the Implementation of the Paris Agreement, a high-level government committee tasked with formulating guidelines on carbon market mechanisms, among other functions
2022	Energy Conservation (Amendment) Act 2022 passed in the Lok Sabha, empowering the government to set up a national carbon market

Source: WRI authors.

The MoEFCC has also been actively exploring the idea of new market mechanisms or ETS for GHG emissions. In 2017, India signed up for the World Bank's Partnership for Market Readiness (PMR) program with the objectives of broadening and deepening the scope of the existing PAT and REC schemes, developing and piloting a market-based instrument to reduce emissions in the micro small and medium enterprise (MSME) and municipal solid waste (MSW) sectors, and developing the specifications of a national meta-registry that would enable the linkage of existing and new MBMs for GHG emissions in the country (PMR 2017). In December 2020, the Indian government constituted the AIPA, a high-level inter-ministerial committee comprising 13 ministries of the central government, and included the task of formulating guidelines on carbon pricing and market mechanisms in the country among its key functions (GoI 2020b). In August 2022, the lower house of the Indian Parliament (Lok Sabha) passed the Energy Conservation (Amendment) Act 2022, which, among other measures, empowered the government to set up a national carbon market (MoP 2022). Table 3 summarizes the key moments in the evolution of MBMs in India.

Challenges in existing MBMs in India

While India has made considerable progress in exploring and rolling out various MBMs for emissions reduction over the last decade, several crucial gaps remain in the current MBMs targeting GHG reduction in the country. These include limited coverage, limited flexibility in choice of emissions reductions options, and design and implementation issues.

Limited coverage: Both existing MBMs, PAT and RPO/REC, cover a subset of industrial sectors and emissions sources. As of 2020, PAT covers 1,073 entities from across 13 energy-intensive economic sectors, while RPO covers DISCOMS and industrial facilities that have captive power plants or procure electricity directly through power purchase agreements (BEE 2020). While the coverage of PAT has expanded over time, some energy-intensive industries, such as glass and sugar, are still outside the purview of the scheme. Moreover, both the PAT and RPO schemes target only energy-related emissions.

Limited flexibility in choice of emissions reduction options: By setting specific energy consumption and renewable energy targets respectively, PAT and RPO provide limited flexibility to regulated entities in the choice of emissions reduction options. For example, an entity covered by PAT only has an incentive to choose emissions reduction options that reduce its specific energy consumption. Similarly, an entity covered by RPO must generate or procure a specified proportion of consumed electricity from renewable sources, even if other, more cost-effective options are available to reduce emissions by the same amount.

Design and implementation issues: Both MBMs have also suffered from certain issues with design and implementation.

- A notable issue with the current PAT scheme is the ex-post issuance and trading of ESCerts. ESCerts are issued after verification of energy savings at the end of each scheme cycle and traded thereafter, which means there is a lack of an active price signal (in the form of

a traded price for ESCerts) for the regulated entities during the compliance cycle (Bhattacharya and Kapoor 2012). The relatively long length (three years) of each cycle exacerbates this shortcoming because it implies prices discovered in the previous cycle are not likely to be reflective of demand and supply dynamics at the end of the current cycle. This makes it challenging for regulated entities to optimally use the market to reduce their cost of compliance.

- Another issue in PAT has been that of unambitious target-setting, resulting in the lack of demand and consequently low prices for ESCerts. 2.53 million surplus ESCerts in cycle-I were banked, with the volume of unsold ESCerts estimated to have increased to around 4.57 million at the end of cycle-II (BEE 2021).
- Lack of compliance has been the main challenge in the case of the RPO scheme. The responsibility of enforcement is entrusted to respective electricity regulatory commissions at the state level, a majority of which have failed to either prescribe a sufficiently high penalty to deter non-compliance or enforce the prescribed penalties. This has resulted in more than 20 states consistently achieving less than 60 percent of their mandated targets (Prayas n.d.), leading to low demand and trade volumes in the REC market.

Opportunities from a carbon market in India

A carbon market at the national level has the potential to address the aforementioned gaps in existing MBMs, increase the cost effectiveness of achieving India's NDC targets, provide new opportunities to tap into sources of international carbon finance for emissions reduction, prepare export-oriented sectors for complying with emerging policies at the global level, and offer economic and social co-benefits.

Addressing gaps in existing MBMs: A carbon market can synthesize existing MBMs through a common carbon currency. Defining targets and trading units in terms of CO_2e, even when its goals are defined in carbon intensity terms, would make the market amenable to covering emissions sources beyond energy-related emissions, such as process emissions from industries—which comprise approximately 36 percent of the emissions from the industrial sector and 8 percent of total national emissions (MoEFCC 2021)—and include other GHGs, such as fluorinated gases (F-gas). A carbon currency would also provide greater flexibility to regulated entities in terms of their emissions reduction choices, rather than targeting specific interventions such as energy efficiency or renewable energy, making emissions reductions more cost effective. However, this would require a redefinition of sector-specific goals in terms of emissions, as opposed to energy efficiency or renewable energy. While this can result in the potential need to navigate problems of political mis-signaling in the short term, this is not expected to be a significant barrier, given that targets set in terms of emissions are prevalent among voluntary corporate targets (Hingne et al. 2021) and that specified factors to convert units of energy savings or renewable electricity generated into emissions avoided already exist (BEE 2021).

Finally, synthesizing the various MBMs under a national carbon market is likely to reduce the total administrative and transaction costs associated with the different markets and potentially improve enforcement and compliance outcomes, as exemplified in the RPO scheme and discussed in Section 2.2.2, by harmonizing market rules and procedures into a common, consistent framework. For example, the monitoring, reporting, and verification (MRV) for a carbon market in India can be built on the existing

MRV framework set up under PAT, while also encouraging harmonization with global MRV standards like the internationally accepted GHG inventorization frameworks to ensure potential for future linking to global ETSs.

Lowering the cost of achieving NDC targets: A carbon market can further reduce the cost of achieving India's climate targets, thereby enabling a higher level of ambition in future targets. In addition to lowering transaction costs and flexibility in the choice of reduction options, combining sectors covered by different MBMs under one framework allows for trading across a larger number of sectors with varying emissions abatement costs. This increases the potential for trade and potential efficiency gains from the market. Coverage of such a market can also be easily extended to sectors not covered by existing policy mandates, including less emissions-intensive sectors that have demonstrated significant voluntary climate ambition through their voluntary targets, such as light manufacturing or services (Hingne et al. 2021), and sectors with a high untapped emissions reduction potential, such as the MSME sector. Where direct coverage of these entities is not feasible (either politically or due to disproportionately high transaction costs of inclusion in relation to the incremental emissions coverage), they can be included in the market through innovative design choices, such as market-linked offset mechanisms. Extending market coverage to such sectors can further reduce the cost of emissions reduction through trade, especially for the hard-to-abate sectors.

Opening opportunities for carbon finance through linkage with international carbon markets: Article 6 of the Paris Agreement acknowledges the role of international cooperation through MBMs in enhancing ambition and reducing the cost of achieving countries' NDCs. The total cost of achieving countries' committed NDCs is estimated to be reduced by USD 250 billion per year in 2030 through improved economic efficiency via cooperation under Article 6. Such savings could result in an additional emissions reduction of up to five gigatons (Gt) of CO_2e per year globally (ADB 2020). Negotiations for finalizing

rules under Article 6 were concluded in November 2021 at the 26th session of the Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC) (UNFCCC n.d.). While rules to operationalize Article 6 are yet to be finalized, Article 6.2 allows for the linkage of emissions trading schemes of two or more countries. As compared to existing MBMs, a national carbon market would be more amenable to linkages with major international carbon markets, which use CO_2e emission units as their trading currency. A national carbon market in India linked to well-established markets such as the EU ETS, where marginal emissions abatement costs could be higher, could create international demand for emissions reduction units from the Indian market, thereby channeling international finance for emissions reduction investments in India and creating financial incentives for more ambitious emissions cuts. The Article 6 decision adopted at COP26 also shows consensus on addressing sustainable development, environmental, and social safeguards in the rules that will be subsequently developed based on this decision to operationalize international carbon markets. Linking a domestic carbon market framework with international markets under Article 6 can further facilitate the design of a more environmentally and socially sustainable national market.

Protecting export-oriented sectors: The interconnectedness of today's economies means that the rising cost of carbon in international markets would have an impact on India's economy, irrespective of whether or not the Indian government chooses to introduce carbon pricing policies. For example, the Carbon Border Adjustment Mechanism (CBAM), currently under development by the European Commission and expected to come into force in 2026, aims to impose carbon prices similar to those paid by European businesses under the EU ETS on emissions-intensive imports into the EU in order to safeguard their competitiveness and prevent businesses from shifting production to jurisdictions with laxer emissions constraints, a phenomenon known as carbon leakage (European Commission 2020). While the details of its mechanism are still under negotiation, given that the EU is India's third largest trading partner, the EU-CBAM would impact Indian exports from energy-intensive sectors such as cement, steel, aluminum, and fertilizers, which are targeted by the present proposal. The impact on India's cement and steel sectors would be significant, with projected exports to the EU falling by 65 percent and 59 percent, respectively, by 2030, compared to a no-CBAM baseline (Xiaobei et al. 2022). To maintain its trading position with Europe and other economies that may undertake similar measures, India would have to impose a domestic carbon price in order to keep revenues within its borders, decarbonize its emissions-intensive exports, or shift the constitution of its exports to low carbon products. A carbon market in India could help achieve all of these options, as it would put a price on carbon domestically, keeping potential public revenues within the economy that can then be reinvested to support various socio-economic, developmental, and environmental objectives while also incentivizing businesses to shift to low-carbon technology, processes, and products to maintain international competitiveness.

Offering economic and social co-benefits: By incentivizing low-carbon investments and efficiency improvements, reducing fossil fuel use, and generating public revenue, a carbon market could also deliver important co-benefits like generating jobs, improving air quality and human health, and supporting redistribution of finances to vulnerable sectors or groups at risk from carbon pricing.

NEED FOR THIS STUDY

A carbon market is complex to implement, involving an evaluation of an array of design choices and trade-offs. Global experience in market implementation suggests that countries have tailored the design of their markets to fit national circumstances and priorities, taking into account achievement climate and clean energy targets, economic development, and protection for vulnerable industrial sectors or consumer groups.

While the lessons from global markets and existing MBMs in India serve as a useful starting point in informing the design of a market in the Indian context, global experience also indicates the critical role of practical evidence or "learning-by-doing" through a pilot (small-scale carbon market) or simulation (notional or mock market at a more preliminary stage). The resulting evidence helps to inform market design, ensure stakeholder buy-in, and take stock of technical and administrative capacity requirements for market implementation.

This study builds on existing literature, such as Hingne (2018), that explores design considerations for a carbon market in India and aims to address the crucial gap of practical evidence in this context by presenting—for the first time—outcomes from a simulation of a notional carbon market with participation of the Indian industry.

OBJECTIVE AND APPROACH

Objective

Through this research, we aim to explore the design and implementation options to inform the development of a potential carbon market in India. The ideal framework will lead to real emissions reductions while being cost-efficient in its implementation, resilient to external shocks, sustainable in the long term, and complementary to India's developmental goals. In particular, this study aims to unpack the design and implementation decisions that need to be made and provides:

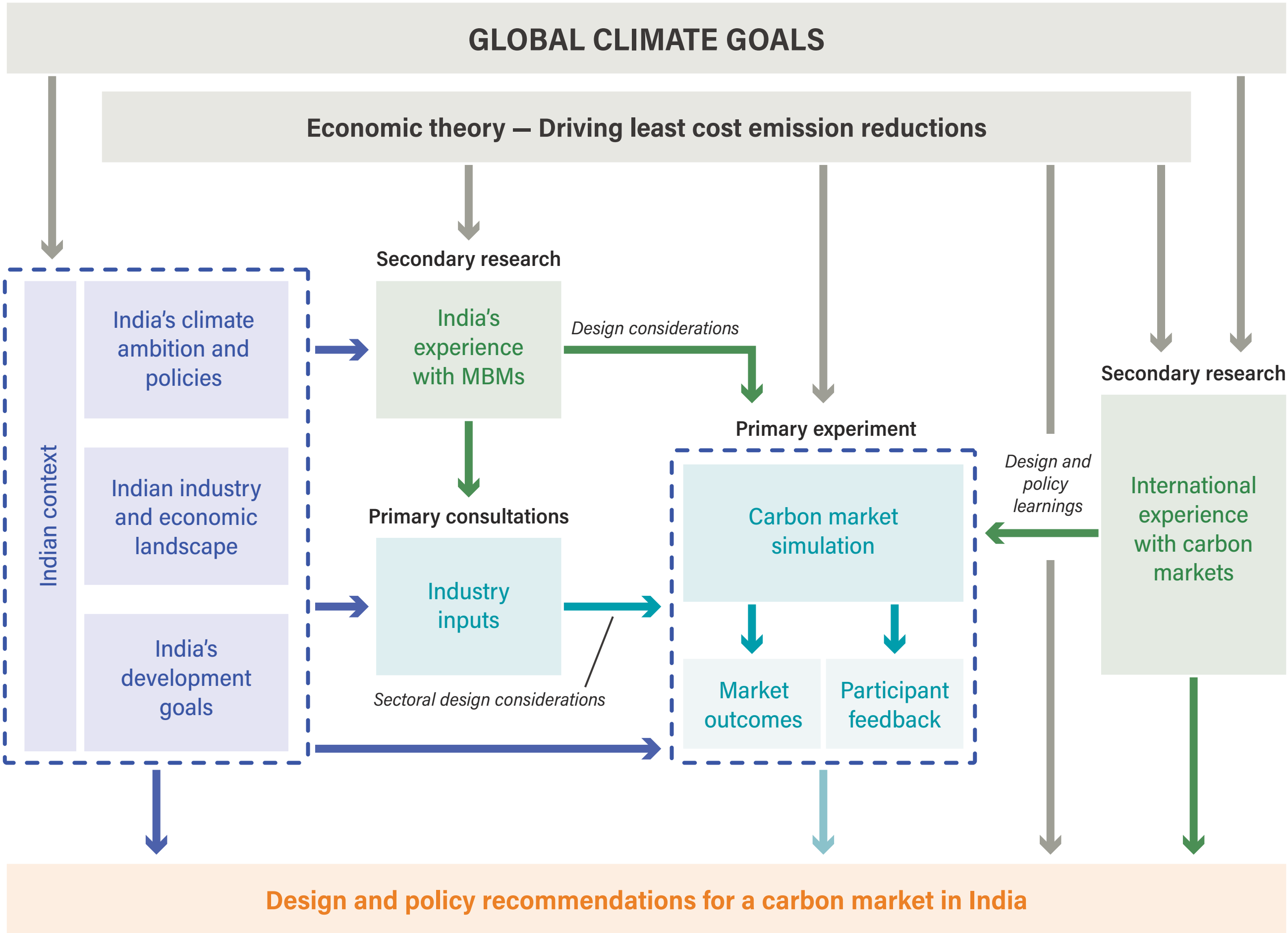
- Recommendations specific to the Indian context to help make design decisions;
- Policy and implementation recommendations for achieving the cap effectively and sustainably; and
- Capacity building needs toward low-carbon industry growth.

Approach

The overarching principles guiding the analysis and recommendations are environmental integrity (driving real emissions reductions), cost effectiveness, ambition (encouraging deeper decarbonization), sustainability (local relevance), market resilience (stability), and international compatibility. Thus, this study uses a combination of primary and secondary research to inform the design of a carbon market in India. Beginning with an extensive review of the 15 years of international experience with carbon markets and 10 years of domestic experience with MBMs, we draw lessons from their experiences, challenges, best practices, and innovative new design mechanisms to understand how they revised and adapted their market design in response to external shocks and other market dynamics to build market resilience and industry support over the years. To contextualize these learnings to the Indian context, we simultaneously conducted consultations with large Indian businesses to understand the needs, challenges, and perspectives of the Indian industry. Hingne (2018) presents the findings from this previous research in the form of a set of key considerations while designing a carbon market for India.

Next, to understand how these design considerations may practically play out in the Indian context, we designed a notional carbon market based on the findings from the above-mentioned review of literature, industry consultations, and India's current context and priorities vis-à-vis its NDC and previous MBM. We then invited large businesses from the Indian industry to participate in notional target setting and carbon trading based on their real emissions data. The evidence collected from the market outcomes, participant feedback, and our experience of designing and administrating the market shed light on the effectiveness of the chosen design mechanisms on the desired outcomes (emissions reduction and cost efficiency gains) and key considerations for designing and implementing a carbon market for India. The final set of recommendations are a combination of learnings from the simulation, the literature review on international and domestic markets, and feasibility considerations for India's current context.

FIGURE 2 | Approach of the study



Source: WRI authors.


सार्वजनिक निर्माण
SAM SAND DU
KULDHARA
LUDHARWA
KAHALA INDUS

CHAPTER 3

Carbon market design considerations for India

Carbon markets have been around for about two decades. This chapter discusses the design features of prominent carbon markets around the globe, summarizing learnings and best practices from their operation. It outlines key design considerations for a carbon market in India by contextualizing these to local economic and political priorities of the country.

PERFORMANCE OF INTERNATIONAL CARBON MARKETS

The lessons learnt by international carbon markets and resulting revisions in their policies, eventually leading to a robust market design, have in turn led to considerable emissions reductions as well as economic, health, and redistributive co-benefits. Table 4 provides a snapshot of these impacts in three markets and shows how, if designed well, carbon markets can also help achieve socioeconomic and health objectives.

TABLE 4 | Emissions reductions and co-benefits achieved in three international carbon markets

	COVERAGE	EMISSIONS REDUCTION	ECONOMIC CO-BENEFITS	HEALTH CO-BENEFITS	REDISTRIBUTION OF REVENUES
EU ETS	40% of total emissions: power, aviation, some industrial sectors	-1.2 $GTCO_2$, or -11.5% as compared to business-as-usual, 2008–16	▪ As of 2014, 16% higher revenues and 8% higher fixed assets as compared to business-as-usual ▪ Employment, profit, and returns on assets also increased but the difference is not statistically significant.	X	▪ Modernization Fund: 2% of allowances in phase IV = EUR 14 billion to support investments in 10 lower-income EU member countries on energy: renewables, efficiency, storage, networks and just transition ▪ Innovation Fund: 450 million allowances = EUR 10 billion to support innovation of low carbon solutions in the EU
California Cap-and-Trade Program	75% of total emissions: power, industry, buildings, transport	-5.3% in GHGs, 2013–17	▪ Created an estimated 8.8 jobs/million USD invested as a result of the program, compared to 1.6 in oil and gas ▪ Led to cost savings from lower energy and fuel consumption in transport	Savings worth USD 19.7 billion as of 2019—5 times the cost of implementing the program—by reducing premature mortality, cardiovascular and respiratory diseases, and emergency room visits from pollution exposure	▪ Share of auctions rise over time and in 2021, 62% of allowances were auctioned ▪ Auction revenues are deposited in the GHG Reduction Fund (GGRF), which by November 2019 had collected more than $12 billion for programs to reduce carbon emissions, improve public health, and increase climate resilience ▪ Law requires that 35% of GGRF revenues be used to benefit disadvantaged communities or households ▪ Revenues also supported GHG reductions in transport: electrifying bus lines, extending train lines, and offering rebates on EVs
RGGI	11% of total CO_2 emissions: power sector in 11 US states	CO_2 reduction: -36%: 2005–11 -20%: 2012–18 (both compared to 2005 baseline)	▪ Estimated cost savings from lower electricity bills due to energy efficiency (-35% by 2031 as compared to 2019) ▪ 5.7% fall in electricity prices in the first 10 years, while they rose in the rest of the country	Estimated savings worth USD 5.7 billion from lower premature death and illness due to improved air quality	X

Sources: WRI, based on: Bayer and Aklin 2020 (EU ETS emissions reduction); OECD 2018 (EU ETS economic co-benefits); C2es 2023 (Cap-and-Trade coverage); Breslow 2020 (Cap-and-Trade economic and health co-benefits and redistribution); ICAP 2023 (Cap-and-Trade redistribution); Ramseur 2019 (RGGI emissions reduction and economic co-benefits); Manion et al. 2017 (RGGI health co-benefits).

ADAPTING LESSONS FROM INTERNATIONAL MARKETS TO THE INDIAN CONTEXT

Most international markets have evolved in design since their inception through a process of learning-by-doing. These experiences provide rich learnings for India to design its domestic carbon market. This section discusses the key design aspects of a market, international lessons learned, and what they mean for the Indian context.

Market scope

The scope of the market determines how varied the marginal abatement costs of the entities regulated in the market would be, which is crucial to the cost efficiency with which the same emissions reduction target is met. Market scope or coverage is decided in terms of sectors, gases, at what point in the economic value chain the emissions should be regulated ("point of regulation"), and the emissions threshold for the inclusion of an entity in the market.

1. **Emissions threshold and level of aggregation of regulated entities**

An eligibility criterion for the inclusion or exclusion of entities is necessary to balance the trade-off between the cost efficiency of emissions reduction achieved in the market and the administrative, MRV, and transaction costs of including the participating entities. This can be determined by a threshold that they must exceed to be regulated. A threshold can be in terms of GHG emissions per year, activity level (production), energy consumption, imports, or capacity. Typically, large facilities are regulated to maintain cost efficiency. Table 5 provides an overview of thresholds in international markets.

The level of aggregation defines the level of the entity that is regulated under the carbon market; that is, the company level: each plant site/installation or a group of plants together. The Climate Change Agreements (CCA) scheme in the United Kingdom, for instance, adopted an approach wherein the regulator enters into umbrella agreements for emissions reduction with industry sector associations (discussed in more detail in Section 5). In India, the aggregation of regulated entities under PAT is at the facility level and has generally been at the company level for voluntary corporate reporting.

Takeaways for India: Regulating the point of emissions can be the most efficient course in terms of balancing the trade-off between transaction costs and flexibility of emission reduction (which is important to preserve the efficiency and liquidity of the market). The threshold can be determined based on the inventory of the large and energy-intensive facilities covered under PAT, while other large and medium-sized facilities undergo MRV activities. The threshold can be modified over time to include more facilities under the coverage of the market. Facilities below the threshold can also be allowed to participate in the market voluntarily, as seen in the California Cap-and-Trade Program.

TABLE 5 | Compliance thresholds in international markets

MARKET NAME	POWER SECTOR	INDUSTRY	OTHER SECTORS
EU ETS	20 MW thermal rated input	Activity level (multiple)	▪ Commercial Aviation: 10,000 tCO_2 ▪ Non-commercial aviation : 1,000 tCO_2
California Cap-and-Trade Program	25,000 tCO_2		
K-ETS	▪ Companies: 125,000 tCO_2 ▪ Facilities: 25,000 tCO_2		
RGGI	25 MW	n/a	n/a
China ETS	26,000 tCO_2 per year, 2013–19	n/a	n/a

Note: All minimum thresholds for the inclusion of an entity in the given sector are based on GHG emissions per year. For the California Cap-and-Trade Program, entities with fewer than 25,000 tCO2 per year may participate on a voluntary basis.

Source: Based on data from ICAP 2021a.

2. **Sectoral and GHG coverage**

Although a wider coverage implies higher potential efficiency gains, two primary considerations should be kept in mind. First, a carbon market should cover GHGs that can be measured, monitored, reported, and verified with reasonable accuracy and cost to ensure a credible trading system. Second, the incremental efficiency gains from the inclusion of less emissions-intensive sectors and other GHGs will have to be weighed against the transaction costs of market participation, which are largely fixed and can potentially outweigh these gains in the case of less emissions-intensive sectors. Table 6 provides a snapshot of the sectoral and gas coverage of five international carbon markets.

Takeaways for India: Although PAT only covered energy-intensive industry subsectors, thermal power plants, DISCOMS, and commercial buildings, other industrial sectors such as chemicals, textile, and services have also demonstrated significant ambition in their voluntary emissions reduction targets (Hingne et al. 2021). It would therefore be relevant to understand the feasibility and scale of potential efficiency gains from a wider, cross-sectoral market in the Indian context.

3. **Point of Regulation**

Emissions can be regulated either "upstream" at the source of production/entry of fossil fuels into the economy, or "downstream," where the fossil fuel is combusted (PMR and ICAP 2021a). While upstream regulation would reduce transaction costs because of the need to regulate fewer actors, most carbon markets around the world regulate the downstream emissions, possibly because of the greater flexibility in their choice of abatement options. In contrast, upstream regulation would mainly provide a price signal for reducing the emissions intensity of the inputs (Mansur 2010), but in the absence of alternatives to achieve deep decarbonization options, the efficiency and liquidity of the market would remain low (discussed in further detail in Section 5).

Targets and allocation

1. **Setting the market cap**

   i. **Type of the target/cap: Absolute or intensity**

The emissions cap of the market can either be set in terms of absolute emissions or emissions intensity. While an absolute emissions cap leads to an absolute reduction in emissions, an emissions intensity cap reduces emissions per unit output, which may allow for a rise in absolute emissions while meeting the intensity target if output grows at a faster rate than emissions. Carbon markets such as the EU ETS generally adopt an absolute emissions cap to foster a declining trend in total emissions (ICAP 2021c). However, developing countries often prefer adopting an emissions intensity cap to decarbonize while accommodating for economic growth objectives, as in the Chinese ETS's regulation of the power sector (ICAP 2021b). Intensity-based targets can also protect the regulated entities as well as the balance of demand and supply in the

TABLE 6 | Coverage of international carbon markets (gases and sectors)

INTERNATIONAL MARKETS	GASES COVERED	SECTORS COVERED	POINT OF REGULATION
EU ETS	CO_2, N_2O, PFCs, NOx	Power, industrial subsectors, aviation, carbon capture and storage installations, maritime under consideration	Downstream
California Cap-and-Trade Program	CO_2, CH_4, N_2O, SF_6, HFCs, PFCs, NF_3, and other fluorinated GHGs	Power, industry, transport, buildings	Upstream: transport; Downstream: industry, power
RGGI	CO_2	Power	Downstream
K-ETS	Several gases	Power, industry, buildings, domestic aviation, waste	Downstream
NZ ETS	Several gases	Power, industry, buildings, transport, aviation, waste, forestry	Upstream
Chinese ETS	CO_2	Power	Downstream

Source: ICAP 2021a.

market from economic fluctuations, which are typically higher in emerging and developing economies. However, the trade-off for the flexibility provided by an intensity cap is lower predictability of the change in total emissions.

Takeaways for India: In the Indian context, an intensity-based cap would be the likely choice in the initial years of the market, given that India's current NDC format and the ongoing PAT scheme have both chosen intensity-based targets for emissions reduction and energy efficiency, respectively.

ii. **Approach of setting the cap: Top-down or bottom-up**

A cap can be set top-down, wherein the overall cap is set and then distributed among participants, or bottom-up, wherein the targets are set individually for each sector or participant and added up to get the overall cap. The choice lies in the trade-off between the transaction cost of setting the target and their flexibility to reflect individual circumstances of regulated entities (both higher in the case of bottom-up targets), which can make targets more realistic and increase political feasibility. India's PAT scheme has adopted the bottom-up approach for target setting, individually setting targets for each participating entity—but the transaction costs of doing so in a carbon market with wider coverage would be higher and need to be studied. The Chinese ETS, which covers only the power sector, also uses a bottom-up approach, but instead of setting individual targets for each entity, it divides power plants into four categories and uses a benchmark to set the target for each category (ICAP 2021b).

Takeaways for India: A bottom-up approach with entity-level targets (similar to the PAT scheme) can be used in the initial years of the market when sectoral emissions benchmarks could be difficult to establish due to limited data. This approach can also help achieve stakeholder buy-in, prevent negative impacts on competitiveness, and provide entities with some flexibility while they build their capacity in trading in a market. India's experience and infrastructure from bottom-up target setting in PAT can also be leveraged to minimize transaction costs.

2. **Allocation of allowances**

i. **Free allocation vs auctioning**

For all regulated entities to meet compliance, they must submit allowances corresponding to their total emissions during the compliance period. These allowances can be acquired through an auction, which gives all regulated entities the opportunity to bid for emissions permits according to their anticipated needs at the start of the compliance period, or through the allocation of a quantity of free allowances, or through a combination of both approaches. Auctioning of allowances raises public revenue, which can be used for other redistributive or low-carbon objectives. However, auctioning also puts a price on each tonne of emissions, in contrast to free allocation, which puts a price only on the proportion of emissions that exceed an entity's freely allocated quota. The higher cost

of compliance in the case of auctioning increases competitiveness impacts for firms and increases the risk of firms shifting their operations outside of the market jurisdiction (carbon leakage). A common and important consideration is thus to allocate a free quota of allowances to regulated entities in the initial years. This enables the transfer of new resource scarcity rents to incumbents, thereby buying their political support—a necessary step when establishing the market. We observe this in all major markets (see Box 1), which initially allocated 100 percent allowances amongst the regulated entities for free then gradually shifted toward auctioning. The share of free allowances awarded will decline over time, at a rate dependent upon the susceptibility of each sector to carbon leakage; share of free allowances is then kept the highest for emissions-intensive and trade-exposed (EITE) sectors.

