NCSL Energy Supply Task Force 2022

Mike McCurdy, P.E.
Managing Director – Fuels & Power
Energy Advisory, ICF
Electric Power Generation and Fuels = 1.9 million workers in US (DOE 2016)
• 1.1 million traditional coal oil & gas
• 800 thousand in low carbon emission technologies
You Still Need Dispatchable Power, How to Do it GHG Free?

Renewable Penetration in Isolated Island Grid

Levelized Cost of Electricity at Various Levels of Intermittent Renewables

Average Annual MW by Hour of the Day: (3) 2040 Small Market: Fast Renew. Growth

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Declining hydrogen production prices are opening new opportunities
Hydrogen production costs in context of delivered energy prices

AEO Average Energy Prices for 2020

AEO Average Energy Prices for 2050

Notes:
- Delivered energy prices/costs are national averages from EIA’s 2021 Annual Energy Outlook (AEO)
- Hydrogen production costs are an ICF calculation for green hydrogen, based on assumptions on previous slide
- These bars do not account for relative efficiency of equipment using different fuel types
Everyone Gets Cake
Hydrogen in Combined Cycle Service

- Existing GT’s can be Retrofit for High Hydrogen Service
  - Hydrogen combustors
  - Larger fuel piping and valves
  - Safety sensors and flame detectors
  - Control system changes

- Major OEMs (GE, Mitsubishi, Siemens) Targeting 100% Hydrogen Compatibility between 2025 and 2030

- GE lists 75 turbines with 6MM+ operating hours, the Deasan Refinery 6B’s in South Korea have been running on 70–95% hydrogen since 1997 (guaranteed at 95%)

Source: https://www.ge.com/power/gas/gas-turbines/6b-03

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Long Duration Storage – Advanced Clean Energy Storage (Delta Utah)

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

DOE Loan Programs Office Issued $504MM Conditional Loan Guarantee, April 6, 2022
ICF does produce thought pieces on hydrogen from time to time. Recent examples include:

- Exploring the Economic Potential of Hydrogen Energy (collaboration with Norton Rose)

- Examining the current and future economics of hydrogen energy
  https://www.icf.com/insights/energy/economics-hydrogen-energy

- Fueling the future of India’s long-haul vehicles with hydrogen

- Exploring hydrogen as a versatile option for decarbonization

- The hydrogen value proposition
  https://www.icf.com/insights/energy/hydrogen-value-proposition

- Repurposing infrastructure for hydrogen in a net-zero future

- Hydrogen's essential role in the decarbonization of aviation
  https://www.icf.com/insights/transportation/hydrogen-role-decarbonization-aviation

- Hydrogen energy insights page
  https://www.icf.com/insights/hydrogen-energy

→ Additional Resources
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Natural Gas System (Chemical Storage) Currently Provides Peaking and Long-Term Storage Capacity

- Demand can double or even treble in days, difficult for battery storage
- Battery storage economically viable for 4-8 hours
- ERCOT would have needed ~90 hours this spring