

Hydrogen Futures And Technologies

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Why the Hydrogen Economy?

National Security

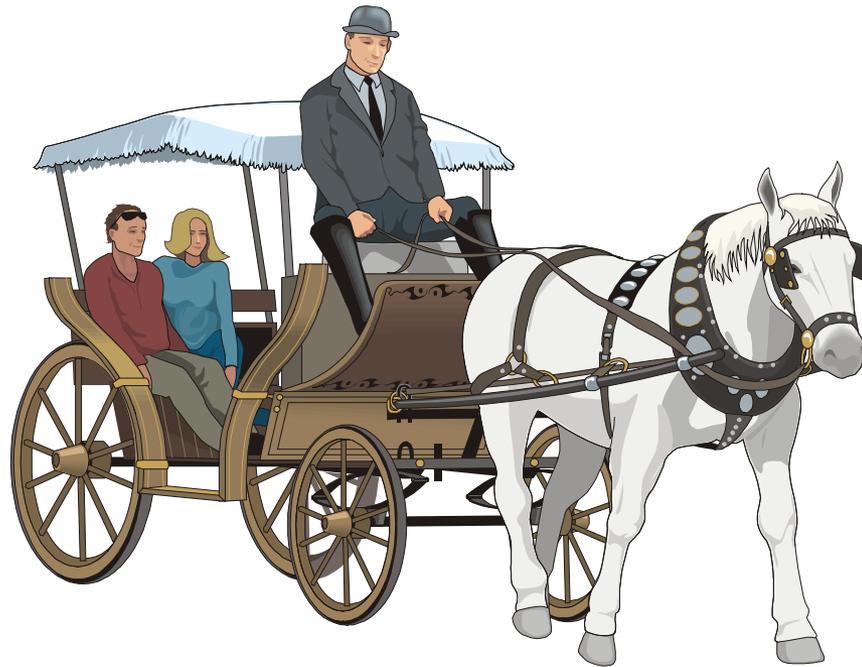


Imported Oil

Protect the Environment

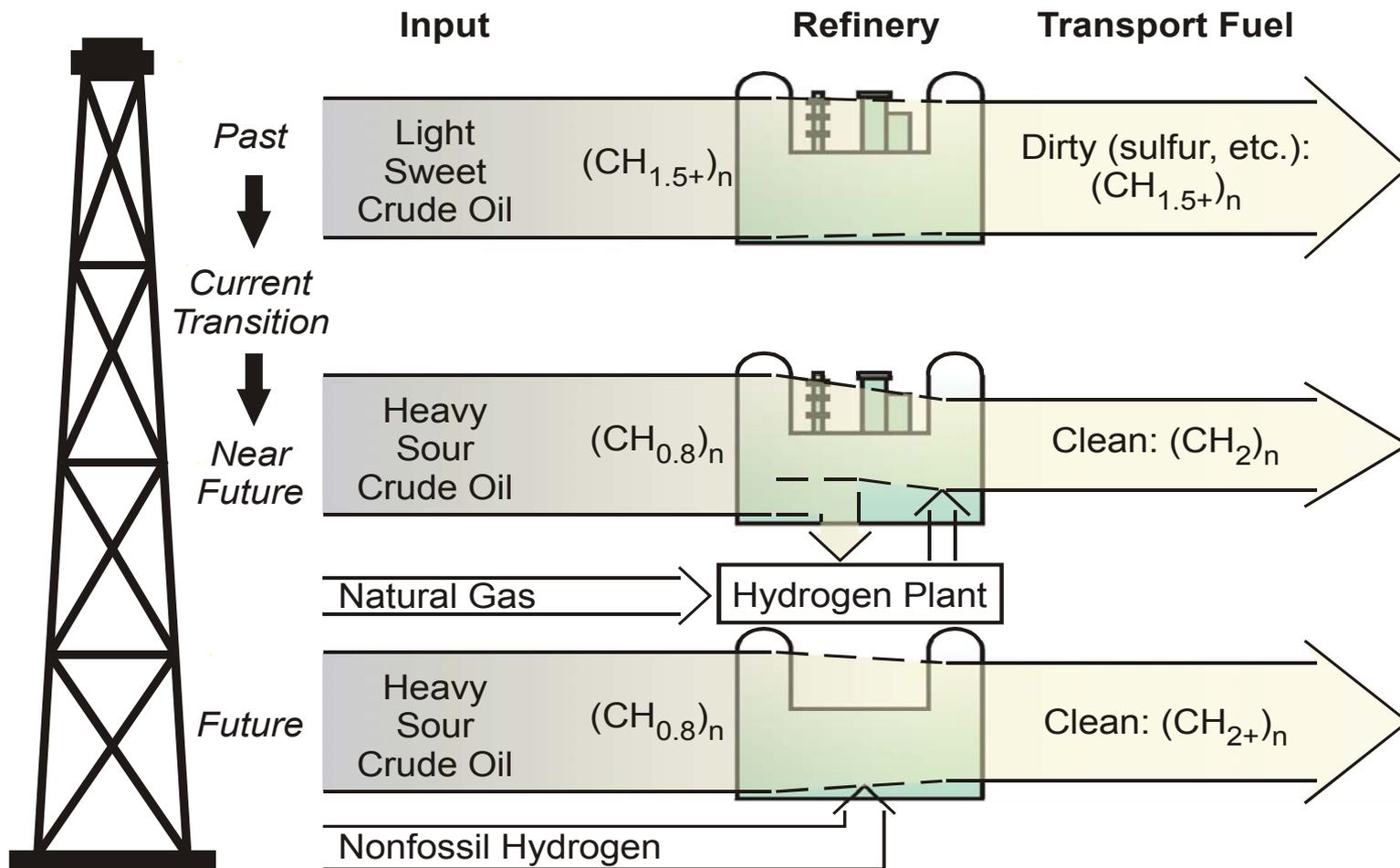


