Some Beneficial Uses of CO_2 in Subsurface Systems

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Point of Departure

- **Under expected cap and trade policies, there may be lots of CO_2 available to anyone who can take it and assure that it will not enter the atmosphere.**
- **What are some of the beneficial uses of vast amounts of CO_2 that make no economic sense today but that may become economically favorable in the future?**

CO_2 as Cushion Gas for CAES

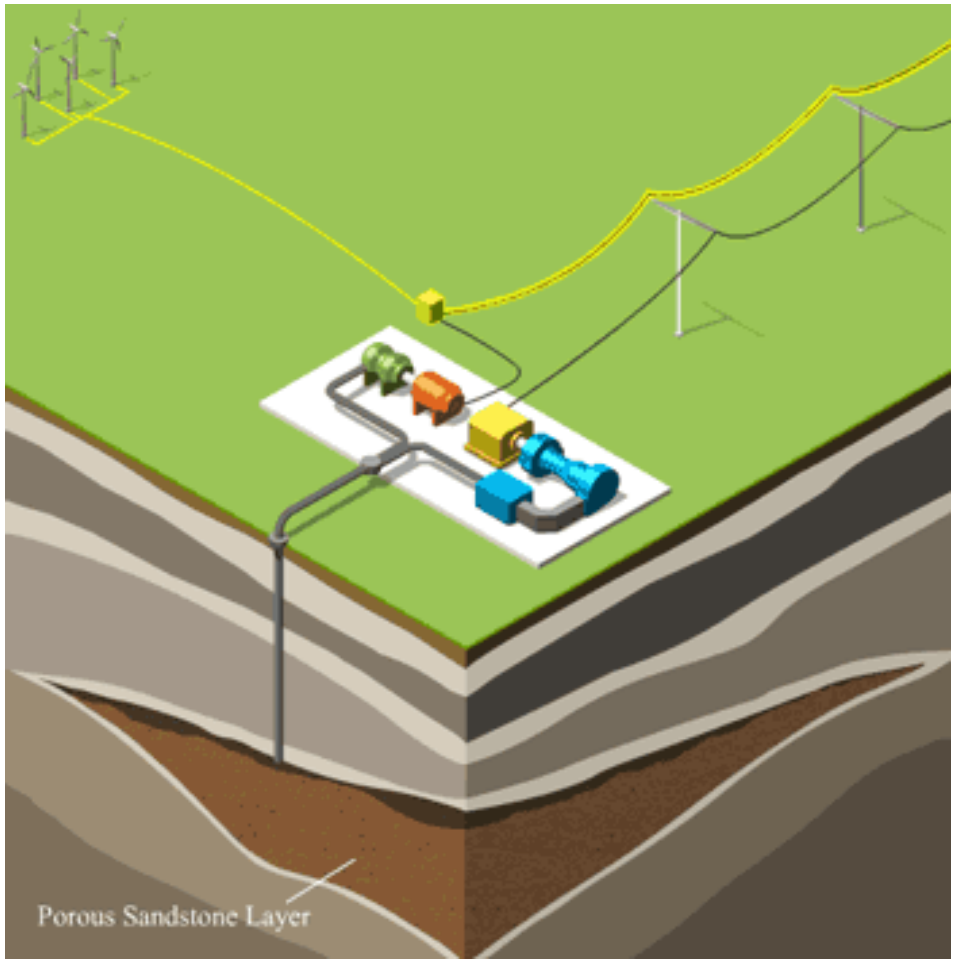
(Oldenburg)

- Electricity generated by renewables during periods of low demand can be used to compress air which can be injected into subsurface reservoirs.

- During periods of high electricity demand, the compressed air can be used to enhance net power output of gas turbines by reducing the need to run compressors.

- Storage capacity can potentially be enhanced by the use of CO_2 as the cushion (base) gas, with revenue collected for storing CO_2 under future cap and trade policy.

- Research is needed to assess the use of CO_2 as cushion gas.



