

# Decarbonizing the Industrial Sector with Clean Hydrogen

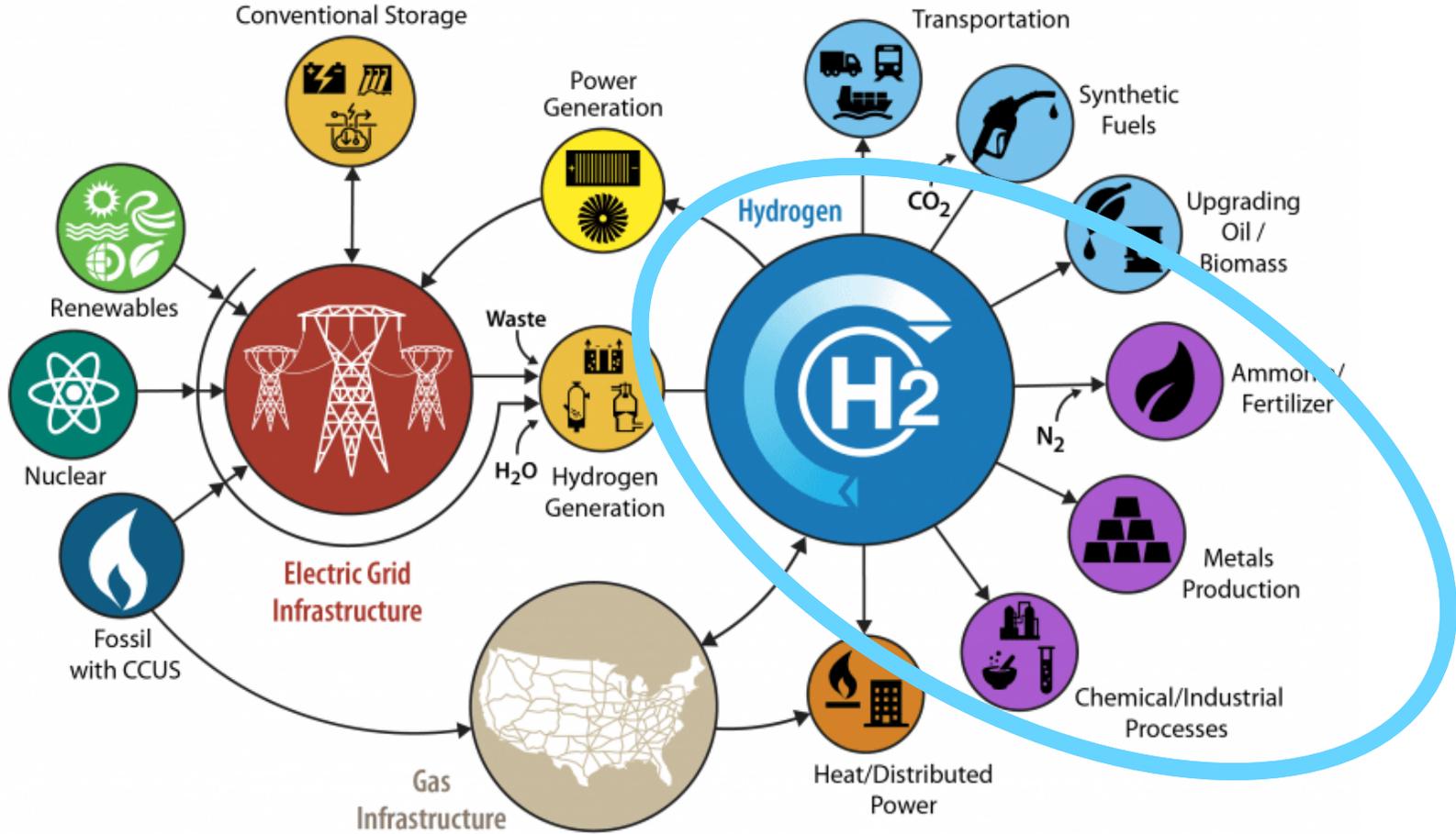
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# Systems Development & Integration: Industrial & Chemical Processes



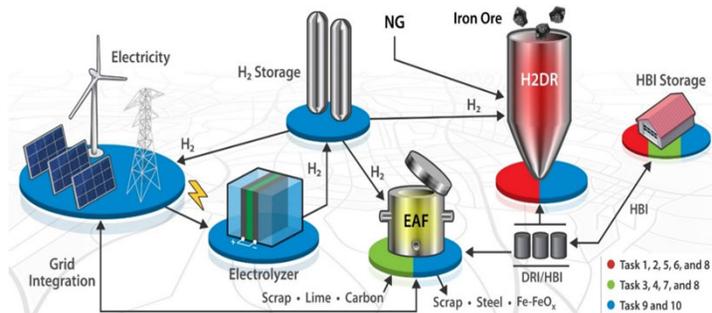
# Systems Development & Integration : Industrial Processes (Steel)

## Decarbonizing Iron/Steel Production with Hydrogen (HySteel)

### Missouri U. of S&T - Grid Interactive Steelmaking with H<sub>2</sub> (GISH) (TA053)

#### Goals:

- Demonstrate H<sub>2</sub>-based direct reduction of iron & steelmaking
- 1 tonne/week iron production using variable H<sub>2</sub>/NG content; scalable to 5,000 tonnes/day



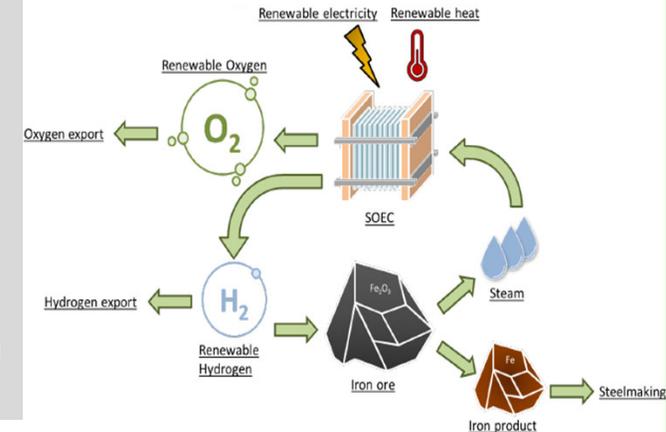
#### Key Accomplishments:

- Developed TEA of GISH process
- Kinetic model for H<sub>2</sub>, NG & mixed gas reduction, and a DRI melting model developed and verified
- GISH pilot reactor constructed (operation expected 3/23)

### U. of California Irvine - H<sub>2</sub> SOEC integrated with Direct Reduced Iron (DRI) plants (TA052)

#### Goals:

- Demonstrate a thermally and chemically integrated SOEC system with a DRI plant
- 1 tonne/week equivalent H<sub>2</sub>-Direct-Reduction pilot system (design for 2 MT/year)



#### Key Accomplishments:

- System models show potential energy intensity of <8 GJ/ton (crude steel) compared to 19-20 GJ/ton for traditional blast furnace + basic oxygen furnace
- SOEC modelling predicts electric-to-H<sub>2</sub> efficiency <35 kWh/kg
- SOEC design and testing completed