ENEOS Group Overview

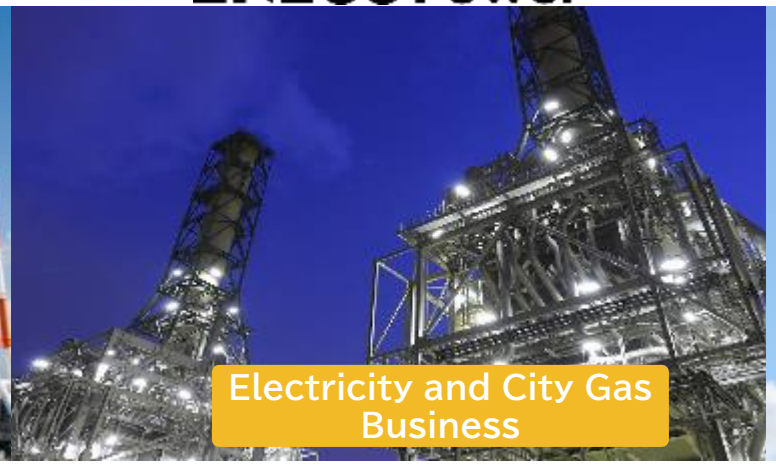
ENEOS

ENEOS Xplora

JX Advanced Metals

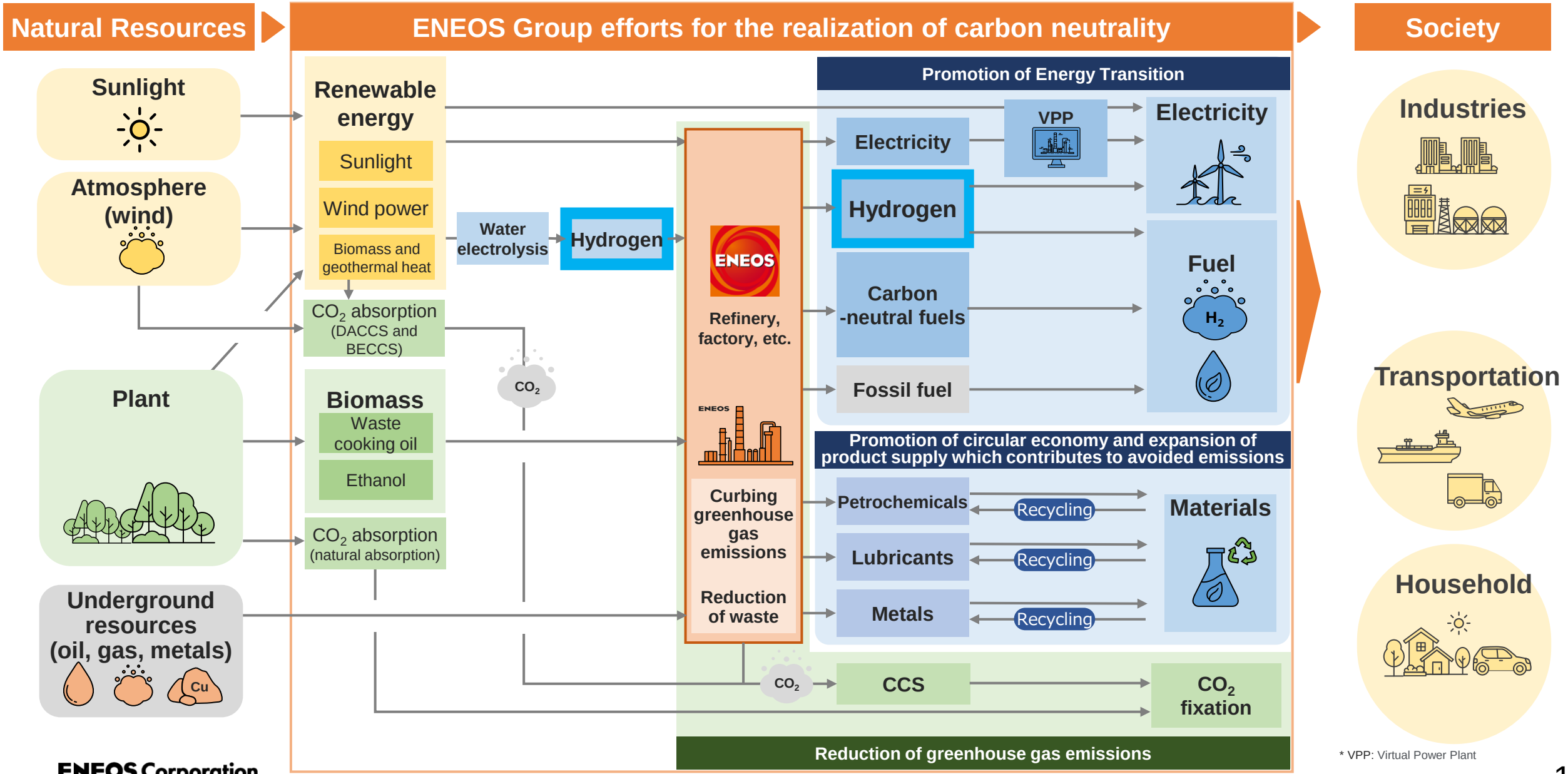
ENEOS Materials

ENEOS Power



ENEOS Renewable Energy

Conceptual Diagram of Carbon Neutrality Plan



* VPP: Virtual Power Plant

