Ammonia Co-firing Project at Adani Power

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Context for India

- India’s economy has to grow multiple fold if its people are to have the quality of life they deserve.
- This growth will have to underpinned by a significant expansion in India’s energy production - especially electricity generation
- India’s per capita energy consumption is 40 per cent of the world’s average and one-tenth of many developed economies
- Despite India accounting for just 3 per cent of the planet’s cumulative greenhouse emissions, India’s energy growth trajectory has to be responsible as the world faces adverse impact of global warming
- For this reason, at COP26, Prime Minister Modi pledged 45 per cent reduction in carbon intensity of India’s economy by 2030 over 2005 levels
- Also, India to reach 500 GW non-fossil energy capacity by 2030 and 50 per cent of its energy requirements from renewable energy by 2030

India’s Quest for Base Load Power

- India has demonstrated significant progress toward its renewable energy ambition and Adani Group has played a leading role with over 5 GW of operational assets and more than 20 GW in pipeline.
- The intermittency of renewals, however, requires steady base load power; India has limited options:
  - ✓ It does not have abundant natural gas and imported LNG for power generation is not economically viable.
  - ✓ While nuclear has a role to play, it requires long lead times, high capital expenditure, and import of uranium.
  - ✓ Expansion of India’s hydro-electricity capacity has to consider ecological impact and community displacement.
- Hence, coal is necessary as a source of base load power in India for the medium term.
- India’s National Hydrogen Mission and Adani Group’s significant planned investment in the Green Hydrogen value chain - USD 70 billion over the next decade in partnership with Total Energies - is an attempt to address energy storage and decarbonization pathways.
- At a price point of under USD 1/kg of green hydrogen, combined with cost reduction in combined cycle hydrogen turbines and utility scale fuel cells, there is a pathway out of fossil fuels for electricity generation.
- In the meantime, blending with coal of green ammonia - produced from green hydrogen - provides a responsible approach to reducing emissions from thermal power plants.

Ammonia Co-firing in Thermal Power Plants

- Hydrogen as an energy vector is a great store of energy as it has high gravimetric density. However, hydrogen has low volumetric density and storage and transportation of hydrogen is difficult and costly.
- Controlled combustion of hydrogen in coal fired furnace even at blending levels as low as 10 per cent poses safety challenges.
- Ammonia can be viewed as a hydrogen energy vector and as the combustion point for ammonia is similar to coal, it is a good candidate for co-firing.
- M/s JERA Japan (a joint venture between Tokyo Electric Power and Chubb Electric Power) have chosen ammonia co-firing in coal-based thermal power plants to utilize hydrogen as an energy vector as a path to net-zero emissions by 2050.
- M/s JERA aim to achieve an ammonia co-firing rate of 20 per cent at their 1 GW Hekinan thermal power station in Aichi, central Japan, by FY 2024-25. Estimated carbon dioxide reduction would be 1 million tonnes and estimated ammonia consumption would be 0.5 million tonne.
- M/s JERA will begin a demonstration project at the Hekinan plant from August 2022

Current Status : IHI & KOWA - Ammonia cofiring feasibility study

- Ammonia cofiring feasibility study has been taken up with IHI and KOWA.
- MOU has been signed between APL, IHI and KOWA for feasibility study.
- Ammonia Co-firing feasibility study started on 1st June 2022.
- Ammonia supply chain and supply scheme designs are in progress
- Study is planned in 3 phase (Phase -I, Phase - II and Phase III) at APL Mundra

Sr No	Ammonia Co-firing	Scope	Project timeline
1	Phase - I study	Techno economic feasibility study - CAPEX, OPEX, Modification required, emission reduction potential, site survey etc..	Dec 2022
2	Phase - II study	Simulation model development and study for Boiler	Dec 2023
3	Phase - III Implementation (20% Ammonia cofiring)	Implementation based on Phase - I and Phase - II successful feasibility studies	Nov 2025

A Brief Survey of Ammonia Co-firing

- L&T MHI : L&T MHI had demonstrated Ammonia & Hydrogen Co-firing along with Natural gas in Gas Turbine (30%).
- EPRI : involved in Ammonia & H2 production, storage, and cofiring in Gas Turbine study.
- M/s B&V had experience in cofiring of Ammonia & H2 along with Natural gas in Gas Turbine.
- M/s Siemens : M/s Siemens has experience in cofiring of Ammonia in Gas Turbine.

Carbon Free Combustion System Development

MITSUBISHI POWER

Several development of combustion system for carbon free (=CO_2 zero)

Product		Detail	Status
Ammonia Mixed Boiler		20-30% ammonia mix for coal firing boiler	2023 verification
H2 GT	30% H2	30% hydrogen mix for current LNG GT combustor or with minimum modification	2018 completion
	100% H2	100% hydrogen combustor (multi cluster)	completion M:2025 H:2023
Ammonia Cracking GTCC		Ammonia cracking and conversion to H2 by GT exhaust heat (good for high temperature large GT)	2026-2029
Ammonia Direct Combustion GT		No need of ammonia cracking system, higher NOx due to ammonia direct combustion and deNOx in HRSG required	2024 completion

New!

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Thank You