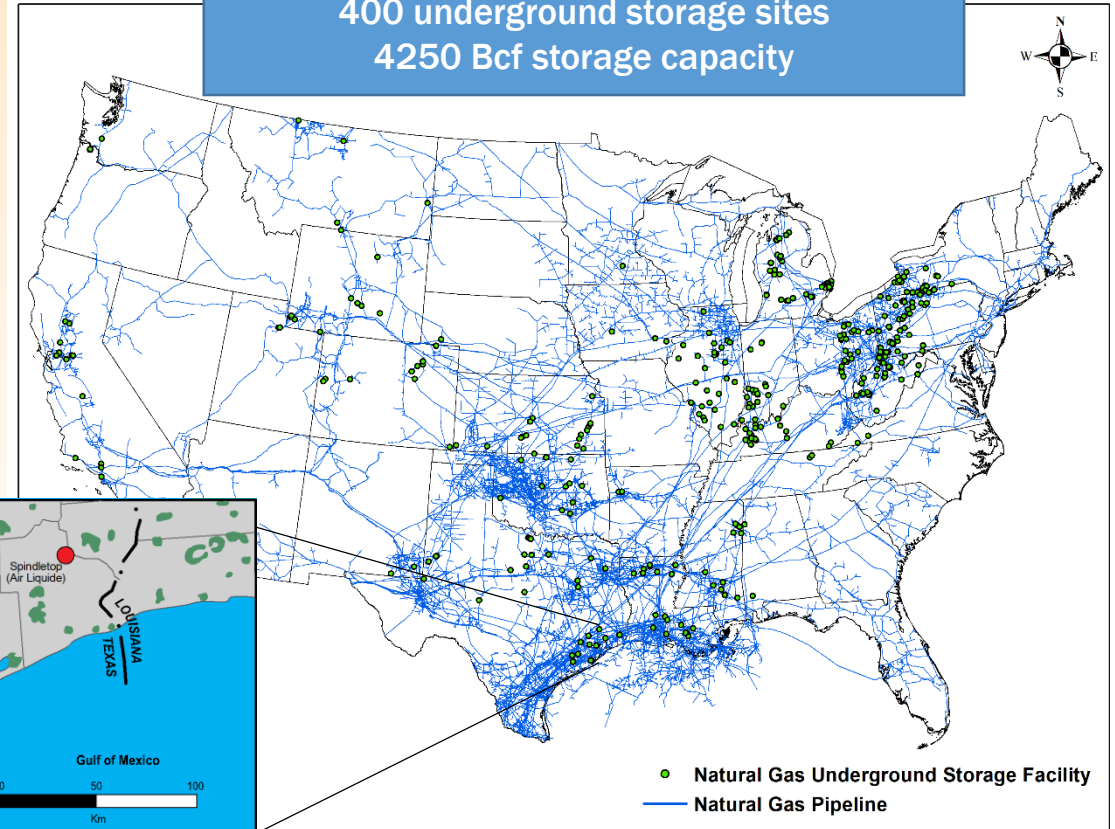


Why Geological Storage ?

- H_2 ~ 1/3 energy of natural gas by volume
- Current H_2 storage in US is ~6 Bcf (14,000 tonnes H_2)
- Potential H_2 Growth

United States Natural Gas Storage & Pipeline Infrastructure

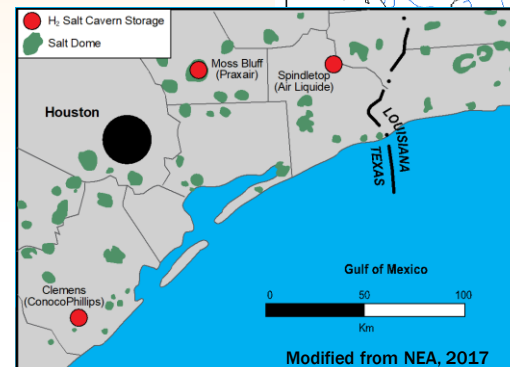
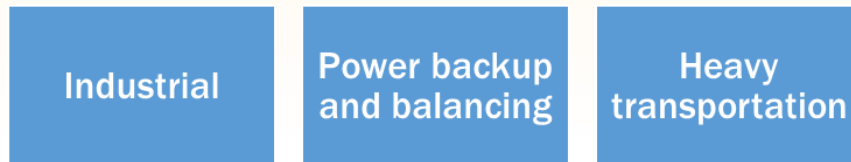
US Natural Gas
85 Bcf/day consumed
400 underground storage sites
4250 Bcf storage capacity



H ₂ Future Share of Natural Gas Market	Equivalent H ₂ Storage Needed*
1 %	94 Bcf
10 %	940 Bcf