Large Scale Hydrogen Production Is an Old Business: Town Gas

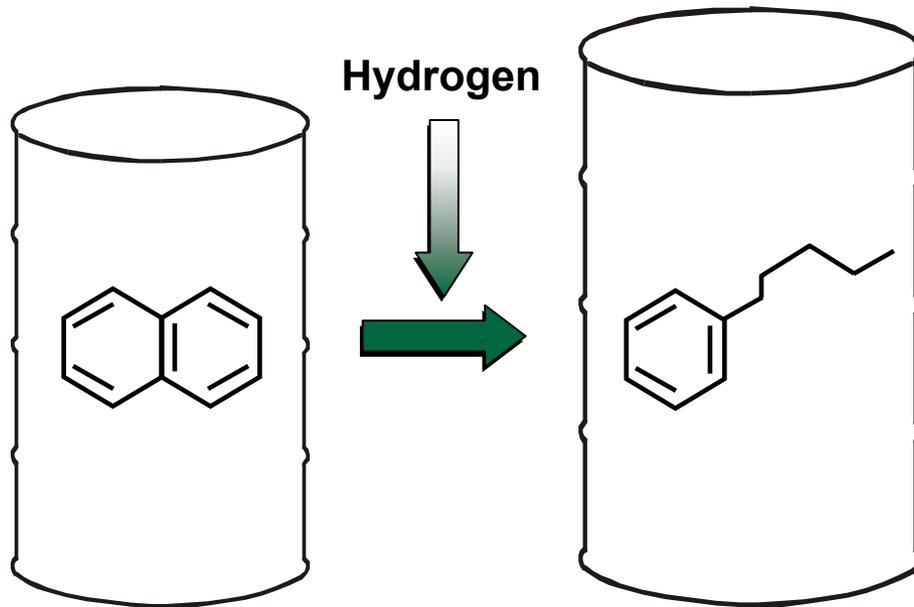


Liquid Fuels Production Is Rapidly Becoming the Major Market for Hydrogen

(Worldwide All Uses: 50 Million Tons/Year)



