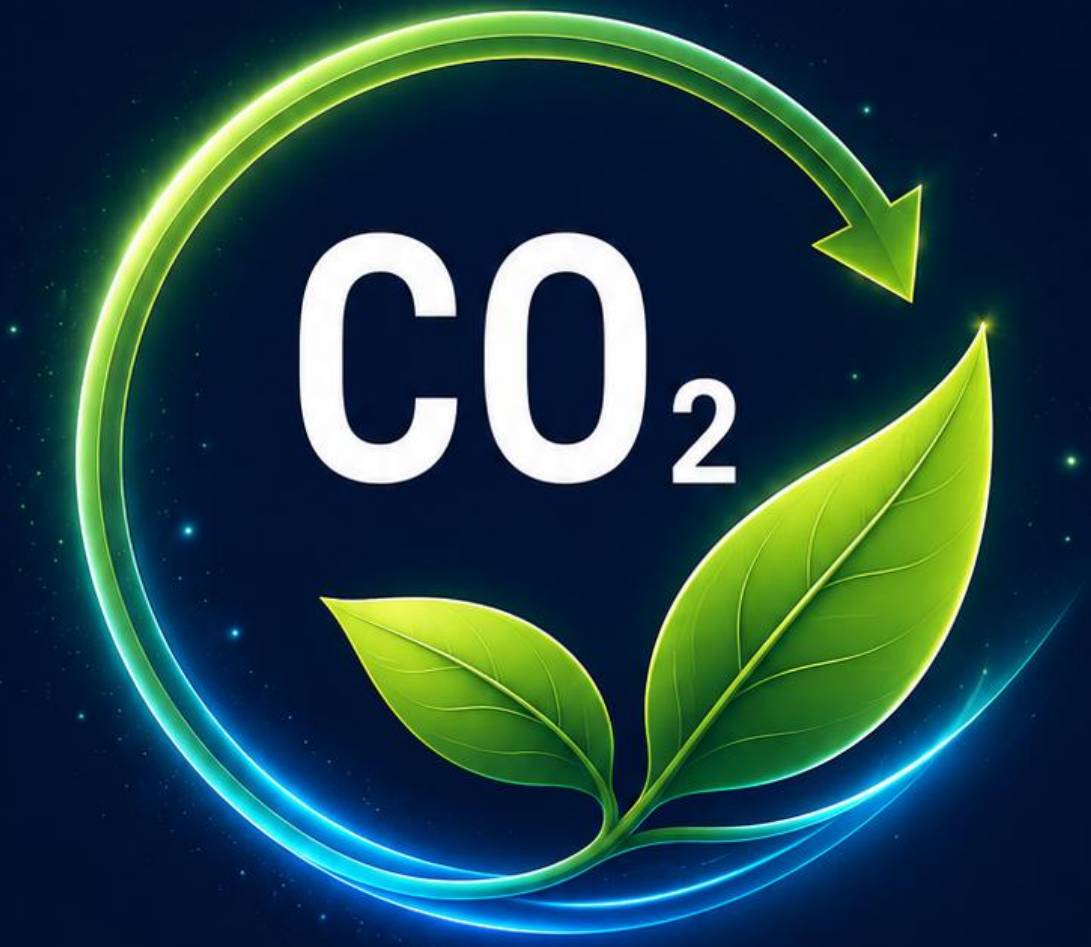
Confederation of Indian Industry

Addressing India's Strategic Needs:

Achieving a Circular Carbon Economy

through Carbon capture, Utilization and Storage (CCUS)



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Foreword

The Confederation of Indian Industry (CII) is pleased to present this White Paper on achieving a Circular Carbon Economy through Carbon Capture, Utilisation and Storage (CCUS). The paper draws upon the work of the CII Task Force on CCUS Technologies, constituted to assess the current status of CCUS deployment in India, identify key barriers to scale-up, and develop actionable recommendations for industry and government. It reflects insights and contributions from industrial stakeholders, technology providers, engineering firms, financial experts, and policy practitioners.

India stands at a defining crossroads. On one hand, the nation is committed to an ambitious development trajectory that demands a massive expansion of its industrial base — in steel, cement, petrochemicals, fertilizers, and power. On the other, India has made binding international commitments: to achieve Net Zero greenhouse gas emissions by 2070, to reduce emissions intensity by 45 per cent below 2005 levels by 2030, and to source 50 per cent of its electricity from non-fossil sources within this decade.

The central challenge of India's industrial future is not a choice between growth and climate responsibility, it is the imperative to pursue both simultaneously. For the hard-to-abate sectors that form the backbone of our economy, this is not merely a policy aspiration; it is an engineering and economic necessity. Carbon Capture, Utilisation and Storage (CCUS) is the critical bridge technology that makes this possible.

India possesses the industrial base, geological potential, and technological capability to develop a world-class CCUS ecosystem. What is needed is a coherent, mission-driven policy framework that de-risks private investment, creates market demand for low-carbon products, and enables coordinated action across the ministries and sectors critical to CCUS deployment.

We believe this White Paper will serve as a valuable resource for policymakers, industry leaders, researchers, and other stakeholders engaged in advancing India’s decarbonisation journey and achieving the nation’s net-zero ambitions.

We would like to express my sincere appreciation to all the individuals and organizations that contributed to the development of this white paper. Their expertise, insights, and dedication have been instrumental in shaping its content and recommendations. We are confident that this white paper will stimulate further dialogue and action toward creating a more sustainable and circular economy in India.

Mr Masood Maliick,
Chairman, CII National Committee on Waste to Worth Technologies 2026-27, Group CEO & MD, Re Sustainability Limited

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Glossary of Key Terms

A. Background

India is navigating a pivotal development phase that demands simultaneous expansion of its manufacturing and infrastructure base while honoring ambitious climate commitments. Under its updated 2022 Nationally Determined Contribution (NDC), the country has pledged to achieve Net Zero emissions by 2070, reduce the emissions intensity of its economy by 45 % by 2030, and derive half of its electricity capacity from non-fossil sources within the decade.

These targets are inseparable from India's broader social and economic priorities. The industrial sector accounts for roughly 25% of national carbon dioxide emissions, yet it also functions as the primary engine of regional development and local livelihoods. Four sectors sit at the heart of this tension:

- Crude Oil Refining contributes 60 to 70 $MTCO_2$/yr, supported by an operational capacity exceeding 250 million tonnes per year.
- Steel Manufacturing makes India the world's second largest steel producer, accounting for approximately 39 % of total industrial carbon emissions.[8][9] Traditional coal-based methods generate substantial emissions while directly employing millions of workers in industrial towns whose economies depend on the sector.
- Cement Production is indispensable to housing and infrastructure growth, and India ranks as the world's second largest producer, with an installed capacity exceeding 409 MT/yr.[3] Yet over 60 % of its emissions arise from the chemical process of heating limestone, a reaction that cannot be engineered away.
- Fertilizers underpin agricultural productivity and food security, but the sector currently depends on carbon intensive processes to produce the hydrogen essential for crop nutrients.