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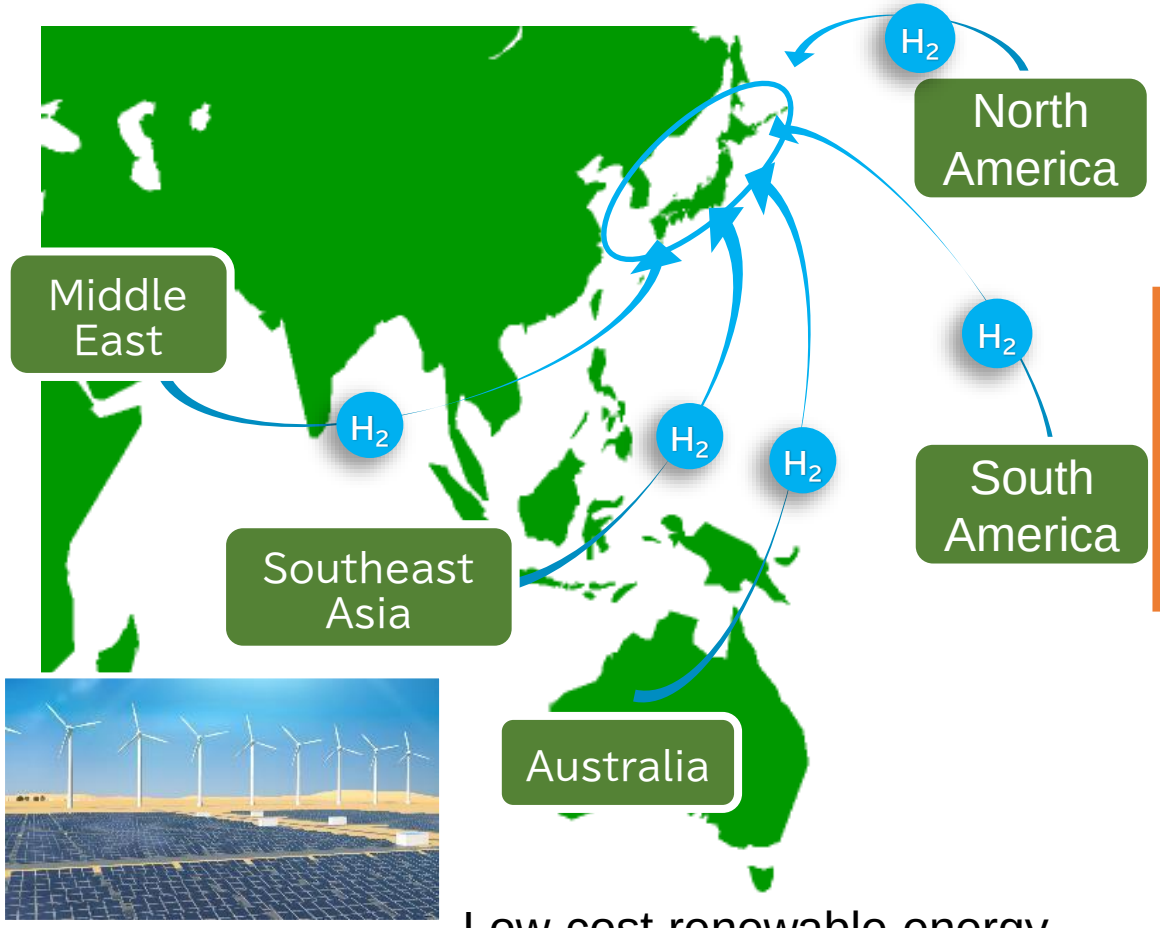
ENEOS Clean Hydrogen Supply Chain

- Exploring competitive hydrogen sources, e.g. Australia, Southeast Asia and the Middle East
- Plan to utilize ENEOS refineries as hydrogen receiving terminal for Clean Hydrogen Supply Chain.

