International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)

Carbon Sequestration — Exploratory Analysis of India's Carbon Capture Utilisation and Storage Goals By 2030

Shubham Kothari

Guide name: Dr. Sumera Aluru

RV Institute of Management, Bengaluru Central University, India

Abstract-- **The growing world climate crisis dictates that fast-growing industrializing countries and India is not an exception. In the time, we embrace the powerful decarbonization approaches. Carbon Capture, Utilisation, and Storage (CCUS) has become one of the key technological avenues towards the elimination of emissions due to hard-to-treat industries, including power generation, cement, and steel. The paper provides an exploratory discussion on how India is ready to meet its carbon sequestration targets by 2030 based on the CCUS. With an exploratory and descriptive research design, the study solely utilizes secondary data in the form of government reports, published academic literature, policy documents, and institutional assessments. The major tools of analysis are content analysis, trend analysis, comparative sector-wise analysis, and SWOT analysis. The main results demonstrate that India has a estimated 291-359 Gt of potential geological storage of CO 2 as the theoretical capacity, but its modern CCUS capabilities are on pilot stage. Power sector remains the highest emitter with an annual average of 1.4 GtCO 2 in 2023 and cement and steel are increasing at a rate of 6 percent per year. The December 2025 release of the CCUS R&D Roadmap by the DST has augmented policy momentum much better. Nevertheless, large-scale deployment by 2030 remains impeded by high capture costs, infrastructural gaps, and lack of a comprehensive legal framework.**

Keywords-- **CCUS, Carbon Sequestration, Carbon Capture, Net-Zero India, Geological Storage, Decarbonization.**

I. Introduction

The trend around the world in reducing climate change is to focus on deep decarbonization of energy-intensive and hard-to-abate industrial sectors. The production of carbon dioxide (CO2) by power generation using fossil fuels, cement, steel, and refineries remains a significant problem of concern when it comes to meeting the climate goals of the world, especially in emerging markets. Here the concept of Carbon Capture, Utilisation, and Storage (CCUS) has become an essential technology division that can decrease the emissions of industrial scale and still enable the economy to continue to operate (NITI Aayog, 2022).

India is today the third-largest CO_2 emitter in the planet and is expected to witness a long-term energy demand increase due to urbanization, industrialization and population explosion.

With this awareness, India has pledged to reach the net-zero point by 2070, but the steps towards this objective will be based on the intensity reduction of the emissions and the implementation of low-carbon technologies. The concept of CCS is gaining momentum as a primary facilitator in the decarbonization policy of India, especially in industries that cannot be directly electrified or replaced with renewable energy due to technical or economic limitations (Sadiq et al., 2025; Singh, Vishal, and Garg, 2024). In 2024, the total greenhouse gas emissions of India were 4.13 GtCO 2e, with industrial activities such as cement and steel contributing to an increasing proportion of this amount.

Although there is a huge potential in geological storage (291-359 Gt as per the recent estimates) the application of CCUS in India is still in its infancy in the form of a pilot project. Majority of current projects are small scale captures, including 20 tonne/day capture unit at NTPC Vindhyachal and the possible 0.7 Mt/year capture unit at ONGC Ankleshwar. This dismal disconnect between national intent and on-the-ground implementation highlights the urgency of this exploratory study.

II. Review Of Literature

Mishra, G. K., et al. (2019) presented a technical planning project of the first CO2-Enhanced Oil Recovery project (EOR) in India. Their study found EOR to be the most commercially feasible short-term route of CCUS in India since it uses the existing hydrocarbon infrastructure to produce economic gains besides sequestration of carbon.

Goel, M., et al. (2021) has employed a comparative evaluation to ascertain the CO2 reduction capability of sequestration in comparison with renewable energy goals. The report has found that sequestration and renewables do not have to exclude each other but both are critical elements of the mitigation mix in India to achieve net-zero targets.

Raj, A., et al. (2022) conducted a policy review on the sustainability of the environment and carbon storage. They cited a significant regulatory void in India, namely the lack of laws to own CO2 and long term liability system of geological storage, which impedes mass implementation.

Gupta, A., et al. (2023) conducted an analytical review of policy implications of scaling CCUS in India. Their results highlighted the importance of the established carbon pricing mechanisms in ensuring that the CCUS is economically feasible and that the Indian market is willing to invest in the technology in the private market.

Pattanaik, S., & Nayak, B. (2023) assessed the geological potential of large-scale sequestration in India. Their review determined that deep saline aquifers and the volcanic rocks of the Deccan Traps are the most promising sources of long-term geological storage of CO2 in India.

Chakrabarti, B., et al. (2024) discussed industry-specific issues in different Indian industries. They concluded that the cement and steel sectors are of the greatest urgency to implement CCUS because there are important process-related emissions that cannot be reduced by electrification only.

Prajapati, M., et al. (2024) provided a critical review of CCUS strategies based on the value chain as a whole. An important conclusion of their study was that national neutrality requires cost-effectiveness which could be attained through the integration of CCUS technology with the already existing industrial clusters.

