# Regulatory and Legal for Issues for CCS

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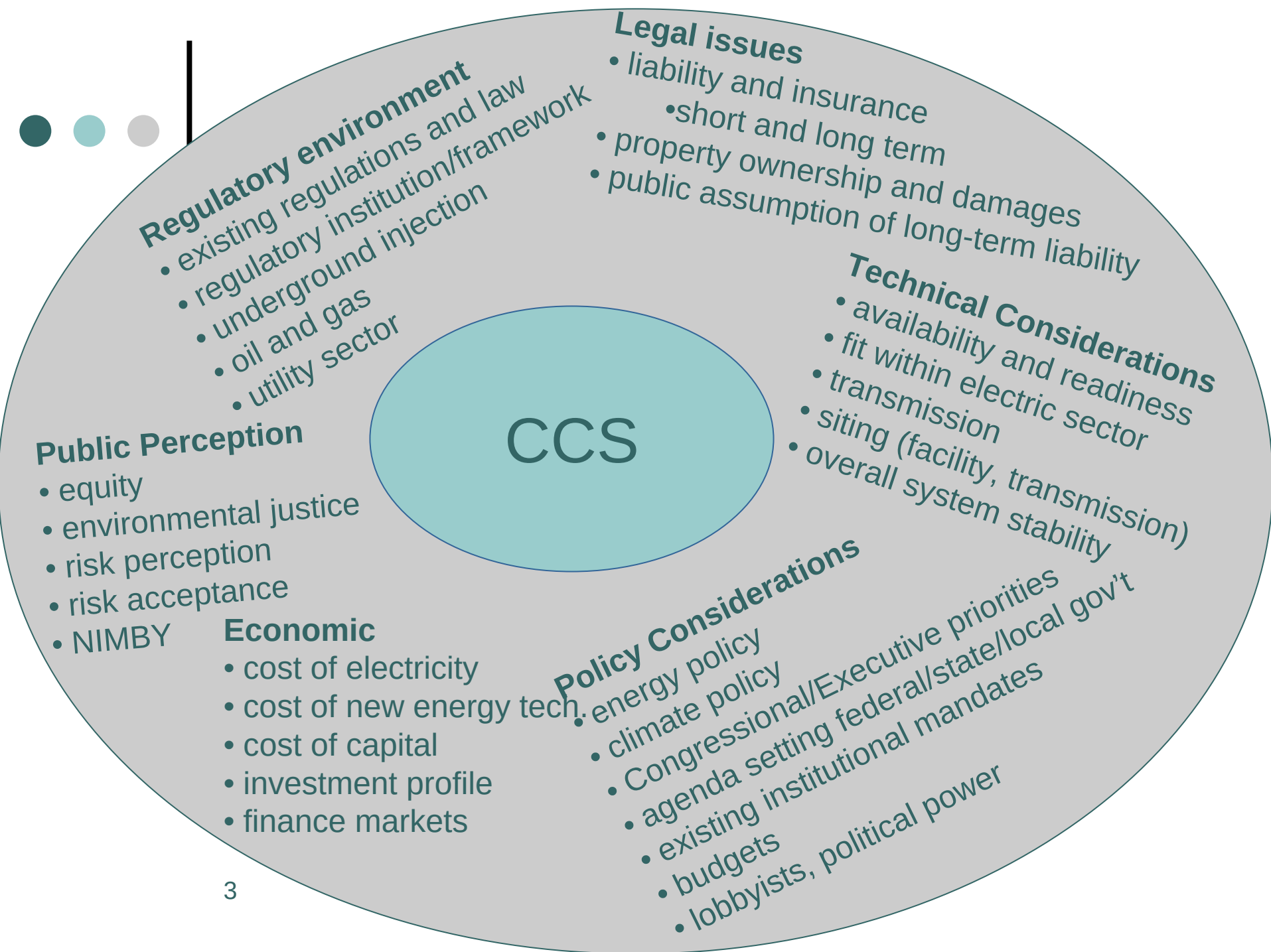
# Dialogue on technology embedded

