U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

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Electrolyzer Installations Webinar Opening Remarks

Dr. Sunita Satyapal, Director, Hydrogen and Fuel Cell Technologies Office and DOE Hydrogen Program Coordinator
Dr. David Peterson, Acting Program Manager, Hydrogen Production
U.S. Department of Energy

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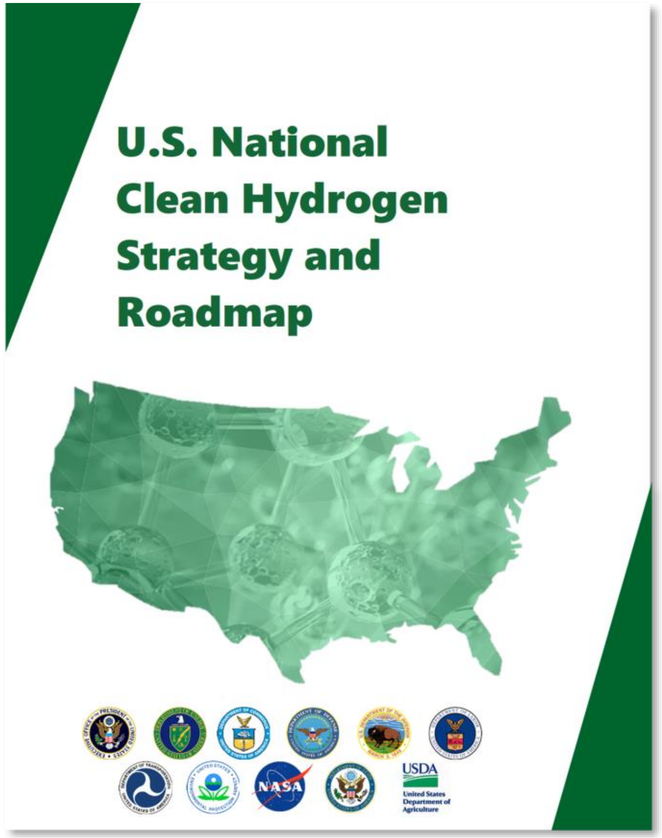
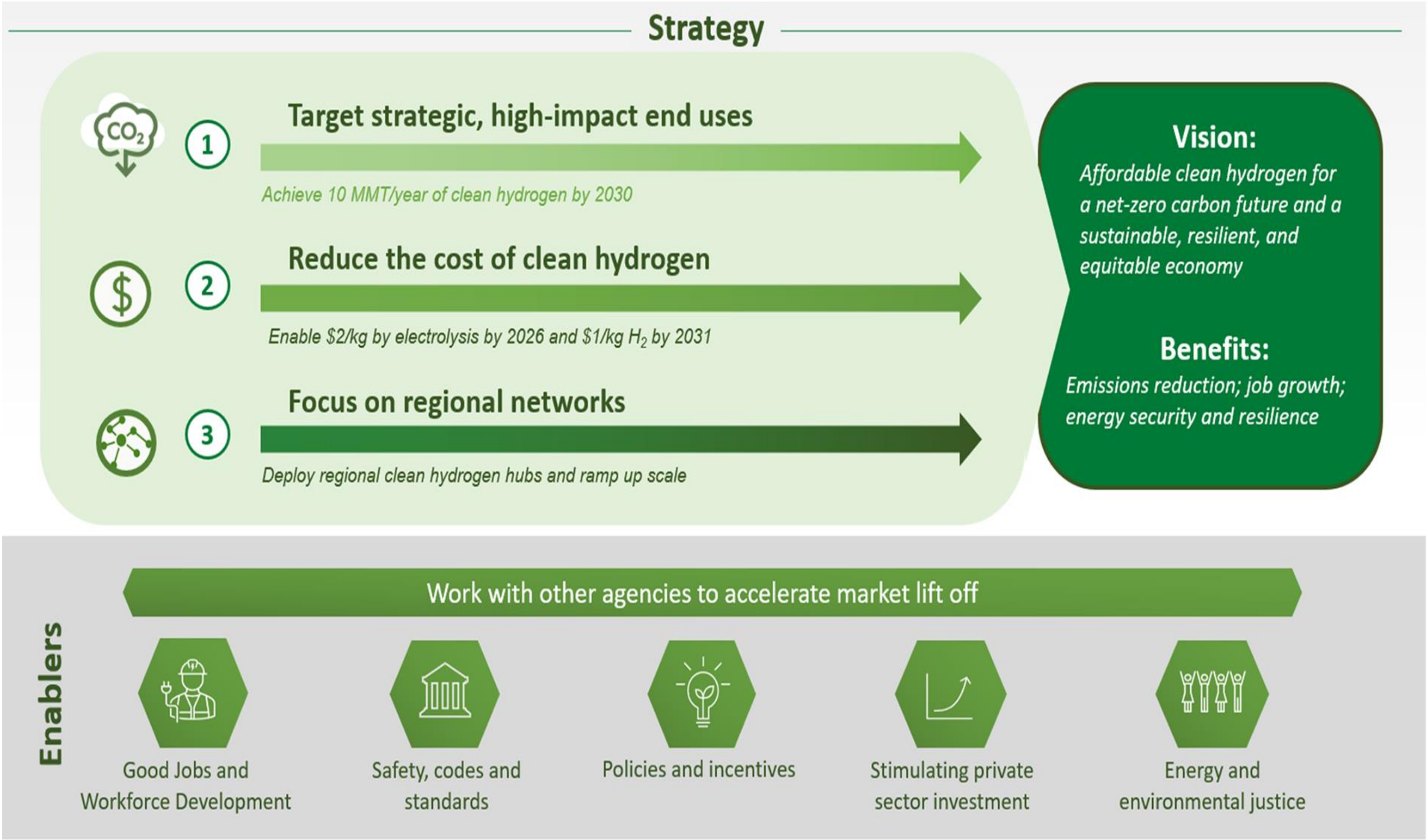
U.S. National Clean Hydrogen Strategy and Roadmap