The scale of India's projected industrial growth sharpens this challenge considerably. National policy, as articulated in the National Steel Policy, envisions expanding domestic steelmaking capacity to 300 MY/yr by 2030–31,[10] effectively doubling the sector's historical baseline, while significantly expanding refining networks to meet rising economic demand. Because the emissions from these processes cannot be eliminated simply by switching to renewable electricity, and because cleaner alternative technologies remain years from financial viability, the policy choices are acutely difficult. Imposing abrupt restrictions would jeopardize millions of industrial jobs and slow infrastructure development. Yet prolonged inaction risks severe consequences: Indian exporters face mounting exposure to mechanisms such as Europe's carbon border adjustment, which effectively penalizes high emission goods at the point of import.

India's refining sector operates with an average emission intensity of 0.25 to 0.35 tonnes of carbon dioxide per tonne of crude oil processed.[7][15] On a more conservative scenario, current capture and conversion technologies could redirect between 5 – 15 % of refinery emissions, equivalent to 3-10 MT/yr, into value-added products. This near-term utilisation potential offers an early, commercially viable entry point for industrial decarbonisation before broader storage infrastructure is in place.

Carbon capture, utilization, and storage (CCUS) technologies offer a credible path through this dilemma. Rather than forcing an abrupt choice between economic continuity and climate

responsibility, CCUS acts as a bridge that allows India's industrial heartland to decarbonize progressively while preserving manufacturing employment and sustaining regional growth.

Its value extends beyond emissions compliance. By retrofitting existing facilities such as blast furnaces, coal reliant plants, and chemical installations, CCUS can meaningfully reduce emission intensities without requiring premature shutdowns. This protects billions of dollars in existing infrastructure from becoming stranded or politically untenable and buys the time that communities and industries need to transition as next generation green technologies reach commercial scale.

B. Identified Issues and Recommendations

1. Financial and Commercial Viability

1.1 The Viability Gap

Issue: The single biggest barrier to CCUS investment in India is cost. Today, the full cost of capturing, transporting, and storing 1T CO_2 ranges from USD 70 to 120. Against this, the effective price that Indian industry pays for emitting carbon is essentially zero. No private company will invest billions in technology that has no revenue model. Additionally, CCUS equipment consumes significant energy (typically 15 to 25 % of a factory's output) which further erodes the business case unless clean electricity is available at affordable rates. Until this gap between cost and revenue is closed through policy, CCUS will remain confined to pilot projects. The economics of the sector are also influenced by the degree to which lower-carbon steelmaking routes, particularly those using recycled scrap metal in electric arc furnaces, can reduce the total volume of carbon dioxide that the industry needs to address. Policies that increase the availability of recyclable steel scrap, building on the foundations of the Vehicle Scrapping Policy, therefore have a direct and complementary bearing on the scale and cost of CCUS deployment required.[8][9][12][20]

Table 1: Carbon capture and storage cost breakdown (USD per tonne CO_2)[12]

Cost Component	Estimated Range (USD per tonne CO_2)
CO_2 capture and compression	45 to 65
CO_2 transport (100–300 km)	5 to 15
CO_2 storage (geological injection)	5 to 15
Project financing costs	10 to 25
Total lifecycle cost	70 to 120

Concerned Ministries: Ministry of Finance (MoF), Ministry of Power (MoP).

Recommendations:

A. Build a comprehensive revenue model for CCUS that includes guaranteed price support, low-carbon product standards, and mandates for using captured carbon dioxide.

B. Ensure that factories operating CCUS equipment receive priority access to the electricity grid and preferential power tariffs, create a dedicated 'CCUS electricity tariff' category.

1.2 Financial Instruments: Priorities and Sequencing

Issue: The absence of targeted risk-mitigation and revenue-stabilization mechanisms prevents large-scale Carbon Capture, Utilization, and Storage (CCUS) projects from reaching

Final Investment Decisions (FID). Private investors face unviable financial risks due to high upfront costs and volatile carbon pricing. Without primary financial instruments, specifically mechanism guarantees and direct tax offsets, commercial capital will remain locked, rendering secondary incentives ineffective.

Concerned Ministries: Ministry of Finance (MoF), National Bank for Financing Infrastructure and Development (NaBFID), Department of Science and Technology (DST).

Recommendations:

A. Carbon Contracts for Difference may be considered as a primary instrument to guarantee a minimum carbon price for large CCUS projects (above 0.5 million tonnes per annum of CO_2), with prices set through competitive bidding and a maximum volume of 50 MTPA by 2035. Each contract could run for 15 years.

B. A per-tonne CCUS Tax Credit in the range of INR 3,000 to 5,000 per tonne of CO_2 that is verifiably captured and either stored underground or converted into useful products may be introduced. Geological storage should attract the higher rate. The credit could apply for 15 years per project.

C. The Production-Linked Incentive scheme may be extended to include a dedicated tranche supporting the domestic manufacture of CCUS equipment, with a funding envelope to be determined through detailed techno-economic assessment. Reducing GST tax slab for the CCUS components and providing accelerated depreciation for the CCUS will further bolster the economic viability of the CCUS projects.

D. Set up a dedicated CCUS Financing Window within National Bank for Financing Infrastructure and Development (NaBFID) offering below-market-rate loans and partial sovereign guarantees. Design blended finance structures that combine concessional public capital with private investment.

1.3 Carbon Market and Trade Defence

Issue: India's Carbon Credit Trading Scheme (CCTS) does not yet include rules for generating carbon credits from CCUS projects. Without a clear accounting framework, project developers cannot monetise the carbon dioxide they capture, removing a critical source of revenue. At the same time, Indian exporters are increasingly exposed to the European Union's Carbon Border Adjustment Mechanism (CBAM), which imposes financial penalties on imports from countries that do not price carbon. Every year that India delays putting a functioning carbon price in place, its exporters pay levies to Europe that a domestic carbon market would have retained within India. A credible domestic carbon market with CCUS-compatible rules is therefore both an industrial policy tool and a trade defence measure.

Table 2: CBAM levies on Indian exports: revenue lost to Europe without a domestic carbon price [14]

Sector	India to EU Exports (MTPA)	CBAM CO_2 Exposure (MT/yr)	CBAM Levy @ €50/t	CBAM Levy @ €100/t
Steel	~5.5	~11	~EUR 550M/yr	~EUR 1.1B/yr
Cement	~1.0 to 1.5	~1.1	~EUR 55M/yr	~EUR 110M/yr

Fertilizers	~0.8	~1.8	~EUR 90M/yr	~EUR 180M/yr
TOTAL		~14	~EUR 695M/yr	~EUR 1.4B/yr

Concerned Ministries: Ministry of Environment, Forest and Climate Change (MoEFCC), Bureau of Energy Efficiency (BEE), Ministry of Commerce and Industry (MoCI).

Recommendations:

A. The development of CCUS-specific crediting rules under the CCTS could be prioritised, with a view to enabling the crediting of verified capture volumes where feasible.

B. May develop a CBAM Defence Strategy by accelerating the launch of the CCTS with binding minimum carbon prices, and opening government-to-government talks with the EU on mutual recognition of Indian CCUS credits.

C. Ensure that Indian CCUS credit rules are compatible with international standards (ICVCM Core Carbon Principles and Article 6 of the Paris Agreement) so that credits are recognized globally and traded seamlessly.

