TOWARDS A
LOW-CARBON FUTURE

DASTUR ENERGY

CCUS application for decarbonization of Oil and Gas industry of North East India

Capturing Today. Securing Tomorrow.

ASIA CLEAN ENERGY FORUM 2026

Beyond Transition: Building Secure, Resilient, Inclusive, and Intelligent Energy Systems

8–11 June | ADB Headquarters, Metro Manila, Philippines

Speaker
Soukarsa Das
Dastur Energy Pvt. Ltd., India

Co-Speaker
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H_2 via Water Electrolysis

Sustainable Methanol

e-SAF for Aviation

11th June 2026

ADB

1 About Dastur

2 Indian refineries & Emissions

3 CCU Project Design

4 Policies & Markets

5 Project Economics

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Advancing global energy transformation by designing and deploying scalable, high-impact solutions grounded in both techno-economic rigor

DASTUR ENERGY

1. ~ 7 decades of experience in engineering, technology and consulting

2. Architecting marquee industrial-scale projects across chemicals, clean energy, carbon capture, CO_2 to value, hydrogen, gasification systems, steel and cement

3. 1000+ clients in over 20 countries; several Fortune 500 clients

4. Thought leadership in shaping the Decarbonization policies and technology narratives

5. End-to-end solution providers with a comprehensive team of Business consultants, technologists, engineers, and economic & commercial experts

Dastur Energy Value Proposition

Design & Solutions

Concept, Market Model, Policy, Feasibility, System Design

Technology & Engineering

Technology Licensing, IP & Knowhow, Basic Engineering / PDP

Economics & Finance

Techno-Economics, FEED, pre-FEED

Formulating Strategies for Policy Development

Policy Framework, Implementation and Regulatory Support

Decarbonization

- Carbon Capture Systems
- CO_2 Transport – Clusters & Grids
- EOR & Sequestration
- Carbon to Value (Methanol, Mineralization)

Clean Energy

- Coal Gasification
- H_2, Ammonia, Methanol and Derivatives
- Fuel Blends
- Clean Power Systems

Our Global Footprint

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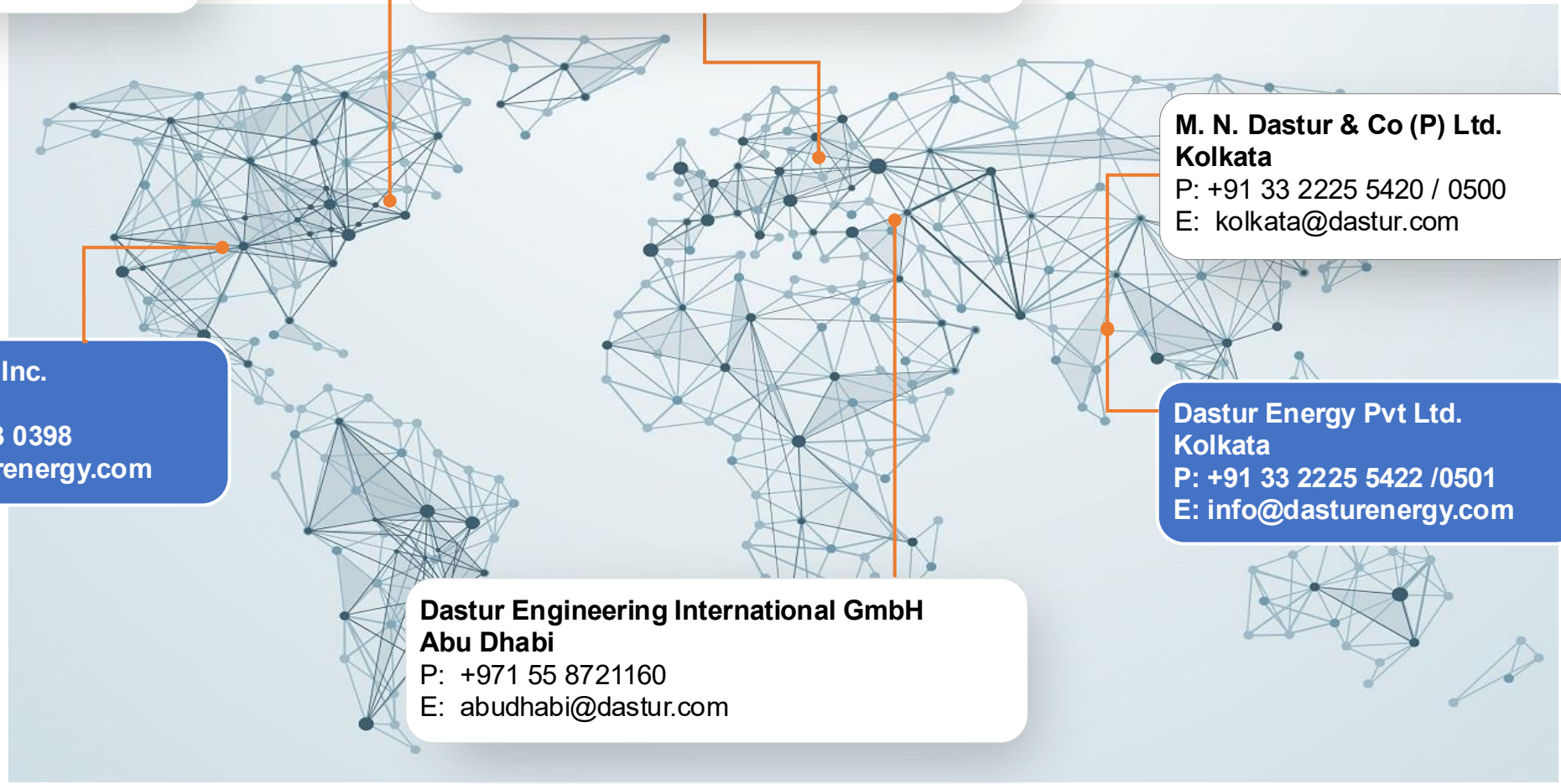

