The Future of Hydrogen as a Resource: Scenarios, Trends and Risks

UNECE Resource Management Week 2023

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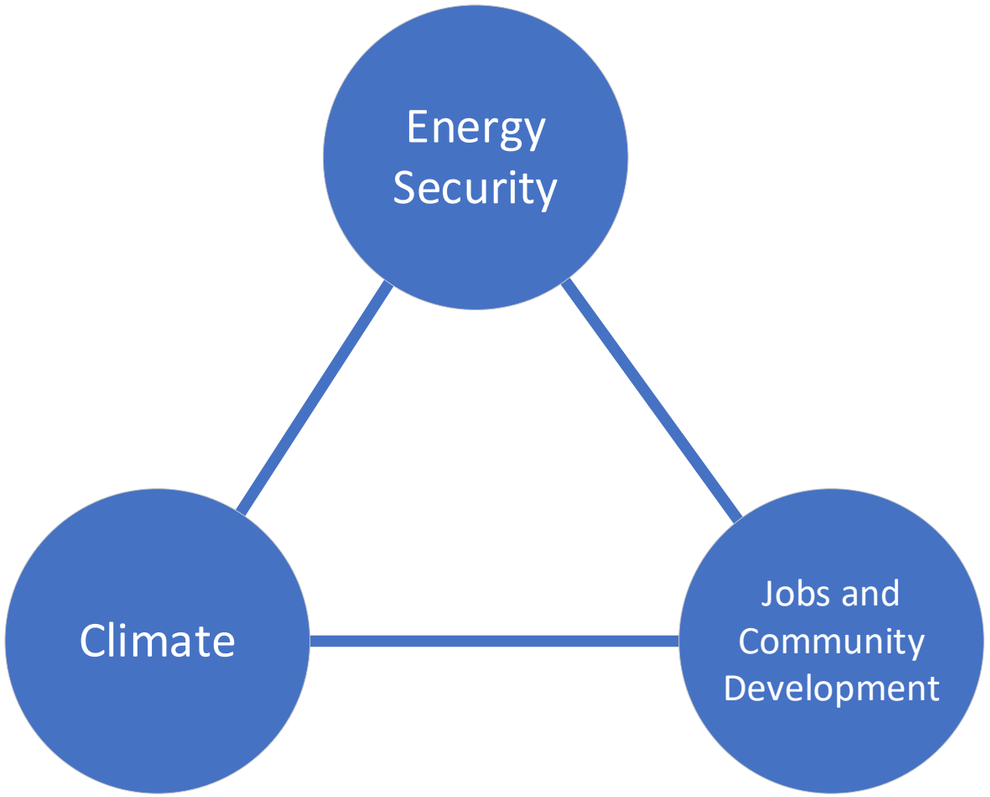
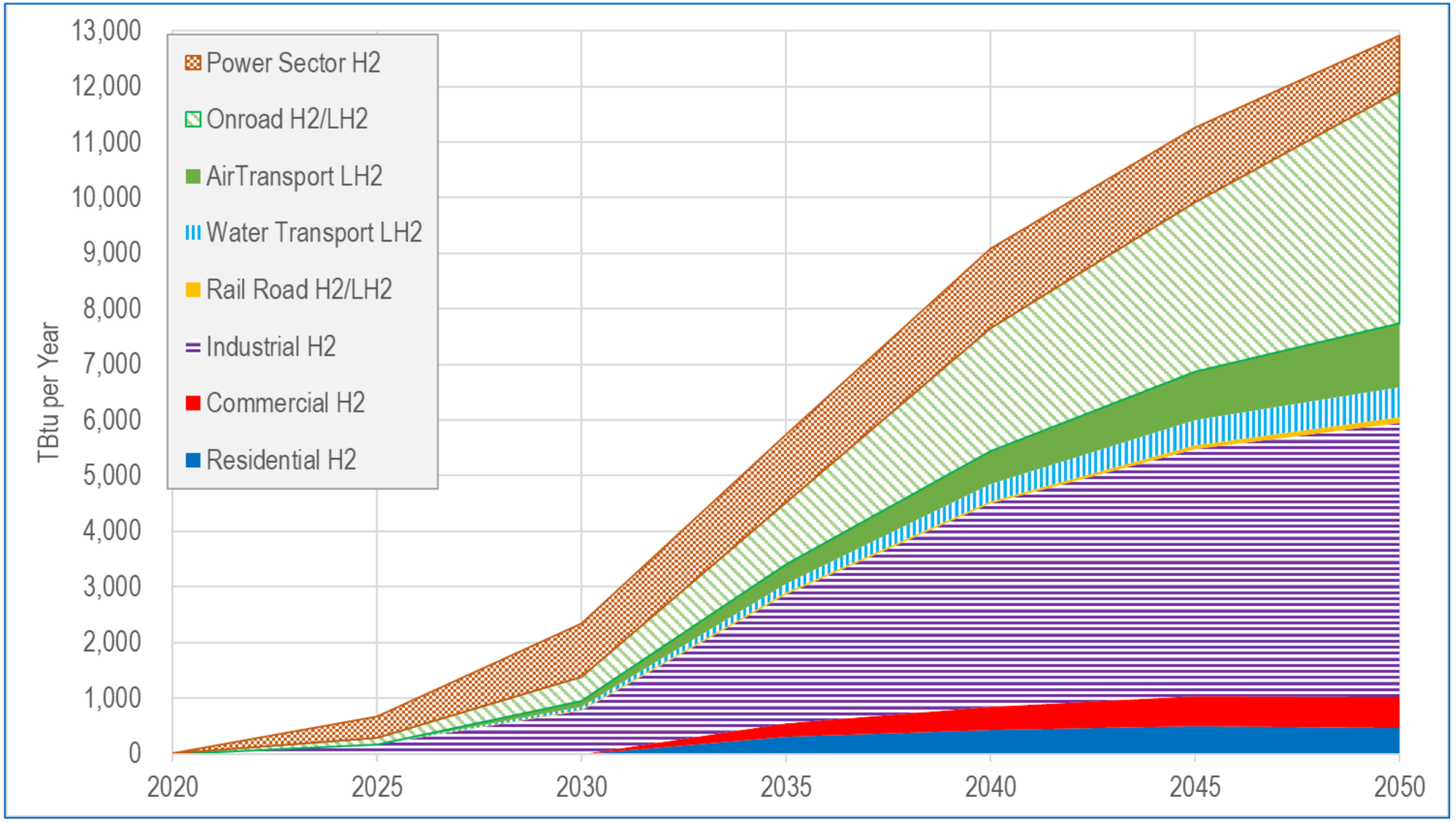


