Legal and Regulatory Considerations in Commercialization and Use of Underground Pore Spaces for Energy Decarbonization

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OUTLINE

I. Legal and Regulatory Considerations in Commercialization and Use of Underground Pore Spaces for Energy Decarbonization

II. Why consider CO2 Storage Spaces and Utilization Issues

III. Underlying principles for permitting and access to underground storage spaces

- *North Dakota*
- *Canada, Alberta*
- *Norway*

IV. Conclusion – the role of law and regulation

The Decarbonisation and the Energy Industry (2020)

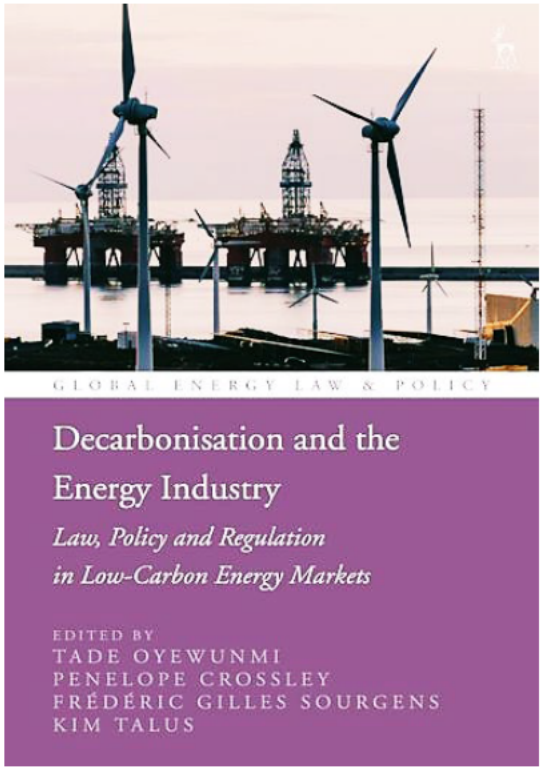
Exploring the role of law and regulation as economies traditionally reliant and rich in hydrocarbons seek to decarbonize and evolve towards a net-zero low-carbon economy.

The book explores this topic by considering the applicable energy law and policy frameworks in both:

1. highly industrialized and major economies such as the US, EU, China, and Australia;
2. resource-rich developing countries such as Nigeria and regions like Southern Africa.

Comprising of 16 chapters-

- Chapter 2 examined the US Gas Supply Boom under Carbon Constraints
- Chapter 3 regulatory issues in decarbonizing gas and electricity systems, including technology-based approaches such as power-to-X, hydrogen, CCUS etc.



Why consider CO2 Storage Spaces and Utilization Issues

- According to the International Energy Agency (EIA) and other relevant institutions-

  ✓Limiting the availability of CO2 storage technologies would increase the cost of the energy transition.

  ✓The emissions reduction pathway of the Clean Technology Scenario (CTS) assumes that CO2 storage is widely available to meet globally-agreed climate goals.

    ❖It requires an additional investment of USD 9.7 trillion in the power, industrial and fuel transformation sectors, relative to a scenario that includes only current national commitments.

  ✓Limiting access to CO2 storage results in an increase of these additional investments by 40%, to USD 13.7 trillion, relying on more expensive and nascent technologies

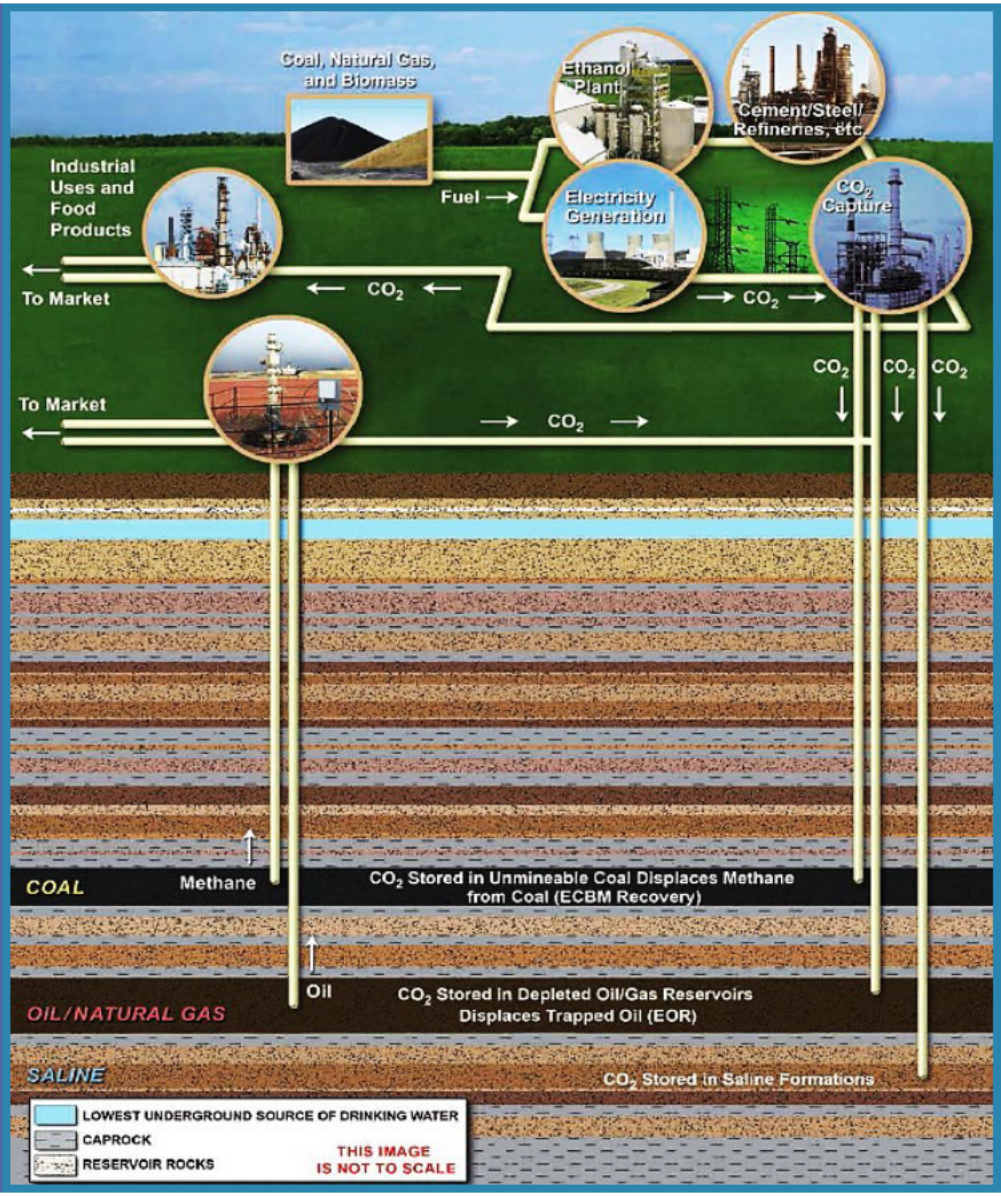
IPCC, AR6 Synthesis Report Summary for Policymakers- 19 March 2023

