4-1. APERC Hydrogen Workshop in conjunction with EGNRET 60

APERC Workshop at EWG 68

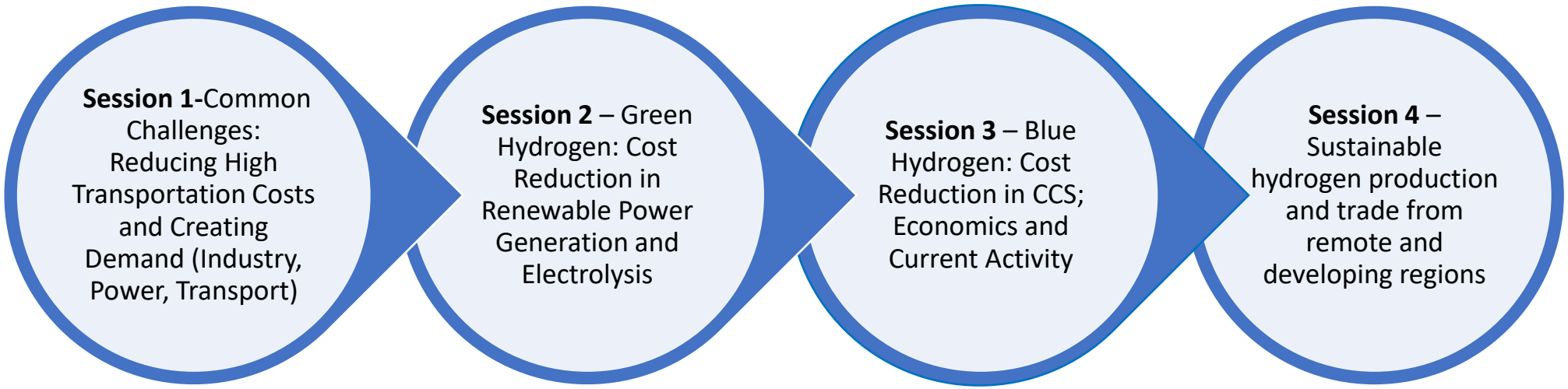
12 August 2024 – Lima, Peru

Dr. Manuel Heredia, Senior Researcher, APERC

APERC Hydrogen Workshop Agenda

The APERC Hydrogen Workshop was organized by APERC under the auspices of EGCFE and EGNRET and held in conjunction with the EGNRET 60 sessions hosted by Chinese Taipei in Kaohsiung on April 23rd, 2024. The workshop was focused on the reduction of zero- and low-carbon hydrogen production and transportation costs.

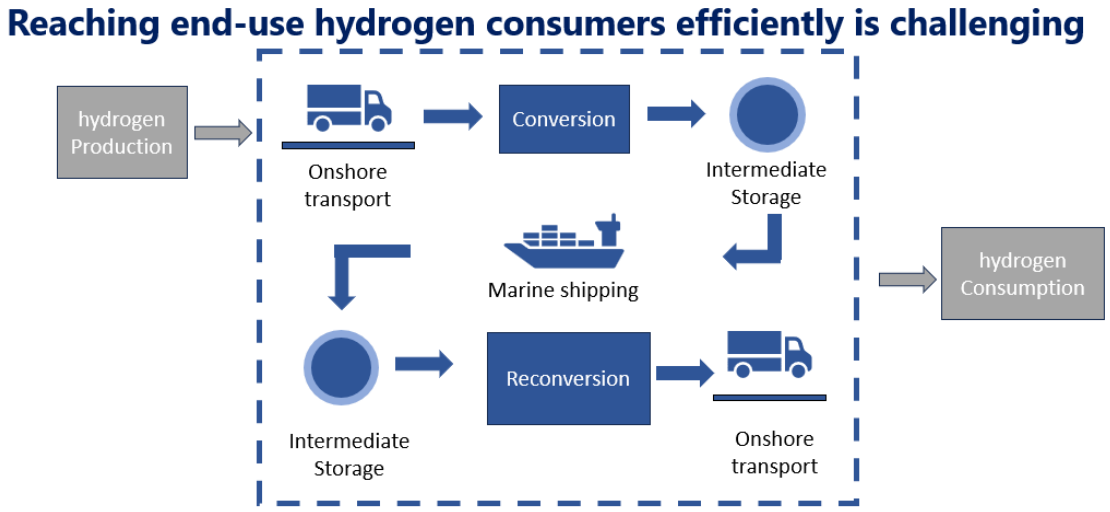
Workshop Agenda



Session 1 – Common Challenges: Reducing High Transportation Costs and Creating Demand (Industry, Power, Transport)

Reducing High Marine Transportation and Onshore Distribution Costs
by Manuel Heredia, APERC

- Low energy density makes hydrogen transport challenging.
- Transporting hydrogen affects efficiency and environmental benefits.
- Safety protocols must adapt to toxic hydrogen carriers.
- Transportation costs vary by method and demand.
- Compressed hydrogen is cheaper for short distances.
- Lack of investment in hydrogen transport infrastructure.