U.S. Opportunity: 10MMT/yr by 2030, 20 MMT/yr by 2040, 50 MMT/yr by 2050.
~10% Emissions Reduction. ~100K Jobs by 2030





Released June 2023 . https://www.hydrogen.energy.gov/clean-hydrogen-strategy-roadmap.html

ENERGY earthshots U.S. DEPARTMENT OF ENERGY | Hydrogen

Hydrogen Energy Earthshot

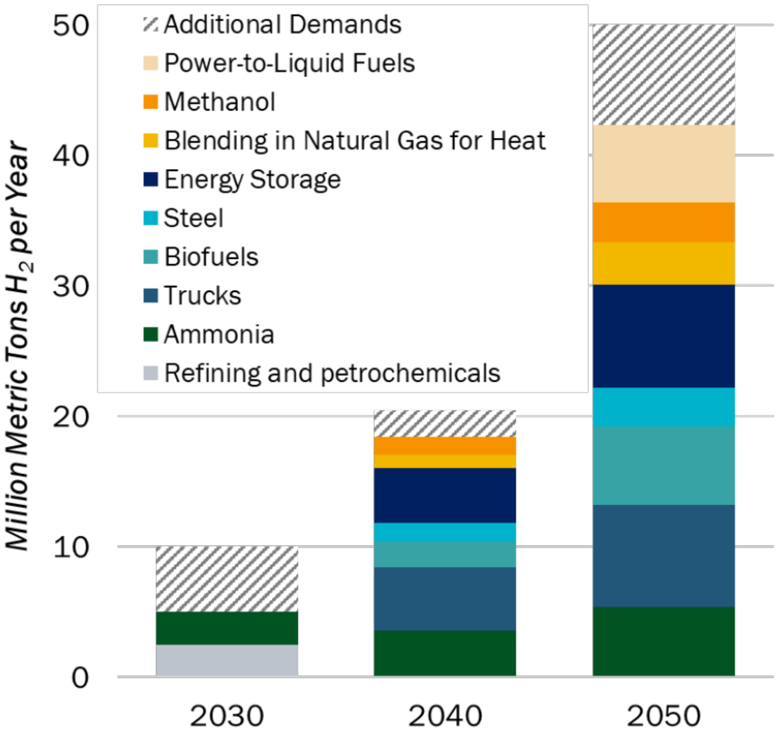
“Hydrogen Shot”