- Main points for this talk:
  - CCS will be deployed within a complex regulatory, legal, and political world
  - Technologies have stumbled on deployment: GMO's, nuclear energy, stem cell research, biotechnology
  - Legal and regulatory systems must clarify property issues, liability, and long-term care
  - Establishing a regulatory and legal system for CCS
    - Structural and incentive issues
    - Adaptive management


Regulatory environment
• existing regulations and law
• regulatory institution/framework
• underground injection
• oil and gas
• utility sector
Legal issues
• liability and insurance
•short and long term
• property ownership and damages
• public assumption of long-term liability
Technical Considerations
• availability and readiness
• fit within electric sector
• transmission
• siting (facility, transmission)
• overall system stability
CCS
Public Perception
• equity
• environmental justice
• risk perception
• risk acceptance
• NIMBY
Economic
• cost of electricity
• cost of new energy tech.
• cost of capital
• investment profile
• finance markets
Policy Considerations
• energy policy
• climate policy
• Congressional/Executive priorities
• agenda setting federal/state/local gov't
• existing institutional mandates
• budgets
• lobbyists, political power

# Today

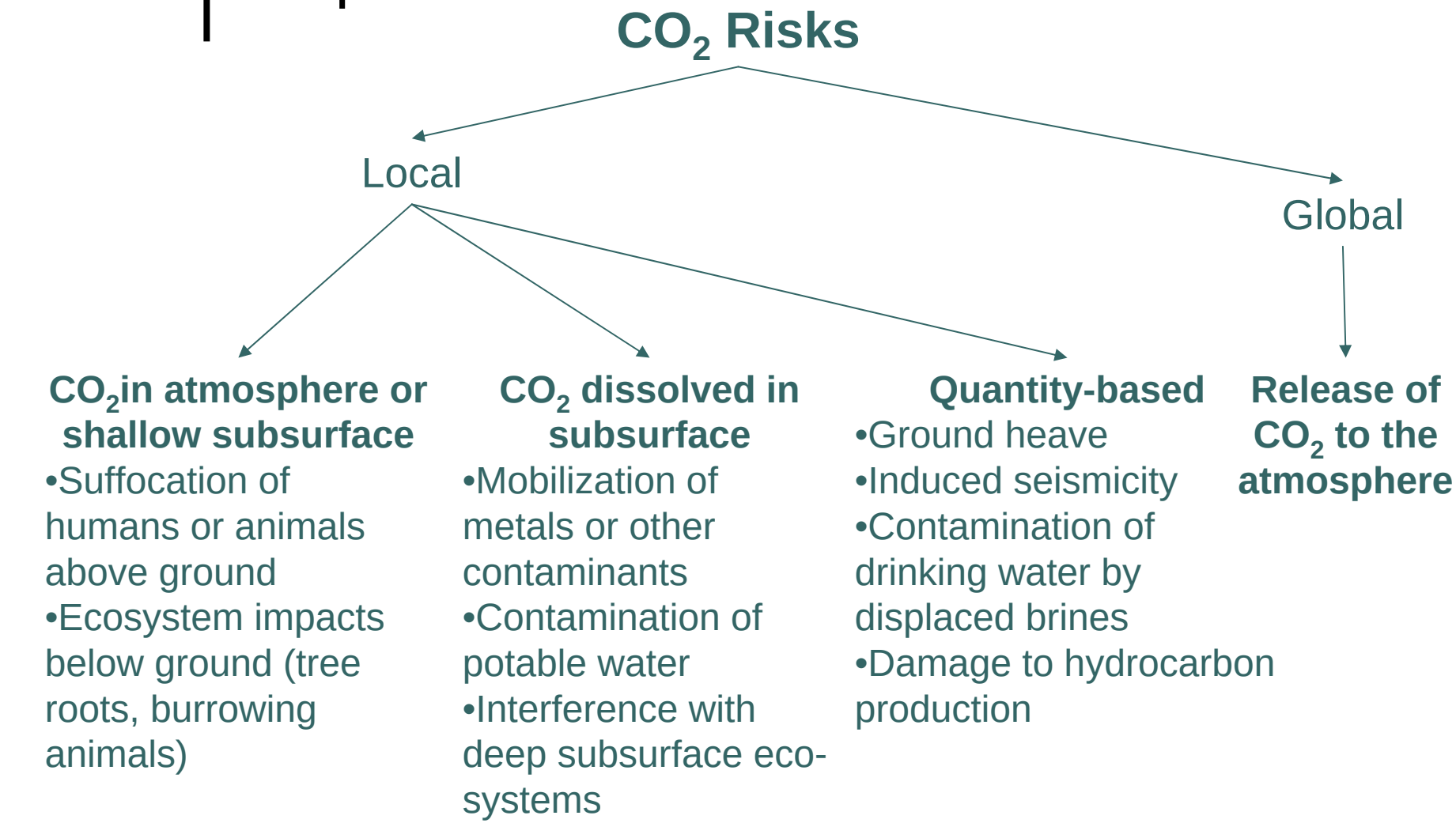
- Needs of CCS
- Existing regulatory framework
- Legal considerations
- Path for technology deployment
- Adaptive management regime