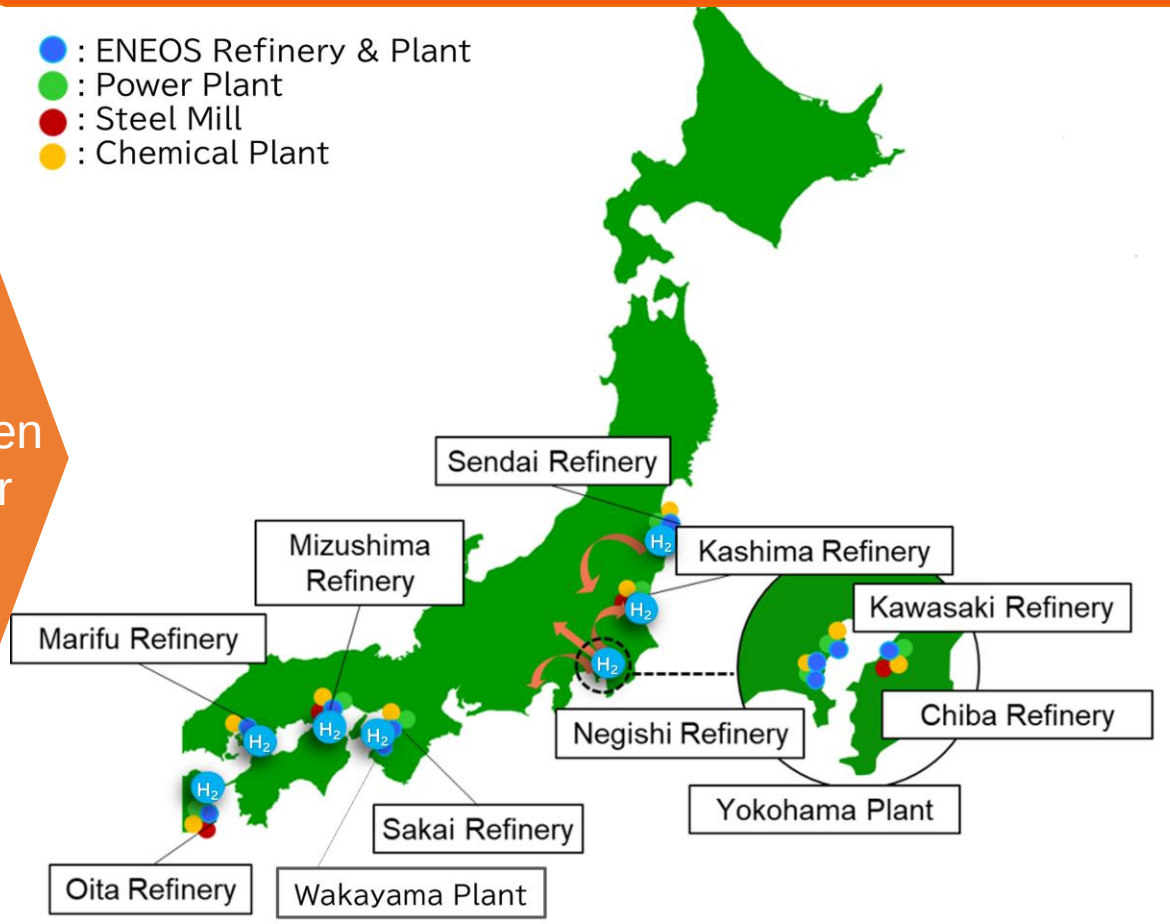
Clean hydrogen production outside Japan



Low-cost renewable energy

Hydrogen Carrier

Receiving at ENEOS existing assets in Japan