“1 1 1”

$1 for 1 kg clean hydrogen in 1 decade

Opportunities for Clean Hydrogen – National Goals

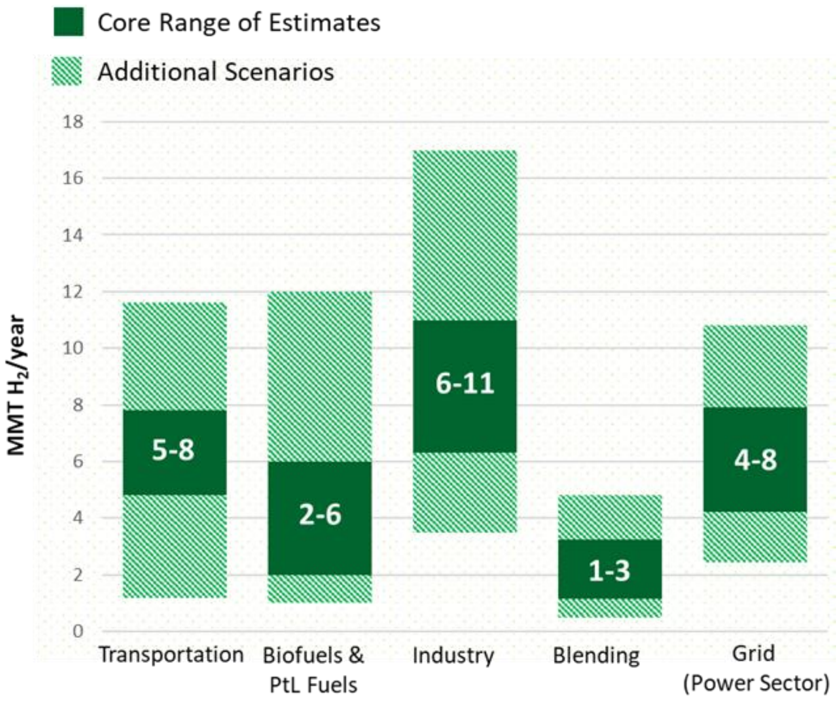
Opportunities for Clean Hydrogen Across Applications



Clean Hydrogen Use Scenarios

- Catalyze clean H_2 use in existing industries (ammonia, refineries), initiate new use (e.g., sustainable aviation fuels (SAFs), steel, potential exports)
- Scale up for heavy-duty transport, industry, and energy storage
- Market expansion across sectors for strategic, high-impact uses

Range of Potential Demand for Clean Hydrogen by 2050



- **Core range: ~ 18–36 MMT H_2**
- **Higher range: ~ 36–56 MMT H_2**

Refs: 1. NREL MDHD analysis using TEMPO model; 2. Analysis of biofuel pathways from NREL; 3. Synfuels analysis based off H2@Scale ; 4. Steel and ammonia demand estimates based off DOE Industrial Decarbonization Roadmap and H2@Scale. Methanol demands based off IRENA and IEA estimates; 5. Preliminary Analysis, NREL 100% Clean Grid Study; 6. DOE Solar Futures Study; 7. Princeton Net Zero America Study

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Legislation Highlights: 2021 – 2022

Bipartisan Infrastructure Law

- **Includes $9.5B for clean hydrogen**:
  - $1B for electrolysis
  - $0.5B for manufacturing and recycling
  - $8B for at least four regional clean hydrogen hubs
- **Requires** developing a **National Clean Hydrogen Strategy and Roadmap**