# CCS: Large volumes, buoyant fluid, long time (~1000 years)

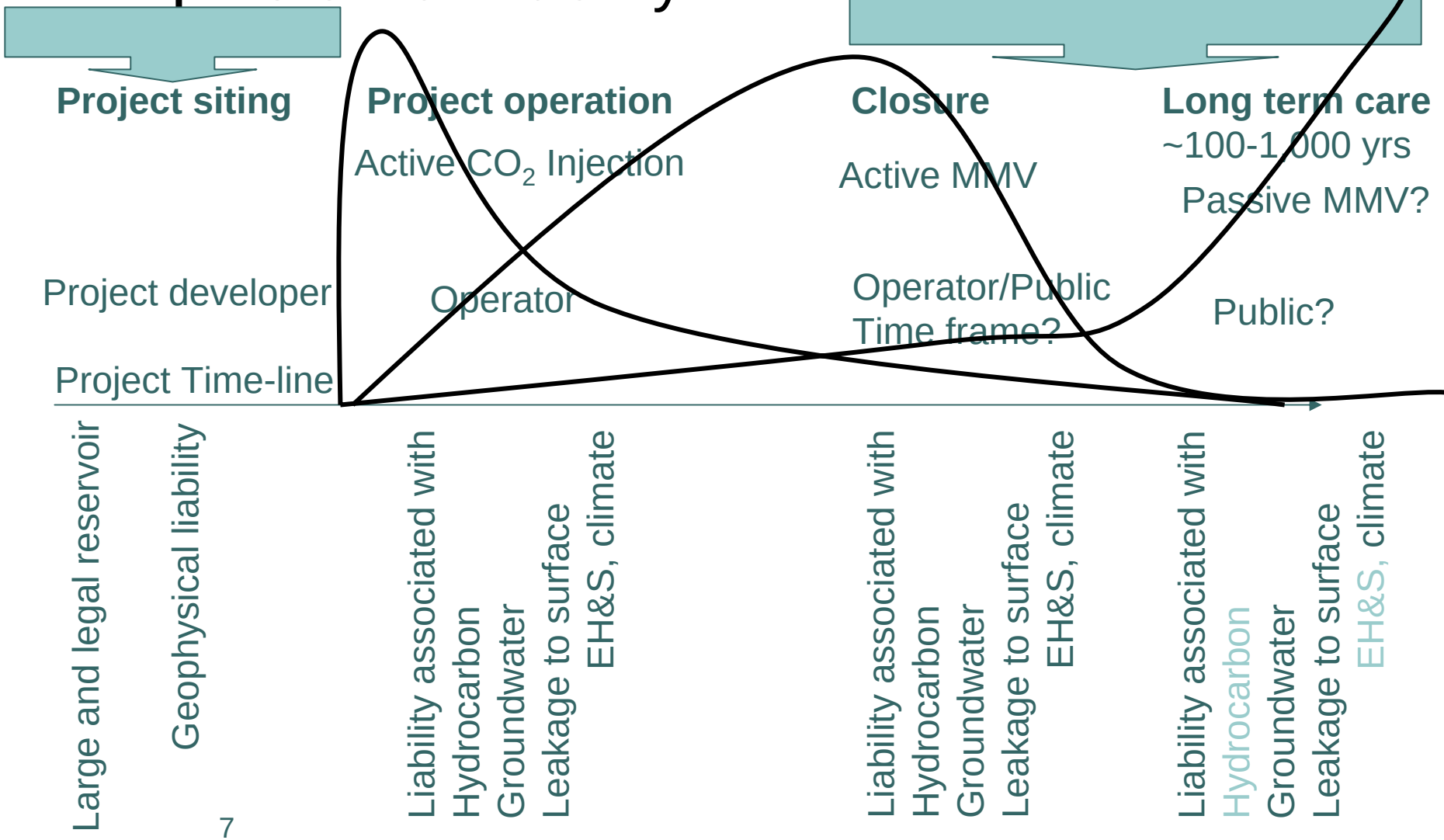
- Estimate: 1GW coal-fired power plant injecting into 100m thick reservoir, areal pool of $CO_2$ ~40$mi^2$
- Years of practical experience with enhanced oil recovery

