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November 08, 2022

MEMORANDUM

TO: Council Members

FROM: Steven Simmons

SUBJECT: Presentation on Renewable Hydrogen Policy and Projects

BACKGROUND:

Presenter: Michelle Detwiler, Executive Director of the Renewable Hydrogen Alliance (RHA). Michelle's career spans over twenty years in the energy sector, primarily in government affairs. She holds a Bachelor of Arts degree in Policy Studies from Syracuse University and a Master's degree in public administration from George Washington University.

Summary: The production and use of hydrogen as a carbon free energy carrier has the potential to greatly impact the region's future economy and power system. Hydrogen use could cross many sectors, including power generation and storage, transportation, industry, and even residential and commercial heating. With the clean energy policies in place, the region could become a key player nationally in the hydrogen space.

In this presentation, Michelle Detwiler from the RHA will be discussing recent Federal and State policies related to the use and production of hydrogen and will also cover current and future hydrogen projects in the Northwest.

Relevance: The 2021 Power Plan was the first Council Plan to explore the potential use of hydrogen to help decarbonize the transportation and industrial sectors of the Northwest economy. Currently there is limited demand and

production in the region, however this may change in the future with the clean electricity grid and state emission reduction goals. If demand for hydrogen were to materialize and large-scale production in the region was built in response, the impact on the power system could be significant, in particular for hydropower and renewable generation from solar and wind.

Background: An analysis of hydrogen consumption and production was included in the 2021 Power Plan. Use cases included on-board, hydrogen-powered fuel cells for the heavy-duty transportation vehicle category, and replacement of fossil fuels in select industrial heating processes.

More Info: https://www.nwcouncil.org/2021powerplan_hydrogen-and-fuel-cells/

The Renewable Hydrogen Policy and Project Landscape

Presentation to NW Power & Conservation Council

Renewable Hydrogen Alliance
Michelle Detwiler, Executive Director
November 16, 2022



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Renewable Hydrogen Alliance – About Us

- Established in 2018
- Non-profit trade association focused on advancing the renewable hydrogen sector throughout the NW
- Over 75 members representing full hydrogen value chain
- Advocate for effective hydrogen policy to help meet statutory GHG emission reduction goals
- Recognized and regularly sought out as a source of reliable, timely information on issues related to hydrogen and specific to the NW region



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Renewable Hydrogen: A Cleaner, Better Way

- Producing Renewable Hydrogen
 - Using a device called an electrolyzer, electricity from renewable energy (wind, solar, hydropower) is used to split water into its component parts of oxygen and hydrogen
 - Can replace fossil produced hydrogen in all applications where used today
- Goal – use it in traditional industries and in new applications like:
 - Hard to abate high emission industries – steel, glass & cement manufacturing, aviation, heavy & medium duty truck, and maritime transportation
 - Transition power plants from fossil fuel electricity generation to zero emission fuel electricity generation
 - Energy storage = grid resiliency & economic value for excess renewable energy
 - Decarbonize natural gas distribution system



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Pacific Northwest Perfect for Hydrogen

- Region is blessed with several of the attributes needed to be at the forefront of advancing clean energy and clean fuels:
 - Robust climate policies enacted in Washington & Oregon
 - Abundant renewable resources
 - Low power rates
 - Very active and influential environmental and environmental justice advocacy groups
 - Significant *existing* demand for hydrogen in the agriculture and fuels refining sector, and significant *potential* demand in industrial process, and heavy-duty road, maritime and aviation transportation



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State and Federal Hydrogen Policy



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Federal Hydrogen Policy and Funding

USDOE “Hydrogen Earthshot”: \$1 for 1 kg of renewable hydrogen (gallon of gasoline equivalent) in 1 decade

\$9.5b for hydrogen technology and project development including \$8b for at least 4 regional clean hydrogen demonstration hubs in Bipartisan Infrastructure Law (BIL)

\$3/kg Production Tax Credit (PTC) and Investment Tax Credit (ITC) included in the Inflation Reduction Act



