



**ENEOS**

# **ENEOS's Strategic Approach to Hydrogen Society**

**26<sup>th</sup> May, 2025**

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**ENEOS Group** Japan's Premier Energy and Materials Corporate Group

# ENEOS Group Overview

## ENEOS



## ENEOS Xplora



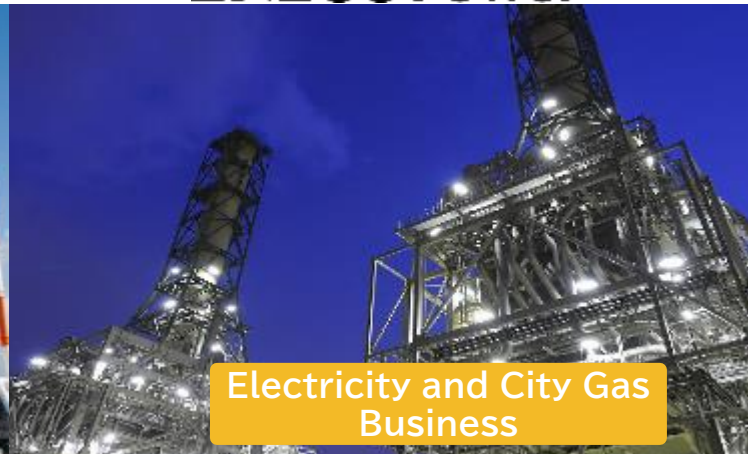
## JX Advanced Metals



## ENEOS Materials



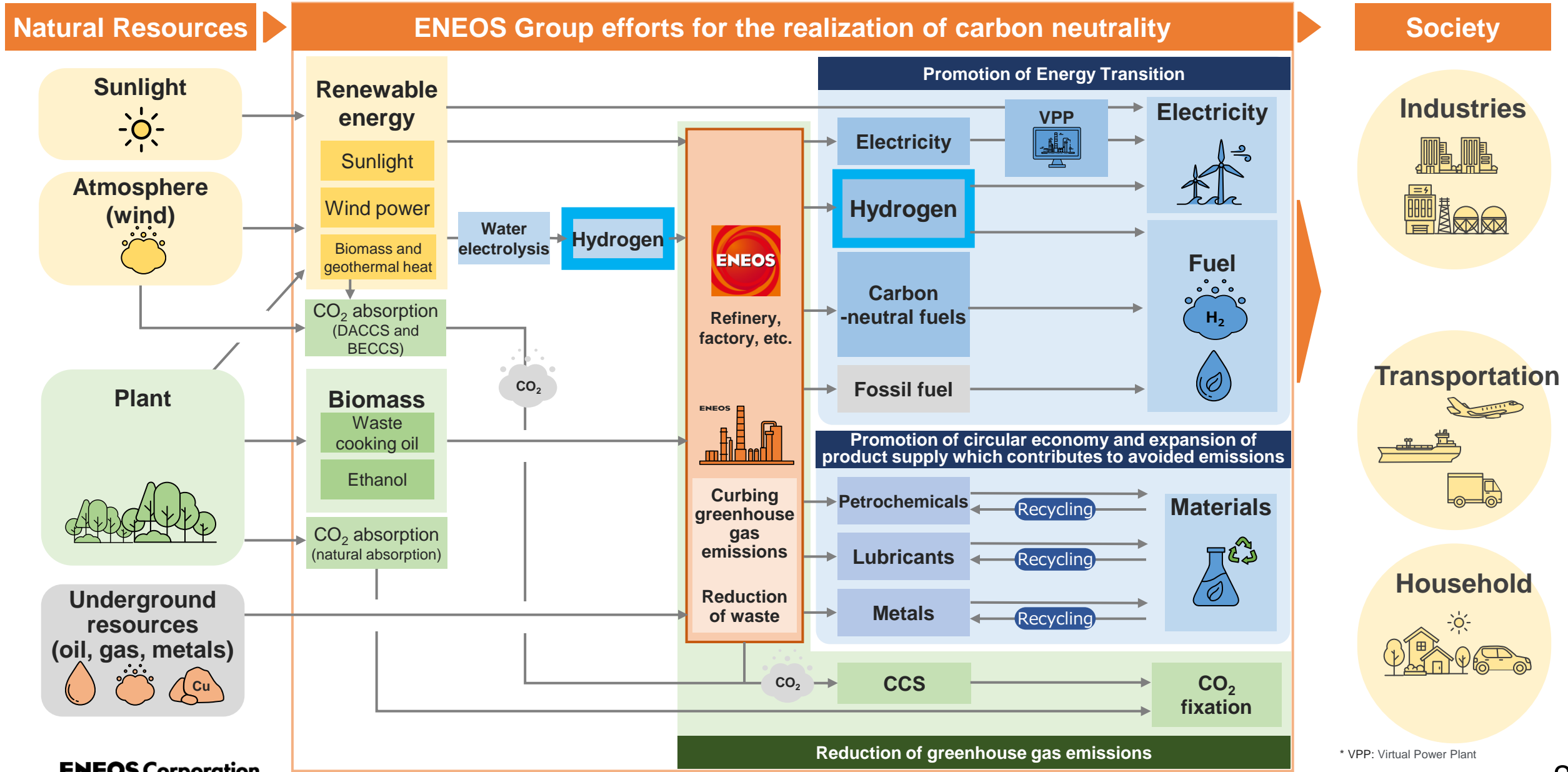
## ENEOS Power



## ENEOS Renewable Energy



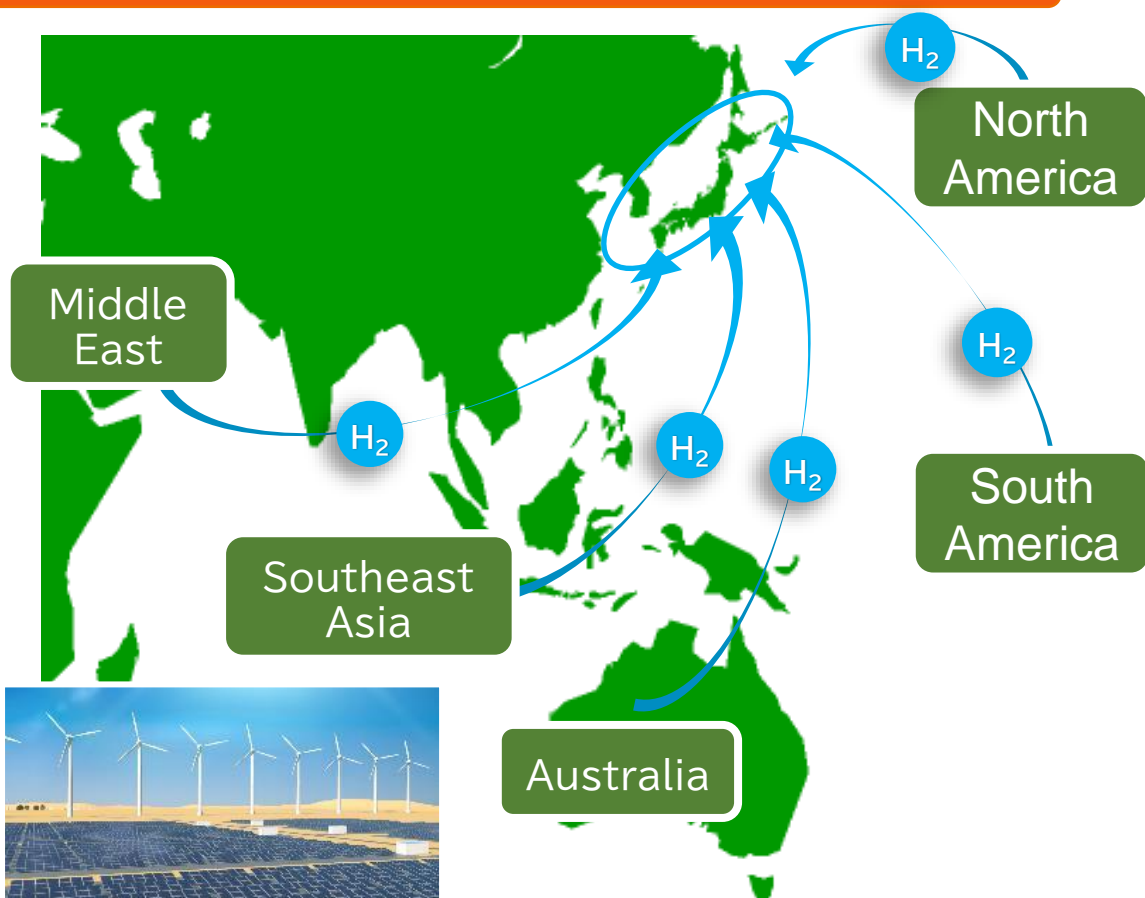
# Conceptual Diagram of Carbon Neutrality Plan



