United States Business Council for Sustainable Development

Great Lakes Carbon Collaborative

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Hydrogen Working Group Meeting

February 22, 2022 on Zoom
Prepared for Great Lakes Carbon Collaborative members. Not for external distribution.

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Ted Krause - Argonne Krauset@anl.gov

Agenda

- Welcome! + antitrust reference (usbcsd.org/antitrust)
- Introductions and interests from attendees
- Presentation: Midwestern Hydrogen Partnership Hydrogen Hub
- Hydrogen news updates from attendees
- Exploration of opportunities

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MIDWESTERN
HYDROGEN
PARTNERSHIP

MIDWESTERN HYDROGEN PARTNERSHIP HYDROGEN HUB

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Argonne National Laboratory

February 22, 2022
GLCC

MIDWESTERN HYDROGEN PARTNERSHIP

Midwestern Hydrogen Partnership was launched in October of 2019 by Argonne National Laboratory and the University of Illinois at Urbana Champaign.

Partnership

The Midwestern Hydrogen Partnership is a collaboration of industrial, academic, research institutions, government, and other interested stakeholders that work cooperatively to enable the Midwest to address the challenges, barriers, and opportunities that can enable a prosperous hydrogen economy in the Midwest.

Mission Statement

The Midwestern Hydrogen Partnership aims at advancing and promoting the development and adoption of hydrogen technologies to provide clean, secure, and resilient energy sources, and create economic development opportunities throughout the Midwest.

Why the Need for A Partnership

- Lack of knowledge and awareness of hydrogen and fuel cells among the general public, public officials, and decision-makers in the Midwest.
- Lack of visibility of fuel cells and hydrogen technologies in the Midwest.
- Developing markets for hydrogen and fuel cell technologies in the Midwest has received less attention compared to California and the Northeast.
- Midwest states offer tremendous opportunities for deploying hydrogen and fuel cell technologies.

Infrastructure Bill – Promoting the Development of Hydrogen as a Clean Energy Source

Authorizes $9.5B to promote the development of hydrogen as an energy source

- $8B for the development of at least four (4) Regional Clean Hydrogen Hubs
  - Production: Fossil Fuels, Renewable Energy, Nuclear Energy
  - End Use: Electric Power Generation, Industrial, Residential and Commercial Heating, and Transportation
- $1B for Clean Hydrogen Electrolysis Research and Development.
- $0.5B for Clean Hydrogen Manufacturing and Recycling.

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DOE RFI DE-FOA-0002664 “Regional Clean Hydrogen Implementation Strategy” (responses due 3/8/2022 at 5:00 EST)