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State Hydrogen Policy

- Robust climate policies enacted in Washington and Oregon:
 - **100% Clean Energy** - directed at the electric and gas utilities where generation portfolios must be carbon neutral by 2030 and 100% fossil free by 2040 or 2045
 - **Cap & Trade (Washington, Just “Cap” in Oregon)** – economic sector wide; caps carbon emissions with a goal to reduce greenhouse gas emissions from the largest polluters by a certain date
 - **Low Carbon Fuel Standards** - requires reduction in the carbon intensity (CI) of transportation fuels and provides credits for production of low or zero emission fuels that can be sold to fossil fuel producers to comply with the law
- Renewable hydrogen explicitly included as a compliance mechanism in WA Clean Energy Transformation Act (CETA)
- Much more public funding, tax incentives and project development activity in WA than in OR



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Why Do We Need Hydrogen?

- Impossible to fully decarbonize the economy without it
- Benefits include:
 - Availability (relatively simple to produce)
 - Transportability (not temporally or locationally constrained)
 - Long-duration energy storage capability
 - Various production pathways, many of which result in low or zero emissions
 - Only way to enable a reliable supply of power and a resilient grid from increased penetration of intermittent renewables (e.g., wind and solar) requiring multi-day and seasonal storage



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Hydrogen By the Numbers in the US

- Hydrogen Use: 11m tons
- 1m+ tons used for fertilizer production
- 1600 miles of dedicated hydrogen pipelines
- 14,000+ Hydrogen Fuel Cell Vehicles
- 87 Fuel Cell Buses
- 56 Hydrogen Fueling Stations (CA)
- 20k+ Fuel Cell Forklifts



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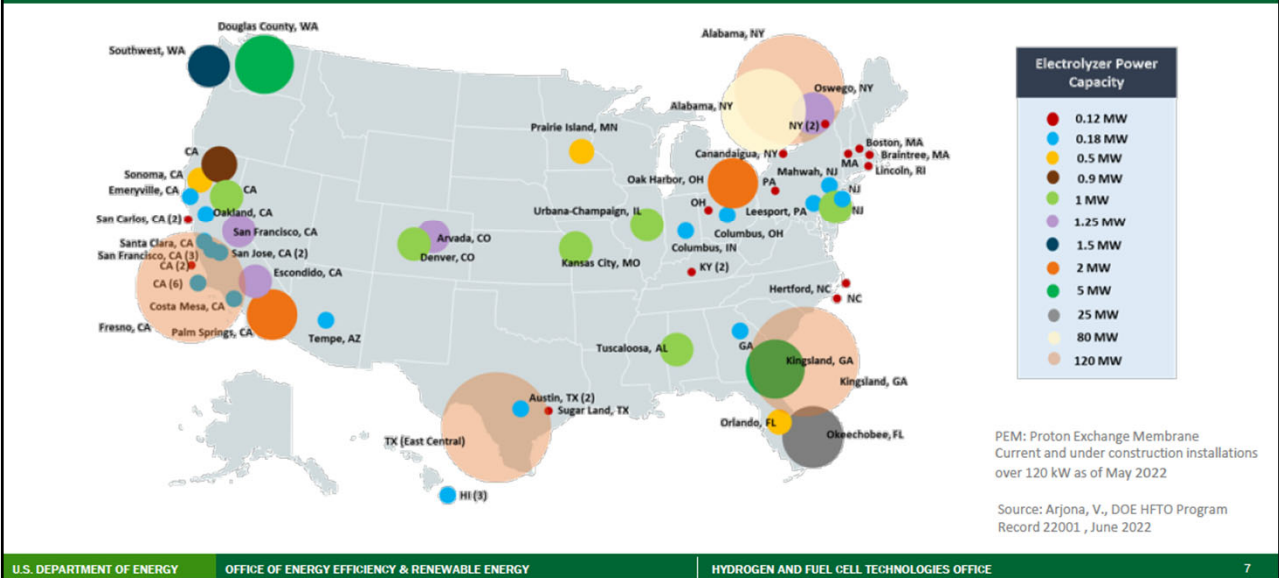
Projects



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PEM Electrolyzer Locations and Capacity – 2022 Snapshot

> 620 MW Total PEM Electrolyzer Capacity (operational and under construction)