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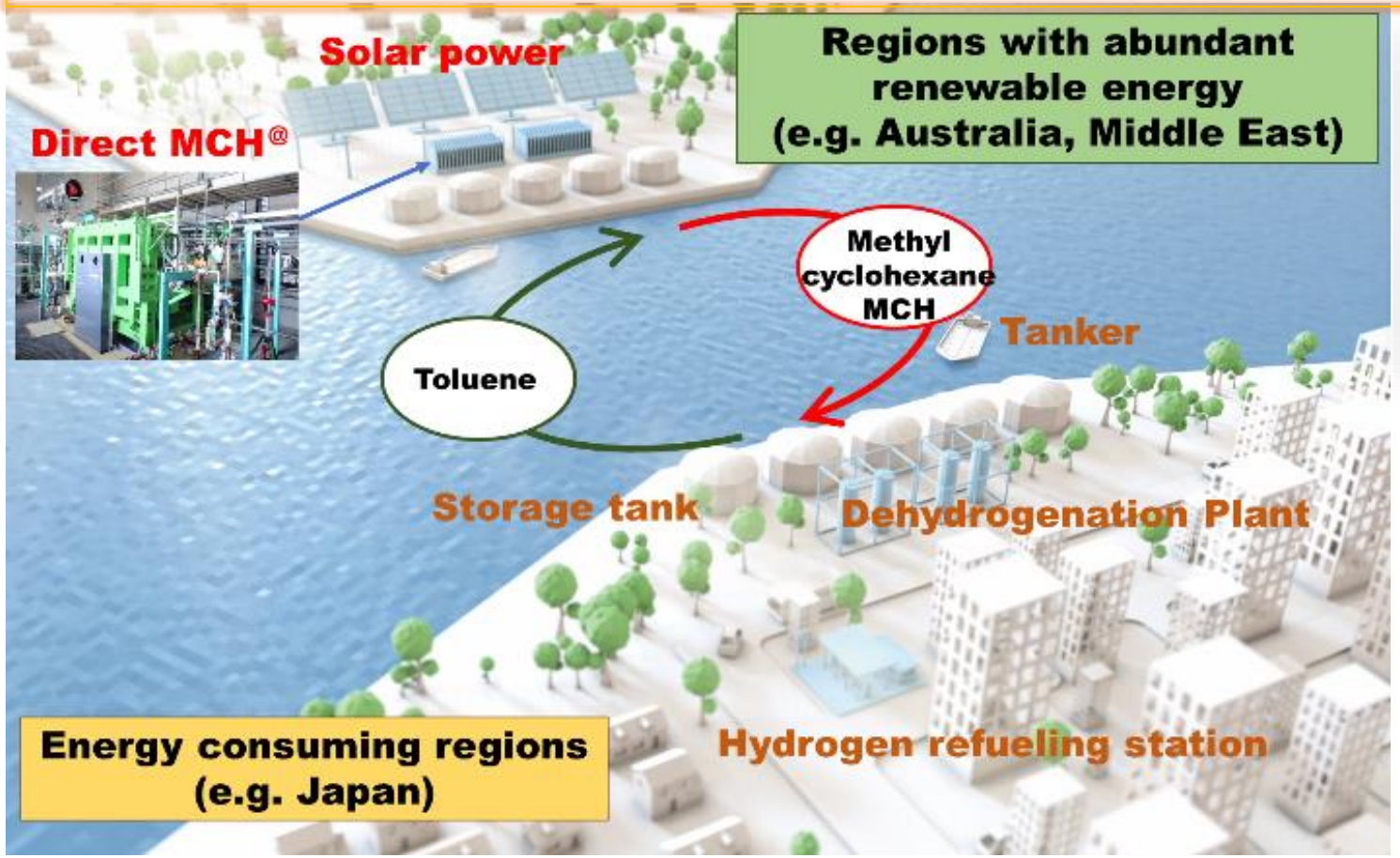
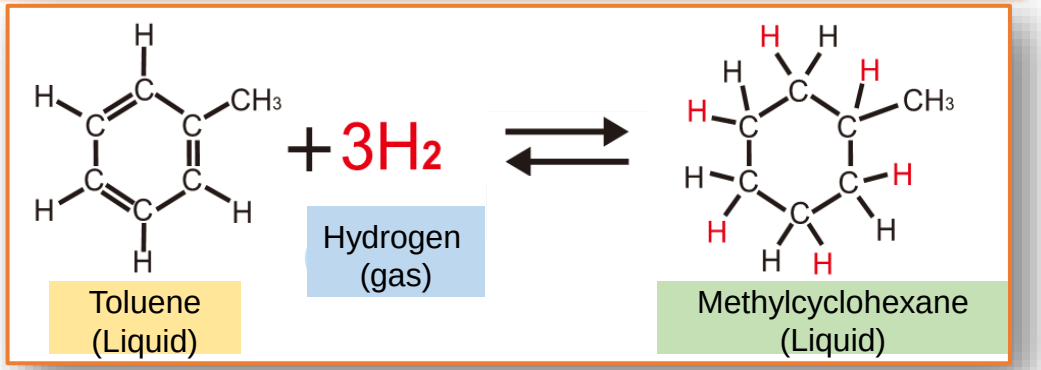
Strategy 1

