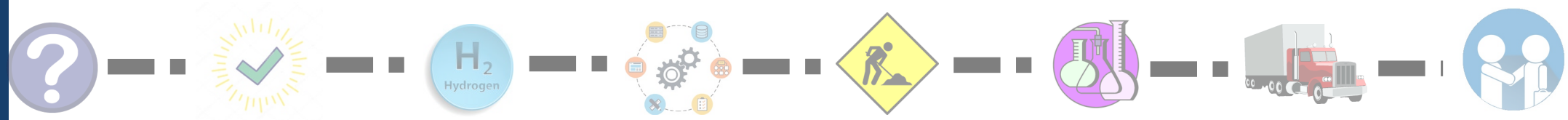
LWR IES INTERFACE TECHNOLOGY DEVELOPMENT & DEMONSTRATION

FUNDING ANNOUNCEMENT DE-FOA-0001817

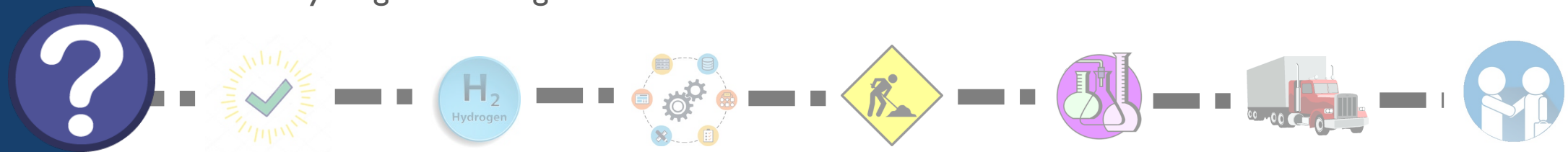
PROJECT MANAGER – ALAN SCHEANWALD



WHY DAVIS-BESSE?

The objective is to diversify and increase the revenues of nuclear plants facing increased competition from renewables and low-cost natural gas. This project will demonstrate the technical feasibility and economic viability of a hybrid system in order to facilitate large scale commercialization.

- Benefits of operating at Davis-Besse Nuclear Power Station (DBNPS)
  - Electrical power is taken at plant output and prior to the switchyard (no grid tariffs applied – reduces cost to power skid).
  - Inputs for hydrogen production are electricity and water (ability to scale up at DBNPS using existing utilities). Future scale-up activities could utilize a portion of the plant's thermal energy.
  - Plant's relative proximity to key markets are ideal for reducing transport distances (Toledo, I-80/I-90 Corridor, Detroit, Cleveland, Columbus, Cincinnati, Pittsburgh, etc.).
  - Hydrogen will be generated from a "carbon-free" source.

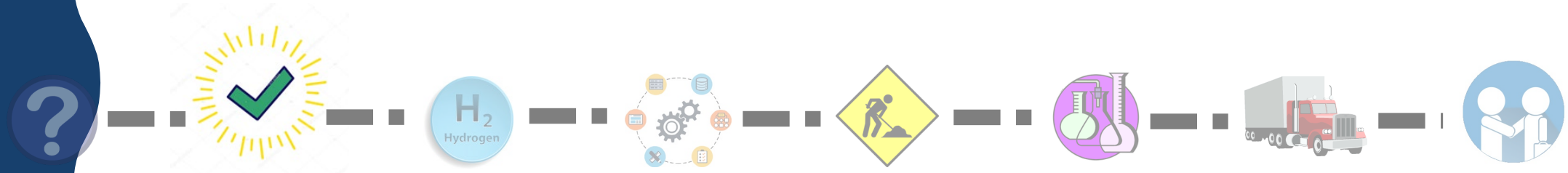


GRANT PROPOSAL STATUS

- Proposal was submitted to the Department of Energy (DOE) on 04/26/2019.
- Received notification to begin award negotiations on 09/10/2019.
- Received pre-award authorization of funding on 11/26/2019.
- Still in negotiations for complete award.