"… CCS is an option to reduce emissions from large-scale fossil-based energy and industry sources provided geological storage is available. When CO2 is captured directly from the atmosphere (DACCS), or from biomass (BECCS), CCS provides the storage component of these CDR methods.

CO2 capture and subsurface injection is a mature technology for gas processing and enhanced oil recovery. In contrast to the oil and gas sector, CCS is less mature in the power sector, as well as in cement and chemicals production, where it is a critical mitigation option.

The technical geological storage capacity is estimated to be on the order of 1000 GtCO2, which is more than the CO2 storage requirements through 2100 to limit global warming to 1.5°C, although the regional availability of geological storage could be a limiting factor.

If the geological storage site is appropriately selected and managed, it is estimated that the CO2 can be permanently isolated from the atmosphere…"



Options for an Integrated CCS Process : Capture, Injection and Utilization

Source: U.S. Department of Energy, Office of Fossil Energy, "Carbon Utilization and Storage Atlas," Fourth Edition, 2012, p. 4.

Notes: EOR is enhanced oil recovery;

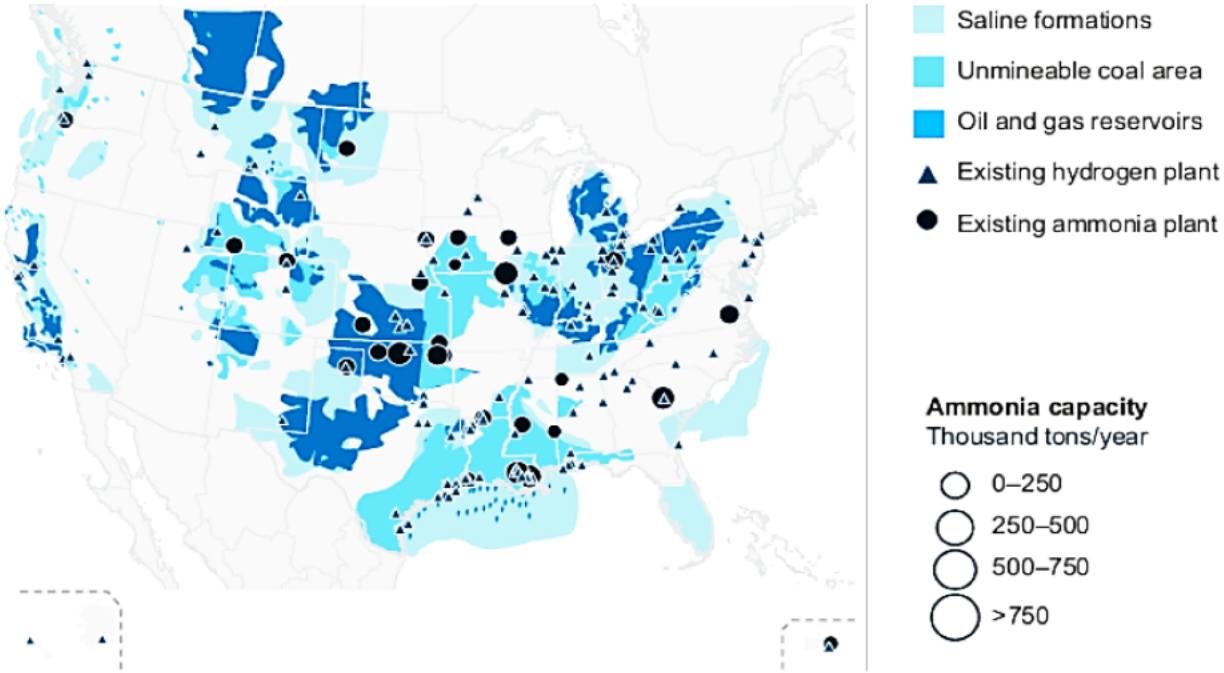
ECBM is enhanced coal bed methane recovery.

Caprock refers to a relatively impermeable formation.

