First-Generation Green H2 Project Development & Funding 2023-25

IH2A
INDIA HYDROGEN ALLIANCE

Building India's Hydrogen Economy

Proposed 25/25 Development Plan for National Green H2 Projects, Hubs

FTI CONSULTING

June 2022

National 25/25 Green H2 Development Plan – 25 H2 hubs + projects by 2025

First-Generation National Green H2 Projects to accelerate commercialisation, learning rates, induce demand at critical scale

Scalable, Co-located National Green H2 Hubs, Projects using RE-Electrolysis, Gasification across RE-rich coastal states

18 GH2 Bharat Hubs (with RE-Electrolysis)
Industrial, Heavy-Duty Transport Offtake, each potentially scalable to GW capacity

7 Green H2 Bharat Cities - Waste-to-H2 Municipal Projects (with Gasification)
Local Industrial, Municipal Transport Fleets

25 National Green H2 Bharat Projects by 2025
150 MW Installed Electrolyser Capacity
Green H2 Use in Industrial, Heavy Duty Transport
Future Coastal Shipping, Land Transport (Liquid, Gas)

Five Key Enablers

- National Green H2 Dev Corp (NHDC) & Public-Private Taskforce
- State Green H2 Plans, Nodal Office
- Project Dev SPVs, Consortia
- Public Funding/ Infra, National Innovation Status
- National Testing/ Certification, Standards, Skilling

First-Generation National Projects (Phase I) – 18 Green H2 Hubs, 7 H2 Cities

26K+ tonnes Green H2 Induced Demand pa. with USD 360 mn Public Spend over 3 years, 2.6 Mmt CO2 reduction in a decade

Twelve 10-MW Green H2 Industrial Hubs– USD 240 mn public finance (USD 120mn Electrolyser CAPEX*+ USD 36mn pa OPEX price subsidy @USD 2/kg) **for 18,000 tonnes pa**

Three 5-MW Green H2 Transport Hubs– USD 30 mn public finance (USD 15mn Electrolyser CAPEX Support + USD 4.5 mn pa OPEX price subsidy @ USD 2/kg) **for 2250 tonnes pa**

Three 5-MW H2-CGD Network Hubs – USD 30 mn public finance (USD 15mn Electrolyser CAPEX Support + USD 4.5 mn pa OPEX price subsidy @ USD 2/kg) **for 2250 tonnes pa**

Seven Distributed Waste-to-H2 Projects – USD 56 mn public finance (USD 35mn for 25% Capex Support^ + USD 7 mn pa OPEX price subsidy @ USD 2/kg) **for 3500 tonnes pa**

PHASE I	150 MW Green H2 production capacity by 2025; 26,000 tonnes pa. industrial offtake; scalable	PHASE II	500 MW+ Green H2 production capacity

**est. USD 1mn per MW Electrolyser + BoP costs (based on Electrolyser tech chosen at project-level); ^est. USD 20 mn for 30 tonnes/day Waste-to-H2 plant*

GUJARAT H2 HUB/ PROJECTS & STATE PLAN

- **Green H2 & Ammonia Hub - Bharuch-Ankleshwar-Dahej Chemical / Industrial Cluster -** GIDC-GNCF led SPV, proximity to Cement, Fertilizers & Steel clusters
- *Other Clusters – Vadodara, Ahmedabad-Gandinagar-Dholera, Surat-Navsari-Hazira)*

MAHARASHTRA H2 HUB/ PROJECTS & STATE PLAN

- **MAH2 Transport Hub (Heavy-Duty) in Pune-Mumbai** – led by MEDA-PMC-MSRTC, with Industrial Use
- **Bharat H2 Steel Cluster in Dolvi**

KARNATAKA H2 HUB/ PROJECTS & STATE PLAN

- **H2 Green Steel Cluster** – Link to East Coast (Krishnapatanam/ Nellore/ AP) **Chemicals Clusters**

KERALA H2 HUB/ PROJECTS & STATE PLAN

- **H2KOCHI Transport, H2 Industrial Hub** – link to Chennai Bangalore Industrial Corridor (CBIC), via Coimbatore
- Funding Partnerships – WB/IFC, GIZ with Kochi

Future Sea, Road H2 Storage Network and Transport Corridors (Liquid H2/ Ammonia/ Gas) **connecting H2 hubs, projects** to create integrated National H2 Economy

