A Public Interest Perspective on Deployment of CCS Technologies

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Why CCS?

- CCS is essential <u>component</u> because fossil fuels will not disappear soon
- Technology largely exists; voids in policy, regulatory, and institutional frameworks
- Policy drivers essential
- Public acceptance uncertain
- Developing country participation crucial, but U.S. leadership needed first

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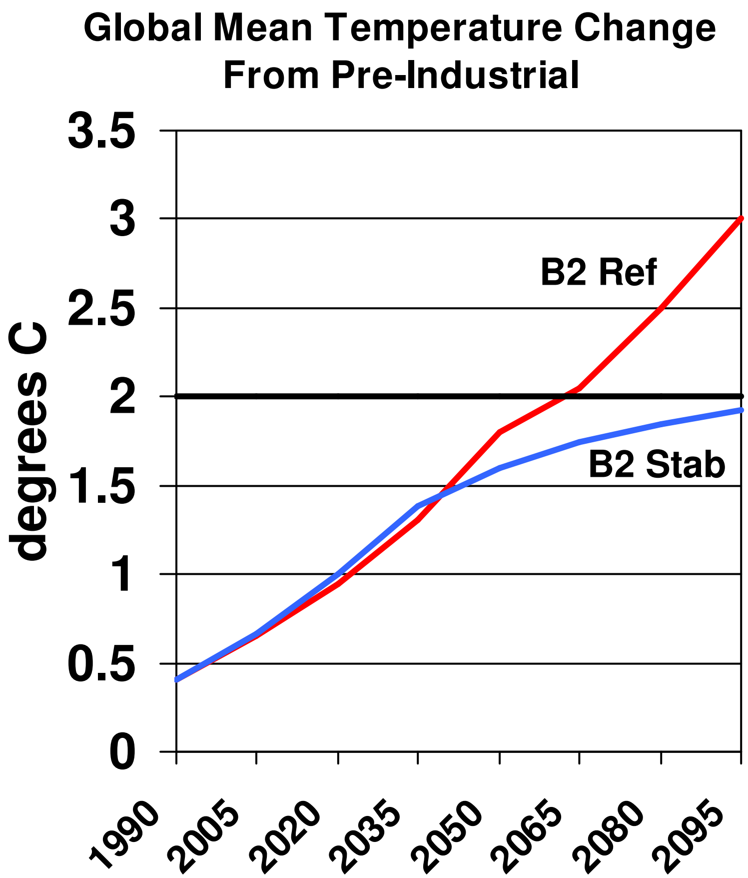
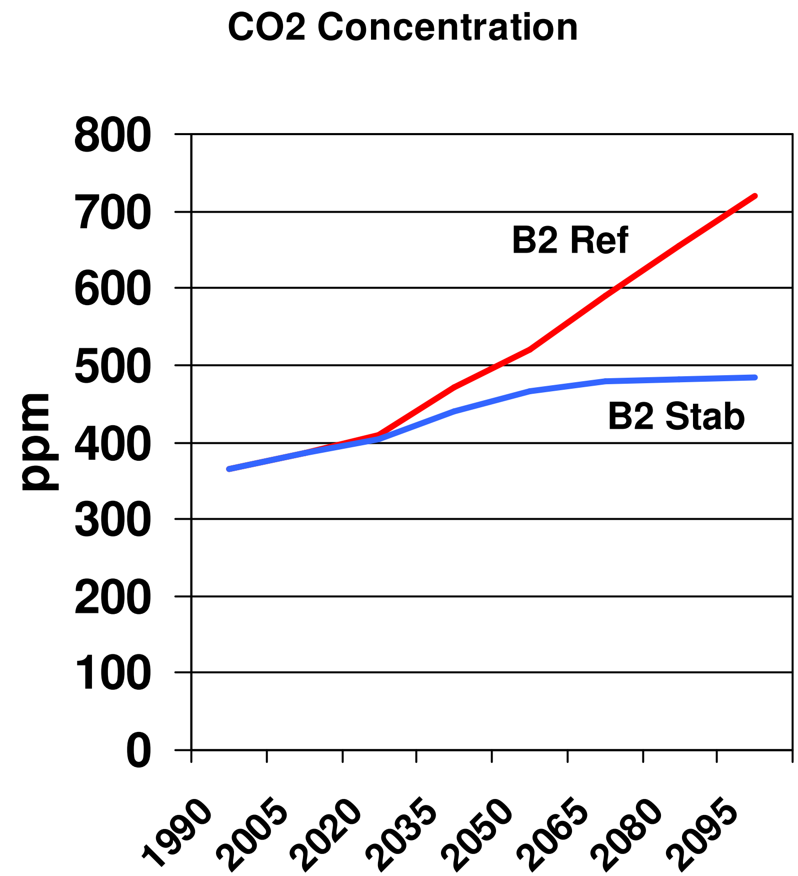
One Version of the Climate Challenge