- Regulation
  - Environmental, health and safety (EH&S)—Local
  - Climate—fungible credits
- Legal considerations
  - Property rights
    - Surface
    - Subsurface
      - Mineral (hydrocarbon)
      - Water
- Financial interests, Insurance interests
- Public interest

# Potential hazards from geologic sequestration



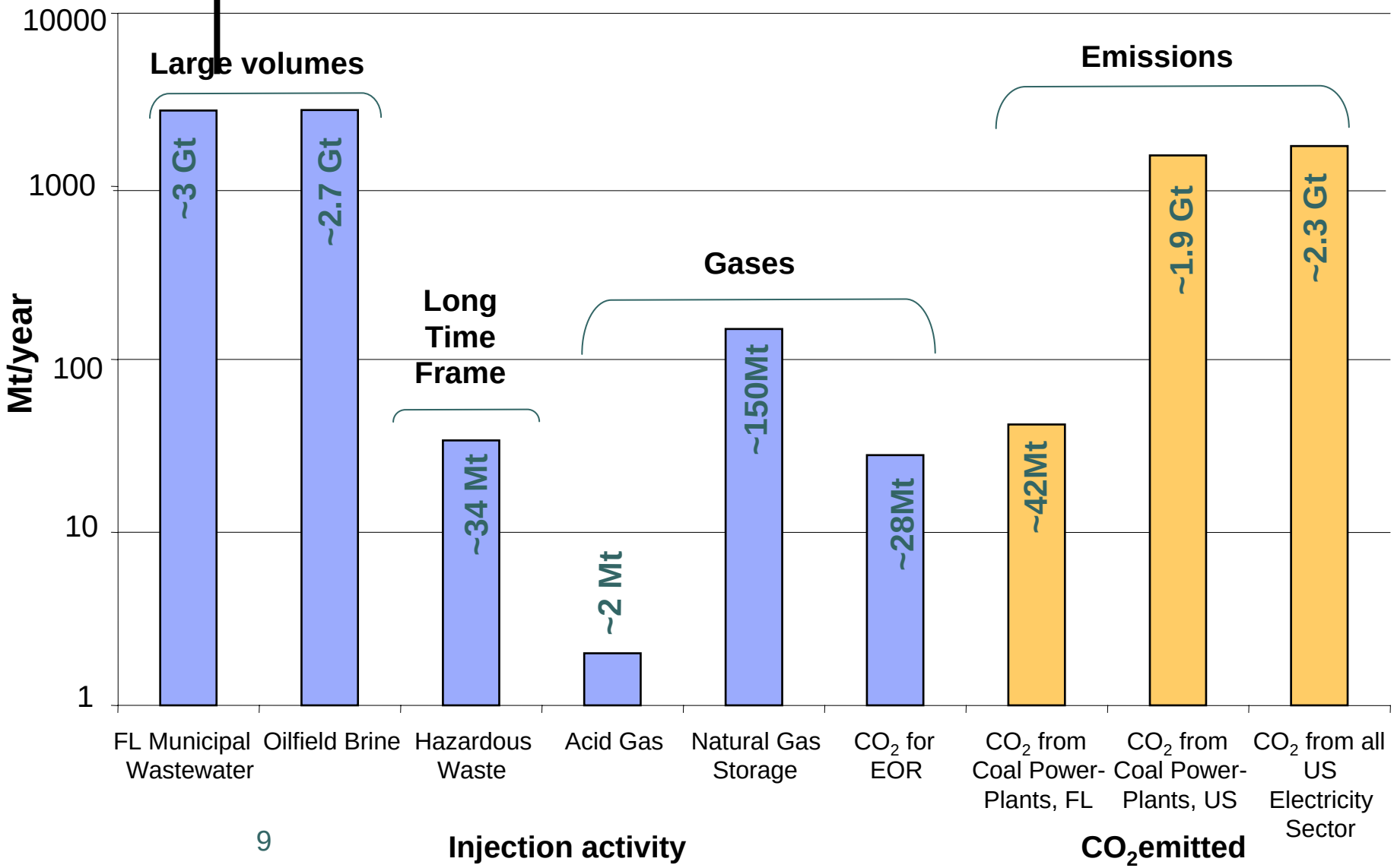
# CCS Project Life Cycle, Regulation and Potential Liability