CCUS – Substantial US Potential

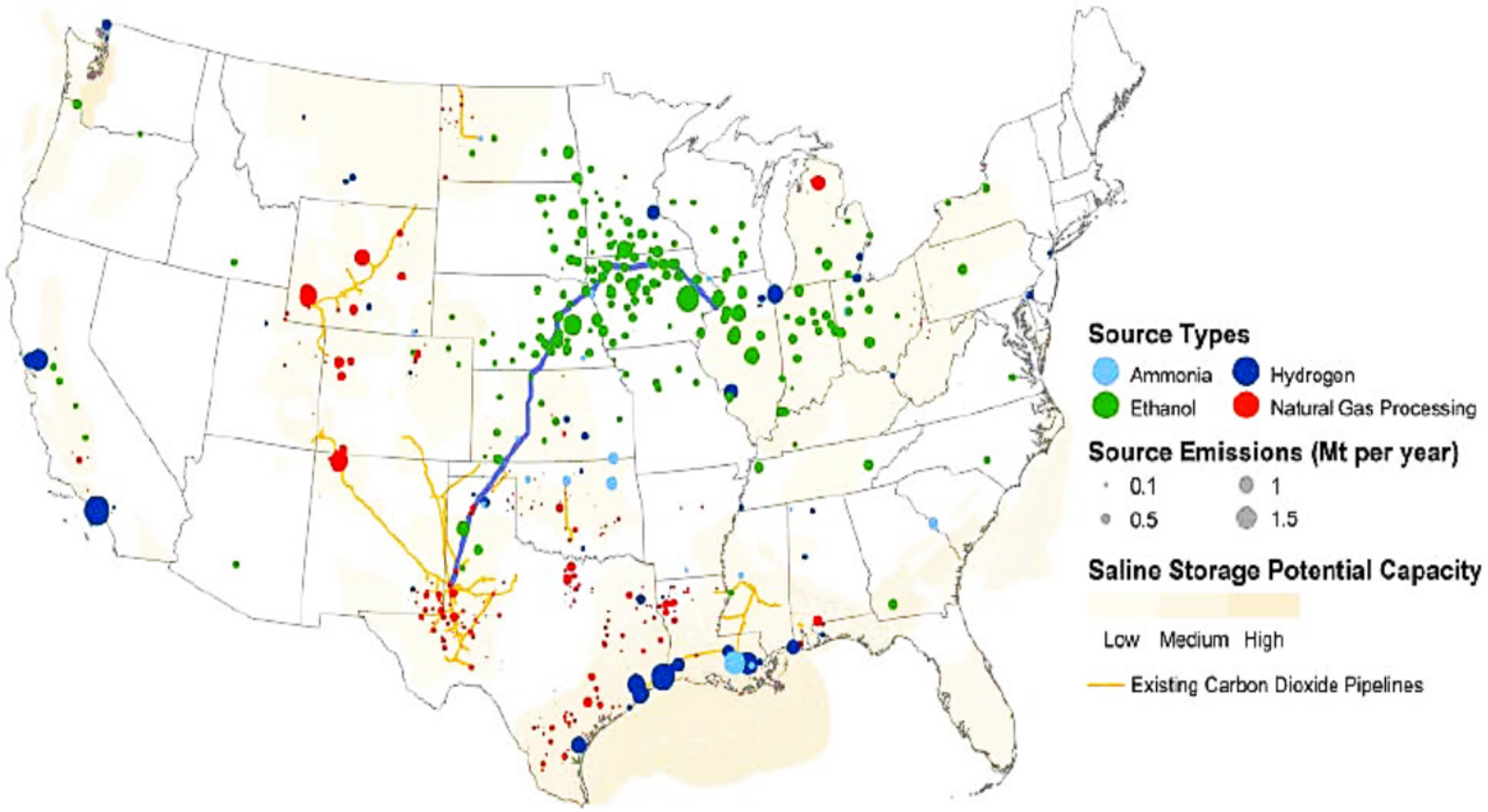
- According to DOE, the US has enough underground geological sites to store **2.6 trillion tons** of carbon dioxide.

CCS locations in the US

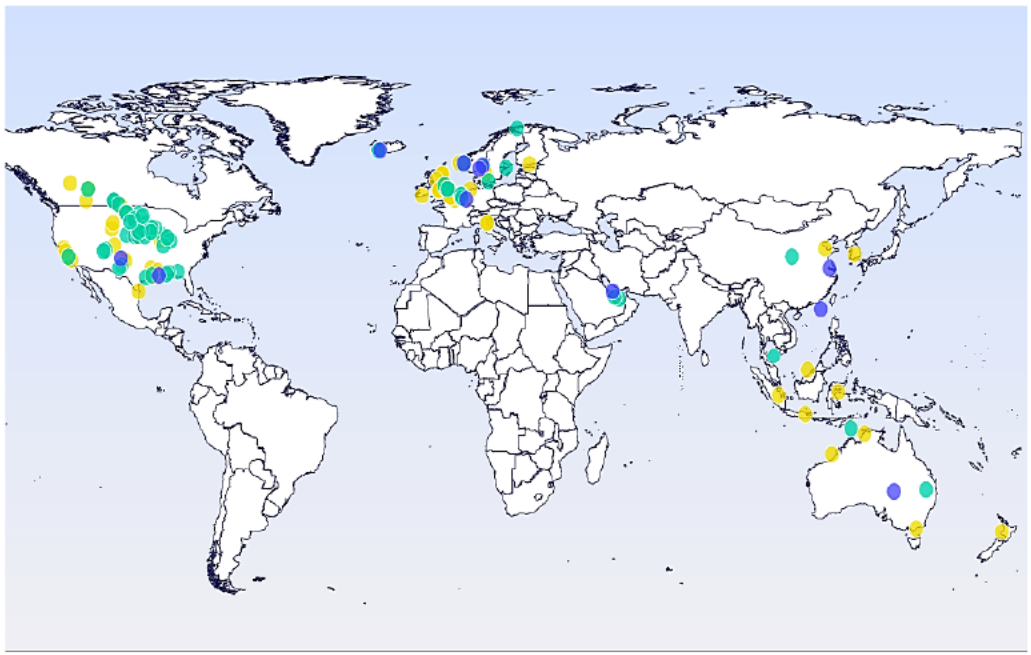


Source: *FCHEA, Roadmap to a US Hydrogen Economy (2020) (citing Gary. F Teletzke)*