# ENEOS Clean Hydrogen Supply Chain

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

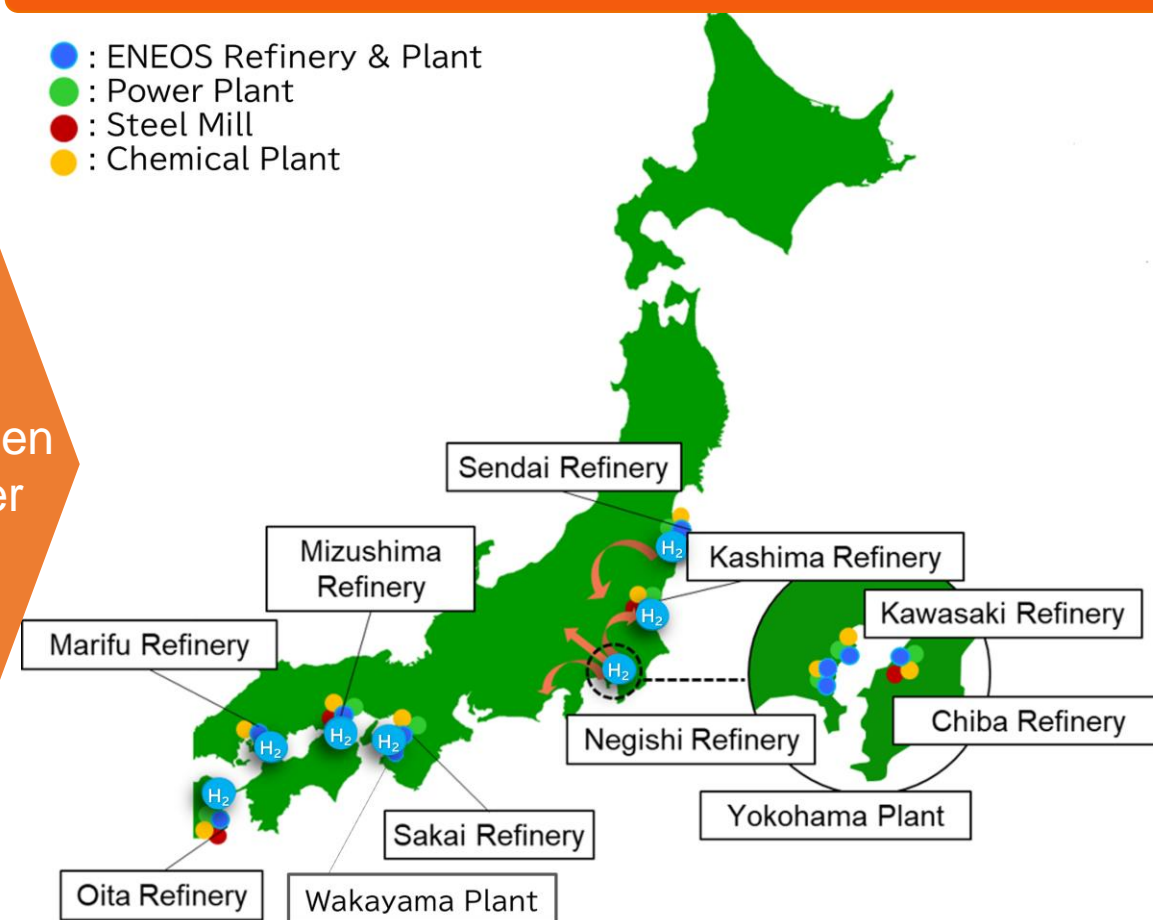
## Clean hydrogen production outside Japan