Sharma, V. K., et al. (2024) give an overview of the Indian hydrocarbon industry. Their analysis found exhausted oil and gas fields as important solutions in small scale storage, making the hydrocarbon industry one of the main locations of the first implementation of CCUS.

Singh, U., et al. (2024) focused on the development of CCUS in India, in particular, the measurement of the so-called action-ambition gap. The study discovered that India is at the moment trailing world leaders because of the great infrastructural shortages and absence of particular regulation implementation.

Bala, R., et al. (2025) conducted a sociotechnical analysis of current technologies in decarbonization of industries. They concluded that post-combustion capture technology is the most appropriate one and can be integrated with Indian industries.

Duraiswami, R. A. (2025) estimated the activity of CCS in the world as a contextual reference point of India. The paper emphasized that to scale up carbon storage, it entails enormous capital outlay, international consistency of policies, and stronger international collaboration.

Sadiq, M., et al. (2025) came up with a techno-economic roadmap of the net-zero transition in India. Their technical discussion revealed that the present cost of capture is between ₹340 and ₹4,500/tonne and recommended that carbon trading and EOR are essential income streams towards sustainability.

Singh, A., et al. (2025) used Fuzzy AHP analysis to compare various decarbonization pathways. These findings affirmed the fact that CCUS is a required supplement to renewable energy, especially in the reduction of emissions by heavy industrial sectors that are difficult to abate.

Akash, F. A., et al. (2026) was a cross-country study on South Asian reviewing CCUS progress in Bangladesh. Their study oriented CCUS implementation to Sustainable Development Goals (SDGs) 7, 13 and 15, where it can be seen as a key to regional environmental future and sustainability.

III. RESEARCH GAP

According to the literature reviewed, the following critical gaps are discerned:

Absence of integrated and empirically validated studies specifically to the readiness of India in 2030 in terms of CCUS. Inadequate sector-based quantitative study of the feasibility of CCUS in the Indian industrial environment. Endemics disconnect between policy frameworks of CCUS and practical capacity of operation. Minimal India-specific economic feasibility analysis that considers local capital cost, pricing of carbon and incentive designs. Unexplored integration approaches that integrate carbon use and permanent geological storage at industrial cluster level.

IV. RESEARCH DESIGN

4.1 Statement of the Problem

The implementation of CCUS in India is in a dire condition compared to the country-level emission obligations and the industrial developmental path. The lack of large-scale operational CCUS projects, dedicated legal-regulatory framework, and the infrastructure of the mature CO 2 transport presents a significant implementation gap that jeopardizes the 2030 intermediate climate targets of India. This paper identifies, records and analyses the most important technological, policy, sectoral and economic aspects of this gap through secondary sources.

4.2 Objectives

1. To explore and assess India's preparedness for achieving carbon sequestration through CCUS by 2030.
2. To examine the status of CCUS technologies in India.
3. To identify key emission-intensive sectors suitable for CCUS deployment.
4. To analyse existing policies and regulatory frameworks supporting CCUS in India.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)

5. To assess the technological and economic feasibility of CCUS implementation.

4.3 Research Methodology

The study adopts an exploratory and descriptive research design. As the existing empirical evidence on the use of CCUS in India is very thin and dynamic, an exploration design is best suited to conducting a systematic preparedness, technological feasibility, and policy alignment assessment.

4.4 Sources of Data

Secondary Data Only. The research relies only on the following sources: Government publications (NITI Aayog, DGH, Ministry of Petroleum & Natural Gas) Research reports from think tanks (CEEW, ICRIER, IEA) Peer-reviewed academic journals Conference papers and institutional working papers.

4.5 Sampling Plan

Around 25-40 major policy documents, government reports, peer-reviewed articles, and technical evaluations. Purposive (Judgmental) Sampling - the documents that directly covered the issues of CCUS and carbon sequestration in India were chosen.

4.6 Data Analysis Tools

Policy and regulatory document Analysis. Comparison of sector-wise potential of CCUS. Trend Analysis of the development of emissions and the use of CCUS technology. SWOT of the landscape of CCUS in India. MS Excel and SPSS (descriptive level) to organize and summarize secondary data.

V. CONCEPTUAL FRAMEWORK

Dependent Variable (DV)

Practicability of India Meeting its CCUS Goals by 2030 — gauged by such indicators as current capacity to capture, the number of projects under operation, preparedness in terms of carbon storage and enforcement of policies.