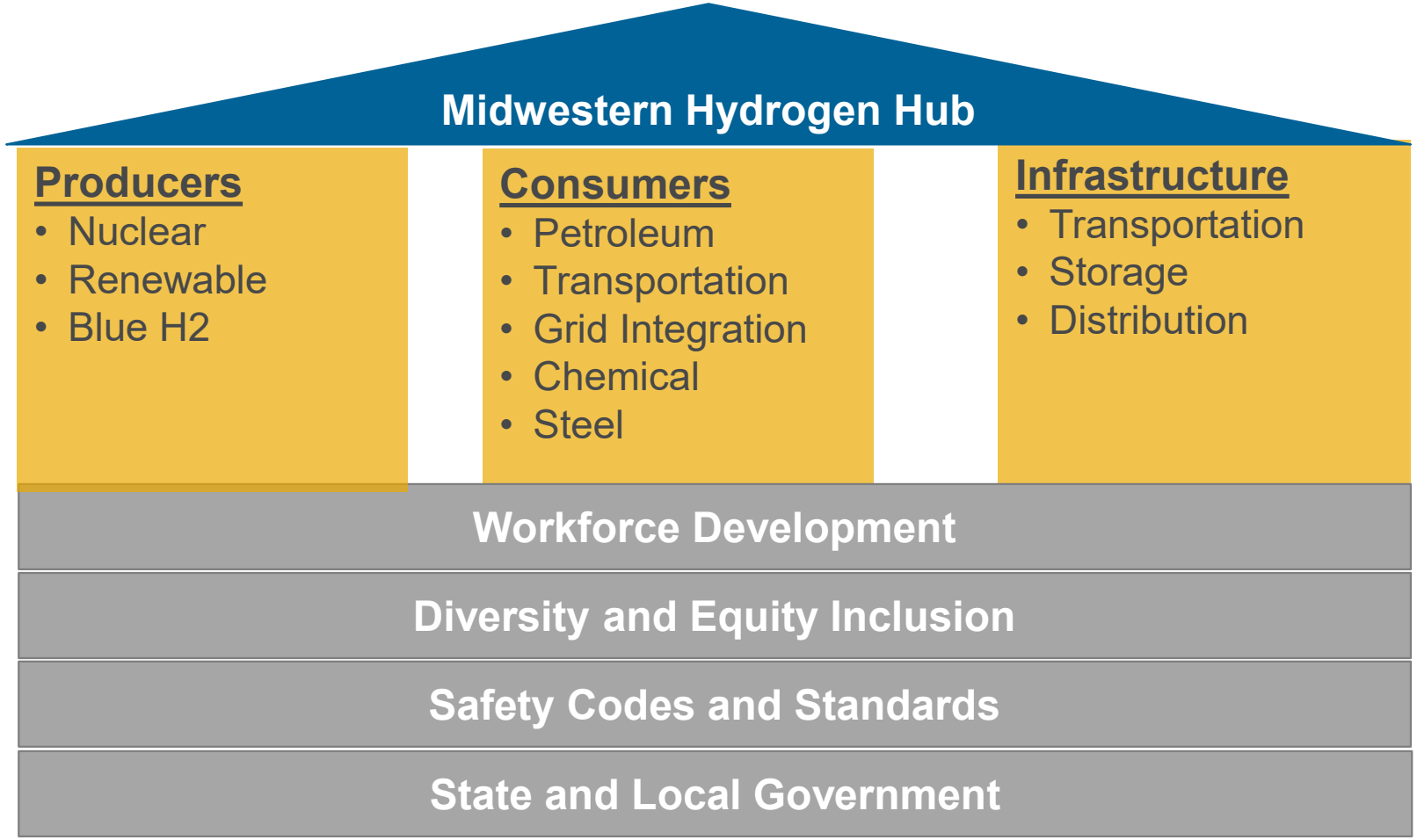
- $1B for Clean Hydrogen Electrolysis Research and Development.
- $0.5B for Clean Hydrogen Manufacturing and Recycling.

DOE RFI DE-FOA-0002698 “Clean Hydrogen Manufacturing, Recycling, and Electrolysis” (responses due 3/29/2022 at 5:00 EST)