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Our Selected recent Experience in Industrial Scale Decarbonization Across the Globe

Feasibility for CCU- 0.7 MTPA **CO_2 capture from Refinery SMR**

CO_2 disposition - CO_2 EOR and Food Grade utilization

Roadmap for CO_2 emission avoidance

Feasibility for CCUS - CO_2 capture at 3 IOCL refineries

Utilization of **captured CO_2 for alternative fuel -** marine and aviation sectors

Techno economics , Policy, Environment, Social, Risk Analysis of CCU value chain

0.9 MMTPA CO_2 capture from Merchant SMR

FEED Engineering, Class 3 cost estimate, CO_2 Life Cycle Analysis

Enabling production of 100 ktpa of clean hydrogen

Techno-economic assessment of 3.6 MMTPA CO_2 capture

Decarbonization of 618 MW IGCC power plant

Assistance in securing Govt. funding

Decarbonisation Strategy for multiple steel plants

Steel growth with reduced carbon footprint

GHG mapping and reduction roadmap

CCUS in Decarbonization of Indian ISPs

Carbon Capture in BF-BOF based ISP, CO_2 to X, CO_2 Storage

Policy review, Carbon Markets, techno economics

3 MMTPA CO_2 capture from a steel plant with H_2 production optionality

Pre-FEED Engineering, Class 4 cost estimate, CO_2 Life Cycle Analysis

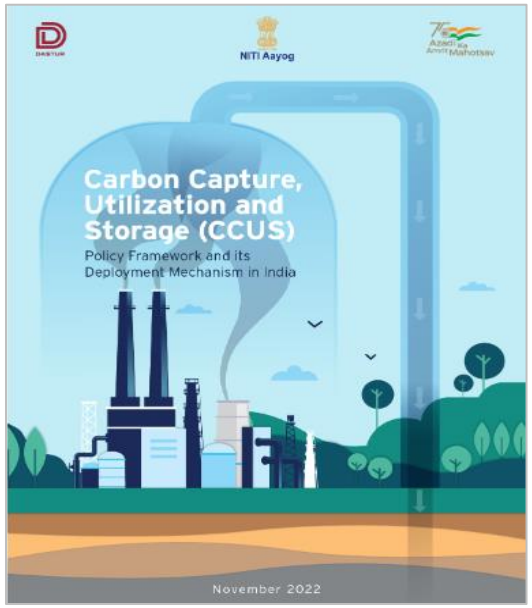
Assistance in securing Govt. funding

Techno-economic assessment of 2 MMTPA CO_2 capture

H_2 based DRI making – options for switching from natural gas to H_2

Our **Thought Leadership** in Industrial Decarbonization Initiatives

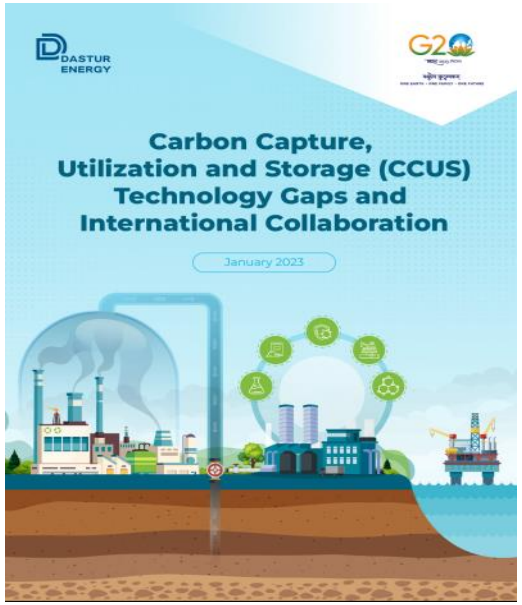
CCUS Policy & Implementation Roadmap for India



https://tinyurl.com/29a5k985

Milestone report on CCUS in India published in 2022 highlights key areas of Policy, Technology, Regulation, and Financing Framework

CCUS Technology Gap Assessment for G20



https://tinyurl.com/48a3bhs4

Technology-focused report published in 2023 during India's G20 presidency highlights areas of Technology, Economics, Policy & Collaboration Ecosystem essential to advance CCUS

CCUS in Decarbonizing India's Steel Sector

Role of Carbon Capture, Utilization, and Storage in Decarbonizing India's Steel Sector

