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Hydrogen's Potential in New England

A Conversation with the Massachusetts Clean Energy Center

PIERCE ATWOOD 

A Brief Overview of this Nascent Industry

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Overview & Outline

- DOE's Clean Hydrogen Roadmap:
 - › Clean H₂ can support 10% economy-wide emission reductions by 2050 compared to 2005;
 - › Create 100,000 jobs by 2030
 - › Potential domestic demand of 50 million metric tonnes (MMT) by 2050
- **Outline**
 - › Production,
 - › Transportation & Storage
 - › End-Uses
 - › Issues

Production

- Hydrogen is often categorized by color based on the method it was produced.

Green	Blue	Grey	Pink
<ul style="list-style-type: none">• Produced from renewable energy resources• electrolysis	<ul style="list-style-type: none">• From Natural Gas Steam Methane Reforming (“SMR”)• Paired With CCS	<ul style="list-style-type: none">• From Natural Gas via SMR similar to blue hydrogen• Not Paired with CCS	<ul style="list-style-type: none">• From nuclear generation

- Possibility that “green hydrogen” will become more prevalent with addition of more renewables on grid lead to increase curtailment
 - › “inter-seasonal energy storage”

Transporting and Storage

Transportation

- Interstate and Distribution pipelines
 - Possibly start with blending, move on to fully dedicated pipelines
- Liquid Organic Hydrogen Carriers (LOHCs) – liquids that can absorb and release hydrogen through chemical reactions.
- Tube Trailers (trucks) – transport compressed H₂ at 180 Bar

Storage

- On-site tanks – Either compressed gas or liquid hydrogen (cryogenic temperatures)
- [Salt caverns](#)
- Other materials (including LOHCs)

End-Uses and Applications

- **Combustion**

- › Co-firing in natural gas turbines
 - Most gas turbines already tolerate low H₂:NG blends (10-30%)
 - Retrofit of existing turbine fleet may lead to higher percentages of H₂
- › Possible Residential Uses
 - For example, National Grid anticipates blending 20% green hydrogen in its network prior to 2040 (National Grid Roadmap Filing from DPU 20-80 proceedings available [here](#))

- **Fuel Cells**

- › Heavy duty vehicles
- › Medium size plants (1-30MW in size)
- › Forklifts

- **Feed stock** for other fuels, such as ammonia, another carbon free fuel.

Important Developments

- Inflation Reduction Act provides 45V Production Tax Credit (“PTC”) for clean hydrogen production
 - › Up to \$3 per KG based depending on the lifecycle greenhouse gas emissions rate that results from the production of the qualified clean hydrogen
 - IRS still has not provided guidance as to how lifecycle greenhouse emission will be determined.
 - › Credits can be “stacked”
- Tax credits for alternative fuel vehicle refueling property
 - › \$100,000 for each single item of property
- LDCs in Massachusetts submitted plans to blend hydrogen with distribution system.
- Connecticut seems to be early adopter of H2 – [20 MW Fuel Cell facility](#) in New Britain, CT.
- DOE selected Hydrogen Hubs in October, awarding \$7 billion
 - › Northeast Hub was not selected.

Issues (To Name A Few)

- More volatile than natural gas
 - › Primarily issue with residential uses
 - › Tough to odorize
- Smaller molecule – leading to higher losses when transported via pipelines
- Hydrogen content in interstate pipelines may lead to hydrogen embrittlement.
- Public perception – H₂ combustion is reminiscent to natural gas
- Low volumetric energy density

Helpful Resources

- [U.S. Clean Hydrogen Roadmap](#)
- [Center for Hydrogen Safety](#)
- [Intermountain Power Project in Delta, Utah](#)
 - › 1,800 MW Power Plant with Salt Dome Storage

Questions?

Thanks!