MOVE THE WORLD FORWARD MITSUBISHI HEAVY INDUSTRIES GROUP

Hydrogen:
A Fuel of the Future

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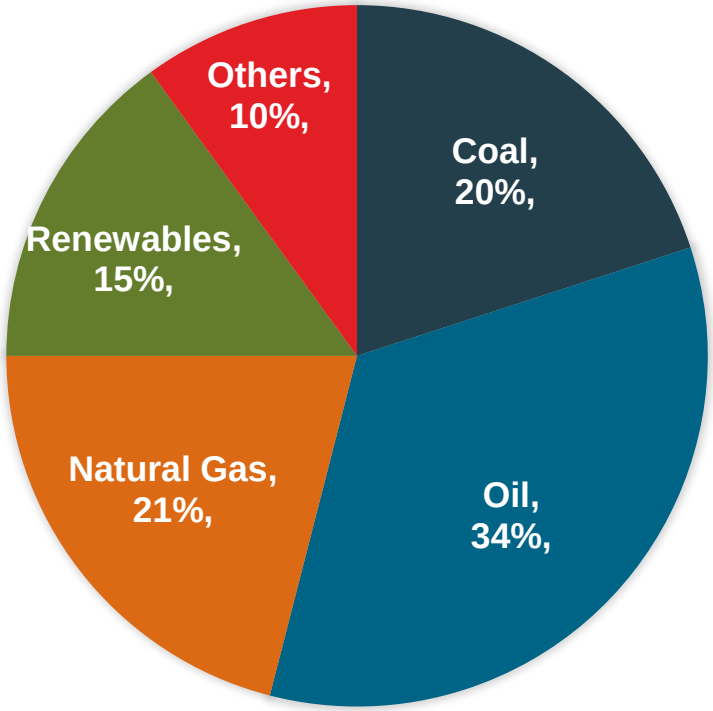
The ASEAN energy landscape today

SOUTHEAST ASIA'S ENERGY MIX



The region is still heavily reliant on oil and coal with both carbon-intensive fuels accounting for more than half of the region's power.

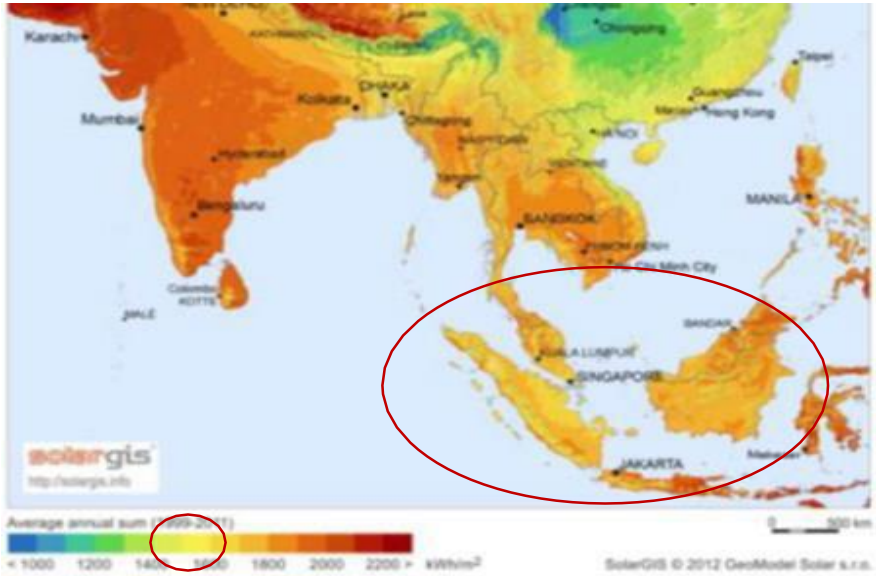
As countries in the region look to reduce emissions, more low-carbon and zero-carbon fuels will need to more prominent parts of the mix.