December 2025

CLIMATE POLICY INITIATIVE · SED FUND · DASTUR ENERGY

https://tinyurl.com/3tnehwdk

Decarbonization of BF-BOF based ISPs through Techno-Economically Viable CCS – a key imperative for Net Zero Goals for Iron & Steel Sector in India

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Background of the Indian Refinery Industry & Emissions Challenge

INDIA'S REFINERIES

CAPACITY (MMTPA)

INDIAN OIL CORPORATION (IOC)	
1 Panipat	15.0
2 Mathura	8.0
3 Barauni	6.0
4 Haldia	8.0
5 Paradip	15.0
6 Guwahati	1.0
7 Bongaigaon	2.7
8 Digboi	0.65
9 Koyali (Gujarat)	13.7
IOC TOTAL	69.0

BHARAT PETROLEUM CORP. LTD. (BPCL)	
10 Mumbai	12.0
11 Kochi	15.5
BPCL TOTAL	27.5

HINDUSTAN PETROLEUM CORP. LTD. (HPCL)	
12 Mumbai	9.5
13 Visakhapatnam (Vizag)	15.0
HPCL TOTAL	24.5

RELIANCE INDUSTRIES LIMITED (RIL)	
14 Jamnagar (DTA)	33.0
15 Jamnagar (SEZ)	35.2
RIL TOTAL	68.2

NAYARA ENERGY	
16 Vadinar (Jamnagar)	20.0
NAYARA TOTAL	20.0

MRPL (ONGC Group)	
17 Mangalore	15.0
MRPL TOTAL	15.0

NRL (Numaligarh Refinery Ltd.)	
18 Numaligarh	3.0
NRL TOTAL	3.0

CPCL (Chennai Petroleum Corp. Ltd.)	
19 Chennai (Manali)	10.5
CPCL TOTAL	10.5

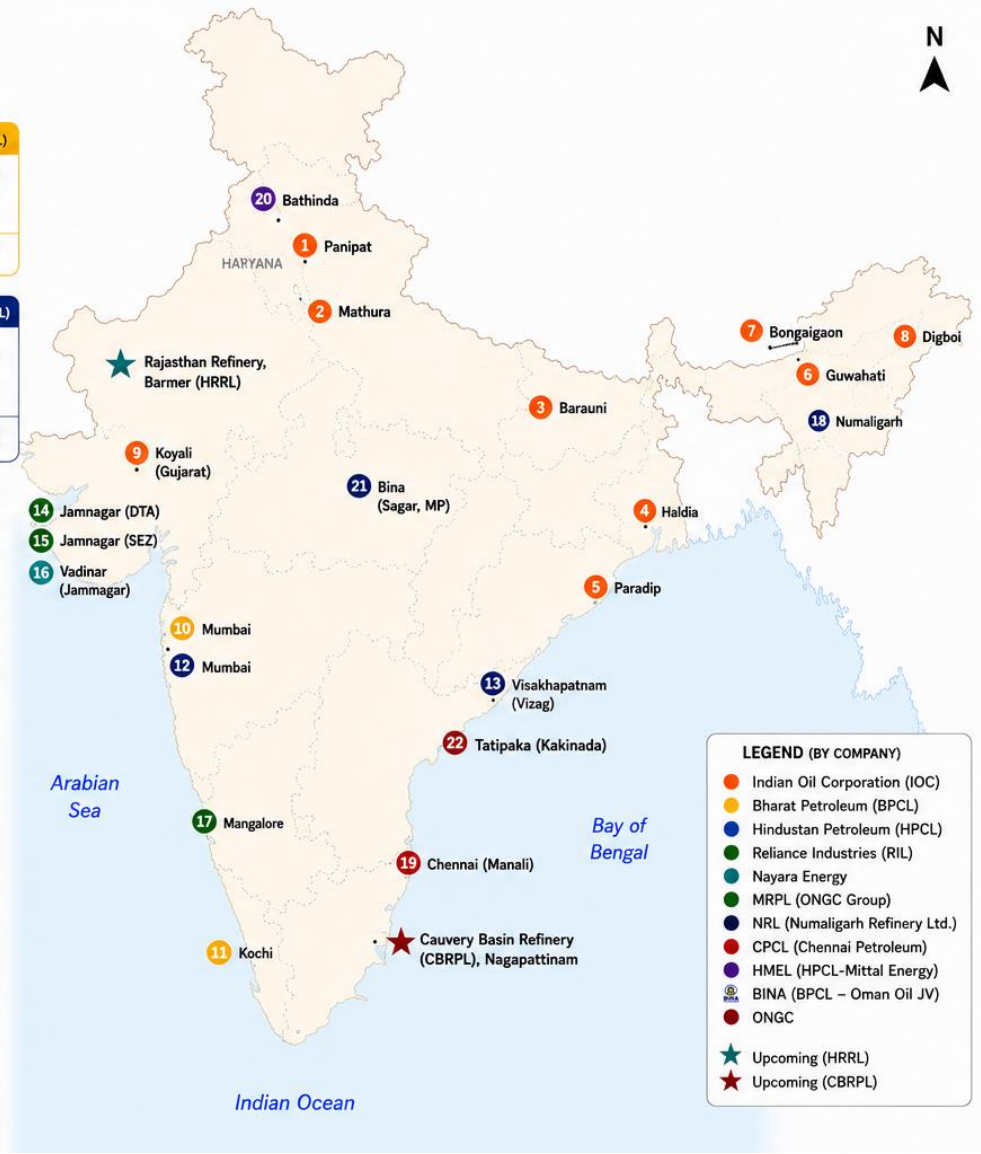
HMEL (HPCL-Mittal Energy Ltd.)	
20 Bathinda	11.3
HMEL TOTAL	11.3

