

International Conference on
Carbon Recycling 2022

Introduction to Chiyoda's Carbon Recycling Activities

Chiyoda Corporation



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2. Chiyoda's Carbon Recycling Activities

- ◆ Chiyoda's Carbon Capture and Utilization (CCU) business from CO₂ capture to utilization.
- ◆ Chiyoda is aiming to establish a Carbon Recycle Supply Chain in the near future.

CO₂ Capture

- ◆ Large-scale CO₂ separation and recovery from gas-fired power generation exhaust gas
- R&D stage in NEDO's Green Innovation Fund project (FY2022–2030)
- Partnership with JERA Co. Inc., RITE (The Research Institute of Innovative Technology for the Earth)

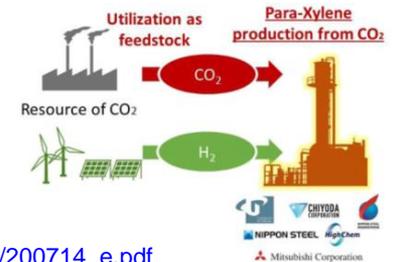


https://www.chiyodacorp.com/media/220513_e.pdf

Para-xylene (Polyester clothes/plastic bottles)

- ◆ Para-xylene production from CO₂ and H₂
- Para-xylene is essential to manufacture polyester clothes and drink bottles
- R&D stage in NEDO project (July 2020 – February 2024)

- Partnership with the University of Toyama, Nippon Steel Engineering Co., Ltd., Nippon Steel Corporation, HighChem Company Ltd. and Mitsubishi Corporation



https://www.chiyodacorp.com/media/200714_e.pdf

Carbonate (Concrete)

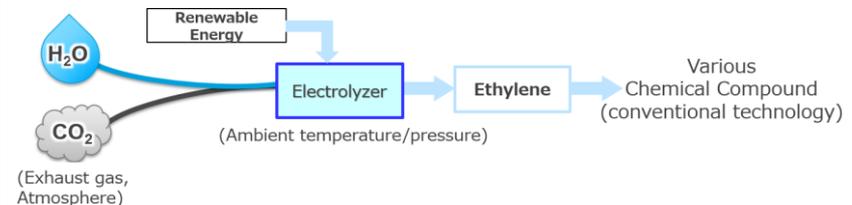


- ◆ Technology by Blue Planet (a start-up company in the USA).
- ◆ Chiyoda has entered into an MOU with Blue Planet and Mitsubishi Corporation.
- ◆ Chiyoda participates in a demonstration project in the USA, providing technical support and accelerating commercialization.

https://www.chiyodacorp.com/media/210205_e.pdf

Ethylene

- ◆ Ethylene production from CO₂ + H₂O by Integrated Electrochemical Systems.
- Reaction under ambient pressure/temperature
- Ethylene can be made into chemical products such as e-fuel.
- R&D stage in NEDO project (July 2020 – March 2030)