Low-cost renewable energy

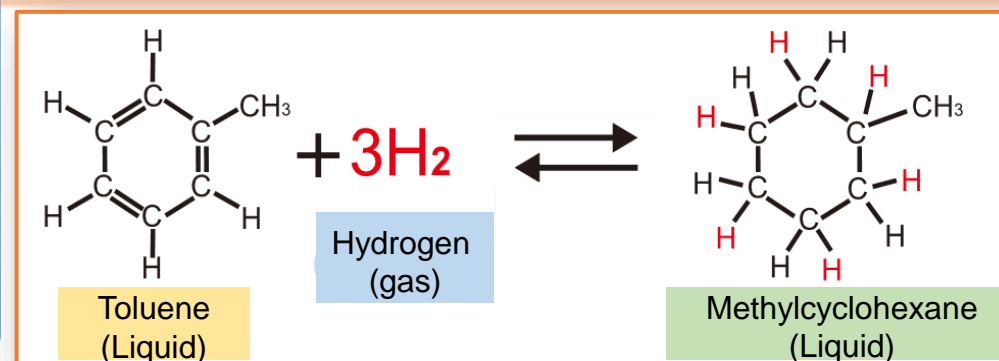
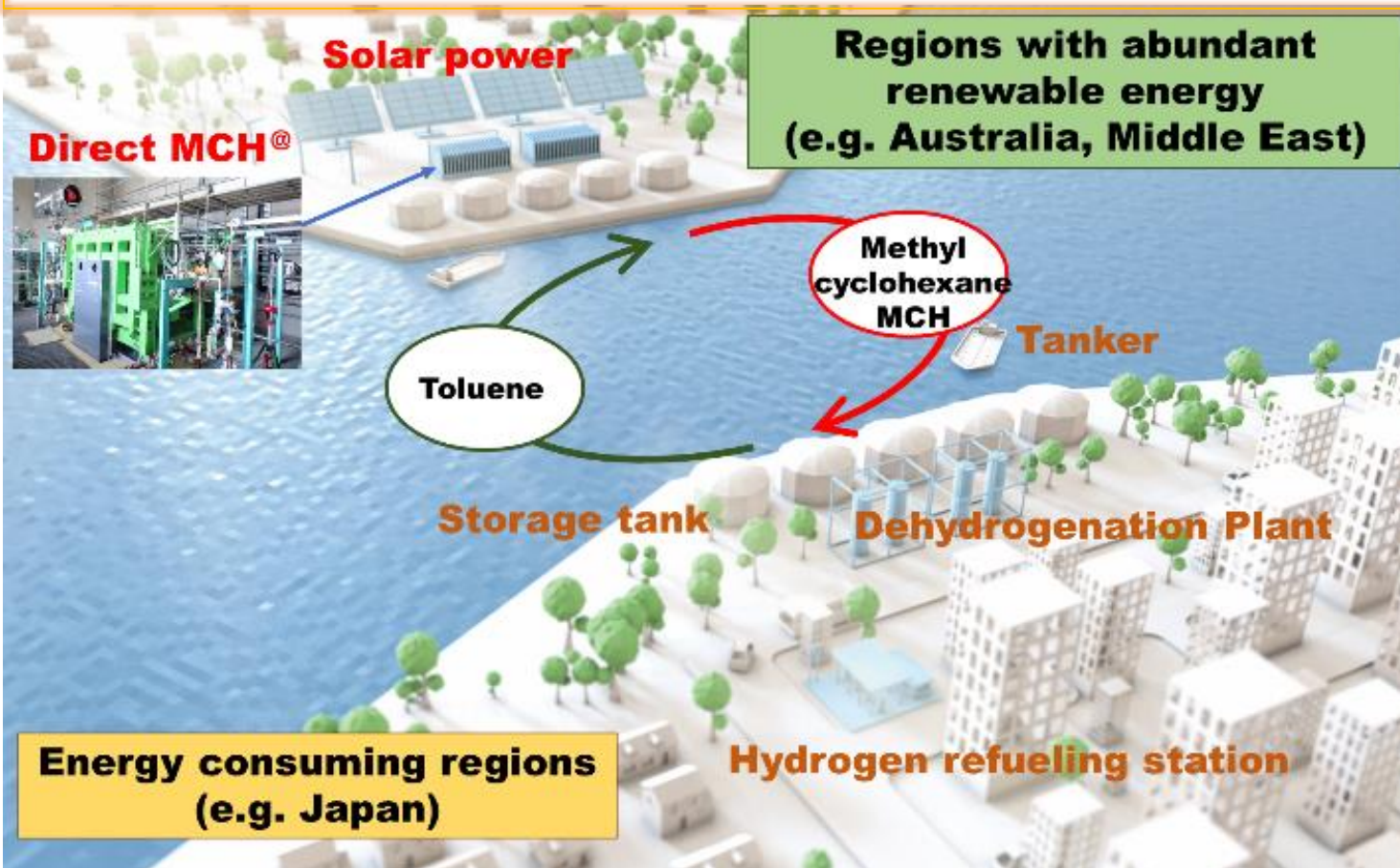
## Receiving at ENEOS existing assets in Japan