BINA REFINERY (BPCL – Oman Oil JV)	
21 Bina (Sagar, MP)	7.8
BINA TOTAL	7.8

ONGC	
22 Tatipaka (Kakinada)	0.07
ONGC TOTAL	0.07

OTHER / UPCOMING	
Rajasthan Refinery, Barmer (HRRL)	9.0
Cauvery Basin Refinery (CBRPL), Nagapattinam	9.0

All capacities in MMTPA



~7% of India's GHG Emissions

India's O&G sector, dominated by 260 MMTPA refineries emit ~250 MMTPA CO2 eq. GHG presently

50-60 MMTPA Refinery expansions

Committed and ongoing projects take India to 310-320 MMTPA by 2030-2035

Emissions expected to double in a decade

Emissions could reach 450-500 MMTPA by 2030-2035

CCUS is the key decarbonisation lever

BAU emissions curve unlikely to be tilted by non CCUS initiatives

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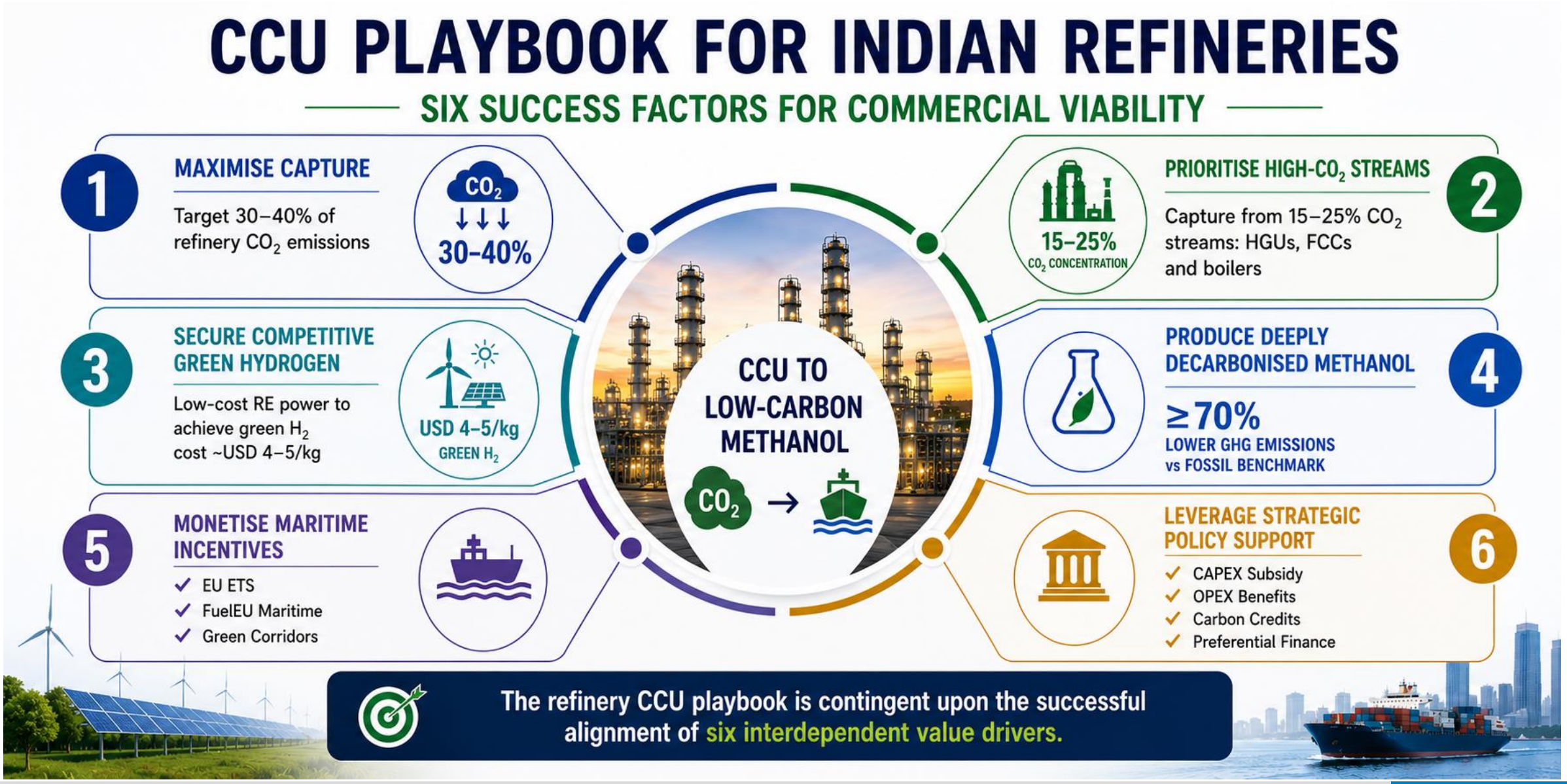
CCU PLAYBOOK FOR INDIAN REFINERIES