ANDHRA PRADESH H2 HUB/ PROJECTS & STATE PLAN

- **H2VIZAG INDUSTRIAL HUB** – along Kakinda-Vizag Industrial Corridor (part of East Coast Economic Corridor ECEC/Phase II)
- Refineries & PetroChem/ PCIPR Hub (RINL/ HPCL)

TN H2 HUB/ PROJECTS & STATE PLAN

- **H2CHENNAI Industrial Hub** – Ponneri (CBIC Node)
- **GREEN H2 NAGA HUB** (Nagapattinam-Cuddalore NC-Chennai H2 Corridor) - part of ADB-funded ECEC), proximity to Cement Cluster, Wind Energy projects, Ponneri Refinery Cluster (IOCL/ RINL)

Five Key Enablers - National 25/25 H2 Development Plan

Accelerating H2 commercialisation – priority actions

	KEY GOVT ACTIONS	KEY INDUSTRY ACTIONS
National H2 Dev Corp (NHDC), Public-Private Bharat H2 Taskforce	**NHDC as Public-Private, Non-Profit; National H2 Development Roadmap & Implementation** 10% equity Central Govt, State Govts, Industry Champions (akin to NPCI) **Align Commercialisation Plan, 2030 Mission Document to National RE, EV Plans**	
State Green H2 Plans, Projects Nodal Office	**State Green H2 Policy and Hub Dev Plans** Nodal Office, CMO support for First-Gen H2 Projects	**Industrial 'Producers-Offtakers' Matching** State-Level Champions, Govt identify first-gen Green H2 hubs/projects at local level
Project Dev - SPVs, Consortia	**'National' Status, Incentives for 25 H2 Hubs, Projects** Guaranteed Offtake (public and private); Value Chain Focus across Production, Storage, Uses; State Govt Support	**Project Consortia/ SPV Formation** Industry Champions lead on Project Scoping, Pre-Feasibility - with Industrial Dev, Energy Departments
Public Funding, National Infra Innovation Project status	**3-yr USD 360 mn, 'Green H2 Project Dev' Public Funding** Tax Incentives, VGF, USD 2/kg price support for 25 First-Generation projects	**Investments into First-Gen National Projects** Electrolysers, Components, BoP, Storage, RE-Integration, Transport, Compression/Liquification & Dispensing
National Standards, Testing/ Certification, Skilling	**Green H2 Safety Certification & Testing Agency** Production, Storage & Transport (LH2, Gas), Compression/Liquification, Dispensing, Handling/Training – First-Gen National H2 Projects for improving 'learning rates'; Project Risk Assurance/ Insurance (link to technical standards)	

Proposed USD 360 mn National Green H2 Public Spend over 3-years

How does it compare with global jurisdictions

USD 360 mn Public Spend for CAPEX (Electrolyser, BoP), Green H2 Pricing Support (USD 2/kg) next 3 years (2023-25) enables national innovation and learning.

GREEN H2 PUBLIC FUNDING – HUBS/ LARGE PROJECTS	
JAPAN	USD 19 BN
GERMANY	USD 10 BN
FRANCE	USD 8.2 BN
UNITED STATES/ USA	USD 8 BN
KOREA	USD 2.4 BN
AUSTRALIA	USD 1.4 BN

- Public funding of first-gen projects critical for 1) inducing Green H2 demand, 2) create matching supply-side linkages – enable national hydrogen economy.
- Domestic manufacturing (Make-in-India) ambition for Electrolysers, Balance-of-Plant (BoP), Storage/ Transport (Liquid, Gas H2) and Dispensing Equipment.
- Global climate finance/ funds, sovereign green bond allocation to be dedicated for 25/25 National Green H2 Commercialisation & Hub Dev Plan.

India public funding commitments for Green-H2 Industrial Decarbonisation Project Development should be increased progressively, target USD 1 bn National Green H2 Decarbonisation Funding, post first-phase (first-gen) i.e. within 2025-30 period

First-Generation

25/25 National Green H2 Project Development Plan

25 National Green H2 Hubs^

12 Industrial Hubs (across Chem/Fert, Steel, Refineries), 3 Transport Hubs, 3 CGD Networks, 7 Municipal Projects

150 MW Electrolyser Capacity^

USD 360 mn, 3-year Public Finance Support

NHDC, Bharat H2 Taskforce

Project Dev National Learning Metrics, Milestones Sharing

40MW National Green Chem Hubs

Four 10MW Green H2, NH3/Fert. Hubs

Ankleshwar-Bharuch-Dahej/GUJ*
Pune-NhavaSheva/ MAH
Nellore OR Vizag/ AP
Chennai/ TN