- : ENEOS Refinery & Plant
- : Power Plant
- : Steel Mill
- : Chemical Plant



# Hydrogen supply chain using toluene/MCH system

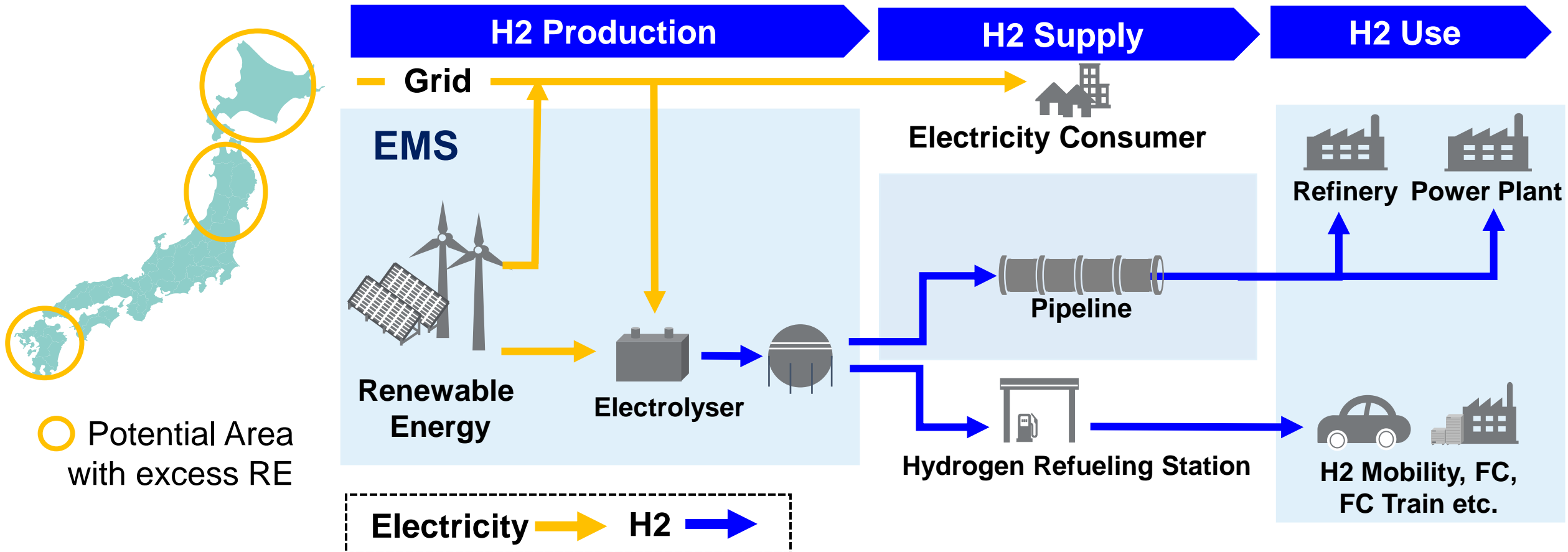
- Use MCH/Toluene, one of the Liquid Organic Hydrogen Carrier (LOHC), as carrier for hydrogen supply chain.
- Hydrogen can be converted to MCH by toluene hydrogenation process, and hydrogen can be retrieved by MCH dehydrogenation process.
- MCH / toluene are liquid at room temperature, which fit ENEOS's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

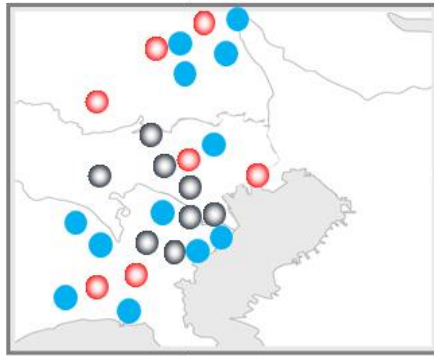


# Hydrogen Refueling Station (HRS) Network

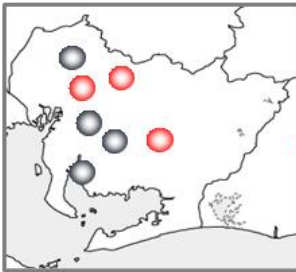
- ENEOS started the FIRST Hydrogen Refueling Station operation from 2014.
- Now we operate 35 HRSs, out of 160 HRSs in Japan.