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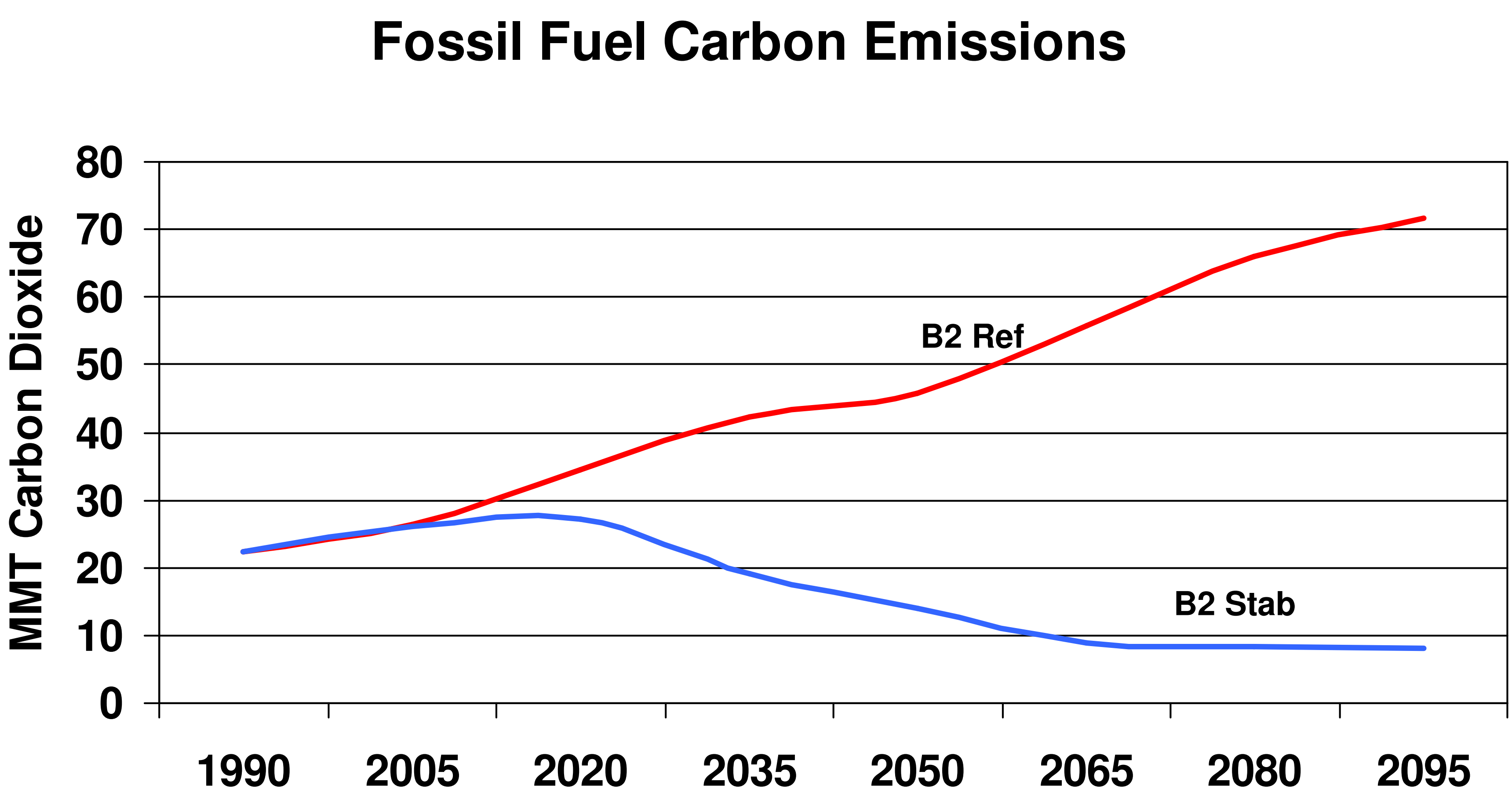
Global CO_2 Emissions



Source: J. Edmonds, Battelle, 2004.

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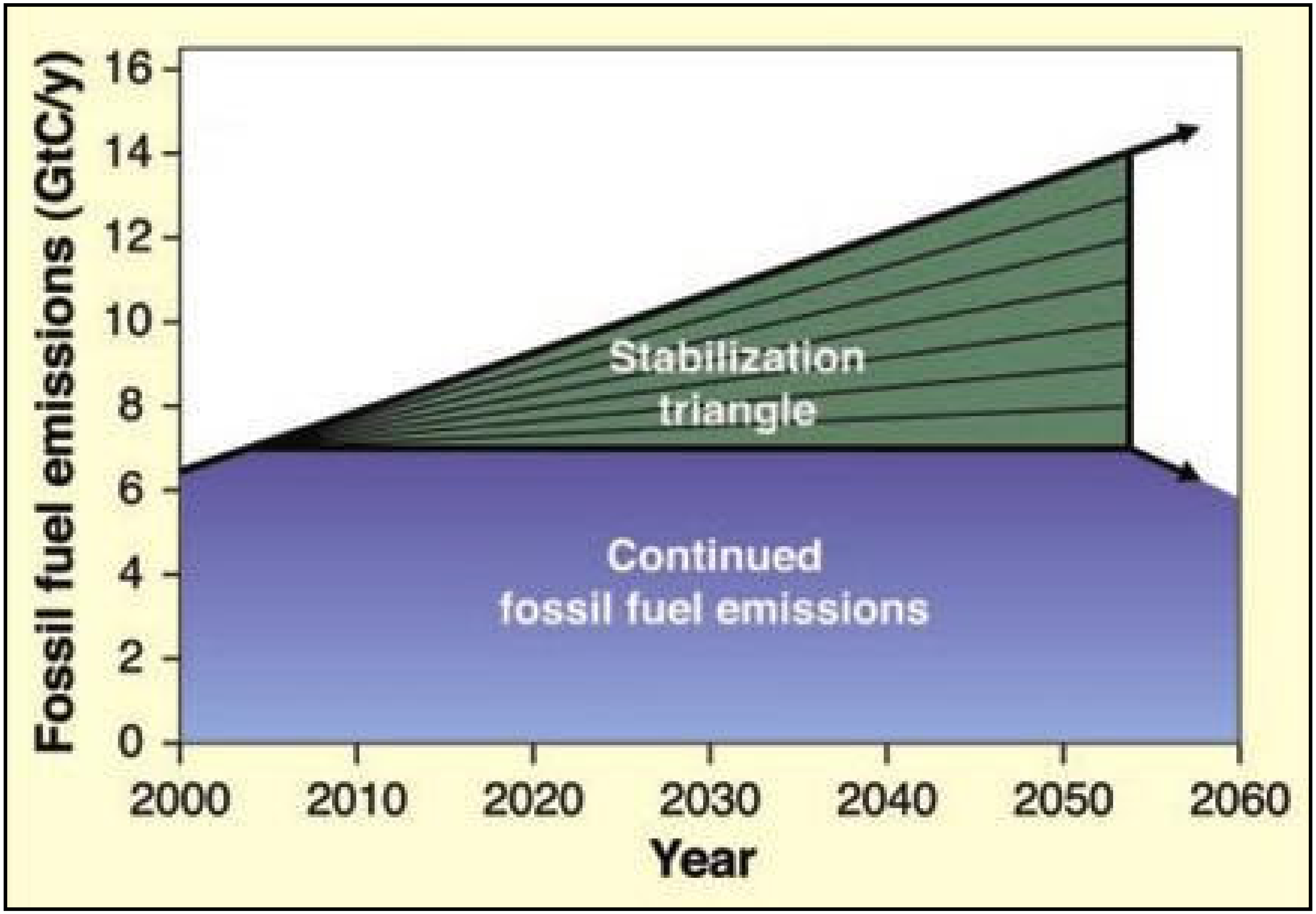
CCS Key for New (and Retrofit) Technology



