THE INDIAN CARBON MARKET

Pathway Towards an Effective Mechanism

Research direction: Sunita Narain and Nivit Kumar Yadav

Writers: Parth Kumar and Manas Agrawal

Editor: Rituparna Sengupta

Cover and design: Ajit Bajaj

Graphics: Vineet Tripathi

Production: Rakesh Shrivastava and Gundhar Das

The Centre for Science and Environment is grateful to the Swedish International Development Cooperation Agency (Sida) for their institutional support.

We are also grateful to these experts for their valuable inputs:

Zhibin Chen, Senior Carbon Market Expert, International Carbon Action Partnership

Dr. Sebastian Osorio, Senior Scientist, PIK - Potsdam Institute for Climate Impact Research

Darius Sultani, Doctoral Researcher, PIK - Potsdam Institute for Climate Impact Research

Citation: Parth Kumar and Manas Agrawal 2024. *The Indian Carbon Market: Pathway towards an effective mechanism*, Centre for Science and Environment, New Delhi

Published by
Centre for Science and Environment
41, Tughlakabad Institutional Area
New Delhi 110 062
Phones: 91-11-40616000
Fax: 91-11-29955879
E-mail: parthkumar@cseindia.org
Website: www.cseindia.org

THE INDIAN CARBON MARKET

Pathway Towards an Effective Mechanism

CONTENTS

Objective of the research		**7**
CHAPTER 1: AN INTRODUCTION TO CARBON MARKETS		**9**
1.1	Market mechanisms for emission reduction: A background	10
1.2	What are carbon markets?	11
1.3	Why do we need carbon markets?	12
1.4	Types of carbon markets: compliance and voluntary	12
1.5	How do compliance markets function through emission trading systems?	14
Carbon Markets Glossary		19
CHAPTER 2: CASE STUDIES OF MAJOR CARBON MARKETS		**20**
2.1	Case study 1: European Union ETS (EU-ETS)	23
2.2	Case study 2: Korea ETS	38
2.3	Case study 3: China ETS	47
2.4	Case study 4: Surat Emission Trading System	57
2.5	Overall summary	65

CHAPTER 3: LEARNINGS FROM THE PAT SCHEME **67**
3.1 The PAT scheme: An introduction 68
3.2 Steel sector: Analysis of CO_2 emission reductions 72
3.3 Cement sector: Analysis of CO_2 emission reductions 73
3.4 Power sector: Analysis of CO_2 emission reductions 74

CHAPTER 4: OVERVIEW, CHALLENGES AND RECOMMENDATIONS **79**
4.1 Overview 80
4.2 Necessary design elements for an ideal carbon market 88
4.3 Challenges and recommendations 89

REFERENCES **101**

OBJECTIVE OF THE RESEARCH

OBJECTIVE OF THE RESEARCH

India has pledged to meet its Nationally Determined Contribution (NDC) targets by 2030. Additionally, it aims to attain net-zero emissions by 2070, following the guidelines set forth by the United Nations Framework Convention on Climate Change (UNFCCC). In order to achieve these goals, India is actively exploring decarbonization strategies and employing emission reduction tools and mechanisms for greenhouse gas (GHG) emitting sectors in the country. Carbon markets represent one such tool or mechanism implemented globally, as well as at national and sub-national levels by numerous countries. India, too, is in the process of developing and launching its own national compliance-based carbon market. This report aims to collate a clear set of learnings from the past and ongoing compliance-based emission trading schemes worldwide, including those operating in India. The aim is to facilitate the effective operationalization of carbon markets in India and ensure they continue to serve their intended purpose of reducing emissions. The major questions that this report attempts to answer are:

- What are the market-based mechanisms for emission reduction, how have they evolved, and what factors have led to the emergence of compliance-based carbon markets and their various types?

- What can be learnt from existing international and Indian emission trading systems for the upcoming Indian carbon markets?

- What lessons from the Perform, Achieve, and Trade (PAT) scheme should be carefully taken into account when designing the forthcoming carbon markets in India and its transition from the PAT scheme?

- What are the possible risks associated with the market? What can be the possible challenges for the upcoming Indian carbon market and what are the suitable and necessary measures to make it effective?

1

AN INTRODUCTION TO CARBON MARKETS

Carbon markets are market-based mechanisms to reduce carbon emissions. If run effectively, they can become key players in meeting GHG reduction targets globally.

There are two primary types of carbon markets: compliance markets that are regulated by governments, and voluntary markets, where entities can offset their emissions by buying credits from carbon offset projects.

India is developing its own carbon market to meet its Nationally Determined Contributions, aiming for a 45% reduction in emission intensity of GDP by 2030. The Indian market will cover multiple sectors and emissions under a national regulatory framework.

1.1 Market mechanisms for emission reduction: A background

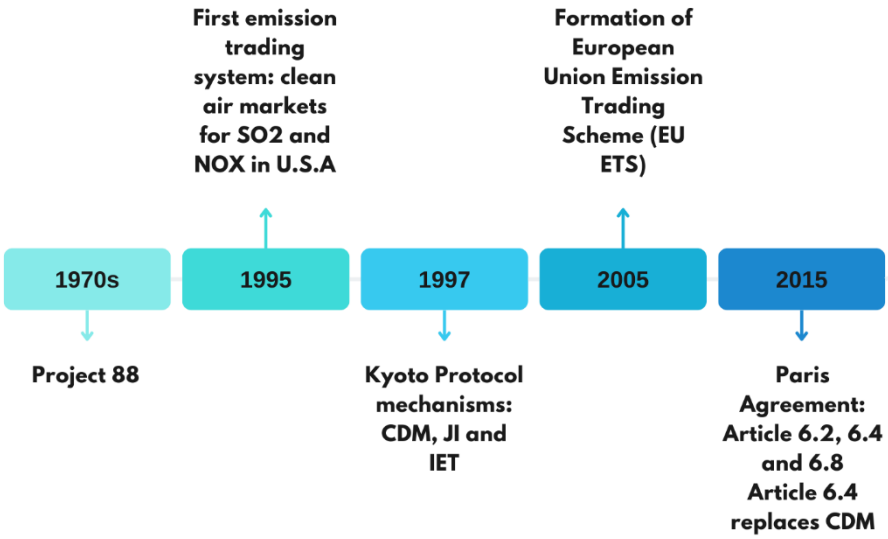
The idea of using market mechanisms for environmental policy came up in the late 1960s and 1970s as a part of 'Project 88' in the United States of America. Project 88 was an effort by a group of US economists and policy makers to find innovative solutions to major environmental and natural resource problems. A similar idea was proposed in Europe in the 1980s. However, the potential role of market mechanisms in environmental policy was not really addressed in the 1992 United Nations Framework Convention on Climate Change. Finally, in 1995, the United States of America launched the first major market-based emission trading system. However, this system was only for air pollutants such as SO_2 and NOx.[1]

Market mechanisms for greenhouse gas (GHG) emissions were first introduced at the Kyoto Protocol in 1997. One of the central features of the Kyoto Protocol was its requirement for countries to reduce their GHG emissions to set levels, which added economic value to emission reduction. To help countries meet their emission targets under the Kyoto Protocol and encourage developing countries and the private sector to contribute to emission reduction efforts, the protocol introduced three market-based mechanisms—International Emission Trading (IET), Clean Development Mechanism (CDM) and Joint Implementation (JI).[2]

In the framework of International Emission Trading (IET), nations bound by the Kyoto Protocol can exchange emission units with other participating countries to address deficits in meeting their respective targets. This further led to the establishment of the European Union Emissions Trading Scheme in 2005 and many other such trading schemes/markets in different regions. The linking of these markets at the global level is expected to happen at some point.

The Clean Development Mechanism (CDM) allowed for a developed nation to undertake a GHG reduction (or emission removal) project in a developing country through which they could earn certified emission reductions (CERs) which could be traded and used by developed countries to meet their emission reduction targets under the protocol. Developing countries could be recipients of capital investment and clean technology under this mechanism. Under Joint Implementation (JI), developed countries with emission reduction commitment under the protocol, can set up clean energy projects in other developed countries with commitments and could use the earned emission reduction units (ERUs) to meet their targets under the protocol.[3]

Figure 1: Evolution of the market mechanisms



Source: CSE, 2023

Article 6 of the Paris Agreement, ratified by 195 nations in 2015, established both market-based mechanisms (outlined in Sections 6.2 and 6.4) and non-market approaches (specified in Section 6.8) for reducing emissions. Under Clause 6.2 of the Agreement, parties or nations have the option to voluntarily participate in cooperative initiatives, such as emission trading. These initiatives involve the utilization of internationally transferred mitigation outcomes (also known as emission reduction units) to help fulfil the targets established within their Nationally Determined Contributions. Article 6.4 of the Agreement replaces the CDM and institutes a global market for trading emissions. This market operates under the oversight and direction of the Conference of the Parties and is available for voluntary use by parties or countries. It mentions that this market shall be supervised by a body designated by the Conference of Parties. Article 6.8 acknowledges non-market approaches available to parties to assist the implementation of their NDCs through mitigation, adaptation, finance, technology transfer, and capacity building, without involving emissions trading.[4]

1.2 What are carbon markets?

Article 17 of the Kyoto Protocol introduced GHG emission reduction targets for developed countries and market mechanisms to help these countries meet their respective targets. This led to the formation of a new commodity in the form of emission reductions or removals along with a corresponding market. Since carbon dioxide is the principal greenhouse gas, emission reduction units and their trading markets are simply referred to as carbon credits and carbon markets.[5]

1.3 Why do we need carbon markets?

The world needs to reduce its GHG emissions in order to adhere to the Paris Agreement's goal of limiting global warming to 1.5°C. While there are various direct pathways for avoiding and reducing emissions from different emission sources, the challenges and enabling conditions vary within and across different sectors and regions. A market-based tool like a carbon market is seen and advocated as a bridge for abating emissions during the time it may take to develop technology, infrastructure and an enabling environment to achieve the required reduction.[6] Here are some anticipated advantages within an ideal framework of carbon markets:

- **Enabling achievement of planned emission targets**: The cap or the target setting system under this mechanism creates a possibility for regulators/ companies to put out scientific and planned targets for emitters that align with the NDCs and the Paris Agreement.

- **Following the polluter pays principle**: If an emitter surpasses the established target or cap for emissions, they are required to purchase carbon credits, or face a penalty.

- **Promotes cooperation and low-carbon initiatives**: Carbon markets provide a platform for cooperation amongst emitters, thus increasing the playfield for emission reduction and promoting investment in low-carbon initiatives.

- **Cost-effective**: The mechanism is considered cost-effective compared to direct command and control compliance measures.

- **Provides flexibility**: Carbon markets provides the flexibility to emitters to take the time to develop and adopt the required technologies for emission reduction.

- **Possible source of financing decarbonization**: Markets are also looked at as a possible source of finance for decarbonization initiatives.

- **Competition as a tool**: In a well running market with a good carbon price, this mechanism uses competition as a tool to incentivize emission reduction.

1.4 Types of carbon markets: compliance and voluntary

There are two types of carbon markets—compliance and voluntary. Compliance markets are created and regulated by national, regional, supranational or international governments or bodies, where the regulated entities (companies/

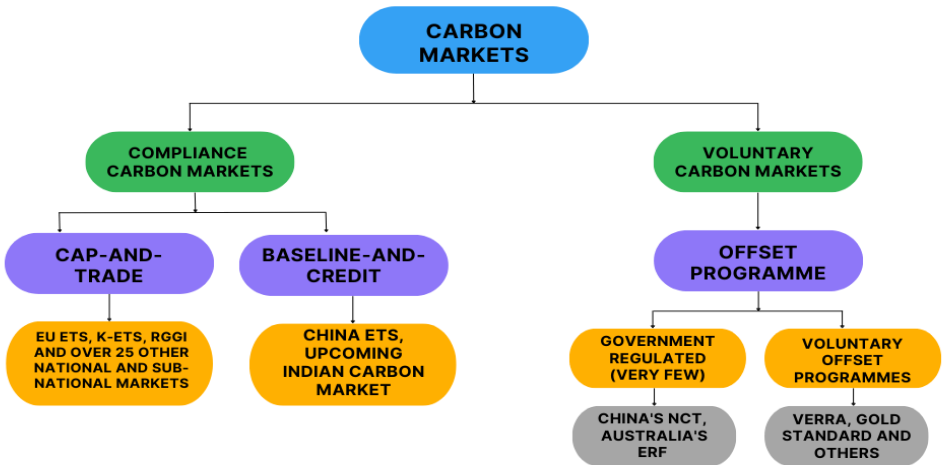
units/sectors) have a legal target or cap to their emissions but can buy or sell allowances with other regulated entities to meet their targets (sectors such as steel, cement etc. and their units are included in the cycle). Voluntary markets are national and international markets where companies and individuals can choose to offset their emissions by buying credits generated by carbon offset projects like biogas plants, improved cook stoves for households etc. These markets usually function outside of compliance markets and enable the purchase of carbon credits or offsets on a voluntary basis with no intended use for compliance purposes.[7,8]

Compliance offset market credits may, in some instances, be purchased by voluntary, non-regulated entities, but voluntary offset market credits, unless explicitly accepted into the compliance regime, are not allowed to fulfil compliance market demand. Both markets are said to play a role in addressing climate change by incentivizing emission reduction and supporting climate mitigation projects, but they operate under different regulatory frameworks and motivations.

Table 1: Compliance and voluntary markets

	Compliance market	Voluntary market
Purpose	Established to help entities meet legally binding emission reduction targets that are set under regulations.	They are based on voluntary actions by companies and industries to mitigate their carbon footprint, and are not driven by legal mandates.
Regulation	They are heavily regulated and typically operate under a 'cap-and-trade' or 'baseline and credit' mechanism set by government bodies or international organizations. The authorizing body makes compliance mandatory for all entities covered in the market.	They are less regulated compared to compliance markets. They are often facilitated by third-party organizations, standards bodies, or market platforms, and participants voluntarily choose to engage in carbon offset projects.
Penalties	Entities that do not meet the reduction targets may face legal consequences or penalties.	Participants in voluntary markets are not legally obligated to offset emissions. Therefore, there are typically no penalties.
Type of credit/offset	Generally, in compliance markets, entities that emit greenhouse gases (GHGs) can purchase carbon credits or offsets to meet a portion of their emissions reduction obligations. These credits are generated from real emission reductions achieved through various emission reduction projects and activities within the company/industry, and they are subject to rigorous monitoring, accounting and verification standards.	In voluntary markets, participants purchase carbon credits or offsets as a means to compensate for their own emissions. These credits come mostly from private entities that generate it from projects that reduce or remove carbon emissions, such as reforestation, renewable energy projects, or methane capture from landfills.
Examples	The European Union Emissions Trading System (EU-ETS) is an example of a compliance carbon market, where regulated entities are required to obtain and surrender emission allowances to cover their emissions.	An international voluntary carbon market already exists. The Verified Carbon Standard (VCS) and the Gold Standard are examples of standards used in voluntary carbon markets to certify and verify carbon offset projects across the world.

Figure 2: Broad framework of existing carbon markets



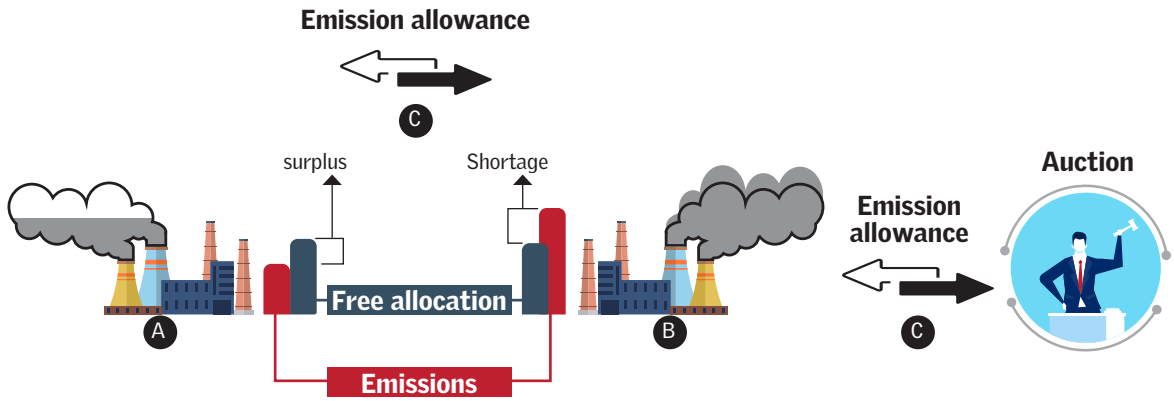
Source: CSE, 2024

1.5 How do compliance markets function through emission trading systems?

As this report focuses on compliance markets and their mechanisms, it is crucial to understand the various types of compliance markets worldwide and their operational dynamics. Typically, compliance markets are instituted within an emission trading scheme, which can operate in two primary ways: cap-and-trade or baseline-and-credit. These trading systems or mechanisms are defined as[9]:

- **Cap-and-trade** is a system where a central authority, usually a government body, limits the aggregate emissions from a group of emitters by setting a 'cap' on maximum emissions. Additionally, it sets limits on the number of emissions permissible for each industry in that group. The cap and targets are based on grandparenting and/or benchmarking sectoral and individual emissions.[10] In this system, the government grants the right to emit pollutants through emission allowances, which are initially distributed, usually for free or through auctions, for the amount of emissions equivalent to the cap. In the beginning, each firm is allotted or required to hold a number of permits (or allowances or carbon credits) equivalent to their targets. Based on the achievement of their targets, the entities can trade these allowances/credits in the market. The total number of permits/allowances or credits cannot exceed the cap, therefore limiting the total emissions below or equal to the designated cap.[11,12,13]

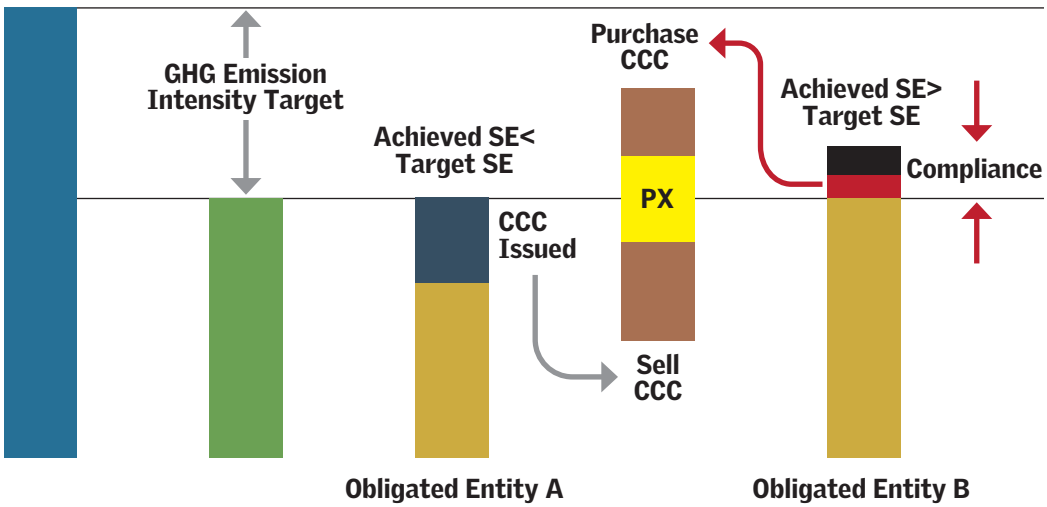
Figure 3: Mechanism of a typical cap-and-trade system



Source: European Court of Auditors Special Report -- The EU's Emissions Trading System: free allocation of allowances needed better targeting, 2020

Graph 1: Mechanism of a typical baseline-and-credit mechanism

Baseline GHG emission intensity



Source: Bureau of Energy Efficiency, 2023

- **Baseline-and-credit system** is a system where there is no fixed cap or limit on the overall total emissions, but it sets a baseline on emissions; reducing emissions below this level generates credits that can be sold to entities that have emitted beyond their baseline. Baseline emission levels are set for a group of individually regulated entities. It has been noted that at times, within the baseline-and-credit system, the baseline might be defined based on emission intensity rather than an absolute figure. Growing economies typically adopt

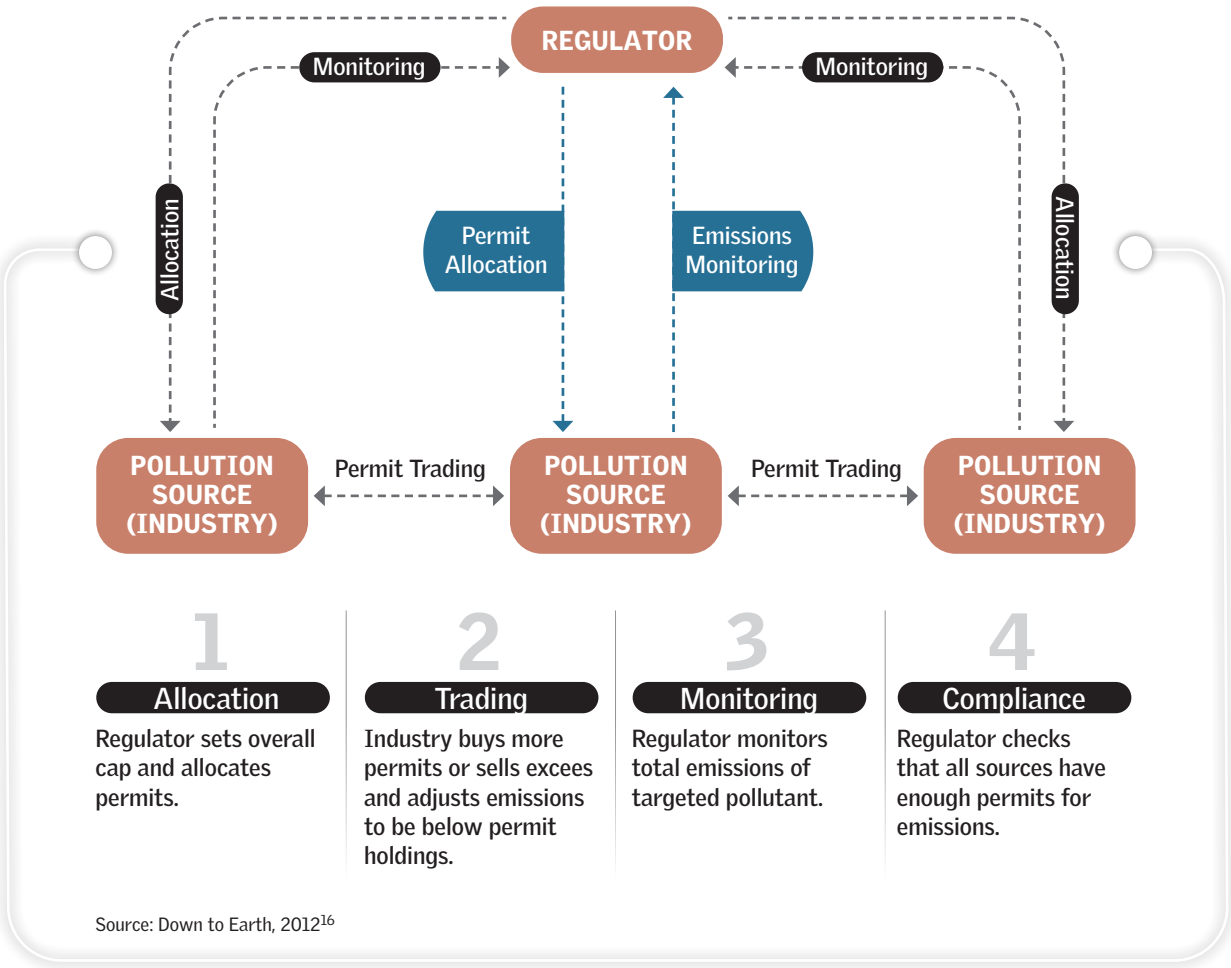
this system because overall emissions tend to increase under it, but the rate of emissions growth decreases thanks to targets focusing on emission intensity. This system is also referred to as the 'intensity-based emission cap scheme'.[14] There are some fundamental differences between the two mechanismsthat have been listed in the table below:

Table 2: Cap-and trade and baseline-and-credit systems

	Cap-and-trade	Baseline-and-credit
Methodology	There is an overall cap on the total number of emissions and, based on that, targets/limits are set for individual entities	Baseline emission limits are set for individual entities, and are defined in terms of emission intensity. The system does not have an overall cap.
Credit allocation	It is an absolute framework. Firms are allocated credits/allowances at the start of the compliance cycle. One credit equals one tonne of CO_2 /CO_2e emissions. Cleaner firms can sell unused credits to a polluting entity who has surrendered all allocated credits, i.e., used the limit of emissions allocated to them and require more to meet their target.	It is a relative framework. Firms/entities are given performance standards or emission intensity benchmarks. Credits are for entities if their emission intensity deviates from the standard or baseline. Cleaner firms that outperform the baseline target are allocated credits and underperforming entities can then buy credits to comply with the target. In some cases, pre-allocation of credits may also happen based on the previous years' emissions which is accounted for at the end of the cycle. Like in the case of China ETS, which partially follows the baseline and credit system.
Target setting	Grandparenting: Companies are allocated allowances based on their historical emissions from a baseline year or from a specific period. For example, in Phase I of South Korean ETS, most sectors received free allowances based on the average GHG emissions of the base years (2011 to 2013). Benchmarking: benchmark or performance standard is set by regulators for entities to comply with. For example, in Phase I of South Korean ETS, three sub sectors (grey clinker, oil refining and aviation) received allowances following benchmarks based on previous activity data from base years. Both grandparenting and benchmarking are used as a process to set targets in both types of systems, e.g. South Korean ETS. Although some ETS might use only one of them, e.g. the Indian PAT scheme uses only benchmarking.	
	In cap-and-trade, the target for an individual entity is set based on the overall emission cap.	Under the baseline credit system, the target is usually emission intensity-based, therefore the increase in overall emissions does not matter.
Pricing	Under cap-and-trade, different carbon markets have allocated majority credits for free. Only older markets like EU (57 per cent in Phase IV) and Korean ETS (10 per cent in phase III) have been auctioning a certain percentage of credits. Annual average carbon price in EU-ETS was around USD 90 in 2022. Many ETS also set a floor price to prevent the market from falling below a certain price.	Usually, under this system carbon credits are allocated to entities that outperform the benchmarks at the end of the cycle. Although, in markets like the China ETS, which partially follows this system, pre-allocation of free allowances also happen. These credits/allowances are then traded on exchange portals. Here also, ETS often sets floor prices. For example, the PAT scheme in India had a floor price for ESCerts (credits) and entities could then trade credits above or at the floor price of INR 1, 8t40 (22.11 USD). The average annual price for China's ETS was USD 9.62 in 2023.[15]

	Cap-and-trade	Baseline-and-credit
Emission reduction	The emission reduction target is calculated and set as a cap *ex-ante*, i.e., at the start of the compliance cycle. Sectors and individual entities are given targets based on the overall cap on emissions.	The emission reduction is calculated *ex-post*, at the end of the compliance cycle. Individual entities and sectors emit according to benchmarks and total emission reduction can be calculated based on performance of individual entities.
Distribution of allowances/ credits	Allowances or credits are distributed at the start of the compliance cycle. For example, for a cap of 100 tonne CO_2e emissions, 100 credits (1 credit = 1 tonne CO_2e) will be allocated to the emitter, which they can use in the compliance cycle. If the unit exhausts all the credits, and fall short of them, they can buy from other entities.	Usually, emission intensity baselines are given to the units at the start of the compliance cycle. Underperformance or overachievement of which will decide how credits will be allocated to the unit at the end of the cycle For example, if the target intensity is set at 0.62 CO_2e/ tonne of product, and a unit achieves a target of 0.61 they are entitled to credits. Although, in the case of China, based on grandparenting a certain number of allowances are pre-allocated, and once the cycle is complete, they are adjusted as per the entity's achievement of the target.
Example	EU-ETS, Kazakhstan ETS, California ETS, RGGI etc.	China ETS (partially), Saitama ETS, Indian PAT scheme

Figure 4: Framework of the emission trading scheme



Source: Down to Earth, 2012[16]

The European Union Emission Trading System (EU-ETS) is the world's first international compliance carbon market. It was set up in 2005 in the aftermath of the Kyoto Protocol and is in its fourth phase now. Since then, multiple national and sub-national markets have come up in Canada, China, Japan, New Zealand, South Korea, Kazakhstan, Switzerland and the United States.[17] While California's cap-and-trade programme was launched in 2013, China went on to set up the world's largest ETS that came into force in 2021. In terms of GHGs, China's ETS only covers CO_2 for trading, on the other hand the EU-ETS covers CO_2 and per fluorocarbons (PFCs), and Korea's ETS covers CO_2, CH_4, N_2O, PFCs, HFCs and SF_6. The rest of them mostly cover only CO_2 like China, at present. Globally, the major sectors in focus under the various ETS are power, industry and the aviation sector.