Both RFI’s available at grants.gov or eere-exchange.energy.gov

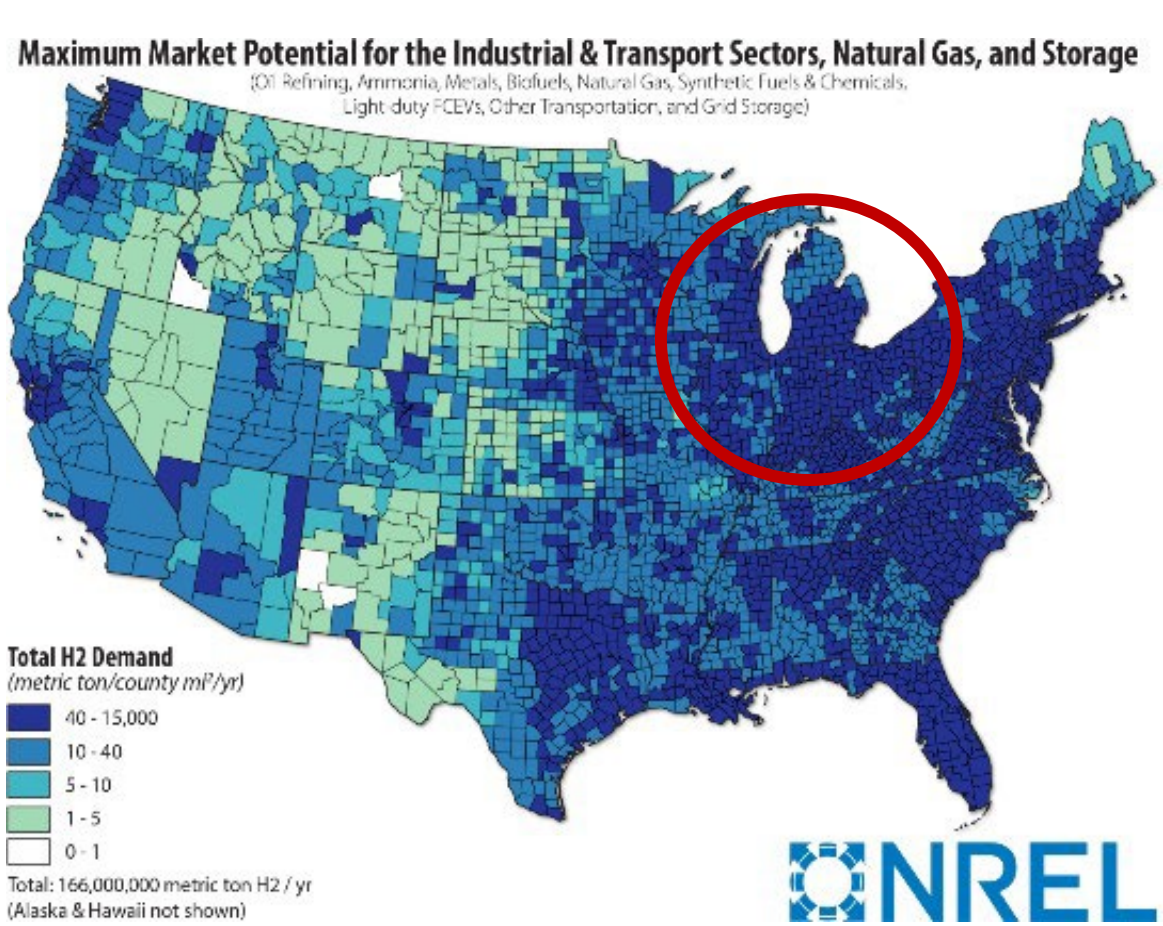
MIDWESTERN HYDROGEN PARTNERSHIP

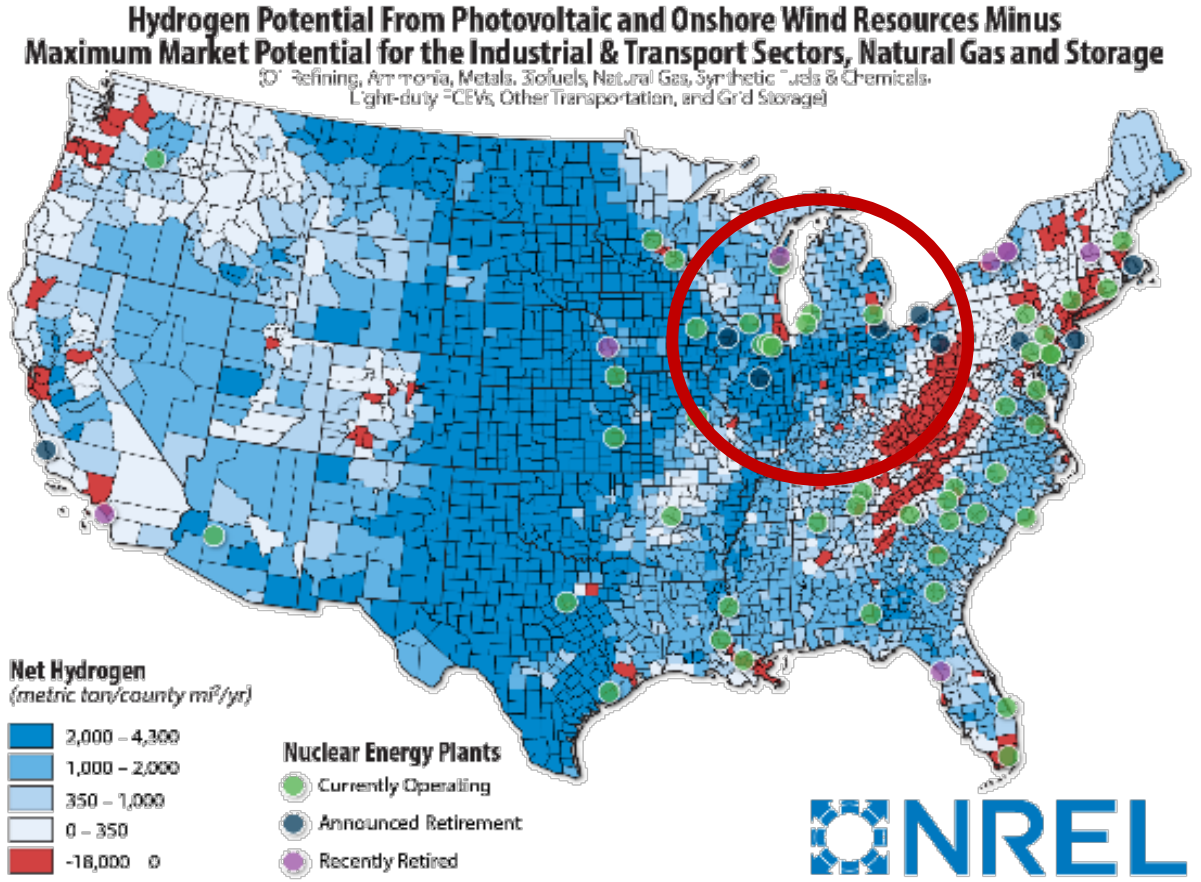
Midwestern Hydrogen Hub Concept