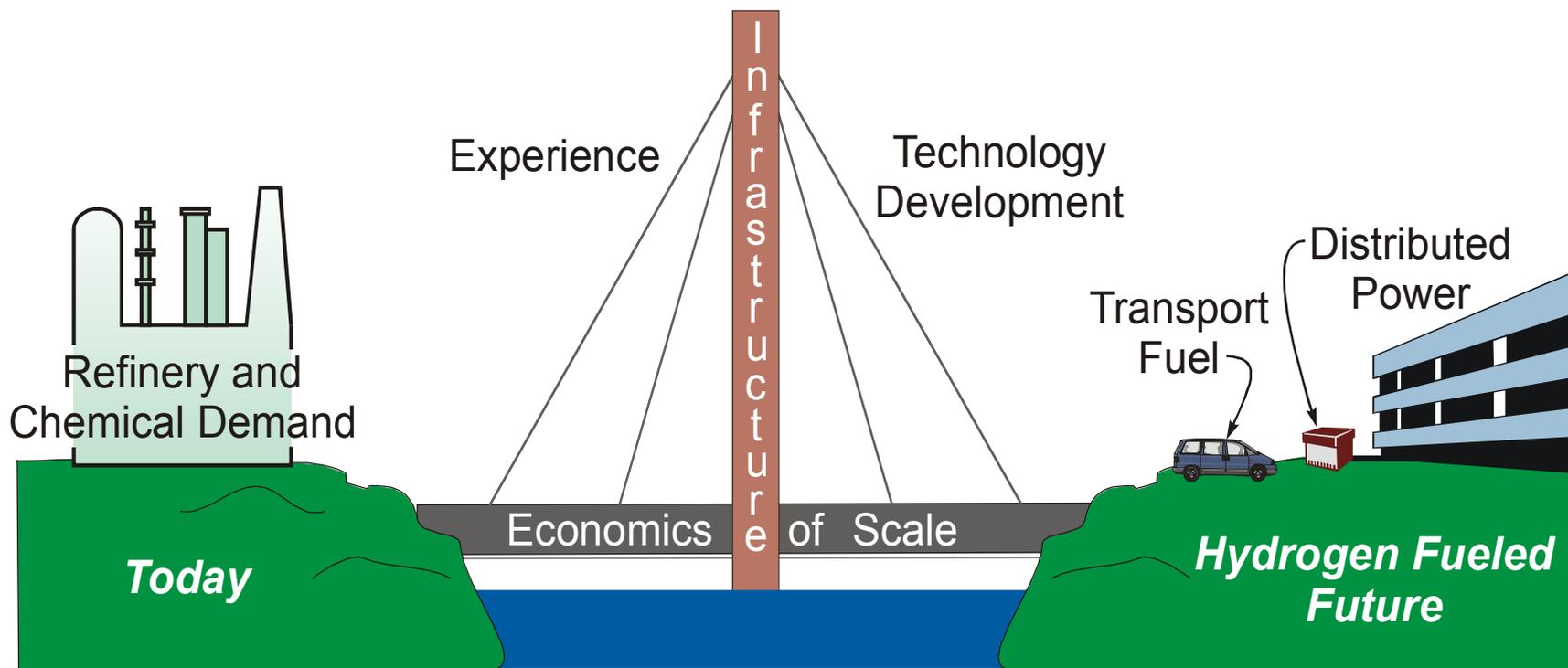
Addition of Hydrogen Can Increase Liquid Fuel Yields per Barrel of Oil by Up to 15% (Transition to the Hydrogen Economy)



