INDIA

Industrial Decarbonization and Carbon Markets – setting the context

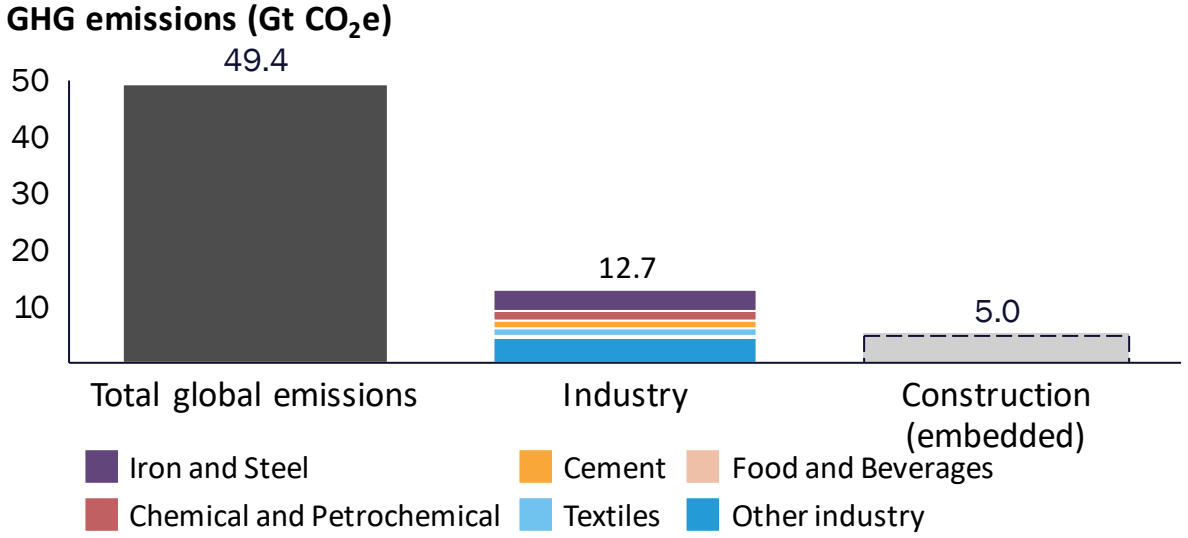
TERI event: Mainstreaming Industry Transitions to Drive India's Low Carbon Growth

June 7, 2022

To align with the Paris Accord, industry must reduce direct CO_2 emissions 60% by 2050

Developing countries are a growing source of emissions with deep reductions requiring a significant break from historical trends

- **Under current policies,** non-OECD industrial emissions are projected to **increase by 40%**
- **In a global pathway compliant with the Paris Agreement**, developing country industry emissions will need to **fall by nearly 60%**
- **Industrial emissions will therefore need to plateau as soon as possible** and decrease rapidly
- **Innovation will be critical** for industries to decarbonize while improving their competitiveness