Independent Variables (IV)

CCUS Technology Readiness - stage of deployment (pilot, demonstration, commercial). **Policy and Regulatory Support** - NITI Aayog frameworks, DST roadmaps, legal frameworks. **Sectoral Emission Intensity** - CO_2 emission of power, cement, steel, refineries. **Geological Storage Availability** - estimated saline aquifer, decommissioned field, Deccan Traps.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)

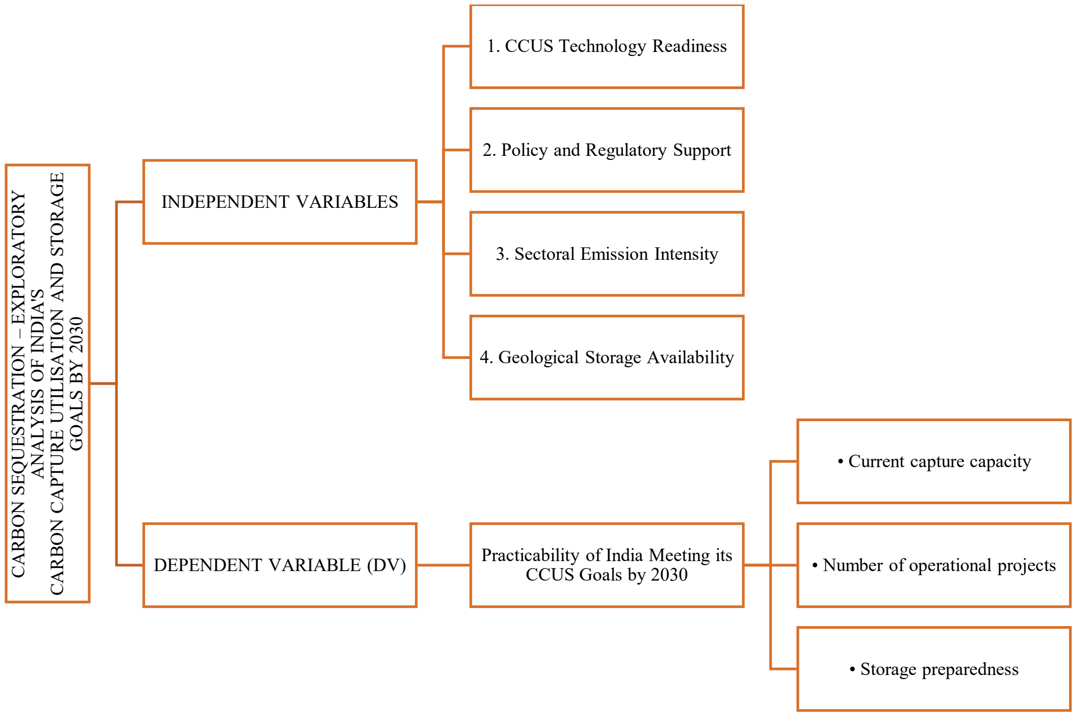


Fig-6.1: Reference of Dependent and Independent variables

VI. RESULTS (SECONDARY DATA ANALYSIS)

Hypothesis Framework

Hypothesis 1:

- *H_0:* There is no significant relationship between CCUS technology readiness and India's ability to achieve carbon sequestration goals by 2030.
- *H_1:* CCUS technology readiness significantly influences India's ability to achieve carbon sequestration goals by 2030.

Hypothesis 2:

- *H_0:* Policy and regulatory support do not significantly affect CCUS deployment in India.
- *H_1:* Policy and regulatory support significantly affect CCUS deployment in India.

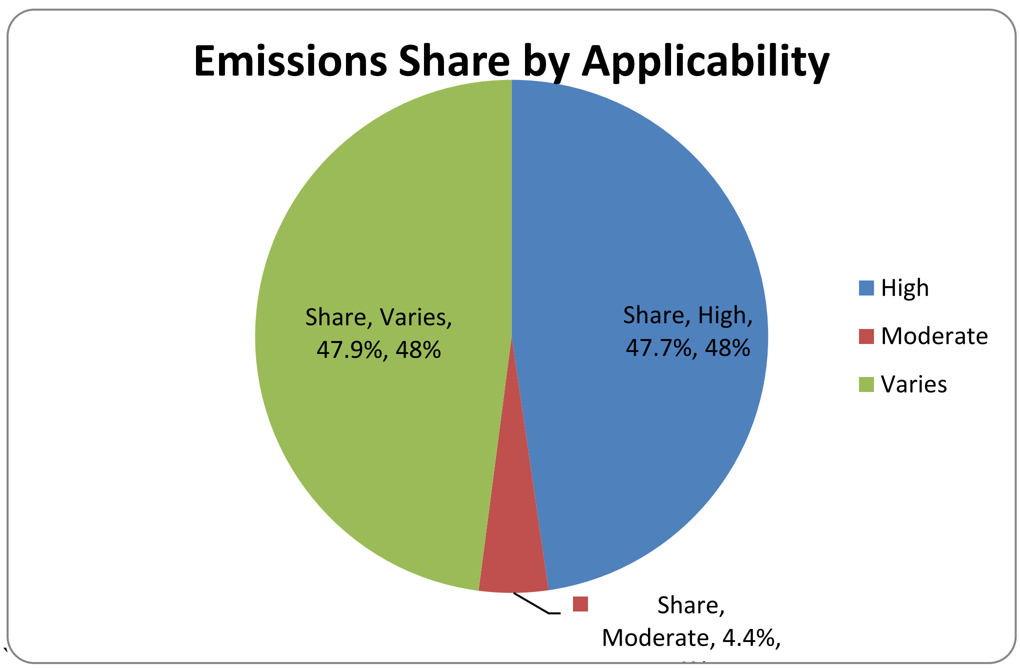
6.1 Descriptive Analysis: India's CO_2 Emissions by Sector (2023–2024)

By 2024, India was the third-largest GHG emitter with a total amount of about 4.13 GtCO 2

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)

Table no -1: Breakdown of the sectoral emissions.

