

JCM Implementation in Indonesia 2021

- Innovation for Carbon Neutrality through JCM -

29MW Binary Power Generation Project in Philippines
by support of JCM

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MHI Group - Achievements in Indonesia

Power Plant

17 GW by 2022 (Total supply capacity)
with GTCC, Coal fired, Industrial and **Geothermal** power plant

3 ongoing construction projects
(Central Java, Tanjung Jati and Cirebon II)



Chemical & Fertilizer Plant

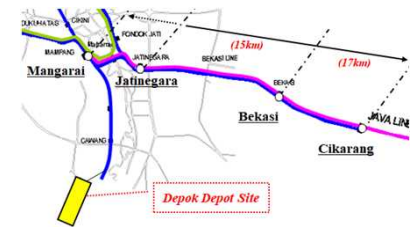
8 chemical & fertilizer plants delivered since 1998
(Ammonia, Urea, Sulfuric Acid, Gas Gathering, Styrene Monomer & Ethylbenzene, Acrylic Acid & Acrylic Ester and Octanol)



Transportation

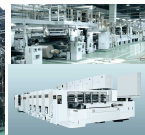
Depok Depot Project completed in 2007
- The largest class train depot in ASEAN

Java Main Line (Manggarai – Cikarang) completed in 2017
- Double-double tracking
- Electrification
- Signal system renewal