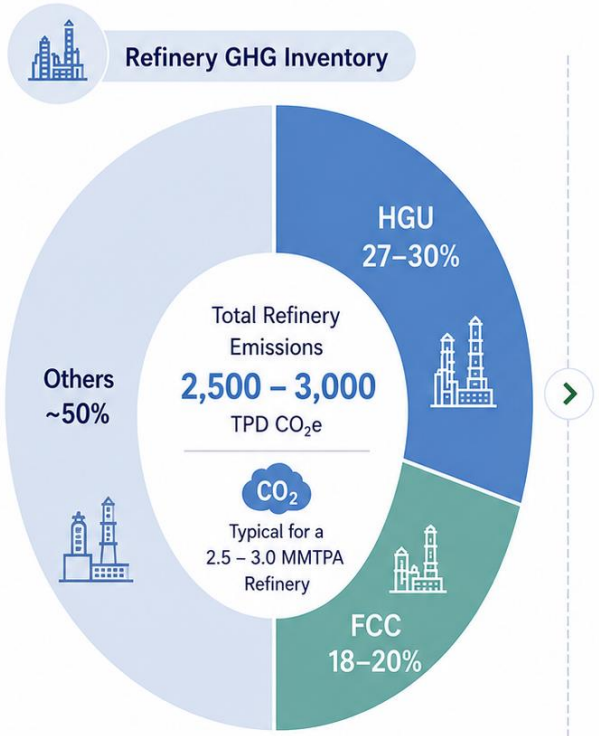
SIX SUCCESS FACTORS FOR COMMERCIAL VIABILITY

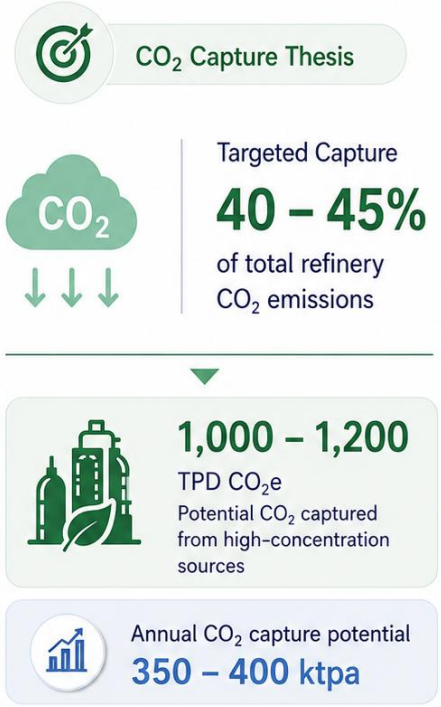


CCU Project Design for a North-East refinery of India

2.5–3.0 MMTPA refinery – emissions profile and CO_2 capture thesis

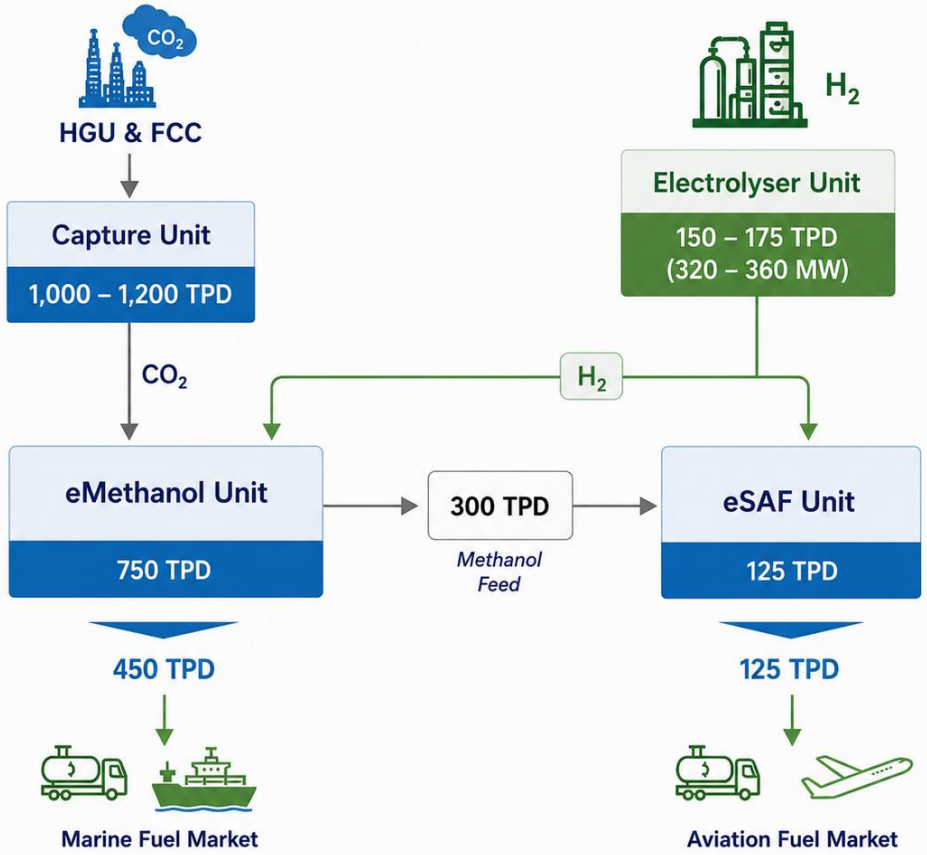
Focus on high-concentration, high-volume sources to maximise capture value