40MW H2 Bharat Steel Plants

Four 10MW GreenH2 Steel Plants

Bellary/KAR*
Hazira/ GUJ
Dolvi/ MAH
Vizag/ AP

40MW H2 Refineries

Four 10MW GreenH2 Refineries

Jamnagar or Vadodara/GUJ
Mumbai/MAH
Kochi/KER
Vizag/ AP

15MW Green Transport Hub*

Three 5MW Heavy-Duty Transport

MAH2 Mumbai-Pune/MAH*
KochiH2-Coimbatore/KER-TN
Vizag/ AP

15MW H2-CGD Networks*

Three 5MW H2-CGD Networks

Indore CGD/ MP*
Pune CGD OR Nagpur CGD/ MAH
Vadodara CGD/ GUJ

Waste-to-H2 City Projects

Seven Municipal Projects

Pune*, Nagpur, Mumbai, Delhi, Bangalore, Chennai, Ahmedabad

H2 Storage & Transport Supply Chain Network

Storage-Transport-Regeneration Network at Ports - sea, land transport corridors (in Phase II)

**indicative project SPV structures; project locations in following slides, SPV contracting and pre-feasibility to include RE-Integration, transmission*
^over and above individual private sector project development and investments

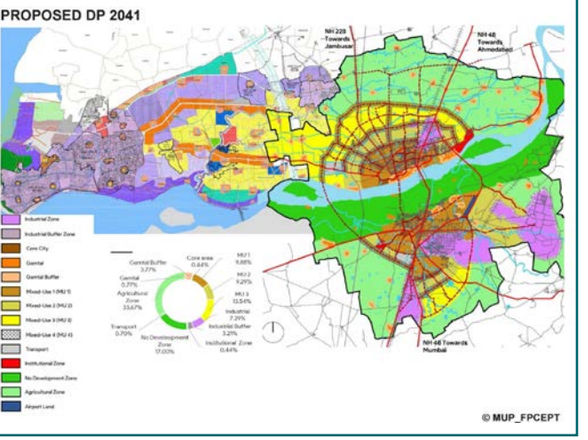
A. 10 MW GUJ GREEN CHEM HUB - INDUSTRIAL GREEN H2 & NH3

H2 replacement by Chem/ Fert Industrial Units in Bharuch-Ankleshwar-Dahej – Production-Storage-Use SPV

Decarbonize Industrial Chemical /Fertilizer Hub (replace Grey H2) with **USD 20 mn** public finance (USD 10 mn CAPEX (Electrolyser + BoP), USD 3 mn pa OPEX Green H2 price subsidy @USD 2/kg), delivering 1500 tonnes/annum, saving 15,000 tonnes CO2/annum over 3 years - with Govt of Gujarat support

GUJARAT GREEN CHEM HUB / INDUSTRIAL GREEN H2 AND **AMMONIA** – PUBLIC-PRIVATE PARTNERSHIP/ SPV

- Decarbonize Chemical/Fertilizer Industrial Units, with GIDC (Ankleshwar Industry Association, AIA) – with Green H2 infra, offtake and production master dev plan, to reduce emissions, improve AQI (136)
- BAUDA Industrial Decarbonisation Economic Research and Demand Projection study to be undertaken, as part of pre-feasibility and chemical/fertilizer decarbonisation study
- Decarbonizing targets/metrics of participating units, through GIDC, and provide incentives to units that opt-in
- State Green H2 and Ammonia Plan – align to State Industrial Decarbonisation and RE-EV-H2 plan
- Target 10MW Electrolyser Capacity, scalable to 20 MW – Joint SPV Ownership by Producers, Offtakers with Pricing Subsidies; potential to scale up to cater to industrial clusters in Vadodara, Surat-Hazira-Navsari, replicable format for 12 national clusters