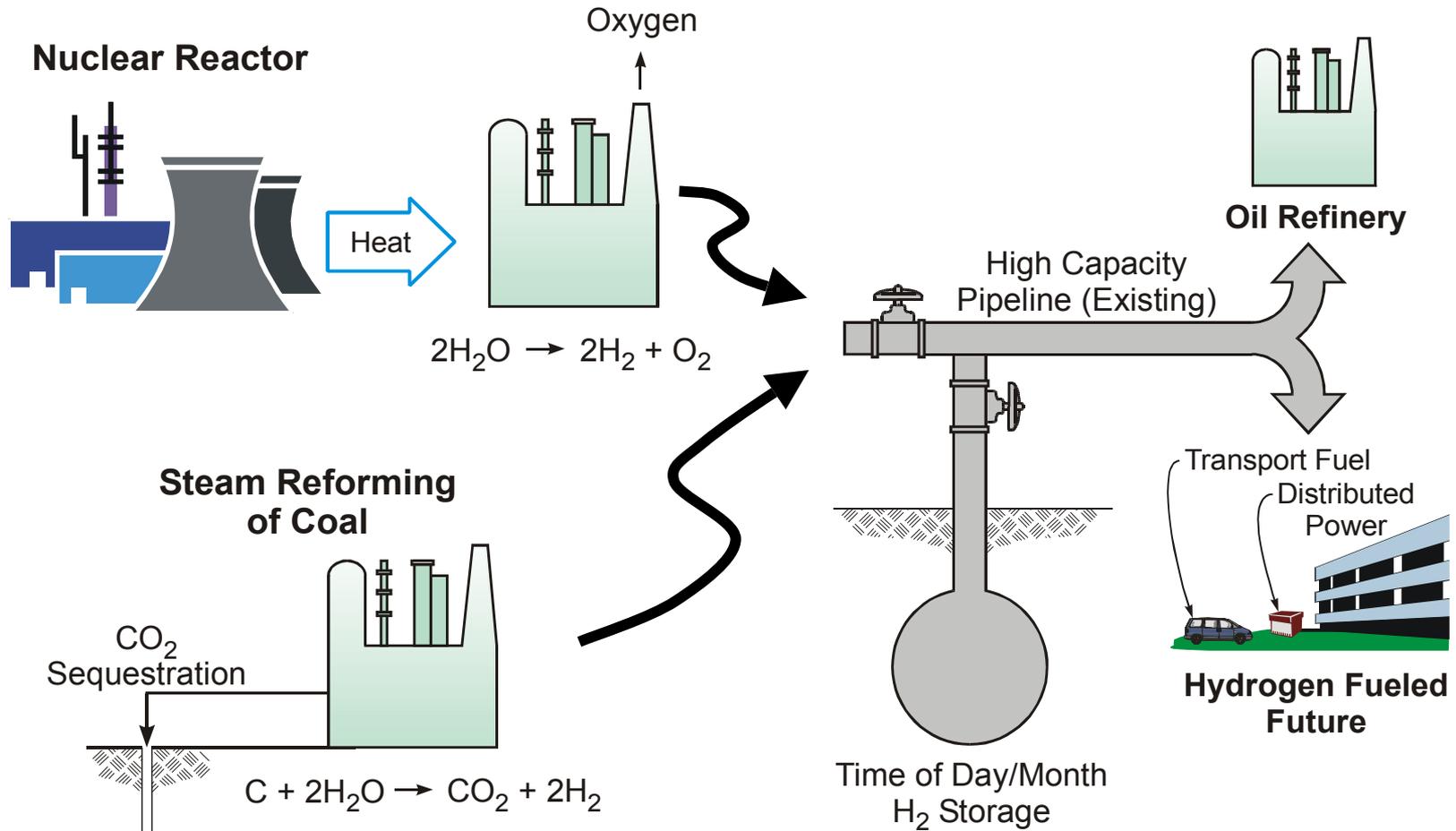
Benefits

- Lower imports
- Reduced CO₂
- Reduced NO_x
- Reduced sulfur
- Reduced diesel particulate