BOX 1 | Choice of allocation and associated considerations in global carbon markets

The susceptibility of a sector to carbon leakage can be determined using a composite indicator developed based on multiple variables. In most markets around the globe, the industry/manufacturing sector needs the most assistance, and subsectors are allocated free allowances based on their emissions intensity and trade exposure. The EU ETS (phase 2) and K-ETS also took cost-based impacts into consideration, including direct and indirect cost increases and additional production cost. Other qualitative considerations may include abatement potential, market characteristics, and profit margins. The California Cap-and-Trade Program also provided "transition assistance" in the form of free allocation to public wholesale water entities, legacy contract generators, universities, public service facilities, and, beginning in 2018, waste-to-energy facilities. Industrial subsectors may be categorized into different levels of EITE risk and free allocation for the highest level may remain at 100 percent, while those of lower levels may be reduced proportionally in each subsequent phase of the market. To phase out free allocation for the high-risk levels of sub-sectors, the EU ETS is now planning to introduce CBAM to protect their competitiveness by imposing a carbon price pegged to the EU ETS price on all competing carbon-intensive imports.

Source: WRI authors, based on ICAP 2021a.

ii. **Approach for free allocation: Grandparenting or benchmarking**

The approach to allocate allowances for free among regulated entities can be either based on their historical emissions, known as "grandparenting," or benchmarked to industry best practices. A comparative assessment of the two approaches is provided in Table 7.

Takeaways for India: Free allocation for vulnerable players will be important in the initial years of the market to prevent perceived threats to their market competitiveness and develop stakeholder buy-in. At the same time, data can be collected to define different levels of EITE risk of the participating sub-sectors and in each subsequent phase of the market, a higher level of auctioning can be mandated for them, with the level of auctioning inversely proportional to their EITE risk level. The impact and rules of CBAM will also have to be considered while defining auction rules for the impacted businesses to ensure that their competitiveness is preserved. For free allocation, in the absence of robust best practice benchmarks for many industry subsectors, grandparenting can be used in the initial years while data is gathered, and benchmarks can be developed for use in subsequent phases. For robust allocation using grandparenting in the power sector, an average of CO_2 emissions from the previous five to seven years should be used to avoid short-term variability due to weather and economic fluctuations.

Market flexibility measures

1. **Spatial flexibility: The use of offsets**

Linkage to project-based emissions reductions generated outside the scope of the market, or "offsets," has been an important mechanism adopted by several markets to reduce the cost of compliance. For example, the EU ETS and NZ ETS allowed the purchase of CERs from international projects implemented under CDM in their early phases for compliance. The Chinese ETS, California Cap-and-Trade Program, K-ETS, and the RGGI allow the use of domestic offsets from projects that meet pre-defined quality standards. However, to ensure real emissions reductions by the regulated entities, the use of allowances must be capped to a certain share of the final surrender, which gradually declines over time (even if that limits the scope for the cost efficiency of meeting the target). For example, in phases 2 (2008–12) and 3 (2013–20) of the EU ETS, the use of offsets was capped at 50 percent of the total reduction target and is not envisaged to be allowed

TABLE 7 | Grandparenting vs benchmarking approaches of free allocation

CATEGORY	GRANDPARENTING	BENCHMARKING
Definition	Allocates permits to businesses in proportion to their historical emissions	Allocates permits to businesses in proportion to a sectoral performance benchmark (e.g., an average of the 10 most efficient installations in the sub-sector)
Impact on first movers	Penalizes first movers that have already reduced their emissions, creating a disincentive for early action unless alleviated by "early mover" provisions	Encourages first movers by requiring smaller emissions cuts from businesses closer to the performance benchmark
Ease of implementation	Simpler to implement and typically has higher stakeholder acceptability among the industry	Requires an understanding of industrial processes and the availability of related data to set performance benchmarks, such as available sectoral technology options or availability/ feasibility of alternative fuels

Source: WRI authors, adapted from PMR and ICAP 2021.

in phase 4 (2021–30) (ICAP 2021c). Most markets have also imposed qualitative restrictions on the nature of the projects generating the offset credits to ensure credibility of the market, drive additional emissions reductions in sectors outside the scope of the market, or support other policy objectives like afforestation. For example, the California Cap-and-Trade Program has mandated that at least 50 percent of the offsets used lead to direct environmental benefits within the state of California.

2. **Temporal flexibility: Banking and borrowing**

Banking refers to the storage of unused allowances for use in future compliance periods, while borrowing refers to the borrowing of allowances from quotas in future compliance periods. Such flexibility and market stability considerations are design aspects to be explored in the context of a carbon market in India. While banking is allowed in several international markets because it incentivizes early action, borrowing is a fairly uncommon mechanism, since it postpones emissions reduction to the future (see Table 8).

Takeaways for India: India can consider allowing the use of domestic offsets from sectors that cannot be regulated directly within the market and/or from small businesses such as MSMEs to incentivize emissions reduction amongst them by providing them with a source of carbon finance, while increasing the flexibility of compliance for regulated entities. However, clear qualitative criteria and mechanisms for ensuring additionality, no double counting, and accounting integrity will have to be put in place to ensure that the offsets don't undermine the environmental integrity of the market. As in California, the offset market could also be designed to achieve other social or environmental co-benefits. Borrowing is not recommended in the

TABLE 8 | Flexibility mechanisms in international markets

ETS	BANKING	BORROWING	OFFSETS/ CREDITS
EU ETS	Unlimited banking since 2008	Not allowed However, implicit borrowing within trading periods is allowed (usage of allowances allocated in the current year for compliance in the previous year)	Phase 1 (2005–07): Unlimited Phases 2 & 3 (2008–20): Maximum 50% of total reduction in each phase Phase 4 (2021–30): Not envisaged
California Cap-and-Trade Program	Entities are allowed to bank allowances to a limited extent, defined by the "holding limit," which varies according to the cap and is reduced every year	Not allowed	2013–20: 8% of an entity's compliance obligation 2021–25: 4% After 2025: 6%
RGGI	Unlimited banking, but the cap is adjusted accordingly, reducing the number of allowances available for auction by the number of allowances not used for compliance in the previous period	Not allowed	3.3% of an entity's compliance obligation
K-ETS	Allowed with restrictions	Allowed between consecutive years of the same trading phase	Phase 1 (2015–17): 10% Phase 2 (2018–20): 10% Phase 3 (2021–25): 5% of entity's compliance obligation

Source: ICAP 2021a.

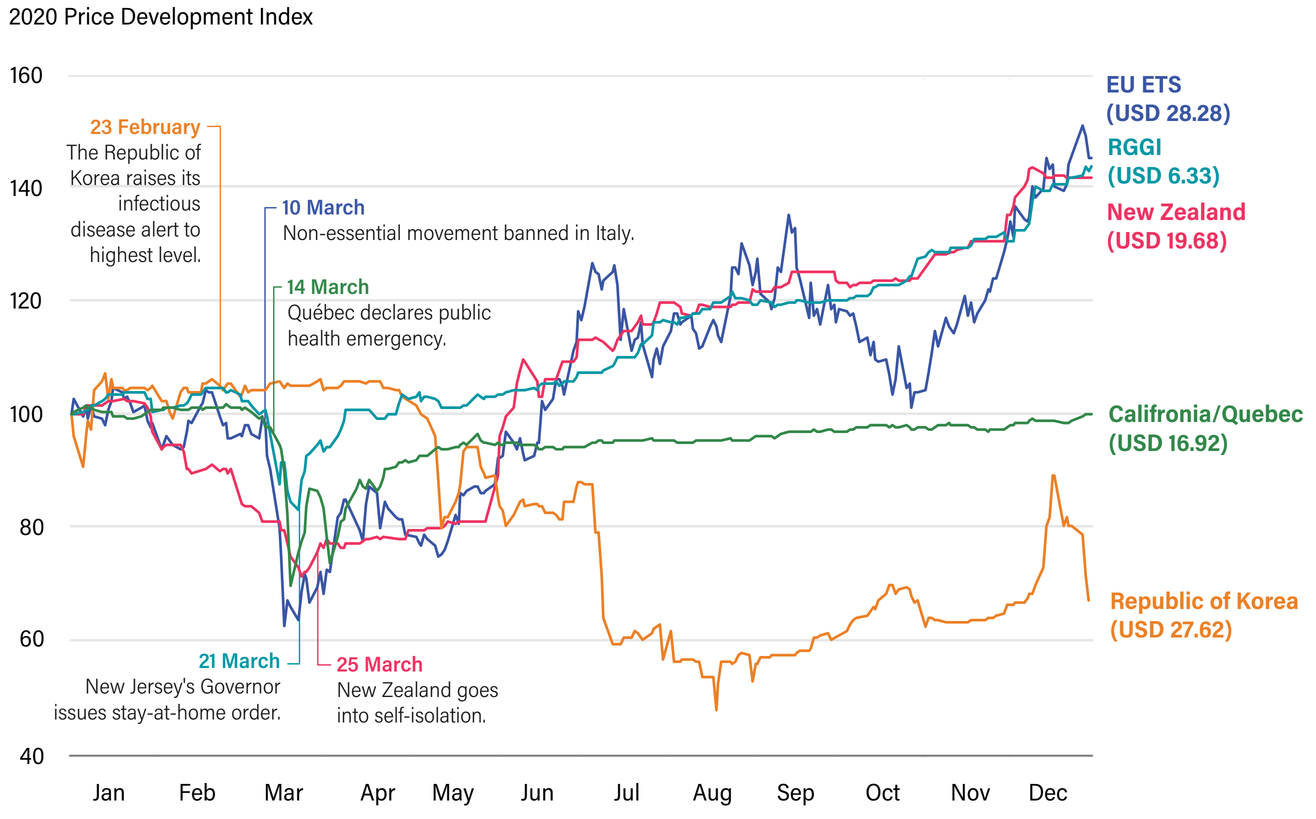
initial years of the market, given that it may disincentivize early action. Banking could be allowed within consecutive years of the same phase, and in the case of oversupply entities could be allowed to carry them forward to the next phase, but with an equal total quantity of allowances from the new pool of allowances available for free allocation backloaded into a market stability reserve that can be triggered if the market price crosses a certain price ceiling (see Section 3.2.4).

Ensuring price stability

Price stability is an important factor to consider in the design of a carbon market. On the one hand, price controls limit the cost efficiency gains that a free market provides by reducing the role of price as a responsive signal to the gap between targets and performance, as expected by economic theory. On the other hand, most systems have built price stability mechanisms over time with the argument for them to be able to plan medium- and long-term investments, maintain acceptability of the market, and maintain some stability in the case of exogenous shocks or changing circumstances. Over the last 15 years, a variety of price stability mechanisms have been created, tested, refined, and implemented in different markets across the globe to address price volatility from shocks.

The year 2020 was a resilience test for carbon prices in markets across the globe. The 2007–08 financial crisis heavily impacted market prices in the EU ETS, which by 2012 dropped below USD 10 (ICAP 2021g). The prices remained at that level until 2018 in part due to the economic aftershock of the recession, and in part due to the dwindling of the Kyoto Protocol and excess supply of CDM offsets. On the contrary, the economic recession caused by the COVID-19 pandemic beginning in 2020 did not result in the same extended slump. In fact, market prices jumped to an all-time high after a brief fall during the few months of the pandemic-induced lockdown in each market (see Figure 3). This resilience in prices can be attributed to a strong medium- and long-term policy signal on increasing climate ambition and the price stability features added to the market following the 2007–08 financial crisis.

FIGURE 3 | Trends in global carbon market prices, 2020



Source: ICAP 2021a.

A variety of price stability mechanisms may be employed to address different issues in the market.

1. **Managing low prices due to oversupply of allowances**

The EU ETS witnessed a prolonged slump in prices from 2008 through 2018 due to an oversupply of allowances following the 2007–08 financial crisis. To manage this, they postponed the auctioning of 900 million allowances from 2014–16 to 2019–20 in a method known as "back-loading," a redistribution of allowance disbursement across different time frames of the same trading period (ICAP 2021c). This can balance the supply of allowances in the short term and reduce price volatility without a significant impact on competitiveness. These allowances were later transferred to the Market Stability Reserve (MSR) (along with other unallocated allowances), which is a repository of allowances available for auctioning based on the demand and supply (prices) in the market subject to strict rules (European Commission 2016), thus maintaining stability in the long run. The RGGI addresses the oversupply of allowances with a similar reserve known as the Emissions Containment Reserve, which withholds allowances from circulation if prices fall to below a trigger price. This trigger price is slowly raised over time (ICAP 2021f).

2. **Managing high prices due to under-supply of allowances**

A cost containment reserve (CCR) is a reserve that stores extra allowances to be released into the market in the case of a low supply of allowances, to prevent prices from overshooting a pre-determined trigger price. This price trigger is often raised over time. These extra allowances can come from different sources. For example, in the NZ ETS, the reserve is stored with allowances from within the cap that were previously withheld from auctioning to prevent an oversupply (similar to the MSR), as well as an additional quantity outside of the cap equal to 5 percent of the year's total allowance volume, backed by equivalent removals by the government either through international markets or government-funded domestic mitigation activities (ICAP 2021e).

3. **Minimum and maximum price thresholds**

Auctions can be subject to price thresholds to control undesirable price fluctuation. In the K-ETS, a minimum auction price, or "auction price reserve," is set based on a pre-defined formula (ICAP 2021d) to help maintain price continuity and minimize a significant drop in the price. The NZ ETS, RGGI, and California Cap-and-Trade Program have defined fixed floor prices as the auction reserve price, which will rise by a certain percentage each subsequent year. However, the government of New Zealand is planning to introduce a "technical floor price" (TRP) based on secondary market prices, which would supersede the hard floor price in the case that it is the higher of the two (ICAP 2021e). Similarly, ceiling prices are set as price triggers to set off CCRs into motion, as seen above.

4. **Governance to ensure market liquidity**

The K-ETS has established an allocation committee that oversees the adjustment of several price stability mechanisms in the case of an excessive fall or rise in price. Stabilization measures include additional auctioning from a reserve, establishment of minimum and maximum quantities of allowances in an entity's account, a change in the borrowing limit, a change in the offsets limit, and setting temporary floor and ceiling prices. Moreover, the Korea Development Bank and the Industrial Bank of Korea are officially designated as "market makers" and control market liquidity by engaging in daily market transactions using a government-held reserve of five million allowances (ICAP 2021d).

Takeaway for India: The creation of a reserve of allowances should be considered for India to manage under- or over-supply of allowances, the latter of which has typically been the experience in PAT. The reserve could absorb/release allowances from/into the market triggered by floor/ceiling prices, respectively, and a committee within the institutional framework of the carbon market may be considered to oversee and develop its rules and management. Such a committee could be responsible for ensuring market stability and decide upon measures such as reserve and price collars for each cycle.

Driving robust emissions reductions, ensuring compliance, and preserving competitiveness

To ensure that the market meets its environmental and social objectives satisfactorily, mechanisms and design aspects that ensure compliance and long-term effectiveness are key. There are several important aspects to be incorporated into market design.

1. **Robust long-term policy signals on market ambition**

Conveying the long-term emissions reduction targets of the market is crucial to provide a robust long-term policy signal to regulated entities and influence their long-term business decisions toward low-carbon technologies. For example, in the EU ETS, while the uncertainty of climate action under the faltering Kyoto Protocol was one of the reasons for the sustained period of depressed prices from 2012 to 2018, the rise of ambition since the Paris Agreement, backed by robust targets for 2030 and 2050, led to the market price breaking record highs every week in 2021 (ICAP 2021c). However, it is equally important to ensure a strong sense of confidence among market players in the political regime driving the achievement of these targets. For example, the EU's 2014 announcement of their 2030 target of 40 percent emission reduction as compared to 1990 did not lead to a jump in prices, whereas its update of this 2030 target to a 55 percent reduction and a strong signal of ambition by policymakers boosted the demand for allowances (*The Economist* 2021). This can be done by announcing short-, medium-, and long-term targets. For example, in the K-ETS, the long-term target is carbon neutrality by 2050, the medium-term target is a 40 percent reduction of emissions as compared to 2018 levels (equating to an emission target of 437 $MTCO_2e$ by 2030) (Government of Korea 2021), and the short-term targets are annual caps set at the beginning of each phase (ICAP 2021d).

Takeaways for India: Similar to the K-ETS, a medium-term target that is aligned with India's 2030 NDC targets (based on the estimated reduction potential of the sectors and backed by sectoral roadmaps) should be announced. That target can then be broken down into short-term compliance targets. This would provide businesses with a long-term policy outlook and nudge their decisions and investments toward low-carbon alternatives.

2. **Ensuring compliance: Penalties**

The success of a carbon market in meeting its emissions reduction targets is highly contingent upon the regulator's legal enforcement of compliance. There are three ways in which regulated entities may be non-compliant, with increasing levels of stringency in their corresponding penalties: administrative delays and defaults, non-compliance of target, and falsification of information. Most markets around the world impose a penalty for non-compliance of the target (Table 9).

The cost of enforcement and compliance must be considered while determining the value of the penalty in order to ensure its effectiveness (Sigman 2010). Further, the penalty must be imposed more frequently and severely for its economic impact to be significant (Adrison 2008). Different forms of penalties include financial penalties, naming and shaming, and temporary revocation of the consent to operate. In the Kazakhstan ETS, one challenge has been the lack of capacity and training among third-party verification firms on ISO- or government-approved procedures, leading to poor verification of regulated entities' emissions. Thus, in addition to imposing penalties, it is imperative to establish a robust MRV system with adequate capacity among regulated entities and verifiers to ensure compliance.

TABLE 9 | Penalties in international carbon markets

MARKETS	PENALTY VALUE
EU ETS	EUR 100/ tCO_2 Publicizing the names of the defaulted companies
K-ETS & NZ ETS	3x the average market price of the compliance period
RGGI	Allowances worth 3x the quantity of emissions defaulted State-specific penalties

Sources: ICAP 2021c (EU ETS); ICAP 2021d (K-ETS); ICAP 2021e (NZ ETS); ICAP 2021f (RGGI).

Takeaways for India: India's REC market collapsed due to a severe lack of compliance, primarily due to a lack of enforcement of the penalties, which stemmed from concerns around passing higher costs either to the already-financially-distressed distribution companies or to consumers. Thus, while penalties must be high enough to make compliance the more financially viable option for regulated entities, those penalties must also be supported by complementary policies that (i) enable compliance by making alternative technologies affordable and accessible, and (ii) allow for the redistribution of revenues among vulnerable impacted stakeholders to alleviate any negative impacts. This should be further supported by a robust MRV system and capacity building programs for verifiers and regulated entities.

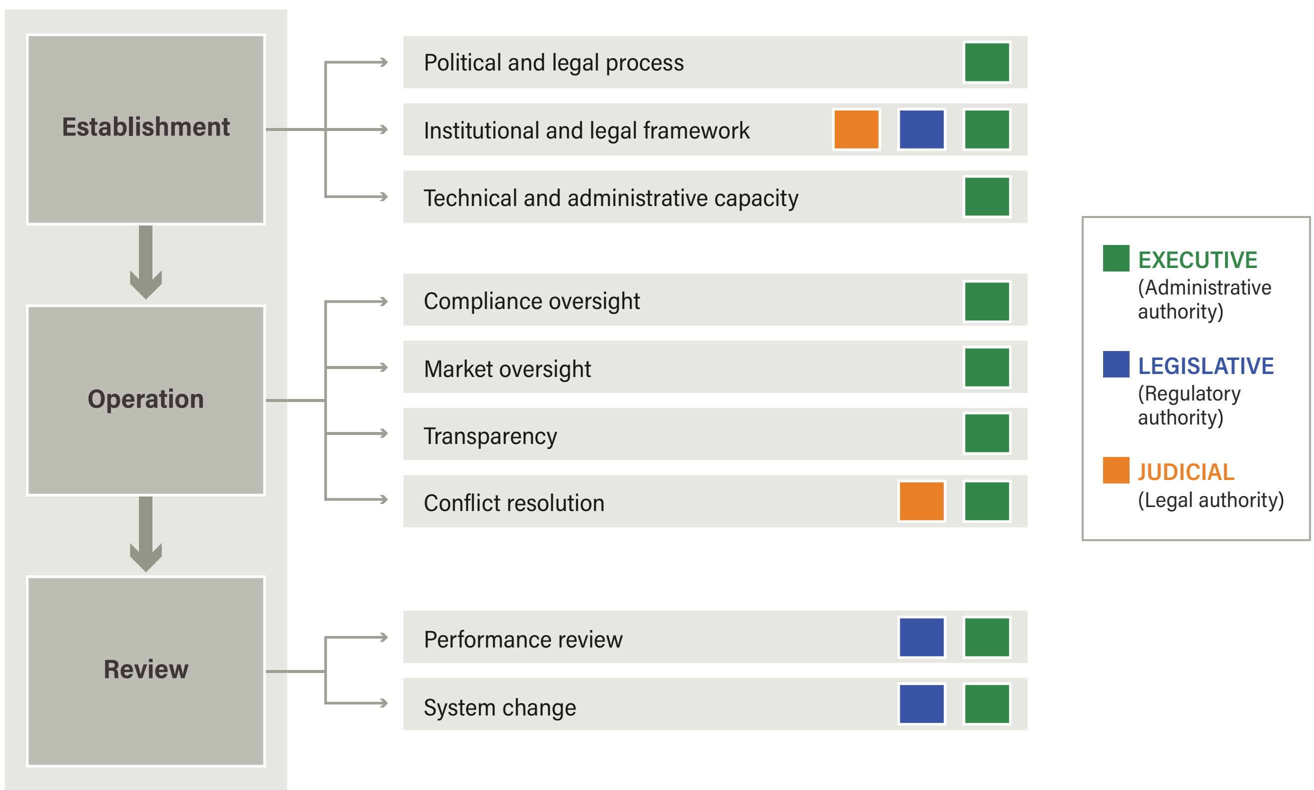
3. **Establishment of a robust regulatory body, rules, regulations, and frameworks**

In order to ensure the smooth, effective, and efficient functioning of the market, robust institutions must be established. Figure 4 presents a mapping between the typical governance aspects related to an ETS and institutions involved. As outlined by Hingne (2018), three kinds of institutions are necessary:

- **Regulatory authority.** Develops the rules, regulations, policies, guidelines, and standards of implementation. This authority also governs the market by enforcing regulations and ensuring compliance through the enforcement of a penalty, and engages with stakeholders through every step of the process.
- **Administrative authority**. Oversees core implementation, manages the technical platforms for MRV and trading, and builds capacity.
- **Legal authority.** Resolves conflicts or grievances through legal proceedings and holds all stakeholders and institutions accountable to democratically legislated policies.

For example, the Chinese ETS is governed at three levels of government: the Ministry of Ecology and Environment at the national level is the overall regulator that sets the rules and oversees the system and trading; the subsidiaries

FIGURE 4 | Institutions responsible for different governance aspects of ETS



Source: PMR and ICAP 2022.

of the Ministry at the provincial level oversee the implementation of the rules; and municipal-level authorities take up local management responsibilities (ICAP 2021b).

In the case of the EU ETS, the overall mandate on objectives, measures, scope, coverage, and cap is governed by formal legislation at the EU-level by the European Commission. Allocation of allowances and registry management were initially governed at the country level but have been centralized in recent years to maintain consistency in methodology and reduce the administrative burden across member countries. Non-government entities have also been involved, such as the common auctioning platform in the EU ETS (European Energy Exchange) and third-party compliance officers for the verification of data, which is present in most carbon markets (PMR and ICAP 2022).

In India's PAT scheme, the governance structure is similar, with public institutions responsible for all aspects except third-party accredited agencies for the verification of data (see Table 10).

Takeaways for India: A three-tiered structure, similar to the Chinese ETS, is recommended for India. A legal authority is especially important to ensure accountability and transparency by the regulator and regulated entities.

4. **Safeguarding competitiveness and avoiding leakage: New entrants reserve**

Apart from providing free allowances to EITE entities as discussed in Section 3.2.2, countries may also create a new entrants' reserve (NER) of allowances for new factories or power plant installations or for those installations whose capacity has increased significantly since their free allocation was determined. This avoids giving (carbon) market power to incumbents in free-allocation systems, where exclusive grandparenting could be used to strategically block competition or reduce incentives to expand production. However, the reserve should be counted toward the country's emissions reduction target to provide transparency and ensure that the quantity-based nature of carbon pricing in carbon markets is retained, rather than allowing for increased emissions as a result of increased economic activity. In the EU ETS, for example, the NER is equal to 5 percent of the total allowances (ICAP 2021c).

Takeaways for India: To ensure that the new market entrants don't face barriers to entry, this would be an important consideration for a growing country like India.

5. **Managing distributional impacts**

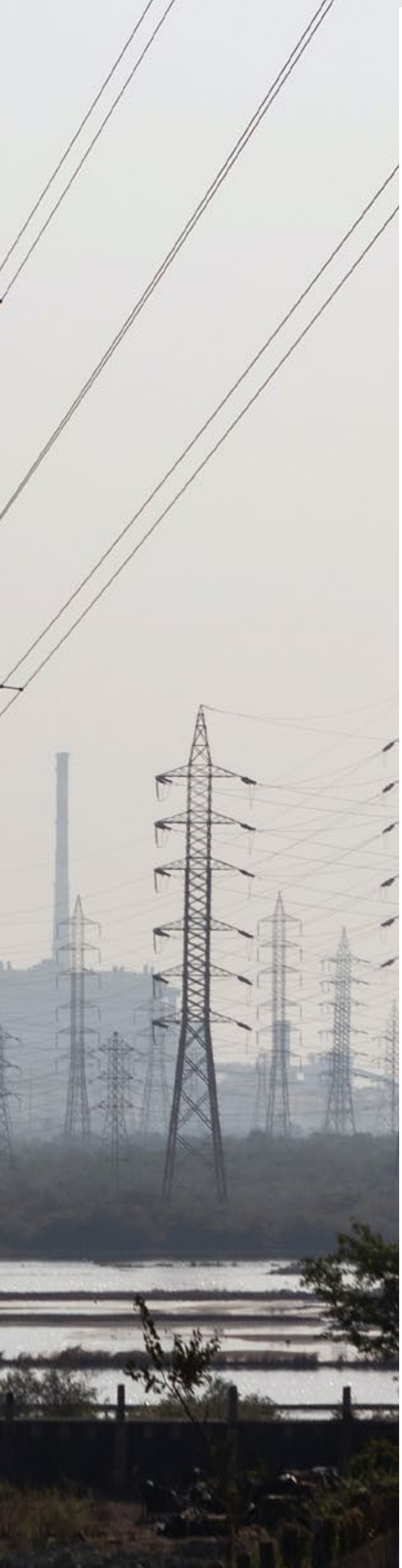
Putting a price on carbon may increase energy prices for consumers, impacting disadvantaged communities, small businesses, and other vulnerable stakeholders the most. It is important to at least partially alleviate the negative impacts on these stakeholders. Table 4 (in Section 3.1) provides an overview of some of the ways in which countries have attempted to redistribute auction revenues to support impacted stakeholders, achieve other socio-economic objectives, and support innovation and technology adoption among poorer countries.

Takeaways for India: Including measures for the redistribution of auction revenues among impacted and vulnerable stakeholders is a very important consideration for India to ensure that climate policy avoids negatively impacting the most vulnerable people and businesses while still pursuing clean development or adaptation goals. In the initial phases, when 100 percent of allowances are allocated for free, the budget for these measures must come from the government. Further, as long as electricity prices in India are regulated, the additional cost from the carbon price will fall upon distribution companies, so measures to alleviate negative impacts from higher prices of electricity generation will have to be directed toward them (such as financing technical upgrades needed to absorb more renewable energy into the grid and adopting more battery storage).

TABLE 10 | Governance structure of India's PAT scheme

REGULATOR	ADMINISTRATOR	STATE NODAL AGENCY/ ADJUDICATOR	VERIFIER	TRADING REGULATOR	REGISTRY
Ministry of Power (MoP)	Bureau of Energy Efficiency (BEE)	State-designated Agency/ State Electricity Regulatory Commission (SERC)	Empanelled Accredited Energy Auditor	Central Electricity Regulatory Commission (CERC)	Power System Operation Corporation (POSOCO)

Source: BEE 2021.

CHAPTER 4

Simulating a carbon market

To inform evidence-based design for a carbon market in India, we conducted a carbon market simulation between January through December 2020, with 21 leading Indian companies, representing 9.2 percent of India's industry sector GHG emissions. This chapter outlines the design and operationalization of the simulation, the emissions reductions and compliance achieved as well as trading and price trends observed in the market.

OVERVIEW OF THE CARBON MARKET SIMULATION

The carbon market simulation included 21 leading Indian companies, representing 9.2 percent of India's industry sector GHG emissions,[3] and covered a compliance period of one calendar year (January through December 2020). The simulation covered activities spanning target setting and allocation of emissions allowances to participants, three trading cycles for the buying and selling of allowances, self-reporting of emissions data, and the surrender of allowances at the end of the one-year compliance period of the notional market. The research exercise involved no real monetary exchanges among the participating companies and trading conducted was based on notional allowances and targets. Figure 5 shows an overview of the simulation activities.