GUJARAT GREEN CHEM H2 & AMMONIA HUB – STATE GOVT PARTICIPANTS

GEDA

Gujarat Industrial Development Corporation
A Government of Gujarat Undertaking

ANKLESHWAR INDUSTRIES ASSOCIATION

GUJARAT GREEN CHEM H2 & AMMONIA HUB – INDUSTRY PARTICIPANTS

GNFC

CHART

Reliance Industries Limited

IFFCO

Atul

KCI

BOROSIL renewables

HERO FUTURE ENERGIES
planet positive power

Gujarat Chemical Association

JSW

adani

UPL

SRF

DEEPAK FERTILISERS AND PETROCHEMICALS CORPORATION LIMITED

TATA
TATA POWER SOLAR

KP GROUP

DEMAND SIDE ACTORS - INDUSTRIAL/ CHEMICALS OFFTAKERS

- FERTILIZER/ GREEN AMMONIA - IFFCO, Deepak Nitrate/ Fert & Chem, Guj NarmadaVal Fert & Chem(GNFC), UPL
- GREEN H2/CHEMICAL INDUSTRY - Kanoria Chem, Khaitan Chem, Rallis, SRF, Atul, Arihant Chem, Bharat Rasayan

SUPPLY SIDE ACTORS - RE-H2, AMMONIA PRODUCTION-STORAGE

- RE PLAYERS - Borosil Renewables, ONGC Solar, Azure Solar, Rallis Solar, KP Solar, Tata Solar
- STORAGE PLAYERS – Chart Industries

**names are indicative and for reference only*

B. 10 MW H2BHARAT STEEL PROJECTS

H2Bharat Steel Production – H2-DRI/ EAF, DirectH2-BFs in Integrated Steel Plants (Karnataka, Gujarat, Maharashtra)

Decarbonize Steel (replace Grey H2) **with USD 20 mn public finance support (**USD 10 mn CAPEX (Electrolyser + BoP) and USD 3 mn pa OPEX Green H2 price subsidy @USD 2/kg) for 1500 tonnes H2 per annum, saving 15,000 tonnes CO2 per annum over three years, replace Coking Coal imports

H2**BHARAT STEEL PROJECTS**

- H2Bharat Steel Cluster Development & Research Institute – affiliated to School of Mines, Dhanbad/ IIT-Mumbai/IIT-Chennai, with support from Indian Steel Association (ISA), Steel Majors (JSW, Tata Steel, SAIL, ArcelorMittal, Rashtriya Ispat), Ministry of Steel
- Four National H2Bharat Steel Demonstration plants – JSW, SAIL, RINL, Tata Steel, AM – identified as First Generation Green H2 projects, supported by incentives, pricing support/subsidies for 3-year Green H2BHarat Steel support plan
- Progress of all four plants, H2Bharat Steel outputs reviewed annually, by NHDC, H2 Bharat Taskforce; eligible for production-incentives
- Resource/investments to be incurred by Finalized Majors Steel Players, eligible for incentives (production/investment-linked, price subsidies), estimated to be located in Karnataka, Maharashtra and Gujarat

H2BHARAT STEEL PROJECTS – GOVT PARTICIPANTS

H2BHARAT STEEL PROJECTS – INDUSTRY PARTICIPANTS

*names are indicative and for reference only

C. 10 MW H2BHARAT REFINERY HUBS

H2Bharat Refineries – Green H2/ Ammonia Use-Production in Integrated Refineries (Guj, Maharashtra, AP, Kerala)

Decarbonize Refineries (replace Grey H2) **with USD 20 mn public finance support** (USD 10 mn CAPEX (Electrolyser + BoP) and USD 3 mn pa OPEX Green H2/ Ammonia price subsidy @USD 2/kg) for 1500 tonnes H2 per annum, saving 15,000 tonnes CO2 per annum over three years

H2**BHARAT REFINERY PROJECTS**

- Decarbonize Identified Refinery Units, with MoPNG – with Green H2/Ammonia infra, offtake and production master dev plan, to reduce emissions
- Refinery Decarbonisation Economic Research and Demand Projection study to be undertaken, as part of pre-feasibility and refinery decarbonisation study; track decarbonizing targets/metrics of participating units, through GIDC, and provide incentives to units that opt-in
- Target 10MW Electrolyser Capacity, scalable to 20 MW – Joint SPV Ownership by Producers, Offtakers with Pricing Subsidies; potential to scale up to cater to refineries, replicable format across all refineries over time
- Four National H2Bharat Refinery plants – RIL, Nayara, ONGC, BPCL, HPCL, IOCL – identified as First Generation Green H2/Ammonia projects, supported by incentives, pricing support/subsidies for 3-year Green H2Bharat Refinery support plan
- Progress of all four plants, H2Bharat Refinery outputs reviewed annually, by NHDC, H2 Bharat Taskforce; eligible for production-incentives
- Resource/investments to be incurred by Finalized Majors Refiners, estimated to be located in Gujarat, Maharashtra, Kerala and Andhra Pradesh.