In its Energy Conservation (Amendment) Act, 2022, the Government of India announced the formation of an Indian carbon market (ICM). The formation of carbon markets comes at a crucial time with India's commitment to the updated Nationally Determined Contributions (NDC) submitted to the UNFCCC in August 2022. The revised NDC includes a 45 per cent reduction target in emission intensity of GDP by 2030, compared to the 2005 level. The Indian Carbon Market is expected to be instrumental in meeting the NDC targets.

The national carbon market will be regulated by the Bureau for Energy Efficiency (BEE). It is being planned that the market would cover CO_2 emissions from multiple sectors and PFC emissions from processes like Aluminium smelting. Furthermore, in June 2023, a Carbon Credit Trading Scheme (CCTS) was notified, along with the formation of a National Steering Committee tasked with establishing the regulatory framework for the Indian carbon market and overseeing its operations. Before exploring the potential of the Indian carbon market, the upcoming chapter will examine prominent national and international experiences with Emission Trading Schemes (ETS) through case studies.

CARBON MARKETS GLOSSARY

In this section, we have defined terms that are related to emission trading schemes and will appear in the following chapters.

- **Grandparenting/grandfathering:** Allocation of emission allowances to regulated entities based on their historical emissions or production levels, typically provided for free.
- **Benchmarking:** Setting a standard or benchmark against which the emissions of individual entities are measured. This benchmark is often based on historical emissions, industry averages, or other predetermined criteria.
- **Market liquidity:** Market liquidity is the degree to which a market allows assets to be bought and sold with minimal price disturbance. In emission trading systems, market liquidity refers to the ease with which emission allowances or credits can be traded in the market. It also refers to the number of credits available in the market.
- **Market stability mechanism:** Measures implemented within an emission trading system to stabilize the market and prevent extreme price fluctuations. This can include mechanisms such as price floors, price ceilings, reserve allowances, or other regulatory interventions.
- **Banking:** Allowing entities to save or "bank" unused emission allowances for future use. This enables entities to carry over allowances from one compliance period to another.
- **Borrowing:** Allowing entities to borrow emission allowances from future compliance periods to cover current emissions. Borrowing is usually subject to certain conditions and repayment obligations.
- **Emission allowances:** Emission allowances are the unit of a carbon market. These are permits or authorizations issued by a regulatory authority that allow the holder to emit a specified amount of greenhouse gases within a given time period. These allowances are often tradable within an emission trading system. One allowance or carbon credit is equal to one tonne of carbon dioxide
- **Cap:** The overall limit set on the total amount of emissions allowed within a specific jurisdiction or sector over a certain period. This cap is usually gradually reduced over time to encourage emission reductions.bb
- **Backloading:** Delaying the auction or issuance of a portion of emission allowances to a later point in time within an emission trading system. This can be done to address issues of oversupply or to manage market stability.
- **Auctioning:** The process of selling emission allowances to the highest bidder through a competitive bidding process. Auctioning is one method of distributing allowances within an emission trading system.
- **Carbon leakage:** The phenomenon where emission reduction policies in one jurisdiction leads to an increase in emissions in another jurisdiction with less stringent regulations. This can occur due to shifts in production or diverting operations to regions with weaker climate policies.
- **Offset credits:** Credits earned by implementing emission reduction projects outside the regulated sector or jurisdiction. These credits can be used to offset emissions within the emission trading system.
- **Market-based-mechanism:** Policies or systems that use market forces, such as supply and demand dynamics and price signals, to achieve environmental objectives, such as reducing greenhouse gas emissions. Emission trading systems are an example of a market-based mechanism for tackling climate change.
- **Compliance period:** The timeframe during which regulated entities are required to meet their emission reduction targets or surrender a corresponding number of emission allowances.
- **Allocation:** The process of distributing emission allowances to regulated entities, either for free or through auctioning, to cover their permissible emissions within the emission trading system.
- **Monitoring, reporting, and verification (MRV):** The process by which regulated entities measure, report, and have their emissions independently verified to ensure compliance with their obligations under the emission trading system.
- **Baseline:** A reference level against which emission reductions are measured. It represents the expected level of emissions in the absence of emission reduction measures.
- **Compliance/obligated entity:** Any entity subject to the emission reduction obligations and requirements of the emission trading system, typically including large industrial facilities, power plants, and other significant emitters.

Source: International Carbon Action Partnership and European Commission

2

CASE STUDIES OF MAJOR CARBON MARKETS

As of March 2023, global emission trading systems (ETS) cover 8.91 GT CO_2e across 36 markets, with 14 more under development, valued at over $850 billion in 2021.

The EU-ETS, the first carbon market launched in 2005, holds the highest carbon price ($ 83.10 as of 2022) across allmarkets, has evolved with reforms like the Market Stability Reserve, innovationand modernization fund, increased auctioning and banning of offset credits.

The South Korean ETS covers 89% of Korea's national emissions which is the largest share of emissions being covered under an ETS, including multiple GHGs. China's ETS, is the largest by absolute emissions, covering five billion tonnes of CO_2 annually with intensity-based benchmarks.

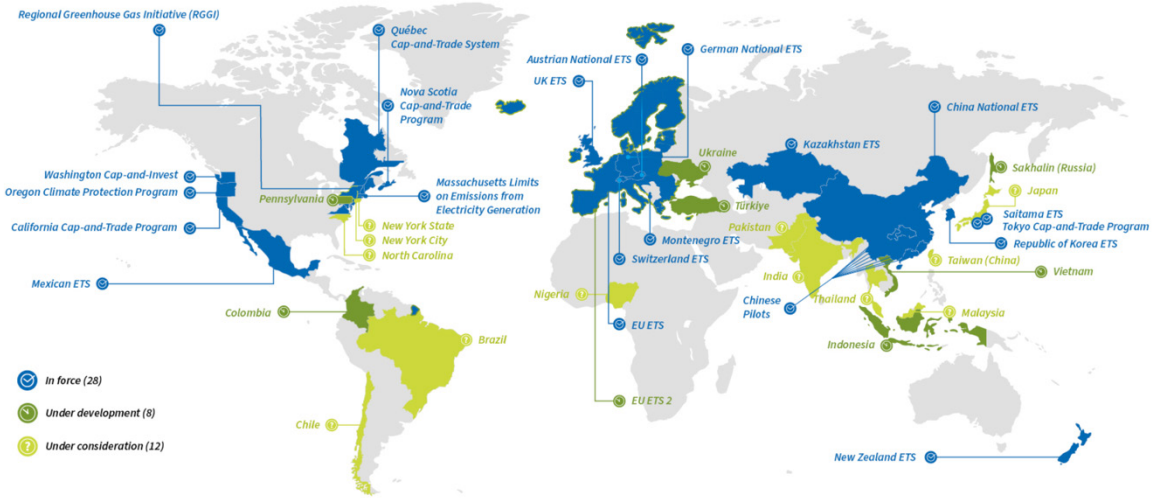
Over time more and more countries are adopting emission trading systems (ETS) in order to achieve their climate goals. As of March, 2023, the ETS initiatives cover 8.91 GT CO_2e representing 17.64 per cent of the global GHG emissions (which includes implemented, scheduled and under consideration schemes/systems),[18] up from just five per cent in 2005. There are 36 compliance markets in force, 14 under development globally.[19] Compliance carbon markets have been operating worldwide and together these markets have reached a value of more than 850 billion dollars as of 2021,[20] a 164 per cent increase from 2020.[21]

As India gets ready to enter this list, the share of emissions covered under carbon markets would again take a leap as it did drastically when China kick started its carbon market. EU-ETS is the first carbon emission trading scheme which started in 2005 followed by a number of other ETS around the world (*see Figure 5: A timeline of compliance carbon markets in the world*)

As India prepares, it's crucial to examine existing emission trading systems worldwide, both old and new, and draw insights from their experiences to effectively implement one tailored for India's needs. In this chapter, we will be looking at some of the major emission trading systems (ETS) of the world. To develop a comprehensive understanding, a diverse set of case studies have been chosen for this research. The four case studies covered in this chapter are from the European Union, China, South Korea and Surat in India. The third chapter in this report is dedicated to a detailed analysis of the Indian Perform, Achieve and Trade (PAT) scheme as it will become the basis for the upcoming Indian carbon market. These case studies were chosen based on their diverse nature, in terms of operational time period (old and new), type of scheme and scale and region of the market.

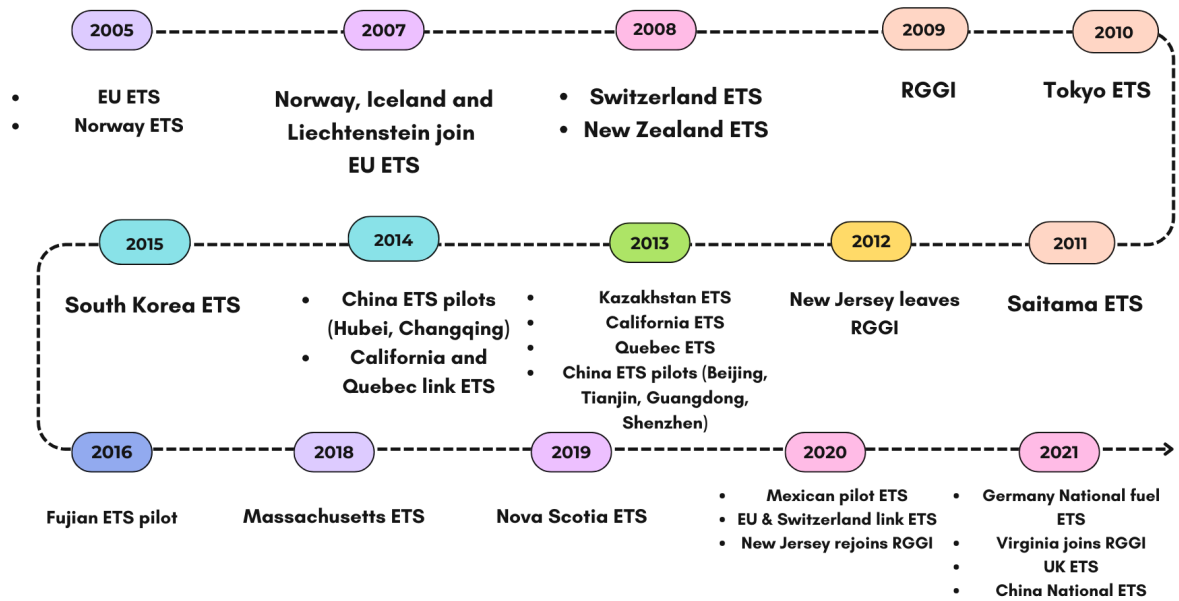
As discussed in the previous chapter, carbon markets or ETS usually function in two ways, namely cap-and-trade and baseline-and-credit. A cap-and-trade mechanism is more viable when the overall production of industries has peaked and is expected to see a downward trend, but with countries where production levels are growing, it is difficult to set an overall or sector-wise cap on emissions as GHG emissions are directly linked to production levels. Hence, developing regions or countries often adopt a baseline-and-credit system, which prioritizes reducing emission intensity rather than overall emissions. The table below illustrates some of the major trading schemes currently in operation, detailing their respective functioning systems and the total emissions they cover.

Map 1: Emission trading systems around the world as of 2023



Source: International Carbon Action Partnership, 2024

Figure 5: A timeline of compliance carbon markets in the world



Source: Compiled by CSE, 2024

Table 3: Major carbon markets of the world

ETS and Region	Year of commencement	Type of system		Total emissions covered (as of 2023)	Sectors covered by ETS (as of 2023)
		Cap-and-trade	Baseline-and-credit		
EU-ETS	2005	✓		38 per cent of EU's total emissions from 2021	Industry, power, aviation, maritime
South Korea ETS	2015	✓		89 per cent of South Korea emissions	Maritime, waste, domestic, aviation, transport, buildings, industry, power
China ETS	2021		✓	40 per cent of national emissions	Power
Saitama ETS, Japan	2011		✓	18% of the prefecture's/ region's 2020 emissions	Buildings, industry
Tokyo cap-and-trade program, Japan	2010	✓		20% of the metropolitan area's emissions.	Buildings, industry
California cap-and-trade system	2012	✓		75% of state's GHG emissions	Transport, buildings, industry, power
India PAT scheme	2012		✓	PAT Cycle II, which covered 621 designated consumers amounted to energy consumption of 226.76 Million tonnes of Oil equivalent [22]	Industry, power, railways, buildings
Kazakhstan ETS	2013	✓		47% of national CO2 emissions	Industry, power
Regional Greenhouse Gas Initiative (RGGI) (11 states in United States)	2009	✓		14% of the aggregate participant states' emissions	Power

2.1 Case study 1: European Union ETS (EU-ETS)

Background and evolution

In the 1990s, prior to the Kyoto Protocol, the European Union was sceptical regarding the idea of using flexible instruments, such as emissions trading, in the context of climate change policy. Later in 1998, the EU changed its approach after the failure to get an internal carbon tax adopted, along with some other factors, and it started developing an EU-ETS. In March 2000, the EU presented a green paper with initial ideas on EU-ETS. Numerous stakeholder discussions helped shape the design further.

The EU-ETS directive was adopted in 2003, and rules were designed for the pilot phase (2005 to 2007) and the subsequent Kyoto commitment phase (2008 to 2012). The system was launched in 2005, making EU the first carbon emission

market in the world. The EU-ETS has had three phases (2005–07, 2008–12 and 2013– 20) and is currently running in its fourth phase (2021–2030).

Initially, the system covered around two billion tonnes of CO_2 i.e. roughly 40 per cent of EU's CO_2 emissions.[23] The initial design was decentralized; considerable power was given to member states for implementing the system, and permits or allowances were handed out for free. Power and other key energy intensive sectors were the main target groups. To increase flexibility, CDM credits were included in the pilot phase in 2005 and JI credits were included 2008 onwards.

Initially, the carbon price was generally low as allowances were handed out for free and often very generously by the member states. It even reached a near zero price in 2007. Therefore, in 2008, a significantly changed design was adopted for the third phase (2013 to 2020). The reform introduced a single EU wide emission cap with a common Linear Reduction Factor (LRF). This was intended to make the system more centralized and auction based from 2013. However, the financial crisis had hit Europe around the same time which led to lower production and emissions, thereby the issue of surplus allowances came in and the carbon price remained low. Oversupply of international carbon credits and overlap with renewable energy policies also played a role.[24]

Therefore, as a response to this, a further reform process was initiated in 2012. The first element of the reform was the postponement of auction or back loading of 900 million allowances from 2014–16 to 2019–20. The second and more important reform was the introduction of the Market Stability Reserve (MSR). The MSR is seen as a market thermostat which automatically releases allowances in the market if the number of allowances drop below 400 million, and it withdraws allowances if the number exceeds 833 million. The MSR was adopted in May, 2015 and following the pressure from ambitious member states, the operational start was shifted from 2021 to 2019. Instead of being auctioned in 2019–20, the 900 million allowances backloaded in 2014–16 were transferred to the Market Stability Reserve (MSR). Any unallocated allowances would also go to the reserve. In Phase III, the EU-wide cap was set to decrease by 1.74 per cent annually, a departure from the no-reduction path observed in previous phases. This reduction factor was to be further increased to 2.2 per cent in Phase IV under the Fit for 55 packages. EU was also successful in reducing free allowances to 43 per cent during Phase III and Phase IV.

With respect to offset credits, although unlimited JI and CDM credits were allowed, none were used in Phase I, most probably due to excess free allowances.

In Phase II most categories of CDM/JI credits were allowed (except LULUCF and nuclear power) along with strict requirements for large hydro projects. Phase II also saw the beginning of limitations being put on offset credits under which a certain percentage limit was applied to CDM and JI credits in the National Allocation Plans of the member states.

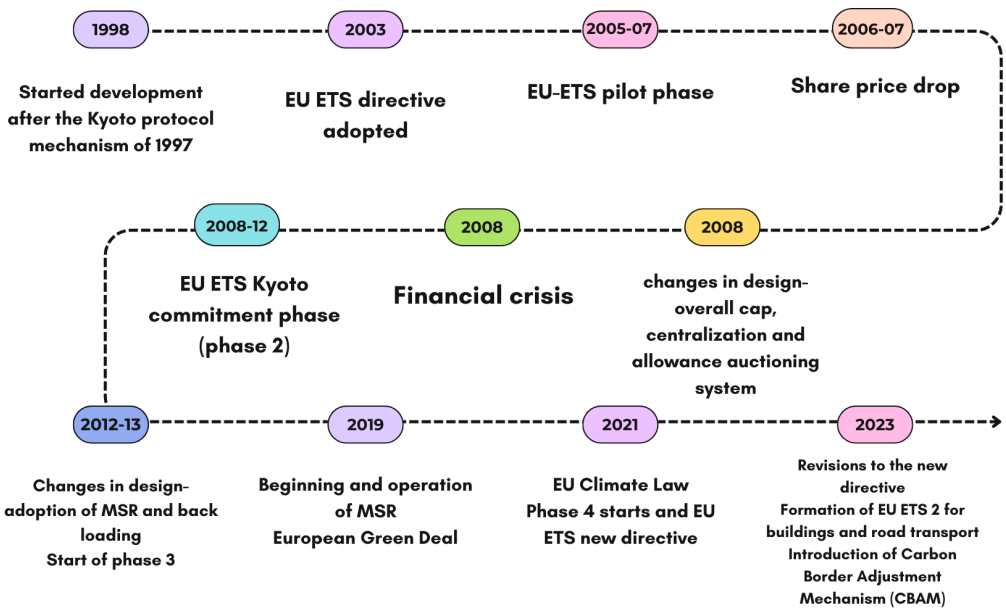
Phase III brought in more conditions and limitations on offset credits. Entities could use international credits from CDM and JI to fulfil their obligations under EU-ETS until 2020, but this was subjected to qualitative and quantitative restrictions. The use of new project credits from CDM and JI projects after 2012 was prohibited, unless the generated international credits originated from the least developed countries[25]. Credits for emission reduction that occurred during the first commitment period of the Kyoto Protocol (2008–12) had to be exchanged to EU allowances by March 2015. During the third phase, the total use of credits for Phase II and III was capped at 50 per cent of the overall reduction under the EU-ETS during that period. Finally in Phase IV, the use of offsets is not allowed for obvious reasons, the integrity of these credits being the centre of it.[26]

Against the backdrop of the "European Green Deal," initiated in 2019, the European Commission proposed reforms to the EU-ETS in 2021. These reforms were aimed at aligning the system with the EU's revised 2030 target of achieving at least a 55 percent net reduction in emissions compared to 1990 levels. The reforms were adopted in the EU-ETS Directive of 2023. These reforms included[27]:

- Raising sectoral emission reduction targets for 2030 to 62 per cent from 2005 levels
- Increasing the linear reduction factor
- Rebasing the cap for 2024 (by 90 million) and 2026 (by 27 million)
- Updating the parameters for Market Stability Reserve
- Gradually phasing out free allocations for CBAM sectors over 2026 to 2032 and for the aviation sector by 2026.
- Including the maritime sector by 2024
- Increasing the size of innovation and modernization funds
- Establishing a separate emission trading system, ETS 2, for fuels used in buildings, road transport and additional sectors, that are mainly small industry not covered by the existing EU-ETS. Expected to be fully operational by 2027.

More recently, in February 2024, the EU Commission further announced its target of achieving a 90 per cent net greenhouse gas emissions reduction by 2040, compared to the levels in 1990.[28]

Figure 6: EU-ETS timeline

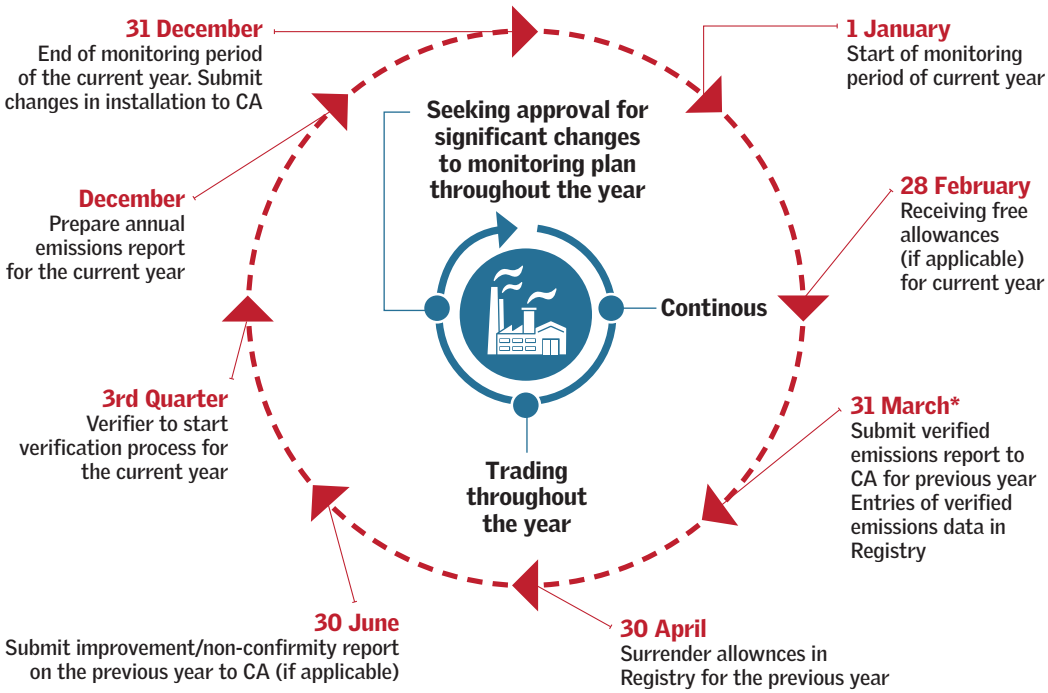


Source: Compiled by CSE, 2024

EU-ETS operational design

The EU-ETS compliance cycle starts in January with the start of the monitoring period for the current year, followed by the allocation of allowances (free or through auctioning) at the end of February. By the end of March, the regulated entities need to submit their verified emissions report for the previous year to their competent authority (CA), and these verified emissions are then entered into a registry. The emissions report is verified and emitters surrender allowances for the previous year by 30 April. If an installation has reduced their emissions, they can keep the allowances for future use or sell them to other installations that are short of allowances. In case an emitter fails to surrender enough units, they are to pay a penalty. The penalized companies may face more backlash in terms of national fines. By 30th June, any improvement or non-conformity report on the previous year needs to be submitted to CA (if applicable). By the third quarter the verifier needs to start the verification process for the current year and prepare an annual emissions report for the current year by December. By the end of December, the monitoring period for the current year ends and with this any changes in installation has to be submitted to CA. With the beginning of the new year, the monitoring period for the new year starts. The trading keeps happening throughout the year. The detailed compliance cycle can be seen in the figure below.

Figure 7: EU-ETS compliance cycle



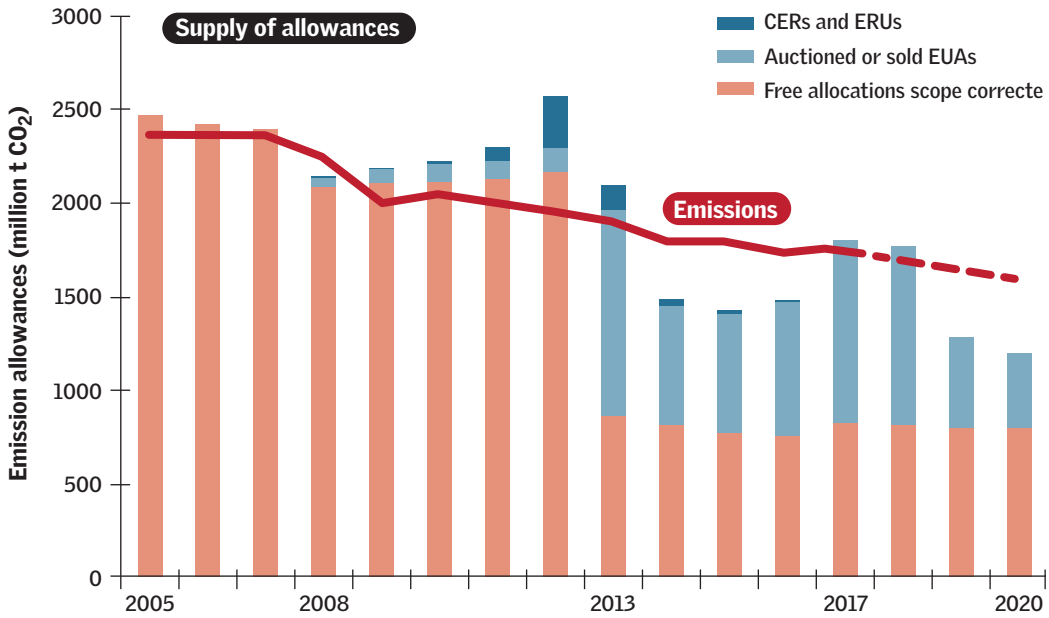
*Operators and aircraft operators may be requested by their CA to submit verified emissions report of the previous year as early as 28 February

Source: BEE Indian Carbon Market: draft blueprint for stakeholder consultation

Graph 2: EU-ETS carbon price timeline: 2005 to current

Source: ICAP allowance price explorer, 2024

Graph 3: EU-ETS emission allowances timeline



Source: Stefan P. Schleicher, 2018

Major challenges

It is important to understand the challenges encountered overtime and the strategies adopted to overcome these challenges from time to time, particularly when considering the world's oldest carbon market. Some of the major challenges were:

1. **Decentralization**: Initially, the EU-ETS operating as a supranational system, was decentralized to a considerable extent, granting EU member states greater authority over the implementation of the system. There wasn't even a common central emission cap decided for the entire European Union. Authority to make specific decisions (like allotment of allowances) was given to the member states, who implemented the same system differently, leading to a number of issues in the initial phase.

