U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

H2@Scale: Enabling affordable, reliable, clean, and secure energy across sectors.

H2@Scale U.S. Department of Energy

What is H2@Scale?

H2@Scale is a U.S. Department of Energy (DOE) initiative that brings together stakeholders to advance affordable hydrogen production, transport, storage, and utilization to increase revenue opportunities in multiple energy sectors. It is a framework inwhich national laboratories and industry can work together through government co-funded projects to accelerate the early-stage research, development and demonstration of applicable hydrogen technologies.

The U.S. currently produces more than **10 million tonnes** of hydrogen, one sixth of the global supply, primarily for oil refining and fertilizer. Large-scale infrastructure includes over 1,600 miles of hydrogen pipelines, a growing network of stations, and thousands of tons of storage in underground caverns.

Why H2@Scale?

Hydrogen can enable U.S. energy security, resiliency and economic prosperity, and is part of our "all of the above" energy strategy for these reasons:

1) Hydrogen can be produced from diverse domestic resources for use in multiple sectors, or for export.
2) Hydrogen has the highest energy content by weight of all known fuels – 3X higher than gasoline - and is a critical feedstock for the entire chemicals industry, including liquid fuels.
3) Hydrogen and fuel cells can enable zero or near zero emissions in transportation, stationary or remote power, and portable power applications.
4) Hydrogen can be used as a "responsive load" on the grid to enable grid stability and gigawatt-hour energy storage, and increase utilization of power generators, ***including nuclear, coal, natural gas, and renewables.***
5) Hydrogen can enable innovations in domestic industries (such as steel manufacturing and energy storage) and in transportation (e.g. in vehicles, rail, aviation, and marine applications) and iron making.

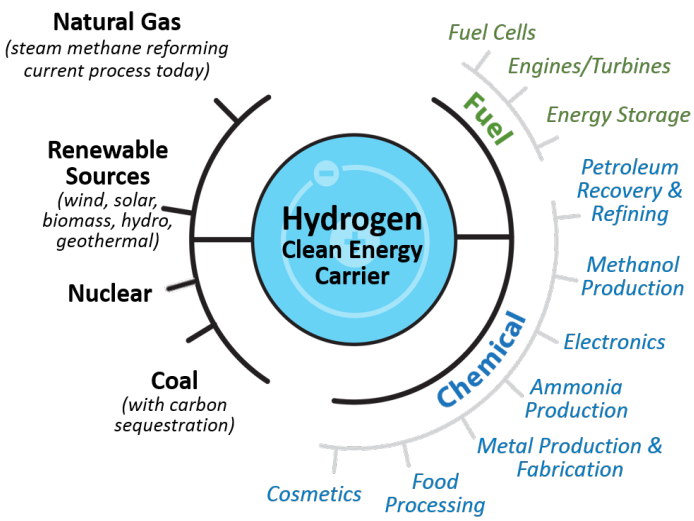


Figure 1 depicts the H2@Scale vision with hydrogen as an energy carrier, like electricity – that also serves as a critical feedstock in multiple industries.

More than 25 industry projects are currently part of the H2@Scale initiative.

Emerging Hydrogen Markets

Hydrogen is an essential feedstock and fuel in many current and emerging industries, such as the petrochemical sector and fuel cell transportation. Thousands of fuel cells are already in use in commercial vehicles, forklifts, and backup power units throughout the United States. Next steps to increase the value proposition of hydrogen technologies are to expand hydrogen infrastructure, and determine additional applications where hydrogen has a strong business case.

Hydrogen is the energy carrier that unites all our nation's energy resources: natural gas, coal, nuclear, and renewables.

Regional development of hydrogen infrastructure and end-use technologies could enable economies of scale, making hydrogen more affordable.

H2@Scale R&D Challenges

The DOE's H2@Scale Consortium facilitates R&D projects that leverage the world-class capabilites of the national laboratories in partnership with industry and academia. Partnerships with key stakeholders (e.g. power generators and technology developers) on early stage R&D projects can be facilitated through cooperative agreements with matching DOE funds. R&D challenges to enable the goals of H2@Scale span hydrogen production, delivery, storage, infrastructure, and use in diverse applications. While DOE's role focuses on early-stage R&D, such as new concepts for dispatchable hydrogen production, delivery and storage, reliance on the private sector for demonstration is critical. First-of-its-kind demonstrations can allow cutting edge technologies to be integrated into existing systems and validated to show a business case for future deployments and guide future R&D plans.