SIMULATION DESIGN AND METHODOLOGY

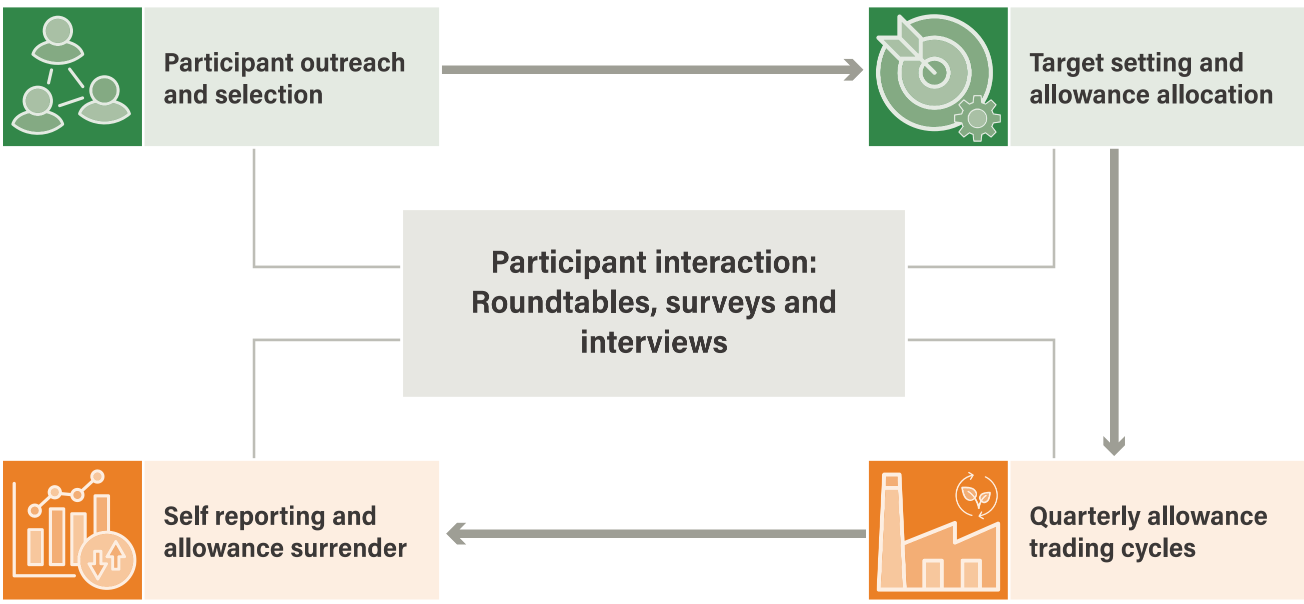
The design of the notional market for the simulation was informed by the considerations discussed in Section 3, taking into account the practical limitations from the voluntary nature and limited scope of this study. The following section describes the design of the market and how the different design parameters were operationalized within the simulation exercise.

Market scope

The market was open to companies from all sectors in order to understand the feasibility of a market with a wider sectoral coverage, as compared to existing MBMs in India (see Section 3.2), and also to obtain a feasible sample size, given the voluntary nature of the exercise. No emissions threshold was imposed for the same reason. The only prerequisite for participation was the availability of a GHG inventory to meet the requirement of emissions data for the exercise, which several large Indian companies undertake on a voluntary basis. As a result, the emissions of participants exhibited a wide range, from 362 tonnes of CO_2e to 52 million tonnes CO_2e in 2018.

The organizational boundaries of the regulated entities were kept consistent with those adopted for their voluntary accounting and reporting. All direct (Scope 1) and energy indirect (Scope 2) emissions sources included in the GHG inventory of companies were covered to increase the

FIGURE 5 | Overview of simulation activities



Source: WRI authors.

emissions coverage of the market. Other indirect (Scope 3) emissions were excluded due to a lack of consistency in accounting this category of emissions among companies, and the possibility of overlap in Scope 3 emissions sources of participating companies.[4] The scope of the market is summarized in Table 11.

Participant selection

To select participants for the exercise, we identified a list of all Indian companies that voluntarily report their GHG emissions through corporate sustainability reports or as disclosures to non-governmental organizations, such as CDP, that collect such information from the corporate sector for investors. From the resulting list of approximately 60 possibilities, we then contacted each company for participation in the exercise; 21 companies from across 9 corporate sectors chose to participate. The list of participants is included in Appendix A. The sectors of the participating companies have been grouped into four categories based on their emissions profile for ease of representation in the analysis:

- Cement and utility (including power generation and distribution and transport sectors)
- Fast-moving consumer goods (FMCG), engineering, and automotive
- Chemical and textile
- Service and real estate (including banking, insurance, and information technology)

Figures 6 and 7 provide an overview of the distribution of the participating companies and emissions, respectively, among the four sectoral categories. Figure 8 shows the distribution of emissions among the 60 Indian companies that voluntarily report their GHG emissions and the

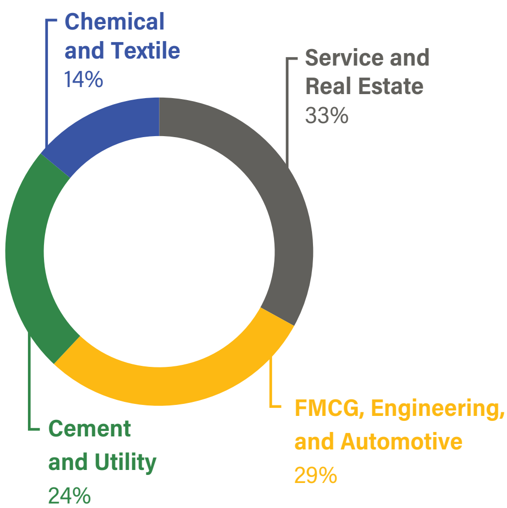
TABLE 11 | Scope of the simulation market

DESIGN PARAMETER	CHOSEN OPTION
Sectors covered	All corporate sectors
Emissions threshold	No threshold
Regulated entity	Company
Emissions covered	All Scope 1 and Scope 2 emissions sources included in the GHG inventory of the company

Source: WRI authors.

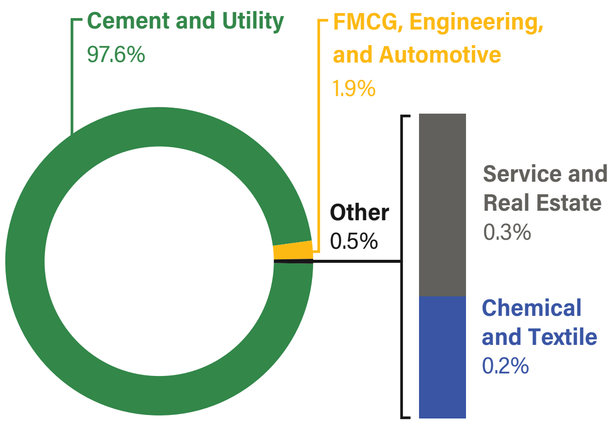
21 companies that opted to participate in this exercise through a Lorenz curve. The distribution is similar, with over 90 percent of total emissions of the set represented by less than 20 percent of companies; this indicates that companies from emissions-intensive sectors comprise only a small part of the sample in both cases.

FIGURE 6 | Sectoral distribution, based on number of participating companies



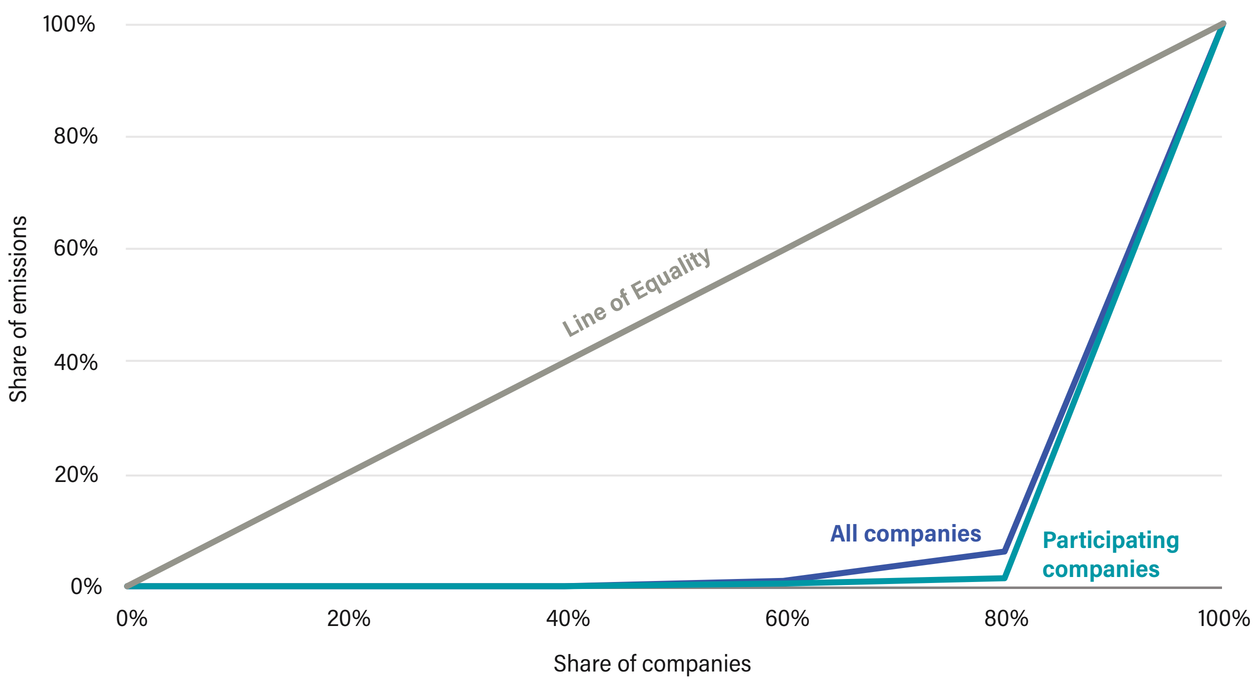
Source: WRI authors.

FIGURE 7 | Sectoral share of total emissions from participating companies (tCo_2e)



Source: WRI authors.

FIGURE 8 | Distribution of emissions of all reporting companies as compared to participants



Source: WRI authors.

Target setting and allocation

We chose an emissions intensity cap for the market due to the likelihood of its adoption in the Indian context, given the nature of targets adopted in India's NDC, the PAT scheme, and voluntary targets in the corporate sector (see Section 3.2). We used a bottom-up approach to determine the cap by setting an emissions reduction target for each participating company. The choice of the intensity metric for the target varied among participants. For example, for manufacturing-based companies, the target was set in terms of emissions per unit of production, whereas for service sector companies it was set in terms of emissions per unit of revenue generated. The bottom-up approach for target setting was chosen to:

- Add a reasonable level of ambition into existing targets of companies, given that no additional emissions reduction efforts may be feasible for participants for this notional exercise.
- Obtain stakeholder buy-in from organizations across different sectors and various levels of climate ambition, given the voluntary nature of the exercise.

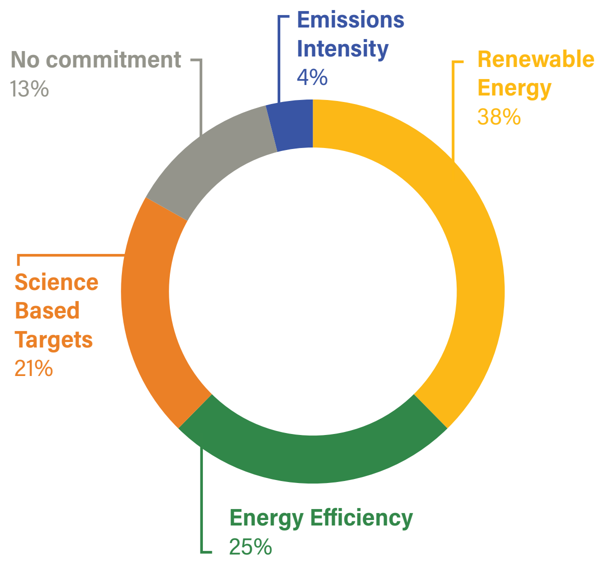
This bottom-up approach implies a free allocation of allowances to each participant corresponding to their set target (see Section 4.2.5 for the correspondence between set targets and issued allowances). The cap setting and allocation approach for the exercise is summarized in Table 12.

To arrive at the target value for each participant for the year 2020, which represented the compliance period for the exercise, we used an approach that combined grandparenting and benchmarking. 2018 was used as the base year for target setting. Sectoral performance or technology benchmarks were not used in target setting, due to their unavailability in the Indian context and the intensive data requirements associated in creating such benchmarks. Instead, up to four scenarios projecting different annual emissions trajectories were developed for each company, of which one was selected as their target trajectory. The four scenarios were as follows:

- **Scenario 1 – Business as Usual (BAU):** Employing a grandparenting approach, the BAU scenario was constructed by linearly extrapolating the emissions intensity in the base year (2018), based on the trend of the change in the emissions intensity of the company observed over the past two years, to the target year (2020). This scenario represented their future emissions trajectory based on past reduction trends, with no additional effort to reduce emissions in the future.

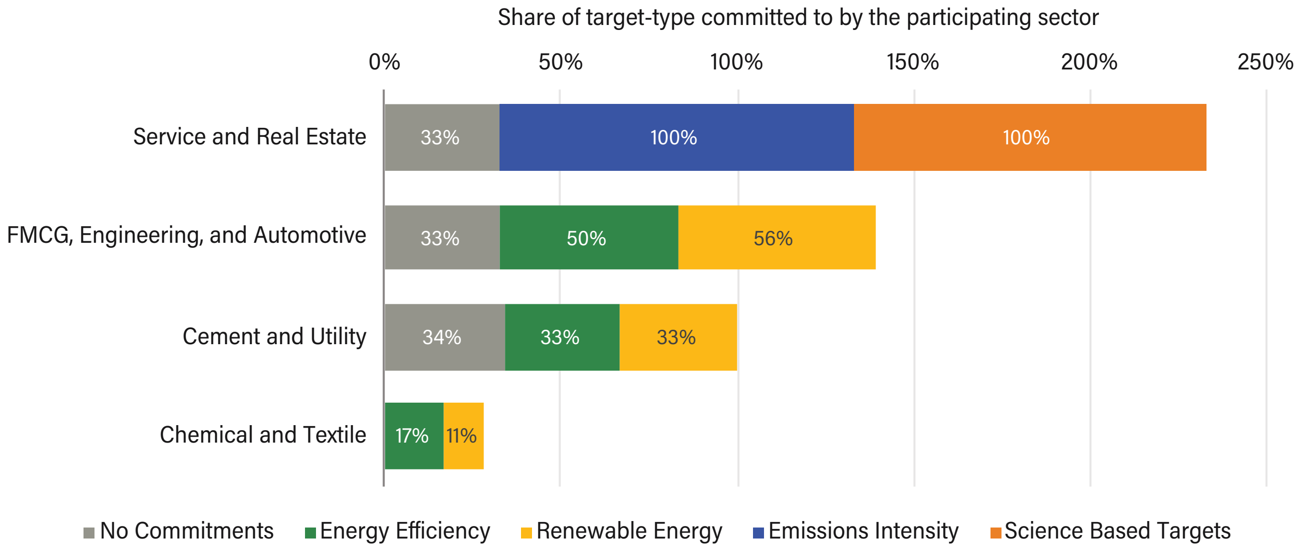
- **Scenario 2 – Government Policy Mandate**: For those participants covered under the PAT scheme—5 of the 21 participants—their PAT target was considered as a target option, converted from energy intensity to emissions intensity. The 2020 value required for the exercise was determined by linearly interpolating the emissions intensity between the base year value and the target year value of the PAT target.
- **Scenario 3 – Voluntary/Internal Target**: All but three participating companies had voluntary commitments to reduce their emissions intensity or other commitments quantifiable in terms of reductions in emissions intensity, such as energy efficiency or renewable energy uptake (see Figures 9 and 10). In such cases, these commitments (converted to emissions intensity) were also considered as a target option. The 2020 value required for the exercise was yielded by linearly interpolating the emissions intensity between the base year value and target year value of the voluntary target.
- **Scenario 4 – Benchmark/Science Based Target**: The Science Based Targets initiative (SBTi) provides an approach to set company-level targets compatible with a global 1.5°C or 2°C temperature rise scenario (SBTi 2023).[5] In the simulation, an SBT was calculated for each company as the benchmark scenario using the SBTi target-setting tool, considering 2018 as the base year and 2030 as the target year for constructing the target trajectory (SBTi requires target timeframes between five and fifteen years). The 2020 value from this trajectory was considered as a target option for the exercise.

FIGURE 9 | Existing voluntary targets of the participating companies, by target type



Source: WRI authors.

FIGURE 10 | Distribution of voluntary target types of participating companies across sectors



Source: WRI authors.

Each company was then given the option to choose from either the most ambitious target option between Scenarios 1, 2, and 3 or the target option from Scenario 4 as its target for the exercise. Figure 11 presents a comparative overview of sectoral target ambitions set for this exercise—in terms of average percentage reduction in emissions intensity from the base year—as compared to the existing targets (voluntary or policy) of participating companies.

Other market design parameters

We chose a one-year compliance period for the market, as an annual timeframe aligns well with compliance periods observed in several markets around the world and with emissions reporting at the corporate and national levels. It also fit the timeframe of this study, which precluded the possibility of a longer compliance period.

In the absence of any information on the dynamics of a carbon market in the Indian context, no current evidence exists on the need for temporal and spatial flexibility parameters such as banking, borrowing, or offsets. Thus, to reduce the complexity of the market rules and limit the duration of the exercise to a single compliance period, they were not included in the market design. Price collars also were not introduced for the market clearing prices to be fully reflective of the market dynamics.

BOX 2 | Illustrative example of target setting

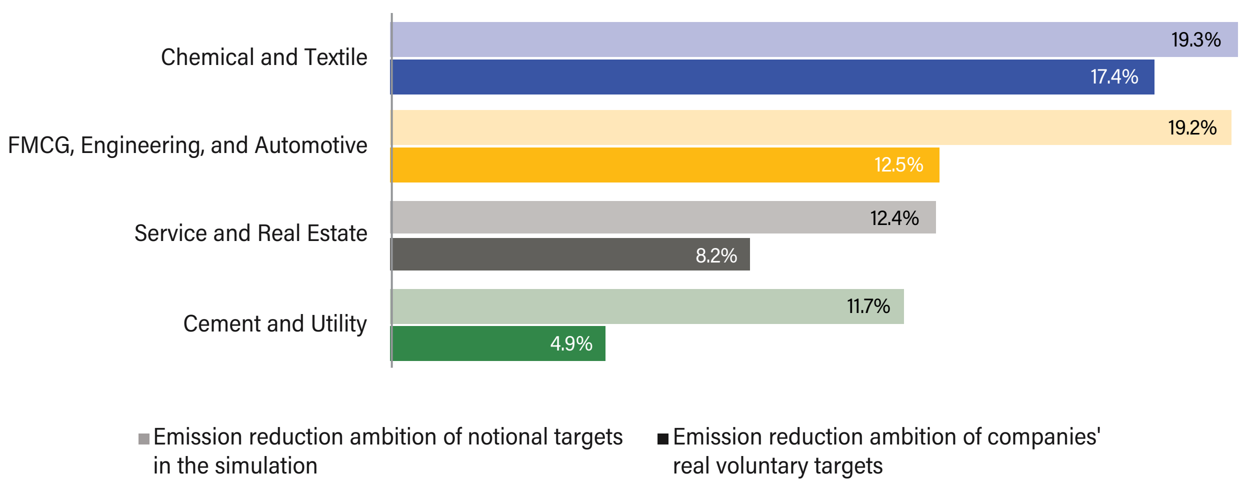
A cement company ABC has a base year (2018) emissions intensity of 0.72 tonnes CO_2e per tonne of cement. ABC's emissions intensity was reduced by 3 percent between 2016 and 2018. The 2020 target values calculated for the company under the four target scenarios are:

- **Scenario 1, BAU:** 0.70 tonnes CO_2e per tonne of cement (assuming a 3% reduction between 2018 and 2020)
- **Scenario 2, Government Policy Mandate:** 0.69 tonnes CO_2e per tonne of cement
- **Scenario 3, Voluntary/Internal Target:** 0.68 tonnes CO_2e per tonne of cement
- **Scenario 4, Benchmark/ SBT:** 0.65 tonnes CO_2e per tonne of cement

In this case, company ABC is given an option to choose either 0.68 tonnes CO_2e per tonne of cement (the most ambitious target option between Scenarios 1, 2, and 3) or 0.65 tonnes CO_2e per tonne of cement (the target option from Scenario 4) as its target for the exercise.

Source: WRI authors.

FIGURE 11 | Average ambition of simulation targets vs voluntary targets, by sector



Note: Target ambition represents the average targeted reduction in emissions intensity by sector in 2020, relative to baseline (2018) levels.

Source: WRI authors.

Given its voluntary nature, the exercise relied on participating companies' self-reported emissions data and imposed no penalty for non-compliance. These design parameters are summarized in Table 13.

Allowance issuance and surrender

Allowance issuance and surrender was done statically for simplicity: base year activity levels (in terms of participants' chosen intensity metric) were used to convert participants' targeted and achieved emissions intensity values to the number of allowances issued and surrendered, respectively. 2018 was chosen as the base year.

TABLE 12 | Cap-setting and allocation in the simulation market

DESIGN PARAMETER	CHOSEN OPTION
Type of cap/target	Emissions intensity in *tCO_2e per unit of output*
Cap/target-setting approach	Bottom-up (heterogeneous approach chosen on a voluntary basis)
Value of overall cap/target for the market	55.6 $MtCO_2e$ in 2020 (compared to base year emissions of 57.9 $MtCO_2e$)
Cap/target allocation	Free allocation

Note: Value of overall target obtained by summing bottom-up targets of each participant at static (base year) levels of economic activity.
Source: WRI authors.

TABLE 13 | Other design parameters of the simulation market

DESIGN PARAMETER	CHOSEN OPTION
Length of compliance period	1 year
Penalty	No penalty
MRV	Self-reported data; no verification
Temporal flexibility parameters	No banking or borrowing
Spatial flexibility parameters	No offsets
Price stability parameters	No price collars or market stability reserve

Source: WRI authors.

Issuance

Each participant was issued a quota of emissions allowances at the beginning of the compliance period corresponding to their individual target, calculated as:

$$A_f = \textit{Targeted emissions intensity (2020)} \times \textit{base year (2018) value of intensity metric}$$

Surrender

Each participant was obliged to surrender a certain number of allowances after the end of the compliance period depending on the actual emissions intensity achieved in the compliance period, calculated as the following, in which achieved emissions intensity is calculated as (Emissions in 2020) / (Activity Level in 2020):

$$A_s = \textit{Achieved emissions intensity (2020)} \times \textit{base year (2018) value of intensity metric}$$

Trade

Participants were given the opportunity to trade allowances quarterly during the compliance period (see 4.2.6 for the trading methodology). A participant's net balance of traded allowances, A_t, at any time can be calculated as:

$$A_t = \textit{Number of allowances purchased} - \textit{number of allowances sold}$$

The number of surplus (or deficit) allowances A_+ with a participant can then be calculated as (with a negative value indicating a deficit):

$$A_+ = A_f - A_s + A_t$$

Participants were encouraged to trade such that at the end of the compliance period, they would achieve a value of $A_+ = 0$. A value of $A_+ < 0$ at this point would imply a failure to meet the required surrender obligation and result in a default, whereas $A_+ > 0$ would imply the participant having unused allowances that could have been sold in the market for a price, given the absence of temporal flexibility provisions in this market.

Furthermore, assuming that the regulated entity participates in the market in the most cost-effective manner, they should attempt to achieve a final value of $A_+ = 0$. This implies that participants need to assess their marginal abatement cost of emissions with regard to prevailing and expected market prices of allowances to decide an optimal compliance strategy as a combination of emissions abatement and market trade.

BOX 3 | Example of allowance issuance and surrender

A cement company ABC chooses target emissions intensity of 0.65 tonnes CO_2e per tonne of cement for the simulation. ABC produced 1,000 tonnes of cement in the base year chosen for target setting. The number of emission allowances allocated to ABC in this case will be:

$$A_{f\,ABC} = 0.65 \times 1{,}000 = 650 \text{ allowances}$$

ABC had an emission intensity of 0.67 tonnes CO_2e per tonne of cement in the compliance period. The number of allowances ABC is obliged to surrender at the end of the compliance period will be:

$$A_{s\,ABC} = 0.67 \times 1{,}000 = 670 \text{ allowances}$$

In the ideal case, ABC would purchase 20 allowances during trading by the end of the compliance period to be able to exactly meet its surrender obligation, achieving a value of $A_t = 20$ so that $A_+ = 0$ at the end of the compliance period.

Source: WRI authors.

Note that this simplified implementation avoids the need for ex-post adjustment of allowance quotas based on activity levels during the compliance period, but allowances do not represent absolute emissions (in tonnes) over the compliance period. Emissions trading schemes with intensity targets, such as the Chinese ETS, use activity levels in the compliance period for allocation such that allowance quotas equal actual tonnes emitted in the compliance period (similar to a system with an absolute cap). However, since activity levels are not known ex-ante, the design of such schemes must incorporate a provision for ex-post adjustment—that is, adjustment for over-allocation or under-allocation of allowances, depending on the difference between forecasted and actual activity levels.

Trading methodology

The method employed for trading was a double auction, typically used to facilitate the exchange of a homogeneous commodity (such as emissions allowances) between multiple buyers and sellers. A double auction allows market participants to submit buy offers (bids) or sell offers (asks), which are matched against each other, and eligible offers are executed.

Auction variant and pricing scheme used

A double auction has two basic variants. The first is continuous auctioning, wherein bids and asks are continuously matched against each other and executed if the bid price exceeds the ask price. The corresponding pricing scheme to this variant is *discriminatory pricing*, because each trade is typically executed at a different matching price.

The other variant is periodic or call auctioning, through which participants submit bids and asks within a predetermined time interval. The market is cleared at the end of this time interval by determining the aggregate market demand and supply, which in turn determine the market clearing price (MCP) and trade volume. The corresponding pricing scheme is typically a uniform pricing scheme, wherein all eligible bids (greater than or equal to MCP) and eligible asks (less than or equal to MCP) are executed at the MCP.

We chose call auctioning with uniform pricing as the trading variant for this exercise in order to bring all participants to the market within a specified time-window, which was important to provide liquidity in the market, keeping in mind the small number of participants in the exercise. Each quarterly trading cycle was conducted as a static or single-round auction, wherein each participant is allowed to submit multiple bids or asks (desired quantities of allowances for purchase or sale at different price points), without any interaction with or knowledge of bids or asks of other market participants. Submitted bids and asks that meet the eligibility criterion upon market clearance are then executed. A static, uniform price call auction is similarly the trading approach adopted by both existing MBMs in India (PAT and REC), indicating the potential likelihood of its adoption in the context of a carbon market, which also made it an appropriate choice for this exercise.

Market clearance

Market clearance, performed after the close of the time window for the submission of bids and asks in each trading cycle in the exercise, involved the following steps:

1. The aggregate demand and aggregate supply curves for allowances were constructed by aggregating the received bids and asks, respectively, at all available price points.
2. The MCP was defined as the price point at which the aggregate demand and aggregate supply curves intersect.

3. All bids with bid prices greater than or equal to the MCP and asks with ask prices less than or equal to the MCP were executed at the MCP.

For example, in the case of the aggregate demand and aggregate supply curves shown in Figure 12, the market would be cleared at a price of INR 800, resulting in a trade volume of 150 allowances at that price; bids made at or above INR 800 and asks made at or below INR 800 would be executed at a uniform price of INR 800.

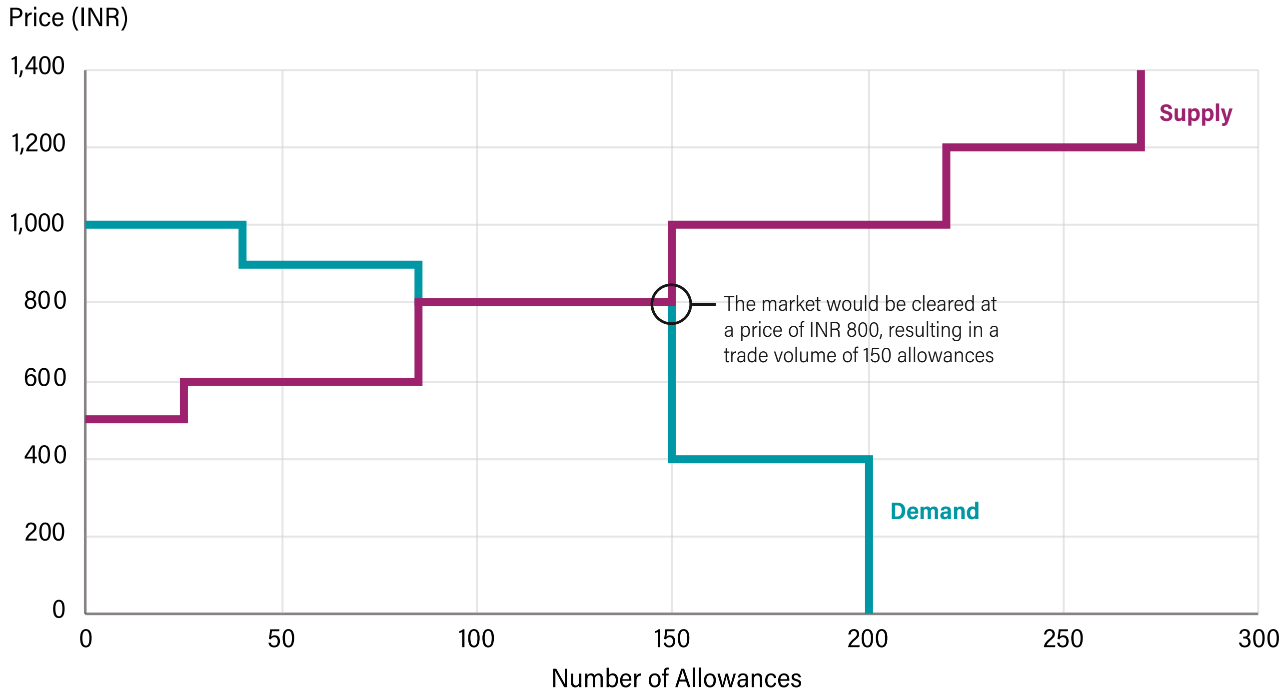
Capacity building and stakeholder engagement

There are various capacity needs in the context of carbon markets: ability to measure and report GHG emissions (GHG accounting); ability to identify and implement emissions reduction interventions (GHG management); and ability to effectively participate in the carbon market, understand its modalities and processes, and make appropriate trading decisions to demonstrate compliance at the least (internal) cost. For our analysis and recommendations, we classify these into four levels of capacity, elaborated in Table 14.