- ***3 out of 15 potential "wedges"***

Pacala & Socolow, 2004

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Magnitude of Wedge Examples

Each providing 1GtC reduction by 2055

- **Wind**: new 2000 GW (50x today)
- **PV**: new 7200 square miles (700x today)
- **Natural Gas**: coal to gas at 700 large plants
- **Efficiency**: double mileage of 2 billion cars
- **CCS**: 800 GW of coal plants or 3500 Sleipners
- **Biofuels**: 1/6th of world's cropland (ethanol)
- **Nuclear**: new 700 GW (2x today)

Source: Pacala and Socolow, 2004.

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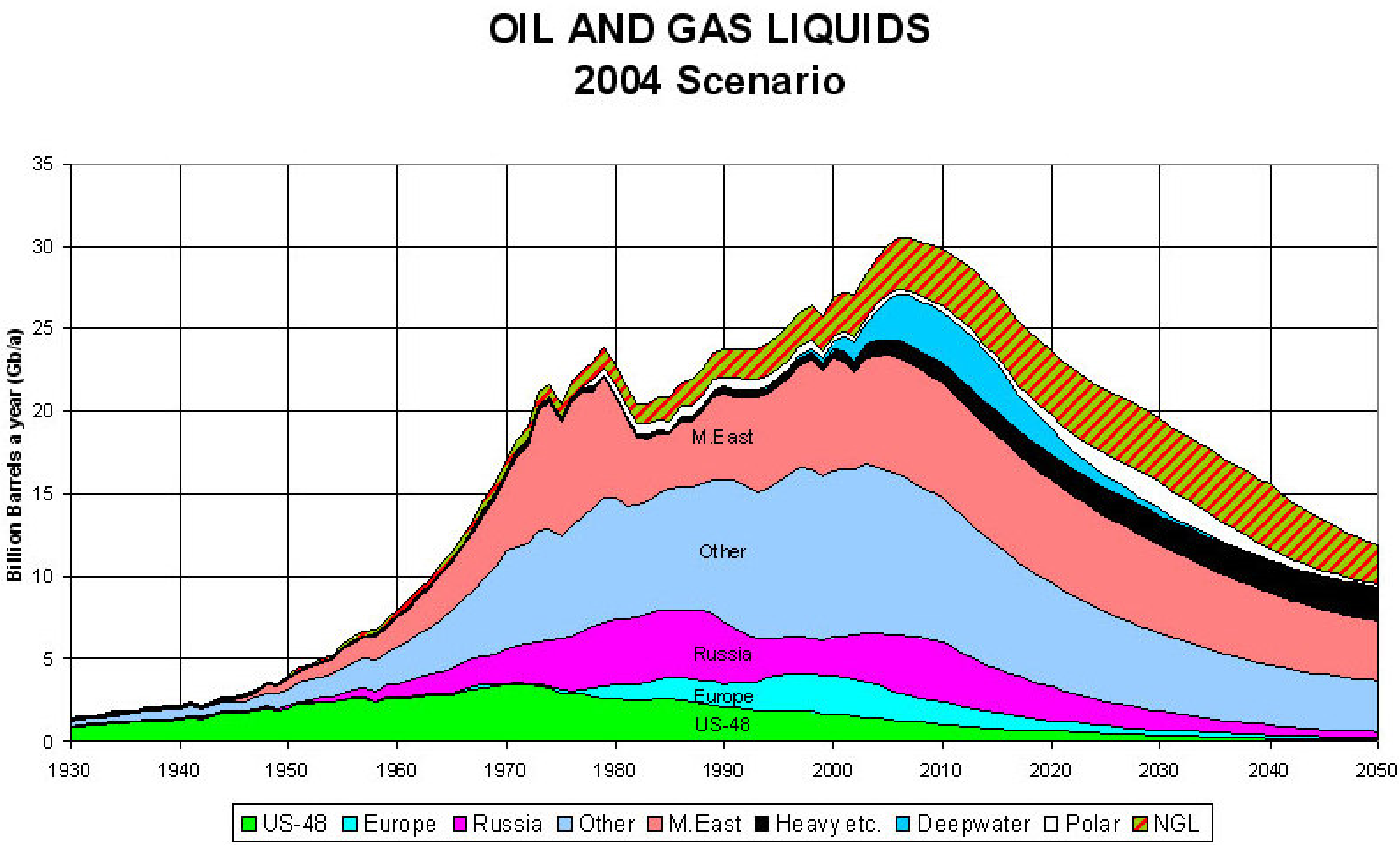
Conventional Global Oil Output Will Peak