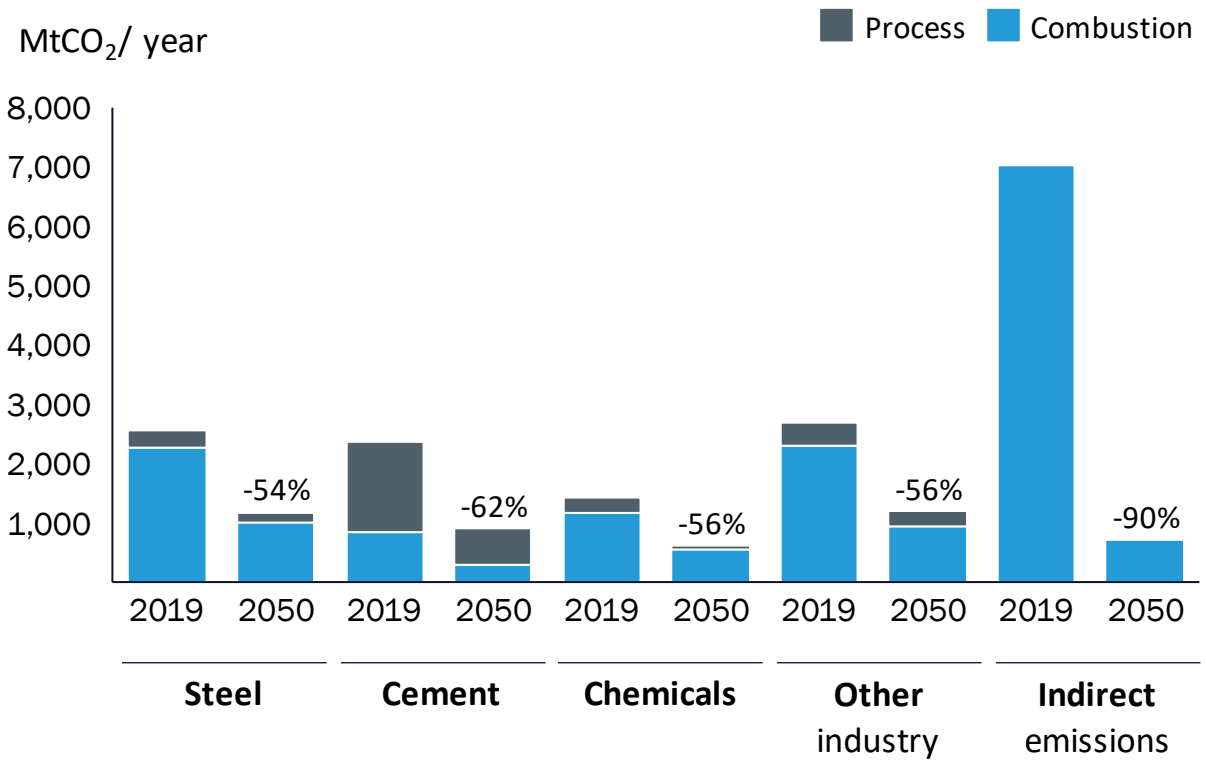


- The new WBG study *"**Decarbonizing industry through innovation: A scoping study of opportunities in developing countries**"* explores **promising innovations** to unlock large emission and cost reductions **in energy-intensive sectors** accounting for 70% of direct global emissions including **iron & steel, cement, chemicals, textiles, and food/beverages.**
- It also considers **the construction sector which is a key downstream consumer of steel and cement** (52% of steel demand and the entirety of cement demand)
- It focuses on opportunities for **unlocking potential in developing countries**

ESMAP
Energy Sector Management Assistance Program

Decarbonizing energy-intensive industry is more challenging compared to other sectors due to economic and technical barriers

Estimated industry emissions reduction by source in the IEA Sustainable Development Scenario, 2019-50



Emissions reduction measures must include both supply- and demand-side measures, and both well-known and entirely new technologies

Several challenges of decarbonizing industry, both globally and in developing countries:

- **International competitiveness.** Carbon leakage, when industries (and emissions) move from countries with stringent climate regulation to countries with weaker climate regulation, and competitiveness concerns together constitute a key and often-cited barrier to industrial decarbonization
- **Long payback periods.** Capital is constrained and targeted toward investments with the highest short-term returns
- **Long asset life and young fleet** are common conditions in developing countries, which tees up difficult technological transitions
- **Coordination is required between competitors,** or across industries with substantially different rate-of-return expectations
- **Technological immaturity.** Many technologies needed for deep industrial decarbonization are immature and costly, creating risks to deployment

Decarbonizing heavy industry requires both cross-cutting and sector-specific technologies

Several cross-cutting decarbonization technologies are considered enablers for deploying innovative industry-specific options

Cross-cutting technologies	Description
CCUS	• CO_2 emitted from fuel combustion, or industrial processes is captured and transported to be used or permanently stored in underground formations • Key innovations to enable CCUS are not technology based but on the creation of a policy frameworks to enable CCUS business models
Green H_2	• H_2 produced from renewable electricity can be used to displace fossil fuels where direct electrification is not possible
Renewable Heat	• Use of renewable sources to provide low (<150 °C) or medium (150–400 °C) temperature (often cheaper than fossil fuel alternatives): ▪ Geothermal energy ▪ Solar Thermal energy ▪ Bioenergy
Circular Economy	• Reuse and recycling practices circulate material/energy flows and reduce demand for primary production • Requires changes in industrial production and importantly, changes in downstream sectors in the way products are designed, consumed, used, and disposed of.