For the purpose of the exercise, we did not invite companies from Category A, due to their lack of data availability. Given the differing levels of capacity in participants, the exercise also included activities to build readiness of the participants through the following opportunities:

- Continuous one-on-one engagement with each participant on market modalities, emissions and allowance calculations, and trading rules.
- Roundtables to disseminate information and answer queries on the rules, modalities, and outcomes of trading.
- Detailed analysis of market outcomes, price discovery, and demand-supply of allowances, shared with participants through a trading newsletter after each round of trading.

FIGURE 12 | A representative illustration of market clearance in the exercise



Source: WRI authors.

TABLE 14 | Classification of capacity for market readiness in the corporate sector

CATEGORY	CURRENT CAPACITY	READINESS
A	No understanding of accounting and reporting of GHGs No GHG management plan No experience in carbon markets or other market-based mechanisms	Needs substantial capacity building
B	Accounting and reporting GHGs No GHG management plan No experience in carbon markets or other market-based mechanisms	Needs significant capacity building
C	Accounting and reporting GHGs Has GHG management plan No experience in carbon markets or other market-based mechanisms	Needs some capacity building
D	Accounting and reporting GHGs Has GHG management plan Has experience in carbon markets or other market-based mechanisms	Ready or needs minimal capacity building

Source: WRI authors.

LIMITATIONS OF THE SIMULATION

- This research exercise imposed no legal or financial obligations on the participating companies, and all financial transactions were notional without the involvement of real money. This has implications for outcomes observed in the notional market, such as the demand and supply of allowances, market clearing price, efficiency gains, and compliance rate, which may not be fully representative of those in a real market with legal and financial obligations.
- Given the voluntary nature of this exercise, eligible companies under the chosen scope of the simulation market were not mandated to participate. As a result, the final sectoral spread and size of the notional market were a result of voluntary participation and do not fully represent the sectoral spread and level of capacity of the Indian industry. This implies a self-selection bias, which may over-represent the scale of climate ambition or capacity in market participants, as compared to the average in the Indian corporate sector, and in turn reflect in the outcomes of the notional market. To the extent possible, our analysis of the outcomes and our recommendations have tried to account for this bias.
- Outcomes of the notional market rely on the assumption of profit maximization behavior of participants, which in turn relies on the knowledge of internal marginal abatement cost curves as well as the ability to track and forecast emissions performance over the compliance period. Given that the exercise represented the first experience of emissions trading for market participants, outcomes in the notional market are not only representative of the chosen design parameters, but also of the capacity and/or information (or lack thereof) among market participants.
- The exercise relied on participants' self-reported emissions data. The notional market outcomes therefore must assume integrity of the data submitted by the participants.

STUDY OUTCOMES

Trading outcomes

The simulation consisted of three trading cycles over the duration of the annual compliance period (2020). Of these, the first two were interim, taking place after six months and nine months, respectively, from the start of the compliance period. These gave participants an opportunity to buy or sell allowances, based on their respective evaluations of current and expected performance in regard to their targets and internal strategy of meeting the same at the least cost. The third and final trading cycle involved two rounds of trading and took place at the end of the compliance period, giving them an additional opportunity to clear any remaining allowance surplus or deficit. After the completion of this trading cycle, participants were required to surrender allowances corresponding to their achieved emissions intensity over the compliance period. The key market outcomes from the three trading cycles are summarized in Table 15 and discussed further in Section 4.5. Figure 13 provides an overview of the market clearing price and trade volumes across the trading cycles. Further details on market outcomes of each trading cycle are included in Appendix C.

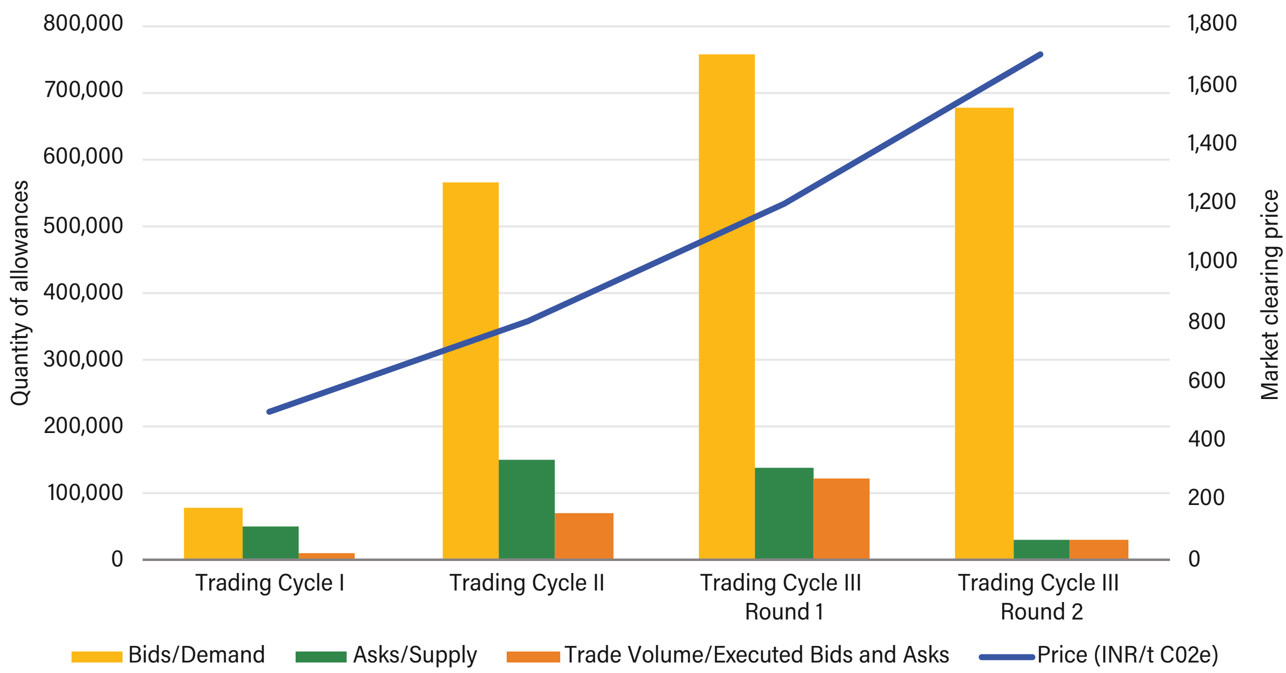
TABLE 15 | Overview of key trading outcomes from the simulation

PARAMETER		TRADING CYCLE I	TRADING CYCLE II	TRADING CYCLE III - ROUND 1	TRADING CYCLE III -ROUND 2
Bid market (demand)	Quantity of bids submitted (in number of allowances; 1 allowance = 1 tCO_2e)	77,570	5,65,725	7,54,675	6,74,341
	Minimum & maximum bid prices quoted	INR 300–1100	INR 100–1500	INR 300–1500	INR 900–2000
Ask market (supply)	Quantity of asks submitted (in number of allowances; 1 allowance = 1 tCO_2e)	48,440	1,49,070	1,35,124	27,523
	Minimum & maximum ask prices quoted	INR 500 – 4000	INR 100 – 5000	INR 600 – 2100	INR 700 – 1600
Market aggregation	MCP	INR 500	INR 800	INR 1200	INR 1700
	Trade volume	10,000	69,535	1,21,024	27,523
	Trade volume as % of max possible trade volume	21%	47%	90%	100%

Note: The maximum possible trade volume is defined as the minimum quantity between the total quantity of bids submitted and the total quantity of asks submitted. For example, for Trading Cycle I, the total quantity of bids was 77,570 and the total quantity of asks was 48,440. Thus, the maximum possible trade volume for Trading Cycle I was 48,400.

Source: WRI authors.

FIGURE 13 | Market clearing price and trade volumes across the three trading cycles



Source: WRI authors.

Emissions abatement and compliance

The sum of all the individual emissions intensity targets of each participating company added up to an emissions cap of 55.6 million metric tonnes of CO_2e ($MMTCO_2$e), a targeted reduction of 2.3 $MMTCO_2$e from total base year (2018) emissions of 57.9 $MMTCO_2$e. Total emissions of participants over the compliance period were reduced by 1.1 $MMTCO_2$e from the base year—49 percent of the targeted reduction—owing to the achieved improvements in their emissions intensity values over this period. The total excess emissions over the cap (equal to the total deficit of emissions allowances across participants after the conclusion of all cycles of trading) amounted to 1.2 $MMTCO_2$e.[6] These outcomes are summarized in Figure 14 and their causes discussed in Section 4.5.

Efficiency gains

Efficiency gains refer to the economic gains from trade achieved for buyers and sellers in the market, as compared to a scenario where the individual entities would individually meet their respective targets without any trade. Efficiency gains for buyers (consumer surplus) and for sellers (producer surplus) from executed (resulting in trade) bids and asks, respectively, can be calculated as follows:

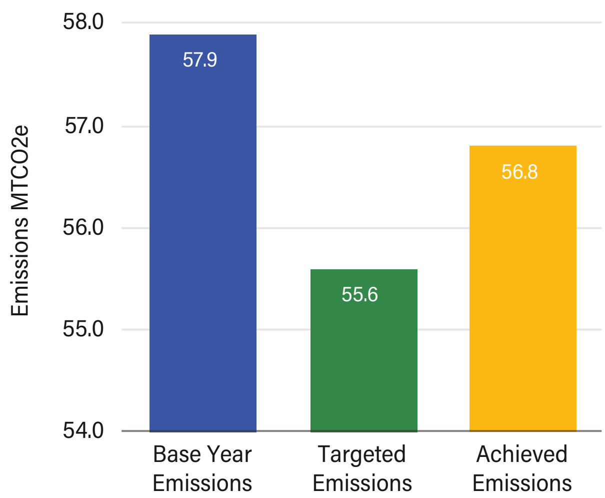
Consumer surplus: Σ [(bid price – MCP) × executed bid quantity]

Producer surplus: Σ [(MCP – ask price) × executed ask quantity]

Summing the consumer and producer surplus gives the total market surplus or efficiency gains from the market. The efficiency gains for each trading cycle in the notional market are summarized in Table 16. The calculations and assumptions are explained in Appendix D.

The total efficiency gains from trade in the notional market across the three trading cycles amounted to INR 8.6 crore. The efficiency gains represented approximately a 28 percent reduction in total compliance costs for participants as compared to a scenario in which the entities would meet their respective targets individually (in the absence of a market).

FIGURE 14 | Base year, total targeted, and achieved emissions ($MTCO_2$e)



Source: WRI authors.

TABLE 16 | Efficiency gains in the market

	EFFICIENCY GAINS (INR)				
	TC I	TC II	TC III-R1	TC III-R2	Total
For buyers (A)	8,72,500	56,75,000	13,10,000	46,60,000	1,25,17,500
For sellers (B)	0	2,34,72,500	3,48,12,200	1,57,63,700	7,40,48,400
Cost efficiency gains through the market (A+B)	872,500	2,91,47,500	3,61,22,200	2,04,23,700	8,65,65,900

Note: For Trading Cycle I there were no asks below the MCP (INR 500), which translates to no efficiency gains for the sellers.

Source: WRI authors.

KEY MARKET OBSERVATIONS

Below we highlight some of the important observations from the simulation and the possible rationale, which may lend itself to useful insights on design parameters and capacity needs.

Demand-supply dynamics, market prices, and compliance

Demand-supply dynamics

- The quantity of bids submitted consistently exceeded the quantity of asks (see Figure 15).
- The range of prices quoted by the bidders consistently rose in each trading cycle. As a result, the market clearing price consistently rose across the four rounds of trading (see Figure 16).

Compliance rate

- The demand for allowances consistently outweighed supply in the market over the course of the compliance period; 45 percent of the companies were not able to meet their respective surrender obligations at the end of the compliance period, resulting in a default.

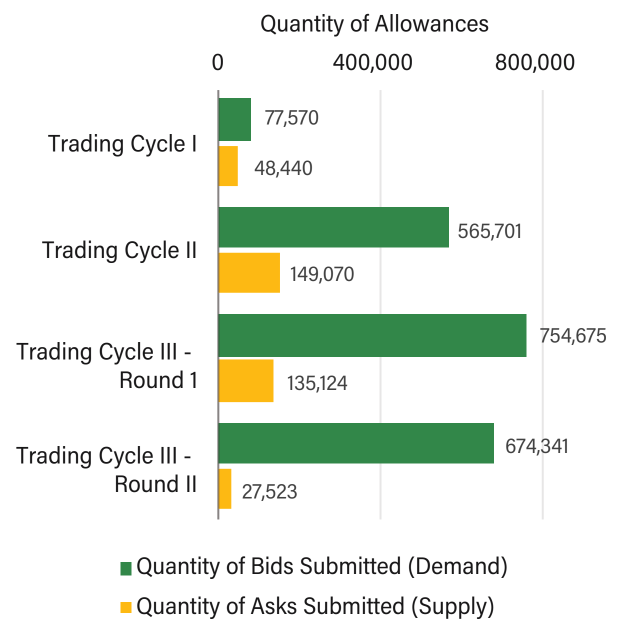
Emissions reductions

- The market achieved 49.3 percent of the targeted emissions reductions (see Figure 14).

Rationale: These observations may be attributed to a relatively high ambition of targeted emissions reduction as compared to participants' voluntary targets (see Figure 17) and the notional nature of the market and compliance. In fact, we see the compliance rate of participants (grouped by sector) is inversely correlated with the difference between the average emissions reduction target for the sector for the simulation exercise and its average voluntary target (see Figure 18).

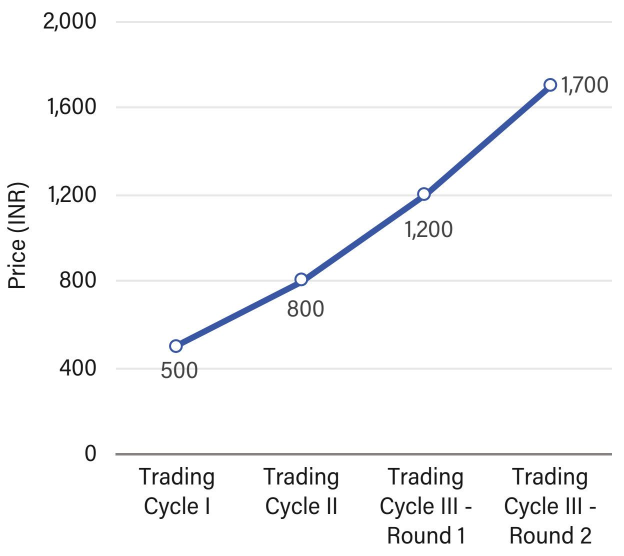
The observations can also be partially attributed to the global COVID-19 pandemic and the associated disruption in planned emissions reduction interventions of companies over this period (see Section 4.6).

FIGURE 15 | Demand and supply in the three trading cycles



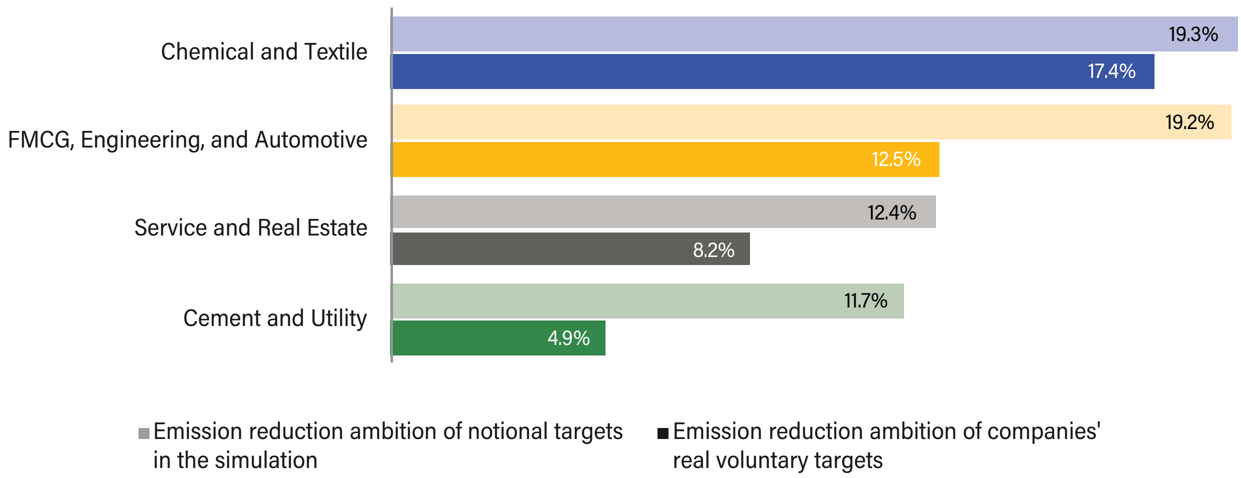
Source: WRI authors.

FIGURE 16 | Market clearing price across the three trading cycles



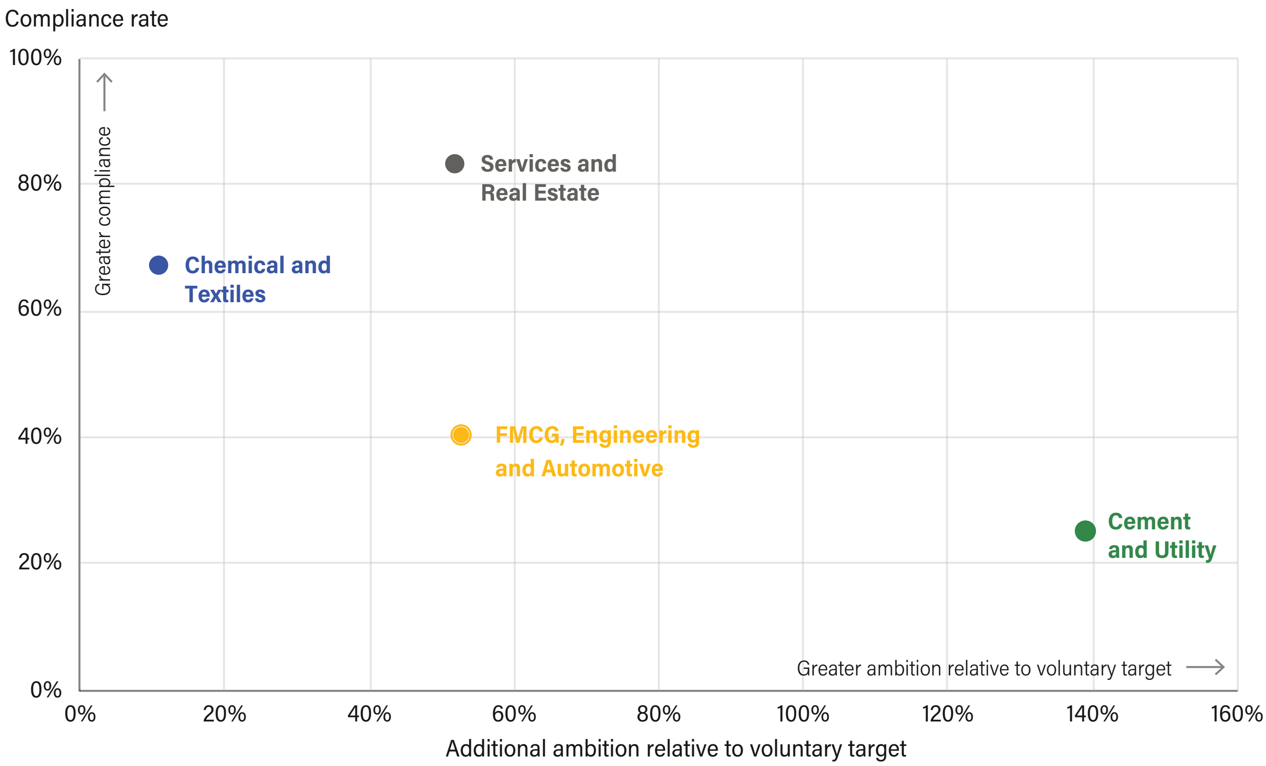
Source: WRI authors.

FIGURE 17 | Targeted reduction in emissions intensity by sector: simulation versus voluntary targets



Source: WRI authors.

FIGURE 18 | Correlation between additional ambition of the simulation targets and compliance in the simulation trading exercise



Source: WRI authors.

Trade volume

Trade volume is the quantity of allowances transacted in the market. We saw a rising trend in trade volume with each successive trading cycle, although the trade volume fell in absolute terms in the last trading round of the final cycle due to the limited supply of allowances in the market. However, looking at the trade volume as a proportion of the maximum possible trade volume—represented by the lesser of the two quantities, the aggregate demand and aggregate supply of allowances in a trading round—we saw a consistent rise across the four rounds of trading from 21 percent in Trading Cycle I to 47 percent in Trading Cycle II, to 90 percent in Trading Cycle III–Round 1, and 100 percent in Trading Cycle III–Round 2 (see Figure 19).

Rationale: This rise may be attributed to an increase in market information on price levels, demand and supply trends, and participants' increasing ability to incorporate market information (namely, the MCP and bid/ask price points of other market players) from the previous rounds of trading into their trading considerations. This explanation is further substantiated by participants' feedback that trading increased their ability to effectively participate in the market and place successful bids and asks.

ECONOMIC SHOCK OF COVID-19 ON THE MARKET

The COVID-19 pandemic imposed unprecedented lockdowns on the Indian economy through 2020, bringing business operations to a halt or slowdown, disrupting supply chains, causing a fall in electricity and fuel consumption, and shifting all service sector operations to telework.

The lockdown also severely impacted the emissions of businesses, as emissions fell with a slowdown in operations in most sectors. India's annual CO_2 emissions from fuel combustion declined by 160 million tonnes, or 7 percent, in 2020 as compared to 2019, in contrast with the average annual growth of 3.3 percent in emissions recorded in the previous four years (IEA 2021a). However, emissions per unit of GDP over the same period actually increased by 1 percent because GDP declined even more sharply than emissions, falling by approximately 8 percent over this period. Other related impacts included the leakage of service sector emissions from electricity consumption (Scope 2 emissions) to employees' residences due to the telework model and the disruption in the planned emissions reduction interventions of several companies from the financial crunch and slowing of supply chains brought about by the lockdown.

FIGURE 19 | Trade volume across the three trading cycles

Source: WRI authors.

As the compliance period for which trading was conducted in this study was January through December 2020, the economic shock due to the COVID-19 lockdowns played a significant role in the participant and market outcomes.

The design of the notional market for the study did not include any stability provisions (see Section 4.2.4), whose effectiveness in response to the market shock could have been tested. However, one chosen design parameter for this study—an emissions intensity target—can increase the resilience of the market to such a shock, in theory. This is because the allocation and surrender of allowances are functions of participants' emissions intensity, which can be expected to remain largely unaffected by the shock. The impact of the shock reflects on both emissions and the intensity metric, thus nullifying or mitigating its effect when taking a ratio of the two. This hypothesis can be practically informed by the impact of the COVID-19 shock on the participating companies' performance, given the choice of emissions intensity targets in the notional market of the study. Consultations with participants on this question revealed that emissions intensity targets had a limited impact on mitigating effects of the shock on market outcomes for two reasons:

- Participants from the service or heterogeneous sectors, such as FMCG, primarily used economic metrics (like revenue) or fixed metrics (such as number of employees) to calculate emissions intensity. They found that the values of emissions and the intensity metric were not proportionally affected by the shock due to a loose coupling between emissions and the intensity metric. This is a problem with intensity metrics for such sectors (See Box 4).
- Participants from homogenous, manufacturing-based sectors primarily used physical metrics, such as production, to calculate emissions intensity. They also found their emissions intensity affected by the shock, although to a lesser degree. This was due to the link between the efficiency of production processes and the scale of production. Companies that were producing at less-than-optimum capacity due to disruptions from the shock found, in general, that emissions did not fall in proportion to production because of a decline in efficiency at smaller production scales.

Figure 20 shows the response of the participating companies, by sector, to the perceived impact of the pandemic on their performance with respect to their emissions intensity targets in the simulation.

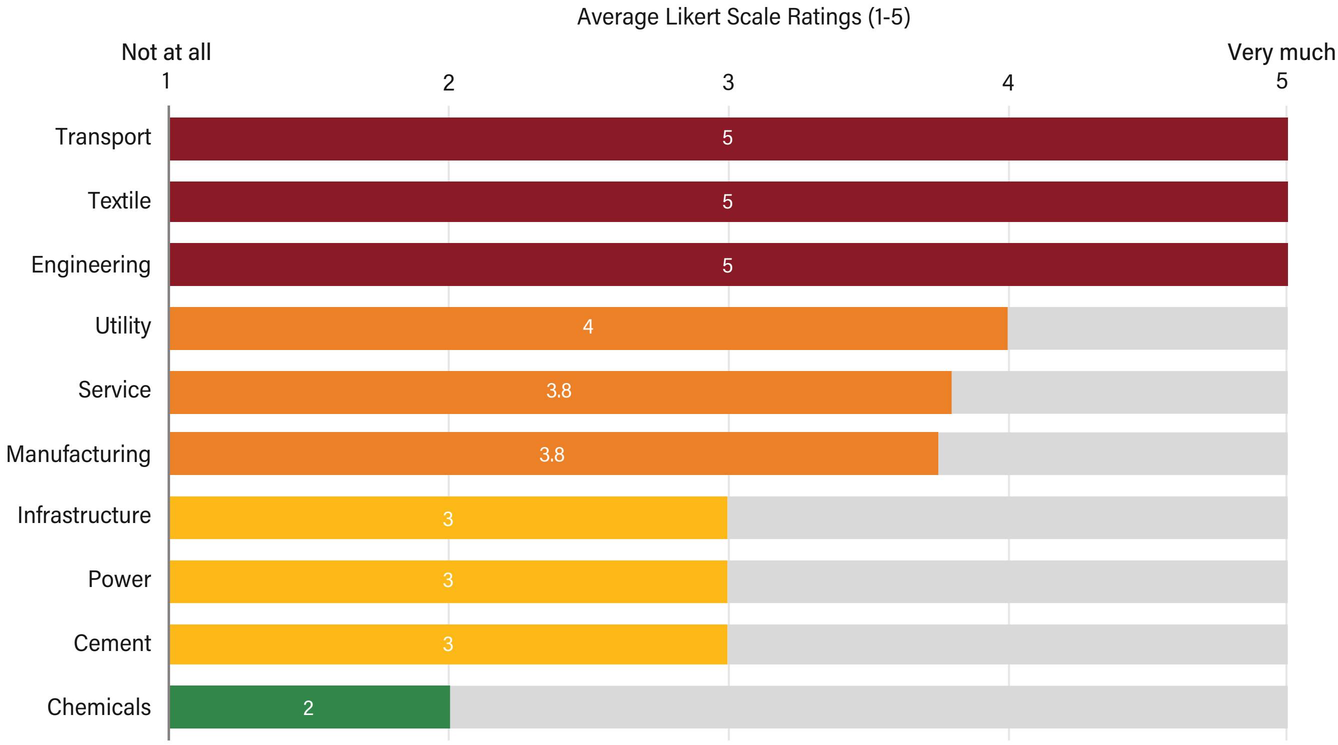
BOX 4 | Weak coupling between economic intensity metrics and emissions in the COVID-19 pandemic

Economic intensity metrics are more loosely coupled with emissions in general (as compared to physical intensity metrics) because they are susceptible to price changes and to inflation (unless used in real terms, which is not the case with voluntary targets in the Indian corporate sector).

Furthermore, during the economic shock due to the COVID-19 pandemic, we observed that production and sales were not proportionally disrupted for several participating companies, further resulting in disparities between emissions and economic intensity metrics. For example, in the case of a company that used revenue as its intensity metric, production was severely disrupted (thereby significantly reducing emissions), but sales were not significantly disrupted—the company continued to sell from its inventory, thereby showing no significant reduction in revenue. This resulted in its calculated emissions intensity value over-representing its emissions reduction efforts.

Source: WRI authors.

FIGURE 20 | Perceived impact of COVID-19 on participant performance in the carbon market simulation



Source: WRI authors.


CHAPTER 5

Analysis and recommendations

This chapter synthesizes our analysis of the simulation outcomes and participants' feedback in the light of India's socio-economic context and the emerging carbon market landscape internationally to provide practical recommendations on carbon market design, allied policies and capacity building needs to ensure efficient, effective, and sustained emissions reductions and a stable, enduring carbon market in India.

This section presents the key considerations for carbon market design and implementation, drawn from the lessons of international and domestic markets (Section 3) and outcomes from the carbon market simulation and feedback from participants (Section 4). These are contextualized for India, given its economic, climate, and other developmental priorities and prospects, and rooted in economic theory to provide clear recommendations on design, implementation, and capacity building needs for an effective carbon market in India. Figure 21 depicts the questions addressed by these recommendations. The overarching principles guiding the analysis and recommendations, as outlined in the approach, include environmental integrity, cost effectiveness, ambition, sustainability, market resilience, and international compatibility.