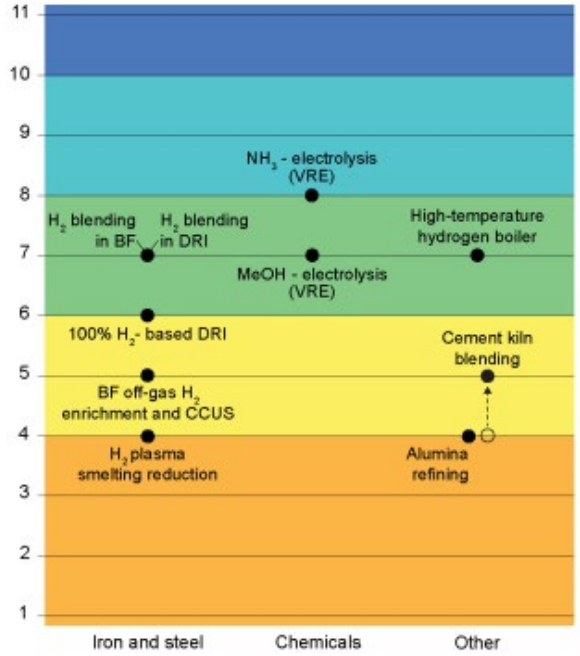


Source: Reducing High Marine Transportation and Onshore Distribution Costs (APERC)

Session 1 – Common Challenges: Reducing High Transportation Costs and Creating Demand (Industry, Power, Transport)

Creating Demand in the Industry Sector
by Mathew Horne, APERC

Technology readiness levels of hydrogen end use in Industry



Source: Global Hydrogen Review 2023 (IEA)

- Hydrogen is crucial in various industrial processes, but as a feedstock rather than as an energy source.
- Governments provide subsidies to boost hydrogen competitiveness.
- Speed of hydrogen adoption remains challenging.
- Electrification viable for low heat requirements, but new technologies including hydrogen are needed for higher heat needs.
- Low-carbon hydrogen is costly and currently requires policy and/or financial support.

Session 1 – Common Challenges: Reducing High Transportation Costs and Creating Demand (Industry, Power, Transport)

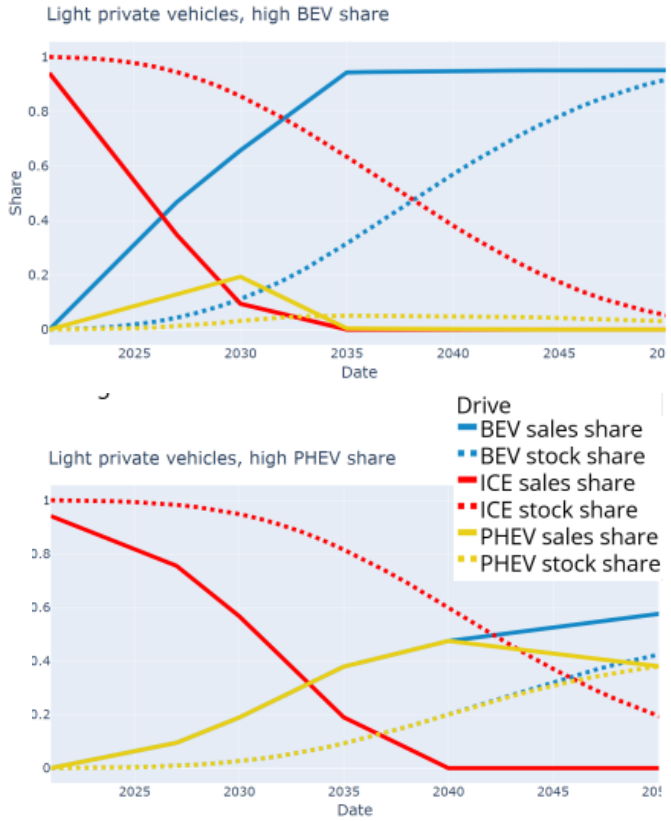
Hsinta GT33 H2 Co-firing Demonstration Project
by Mr. Hao Hsien Hsu, TPC