The Growing Hydrogen Demand Creates a Bridge to the Hydrogen Economy—With a Future Hydrogen Energy Demand That May Exceed That for Electricity

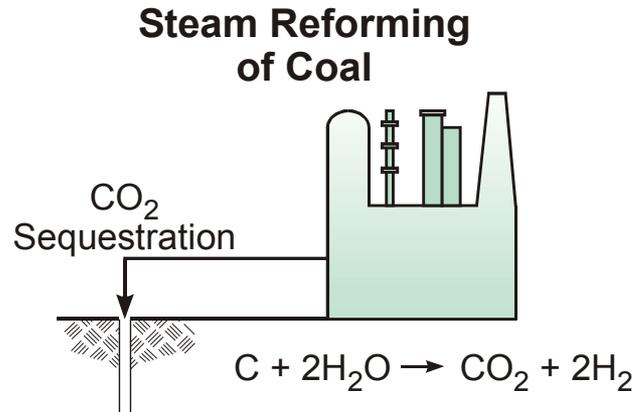
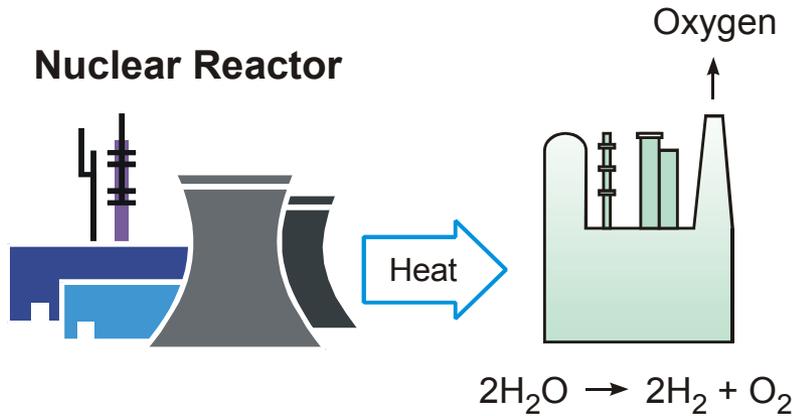