Source: Campbell, C. J. http://www.hubbertpeak.com/campbell/

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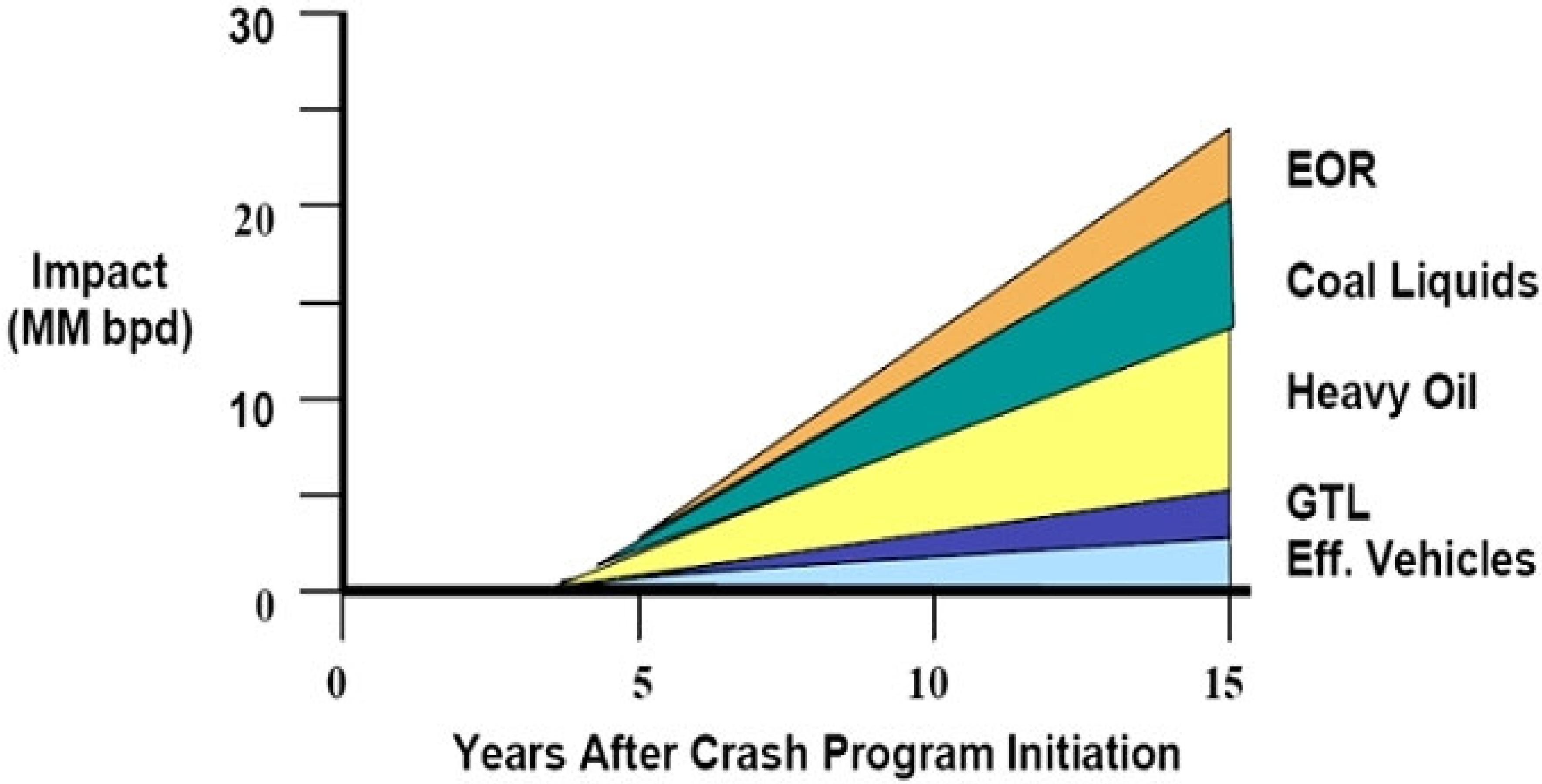
Peak Oil Wedges



Hirsch, Bezdek, Wendling, 2005.

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Liquid Fuel Alternatives Scorecard

	Readiness	Climate	Cost
CTL	0	-3	-1
GTL	+1	-1	-1
Heavy Oil	+1	-2	-1
Hydrogen	-1	depends	-2
Biofuels	+1	+2	-1
Oil Shale	-1	-2	-2
End-Use	+3	+1	+1

Scale: +3 (best) to -3 (worse)