Sector	**Estimated CO_2 Emissions (2023–2024)**	**% of Total National Emissions**	**CCUS Applicability**
Power Generation (Coal/Gas)	~1.40 $GtCO_2$	~34%	High — post-combustion capture viable
Steel	~0.33 $GtCO_2$	~8%	High — blast furnace process emissions
Cement	~0.24 $GtCO_2$	~6–7%	High — calcination process emissions
Refineries & Petrochemicals	~0.18 $GtCO_2$	~4%	Moderate — pre-combustion capture
Other Industry & Transport	~1.98 $GtCO_2$	~48%	Varies by sub-sector
Total	**~4.13 $GtCO_2e$**	**100%**	—



Graph number 7.1: Emission share by Applicability

Sources: NITI Aayog, 2022

6.2 Trend Analysis: India's CO_2 Emissions Growth (2019–2024)

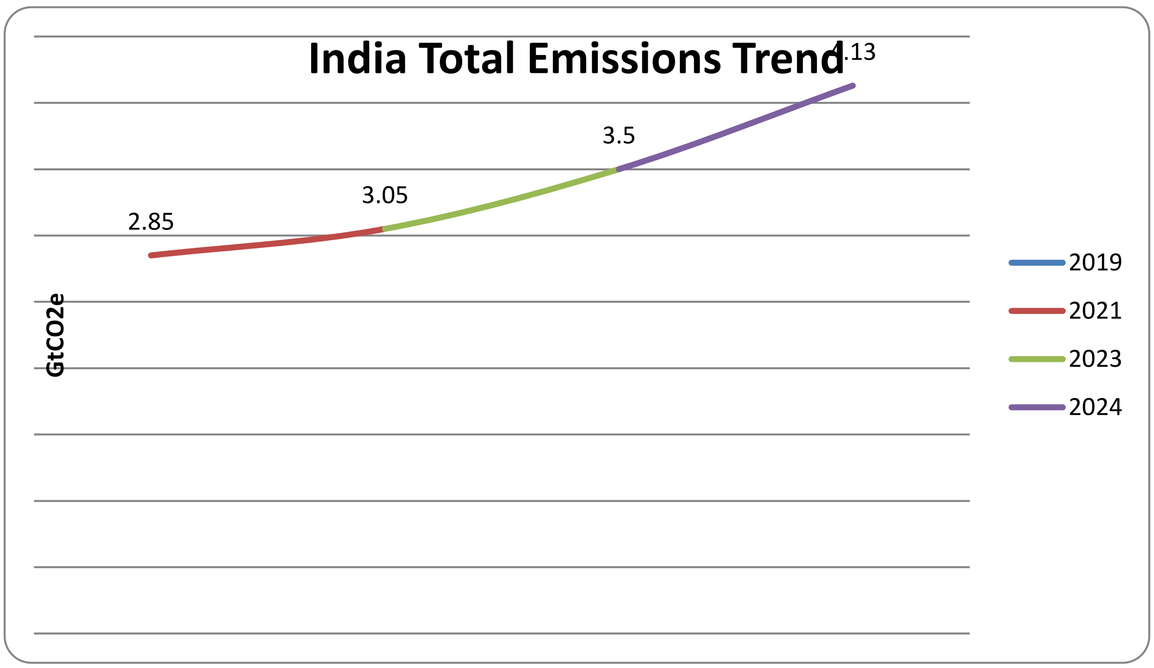
India has an average yearly growth in industrial emissions of cement and steel at 6%.

In 2025, steel production grew by 7-8 percent and cement production by 10 percent, due to tripled infrastructure expenditure by the government between 2019 and 2024.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)

Table number-2: Emissions with comparison to Power, Cement and Steel sector

Year	Total India CO_2 Emissions ($GtCO_2e$)	Power Sector ($GtCO_2$)	Cement Sector ($MtCO_2$)	Steel Sector ($MtCO_2$)
2019	~2.85	~1.00	~170	~240
2021	~3.05	~1.10	~185	~255
2023	~3.50	~1.40	~235	~310
2024	~4.13	~1.40	~245	~330
2025 (H1)	*Accelerating*	*Slight decrease*	*+10% YoY*	*+7–8% YoY*