2. **Free and excess allocations of allowance:** In the initial phase, member states were given the authority to allocate allowances under the National Allocation Plans (NAPs), to which they ended up handing out free allowances and that too quite liberally. Consequently, the allowances issued exceeded the total emissions from the covered sectors[29]. There was also no banking of allowances allowed at the time, leaving no room for saving allowances from the pilot phase

to the next phase. This led to the plummeting of the carbon price to near zero in 2007. The total EU allocations were based on a business-as-usual scenario (BAU) and initially, the allocations turned out to be just one per cent below the overestimated BAU scenario. Previous trading schemes like the US sulphur dioxide training programme had allocation levels at 50 per cent below the baseline emissions.[30]

3. **Lax emission targets, low pricing of allowances and no pricing mechanism in the initial stage**: In the initial phase, the intense lobbying among member states led to relaxed emission targets. Concerns about carbon leakage prompted member states to allocate excessive free allowances during the pilot phase. The excess allocation ultimately brought the carbon pricing to near zero by 2007. Even after the 2008 reforms, the economic crisis and other factors kept the carbon price in EU-ETS pretty low. It was only after 2018 that the carbon prices in EU-ETS improved and became more stable. The introduction of the market stability mechanisms helped in recovering carbon prices at a fast pace post-COVID, along with other factors like tightening of the regulations

4. **Offset credits**: At one point, the EU-ETS was flooded with offset credits. Over time, it identified major issues around the integrity of offsets followed by the challenges around being able to monitor how genuine they are and identifying the problems that occur while measuring the actual emission reduction. This was also a factor affecting their compliance market.

5. **Effective implementation of CBAM**: The whole idea behind increasing the share auctioning of allowances further between 2026 and 2034 depends upon the effective operationalization of CBAM and its effectiveness in preventing carbon leakage. The biggest challenge here would be to ensure authenticity of the information being provided by foreign exporters and the authenticity of foreign based verifiers. Ensuring authentic reporting from across the globe will be a big challenge for CBAM, and subsequently for the ETS.

Measures to deal with challenges

Some of the significant measures that were brought in to deal with the prominent challenges of this scheme, along with improving the conditions and operations of the market were:

1. **Market stability reserve**: MSR was adopted under the reforms initiated in 2012 for Phase III. In 2019, the Market Stability Reserve (MSR) became operational. Based on a predefined set of rules, it withholds a certain volume

of auction allowances based on the total number of allowances in circulation. The MSR mechanism ensures reduction in the surplus of emission allowances in the market and makes the market ready for future shocks and market instability. The amount of reserve between 2019 and 2023 will reach 24 per cent (from 12 per cent) of all the allowances in circulation.

2. **Reduced free allowances and increased auctioning of allowances**: Similar to Phase I, 90 per cent of the allowances in Phase II were done for free. It was in Phase III that 57 per cent of the allowances were auctioned and the same share was auctioned in Phase IV. In Phase III, the power sector was subjected to 100 per cent auctioning with an optional derogation for 10 lower-income member states (which continued in Phase IV as well), whereas the industry sector received a lot of free allowances. The sectors that were at risk of carbon leakage were given 100 per cent free allowances, whereas sectors with a low risk of carbon leakage had their free allocation reduced from 80 per cent of the benchmark in 2013 to 30 per cent by 2020. The demand for free allowances exceeded the supply and hence a cross-sectorial correction factor was brought for free allocation volumes. Ultimately, the EU gradually plans to phase out free allocations for the CBAM sectors between 2026 and 2034.

3. **Backloading allowances**: Backloading is a short-term measure under which emission allowances are discontinued temporarily to rebalance supply and demand in the market. It does not reduce the overall number of allowances. Due to the excess allowances during Phase II, the EU-ETS postponed the auctioning of 900 million allowances from 2014–16 to 2019–20.

4. **New entrant reserve:** This was established in Phase III and IV, under which five per cent of the cap was reserved for new installations or for installations that increased significant capacity. Around 300 million allowances were allocated for this from the reserve in Phase II, which became 331 million in Phase IV.

5. **Innovation and modernization funds**: These funds are financed by revenues from auctioning emission allowances under the EU-ETS. Usually, it is 2 to 2.5 per cent of the total quantity of ETS allowances auctioned. The fund supports investment in six priority areas that are:
   - energy generation and use from renewable resources
   - heating and cooling from renewable resources
   - reduction of energy use through energy efficiency

- energy storage and modernization of energy networks, demand side management, district heating, grids for electricity transmission and increasing interconnections between member states
- support low-income households, include rural and remote areas, to address energy poverty, modernize heating systems and create infrastructure for zero-emission mobility
- Just transition in carbon-dependent areas.

A maximum of 20 per cent of the modernization fund can be used to support non-priority investments. If the proposal is not from a priority sector, it goes through technical and financial assessment by the European Investment Bank (EIB).

6. **Restricting and banning offset credits:** The EU-ETS went from allowing unlimited offset allowance in Phase I, to meeting emission reduction targets through 50 per cent offset credits in Phase II and III, to finally allowing no offset credits in Phase IV.

Table 4: Summary of major challenges and measures

S. No.	Major challenges	Measures taken
1.	Decentralization	Overall EU cap and more centralization.
2.	Low carbon pricing and no market stability mechanism for a long time	Market stability reserve, backloading auctions and stringent regulations/ policies.
3.	Free allocation and excess allowances	Increased share of auctioning of allowances, market stability reserve and backloading of auctions.
4.	Offset credits	Initially restricting and finally banning offset credits in ETS in Phase IV.
5.	Upcoming challenge: Effective implementation of CBAM	N.A.

Table 5: Summary of the EU-ETS

European Union emission trading system	
Status	Started in 2005, ongoing, Phase IV (2021–2030)
Type of system	Cap and Trade
ETS Brief	EU emission trading system is the oldest emission trading system, the inception of which was laid after carbon market became the central theme of Kyoto Protocol in 1997. Started in 2005, it has completed three phases and is now in its fourth phase. It operates in all EU countries plus Iceland, Liechtenstein and Norway (EEA-EFTA states).
Sectors	Energy, industry, aviation and maritime (included in Phase IV)
No. of units covered	10,000 stationary installations[31]
GHGs covered	CO_2, N_2O, PFCs

Emissions covered	38 per cent of EU's total emissions as of 2021
Cap	In Phase IV, the cap for 2021 from stationary installations is fixed at 1,571 million tCO_2e which is subject to an annual linear reduction of 2.2 per cent
Allowance price	EUR 78.91 ($ 83.10)[32] (average auction price, 2022)
Penalty	EUR 100 per tonne of CO_2
Compliance cycle	Annual
Reduction target	European Union: 55 per cent GHG emission reduction by 2030 from 1990 level. Net zero by 2050 EU-ETS (emissions covered by EU-ETS) reduction target: 62 per cent GHG emission reduction by 2030 from 2005 level.
Emission reduction*	Since 2005, the EU-ETS has helped bring down emissions from power and industry plants by 37 per cent.
HIGHLIGHTS	
High carbon price	-Highest globally -Took 18 years to reach there
Market stability mechanisms	- In 2019, the Market Stability Reserve (MSR) became operational. - It kicks in if the allowance goes below 400 million or above 880 million - The amount of reserve between 2019 and 2023 will reach 24 per cent of all the allowances in circulation.
Large and Diverse Sectors Covered	Power, industry, buildings, aviation, maritime etc.
New Entrant Reserve	Facilitating capacity expansion or the establishment of new units which is particularly pertinent for developing countries.
EU-ETS 2	A new ETS for emissions from buildings and road transport and certain industries not covered in the existing system was announced in December 2022 where fossil fuel emissions from these sectors will be covered. This will be separate from the existing ETS.
Innovation and Modernization Fund	The power sector of eight EU member states (countries) with per capita GDP below EU average were *allocated free allowances* to support modernization of their electricity production.

*Emission reduction from emission trading system

Effectiveness of EU-ETS and its sectoral impacts

As the oldest carbon market in the world, EU-ETS is also the main reference point for assessing the effectiveness of an ETS in terms of emission reduction. CSE analyzed a few studies that have tried to establish the role EU-ETS has played in reducing EU's overall emissions (*see Table 6: Studies on role of EU-ETS in emission reduction)*. This section also looks at other factors (events and regulations) along with EU-ETS which were responsible for the drop in EU emissions along with unwinding the sectoral impacts of the EU-ETS.

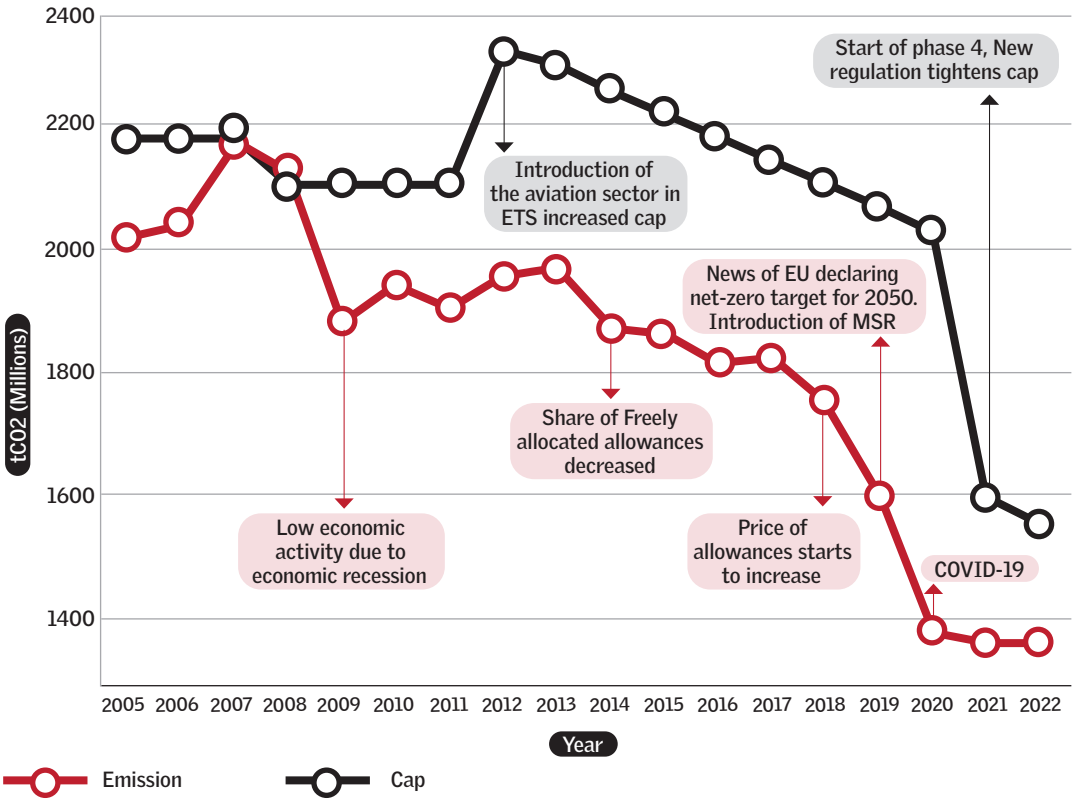
Table 6: Studies on the role of EU-ETS in emission reduction

Source	Overall reduction in GHG emissions	GHG emissions from electricity generation	GHG emissions from industrial sectors
EU Commission[33]	Reduction of 15.5 per cent in EU ETS emissions in 2023, compared to 2022 levels	The emissions from electricity production reduced 24 per cent in 2023 compared to 2022. This can be primarily attributed to the increase in renewable, especially wind and solar, electricity production.	Industrial sectors had a dip of 7 per cent from 2022 whereas aviation emissions increased by around 10 per cent in one year from 2022–23. [34]
Study by Bayer et al, 2020 [35] Publication: Proceedings of the National Academy of sciences of the United States of America (PNAS)	EU Emissions Trading System (ETS) had a significant impact in reducing CO_2 emissions beyond what could be attributed solely to the decrease during the 2008 financial crisis. Calculations from the study indicate that the EU carbon markets contributed to a cumulative reduction of approximately 1.2 billion tons of CO_2 emissions from 2008 to 2016, representing approximately 3.8 per cent of total EU wide emissions during this period.	The overall reduction in the second phase may not directly translate to a similar decrease in global emissions due to the potential for carbon leakage. There is a possibility that some emissions may have been shifted to regions with less stringent regulations, The analysis suggests substantial reductions in emissions from electricity generation due to their non-possibility of carbon leakage.	
Study by Dechezleprêtre et al 2023[36] Publication: Journal of Environmental Economics and Management	Analysis of EU ETS in the period of 2005–2014 shows significant 10 per cent reduction in emissions from the EU ETS sectors. Most reductions occurred during the second trading phase (2008–2012), driven by large installations.	The study also reveals that higher free allowances in the power sector and industries correlate with lower GHG emission reductions.	Of the industrial sectors, the study reveals chemical sectors having significant reductions.
Study by Colmer et al, 2023[37] Publication: Social Science Research Network (SSRN)	The study estimates that regulated firms reduced emissions by 14 per cent in phase 1 (2005-2007) and 16 per cent in phase 2 (2008-2012). Between 2005 and 2012, aggregate emissions without EU ETS would be higher by 5.4 million tonnes per year. The study suggests no evidence of outsourcing to unregulated markets.		

When we assess the effectiveness of the EU-ETS in reducing emissions covered by the system, the graph below clearly shows that the decline in greenhouse gas emissions from the EU-ETS closely aligns with the decreasing trend of the EU-ETS cap. There is a 42 per cent decrease in the overall EU-ETS emissions from 2005 to 2022. The gap between the cap and total ETS emissions can be attributed to market stability reserve, maintaining a new entrant reserve and the backloading of emissions. There was a sudden drop in emissions in 2009 because of low economic activity due to the economic recession of 2008-09. We see a rise in the cap in 2012 due to the introduction of the aviation sector in Phase III; the cap increased from 2,105 $MtCo_2$ in 2011 to 2,302 $MtCo_2$ in 2012. Corresponding emissions also increased from 1,904 $MtCo_2$ in 2011 to 1,953 $MtCo_2$ in 2012. The cap has followed a linear reduction factor in Phase III.

As the share of freely allocated allowances started to drop in 2013, the emissions also dropped from 1,950 $MtCo_2$ in 2012 to 1,800 $MtCo_2$ in 2014. In the third phase, the cap has decreased from 2,294 $MtCo_2$ in 2012 to 2,026 $MtCo_2$ in 2020. Corresponding emissions have also fallen from 1,950 $MtCo_2$ to 1,350 $MtCo_2$. As

Graph 4: EU-ETS cap and emissions



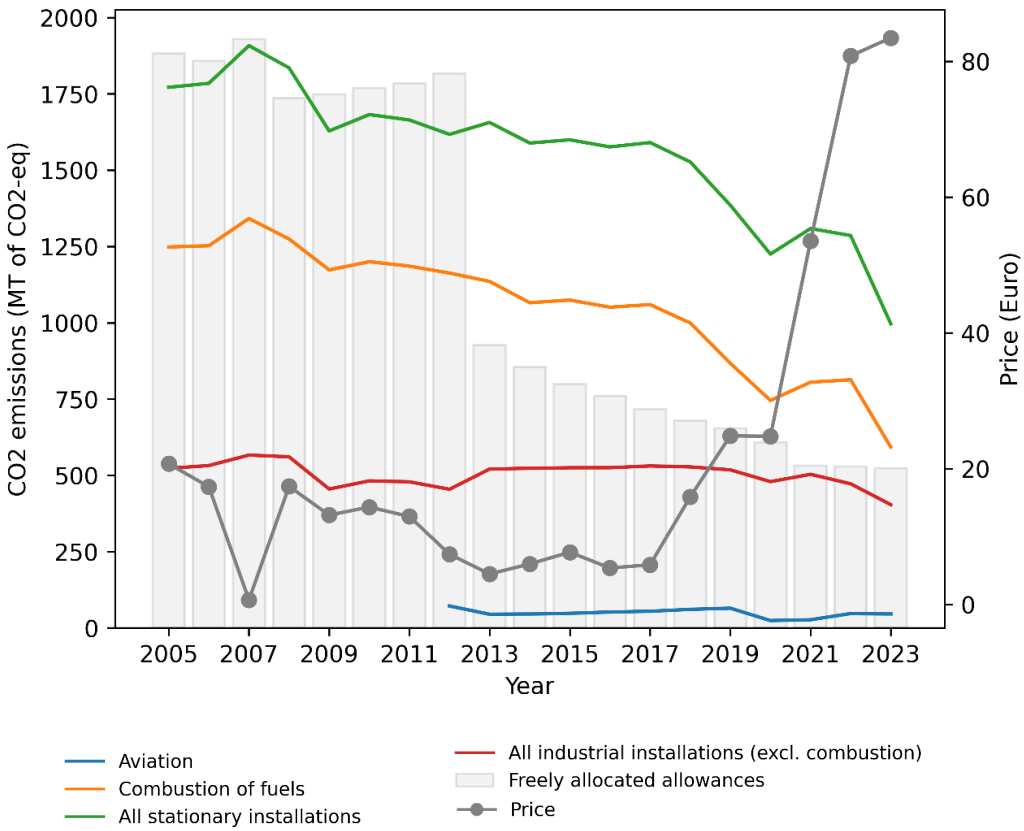
Source: Sandbag EU-ETS dashboard, prepared by CSE, 2024

the price of emissions started to increase from EUR 5 in 2017 to EUR 15 in 2018 and EUR 25 in 2019, the emissions also began to drop more steadily. This was also the period when significant developments such as the introduction of the MSR, the European Climate Law, and the EU's net zero target were either implemented or were on the verge of being introduced. There was a sudden dip in emissions in 2020 owing to the pandemic. The cap has also been tightened in the fourth phase starting from 2021. The cap was decreased by 400 Mt CO_2 (from 2,000 MT CO_2 in 2020 to 1,600 MT CO_2 in 2021). Since the emissions in 2020 were at a low due to the pandemic, there was only a slight decrease in emissions from 1,381 Mt Co_2 in 2020 to 1,364 MT CO_2 in 2021.

When we analyzed the sectoral reduction of the sectors under EU-ETS as presented in Graph 5 *(See Graph 5: EU-ETS sectoral emissions)*, we can see that:

- The overall EU-ETS emissions from EU 27 countries stood at 1,750 $MtCO_2e$

Graph 5: EU-ETS sectoral emissions



Source: Data from EU-ETS Viewer, ICAP Allowance Price explorer. Prepared by Centre for science and Environment, 2024

in 2005 following which the scope of ETS was increased. This has decreased to 996 $MtCO_2e$ in 2023. We can also see that as the level of free allocation has decreased significantly after 2013 there has been a corresponding steep fall in emissions since.

- Emissions have fallen steadily after 2017. The price of allowances has also started to rise from 5 Euro in 2017 to 15 Euros in 2018 and even more significantly to 53 Euros in 2021. With the rise in price, emissions have fallen correspondingly. This is also the phase when new regulations were introduced including, MSR, and there was increased public knowledge of banning offset credits. Additionally, the EU also announced its 2050 net zero target in the same timeframe.

- The low point of overall emissions from stationary installations in 2020 is also attributed to low economic activity during the COVID-19 pandemic, which then begins to pick up post 2020 due to revival of the same.

- The overall reduction in the ETS years starting from 2005 is proportional to the reduction of emissions in the power sector. The emissions from the power sector (combustion of fuels) in EU countries have dropped from 1,428 Mt CO_2e in 2005 to 592 Mt CO_2e in 2023.

- Reduction from the industrial sector does not account for much. We only see a reduction of 119 Mt CO_2e from 2005 to 2023. These reductions may not be concrete as part of the emissions were outsourced to other countries with weaker regulations (carbon leakage).

- Emissions from the aviation sector, included in Phase III, saw a big reduction in its first year. The CO_2 emissions decreased from 70 $MtCO_2e$ in 2012 to 45 $MtCO_2e$ in 2013. But they have been stagnant since then and currently stand at 46 $MtCO_2e$ in 2023.

- The steep decline in ETS emissions from 2022 to 2023 is due to the increase in the share of renewables in the power sector. The Russia-Ukraine War severed gas supplies in major EU countries, as a result of which investment in renewables rose significantly.

Therefore, it is right to say that EU-ETS has been most effective in the power generation sector.

An analysis of the reduction in CO_2 emissions covered under EU-ETS suggests that ETS, along with other factors, has contributed to reduction in emissions from the sectors included. Out of the three sectors—power, industry and aviation—emissions from the power sector have seen the most reductions. The three major reasons that contributed to effective emission reduction through EU-ETS:

- **High carbon price:** The emissions from sectors have fallen down more steadily after the carbon price started to rise from 2017, 2018. A high carbon price is necessary for an effective emission trading system as it accounts for abatement costs and makes polluters pay. It also incentivizes the cleaner firms as they get rewarded by trading allowances.

- **Decreasing share of freely allocated allowances:** With the decrease in free allowances, emissions also reduced. The EU-ETS plans to reduce freely allocated allowances further in the future. High carbon price coupled with decreasing share of free allocation have reduced emissions effectively in the last decade.

- **Stringent measures within ETS:** EU-ETS implements linear reduction factor in the overall cap. This is also in line with the net zero target. According to the current LRF, the cap will be zero by 2039, meaning EU-ETS emissions will be net zero by 2039. Continuous amendments and directives like strengthening the cap every year and banning offset credits are measures that have proved successful in reducing EU-ETS emissions

Apart from the ETS, other regulations and events that have contributed to both momentary and permanent reductions in GHG emissions in the EU are:

- **European Green Deal:** The European Green Deal represents an umbrella policy of ambitious commitment by the European Union to transform its economy into a sustainable and carbon-neutral model by 2050. Under the deal, the union commits to net zero by 2050. Through comprehensive policies and investments, it aims to foster green innovation, tackle climate change, and promote environmental sustainability while ensuring a just and inclusive transition for all citizens.

- **Russia-Ukraine War**: The invasion of Ukraine by Russia starting in 2022 created an economic ripple in the EU as the EU depended largely on Russia for natural gas which was used for power generation. The sudden increase in renewable energy profile for electricity generation in EU is due to the fact that their supply of gas from Russia was hampered. Therefore, there has been considerable decrease in power sector emissions in 2023.

- **Economic crisis**: The economic recession of 2008–09 impacted the whole of the world and EU economies were also affected. This is clear when we see a sudden dip in emissions in 2009 due to low economic growth and activity during the period.

- **COVID-19**: In 2020, as in 2009, there is a dip in emissions as the pandemic resulted in closure of industrial activities and low economic activity during the year.

2.2 Case study 2: Korea ETS

Background and evolution

South Korea was a non-Annex I country under the Kyoto Protocol in 1997, but in the following decades, due to its economic growth, it came in the list of top ten GHG emitting countries in the world, which led to increased pressure upon them to act on climate mitigation. Therefore, South Korea launched the 'Low Carbon, Green Growth Strategy' in 2008. Just a year later, South Korea made its first climate pledge to reduce 30 per cent of its GHG emissions below the business-as-usual scenario by 2020. The Low Carbon, Green Growth Framework that was adopted in 2010, required large emitters and energy consumers to report their GHG emissions and energy consumption every year to the GHG Inventory and Research Centre (GIR), which was also established in 2010.

The Low Carbon, Green Growth Act had put forth three options for climate mitigation: a GHG-Energy Target Management System (TMS), a carbon tax and a GHG ETS. The carbon tax didn't perform as expected, but the TMS was implemented, followed by the establishment of the South Korea ETS. In November, 2012, the Enforcement Decree on allocation for Greenhouse Gas Emissions Allowance Act (ETS Act) was adopted and the South Korean ETS was launched in 2015.

The TMS acted as a preparatory exercise for the ETS in South Korea. It introduced an infrastructure for monitoring and verification of set GHG emission targets before the ETS came in. All installations that emitted more than 20 kt CO_2e per year or consumed more than 90 TJ per year were required to submit their annual GHG emissions and energy consumption data to GIR. Broadly, seven sectors were included and given targets based on grandfathering. The same method was adopted for ETS initially. The governance structure of TMS built the basis for ETS in South Korea.

The ETS Act was adopted by the South Korean Parliament with a vast majority in 2012, although the Act faced fierce criticism from its Ministry of Trade, Industry and Energy and from business groups mainly due to increased costs of production and international competition. Despite the opposition ETS was adopted but only after certain concessions, primarily involving the postponement of its start from 2013 to 2015. The Master Plan for the Emissions Trading Scheme and the Phase I National Allowance Allocation Plan were announced in 2014 to implement the ETS Act.

The ETS has an overarching cap based on the business-as-usual (BaU) forecast. This overall cap is broken into sectoral caps. The ETS has undergone three phases, with the first two lasting three years each (2015–17 and 2018–20), while the current third phase, which is ongoing, spans five years (2021–25). The fourth phase is set to begin in 2026. South Korea's NDC was increased from 30 per cent reduction by 2020 to 37 per cent reduction by 2030 from the BaU scenario, which is the guiding target for the ETS. Out of the 37 per cent reduction, Korean government plans 25.3 per cent through domestic reductions and 11.3 per cent through the international carbon market. During the first phase the allowances were allocated for free with auctioning being phased in by three per cent in the second phase and 10 per cent in the third phase. The K-ETS covers 684 of the country's largest emitters, from power, industry and buildings to waste, transport and domestic aviation sectors.

The Ministry of Environment, South Korea was the lead organization guiding the administration and implementation of the South Korean ETS, while the Ministry of Strategy and Finance hosted the Emissions Allowance Allocation Committee. In June, 2016, the lead responsibility was shifted to the Ministry of Strategy and Finance.

KETS allows three types of allowances/credits in its market. They are:[38]

- **Korean Allowance Unit** (**KAU**)**:** Emission allowance subjected to businesses under KETS

- **Korean Credit Unit** (**KCU**)**:** Emission allowance converted from Korean Offset Credits

- **Korean Offset Credit** (**KOC**)**:** Emission allowance issued and certified by the South Korean government for reducing, absorbing, and removing GHG emissions outside KETS

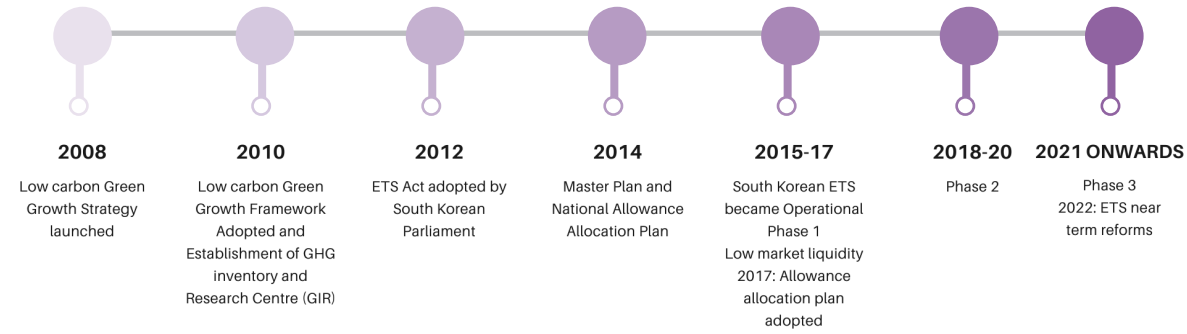
Only domestic offsets, i.e. Korean Offset Credits (KOCs) and domestic CDM credits (CERs) were allowed in Phase I with a quantitative limit of up to 10 per cent for each entity. KOCs and international offset credits were allowed in Phase II. It only allowed international CERs from international CDM projects generated by June, 2016, developed by companies that had at least 20 per cent of ownership rights owned by a Korean company or is supplied with a low carbon technology by a Korean company that is at least 20 per cent of the total project cost. The quantitative was continued to be 10 per cent, out of which only five per cent could be international offset credits. In Phase III, offsets were allowed under the same qualitative criteria as Phase II but certain limitations were added. Set time periods were allotted for the conversion of GHG reduction projects to KOC and KOC to KCU. Along with this the share of offsets was reduced to five per cent of an entity's compliance obligation. Both domestic and international offset credits must be converted to KCUs to be used for compliance.