H2BHARAT REFINERY PROJECTS – GOVT PARTICIPANTS

Goverment Of India

पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
MINISTRY OF PETROLEUM AND NATURAL GAS

H2BHARAT REFINERY PROJECTS – INDUSTRY PARTICIPANTS

Reliance Industries Limited

ओएनजीसी ONGC

NAYARA ENERGY

Bharat Petroleum

हिन्दुस्तान पेट्रोलियम HP

इंडियनऑयल IndianOil

**names are indicative and for reference only*

D. 5 MW MAH2 GREEN TRANSPORT HUB

Green H2 Offtake - Heavy-Duty Truck, Forklift Fleets (Public-Private) – 5 MW H2 Production-Storage-Use SPV

Decarbonize 150-strong Heavy-Transport Fleet to cut vehicular emissions,– with **USD 10 mn public finance support** (USD 5 mn CAPEX (Electrolyser + BoP) and USD 1.5 mn OPEX Green H2 price subsidy USD 2/kg) for **750 tonnes pa**, for 3 years - with support from Govt of Maharashtra

MAH2 TRANSPORT WORKGROUP – PUBLIC-PRIVATE PARTNERSHIP

- Pune H2 Cluster Development & Research Institute – affiliated to NCL, MEDA (akin to Automotive Cluster Dev and Research Institute)
- Engineering Research and Skills/Capacity Dev, and Zero-Emission Transport (FCEV+EVs) – with IIT-Mumbai, MIDC-units in Mumbai-Pune region
- H2 Storage & Handling/Skilling CoE (Liquid H2, Compressed Gas) – with Safety/Certification Unit – NCL (proposed)
- Add Heavy-Duty FCEVs Trucking to State EV Policy – akin to California Zero Emission Vehicles (ZEV) policy; RE-EV-H2 inclusion in State Clean Air Programme – to cut emissions
- State Green H2 Plan – align to State Industrial Decarbonisation and RE-EV-H2 plan, replicable across industrial clusters - Economic Research and Projections/ State Targets
- Target expansion to 10 MW – Joint SPV Ownership by Producers and Users/ Offtakers, with Green H2 Price Subsidies; potential to scale up to cater to industrial clusters + heavy-duty transport in Navi Mumbai, Mumbai, Nhava Sheva

MAH2 WORKGROUP – STATE GOVT PARTICIPANTS

MAH2 WORKGROUP – INDUSTRY PARTICIPANTS

DEMAND SIDE ACTORS – HEAVY DUTY TRANSPORT

- HEAVY DUTY TRANSPORT OEMs/ FLEETS - Tata Group, Mahindra, KPIT, Toyota Kirloskar, Bosch

SUPPLY SIDE ACTORS - RE-H2, PRODUCTION

- RE PLAYERS - Maha GenCo, Mytrah, Powercon, JSW Energy

**names are indicative and for reference only*

E. 5 MW GREEN H2 - CGD BLENDING PROJECT

5-15% H2 Blending in CGD Network – with existing CGD pipeline infrastructure - 5 MW H2 Production-Storage-Use SPV

H2-Blending in CGD Network (5-15%), with **USD 10 mn public finance support** (USD 5 mn CAPEX (Electrolyser + BoP), USD 1.5 mn Green H2 OPEX price subsidy (USD 2/kg) for **750 tonnes pa**, for 3 years

GREEN H2 BLENDING IN CGD NETWORKS – PUBLIC-PRIVATE PARTNERSHIP

- Scaling up GAIL Indore Pilot – current pilot at Indore with GAIL (1% blending/ 100 kg/day to be scale subsequently to 5-15%)
- Target 5 MW Electrolyser Capacity expansion to 10 MW – by CGD Operators, Incentives to purchase from co-located Green H2 production facilities (captive, RE players)
- Expand H2 Blending in CGD Network to at least 3 CGD Networks within 3 years

BHARAT H2-CGD BLENDING PROJECT – GOVT PARTICIPANTS

सत्यमेव जयते
Goverment Of India

सत्यमेव जयते
पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
MINISTRY OF PETROLEUM AND NATURAL GAS

BHARAT H2-CGD BLENDING PROJECT – INDUSTRY PARTICIPANTS

GAIL
adani Gas
IndianOil
torrent GAS
AG&P
igl
ASHOKA Ashoka Gas
MAHANAGAR GAS
GUJARAT GAS
THINK GAS