Hydrogen supply chain using toluene/MCH system

- Use MCH/Toluene, one of the Liquid Organic Hydrogen Carrier (LOHC), as carrier for hydrogen supply chain.
- Hydrogen can be converted to MCH by toluene hydrogenation process, and hydrogen can be retrieved by MCH dehydrogenation process.
- MCH / toluene are liquid at room temperature, which fit ENEOS's existing refining assets.
- ENEOS is conducting MCH supply chain development as NEDO Green Innovation fund project.

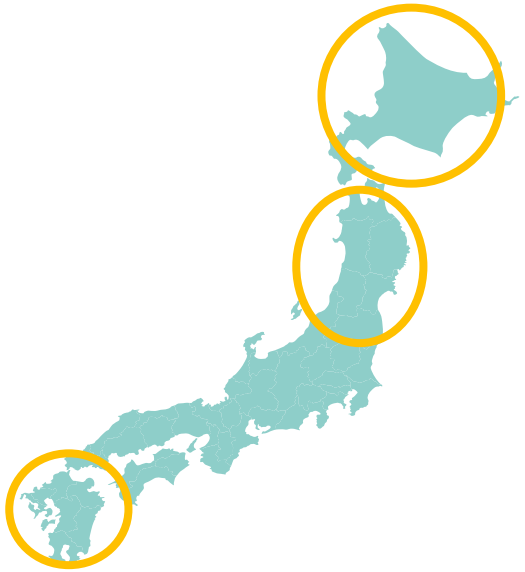




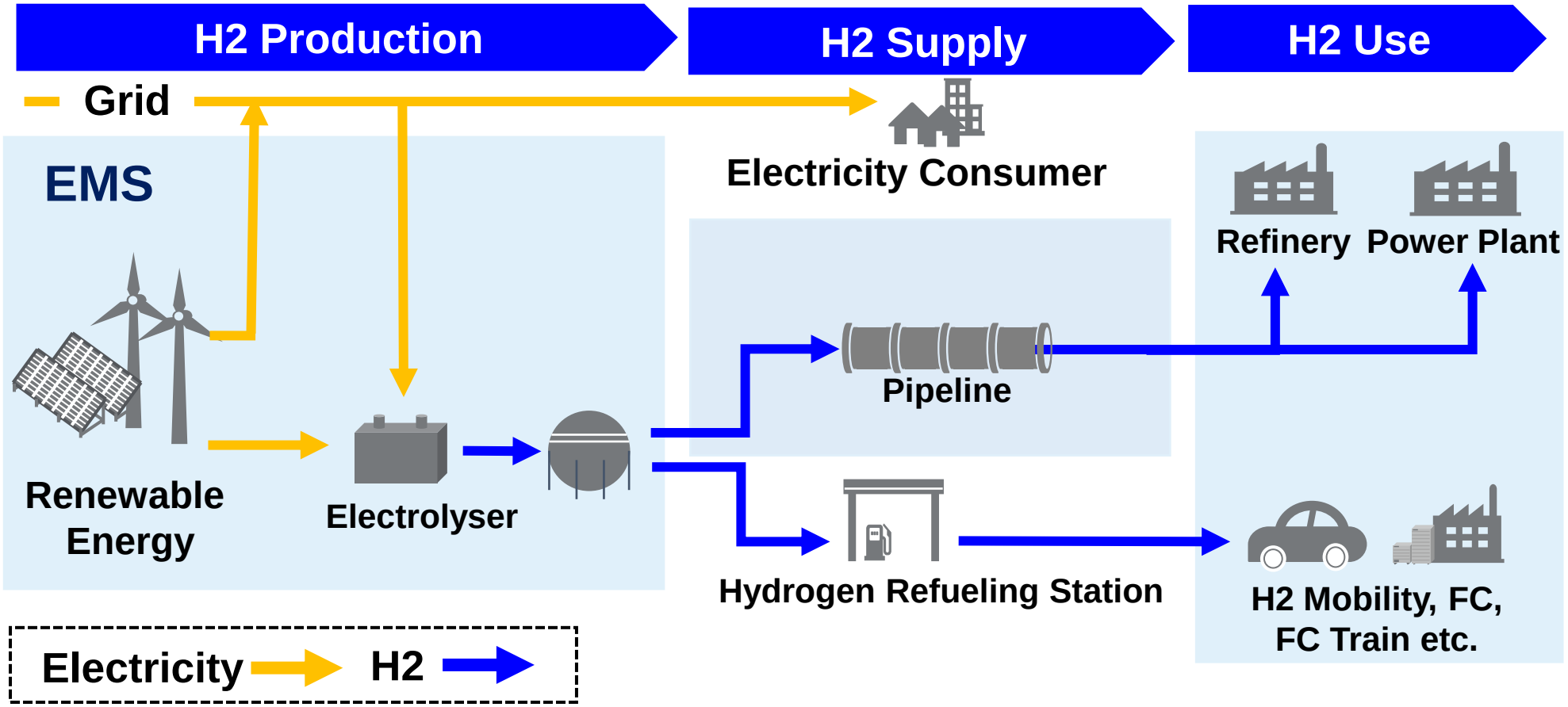
・Both liquids are similar to gasoline
・Existing infrastructure available