MARKET SCOPE

Sectoral coverage

The industrial sector (including the power sector) comprises approximately 65.7 percent of India's total GHG emissions, based on the national GHG inventory of 2016 (MoEFCC 2021).[7] A carbon market for the industrial sector (including electricity generation companies) has the potential to cover more than half of total national emissions, with the proportion likely to increase over time due to a net projected growth in the sector relative to other sectors and reduced primary fuel-use in other sectors from increasing electrification. For example, between 2019 and 2030, taking into account policies that were announced up until 2019, India's industrial sector emissions are projected to increase by 73 percent, representing the largest increase in emissions among all sectors in this period (Swamy et al. 2021). Moreover, the distribution of emissions in the industrial sector across a relatively few point sources makes it possible to regulate emissions downstream (industrial units combusting fossil fuels for their processes), providing more liquidity than upstream regulation (producers, importers, and distributors of fossil fuels) in a market (see Section 3.2.1).

On the other hand, the building and transport sectors—where emissions are distributed across millions of point sources—require upstream regulation, in which case a market functions essentially as a tax that can typically be administered directly at a lower cost (Coria and Jaraitė 2019). Similarly, inclusion of highly informal sectors such as such as agriculture (comprising 14.4 percent of national emissions) and waste (comprising 2.6 percent of national emissions) in a potential carbon market would involve significant administrative and technical barriers without significantly increasing emissions coverage.

Within the industrial sector, market coverage can either remain limited to emissions-intensive industrial sectors, as in the PAT scheme, or be extended to include sectors that are less emissions-intensive. Industry participants in the study were overwhelmingly in favor of a market design that is open to participation from all industrial sectors, which they felt would reduce compliance costs for the hard-to-abate sectors and provide a financial incentive for emissions reduction in less emissions-intensive sectors that have also demonstrated climate ambition by undertaking voluntary emissions reduction targets. Section 5.1.3 discusses how transaction costs could be addressed in the design of such a market.

While considering coverage of the power sector, it is important to note that the electricity market in India is regulated—there are fixed retail tariffs for different segments of consumers, irrespective of the cost of generation. In this regard, the imposition of a carbon price on electricity generators will be passed on to DISCOMs but not to the end consumers. Indian DISCOMs are currently buckling under tremendous debt and the carbon price would add to their financial difficulties, which the government would have to alleviate through compensatory measures.

On the other hand, deregulating the power sector so that the cost of the carbon price could be passed down to the consumer (of which, vulnerable and low-income segments could be directly subsidized by the government) is a politically charged issue. This was evident in the massive farmer protests of 2020 and 2021, which, among other things, opposed certain clauses in the Electricity (Amendment) Bill, 2020 that proposed to deregulate the power sector such that consumers would pay a market-based price for electricity and vulnerable stakeholders like farmers would receive the subsidy directly from the state (MoP 2020). As a result, the new Electricity (Amendment) Bill, 2022 dropped that clause, instead proposing to (1) privatize the electricity distribution sector, which will reduce their aggregate technical and commercial (AT&C) losses and thus their mounting debt; and (2) enforce renewable purchase obligations on all DISCOMs, in addition to some other regulatory changes. The new bill also calls for electricity tariffs to be revised every year to reflect generation costs and move closer to deregulation, although the extent to which this will come to fruition is uncertain (Athawale 2022).

FIGURE 21 | Questions addressed by our recommendations in relation to market design

DESIGNING AN EFFECTIVE CARBON MARKET

BUILD CAPACITY ACROSS ALL RELEVANT STAKEHOLDERS

For participants:

On GHG inventorization, emissions management, effective trading and planning, and achieving climate goals.

For regulators and administrators:

On designing, setting up, regulating, managing, trouble shooting, and improving markets.

For accredited agencies, registry operators, consultancies, and experts:

On trading rules, procedures, data standards, and protocols.

1. DEFINE THE SCOPE

What gets covered?

What: Greenhouse gases

Who: Sectors, emissions threshold

Where: Geographical boundary (state, national, regional, etc.)

How: Point of regulation (upstream, downstream and plant, company, group level)

2. DETERMINE THE EMISSIONS CAP

Total emissions allowed in the market

What: Absolute emissions or emissions intensity (emissions per unit output)

How: Top-down (dedermined at the aggregate/sectoral level) or bottom-up (individual targets for regulated entities)

Time Horizon: Short, medium, and long term

3. ALLOCATE THE EMISSIONS CAP

Distribute allowances (tCO_2e) amongst regulated entities

Allocation: Free vs auctioned

If free, method: Using historical emissions ("grandparenting") or sectoral benchmarks

Free for whom: Identify vulnerable sectors based on trade intensity and emissions intensity

Compliance period: Time horizon to demonstrate target compliance

4. SET UP MONITORING, REPORTING, AND VERIFICATION (MRV) PROTOCOL AND REGISTRY

To ensure accuracy, consistency, transparency of emission reductions, and prevent double counting

MRV framework: Data and methods for determining emissions level/ allowances, processes and frequency of reporting, and verification standards

Set up registry: Robust databases for tracking movement of emission allowances

5. DEFINE MARKET RULES

Define modalities and procedures for trading of allowances

Trading frequency: How often entities can trade allowances

Trading methodology: Rules of trading and auctions

Trading platform: Interface for buying and selling allowances

6. BUILD STABILITY AND FLEXIBILITY: TO INCREASE EFFICIENCY AND RESILIENCE

i. Spatial flexibility:

Purchase of allowances or "offsets" from entities not regulated in the market

ii. Temporal flexibility:

Saving of allowances for the future ("banking") or borrowing of allowances from the future

iii. Price stability:

Price collars: Minimum (floor) and maximum (ceiling) price of allowances

Back loading: Temporary discontinuation of allowances

Market stability reserve: Storing unallocated allowances in a reserve

iv. Linking of markets:

International or regional cooperation of markets. Prevents shifting of carbon-intensive operations to non-regulated geographies (carbon leakage)

v. Ensuring compliance:

Financial or non-financial penalties (naming and shaming) for non-compliers, incentives (tax breaks) for compliers.

Complementary policies: Supporting policies, financial incentives/subsidies to protect vulnerable sectors, removal of regulatory barriers, easing of operational requirements, and reduction of transactional costs

7. ENGAGE WITH STAKEHOLDERS

Feedback on challenges, risks, inefficiencies to protect competitiveness, balance ambition with feasibility, and create buy-in.

8. EVALUATE, REVIEW, AND IMPROVE MARKET

Short, specific, and long comprehensive reviews for course-correction and optimal functioning.

Establish a transparent and predictable process for market design change to avoid policy uncertainty.

Source: WRI authors.

Thus, if power generation companies are regulated under the carbon market, until deregulation is made politically feasible, the carbon price will be borne by DISCOMs. However, the new amendments mentioned above will also be bolstered by the falling costs of renewable energy (RE) and the more efficient and upgraded technology of private companies, which will help DISCOMs to increase the share of RE in their power mix—contributing to their mandated emissions reductions in the carbon market and reducing potential negative impacts. Other efforts toward this end include retiring legacy power purchase agreements (PPAs) with old inefficient thermal power plants and upgrading the grid to be able to handle larger volumes of renewable electricity.

Alternatively, instead of regulating power generation companies, the market could regulate the Scope 2 emissions of large industries in the initial years, as seen in the K-ETS. With the new amendment allowing for consumers to select their electricity distributor, the increased demand for RE from regulated industrial players would help indirectly transition the power sector to cleaner energy. However, in the case of unavailability or lack of access to RE, industries would face double compliance costs, since both their Scope 1 and 2 emissions are regulated, which could impact their competitiveness. In that case, new supportive policies would be required—either compensatory or complementary, such as improving access to RE.

Gases covered

In terms of the GHG coverage of the market, as of 2016, the emissions profile of the power and industry sectors—including process emissions from the latter—indicates that about 96.2 percent of their total GHG emissions (in CO_2e) are from CO_2 alone (MoEFCC 2021). This makes excluding non-CO_2 emissions a viable option in terms of reducing transaction costs related to MRV of emissions, while not significantly compromising on the emissions coverage of the market. However, it should be noted that national accounting and reporting practices, which do not comprehensively account for GHGs such as F-gases, could overestimate the share of CO_2 in total emissions, since non-Annex-1 parties to the Paris Agreement are currently not obliged to report emissions of GHGs except CO_2, methane, and nitrous oxide (UNFCCC n.d.). Furthermore, the share of non-CO_2 GHGs can be expected to increase over time with projected growth in industrial sectors such as electronics, and declining use of fossil fuels.

Therefore, a pragmatic option could be to start by regulating CO_2 emissions and only measuring and reporting non-CO_2 gases. Expansion of the regulation to non-CO_2 GHGs can then be reassessed from time to time. Our analysis of voluntary corporate accounting and reporting practices of participants in the study also revealed a lack of consistency in accounting for emissions of gases other than CO_2, indicating a need for standardization of accounting practices, especially in the case of non-CO_2 GHGs, followed by mandatory reporting over a period of time if they are to be included in the market.

Level of aggregation of regulated entities

In the case of emissions-intensive sectors, the emissions threshold is likely to be met at the facility level, which could be chosen as the level of aggregation for regulation, as was done in the PAT scheme. However, participants in the study were in favor of aggregation at the company level, which would be more harmonized with voluntary corporate accounting and reporting practices and provide greater flexibility to companies in terms of where to reduce emissions across the spread of their operations, thereby reducing the potential cost of compliance.

For less emissions-intensive sectors, where the emissions threshold is not met at the facility or company level, allowing for further aggregation offers one option to extend market coverage. This can be done, for example, by the approach adopted by the Climate Change Agreements (CCA) scheme in the United Kingdom, wherein the regulator enters into umbrella agreements for emissions reduction with industry sector associations. Sector associations then establish and manage underlying agreements derived from the umbrella agreement with companies or groups of companies within their respective sectors, which reduces transaction costs for the regulator (UK Environment Agency 2020). However, given the role of sectoral associations in negotiating and managing targets on behalf of their members in such a scheme, their institutional capacity would need to be appraised and built in the Indian context.

While a higher level of aggregation can help reduce transaction costs, in geographically concentrated emissions zones such as MSME clusters, the market could include sectors that are less emissions-intensive by aggregating multiple units. It can involve a trade-off in terms of increased complexity and cost of MRV procedures. The feasibility of aggregation also relies on the homogeneity of operations within a sector and could prove to be challenging for heterogenous industrial sectors. Therefore, assessing and aggregating entities within a high emissions cluster of industries may be explored where feasible; for example, with shared energy or fuel infrastructure and reduction options.

Recommendations on market scope

- We recommend a national boundary for a carbon market in India based on the geographical spread of economic activity and emissions across the country, simultaneously preventing the risk of carbon leakage or competitiveness impacts across subnational regions.
- The carbon market should regulate the industrial sector (including the power sector), given the feasibility of such a regulation owing to the emissions profile of the sector and the higher degree of its integration into the formal economy, relative to other sectors.
- The market may begin with partial downstream coverage of the power sector by regulating indirect emissions from purchased electricity (Scope 2 emissions) of other industrial sectors because of the highly regulated nature of electricity tariffs in India, which does not allow power producers to reflect potential costs of compliance in tariffs. This has the potential to cover up to 43 percent of total electricity production, which is consumed in the industrial sector (MoSPI 2021), and would be consistent with the present corporate practice of including Scope 2 emissions in voluntary target boundaries. Further, to transition to direct and complete coverage of the sector in the medium to long term, it is necessary to build political feasibility for reform and deregulation of tariff structures in the power sector.
- The market may begin by regulating CO_2 emissions, which currently comprise over 90 percent of total GHG emissions from the industrial sector, in order to

reduce transaction costs of MRV without significantly compromising on emissions coverage. However, the market should expand coverage to non-CO_2 GHGs over time, given the anticipated rise in the share of non-CO_2 emissions like F-gases.

- We recommend that the market extend its coverage beyond the emissions-intensive sectors covered by the PAT scheme, based on company feedback and the potential for higher cost efficiency. This can be supplemented by aggregating entities in less emissions-intensive sectors to meet the emissions threshold for inclusion in the market.

TARGETS AND ALLOCATION

Target type

Consultations with study participants revealed a clear preference for emissions intensity targets, which is also reflected in the choice of voluntary targets currently undertaken by all participants of the exercise except one. This is because anticipated growth in most industrial sectors is expected to outpace improvements in emissions intensity over the short term, leading to an increase in absolute emissions. The exercise also indicated the feasibility of a potential system of bottom-up intensity targets with heterogeneous intensity metrics in the context of a carbon market.

While designing an emissions trading scheme with absolute targets is easier and provides greater ex-ante predictability of the reduction in emissions through the market, allowing for growth in emissions, at least in the short term, is an important consideration in the design of a target-setting scheme for the Indian industry.

The choice of an appropriate intensity metric is an important one, in the case of emissions intensity targets. An analysis of participants' voluntary targets as well as those set for the purpose of this study revealed that changes in emissions intensity are not necessarily reflective of changes in emissions when the intensity metric is susceptible to variation from factors that do not affect emissions (such as the COVID-19 pandemic, as explained in Section 4.6). For example, economic intensity metrics, such as value added or revenue, commonly employed by the service sector or sectors with heterogeneous products, are susceptible to price changes and inflation. In general, physical intensity metrics, such as production, are more closely coupled with emissions and should be used wherever feasible. However, the simulation exercise conducted during the economic shock of the COVID-19 pandemic in 2020 also highlighted a link between the energy (and thus emissions) efficiency of production processes and the scale of production. Companies that were producing at less-than-optimum capacity due to disruptions from the shock found, in general, that emissions did not fall in proportion to production because of a decline in energy efficiency at smaller production scales. Thus, when using intensity metrics susceptible to variation from factors that do not affect emissions, the factors should be identified and adjusted for the MRV process.

Given the uncertain change in the level of emissions with intensity targets, as well the added complexity of implementation that is likely to result in higher transaction costs, the choice of an intensity cap is only recommended in the short to medium term. The nature of the cap should be reassessed from time to time and replaced with an absolute cap when absolute emissions cuts become feasible—in a decarbonization pathway based on India's net zero 2070 target, this could be around 2040, when emissions are expected to peak (Chaturvedi and Malyan 2021)—or when per capita incomes or absolute poverty levels are comparable to high income economies. Provisions such as keeping allowance reserves to cover emissions of new market entrants or significant capacity addition (see Section 3.2.5) may be considered to manage competitiveness impacts when an absolute cap is adopted.

Target-setting approach and ambition

The bottom-up approach for setting targets adopted for this study was widely accepted among participants. However, SBTs, which were used as benchmarks to inform the target-setting process in the study, were found to be too ambitious for emissions-intensive sectors like cement and utility (see Figure 22), and participants indicated a preference for the development and use of sectoral benchmarks in the Indian context for target setting in a potential carbon market. A pragmatic design choice in this context would be to start by using a bottom-up grandparenting approach to set targets, then use the information collected in this process to develop sectoral performance benchmarks over time, enabling a transition to a benchmarking-based approach for target setting. During this time, it would be important to also gather sufficient data and technological assessments to select an appropriate benchmarking approach suited to the Indian industry.

Based on an analysis of existing voluntary targets of 50 Indian companies, Hingne et al. (2021) estimate an emissions reduction potential of 5.6 percent in projected national emissions in 2030, if all companies were to adopt similar targets. This could serve as a rough estimate for a feasible level of emissions reduction achievable from a carbon market covering the industrial sector in the short term.

Allocation

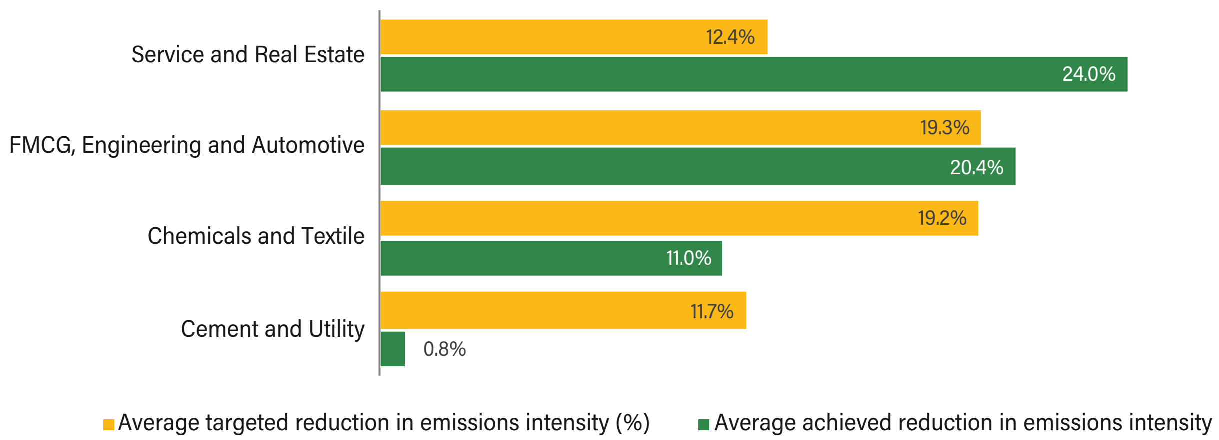
Free allocation is implicit in the case of a bottom-up target-setting approach. However, the development of sectoral performance benchmarks over time allows for the use of top-down emissions caps for homogeneous sectors, thereby opening the possibility of the use of auctioning as a method to allocate the top-down cap among regulated entities. Auctioning reduces transaction costs of free allocation and raises public revenue, which can be used to fund related policy objectives, compensate for any loss in competitiveness for regulated entities, or protect vulnerable sectors.

However, the potential risks of loss of competitiveness and carbon leakage must be assessed in the context of auctioning. There could also be other specific risks in India that would need to be evaluated. These include the impact on emissions-intensive sectors with regulated prices like power and fertilizer (which have limited ability to pass increased costs of compliance downstream), potential loss in wages or jobs for low-income workers due to an increase in compliance costs for high employment sectors, and potential rise in commodity prices via cost pass-through to consumers that affects low-income households. While the assessment of such impacts was beyond the scope of the simulation, our research suggests that an assessment of such risks should be carried out in the Indian context and addressed in the design of a potential auctioning scheme, such as through targeted rebates for small consumers (residential, farmers, and MSMEs) whose consumption falls below a certain threshold.

Recommendations on targets and allocation

- We recommend an emissions intensity cap in the short to medium term, given the context of a fast-growing industrial sector, the nature of India's NDC and voluntary corporate targets, and to ensure buy-in from all relevant stakeholders. However, we recommend a transition to an absolute emissions cap in the long term that can provide better ex-ante predictability of the reduction in emissions and reduce transaction costs, being simpler to implement than intensity caps.
- We recommend the use of physical output metrics for calculating emissions intensity (such as production, as opposed to revenue) wherever feasible. Such metrics are more closely coupled with emissions and therefore more appropriately reflect emissions efficiency.
- For cap setting and allocation, we recommend a bottom-up grandparenting-based free allocation approach due to its simplicity and stakeholder acceptability, to begin with. We also recommend that

FIGURE 22 | Sectoral ambition and achievement of targets of participants in the study



Source: WRI authors.

information collected in this process be used to develop sectoral emissions benchmarks to enable the transition to a top-down sectoral cap setting over time to reduce transaction costs.

- The feasibility of auctioning should be assessed on a sectoral basis with the transition to top-down cap setting to further reduce transaction costs and raise public revenue, which can be redistributed to support complementary or compensatory policies to protect industries, workers, and consumers vulnerable to the impacts of carbon pricing.

TRADING AND MARKET STABILITY

Issuance of allowances

Most international trading schemes issue ex-ante emissions-use allowances as opposed to ex-post emissions-saving certificates (ICAP 2021a). PAT is a notable exception in issuing ESCerts ex-post, after verification of energy savings at the end of a compliance period. A clear drawback with ex-post issuance and trading, at least in the initial phases of a market, is that market participants have no price signal during the compliance period to inform their compliance strategy as an optimal combination of internal abatement and trade in the market.

Ex-ante issuance of allowances followed by periodic (non-mandatory) trading at intermediate stages during the compliance period helps overcome this problem, as it provides participants with a market price signal throughout the duration of the compliance period and not just at the end of it, and therefore was the chosen method for this study. Under such a scheme, participants are obliged to surrender a quantity of emissions-use allowances at the end of the compliance period to cover their emissions over this period. Participant surveys and interviews during the study confirmed that the market price signal provided by interim trading cycles during the compliance period was useful in planning compliance strategy and indicated a clear preference for such a design.

While allocation in this study was done statically for simplicity—that is, using base year activity levels (in terms of their chosen intensity metric) to calculate allowance quotas—most emissions trading schemes use forecasted activity levels for this purpose, so that allowance quotas more accurately correspond to emissions during the compliance period. In such a case, the design would also need to incorporate a provision for reconciliation, adjusting for over- or under-allocation of allowances at the end of the compliance period, depending on the difference between forecasted and actual activity levels.

Trading methodology and frequency

Call auctioning is typically preferred to continuous auctioning in emissions trading schemes, including in existing MBMs in India, where market size tends to be small to improve market liquidity and reduce transaction costs for participants (see Section 4.2.6).

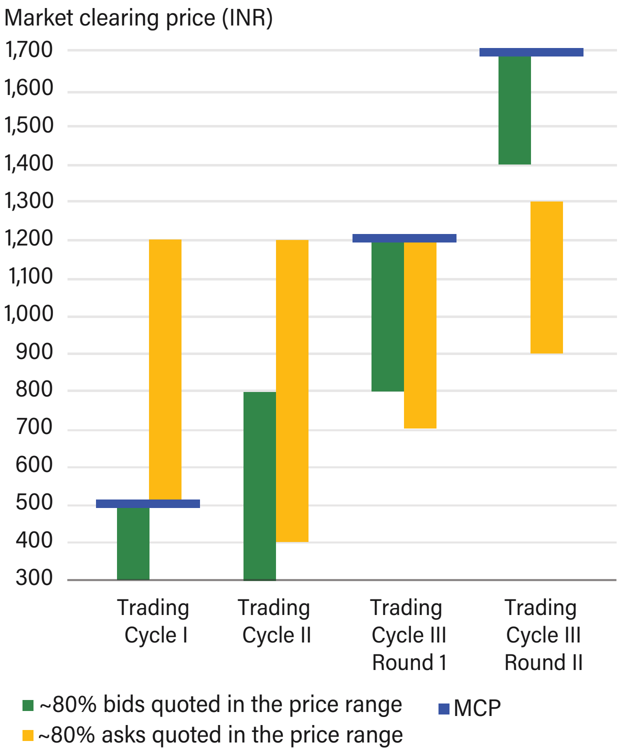
A uniform pricing scheme is typically preferred to a discriminatory pricing scheme, where optimal bids relate more to a best guess of the clearing price rather than the bidders' marginal values, which increases the potential for economically inefficient allocation. Moreover, discriminatory pricing favors large bidders that have better information about the clearing price because of the knowledge of their own bids, which strongly influences the clearing price. This is an important factor to consider in the design of a cross-sectoral market that includes smaller players from less emissions-intensive sectors.

Given these considerations, as well as participants' familiarity and comfort with this approach, validated through interviews, a double-sided call auction with uniform pricing would be a good choice in the context of a carbon market.

In terms of the frequency of trading, all participants felt quarterly trading chosen for the study provided an adequate signal of the market price of allowances to form an effective compliance strategy, although some participants indicated the need for additional rounds of trading after allowance surrender obligations are known at the end of the compliance period (as compared to the two rounds provided in the study in the final trading cycle), in order to provide more opportunity to comply. There was also clear evidence of price discovery over the interim trading cycles from market outcomes of the study, with convergence in bid and ask price ranges rising consistently over successive trading rounds (see Figure 23), resulting in increasing trade volumes (see Figure 24).

It is important to note here that efficiency gains from interim quarterly trading are contingent upon participants making maximizing trading decisions, which in turn depends upon their ability to track their emissions and

FIGURE 23 | Range of prices quoted across the three trading cycles



Source: WRI authors.

activity levels (in terms of their chosen intensity metric) on a quarterly basis, as well as forecast these variables over the remaining duration of the compliance period. In terms of the former, all but three participants were able to collate the necessary data to inform trading decisions; however, an analysis of participants' trading activity over the three trading cycles suggests that several were not able to accurately forecast these variables and ended up over-buying or over-selling early on. While this can be partly attributed to the effects of the COVID-19 pandemic during the exercise (see Section 4.6), it indicates a capacity gap that should be addressed through mock exercises or pilots to realize the potential efficiency gains through a carbon market.

Flexibility and price stability measures

Most emissions trading schemes incorporate design features to provide greater flexibility of compliance and price predictability to regulated entities (see Section 3.2). Typically, such features have evolved as a response to market behavior over time. While this was not included in the notional market for the study (see Section 4.2.4), we collected participant feedback on the perceived relevance of such provisions, based on their market experience.

FIGURE 24 | Trade volume across the three trading cycles

Source: WRI authors.

Temporal flexibility: Banking and borrowing

Banking is a common feature in schemes, including PAT, and is seen as a provision that can encourage early action by providing over-achieving entities the flexibility to carry forward their allowance surpluses in a situation where market prices are unfavorable for selling. Enabling a longer allowance lifetime also has the potential to provide greater price stability in the market, which will tend to respond less to short-term demand and supply issues. Participants in this study were also largely in favor of this provision. However, before allowing for banking, it is important to ensure that targets are set at the right ambition level; otherwise, there is a risk of target over-achievement, leading to large banked surpluses, which can undermine emissions reduction achieved in subsequent compliance periods. Therefore, banking should be introduced after pilots or initial phases of the market have provided some evidence for the appropriateness of the targeted ambition level.

The provision of borrowing is less commonly provided for as compared to banking in existing schemes because it can disincentivize early action, depress prices, and undermine the environmental integrity of the market by increasing the risk of future defaults. While borrowing is a possible mechanism to address the issue of the time lag between emissions reduction investments and results (a concern expressed by the hard-to-abate sectors in participant interviews), the choice of an appropriate length of compliance period, with interim compliance, is likely to be a simpler solution from the implementation perspective to address this issue (see Section 5.4.1).

Spatial flexibility: Offsets

Another feature in this context is providing regulated entities with the option of meeting a specified proportion of their target by buying offsets generated from emissions reductions achieved outside the scope of the market, such as the provision for the use of CDM offsets in the EU ETS. Given past experience with the use of offsets in emissions trading schemes, concerns about offsets undermining the environmental integrity of markets have emerged around two key issues: additionality (whether offsets are generated from activities resulting in additional emissions reduction over and above a BAU scenario) and double counting (the use of the same offset more than once). However, a well-administered domestic offset scheme has the potential to incentivize emissions reduction from sources that are not feasible to regulate directly within the market due to high transaction costs, while ensuring environmental integrity.

In the Indian context, a voluntary offset scheme linked to the market can be used to target emissions reduction in the MSME sector in India, which contributes to approximately 45 percent of the manufacturing output (GoI 2020a) and 25 percent of industrial energy consumption (GIZ 2018) and has significant untapped potential for cost-effective emissions reduction, given the lack of interventions thus far. A supply of such offsets also has the potential to address excess demand (as seen in the notional market of this study) and reduce the cost of compliance for regulated entities in the market. However, the feasibility of such a scheme would have to be appraised in terms of the needs and capacity gaps to be addressed to enable participation of the MSME sector, as well as the transaction costs of establishing the environmental integrity of the allowed offsets. Participants of the study were in favor of such a provision, but also highlighted a need for awareness and capacity development in terms of GHG accounting and reduction opportunities, based on their experience of engagement with MSMEs in their respective value chains, before the sector could be considered for such a scheme.

Price stability

Provisions to improve price predictability can include a price floor and/or a ceiling, adopted for example by the REC scheme in India. A more common form of price control in existing global markets is to maintain a reserve volume of allowances (see Section 3.2.4), which may be introduced or withdrawn from the market by the regulator to manage price volatility. While a stable price signal provides more certainty to regulated entities in planning long-term investments to reduce emissions, price controls lower the overall efficiency gains from trade by creating deadweight losses.

Given their potential efficiency tradeoffs, price control provisions should only be introduced after a careful evaluation of their necessity and reserved for use in the case of external shocks to the market. Introducing price controls in the initial phases of the market can inhibit true price discovery. Moreover, free market prices in the initial phases of the market can be a good indicator of market ambition and inform target setting for future phases. Study participants expressed no particular concerns about price volatility or the need for price controls in the market, in general, despite the impact of the economic shock due to the COVID-19 pandemic on the notional market of the study.