Source: IEA Southeast Asia Energy Outlook 2019

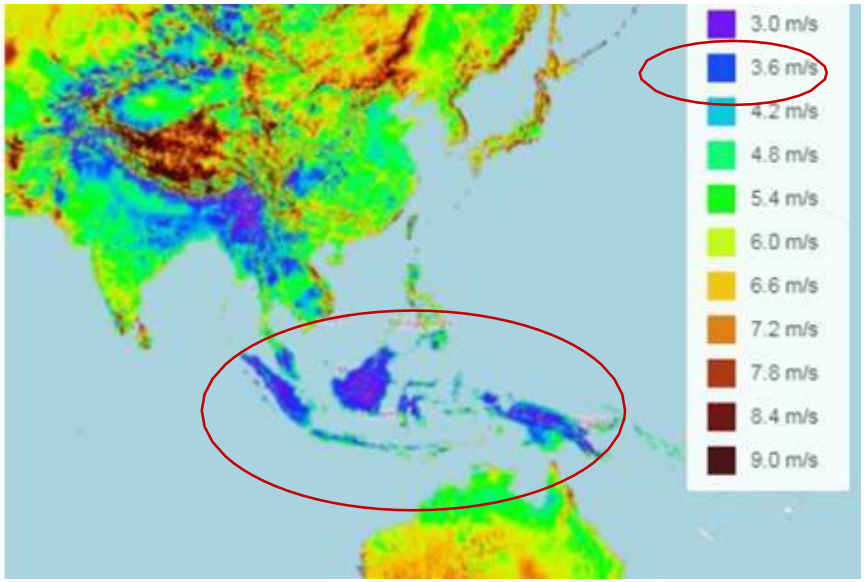
(Sample)Renewable Energy Development in Indonesia

Source: IRENA
Renewable Energy Institute

Solar Radiation



Air volume for Wind turbines



- In Indonesia, Good area for Solar and Wind is limited
- Indonesia produces electricity almost 50% from Coal, 25% from Gas.
- Difficult to expect wide spread of Solar & Wind Power.

Utilization of thermal power is the most important challenge for energy transition in Southeast Asia.

Technological roadmap for decarbonization

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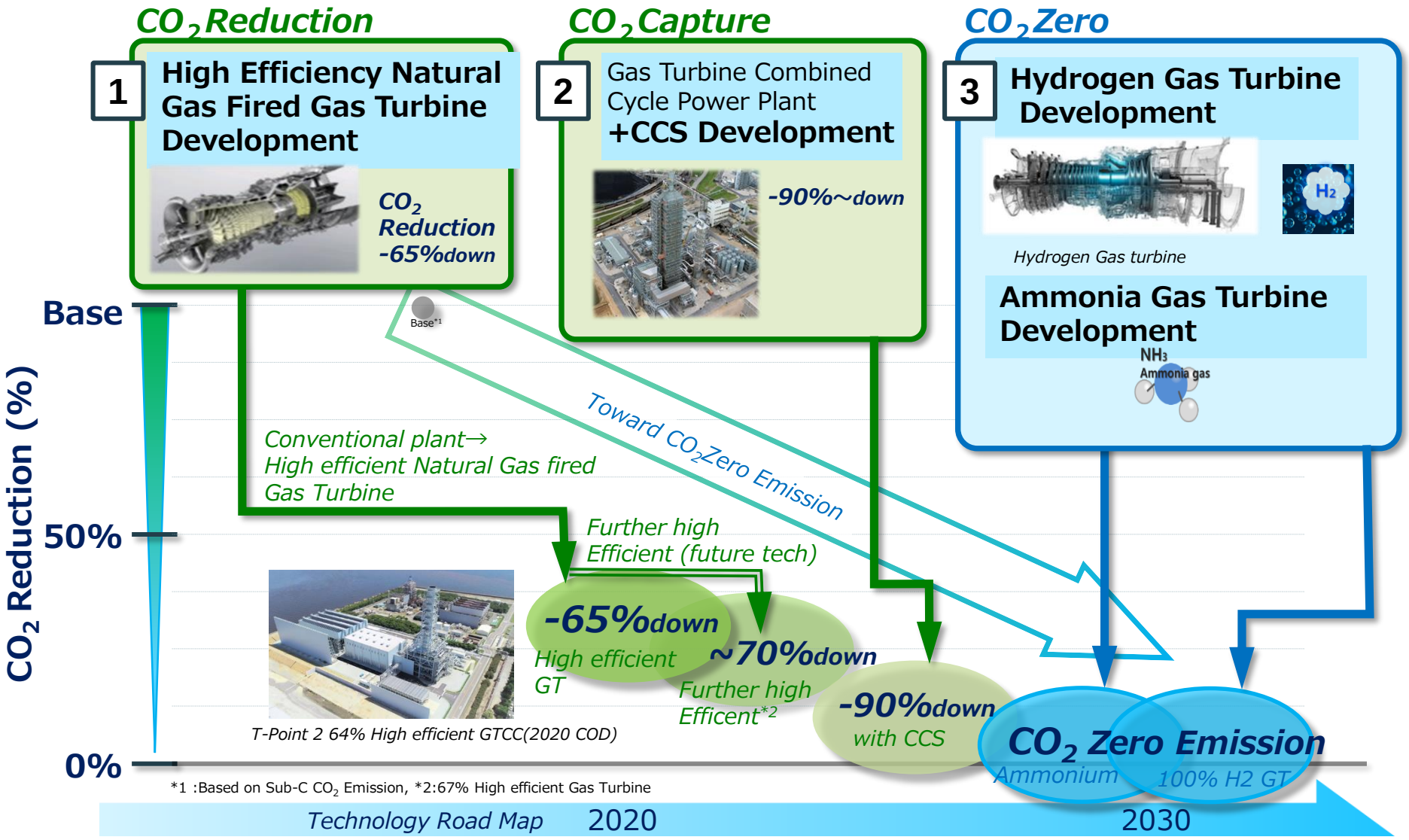
Decarbonization will occur in various stages, and technologies must evolve accordingly.