Local Production and Consumption Model in Japan

- Exploring local hydrogen supply chain opportunity at potential Renewable Energy excess area. (Hokkaido, Tohoku, Kyusyu)
- Studying to utilize ENEOS Hydrogen EMS (Energy Management System) to optimize hydrogen production and demand to lower hydrogen production cost.



Potential Area with excess RE



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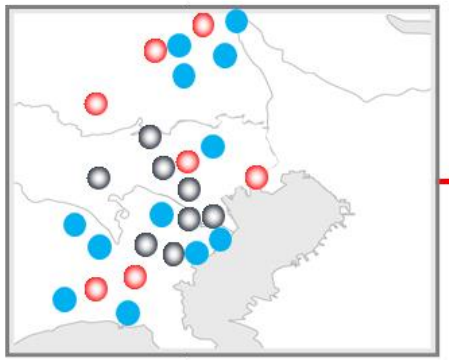
Hydrogen Refueling Station (HRS) Network

- ENEOS started the FIRST Hydrogen Refueling Station operation from 2014.
- Now we operate 35 HRSs, out of 160 HRSs in Japan.

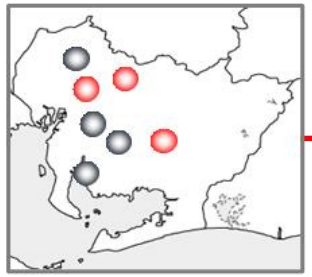
35 ENEOS HRS in JAPAN

Tokyo Metropolitan : 20

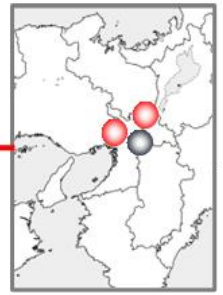


Tohoku : 1

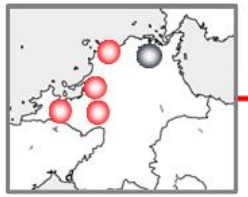
Chukyo : 8



Kansai : 2

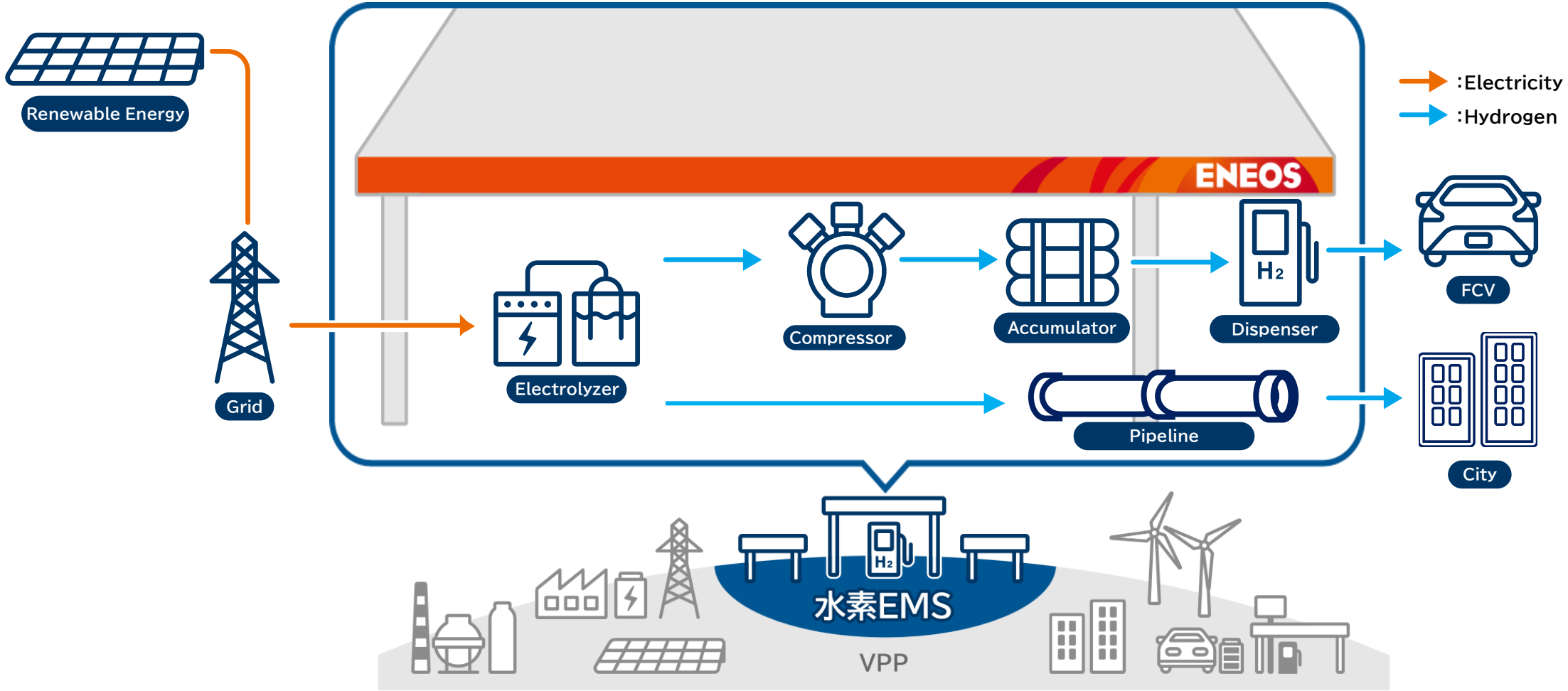


Kyushu : 4



New Concept Hydrogen Refueling Station

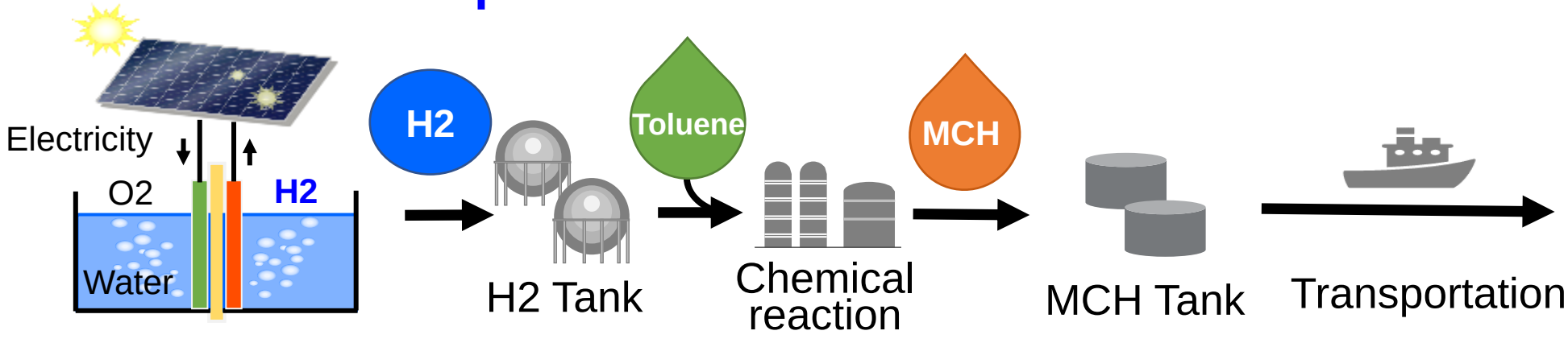
- ENEOS's Shimizu and WOVEN CITY HRSs supply hydrogen not only for FCVs, but also for home and industry via pipeline
- ENEOS Hydrogen EMS optimize hydrogen production, storage, and supply for customer.