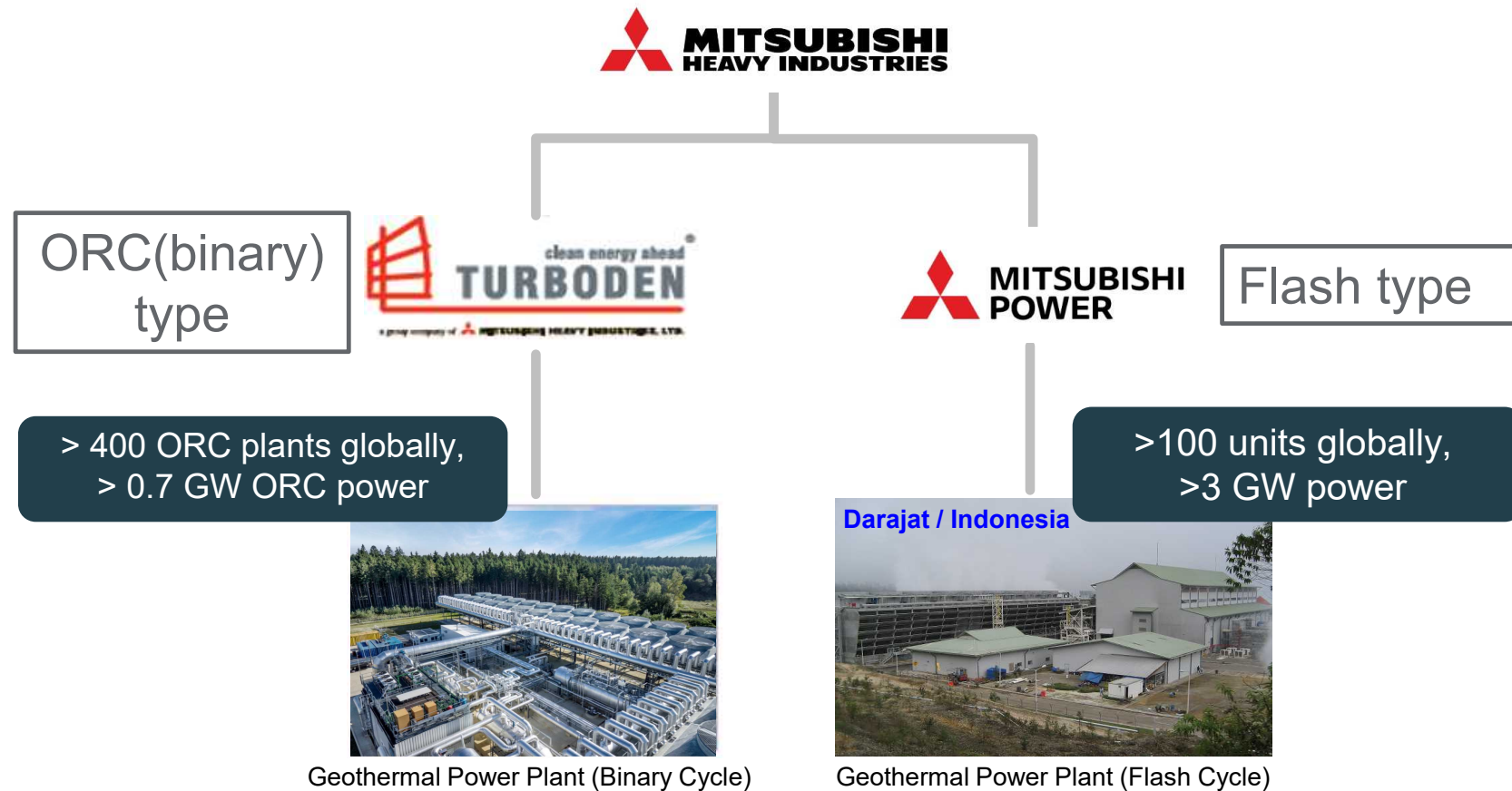
Industrial Equipment

- Diesel/Gas Engine Generator Set
- Air Conditioning System/Chiller
- Forklift
- Marine Engine
- Rubber & Tire Machinery
- Food & Packaging Machinery
- Printing & Packaging Machinery



MHI Group – Geothermal Solutions

MHI Group can contribute to reduce GHG emission for various geothermal field, with our best practice through our global experience.



Philippines Palayan Project under JCM scheme

29MW Binary Power Generation Project at Palayan Geothermal Power Plant

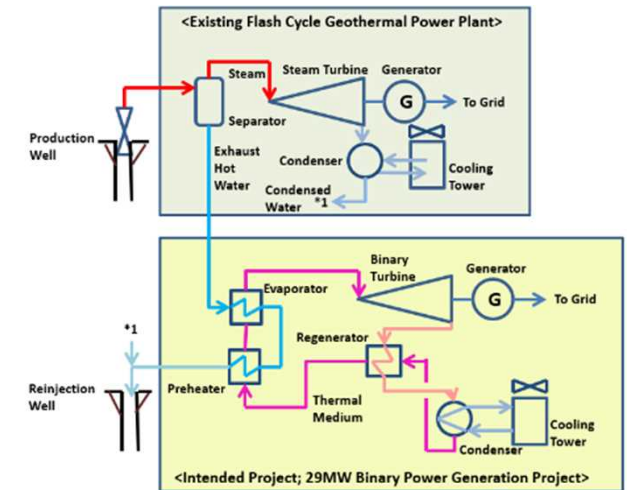
- ✓ 29 MW binary geothermal power plant with the Organic Rankine Cycle (ORC) system to the existing 120MW flash type geothermal power plant owned and operated by Bac-Man Geothermal Inc.
- ✓ Located at Palayan area of southern part of the Luzon island
- ✓ Effectively utilizes exhaust hot water of low enthalpy from the existing flash geothermal power plant without producing hazardous gasses
- ✓ Replaces the grid power produced by fossil fuel with renewable energy and reduces greenhouse gas (GHG) emissions

Expected GHG Reduction

$$\mathbf{72,200\ tCO_2/Year} = (\text{Reference CO}_2 \text{ emissions}) - (\text{Project CO}_2 \text{ emissions})$$

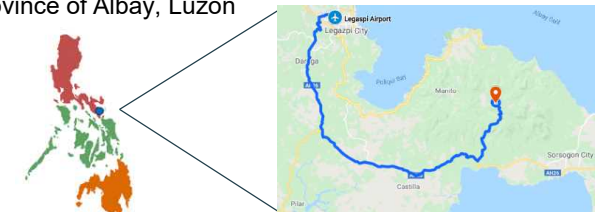
- Reference CO₂ emissions
= (Quantity of the electricity generated by the project) [MWh/year]
× Emission factor [tCO₂/MWh]
- Project CO₂ emissions = 0 [tCO₂/year]