* Assumes 10 % storage/consumption requirement; 2019 NG market reference

Main envisioned application categories of H₂

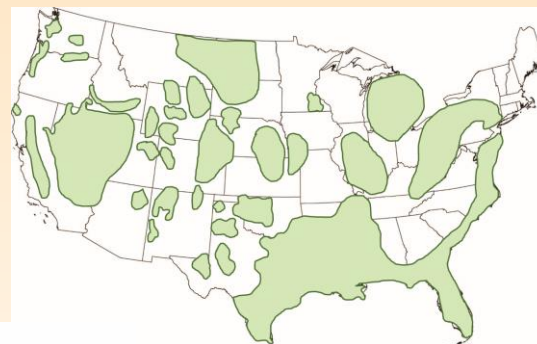


● Natural Gas Underground Storage Facility
— Natural Gas Pipeline

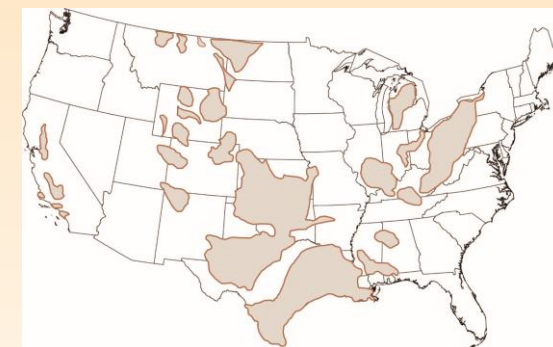
Geological Storage

- Geological storage provides options for large (> 1000 tonne H₂) storage sites
- Viable geological storage options include:
 - Dissolution caverns in salt domes
 - Depleted oil & gas fields
 - Saline aquifers
- Geographic coverage important
 - Generation sites
 - End use sites
 - Infrastructure

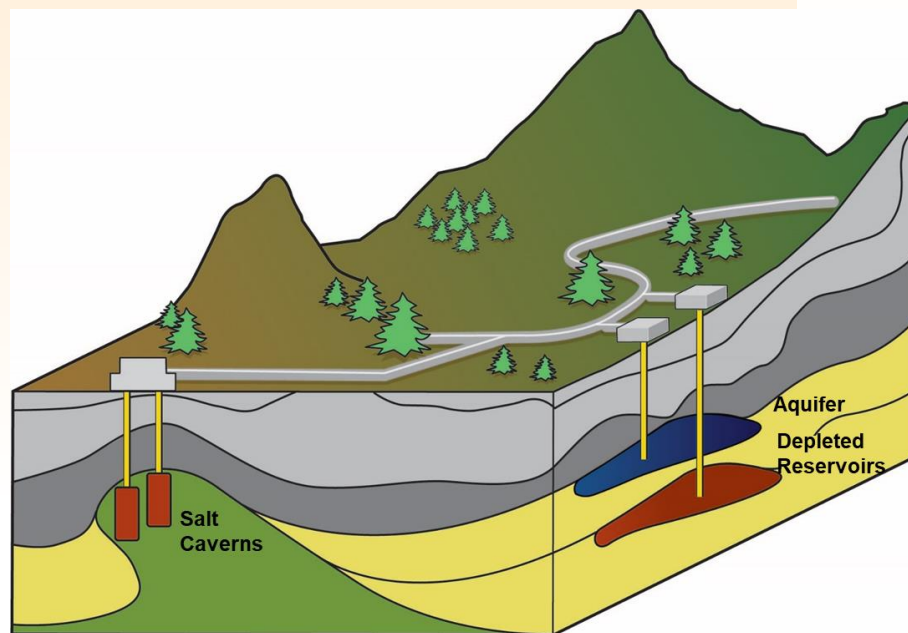
Sedimentary Basins



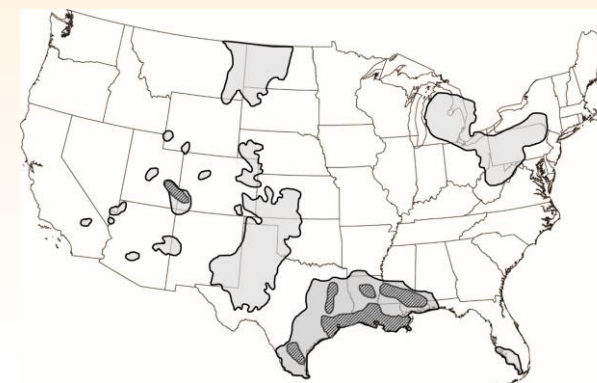
Oil & Gas Producing Areas



Geological Storage



Major Salt Deposits



Diagrams modified from EIA; Lord et al, 2014

Large-scale Geological Storage of H₂ in US

Type	Status	Comments	Research
Salt (dissolution) caverns	3 active H ₂ storage sites in Texas for industrial use	<ul style="list-style-type: none"> Limited geographic distribution of suitable salt deposits 	<ul style="list-style-type: none"> Cost/life-cycle analysis Catalog areas for expanded storage
Depleted oil & gas fields	Untested for H ₂ storage (proven for NG)	<ul style="list-style-type: none"> Wide geographic distribution H₂-reservoir interaction is not well understood 	<ul style="list-style-type: none"> Cost/life-cycle analysis storage in reservoirs Chemical reactions Geomechanics Pilot field tests of H₂ Catalog suitable sites
Saline aquifers	Untested for H ₂ storage (proven for NG)	<ul style="list-style-type: none"> Wide geographic distribution H₂-reservoir interaction is not well understood Suitability of sealing caprocks 	<ul style="list-style-type: none"> Cost/life-cycle analysis storage in reservoirs Chemical reactions Geomechanics Pilot field tests of H₂ Catalog suitable sites

Bureau of Economic Geology Hydrogen Working Group:

- Peter Eichhubl, Seyyed Hosseini, JP Nicot, Ian Duncan, Ning Lin, Jay Kipper, Farzam Javadpour, Mark Shuster
- Large-scale geological storage, H₂ generation, and economics*