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Douglas County PUD (WA) Wells Dam Renewable H2 Production Project

Cummins 5MW PEM
Electrolyzer

Capacity: 2000 kg/day (2 metric tons)

Size: 27 ft x 7.5 ft

Expandable

Ramped up and down very quickly

Interruptible power controlled by utility

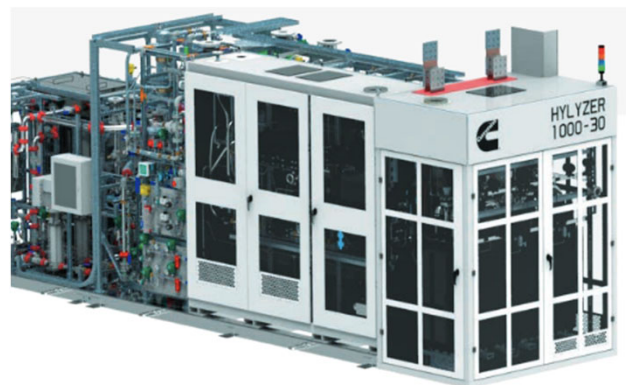
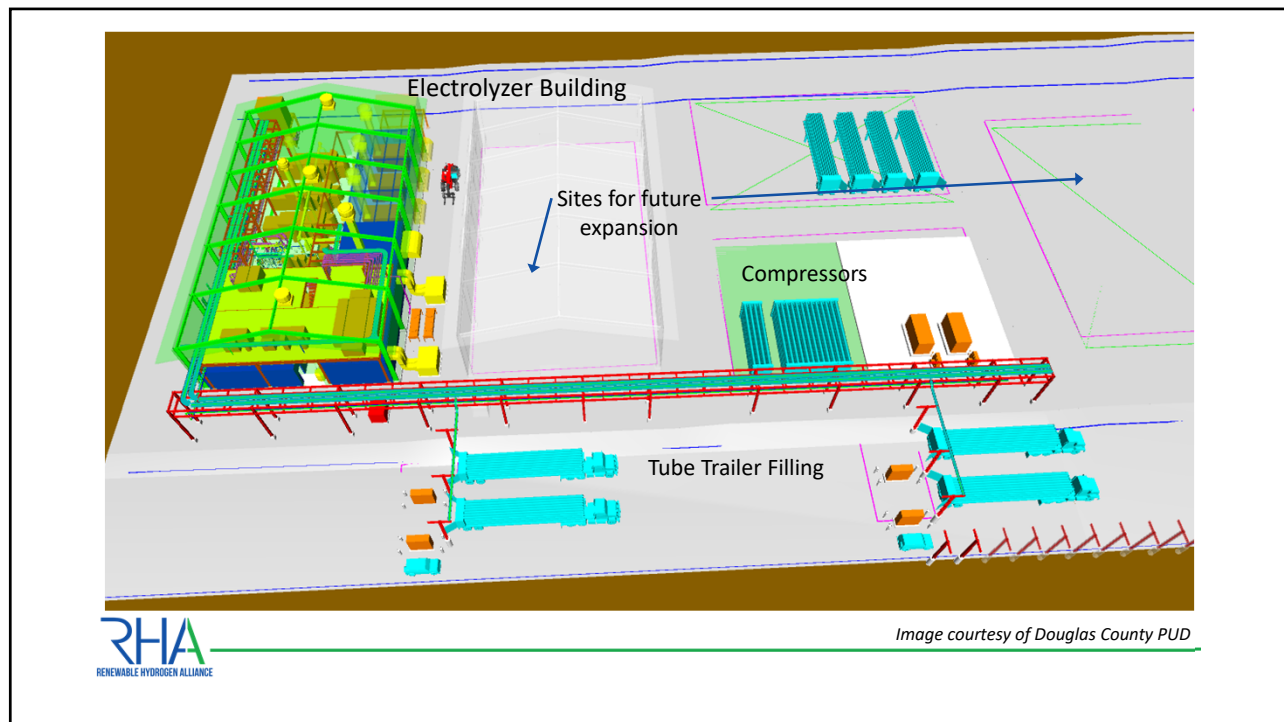


Image courtesy of Cummins, Inc.



