• 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
Trends: Significant Quantities will Be Needed, Helping with Economic Viability
Hydrogen Trends, Government Support Moving Hydrogen from E3 to E1.2
Hydrogen Trends, Fuel cost expected to be less than incumbent fuels in medium term, Moving projects from E1.2 to E1.1
Trends: Stacking of Government Incentives Necessary for E3 to E1.2 Move

Value Component

- **Production Tax Credit Value**
  (Section 45V Prevailing Wage)

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

- **CO₂ offset value**
  (California LCFS at Carbon Intensity (CI)=0g CO₂/MJ)

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

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

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

LCFS Credits are State level CO₂ emissions, West coast states have programs in place with many studying similar programs.

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

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• 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

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