https://www.chiyodacorp.com/media/200909_e.pdf

NEDO: the New Energy and Industrial Technology Development Organization

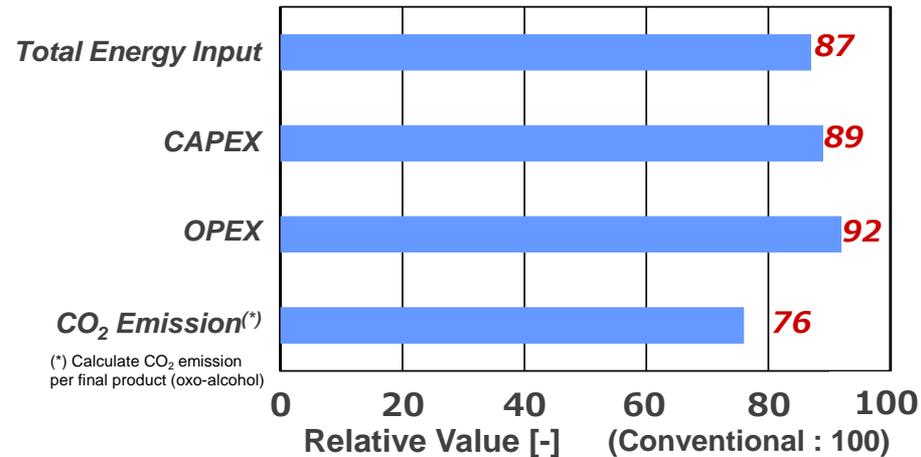
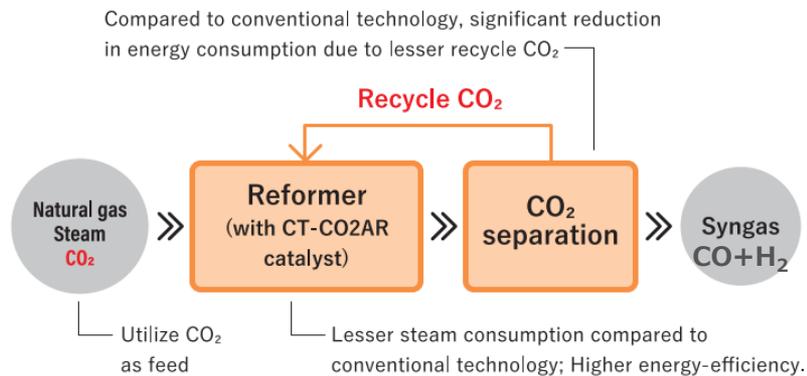
Blue Planet: Blue Planet Systems Corporation

MOU: Memorandum Of Understanding

CT-CO2AR Process

- ◆ Chiyoda has commercialized a reforming catalyst to use less H₂O and CO₂ as feedstock
- ◆ Synthesis gas with wide range of H₂/CO ratio can be produced.
- ◆ This Chiyoda technology is currently being used by a chemical company in Japan.

Conceptual Diagram of CT-CO2AR



By adjusting CH₄/H₂O and CH₄/CO₂ ratios in the reformer feed, synthesis gas with a wide range of H₂/CO ratios can be produced.

Example: H₂/CO=1.0 for chemicals (ex. oxo-alcohol)
 H₂/CO<1.0 for carbon monoxide
 (ex. as a feedstock of acetic acid)

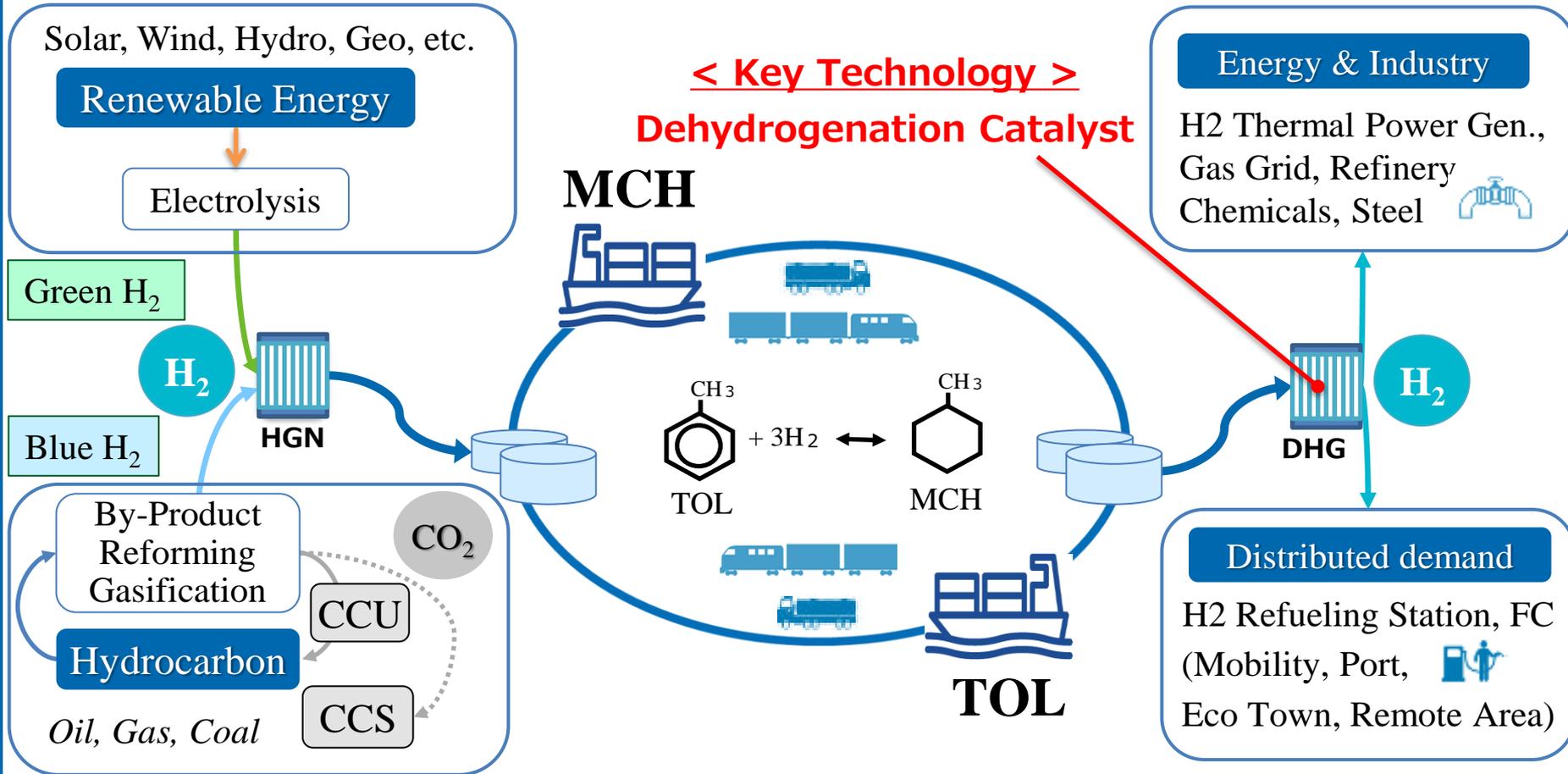
When the H₂/CO ratio =1.0
 (for oxo-alcohol production),
CO₂ emissions are reduced by 24%.