Cross sectorial technologies relevant to decarbonizing industry — Level of applicability

	CCUS	Green H2	Renewable heat	Circular economy
Iron and steel				
Cement				
Construction				
Chemical				
Food and beverages				
Textiles				

ESMAP
Energy Sector Management Assistance Program

Cement and construction are most promising sectors; need to lever cross-cutting technologies across the six sectors

Abatement potential ($MtCO_2$ in 2050)	Expected future technology costs		
	High (>$100/tCO2)	**Medium ($50–100/tCO2)**	**Low (<$50/tCO2)**
>1,000 $MtCO_2$	**Steel:** Top-gas recycling in steel blast furnace (with CCS)	**Cement:** Cement-specific CCS options	**Cement:** Alternative non-clinkered cement **Construction:** Material efficiency
500–1,000 $MtCO_2$	**Cement:** Hydrogen and electrification in cement **Chemical:** Ammonia production from electrolysis-derived hydrogen **Chemical:** Ethylene from bioethanol	**Steel:** Smelting reduction for steel production (with CCS) **Textiles:** Chemical recycling of textiles	**Cement:** Alternative clinkered cements **Construction:** Material substitution
<500 $MtCO_2$	**Steel:** Hydrogen in steel blast furnace **Chemical:** Ethylene from the methanol to olefins process	**Steel:** Hydrogen direct reduction in steel **Chemical:** Chemical recycling of plastics **Food & Beverages:** Alternative pasteurization for food preservation	**Steel:** Iron ore electrolysis for steel production **Cement**: Biomass and waste fuels **Construction:** Enhanced building utilization **Construction:** Digital construction **Food & Beverages:** Alternative refrigeration systems **Textiles:** Solar drying in food processing **Novel anaerobic digestion for biogas gen.** **Concentrated solar heat**

Most promising tech

- Study focuses on promising technologies in **economically relevant industries in developing countries** (e.g. food and beverage) and industries with **large circular economy opportunities**
- **All technologies have large abatement potentials in non-OECD countries** (e.g. at minimum can abate 50 metric tons of CO_2)
- **Innovations in cement and construction appear particularly promising**, delivering large-scale reductions at relatively lower cost
- Interviews with **stakeholders suggest that cost is not the main deterrent to innovation**; but rather low carbon innovation faces a **diverse set of country-, sector- and technology specific barriers**

ESMAP
Energy Sector Management Assistance Program

Supporting innovation requires the creation of strategies to "push" and "pull" the demand of the innovative products

Context	Category of policy	Potential levers

A combination of **policies supporting innovation, directly as well as creating markets** for relevant products and services are needed to support industrial decarbonization in developing countries	**Supply or technology push**	• Government-funded early-stage research plays an important role in bringing new technologies to market
		• Demonstration projects facilitate knowledge transfer from the research community to the private sector
		  • Infrastructure to facilitate collaboration and knowledge transfer
		  • Loans, loan guarantees, and equity finance
		  • Proof of concept funds and grants

	Demand or market pull	• Regulation can drive private firms to invest in innovation in anticipation of its coverage • Fiscal incentives can encourage innovation • Public procurement can be used to increase the adoption of low-carbon technologies by directly creating demand

