

Role of Hydrogen for Back-Up for Wind

Many renewable sources of energy, such as solar or wind, are intermittent. The State of Delaware is currently building a wind farm off-shore. What role could fuel cells play in storing energy from high wind periods, and providing energy later?

Uses? Local?

Where would the hydrogen come from? Native sources, local generation, import

Transport? Under these scenarios it might be important to transport hydrogen—which scenarios, and how?

Storage? What storage options of hydrogen are necessary?

Policy? What policy issues are there—safety, incentives, maintenance, reliability, ...

Cost Issues? For each of these scenarios what are the price benchmarks (installation, maintenance, \$\$/watt)

Q: Which scenarios make sense?

Feb 2

10:00 – 11:00 Problem presentation

11:00 – 12:00 Costing discussion (Alex Waegel)

12:00 – 1:00 problem assignment within group and timeline

Feb 4

9:00 – 10:00 Preliminary presentation preparation

10:00 – 11:00 Preliminary presentation (*Which scenarios make sense?*)

11:00 – 12:00 Scale-up

12:00 – 1:00 Use Whiteside's spaghetti diagram to Estimate Reasonable Sources of Energy in 2020? What fraction hydrogen and which scenarios? Prepare energy spread sheet showing sources, uses, and wasted energy. One page for final report.

Statement of scale-up problem: How would sensible hydrogen scenarios be integrated into full system (PV, wind, fossil, nuclear, geothermal, ...) for Delaware in 2020? Here the full system would need to consider grid vs. off grid.

Feb 5

12:30 – 1:15 Describe technical advances necessary for hydrogen incorporation. Prepare description of advances, where are we now, what do we need to attain. One page for final report

1:15 – 2:00 Describe policy advances necessary for hydrogen incorporation. Prepare description of government policies that would make technical solutions possible. One page for final report

2:00 – 3:00 Jigsaw Uses, Sources, Transport, Storage, Policy and Cost

3:00 – 4:00 Revisit technical and policy advances necessary for advancement. Finish up report and turn in.

4:00 – 4:30 Make assignments for presentation on 9 Feb.

Feb 9

9:00 – 10:00 Presentations *Roadmap for Incorporation of Hydrogen Energy Technology as a Component to Delaware's Energy Grid*

10:00 – 11:00 Revisit problem #1—what would your group change

11:00 – 12:00 evaluation of group, course

12:30 lunch, Blue and Gold

Preliminary reading—G. M. Whitesides and G. W. Crabtree, “Don’t Forget Long-Term Fundamental Research in Energy,” *Science*, **315**, 796 – 798 (2007).

Most recent DOE spaghetti diagram: http://www.eia.doe.gov/aer/pdf/pages/sec1_3.pdf

Bluewater Wind; <http://www.bluewaterwind.com/delaware.htm>

Delmarva Energy Mix; http://www.delmarva.com/_res/documents/DE_fuel_mix.pdf