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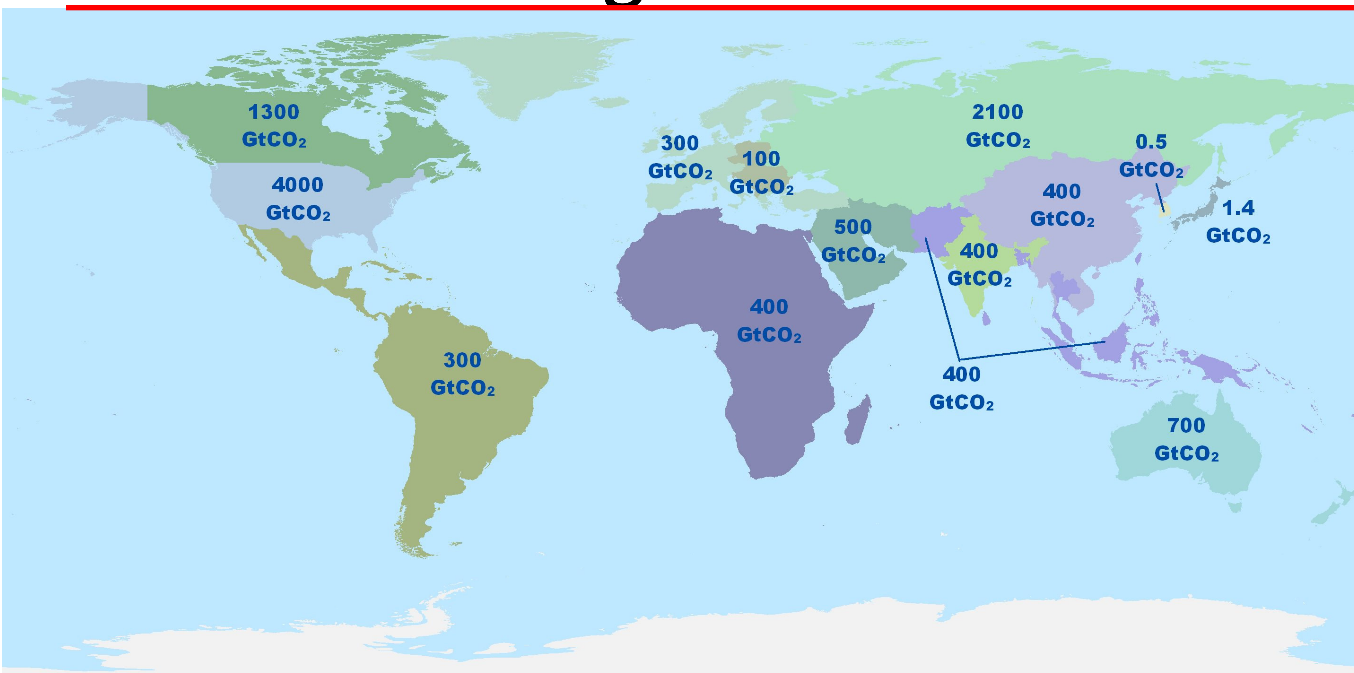
Global CO_2 Storage Capacity
A Heterogeneous Natural Resource



Sinks

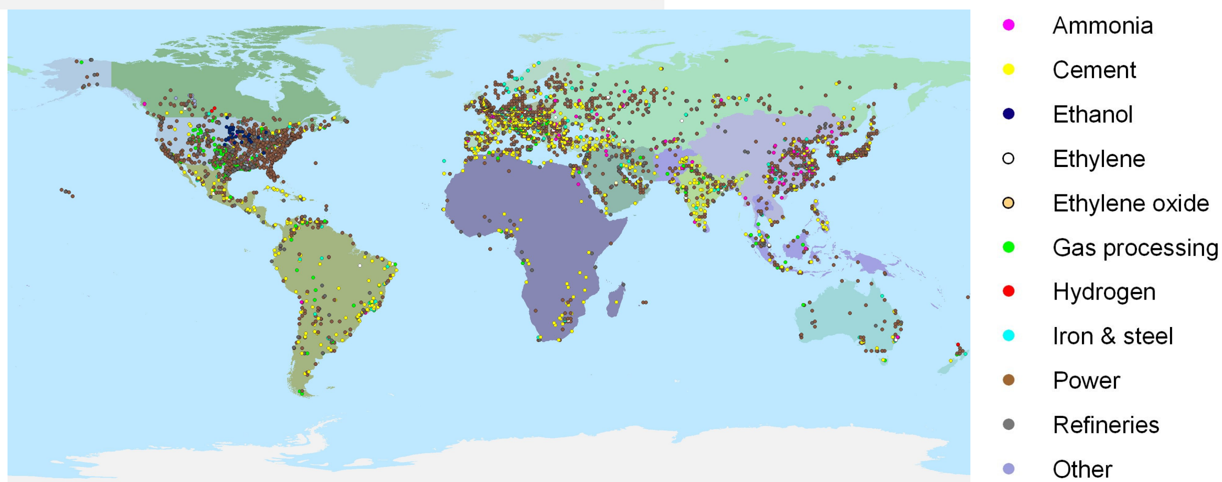
Potential global storage capacity 11,000 Gt CO_2

Plentiful in U.S., Canada, Australia

Sources

8100 Large Point Sources

>60% of all human CO_2



Source: J. Dooley, Battelle Memorial Institute

Some Key Questions

- How to site GS projects?
- How long should CO_2 stay there? Remediation?
- MMV: What, when, how?
- Inventory and accounting?
- How should we structure long-term liability?
- EOR vs. CO_2 sequestration?
- Something for everyone…