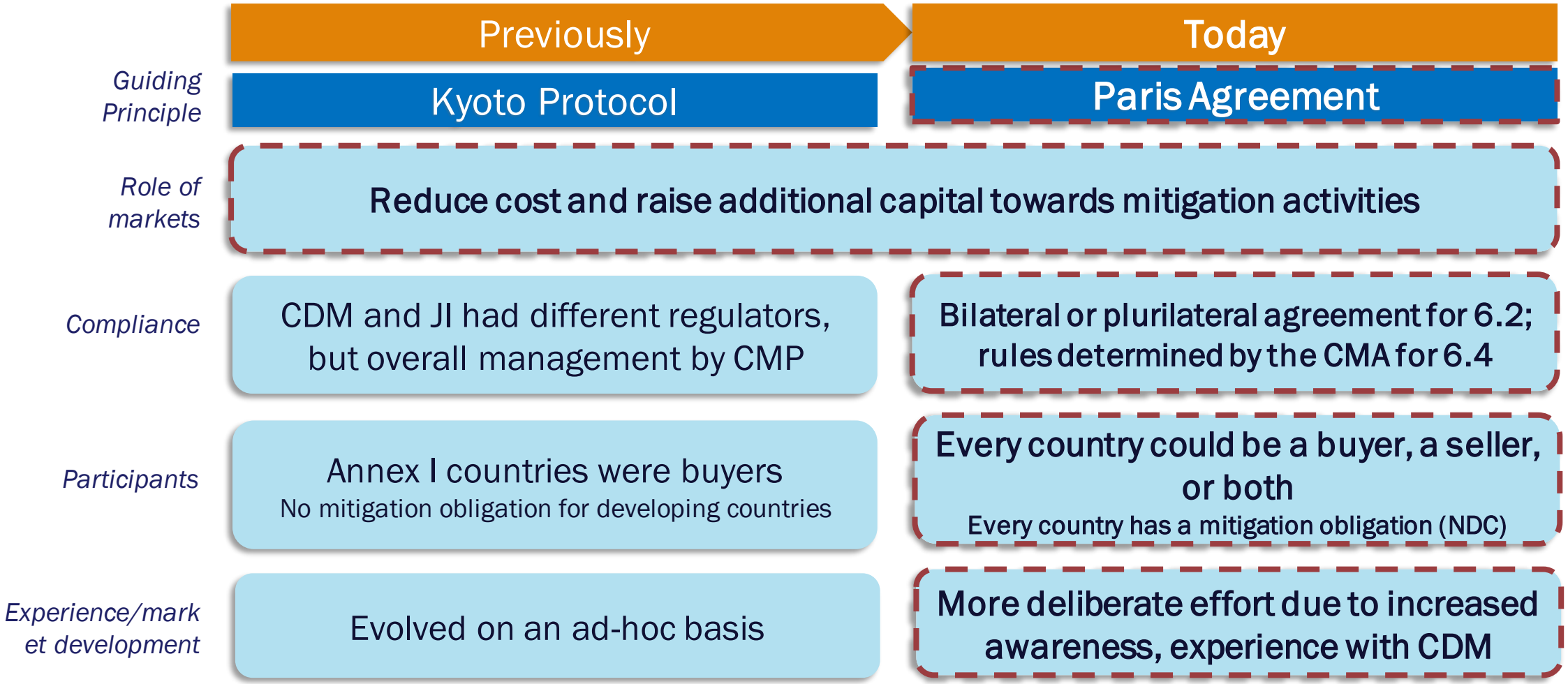
Broader policy environment

- Supportive policies such as intellectual property protection promote macroeconomic conditions conducive to innovation.
- Framework conditions include clear, long-term policy signals; an enabling environment to support innovation i.e., through investment in human capital and relevant infrastructure.
- Well-designed regulation that creates a level playing field for low-carbon technologies to compete.