http://www.isepa.com/about_isep.asp

Water Production for Algal Biofuels

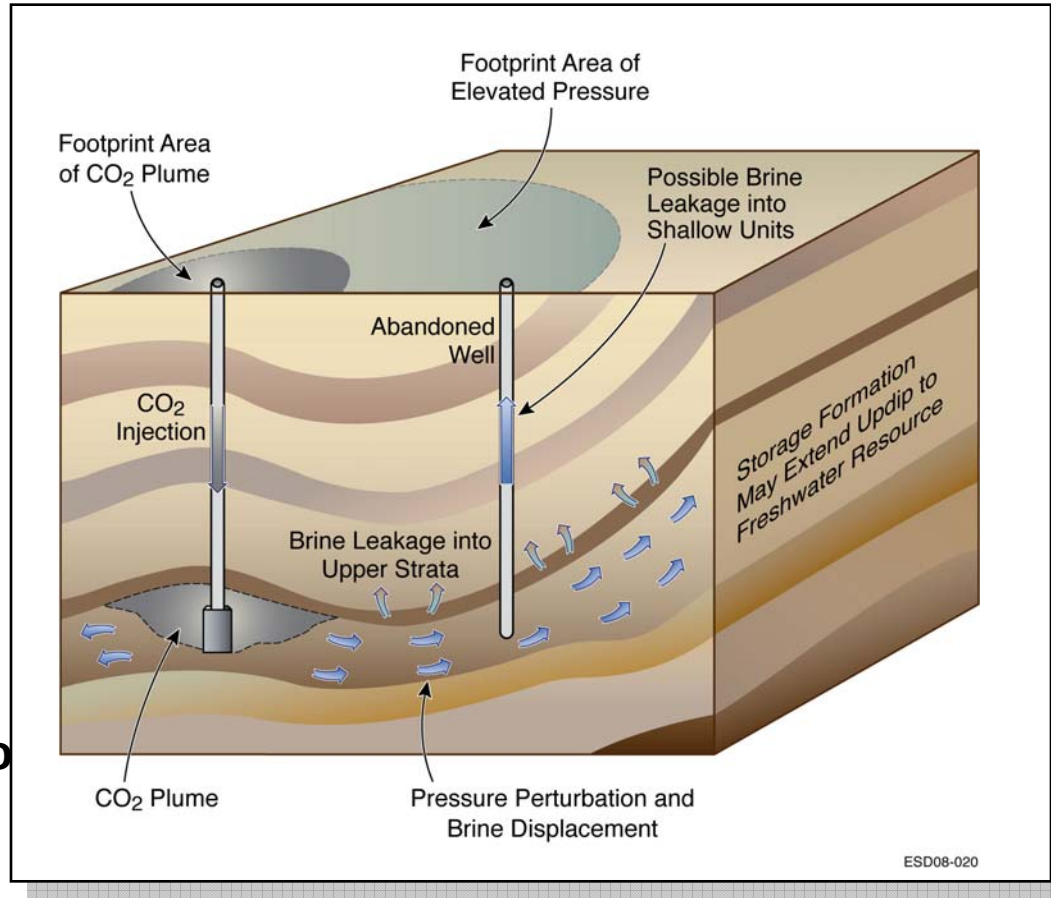
(Birkholzer, Jansson, Oldenburg)

- **Large-scale injection of CO_2 for geologic carbon sequestration causes widespread pressure increases.**

- **These pressure increases can cause brine migration into potable water thereby degrading it.**

- **To manage pressure, it may be necessary at some sites to produce (extract) water from the saline formations receiving CO_2.**

- **Produced water could be used to irrigate algal biofuel operations in desert areas where water is naturally scarce.**