The price began at EUR 6.3 in 2015 and moved up to EUR 21.5 in February 2016 but then experienced a slight decline. It is also important to note that the trading volume for 2015 was zero, it remained low throughout 2016 and only picked up in 2017. Initially, the major reason for low market liquidity was the lack of restrictions on the banking of allowances between cycles. To stimulate the market, the government released some allowance credit reserve to the market but that too led to further hoarding of allowances rather than encouraging participation.[39] Even with low emission traded volume between 2015–2017, the market still showed a consistent positive trend.[40] The average carbon price as of 2022 is higher than other markets (except EU) i.e. almost USD 18 but still far below the European ETS carbon price which touched above 100 USD per credit in 2022.[41] As of 2024, the prices have been going down due to excess availability of free allowances.

For the purpose of market stability, a reserve of 89.4 Mt CO_2e for early action and new entrants was utilized within the first phase. In the second phase, along with 14 million allowance reserve for market stability, a system called "Market Maker" was introduced and five million allowances were allotted to the market makers which were institutions like federal banks that could draw on government held reserves in a bid to increase liquidity in the market. This reserve went up to 20 million in Phase III. There were two market makers appointed in 2019, three new financial firms were appointed in 2021 and two more were appointed in 2022, making it a total of seven market makers as of 2023.[42]

Another unique feature of the Korean market is that it covers multiple GHGs—CO_2, N_2O, CH_4, PFCs, HFCs and SF_6 under its ambit. Other large carbon markets

Figure 8: South Korean ETS timeline



Source: CSE 2024

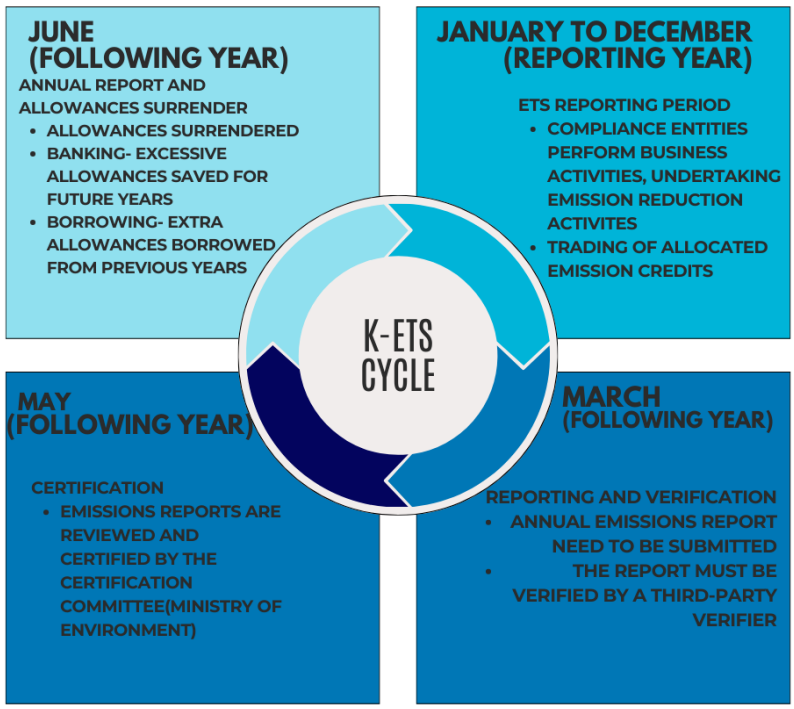
in the world such as EU-ETS and China ETS only cover CO_2, PFC and N_2O respectively. The South Korean ETS is also known for its large share (approximately 89 per cent)[43] of coverage of the total emissions of the country. There is lack of information as to how much real reduction has happened due to presence of the ETS.

In 2022, the South Korean Government did a consultation process with stakeholders and announced some near-term changes in the ETS in November, 2022, which included, giving incentives to reduce emissions, opening up ETS to more firms, facilitating conversion of international offset credits to KCUs, strengthening MRV system and increasing support for small businesses and new entrants.[44]

K-ETS operational design

The Korean ETS has an annual compliance cycle and the covered entities have to follow certain steps to comply with the ETS. The period between January to December of a year is known as the ETS reporting period during which obligated entities perform their business activities and also undertake any emission reduction measures they can. The trading of allocated emission credits also happens during this period. The next step comes in March of the following year, which is called the time for reporting and verification. In March, the annual emission report needs to be submitted and the report needs to be verified by a third-party auditor. The next step comes in May in the following year, under which emission reports are reviewed and certified by the Certification Committee of the Ministry of Environment. In the following month of June, the surrendering of allowance, borrowing (excess allowance borrowed from next year) and banking (excess allowance saved for

Figure 9: Korean ETS compliance cycle



Source: Asian Development Bank publication on Korea ETS,[45] Prepared by CSE, 2024

Graph 6: South Korea ETS carbon price trajectory

Source: ICAP allowance price explorer, 2024

future years) takes place.

Major challenges

- **Initial adoption of ETS by industries and businesses**: When the ETS Act was set to be passed in the South Korean Parliament, it faced significant resistance from businesses and manufacturing industries. This opposition stemmed from concerns regarding the increased production costs it would entail, particularly in comparison to major competitors such as the US and China, which had no such comparable national regulations. Due to international competition, this can pose a challenge for countries planning to come up with carbon markets.

- **Banking allowances and low market liquidity**: At the outset of market operation, the high uncertainty surrounding carbon pricing, coupled with the absence of restrictions on banking allowances, resulted in minimal activity within the market. Participants were reluctant to sell their unused allowances, wanting to bank them for future compliance periods. This resulted in raised carbon prices. The government released some additional allowances through its reserve, but they were unsuccessful in stimulating trade in the market as much. This clearly showed that balancing supply and demand is not always enough when it comes to handling low liquidity. Instead, the larger uncertainty around overall policy direction, the market and carbon price need to be addressed.[46]

- **Multiple coordinating agencies/ministries and unclear market signalling**: During Phase I, and especially after the KETS management was restructured in 2016, the scheme was being managed by four sectoral ministries along with the Ministry of Environment and the Ministry of Strategy and Finance. This led to the absence of clear signalling and hence uncertainty over decision making about the market and its future. This uncertainty led the KETS participants to hold allowances for future safety rather than actively trading them in the market.

- **Biggest polluters aren't paying for their emissions**: Plan 1.5, a Seoul-based climate advocacy group found that the 10 biggest emitters of the country had sold almost 22 million tonnes of excess credits from 2015 to 2022. The cap-and-trade system which covers almost 700 entities has had a combined surplus of 39.2 million tonnes in 2021 and 2022, which is equivalent to almost six per cent of Korea's GHG emissions in 2022. Their study highlights how the largest Korean emitter and steelmaker POSCO was left with unused carbon credits in 2022. The think tank recommends a reduction of around 30 per cent of the

allocations by 2030 from the current levels.[47, 48]

- **Challenges in the power sector:** The major challenge faced with respect to the power sector in KETS was the lack of any significant reduction in emissions in the sector. According to an Issue Paper dated March 2023 from the Asia Society Policy Institute, there has been no reductions in emissions in the power sector. This has been largely attributed to the fact that carbon costs were not factored into power stations' dispatch decisions within the economic merit system of the overall market. The cost paid by power generators to purchase carbon allowances were refunded to them monthly (as electricity is subsidized), thus leaving no economic incentive for decarbonizing their power sector. Also, there was no passing down of carbon costs to electricity consumers which could have had some behavioural impact on electricity consumers. Usually, it is said that the ETS works well in a more liberalized power sector whereas in Korea, it's mostly government controlled, with KEPCO (a public utility) being the largest power generator.

Measures

- **Market Stability Reserve and Market Makers:** Learning from the EU experience, the Korean ETS established an allowance reserve from the first phase itself. In the second phase the concept of Market Makers was also introduced. Existing financial Institutions like federal banks were made Market Makers. These institutions could draw on government held reserves to simulate market liquidity. However, these measures struggled to increase the market liquidity.

- **Allocation committee:** An allocation committee was tasked with creating an allocation plan across various phases and implementing market stabilization measures under specific conditions. These conditions include instances where the market price remains at least double the average price of the two previous years for six consecutive months, or if the price falls below 60 per cent of the average price of the previous two years. In 2018, the allocation committee had put up an additional 5.5 million allowances from the stability reserve for auction in order to ease the market before the 2017 deadline of Phase I. In 2021, the allocation committee had also set a floor price of around USD 9.98 per tonne in April and USD 7.31per tonne in June.[49]

- **Restriction on banking of allowances and increase in borrowing allowances:** After the initial no-restriction on the banking of allowances, in

April 2017, The Ministry for Strategy and Finance announced that allowances would be deducted from an entity's future free allowances if they have excessive carryover. Entities were now allowed to bank 10 per cent of their annual average phase one allowances plus an additional 20,000 allowances. Any entity having more than that will have them deducted in the next phase. The change in banking restrictions came along with an increase in borrowing provisions. Now any entity could borrow up to 10 percent of its next year's allocation.

- **Limiting offset credits but simplifying its processes**: This may not be a direct challenge faced by K-ETS but based on learnings from the EU case, the K-ETS allowed only domestic offset credits in its inception phase. The second phase did allow use of international offset credits (only up to 5%) but with conditionalities of having Korean ownership involved to be able to hold someone accountable for the same. But due to rising challenges around offset credits, in its third phase the share of offsets for an entity has been reduced to 5 per cent overall. There is no separate limit for international offset credits. Although in 2022, the Korean government proposed to simply the processes for international offset credits. All CDM generated credits have to be converted to Korean Offset Credits for compliance and the process for these involved reviews of multiple ministries thus making it complicated. In 2022, the government had proposed to simplify these processes.[50]

- **Environment merit order dispatch for power sector:** In 2021, Korea planned to adopt an environmental merit order dispatch so that the carbon cost can be reflected in the energy retail tariff for 2021. However, it is said that the adoption of an environmental merit order may not be enough for fuel switching and low carbon investments, as the real issue rests with the government-regulated electricity market structure.[51]

- **Revenue used for small businesses and new entrants**: Through a stakeholder consultation process in 2022, it was proposed that revenues generated from auctioning allowances will be directed to small companies, new entrants and low-carbon research and development. It also includes expansion of exemptions on value added taxes.

- **Incentives to reduce emissions:** The Korean government has decided to issue more free allowances to the top 10 per cent of the most efficient entities in every sector and to those who have installed new energy efficiency measures in their facilities. It will also support low-carbon production and products. [52]

- **Improving monitoring, reporting and verification:** In order to enhance the efficiency of the MRV system and ensure international compliance, it was proposed that covered entities adopt international MRV standards, such as the IPCC guidelines. Additionally, entities were not required to submit a new report annually unless significant changes had occurred in the industry.

2.3 Case study 3: China ETS

Table 7: Summary of major challenges and measures

S. No.	Challenge faced	Measures taken
1.	Banking of allowances and low market liquidity	The release of allowances from the reserve by the allocation committee, introduction of market makers, setting the floor price, restriction on banking allowances, easing processes for international offset credits
2.	Biggest polluters aren't paying for their emissions due to excess free allowances	No direct measure taken. Seoul think tank recommends that the auction of allowance be increased to almost 30 per cent by 2030
4.	Hot and cold on offset credits	Offset credits have been limited to just five per cent and its processes are being made efficient to help increase market liquidity
5.	No substantial emission reduction in the power sector	Korea planned to adopt an environmental merit order dispatch, incentives to reduce emissions

Table 8: Korean ETS summary table

Korea emission trading system	
Status	Started in 2015, ongoing- phase 3(2021-2025)
ETS Brief	Emission trading in the Korean ETS market started in 2015. In the first phase, all the allowances were allocated for free, which reduced in later phases. Korean ETS was the world's second largest such market in scale when launched.
Sectors	Power, Industry, Buildings, Transportation, Waste, Domestic Aviation
GHGs	CO_2, N_2O, Methane, HFCs, PFCs, SF_6
Emissions covered	89 per cent
Cap	In Phase 3, the cap is set at 2,902 million tCO_2e and 180Mt reserve
Allowance price	KRW 23,243 ($ 17.99) (average auction price, 2022)
Penalty	The penalty for non-compliance shall not exceed *three times the average market price of the given compliance year* or KRW 100,000 per tonne.
Compliance cycle	Annual
Reduction target	To reduce GHG emissions to 40 per cent below 2018 levels by 2030. Net zero by 2050
Emission Reduction*	No data available on ETS linked emission reduction

HIGHLIGHTS	
Market Makers	Introduced in Phase 2, market makers, are institutions who can accrue credits from the government reserve and ensure market stability through liquidity. There are currently seven market maker institutions in the K ETS.
Restriction on banking of allowances	Allowances have been allocated for free in the K ETS for the most part. Phase 1: 100 per cent free allocation Phase 2: 97 per cent free allocation Phase 3: 90 per cent free allocation For hard-to-abate sectors called energy-intensive, trade exposed (EITE) sectors, 100 per cent allowances are allocated for free.
Limited use of offsets	Entities under K ETS can trade a maximum of five per cent of their compliance obligation through Korean offset credits (KOCs) which are domestic credits generated through offset. This limit in Phase 3 has been reduced from 10 percent in earlier phases. CERs generated from CDM projects are allowed to be converted to KOC with a set rule. The offset credits need to be converted to Korean Credit Unit (KCU) in order to be used for compliance.
Restriction on banking of tariffs	The banking of tariffs was one of the major challenges in KETS' initial phase, therefore introducing restrictions on banking was essential.
Environmental dispatch order for power sector	Was proposed to bring in carbon costs in the power tariffs.
Emission reduction Incentives and revenue for small businesses	Incentives to give 10 per cent free allowances to top energy efficient entities along with providing support to low-carbon products

*Emission reduction from emission trading system

Background and evolution

China has seen unparalleled growth over the years driven largely by energy intensive industries. Coal has been the primary source of energy in the country. The share of coal in the primary energy consumption of the country has been around 70 per cent between 1978 and 2012. It is only since 2012 that the share has been coming down, and at 2022 the share stood at 55 per cent.[53]

At the start of the millennium, China was unwilling to accept any emissions cap, as it considered itself a developing country. Despite increasing energy consumption, China experienced a decline in energy intensity from 1980 to 2001. It was between 2002 and 2005 that energy intensity rose unexpectedly due to a surge in industrial development, rapid urbanization and rise in coal usage. Therefore, in its eleventh five- year plan, China addressed the issue of energy intensity by setting a target to reduce energy intensity by 20 per cent within those five years. The following year China surpassed the United States as the largest CO_2-emitting country in total terms. The implementation of this energy intensity reduction target was not easy and many units were shut down in the process in 2009–10. This made the Chinese administration realize that old command and control measures would be tough to

implement.

In 2011, China officially announced its plan to gradually develop a carbon emission trading scheme, approving seven jurisdictions as carbon market pilots. The first emissions trading scheme was piloted in China in the 1980s for SO_2 emission trading, with additional pilots for SO_2 emissions starting from 1999 onwards. Between 2007 to 2016, the Ministry of Environmental Protection (MEP) and Ministry of Finance ran 11 pilots on SO_2 and chemical oxygen demand (COD) in China. The experience with SO_2 trading was mixed due to difficulties in implementation. Despite this, China even tried market mechanisms such as Clean Development Mechanism (CDM), and by 2007, accounted for 60 per cent of all CDM projects in the pipeline, primarily focusing on renewable energy projects. After the 2011 announcement, the carbon regional ETS pilots began operations in 2013–14 and had a sort of aim to test out designs and provide lessons for the national market.

In 2017, China announced a plan to implement a national ETS. The national ETS became operational in January, 2021, following the publication of key policy documents by the Chinese Ministry of Ecology and Environment (MEE). This required over 2000 major emitters in the power sector to report their emissions for the years 2019 and 2020. The compliance period spans two calendar years. The scope of ETS as of 2022 covers more than five billion tonnes of CO_2 per year or almost 40 per cent of China's total carbon dioxide emissions.[54] China's national ETS does not have a cap but is based on emissions intensity-based benchmarks of CO_2. The coal power plant benchmarks are divided into three categories i.e. 0.8177 tCO_2/MWh for conventional coal fired plants over 300 MW, 0.8729 tCO_2/MWh for conventional coal fired power plants below 300 MW and 0.9303 tCO_2/MWh for unconventional coal fired power plants. Apart from this, the gas-based power plants had a separate benchmark of 0.3901tCO_2/MWh.[55] These benchmark figures are for 2022, and they have been revised every year since 2019–20.

In 2021, the launch year, the activity in China's ETS was limited with an overall trading of around 412 million tonnes[56] of allowances (including trade volumes of regional pilots and domestic offsets known as CCERs), out of which 178 million tonnes were in national ETS, 63 million tonnes were in regional markets and around 169 million tonnes were through CCERs. This is not unusual to begin with as EU-ETS in 2005 traded around 321 million tonnes of allowances but has gradually increased its volume to 12 billion by 2021 and around 12.5 billion in 2022.[57] As of 14 July 2023, the cumulative transaction volume of carbon emission allowances had reached 240 million tonnes in China's national ETS. The regional

pilots have also been running parallel to the national ETS. Currently all allowance allocations in China's national ETS are free. Allowances, which are called China Emission Allowances (CEA), can be traded on a dedicated trading platform managed by the Shanghai Energy and Environment Exchange. After the first cycle, the MEE states that 1,833 companies handed in enough allowances from July to December 2021 to cover their emissions from 2019 and 2020, while 178 firms partly covered their emissions. It further stated that the compliance rate of allowances reached 99.5 per cent in the first cycle.

In May 2021, the MEE announced the setting up of a market regulation and protection mechanism. This was to enable MEE to take steps like buy-back, auctioning, adjusting CCER rules etc. to respond to any unusual fluctuations in the market. The specifics of this mechanism are yet to be defined.

China's new emission trading scheme is the world's largest carbon market and is thrice the size of Europe's. With China's intention to include heavy industry and manufacturing sectors, its carbon market is projected to expand by 70 per cent, solidifying its position as the most extensive climate policy covering emissions, exceeding the collective scope of all other carbon markets worldwide.[58] The MEE has launched many studies looking into the possibility of bringing in several sectors into the fold, including iron and steel, non-ferrous metals, building materials, petrochemicals, chemicals and aviation sector. However, no specific timeline for their inclusion has been disclosed as of now.

The old CCER scheme for offset credits was suspended in 2017 due to low trading volumes and lack of regulation for some projects. Around 80 million tonnes of credits were issued between 2012 and 2017 which were used in China's regional and national ETS. As per MEE, entities under the national ETS could use the left over CCER credits to offset five per cent of their verified emissions. In January 2024, the Chinese government re-launched the CCER scheme after a six-year suspension and reform period. The re-launch will allow project owners to apply for CCER projects and generate offset credits that can be used in national ETS. It is expected that the CCER scheme will begin operating in 2024 and will be open to projects like offshore wind farms, solar thermal power plants, mangrove development and forestry. Under this relaunched scheme, CCERs can be used by entities covered under the national ETS to offset up to five per cent of their verified emissions, up to a total of approximately 250 million tonnes across the scheme.[59]

According to the latest update, as of February 2024, the State Council of China, under the leadership of the Chinese Premier, announced a new set of regulations

for the national ETS. These regulations aim to elevate the governance of the China Emission Trading Scheme (ETS) from ministerial oversight to the state council level, thereby establishing a solid framework and foundation for the national ETS. These regulations will be effective from May, 2024. Under the regulation some of the major measures that have been taken are:

- **The ETS governance framework** will have new authorities like National Development and Reform Commission, The Civil Aviation Administration of China etc. join the MEE in taking decisions regarding ETS. China's Ecological Environment Department has been given responsibility for supervising and managing China's carbon emissions trading

- **Enhanced financial and non-financial enforcement measures** to prevent obligated entities from falsifying reported emissions, failure to submit samples for inspection, etc. The fine and penalty amount was increased substantially, which ranged five to ten times the market value of the gap. Deductions will be made from entities' next year's allocation, along with potential suspension if they refuse to surrender their allowances after a warning.

- **Penalties and enforcement measures** were brought in for third party verifiers, consultants involved in emission data frauds, which was up to 10 times their illegal gains.

- It also mentions that China will bring in the **auctioning of allowances** gradually which will be expanded, although no clear timeline has been specified.

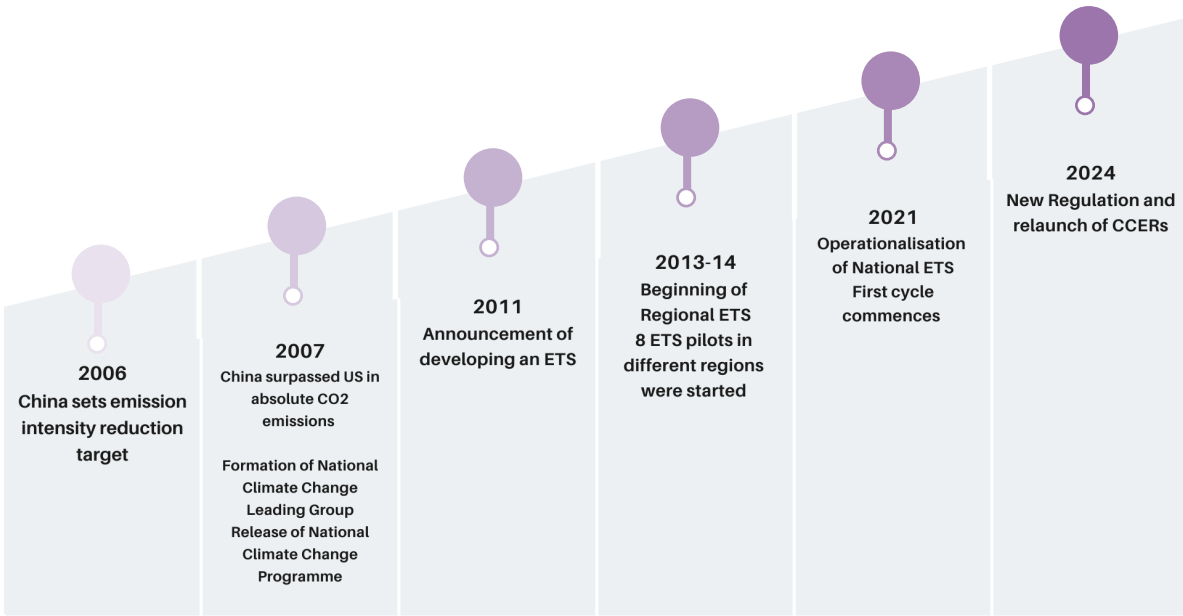
- **Offset credits** are allowed in the national ETS, although this regulation does not specify any limits. The current ministerial-level regulations have a limit of five per cent of the verified emissions. The MEE will be responsible for developing specific rules.

- According to this regulation the **regional markets** will have to **improve their market management rules**. The State Council won't allow any new regional emission schemes in China.

Design and operation of China's national ETS

Although the general rules of an ETS regarding allocation, compliance, MRV

Figure 10: China ETS timeline



Source: Prepared by CSE, 2024

Graph 7: China ETS carbon price trajectory

Source: ICAP carbon price explorer, 2024

etc. have been followed in designing China's national ETS, it differs in certain ways. For example, it covers only the power sector and has an emission intensity-based benchmarking system to maintain a balance between economic growth and emission reduction.

MEE laid out the steps for the first compliance cycle of China's national ETS. By the end of March 2021, the pre-allocation of emission permits to all 2,225 entities for 2019 and 2020 took place (70 per cent of their 2018 output) and all entities opened accounts in the Shanghai Environment and Energy Exchange. By the end of April, 2021, the obligated power generation sites had to complete their online reporting of emissions for 2020. By the end of June, 2021, the power sector conducted the verification of GHG emissions of 2020 and reported the results to MEE. From the end of June 2021, the trading period began for the power sector. Further, by the end of September, 2021, the other seven selected sectors (petrochemicals, chemicals, building materials, steel, non-ferrous metals, paper and domestic aviation) had to complete the online reporting of their 2020 emissions. Parallelly, MEE completed the verification and made the final allocations of emission permits for the power generation sector in 2019 and 2020. By the end of December, 2021, the other seven selected sectors completed their verification of GHG emissions and reported it to the MEE. The end of December was also the compliance deadline of the first round of implementation. Therefore, power plants surrendered allowances covering their emissions in 2019 and 2020. The power sector also includes captive plants.

The table below shows the step-by-step details of the first compliance cycle.

Major challenges

- **Low and seasonal market liquidity, shortage of supply, and low-carbon price:** These issues are closely interconnected and are commonly observed during the initial phases of market establishment. The liquidity of China's national carbon market has been noted to be low and seasonal, with transaction levels typically remaining subdued. This pattern may stem from companies engaging in allowance purchases and sales primarily to meet their compliance obligations. As a result, most transactions occur towards the end of the compliance period, leading to imbalanced market activity throughout the year, with minimal activity observed for much of the year. Because of this there won't be enough supply of allowances throughout the year. Recent stricter MRV rules have also led to delay in release of new allowances, adding to the shortage of supply in the market. The design of the cycle is such that the trading window is also short when compared to markets like EU-ETS. Trading

Table 9: China national ETS compliance cycle

Deadline	Monitoring, reporting and verification (MRV)	Emission permits
30 March, 2021		Pre-allocation: All 2,225 regulated power generation sites received their preliminary allocation of emission permits for 2019 and 2020, and opened a trading account in the Shangai Environment and Energy Exchange.
30 April 2021	Reporting: Power generation sites complete the online reporting of emissions in 2020.	
30 June, 2021	Verification: The power sector completes verification on the GHG emissions in 2020 and reports the results to the MEE. Confirmation of coverage: MEE's provincial subsidiaries submit a list of regulates sites in the power generation sector.	
From end of June 2021		Online trading starts for the power generation sector.
30 September, 2021	Reporting: All other seven selected sectors complete the online reporting of GHG emissions in 2020.	Allocation: MEE completes the verification and makes final allocations of emission permits for the power generation sector in 2019 and 2020.
31 December, 2021	Verification: All other seven selected sectors complete the verificaion on the GHG emissions in 2020 and report to the MEE.	Compliance deadline of the first implementation cycle: Regulated power generation sites surrender permits covering their emissions in 2019 and 2020.

Source: Carbon Brief,[60] 2021

activities have further slowed down in the second year compared to the first year of trading in the national ETS. This also affected the carbon price of the market. On 8 March, 2024, China ETS achieved a record high carbon price of Yuan 83.33/ Mt Co_2e ($11.74/ Mt Co_2e). This was the highest price it had achieved since its inception in 2021, when its price was Yuan 51.23/ Mt Co_2e or USD 7.22/ Mt Co_2e as per Shanghai Environment and Energy Exchange (SEEE). The price hike on 8 March can be attributed to the announcement of the new regulation. The price has gone as low as USD 5.84/ Mt Co_2e in 2021 as well. Even with the slight rise in the price over the few years, the carbon price is still almost one tenth of the carbon price of EU-ETS.[61]

- **Data accuracy**: China's national ETS has various issues with data integrity. Within the initial period, a power plant emitting around 10 million tonnes of CO_2 was caught doctoring its emissions data. This case affected almost one million tonnes of emission allowances which was worth seven million USD.[62]

The MEE has highlighted that there is a widespread problem of data fraud among power plants and consultancies that have helped emitters manipulate their data.

- **MRV challenge for small companies**: China has a large number of small-scale generators and manufacturers which, at some point, will be included in the national ETS. The larger companies have experience and a proper system developed in terms of data collection and management whereas MRV compliance with smaller entities which lack experience, instrumentation and systems in place will make it challenging.