- Project Collaborators Include:
    - Idaho National Labs (INL)
    - Arizona Public Service - Palo Verde
    - Xcel Energy – Monticello & Prairie Island

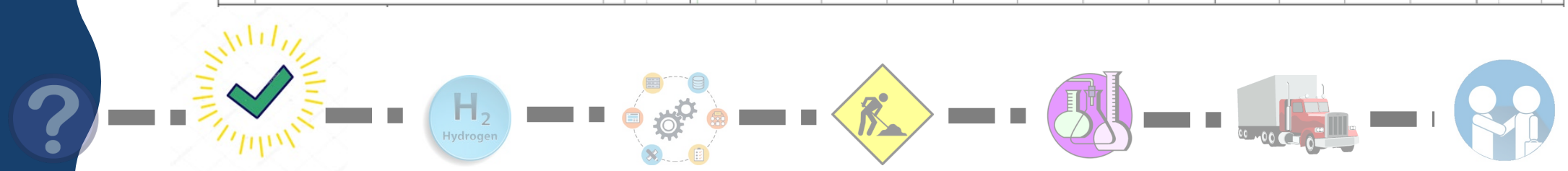
- Project duration is 24 months from entry into the period of performance.



GRANT PROPOSAL STATUS (CONT.)

DBNPS Hydrogen Project - Proposed Schedule

ID	Task Mode	WBS	Task Name
1		1	Gain Approval to Start Project
5			
6		2	Issue Contract(s) to Vendor(s)
19			
20		3	Prepare Modifications
29			
30		4	Approve Modifications
35			
36		5	Modification Implementation
43			
44		6	Install / Test 2 MW Skid
48			
49		7	Train Personel
52			
53		8	Operation & Verification
60			
61		9	Project Scale Up Plan



HYDROGEN SKID SELECTION

- Equipment to be used is Low Temperature Electrolysis (LTE) using Polymer Electrolyte Membrane (PEM) technology.
  - Using a proven technology to minimize risk for the project.
- Equipment is to be containerized.
  - "Turn-key" solution will help to reduce additional engineering efforts and project risk.
- Requires roughly 2 MW of electricity and 2,400 gallons of water per day at maximum operating capacity.