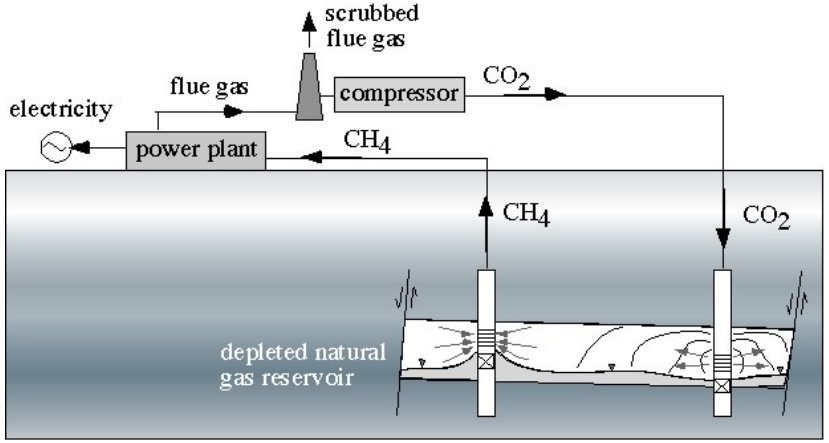


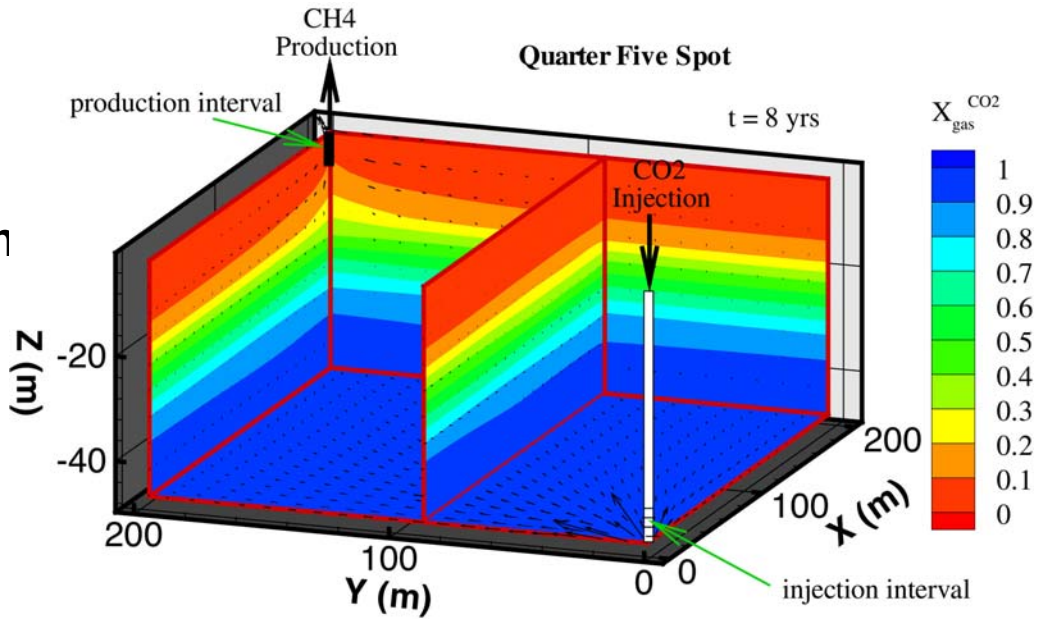
Birkholzer and Zhou (LBNL)

Enhanced Gas Recovery, CAES

(Oldenburg)

- Natural gas reservoirs have a proven capability to store gas
- Increasing numbers of depleted natural gas reservoirs are becoming available for other uses
- CO_2 can be injected into the depleting reservoirs for enhanced gas recovery (EGR)
- Following EGR, the reservoir can be filled with CO_2 and used for natural gas storage or CAES with CO_2 as the cushion gas
- Research and pilot tests are needed to assess the feasibility of these approaches





(Oldenburg, et al., Energy 29, 1413-1422, 2004)

Enhanced Geothermal Systems with CO_2 as Heat Transmission Fluid (Pruess)

- EGS operating with water faces severe technical challenges to become economically viable.

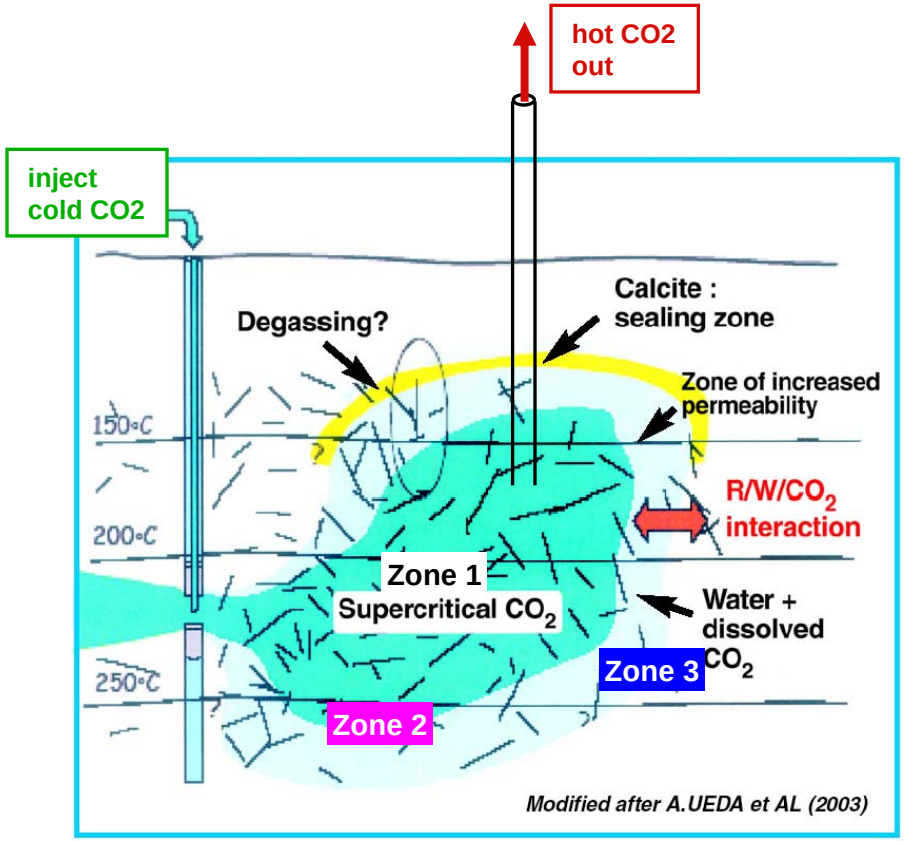
- Using CO_2 as heat transmission fluid is a game-changing technology, that can avoid many of the problems of water-based systems.

- In addition to producing renewable energy, EGS-CO_2 would achieve carbon storage as ancillary benefit.

- Theoretical studies have indicated that CO_2 is a more effective heat transmission fluid than water.

- The theoretical results need to be tested in laboratory and field experiments.

General Makeup of a CO_2-Based EGS Reservoir



(modified after Fouillac et al., 2004)