The role of hydrogen in the region's decarbonization

Hydrogen – especially when used in gas turbines – is a potential gamechanger for decarbonizing power generation and in the long run, society at large.

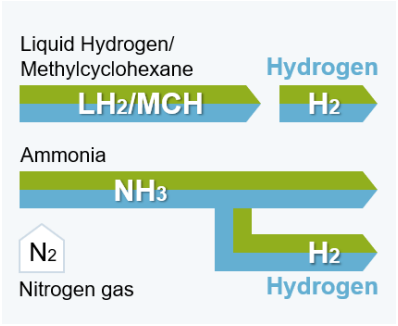
Carbon-free

As it does not contain any carbon in its molecular structure, burning hydrogen as fuel does not produce any carbon emissions.

Path to renewables

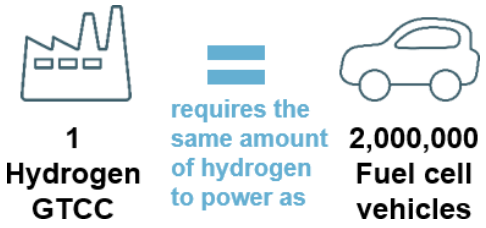
Natural gas can function as a flexible energy source addressing intermittencies with renewables, while hydrogen can be used for long-term energy storage from excess renewables.

Carrier agnostic



Gas turbines can be fueled with hydrogen transported by any type of carrier, thus contributing to significant cost reduction.

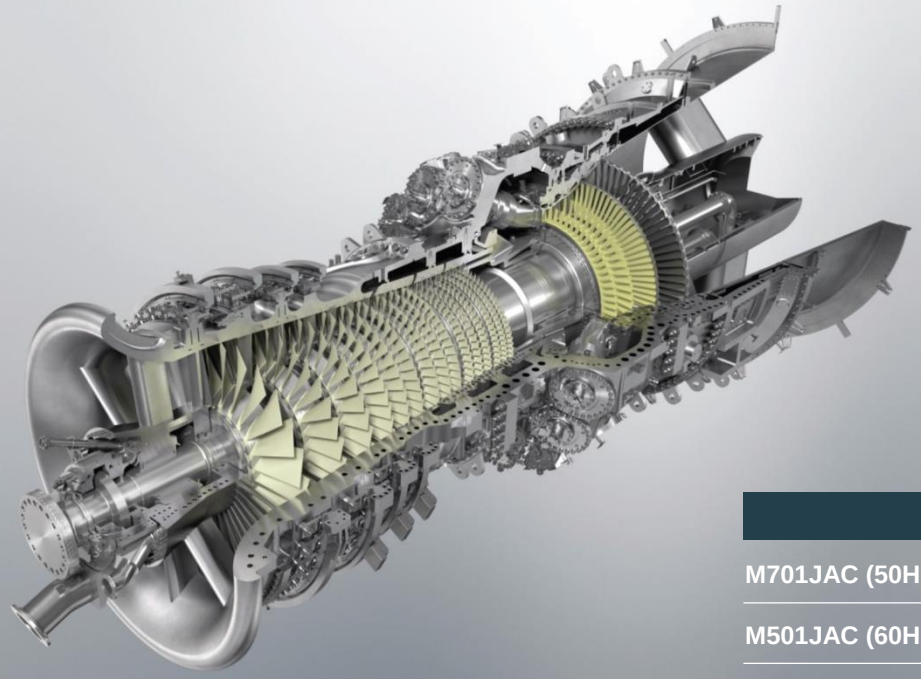
Driver of demand



Increasing demand for hydrogen will drive infrastructure expansion and further cost reduction.