<https://www.chiyodacorp.com/jp/service/gtl/co2-reforming/>

https://www.youtube.com/watch?v=f6Ttf_vm-E

SPERA Hydrogen™ System

Chiyoda developed a large and efficient H₂ storage and transportation system. Methylcyclohexane (MCH) and Toluene (TOL) are in the liquid state due to ambient temperature and pressure condition.



Features of SPERA Hydrogen™ System Technology

Long term storage
& long distance
transportation

Chemically stable, very little MCH (H_2) loss during long term storage and long distance transportation

Easy to handle

Liquid under ambient temperature and pressure
Approximately 1/500 in volume

Use of
existing oil
infrastructure

Utilize existing infrastructure, standard, regulation, to minimize social investment for H_2 introduction

Storage and
transportation
risk equivalent to
petroleum products.

Safe storage and transportation that is equivalent level to petroleum products

Combination of
new and proven
technologies

Combination of conventional technology
And new dehydrogenation catalyst technology



Conclusion

- ☆ Chiyoda has four basic research activities as national projects which are CO₂ capture, Para-Xylene process, Ethylene process, Carbonate for concrete. In detail, please refer to this conference website
- ☆ Chiyoda developed CT-CO₂AR™ process for a synthesis gas production process using CO₂ as feedstock in addition to natural gas and steam. The process can reduce CO₂ emissions more than 20% and the H₂/CO ratio of synthesis gas can be controlled according to the production of chemicals in the subsequent process. We are ready for license. In detail, please refer to our HP.
<https://www.chiyodacorp.com/en/service/gtl/co2-reforming/>
- ☆ Chiyoda developed SPERA Hydrogen™ system for massive hydrogen storage and transportation. In detail, please refer to this conference website or our HP.
<https://www.chiyodacorp.com/en/service/spera-hydrogen/>
- ☆ SPERA Hydrogen™ system moved to commercialization stage and we are ready for license and you can start hydrogen supply business project.
- ☆ Chiyoda is executing practical projects in Singapore, and are also conducting FS for practical application with many players in the world.
- ☆ Chiyoda would like to contribute to decarbonization and carbon recycling through above activities.

Thank you for your attention!



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