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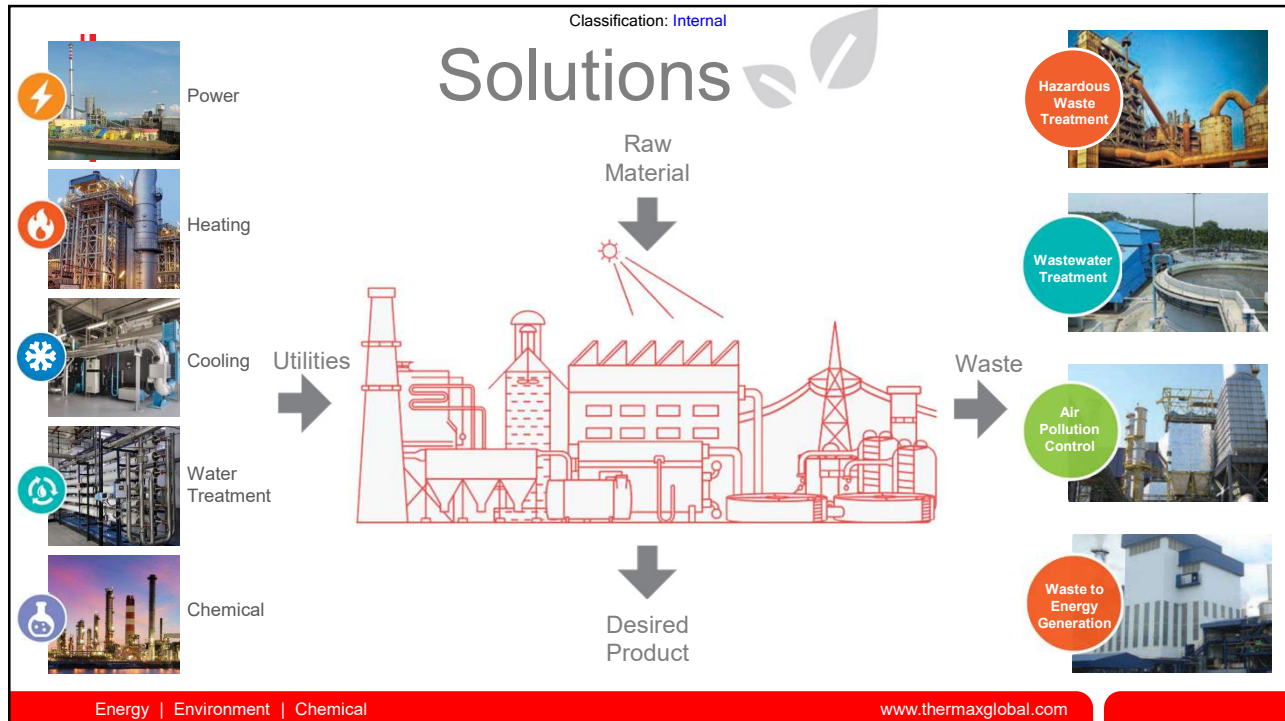
Thermax Green Hydrogen Overview At Greenco Summit 2024 (26 – 27 June)

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Manufacturing Capability

- ✓ Proven manufacturing expertise and track record as reputed OEM across multiple product categories
- ✓ Steady investment in new plants and capacity augmentation in India and overseas
- ✓ Operating 14 manufacturing facilities, 10 in India and 4 overseas
- ✓ Focus on automation and digitization – moving towards industry 4.0
- ✓ Highest standards of safety and compliance

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Manufacturing Footprint



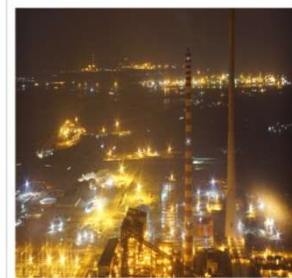
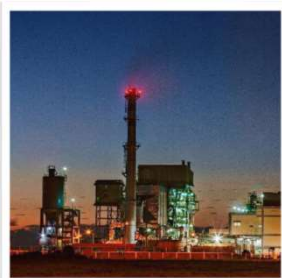
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EPC Capabilities