Working with about 20 Companies
Currently Covers 3 states: Illinois, Indiana, Michigan

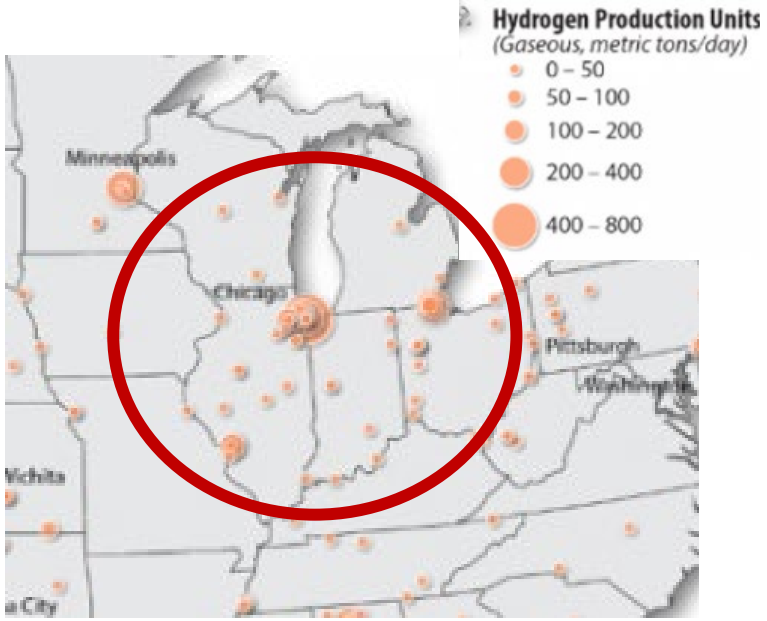
Potential H_2 Demand and Production from Renewable Energy