Recommendations on trading and market stability

- Distribution of ex-ante quotas of emissions-use allowances would enable periodic trading and provide a market price signal for allowances to inform participants' compliance strategies during the compliance period. We also recommend a quarterly frequency for trading, to balance the strength of the market price signal against the transaction costs of more frequent trading.
- We recommend Uniform Price Call auctioning as the method for trading, given its likelihood to improve market liquidity and allocative efficiency and reduce transaction costs compared to continuous trading, given the size and structure of a potential carbon market in India. Participants' familiarity and comfort with this method, due to the existing PAT and REC schemes, further supports this method for trading.
- Banking allowances should be permitted, to encourage early action. However, to avoid the risk of accumulation of large banked surpluses, the allowance provision should be incorporated after pilots or initial phases of the market have provided some evidence for the appropriateness of the targeted ambition level of emissions reduction. Similarly, carryover of allowances may be limited to a specified proportion or for one compliance period only. We do not recommend a provision for borrowing allowances as it entails the risks of disincentivizing early action, depressing market prices, and the increased possibility of future defaults.
- The use of offsets is not recommended in the initial stages of the market, when demand and supply are still being established, where regulated entities have enough emissions reduction potential and the level of market price and ambition are reasonably low. Domestic offsets may be phased in over time from sectors, such as from MSMEs, the waste sector, or community-based projects like nature-based solutions and captive power plants from non-fossil fuels that have emissions reduction potential but are difficult to regulate directly. Meanwhile, in the initial phases of the market, capacity building and robust MRV systems can be set up for the offset market that would be required to ensure its environmental integrity when it is phased in during later phases.
- Price controls can potentially offset efficiency gains from a free price movement and inhibit true price discovery in the market. Therefore, price controls are not recommended in the initial phases of the market. Their necessity may be evaluated over time and their use limited to build price stability in the case of external shocks to the market.
- The creation of a reserve of allowances should be considered for India to manage under- or over-supply of allowances, the latter of which has typically been the experience in PAT. The reserve could absorb/release allowances from/into the market triggered by floor/ceiling prices, respectively, and a committee within the institutional framework of the carbon market may be oversee and develop its rules and management. This committee could be responsible for ensuring market stability and decide upon measures such as reserve and price collars for each cycle.

MRV AND COMPLIANCE

Compliance period

The length of the compliance period is another important design consideration, as it determines the temporal flexibility available to regulated entities in achieving their targeted emissions reductions. In general, longer compliance periods have the potential to reduce compliance costs by allowing regulated entities the flexibility to better incorporate temporal considerations, such as the lag between emissions reduction investments and results, as well as seasonal variation in business activity, into their compliance strategy. However, similar to the provision of borrowing, excessively long compliance periods can create undesired incentives for delaying investment in emission reduction. The feedback from hard-to-abate sectors in the study was that a one-year compliance period, as chosen for the study, is not long enough to provide the flexibility of an optimal compliance strategy; instead, they indicated a preference for a three-year compliance period, similar to that adopted by the PAT scheme.

Typical lengths of compliance periods in existing markets globally also range from one to three years. If considering the adoption of a longer compliance period, it is also relevant to consider introducing a provision of interim compliance within this period, that can increase certainty of timely action and improve alignment of market outcomes to annual emissions reduction objectives. For example, the RGGI scheme, which uses three-year compliance periods, requires an annual surrender of allowances to cover at least 50 percent of emissions in each of the first two years of this period. Allowances to cover emissions from the third year and all remaining emissions from the first two years must be surrendered at the end of the third year. A similar design could be a pragmatic choice in the Indian context if a longer compliance period is adopted.

It is worth noting that the lifetime of emissions reduction investments, typically on a scale of decades, can be significantly longer than a compliance period. Although excessively long compliance periods are undesirable for the reasons stated above, regulated entities can be given a policy signal by announcing the medium- to long-term ambition of market targets (going beyond the length of a compliance period), which has a clear effect on market prices, as evidenced in the case of the EU ETS following the announcement of EU's Green New Deal (see Section 3.2). This drives greater ambition among regulated entities by giving them a clear policy signal to shift investments toward low-carbon technology.

BOX 5 | Compliance period of carbon markets across the world

- EU ETS: One year
- California Cap-and-Trade Program:
  - First compliance period: One year
  - Subsequent compliance periods: Three years
- RGGI: Three years
- Mexico: One year
- Chinese ETS and all Chinese pilots: One year
- NZ ETS: One year
- K-ETS: One year

Source: ICAP 2021a.

MRV and enforcement

The design of a good MRV system must balance the comprehensiveness and accuracy of emissions accounting, reporting, and verification against the transaction costs of doing so. Since transaction costs are largely fixed in nature and hence disproportionately high for small emitters, this becomes even more relevant in the design of a cross-sectoral market.

Currently, the tracking and reporting of GHG emissions in India is voluntary, without a standardized MRV methodology. Data are typically collected manually with rudimentary tracking of key parameters and as a result are time-consuming, prone to human error, and have higher transaction costs. Thus, some general approaches that have been used to reduce transaction costs of MRV and can be adopted in the Indian context are the use of standardized electronic reporting formats and default emission factors for predictable sources of emissions, as well as creating incentives for self-enforcement. This may include reducing the frequency of quality assurance procedures, such as the requirement of third-party verification of emissions data, for participants that consistently conform with established performance standards.

An analysis of voluntary accounting and reporting practices of study participants showed consistency in accounting of CO_2 emissions, with slight variation in emissions factors used. There was less consistency in accounting of non-CO_2 emissions, in terms of both the emissions sources included in the inventory and the emissions factors used. As noted previously, a pragmatic choice to simplify MRV procedures and reduce transaction costs would be to start with the regulation of CO_2 emissions in the market, which would cover over 90 percent of current emissions of the industrial sector. Participants suggested the development of a set of default national emissions factors for fossil fuels used in the industry for standardizing the quantification of energy-related CO_2 emissions. These include the different grades of coal, furnace oil, diesel, gasoline, crude oil, and natural gas. In addition, accounting methodologies for process-related emissions from the calcination of limestone in the cement and lime sectors and metallurgical reduction using carbon-based fuels in the metals sector—which together comprise approximately 10 percent of total industrial CO_2 emissions—would need to be specified. To reduce transaction costs, these may adopt or be harmonized with the existing mass-balance approaches specified by sectoral standards currently used at the corporate level for voluntary reporting, such as the Cement CO_2 Protocol (cement sector) and ISO 14404 (steel sector).

In order to reduce transaction costs, participants also suggested aligning reporting and verification requirements of the market with the financial year rather than the calendar

year, which would help harmonize the required internal processes for data collation and reporting with existing organizational processes used for annual reporting on a financial year basis. This was suggested by most simulation participants, though it is not a trend in other international markets. For example, the MRV submission deadline in the California Cap-and-Trade Program is August 10 (while the financial year is October 1–September 30) and in the EU ETS, the submission deadline is April 30 (financial year is January 1–December 31).

Further studies on quantitatively estimating the transaction costs for companies of different sizes and from different sectors would be important in forming the policy design of the market, as well as informing the scope for MSMEs to participate in the offset market.

All participants agreed on the need for a financial penalty for non-compliance. To act as a deterrent for non-compliance, the penalty would have to be sufficiently high to make the cost of non-compliance greater than the cost of compliance. Some participants also felt that the reputational damage from public disclosure of non-compliance could be a significant deterrent in the case of large companies. Participants also highlighted the importance of timely enforcement of the defined provisions for non-compliance, citing this as the main reason for the poor compliance rates seen in the RPO scheme.

Recommendations on MRV and compliance

- We recommend a multi-year (three-year) compliance period to better account for the lag between emissions reduction investments and results, especially for the hard-to-abate sectors, and to rationalize seasonal variation in business activity. This would ensure greater market stability and give regulated entities more flexibility in compliance. However, this should be supplemented by an interim compliance within this period (as in the case of the California Cap-and-Trade Program), which will help increase certainty of timely action and improve alignment of market outcomes to annual emissions reduction objectives.
- MRV should include transparent information reporting on any use of carbon removals sequestration or carbon capture and storage to meet targets and provide information to support its permanence.
- MRV requirements should be simplified and streamlined as far as possible to reduce transaction costs. This may include, for example, minimizing data points monitored, piggybacking on voluntary emissions accounting and reporting standards at the corporate level, and creating incentives for self-enforcement.
- To maintain accuracy and transparency, we recommended the adoption of standardized electronic/digital reporting formats, development of default emission factors for predictable sources of emissions, and building of standardized tools for accounting and reporting emissions to cater to entities of varying capacities.
- We recommend aligning MRV requirements with the financial year rather than the calendar year, to further reduce transaction costs for participants by enabling them to harmonize internal processes to meet MRV requirements with existing organizational processes used for annual reporting on a financial year basis.

SUMMARY OF DESIGN RECOMMENDATIONS

Table 17 summarizes our design recommendations for a carbon market in India.

TABLE 17 | Design recommendations for a carbon market in India

SCOPE AND COVERAGE		RATIONALE
Geographical boundary	National	Avoid the risk of carbon leakage and competitiveness impacts across subnational regions; based on domestic and international experience with MBMs and stakeholder interviews
Sector	Industry with downstream power sector emissions (Scope 2)	The industrial sector's emissions profile and feasibility of regulation relative to other sectors; based on literature review, domestic and international experience with MBMs, and stakeholder interviews
Sub-sectors	All	Potential for greater cost-efficiency in a cross-sectoral market and to reduce participation costs for less emissions-intensive sectors; based on economic theory and stakeholder interviews
Level of aggregation of regulated entity	Company level (with flexibility provisions for different sub-sectors)	
Threshold	Initially, PAT-regulated entities. Expand over time based on collected MRV data	Entities covered by PAT are the most energy-intensive and already have some form of MRV systems in place so would be the easiest to begin with. As data is collected over time, the threshold can be reduced to include more sectors depending on their emissions trends and transaction costs.
Gases	CO_2, with inclusion of other GHGs over time	Increase emissions coverage while keeping transaction costs low; based on emissions profile of participating companies, validated by a literature review
Target Setting and Allocation		
Nature of cap	Intensity-based for short to medium term	Projected growth in output (and emissions) in the short to medium term; based on literature, experience of domestic MBMs, analysis of voluntary targets of participating companies, and stakeholder interviews
Intensity metric	Physical intensity metric preferred	Increase resilience to market shocks; based on market outcomes of the simulation
Method	Grandparenting, with a transition to benchmarking over time	Simplicity and stakeholder acceptability of grandparenting and the absence of appropriate sectoral emissions performance benchmarks; based on market outcomes of the simulation and stakeholder interviews
Allocation	Free in the short to medium term, transitioning to auctioning as the market matures	
Allowance distribution	Ex-ante	Provide a market price signal for allowances to inform participants' compliance strategies during the compliance period; based on market outcomes of the simulation and stakeholder interviews
Compliance period	Three years	Ensure greater market stability and give regulated entities more flexibility in compliance; based on experience of domestic MBMs and stakeholder interviews
Trading		
Trading methodology	Uniform price call auctioning	Lower transaction costs and increase allocative efficiency; based on experience of domestic and international MBMs and stakeholder interviews
Trading frequency	Quarterly, with two rounds of trading in the trading cycle between the end of the compliance period and date of final submission of surrender obligation	Maintain a clear signal of the market price and transaction costs of more frequent trading; based on market outcomes of the simulation and stakeholder interviews
Flexibility and Stability		
Banking	Allowed, but to be decided based on initial pilots	Encourage early action while mitigating the risk of accumulation of large banked surpluses; based on experience of domestic MBMs and stakeholder interviews
Borrowing	Not recommended	Mitigate risks of disincentivizing early action, depressing early market prices, and future defaults; based on international experience with MBMs

TABLE 17 | Design recommendations for a carbon market in India (Cont.)

SCOPE AND COVERAGE		RATIONALE
Offsets	Domestic offsets may be phased in as market matures	Reduce compliance costs in the future and facilitate emissions reductions in sectors infeasible for direct regulation like MSMEs; based on international experience with MBMs and stakeholder interviews
Price stability	Market reserves can be considered, in case of external shocks	Improve price predictability and resilience market to shocks; based on international experience with MBMs and stakeholder interviews
Monitoring, Reporting, and Verification		
Monitoring	Minimize data points, establish default emissions factors, and adopt standardized tools	Reduce transaction costs, increase transparency, and improve compliance; based on international experience with MBMs and stakeholder interviews
Reporting	Piggyback on existing reporting channels, through standardized electronic/digital reporting formats	
Verification	Develop standards for verification and build capacity across verification agencies	
Frequency	Annual, harmonized to financial year	

Source: WRI authors

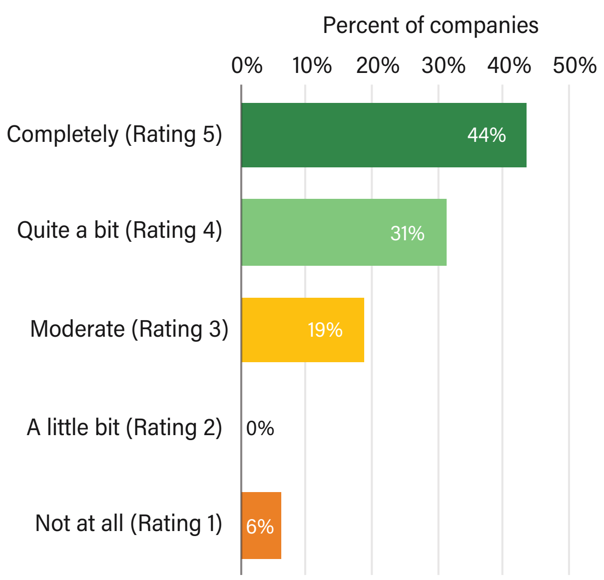
CAPACITY NEEDS

In order to understand the capacity needs among the participants and the capacities built due to the simulation, we analyzed data gathered from surveys[8] and interviews (see Appendix B for the survey and interview questionnaires). The key insights are outlined in this section. These also point to ways in which pilots and simulations can be used to build capacity among various relevant stakeholders while implementing a potential carbon market in India.

Building capacity through baseline determination and target setting

Figure 25 gives an overview of how companies rated the impact of the baseline and target setting exercises on their internal GHG emissions planning and management. As can be seen, 75 percent of the participants found the exercises extremely useful (with a rating of 4 or 5). This is supported by their feedback in the stakeholder consultations, in which several companies acknowledged using the different target scenarios across the short and medium timeframes constructed during the target-setting exercise to inform their voluntary emissions reduction strategies.

FIGURE 25 | Impact of baseline and target-setting exercises on internal GHG emission management



Source: WRI authors.

While the simulation relied on emissions data as accounted by participants in accordance with voluntary corporate standards (GHG protocol or ISO 14064), in the case of a national market, large scale capacity will have to be built among the industry at large on GHG inventorization prior to introducing a carbon market. A standard for completing the inventory process will also need to be adopted or defined to ensure that emissions are accounted consistently and comparably across the industry.

Building capacity to enable effective trading

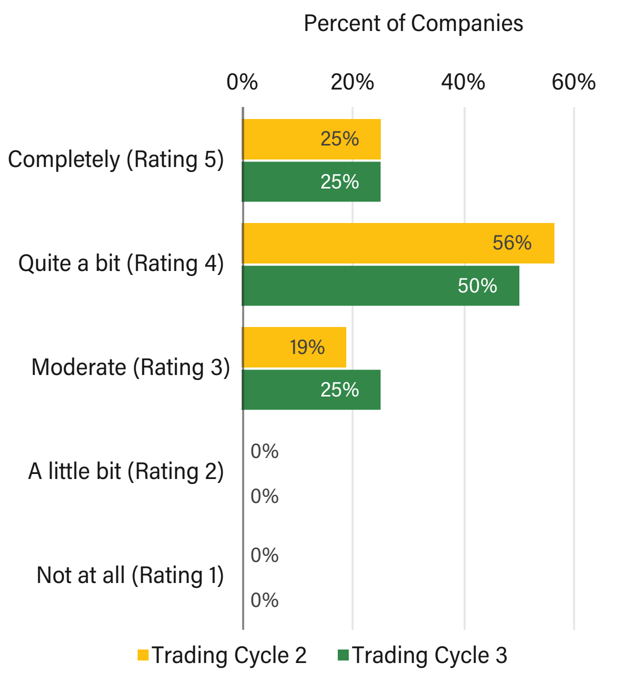
Regulated entities often plan their target achievement strategies based on a combination of their internal considerations and of market expectations. These considerations may include, among others, their expected emissions intensity at the end of the compliance period, expected market price of allowances, internal costs of reduction (marginal abatement cost, or MAC), as well as information from previous trading cycles. In order to understand how such decisions were made and how they can be improved, we analyzed insights from participants' experiences in the simulation.

Feedback from the stakeholder consultations suggested that the two main parameters participants used to inform their trading decisions were market information and price signals from the previous trading cycles, and their expected allowance surplus or deficit at the end of the compliance period.

Figure 26 presents the participants' perception of their ability to consider market information and price signal while making trading decisions during the exercise. Participants' ability to incorporate the market information into trading decisions was also evidenced in the trade volume, which was initially low (where no prior signal of the market price of an allowance was available) but then increased over time as the volume of market information available to the participants also increased (see Section 4.5). The market information also helped participants become cognizant of the high demand in the market, and most were able to predict a further rise in the market clearing price in the subsequent trading cycles, reiterating the importance of a clear price signal to enable effective trading (see Section 5.3.2).

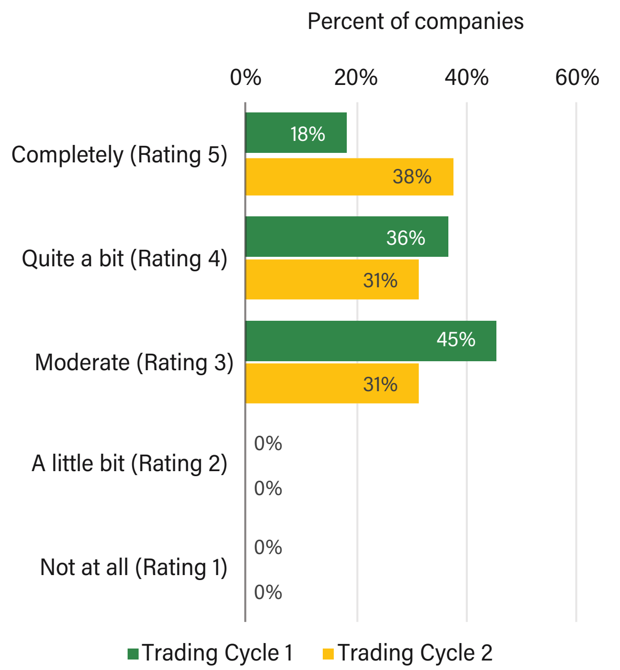
Participants' expected allowance surplus or deficit at the end of the compliance period at any point in time is a function of their emissions performance so far (in the period preceding a trading cycle), as well as their expected performance in the remaining part of the compliance period. Figure 27 shows participants' perception of their ability to forecast expected emissions performance while making trading decisions. This reflects the need for capacity building in businesses to account and track their emissions in real time, as well as forecast their emissions performance in the near future, especially in terms of intensity metrics, in order to enable effective trading in a carbon market.

FIGURE 26 | Ability to consider market information and price signal from previous trading cycles while making trading decisions



Source: WRI authors.

FIGURE 27| Ability to consider expected emissions intensity while making trading decisions



Source: WRI authors.

Building capacity to reduce emissions at the least cost

Reducing emissions at the least cost involves making the decision to either reduce emissions internally to meet targets or trade at a price lower than internal abatement costs. These decisions demand a level of awareness of internal reduction costs and expected market price of allowances. While market information is only built over trading cycles, the ability to assess their own Marginal Abatement Cost Curve (MACC) could have been an important tool to drive least cost emissions reductions. Participants' self-assessment of their ability to factor in their MAC while informing their trading decisions is highly varied, as shown in Figure 28. In interviews, most participants admitted to not being aware of their MACCs, despite having undertaken emissions reduction activities in the past, and had just made rough estimations of their MACC for the purpose of the simulation. This highlights a need to build capacity and awareness among large businesses on understanding their MACCs in order to make the most informed emissions reduction investments and trading decisions.

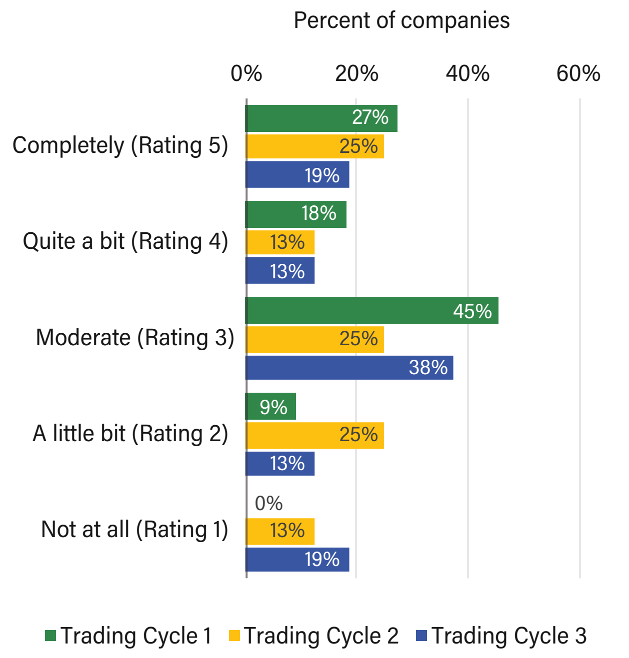
Building preparedness to make trading decisions

Trading rules, modalities, and ability to make timely and efficient bids or asks are important in achieving least cost emissions reductions. Simulations and pilots can play an important role in building such readiness. Figure 29 shows that the overall confidence of the market players in making trading decisions rose after both interim trading cycles, from 82 percent of participants rating 4 or more in Cycle I to 88 percent in Cycle 2, in addition to 19 percent feeling completely confident in making trading decisions after Cycle 2—up from 0 percent in Cycle 1. This highlights the impact that a simulation exercise can have on the overall readiness and capacity of participating companies in trading.

Readiness and need for further capacity building following the simulation exercise

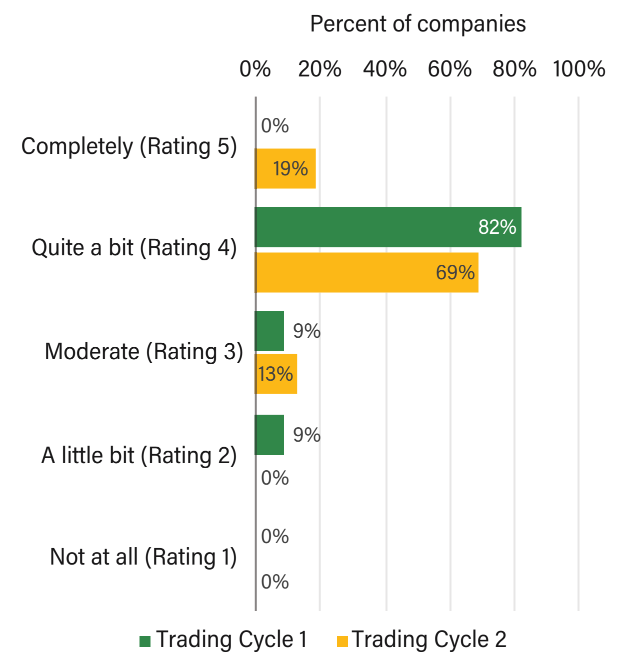
While this exercise was the first experience for companies to participate in a carbon market in the Indian context, further large-scale capacity building will have to be undertaken if a national carbon market is to be introduced in India.

FIGURE 28 | Ability to consider internal cost of emissions abatement while making trading decisions



Source: WRI authors.

FIGURE 29 | Confidence in making trading decisions in the following trading cycle



Source: WRI authors.

Figure 30 shows the perceived readiness of the companies to participate in a national carbon market after their experience in the simulation. While 88 percent of the market players felt quite ready to do so, at the same time, approximately 75 percent also felt a strong need for further large-scale capacity building prior to participation in a national carbon market, as seen in Figure 31. This is strong evidence of the need for further large-scale exercises such as this simulation, as well as national-level capacity building by the regulatory authorities on carbon markets, prior to introducing a carbon market in India.

Recommendations for capacity building

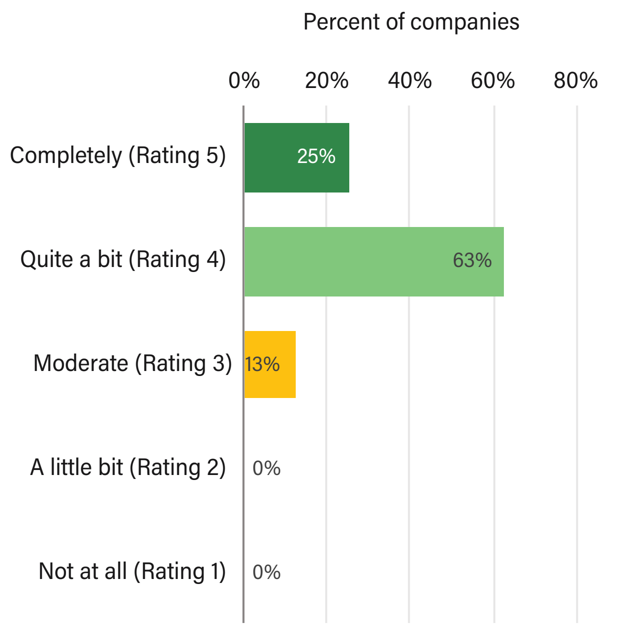
A successful carbon market must be accompanied by a comprehensive capacity building program. The capacity building program should be targeted for all relevant stakeholders, including regulators, consultants, and verification entities and regulated entities. It is also important to build the capacity of entities not presently planned to be targeted or regulated through the market, but who may be included in the future, in order to increase awareness across the industry sector on moving toward a low carbon pathway. These capacity building programs, however, need to be built according to the training needs for stakeholders based on their current level of capacity.

Building on the classification of capacity levels for the industry sector outlined earlier (see Table 14), and based on our experience of working with participating companies through the simulation and their feedback, Table 18 summarizes recommended training elements of the targeted capacity building programs and the frequency and timing for them.

Categories C and D constitute at least 50 Indian businesses that represent approximately 35 percent of India's industrial sector emissions, with voluntary commitments that can reduce 1.7–1.9 percent of India's national emissions in 2030 (Hingne et al. 2021). A carbon market can help achieve such reductions at a much lower cost due to the efficiency gains, as seen in the simulation. Moving forward, with ongoing capacity building, businesses from categories A and B could be brought toward better preparedness, ultimately maximizing these efficiency gains for the industry sector.

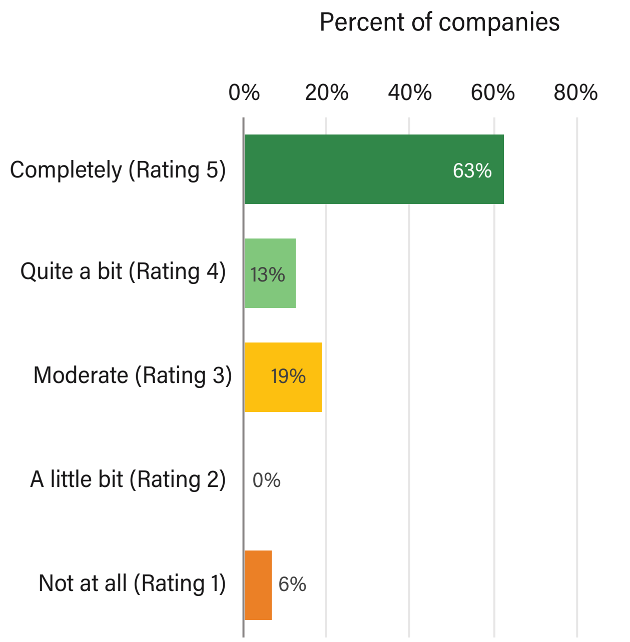
Both simulations and pilots provide an important platform for building capacity. Simulations can be conducted at lower costs, with no policy regulations or financial penal-

FIGURE 30 | Perceived readiness for a carbon market after experience in the simulation



Source: WRI authors.

FIGURE 31 | Perceived need for large-scale capacity building prior to participation in a national carbon market



Source: WRI authors.

TABLE 18 | Recommendations for capacity building for a carbon market

CATEGORY	CURRENT CAPACITY	READINESS	CAPACITY NEEDS	METHODS	FREQUENCY
A	▪ No understanding of accounting and reporting of GHGs ▪ No GHG management plan ▪ No experience in carbon markets or other market-based mechanisms	Minimal or no awareness	▪ Monitoring and measurement of GHGs ▪ Collecting activity data ▪ Developing emissions factors ▪ Estimating emissions ▪ Ensuring quality and meeting MRV requirements	Trainings, e-trainings, DIY tools, guidebooks, online courses	Ongoing/ continuous
B	▪ Accounting and reporting GHGs ▪ No GHG management plan ▪ No experience in carbon markets or other market-based mechanisms	Needs substantial capacity building	▪ GHG management ▪ Cost of abatement ▪ Trajectory of emissions along with growth ▪ Benchmarking against sectoral standards ▪ Setting targets ▪ Meeting targets ▪ Raising ambition	Trainings, workshops, peer-peer learning	Ongoing/ continuous
C	▪ Accounting and reporting GHGs ▪ Has GHG management plan ▪ No experience in carbon markets or other market-based mechanisms	Needs some capacity building	▪ Understanding carbon markets and meeting compliance targets ▪ Baselining ▪ Target setting ▪ MRV ▪ Trading	Workshops, simulation	Phased
D	▪ Accounting and reporting GHGs ▪ Has GHG management plan ▪ Has experience in carbon markets or other market-based mechanisms	Ready or needs minimal capacity building	▪ Participating effectively in a carbon market ▪ Market price (current and future) ▪ Understanding and planning internal costs (current and future) ▪ Returns on low carbon investments ▪ Minimizing risks ▪ Interface/trading methods	Simulation/pilots	Phased

Source: WRI authors.

ties, across a much wider range of stakeholders or participants, and still help improve capacities, as is evident from our simulation exercise. However, with more certainty on policy, design, and scope of a potential carbon market, a pilot exercise can help fine tune important design elements and help the transition toward a national carbon market, as is seen from China's experience with regional pilots informing a national carbon market.

Though a potential carbon market may not include entities from categories A or B at the outset, keeping in mind the longer-term vision of a low-carbon industry pathway, it is important to build basic capacities across these categories as well, through relevant modules made available in regional languages and across platforms.