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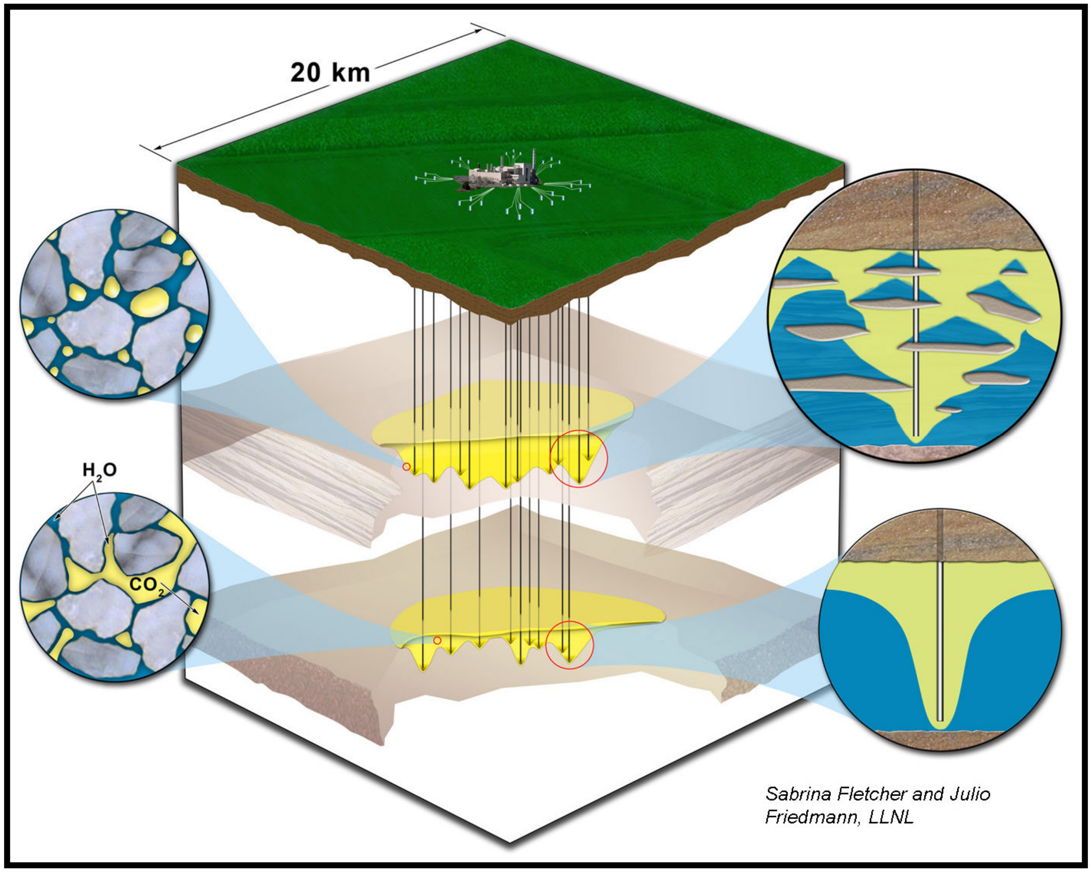
The Case for Large-Scale Field Experiments

Scope and scale of injection from a single 1,000 MW PC plant:



- **6 MM t CO_2/yr**
- **100,000 bbl/d (supercritical)**
- **After 50 years, 2 G bbls**
- **CO_2 plume at 50 yrs: 30 km radius**
- **Many hundreds of wells**
- **Likely injection into many stacked targets**

Sites must receive large volumes of CO_2 at a high rate and contain them for long periods

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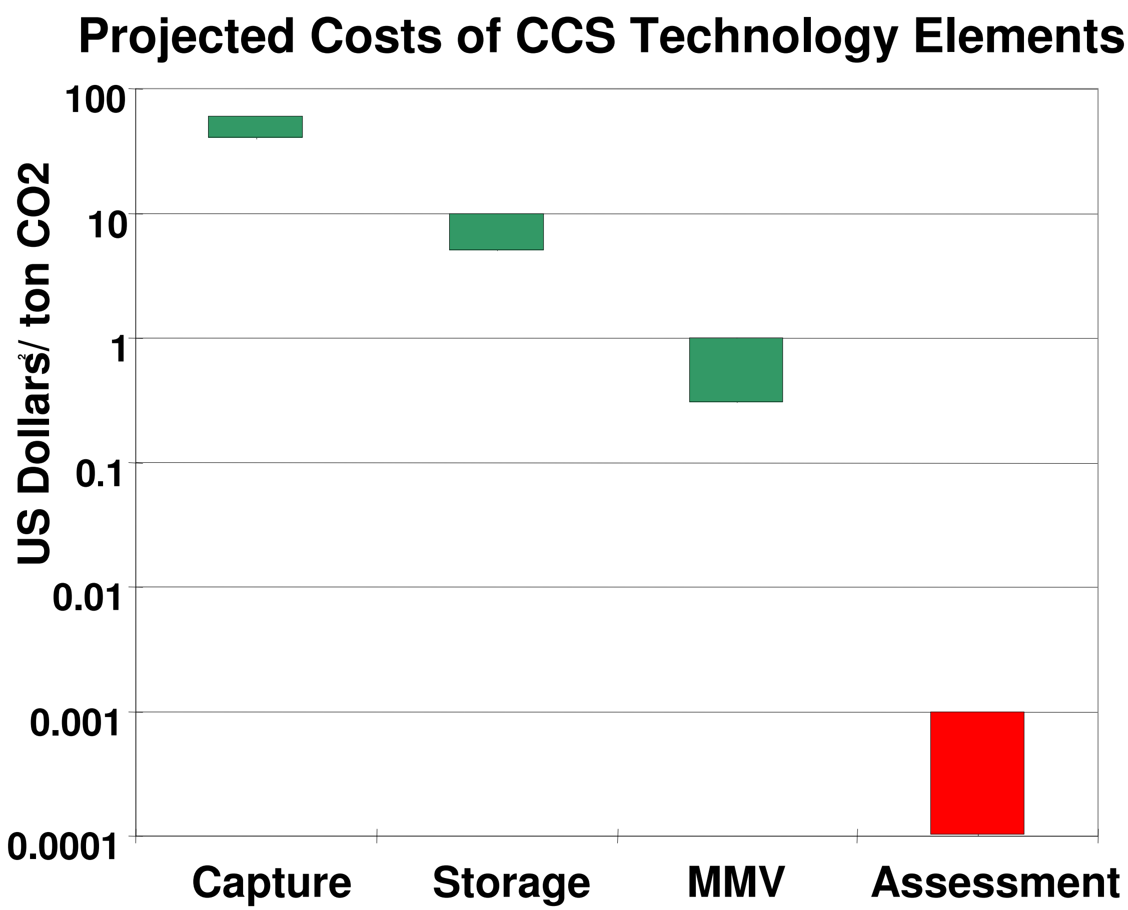
CCS Cost Components: Low-hanging Fruit