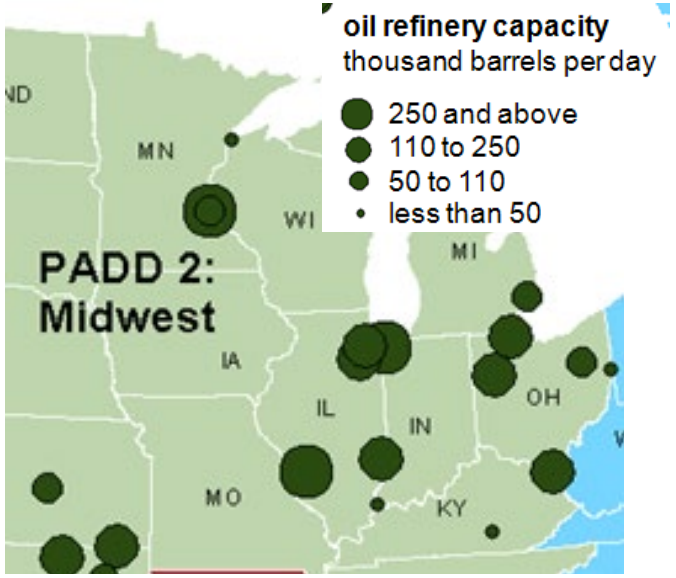
Current Regional Hydrogen Users

Hydrogen Production



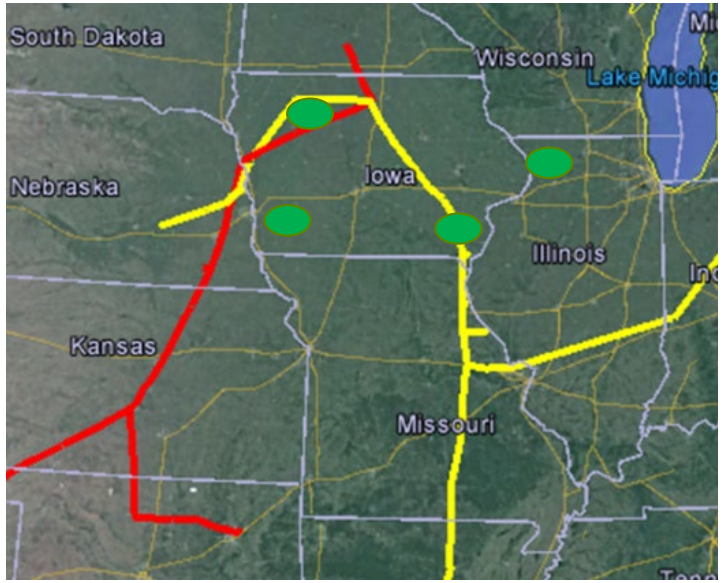
- Significant Hydrogen Production
- Hydrogen produced by steam reforming of natural gas
- ***Challenge: None equipped with Carbon Capture and Sequestration***
- ***Positive: Region well suited for carbon sequestration***

Petroleum Refining



- Seven Petroleum Refineries
- Combined refining capacity of 1.6 million barrels per day

Ammonia Industry

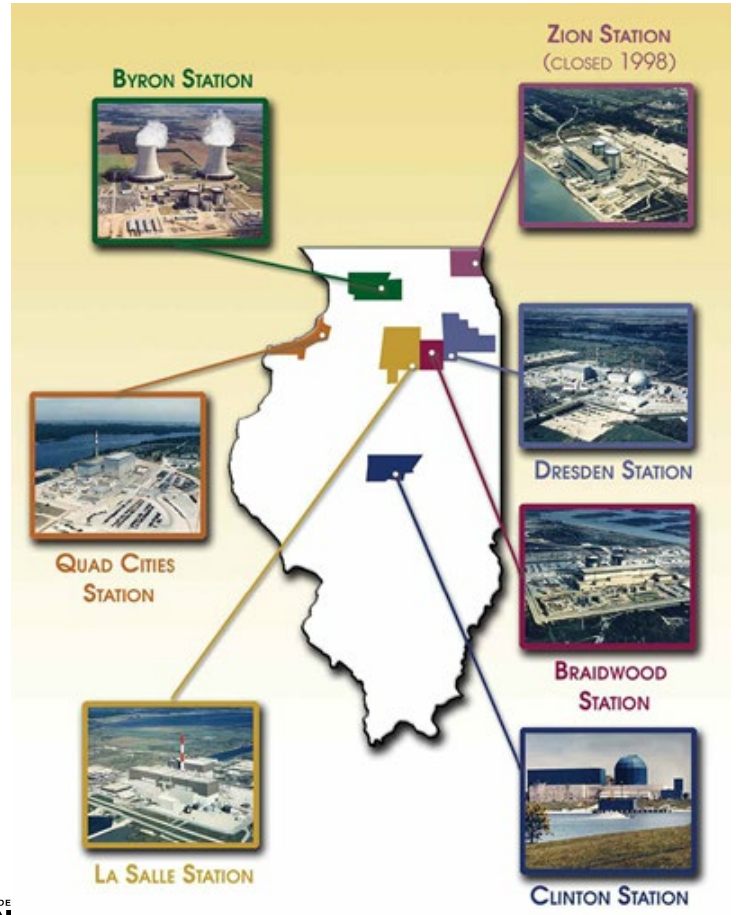


- One plant in Illinois – 337,000 metric tons annually
- Four plants in Iowa - ~2,000,000 metric tons combined annually