Given the scale of the Indian carbon market and the diverse capacity needs, online and digital learning can be efficient tools to deliver large-scale trainings to a wider audience at lower costs.

In addition to the outlined training programs, entities regulated in a carbon market must be supported through handholding and online support in the initial phases of the market roll out.

ALLIED POLICY RECOMMENDATIONS

Integrating the carbon market into India's existing policy framework

A relevant policy question in the context of a potential carbon market is its integration within the existing framework of mitigation instruments, especially the MBMs for energy efficiency (PAT) and renewable energy (REC). In theory, subsuming these schemes within a national carbon market is an attractive proposition because CO_2e emissions regulated in such a market would reflect the impact of both energy efficiency and renewable energy interventions. Setting a common target in terms of CO_2e would also increase efficiency by providing regulated entities more flexibility in their choice of emissions reduction options—for example, reducing process emissions that are unaffected by energy-related interventions—and reduce transaction costs that would otherwise be replicated across the multiple markets, both for the regulated entities and the regulator.

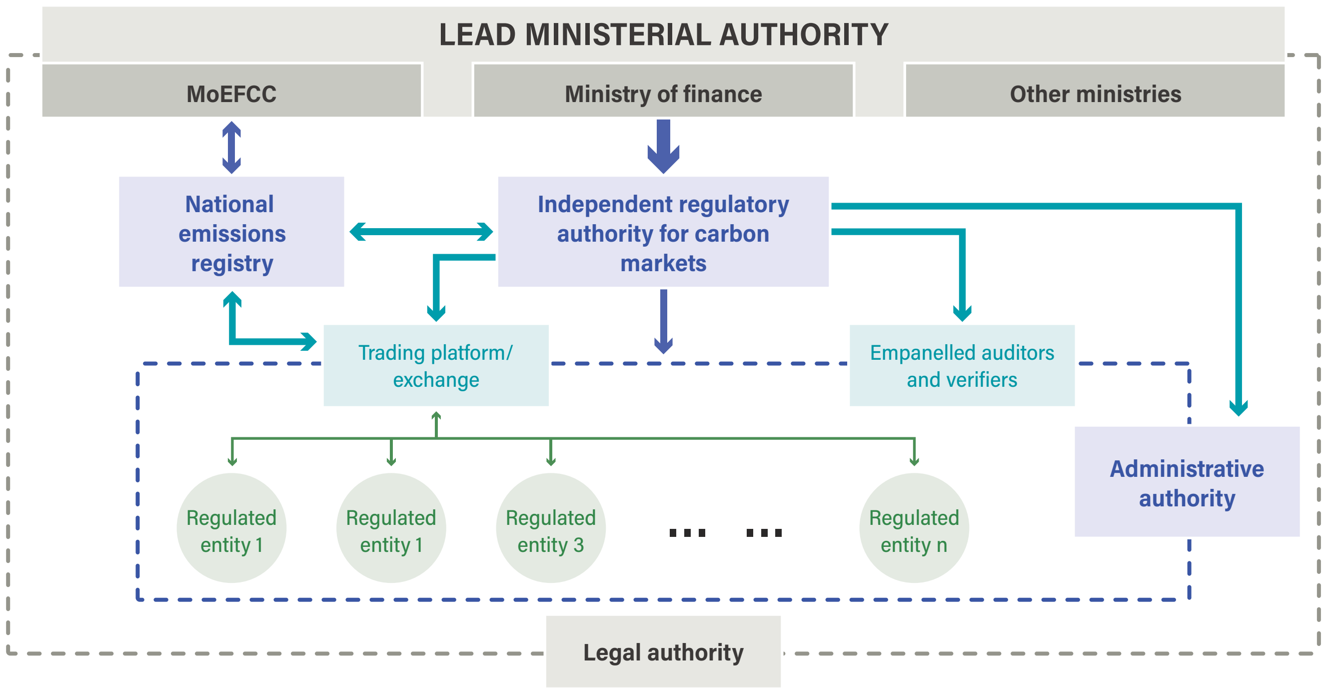
However, doing so would involve addressing questions of the political feasibility of discontinuing the existing, well-established MBMs in favor of a new market yet untested in the Indian context. Therefore, we recommend operationalizing a carbon market in parallel with existing MBMs, which gets around the problem of double counting of emissions by setting targets additional to those set by the existing schemes and allows for flexibility in reduction options through market linkage with existing schemes. As the carbon market matures, the existing MBMs may be subsumed within the single national carbon market in the medium to long term.

Establishing robust institutional structure and governance

As discussed in Section 3.2.5, the governance of a carbon market can typically be broken down into three verticals: regulatory authority, administrative authority, and legal authority. In India, the Energy Conservation (Amendment) Bill, 2022 passed in August 2022 made a provision for the establishment of a carbon market in India. Additionally, PAT's administrator (BEE) is exploring this opportunity of developing a national carbon market, under which PAT and REC may potentially be subsumed (BEE 2021). In this context, we suggest the following governance structure (see Figure 32).

1. **Lead ministerial authority**: We recommend that the Ministry of Finance (MoF) be the overarching regulator of the market who will provide the overall structure and guidance to the market. This would include setting the long-term vision of the market and giving policy directives. The choice of the MoF aligns with its cross-cutting role in the Government of India across ministries and policies to bring different ministries on board, its ability to provide guidance on pricing mechanisms and how it impacts the various sectors, and its ability to govern the usage of the collected revenues to mitigate negative impacts. Further, as the Chair of the AIPA, the Ministry of Environment, Forests and Climate Change (MoEFCC) would play an integral role as India's focal point to the UNFCCC for the national communications that track the country's emissions inventory, and because it is the Designated National Authority for India under the CDM and will be in charge of tracking and other processes under Article 6. Apart from the MoF and MoEFCC, coordination will be needed across multiple ministries while developing the regulatory base of the market, including the Ministry of Power, Ministry of Corporate Affairs, and Ministry of MSMEs.
2. **Regulatory authority:** We recommend establishing an independent regulatory authority under the purview of the overarching regulatory authority (MoF), which will be in charge of setting the detailed rules, regulations, policies, and guidelines of the market and the standards of implementation, and will govern the market, including the enforcement of regulations and ensuring compliance. They will engage with stakeholders every step of the way. This includes designing and managing the modalities of the scheme, target setting, issuing credits, and accreditation of auditors/ verifiers. One

FIGURE 32 | Proposed institutional structure for a carbon market in India



Source: WRI authors.

of the key functions of the AIPA is to operate as a national authority on carbon markets under Article 6, as well as domestic pricing mechanisms. An independent authority under the AIPA could play the role of the market regulator.

3. **Administrative authority:** The BEE is the likely choice for the role of the administrative authority of India's national carbon market, given its experience with administrating the PAT. It would oversee the core implementation of the market, manage the technical platforms for MRV and trading, and build capacity.

4. **Legal authority:** The judicial system of India will be the legal authority to resolve any conflicts and grievances through legal proceedings and hold all stakeholders and institutions accountable to democratically legislated policies.

5. **National emissions registry:** While the Power System Operation Corporation (POSOCO) handled the registry for the PAT scheme, which dealt with Energy Efficiency Certificates, a national carbon market would require a separate national emissions registry that creates, manages, and tracks all emissions credits in the market and supports national accounting and reporting requirements under the Paris Agreement. This would include the development of a state-of-the-art, multiple-year digital MRV system registry that deploys technologies like artificial intelligence, smart sensors, internet of things (IoT), cloud-based computing, and drones to automate data collection and track emissions allowances while protecting the system from fraud. In the short term, a mandatory emissions reporting program can be piloted for large emitters and public sector utilities, many of whom already report on a voluntary basis and can gradually be expanded to cover other regulated sectors.

6. **Trading exchange:** An independent trading exchange platform for the trading of allowances between all regulated entities should be appointed by the regulator.

7. **Empanelled auditors and verifiers:** A panel of third-party auditors and verifiers should be set up by the regulatory authority to verify the emissions data of the regulated entities as part of the MRV process. Randomized audits should also be conducted to detect and reduce fraudulent activity.

8. **Market makers:** The inclusion of a body (such as the Reserve Bank of India) as a "market maker" who participates in the market to maintain liquidity and stabilizes prices may be considered.

Achieving sustained emissions reductions

1. **Long-term policy signals**: To give regulated entities a clear policy signal to shift investments toward low carbon technology, it is recommended to announce in advance the ambition of the targeted emissions reduction from the market over medium- to long-term timeframes relevant to investment decisions.

2. **Complementary policies in allied sectors:** Regulated entities may invest in renewables or renewable procurement and enhance energy efficiency through upgradation or change of technology, or through operational and product innovations. The carbon market should be complemented with new or existing enabling policies to support such interventions that can create a reinforcing effect and ensure target achievement, since barriers to implement these interventions will lead to defaults in the market. Enabling policies may include easing regulations, simplifying procedures, or creating financing mechanisms in sectors such as renewables or for upgradation of technologies to enhance energy efficiency, for example, through Sovereign Green Bonds planned by the Government of India. These would also include deregulation or amendments in the power sector as discussed above to facilitate their participation in the medium run.

Investment in the research and development of technologies that are currently in a nascent stage but hold a very high potential for decarbonization in the medium to long terms can also help prepare the market for more stringent or absolute caps in the future by making low-carbon alternatives cost-competitive. An example of such a technology is green hydrogen derived from electrolysis using renewable energy as an alternative to fossil fuels in the industry sector.

Ensuring compliance

1. **Interim targets:** Interim targets are recommended, as they encourage early action and provide necessary correction in time for meeting compliance targets at the end of the compliance period.

2. **Penalties:** The level of the penalty will depend on the type of non-compliance. For administrative delays and defaults, a flat financial penalty could be considered. For non-compliance toward the target, the penalty must be higher than the cost of compliance to drive real reductions. A value, at least two to three times the market price, along with an obligation to surrender the required (or higher) allowances and the public disclosure of their non-compliance is recommended to discourage entities from buying their way out of emissions reductions. The severity of penalties could begin at a lower level in the first phase of the market and be phased to the full recommended value in the second or third phase, as the market matures and participants become well-equipped to participate. This will be supported by a legal framework for the timely enforcement of the penalty. Non-compliance in the form of fraudulent activities, like misrepresenting data to the verifier, would involve more severe penalties, such as a financial penalty five times that of the market price and potentially a revocation of their consent to operate, as well as "naming and shaming." Randomized checks by external auditors hired by the regulatory authority would also help in detecting and reducing fraudulent activities.

3. **Policy incentives:** Compliers could earn concessions in the form of tax breaks or be given preference in government procurement of goods and services by including emissions performance as a criterion for decision-making.

Safeguarding competitiveness and avoiding carbon leakage

Without complementary policies, a carbon market may directly or indirectly impact vulnerable sectors such as MSMEs that are already struggling. It may also adversely impact export competitiveness of goods and services. These by themselves are undesirable and may even cause capital flight and shifting of operations to other jurisdictions without emissions regulations, leading to carbon leakage. In addition, while the marginal costs of emission reduction might be the same for two entities, resource constraints may unfairly impact smaller sized firms. Resource constraints could also limit the capacity required to meet compliance targets; smaller firms may therefore be disproportionately impacted, affecting their profitability and business sustainability and ability to meet targets.

We recommend identification of such sectors or entities by considerations of trade exposure and emissions intensity and increase in costs due to regulation or cost of abatement relative to revenues. Depending on the relative level of vulnerability and potential costs of such impacts on the vulnerable sectors, market design may consider measures such as free allocation of allowances to such sectors.

On a policy level, provisions such as keeping allowance reserves to cover emissions of new market entrants or significant capacity addition may be considered to manage competitiveness impacts when an absolute cap becomes feasible. Similarly, as the market transitions over time to auctioning as the method for allocating allowances, auction revenues may be utilized to compensate or assist vulnerable players to ensure compliance while safeguarding competitiveness and minimizing leakage risks (see Section 5.2). In the meantime (while the market still has no or low levels of auctioning), the government will have to fund the compensatory measures, either from the national coffer or from international climate finance flows.

Managing distributional impacts

Carbon caps, with or without markets, bring in an implicit or explicit price on emissions, which inherently make emissions costlier and thus operations costlier. This cost may be passed on to consumers or may result in job losses to cut costs or as an effect of technology upgradation to meet targets. These impacts are disproportionately higher for low-income groups or informal workers who have less purchasing power or no income security. Passing the cost to consumers also affects affordability for lower income classes, as the rising costs form a larger share of their incomes.

Policy measures such as redistribution of auction revenues toward direct cash transfers, investing in health and education or in employment guarantee schemes, or targeted compensatory transfers, along with necessary skills training for affected workers, must be planned for in order to avoid the inequitable impacts of a potential carbon market.

Stakeholder engagement

Buy-in from all relevant stakeholders is necessary for the success of even the best designed carbon markets. It is critical to develop a carbon market and its design through a consultative process to make it relevant, effective, and grounded in practical considerations. The experience of this exercise demonstrated that the corporate sector is amenable to the possibility of a carbon market and providing feedback in this context.

In the absence of robust sectoral benchmarks and emissions data, feedback from industries would be crucial for ensuring an effective carbon market. Additionally, coordination across government line ministries, such as through the AIPA, is necessary to effectively plan and operationalize an efficient carbon market. Finally, mechanisms should be created to continually seek feedback and improve market design and implementation over time. Overall, stakeholder engagement should be meaningfully integrated at every stage to ensure the sustainability and effectiveness of any market policy. These stakeholder engagement efforts would have to span from the outset, through the design and roll out and in the review process to help improve the effectiveness over subsequent phases.

CHAPTER 6

Way forward

Recommendations from our study must be complemented by extensive consultations with experts, industry and relevant governmental agencies. Institutional and industry capacity building and streamlined emissions data reporting infrastructure are key to the success of a carbon market in India. These, along with simulations and pilots can strengthen the design choices and help identify key policies for leveraging carbon markets for cost-efficient achievement of India's climate and developmental goals.

A carbon market is a powerful policy tool that enables emissions to be reduced where it is most cost-effective in the economy, while also providing the flexibility to incorporate provisions to address the potential impacts of carbon pricing on businesses and society. Amid increasing expectations from countries, including India, to enhance the ambition of their climate targets, it is critical to explore carbon markets as a means to lower the cost of achieving emissions targets and facilitate the exchange of emissions reduction outcomes across the global economy.

Through the implementation of the PAT and REC schemes over the last decade, India has been able to create some institutional capacity for operationalizing MBMs. This provides a good starting point for implementing a carbon market that expands the emissions and sectoral coverage of these schemes and synthesizes them into a common, carbon currency-based framework. Such a framework is likely to increase efficiency by providing more flexibility in the choice of emissions reduction options, reducing transaction costs of administering multiple markets, and bringing sectors with untapped emissions reduction potential or lower emissions abatement costs into the market.

This study used lessons from global carbon markets and domestic MBMs to identify the key design considerations for a carbon market in the Indian context. It also gathered preliminary evidence in relation to the potential opportunities, challenges, and stakeholder perspectives in the context of operationalizing such a market by simulating a notional market that was designed based on these considerations. We found that the cost-efficiency gains from emissions trading in a cross-sectoral carbon market are likely to be significant if transaction costs can be kept low via intelligent design choices. We also saw a positive outlook and a willingness to engage in relation to a potential carbon market in the corporate sector through our outreach and study activities.

Our sample, however, represented companies that voluntarily track and report their emissions and have undertaken measures to reduce their emissions, which is not true for the Indian corporate sector at large in the absence of a mandatory emissions reporting program. As the first step toward a potential carbon market, we therefore recommend an emissions reporting program for the corporate sector, which will help build capacity and consistency in emissions accounting practices across companies. This, in turn, will enable market simulation exercises such as this one or pilots to be conducted with larger samples and better sectoral representation.

There are also several other relevant questions in the context of a potential carbon market in India, which we have referred to but not addressed in this study. This includes the feasibility of aggregation of regulated entities in less emissions-intensive sectors to enable their participation in the market, and that of market-linked domestic offset schemes, which can incentivize emissions reduction in small or unorganized industry segments such as the MSME sector. Other questions include those of linkage or subsumption of existing domestic MBMs within a potential national carbon market, design choices that can enable market linkage to other carbon markets around the world under Article 6.2 of the Paris Agreement, and specific mechanisms for addressing the potential impacts of carbon pricing through the market on vulnerable sections of society. Further research can provide answers to these questions as the discussion around the scope and structure of a carbon market in India takes a more concrete shape and the international rules to operationalize carbon markets under Article 6 of the Paris Agreement are developed in the near future.

Appendices

APPENDIX A. PARTICIPANTS IN THE CARBON MARKET SIMULATION

1. Adani Green Energy Limited (AGEL)
2. Adani Power Limited*
3. Adani Transmission Limited
4. Delhi Metro Rail Corporation (DMRC)
5. Godrej & Boyce Mfg. Co. Limited (G&B)
6. Infosys Limited
7. ITC Limited*
8. Jain Irrigation Systems Limited
9. Jain Farm Fresh Foods Limited
10. JK Tyre & Industry Limited
11. Mahindra Lifespace Developers Limited
12. Mahindra World City, Chennai
13. Mahindra World City, Jaipur
14. Marico Limited
15. Pratibha Syntex Limited
16. SABIC India Private Limited
17. Thermax Limited
18. Tata Capital Financial Services Limited*
19. UltraTech Cement Limited
20. Wipro Limited
21. Yes Bank Limited

**Companies did not participate in trading.*

APPENDIX B.
PARTICIPANT SURVEY AND INTERVIEW QUESTIONNAIRES

Survey Questions

TRADING CYCLE I SURVEY	
1	Did you have any successful bids/asks? a. Yes, without any difficulty. b. No.
2	Can quarterly reporting through the MRV exercise of the simulation help in streamlining the frequency of your internal data collation/emission estimation/reporting process?
3	How well were you able to consider the following factors to inform your bid/ask? Comparing with Internal Abatement Cost (rate 1: Not at all, to 5: Very well) Expectation on achieving the emission intensity target in the remaining duration of the compliance period (rate 1: not at all, to 5: very well) Expectation on Market Clearing Price (MCP) in the subsequent trading cycles (rate 1: Not at all, to 5: Very well)
4	How prepared/confident did you feel while making the trading decision in the 1st trading cycle? (rate 1: Not at all confident, to 5: Very confident)
5	After having experienced 1 trading cycle, how prepared/confident do you feel about making a trading decision in the next cycle? (rate 1: Not at all confident, to 5: Very confident)
6	From this experience, do you feel large-scale capacity building will be required among companies to make trading decisions/participate in a real carbon market? (rate 1: Not required, to 5: Very much required)
7	Do you have experience in trading through other Market Based Mechanisms? (PAT/REC) Yes. No.
8	If yes, what were the most stark differences between that experience and the simulation trading?

TRADING CYCLE II SURVEY	
1	Did you have any successful bids/asks? a. Yes, without any difficulty. b. No.
2	Were you able to complete quarterly accounting and reporting of scope-1 and scope-2 emissions required for the interim MRV exercises? a. Yes, without any difficulty. b. Yes, although we faced some challenges in quarterly collection/consolidation of relevant data. c. No.
3	To what extent can quarterly reporting through the MRV exercises help in streamlining the frequency of your internal processes for emissions tracking/management? (rate 1: Not at all, to 5: Yes, a lot)
4	Do you consider the notional target set for your company for the Carbon Market Simulation to be: Realistic. Too ambitious. Not ambitious enough.
5	To what extent can the baseline and target-setting exercise of the Carbon Market Simulation be useful for your company in planning and setting internal emission reduction targets? (rate 1: Not at all useful, to 5: Extremely useful)
6.	How well were you able to consider the following factors while quoting your bid/ask? Your internal abatement cost (rate 1: Not at all, to 5: Very well) Emission performance in the remaining part of the compliance period (rate 1: Not at all, to 5: Very well) Market information from the previous trading cycle (rate 1: Not at all, to 5: Very well)
7	How well were you able to understand the trading and market clearance rules? (rate 1: Not at all, to 5: Totally clear)
8	To what extent was the market outcome in this trading cycle in line with your expectations, given market information from the previous trading cycle? (rate 1: Not at all in line with my expectations, to 5: Completely in-line with my expectations)
9	To what extent has the Covid-19 pandemic affected: Performance with respect to your Simulation target Predicting your emissions performance over the remaining compliance period for making your trading decisions (rate 1: Not at all, to 5: Completely)
10	After having experienced 2 trading cycles, how prepared/confident do you feel about making a trading decision in the next cycle? (rate 1: Not at all confident, to 5: Completely confident)
11	From this experience, do you feel large-scale capacity building will be required among companies to make trading decisions/participate in a real carbon market? (rate 1: Not at all, to 5: Yes, definitely)

TRADING CYCLE III SURVEY	
1	Were you able to complete quarterly accounting and reporting of scope-1 and scope-2 emissions required for the interim MRV exercises? Yes, without any difficulty. Yes, although we faced some challenges in quarterly collection/consolidation of relevant data. No.
2	Do you consider the notional target set for your company for the Carbon Market Simulation to be: Realistic. Too ambitious. Not ambitious enough.

TRADING CYCLE III SURVEY	
3	How well were you able to consider the following factors while quoting your bid/ask? your internal abatement cost (rate 1: Not at all, to 5: Very well) market information from the previous trading cycle (rate 1: Not at all, to 5: Very well)
4	How well were you able to understand the trading and market clearance rules? (rate 1: Not clear at all, to 5: Very well)
5	To what extent was the market outcome in this trading cycle in line with your expectations, given market information from the previous trading cycle? (rate 1: not all in line with my expectations, to 5: completely in line with my expectations)
6	To what extent has the Covid-19 pandemic affected: performance with respect to your Simulation target (rate 1: Not affected at all, to 5: Completely affected)
7	After having participated in this entire exercise, how would you estimate the readiness of you and your company towards trading in a carbon market? (rate 1: not at all ready, to: completely ready)
8	Based on your experience in this simulation, do you think a national carbon market would be an effective mechanism to facilitate emission reduction for the Indian Industry? Yes No Unsure

Interview Questionnaire

QUESTIONNAIRE FOR NON-PARTICIPATING COMPANIES	
1	**COMPANY OR SECTOR'S GENERAL ATTITUDE TOWARDS A CARBON MARKET/MARKET DESIGN** What kind of carbon pricing mechanism do you think would be most applicable and beneficial to your organization and sector, keeping in mind that a carbon price would lead to implementing emissions regulations?
2	**NEED FOR A COMPLEMENTARY POLICY** What kind of government interventions and support (in terms of subsidies/low-interest loans for technology upgrades/tax holidays for RE installation/capacity building etc.) would you think your sector/organization would benefit from?
3	**THE COMPANY/SECTOR'S GENERAL VIEW ON THE DESIGN OF A CARBON MARKET IN INDIA** I) Price Stability: Given the trade-off of price stability (floor price and ceiling price), which gives you a price signal would restrict the transactions that would happen will not happen. Would you prefer a market that would give you more flexibility to trade or a more stable market price for allowances? II) Target setting and allocation: What kind of target setting (intensity/absolute) and allocation (sector benchmarking/individual company) do you think your company and your sector would prefer and benefit from? Should non-compliance be penalized? In what form (financial/name and shame) and why? III) If the company is already a part of the PAT scheme: If the carbon market for India is designed and implemented on the lines of those of PAT: What would be your key concerns? This could be in the scheme's actual design, the process of implementations (would you prefer sectors be introduced in phases), the entity level participation (preferred trading is group/company/unit level). Do you feel that that they have benefited from the PAT scheme?
4	**POTENTIAL ROLE OF THE MSME SECTOR IN A CARBON MARKET** 1) Scope 3 and what role would MSMEs place in reducing it Since a specific proportion of your emissions can be offset through their value chain, does reducing your scope 3 become more cost-effective than reducing your Scope 2 and 1? If yes, would you be willing to support your supply chain to facilitate emission reduction offsets? 2) (if time permits and if there is a sense that OEMs can do more to facilitate further scope 3 emission reduction MSME collaboration) What other interventions are possible to adopt (what other forms of assistance to the MSMEs), and which ones your organization plans to take up?
5	**READINESS IN TERMS OF CAPACITY TO PARTICIPATE IN TRADING** If the company does not monitor and report their emissions: Does your organization plan to start monitoring and reporting their GHG emissions?

QUESTIONNAIRE FOR PARTICIPATING COMPANIES	
1	**CAPACITY BUILDING THROUGH THE SIMULATION** How was your experience in the simulation? How did it help you in any way, in terms of enhanced internal climate ambition through a new strategy or projects, streamlining reporting systems, capacity building, etc.? Has there been any change in your internal processes as a result of participating in the simulation?
2	**CARBON PRICING** In case a carbon pricing regulation is implemented for emission reduction in India, what form of carbon pricing would be the most beneficial for your organisation and sector: a carbon tax, a carbon market or subsidies on emission reduction technologies? And why? What are some of the challenges of this carbon pricing regulation for your company and sector? Do you think a carbon market, or any other form of carbon pricing mechanism, would have an impact on competitiveness or industry growth?

QUESTIONNAIRE FOR PARTICIPATING COMPANIES	
3	**ACCOUNTING, TARGET SETTING & REPORTING**
	If a carbon market is introduced in India, would there be a need for standardisation of accounting practices and emission factors adopted across sectors?
	What kind of target setting method (sectoral benchmarking, grandparenting, etc) would be most applicable and beneficial to your sector? Would you have any comments on the target setting method we used for the simulation?
	Did setting a short, medium and long term target help your organisation in any manner, example: stock taking of current progress to achieving target, exploring targets, etc.?
	Keeping in mind that intensity targets may not always lead to decline in total emissions, would you prefer an absolute target over an emissions intensity target?
	What were the reasons for selecting the target scenario you chose for the purpose of the simulation? In hindsight, do you think the selected target scenario was realistic? If not, please elaborate.
	Was collecting data on the parameters that we as regulators required you to report taxing to collect? Are there any additional parameters that we should have considered?
4	**MRV & TRADING**
	MRV
	Did the frequency of emission data to be reported aid in keeping track of your overall target achievement?
	Additionally, did the frequency aid to better inform your interim trading decisions or did it add to your transaction cost?
	Did the frequency of data collection help to streamline your organisation's internal data collection processes?
	TRADING
	What were the parameters (MAC, MCP, future performance, market behaviour) did you use to inform your trading strategy? Were your price points quoted in line with your internal cost of abatement?
	Did the interim trading helpful for you to achieve your organisation's overall emission reduction target/help improve your financial gain from the market?
	Where there any particular challenges you faced while trading?
	Was the content provided in the newsletters helpful to make better informed trading decisions? Was there any additional information, that was not included, that would have helped your trading decisions?
	Based on your experience in the simulation, do you think a carbon market could help reduce your organisation's cost of abatement?
	What degree was cost-saving a driving force in your decision to be a part of the market?
	PANDEMIC
	How did the pandemic affect your operations and your planned emission reduction activities?
	How did the pandemic impact your target compliance? Do you think in the absence of a pandemic, your company would have performed differently in terms of meeting your targets?
5	**DESIGN CONSIDERATIONS FOR A CARBON MARKET**
	Do you think a cross-sectoral market will be more beneficial to your organisation or sector than a market with only a few carbon-intensive sectors, like that in PAT?
	Flexibility allows maximum economic efficiency but lesser price stability, whereas more price stability, through a floor and ceiling price, reduces economic efficiency but gives you a stable price signal. a) Would you prefer flexibility or stability in the market price? b) According to you, what would be a reasonable floor price for India?
	Should a non-compliance be penalized? Would you prefer a financial or a non-financial "naming and shaming" penalty?
	Do you have any feedback on the following design considerations:
	Frequency of trading
	time allocated to trading
	format of bid/ask form
	information provided before the trading

QUESTIONNAIRE FOR PARTICIPATING COMPANIES	
6	**NEED FOR COMPLEMENTARY POLICIES** In the case of an emission reduction regulation, what kind of government supporting interventions would be helpful for your sector/organization? For example, subsidies, low-interest loans for technology upgrades, tax holidays for RE installation, capacity building, etc.
7	**ROLE OF MSMEs** One design option of an ETS is to generate carbon credits by facilitating emission reduction in the MSMEs in your supply chain, which then can be traded in the market. Would this offsetting of emissions be a more cost-effective option for your organisation than reducing your scope 1 and 2 emissions? If yes, would you be willing to support the MSMEs in your supply chain to reduce their emissions? What are some ways in which you could support the MSMEs in your supply chain to adopt emission reduction measures? How do you currently engage with them in this context?