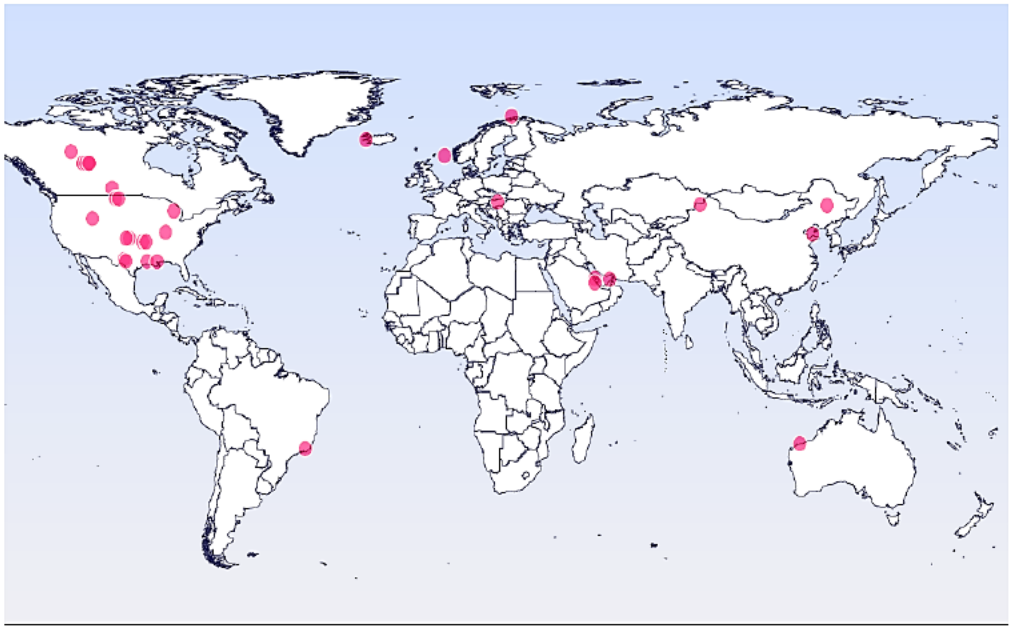
CO2 Pipeline Infrastructure in the US as at 2021



GLOBAL CCS FACILITIES AT VARIOUS STAGES OF DEVELOPMENT
Source: Global CCS Institute Status Report,



● EARLY DEVELOPMENT ● ADVANCED DEVELOPMENT ● IN CONSTRUCTION



● OPERATIONAL

What are the key issues and drivers for commercialization…

- **The US Context-**
  - Fiscal incentives provided under the US Section 45Q framework, more recently the Infrastructure Investment and Jobs Act and Inflation Reduction Act (IRA) of 2022.
  - State-driven climate and decarbonization goals
- **Highlights from International scenarios**
  - ✓Firm policy, state, and private sector backing – experiences in Alberta, Canada
    - ✓Alberta Carbon Trunk Line Project
  - ✓EU's Innovation fund for CCS, and the EU Emissions Trading Scheme (EU ETS) in Europe
  - ✓Proposed EU Regulation - Net Zero Industry Act 2023
  - ✓The transportation of CO2 across international maritime boundaries
  - ✓Introduction of Carbon Tax in Norway –
    - ❖Capturing CO2 from natural gas production Sleipner and Snøhvit field
    - ❖the Longship project
    - ❖The Klemetsrud Waste-to-Energy CCS project in Norway

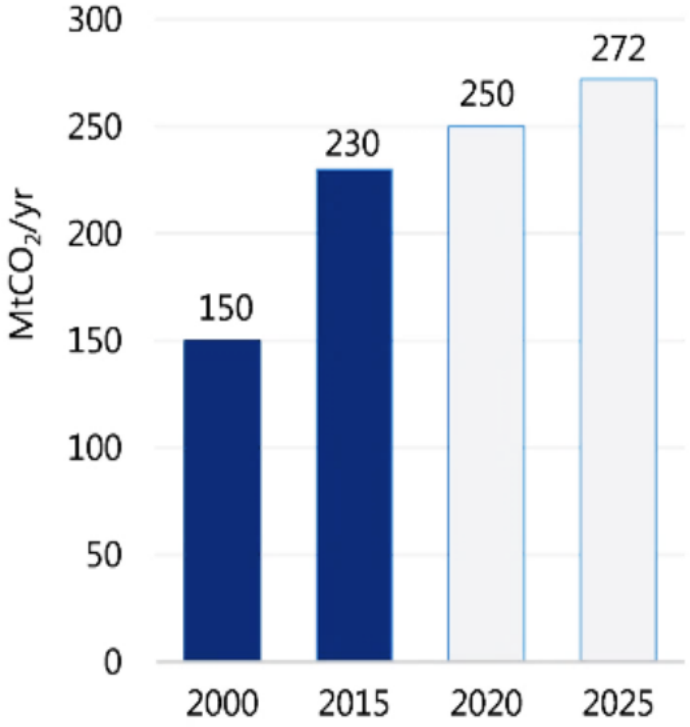
The US IRA and Section 45Q Credit Provisions

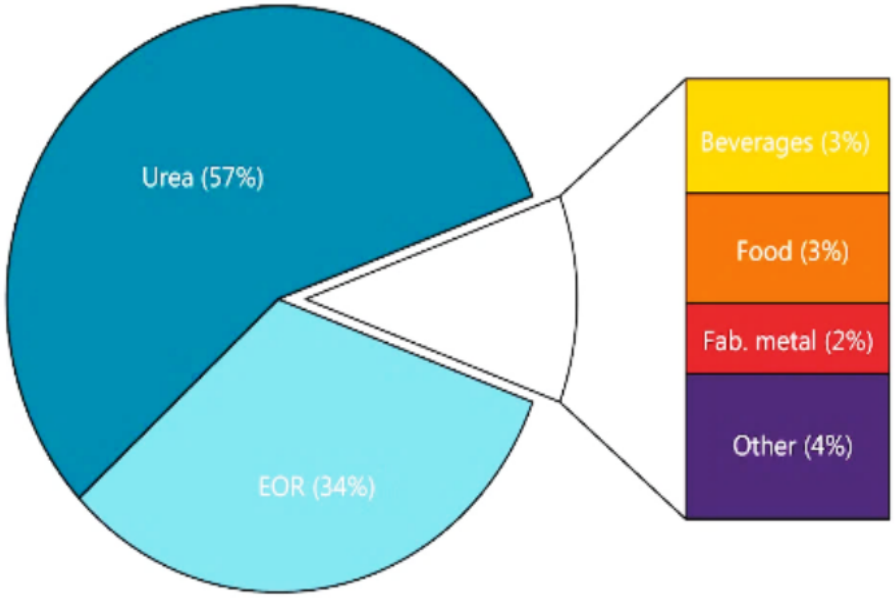
	Pre-Inflation Reduction Act Section 45Q - $/ton CO_2					Inflation Reduction Act (Rates for 2023 & on)
	2022	2023	2024	2025	2026 & on	
Permanent Sequestration	$37.85	$40.89	$43.92	$46.96	$50	$85
EOR or other utilization	$25.15	$27.61	$30.07	$32.54	$35	$60