Clean Hydrogen Production Opportunity

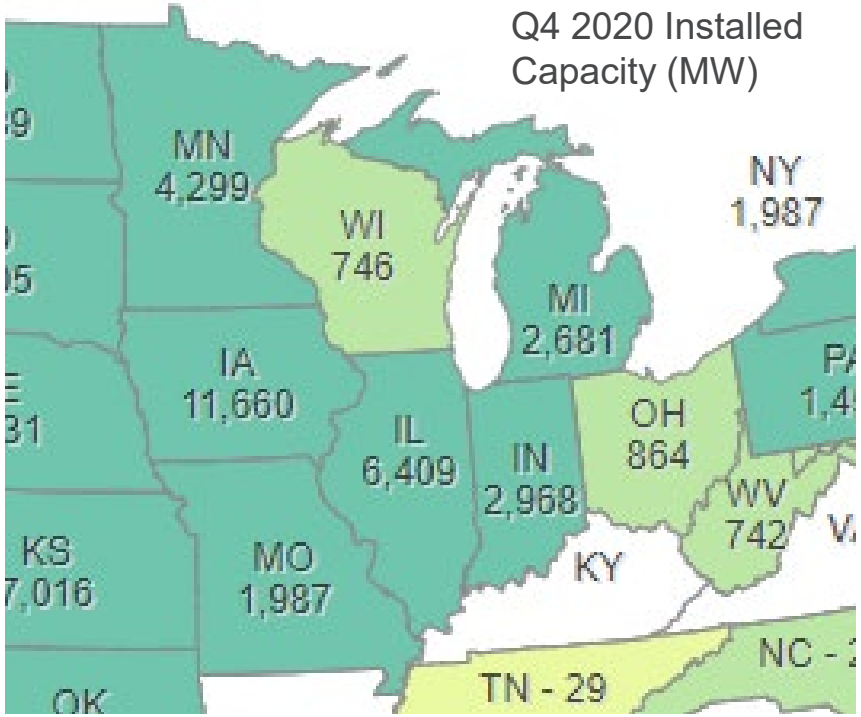
Nuclear Energy

- Illinois has 6 nuclear plants with 11 reactors, the most of any state, with nearly 11,500 MW nameplate capacity.



Wind Energy

- Illinois, Indiana, and Michigan have nearly 12 GW of installed nameplate capacity.
- Adding Iowa would nearly double the capacity.



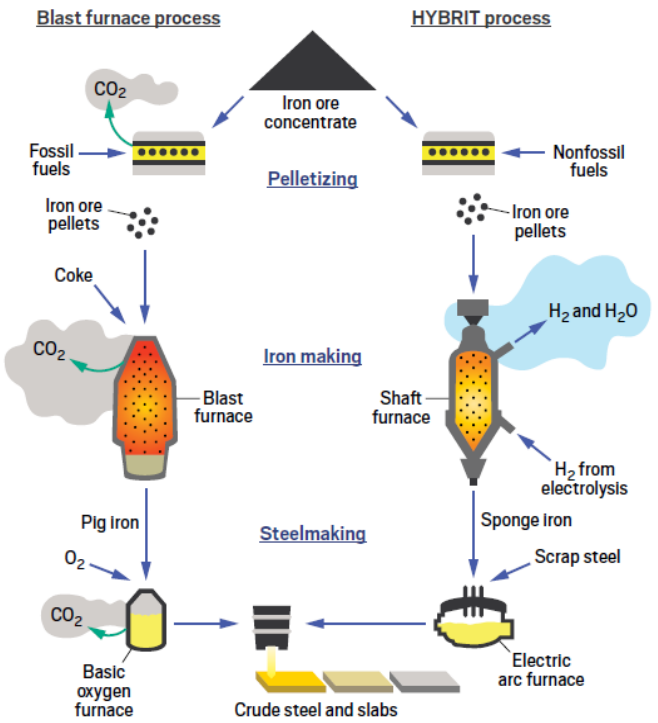
Challenge: No Electrolysis Facilities in the Region