# History of regulation for underground injection

- Produced waters from oil production first injected as environmental benefit
- States regulated first, but patchy with some problems
- No federal jurisdiction to regulate under the Clean Water Act
- Authority granted under 1974 Safe Drinking Water Act
- Underground Injection Control regulations promulgated in 1990
- Today program run by U.S. EPA and states
  - Five well classes with different levels of control and responsibility
  - Classes I, II and V (experimental) most relevant
- GOAL: To ensure protection of Underground Sources of Drinking Water (USDW)

# Injection activity, compared with $CO_2$ emissions ( Mt/year)






Sources: Wilson, Johnson, and Keith, 2003

# What regulatory system does NOT currently cover

- Siting
  - Reliance on publicly available data and well specific data, no seismic required
  - No local or regional modeling (only for hazardous waste)
- Operation: Generally OK
  - No verification of modeling with operational data
  - No leakage to the surface allowed
- Closure
  - Bond for proper plugging and abandonment
  - No post-closure M&V in federal regulations (Florida yes)
  - No storage time requirement (except hazardous waste)
- Long-term care
  - None
- Current EPA approach to permit pilot projects as Class V experimental on a case-by-case basis

# Legal Considerations: FutureGen RFP

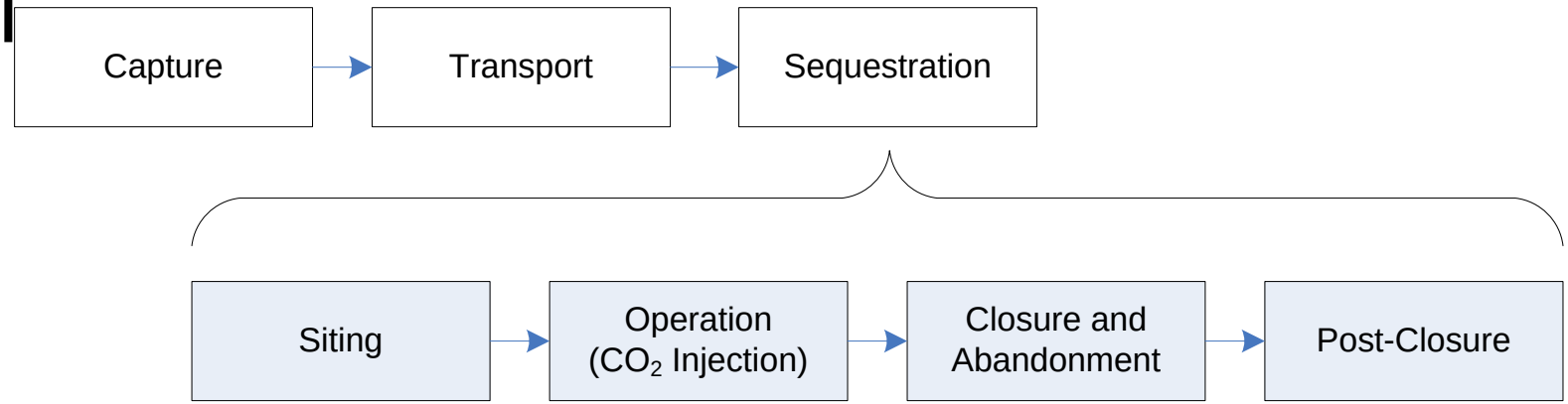
**$CO_2$ Title and Indemnification**

The offeror should discuss the extent to which it can or is willing ***to take title to the injected $CO_2$ and/or indemnify or otherwise protect the FutureGen Industrial Alliance and its members from any potential liability associated with the $CO_2$.*** Offerors may discuss other alternatives such as a state-law mandated cap on liability, use of a state-instituted insurance program, or use of a state-mediated bonding program similar to that used for the installation of an underground gas storage field or well storage subject to the UIC program or mine reclamation.

FutureGen RFP (emphasis added)