Other Key Features:

- Added prevailing wage/apprenticeship requirements
- Must begin construction of capture facilities before 2033
- Reduced minimum annual capture thresholds for qualified facility status
- Direct pay
- For qualified direct air capture facilities, credit increased to $130 for EOR or allowed uses and $180 for geologic sequestration

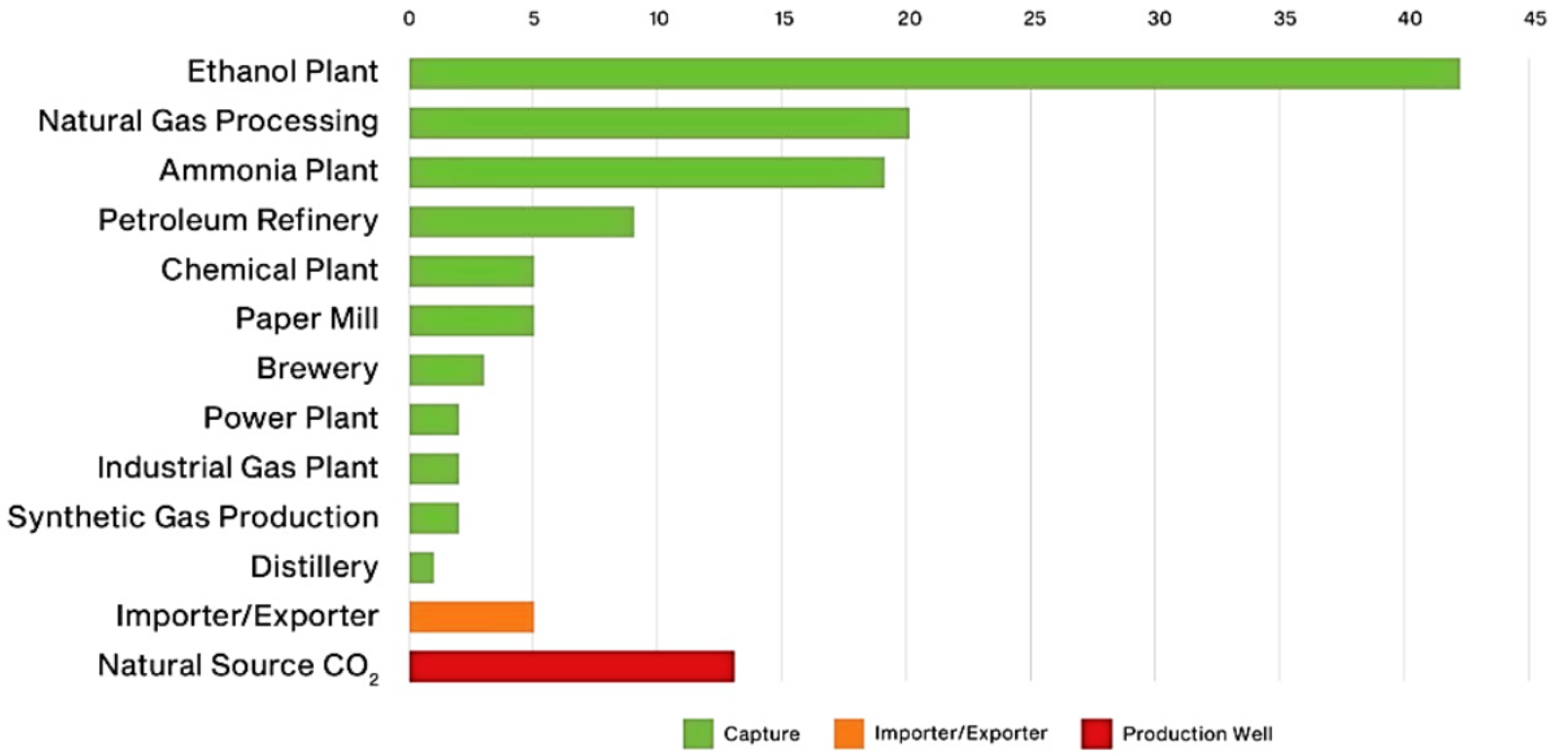
Growth in global demand for CO2 over the years (left)
Breakdown of demand in 2015 (right)





Note: Projections for future global CO2 demand are based on an average year-on-year growth rate of 1.7%. Sources: Analysis based on ETC (2018); IHS Markit (2018); US EPA (2018).

FACILITIES THAT CAPTURE AND SUPPLY CO_2



Data Source: 2021 Greenhouse Gas Reporting Program (As of 8/12/2022)

EPA United States Environmental Protection Agency

Potential Parties and Transactional Issues

Landowners, ranchers, and farmers close to CO2-emitting facilities

Pipeline Co -responsible for securing easements, pipes, and permits for lines, and subsequent operations