- Hsinta H2 co-firing project in Kaohsiung tested with 5% hydrogen co-firing.
- 5% hydrogen co-firing reduces CO2 emissions by 1 ton per hour at full load (119 MW).
- Co-firing does not affect power efficiency

Source: Hsinta GT33 H2 Co-firing Demonstration Project (TPC)

Session 1 – Common Challenges: Reducing High Transportation Costs and Creating Demand (Industry, Power, Transport)

Creating Demand in the Transport Sector
by Finbar Maunsell, APERC



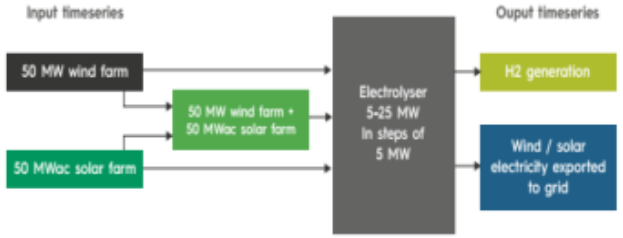
Source: Creating Demand in the Transport Sector (APERC)

- Electric vehicles face critical mineral, driving charging, range issues.
- E-fuels could play a key role in the transition from ICE vehicles to EVs.
- E-fuels can use existing petroleum product infrastructure.
- E-fuels provide an additional decarbonisation pathway for passenger transport.
- E-fuels can use green or blue hydrogen.

Session 2 – Green Hydrogen: Cost Reduction in Renewable Power Generation and Electrolysis

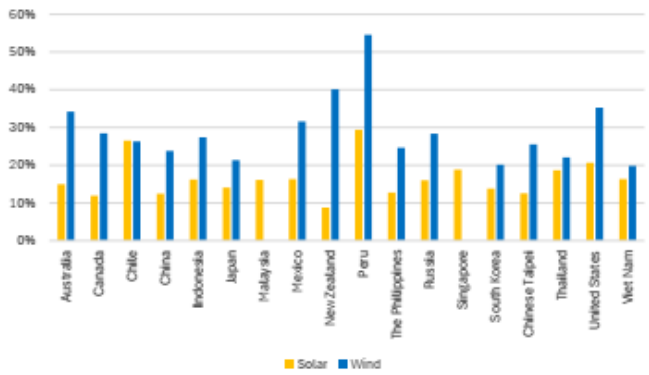
Cost Reduction in Renewable Power Generation
by Noriel Reyes, APERC

Electrolyzers co-located with VREs



Source: Natural Power (2023)

Capacity factor of solar PV and wind plants in APEC, 2022



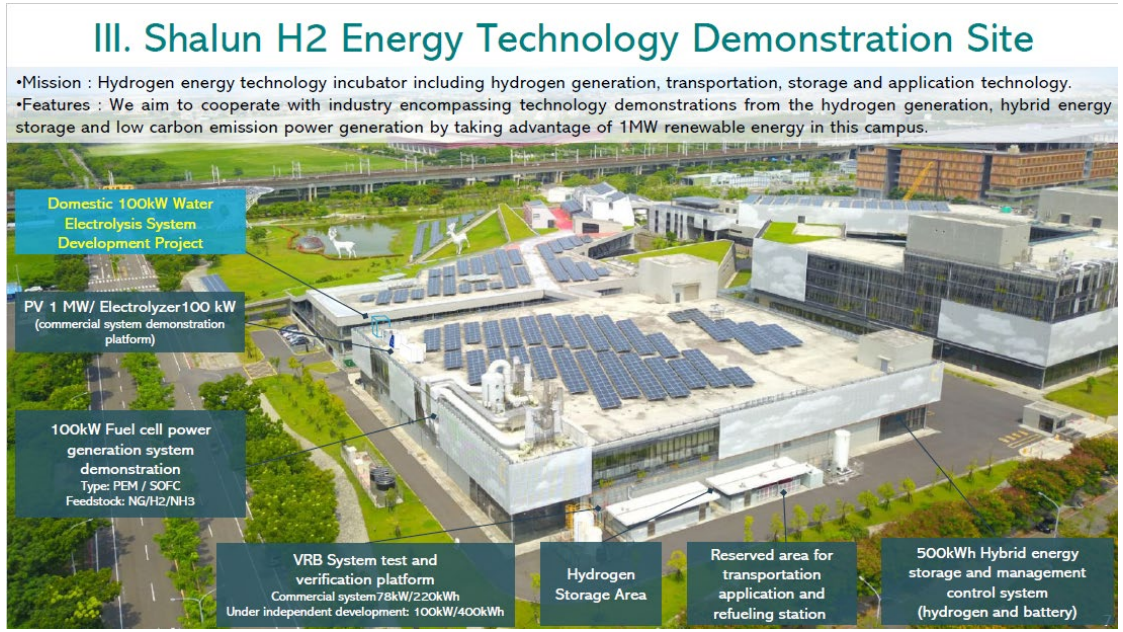
Source: Ember (2024)