D. Carbon credit buyers, and the international markets in which those credits are ultimately priced, apply close scrutiny to the risk of double counting, the clarity of long-term storage liability, and the robustness of measurement against declared volumes. India's CCTS development process may benefit from explicitly addressing these integrity risks in its CCUS-specific methodology, drawing on the standards established by credible international frameworks for engineered carbon removal.[1][7]

E. Promote domestic demand for carbon credits through ESG disclosure requirements and green procurement guidelines. SEBI may set carbon credit procurement targets for large, listed companies.

2. Regulatory and Legal Framework

2.1 CCUS Legislation and Storage Liability

Issue: India currently has no law that governs the storage of carbon dioxide underground. Critical questions remain unanswered: who owns the underground rock formations (pore space) where CO_2 would be injected? Who is liable if stored CO_2 leaks decades after a project have closed? What standards must operators follow for site selection, injection, monitoring, and closure? Without answering these questions, no private investor will commit capital to a storage project.

Countries such as Australia, the United Kingdom, and the European Union have enacted comprehensive legislation covering all these areas. India can adapt these international models to its own federal structure. Additionally, the permitting process for CCUS projects is currently fragmented across mining, environment, hydrocarbon, and land-use agencies, with no single-window mechanism to streamline approvals.

Concerned Ministries: Ministry of Law and Justice (MoLJ), Ministry of Environment, Forest and Climate Change (MoEFCC), Ministry of Petroleum and Natural Gas (MoPNG).

Recommendations:

A. It is proposed that a dedicated statutory framework for CCUS be developed, addressing pore-space ownership, permitting, and the conditions for long-term liability transfer following verified site closure. Such a framework would vest underground pore-space ownership in the Union Government, establish a clear permitting framework for storage sites, define liability transfer to the Government after a 20-year post-closure monitoring period, create a CCUS Closure Fund financed by operators, and address cross-state storage scenarios.

B. In the interim, issue storage regulations under the Environment Protection Act 1986 so that pilot injection projects can proceed while the full legislation is prepared.

C. Consideration may be given to designating a single nodal authority, potentially within the Directorate General of Hydrocarbons (DGH), to coordinate approvals across the ministries and agencies currently involved in CCUS permitting, with cross-ministerial membership and binding timelines for all approvals.

2.2 CO_2 Pipeline Regulation

Issue: Transporting captured carbon dioxide from factories to storage sites requires dedicated pipelines. However, the Petroleum and Natural Gas Regulatory Board (PNGRB) Act of 2006 restricts its statutory jurisdiction to petroleum, petroleum products, and natural gas, leaving carbon dioxide transport lines outside its regulatory scope.[7] Basic questions about open-access tariffs, right-of-way allocations, and transport safety codes consequently remain unaddressed in statute. Obtaining environmental clearance for CO_2 pipelines currently requires multiple consents from different agencies with no coordinated process, leading to timelines of three to five years for clearance alone.

Concerned Ministries: Ministry of Environment, Forest and Climate Change (MoEFCC), Petroleum and Natural Gas Regulatory Board (PNGRB), Bureau of Indian Standards (BIS).

Recommendations:

A. The mandate of Petroleum and Natural Gas Regulatory Board (PNGRB) may be extended by executive notification to encompass carbon dioxide transport as a distinct regulated category, with safety standards and access rules tailored to its physical properties, including mandatory third-party open access and regulated tariffs.

B. Develop a national CO_2 Pipeline Safety Standard through Bureau of Indian Standards (BIS) and Petroleum and Explosives Safety Organisation (PESO), drawing on established international codes.

C. Create a single-window clearance process for CCUS infrastructure under the National Industrial Corridor framework, with a mandated 180-day approval timeline.

2.3 CCUS in India's Climate Commitments

Issue: India's official Long-Term Low-Carbon Development Strategy (LT-LEDS), submitted to the UNFCCC, formally designates carbon dioxide removal and advanced industrial carbon capture as priority decarbonisation pathways.[7][11] Under Article 6.2 of the Paris Agreement, India has established the legal basis for international trading of CCUS-linked carbon credits. However, CCUS lacks a dedicated, standalone statutory mission within the older National Action Plan on Climate Change (NAPCC) framework. Integrating CCUS more explicitly into headline national climate policy roadmaps would strengthen the policy signal to domestic and foreign investors, providing the regulatory predictability needed to de-risk high-capital, long-term carbon removal infrastructure.

Concerned Ministries: Ministry of Environment, Forest and Climate Change (MoEFCC), Office of the Principal Scientific Adviser.

Recommendations:

A. Develop a standalone National CCUS Strategy with clear deployment targets: 50 million tonnes per annum by 2035 and 200 million tonnes per annum by 2040, with sector-wise contributions and infrastructure mapping.

B. Include CCUS as a recognised emission-reduction pathway in India's next NDC update.

C. New large industrial facilities (emitting more than 1 million tonnes of CO_2 per year) commissioned after a defined date may be expected to meet a Carbon Capture Ready design standard, ensuring that the physical space, utility connections, and structural provisions for future capture equipment are incorporated at the design stage, so that capture equipment can be added later without major retrofitting.

3. Infrastructure: CO_2 Transport and Storage

3.1 Shared CO_2 Pipelines and the Hub-and-Cluster Model

Issue: India lacks shared infrastructure for transporting carbon dioxide, forcing individual project developers to build independent pipelines from factories to storage sites and bear the full capital burden alone, which renders CCUS economically unviable as a standalone investment. This infrastructure deficit directly hinders the utilization of three major industrial corridors that are otherwise primed for carbon management: the Eastern India Steel Belt across Odisha, Jharkhand, and Chhattisgarh, where concentrated steel plants sit near suitable underground formations; the Western Refining Cluster in Jamnagar and Vadodara, which contains dense groupings of refineries producing high-purity CO_2; and the Indo-Gangetic Fertilizer Belt spanning Uttar Pradesh and Bihar, where ammonia-urea plants generate concentrated CO_2 streams. The eastern seaboard refining corridor, anchored by Paradip in Odisha, represents a complementary cluster where proximity between major refineries, fertiliser producers, and port infrastructure creates conditions well-suited to shared carbon management infrastructure.[15]

Concerned Ministries: Ministry of Petroleum and Natural Gas (MoPNG), Directorate General of Hydrocarbons (DGH), Petroleum and Natural Gas Regulatory Board (PNGRB).

Recommendations:

A. Designating CO_2 transport and storage infrastructure as Critical National Infrastructure would unlock access to long-term financing and sovereign guarantees, a step that could significantly improve the investment case for shared pipeline networks. Directorate General of Hydrocarbons (DGH) may be designated as the lead agency for national CO_2 pipeline planning.

B. Direct Petroleum and Natural Gas Regulatory Board (PNGRB) (through an executive notification) to extend its pipeline regulation framework to CO_2 transport networks, establishing open-access tariffs and safety standards.

C. The Eastern India Steel Belt may be developed as India's first CCUS Hub on a public-private partnership basis, with the Government's equity contribution and financial structure to be determined through a detailed feasibility assessment.

3.2 Geological Storage Readiness

Issue: India has a 600-billion-tonne theoretical CO_2 storage capacity but lacks a legal and regulatory framework for underground ownership and long-term liability. Launching a national storage survey in 2026 is highly time-critical, as the necessary physical appraisal means investment-grade data will not be available until 2031–2033. Storage readiness varies significantly across formations: mature oil and gas fields are closest to deployment (less than 5 years), coal-beds are moderate, while high-potential deep saline aquifers and basalts require a decade or more of field-scale validation.