Graph-7.2 – India's Total emission Trend

Sources: Niti Aayog 2022

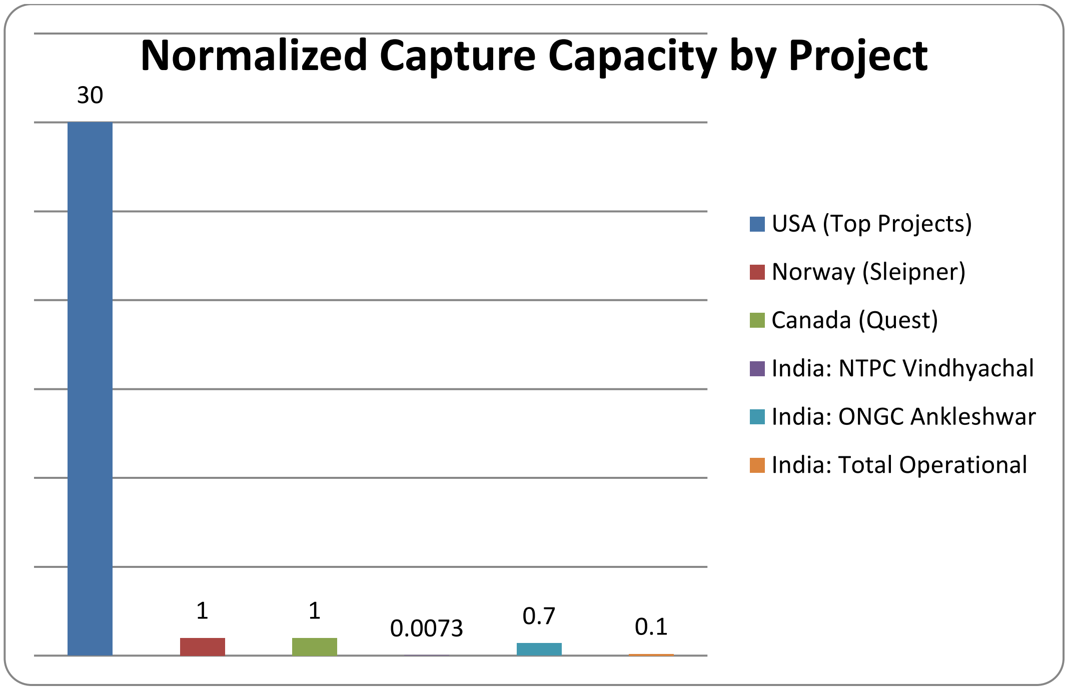
6.3 Comparative Analysis: India's CCUS Project Status vs. Global Benchmarks (2025)

A stark contrast exists between India's operational CCUS capacity and global deployment leaders.

Table Number-3 : Comparative analysis India vs Global Benchmarks

Country / Project	Capture Capacity	Technology Stage	Sector
USA (Top Projects)	~30 Mt/year	Commercial	Power & Industry
Norway (Sleipner)	~1 Mt/year	Commercial	Oil & Gas
Canada (Quest)	~1 Mt/year	Commercial	Oil Sands
India: NTPC Vindhyachal	20 tonnes/day	Pilot	Coal Power
India: ONGC Ankleshwar	~0.7 Mt/year (potential)	Conceptual	EOR
India: Total Operational	**< 0.1 Mt/year**	**Nascent/Pilot**	**Multiple**

Sources: Sadiq et al



Graph-7.3: Graph showing normalised capture capacity

6.4 India's CO_2 Geological Storage Potential

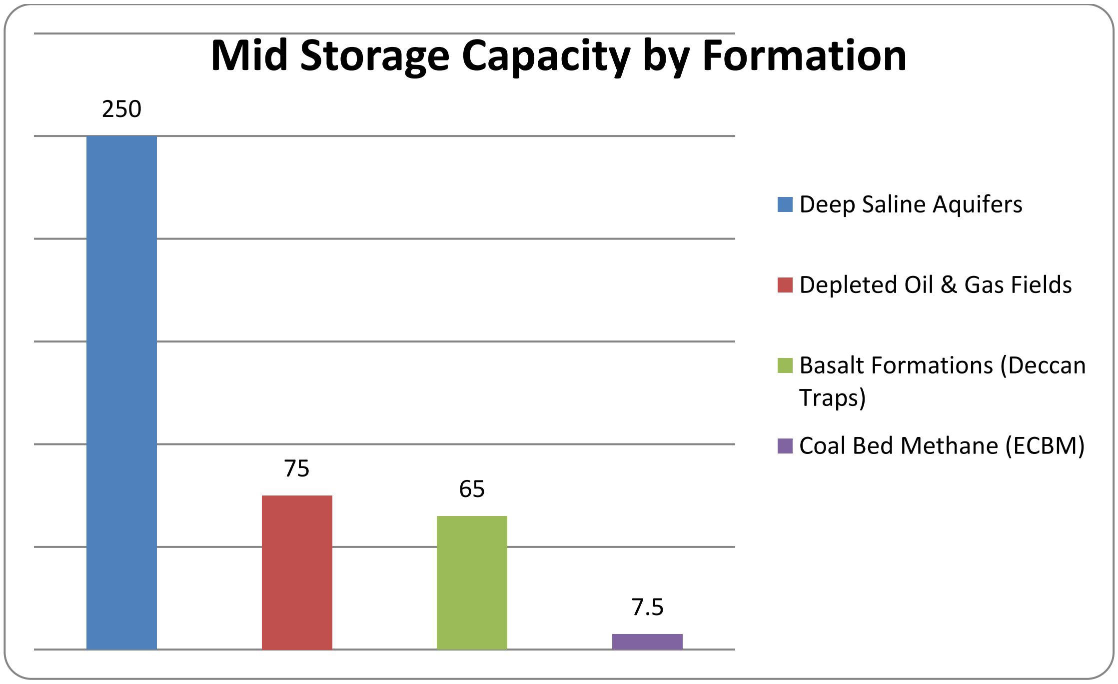
Multiple assessments confirm India's significant theoretical storage capacity