**names are indicative and for reference only*

F. NATIONAL ‘GREEN H2CITIES’ – MUNICIPAL WASTE-TO-H2 PROJECTS

Ahmedabad, Pune, Mumbai, Nagpur, Kochi, Bangalore, Indore - Waste-to-H2 plants, guaranteed waste feedstock and offtake

GREEN H2CITIES (Clean H2 classification with Waste-to-H2 plants) with **USD 8 mn/city** or **USD 56 mn public finance support** across 7 cities for 3-years (USD 5 mn CAPEX @ 25% 30-tonnes/day waste processing plant; USD 1 mn pa price subsidy per city), with guaranteed offtake of 500 tonnes pa

NATIONAL GREEN H2CITIES INITIATIVE – PUBLIC-CIVIC/PRIVATE COLLABORATION IN IDENTIFIED CITIES

- Distributed Green H2 production at city-level for public awareness and support, initiative on addressing Clean Air issue
- 2-3 Use-Cases to be identified, executed with Municipal Bodies – showcased as part of National Green H2Cities Programme during G20 Presidentship 2023
- Safety certifications/ testing from central/technical agency, prior to use
- Programme to be reviewed and incentivised – recognition of municipalities that achieve/cross Green H2 production and use in respective municipalities
- Oversight by Ministry of Urban Affairs (MUA) - with city/municipal stakeholders, civil society, industry champions at local level

GREEN H2CITIES INITIATIVE – GOVT PARTICIPANTS

Ministry of Housing and Urban Affairs, Government of India

विद्युत मंत्रालय MINISTRY OF POWER

Government of Maharashtra

GREEN H2CITIES INITIATIVE – INDUSTRY PARTICIPANTS

WAYS2H

JSW

Reliance Industries Limited

CHART

Boson Energy

H2 Industries

THERMAX

h2e

ador peace of mind

SIEMENS energy

*names are indicative and for reference only

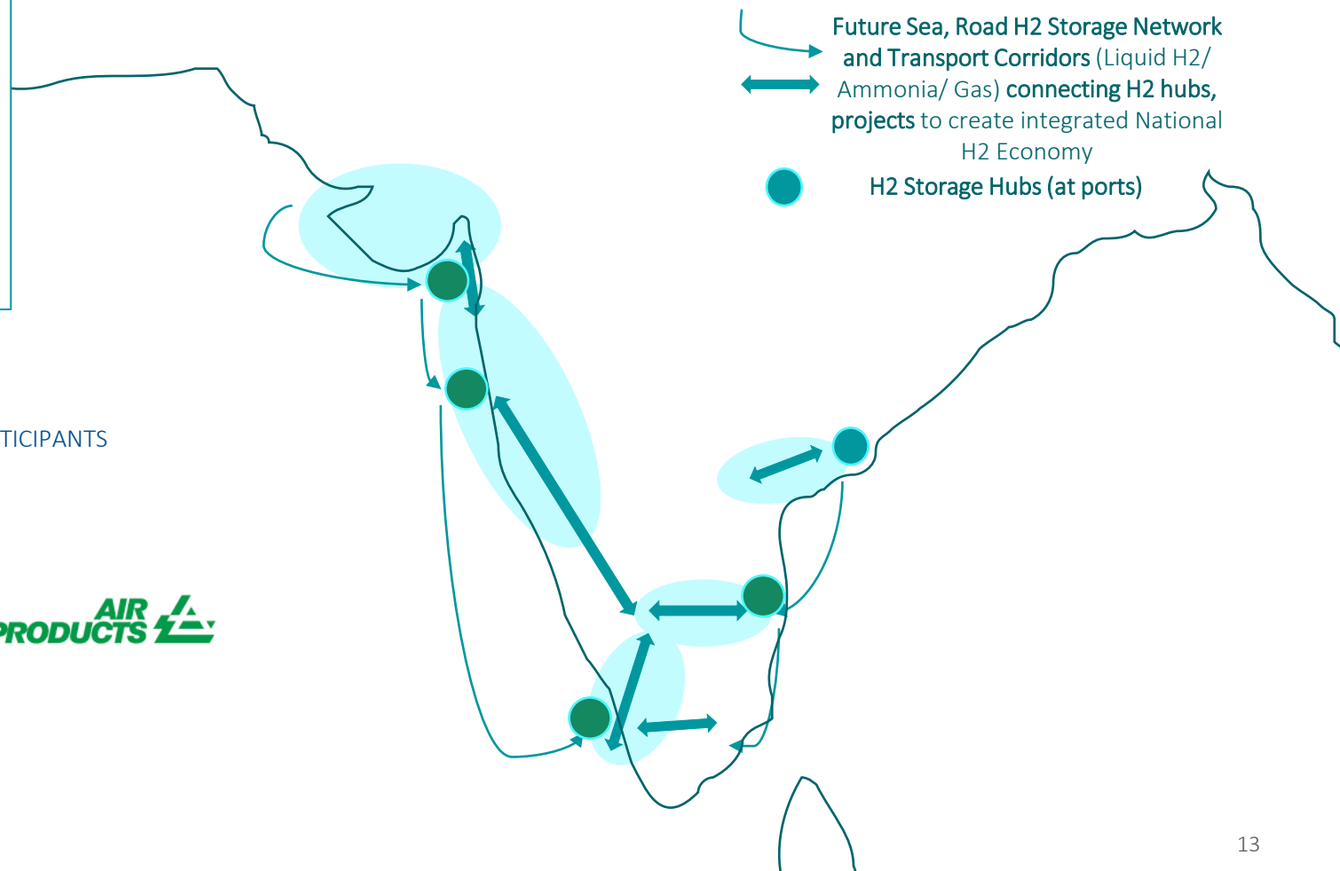
G. NATIONAL H2 STORAGE & TRANSPORT – SUPPLY CHAIN NETWORK