Instead of a nationwide rollout, the near-term strategy should focus on proving one or two strategic storage hubs near industrial clusters. The goal is to validate site-level injection data

at these hubs by 2030, establishing the technical, legal, and financial templates required to systematically scale deployment across other basins and basalt provinces by 2040.[7]

Concerned Ministries: Directorate General of Hydrocarbons (DGH), Ministry of Coal (MoC), Ministry of Mines (MoM), Department of Science and Technology (DST), Ministry of Environment, Forest and Climate Change (MoEFCC).

Recommendations:

A. Initiate a National CO_2 Storage Atlas programme backed by a phased, five-year budgetary framework. The initial phase, covering the period from 2026 to 2028, could prioritise the three identified corridors, targeting a commencement date in early 2027 to maintain alignment with ideal deployment trajectories. The Atlas methodology should incorporate an early screening process for each prospective site, including assessment of proximity to groundwater resources and population density, so that projects with elevated land-access or environmental sensitivity risks are identified before capital-intensive appraisal work begins. This front-loaded risk filter reflects international experience, where community opposition has been a material cause of project delay.[7]

B. Formulate a comprehensive National Carbon Storage Policy framework designed to clarify underground pore-space ownership, establish structured site-leasing processes, outline clear timelines for liability transfer after a sufficient post-closure monitoring period, and recommend baseline safety standards.

C. Explore the feasibility of establishing a Deccan Basalt Mineralisation Pilot Programme, encouraging collaborative research partnerships between academic institutions and the Department of Science and Technology (DST) to evaluate alternative solid-mineral storage pathways.

D. Evaluate the potential for including abandoned coal mines in the early phases of the Storage Atlas, exploring joint co-funding and resource-sharing opportunities between the Ministry of Coal (MoC), Department of Science and Technology (DST), and Directorate General of Hydrocarbons (DGH).

3.3 CO_2-Enhanced Oil Recovery (EOR) as an Entry Point

Issue: Among India's most clearly delineated early opportunities are the partially depleted oil and gas fields of the Upper Assam and Cambay Basins, where the geology is well-characterised and the existing operational infrastructure of public sector exploration companies provides a practical foundation for pilot injection activity.[7] While mature, partially depleted oil fields in western India offer a clear revenue-generating opportunity for CCUS by using CO_2-Enhanced Oil Recovery (CO_2-EOR) to offset capture costs with incremental oil revenues, this pathway remains commercially unattractive, primarily because the cost of sourcing and transporting carbon dioxide from adjacent industrial facilities cannot currently be justified on an individual operator's balance sheet, and no fiscal mechanism yet exists to bridge that gap. Because India currently lacks targeted policy support, dedicated fiscal incentives, or structured procurement mechanisms to address this commercial gap, this early-stage utilization option remains entirely unviable for private investment.

Concerned Ministries: Ministry of Petroleum and Natural Gas (MoPNG)

Recommendations:

A. Formulation of a supportive CO_2-EOR Policy framework by Ministry of Petroleum and Natural Gas (MoPNG) to evaluate potential fiscal incentives, such as investment-linked tax credits or royalty concessions, for projects utilizing captured industrial CO_2. This could also include exploring structured procurement mechanisms to help streamline the sourcing of CO_2 from nearby factories.

B. Explore the possibility of commissioning bankable feasibility studies for CO_2-EOR across select mature oil fields. To encourage participation, Ministry of Petroleum and Natural Gas (MoPNG) could consider supporting these assessments through a partial cost-sharing mechanism, potentially covering up to 50 % of the study expenses.

4. Technology and Capture Readiness

4. 1 Capture Technology and Costs

Issue: Carbon capture costs in India vary heavily by sector, starting with lower-cost, high-purity sources such as ammonia and fertiliser plants (USD 15 to 25 per tonne) before rising to more expensive and diluted streams in steel and cement production (USD 45 to 85 per tonne). Local deployment is further constrained by a lack of domestic manufacturing, which inflates project costs by 20 to 35 % due to equipment imports. Additionally, critical pre-investment engineering studies require an unassisted outlay of between INR 20 and 50 crore per project, as India currently lacks the public grant frameworks utilized by the US, UK, and Canada.

Concerned Ministries: Department of Science and Technology (DST), Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Power (MoP), Ministry of Environment, Forest and Climate Change (MoEFCC).

Recommendations:

A. Initiate the immediate deployment pathway by prioritizing low-cost, high-purity emissions sources. Under this framework, fertilizer plants, gas processing facilities, and ammonia producers should be required under national carbon trading schemes to capture and either utilize or permanently store their carbon emissions.

B. Establish a Pre-FID Grant Programme (administered by Department of Science and Technology (DST)) that provides reimbursable engineering grants per project, recoverable from project revenues after the investment decision is made.

C. Scale the framework of the recently announced public-private carbon capture and utilization test beds in the cement sector by extending similar technological validation initiatives directly into the steel and power sectors.

D. Invest in research and development through Department of Science and Technology (DST) to improve the chemical solvents and materials used in capture systems, with the goal of reducing the energy consumed by capture equipment to below 15 % of total plant output.

E. Facilitate investment for research in the integration of CCUS technologies in brownfield projects from hard-to-abate sectors. Existing assets, which were not designed to integrate with CCUS systems face an uphill battle due to the space constraints. [7][8]

4.2 CO_2 Utilisation Pathways

Issue: Once carbon dioxide is captured, it can be converted into commercially valuable products. A comparison of the main utilisation pathways is useful context for prioritising policy support. Urea synthesis, the most commercially mature pathway, is already operating at scale in India's fertiliser industry and incorporates the highest proportion of carbon per unit of product.

Methanol synthesis, ethanol production and concrete mineralisation are the most promising routes for near-term scale-up in hard-to-abate industries. Conversion of industrial waste gases from steel plants, ferro-alloy facilities and refineries into ethanol and transport fuels, including

aviation fuel, is commercially promising, with gas fermentation and alcohol-to-jet technology pathways at various stages of deployment in India and globally, but requires coordinated development of gas supply, conversion technology, and market offtake. Emerging biochemical pathways for converting CO_2 into nutritional protein for animal and human consumption have also reached pilot scale (TRL 5).

Biological conversion using algae or microorganisms offers a low-energy, decentralised option with potential co-benefits beyond carbon, though it remains at an earlier stage of development.[7][12] Producing methanol from captured CO_2 requires green hydrogen, which at current domestic costs of approximately USD 3 to 4 per kilogram remains above the threshold at which conversion economics become competitive with conventional fossil-based methanol. While costs are declining, bridging this gap requires coordinated support for both renewable energy supply and hydrogen off-take.

Another high-value pathway involves converting carbon monoxide-rich gases from steel blast furnaces into ethanol, which can then be upgraded into sustainable aviation fuel (SAF). However, policy uncertainty about whether ethanol produced from industrial waste gases qualifies for export benefits and government price support is deterring investment. More broadly, the various elements needed for CO_2 utilization: carbon sources, hydrogen supply, processing technology, and buyer agreements, are being pursued in separate silos rather than through coordinated cross-sector planning.

Concerned Ministries: Ministry of Steel (MoS), Ministry of Petroleum and Natural Gas (MoPNG), NITI Aayog, Ministry of Civil Aviation (MoCA), Ministry of Environment, Forest and Climate Change (MoEFCC).