Landman/Attorney - Secures the ranch owner's property and emitter relationships

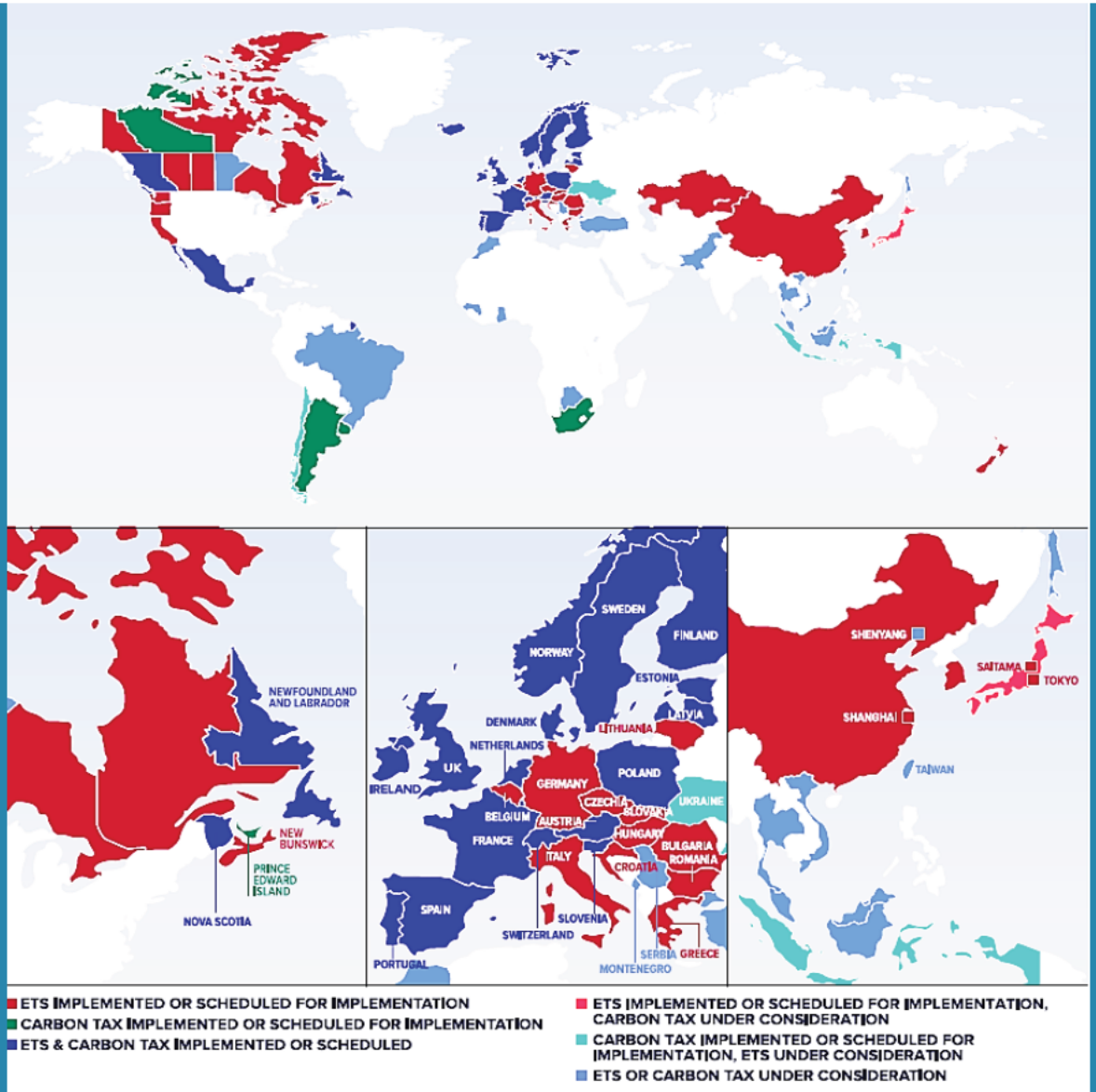
Upfront bonus and rental payments?

Once injection of CO2 begins, revenue "charge" based on metric tons injected.

Revenue charge increases if the relevant tax credits earned for injection increase based upon changes in law (IRA increases the carbon capture credits to $85 from $50 per metric ton injected)

Economics for Emitter influenced by the fiscal incentives and operating environment

CO2 Sales arrangements to utilization markets, storage site operator revenues



EMERGING WORLDWIDE CARBON MARKETS – COMPLIANCE AND VOLUNTARY

(SOURCE: WORLD BANK 2022)/Global CCS Institute Status Report, 2023

- The price of a CCS carbon credit will be determined by underlying market supply and demand interactions, although credits generated by CCS projects could attain higher values…if…???

The role of permitting and access to underground storage spaces

- By and large, scaling-up CCUS revolves around-

❑ **The legal and regulatory measures that define-**

- ❖The permitting and authorization of access to underground storage spaces
- ❖Effective management of long-term liability for stored CO2, and
- ❖the pricing of CO2, and (iii) mitigating the upfront costs of investing in these technologies.

❖This working paper/talk will now focus on the **recent legal developments** in North Dakota and, in addition, **highlight relevant legal provisions governing the ownership and use of subsurface pore spaces for geologic sequestration** of CO2 jurisdictions such as Alberta, Canada, and Norway.

- ✓To underscore the need for clarifying and simplifying such issues and the implications for future energy decarbonization plans.

Underlying Legal Concepts and Principles

- An old common law recognition of the rights of a typical landowner to own and possess the estate in land
  - ✓extending upwards into the sky and downwards to the center of the earth. the *ad coelum* doctrine.