# Legal considerations

- Liability closely linked with pre-existing property rights and damages
- Establishing large and legal sequestration site
  - Unitization—oil and gas production
  - Eminent domain—natural gas storage
- Long-term care
  - Long storage times and short lifetime of private firms = Public assumption of liability at some date
- Climate liability from leakage
- Will vary across state and national jurisdictions for property, hydrocarbons and water




| | | | | |
|---|---|---|---|---|
| Issue | Large/legal reservoirs; geophysical trespass | Leakage to surface; groundwater, minerals; seismicity; trespass | Leakage to surface; groundwater, minerals; seismicity; trespass | Leakage to surface; groundwater, minerals; seismicity; trespass |
| Who sets the rules? | Legislature; courts | EPA/UIC; OSHA; state regulator | EPA/UIC; state regulator | Legislature/Congress; EPA; courts |
| Potential tortfeasors? | Developer | Operator | Operator | Operator; long-term responsible entity |
| Potential victims? | Surface, mineral owners | Surface, mineral, groundwater owners; workers | Surface, mineral owners | Surface, mineral owners; public; env't |



Wilson and de Figuriedo, 2007

# Easy, basic bounding research questions for reducing uncertainty affecting regulatory and liability concerns

- Distance $CO_2$ pool (pressure influence) can spread
- $CO_2$ affect on drinking water
  - In different formations
  - Directly and indirectly
  - Mobilizing other metals or organic constituents
  - Within old plumbing systems (?)
  - COMPROMISE DRINKING WATER STANDARDS
  - Change WATER TASTE
- Amount of $CO_2$ that can leak to the surface
  - From abandoned wells
  - From range of faulting zones
  - Amount allowed under EH&S and climate regime
- How to remediate leakage
  - Into groundwater
  - To surface

# Early Deployment Now

- Limited number of large early projects now under existing regulations to learn
  - Capture reliability
  - Geologic site performance
  - Adequacy of models to predict reservoir performance at scale
  - MMV methodology, detection limits
  - Long-term liability
  - Industrial organization