The Hydrogen Economy



The Big Barriers to the Hydrogen Economy

Hydrogen Production



Vehicle On-Board Hydrogen Storage

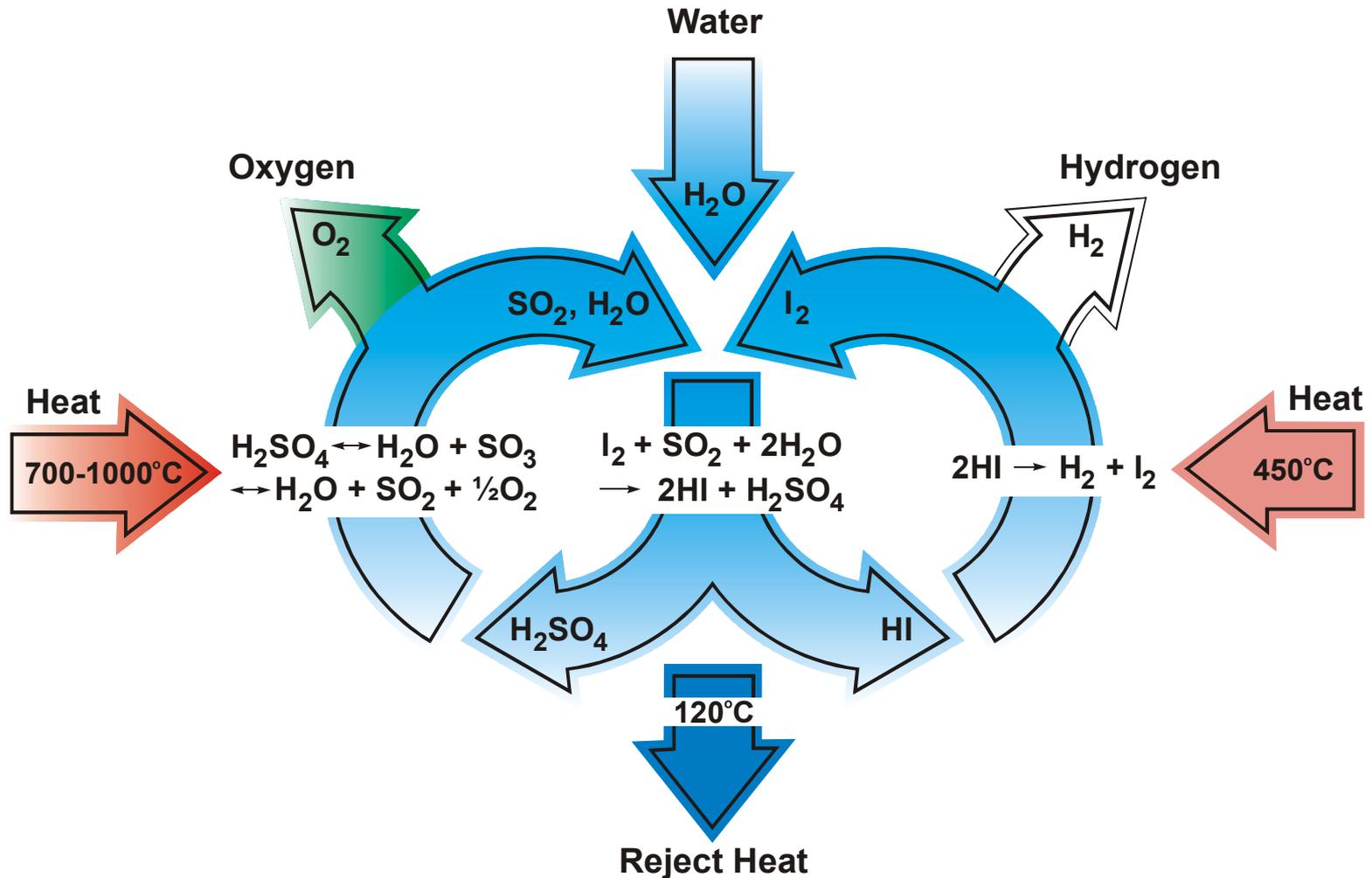


Heat Transfer Challenges

Hydrogen Production

Example: Nuclear Energy