Recommendations:

A. Consider exploring the issuance of a formal notification confirming that ethanol produced from industrial waste gases is eligible for export incentives and government price support under the Clean Hydrogen and Transition Framework.

B. Introduce a pricing mechanism for Sustainable Aviation Fuel (SAF) where the premium over conventional jet fuel is met through a blending obligation levy on airlines.

C. Create a formal CCUS Utilisation Platform that brings together steel, oil and gas, refining, petrochemical, and chemical producers to coordinate the conversion of captured CO_2 into fuels and chemicals.

D. Include biomass-based gasification and gas conversion pathways in the national CCUS framework.

E. A related priority is providing dedicated support for the conversion of carbon-bearing process gases, such as the gases produced by blast furnaces, basic oxygen furnaces, and coke ovens in integrated steel plants, into chemicals, fuels, or energy products within the same industrial site. This in-plant conversion approach reduces the need for external transport infrastructure, improves the overall carbon efficiency of the facility, and can generate direct revenue from what are currently waste streams.[8]

5. Green Energy and Hydrogen Convergence for CCU

Issue: CCUS equipment needs large amounts of electricity to operate. If that electricity comes from India's current generation mix, where the weighted average grid emission intensity is approximately 0.71 kg CO_2/kWh,[2][4][7] the environmental benefit of capture is partially offset. Where the electricity powering the capture facility comes from high-carbon grid sources, the net carbon benefit of the project is diminished.

The energy consumed in running the capture equipment generates its own emissions that partially offset the gross volume captured. For capture systems based on chemical solvents, a reliable 24-hour energy supply is essential, and ensuring that this supply is 95 % or more renewable adds between USD 5 and 15 per tonne to overall costs. At the same time, converting captured CO_2 into useful products like methanol requires green hydrogen, which at current domestic costs of approximately USD 3 to 4 per kg remains above the sub-USD 2.5 per kg threshold at which conversion economics become viable. The existing incentives under the National Green Hydrogen Mission do not distinguish between hydrogen used in general applications and hydrogen used specifically for CO_2 conversion, missing an opportunity to support this high-value use case.

Concerned Ministries: Ministry of Power (MoP), Ministry of New and Renewable Energy (MNRE), Central Electricity Regulatory Commission (CERC), Ministry of Petroleum and Natural Gas (MoPNG).

Recommendations:

A. Establish 'CCUS Renewable Energy Zone' designations for major industrial clusters, giving them priority connection to the electricity grid, open access to renewable energy, and exemption from cross-subsidy surcharges for CCUS operations.

B. Develop a Renewable Energy and CCUS Integration Standard specifying the minimum share of renewable energy that CCUS operations must use: 30 % by 2028 and 70 % by 2033.

C. Introduce a CCUS-Linked Hydrogen Incentive under the National Green Hydrogen Mission providing an additional benefit of INR 20 to 30 per kg specifically for green hydrogen supplied for CO_2 conversion processes.

D. Jointly develop a CO_2 Utilisation Roadmap that maps how much captured CO_2 will be available over time against the projected decline in green hydrogen costs, so that investment timing can be coordinated.

6. Market Creation and Demand-Side Enablers

6.1 Creating Demand for Low-Carbon Products

Issue: Even if capture technology becomes affordable, companies that invest in CCUS will face a competitive disadvantage unless buyers are willing to pay a premium for low-carbon steel, cement, and other products. Today, that market barely exists. The most powerful tool to create it is government purchasing power. The Government of India is the single largest buyer of steel and cement in the country, through infrastructure projects by NHAI, Indian Railways, HUDCO, and others. The Government may consider entering into long-term procurement agreements of 10–15 years for low-carbon materials at a predetermined premium, thereby transforming CCUS from a compliance cost into a bankable revenue stream. Additionally, India lacks Bureau of Indian Standards (BIS) quality standards for CO_2-based construction materials such as CO_2-cured concrete and carbonated aggregates, which limits the market pull for products made from captured carbon dioxide.

Concerned Ministries: Ministry of Finance (MoF), Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Steel (MoS), Ministry of Road Transport and Highways (MoRTH), Bureau of Indian Standards (BIS), Ministry of Petroleum and Natural Gas (MoPNG), Ministry of Civil Aviation (MoCA), Ministry of Chemicals and Fertilizers (MoCF).

Recommendations:

A. A Green Public Procurement Framework may be phased in with progressively increasing quotas for low-carbon steel and cement in government projects above INR 500 crore, targeting 10 % by 2027, 25 % by 2030, and 50 % by 2035.

B. It is proposed that NHAI, Indian Railways, and HUDCO enter into 10–15 year supply agreements with CCUS-enabled producers, offering a green premium of 8–12% above conventional prices during the first five years.

C. Establishment of a Sustainable Aviation Fuel Blending Obligation set at 2 % by 2027, 10 % by 2030, and 25 % by 2035, allowing SAF produced from captured CO_2 to qualify for double-counting toward the target.

D. Formulation of comprehensive quality standards by Bureau of Indian Standards (BIS) for CO_2-cured concrete, carbonated aggregates, and alternative CO_2-derived building materials to cover product quality, long-term durability, and embedded carbon accounting.

E. A complementary market-creation opportunity exists at the intersection of the steel and construction sectors. The mineralisation of captured carbon into aggregates, concrete blocks, and construction materials, using slag and process residues from steel plants as a feedstock, could create a direct, scalable commercial linkage between two of India's largest hard-to-abate industries. A formal framework for this cross-sector collaboration, anchored by green procurement commitments from infrastructure agencies and supported by Bureau of Indian Standards (BIS) product quality standards, would establish the demand signal needed to make mineralisation projects commercially viable.[3][8]

6.2 Carbon Credit Markets and Measurement Standards

Issue: The accounting relationship at the heart of any carbon credit is straightforward: the net carbon reduction credited to a project equals the gross volume captured, minus the emissions generated by the capture process itself, by the transport of carbon dioxide to its destination, and by any leakage over time. This chain-of-custody approach, tracing carbon from capture point to final storage or utilisation, is the foundation on which verification bodies, buyers, and regulators will assess credit integrity.[7][13] For carbon credits to be credible and tradeable, buyers must be confident that the claimed emission reductions are real, measurable, and permanent. India's CCTS currently lacks CCUS-specific measurement rules.

Concerned Ministries: Department of Science and Technology (DST), Ministry of Environment, Forest and Climate Change (MoEFCC), Bureau of Energy Efficiency (BEE), Ministry of Corporate Affairs (MCA).

Recommendations:

A. Establish a National CCUS Measurement and Verification Centre of Excellence, jointly led by the Department of Science and Technology (DST) and the Bureau of Energy Efficiency (BEE). The Centre would develop India-specific carbon credit standards, accredit verification agencies, and work with international organizations such as Integrity Council for the Voluntary Carbon Market, Verra and Gold Standard to promote mutual recognition of standards. It would develop verification methodologies based on six key factors: carbon capture efficiency, energy use, leakage risk, storage duration, measurement accuracy, and traceability of carbon throughout the system. These factors are already used by leading international carbon credit frameworks and can serve as the foundation for India's CCUS standards.[7][13]

B. Amend Corporate Social Responsibility regulations to allow CSR expenditure to fund indigenous CCUS technology development through public-private research partnerships.