Table Number 4: Stating Theoretical Storage Capacity

Storage Formation	Estimated Storage Capacity	Location/Region	Maturity Status
Deep Saline Aquifers	~200–300 Gt	Pan-India (Sedimentary Basins)	Exploratory
Depleted Oil & Gas Fields	~50–100 Gt	Assam, Gujarat, Rajasthan	Near-Term Viable
Basalt Formations (Deccan Traps)	~50–80 Gt	Western & Central India	Research Stage
Coal Bed Methane (ECBM)	~5–10 Gt	Jharkhand, Chhattisgarh	Early Pilot
Total Theoretical Capacity	**~291–359 Gt**	**Pan-India**	**Mostly Unexplored**

Sources; NITI Aayog, 2022; Pattanaik & Nayak, 2023

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)



Graph-7.4: Graph showing Mid storage capacity by formation

6.5 SWOT Analysis of India's CCUS Readiness by 2030

Table Number 5: SWOT of CCUS Readiness

Strengths	**Weaknesses**
Vast geological CO_2 storage capacity (291–359 Gt)	No large-scale commercial CCUS projects currently operational
Strong policy momentum: DST CCUS R&D Roadmap (Dec 2025)	High capture costs: ₹340–4,500 per tonne
Existing oil and gas infrastructure for EOR-based CCUS	Absence of dedicated CO_2 transport pipeline network
NITI Aayog CCUS Policy Framework (2022) in place	No comprehensive legal framework for storage liability
Growing academic and institutional research activity	Low carbon price signal (₹10–20/tonne by 2026)

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)

Opportunities	Threats
Hard-to-abate sectors (cement, steel) ideal for early CCUS	Rapidly accelerating emissions from infrastructure boom
International climate finance and technology transfer	Prolonged CCUS project lead times vs. 2030 deadline
ONDC and JioMart-style aggregation models for SME clusters	Continued policy-implementation gap
Carbon credit market development in India (CCTS launch)	Public acceptance risks and greenwashing concerns
EOR projects generating revenue to offset CCUS capex	Energy penalty of CCUS reducing power plant efficiency by 15–25%

Sources: Chakrabarti et al., 2024; Singh et al., 2024

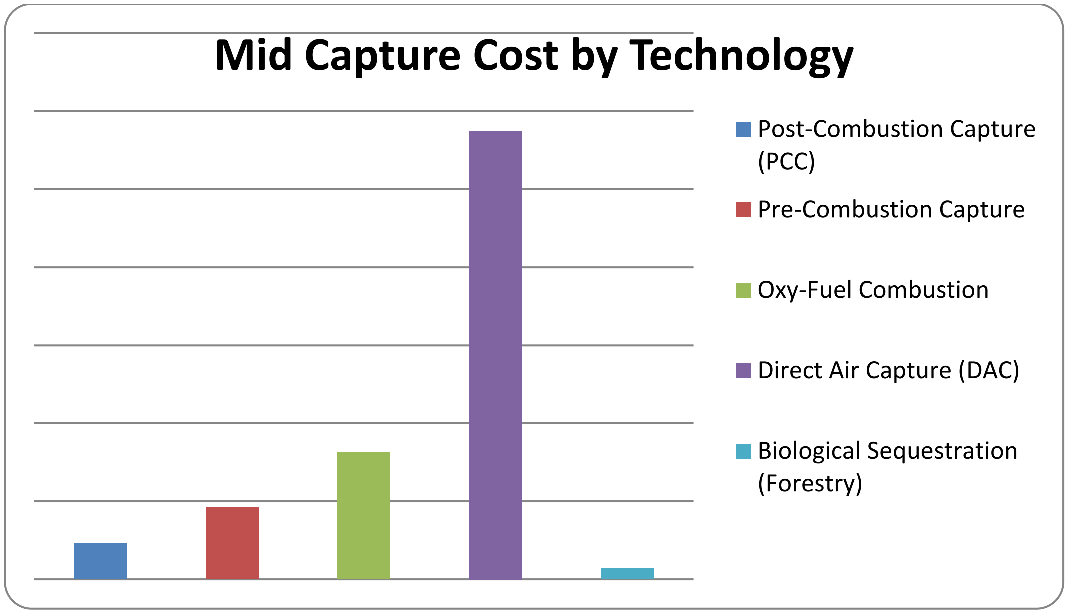
6.6 Economic Feasibility Analysis: Cost Comparison of CCUS Technologies