- Countries across the globe are looking at hydrogen to leverage their internal resources
- Hydrogen can dramatically reduce Greenhouse Gas Emissions making hydrogen projects Environmentally Viable
- Energy security has taken center stage, particularly in countries without fossil resources
- New jobs associated with distributed production in the areas hydrogen is consumed increase the Social and Environmental Viability

Global Interest in Hydrogen Scenarios

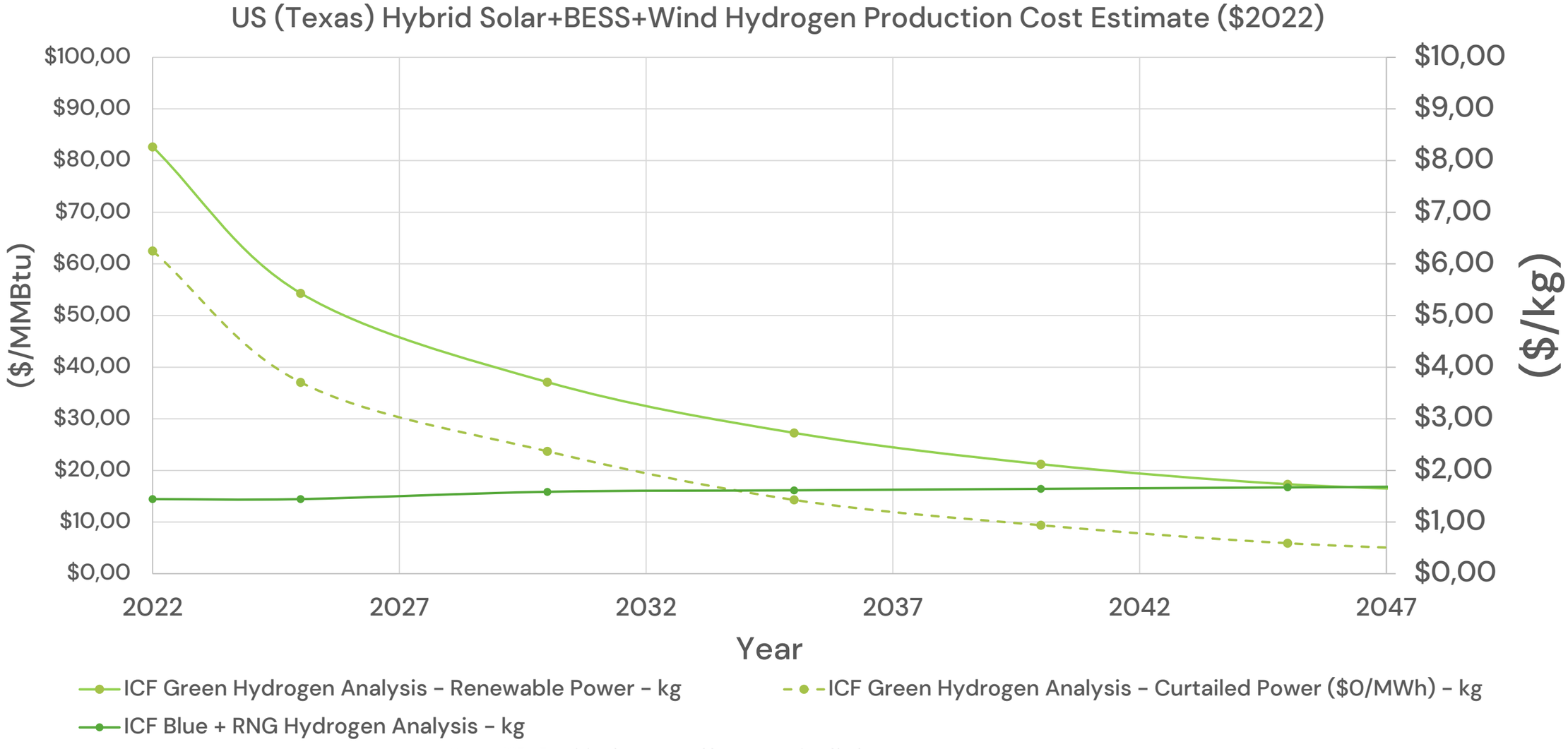
US Hydrogen Consumption: High Case, Technology Agnostic