C. Encourage the phased adoption of digital monitoring systems for CCUS projects seeking carbon credits, while working towards hosting verified data on a national transparency platform.

7. Just Transition: Labour, MSMEs, and Community

7.1 Workforce Transition

Issue: India's steel sector alone directly employs approximately 2.6 million workers, concentrated in the industrial towns of eastern India. CCUS introduces entirely new skill requirements in chemical process operation, pipeline management, geological data analysis, and digital monitoring. These requirements are not adjacent to the existing workforce's capabilities. Retraining takes three to five years for chemical process roles and two to three years for monitoring technicians. This retraining timeline is misaligned with the pace at which CCUS deployment needs to happen. Unless workforce planning begins now, skill shortages will become a binding constraint on project delivery.

Concerned Ministries: Ministry of Skill Development and Entrepreneurship (MSDE), Ministry of Steel (MoS), Sector Skill Councils.

Recommendations:

A. Publish a CCUS Workforce Needs Assessment, mapping new job roles, skills gaps, and available retraining capacity through Industrial Training Institutes, polytechnics, and industry apprenticeship programmes.

B. A CCUS Skills Development Fund outlay over five years may be considered, co-financed by the Skill India Mission and a modest levy of 0.1 % on large industrial emitters above 1 million tonnes of CO_2 per year.

7.2 MSME Access to CCUS

Issue: Micro, small, and medium enterprises (MSMEs) account for approximately 35 % of India's steel production capacity. These smaller enterprises face a structural disadvantage in accessing CCUS technology and capital. The upfront engineering study costs, typically between INR 20 and 50 crore, are prohibitive for a small foundry emitting 100,000 to 500,000 tonnes of CO_2 per year. If financial instruments are designed only for large emitters, MSMEs will be unable to comply and could face accelerated consolidation or closure.

Concerned Ministries: Department for Promotion of Industry and Internal Trade (DPIIT), Small Industries Development Bank of India (SIDBI).

Recommendations:

A. Establish an MSME CCUS Access Programme with three components: (a) a cluster approach that groups nearby MSMEs so their combined volumes justify shared infrastructure; (b) shared pre-investment engineering studies with costs spread across all participants; and (c) a dedicated MSME credit line through SIDBI at 4 to 5 percentage points below prevailing market rates.

B. Set emission intensity benchmarks for MSMEs under the CCTS at a higher threshold than for large integrated plants, with a longer phase-in timeline to allow smaller businesses time to adapt.

7.3 Community Engagement and Environmental Justice

Issue: CCUS projects will be located alongside communities that have historically borne the burden of industrial pollution. Experience from Europe and the United States shows that community resistance has delayed or cancelled CCUS projects where engagement was treated as an afterthought. Proactive engagement is both a moral responsibility and a practical necessity. CCUS operations also consume significant amounts of water, and many potential sites are in regions already experiencing water stress. Rigorous water management, including zero-waste water systems, must be built into projects from the start.

Concerned Ministries: Ministry of Environment, Forest and Climate Change (MoEFCC), State Governments, Urban Local Bodies.

Recommendations:

A. Community Benefit Agreements, covering local employment commitments, environmental monitoring, and grievance mechanisms, could be made a standard condition of government financing and regulatory approval for CCUS projects. These agreements should include local employment quotas, community investment commitments, independent environmental monitoring, and a grievance redress mechanism.

B. Add water use limits and Zero Liquid Discharge requirements to environmental clearance conditions for all CCUS projects. Fund independent water monitoring programmes for the full duration of operations and post-closure.

C. Ministry-wise Recommendations

The following consolidated recommendations are organised by Ministry. Under each Ministry, actions are grouped into Short-Term, meaning achievable within two years through executive or administrative action; and Long-Term, covering actions requiring between three and seven years, legislation, or sustained investment.

Ministry of Finance (MoF)

Short-Term:

A. Carbon Contracts for Difference and a per-tonne CCUS Tax Credit in the range of INR 3,000 to 5,000 per tonne of CO_2 captured may be considered.

B. The Production-Linked Incentive scheme may be extended to include a CCUS equipment manufacturing tranche.

C. Reduce the GST tax slab applicable to CCUS components.

D. Establish a Pre-FID Grant Programme (reimbursable) so that companies can fund detailed engineering studies before committing capital.

E. Introduce blended finance structures for first-of-a-kind CCUS projects, combining concessional public capital with private investment.

Long-Term:

A. Create a dedicated CCUS Financing Window in National Bank for Financing Infrastructure and Development (NaBFID) with sovereign guarantees.

Ministry of Environment, Forest and Climate Change (MoEFCC)

Short-Term:

A. CCUS-specific carbon credit rules under the CCTS could be prioritised, with a view to enabling crediting of verified capture volumes by December 2026.

B. Issue interim CO_2 storage regulations under the Environment Protection Act 1986.

C. Create a single-window environmental clearance process for CCUS infrastructure with a mandated 180-day timeline.

D. Add water use limits and Zero Liquid Discharge requirements to environmental clearance conditions for CCUS projects.

E. Require new large industrial facilities emitting more than 1 million tonnes of CO_2 per year, commissioned after a defined date, to meet a Carbon Capture Ready design standard, ensuring physical space, utility connections, and structural provisions for future capture equipment are incorporated at the design stage.

F. Require Community Benefit Agreements as a standard condition of government financing and regulatory approval for CCUS projects, covering local employment commitments, independent environmental monitoring, and grievance mechanisms.

Long-Term:

A. Enact a National Carbon Storage Policy defining pore-space ownership, liability transfer, and monitoring standards.
B. Integrate CCUS into India's next NDC update as a recognised emission-reduction pathway.
C. Align the CCTS with international carbon credit standards (ICVCM Core Carbon Principles).
D. Develop a national CCUS transparency and monitoring platform.
E. Develop a standalone National CCUS Strategy with clear deployment targets of 50 million tonnes per annum by 2035 and 200 million tonnes per annum by 2040, with contributions identified by sector and supported by infrastructure mapping.
F. Initiate bilateral talks with the European Union on mutual recognition of Indian CCUS credits for CBAM compliance, aligned with India's CCTS development process.

Ministry of Law and Justice (MoLJ)

Long-Term:

A. In consultation with the Ministry of Environment, Forest and Climate Change and the Ministry of Petroleum and Natural Gas, develop a dedicated statutory framework for CCUS addressing underground pore space ownership, site permitting standards, conditions for liability transfer following a verified period of site closure monitoring, and storage scenarios that span multiple states.

Ministry of Petroleum and Natural Gas (MoPNG)

Short-Term:

A. Direct Directorate General of Hydrocarbons (DGH) to commence the National CO_2 Storage Atlas by Q1 2027.
B. Co-fund CO_2-Enhanced Oil Recovery feasibility studies at five mature oil fields.
C. Establish a fiscal incentive framework for CO_2-EOR projects using industrial CO_2.
D. Extend Petroleum and Natural Gas Regulatory Board (PNGRB)'s mandate to cover CO_2 pipelines.
E. Establish pricing clarity for advance ethanol and E-SAF produced from industrial waste gases, CO_2 and syngas, including eligibility for prevailing advance ethanol prices and a market-based or cost-plus pricing mechanism for E-SAF that bridges the gap with conventional fuel through fiscal support, tax credits, or blending levies.