- 150+ turnkey projects contracted across the globe
- 20+ projects totaling >400 MW across Middle East, Africa and South-East Asia
- Market leader in India for EPC of captive (in-situ generation) power projects (>3500 MW) for 25 years
- Supported by in-house manufacturing
- Strong technology driven project management with integrated online dashboards

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Power EPC - Key Projects



- 18 MW waste heat recovery power plant for Wonder Cement in Rajasthan; one of the largest in India



- 300 MW independent power plant for Meenakshi Energy Private Limited, India



- 40 MW coal based captive power plant for Sharjah Cement Factory on EPC basis



- 100% rice husk fired independent power plant for Isabela Biomass Energy Corporation, Philippines



- Synchronised 4.9 MW cogeneration plant in Visakhapatnam, India, for a leading API and speciality chemical manufacturer



- A 50 MW gas based cogeneration plant for Rashtriya Chemicals and Fertilizers Limited (RCF), India

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Thermax Waste Heat recovery capability



Power Generation



- ~1000 MW of waste heat recovery power plants executed on EPC basis over 25 years
- Key references across sectors include:
 - Steel - Vedanta/ SAIL/ Tata
 - Cement – JK Lakshmi/ Madras Cement
 - Sponge Iron – Tata Sponge/ Kirloskar Ferrous
 - Fertilizers – National Fertilizer Ltd.

Steam Generation



- With over 1000 installations worldwide, Thermax is the leader in waste heat recovery solutions in various industries
- Waste heat sources addressed by WHR boilers include:
 - Sponge Iron Kilns,
 - Coke Ovens / Blast Furnace Gas,
 - Refinery & Petrochemical plant,
 - Fertilizer/Chemicals

Cooling Solutions



- ~3000+ global installations of waste heat-based vapour absorption chillers and heat pumps
- Thermax exhaust fired absorption machines directly utilize waste heat from below sources to generate almost free air conditioning:
 - Gas/diesel engine
 - Turbine exhaust gases,
 - Micro turbine or Fuel cell

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Our Green Solutions





Green Hydrogen



Renewable Power
Solar, Wind & Hybrid



Bio-CNG



Fuel Cells



Green Utility Solutions
under
Build-Own-Operate

Supported by strong manufacturing capability and strong track-record of executing complex EPC projects


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Thermax play in Green Hydrogen




Thermax is an integrated solution provider with capabilities across the green hydrogen value chain including biomass

Manufacturing




Set up Giga-scale electrolyser manufacturing facility

BOO




Green Hydrogen generation projects on build own operate basis

EPC



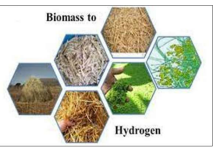
Green hydrogen and green ammonia project execution on EPC basis

R&D



Partnering with institutes & startups for emerging technologies

Bio-Hydrogen



Scale up and commercialization of gasification & microbial tech.

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Thermax Offerings

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Electrolysis Solutions

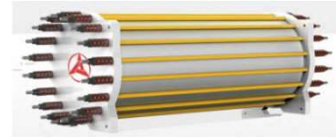
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Customized Hydrogen Plant Solutions



- ✓ Strong in-house process design and engineering capability
- ✓ OEM for BoP equipment like water treatment, gas purification, chillers etc.
- ✓ Developing unique solution for low grade waste heat recovery in Alkaline process
- ✓ System level optimization for cooling water, chiller etc. based on extensive system engineering experience
- ✓ Ability to offer customized BoS and BoP solutions based on plant requirement



Stack

Collaborate with AWE stack OEM for stack supply/manufacturing

Currently developing in-house solution for BoS components like, Gas lye separator and Hydrogen purification system

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Thermax In-house capability



Supply from Hydrogen Division

- Gas Lye Treater Package
- Hydrogen purification
- Hydrogen storage tank
- Overall fabrication

Supply within Thermax

- DM Water system
- Chilled Water Package
- Waste water plant
- Zero Liquid Discharge
- Effluent treatment
- Cooling tower

Bought out

- Hydrogen compression
- Pumps
- Fire fighting
- HVAC
- Flaring system
- Transformer – Rectifier set
- PLC

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Optimized Hydrogen generation solutions