13,000 Tbtu/yr ~
115,000,000 MT/yr

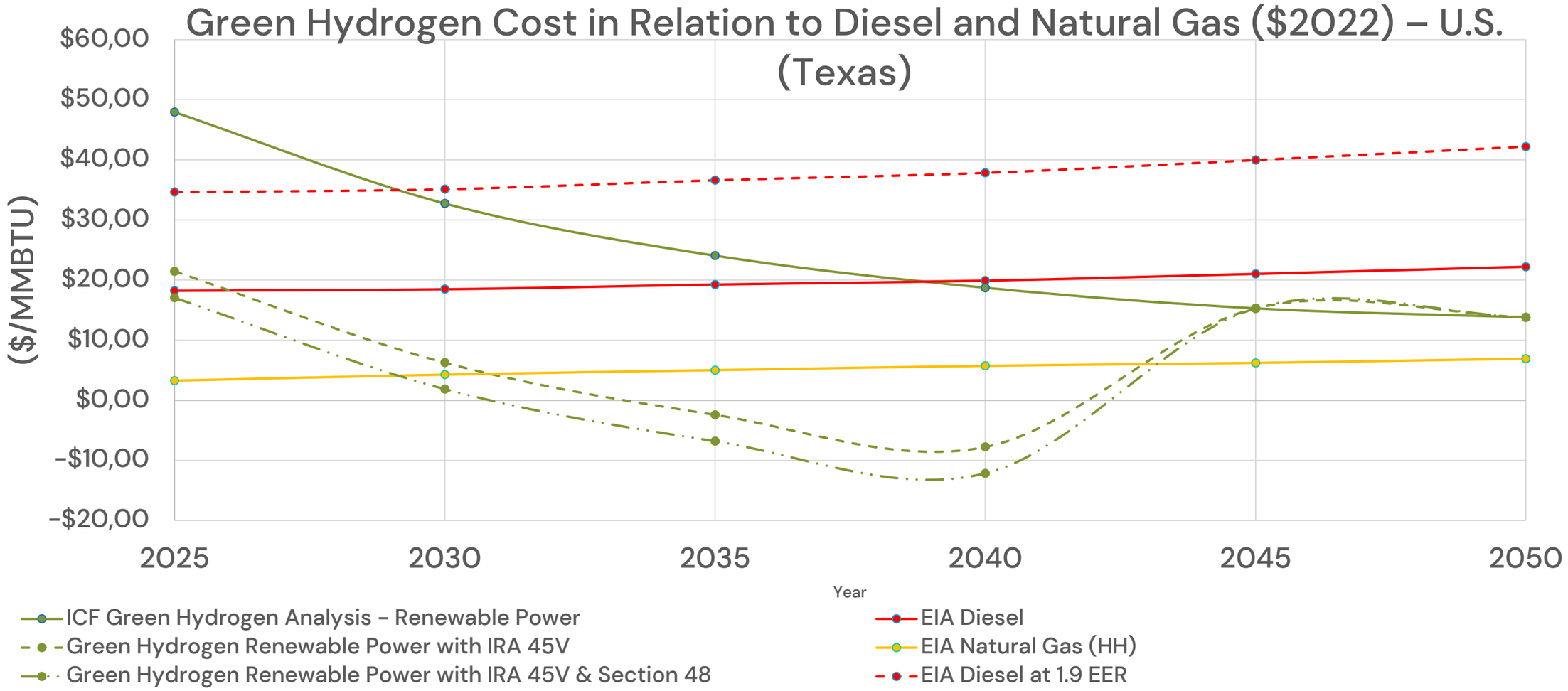
Source: ICF - Examining the current and future economics of hydrogen energy