Capturing ~40–45% of refinery CO_2 emissions from high-concentration sources delivers **optimal abatement impact.**

CCU Methanol & SAF



~70% lower lifecycle emissions vs fossil benchmark fuels, enabling access to global transport fuel incentives (FuelEU Maritime, EU ETS, SAF mandates and green fuel premiums).

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CO_2 to Fuels Market offer opportunities for product line diversification for refineries' meeting decarbonisation ambitions

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Expanding Methanol & SAF Markets, Rising Demand for Low-Carbon Solutions

Global markets are expanding
Strong growth outlook for methanol and SAF across key end-use sectors

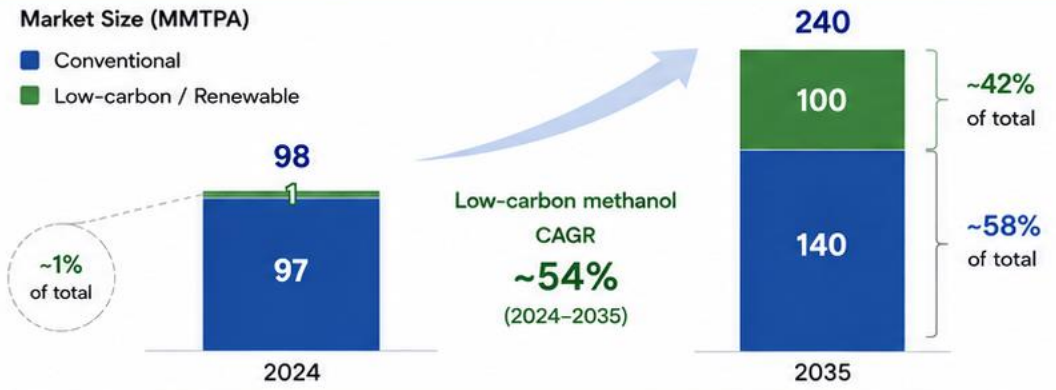
→

Rising demand requires low-carbon supply
Decarbonisation targets and regulations mandate cleaner fuels

→

Compliance-driven willingness to pay
Customer markets are incentivised to pay a premium for low-carbon fuels

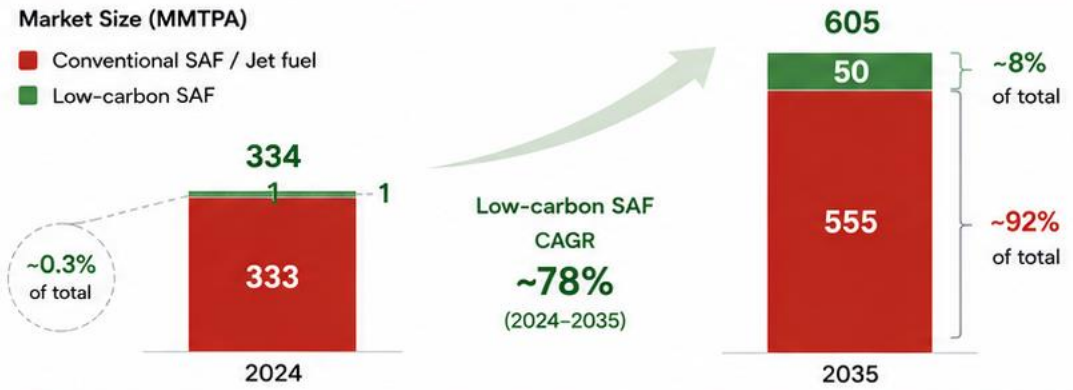
GLOBAL METHANOL MARKET



Key Demand Drivers

- Marine fuel blending
- Chemicals & derivatives
- Fuel for road transport
- Energy applications

GLOBAL SAF (AVIATION FUEL) MARKET



Key Demand Drivers

- Aviation decarbonisation mandates
- Blending mandates (ReFuelEU, CORSIA, ICAO LTAG)
- Corporate net-zero commitments
- Growing air travel demand

POLICY PUSH IS ACCELERATING LOW-CARBON FUEL ADOPTION

FuelEU Maritime
- GHG intensity reduction targets
- Incentivises low-carbon methanol in marine fuels

EU ETS
- Carbon pricing for shipping
- Creates direct economic value for low-carbon fuels

SAF Mandates (Global)
- ReFuelEU Aviation, UK Mandate, CORSIA, ICAO LTAG
- Drive demand and premium for low-carbon SAF