Port-Linked H2 Storage, Transport and Re-Generation Network (to be taken up in Phase II)

H2 STORAGE NODES AT KEY PORTS – connected BY **SEA/LAND TRANSPORT CORRIDORS -** WITH **RE-GENERATION FACILIITIES** – flexible, national H2 supply chain and economy to cater to different H2 in its forms (Liquid H2, Compressed Gas, Ammonia, LOHC)

NATIONAL H2 STORAGE – TRANSPORT – RE-GENERATION NETWORK

- National H2 Storage and Transport Network – plan for national H2 supply chain
- Allows for flexibility across different forms of H2 (compressed gas, liquid H2, ammonia, LoHC), and improved learning curves
- Create national H2 economy and market, enabling scale economics
- Storage/ transport facilities to be supported as National H2 Projects
- Coordination across multiple ministries/agencies – MNRE, Chemicals, Shipping, Road & Highways, Railways, MoPNG, Steel and Heavy Industries



H2 STORAGE & TRANSPORT – GOVT PARTICIPANTS

नवीन एवं नवीकरणीय ऊर्जा मंत्रालय MINISTRY OF NEW AND RENEWABLE ENERGY

पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय MINISTRY OF PETROLEUM AND NATURAL GAS

रेल मंत्रालय MINISTRY OF RAILWAYS

रसायन एवं उर्वरक मंत्रालय MINISTRY OF CHEMICALS AND FERTILIZERS

Ministry of Shipping Government of India

MoRTH Ministry of Road Transport and Highways

H2 STORAGE & TRANSPORT – INDUSTRY PARTICIPANTS

CHART

Reliance Industries Lim

Linde

Air Liquide

AIR PRODUCTS

**names are indicative and for reference only*

State-Level

Five National Green H2 Hubs

(alternate structuring)

Multi-use/offtake SPVs

Co-located Production-Use

150 MW Electrolyser Capacity

USD 360 mn, 3-year Public Finance Support

Oversight by NHDC, Bharat H2 Taskforce & State-Level Green H2 Advisory Groups

40 MW GREEN H2GUJ

National Chem-Steel-Refinery-CGD Hub

Ankleshwar-Vadodara-Hazira (GUJ)

USD 78 mn public spend, c8000 tonnes pa Green H2 production & offtake, cut 8 Mmt CO2 in a decade

10MW Green H2, NH3/ Fertilizer Hub (Ankleshwar)
10MW GreenH2 Steel Plant (Hazira)
10MW GreenH2 Refinery (Vadodara)
5MW H2-CGD Networks (Vadodara)
5MW Heavy-Duty Transport/ Forklifts (Vadodara)
Waste-to-H2 City (Vadodara/ Dahej/Hazira)

30 MW GREEN H2KAR-AP

National Steel-Chem-CGD Hub

Bellary-Nellore-Krishnapatnam (KAR-AP)

USD 68 mn public spend, c5000 tonnes pa Green H2 production & offtake , eliminate 5 Mmt CO2 in a decade