- **Issues around offset credits (CCERs):** CCERs, which is China's version of the Kyoto Protocol's Certified Emission Reduction, was launched in 2012, but was halted in 2017 due to small transaction volume and lack of standards in carbon audits.[63] The mechanism before 2017 featured 200 methodologies[64] (difficult to monitor) and various projects with poor economic returns which could be amongst the reasons for policy suspension.[65] The decision to suspend offset credits was taken by NDRC as they wanted to reform the scheme, but soon the responsibility of the scheme shifted from NDRC to MEE, which took time to relaunch the scheme.

- **Low penalty amounts**: The lack of a comprehensive climate change law has resulted in penalties not being sufficiently severe. Ministry regulations have restrictions and therefore, penalty amounts in China have been lower than the amount of money companies would have to spend on buying allowances. The maximum fine on a company is only 30,000 Yuan (USD 4,200), which is a fraction of what a company could save by breaking the rules by not buying allowances. This has been addressed in the new regulation that has come in May 2024.

- **Lack of effective overarching legislation**: China lacks an overarching law on climate change or a law for reducing GHG emissions. Therefore, the country has to follow an internal set of regulations prepared by MEE and usually, ministerial data has certain restrictions in place. Although with the recent regulation coming directly from the State Council, more policy strength has come to the China ETS.

Resolution measures

- **Tightening benchmarks but with exemptions:** Compared to the first

compliance cycle in 2019–20, the benchmarks were tightened by 6 to 18 per cent and 7 to 19 per cent for coal power generators in 2021 and 2022 respectively, and 0.5 percent for gas fired plants. This was done mainly to eliminate the surplus of allowances observed in the first cycle.[66] This tightening came but with exemptions; for example, their target obligation has a cap of 20 per cent above verified emissions, companies with a shortfall of 10 per cent or more can apply to borrow allowances (up to 50 per cent of the shortfall) from their pre-approved allocation for 2023 to fulfil obligations of 2021 and 2022, and special relief packages for certain plants which are important for livelihood reasons and couldn't meet their obligations.[67, 68]

- **Actions to improve data integrity**: In March 2022, MEE sent out a notice for companies to carry out monthly inspections in the key parameters of their emissions and to submit the results online. It also launched a research project in June 2023, to build a long-term mechanism to help manage data quality.[69]

- **Introducing the auctioning of allowances:** In the latest regulation issued in February 2024, there were plans to introduce and expand auctions within the market, although a specific timeline for implementation has not been specified.

- **Stricter MRV rules**: The MEE is amending and strengthening the MRV guidelines almost every year for the national ETS, to prevent any form of data fraud or manipulations from occurring any more.

- **Stricter penalties:** The new regulation sets stricter penalties for obligated entities as well as consultants and third parties involved in the evaluation processes. The penalties for failures or cheating in reporting range from CNY 500,000 (USD 70,582) to ten times the illegal gains. Non-compliance penalties range from 5 to 10 times the market value of the gap, while consultants and MRV (Monitoring, Reporting, and Verification) verifiers can face penalties of up to 10 times the illegal gains for data fraud.[64]

- **Relaunching CCER scheme:** In January 2024, the CCER scheme was relaunched after a reform period which will allow projects to generate offset credits for national ETS. The MEE has publicized four methodologies that would be used to quantify net emission reductions from four types of projects i.e. forestation, solar thermal power, offshore wind power generation and mangrove revegetation. The authorities expect that this will help in increasing market liquidity.

Table 10: Summary of major challenges and measures

S. No.	Major challenges	Measures taken

1.	Low and seasonal market liquidity, shortage of supply and low carbon price	Tightening benchmarks, relaunching CCERs, introducing auction of allowances, market regulation and protection mechanisms.
2.	Data quality	Monthly inspection and reporting of key parameters, continuous strengthening of MRV system, research project to develop long-term mechanism for data quality.
4.	Offset credits	Relaunch of reformed CCER (offset credit) system after a six-year suspension
5.	Low penalty amounts	Introduction of stricter penalties based on illegal gains or market gap for not only market entities but also consultants and third-party verifiers

Table 11: China national ETS summary

China emission trading system	
Status	Started in 2021 without specific phases; the current rules apply to both the first compliance period (2019 and 2020) and the second compliance period (2021 and 2022)
ETS Brief	China's ETS is the world's largest ETS in terms of covered emissions, estimated to cover around five billion tCO_2, accounting for 40 per cent of the country's CO_2 emissions. It has been established that eight pilot ETS projects ran in different regions of the country from 2013. The pilots are operational parallelly and will gradually integrate into the national ETS
Sectors covered	Currently includes the power sector (including combined heat and power and captive power). Will gradually include seven more sectors
GHGs	CO_2
Emissions covered	40 per cent of the country's emissions
Cap	In this market, cap is the sum of bottom-up total allowance allocation to individual entities. Cap changes according to actual production levels. It adds up to a cap of 5,000 million tCO_2 in 2021 and 2022
Aallowance price	Completely free allocation
Penalty	China's interim regulation which would come in effect from May, 2024 has increased fines from CNY 10,000 to 30,000 to CNY 50,000 to 200,000, and for failing to comply fines have increased from CNY 20,000 to 30,000 to five to ten times the market value of missing allowances
Compliance cycle	Two years
Reduction target	No specific target for the market. Will contribute to country's target of 18 per cent reduction in carbon intensity per unit of GDP compared to 2020 by 2025 and to achieve carbon neutrality by 2060.
Emission reduction*	Data not available
HIGHLIGHTS	
Strict penalties	Higher and more stringent penalties in multiples of illegal gains and market gaps have been brought in under China's new interim regulation.

Re-launch of CCER scheme	MEE has publicized four methodologies for four types of projects under the re-launched scheme, thereby drawing a clear boundary compared to the previous scheme.
Combatting data manipulation and continuous improvement of MRV rules	To combat data manipulation, monthly monitoring is being done and the MRV system is being reformed every year

2.4 Case study 4: Surat Emission Trading System

Background and evolution

In a step towards tackling air pollution, the Ministry of Environment, Forests and Climate Change (MoEFCC), the Central Pollution Control Board, and the Gujarat Pollution Control Board collaborated with researchers from J-PAL South Asia, the University of Chicago and Yale University and designed the world's first Emission Trading Scheme (ETS) for reducing Particulate Matter from the industrial point sources.

In 2019, the ETS-PM (Emission Trading Scheme for Particulate Matter) was introduced among 342 highly polluting textile industries in Surat, Gujarat, as a first of its kind in the world for mitigating particulate emissions. Surat is one of the major industrial hubs in India with 52,252 registered industrial units. Some of the main industries are textiles, chemicals, dyeing and printing, diamond processing, zari (silver) making, and engineering related activities (including manufacturing machines and equipment). The maximum number (nearly 24,000 units) of small and medium scale enterprises are related to the textile industry in the district followed by repairing and the service industry with more than 11,000 units.[70]

Industries under ETS-PM have been selected using the following criteria:

1. Industries belonging to the "red" category of high polluting industries
2. Industries with at least one stack and diameter >24 cm for CEMS installation
3. Industries using solid/liquid fuels, ranked by their PM emissions
4. All large and medium sized industries ranked by capital investment from (3)
5. Small industries with PM emission capacity above predetermined threshold[71]

An emissions inventory study conducted under Surat Municipal Corporation by WRI India for Surat city showed the breakdown of emissions from different sources in 2019. Road dust, transport and industry were the three highest contributors to PM emissions. Industry was also amongst the highest contributors when it came to SOx, NOx and CO emissions *(See Table 12: Surat industrial area profile: Total Emissions from pollutants in Surat city)*. As per the study, industrial sector was contributing 23 per cent of the PM10 emissions and 27 per cent of the PM2.5 emissions of the city. Industries in Surat are predominantly from the textile sector

(94 per cent). Most of them use solid fuels such as coal (37 per cent) or lignite (27 per cent) but some are reportedly using liquid fuel such as diesel (14 per cent).[72]

The inception of CEMS in India opened the doors for a market-based scheme like the one in Surat. The figure below illustrates the timeline of CEMS' inception and how the Surat and Ahmedabad ETS subsequently followed suit.

Design and operation

Target setting

Industries participating under the ETS scheme are given a target for PM emissions. GPCB in consultation with the Market Oversight Committee sets appropriate parameters of market design such as a level of cap, PM emission monitoring from each of the point sources, amount of trading deposits, amount to be deducted from trading deposits in case of excess PM emission or unavailability of data etc. The cap is based on the CPCB particulate emission standard of 150 mg/Nm3.[74]

Permit distribution

According to the scheme, industries must possess emission permits equivalent to

Table 12: Surat emission inventory study: Sector-wise emissions for each pollutant in Surat

Sector	Emissions (kt/year)				
	PM10	PM2.5	SO2	NOx	CO
Industry	8.1	3.87	3.59	4.46	40.42
Transport	4.31	4.19	0.09	32.86	85.78
Road dust suspension	19.55	4.73	-	-	-
Solid waste burning	0.27	0.23	0.01	0.09	0.87
DG sets	0.02	0.015	0.017	0.258	0.056
Residential cooking	1.14	0.68	1.21	0.76	9.29
Eateries	0.111	0.073	0.042	0.072	1.14
Landfills	0.13	0.089	0.008	0.049	0.686
Construction	1.67	0.29	-	-	-
Crematoria	0.156	0.077	0.003	0.021	0.783
Aircraft	0.004	0.004	0.262	0.02	0.543
Total	35.461	14.248	5.232	38.59	139.568

Source: Surat Municipal Corporation and World Resources Institute India, 2021

Figure 11: Surat ETS timeline

Source: ETS success story booklet[73]

their current PM emissions. At the beginning of the scheme, industries are pre allocated 80 per cent of their total PM emissions. The rest of the 20 per cent is adjusted based on whether industries fall short or over achieve their emission targets.[75]

Compliance period

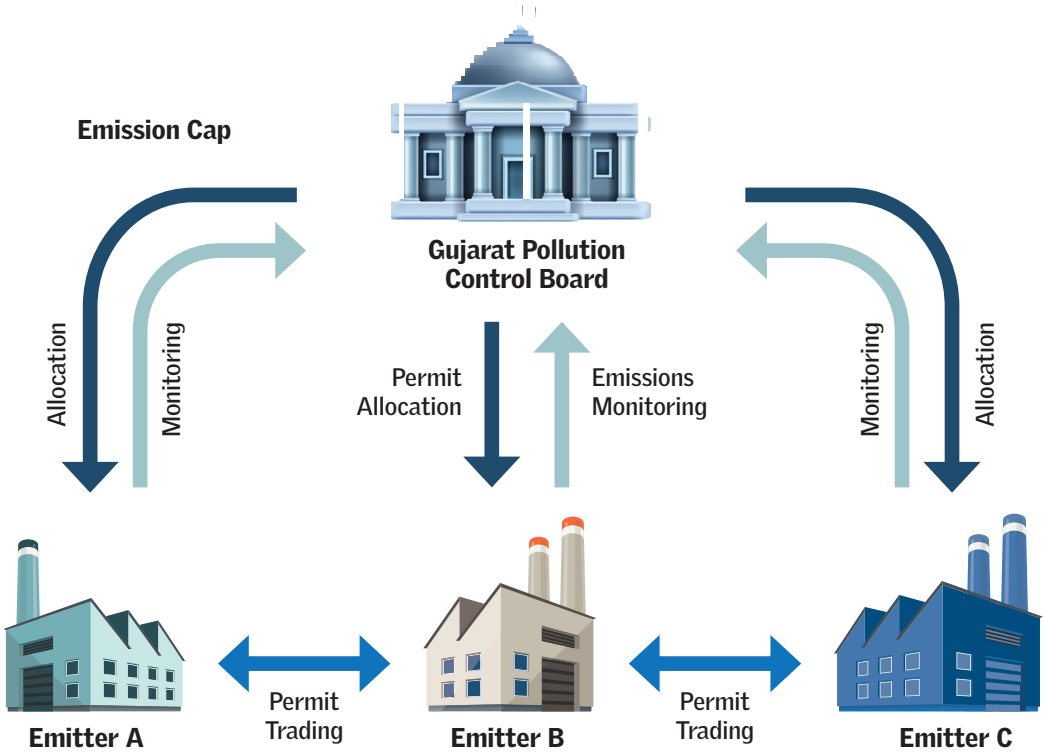
According to CSE's discussion with the experts, it is clear that the industries are given either one or two months depending on the size of the unit as a compliance period. At the end of each compliance period, GPCB shall compare the total pollution released by each industry to their permit holdings. Industry shall be considered in compliance with the scheme if they hold emission permits that are equal to or greater than their actual mass of emissions released during the whole of the prior compliance period.

For example, an industry that emitted 35,000 kg of particulate matter but held permits for only 30,000 kg, at the close of a compliance period, would be non-compliant and is subjected to pay penalty

Trading mechanism

The transfer of permits is referred to as a trade. Industries trade the emission permits on a trading platform hosted by the commodity trading marketplace—National Commodities and Derivatives Exchange e-Markets Ltd (NeML). In effect, the buyer is paying a charge for polluting, while the seller is being rewarded

Figure 12: Functioning of ETS



Source: Booklet on Particulate Matter ETS, Gujarat, Sep 2022

for having reduced emissions, thus, following the polluter's pay principle,

Penalty for non-compliance

All industries participating in the market are required to deposit an environmental bond called Environmental Damage Compensation Deposit (EDCD) at the beginning of the scheme. At the end of the compliance period, if the industry seems to not have enough emission permit, they are liable to pay a penalty called Environmental Damage Compensation (EDC). The price of the penalty is set greater than the maximum permit price in the market. The penalty would be deducted from the initial deposit made by the respective industries.[76]

What has the achievement been?

According to the September 2022 report titled "Gujarat Emission Trading Scheme for Particulate Matter—A Paradigm Shift in Environmental Regulation," by GPCB, the Gujarat ETS scheme introduced in 2019 claims to have reduced PM emissions from industries by 20–30 per cent. The overall cap was initially set at 280 tonnes during the compliance period-1, but was gradually decreased over time because it

was not stringent i.e. the supply of permits was higher than the demand.[77]

Following consultations with the Market Oversight Committee, the emissions cap has been revised and has been trading at approximately 170 tonnes per 30 days in the later compliance cycles after 2021.[78].

Challenges

1. **Low price of emission permits**: As understood from the records, GPCB has set a floor price for emission permits at INR 5/kg. This condition most probably persists because the availability of emission permits has exceeded the demand. According to the ETS Success Story Booklet, GPCB have themselves stated that they have decreased the cap for emissions because of the excess availability of the emission permits.

   A similar situation existed with respect to PAT scheme where the Energy Savings Certificates (ESCerts) were available in excess. The same might be the case for this ETS scheme; availability of excess emission permits may be due to setting less ambitious targets for reducing the particulate emissions. Low targets make industries achieve targets very easily and have higher emission permits for trade, therefore reducing the price of the permits.

   If the price of the permit is low, non-compliant industries would prefer purchasing emission permits rather than making efforts to reduce their PM emission by installing suitable air pollution control devices (APCDs).

   As per GPCB, the latest overall cap under the last few compliance cycles was of 170 tonnes Suspended Particulate Matter. Given there are 342 industries, this translates to an average cap of 497 kgs SPM for each industry. Upon failure to meet the targets, the companies/units are obligated to purchase PM credits.

   Analysis of the highest bids for emission permits in the latest compliance cycles—26,27 and 28 as available on the GPCB Surat Clean Air Dashboard—reveals an average highest bid price of INR 35/kg of PM permit.

   For instance, a 10 per cent increase from the average individual cap of 497 kg SPM would mean the company has to buy 50 kg worth of permit. The price of buying these 50 kg PM permits at INR 35/KG would be INR 1,750.

   The Surat textile manufacturing hub is the second largest in the country, and these companies have turnovers that are in multiples of crores. Therefore, such

a low price does not account for any significant effect for the companies. Even if these companies do not abide by the cap given to them for all compliance periods in a year, the cost of installing APCDs is way higher than buying emission permits.

2. **Data reliability on CEMS**: CSE analyzed Gujarat's Continuous Emission Monitoring System data and found that out of 704 industries connected to CEMS, only 491 were active, 192 showed their status as inactive and 21 as delayed. In addition, industries that display an online status in the image below do not show any data once clicked. These scenarios questioned the reliability of the CEMS data. Apart from this , our country also grapples with issues like no CEMS certification system, installation of CEMS at inappropriate locations in industries, unreliable manufacturers and others. Since the ETS scheme, considering the CEMS data as a means of check mechanism, GPCB should take additional measures to ensure the reliability of the CEMS data.

3. **Lack of transparency:** Unlike the CEMS system, the ETS monitoring system is not available in the public domain as of now. Only the concerned officials involved in the ETS scheme have access to the PM emissions data. Gujarat ETS scheme is currently being monitored by the regulators by the online monitoring system. It is clear from the CSE's discussion with Gujarat PCB officials that the industries under ETS are maintaining a separate online monitoring system for PM monitoring. GPCB also claims that the stack PM emissions have been reduced by 24 per cent in these industries between 2019 and 2022, but there is no proper source apportionment study in public domain or other evidence to back this study. Moreover, there is lack of data on change in ambient air quality, therefore there needs to be a clear transparent study on the same.

Measures

CSE had a discussion with the Gujarat PCB officials and they informed that the industries under ETS scheme have made several efforts to reduce their particulate emissions. The efforts are of three types such as:

1. **Cleaner fuel shift**: Industries are found shifting towards cleaner fuel such as agro-residue to achieve emission target.

2. **Improving combustion efficiency**: In an attempt to improve the combustion efficiency, industries are found adopting different technologies like auto-fuel

Figure 13: GPCB CEMS dashboard

Source: GPCB CEMS dashboard as of December, 2023

feeding system, improving air-fuel ratio, and operation and maintenance improvements.

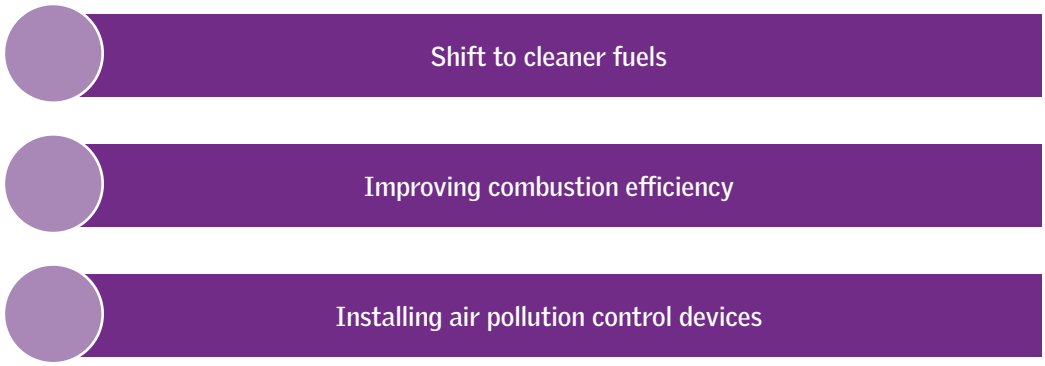
3. **Installing air pollution control devices** (**APCDs**): As the monitoring strengthened after the Gujarat ETS, more and more industries were found to install APCDs.

Although a study should be conducted of the obligated entities and clear data on the above three measures should be shared in public domain to bring clarity on how much of this has actually happened on the ground and that industries are not delaying such measures by buying permits which are available at low rates.

Table 13: Surat emissions trading system

SURAT EMISSION TRADING SYSTEM

Figure 14: Measures to reduce particulate emissions



Source: CSE, 2024

Status	In 2019, ETS-PM was introduced among 342 highly polluting industries in Surat in Gujarat as a first of its kind in the world for mitigating particulate emissions.
ETS Brief	Firms are required to hold a number of permits (or allowances or carbon credits) equivalent to their emissions. The total number of permits cannot exceed the cap, limiting total emissions to that level. Industries under ETS-PM have been selected using the following criteria: 1. Industries belonging to "red" category of high polluting industries. 2. Industries with at least one stack and diameter >24 cm for CEMS installation. 3. Industries using solid/liquid fuels, ranked by their PM emissions. 4. All large and medium sized industries by capital investment from (3). 5. Small industries with PM emission capacity above predetermined threshold.
Sectors	Textile
Pollutant	Particulate matter (PM)
Target/Cap	The cap was initially set at 280 tons during the compliance period–1, but was gradually decreased over time because it was not binding.
Allowance price	latest compliance cycles—26,27 and 28 reveals an average highest bid price of INR 35/kg of PM permit.
Penalty	Companies that do not possess enough emission permits are to pay a penalty called Environmental Damage Compensation. The price is set greater than the maximum permit price in the market.
Compliance cycle	One to two months
HIGHLIGHTS	

Lapse in monitoring	CSE analyzed the Gujarat's Continuous Emission Monitoring System data and found that out of 599 industries connected to CEMS, only 491 were active and 192 showed their status as inactive and 21 as delayed. Apart from that, industries showing status as active are not showing any data. This scenario questioned the reliability of the CEMS data.
Low floor price and permit price	Analysis of the highest bids for emission permits in the latest compliance cycles—26,27 and 28 as available on the GPCB Surat Clean Air Dashboard—reveals an average highest bid price of INR 35/kg of PM permit. The price of permits fluctuate in the range of Rs. 5/KG to Rs. 100/KG, this price is very low. The floor price of Rs. 5/KG is also set low.

2.5 Overall summary

Some important design elements come forward after analysis of all Emission trading systems. CSE has analysed the ETS with different scopes and scales. The key takeaways from design elements are summarized in the table below.

Table 14: Design and operation of ETS Case Studies

ETS case studies	EU-ETS	Korean ETS	China ETS	Surat ETS
Type of system	Cap-and-Trade	Cap-and-Trade	Baseline-and– Credit	Cap-and-Trade
Year of commencement	2005	2015	2021	2019
Allocation mechanism	Initially allocated freely, the share of free allocations reduced and auctioning increased	Mix of free allocation and auctioning	All free allocations	Auctioning at floor price of INR 5/kg of PM emissions
Coverage	37 per cent of GHG Emissions	77 per cent of GHG emissions of the country	40 per cent of country's GHG emissions	340 textile industries from Surat
Offsetting and linking	No offset emissions allowed after 2020	5 per cent of the verified emissions	5 per cent of the verified emissions	No offsetting
Emission reduction achieved	As reported by EU commission in April, 2024, ETS emissions in 2023 are 47 per cent below 2005 levels[79]	Data not available	Data not available	It has claimed to have reduced PM emissions by 24 per cent between 2019 and now. No study in public domain to back these claims.
Carbon price achieved	USD 90 (average auction price 2023)	USD 17.99	USD 11.74 (as of March 2024)	PM permit price-INR 5/kg

ETS case studies	EU-ETS	Korean ETS	China ETS	Surat ETS
Penalties applied	EUR 100 per tonne of CO_2	Three times the average market price of the given compliance year or KRW 100,000 per tonne.	Failures or cheating in reporting starting from 500,000 CNY (USD 70,582) to 10 times the illegal gains. Consultant firms and carbon verifiers involved in MRV data fraud to face penalties up to 10 times of the illegal gains	Not specified
Total market value (in USD)	834.18 billion[80]	245.4 million	2.49 billion [81]	Data not available
Revenue generated (in USD)	206 billion	901 million[82]	No revenue generation	Data not available

3

LEARNINGS FROM THE PAT SCHEME

Initiated in 2012, India's Perform, Achieve, and Trade (PAT) Scheme covers 1,333 designated consumers (DCs) from 13 energy-intensive sectors, setting specific energy reduction targets over three-year cycles.

PAT's overall CO_2 reductions are marginal and most industrial sectors in the initial PAT cycles overachieved the targets, resulting in an excess of more than 2 million ESCerts during PAT II.

Challenges include excess ESCerts availability, low market activity, lenient targets, increased non-compliance, and delayed compliance. The newly proposed Carbon Credit and Trading Scheme (CCTS) which aims to build on PAT's framework, needs to address these shortcomings.

3.1 The PAT scheme: An introduction

India's National Action Plan on Climate Change (NAPCC) was introduced in 2008 with the aim of outlining various strategies and measures to address climate change challenges. It consisted of eight national missions that focused on different aspects of climate change mitigation and adaptation. These missions were aimed at enhancing the country's resilience to climate change impacts while also promoting sustainable development. Some of the key missions included the National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission for Sustainable Agriculture, National Water Mission, and others.

The Ministry of Power and Bureau of Energy Efficiency were given the responsibility of implementing the National Mission for Enhanced Energy Efficiency (NMEEE). Four initiatives were rolled out under the NMEEE, of which Perform, Achieve and Trade Scheme (PAT) was one.[83]

Perform, Achieve and Trade (PAT) was set up in 2012 as a competitive mechanism for reducing energy use in large industries. It was introduced as a market-based mechanism to increase energy efficiency in the industrial sector. In 2023, the Ministry of Power, Government of India, notified the Carbon Credit and Trading Scheme (CCTS) for India. The newly proposed CCTS (which will be discussed in detail in the next chapter) in India is being built upon the experience and framework of the ongoing PAT scheme as PAT is the only national level market-based mechanism currently operating in India.

The direct relation between energy efficiency and reduction in carbon emissions also make them very relatable. Henceforth several design elements of the new carbon emission trading scheme are similar to the framework of existing PAT scheme. This makes it essential to closely examine the experiences and learnings from the PAT scheme to incorporate the same in the upcoming CCTS scheme.

Under PAT, the government shortlists industries, limits the amount of energy they can consume, and defines a time limit for the achievement of targets. Industries have to, in turn, work towards improving their energy efficiency. Industries that are given targets in the scheme are called designated consumers (DCs). The industries that overachieve their targets are issued energy savings certificates (or ESCerts) that can be traded with industries that have not achieved their targets. The table below shows a brief comparison of the two schemes in terms of design and framework.