Compliance-driven willingness to pay a premium

Attractive economics for low-carbon methanol and SAF projects

Policies driving CCU Readiness for Indian Refineries

Design projects in alignment with global, national and regional policy drivers to unlock value and de-risk investments

GLOBAL POLICY ECOSYSTEM

- EU ETS
- FuelEU Maritime
- IMO GHG Net Zero Framework
- ReFuelEU Aviation

Creating demand pull and compliance pressure for low-carbon methanol and SAF across global markets

INDIAN NATIONAL POLICIES

- CCUS BUDGET Support / CCUS Mission – USD 2.2 Bn fund through Budgetary Support
- Indian Carbon Markets – Carbon Credit Trading Scheme (CCTS)
- USD 1.8 Bn National Green Hydrogen Mission / SIGHT Scheme

Enabling domestic funding, carbon monetization and clean hydrogen supply for CCU

Policies Powering CCU Projects in Indian Refineries

UNITED NATIONS UNFCCC FRAMEWORKS

- Article 6 – Voluntary Carbon Markets
- Joint Credit Mechanism for sharing credits across countries for NDC compliance
- **CORSIA** – Carbon Offsetting and Reduction Scheme for International Aviation

Unlocking global to access carbon markets and cross-border credit opportunities for CCU projects

REGIONAL ASSAM GOVT INCENTIVES

- Integrated Clean Energy Policy
- Industrial and Investment Policy
- Tax, Capital, Power Incentives & Subsidies
- Special Economic Zone (SEZ) support

Lower capex, reduce risk through strong state-level incentives and facilitation support

Policy-aligned project design maximizes incentives, ensures compliance, and strengthens offtake visibility

Positioning CCU projects in Indian refineries for long-term resilience and superior returns

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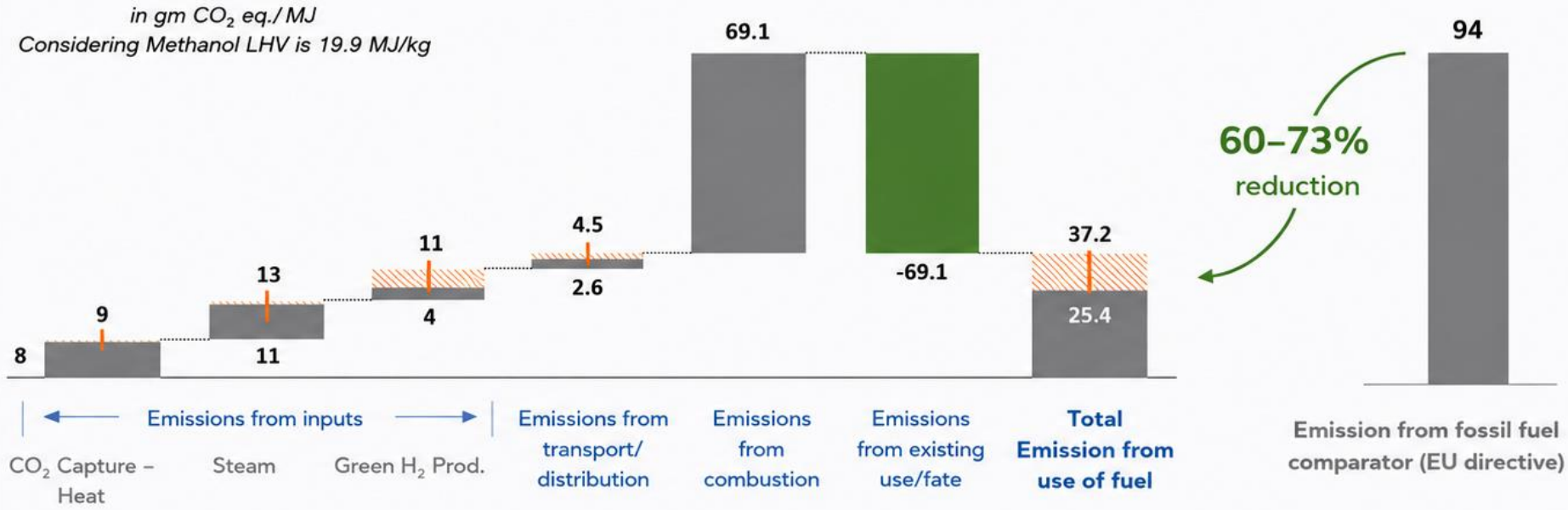
Unlocking carbon credits is critical lever for establishing viable business model for e Fuels

E-Methanol Recycled Carbon Fuel

70%

Low emissiveness required on Well-to-Wake basis to avail EU RED III carbon credit incentives



70%+ Reduction is the Gateway

RED III requires ≥70% GHG reduction vs. fossil comparator on a Well-to-Wake basis.

Every Emission Source Matters

Inputs, utilities, transport, combustion and use/fate determine lifecycle emissiveness.

Green Hydrogen is a Major Driver

Largest upstream contributor—renewable power and electrolysis efficiency are critical.

Capture Helps, But Not Enough

CO_2 capture cuts process emissions, but all other lifecycle emissions must be minimized.