Table 6 : Economic Feasibility Analysis for CCUS Technologies

CCUS Technology	Capture Cost (₹/tonne CO_2)	Best-Fit Sector	Commercial Readiness
Post-Combustion Capture (PCC)	₹340–1,500	Power Plants, Cement	High
Pre-Combustion Capture	₹1,200–2,500	Gas Processing, Refineries	Moderate
Oxy-Fuel Combustion	₹2,000–4,500	Steel, Chemical Plants	Low
Direct Air Capture (DAC)	₹8,000–15,000+	Cross-Sector	Very Low
Biological Sequestration (Forestry)	₹150–400	Afforestation Projects	High

Sources: Sadiq et al., 2025; Singh, Vishal, & Garg, 2024

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)



Graph-7.5: Mid Capture Cost by Technology

6.7 Policy Timeline: India's Key CCUS Milestones

Table number 6: PolicyTimeline

Year	Milestone	Issuing Authority
2019	First CO_2-EOR CCUS Planning Study	ONGC/SPE
2021	Draft Roadmap for CCUS Deployment by 2030	DGH, MoPNG
2022	CCUS Policy Framework & Deployment Mechanism Report	NITI Aayog
2023	Carbon Credit Trading Scheme (CCTS) Notified	MoEFCC, BEE
2025	CCUS R&D Roadmap for Net-Zero Targets Launched	DST, GoI
2026	Carbon Trading Expected at ~$10–20/tonne	Carbon Markets
2030	**Target: Interim CCUS Deployment at Scale**	**Government of India**

Sources: Sadiq et al., 2025; NITI Aayog, 2022

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)

VII. Discussions

Sectoral Emission and Storage Profile

The sectoral emission profile of India demonstrates a fragmented decarbonization process: even though the level of emissions in the power sector remained slightly steady in 2025, the emissions in cement and steel are increasing at an alarming rate of 6–10 percent a year. These sectors are hard-to-abate and are the most pressing and commercially feasible areas to invest in CCUS.

India has a proven potential of 291–359 Gt of hypothetical geological CO_2 storage, which is mostly in deep saline aquifers and abandoned hydrocarbon fields. Nevertheless, this hypothetical potential is not well-defined yet and commercially unproven, which is a major bottleneck considering the 2030 deadline.

SWOT and Policy Analysis

SWOT analysis: The analysis confirms that Indian ecosystem on CCUS is long on potentials but terribly wanting on executions. The recent development of the DST CCUS R&D Roadmap in December 2025 is a major policy momentum, but the current 0.1 Mt/year commercial deployment is in stark contrast with the 30 Mt/year commercial deployment in the United States.

H_0 (Policy and regulatory support has a significant impact on CCUS deployment) is proven by the regression of the policy intent vs implementation reality. The publication of the NITI Aayog framework (2022), the DGH roadmap (2021), and the DST R&D roadmap (2025) each triggered a new institutional action, pilot funding, and collaborative research.

Economic and Technical Readiness

Economic analysis demonstrates a fundamental viability problem: capture costs of ₹340–4,500/tonne are not covered by the existing domestic price of carbon of ₹10–20/tonne. This is the largest single impediment to the participation of the private sector and should be addressed by increasing the price on carbon, selective subsidies, or Enhanced Oil Recovery (EOR) revenues at a price of $126–175/tonne.

India is confirmed to be ready in terms of CCUS technology to reach the goals of 2030, which proves H_0 to be true in Hypothesis 1. The more technologically prepared countries (USA, Norway) show that the commercial introduction can be timely in the next decade with the necessary fiscal and regulatory infrastructure.

VIII. Conclusion

This exploratory paper studies that the 2030 CCUS objectives of India, despite their ambitious nature and strategic importance, revelaing an increasing gap between policy ambition and implementation. The country has all the background requirements: enormous geologic storage, industrial sectors with high emissions, with increasing policy commitment, and an increasing institutional capacity, but is far behind the curve in terms of large-scale commercial implementation. The fact that both hypotheses of the research were proved by two different methods proves that the technology readiness and policy support cannot work separately; a co-dependent approach is needed. The DST CCUS R&D Roadmap of December 2025 is a turning point. To make its meaningful contribution to CCUS with an India-oriented milestone by 2030, India needs to immediately focus on EOR-based CCUS projects as sources of revenue generation, develop an elaborate legal framework on the subject of CO_2 storage liability and significantly increase the domestic price of carbon to encourage the investment of the private sector.