Table 15: Comparison of PAT and CCTS design

Particulars	PAT	CCTS
Objective	Energy efficiency	Carbon emission reduction
Target intensity	Specific energy consumption (SEC)	Specific GHG emission (SGE)
Unit of credit measurement	Tonnes of oil equivalent (TOE)	Tonnes of CO2 equivalent (tCo2e)
Compliance cycle	3 years	1 year
Issuance of certificates	Ex-post	Ex-post
Entity	Designated Consumers (DCs)	Obligated entity (OE)
Monitoring and verification	Accredited Energy Auditors	Accredited Carbon Verifiers
Administrator	Bureau of Energy Efficiency	Bureau of Energy Efficiency
Certificate	Energy Saving Certificates (ESCerts)	Carbon Credit Certificates (CCCs)
Target	Unit-wise targets	Unit-wise targets
Registry	POSOCO	Grid Controller of India
Trading regulator	CERC	CERC

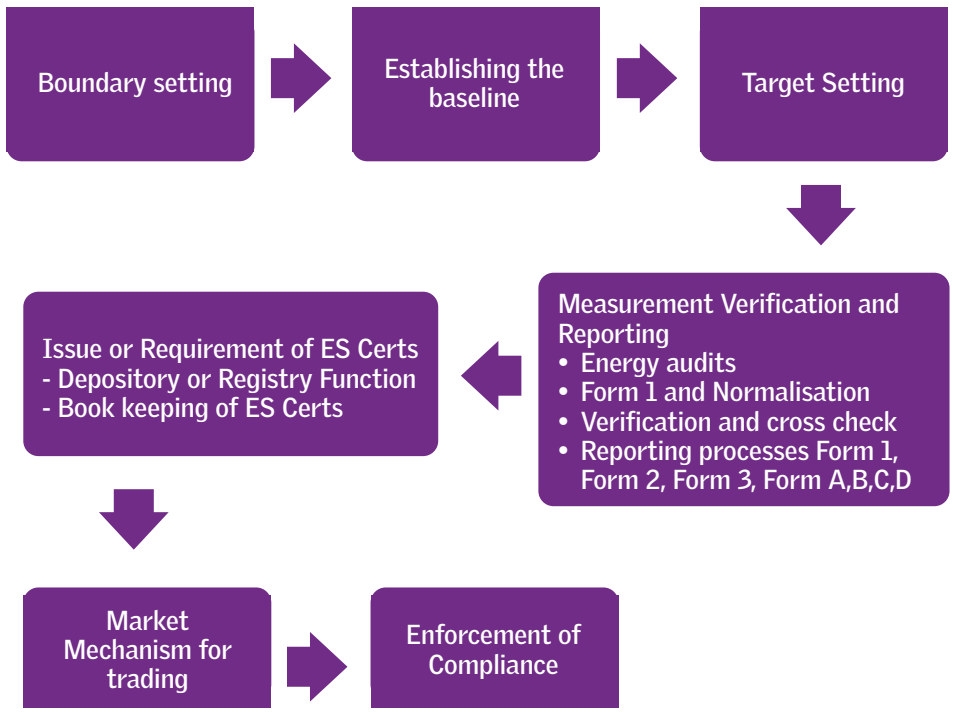
Under the PAT scheme, energy-intensive industries, such as thermal power plants, cement, steel, aluminium, and pulp and paper, are given specific energy efficiency targets to achieve over a certain period. These targets are set based on their historical energy consumption and production levels. Participating industries are required to implement energy-saving measures and technologies to meet their targets. Industries are given three years to achieve the targets set by the agency.

Industries that exceed their energy efficiency targets are awarded Energy Savings Certificates (ESCerts), while those that fail to meet their targets are required to purchase ESCerts to comply with the scheme. This creates a market-based mechanism where industries can trade ESCerts, providing an incentive for energy efficiency improvements.

Non-achievers have to buy the ESCerts after the three years. This period of time given to comply with the energy-reduction targets is called one cycle. After the first cycle, PAT announcements for eight cycles have been made so far since 2012; PAT has covered 1,333 DCs from 13 energy-intensive sectors until now. Sectors included are thermal power plants, cement, aluminium, iron and steel, pulp and paper, fertilizer, chlor-alkali, petroleum refineries, petrochemicals, DISCOMs, railways, textile and commercial buildings (hotels and airports). PAT-I started in 2012 and ended in 2015 but PAT-II onwards, cycles are being implemented on a rolling basis i.e. subsequent PAT cycles were notified annually, to accelerate coverage and include more DCs.

The Bureau of Energy Efficiency (BEE), selects the sector and industry on which targets are placed. Accredited BEE-empanelled energy auditors are engaged by

Figure 15: Design of the PAT framework



Source: BEE Impact of Energy Efficiency measures, 2020-21

the industry to present the audit statements post the cycle. The auditors scrutinize, monitor and verify to ascertain achievements and target shortcomings. Based on the verification results, industries trade on power-exchange portals, i.e., online market platforms where energy certificates are bought and sold by designated consumers.

The process is long due

Sectors are selected on the basis of the BEE feasibility study. Under this study, BEE-empanelled accredited energy auditors survey the number of units in a sector and study the energy consumption pattern to set the minimum threshold of energy consumption limit for the selected sector for the purpose of shortlisting the designated consumers in the sector. After completion of the PAT cycle, measurement and verification of achieved energy savings is carried out by the empanelled accredited energy auditors and the year in which it is performed is referred to as an assessment year (*see Table 16: Baseline year, assessment year and number of DCs listed and current status of each PAT cycle*).

Table 16: Baseline year, assessment year and number of DCs listed in each PAT cycle

The majority of industries were included in the beginning of PAT cycles

PAT cycle	Baseline year	Assessment year	No. of Sectors involved	Sectors added	No. of DCs involved	Energy saving target (in Mtoe)	Status of cycle
Cycle 1	2007–10	2014–15	8	Aluminum, Cement, Chlor-Alkali, Fertilizer, Iron & Steel, Pulp & Paper, Textile, Thermal Power Plant	478	6.68	Trading of ESCerts done
Cycle 2	2014–15	2018–19	11	Petroleum Refinery, DISCOM, Railways	621	8.86	Trading of ESCerts started in 2021
Cycle 3	2015–16	2019–20	6		116	1.06	ESCerts Under evaluation
Cycle 4	2016–17	2020–21	8	Petrochemical, Buildings	109	0.69	M & V compliance phase
Cycle 5	2017–18	2021–22	8		110	0.51	M & V compliance phase
Cycle 6	2018–19	2022–23	6		135	1.27	Ongoing
Cycle 7	2018-19/ 2019-20	2024-25	9		707	8.48	Ongoing
Cycle 8	2021-22	2025-26	6		138	-	Targets notified
		Total	13		1333		

Source: Data from Bureau of Energy Efficiency, 2021. Compiled by CSE, 2024

PAT scheme covers 1,333 DCs from 13 energy-intensive sectors of the country. PAT is in its sixth cycle and targets for PAT VII and VIII have already been notified for FY25 and FY26.

These two cycles will likely be operational parallelly to the CCTS scheme. The BEE might plan to transition the CO_2-intensive sectors from the PAT scheme to the CCTS, which would come with its own set of challenges. It is also to be noted that the entities under previous PAT schemes that will complete their cycles will not be continued in PAT. They will be given targets under the CCTS scheme which may not be the best way to transition as it will also come with certain challenges.

HOW BEE CALCULATES CO_2 EMISSIONS FROM EACH SECTOR

In order to calculate CO_2 emissions, fuel mix for each sector is considered and specified by BEE as given in Table 17

Table 17: Fuel mix for PAT sectors

Sector	Fuel mix %			
	Coal	Oil	Gas	Electricity
Aluminium	94%	4.50%	0.50%	1%
Cement	97%	1%	0%	2%
Chlor-Alkali	75%	2%	13%	10%
Fertilizer	8%	0%	90%	2%
Iron and Steel	83.50%	2%	1.50%	13%
Pulp and Paper	80%	5%	0%	15%
Textile	71.80%	0.90%	2.60%	24.70%
Thermal Power Plant	99.50%	0.50%	0%	0%
Petroleum Refinery	15.90%	24.30%	50.20%	9.60%
Railways	0%	69%	0%	31%
DISCOM	0%	0%	0%	100%

Source: BEE Impact of Energy Efficiency measures, 2020-21

With the amount of energy consumption, calorific values and CO_2 emission factors of each fuel, CO2 emissions can be calculated. GCV and emission factors are mentioned in Table 18

Table 18: kcal value and CO_2 conversion factors for fuels

Gross calorific values	kcal/kg	kcal/kWh	CO_2 emission factors	
			kg of CO_2/kg of fuel	kg of CO_2/kWh
Coal	4500		1.52	
Oil	10050		3.13	
Gas	9500		2.69	
LPG	11900		2.89	
Electricity		860		0.79

Source: BEE Impact of Energy Efficiency measures 2020-21

3.2 Steel sector: Analysis of CO_2 emission reductions

According to the Ministry of Steel, a total of 163 DCs from the steel sector have been covered under the PAT scheme. As reported in PIB,[84] the steel sector has achieved total targeted energy savings (from PAT I, II and III from 2012–2020) of 5.5 MTOE and corresponding CO_2 reduction of 20 million tonnes. On an average, the 20 million tonnes can broken down into 2.5 million tonnes of CO_2 emissions reduction per year from 2012–2020.

Table 19: Steel sector performance in PAT I and II

PAT cycle	No. of DCs	Total energy consumption (million TOE)	Energy-saving target (million TOE)	Target achieved (million TOE)	CO_2 emission reduction (Mt Co_2e)	Percentage increase in achievement from target
PAT I (2012–15)	67	25.32	1.486	2.1	6.51	41.3
PAT II (2016–19)	71	40.44	2.14	2.913	12.74	36.12

Source: Compiled by CSE, 2024

The total emissions from the steel industry, as per the Third Biennial Update Report (BUR-3) to the United Nations Framework Convention on Climate Change (UNFCCC) stood at 135 million tonnes of GHG equivalent for 2016. This means that there was only around 1.85 per cent reduction in CO_2 emissions from the steel industry in 2016. This is a marginal reduction in CO_2 emissions when compared to the contribution of the steel sector to India's overall emissions. Steel sector is one of the biggest industrial sectors, emissions reduction from this sector can have a positive impact on India's emission profile. Steel sector had overachieved their targets set by BEE in the first two cycles.[85] (*see Table 19: Steel sector performance in Pat I and II*)

3.3 Cement sector: Analysis of CO_2 emission reductions

In the first two cycles of PAT, CSE's analysis revealed that the cement sector overachieved their target by 81.6 and 41.82 per cent in PAT I and II, respectively. The total number of cement sector entities were 85 in PAT I and 111 in PAT II. The sector achieved a total emission reduction of 11.92 million tonnes CO_2 from both the cycles (2012–2019). According to BUR reports, the total CO_2 emissions from the sector in 2016 stood at 160.1 million tonnes CO_2. On an average, the sector reduced 1.70 million tonnes of CO_2 emissions per year. This is less than one per cent reduction as compared to total emissions of 160.1 million tonnes in a year (2016).

Like the steel sector, the cement sector also overachieved their targets in the first two cycles. The sector outperformed as it overachieved the target by 81 per cent in the first cycle. In the second cycle, the sectoral coverage was increased.[86] The number of DC's increased from 85 in PAT I to 111 in PAT II. Notably, the total energy saving target for PAT II is still lesser (1.1 MToe) than the sector's achievement in the first cycle (1.48 MToe). There can be an argument that the energy saving target in the second cycle is higher than the target of the first cycle. Given the sector had already overachieved the target of the first cycle by more than 80 per cent, it can be questioned as to why the subsequent target was not made more ambitious.

Table 20: Cement sector performance in PAT I and II

PAT cycle	No. of DCs	Total Energy consumption (million toe)	Energy-saving target (million toe)	Target achieved (million toe)	CO_2 emission reduction (Mt CO_2)	Percentage increase in achievement from target
PAT I (2012–15)	85	15.01	0.816	1.48	4.34	81.6
PAT II (2016–19)	111	21.43	1.1	1.56	7.58	41.82

Source: Compiled by CSE, 2024

A study of the PAT scheme by Oak and Bansal (2022),[87] underlines that the cement industry had been going through linear energy and emission intensity reductions from the 1990s. During 2005–2015, several factors like change in technology from wet process to dry process of manufacturing, increase in production of blended cement, installation of waste heat recovery systems contributed significantly to the emission intensity reduction of the sector. Moreover, the study by Oak and Bansal suggests that the energy efficiency increase in the sector in these years is due to two reasons—declining trend in energy intensity and additional decline in energy intensity of DCs due to PAT scheme. The study breaks down the contribution of both the factors. Total energy saving achieved in PAT I stands at 9.8 per cent from the baseline energy consumption of 15.01 million TOE. Of this, the contribution of PAT scheme is 2.7 per cent. This shows that the contribution of PAT scheme in cement sector, in terms of energy efficiency and emission reduction is marginal when you compare it to the reductions in the BAU scenario.

Therefore, it is clear that the PAT targets were met by cement sector DCs without much difficulty hence they had overachieved the target by a large margin in both the initial cycles. The energy saving and corresponding emission reduction from the scheme are also marginal, as seen in the steel sector.

3.4 Power sector: Analysis of CO_2 emission reductions

Thermal power plants were the biggest sector covered under PAT. Electricity generation is also the highest contributor to India's GHG emissions, at almost 40 per cent of the countries emissions as reported in BUR-3.

TPPs were the only sector that failed to achieve the energy saving targets in PAT-I, whereas they achieved the target in PAT-II.[88] When compared with the overall energy consumption of the sector, the targets assigned were also very low in both the cycles (*see Table 21: Power sector performance in PAT I and II*).

Table 21: Power sector performance in PAT I and II

PAT cycle	No. of DCs	Total energy consumption (million toe)	Energy-saving target (million toe)	Target achieved (million TOE)	CO_2 emission reduction (Mt CO_2e)	Percentage increase in achievement
PAT I (2012-15)	144	104.56	3.211	3.06	13.6	-5.00
PAT II(2016-19)	154	120.16	3.13	3.519	11.57	12.96

Source: Compiled by CSE, 2024

The cumulative reduction in CO_2 emissions from thermal power plants during PAT Cycles 1 and II amounts to 13.64 million tonnes and 11.57 million tonnes, respectively. The combined emission decrease from these plants totals 25.21 million tonnes of CO_2, constituting merely 2.3 per cent of the overall CO_2 emissions from this sector in a single year of 2016, that too, over a span of six years. If one looks at the emission reduction achieved in a single year, the figure would probably be less than one per cent. The reduction targets set for all the sectors were very lenient.

The first PAT cycle was notified in 2012. The scheme has been in force for more than a decade. CSE had done a critical analysis of the PAT scheme (PAT I and II) for the power sector back in 2021. Some of the major shortcomings of the PAT scheme were:

1. Lenient targets, overachieved by most: In PAT I, thermal power plant sector was the major sector with 30 per cent of total DCs. The overall energy reduction in absolute number for the sector was 3.211 million tonnes oil equivalent which translates to 3.07 per cent when compared to the sector's baseline energy consumption. For other sectors in PAT-1, the target percentage is nearly double. Most sectors overachieved their targets by 41 to 142 per cent (*see Table 22: Sector-wise energy consumption and target reduction set by BEE in PAT Cycle I).*

Excess availability of ESCerts, cheaper price of certificate: Prayas Energy Group's 2023 analysis highlights the trading of ESCerts, revealing that 57 lakh ESCerts were issued for PAT Cycle II, while the demand was only 36.68 lakh. Thermal power plants and DISCOMs had a share of 38 per cent of the issued ESCerts whereas they are obligated to purchase 78 per cent. Meaning that the power sector has to buy more ESCerts than they have generated. 40 sessions of trading have been conducted so far from till October 2023 for PAT II where a total of 21.89 lakh ESCerts have been traded, amounting to almost 60 per cent of the demand.

The price of one ESCert during PAT I and starting sessions of PAT II varied between INR 200 to 1,200 after which a floor price of INR 1,840 was set for PAT

Table 22: Sector-wise energy consumption and target reduction set by BEE in PAT Cycle I

Sr. No.	PAT cycle I sector	No. of identified DCs	Energy consumption (Mtoe)	Energy-saving targets set under PAT-I (M toe)	Energy saving achieved in PAT I (Mtoe)	CO_2 emissions reduction ($MtCO_2e$)	Target reduction assigned against energy consumption (per cent)
1	Thermal power plants	144	104.6	3.211	3.06	13.64	3.07
2	Iron and steel	67	25.32	1.486	2.1	6.51	5.87
3	Cement	85	15.01	0.816	1.48	4.34	5.44
4	Aluminium	10	7.71	0.456	0.73	3.1	5.91
5	Fertilizer	29	8.2	0.478	0.78	0.93	5.83
6	Paper and pulp	31	2.09	0.119	0.289	1.24	5.69
7	Textile	90	1.2	0.066	0.129	0.62	5.50
8	Chlor-alkali	22	0.88	0.054	0.093	0.62	6.14
	Total	478		6.686	8.661	31.00	

Source: CSE 2021, BEE document on impact of energy efficiency measures for the year 2019–20

Table 23: Sector-wise energy consumption and target reduction set by BEE in PAT Cycle II

Sr. No.	PAT cycle II sector	No. of identified DCs	Energy Consumption (Mtoe)	Energy-saving targets under PAT-II (Mtoe)	Energy saving achieved in PAT II (Mtoe)	CO_2 emissions reduction ($MtCO_2e$)	Target reduction assigned against energy consumption (per cent)
1	Thermal Power plants	154	120.16	3.13	3.519	11.57	2.6
2	Iron and Steel	71	40.44	2.14	2.913	11.85	5.3
3	Cement	111	21.43	1.1	1.56	5.45	5.1
4	Aluminium	12	10.66	0.47	0.573	4.2	4.4
5	Fertilizer	37	8.25	0.447	0.383	1.18	5.4
6	Paper and pulp	29	2.68	0.15	0.315	1.35	5.6
7	Textile	99	1.48	0.087	0.136	0.66	5.9
8	Chlor-alkali	24	1.77	0.102	0.136	0.55	5.8
9	Petroleum Refineries	18	18.5	1.009	1.48	5.19	5.5
10	Railways	22	1.39	0.077	0.196	1.0	5.5
11	DISCOMs	44	-	4.67	2.077	25.44	
	Total	621		13.382	13.28	68.43	

Source: CSE 2021, BEE document on impact of energy efficiency measures for the year 2019–20

Table 24: Delays in PAT cycle as of November 2023

PAT Cycle	Target Year	Deadline for MoP to issue certificates	Deadline for DCs to buy ESCerts and report compliance	Actual Timelines
I	2014-15	31/12/15	31/07/17	ESCerts trading completed in January 2018
II	2018-19	31/12/19	31/07/21	ESCerts issued in August 2021, delay of 20 months; Trading of ESCerts completed on 31st October 2023
III	2019-20	31/12/20	31/07/22	ESCerts still not issued, delay of 35 months to date
IV	2020-21	31/12/21	31/07/23	ESCerts still not issued, delay of 23 months to date
V	2021-22	31/12/22	31/07/24	ESCerts still not issued, delay of 11 months to date

Source: Prayas (Energy Group), 2024

II. All ESCerts during PAT II have been traded at the floor price since there was excess availability.[89]

Increased non-compliance: The trading cycle for PAT II started in 2021 and there have been multiple extensions from the Bureau for the trading of ESCerts, but even after repeated extensions of the trading window, 40 per cent of the ESCerts which were necessary for compliance were not purchased, DCs have failed to comply and the Bureau is yet to penalize the DCs. The trading of ESCerts was concluded in October 2023. Total volume of 21.89 lakh ESCerts have been traded, whereas the demand was of 36.68 lakh.

Delayed compliance: For PAT II, the official deadline for DCs to buy ESCerts was set as 2021, which was finished in October 2023, a delay of two years. There is even a delay in issuing of ESCerts for subsequent cycles because trading of previous cycles remained unfinished for longer than their set timelines (*see Table 24: Delays in PAT cycle as of February 2024*).

Low market activity: Once the MRV phase of PAT cycle is finished, there needs to be trading of ESCerts. ESCerts for PAT cycle II had not been traded by DCs when the trading window opened. As a result, BEE had extended the trading window multiple times. The ESCerts compliance that was supposed to finish by July 2021, got delayed and ended in October 2023. There has been low market activity as DCs did not trade. The price of certificates has also been low.

Minimal CO_2 reductions: It is evident from the sectoral analysis of power, cement and steel sectors that CO_2 reductions are marginal in the first two cycles of PAT. The scheme's low annual reductions in achieving emission reductions are attributed to its unambitious targeting and extended compliance periods. The total CO_2 emission reduction from PAT cycle I (2012–15) is just 31 million tonnes of CO_2 emissions[90] that translates to an annual average reduction of 10.3 million tonnes. Moreover, when compared to India's GHG emissions in 2014 (as reported in BUR-2), the reduction from PAT-I is only 0.5 per cent of total national CO_2 emissions. Reduction from PAT-II (2016–19) is 71.47 million tonnes CO_2,[91] when compared to India's GHG emissions in 2016 (as reported in BUR-3), the reduction from PAT-II is about 3.2 per cent of total national CO_2 emissions. Even with such a large coverage of industries and thermal power plants, PAT struggles to achieve any significant reductions in CO_2 emissions.

4

OVERVIEW, CHALLENGES AND RECOMMENDATIONS

Based on analysis of global and domestic emission trading schemes, PAT scheme and India's proposed carbon market landscape, CSE identifies several challenges and provides recommendations for the upcoming Indian Carbon Credit Trading Scheme (CCTS).

Challenges include low carbon prices, unambitious target setting, dependency on the PAT scheme, lack of revenue generation, data quality issues, absence of a market stability mechanism, and exclusion of the thermal power sector.

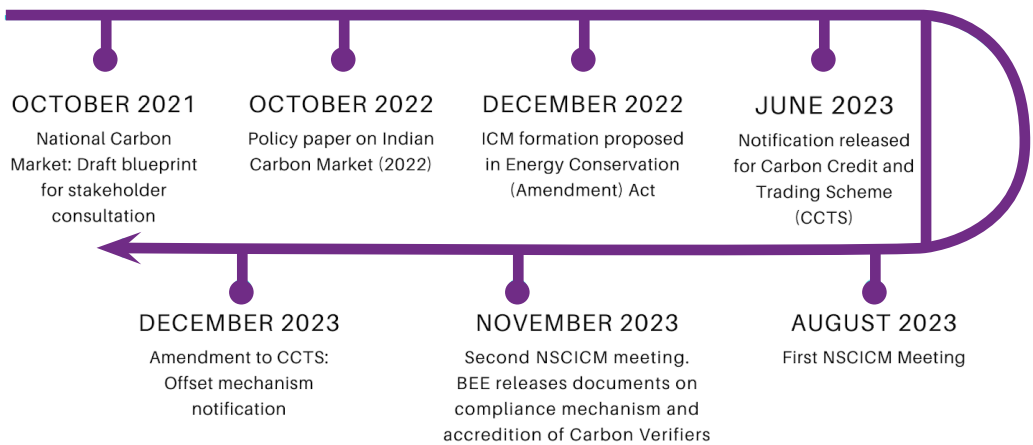
Recommendations emphasize bringing a single nation-wide scheme for carbon-intensive sectors, ensuring a high carbon price, data quality and transparency, introducing revenue generation mechanisms, supporting MSMEs, and advocating for the inclusion of the thermal power sector to enhance emission reduction efforts.

4.1 Overview

In October 2021, BEE had released a draft blueprint of the Nation Carbon Market for stakeholder consultation. Based on some critical inputs provided by stakeholders, this draft blueprint was further worked upon and another policy paper on Indian carbon markets was released in October, 2022. Following this the Energy Conservation (Amendment) Act was passed in the Indian Parliament in December, 2022, which proposed the formation of an Indian Carbon Market. Additionally, a Carbon Credit and Trading Scheme (CCTS) was notified by the Ministry of Power in June, 2023. The notification highlighted the regulatory framework of the Indian carbon market. In November, 2023, a policy document on the detailed procedure for compliance mechanism under CCTS and draft document on accreditation eligibility criteria and procedure for accredited carbon verification agency were released. In December 2023, an amendment to the notification was made which brought in the offset mechanism as a part of the proposed CCTS. (see *Figure 16: Timeline of ICM policy*)

As per the notification, the government has planned to bring in the Indian Carbon Markets to facilitate the achievement of India's enhanced NDC targets. It mentions that it will mobilize new mitigation opportunities through demand for emission reduction credits from both public and private entities. It further mentions that ICM is envisioned to accelerate decarbonization and mobilize finance towards achieving India's NDCs. The purpose of ICM is also seen as a step to match up with the emerging carbon border adjustment tax policies and the new carbon markets coming up around the world.

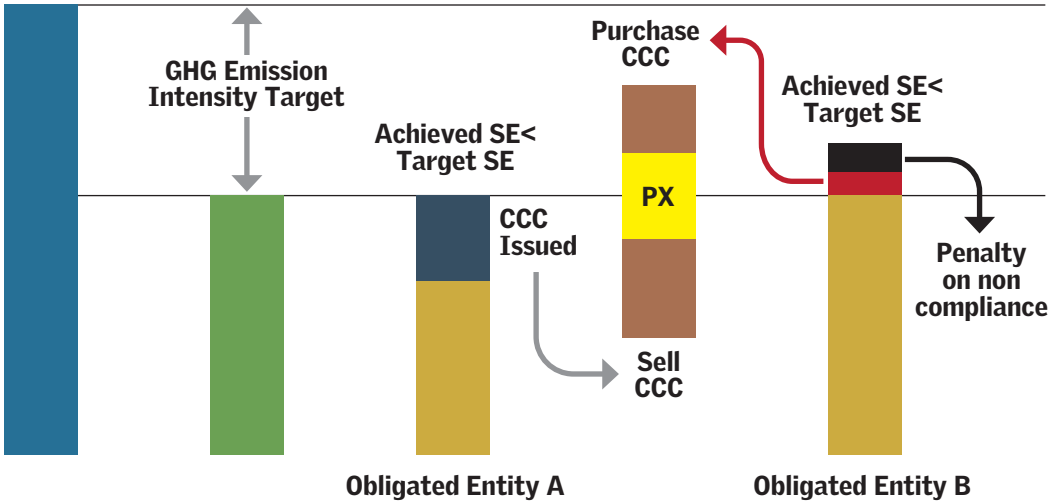
Figure 16: Timeline of ICM policy



Source: CSE, 2024

Graph 9: Issuance of CCC, compliance mechanism

Baseline GHG Emission Intensity



Source: BEE draft compliance mechanism, 2023

The essential elements of the proposed carbon market scheme which have been proposed under its regulatory framework and other policy documents released until March, 2024 have been discussed briefly to give a clear picture of how the Indian Carbon Markets policy is going to function

4.1.1 Compliance mechanism

The compliance mechanism specified in the Bureau of Energy Efficiency draft policy document in 2023, within the Carbon Credit Trading Scheme, sets a framework for monitoring and ensuring compliance with GHG emission intensity targets.

Registered entities designated as **'obligated entities'** are required to meet **GHG emission intensity targets** specified by the Ministry of Environment, Forest and Climate Change (MoEFCC). Carbon Credit Certificates (CCC) are issued as incentives for exceeding targets, while entities falling short can trade CCC to offset deficiencies.

As recent as June 2024, the scheme is scheduled to cover 9 industrial sectors with significant Scope 1 and 2 emissions, the scheme's first cycle targets sectors including petrochemical, iron and steel, aluminium cement, and pulp and paper. Obligated entities from these sectors will be subject to compliance measures, although clarity regarding the extent of coverage and emissions share remains pending.

The illustration given below shows that **obligated entity 'A'** have been issued CCC on achieving the GHG emission intensity greater than the target GHG emission intensity while the **obligated entity 'B'** is entitled to purchase the CCC to meet their GHG emission intensity targets from the Indian Carbon Market. **Obligated entity 'A'** can sell their CCC, and the **obligated entity 'B'** can purchase the CCC over the trading exchange.

4.1.2 GHG emission intensity trajectory and targets

The identification of obligated entities by the Central Government is based on criteria such as energy consumption, the investment needed for energy-efficient equipment, and the industry's capacity to invest. Greenhouse gas (GHG) emissions are converted to CO_2 equivalent (CO_2e) using the Global Warming Potential (GWP) specified in India's Biennial Update Report (BUR 3) under the UNFCCC. This conversion allows for standardized and consistent measurement of different GHGs based on their warming potential relative to carbon dioxide. This will further strengthen reporting of our emission profile of all greenhouse gases.

It is understood that the GHG emission intensity trajectory and targets will be developed by the National Steering Committee (NSC) for specific sectors in line with India's Nationally Determined Contributions (NDC) commitments. Moreover, according to stakeholder consultations, the NSC has set up sectoral technical committees which will consider factors like the potential for fuel switch, non-fossil fuel use, and sectoral decarbonization. Targets for each obligated entity will be tailored to the reduction trajectory for the sector and the average rate of reduction across all obligated entities.

Emission sources will include direct energy, process (non-energy), and indirect energy-related emissions, with exclusions such as certain energy sources, emissions from renewable sources, captured or utilized emissions, and emissions from specific activities.

