GUJARAT POWER CORPORATION LIMITED

सत्यमेव जयते

Energy & Petrochemicals Department
Government of Gujarat

ADB

Key Pillars to Drive Gujarat's Green Hydrogen Economy Leadership

Gujarat is attractively positioned for fostering green hydrogen growth and adoption. The state offers a significant opportunity for investments in the Green Hydrogen economy. To achieve 1 MMTPA production estimates, the state may require a total investment of $ 20-25 bn by 2030.

India is committed to achieve the Net Zero emissions target by 2070. Green hydrogen is anticipated to play a crucial role in decarbonizing hard-to-abate sectors and achieving India's ambitious goals. The country announced the National Green Hydrogen Mission (NGHM) in January 2023, targeting at least 5 MMTPA (Million Metric Ton per Annum) by 2030. The NGHM aims to garner at least 8 lac crore ($ 100 billion) investment, generate employment of 600,000 and achieve an annual reduction of 50 MMTPA of CO_2e. The vision is to make India a global hub for green hydrogen (and derivatives) production and exports.

Gujarat is well poised to leverage the opportunity and create a green hydrogen economy in the state. Gujarat has a significant domestic hydrogen demand as well as deep resource capability from supply side such as abundant RE potential, skilled manpower, dedicated T&D corridor and huge land parcels for setting up green hydrogen ecosystem.

India's climate ambitions

500 GW
India takes another big step towards non-fossil fuel-based electricity

50%
Electricity requirements using RE source by 2030

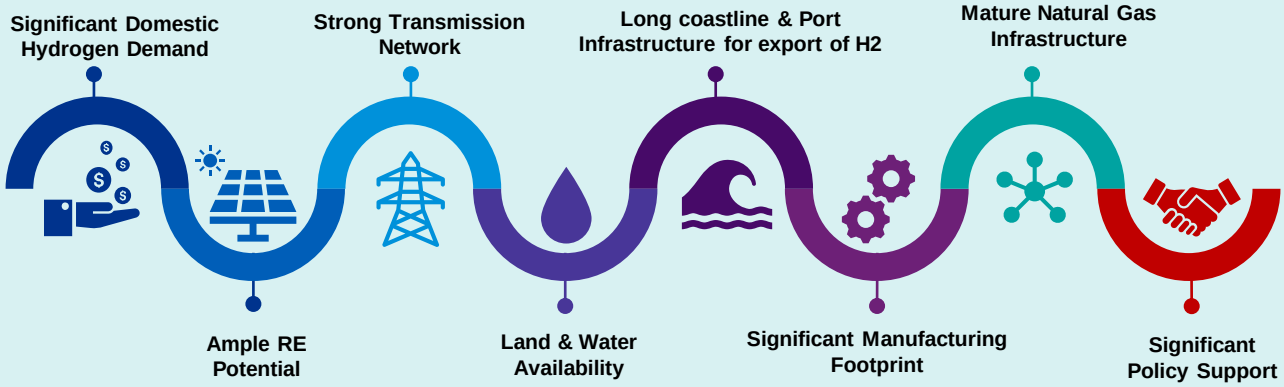
1 bn tonne
Reduce projected carbon emission by 2030

45%
Reduction in Carbon intensity of the economy by 2030

2070
The Year of achieving the target of net zero emissions

Advantage Gujarat: Favourable Destination for Development of Green Hydrogen Ecosystem

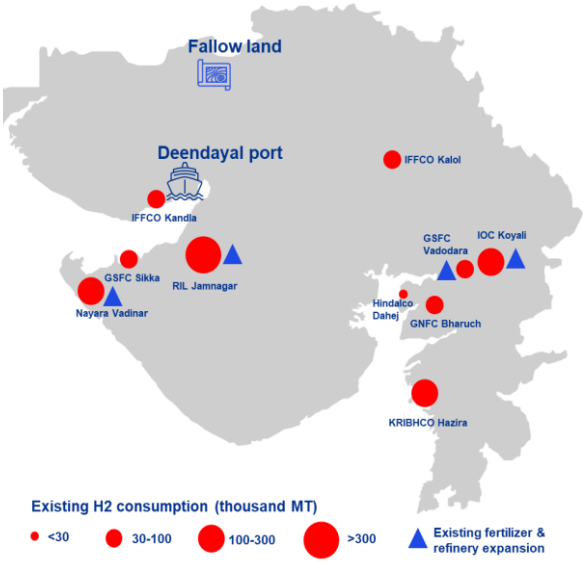
Gujarat's favourable characteristics for a Green Hydrogen ecosystem



Significant Domestic Hydrogen Demand

Gujarat is a key contributor to nation's hydrogen landscape with nearly 25% contribution to India's hydrogen demand. The demand approximately 1.5 to 1.6 million tons per annum primarily emanates from refineries and fertilizers. The strategic proximity between vast fallow lands allocated to green hydrogen developers for development of renewable energy and hybrid plants and Deendayal Port, selected as an export hub for green hydrogen, presents a unique advantage. With the existing demand poised to expand and applications in steel, shipping, and mobility expected to emerge over this decade, the demand is projected to reach almost 2 - 2.5 MMTPA.

