Hydrogen Strategy
Office of Fossil Energy
Overview

Angelos Kokkinos
Associate Deputy Assistant Secretary
Office of Clean Coal and Carbon Management

July 23, 2020 | Hydrogen Workshop | USEA
State of Hydrogen Production Today

Currently 99% of 10 MMT in the U.S. supplied by fossil fuels – least cost

- 96% by SMR
- 3% by gasification
- 1% by electrolysis

70 MMT generated globally

- 76% by SMR
- 22% by gasification
- 2% by electrolysis

Small fraction includes CCUS

Economics dominates generation mix
Current Hydrogen Demand

- Current demand is mostly for oil refining and chemical production.
- Metals, electronics and glass production are main industrial sources of demand.
- Food production is main consumer source of demand.
- Transportation, building heating and electricity generation are areas of demand growth for a decarbonized economy.

- Current demand is mostly for oil refining and chemical production.
- Metals, electronics and glass production are main industrial sources of demand.
- Food production is main consumer source of demand.
- Transportation, building heating and electricity generation are areas of demand growth for a decarbonized economy.
Potential Hydrogen Demand in 2050

- Transport, buildings, and power sectors all have the potential to use cost-competitive hydrogen.

- Fossil fuels with CCUS will support emerging carbon free market opportunities with low-cost hydrogen.
  - Utility scale hydrogen based power generation/energy storage
  - Steel and advanced alloys manufacturing
  - Cement, fertilizer and chemicals production
  - Fuel for marine, rail, and heavy-duty vehicle applications

Example of Scale: Hydrogen for the U.S. transport sector would require 200 MMT of hydrogen - 20X current US production. Transportation fleet expected to increase 2-3X by 2050
Economics of Hydrogen Production

- H₂ production from fossil fuels is the least expensive source, even with CCUS.
- Gasification with CCUS could be carbon neutral or even negative when co-firing biomass.
- R&D advances could significantly reduce SMR and gasification costs further.

Figure 5. Current Hydrogen Production Cost Ranges and Averages by Technology and Equivalent Prices for Fossil Sources with CO₂ Capture and Storage


Fossil Energy Hydrogen R&D Program Elements

Relationship of FE Program Elements to Comprehensive Hydrogen Strategy

- Hydrogen production from diverse domestic resources including natural gas and coal

- Hydrogen turbines and fuel cells enable carbon-neutral to negative emission power applications

- Establish hydrogen’s presence as a critical feedstock for chemicals and liquid fuels

- Utilize existing and future gas turbine assets in centralized and distributed power generation systems

- Contribute “responsive load” on grid using simple cycle hydrogen turbines to enable grid stability and gigawatt-hour energy storage

- Allow coal with CCUS to run as base load with hydrogen production for storage and use

- Support hydrogen-enabled innovations in domestic industries

Widespread availability of carbon-neutral or negative greenhouse gas emissions hydrogen

Energy Security

Economic Prosperity

Resiliency
FE Investments in Hydrogen R&D

- Carbon-Neutral Hydrogen Production Using Gasification and Reforming Technologies
- Large Scale Hydrogen Transportation Infrastructure
- Large Scale On-site and Geological Hydrogen Storage
- Hydrogen Use for Electricity Generation, Fuels, and Manufacturing.
Request for Information—Hydrogen Technologies DE-FOA-0002369

Seeking input from stakeholders about hydrogen technology opportunities and research needs that could lead to technological advances

**Topic Areas**

1. Natural Gas Hydrogen Production, Transport, and Storage
2. Hydrogen Production from Coal, Biomass, and Waste Plastics Gasification
3. Hydrogen Turbines
4. Hydrogen Storage
5. Hybrid Energy Systems with reversible solid oxide fuel cells to produce hydrogen

**Responses Due: August 24th, 2020 to DOE FE National Energy Technology Laboratory**

https://netl.doe.gov/business/solicitations
Hydrogen Workshop Agenda – Sessions 2 and 3

Session 2:
• Hydrogen Production from Solid Feed Stocks, Use, and CCUS technologies to Enable Carbon Free/Negative Products
• Oil and Gas Economy wide Production, Transport and Storage of Hydrogen
• DOE LNG Export Activities and Hydrogen Consideration

Session 3:
• Feedback on Fossil Energy Hydrogen Strategy and Future R&D Needs (15-30 Min) – USEA Facilitated
Thank you

Angelos Kokkinos
Associate Deputy Assistant Secretary
Office of Clean Coal and Carbon Management

Angelos.Kokkinos@hq.doe.gov