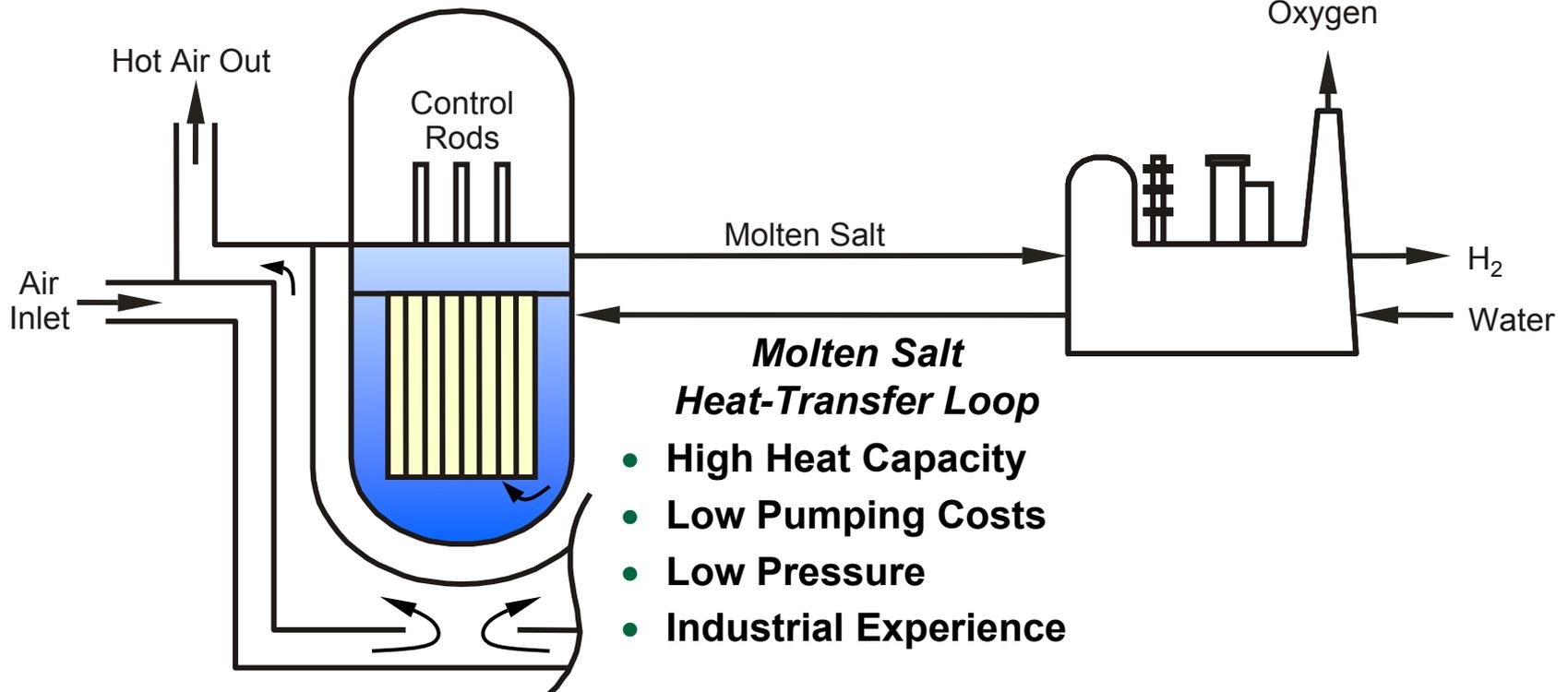
Sulfur Iodine Process For Hydrogen Production



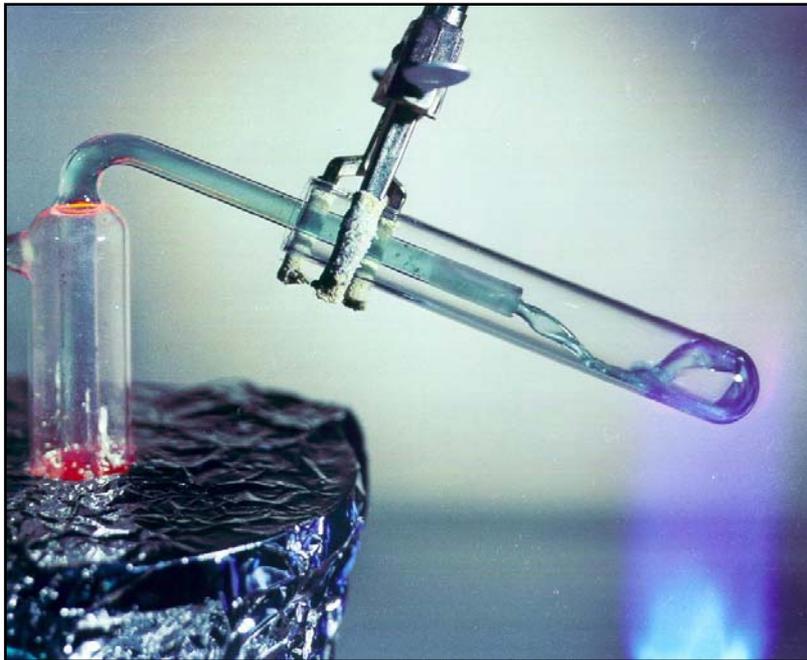
The Reactor and Hydrogen Production Facility Will Be Physically Separated to Ensure Safety