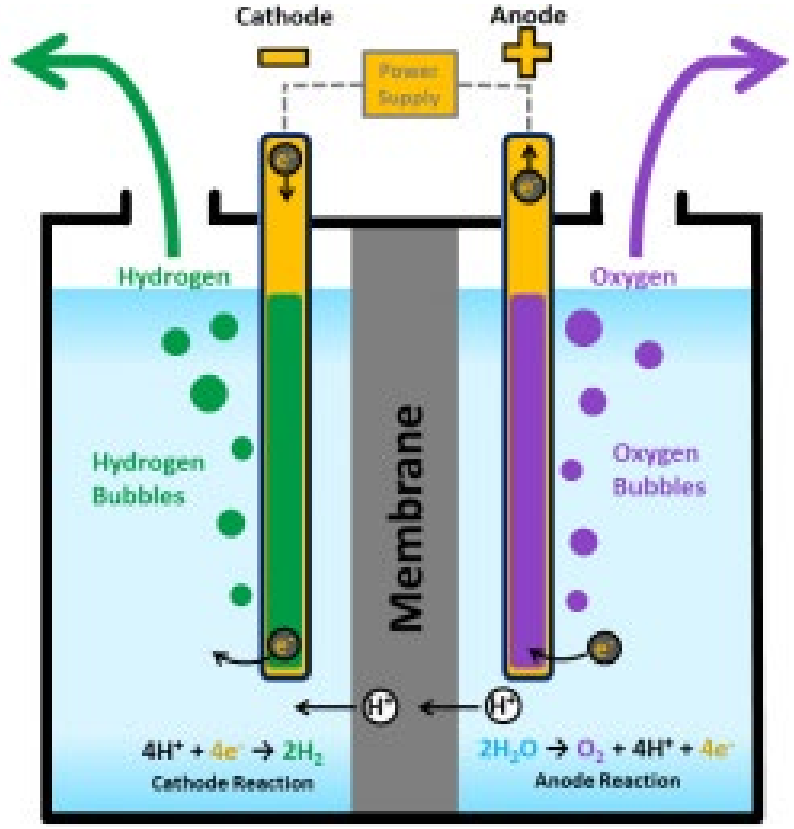
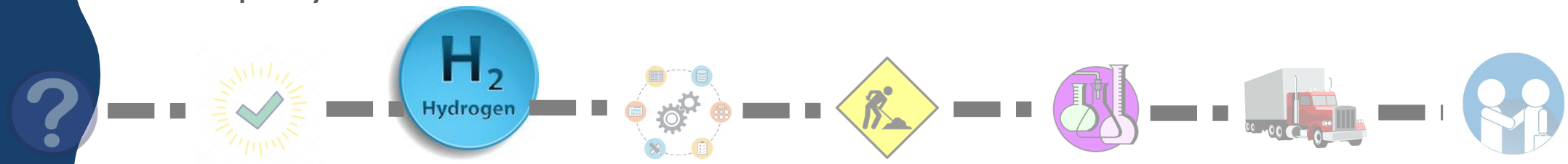
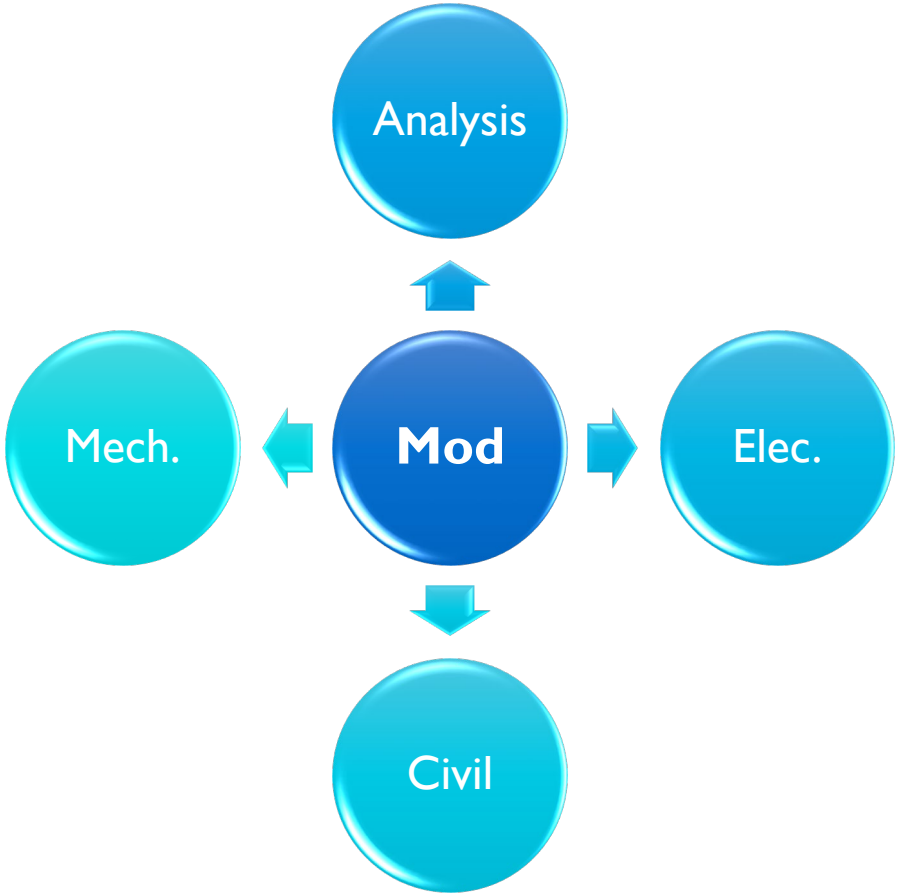


