



# 2024「中技社科技獎學金」

## 2024 CTCI Foundation Science and Technology Scholarship

### 境外生研究獎學金

#### Research Scholarship for International Graduate Students



國立臺灣大學  
National Taiwan University

## A Sustainable Energy Solution: Design and Feasibility Analysis of Chemicals-based International Renewable Energy Supply Chain

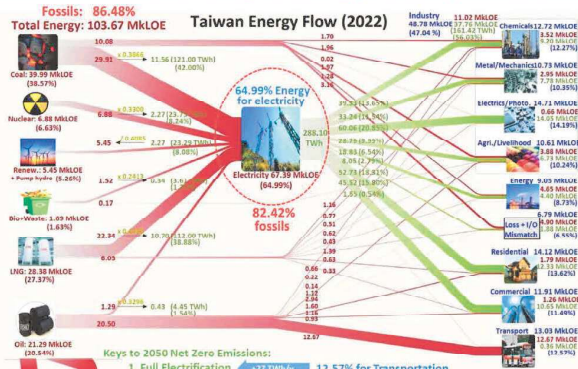
PSE  
LABORATORY

Chong Wei Ong, Cheng-Liang Chen\*

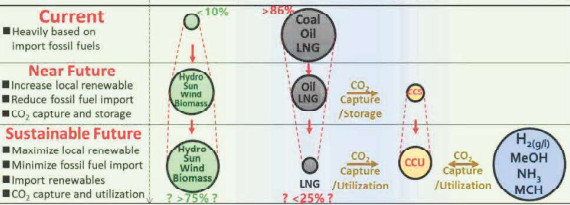
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### Taiwan Energy Situation:

#### >93% of Primary Energy is Imported

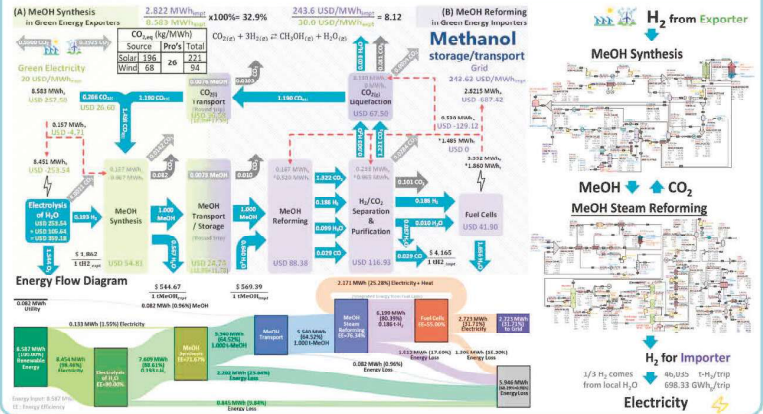


Local Renewable Energy (LRE)	Import Fossil Fuels	CO <sub>2</sub> Capture, Storage & Utilization	Import Renewable Energy (IRE)
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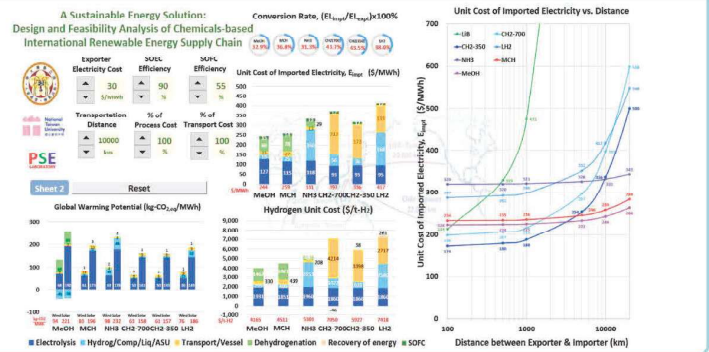


### Case Study: Methanol as Energy Carrier

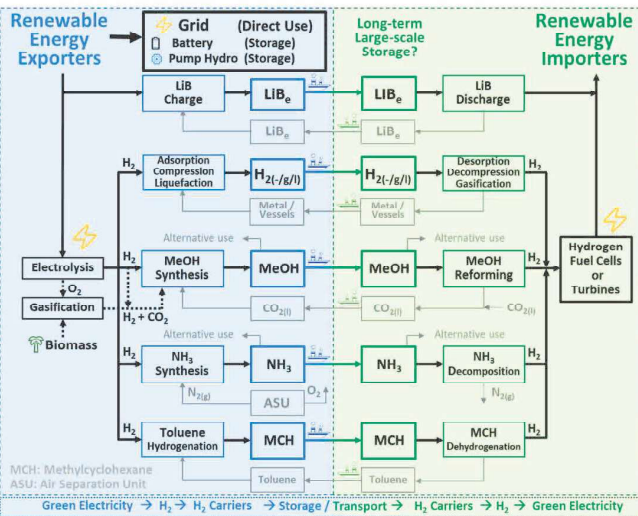
Electrolysis	Transportation	Details/Performance
Renewable electricity price in exporting country (USD/MWh <sub>e</sub> )	30	H <sub>2</sub> from SOEC/ to SOFC
Solid Oxide Electrolysis Cells (SOEC)	312,500 m <sup>3</sup> Ship, 10,000 km	20 bar / 2 bar
HHV of H <sub>2</sub> (kWh/kg H <sub>2</sub> )	247,500	t MeOH/Trip
Efficiency	3.352	MWh/t MeOH
Capital Cost (USD/kW)	2,880	(grid) MWh/t MeOH
LHV of H <sub>2</sub> (kWh/kg H <sub>2</sub> )	829,620	GWh/Trip
Thermal efficiency	33.33	
Electric efficiency	698,334	(grid) GWh/Trip
Capital Cost (USD/kW)	39.4	days/R-trip
		Sailing distance
		10,000 km
		Time per trip
		18.7 d
		Exporting
		USD 30/MWh <sub>e</sub>
		Importing
		USD 244/MWh <sub>e</sub>
		GWP
		94 - 221 kgCO <sub>2</sub> /MWh <sub>e</sub>
		E-conversion
		32.9%



### Interactive Dashboard



### International Renewable Supply Chain



### Conclusion

- For International Transport / Local Storage of Renewable Energy (RE):
- Use **MeOH / MCH** for long-distance transport (>5,000 km)
  - Use **350 bar Compressed H<sub>2</sub>** for short-distance transport (<1,000 km)
  - Use **MeOH / MCH** for monthly power dispatching & storage (W - M)
  - Use **350 bar Compressed H<sub>2</sub>** for weekly power dispatching & storage (D - W)
  - Use **Li Battery** for daily power dispatching & storage (H - D)

### Reference

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- Ong, C.W., Chang, N.L., Tsai, M.L., Chen, C.L., "Decarbonizing the Energy Supply Chain: Ammonia as an Energy Carrier for Renewable Power Systems," *Fuel*, 300, 130627 (2024)
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