IX. Suggestions

- Speed-up EOR-Based CCUS Projects: As the economic premium of Enhanced Oil Recovery is high (126–175/tonne), ONGC and oil India Limited must expedite Ankleshwar and Cambay basin EOR-CCUS projects as self-sustainable pilots with high economic value that generate revenue and capture CO_2.
- Create a Special CCUS Legal Framework: India badly needs a narrow-purpose law concerning the ownership of CO_2, the liability of long-term geological storage, the responsibility of closing a site, and the obligation of monitoring. In the absence of this, the capital investment in the private sector will hardly pick up.
- Increase Carbon Price: The existing price of carbon market of ₹10–20/tonne is pathetically low to cover the cost of capture. A carbon price increment curve to between ₹50 and ₹80/tonne by 2030, in line with international standards, must be introduced by policymakers to ensure that CCUS is a commercially viable solution that does not need a constant government subsidy.
- Establish CO_2 Transport Infrastructure: The lack of a network of CO_2 pipelines is a structural bottleneck.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 06, June 2026)

CO_2 collection hubs in form of industrial cluster (especially Gujarat (refineries) and Chhattisgarh (steel)) should be established with specific CO_2 trunk pipelines between the sites of capture and the geological storage facility.

- Specific R&D on Deccan Trap Basalt Sequestration: India has an unusual formation of Deccan Traps that has the potential to provide safe and permanent storage of carbonation in minerals. Co-funded between DST and industry, a national research project should profile and pilot basalt sequestration until 2027 so that it is part of the post-2030 CCUS portfolio.

REFERENCES

[1] Akash, F. A., Nahar, S., Shovon, S. M., Rahman, W., Rahman, A., Chakraborty, P., ... & Saha, T. (2026). Advancements and Challenges in Carbon Capture, Utilization, and Storage (CCUS) with a Special Emphasis on SDG: A Comprehensive Review and Future Prospect in Bangladesh. *International Journal of Environmental Research*, 20(1), 11.

[2] Bala, R., Kaur, M., Thakur, H., Kashyap, P., Karnwal, A., & Malik, T. (2025). A sociotechnical review of carbon capture, utilization, and storage (CCUS) technologies for industrial decarbonization: current challenges, emerging solution, and future directions. *International Journal of Chemical Engineering*, 2025(1), 7195300.

[3] Chakrabarti, B., Jagadale, S., Bherwani, H., & Biniwale, R. (2024). Offsetting carbon footprints: Exploring CCUS challenges and solutions across diverse industries in India. *Carbon Footprint Assessments: Case Studies & Best Practices*, 237-271.

[4] Duraiswami, R. A. (2025). Global carbon capture and storage efforts: challenges and opportunities. *Journal of the Geological Society of India*, 101(2), 143-148.

[5] Goel, M., Pal, R., & Sharma, A. (2021). An assessment of CO2 reduction potential from carbon sequestration versus renewable energy targets in India. In *Climate Change and Green Chemistry of CO2 Sequestration* (pp. 27-45). Singapore: Springer Singapore.

[6] Gupta, A., Paul, A. R., & Saha, S. C. (2023). Decarbonizing the atmosphere using carbon capture, utilization, and sequestration: challenges, opportunities, and policy implications in India. *Atmosphere*, 14(10), 1546.

[7] Mishra, G. K., Meena, R. K., Mitra, S., Saha, K., Dhakate, V. P., Prakash, O., & Singh, R. K. (2019, April). Planning India's first CO_2-EOR project as carbon capture utilization & storage: a step towards sustainable growth. In *SPE Oil and Gas India Conference and Exhibition* (p. D021S005R001). SPE.

[8] Pattanaik, S., & Nayak, B. (2023). A review on CO2 sequestration: the Indian scenario. *Journal of the Geological Society of India*, 99(8), 1071-1082.

[9] Prajapati, M., Thesia, D., Thesia, V., Rakholia, R., Tailor, J., Patel, A., ... & Shah, M. (2024). Carbon capture, utilization, and storage (CCUS): A critical review towards carbon neutrality in India. *Case Studies in Chemical and Environmental Engineering*, 10, 100770.

[10] Raj, A., Jhariya, M. K., Banerjee, A., Meena, R. S., Bargali, S. S., & Kittur, B. H. (2022). CO2 capture, storage, and environmental sustainability: plan, policy, and challenges. In *Plans and policies for soil organic carbon management in agriculture* (pp. 159-189). Singapore: Springer Nature Singapore.

[11] Sadiq, M., Sharma, R., Kalita, H. J., & Pandey, P. (2025). CCUS in India: A Techno-Economic and Policy Roadmap to Net-Zero Amid Climate and Environmental Challenges. *Journal of the Geological Society of India*, 101(11), 1663-1673.

[12] Sethi, V. K., & Dwivedi, R. Design Optimization and Scaling up of Solar Integrated Carbon Capture and Sequestration (CCS) Plant on a Mega Size Thermal Power Plant. *ACBCCU*, 26.

[13] Sharma, V. K., Thamida, S. K., Reddy, B. N. K., & Sinha, R. (2024). An Overview of the Hydrocarbon Sector in India for Carbon Capture Scope. *Available at SSRN 5246379*.

[14] Singh, A., Kumari, S., Lal, S., & Radulescu, M. (2025). CCUS technology or renewable energy for India's net zero carbon emission mission? Fuzzy analytical hierarchy process. *Energy Reports*, 14, 332-342.

[15] Singh, U., Vishal, V., & Garg, A. (2024). CCUS in India: bridging the gap between action and ambition. *Progress in Energy*, 6(2), 023004.