Trends: Significant Quantities will Be Needed, Helping with Economic Viability



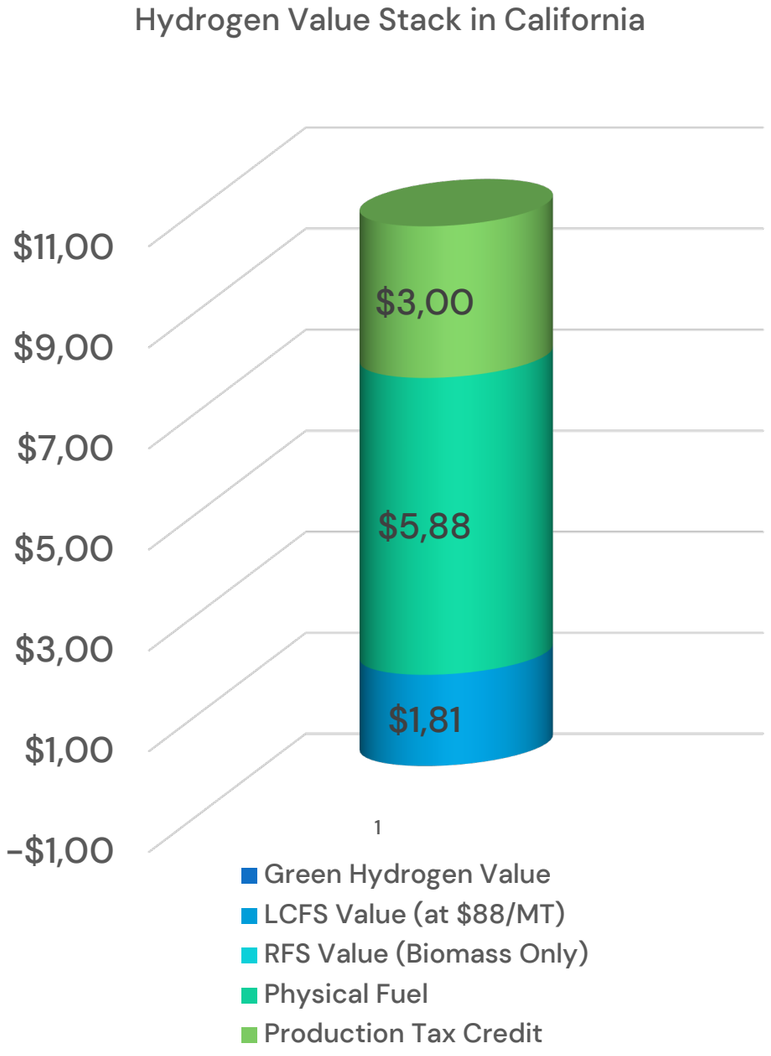
Source: ICF - Examining the current and future economics of hydrogen energy

Hydrogen Trends, Government Support Moving Hydrogen from E3 to E1.2



Source: ICF – Examining the current and future economics of hydrogen energy

Hydrogen Trends, Fuel cost expected to be less than incumbent fuels in medium term, Moving projects from E1.2 to E1.1



Value Component

Production Tax Credit Value
(Section 45V Prevailing Wage)

Physical Fuel Value
(Value at 85% of ULSD and EER of 1.9)

CO_2 offset value
(California LCFS at Carbon Intensity (CI)=0g CO_2/MJ)

US Renewable Fuel Standard (Biomass Only)
(Value varies based on feedstock)

Section 48, 45V, 45Q, some credits can be stacked

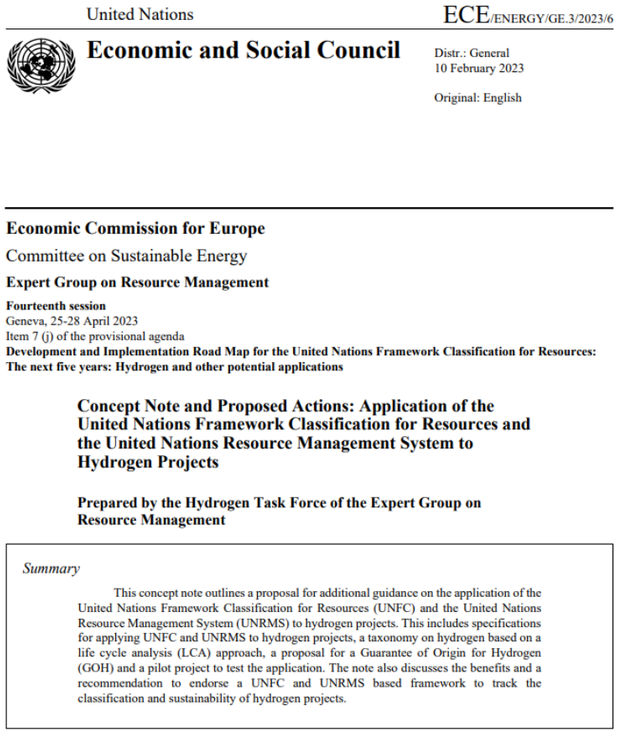
Low carbon fuels sell at slight discount to incumbent fuel to drive uptake