Hydrogen demand locations



Ample Renewable Energy Resources for Development of Green Hydrogen Market

Gujarat stands at 2nd position in terms of total RE installed capacity in India and has significant potential for solar as well as wind resources. Further, it is one of the two states identified for development of offshore wind. Presence of diverse resources can enable developers to innovate on stable RE solutions which is a critical need for facilitating low-cost Green Hydrogen production.

Gujarat's renewable energy strengths

21.8+ GW Renewable Energy Installed Capacity

16% Total RE capacity in India	**1st** Wind power & Solar rooftop
2nd Ground Mounted Solar	**2nd** Wind-Solar Hybrid
179 GW Solar & Wind Potential	**36 GW** Off-shore Wind potential

RE Targets & Investments:
- Target of 50% of RE capacity by 2030 with Investment of INR 5,000 billion and utilizing approx. 4 lakh acres of land

Huge land bank:
- Designated land of 1.99 lakh Ha – in-principle approved land on a 40-year lease for GH production

Dedicated Authority:
- GPCL - Nodal agency for the land related aspects for GH

Conducive RE Policies:
- Recently notified the comprehensive Gujarat RE policy 2023 to facilitate ease of doing business

Innovation in clean energy:
- Promoting RTC renewable power – Hybridization of wind and solar, pumped storage projects, battery storage, etc.

Technical advisory by KPMG India and Mott MacDonald under Technical Advisory grant provided by ADB

Robust Port Infrastructure to facilitate Gujarat as "Green Hydrogen Hub"

Gujarat's extensive 1,600 km coastline and well-developed port infrastructure offers a strong opportunity to develop large-scale Green Hydrogen export projects. Initiatives are already underway to establish Deendayal port as a major Green Hydrogen export hub. Deendayal Port is one of the 13 major ports in the country situated near to the Gulf of Kutch and ranked 1st in terms of handling cargo.

Deendayal Port Characteristics

- **Handled ~ 137 MMT of cargo in FY'23**
- **Major Port which is closest to the Middle East and Europe - key markets for Green H2**
- **Port has existing robust infrastructure of 7 oil jetties and pipelines**
- **Vessel has a draft handling capacity of 12.5 m, which can be increased to 14 m**
- **Significant experience in handling ammonia – at IFFCO terminals**

Selected as "Hydrogen Hub"
Deendayal Port identified as one of the 3 ports to be developed as "Hydrogen Hub" in line with the Maritime India Vision 2030

Availability of Land Parcels
Available for developing Green Hydrogen based facilities (production, bunkering, Logistics – Loading / unloading)

Collaboration & partnerships
Port has received multiple interests to develop a green hydrogen hub

❖ Strong Transmission Network

The state has a strong transmission network managed by GETCO, encompassing approximately 73,000 ckt. km and a power transmission capacity of 163 GVA. GETCO has been undertaking various initiatives to improve grid supply and building infrastructure. Under Phase I of the Green Energy Corridor (GEC) scheme, GETCO identified and approved substations and lines worth ~ INR 20 billion for RE evacuation. Under GEC Phase II, the Intra-State transmission scheme is identified for facilitating around 4.5 - 5.0 GW RE power integration in Kutch & Saurashtra region.

❖ Land and Water Availability

Gujarat has proactively allocated land of 1.99 lac ha for green hydrogen projects. The state developed the country's first government desalination plant at Dahej. There are additional plans for desalination plants with a capacity of 27 crore litres at Devbhumi Dwarka, Bhavnagar, Kutch and Gir Somnath districts. Addressing land and water constraints can contribute significantly to accelerating the development of green hydrogen projects.

❖ Significant Manufacturing Footprint

Gujarat is the most industrialized state in India, with the highest contribution to the national manufacturing output. The state has advanced business ecosystem enabled by robust infrastructure and investment-friendly policies. This has attracted several large-scale investments across sectors. Leveraging its significant manufacturing footprint, the state is well-positioned to contribute to the large-scale manufacturing of green hydrogen production, storage and transportation equipment which will be crucial for the development of a robust localized supply chain.