INDIA

Impact of carbon markets

Guided by the Paris Agreement, all countries can now participate in carbon markets as buyers & sellers of carbon credits…



Summary of key macro trends in the global carbon markets

Voluntary carbon markets are growing faster than compliance markets

- Growth of voluntary markets far supersedes compliance markets; they have funneled more than **EUR5 billion** over the last 20 years
- In 2021, the volume of voluntary market credits reached its maximum since 2010 and **crossed US$1 billion for the first time**
- Demand is growing so fast that market is expected to be supply constrained in the coming years
- The demand for carbon credits from Nature-based Solutions (NbS) projects is growing fast

Paris Agreement will grow compliance markets which are catalyzed by the voluntary markets

- Article 6 can help countries meet their NDC goals in a faster and cheaper way, **55 NDCs** confirm interest in using international market mechanisms; an increasing number of Article 6 pilots
- It is estimated that airlines will need to **offset ~0.5 – 3.0 billion tons of CO_2 from 2021—2035** to comply with CORSIA
- Both schemes can help reduce market fragmentation

World Bank Group working to scale up climate finance via carbon markets

Global emissions are rising, and carbon markets are not growing fast enough

Carbon markets are fragmented – a lack of standardization on quality, use and transacting of credits

WBG Climate Market Club working to ensure integrity; Climate Warehouse Initiative is testing a carbon credit platform

Source: UNEP; IEA; World Bank; Ecosystem Marketplace; Carbon Brief; ecbi; Climate Focus; Refinitiv

WORLD BANK GROUP

Climate Warehouse

Key conclusions and lessons from the country experience so far

- Countries' comprehension of Article 6 rules and governmental role in implementation is rapidly evolving but **there are still major gaps** in understanding on what is needed to be put in place at domestic level. Facilitating exchange of experience from the initial pilots will be important to fill the gaps.

- **Domestic level infrastructure** (mainly registry) and **capacity building** are top priorities for many countries, even for those with Kyoto markets experience given the evolved nature of Article 6 framework. Coordinated efforts among development partners and initiatives will be helpful in providing concerted support. Use of new tools such as digital MRV can help in creating necessary infrastructure at much less cost and effort compared to the past.

- Support is needed for countries in **prioritizing identification of sectors and mitigation activities** eligible for international market transaction (without jeopardizing meeting the NDC targets) at a faster rate since uncertainty over these is making any cooperation and involvement in Article 6 pilots slow. This info can help to estimate the potential size of the carbon market in the country.

WBG in India: Prioritizing the Key Systems Transitions

Transformative interventions are needed in 5 key systems because they account for over 90% of global greenhouse gas emissions. They must be transformed to address climate change, achieve a resilient and low-carbon future, and support natural capital and biodiversity. These sectors are critical to achieving development goals. Transforming them is key for countries at all stages of development and requires action from the public and private sector: both to unlock major economic opportunities and create new markets and jobs.

Energy

Energy accounts for around three-quarters of gross global greenhouse gas emissions, with coal combustion accounting for one-third. Achieving net zero emissions by mid-century is only possible with a rapid, unprecedented, shift of global energy systems from fossil fuels to renewable energy.

Agriculture, Food, Water, & Land Use

Agri-food system transformation is particularly urgent for both climate change and to feed a growing population. Agricultural and land use change accounts for almost 25 percent of GHG emissions.

Cities

Cities consume over two-thirds of the world's energy and account for more than 70 percent of global CO_2 emissions. The transformation of cities and urban systems will be critical in achieving carbon neutrality—and in making cities and human settlements inclusive, safe, resilient, and sustainable in line with SDG 11.

Transport

Transport emits around 24 percent of the energy-related carbon emissions that are associated with global warming and transport emissions have grown faster than other sectors over the past 50 years. Without aggressive measures, emissions from transport are expected to grow 60 percent by 2050.

Manufacturing

Manufacturing activities, especially the production of base materials such as chemicals, steel, and cement, contribute to about 27 percent of global GHG emissions. These sectors are building blocks that lay the foundation for a range of economic activities, create jobs along all value chains, and drive the economic growth of countries.

INDIA

Tom Kerr, Lead Climate Change Specialist