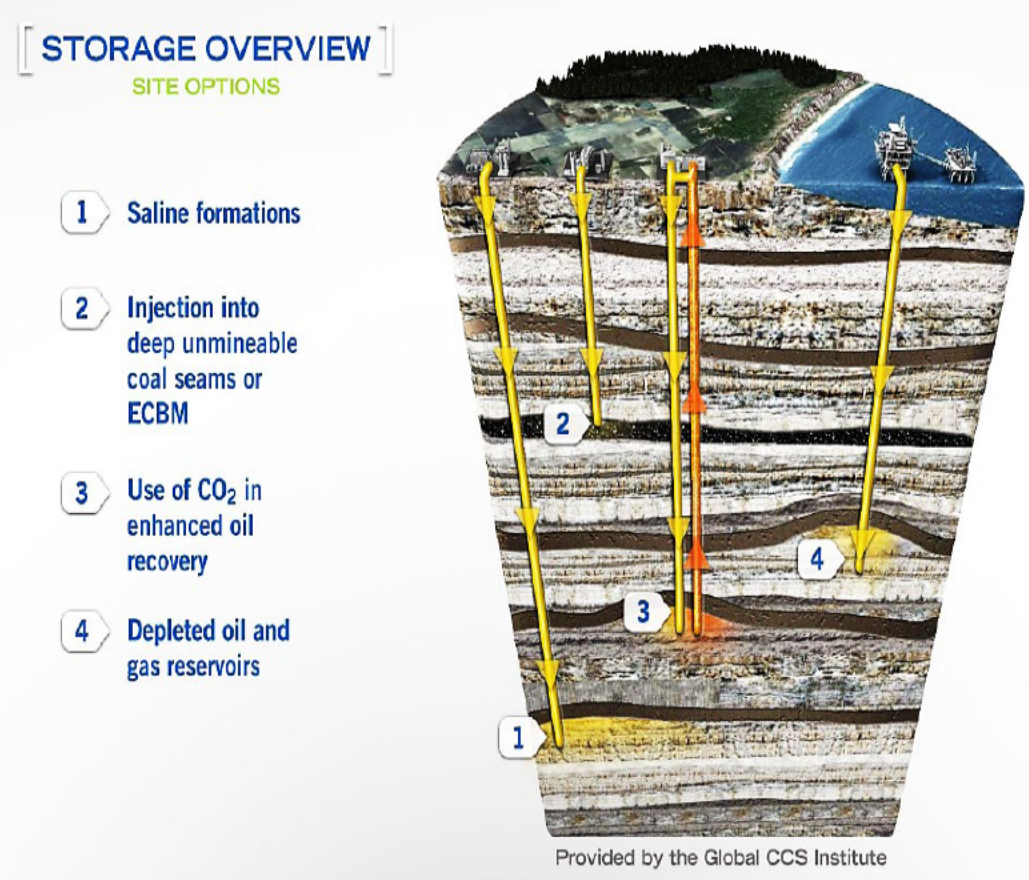
    - ❖Limitations established by courts and applicable statutes
    - ❖The landowner can be a private individual (most of the US) or the state/government (most of the rest of the world)
    - ❖Generally, interference with the landowner's possession of the underground formations in and under his land results in trespass
    - ❖Mineral rights can be severed by the landowner.
      - e.g., via an oil and gas lease conveying interests in oil and gas in place to another person or company
      - Split estate in the land - mineral estate vs. surface estate
        - ✓What is included in those bundles or rights?

Underlying Legal Concepts and Principles

- In many common law countries, rights to minerals (e.g., gold & silver) have been reserved or excepted by the state upon the grant or patent of land to private individuals.
- Initial grants to settlers in the new world (North America) usually didn't include a reservation of minerals other than gold and silver
  - ✓E.g., grants by the Federal Government to the Canadian Pacific Railway (CPR) incorporated in 1881
  - ✓CPR later severed mineral estates out of its land holdings in Western Canada
    - ❖Reserving rights to 'coal' or 'coal, petroleum and valuable stones'
- In the US, public ownership and control of minerals are limited to
  - ✓lands retained in federal or state ownership
  - ✓land which has been granted by the federal government or by a state with a reservation of mineral rights- including large-scale reservation of rights to coal and petroleum.
  - ✓This 'public' state-owned mineral estate parallels the management of state-owned and state-controlled minerals in the rest of the world.

Underlying Concepts and Principles (Contd.)

- Forms of land & mineral estate ownership
  - ✓ Held by private individuals and firms or
  - ✓ Held by federal, state, or tribal governments
- Statutory provisions judicial decisions help categorize particular underground aspects of land such as pore spaces
- Landowners may grant a license to a private company to
  - ✓ enter and use the subsurface area in the land i.e., A non-possessory interest in the land



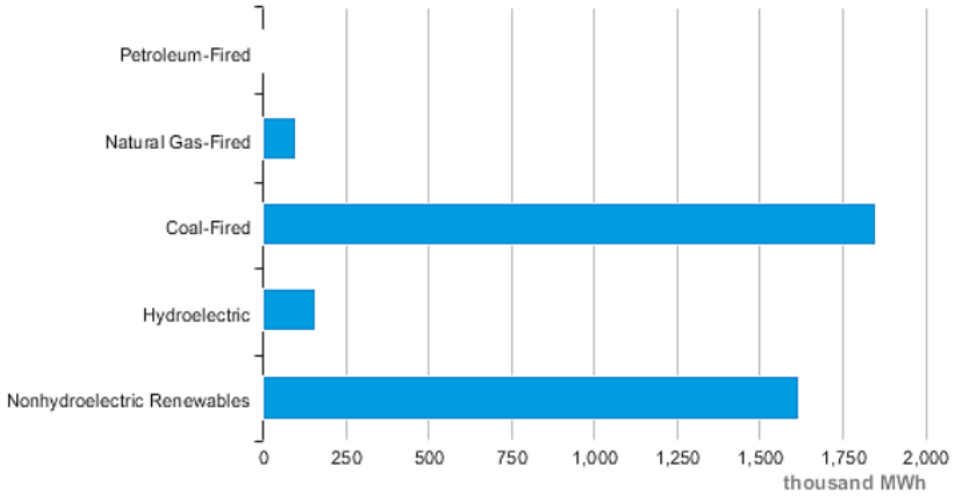
NORTH DAKOTA

- Typically, landowners in North Dakota own the surface, subsurface formations, pore spaces, and everything lying underneath
- A severance through an oil and gas lease creates a split estate between a new mineral estate owner and a land (surface) owner
- The '**split estate**' in land
  - ✓questions about whether the pore spaces remain with the holder of the mineral estate or the landowner.

- ND law (NDCC §§ 47-31-02; 38-11.1-03(7)),
  - ❖"**pore space**" refers to a cavity or void, whether natural or artificially created, in a subsurface sedimentary stratum.

- The title to such pore spaces in all strata underlying the surface of lands and waters is vested in the owner of the overlying surface estate (NDCC §§ 47-31-03).