Image taken from https://www.energy.gov/eere/fuelcells/

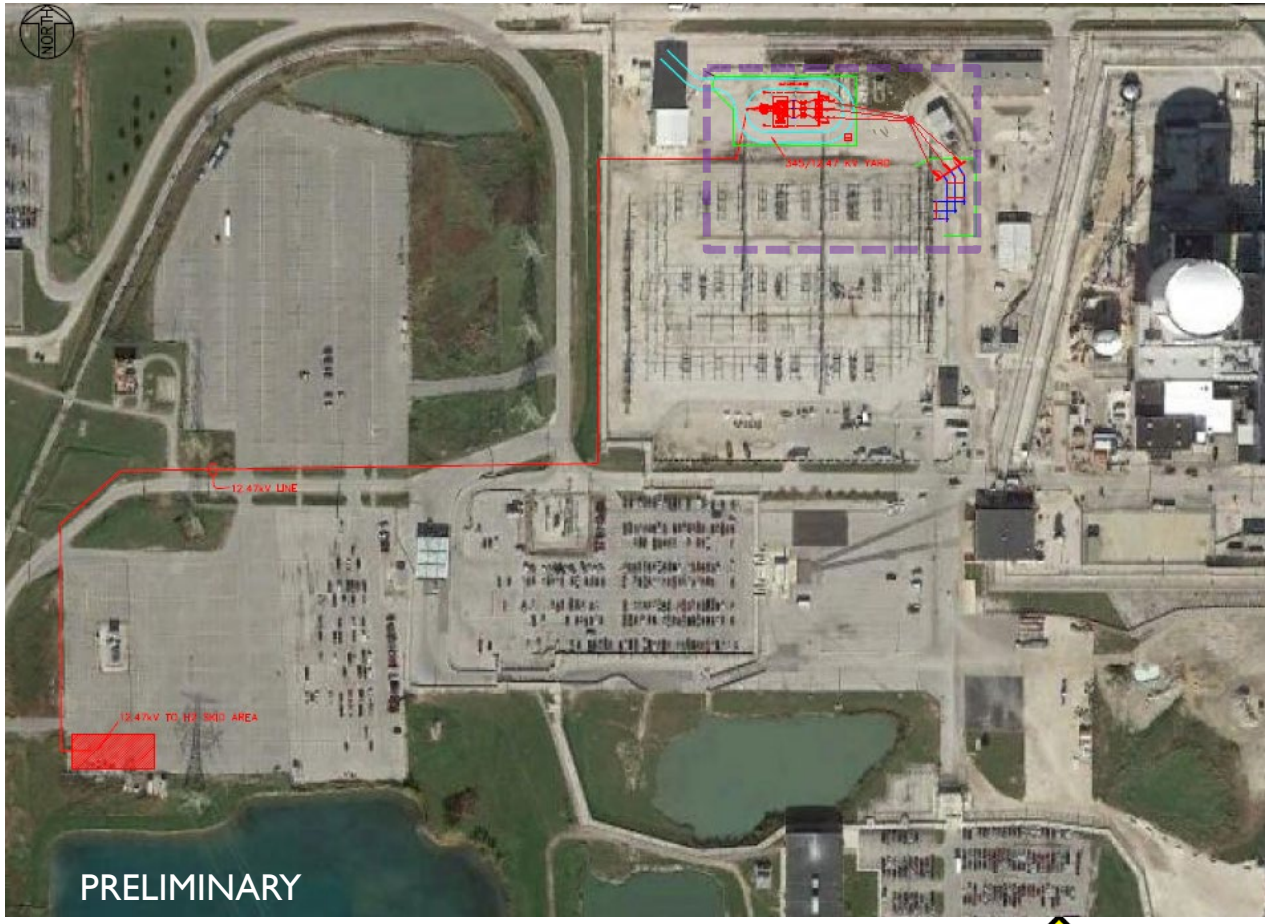


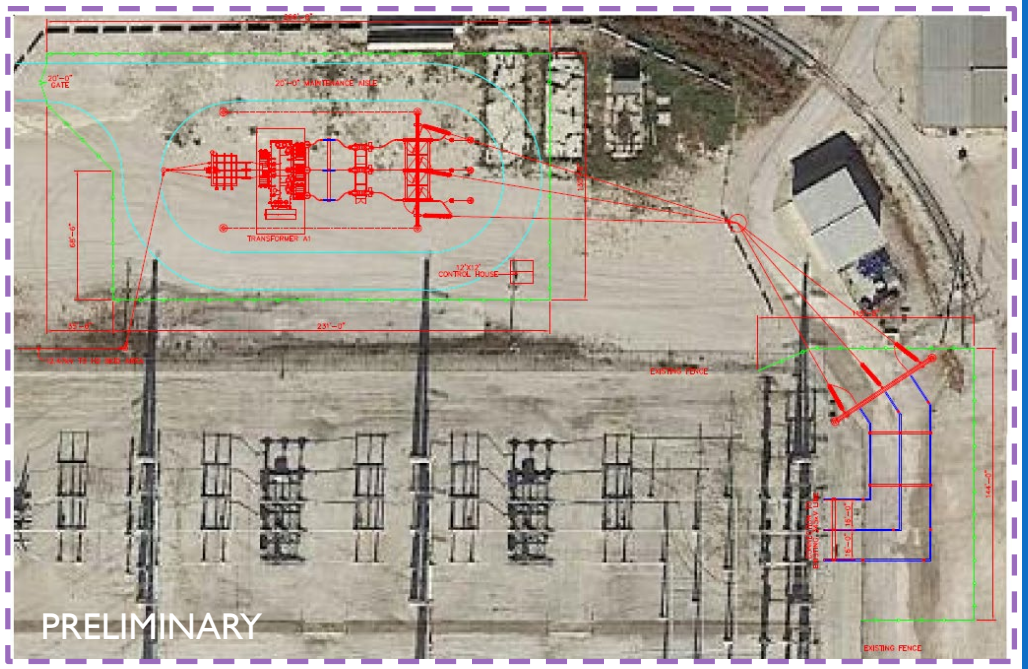
DESIGN & ANALYSIS



- **Analysis** – Determine the effect the skid and supporting equipment will have on plant operation, design and the licensing basis.
- **Electrical Design** – Develop the safest and most efficient means to connect the equipment to the plant's electrical distribution system.
- **Mechanical Design** – Select and design for the optimal water source.
- **Civil Design** – Design foundations, supports, and structures necessary for skid installation.