For any large injection volume, local assessment is relatively low cost and can be executed with conventional technology



Friedmann et al., in press

On a national level, assessments should proceed through geological surveys or in partnerships with the oil and gas industry

Site assessments may be paid for by the site operator, the CO_2 owner, or through bonds.

This step is vital, and should be supported fully.

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Forming public views on CCS

- Awareness of climate change and energy
- Perceived vs. actual risk
- Assemble facts to give meaning vs. “fitting” facts to existing perceptions
- Importance of successful initial projects
- Local stakeholders: NUMBY?

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CO_2 EHS

- CO_2 could: escape into atmosphere; contaminate USDW; contaminate soil
- OSHA 8-hr level: 0.5%; >10% can be lethal
- 2 risk scenarios
  - Slow, steady escape
  - Massive accidental release
- Can be stored with zero effective escape
- Local focus: safety; larger: GHG emissions

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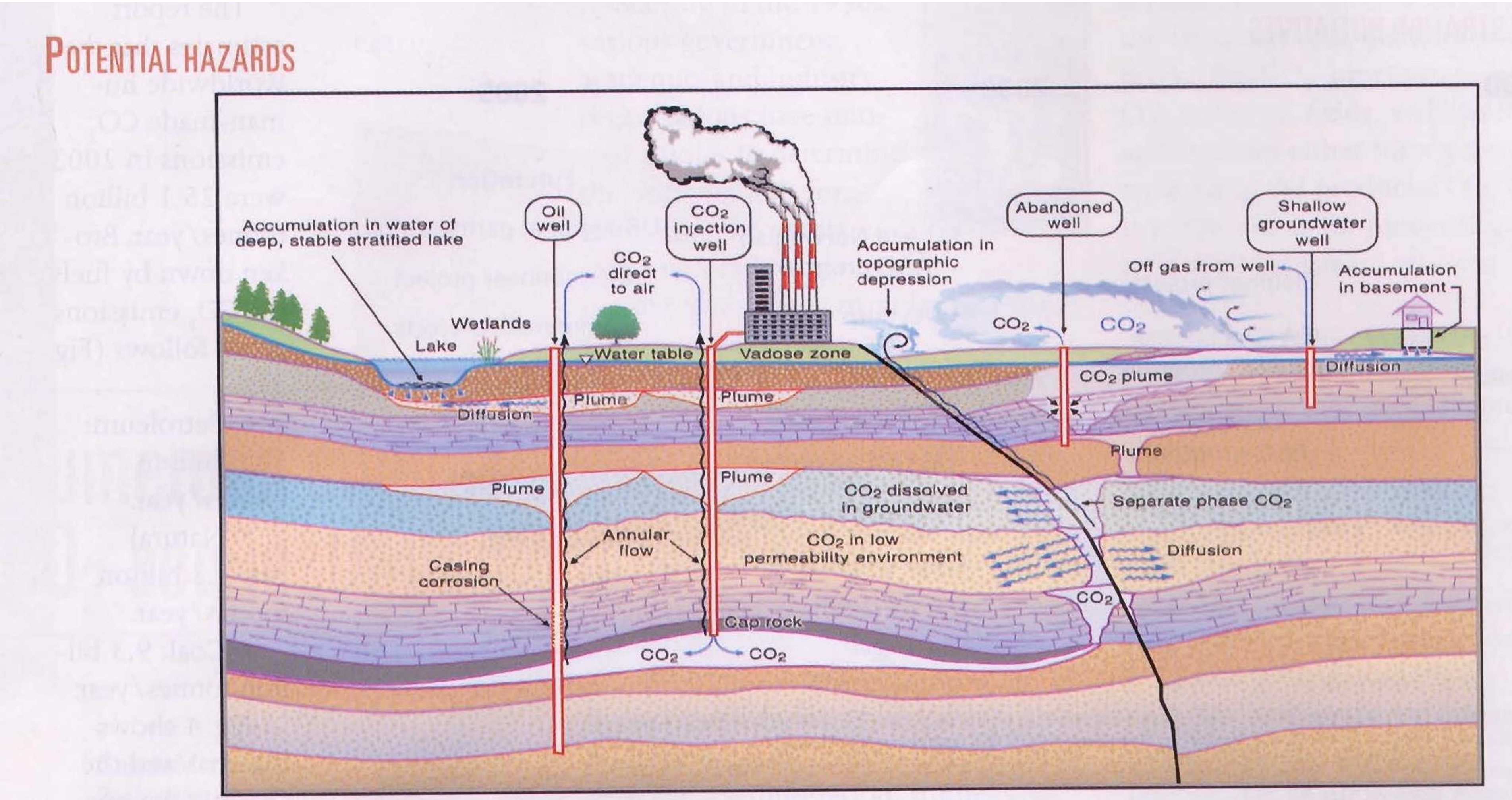
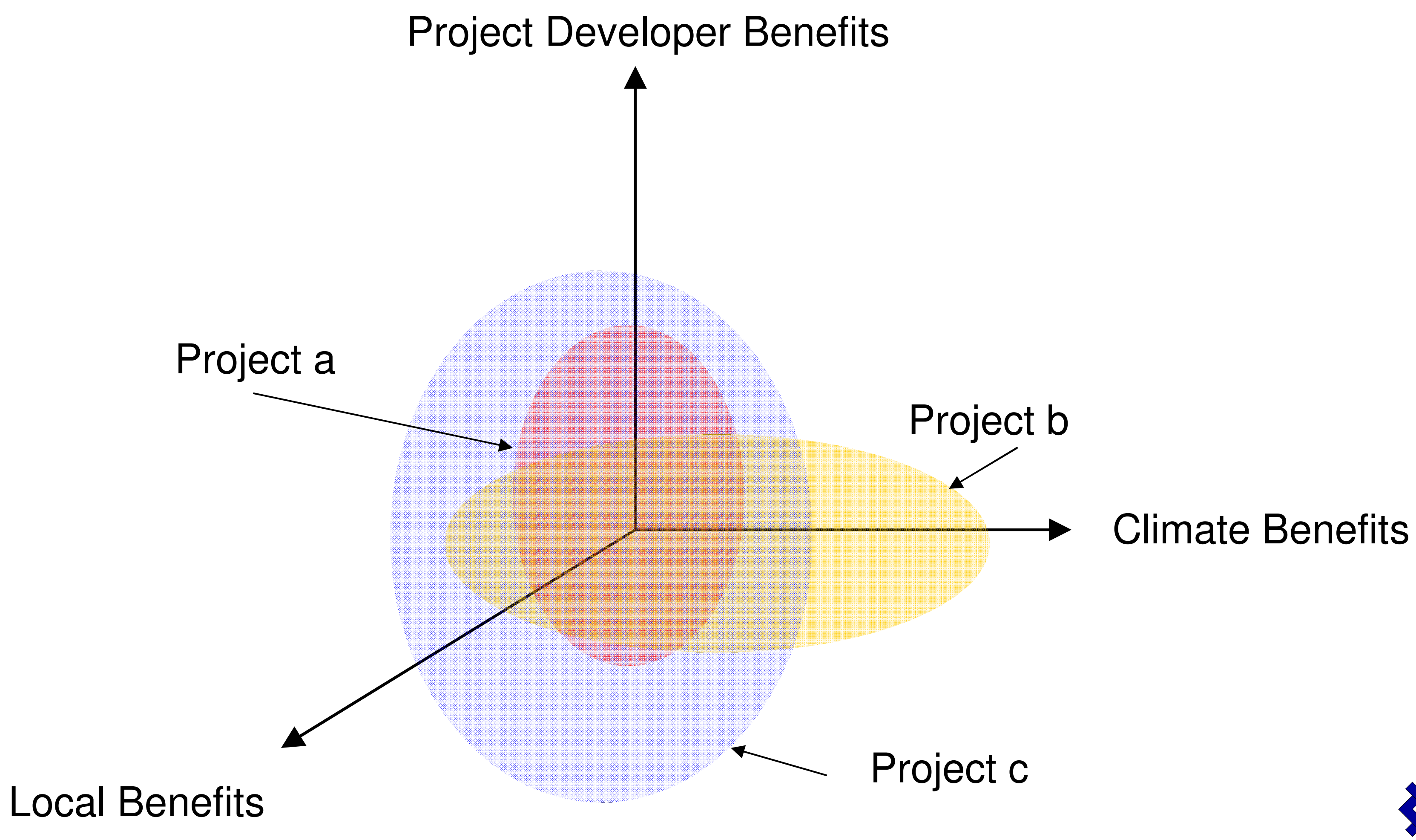
Potential CO_2 Hazard Pathways



Source: Imbus, S.W., "CCP 2003 NGD Focus: Geological Storage Assurance," CO_2 Capture Project NGD Group Meeting, Houston, Nov. 5, 2003.

Meeting CCS Thresholds



Different in Each Case, but Something for Everyone