Steel Making – New Regional Industrial Application for H_2

- 7-9% of total global CO_2 emissions
- ~2 tons of CO_2/ton of steel
- ~70% of CO_2 emissions associated with the use of coke as a reducing agent
- 3 major fully integrated steel mills in northern Indiana along shores of Lake Michigan with potential to produce ~22 million tons annually
  - Gary Steel Works (7.5M tons/yr)
  - Indiana Harbor Works (9.5M tons/yr)
  - Burn Harbor Works (5M tons/yr)

- Potential to replace blast furnaces with HYBRIT or DRI technologies


Burns Harbor BOF

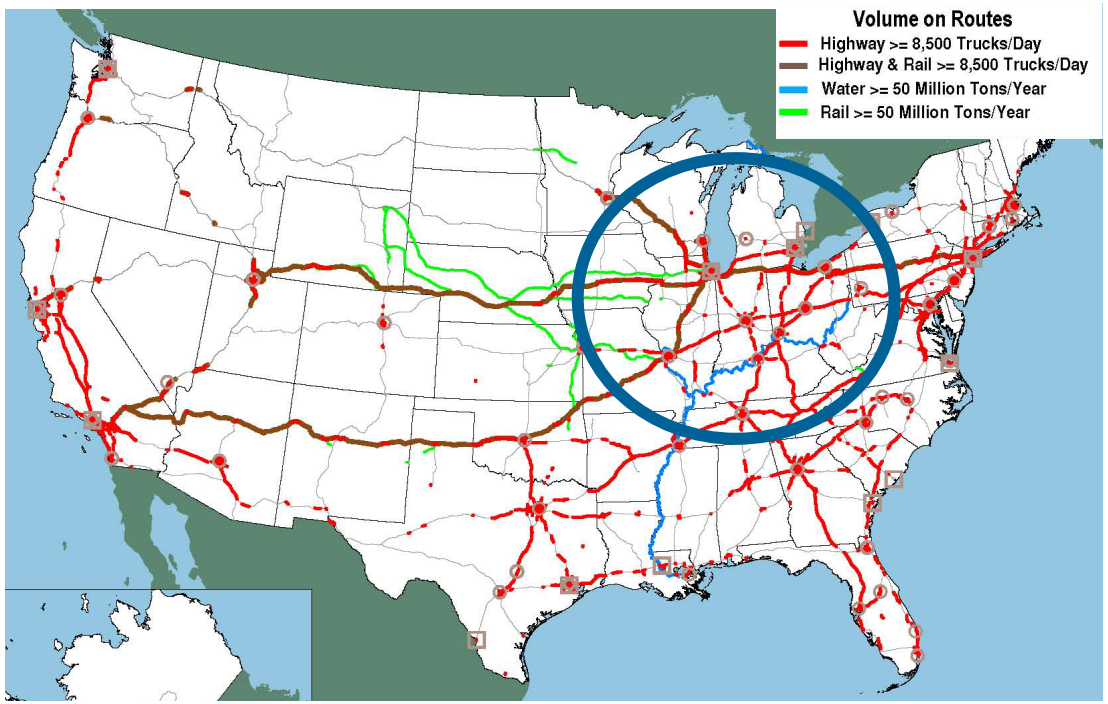


Hybrit Process - Lulea Sweden

ArcelorMittal H2 DRI Hamburg, GE

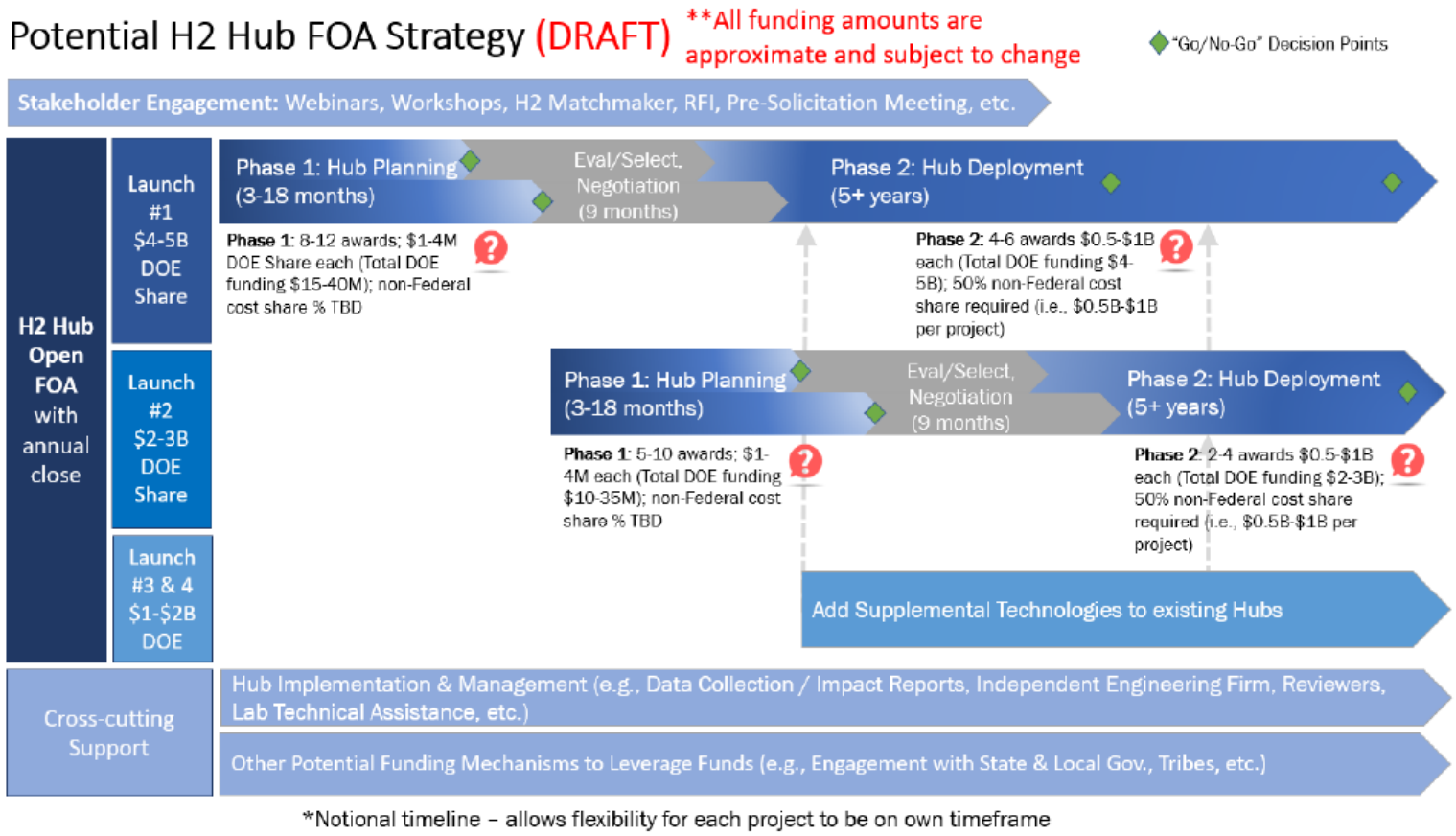
Heavy-duty Trucking/Freight Transportation

- Illinois-Indiana-Michigan is a major U.S. freight corridor
  - Major highways I-55,I-65, I-70,I-80,I-90,I-94
    - One out of every seven vehicles on Illinois highways are trucks
    - Some Chicago facilities handle 30,000 trucks per day
  - 25% of all rail freight goes through Illinois
  - Home to largest inland U.S. ports



Centerpoint Intermodal Port (Joliet, IL)
- Largest U.S. inland port
- Offloads more than 3M/yr TEUs

FOA Response and Timeline (from the RFI)



Phase I – Hub Planning (3-18 months)

- Identify key metrics as decarbonization potential, energy resources, hub design, financing, etc.
- Goal – have a full plan ready for roll out

Phase II – Hub Construction and Design ($0.5-1B gov. share/50:50 cost share, 2-5 years)

- Development and build out of Phase I design.
- Project development → Construction → Operation

Two launches

- Launch I – 4-6 Phase 2 awards
- Launch II – 2-4 Phase 2 awards

For more information about the Midwestern Hydrogen Partnership and potential partnering

Please contact me: krauset@anl.gov

Visit the Midwestern Hydrogen Partnership website: https://hydrogenenergy.illinois.edu/

THANK YOU