Nuclear Safety by Isolation

Hydrogen Safety by Dilution



Challenges in High-Temperature Molten Salt Heat Transfer



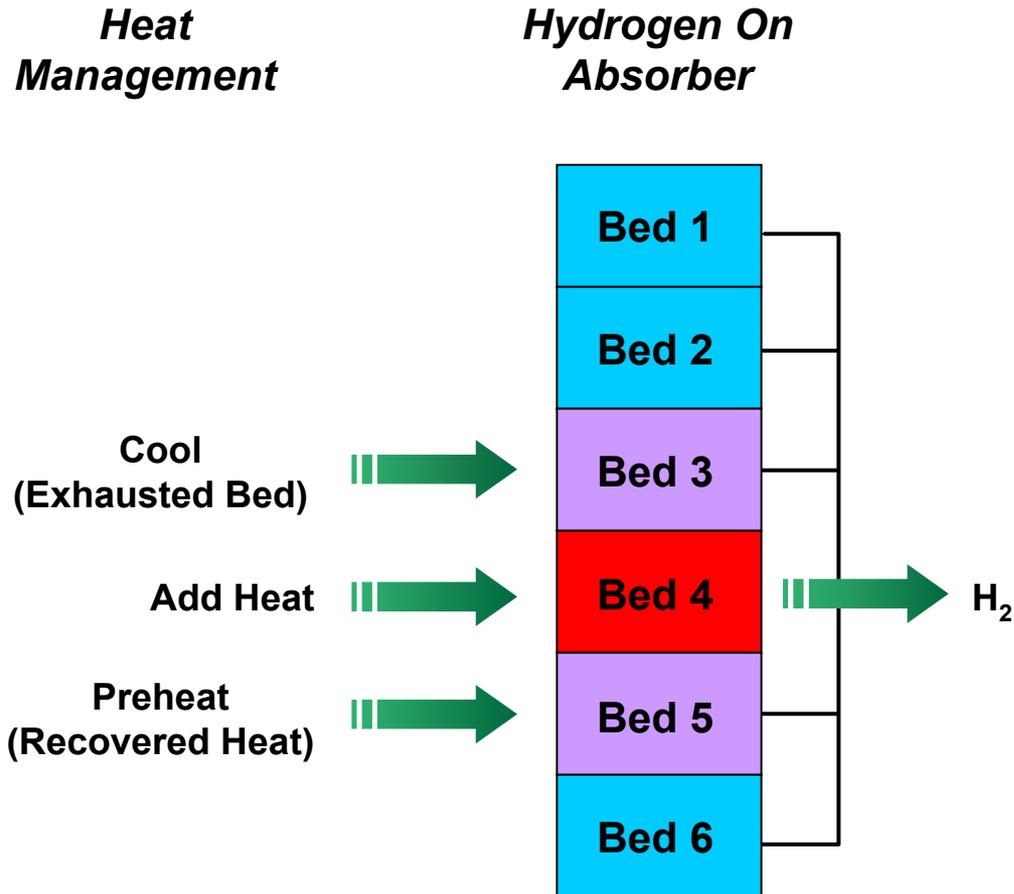
- Temperatures 750 to 1000°C
- Radiation Heat Transfer Important
- Can control transparency
- How should system be designed to maximize capabilities?

Heat Transfer Challenges

Vehicle On-Board Hydrogen Storage

Example: Hydrogen Absorbers

Hydrogen Storage Heat-Transfer Challenges in Vehicles



Conclusions

- **Hydrogen economy**
 - **Great Benefits**
 - **Great Challenges**
- **Key Challenges**
 - **Low-cost environmentally acceptable hydrogen production**
 - **Vehicle on-board hydrogen storage**
- **Major heat transfer challenges**