❖ Mature Natural Gas Infrastructure

The mature natural gas infrastructure, including a comprehensive gas pipeline network, positions Gujarat to facilitate the offtake of hydrogen through natural gas blending. Multiple firms have announced plans to blend green hydrogen in the piped natural gas (PNG) network in Gujarat. Recently, Gujarat Gas Ltd. and NTPC have commissioned India's first green hydrogen blending at Hazira, Gujarat. Such initiatives will enable the demand of hydrogen in newer areas.

Key policy interventions by Gujarat

A

Gujarat's Land Lease Policy for Green Hydrogen Production, 2023

- One of the first land allotment policy in the country for green hydrogen production.
- Gujarat has already provided in-principle approval land of 1.99 lakh ha to various developers.
- Lease period is for 40 years at very economical rate (INR 15,000 + 15% increment in every 3 years)

B

Aatmanirbhar Gujarat Schemes for Assistance to Industries, 2022

- Green Hydrogen / Ammonia & Electrolyser covered under thrust manufacturing sector.
- Attractive financial incentives - Interest subsidy, SGST reimbursement, Reimbursement of Input SGST paid on capital goods and 100% reimbursement of stamp duty and registration charges.

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Key Pillars to Drive Gujarat Green Hydrogen Economy Leadership

A 1 MMTPA green hydrogen production capability can offer significant benefits to Gujarat (broad estimates)

Electrolyser Installed Capacity
8-10 GW

RE Installed Capacity
20-30 GW

Estimated Jobs
110,000-130,000

Investments in Electrolysers
INR 45,920-57,400 Cr

Investments in RE Generation
INR 100,000-150,000 Cr

Estimated Emission Reduction
~10 MnT CO2e

Gujarat has demand factors, supply strengths and critical enablers such as policy and infrastructure in place to develop GH ecosystem. Gujarat can accelerate the development of the economy leveraging key pillars of growth as discussed below;

Leveraging Green Hydrogen Global Trade Opportunities

Gujarat is well placed to serve markets such as Western Europe and North Asia (Japan, South Korea) from which major green hydrogen and derivative demand is expected

Boosting Low-Carbon Infrastructure Development

Gujarat is a leading state in several industries such as steel, refining, fertilizer, chemicals, etc. which are also heavy emitting sectors. Gujarat can create significant impact in the country by leading decarbonisation opportunities across sectors

Innovation in RE Power & Cost of Hydrogen

Availability of diverse RE resources including offshore wind is a distinguishing factor. Gujarat can look to promote extensive innovation in RE power to enable low-cost stable power for green hydrogen

Emerging as Manufacturing Hub

Gujarat can be leader in green hydrogen value chain equipment manufacturing with strong policy and infrastructure, leveraging competencies from industries such as process equipment, auto component and power system equipment

Fostering skill development

Estimated 100,000 jobs may be required in Gujarat to capture 20% of market share of India's 5 MMTPA by 2030. A key pillar for development is addressing critical skill gaps through actions such as industry and academia collaboration, focused skilling policy and road map, etc.

Leverage GIFT city Infrastructure

GIFT City offers a well-planned infrastructure and connectivity, empowering financial service and robust regulatory framework which offers the opportunity for financial innovation for new technologies such as green hydrogen

Bridging Innovation and Collaboration

Gujarat has taken the lead in innovation across the value chain with the Hydrogen Valley Innovation Cluster (HVIC) which is a part of India's commitment to develop three clean Hydrogen Valleys by 2030. This needs to be leveraged to pivot Gujarat to a leadership position

Digitalization Opportunity and Future

There is a unique opportunity to spearhead the development and deployment of digital capabilities to optimize efficiency, cost, safety and transparency in green hydrogen production and delivery which can enhance the state's image as a world class green hydrogen hub

Key ADB Engagement on Energy, Climate & Green Hydrogen

Asia and the Pacific's Climate Bank, Strategy 2030, Energy Policy 2021

- ADB is Asia's Climate Bank, committing $7.1 billion in 2022
- ADB is the FIRST Multilateral Development Bank (MDB) to:
  - ✓ Set clear climate investment targets for 2030 to $100 billion in cumulative climate finance from its own resources.
  - ✓ Implement a long-term climate change operational framework
  - ✓ Establish climate risk screening & management framework
  - ✓ Be accredited by the Green Climate Fund (GCF)
- ADB's Strategy 2030 calls for reliable energy access to all
- ADB's 2021 Energy Policy aims to support universal access to reliable and affordable energy services and promote low-carbon transition.

Green Hydrogen Unleashed: Navigating the future of Gujarat

ADB in partnership with GPCL organized Hybrid Regional Green Hydrogen Workshop on 9th November 2023 in Gandhinagar with international technology experts, energy sector, and renewable energy leaders with over 200 multi-country attendees.