Mitsubishi Power's hydrogen gas turbine technology

By developing advanced-class gas turbines that can run with this carbon-free molecule, we are contributing to the realization of a hydrogen society.



	GT / CC
M701JAC (50Hz)	563MW / 818MW
M501JAC (60Hz)	425MW / 614MW

Hydrogen Readiness

Apart from natural gas, our advanced-class gas turbines can run with **hydrogen** as a carbon-free fuel.

High Efficiency

In combined cycle, our JAC gas turbines have achieved **64%** efficiency and can reduce carbon emissions **65%** better than conventional coal-fired power plants.

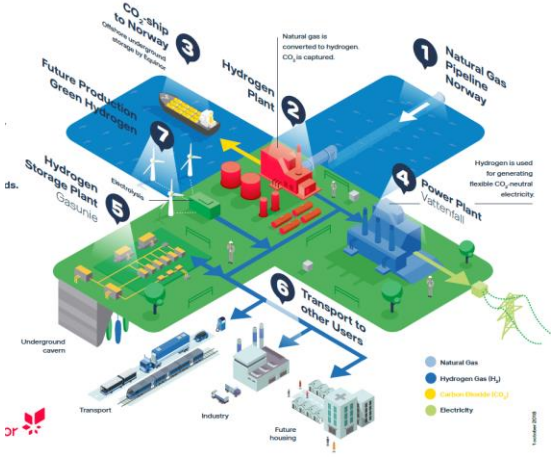
High Reliability

Our global fleet of J-Series gas turbines has accumulated **more than 1 million operating hours** and has achieved **99.5%** reliability.

Mitsubishi Power's key hydrogen projects

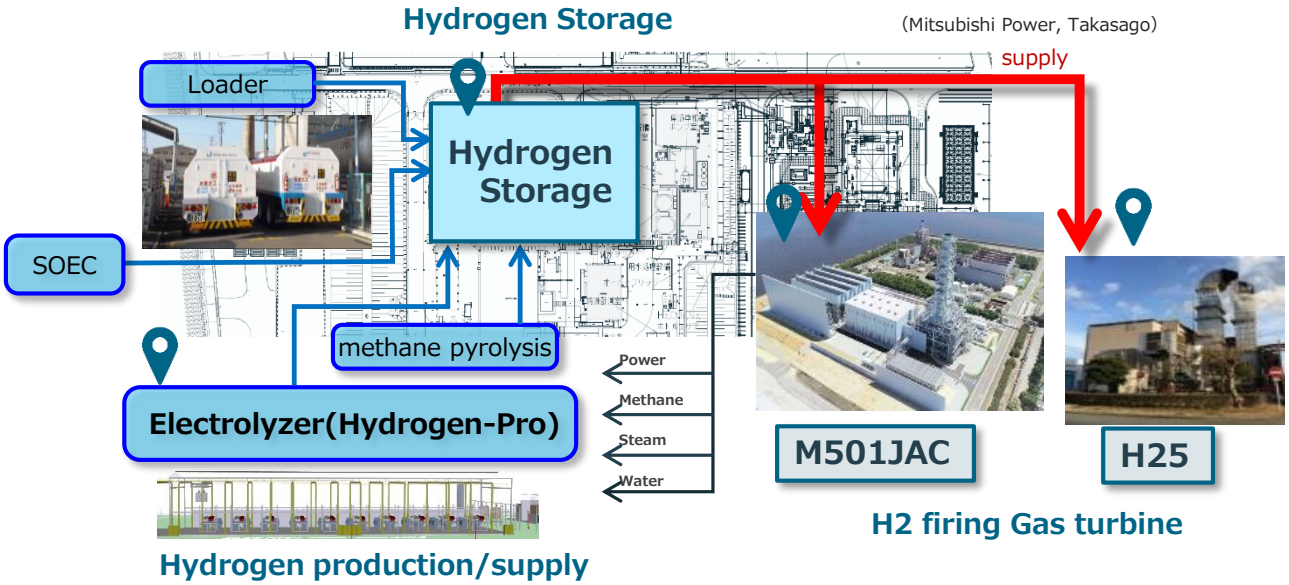
Around the world, Mitsubishi Power is working to expand the utilization of hydrogen for decarbonized power generation and energy storage.

Advanced Clean Energy Storage & Intermountain Power Plant
(USA)



Magnum GTCC Power Plant
(Netherlands)

Takasago Hydrogen Park
(Japan)



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