- Renewable hydrogen costs are determined mainly by the cost of electricity.
- Decreasing renewable electricity costs would improve the economics of electrolysis-based hydrogen production.
- High-capacity electrolysers need continuous electricity supply.
- Electricity storage helps but increases electricity cost.
- Grid electricity introduces emission compliance challenges.

Session 2 – Green Hydrogen: Cost Reduction in Renewable Power Generation and Electrolysis

Cost Reduction in Electrolysis
by Feng-Chia Hsu, ITRI

- Electrolyzer cost is second largest factor.
- Cost reductions expected from technological innovations.
- Shalun H2 site has two 100 kW electrolyzers.
- Site powered by 1 MW renewable energy system.
- One electrolyzer built on-site for development.

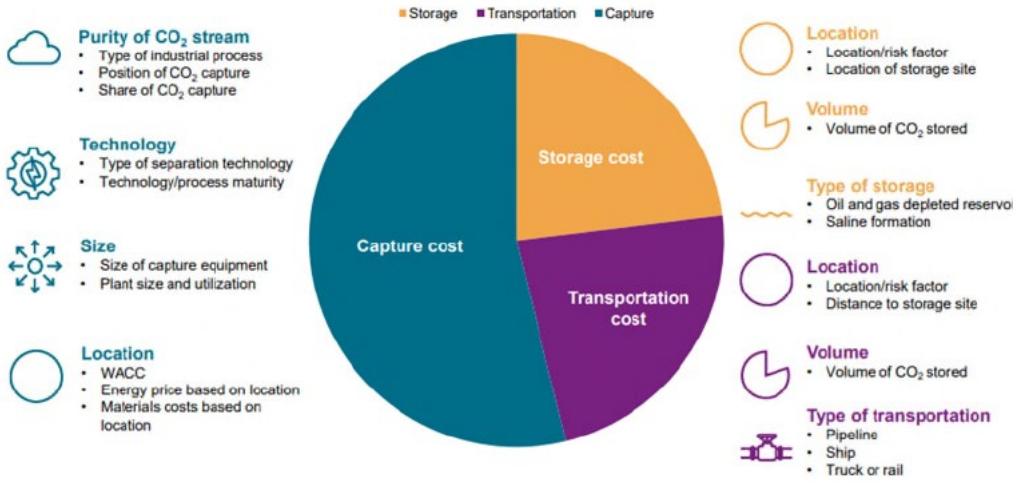


Source: Cost Reduction in Electrolysis (GEL, ITRI)

Session 3 – Blue Hydrogen: Cost Reduction in CCS; Economics and Current Activity

Cost Reduction in CCS
by Allen Huang, CPC

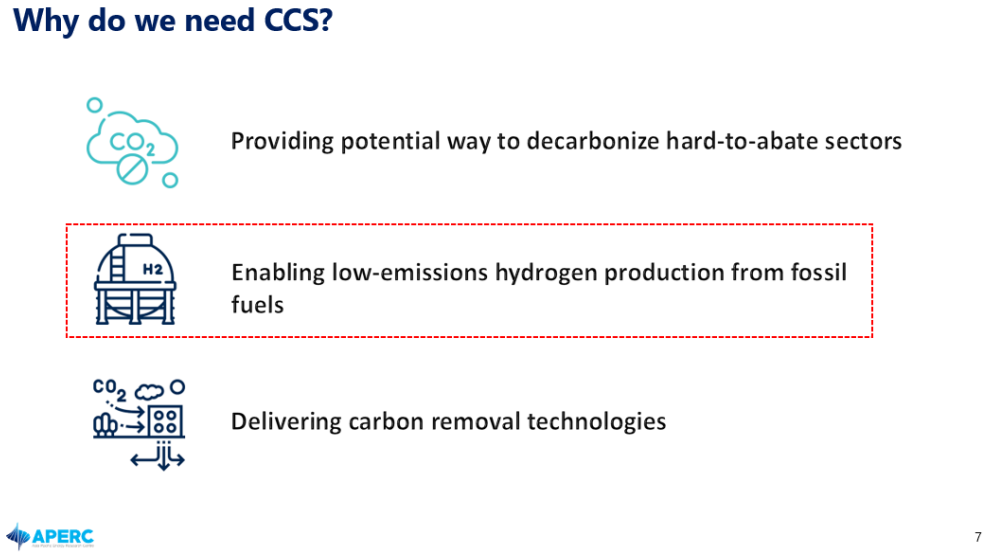
- CCS costs are driven primarily by the cost of capture processes.
- Scale economies reduce transport and storage costs.
- Learning-by-doing could cut 12% total cost.
- CO2 avoidance cost estimated at 100 USD/ton.
- USA expected to have lowest avoidance costs.
- More players needed to reduce CCS costs.