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New WRI Project on CCS Gaps

- **Objective**: Identify key regulatory and policy gaps in CCS framework. Build consensus on addressing them through stakeholder convening process.
- Stakeholders to meet 2-3 times annually
- 2-year project
- Initial focus primarily on US, but outreach with EU and Asian partners
- Tie into pilot/demonstration projects

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Selected Stakeholders

- **Power**: AEP, Southern, Xcel
- **Oil/Gas**: BP, Schlumberger, Falcon Gas, KM CO_2
- **Financial**: JP Morgan Chase, Citigroup
- **Research**: LBNL, LLNL, PNNL, NETL, MIT, Princeton, Battelle
- **Federal**: U.S. DOE, U.S. EPA, NCEP
- **State**: Ohio PUC, Texas Bureau of Economic Geography, WGA, NRRI, IOGCC, GWPC
- **NGOs**: NRDC, Environmental Defense, CATF
- **Legal**: Alston and Bird, LLC.

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Anticipated Outcomes

- Adaptable guidelines focusing on siting, monitoring, liability and accounting
- Test guidelines in field demonstrations to verify
- Development (and support) of state and regional initiatives
- Initial domestic focus, but international outreach component

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Conclusions

- Policy driver essential
- Public acceptability crucial
- Rapid deployment of large-scale field experiments
- Nation-wide assessment of storage sites

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