## 35 ENEOS HRS in JAPAN

Tokyo  
Metropolitan : 20



Chukyo : 8



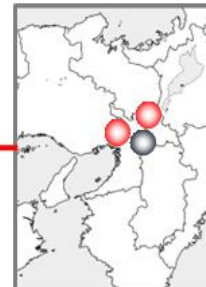
Kyushu : 4



Tohoku : 1



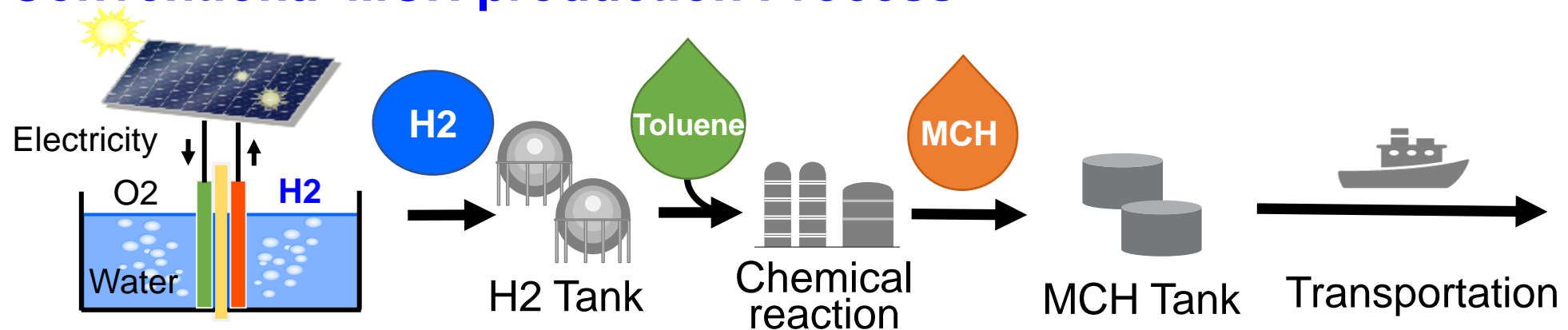
Kansai : 2



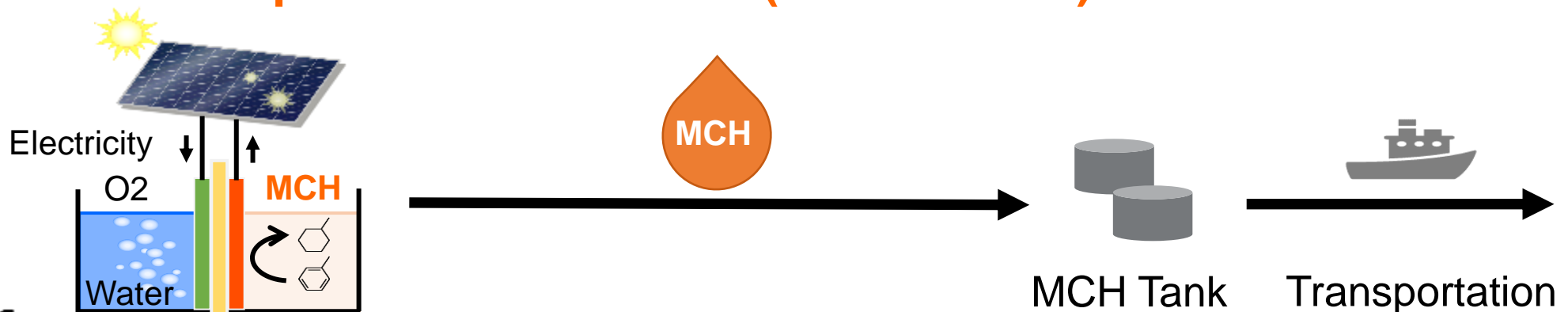
# Direct MCH<sup>®</sup> Process

- Direct MCH<sup>®</sup> 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<sup>®</sup> technology development as NEDO Green Innovation fund project.