System Configurations



Site Location

Province of Albay, Luzon



Approx. 60km Southwest of the Legazpi City Airport

Project Site – Initial Plan

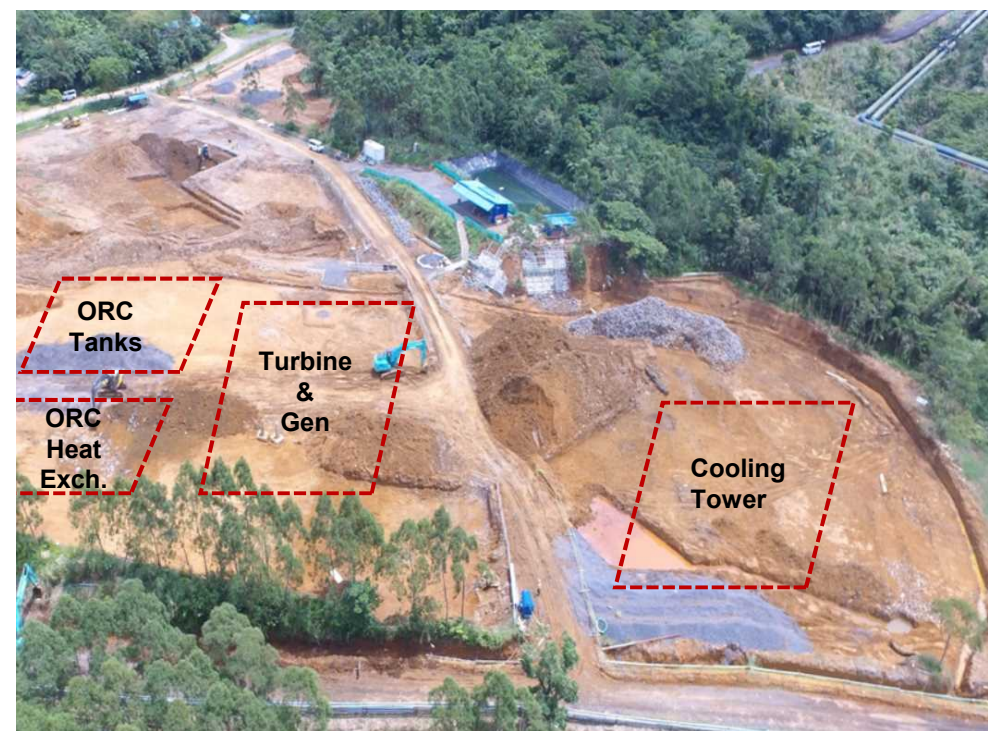


Existing flash type
geothermal power plant

New binary geothermal power plant

Project Site – Current conditions

Civil work has been already started at the project site.



Turboden Organic Rankine Cycle (ORC) Power Generation System

Turboden

- ✓ Established in 1980 as pioneering company specialized in ORC technology.
- ✓ Member of MHI Group since 2013.

What is the ORC System?