Skid based solution for small scale projects



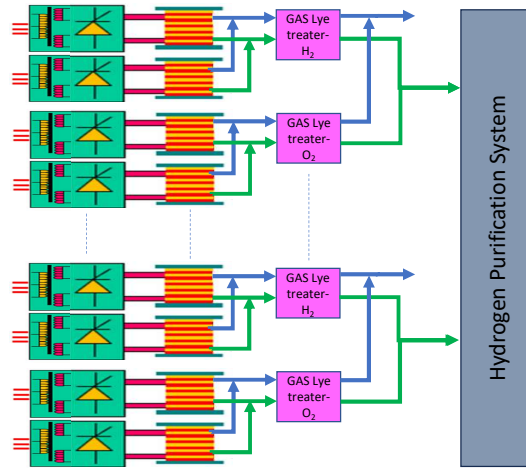
Gas Lye Separator



Gas Purification System

- Skid based solution for gas lye treater up-to 20 MW
- Skid based solution for capacity up-to 40 MW for Hydrogen purification system (HPS)
- HPS can be design and engineered for multiple stacks for large scale projects
- Strong in-house engineering capabilities for optimization of BoS + BoP components

Customized solution for large scale projects



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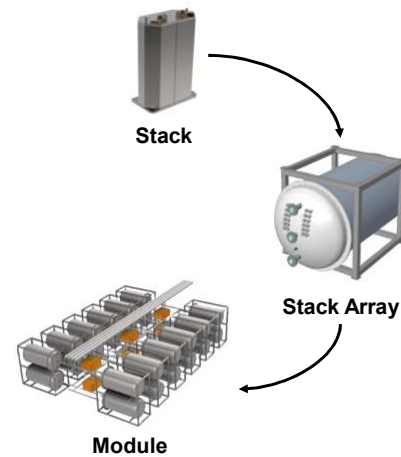
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SOEC – Competitive technology



- ✓ High efficiency compared to other electrolyser technology
- ✓ Heat integration possible with process plants (like Fertilizers, Ammonia, etc.)
- ✓ Lower LCOH compared to other electrolysis technology as technology matures and cost comes down
- ✓ Suitable for production of e-fuels
- ✓ ~10 GW market size globally as per IEA by 2030



Thermax is currently in advance stages of collaboration discussion with SOEC OEM

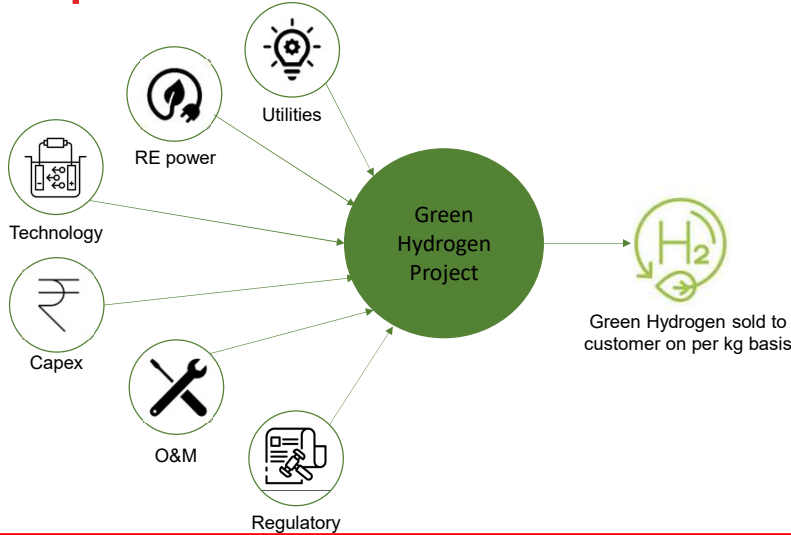
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Built-Own-Operate GH₂ assets



- ❖ Developing GH₂ project on BOO basis for industrial cluster
- ❖ Working with State Nodal Agencies (SNA) for availing state GH₂ policy benefits
- ❖ Working closely with First Energy (Thermax subsidiary) / RE partners for renewable energy source
- ❖ In discussion with various hydrogen developers/suppliers to collaborate for large scale PSU tenders. Form consortium with hydrogen developers/suppliers or act as EPC partner

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SCM capabilities



Supplier Onboarding

- Suppliers are selected based on stringent parameters:
 - Quality,
 - Delivery,
 - Financials and
 - Service level parameters
- Very close interaction between technical teams to have the optimized product.
- Various packages are inhouse within Thermax divisions.