Long-Term:

A. Develop priority CO_2 pipeline corridors for major industrial regions.
B. Implement the Sustainable Aviation Fuel blending mandate (2 % by 2027, 10 % by 2030).
C. Enact a dedicated CO_2-EOR Policy with investment-linked tax credits and royalty concessions.

D. Develop the Eastern India Steel Belt, which spans Odisha, Jharkhand and Chhattisgarh, as India's first CCUS Hub through a partnership between public and private investors, with the Government's equity contribution and financial structure to be determined through a detailed feasibility assessment.

Ministry of Steel (MoS)

Short-Term:

A. Introduce Green Public Procurement mandates for low-carbon steel (10 % quota by 2027).

B. Support pre-investment engineering studies at steel CCUS projects.

C. Engage with CBAM compliance strategy for steel exports to the EU.

Long-Term:

A. New greenfield steel plants emitting more than 1 million tonnes of CO_2 per year may be expected to meet a Carbon Capture Ready design standard.

B. Establish low-carbon steel emission intensity benchmarks under Bureau of Indian Standards (BIS).

C. Scale the Green Public Procurement quota to 50 % by 2035.

Ministry of Power (MoP) and Ministry of Coal (MoC)

Short-Term:

A. New thermal power capacity may be expected to meet a Carbon Capture Ready design standard.

B. Grant priority dispatch and a dedicated CCUS electricity tariff category through Central Electricity Regulatory Commission (CERC). It is further proposed that electricity generated at facilities with integrated carbon capture be considered for merit-order dispatch priority, that is, preferential access to the grid ahead of comparable but non-abated generation, so that the additional operational cost of running capture equipment does not erode the facility's competitive position in the power market.[4][5]

C. Include abandoned coal mines in the National CO_2 Storage Atlas.

D. Develop, in coordination with the Central Electricity Regulatory Commission (CERC) and the Ministry of New and Renewable Energy, a Renewable Energy and CCUS Integration Standard specifying the minimum share of renewable energy for CCUS operations: 30 percent by 2028 and 70 percent by 2033.

E. Provide targeted support for fuels and chemicals (ethanol, methanol, SAF, and other drop-in fuels) produced from CO_2 captured at power projects and coal gasification facilities, including viability gap funding for CCU project CAPEX, minimum offtake mandates, and price support mechanisms aligned with prevailing advance biofuel benchmarks.

Long-Term:

A. Develop dedicated Renewable Energy Zones for CCUS-intensive industrial clusters.

B. Develop a regulatory framework for CO_2 storage in abandoned coal mines.

Department for Promotion of Industry and Internal Trade (DPIIT) / Ministry of Commerce and Industry (MoCI)

Short-Term:

A. Designating CCUS infrastructure as Critical National Infrastructure may be considered to unlock access to long-term financing and sovereign guarantees.

B. Develop a CBAM Defence Strategy by accelerating the launch of the CCTS with binding minimum carbon prices.

C. Issue a formal notification confirming export eligibility for ethanol produced from industrial waste gases.

D. Establish the MSME CCUS Access Programme with SIDBI.

Long-Term:

A. Develop a national CCUS hub policy for major industrial corridors.

B. Mandate low-carbon procurement standards for government contracts.

Ministry of Road Transport and Highways (MoRTH)

Long-Term:

A. Establish 10–15-year supply agreements with CCUS-enabled producers for road construction materials at a green premium of 8 to 12 % above conventional rates.

Ministry of Civil Aviation (MoCA)

Short-Term:

A. Introduce a Sustainable Aviation Fuel pricing mechanism where the premium over conventional jet fuel is met through a blending obligation levy on airlines, supporting commercial offtake for SAF produced from captured CO_2.

Long-Term:

A. Establish a Sustainable Aviation Fuel Blending Obligation of 2 percent by 2027, 10 percent by 2030, and 25 percent by 2035, with SAF produced from captured CO_2 counting twice toward the obligation target.

Bureau of Energy Efficiency (BEE)

Short-Term:

A. Develop CCUS-specific measurement and verification protocols aligned with international standards (ISO 27916).

B. Certify third-party verification service providers.

C. Launch a digital monitoring pilot programme for CCUS projects.

Long-Term:

A. Establish a National CCUS Measurement and Verification Centre of Excellence.

B. Operate a national CO_2 monitoring registry.

C. Develop chain-of-custody standards for tracked CO_2.

Ministry of Corporate Affairs (MCA)

Long-Term:

A. Amend Corporate Social Responsibility regulations to allow CSR expenditure for indigenous CCUS technology development through public-private research partnerships.

Securities and Exchange Board of India (SEBI)

Long-Term:

A. Set carbon credit procurement targets for large listed companies through ESG disclosure requirements.

Department of Science and Technology (DST) / Ministry of Science and Technology (MoST)

Short-Term:

A. Extend carbon capture and utilization test beds from the cement sector to the steel sector.

B. Provide dedicated support for conversion of carbon-bearing process gases from blast furnaces and coke ovens into chemicals and fuels.

C. Fund a CCUS Research and Development Mission (INR 2,000 crore over 5 years).

D. Establish a public-private CCUS research consortium.

Long-Term:

A. Build indigenous CCUS technology capability to reduce import dependence.

B. Facilitate investment for research in integration of CCUS technologies in brownfield projects. [7][8]

C. Establish a Deccan Basalt Mineralisation Pilot Programme in collaboration with academic institutions. [16]

D. Include biomass-based gasification and gas conversion pathways in the national CCUS framework. [18]

E. Develop a carbon permanence assessment programme for storage sites.

Bureau of Indian Standards (BIS)

Short-Term:

A. Develop a national CO_2 Pipeline Safety Standard in collaboration with PESO, drawing on established international codes.

Long-Term:

A. Develop and notify Indian Standards for low-carbon steel, cement, and concrete incorporating captured CO_2.

Ministry of Skill Development and Entrepreneurship (MSDE)

Short-Term:

A. Publish a CCUS Workforce Needs Assessment by June 2027.

B. Initiate CCUS-specific training programmes through Industrial Training Institutes and polytechnics.

Long-Term:

A. A CCUS Skills Development Fund in the range of INR 500 to 800 crore over five years may be considered.

Ministry of New and Renewable Energy (MNRE)

Short-Term:

A. A hydrogen incentive linked to CCUS, of INR 20 to 30 per kg for green hydrogen used in CO_2 conversion, may be considered under the National Green Hydrogen Mission.

B. Designate CCUS Renewable Energy Zones for major industrial clusters in coordination with the Ministry of Power, granting priority grid connection, open access to renewable energy, and exemption from cross subsidy surcharges for CCUS operations.

Long-Term:

C. Develop a CO_2 Utilisation Roadmap mapping captured CO_2 availability against the projected green hydrogen cost trajectory.