Call to Action for Stakeholders

- Respond to Requests for Information (RFIs) and workshop activities to identify potential early, economically viable applications for scaling hydrogen regionally.
- Leverage early-stage R&D resources and funding through partnerships with national labs in the H2@Scale Consortium.
- Take part in merit reviews of proposed approaches using rigorous criteria for technical and economic viability, scalability, and value.
- Provide data from industry-led demonstrations to help guide early-stage R&D and provide feedback to national labs.

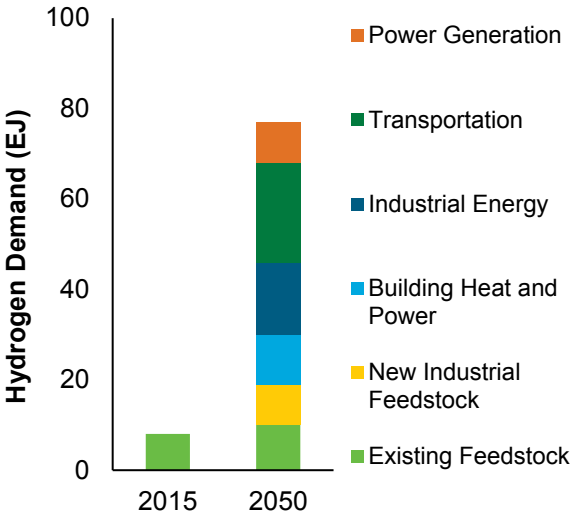
Focus Areas

Regional focus areas, include (but are not limited to):

- West Coast
- Southeast
- Northeast
- Central
- Midwest

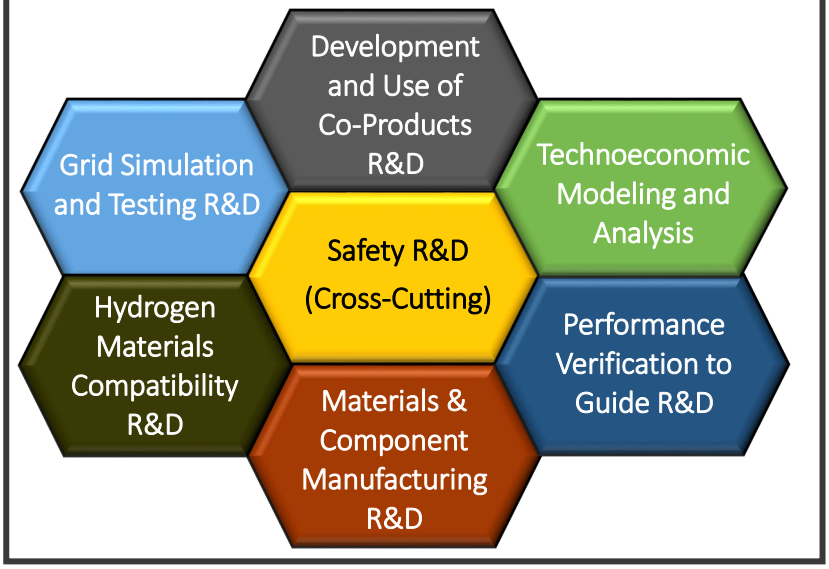
Companies, universities and local organizations could all be involved in developing the framework for regional clusters that evaluate early applications for scaling hydrogen, supported by technical expertise and early-stage R&D from National Laboratories.

VALUE PROPOSITION[2]



2. Source: Hydrogen Council
http://hydrogencouncil.com/wp-content/uploads/2017/11/Hydrogen-scaling-up-Hydrogen-Council.pdf

H2@Scale Consortium R&D Pillars



Emerging applications for hydrogen can enable 10-fold growth in global demand.[2]

How Does it Work?

To join the H2@Scale consortium, interested stakeholders can view national lab capabilities at https://www.energy.gov/eere/fuelcells/h2-scale and determine which lab capabilities and/or working groups may be of value.
Contact: H2Scale@ee.doe.gov.