# Transition to Commercial Deployment

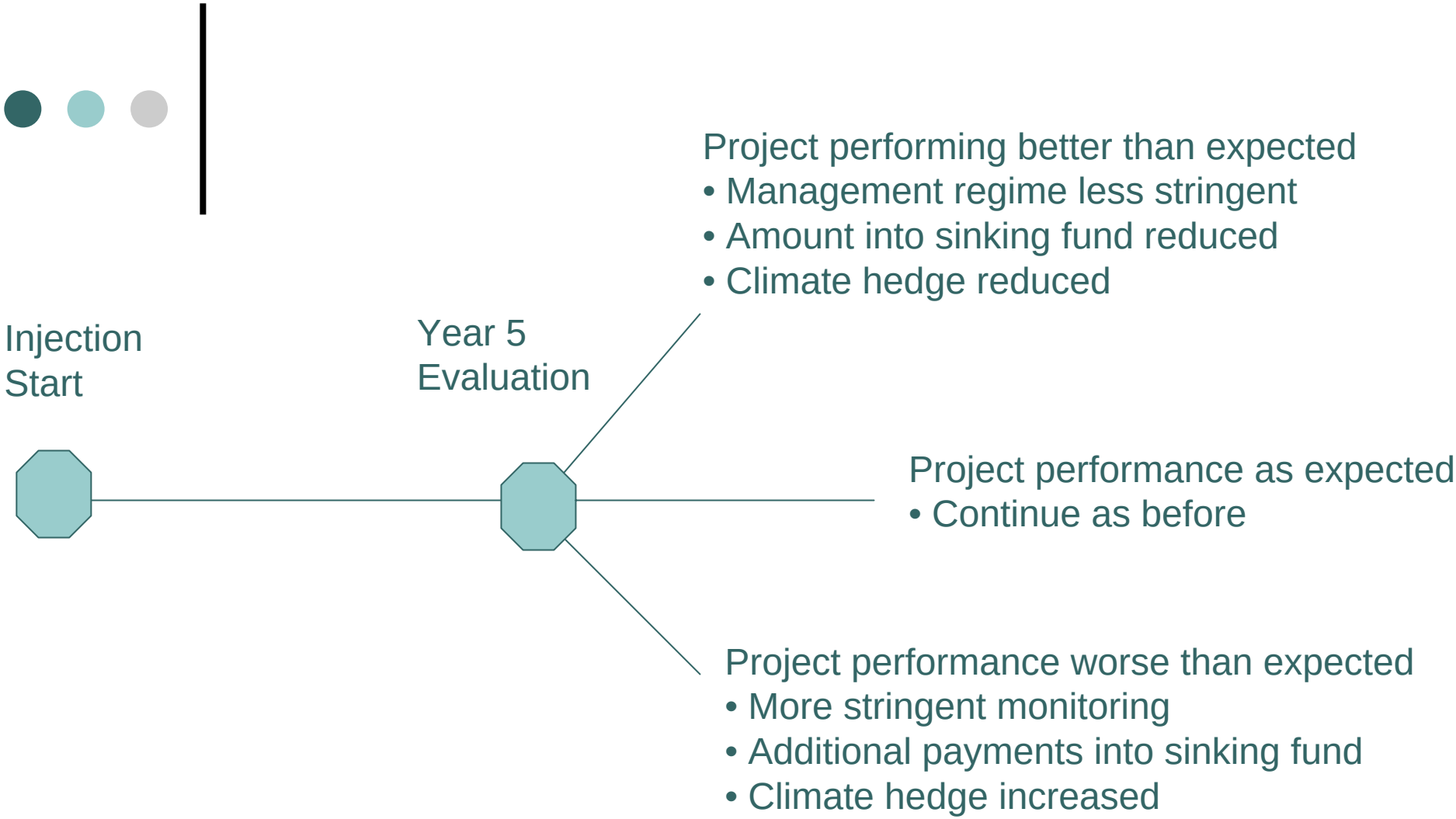
- Boutique regulations are fine for first projects, but more stability and predictability is needed for
  - Operators, financial interests, insurance, regulators, and public
- Regulations must provide predictability, accountability, and be adaptable
- Formal two-stage process, with incorporation of information into regulatory regime

# Adaptive Management of Commercial CCS

- Goal:
  - Clear expectations for all parties
  - Incorporate emerging site information and evolving risk management strategy
- Challenge:
  - Develop a regulatory framework that is both predictable, yet able to incorporate new information

# Adaptive management for long-term care

- Operational period with regular, scheduled ‘true up’ performance reviews
  - Performance-based decision nodes would govern management for next period
  - Operator has control as to how to manage project
  - Regulatory procedures established beforehand
  - Financial community able to judge risk and performance
  - Public assurance that project is being actively managed
- At point of transfer to public, high level of confidence in site performance and funds for long-term care established (no unfunded public mandate…)