LCFS Credits are State level CO_2 emissions, West coast states have programs in place with many studying similar programs

Transport hydrogen in California has $10.69 per kg of 0 carbon hydrogen in value to be divvied up between the parties

Trends: Stacking of Government Incentives Necessary for E3 to E1.2 Move

- Proposed Specifications for Hydrogen from Various Resources is Complex
  - Bundling of technologies by private parties makes hydrogen classification more difficult, need all of the resource groups
    - Fossil + Renewable Natural Gas (biomass) + Injection Resources projects
    - Solar + Wind + Grid Electricity Electrolyzer Projects
    - Nuclear + Solar Hydrogen Projects
- Taxonomy of Hydrogen Based on Lifecycle Approach
  - Different Resources have different Carbon Intensity, overall carbon intensity key to project Economic, Social, and Environmental Viability
  - Important to understand the importance of policy in early years, items such as temporal matching, book and claim on renewable natural gas
  - Storage and transport of hydrogen is difficult, economics dictate more diversified production
- Pilot Projects
  - Most of the technology de-risking has been done to move Projects from F2 to F1.3, need to provide analogues for investors to understand the opportunity for UNFC



United Nations ECE/ENERGY/GE.3/2023/6

Economic and Social Council

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Economic Commission for Europe

Committee on Sustainable Energy

Expert Group on Resource Management

Fourteenth session
Geneva, 25-28 April 2023
Item 7 (j) of the provisional agenda
Development and Implementation Road Map for the United Nations Framework Classification for Resources: The next five years: Hydrogen and other potential applications

Concept Note and Proposed Actions: Application of the United Nations Framework Classification for Resources and the United Nations Resource Management System to Hydrogen Projects

Prepared by the Hydrogen Task Force of the Expert Group on Resource Management

Summary

This concept note outlines a proposal for additional guidance on the application of the United Nations Framework Classification for Resources (UNFC) and the United Nations Resource Management System (UNRMS) to hydrogen projects. This includes specifications for applying UNFC and UNRMS to hydrogen projects, a taxonomy on hydrogen based on a life cycle analysis (LCA) approach, a proposal for a Guarantee of Origin for Hydrogen (GOH) and a pilot project to test the application. The note also discusses the benefits and a recommendation to endorse a UNFC and UNRMS based framework to track the classification and sustainability of hydrogen projects.

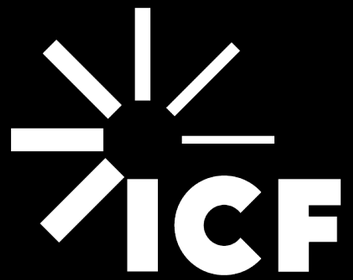
https://unece.org/sites/default/files/2023-02/EGRM-14-Hydrogen%20Concept%20Note%20v4_ECE_ENERGY_GE.3_2023_6.pdf

Risks: UN EGRM efforts designed to de-risk projects

Conclusions:

- The ability to leverage local resources and contribute to energy security, climate, and economic development goals is driving worldwide interest in hydrogen and the Economic, Social, and Environmental Viability of Projects
- Hydrogen may become less costly than incumbent fuels in the near term if learning matches that achieved in other relevant sectors such as solar
- UN EGRM pilot work designed to derisk future hydrogen projects by providing financiers with classification of Projects and quantities to be produced

Get in touch with us:



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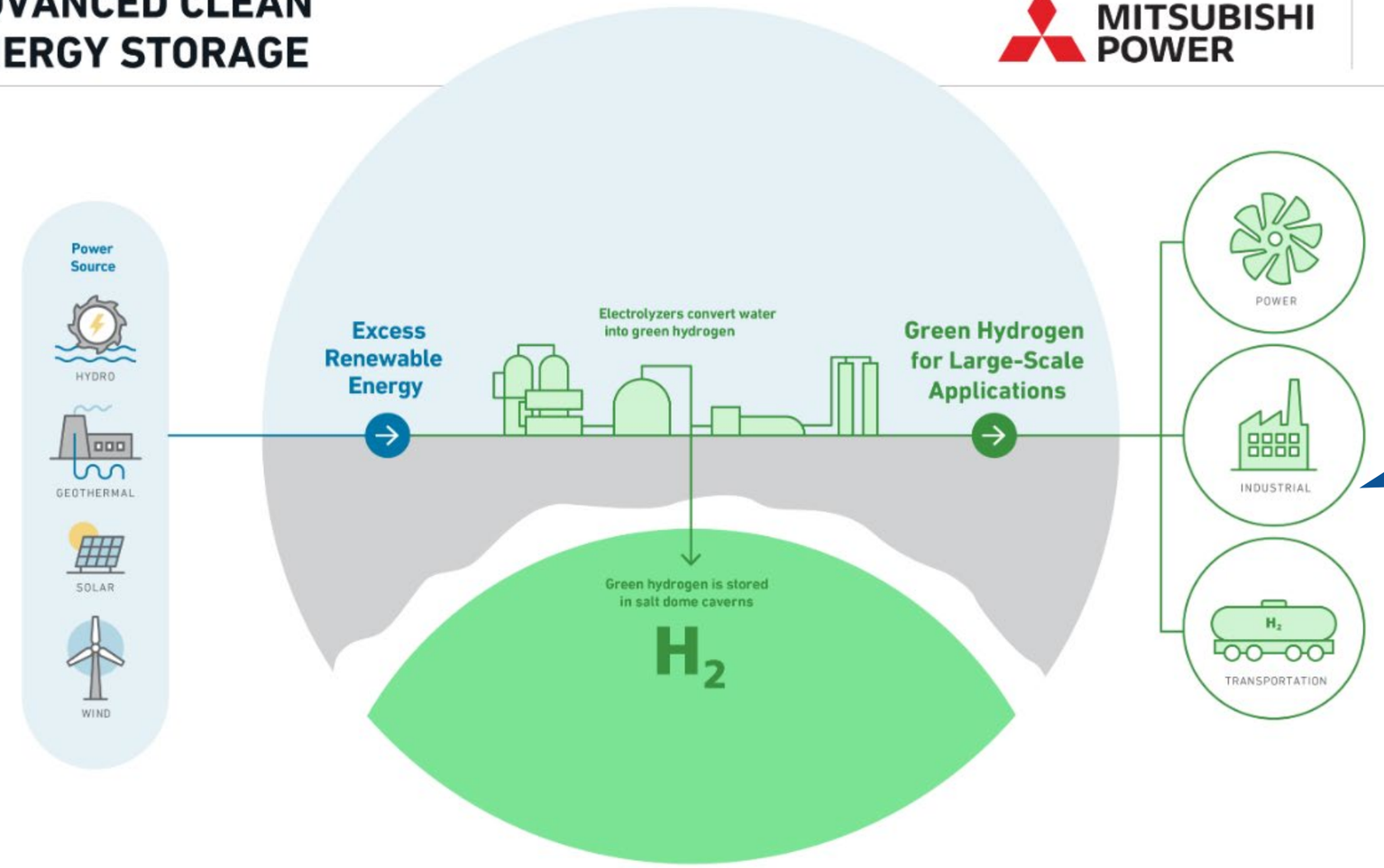

DOE Loan Programs Office Issued $504MM Conditional Loan Guarantee, June, 2022

Source: https://power.mhi.com/regions/amer/news/20210511.html

→ Long duration storage (300 GWh) – Advanced clean energy storage (Delta Utah)