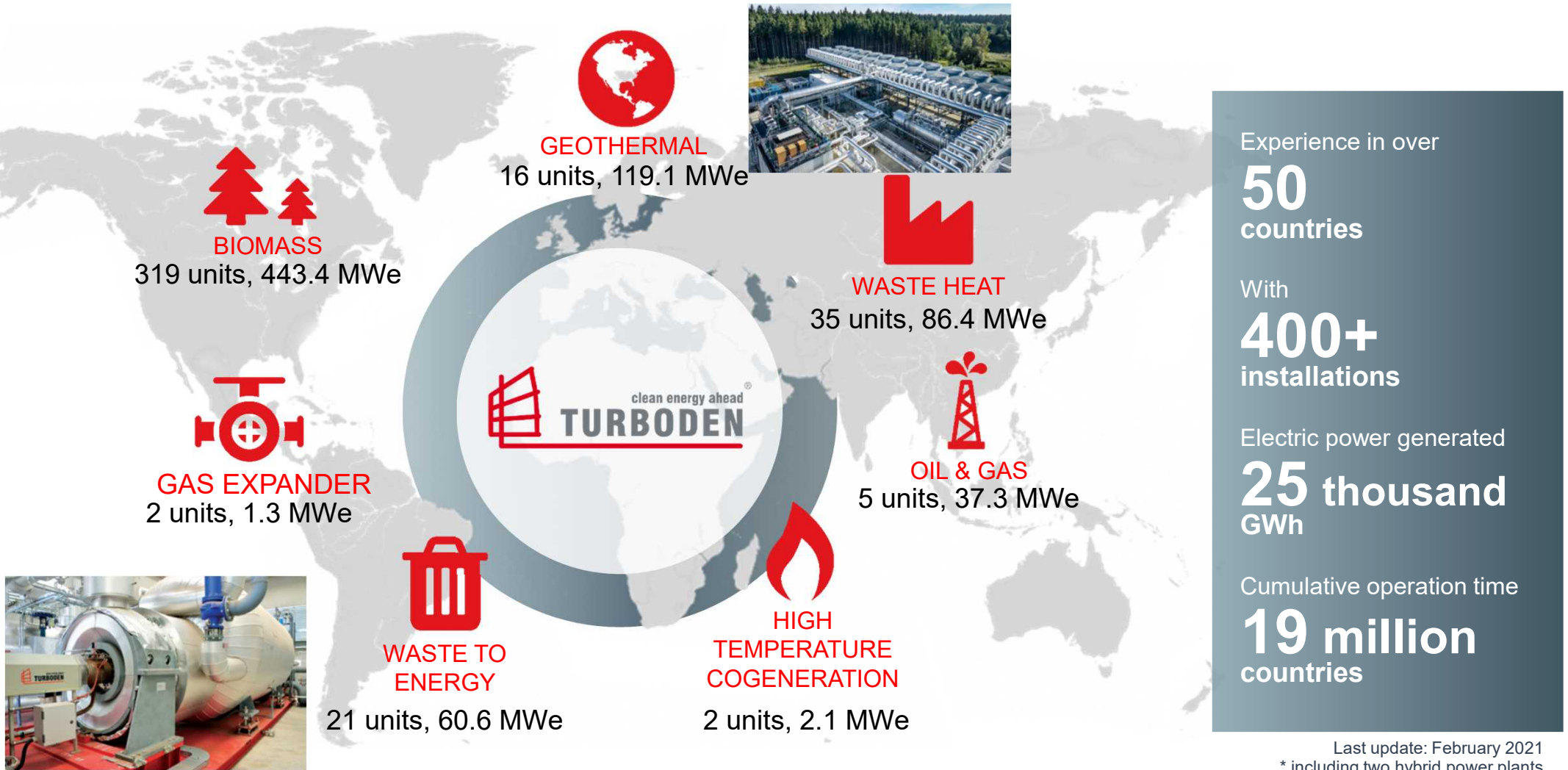
- ✓ Drives turbines to generate electricity by evaporating organic mediums
 - Reduction gearless high-efficiency turbine system
 - Slow rotation speed and small mechanical stress
 - No condensation in the turbine expansion area, and no erosion on blades
 - No combustion involved in the ORC process
 - Selective cooling systems, water-cooled or air-cooled
 - Able to supply stable power compared with solar/wind power generations
- ✓ Applications: geothermal, various industrial waste heat recovery, waste power generation, biomass, etc.
- ✓ Output range: several hundred kW to 20 MW



Delivery record

- ✓ Approx. 400 units (total 660MW) have been delivered to 50 countries around the world
- ✓ 1.1 biomass plant under installation in Indonesia