Supplier Strategic Partnership

- Most of the suppliers are Thermax's trusted business partners having long term relationships.
- Strong connect with suppliers' top managements and having very good leverage over priority for deliveries.
- In the process of having 'Long Terms Contracts' with some key suppliers based on expected business volume.



Critical Packages

- Transformer & Rectifier set
- HV / LV switchgear
- PLC / DCS, Control & Instrumentation system
- H₂ / O₂ separator
- H₂ purification system
- H₂ compressor
- H₂ storage / process vessels
- Bio-mass gasifier
- Desulphurization unit

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Fuel Cell

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Thermax Fuel Cell Development

- Partnered with DRDO (Defense Research & Development Organization) for the development and deployment of PAFC (Phosphoric Acid Fuel Cell) stacks for strategic applications
- Productized the stack for this application - only company in India having Fuel Cell manufacturing facilities

State-of-the-art Manufacturing Facility



Manufacturing Capabilities

Fuel Cell Facility – Operations

Design & Engineering

Production Planning

Manufacturing Engineering

Quality Assurance

Production

Testing & Field support

Scalable State of art production facility catering to strategic needs

ISO 9001 (2015), 14001 (2015) Quality & Environment Management systems

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Biomass to Hydrogen

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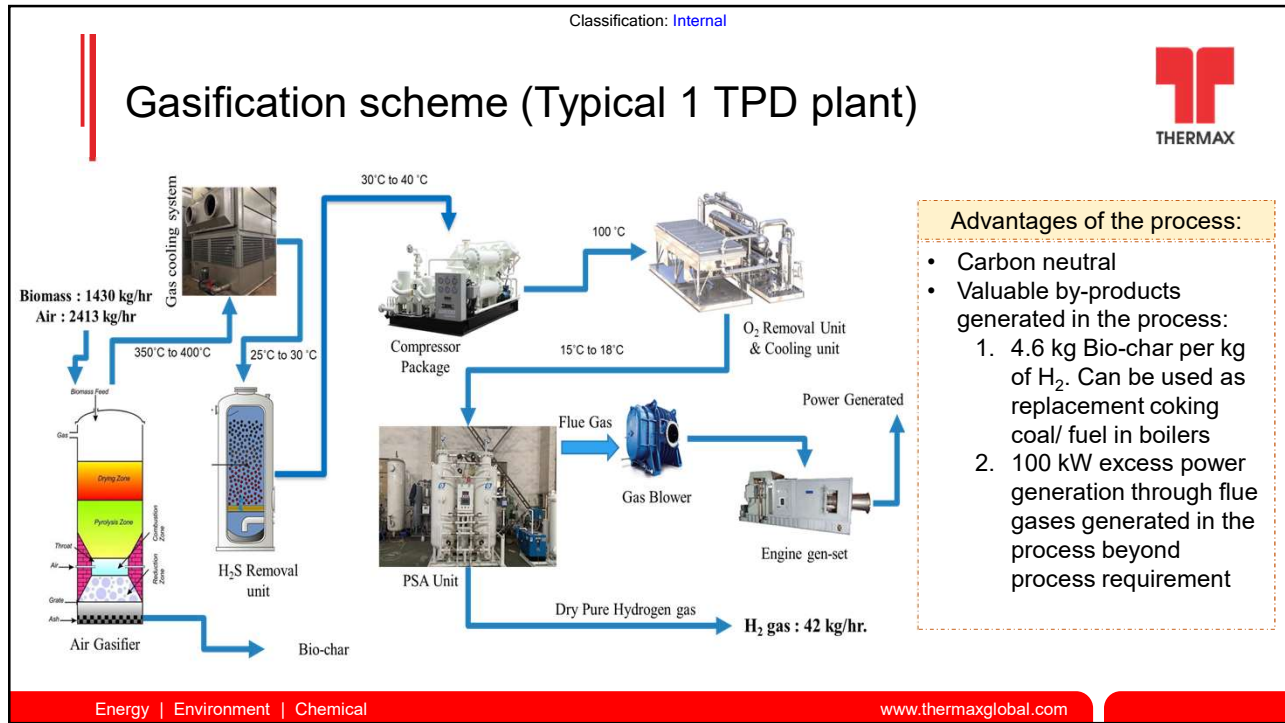
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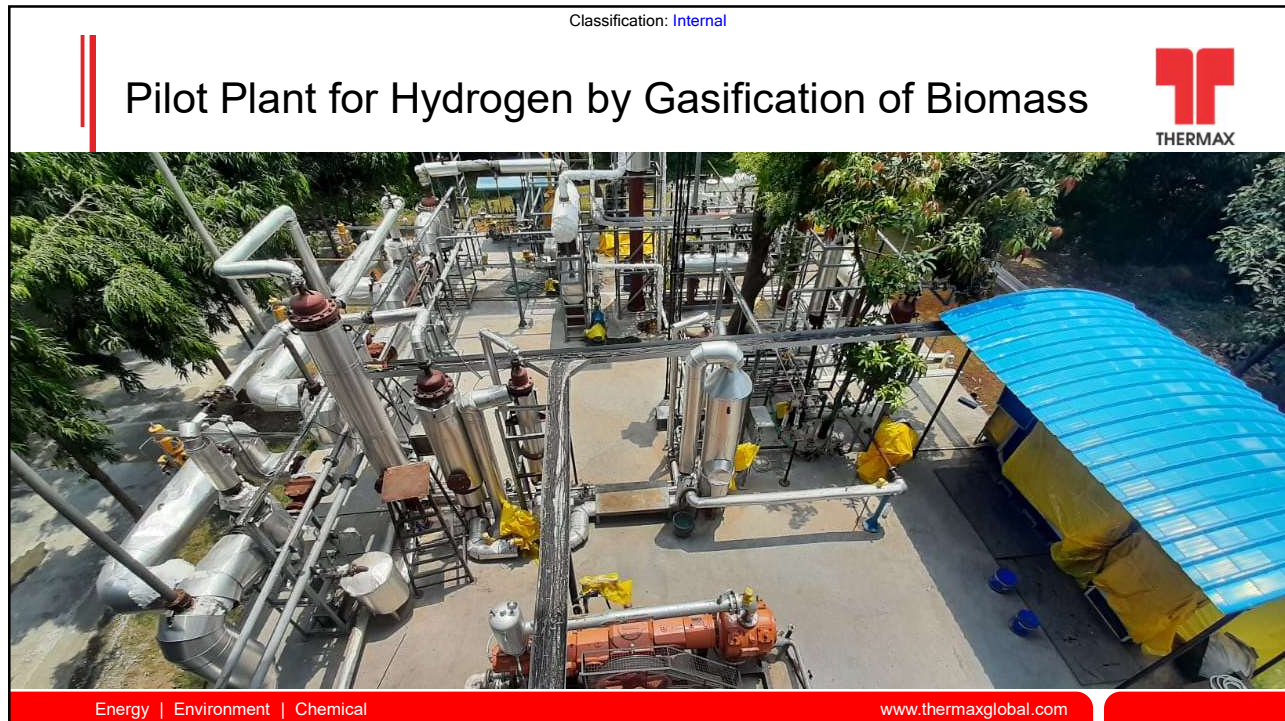
Hydrogen Generation by Gasification of Biomass

- ✓ Technology developed in collaboration with Ankur Scientific Energy Technologies and KPIT
- ✓ Suitable for woody biomass such as bamboo, briquettes, pellets, various husks, shells etc.
- ✓ Yields 1 kg of hydrogen from 30 kg of biomass.
- ✓ Along with the Hydrogen the process also generates bio-char and Green CO₂ as a byproduct
- ✓ Technology is proven at a **pilot plant** scale with Hydrogen generation capacity of **125 kg/day**
- ✓ Critical gasification process is well established with multiple running installations globally
- ✓ NextGen Technology optimization under progress for improving capex & opex

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