The draft compliance procedure lays down a comprehensive process to set targets for the sector. The recommendation and notification process will involve the technical committee preparing a report with obligated entity targets, which is examined by the Bureau before final recommendations are submitted to the sub-working group under NSCICM. The NSCICM will then recommend targets to the central government for notification under the Environment Protection Act, 1986, with the MoEFCC responsible for notifying annual GHG emission intensity targets and penalizing entities for non-compliance. BEE, under the ministry of power has

taken over as the administrator as they have prior experience in executing a target based scheme in form of PAT but MoEFCC, being the concerened ministry for climate change negotiations, should be playing a larger role in the policymaking and have involvement at various levels of policy implementation.

4.1.3 Monitoring and reporting process

According to the draft document, obligated entities will be mandated to establish transparent, independent, and credible monitoring and reporting arrangements for greenhouse gas (GHG) emissions and production. Within three months from the start of each compliance cycle, they must submit a monitoring plan to the Bureau. This plan should include detailed descriptions of activities, emission sources, and monitoring methodologies.

Direct and indirect GHG emissions are to be converted into a single unit (tonnes of CO_2e) using standard emission calculation methodologies. All direct energy, non-energy, and indirect energy-related GHG emissions within the entity's boundary must be reported. Biogenic emissions are to be reported separately and excluded from the overall emissions tally.

It's emphasized in the document that the purchase of Renewable Energy Certificates (REC) cannot be considered a claim towards renewable energy use and should not be factored into calculations of renewable energy consumption.

4.1.4 Verification and assessment of performance

Obligated entities will be required to submit a performance assessment document and a certificate of verification within three months of the conclusion of each compliance cycle. The verification process is conducted by an accredited carbon verification agency appointed by the obligated entity.

Verification procedures encompass site visits, data assessment, sampling, and a thorough review of monitoring and reporting processes. The accredited carbon verification agency then submits a comprehensive verification report detailing the assessment procedures and findings.

Positive verification results indicate compliance with GHG emission norms, affirming that the obligated entity has met the required standards. This verification process needs to be robust and free of any fraudulent activities by any party.

4.1.5 Check-verification process

The Bureau retains the authority to commence an independent review of compliance reports in response to complaints or identified issues. Upon initiation, notices are issued to both the obligated entity and the accredited carbon verification agency, inviting their comments.

The independent review will entail a thorough assessment aimed at ensuring compliance with GHG emission norms. The findings of this review are compiled into an independent review report, which presents either a positive or negative opinion.

A positive opinion denotes compliance with the established norms, affirming the obligated entity's adherence to the requisite standards. Conversely, a negative opinion prompts further investigation into the matter to address any identified discrepancies or non-compliance issues.

4.1.6 Carbon credit certificates

The issuance of Carbon Credit Certificates will involve a thorough verification process conducted by the Bureau, ensuring the accuracy and correctness of compliance reports. Once verified, the Bureau will recommend the issuance of carbon credit certificates based on compliance. Subsequently, the NSCICM will provide recommendations for issuance, followed by seeking approval from the Central Government. Carbon credit certificates will then be made available for trading through registration on the ICM registry, and subsequently on Power Exchanges. Any unused certificates can be stored for future use (banking), providing flexibility within the system.

Trading of Carbon Credit Certificates will be a regulated process requiring the registration of both obligated and non-obligated entities on the ICM Registry within a specified timeframe. This registration is mandatory for entities wishing to engage in trading activities on Power Exchanges, as per the procedures outlined by the Central Electricity Regulatory Commission (CERC).

Additionally, non-obligated entities interested in the voluntary purchase of carbon credit certificates must also register on the ICM registry. The trading of CCC follows procedures defined by CERC, ensuring transparency and accountability within the market.

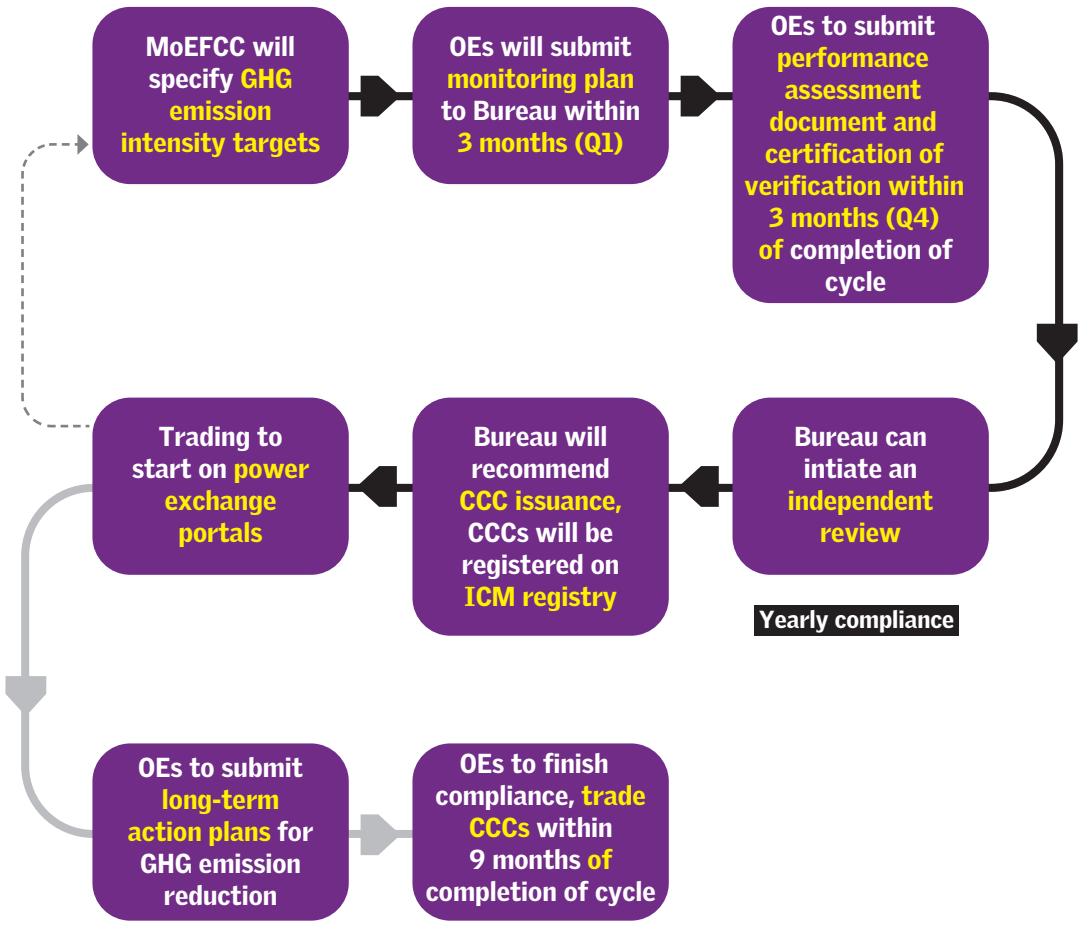
Banking of Carbon Credit Certificates allows for the storage of unused certificates for future compliance cycles. These banked certificates can either be sold or utilized

for compliance purposes, providing a mechanism for entities to manage their carbon credit assets effectively. Currently, there is no limit on banking mentioned in the draft policy documents.

In terms of compliance with GHG emission norms, obligated entities are required to develop long-term action plans for GHG emission reduction within a stipulated time frame. The administrator should make sure that all obligated entities submit their long-term plans without fail.

Annual planned activities and revised long-term action plans are subject to verification, ensuring alignment with emission reduction goals. Compliance status is reported through a 'Compliance Assessment Document', enabling oversight of compliance efforts. Entities must adhere to compliance requirements and furnish the status of compliance after verification and trading processes within a specified timeframe.

Figure 17: CCTS compliance cycle



Source: CSE 2024

4.1.7 Obligations of the obligated entities

Obligated entities need to comply with certain standards and practices under the compliance of CCTS. All the industries involved need to ensure that they actively engage accredited carbon verification agencies for performance assessment, ensure implementation of compliance measures with the utmost integrity. The formation of long-term action plans for GHG emission reduction is mandatory for all OEs under CCTS. The entities should also be pro-active in making long-term action plans for GHG reduction. These action plans should include measures like implementing energy efficient measures, introducing low-carbon technology, increasing resource efficiency and other levers that are important for decarbonization. The long-term action plans should have a roadmap for the entity to rely on.

The OEs for CCTS will be the entities that would complete their PAT cycle, therefore the participation of entities in CCTS depends on the cycles of the PAT scheme which may not be the best strategy to achieve the goals of CCTS.

4.1.8 Offset mechanism

The offset mechanism was introduced in an amendment to CCTS dated 19 December, 2023. Through the offset mechanism, companies are allowed to offset emissions—compensate for the emission reduction through CO_2 savings projects elsewhere. As of June 2023, there has been multiple stakeholder discussions and NSCICM meetings in which the offset mechanism has been discussed. There is lack of clarity as to how and to what extent the obligated entities will be able to use offset credits.

According to the proposed mechanism discussed in stakeholder consultations, the different project activities will be divided into ten sectoral scopes. These are in line with the current seventeen sectoral scopes under UNFCCC, CDM and other major Voluntary Carbon Market registries like Verra and Gold Standard. The seventeen categories seem to have been funged into ten. For example, the first three sectoral scopes under UNFCCC -- Energy (renewable/non-renewable sources), energy distribution and energy demand have been converted to one overarching scope of Energy. The ten proposed sectoral scopes under ICM offset mechanism are: -

1. Energy
2. Industries
3. Waste Handling and Disposal
4. Agriculture
5. Forestry
6. Transport

7. Construction
8. Fugitive Emissions
9. Solvent Use
10. CCU

Analysis by BEE suggests that the top 6 sectoral scopes, as of May 2024, amount for more than 90 per cent of current VCM projects under CDM and other major registries in India. Out of these, Energy industries (scope 1 under UNFCCC) contributes about 74 per cent with high mitigation potential. These are project activities like power generation through renewable energy sources, plant retrofitting and fuel switching. Demand side energy efficiency measures like pumping systems, lighting systems and household appliances and buildings makes up for about 10 per cent of current activities under CDM and VCM with medium mitigation potential.

Some other features in the proposed mechanism are:

- Non-obligated entities can register their decarbonizing projects and generate carbon credits.

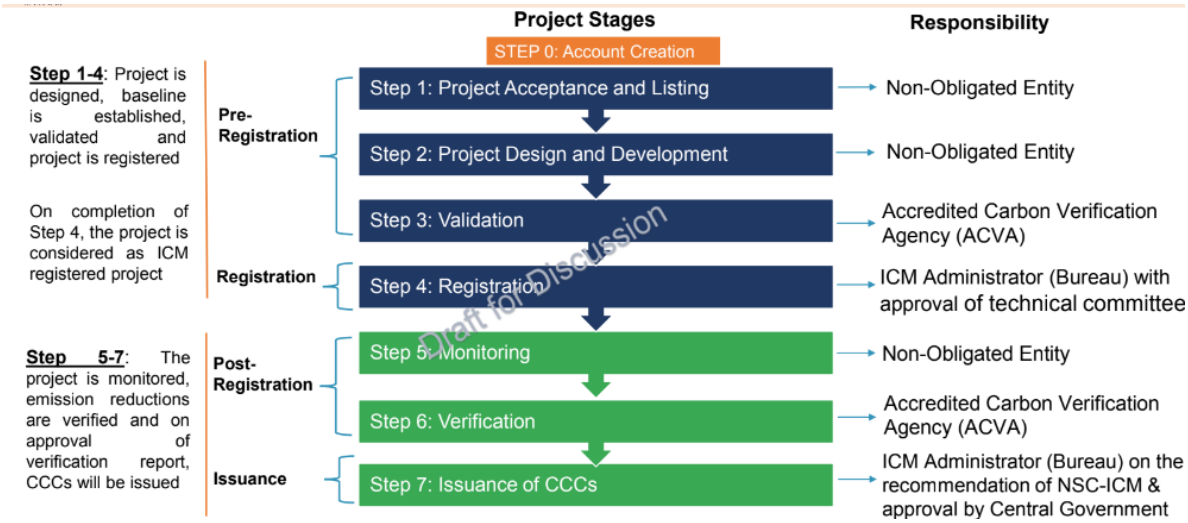
- The Bureau will publish sectoral scope and methodologies for these projects. It will also develop standards and processes for project registration under the offset mechanism.

- The Bureau has proposed to maintain a meta-registry where all national level offset projects will also be listed along with the projects under offset mechanism of ICM.

- The Bureau will also be responsible for validation and verification of these projects. It will build capacity of Accredited Carbon Verifiers (ACVs) which would build from the the existing capacity of PAT Energy Auditors, Voluntary Carbon Market Verification and Validation Bodies. These ACVs responsible for offset mechanism project validation and verification will have a different qualification criteria from the ACVs involved in MRV of Obligated Entities.

- New Methodologies will be formulated under ICM which will follow the Updated Article 6.4 (Paris Agreement) methodologies.. Baseline setting, additionality and double counting procedures will be followed as per the updated Article 6.4 methodologies. The Bureau, is set to release these methodologies in a phased manner. According to the stakeholder consultations of May-June 2024, methodologies for project activities that are high mitigation potential

Figure 18: Offset mechanism project cycle



Source: BEE Overview of Offset Mechanism, 2024

and high demand (like projects under Energy demand) will be released by the end of August 2024 and other methodologies with low mitigation and less demand will be released by January 2025.

The proposed offset mechanism project cycle is shown in the Figure below.

ETS schemes worldwide have limited the share of offsetting to less than ten per cent of the verified emissions and even banned it in markets like the EU-ETS. The proposed mechanism in India has not yet specified any such limit.

4.2 Necessary design elements for an ideal carbon market

Having analyzed existing ETS in the world and learning from implemented policies at the domestic level, CSE has attempted to list down conditions and features that would be necessary to have an effective emission trading market that is successful in achieving its objective of reducing emissions/emission intensity. Although a market with such conditions and features is yet to be seen and documented, this is what an ETS should aim for.

Table 25: Elements for a Model ETS

Elements for a Model ETS
Actual emission/emission intensity reduction
Significant carbon emission coverage of country's/region's total CO2 emissions
Robust MRV framework to ensure no data manipulation and fraud
Data transparency to ensure public scrutiny and full knowledge to all stakeholders
Market stability mechanism to stabilize the market in the case of sensitive economic downturns or other knee jerk situations
Cap-and-trade mechanism with annual reduction in the absolute cap, ultimately setting the cap at zero (growing economies should aim for an absolute emissions cap once the demand and production of industrial sectors, and corresponding emissions have peaked)
Ambitious targets that push the boundaries and help countries meet their net-zero commitments
Revenue generation in order to aid decarbonization initiatives and vulnerable sectors, social groups and communities suffering from the impacts of climate change
A high carbon price that accounts for the abatement cost and makes the polluter pay
Limited offset credits under robust check mechanism and transparency
Market liquidity should be maintained through trading activities across the year. This also ensures a fair carbon price.
Strict penalties need to be applied in accordance with the magnitude of fraud/non-compliance
Market should mature to pricing every tonne of carbon dioxide emissions and move away from any free allocation and subsidies
Equal opportunity to players of all scale and sectors that are key to GHG mitigation
Setting up targets for methane and other GHGs to mitigate overall GHG emissions

Source: CSE, 2024

4.3 Challenges and recommendations

Based on the analysis of the diverse global and domestic carbon market case studies, understanding of the currently proposed and evolving Indian Carbon Market landscape and the larger context of decarbonization and energy transition related policies coming up in India, CSE has come up with a certain set of challenges that the proposed Indian carbon market might face and has also provided certain recommendations for the upcoming scheme to facilitate a better functioning and more effective carbon market in the country.

4.3.1 Challenges

1. **Low carbon price and low market liquidity:** All markets around the world in their initial phases have had low carbon prices and often faced low market liquidity due to different reasons. Even the PAT scheme faced the issue of low pricing and low market activity due to over achievement of targets, excess supply of ESCerts and non-compliance by entities who were required to buy ESCerts.

If the targets set by the CCTS are consistently exceeded, then the CCTS will encounter similar challenges. Markets in countries like Korea faced the issue of low liquidity due to uncertainty around carbon price, low participation by industries and banking of allowances, whereas a country like China had only seasonal activity because too many exemptions were given to power plants and hence, the need to trade remained low and only at the time of compliance. In the case of Europe, the issue of low liquidity was not as prominent due to the large influx of offset credits, which has its own set of challenges. Therefore, the upcoming scheme in India needs to take steps and prepare mechanisms to generate market activity throughout the year at a good carbon price which then pushes participants to accelerate decarbonization pathways. According to the High-Level Commission of Carbon Prices under the Carbon Pricing Leadership Coalition supported by World Bank, countries need to set a strong carbon price, with the goal of reaching USD 40–80 per tonne of CO_2 by 2020 and USD 50–100 per tonne by 2030 to deliver the goals of the Paris Agreement.

2. **Unambitious target setting:** So far, the PAT scheme has faced criticism for its goal-setting, which was perceived as lacking ambition which led to the overachievement of targets and an oversupply of ESCerts leading to a poor market price. As CCTS plans to come out based on the framework of the PAT scheme, it is crucial for it to not repeat the same mistake. Target setting under the CCTS is being done for individual entities as well as the overall sector. Consideration of the sectoral best practices, individual company targets and previous policy targets is essential to raise the bar higher for the market to be able to achieve what it is meant for rather than becoming a compliance formality.

3. **Dependence of CCTS on PAT Scheme:** One of the biggest challenges that Indian authorities face is the dependence of CCTS on the existing PAT Scheme**.** Some difficult questions that need to be explored are:
   - How to prevent the new CCTS and its processes from being affected due to the ongoing PAT scheme – especially the restriction of involving limited and specific entities in the new CCTS due to majority of entities being involved in the ongoing PAT cycles.

   - Is the PAT scheme worth continuing or should there be a clear single year deadline and a single CCTS scheme for all carbon-intensive sectors?

   - Currently, there are plans underway for entities completing their PAT cycles to receive CCTS targets. Is this the best way to shortlist entities to

be able to achieve maximum emission reduction from CCTS? Shouldn't the targets be assigned to the most carbon-intensive entities from a sector at the beginning itself? Additionally, shouldn't a large number of entities from a sector be involved in CCTS since the beginning to achieve maximum impact and market activity?

- Will entities under a CCTS sector (which will be covered under the scheme in the coming years), but still under the PAT cycle have incentive enough to decarbonize until their CCTS cycle comes? Will they be prepared in that later year to achieve a higher target?

These questions clearly point out that the ongoing PAT scheme is becoming a hurdle in the way of the CCTS being able to achieve its full potential.

4. **No revenue generation:** The proposed Indian Carbon Market does not have a clause for revenue generation through the scheme. ETS cap and trade systems around the world have a way of generating revenue. Most of this revenue is collected by the government through auctioning off allowances/credits. A part of the revenue generated from the sale of allowances in EU-ETS is used to generate revenue for renewable energy, energy efficiency improvements, low-carbon technologies and other such areas. There is also an innovation and modernization fund made out of it. Similarly, in South Korea the revenue is being used to support small businesses and new entrants of the market. As international grant financing opportunities diminish, global discussions are increasingly focused on private sector funding and carbon markets for financing decarbonization efforts. However, the proposed Indian carbon market model does not foresee revenue generation through carbon markets. The primary anticipated activity would involve entities buying and selling credits, with no planned revenue generation.

5. **Challenge of data quality:** Authenticity of data is the key for any market mechanism to work in actuality. Amongst the case studies that CSE analyzed, data quality came up as a big issue in the China national ETS and the Surat ETS. In China, there have been instances where entities and third-party verifiers were found to have manipulated data. It's commendable that Chinese authorities acknowledged the issue and implemented strict penalties, which can be five to ten times the illegal gains made by the involved parties. It has also launched research to develop a long-term mechanism to help manage data quality. In the case of Surat ETS, the issue lies with the dependence of the market on the data gathered from CEMS. Based on CSE's analysis of the

CEMS data published online on the GPCB portal, as of April 2024, out of 704 industries connected to CEMS in Gujarat:

- 491 industries were active,
- 192 industries were inactive,
- 21 industries were delayed in status.

The portal did not show data for many industries once they were clicked on. This clearly raises question on the kind of data on which such a market is depending upon.

Major data issues have not been widely reported in the PAT scheme. However, one contributing factor to this may be the lack of transparency in the scheme, specifically the unavailability of data to the general public.

Apart from the above, there will be a specific challenge as to how small and medium scale industries will be able to provide authentic data especially as their sources of raw material and fuels are not organized and that well tested and approved. This will be a big challenge for the authorities of CCTS.

6. **Absence of a market stability mechanism:** Until now the proposed CCTS hasn't mentioned any market stability mechanism being brought in. The PAT scheme in India suffered from market instability due to excess certificates but never had a market stability mechanism in place, which could have improved the situation to some extent. Markets like EU-ETS and K-ETS have come up with different concepts like the Market Stability reserve, Market Maker system etc. Although such systems may not have been able to fully resolve the market liquidity issues as different factors affect it, but have surely played a role every now and then in stabilizing market activities. Even China ETS has come up with its market regulation and protection mechanism. This absence in the Indian market framework will reduce the options of stabilizing the market from time to time which is always required due to changing conditions.

7. **Non-imposition of penalties**: The penalties during the PAT scheme could be strict or not but there was no point as they were hardly imposed. Even if penalties are strict and if regulators won't levy them on entities, the whole purpose gets lost. This is what happened with the power sector defaulters under the PAT scheme who were mostly defaulters but no penalties were imposed on them. If a similar practice continues under the CCTS, entities would not care to buy credits even if they are supposed to.

8. **The challenge of offset credits and other credit schemes:** The proposed CCTS will also include credits from the offset market. Markets like EU-ETS, which had given a free hand to buying offset credits in its initial phases, faced severe challenges at one point due to over surge of offset credits that too with integrity issues. Over the time a number of organisations including CSE have flagged the transparency and integrity issues around the offset credits and if not allowed under a strict regulatory framework, they might pose a serious risk to the effectiveness of the upcoming carbon market in India.

   In India, various other market-based mechanisms are also present or underway, aiming to promote environmental sustainability and energy efficiency. Several schemes are emerging, each with its own currency or credit system. Older schemes like Perform, Achieve, and Trade (PAT) generate Energy Saving Certificates (ESCerts), which currently face oversupply, with a surplus of 44 lakh ESCerts in PAT I and II. The fate of these surplus certificates is a pressing concern, as their potential impact on the upcoming Indian carbon market remains uncertain. There are other crediting schemes that are being rolled out parallely in the country It would be crucial to see the impact of other schemes and the interrelations between them and ICM. The challenge here is how to prevent the double counting of any GHG linked project in different credit schemes, especially, as the registries and the nodal agencies for all schemes are different. Another question arises about the potential interaction between these schemes and their influence on each other, especially on the upcoming CCTS. In such scenarios, implementing check mechanisms may be necessary to prevent manipulation and ensure integrity.

9. **The MSME challenge**: The CCTS plan to initially cover large industrial sectors, but some of these sectors also include production shares from small- and medium-scale units, or are reliant on them. Therefore, some MSMEs might also become part of the CCTS initially and the number might increase in the coming years. The biggest challenge is generating authentic data from MSME units. Usually, the sources of their fuels and raw material are informal which then deprives them of necessary information to be able to report their emissions properly. The second challenge would be to be able to provide a level playing field between MSMEs and larger players. As we know, the majority of MSMEs might be carbon intensive due to use of inefficient technologies and dirty fuel and then it shouldn't be the case that most MSMEs end up buying credits from large players because they may not be able to afford the price to be able to meet the targets set by CCTS. For example, in the steel sector itself, the coal-based sponge iron units are mostly small and medium scale and largely

they do not have the technology and resources to incorporate low-carbon solutions. Therefore, it's challenging to push them to decarbonize without providing them the required support.

10. **Exclusion of thermal power sector: Why is it problematic?** While most of the carbon markets around the world had chosen to begin with the power sector, it seems Indian carbon market plans to exclude the power sector from the market for the time being. This exclusion may have been driven by challenges related to financing, energy security and existing policies aimed at decarbonizing power plants. However, there are compelling reasons why excluding the power sector from CCTS could pose problems. They are:

    Missing out a large part of the country's emissions: The Indian thermal power sector is the biggest contributor of greenhouse gas emissions in India. According to India's Third National Communication to the UNFCCC, the electricity sector contributed 39.2 per cent to the total GHG emissions of the country. Leaving the biggest emitting sector out of the carbon market will largely cut short the chances of a carbon market being able to contribute effectively towards achieving India's updated NDCs. Emission trading systems across the globe have included thermal power plants including developing nations like China and Indonesia as the electricity generation sector makes up for the biggest emissions contributor in these countries too. The challenges the power sector faces shouldn't become a reason for them to be exempted from contributing to India's decarbonization effectively. If India needs to rely on coal power in the upcoming years, it needs to ensure that its coal power plants are cleaned up and efficient.

    ETS schemes around the world cover a large share of their respective country's national emissions—South Korea (74 per cent), EU-ETS (38 per cent), China (40 per cent). The Indian carbon market, even if it covers all the industries in the country by 2030, will be covering only 20 to 22 per cent of the country's emissions. Currently, only a few sectors are being considered in the initial cycles, which would cover close to 10 per cent of national GHG emissions. Excluding the power sector, significantly reduces the covered emissions and the possible reductions from them would be marginal.

Subpar performance of current schemes: Currently, the thermal power sector entities have to comply with the PAT scheme and are also mandated to co-fire biomass of up to five to seven per cent in the subsequent year. The power sector in the PAT scheme has been the only sector that has not been able to achieve its

targets (in PAT I) and no penalties have been applied on them for non-compliance. The overall CO_2 reduction achieved during the first six years of PAT was less than 2.5 per cent of a single year's (2016) CO_2 emissions from the electricity sector. This clearly indicates that the PAT scheme, as an energy efficiency initiative, cannot be relied upon to achieve significant CO_2 reductions in the sector. So, if BEE is planning to not include the power sector in CCTS and continues with the PAT scheme for the power sector, not much benefit is likely to be seen in terms of CO_2 emission intensity reduction.

The implementation of the biomass co-firing mandate is also progressing very slow. As of 2023, out of the 11 coal-fired power plants in Delhi-NCR, none had co-fired even one per cent of biomass in their plants.[92] Very recently two plants in NCR have been able to reach two to three per cent co firing but the majority have not even begun even when 2024–25 is the first year for compliance. The country-wide situation is no better, the national timelines set by the Ministry of Power order for biomass co-firing have already been exceeded.

The thermal power plants will also be given targets and deadlines under the upcoming Renewable Generation Obligation (RGO) scheme. Due to inclusion in CCTS, the thermal power plants would have an incentivised target to meet, with a penalty for non-compliance which would push for better implementation of the RGO and biomass co-firing policy. Without any regulation and penalty in place, the power plants might flout the individual policy deadlines as they have in the past for other policies (SOx emission norms).

Disparity in emission intensity among thermal power plants: CSE's analysis of India's thermal power plants reveal that as of 2022, close to 93 per cent of the coal plant's power generation is attributed to two technologies—subcritical and supercritical. As per the analysis, subcritical plants (largest in number in the country) having a plant load factor of more than 50 per cent, have emission intensities ranging from as high as 1.57 tCO_2/MWH to as low as 0.74 tCO_2/MWH. Similarly, amongst supercritical plants emission intensity variates between 1.04tCO_2/MWH to 0.83 tCO_2/MWH. This shows that Indian thermal power plants have a large scope of reducing their emission intensity within the same technology, especially the subcritical plants that are the largest in the country. This scope remains even if factors like age and varying fuel quality are considered.