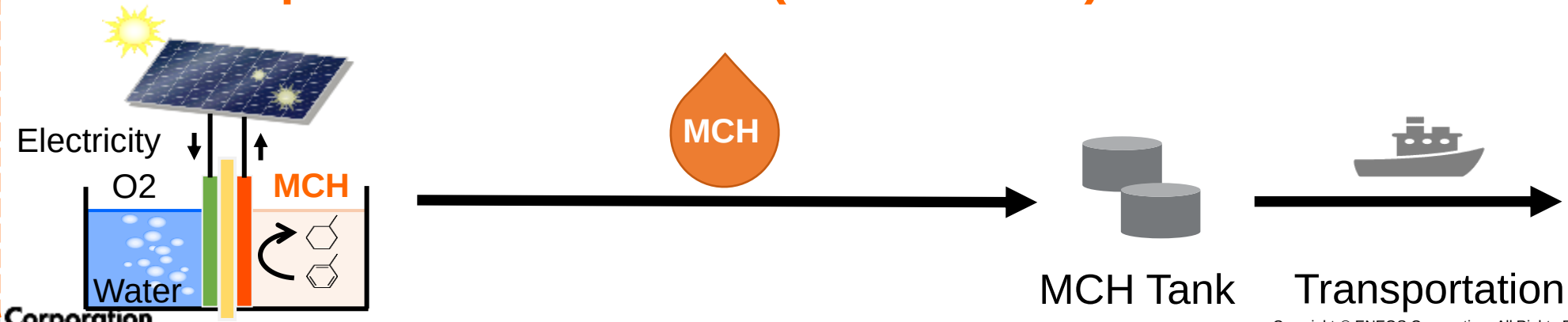
Direct MCH® Process

- Direct MCH® technology helps to reduce CAPEX cost significantly, and it makes operation easier.
- This technology helps to skip Hydrogen Storage and Toluene/MCH chemical reaction process.
- ENEOS is conducting Direct MCH® technology development as NEDO Green Innovation fund project.

Conventional MCH production Process



New MCH production Process (Direct MCH®)



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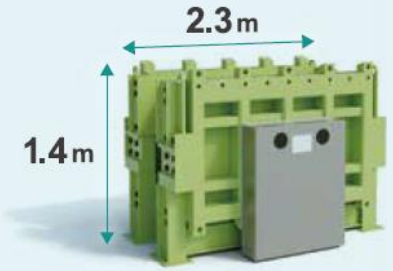
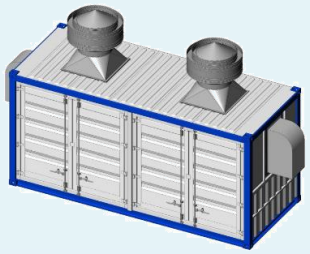
Technology Development Roadmap

- Medium-sized demonstration successfully completed in October 2023 at Brisbane, Australia.
- Planning to conduct large-scale demonstration from 2025, paving the way for commercialization toward 2030s.

Direct MCH® Development and Roadmap

～2022	2025～	2030～





Medium	Large	Commercialization plant
30 Nm³/h 、150 kW	240 Nm³/h 、MW-class	10K～300K ton/year 、100 MW～5 GW

The 1st batch shipped to Japan and fueled to Toyota bus in June 2023

Commercialization target after 2030 (Pilot site in Australia)

The demonstration of Direct MCH was conducted as part of Green Innovation Fund Projects of Large-scale Hydrogen Supply Chain Establishment / Direct MCH electrosynthesis technology development (P21017). This project have been commissioned by the New Energy and Industrial Technology Development Organization (NEDO).We would like to express our sincere thanks to all parties involved.

For Sustainable Clean Hydrogen Value Chain

- As energy supplier, ENEOS play a role to support Japan's energy transition toward Carbon Neutrality
- ENEOS develops infrastructure and technology to build clean hydrogen supply chain as one of the option for decarbonization.
- Global collaboration is important key success factor to establishing sustainable hydrogen value chain.

ENEOS Efforts

- Building Clean Hydrogen Supply Chain
- Direct MCH® Technology Development

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Global / Domestic Collaboration

- Strategic Alignment
- Cost Reduction Efforts
- Demand Creation

H_2 = 水素

【Hydrogen】

⇩

未来のクリーンエネルギー

【Future Clean Energy】