APPENDIX C. MARKET OUTCOMES OF TRADING

C1. Trading cycle I: August 1, 2020

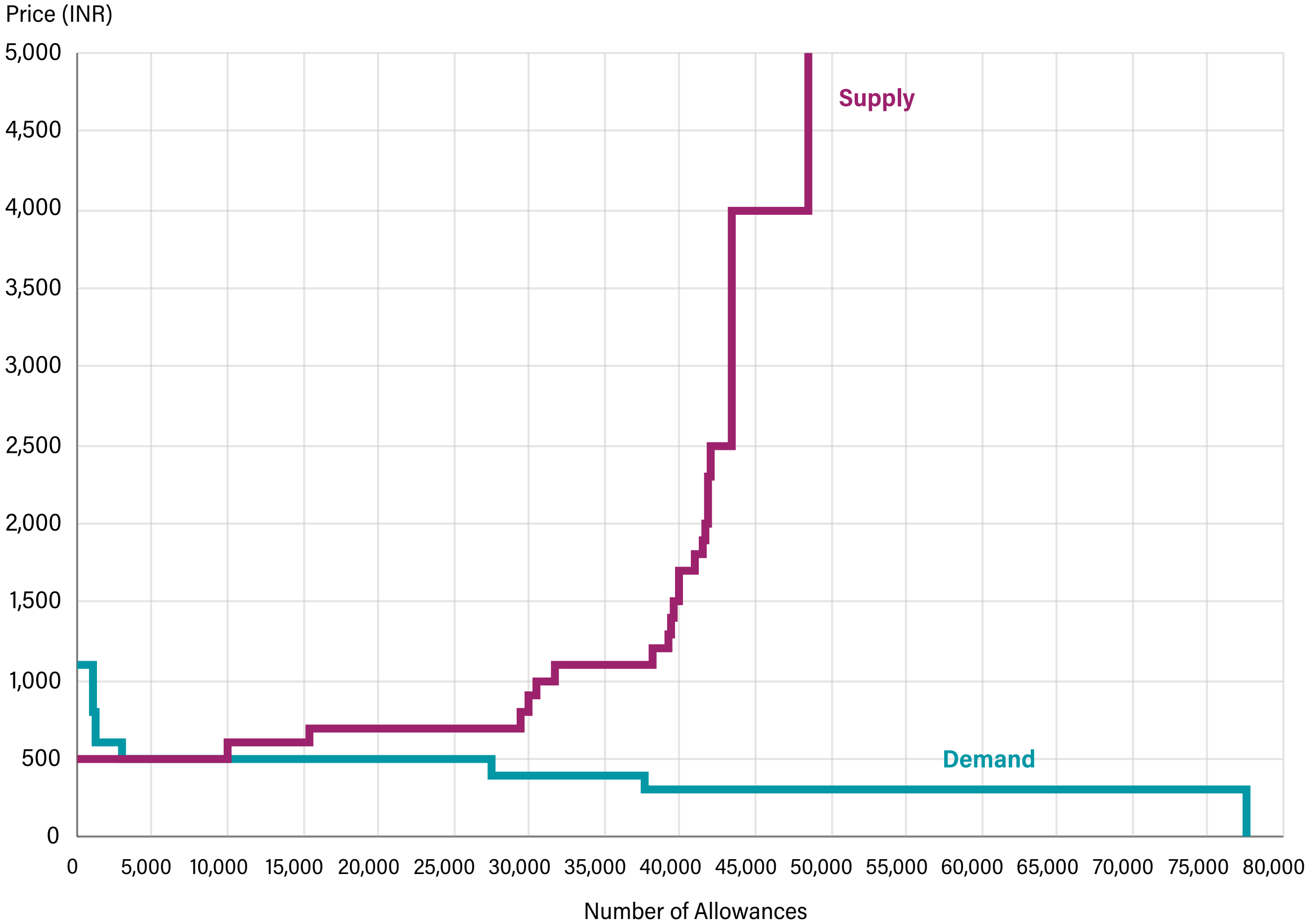
TABLE C1 | Overview of trading cycle I

PARAMETER	TRADING CYCLE I
Type of trading cycle	Interim
Period covered	Q1 & Q2 (January through June 2020)
Number of participants	14 companies
Type of target	Emissions intensity (Scope 1 + Scope 2)
Bidding window	August 19-21, 2020
Method of trading	Sealed bid, uniform price, double auction
Floor and ceiling price	None
Market outcome	August 26, 2020

TABLE C2 | Snapshot of the market

	METRIC	QUANTITY	PRICE (INR)
Bid market	Number of companies	5	n/a
	Total quantity of bids submitted	77,570	n/a
	Minimum bid price quoted	n/a	300
	Maximum bid price quoted	n/a	1,100
Ask market	Number of companies	9	n/a
	Total quantity of asks submitted	48,440	n/a
	Minimum ask price quoted	n/a	500
	Maximum ask price quoted	n/a	4000
Market aggregation	Market clearing price (MCP)	n/a	500
	Trade volume (quantity of bids/asks executed)	10,000	n/a

FIGURE C1 | Aggregated demand and aggregated supply curve for trading cycle I



Source: WRI authors.

C2. Trading cycle II-round 2: December 2020

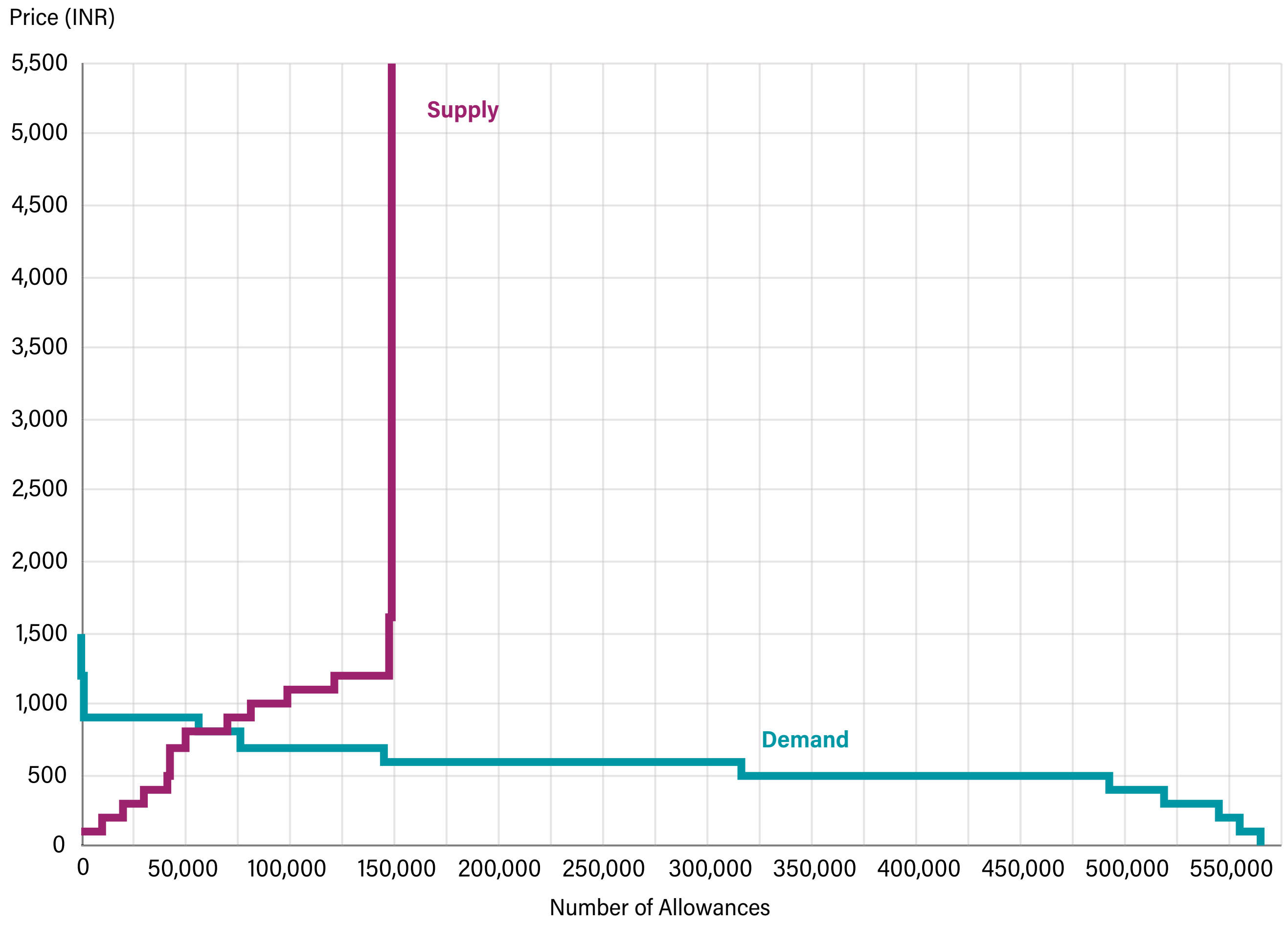
TABLE C3 | Overview of trading cycle II

PARAMETER	TRADING CYCLE II
Type of trading cycle	Interim
Period covered	Q1, Q2, and Q3 (January to September 2020)
Number of participants	18 companies
Type of target	Emissions intensity (Scope 1 + Scope 2)
Bidding window	December 9-11, 2020
Method of trading	Sealed bid, uniform price, double auction
Floor and ceiling price	None
Market outcome	December 17, 2020

TABLE C4 | Snapshot of the market

	METRIC	QUANTITY	PRICE (INR)
Bid market	Number of companies	8	n/a
	Total quantity of bids submitted	5,65,701	n/a
	Minimum bid price quoted	n/a	100
	Maximum bid price quoted	n/a	1,500
Ask market	Number of companies	10	n/a
	Total quantity of asks submitted	1,49,070	n/a
	Minimum ask price quoted	n/a	100
	Maximum ask price quoted	n/a	5000
Market aggregation	Market clearing price of Trading Cycle 2 (MCP_{TC2})	n/a	800
	Trade volume (quantity of bids/asks executed)	69,535	n/a

FIGURE C2 | Aggregated demand and aggregated supply curve for trading cycle II



Source: WRI authors.

C3. Trading cycle III: March 8–10 and 15–17, 2021

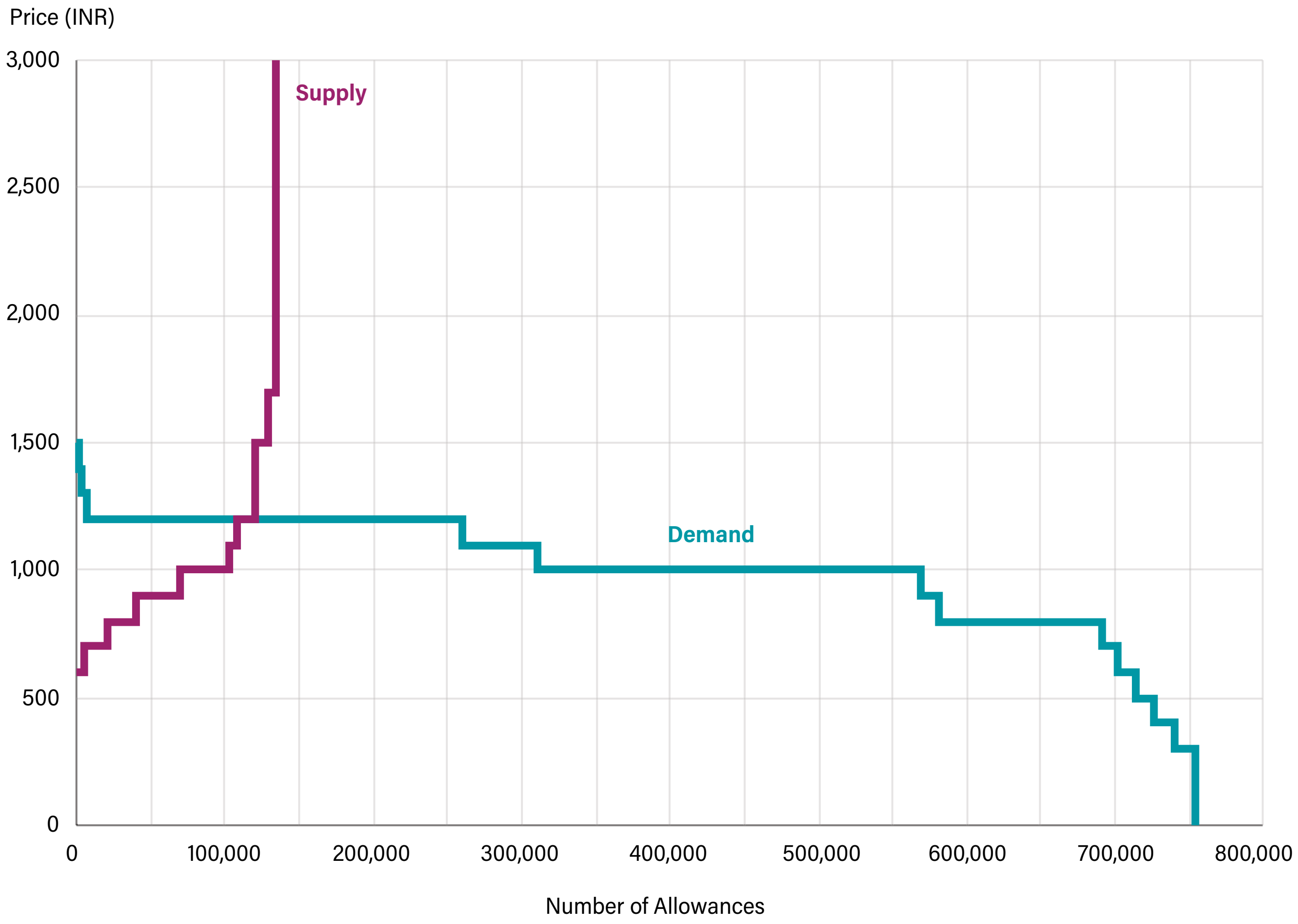
TABLE C5 | Overview of trading cycle III

PARAMETER	TRADING CYCLE III
Type of trading cycle	Final (cumulative of 2 rounds)
Period covered	Calendar year 2020 (January to December)
Number of participants	Round 1: 17 companies Round 2: 15 companies
Type of target	Emissions Intensity (Scope 1 + Scope 2)
Bidding window	Round 1: March 8-10, 2021 Round 2: March 15-17, 2021
Method of trading	Sealed bid, uniform price, double auction
Floor and ceiling price	None
Market outcome	March 24, 2021

TABLE C6 | Snapshot of the market

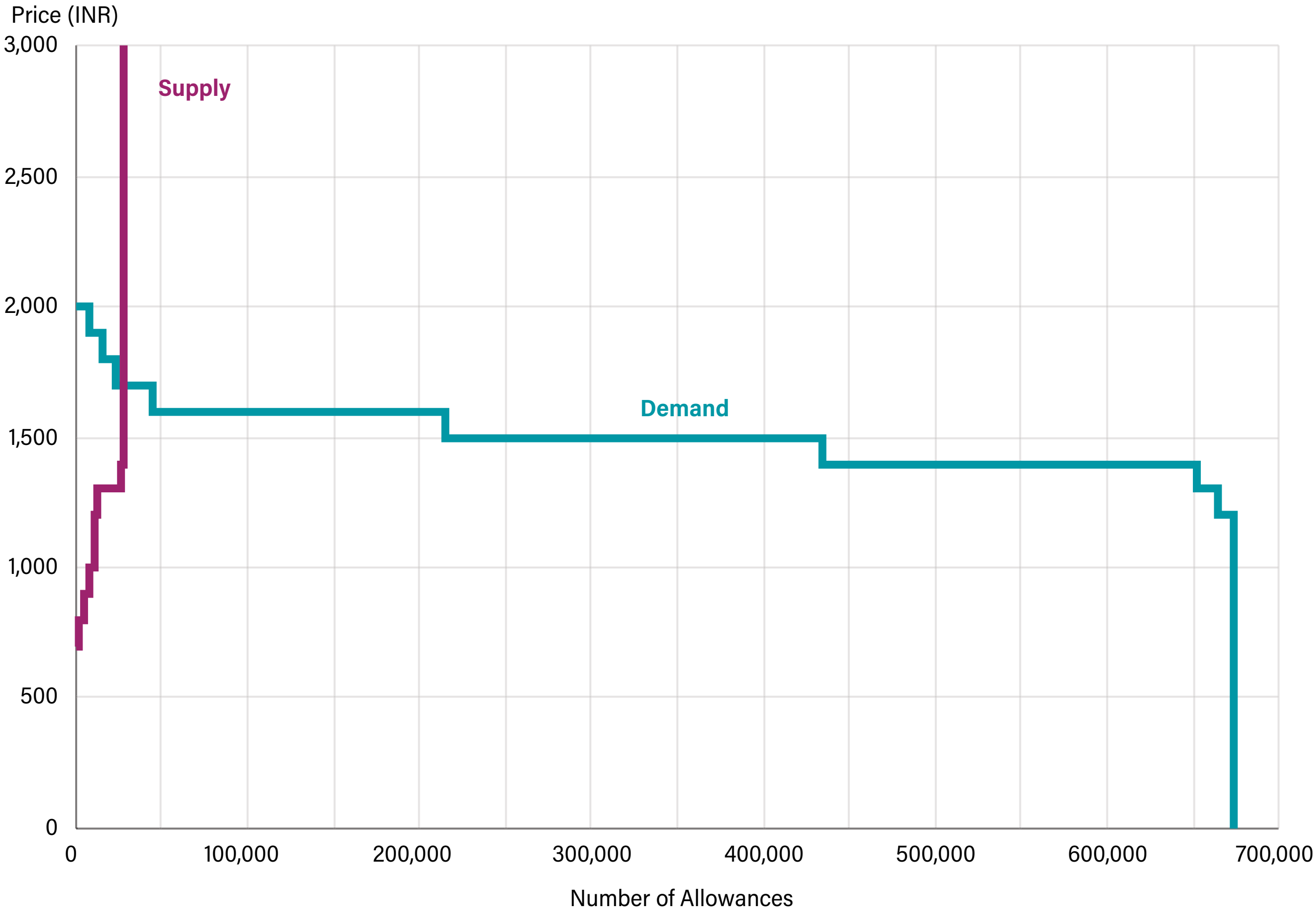
	TRADING CYCLE III				
	Metric	**Round 1**		**Round 2**	
		Quantity	**Price (INR)**	**Quantity**	**Price (INR)**
Bid market	Number of companies	9	n/a	8	n/a
	Total quantity of bids submitted	7,54,675	n/a	6,74,341	n/a
	Minimum bid price quoted	n/a	300	n/a	900
	Maximum bid price quoted	n/a	1,500	n/a	2,000
Ask market	Number of companies	8	n/a	7	n/a
	Total quantity of asks submitted	1,35,124	n/a	27,523	n/a
	Minimum ask price quoted	n/a	600	n/a	700
	Maximum ask price quoted	n/a	2,100	n/a	1,600
Market aggregation	Market clearing price of Trading Cycle III (MCP_{TC3})	n/a	1,200	n/a	1,700
	Trade volume (quantity of bids/ asks executed)	1,21,024	n/a	27,523	n/a

FIGURE C3 | Aggregated demand and aggregated supply curve for trading cycle III-round 1



Source: WRI authors.

FIGURE C4 | Aggregated demand and aggregated supply curve for trading cycle III-round 2



Source: WRI authors.

APPENDIX D. ASSUMPTIONS AND METHODS

D1. Calculation of efficiency gains from the market

Rational trading behavior by participants (in the absence of a financial penalty) would imply quoting bid/ask prices with respect to their marginal abatement cost (MAC) such that bids are quoted at prices less than or equal to corresponding price points in their MAC curve and asks are quoted at prices greater than or equal to corresponding price points in their MAC curve.

The market clearance criteria identified bids and asks that are eligible for execution as bids made at a price ("BidPrice") greater than or equal to the market clearing price (MCP) and asks made at a price ("AskPrice") less than or equal to the MCP. Combining the assumption of rational behavior by participants with the market clearance criteria, the quoted bid and ask prices should fall in the following range:

$$MAC_{ask} \leq AskPrice \leq MCP \leq BidPrice \leq MAC_{bid}$$

The difference between the MAC and the MCP determines efficiency gain achieved in reducing that tonne of CO_2 through the market, as opposed to individual internal abatement. Summing this for all bids refers to the consumer surplus in the market in terms of an "avoided cost" for buyers. Similarly, the difference between the MCP and MAC represents the efficiency gain from reducing an additional tonne of CO_2 and selling the reduction in the market. Summing this for all asks refers to the producer surplus in the market in terms of "revenue generation" for sellers.

In the absence of data pertaining to the marginal abatement cost curves of the participating companies, in order to calculate the efficiency gains from the market in this exercise, the quoted price of each successful bid/ask was assumed to be equal to the company's marginal abatement cost to abate the tonne of CO_2e, calculated as follows:

Consumer surplus: ∑ [(bid price – MCP) × bid quantity executed]

Producer surplus: ∑ [(MCP – ask price) × ask quantity executed]

The sum of the consumer surplus and producer surplus indicates the total efficiency gains made from trading in the market, as opposed to internal abatement by each participant to meet the same emissions reductions (assuming zero transaction costs of market participation).

ABBREVIATIONS

AIPA	Apex Committee for the Implementation of the Paris Agreement
BAU	business as usual
BEE	Bureau of Energy Efficiency (Ministry of Power, Government of India)
CBAM	Carbon Border Adjustment Mechanism
CCA	Climate Change Agreements
CCR	cost containment reserve
CDM	Clean Development Mechanism
CER	Certified Emission Reduction Units
CERC	Central Electricity Regulatory Commission (Ministry of Power, Government of India)
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COP26	26th session of the Conference of the Parties
DISCOM	electricity distribution company
EITE	emissions-intensive and trade-exposed
ESCerts	energy saving certificates
ETS	emissions trading scheme
EU ETS	European Union Emissions Trading System
F-gas	fluorinated gas
FMCG	fast-moving consumer goods
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
K-ETS	Korean Emissions Trading Scheme
LULUCF	land use, land-use change, and forestry
MAC	marginal abatement cost
MBM	market-based mechanism
MCP	market clearing price
MMT	million metric tonnes
MNRE	Ministry of New and Renewable Energy, Government of India
MoEFCC	Ministry of Environment, Forest, and Climate Change, Government of India
MoF	Ministry of Finance, Government of India
MoP	Ministry of Power, Government of India
MRV	monitoring, reporting, and verification
MSME	micro, small, and medium enterprises
MSR	Market Stability Reserve
MSW	municipal solid waste
MTOe	million metric tonnes of oil equivalent
N_20	nitrous oxide
NDC	Nationally Determined Contribution
NER	new entrants reserve
NZ ETS	New Zealand Emissions Trading Scheme
PAT	Perform, Achieve, Trade
PFC	perfluorocarbon
PMR	Partnership for Market Readiness
POSOCO	Power System Operation Corporation (Ministry of Power, Government of India)
RBCF	results-based climate finance
REC	Renewable Energy Certificate
RGGI	Regional Greenhouse Gas Initiative
RPO	renewable purchase obligation
SBTi	Science Based Targets initiative
SERC	State Electricity Regulatory Commissions, Government of India
UNFCCC	United Nations Framework Convention on Climate Change

GLOSSARY

TERM	MEANING
allowance/emissions allowance	A tradable certificate or permit that represents the legal right to emit one metric tonne of carbon dioxide or equivalent GHG
allowance allocation	Distribution of emissions allowances to all regulated entities of a carbon market
allowance surrender	The number of allowances to be submitted by a regulated entity at the end of the compliance period corresponding to its actual emissions during this period
allowance trading	A scheme which allows for the exchange (buying and selling) of emissions allowances between regulated entities
Article 6 of Paris Agreement	Section of the Paris Agreement that allows governments to implement their NDCs through international cooperation, including the international transfer (exchange) of achieved mitigation outcomes between countries
banking	Holding of allowances in one compliance period for the purpose of sale or surrender in a future compliance period
baseline	Verified annual historic GHG emissions data of a regulated entity that is used to project future trends or is used as a base value for future reductions targets
bidding window	A fixed period of time in a trading cycle wherein the regulated entities can submit offers to buy or sell allowances
borrowing	A provision that allows regulated entities to use a specified proportion of emissions allowances from a future compliance period in the current compliance period
business as usual	A scenario that represents future patterns based on the assumption that present trends will continue unchanged
buy offer (bid)	An offer to purchase a quantity of allowances at or below a quoted price
ceiling price	Predetermined maximum value of the price of an allowance in a carbon market; a price stability instrument to prevent the carbon price from rising beyond a set threshold
compliance period	The period of time during which regulated entities must comply with a regulation, here the mandate of the carbon market; this period can be annual, multi-year, or sub-annual
demonstrating compliance	The commitment of an organization to conform with the regulation it falls under the mandate of; in a carbon market, it implies the submission of allowances by regulated entities corresponding to their real emissions in the compliance period
emissions intensity	Level of GHG emissions per unit of physical or economic output
emissions cap	A limit on the GHG emissions that can be emitted within the jurisdiction of the carbon market; distributed in the form of emissions allowances among regulated entities to allow trade in a carbon market
emissions threshold	Maximum level of permissible emissions emitted by an entity that is excluded from an emission regulation; beyond this threshold, the entity must comply by said regulation
flexibility measures	Measures that allow flexibility in the "when, where, and how" of emission reductions in the carbon market, including temporal flexibility provisions such as banking and borrowing, and location-based flexibility such as offsets that allow for mitigation to occur outside the scope of the market
floor price	Predetermined minimum value of the price of an allowance in a carbon market; a price stability instrument to prevent the carbon price from falling beyond a set threshold
GHG monitoring and management	Measurement of the emissions emitted by an entity, understanding their sources, setting a goal for reducing emissions, developing a plan to meet this goal, and implementing the plan to achieve reductions in emissions
intensity metric	Unit of physical or economic output used to calculate emissions intensity
interim reporting	Reporting of emissions data for a period shorter than the compliance period for the purpose of internal stocktaking
market-based mechanism/ instrument	Policy instruments that use markets, price, and other economic variables to provide incentives for GHG emitters to reduce their emissions by addressing negative externalities

TERM	MEANING
monitoring, reporting, and verification (MRV)	Collection of data on emissions, mitigation actions and support. Monitoring is the direct measurement or estimation of emissions following standardized measurement or accounting procedures and protocols. Reporting is the documentation to report the data in a standardized reporting template, protocol, or procedure and includes information on methodologies, assumptions, and data. Verification involves expert review/auditing to verify the quality of the data and estimates.
offsets	Reduction in emissions of carbon dioxide or other GHGs made in order to compensate for emissions made elsewhere
penalty	Monetary compensation by a regulated entity of a carbon market that fails to meet its compliance obligation (i.e., fails to submit allowances equivalent to its real emissions for that compliance period)
point of regulation	The point in the economic value chain that falls under the mandate of a carbon market
price collars	The predetermined upper and lower limits of the market determined carbon price
price stability measures	Mechanisms to control market determined carbon price, including price collars and/or the provision to add or withdraw a reserve volume of allowances to the market to manage price volatility
registry/emissions trading registry	Database that maintains an account of all allowances in a market, tracking the number of allowances with each regulated entity at all times, including allocations, transfers, surrenders, and cancellations
Science Based Target	An approach to set corporate targets for GHG emissions reduction that are consistent with a 1.5° C or 2°C global temperature rise scenario
Scope 1 emissions	Direct emissions from sources owned or controlled by an organization
Scope 2 emissions	Indirect emissions from the generation of energy purchased by an organization
Scope 3 emissions	All indirect emissions (not included in Scope 2) that occur in the value chain of an organization, including both upstream and downstream emissions
scope of emissions	GHGs and associated emissions sources included in the purview of a regulation (e.g., in a carbon market, determining which sectors or entities would fall under the regulation)
sealed bid uniform price double auction	A mechanism of commodity exchange involving multiple buyers and sellers, wherein each buyer is allowed to submit several bids without any interaction with other market participants. Each supplier can similarly submit several asks. After all offers are submitted, the aggregate demand and aggregate supply of the commodity in the market are used to determine the market clearing price (MCP). All bids greater than or equal to the MCP and asks less than or equal to the MCP are successful and executed at a uniform price equal to the MCP.
sell offer (ask)	A quantity of allowances the participant would like to sell at or above a quoted price
specific energy consumption/ energy intensity	Energy consumption per unit of economic output
target setting	The process of determining the emissions target of a regulated entity in a carbon market
target/emissions target	A predefined permissible level of emissions (defined in absolute or intensity terms) for a regulated entity for the duration of the compliance period
trading cycle	A periodic platform for regulated entities to exchange allowances, facilitated by the organizing body and involving several steps, including the collection of bids, determination of the market clearing price, and execution of successful transactions

ENDNOTES

1. Carbon markets can also work using performance-based standards.

2. These include ETSs in Colombia, Indonesia, Montenegro, Sakhalin province (Russia), Ukraine, Vietnam, and Washington state (United States).

3. Industry emissions refer to energy-related emissions from the construction and manufacturing segment, plus IPPU emissions from the third Biennial Report submitted by India to the UNFCCC to report India's 2016 national GHG inventory. IPPU emissions in 2016 were 226 $MMTCO_2e$ and energy-related construction and manufacturing emissions were 398 $MMTCO_2e$ (MoEFCC 2021).

4. Scope 1 emissions are direct GHG emissions that occur from sources that are owned and controlled by the company, such as emissions from chemical processes or controlled process equipment, and emissions from combustion in owned boilers, furnaces, and vehicles. Scope 2 emissions are GHG emissions during purchased electricity generation by the company. Scope 2 emissions occur at the power plant where the electricity is generated, outside of the organizational boundary. Scope 3 emissions are those that occur as a result of the activities of the company, but from sources not owned or controlled by the company. This includes, for example, extraction and production of purchased materials, transportation of fuels, and use of planes, railways, and other public transport.

5. The SBTi has subsequently revised its target-setting criteria and only allows for company targets compatible with a global 1.5°C temperature rise scenario, effective 15 July 2022.

6. All emissions intensity outcomes are converted to absolute emissions at static (base year) levels of economic activity.

7. Including emissions from industrial energy consumption, industrial process emissions, and from electricity generation in the power sector, and excluding the net negative emissions from the land use, land-use change, and forestry (LULUCF) sector.

8. The response rate for the three surveys was as follows: Trading Cycle I: 11/14 companies; Trading Cycle II: 16/18 companies; Trading Cycle III: 16/18 companies.

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