Source: S&P Global

Session 3 – Blue Hydrogen: Cost Reduction in CCS; Economics and Current Activity

Blue Hydrogen: Economics and Current Activity by Phung Quoc Huy, APERC



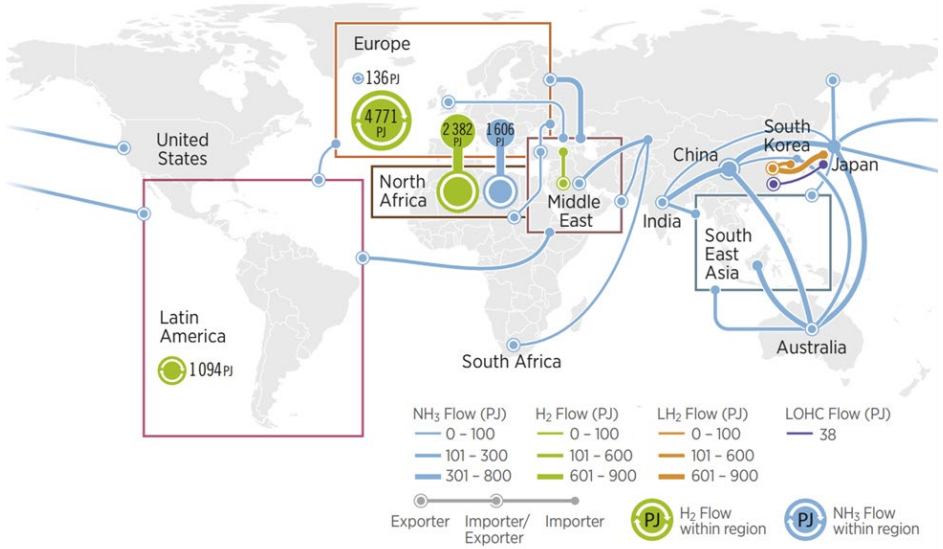
- CCS could play an important role in decarbonizing fossil fuel-based hydrogen.
- Blue hydrogen cost mostly from natural gas/coal.
- Carbon capture adds 9% to 14% of cost.
- Blue hydrogen projects in USA, Canada.
- Most mature clean hydrogen projects use CCS.

Source: Blue Hydrogen: Economics and Current Activity (APERC)

Session 4 – Sustainable hydrogen production and trade from remote and developing

Sustainable Hydrogen Production and Trade from Remote and Developing Regions by Ann-Kathrin Lipponer, IRENA

- Global trade needed across the whole green hydrogen value chain.
- Around 1/4 of hydrogen demand can be satisfied by trade in 2050.
- Under the levels of demand expected by 2050, clean hydrogen will be traded mainly via pipelines and in the form of ammonia for long distance trading.



Source: Global hydrogen trade (IRENA)

Key Takeaway

- High costs are a real challenge, not only in hydrogen production, but also in transport and distribution.
- Technological innovations are required. Pilot projects and research centers in APEC are working to discover those technologies.
- At present zero- and low-carbon hydrogen innovation and projects are not advancing quickly enough for hydrogen to play a substantial role in decarbonization before 2040.
- Zero- and low-carbon hydrogen are more expensive than conventional fuels and therefore could require substantial policy and financial support.
- This workshop focused on the cost barriers, but there are also other relevant barriers such as the need for new infrastructure and incompatible regulatory frameworks that are important to considered when a hydrogen strategy is being developed.

APERC Clean Hydrogen Workshop Photo

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Thank you.

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