10MW GreenH2 Steel Plant (Bellary)
10MW Green H2, NH3 Hub (Nellore)
5MW H2-CGD Networks (Nellore)
5MW Heavy-Duty Transport/ Forklifts (Krishnapatanam)
Waste-to-H2 City (Nellore)

30 MW GREEN MAH2

National Steel–Refinery–Transport-CGD Hub

Mumbai-Pune-Dolvi (MAH)

USD 68 mn public spend, c5000 tonnes pa Green H2 prodn & offtake, cut 5 Mmt CO2 in a decade

10MW GreenH2 Steel Plant (Dolvi)
10MW Green Refineries (Mumbai)
5MW H2-CGD Networks (Pune/Mumbai)
5MW Heavy-Duty Transport/ Forklifts (Nhava Sheva)
Waste-to-H2 City Projects (Mumbai/ Pune)

30 MW GREEN H2VIZAG

National Refinery-Steel-Transport-CGD Hub

Vizag (AP)

USD 68 mn public spend, c5000 tonnes pa Green H2 prodn & offtake , cut 5 Mmt CO2 in a decade

10MW Green H2 Refinery (Vizag)
10 MW Green Steel (Vizag)
5MW H2-CGD Networks (Vizag)
5MW Heavy-Duty Transport (Vizag)
Waste-to-H2 City Projects (Vizag)

20 MW GREEN H2KOCHI

National Chem – Transport -CGD Hub

Kochi (KER)

USD 45 mn public spend, 4000 tonnes pa Green H2 prodn & offtake, cut 4 Mmt CO2 in a decade

10MW Green H2 Refinery (Kochi)
5MW H2-CGD Networks (Kochi)
5MW Heavy-Duty Transport/ Forklifts (Kochi)
Waste-to-H2 City Projects (Mumbai/ Kochi)

**indicative project SPV structures in following slides; project locations, SPV contracting & award to be done by NHDC, Bharat H2 Taskforce*
^over and above individual private sector project development and investments

Green H2 Hubs Development Framework – State Level

Develop Five National Green H2 Hubs with State-Industry Collaboration (CMO-IH2A)

Draft State H2 Policy and H2 Hub Development Plan; oversee implementation with public-private advisory group

State H2 Hub & Project Dev Lead
CMO-nominated Nodal Department

State H2 Advisory Group
Public-Private Participants

Technical/ Certification Lead

Five National Green H2 Hubs Planning and Implementation – Scalable, Multi-Use-Case Hubs

H2 Hubs – Industrial Projects
Chemicals/Refinery, Fertilizer, Steel
First-Gen Projects in State

- **Green H2/ Ammonia Project**
  Fertilizer/Chemical Plant Offtake in State
- **Green H2 Steel Project**
  Steel Plant Offtake in State
- **Green H2 Refinery Project**
  Refinery Plant Offtake in State

H2 City - Waste-to-H2 Projects
Project SPV – Municipal Body, Project Lead/Manager, Offtaker, Tech Partner

- **H2City SPV 1**
  Municipality, Industry Offtaker, Tech Partner

H2 Transport Projects
Heavy-Duty Transport
First-Gen Projects in State

- **H2 Transport Hub**
  Heavy Duty Transport in Metropolitan Region

H2-CGD Blending Projects
CGD Blending – Operator, Municipality

- **H2-CGD Network 1**
  CGD Operator, Municipality

Coordination with central agencies/ ministries

- NHDC
- Public-Private Bharat Green H2 Taskforce
- MNRE
- NITI AAYOG
- Finance
- Power
- MOEF
- S&T
- Chemicals
- MoPNG
- Steel
- Urban Affairs
- MORTH
- Commerce

Next Steps

1. NHDC, Public-Private Taskforce Formation – *collaboration with the govt (proposal)*
2. Public Finance Support for USD 360 mn 3-year Green H2 Dev Plan - *workshop/discussion planned*
3. Commitments from Industrial Offtakers, SPV/ Consortia Leads – *interest to join hub consortia, sign offtake agreements*
4. State Governments Support, Nodal H2 Officer in State – *proposals to with State Govts*
5. Pre-feasibility studies of first-generation projects – *in-principle funding support*

Thank you

IH2A SECRETARIAT TEAM:

Amrit Singh Deo, Prasanto Roy, Rakesh Aulaya, Subhodeep Jash, Jit Banerjee, Kartik Berry, Pragya Gupta, Kerban Rajdeo