Project performing better than expected
• Management regime less stringent
• Amount into sinking fund reduced
• Climate hedge reduced
Injection Start
Year 5 Evaluation
Project performance as expected
• Continue as before
Project performance worse than expected
• More stringent monitoring
• Additional payments into sinking fund
• Climate hedge increased

# Adaptive management, long-term care and climate hedging

- Example:
  - Operator: Payment into a fund that covers both site closure and long-term care
  - Initial amount is set by site risk profile and past performance
  - Periodic ‘true up’ would raise or lower payments into fund and be based upon operational data and site performance
- Advantages
  - Predictable, manageable by operator and financial community
  - “Moral hazard” of bonding avoided
  - Good site selection and responsible management encouraged

# Public Trust, Public Acceptance, Public Confidence

- Asymmetric information
  - Public access to information
  - Long-term data storage
  - Transparency
  - High levels of performance…leakage and public performance
- Regulation and trust in regulator key
  - Risk contagion

# Public Assumption of Responsibility (and public perception risk…)

- FEAR: Requiring public assumption of liability too early may undermine public confidence
  - General sentiment: “if it is as safe as you say, why do you want the government to take responsibility?”

# Issues not covered here…

- EOR→CCS projects
- Injection of impure streams and different risk profiles
  - $CO_2$+$H_2S$
- Mechanisms to encourage local communities to accept CCS (soft path v. hard path)
- Implication of different financial mechanisms for long-term care
- Institutional capacity (between jurisdictions)
- Specific roles for federal and state government
- Special considerations for developing countries—UNFCCC CDM

# Conclusion (1)

- Data from full-scale operations necessary to demonstrate CCS performance to public, insurance and financial industries and regulators
- Adaptive management approach necessary for making modeling fiction match field truth
  - managing geologic uncertainties and ensuring information available for long-term care
- Industrial organization will shape regulatory needs

# Conclusion (2)

- Precedent exists for resolution of regulatory and legal issues
- Link to public perception, financial and insurance considerations
- Balance of different interests and needs
  - Producer of $CO_2$, operator of injection site, regulators, financial and insurance community, local public, global public

# Fin

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# Leakage in subsurface

- Potential to harm hydrocarbon resources
  - Regulations governing injection practice to protect resources
  - Liability in some states from inadvertent harm from EOR, not in other states
- Potential to harm groundwater resources
  - Liability established, dependent upon jurisdiction
  - Directly (metals mobilization, organics mobilization)
  - Indirectly (displacement)**
- Induced siesmicity** (depends upon type of stress regime in formation)
  - Prescriptive management through limits in injection pressure

** could be difficult to prove causality in court

# Seepage to surface

- Through wells
  - Regulations governing abandonment and plugging
  - Liability regimes based upon damages
  - Need to understand bounds of leakage
    - 100 t/day at Crystal Geyser
    - 11,000 t/day at Sheep Mountain
  - Abandoned wells
    - One field analysis found ~20% of wells not marked upon map or not correctly locate
  - We have the technology to remediate
    - Question of cement longevity
- From faults
  - Natural analogs abound
  - Technologies for health risk mitigation

# To the surface

Hutchinson Daily News, 2001

# State actions….

| Proposal | Summary |
|---|---|
| Texas **House Bill 149 (May 15, 2006)** | **Texas Railroad Commission "shall acquire title to $CO_2$ captured" by a FutureGen project** |
| U.S. House of Representatives **[Failed] Costello (IL) Amendment to HR 5656 (June 27, 2006)** | **U.S. Department of Energy indemnifies FutureGen consortium and companies for "any legal liability arising out of, or resulting from, the storage, or unintentional release, of sequestered emissions," up to $500 million per incident** |
| Illinois **House Bill 5825/Senate Bill 3190 (proposed 2005-6, referred to Rules Committee)** | **This bill proposes to create the Clean-Coal Project Indemnification Act which would require the Attorney General to indemnify FutureGen in civil proceedings from damage caused by "the escape or migration of injected carbon dioxide."** |

**Also: CA AB 1925 CCS study, AB 705, proposed MT legislation**