Turboden ORC Global and Proven Experience



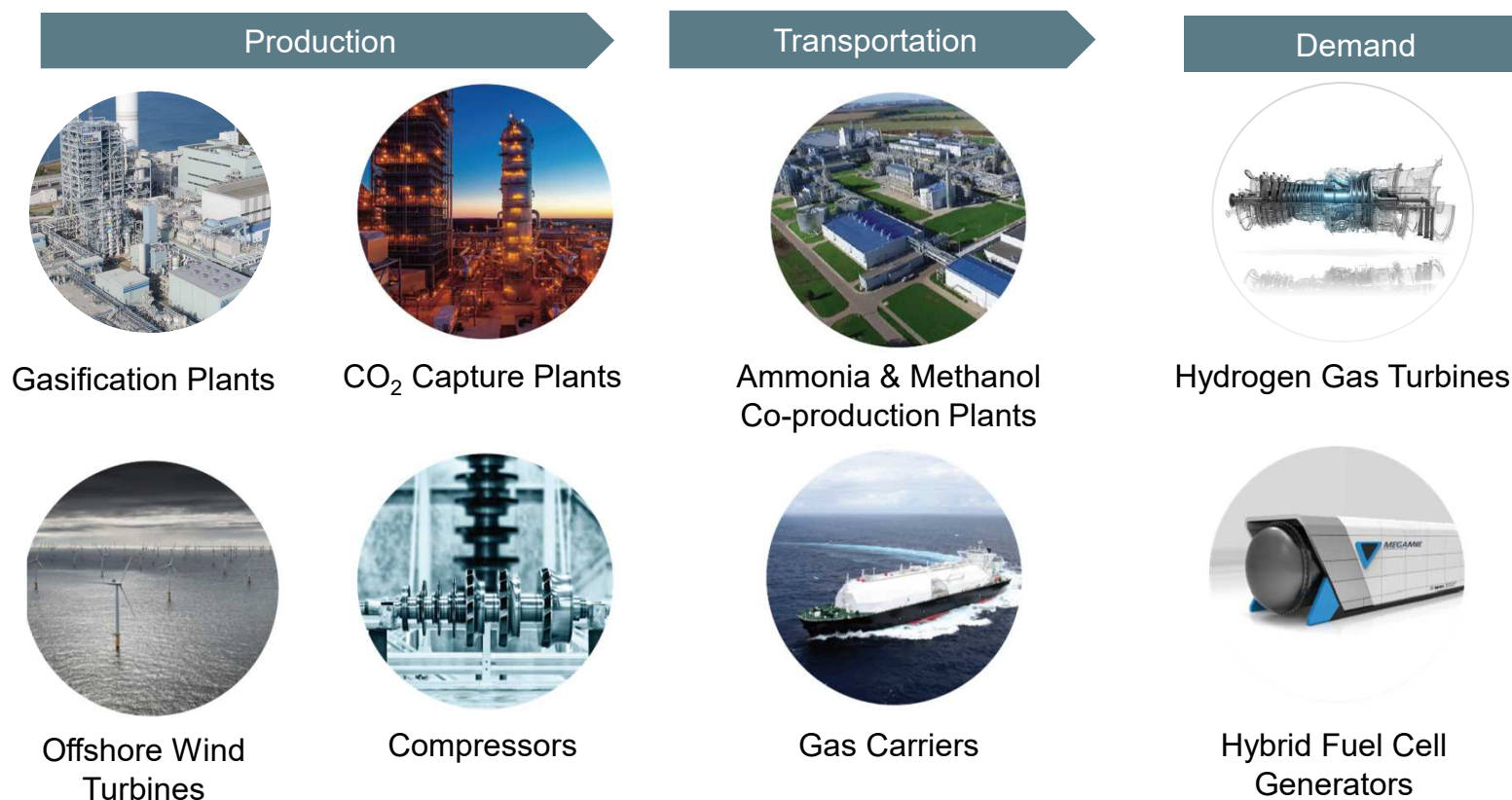
MHI's view of the Energy Transition

Contribute to achieving a carbon-neutral world by 2050 through decarbonization technologies and hydrogen value chain



MHI Group in Global Hydrogen Supply Chain

The MHI Group has a vast range of technologies and end-to-end solutions for the hydrogen supply chain



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