## Conventional MCH production Process



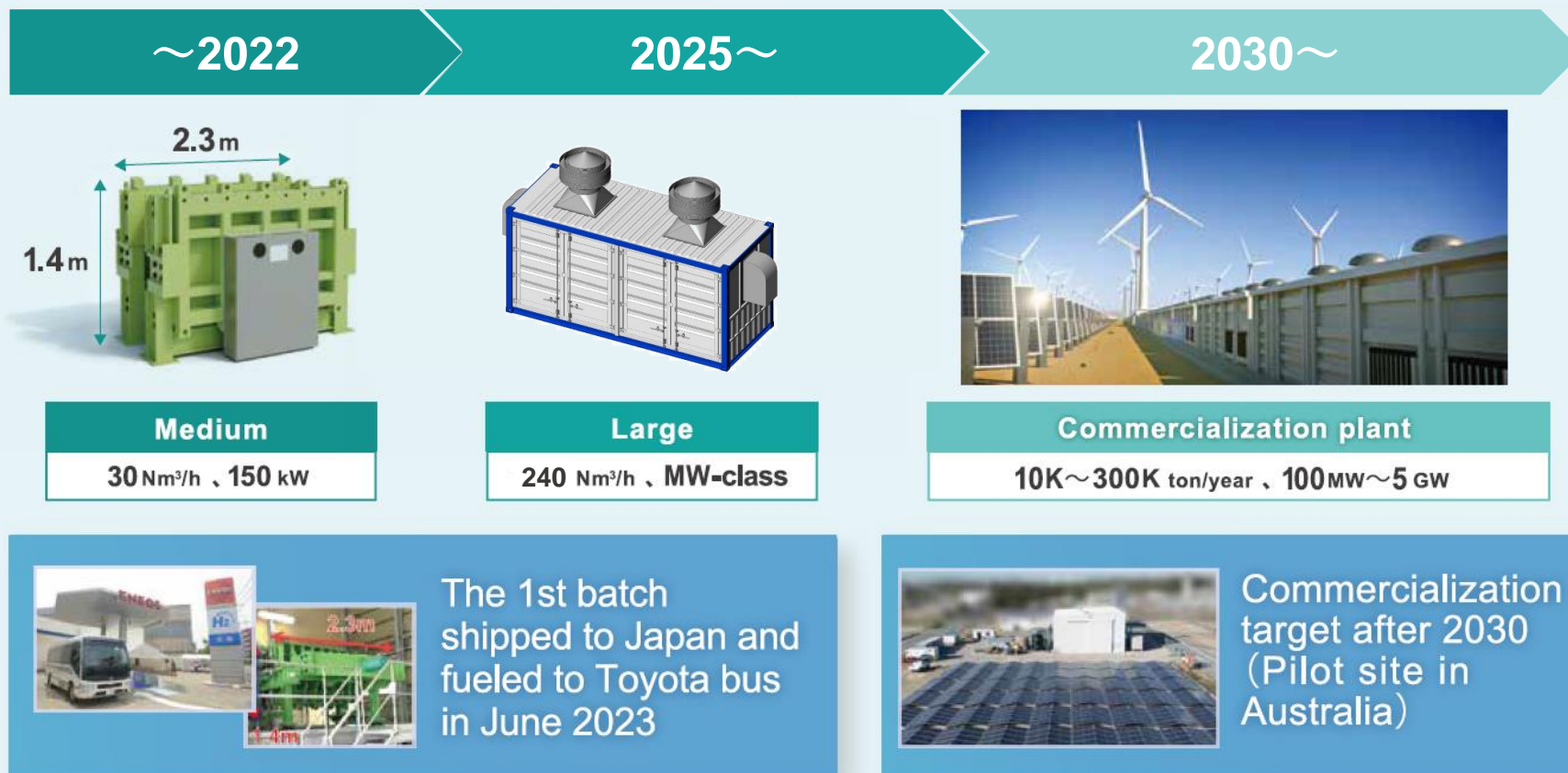
## New MCH production Process (Direct MCH<sup>®</sup>)



# 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<sup>®</sup> Development and Roadmap



# 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.