NITI Aayog

Short-Term:

A. Coordinate a cross-sector CCUS Utilisation Platform connecting carbon sources with potential users.

B. Consideration may be given to constituting a National CCUS Coordination Body, comprising representatives from the steel, cement, power, refining, and chemical sectors alongside relevant ministries, to act as the central forum for public-private partnership development, knowledge sharing across projects, pooling of risk for shared pipeline infrastructure, and sustained ministry engagement. Such a body, potentially convened through CII's existing sectoral engagement mechanisms, would provide the coordination architecture that individual project developers currently lack.[1]

Long-Term:

A. Develop an integrated CCUS deployment roadmap across all hard-to-abate sectors with sector-specific milestones and timelines

References

[1] Chateau, J. (2023). A Framework for Climate Change Mitigation in India. IMF Working Papers, 2023(218). https://doi.org/10.5089/9798400247002.001

[2] Guevara, M. et al. (2024). A global catalogue of CO_2 emissions and co-emitted species from power plants. Earth System Science Data, 16, 337–373. https://doi.org/10.5194/essd-16-337-2024

[3] Kopperi, H. et al. (2026). India's Cement Industry: Meeting the Challenge of Emissions Abatement with Sustainable Growth. ChemRxiv.

[4] Long, X. (2026). Ambitious climate targets can make the phaseout of India's coal-fired power plants cost-beneficial. PMC.

[5] Mukherjee, S. (2022). Exploring a Design of Carbon Tax for Coal- and Lignite-Based Thermal Power Sector in India. Review of Market Integration, 14(2), 83–112. https://doi.org/10.1177/09749292221103916

[6] Paliwal, U. et al. (2016). Monthly and spatially resolved black carbon emission inventory of India. Atmospheric Chemistry and Physics, 16, 12457–12476. https://doi.org/10.5194/acp-16-12457-2016

[7] Shaw, R. & Mukherjee, S. (2022). The development of carbon capture and storage (CCS) in India: A critical review. Carbon Capture Science & Technology, 2, 100036. https://doi.org/10.1016/j.ccst.2022.100036

[8] Tikadar, B. (2025). Process-level emission analysis and decarbonization pathway for BF-BOF route in Indian iron and steel industry. Journal of Environmental Management, 373, 123483.

[9] Witecka, W.K. (2024). Low-carbon technologies for the global steel transformation. Publication Server of the Wuppertal Institute.

[10] Ministry of Steel, Government of India. National Steel Policy 2017.

[11] Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India. India's Long-Term Low Emissions Development Strategy. Submitted to UNFCCC, 2022.

[12] NITI Aayog. Carbon Capture, Utilisation and Storage (CCUS) Policy Framework and Its Deployment Mechanism in India. Government of India, 2022.

[13] NITI Aayog. (2026). Scenarios Towards Viksit Bharat and Net Zero - Sectoral Insights: Industry (Vol. 4). Green Transition, Energy, Climate, and Environment Division, NITI Aayog.

[14] Carbon Border Adjustment Mechanism: An Impact on India–EU Trade; Indian Council of World Affairs (www.icwa.in)

Glossary of Key Terms

Term / Acronym	Definition
45Q-style Tax Credit	Per-tonne income tax credit for CO_2 captured and stored or utilised, modelled on US IRC Section 45Q
Bureau of Energy Efficiency (BEE)	Bureau of Energy Efficiency (BEE), regulator under Ministry of Power (MoP)
BF-BOF	The steelmaking process using a blast furnace followed by a basic oxygen furnace; the dominant production route in India
CBAM	Carbon Border Adjustment Mechanism: EU trade policy imposing carbon levies on imports from 2026
CCfD	Carbon Contract for Difference: government-backed minimum carbon price guarantee for CCUS operators
CCS	Carbon Capture and Storage: capture followed by permanent geological injection
CCU	Carbon Capture and Utilisation: capture followed by conversion into products
CCUS	Carbon Capture, Utilisation and Storage: umbrella term covering CCS, CCU, and CO_2-EOR
CCTS	Carbon Credit Trading Scheme: India's national carbon market under Energy Conservation (Amendment) Act 2022
CO_2-EOR	CO_2-Enhanced Oil Recovery: injection into mature oil reservoirs for oil mobilisation and CO_2 sequestration
DAC	Direct Air Capture: technology for removing CO_2 from ambient air
Directorate General of Hydrocarbons (DGH)	Directorate General of Hydrocarbons (DGH)
FEED	Detailed pre-investment engineering assessment that brings project cost estimates to within a margin of 10 to 15 %, the level of accuracy required by financial investors
FID	Final Investment Decision
GPP	Green Public Procurement
H_2-DRI	Hydrogen-Direct Reduced Iron: near-zero-emission steelmaking route
MRV	Monitoring, Reporting and Verification
National Bank for Financing Infrastructure and Development (NaBFID)	National Bank for Financing Infrastructure and Development (NaBFID)
NDC	Nationally Determined Contribution under the Paris Agreement
PLI	Production-Linked Incentive: India's manufacturing promotion scheme
Petroleum and Natural Gas Regulatory Board (PNGRB)	Petroleum and Natural Gas Regulatory Board (PNGRB)

SAF	Sustainable Aviation Fuel
TRL	Technology Readiness Level: stage of technical development, ranging from laboratory concept (TRL 1) to commercial operation (TRL 9)
VGF	Viability Gap Funding
RPB (Rotating Packed Bed)	Compact, high-centrifugal-force absorption column that reduces the physical footprint of a capture unit by a factor of ten to twenty compared with standard designs
SOEC (Solid Oxide Electrolysis Cell)	High-temperature electrolyser used to convert industrial waste gases into useful chemical feedstocks
EAF (Electric Arc Furnace)	Steelmaking process using primarily recycled scrap metal and electricity, with significantly lower direct carbon emissions than the blast furnace route
Parasitic load / energy penalty	The share of a facility's energy output consumed by running the capture equipment
Injectivity	The rate and ease with which carbon dioxide can be pumped into a storage formation
Caprock integrity	The ability of the geological seal above a storage formation to prevent carbon dioxide from migrating upward
Plume monitoring	Tracking the movement and distribution of stored carbon dioxide underground over time
Supercritical CO_2	Carbon dioxide held at pressure and temperature conditions above a critical threshold, where it behaves like both a liquid and a gas, the state in which it is most efficiently transported by pipeline
Dry reforming of methane	A chemical process that converts methane and carbon dioxide together into a synthesis gas mixture of hydrogen and carbon monoxide, which can be used as a chemical feedstock

Confederation of Indian Industry

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering Industry, Government and civil society through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organisation, with over 10,500 members from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 365,000 enterprises from 332 national and regional sectoral industry bodies.

For more than 130 years, CII has been engaged in shaping India's development journey and works proactively on transforming Indian Industry's engagement in national development. CII charts change by working closely with the Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness, and business opportunities for industry through a range of specialised services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Through its dedicated Centres of Excellence and Industry competitiveness initiatives, promotion of innovation and technology adoption, and partnerships for sustainability, CII plays a transformative part in shaping the future of the nation. Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes across diverse domains, including affirmative action, livelihoods, diversity management, skill development, empowerment of women, and sustainable development, to name a few.

For 2026-27, CII has identified "Accelerating Competitiveness: Growth, Resilience, Inclusion, Sustainability, Trust" as its theme, prioritising five key pillars. During the year, CII will align its policy advocacy, institutional initiatives, partnerships, and outreach to support Indian industry in strengthening these five interconnected pillars of competitiveness.

With 70 offices, including 12 Centres of Excellence, in India, and 9 overseas offices in Australia, Egypt, Germany, Indonesia, Singapore, UAE, UK, and USA, as well as institutional partnerships with 255 counterpart organisations in 102 countries, CII serves as a reference point for Indian industry and the international business community.

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