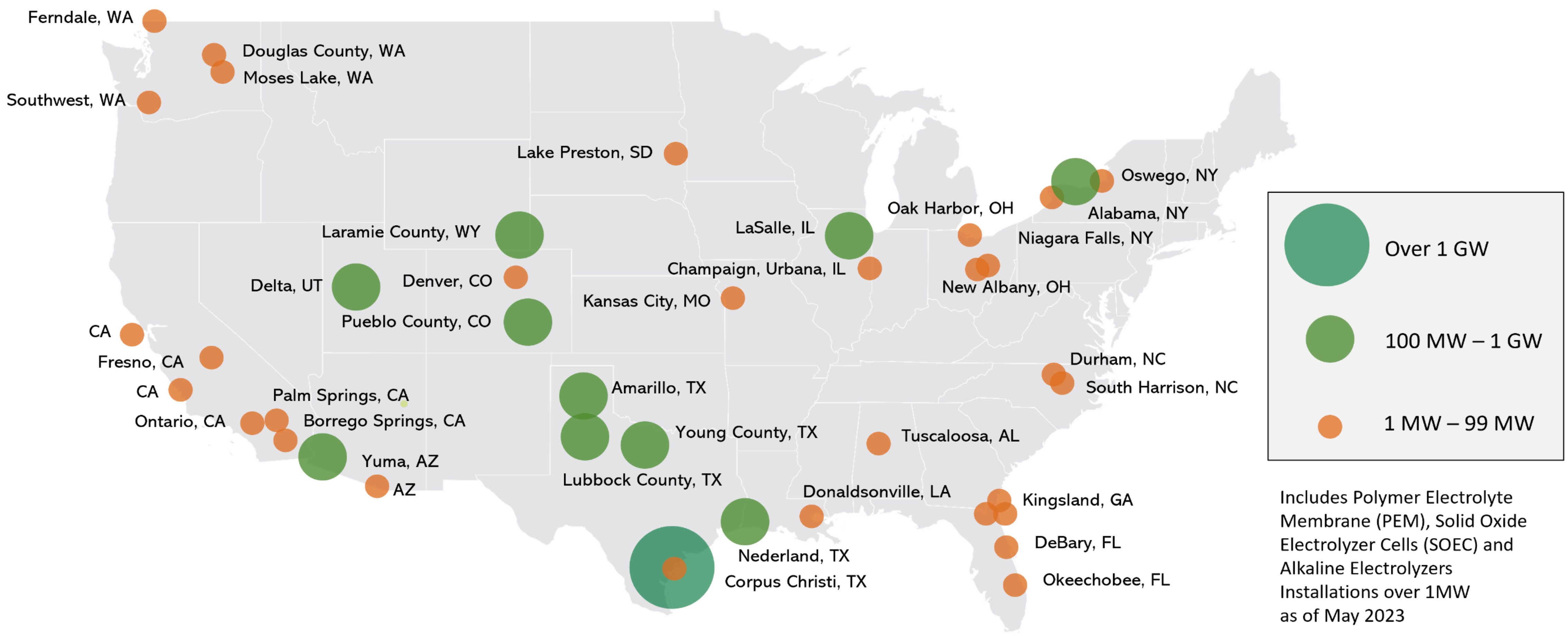
President Biden Signs the Bipartisan Infrastructure Bill into law on November 15, 2021. Photo Credit: Kenny Holston/Getty Images

Inflation Reduction Act

- **Includes significant tax credits** (e.g., up to $3/kg for production of clean hydrogen)