LCA Precision Determines Eligibility

Accurate data, factors, allocation and renewable accounting are essential.

Compliance Unlocks Value

RED III compliance enables carbon credits, FuelEU benefits, EU ETS advantages and premium pricing.

Project success is determined not by CO_2 capture alone, but by achieving a **RED III–compliant Well-to-Wake carbon intensity** through **rigorous lifecycle design** and **robust LCA accounting**.

Project Financials and Business Model

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THE CCU BUSINESS MODEL

Refinery CO_2
(Process & Flue Gas)

CCU + Green H_2
(Capture, Conversion & Synthesis)

eMethanol & eSAF
(Low-Carbon Transport Fuels)

Maritime & Aviation Markets
(Shipping Lines, Airlines, Fuel Suppliers)

Carbon Compliance Value
(Avoid Carbon Penalties, Meet Regulatory Obligations)

REVENUE REALISATION (WILLINGNESS-TO-PAY)

eMethanol	eSAF
~USD 1,200/t	~USD 3,000/t

Pricing reflects compliance-driven demand in maritime and aviation fuel markets

KEY MARKET DRIVERS

- FuelEU Maritime
- EU ETS
- ReFuelEU Aviation
- IMO Net-Zero Framework

INDICATIVE ECONOMICS (USD MN)

REVENUE	450 – 500 USD Mn
OPERATING COST	280 – 320 USD Mn
EBITDA	150 – 180 USD Mn

EBITDA IS PRE-CAPEX AND FINANCING ITEMS

PROJECT INVESTMENT & RETURNS

PROJECT INVESTMENT (CAPEX)	VGF / CAPITAL SUPPORT REQUIRED	PROJECT RETURNS (TARGET)
USD 0.8 – 1.0 Bn	~45 – 55%	~11% MIRR
Total Project Investment	of Project CAPEX	(12 – 13% Project IRR)

PROJECT ENABLERS

1. CAPITAL SUPPORT
- National CCUS support mechanisms
- Green hydrogen incentives
- VGF / capital subsidy support

Critical to bridge viability gap

2. OPERATING COST INCENTIVES
- Electricity duty exemption
- Transmission & wheeling waiver
- SGST reimbursement
- Electrolyser incentives

Reduces hydrogen cost and improves project economics

3. FINANCING STRUCTURE
- Concessional debt
- Blended finance
- Optimized debt-equity structure

Improves project bankability and equity returns

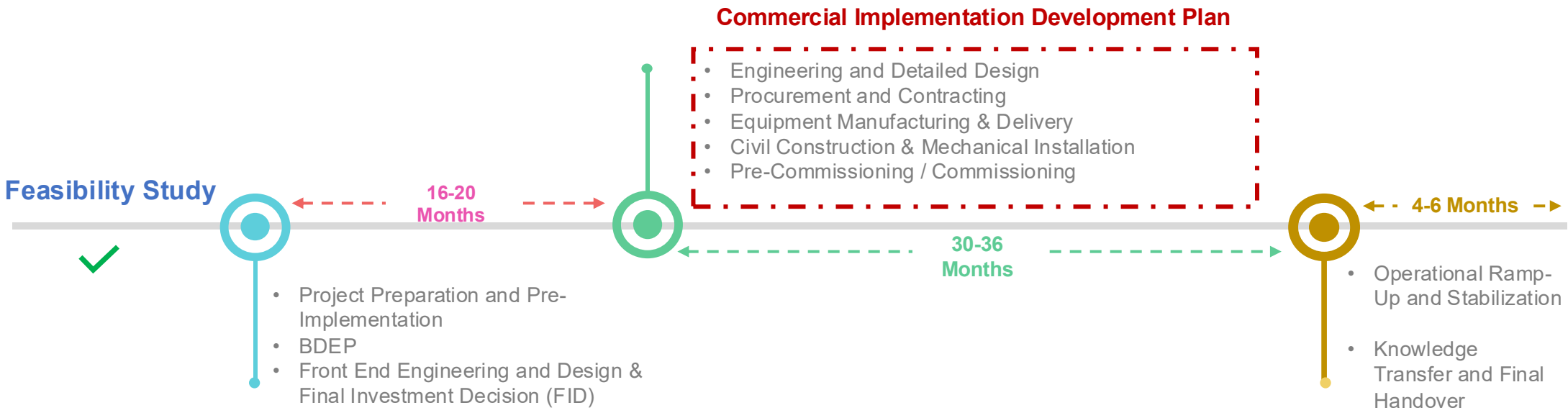
INVESTMENT THESIS

CCU projects create value by converting refinery CO_2 into low-carbon transport fuels that command **premium pricing** in compliance-driven maritime and aviation markets.

Recommendations for CCU projects in Global refineries

Key Outcome

- Large scale refineries can realise 30-40% of emission abatement through CCU applications
- Growing **CO_2-to-Methanol** and **SAF** markets demand CCU projects
- Economic prudence is rooted in carefully crafting project design
- Global, national and regional policies exist; this requires analysis and concurrent consideration
- Rapid scale up possible for refineries with access to RE, Green H_2, ports and customer markets



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