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Advanced Clean Energy Storage (ACES) Project – Delta, UT

- World's largest renewable energy hub to produce, store, and deliver green hydrogen to the Western United States
- Joint venture between Mitsubishi Power Americas and Magnum Development
- Will convert over 220 MW of renewable energy to 100 metric tons per day of renewable hydrogen, stored in two existing onsite underground salt caverns
- Potential to store over 300 GWh of dispatchable clean energy
- Conversion of existing Intermountain Power coal plant to burn 70/30 natural gas/renewable hydrogen blend by 2025; 100% RH2 by 2045
- Utility partner – LADWP
- Received \$500+ million USDOE loan guarantee



Information and images courtesy of ACESDelta

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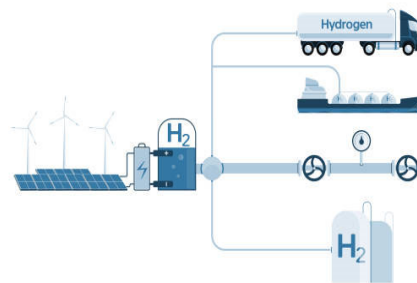
Advanced Clean Energy Storage (ACES) Project – Delta, UT (cont'd)



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PNW Hydrogen Hub



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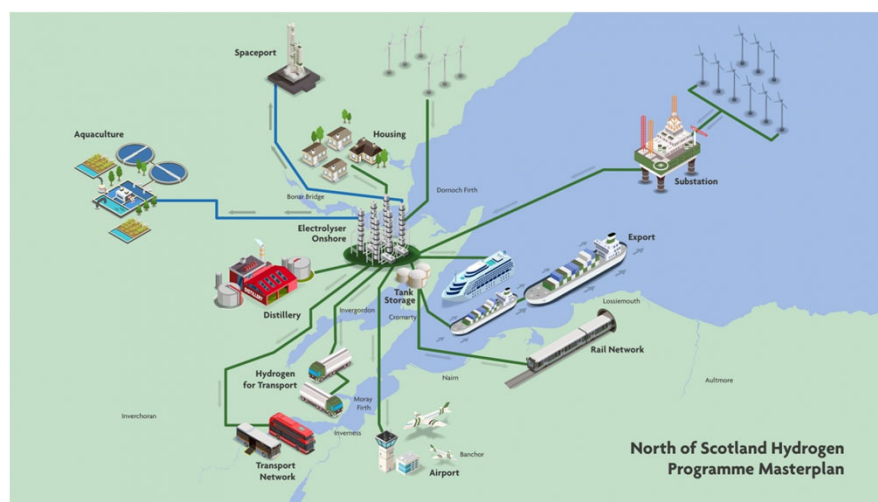
PNW Hydrogen Hub Planning

- WA SB 5910 passed in the 2022 session to accelerate the availability and use of renewable hydrogen in Washington
 - Created a non-profit entity responsible for coordinating response to H2 Hub Funding Opportunity Announcement (FOA – expected late September/early October)
 - Entity established as a 501(c)(3) and is known as the Pacific Northwest Hydrogen Association (<https://pnwh2.com/>)
- WA appropriated \$2 million to support the state's efforts to pursue a Regional Clean Hydrogen Hubs USDOE grant
- No money from Oregon to date
- Letters of support for PNW Hub from Gov's Inslee and Brown
- RHA on Executive Board
- Concept paper submitted November 7th