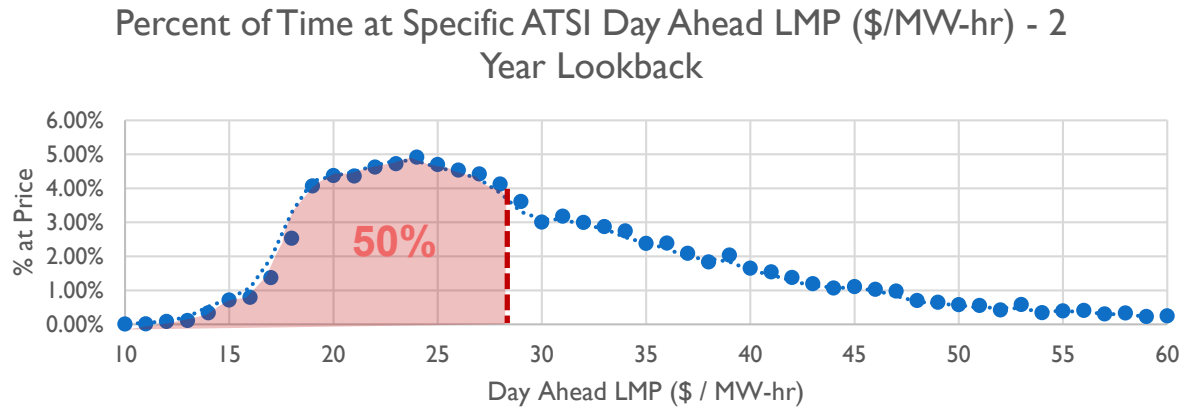
MODIFICATION IMPLEMENTATION

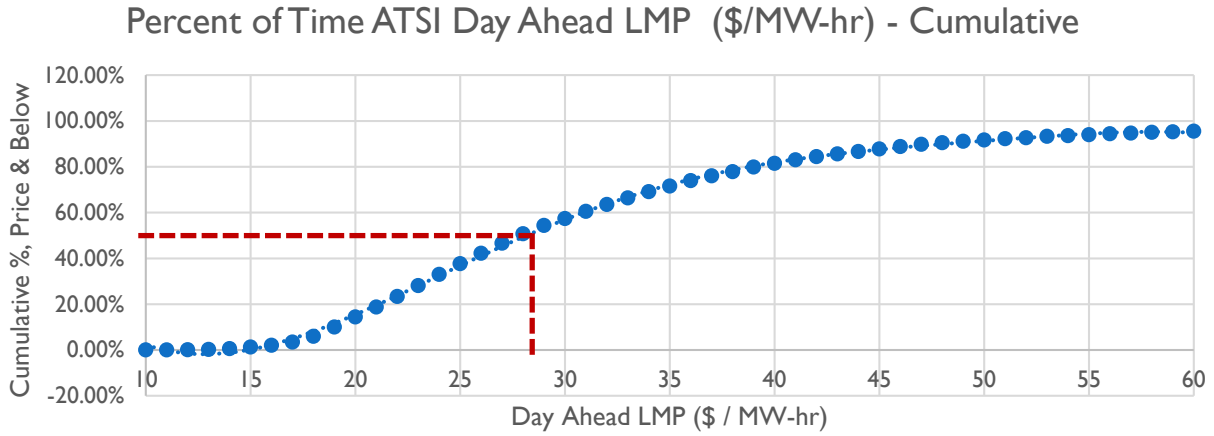




COMMISSIONING & TESTING

- Ensure no adverse effects on the plant, grid, or skid.
- Control software will be able to modulate H_2 output based on input variables.
- Control software will interface with Programmable Logic Computer (PLC) on vendor supplied H_2 skid.

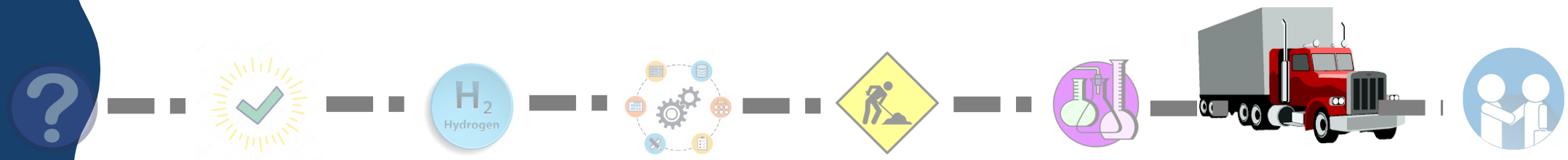




TRANSPORT & CONSUMER BASE

"Need to identify existing and help cultivate emerging markets"

- INL Technical Economic Assessment (TEA)
  - Written for DBNPS by the Idaho National Laboratories (INL)
  - Discusses business case for bulk hydrogen distribution in the Toledo, Ohio area (fuel cell vehicles, petroleum refineries, iron-ore plants, fertilizer production facilities, etc.)
- Local/Regional Partnerships
  - Transportation costs are a significant portion of the expected price of our product. Reducing the transportation distances is important to the success of the project and future scale up activities.
  - Can leverage production facility's proximity to major transportation corridors and potential consumer base.