Planned and Installed Electrolyzer Capacity in the US

Total 3.7 GW in Electrolyzer Capacity
5-fold increase since 2022

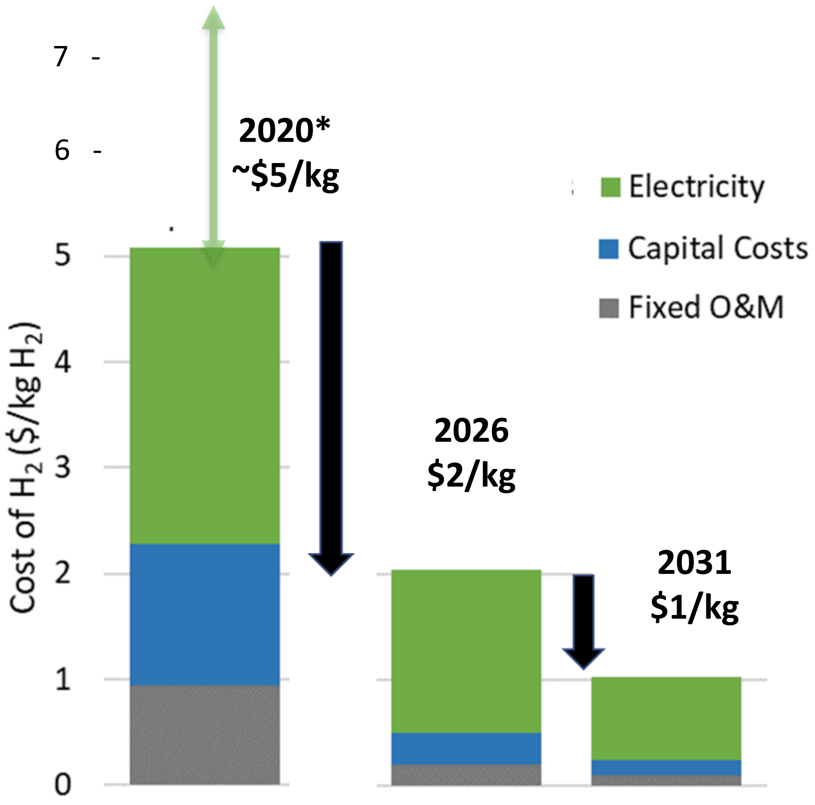


Includes Polymer Electrolyte Membrane (PEM), Solid Oxide Electrolyzer Cells (SOEC) and Alkaline Electrolyzers Installations over 1MW as of May 2023

Source: Arjona, DOE Program Record #23003, June 2023

Hydrogen Cost from Electrolysis and Cost Reduction Strategies

Levelized Cost of Hydrogen from Electrolysis



Today's cost of H_2 from natural gas ~ \$1.50/kg.

Cost Reduction Strategies

- Reduce electricity cost, improve efficiency, and utilization
- Reduce capital cost – stack and balance of plant, including platinum group metals
- Increase manufacturing volumes
- Reduce operating and maintenance cost

Today's Focus

Reduce cost and complexity of installation, siting, permitting (while addressing any environmental/energy justice concerns)

*2020 Baseline: PEM (Polymer Electrolyte Membrane) low volume capital cost ~\$1,500/kW, electricity at \$50/MWh. Pathways to targets include capital cost \$250-300/kW by 2026, < \$150/kW to meet \$1/kg (at scale). Chart shows calculation assuming \$50/MWh in 2020, \$30/MWh in 2025, \$20/MWh in 2030. Specific use case for 90% capacity factor. Multiples scenarios being assessed.

Webinar Goals

- **Initiate dialogue between industry, utilities, and other stakeholders about large-scale electrolyzer installations, critical for:**
  – Sharing lessons learned and developing best practices
  – Better understanding key challenges and cost drivers
  – Streamlining the installation process [without compromising environmental/environmental justice (EJ) concerns]
- **Provide feedback to DOE on potential actions and next steps**

Thank you

Dr. Sunita Satyapal
Director, Hydrogen and Fuel Cell Technologies Office
Coordinator, DOE Hydrogen Program
U.S. Department of Energy
And Director, Hydrogen Interagency Task Force

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