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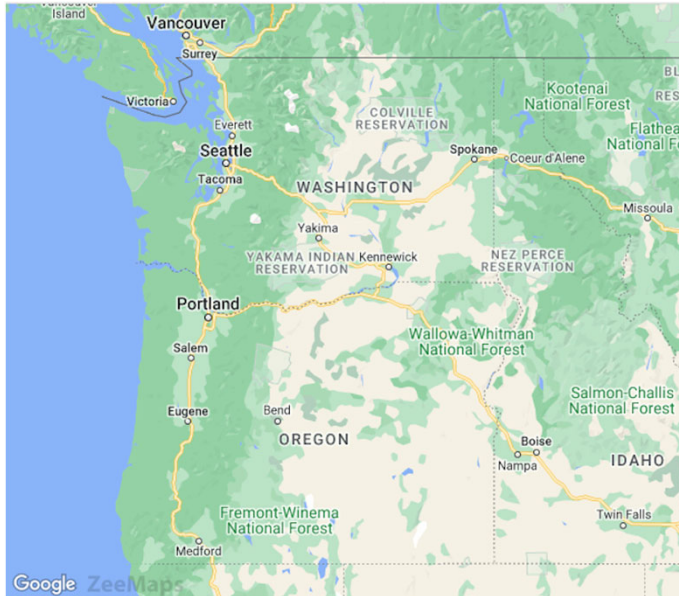
What Does a Hydrogen Hub Look Like?



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Project Landscape Then and Now

Hydrogen Projects Planned, In Development or Under Construction 2018

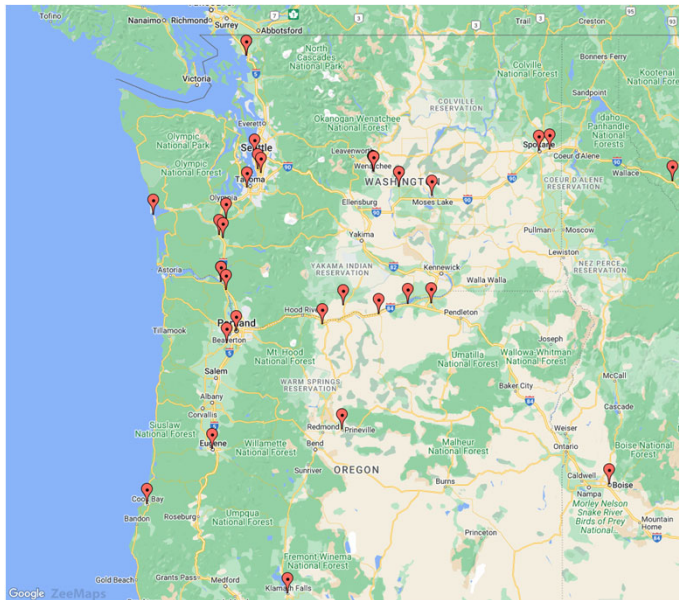


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Project Landscape Then and Now

- As of July 2022
- Over 34 projects publicly announced
- Multiple sectors
 - Light duty to heavy duty transportation infrastructure
 - Maritime
 - Agriculture
 - Distribution infrastructure
 - Energy production

• Link to map:
<https://www.zeemaps.com/map?group=4243516>



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Hydrogen Industry Economic & Jobs Impact

- By 2050, the USDOE estimates that the clean hydrogen economy in the US will generate:
 - \$140 billion in revenue
 - 700,000 jobs
- Pacific NW Hydrogen Hub RFI responses forecasted 8 jobs created for every \$1 million invested in clean hydrogen
- Average pay for a hydrogen fueling station operation and maintenance job = \$84,000/yr (excluding benefits)*
- H2 production facilities permanent jobs average pay = >\$91,000/year*

**Source: Williams, B. Capitol Matrix Consulting, June 2021, Analysis of Proposed Income Tax Credit for Hydrogen Fueling Infrastructure Development*



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Questions?

Michelle Detwiler, Executive Director
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Key Hydrogen Provisions in Federal Climate Bill

- The Inflation Reduction Act of 2022 adds new Section 45V to the IRS code to provide a Production Tax Credit for clean hydrogen
- Also adds clean hydrogen production facilities as qualifying property under the IRS S.48 Investment Tax Credit
- Qualified clean hydrogen defined as hydrogen produced through a process that results in a lifecycle greenhouse gas emissions rate of not greater than 4 kilograms of CO₂e per kilogram of hydrogen
- Percentage of allowable tax credit is tiered and increases as CI decreases
- Maximum credit value is \$3.00 per kg of clean hydrogen if hydrogen production facility meets lowest maximum CI;
- Includes and 10% bonus to the tax credit if prevailing wage and apprenticeship requirements