SCALE-UP / PROJECT CONCLUSION

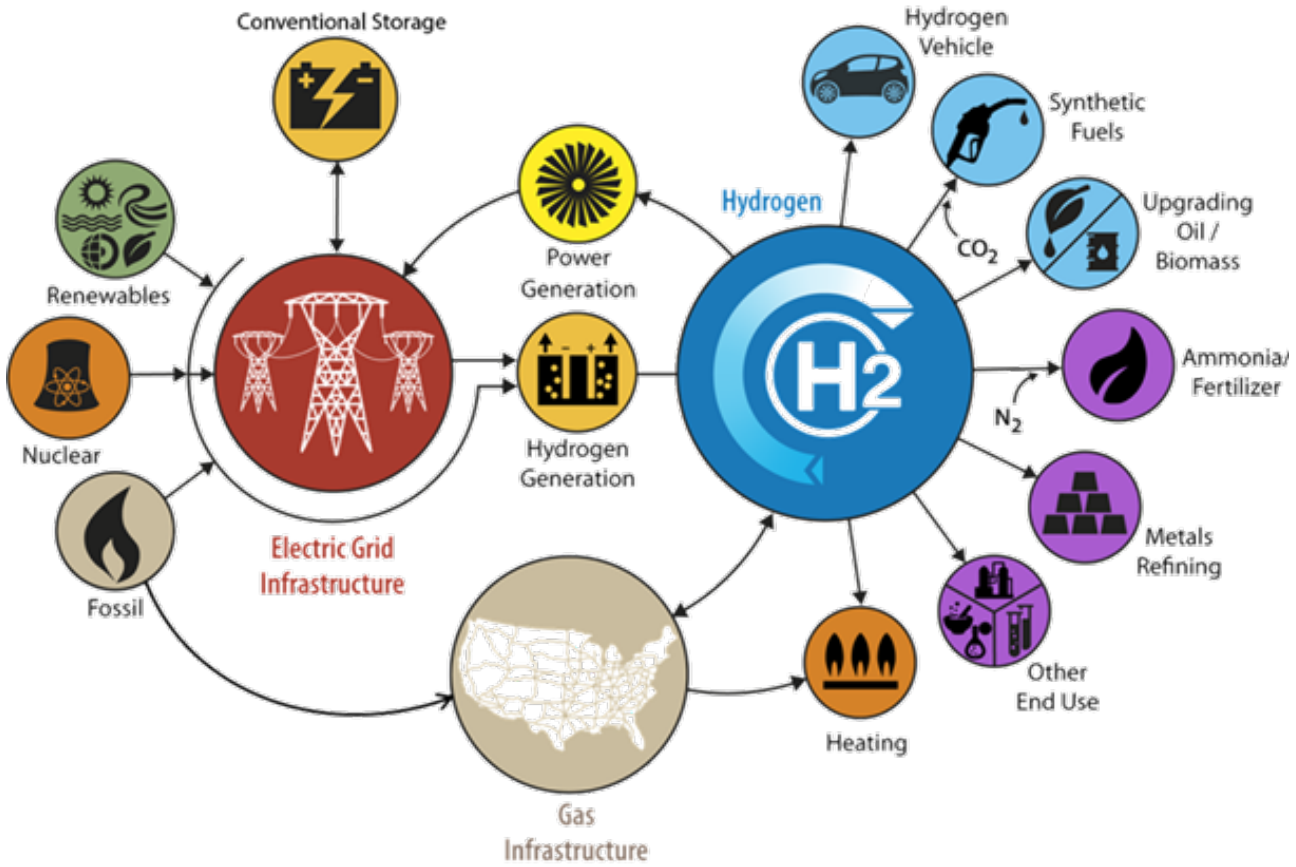


Image taken from https://www.energy.gov/eere/fuelcells/h2scale

At maximum operating capacity, the pilot plant is expected to produce 800-1,000 kg-H_2 / day, and consume roughly 2 MWe.

DBNPS has a nominal output of 925 MWe (2,817 MWt).

Preliminary estimates show a positive return on investment if future scale-up activities are pursued.

QUESTIONS?

Alan Scheanwald
ascheanwald@firstenergycorp.com
Project Manager, Strategic Engineering
Davis-Besse Nuclear Power Station