Table 26: Emission intensity disparity among Indian power plants.

PLF ≥ 50	capacity	emission factor /intensity (tCO_2/MWH)	Average emission factor /intensity (tCO_2/MWH)
Subcritical unit	<250 MW	highest–1.45	1.07
		least–0.74	
	≥ 250 MW < 660 MW	highest–1.57	
		least–0.87	
Supercritical unit	≥ 660 MW < 800 MW	highest–1.04	0.92
		least–0.83	

CSE analysis from CEA data, 2022

4.3.2 Recommendations

1. **Reduce complexity and have a single nation-wide scheme for carbon-intensive sectors**: Currently, the BEE-operated PAT scheme is running its third, fourth, fifth, sixth and seventh cycle parallelly in different stages of operation (with substantial delay), and has already notified the PAT VIII (2025–26) cycle for different industrial sectors. Alongside this, based on the PAT model, BEE is set to launch the CCTS. The CCTS will take up only those entities which will end their respective PAT cycle. Instead of including a large number of entities, and especially the ones with high emission intensities, CCTS will choose its obligated entities based on the PAT scheme cycles.

   Therefore, CSE suggests it is essential to free the carbon-intensive sectors from the PAT scheme so that CCTS is the only nationwide scheme for these sectors, leaving no room for mismanagement and confusion. This will enable a large number of entities to be given CCTS targets from the beginning. A single deadline should be set to phase out the PAT scheme for carbon intensive sectors. In any case, currently all units of the essential carbon-intensive sectors (like steel, cement etc.) have to be monitored either under the CCTS or under PAT, then why not all under CCTS at the same time. This will bring a collective zest and coherence in the sector as a whole and within individual companies, and the feeling that all are moving towards a single goal.

2. **Ensure a high carbon price:** For any emission trading scheme to be successful, it is imperative to have a high credit price. Without a competitive price, the purpose of an ETS is quite likely to be jeopardized. A lower pricing means that the obligated entities would always prefer buying credits than making actual emission reductions. To ensure a stable and high carbon price in the Indian carbon market, it is essential for the upcoming carbon market to ensure that following steps/actions are taken:

- **Setting ambitious targets:** Emission targets set under the CCTS will be crucial to ensure a high carbon price. It is important for them to set ambitious targets for individual units as well as the sector as a whole, that raises the bar beyond the previously set national targets (like the National Steel Policy 2017[93] etc.) and the targets set by individual companies. Along with the world and in India (sector and technology-wise), best practices should also be considered while setting the targets to push obligated entities towards achieving the best levels, already achieved on the ground. The current targets should be such that the ambition and innovation in the industry stays above the current levels.

- **Establish a market stability mechanism:** Just like EU-ETS and K-ETS, the new CCTS scheme should put a market stability mechanism in place to be able to avoid the situation faced during the PAT scheme. One of the prominent features of this mechanism is the market stability reserve (MSR). CCTS should establish one with well prescribed limits of when to release and when to buy credits based on stabilizing the market liquidity and the carbon price. It can regulate supply and demand through which carbon pricing can be stabilized. A market maker system on lines of the Korean ETS can also be considered, which then involves multiple entities responsible for maintaining the market stability.

- **Setting a high carbon floor price:** A high carbon floor price is essential to prevent the market prices from falling below a level that would make it entirely ineffective in its purpose. EU-ETS had set a carbon floor price at 12.3 Euros/tonne of CO_2 in 2020, which is planned to progressively increase to 31 Euros/tonne of CO_2 by 2030. Similarly, the Korean ETS also set a carbon floor price of USD 9.98 in 2021.[94] The PAT scheme had a floor price of around INR 1,840 during PAT II cycle, which went up from INR 200–1,200 in PAT I cycle.[95] The issue in the PAT scheme was that due to the oversupply of ESCerts, all the trading happened at the floor price itself which is not the best scenario. It worsened in the case of Surat ETS which had set a floor price of INR 5, which is equivalent to having no price at all. Therefore, it is important to keep a high floor price in the market which will help in creating a good carbon price which is competitive with respect to decarbonization costs.

- **Effective implementation of sizable penalties:** A major reason behind low prices in the PAT scheme was the non-implementation of penalties on

a number of non-compliant obligated entities. Often, even if penalties are imposed, they are not effective due to their low quantum. Recently, China ETS faced irregularities in data authenticity, reporting and compliance. Therefore, it has come up with a new ETS regulation which has made the penalties heavier, covering all major stakeholders involved and increasing the quantum of penalties in multiples of market value gaps and illegal gains made by non-compliant entities. Therefore, it is important that CCTS in India also considers fixing sizable penalties based on illegal gains and market value gaps, and ensures that this time the penalties are implemented, and paying or dodging a penalty doesn't become more lucrative than complying with the given targets.

- **Limiting voluntary credits**: As the CCTS has already released the amendment to include voluntary carbon offset credits, CSE would strongly recommend to keep it restricted to not more than five per cent of the verified emissions and that too for a very limited number of projects that bring sizable emission reductions and follow a reliable, well-defined and transparent verification methodology. EU-ETS has banned offset credits and Korea and China allow only five per cent, therefore without a well-defined transparent framework in place, it could adversely impact the current CCTS, like it did in the EU-ETS in the past.

  Many other credit systems are being introduced in the country. CSE advocates against establishing an interactive system between CCTS and other credit schemes to prevent potential manipulation within the upcoming carbon market. There should also be a check on the financial additionality of these projects. Maintaining a combined registry of projects for different credit schemes so that credit doubling doesn't happen is also recommended. This registry should be open to the public for regular scrutiny and check.

3. **Ensuring data quality and improving transparency:** Within two months of the launch of China ETS, a power plant was caught doctoring its data.[96] This was followed by data tampering and false reporting charges by MEE on multiple entities under the China ETS.[97] As China faced issues with data quality, it sent out notices to companies to carry out monthly inspections of key parameters and to submit the data online on their portal. It even launched a research project to develop a long-term data management system. Recently, it also came up with increased penalties for all those involved in any form of misreporting or non-compliance.

To avoid any such discrepancies in the proposed Indian CCTS, it is essential to firstly build the capacity of carbon verifiers, increase their numbers substantially, introduce data reporting at short intervals, and then create a random inspection system to ensure that no fraud practices are being followed. Currently, as seen on the BEE website, there is a list of 300 Accredited Energy Auditors under PAT. This number represent both independent auditors and auditing firms[98]. These auditors will participate in capacity building exercises to certify as ACVs. They will face the burden of MRV of both PAT and CCTS, as these cycles are planned to run parallel. As the new scheme comes to force, there will be a need to build capacity of the ACVs further at a large scale. Concurrently, bringing in automation and technology during various stages of MRV can reduce the burden on both the carbon verifier and the administrator (during review and verification).

Along with all this, it is essential to share reporting data in the public domain which would then make it very difficult for any entity to manipulate data as it would be open to scrutiny. Moreover, the long term decarbonisation plans of the obligated entities should be made available in the public domain for transparency. Bringing in transparency could largely solve this issue.

4. **Introduce revenue generation to support MSMEs:** The current Indian carbon market model lacks revenue generation mechanisms. Therefore, it is crucial to devise methods to generate revenue from the scheme, which could fund an MSME fund. This fund could address significant challenges such as improving data quality among MSMEs and supporting their initiatives for decarbonization**.** Since the proposed CCTS does not auction , may be a small percentage of every market transaction could be dedicated to this fund which could be used to support the MSME sectors to have a level playing field under the scheme.

   Some form of support system (technological and financial) needs to be developed to support the MSME sector under CCTS and to create a level playing field for them. Countries like Korea are dedicating their market revenues to support small businesses and something similar is required in India as well. In terms of target setting, it is essential that while setting an ambitious target for them, it should be ensured that there are enough support schemes to enable them to achieve those targets.

5. **Consider inclusion of thermal power sector:** To address the significant contribution of the power sector to greenhouse gas emissions and to ensure

effective progress towards India's Nationally Determined Contributions (NDC) targets, it is imperative to include the power sector in the carbon market scheme. Currently, the Indian carbon market plans to cover only 20 to 22 per cent of emissions by 2030, which would leave out a substantial portion of national emissions. This exclusion hampers the potential for significant emission reductions and undermines the effectiveness of the scheme.

We also believe that the inclusion of the power sector in an effectively operating carbon market would push the implementation of the current biomass co-firing policy for thermal power plants, which is picking up quite slowly. This would also push for better implementation of the Renewable Generation Obligation which includes biomass co-firing as one of the routes. From past experiences it is also clear that the amount of CO_2 emission reduction achieved under the PAT scheme is not substantial, so the PAT scheme cannot be relied upon to achieve CO_2 reduction from the thermal power sector. The increase in renewable capacity might reduce our dependence on thermal power plants but will not have a major impact on decarbonizing the operation of existing thermal power plants. With increasing electricity demand, managing and improving the current coal-fired power fleet will be key to our energy transition. It is essential to include the thermal power sector from the outset of the scheme to expedite decarbonization efforts in thermal power plants.

Under an effective ICM, thermal power companies and plants would have incentive to implement the low-hanging fruits of decarbonization and increase efficient units in the company's fleet. It can also incentivize companies to invest in supercritical and ultra-supercritical plants. Currently, India only has 19 ultra supercritical units and no advanced ultra-supercritical units.

Failure to include the power sector in the carbon market scheme would delay decarbonization efforts and limit the effectiveness of emission reduction initiatives. Therefore, it is recommended that the government take proactive steps to prepare a plan on inclusion of the power sector in the carbon market scheme to achieve significant emission reductions and meet India's climate commitments effectively.

REFERENCES

REFERENCES

1 Jørgen Wettestad and Lars Gulbrandsen 2018. *The Evolution of Carbon Markets Design and Diffusion*, Routledge, New York

2 Anon 2010. *The Kyoto Protocol Mechanisms*, United Nations Framework Convention on Climate Change, Bonn

3 Ibid

4 Emission Trading. Available at https://unfccc.int/process/the-kyoto-protocol/mechanisms/emissions-trading, as accessed on 17 July 2024

5 Ricardo Martinez, Val Srinivas and Jill Gregorie 2023. *The world needs carbon markets. Here's how to make them work better.* Deloitte Insights, United States. Available at https://www2.deloitte.com/us/en/insights/industry/financial- services/future-of-carbon-market.html, as accessed on 17 July 2024

6 Katherine Jack and Hannah Clarke 2022. *Understanding the two types of carbon market.* Agriculture and Horticulture Development Board, Coventry. Available at https://ahdb.org.uk/news/understanding-the-two-types-of-carbon-market, as accessed on 17 July 2024

7 Anon 2022. *What are carbon markets and why are they important?* United Nations Development Programme, Global. Available at https://climatepromise.undp.org/news-and-stories/what-are-carbon-markets-and-why-are-they-important, as accessed on 17 July 2024

8 Carbon pricing dashboard. Available at https://carbonpricingdashboard.worldbank.org/what-carbon-pricing, as accessed on 17 July 2024

9 Carbon pricing dashboard. Available at https://carbonpricingdashboard.worldbank.org/what-carbon-pricing, as accessed on 17 July 2024

10 Anon 2021. *Role of Derivatives in Carbon Markets, International Swaps and Derivatives Association*, New York City

11 Carbon pricing dashboard. Available at https://carbonpricingdashboard.worldbank.org/what-carbon-pricing, as accessed on 17 July 2024

12 Emission trading systems. Available at https://www.oecd.org/environment/tools-evaluation/emissiontradingsystems, as accessed on 15 January 2024

13 Center for Climate and Energy Solutions 2011. *Cap and Trade, Climate Change 101: Understanding and Responding to Global Climate Change,* Pew Center on Global Climate Change, Arlington

14 Carbon pricing dashboard. Available at https://carbonpricingdashboard.worldbank.org/what-carbon-pricing, as accessed on 17 July 2024

15 Ivy Yin 2024. *Commodities 2024: China's domestic carbon market set for revamp; Article 6 in limbo*, S&P Global. Available at https://www.spglobal.com/commodityinsights/en/market-insights/latest- news/energy-transition/011724-chinas-domestic-carbon-market-set-for-revamp-in-2024-article-6-in-limbo, as accessed on 18 July 2024

16 Sadia Sohail 2012. *Emissions trading in particulate matter takes off.* Down To Earth. Available on https://www.downtoearth.org.in/environment/emissions-trading-in-particulate-matter-takes-off---38793, as accessed on 18 July 2024

17 International Carbon Market. Available at https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/international-carbon-market_en, as accessed on 18 July 2024

18 Carbon pricing instruments around the world, 2024. Available at https://carbonpricingdashboard.worldbank.org/, as accessed on 18 July 2024

19 ICAP 2024. *Emissions Trading Worldwide: Status Report 2024*, International Carbon Action Partnership, Berlin

20 Anon 2022. *The Untapped Power of Carbon Markets in Five Charts, BloombergNEF.* Available at https://about.bnef.com/blog/the-untapped-power-of-carbon-markets- in-five-charts/, as accessed on 18 July 2024

21 A Guide to Compliance Carbon Credit Markets. Available at https://carboncredits.com/a-guide-to-compliance-carbon-credit-markets/, as accessed on 15 June 2024

22 Nivit Kumar Yadav, Sowmiya Kannappan, et al 2021. *Perform, Achieve and Trade (PAT) Scheme in Thermal Power Plants: A Critical Analysis.* Centre for Science and Environment, New Delhi

23 Jørgen Wettestad and Lars Gulbrandsen 2018. *The Evolution of Carbon Markets Design and Diffusion*, Routledge, New York

24 Jihyung Joo, Jouni Paavola, et al 2023. *The divergence of South Korea's Emissions Trading Scheme (ETS) from the EU ETS: An institutional complementarity view.* Politics & Policy, 51(6), 1155-1173

25 Use of international credits. Available at https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/use-international-credits_en, as accessed on 12 May 2024

26 EU Emissions Trading System (EU ETS). Available at https://icapcarbonaction.com/en/ets/eu-emissions-trading-system-eu-ets, as accessed on 1 March 2024

27 Ibid

28 European Commission 2024. *Commission presents recommendation for 2040 emissions reduction target to set the path to climate neutrality in 2050*, European Commission, Strasbourg

29 EU Emissions Trading System (EU ETS). Available at https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en, as accessed on 8 February 2024

30 Urjit R. Patel 2007. *The Challenges of Emissions Trading, The Brookings Institution.* Available at https://www.brookings.edu/articles/the-challenges-of-emissions-trading/, as accessed on 9 February 2024

31 EU Emissions Trading System (EU ETS). Available at https://icapcarbonaction.com/en/ets/eu-emissions-trading-system-eu-ets, as accessed on 1 March 2024

32 Ibid

33 Directorate-General for Climate Action 2024. *Record reduction of 2023 ETS emissions due largely to boost in renewable energy*, European Commission. Available at https://climate.ec.europa.eu/news-your-voice/news/record-reduction-2023-ets- emissions-due-largely-boost-renewable-energy-2024-04-03_en, as accessed on 6 May 2024

34 Ibid

35 Patrick Bayer and Michaël Aklin 2020. *The European Union Emissions Trading System reduced CO_2 emissions despite low prices.* Proceedings of

the National Academy of Sciences, 117(16), 8804-8812, Proceedings of the National Academy of Sciences

36 Antoine Dechezleprêtre, et al 2018. *The joint impact of the European Union emissions trading system on carbon emissions and economic performance.* Journal of Environmental Economics and Management, 118, 102758, Elsevier

37 Jonathan Colmer, et al 2023. *Does Pricing Carbon Mitigate Climate Change? Firm-Level Evidence from the European Union Emissions Trading Scheme.* CRC TR 224, Discussion Paper No. 232, Elsevier

38 Jeong Hyuk 2020. *Challenges and Improvements based on the First Trading Period of South Korea's Emissions Trading Scheme (Focusing on Emission Allowance Allocation).* Journal of Climate Change Research 2020, Vol. 11, No. 3, pp. 133–144, Hankuk University of Foreign Studies Institute for EU Studies

39 Anon 2018. *The Korea Emissions Trading Scheme: Challenges and Emerging Opportunities.* Asian Development Bank

40 Ibid

41 Korea Emissions Trading Scheme. Available at https://icapcarbonaction.com/en/ets/korea-emissions-trading-scheme, as accessed on 5 January 2024

42 Ibid

43 Ibid

44 Ibid

45 Anon 2018. *The Korea Emissions Trading Scheme: Challenges and EmergingOpportunities,* Asian Development Bank

46 Ibid

47 Heesu Lee 2024. *Carbon Trading Is Meant to Make Polluters Pay. In South Korea, It's Had the Opposite Effect, Climate Advocacy Group Says.* Bloomberg. Available at https://time.com/6825324/south-korea-cap-and-trade-carbon-emissions-polluters- profit-plan15/, as accessed on 21 March 2024

48 Anon 2023. *How to Fix a Broken ETS: A Korean Case Study*, Plan 1.5.

49 Korea Emissions Trading Scheme. Available at https://icapcarbonaction.com/en/ets/korea-emissions-trading-scheme, as accessed on 5 January 2024

50 Anon 2022. *South Korea approves initial wave of near-term ETS reforms*, International Carbon Action Partnership. Available at https://icapcarbonaction.com/en/news/south-korea-approves-initial-wave-near-term-ets-reforms, as accessed on 17 July 2024

51 Jihyung Joo, Jouni Paavola, et al 2023. *The divergence of South Korea's Emissions Trading Scheme (ETS) from the EU ETS: An institutional complementarity view.* Politics & Policy, 51(6), 1155-1173

52 Anon 2022. *South Korea approves initial wave of near-term ETS reforms*, International Carbon Action Partnership. Available at https://icapcarbonaction.com/en/news/south-korea-approves-initial-wave-near-term-ets-reforms, as accessed on 17 July 2024

53 Primary energy consumption in China from 2018 to 2023, by fuel. Available at https://www.statista.com/statistics/265612/primary-energy-consumption-in-china- by-fuel-type-in-oil-equivalent/, as accessed on 17 July 2024

54 ICAP 2024. *Emissions Trading Worldwide: Status Report 2024*, International Carbon Action Partnership, Berlin

55 Draft benchmark values for the 2021-22 compliance period. Available at https://icapcarbonaction.com/system/files/document/221124%20China%20allocation%20plan%20news_PDF_Vfin.pdf, as accessed on 17 July 2024

56 Tan Luyue 2022. *The first year of China's national carbon market, reviewed*, Dialogue Earth. Available at https://dialogue.earth/en/climate/the-first-year-of-chinas- national-carbon-market-reviewed/, as accessed on 18 July 2024

57 You Xiaoying 2023. *As China's carbon market turns two, how has it performed?* Dialogue Earth. Available at https://dialogue.earth/en/climate/china-carbon-market-turns-two-how-has-it-performed/, as accessed on 17 July 2024

58 Energy Innovation: Policy and Technology and Chris Busch 2022. *China's Emissions Trading System Will Be The World's Biggest Climate Policy.*

Here's What Comes Next. Forbes. Available at https://www.forbes.com/sites/energyinnovation/2022/04/18/chinas-emissions-trading-system-will-be-the-worlds-biggest-climate-policy-heres-what-comes-next/?sh=47a789e52d59, as accessed on 15 July 2024

59. Anon 2024. *China launches domestic offset market to align with national ETS goals,* International Carbon Action Partnership. Available at https://icapcarbonaction.com/en/news/china-launches-domestic-offset-market-align-national-ets-goals, as accessed on 18 July 2024

60. Hongqiao Liu 2021. *In-depth Q&A: Will China's emissions trading scheme help tackle climate change?* Carbon Brief. Available at https://www.carbonbrief.org/in-depth-qa-will-chinas-emissions-trading-scheme-help-tackle-climate-change/, as accessed on 18 July 2024

61. Ivy Yin 2023. *China's compliance carbon price hits record high on stronger demand* S&P Global. Available at https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/081823-chinas-compliance-carbon-price-hits-record-high-on-stronger-demand, as accessed on 18 July 2024

62. You Xiaoying 2023. *As China's carbon market turns two, how has it performed?* Dialogue Earth. Available at https://dialogue.earth/en/climate/china-carbon-market-turns-two-how-has-it-performed/, as accessed on 17 July 2024

63. Ibid

64. Analytical report on the status of the China GHG voluntary emission reduction program. Available at https://www.edf.org/sites/default/files/documents/Analytical-Report_on_the_Status_of_the_China_GHG_Voluntary_Emission_Reduction_Program-ENG.pdf, as accessed on 18 July 2024

65. Are we one step closer for China's CCERs program relaunch? Available at https://www.linkedin.com/pulse/we-one-step-closer-chinas-ccers-program-relaunch-rqnvc/, as accessed on 17 July 2024

66. Xiaonan Feng 2023. *China's national ETS update: Free allowances tightened but overall cost increase still limited*, S&P Global. Available at https://www.spglobal.com/commodityinsights/en/ci/research-analysis/chinas-national-ets-update-free-allowances-tightened.html, as accessed on 18 July 2024

67. Frank Eich, et al 2023. *Chinese government tightens ETS benchmarks for power generators, but offers generous exemptions,* CRU Group. Available at https://sustainability.crugroup.com/article/chinese-government-tightens-ets-benchmarks-for-power-generators-but-offers-generous-exemptions, as accessed on 18 July 2024

68. Anon 2023. *China releases allocation plan and compliance arrangements for 2021 and 2022*, International Carbon Action Partnership. Available at https://icapcarbonaction.com/en/news/china-releases-allocation-plan-and-compliance-arrangements-2021-and-2022, as accessed on 18 July 2024

69. You Xiaoying 2023. *As China's carbon market turns two, how has it performed?* Dialogue Earth. Available at https://dialogue.earth/en/climate/china-carbon-market-turns-two-how-has-it-performed/, as accessed on 17 July 2024

70. Brief industrial profile of Surat District. Available at https://dcmsme.gov.in/old/dips/BIP%20SURAT_guj.pdf, a accessed on 18 February 2024

71. Anon 2022. *Booklet on Particulate Matter, ETS Gujarat*, Gujarat Pollution Control Board, Gujarat

72. Ibid

73. Micheal Greenstone, et al 2019. *The Surat Emissions Trading Scheme*, Energy Policy Institute at the University of Chicago

74. Anon 2020. *Continuous Emission Monitoring Systems (CEMS) Emission Trading Scheme Technical Brief*, Energy Policy Institute at the University of Chicago, Surat

75. Ibid

76. Anon 2022. *Booklet on Particulate Matter, ETS Gujarat*, Gujarat Pollution Control Board, Gujarat

77. Ibid

78. The Impact of an Emissions Trading Scheme on Economic Growth and Air Quality in India. Available at https://www.povertyactionlab.org/evaluation/

impact-emissions-trading-scheme-economic-growth-and-air-quality-india as accessed on 18 July 2024

79. Directorate-General for Climate Action 2024. *Record reduction of 2023 ETS emissions due largely to boost in renewable energy.* European Commission. Available at https://climate.ec.europa.eu/news-your-voice/news/record-reduction-2023-ets-emissions-due-largely-boost-renewable-energy-2024-04-03_en, as accessed on 6 May 2024

80. Susanna Twidale 2024, *Global carbon markets value hit record $949 bln last year - LSEG*, Thomson Reuters. Available at https://www.reuters.com/markets/commodities/global-carbon-markets-value-hit-record-949-bln-last-year-lseg-2024-02-12/, as accessed on 18 July 2024

81. Ibid

82. Korea Emissions Trading Scheme. Available at https://icapcarbonaction.com/en/ets/korea-emissions-trading-scheme, as accessed on 5 January 2024

83. Perform, Achieve and Trade. Available at https://beeindia.gov.in/en/programmes/perform-achieve-and-trade-pat, as accessed on 18 July 2024

84. Anon 2022. *Indian Steel Industry Reduces its Energy Consumption and Carbon Emissions Substantially with Adoption of Best Available Technologies in Modernisation & Expansions Projects,* Press Information Bureau, Delhi. Available at https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1794782, as accessed on 18 July 2024

85. Nivit Kumar Yadav, Sowmiya Kannappan, et al 2021. *Perform, Achieve and Trade (PAT) Scheme in Thermal Power Plants: A Critical Analysis*, Centre for Science and Environment, New Delhi

86. Ibid

87. Hena Oak and Sangeeta Bansal 2022. "Enhancing energy efficiency of Indian industries: Effectiveness of PAT scheme", Energy Economics Volume 113, Elsevier

88. Nivit Kumar Yadav, Sowmiya Kannappan, et al 2021. *Perform, Achieve and*

Trade (PAT) Scheme in Thermal Power Plants: A Critical Analysis, Centre for Science and Environment, New Delhi

89. Aditya Chunekar and Apoorva Apte 2023. *Not a PAT on the back, yet*, Prayas (Energy Group). Available at https://energy.prayaspune.org/power-perspectives/not-a-pat-on-the-back-yet, as accessed on 18 July 2024

90. Anon 2021. *Impact of Energy Efficiency measures for the year 2019-20*, Bureau of Energy Efficiency, New Delhi

91. Ibid

92. Anubha Aggarwal 2023. *Status of biomass co-firing in coal thermal power plants in Delhi NCR region,* Centre for Science and Environment, New Delhi

93. National Steel Policy 2017. Available at https://steel.gov.in/sites/default/files/draft-national-steel-policy-2017.pdf, as accessed on 18 July 2024

94. Simone Tagliapietra and Maria Demertzis, 2021. *Carbon price floors: an addition to the European Green Deal arsenal*, Bruegel. Available at https://www.bruegel.org/blog-post/carbon-price-floors-addition-european-green-deal-arsenal, as accessed on 18 July 2024

95. Nivit Kumar Yadav, Sowmiya Kannappan, et al 2021. *Perform, Achieve and Trade (PAT) Scheme in Thermal Power Plants: A Critical Analysis*, Centre for Science and Environment, New Delhi

96. You Xiaoying 2023. *As China's carbon market turns two, how has it performed?* Dialogue Earth. Available at https://dialogue.earth/en/climate/china-carbon-market-turns-two-how-has-it-performed/, as accessed on 17 July 2024

97. Anon 2022. *China slams firms for falsifying carbon data*, Thomson Reuters. Available at https://www.reuters.com/world/china/china-slams-firms-falsifying-carbon-data-2022-03-14/, as accessed on 18 July 2024

98. List of Accredited Energy Auditors. Available at https://beeindia.gov.in/en/programmesnational-certification-examination/accredited-energy-auditors, as accessed on 18 July 2024

India has pledged to meet its Nationally Determined Contribution (NDC) targets by 2030. Additionally, it aims to attain net-zero emissions by 2070, following the guidelines set forth by the United Nations Framework Convention on Climate Change (UNFCCC). In order to achieve these goals, India is actively exploring decarbonization strategies and employing emission reduction tools and mechanisms for greenhouse gas (GHG) emitting sectors in the country. Carbon markets represent one such tool or mechanism implemented globally, as well as at national and sub-national levels by numerous countries. India, too, is in the process of developing and launching its own national compliance-based carbon market. This report aims to collate a clear set of learnings from the past and ongoing compliance-based emission trading schemes worldwide, including those operating in India. The aim is to facilitate the effective operationalization of carbon markets in India and ensure they serve their intended purpose of reducing emissions

Centre for Science and Environment
41, Tughlakabad Institutional Area, New Delhi 110 062
Phones: 91-11-40616000 Fax: 91-11-29955879
E-mail: cseindia@cseindia.org Website: www.cseindia.org