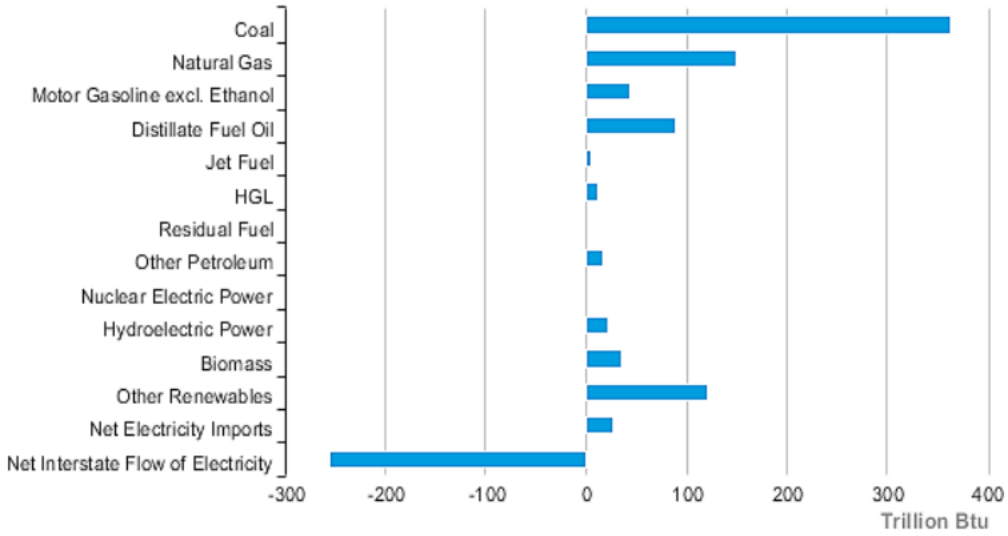
North Dakota Net Electricity Generation by Source, Nov. 2022



eia Source: Energy Information Administration, Electric Power Monthly

NORTH DAKOTA

North Dakota Energy Consumption Estimates, 2020



eia Source: Energy Information Administration, State Energy Data System

The recent ND Supreme Court's Decision- *NW. Landowners Ass'n v. State and others* (2022)

- In 2019, the North Dakota Legislative Assembly enacted SB 2344 to clarify ownership and use of pore spaces

  - ✓essentially authorize mineral estate holders such as oil and gas lessees to utilize pore spaces without compensation to the surface owner.
    - ✓in furtherance of their 'dominant' mineral estate and production operations

  - ✓it is not "unlawful and, by itself, does not constitute trespass, nuisance, or other tort" if an oil and gas operator or mineral estate holder carries out drilling and well completion operations, or injection or migration of substances into pore space for disposal operations, secondary or tertiary oil recovery operations, or otherwise to facilitate the production of oil, gas, or other minerals (NDCC §§ 47-31-09).

NW. Landowners Ass'n v. State and others (2022)

- the Northwest Landowners Association commenced the action to challenge the constitutionality of the highlighted provisions
- The ND Supreme Court opines
  - ✓ The State's constitution provides that "*[p]rivate property shall not be taken or damaged for public use without just compensation having been first made to or paid into court for the owner.*" (ND Const. art. I, § 16).
  - ✓the surface owners have demonstrated they have a constitutionally protected property interest in pore space
  - ✓surface owners have a right to compensation when operators use their pore space for disposal and storage operations.
  - ✓although an oil and gas operator has the right of reasonable use due to an implied easement and consequently could use surface and pore spaces when necessary, the operator must compensate the surface owner accordingly
  - ✓Implied right of reasonable accommodation for the landowner may also apply

Emerging Principles on Pore Space Ownership

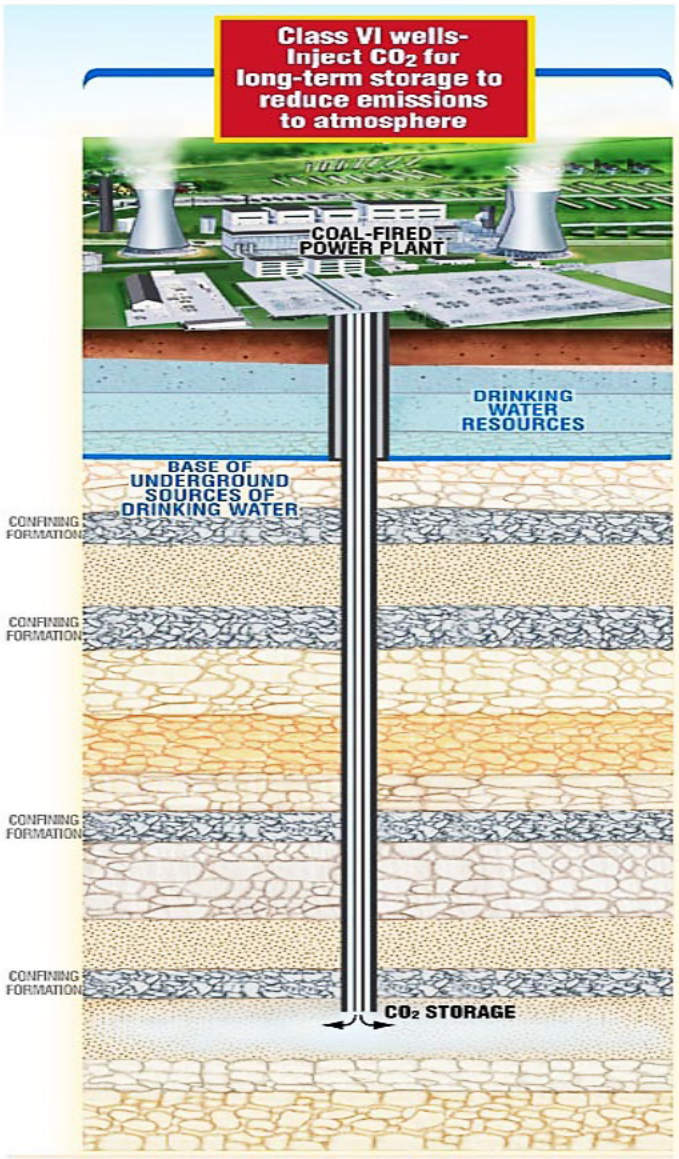
- The ownership of surface and mineral estate covering the project area may be severed.
- The prevailing view in Texas is that ownership of the surface includes ownership of the pore space, in the absence of minerals.
  - ✓Lighting Oil Co. v. Anadarko E&P Onshore (Tex. 2017)
  - ✓Springer Ranch vs. Jones (TexApp. 2013).
- Analysis is more complex when the pore space contains minerals.
  - ✓In Mapco vs. Carter (TexApp. 1991), a subsurface area created in a salt dome (i.e., the minerals) was owned by the mineral estate. The mineral fee owners retain ownership after the underground storage facility, the caverns, were created.

✓Possible solutions-

- ❖the federal and state governments may consider codifying a formal process for permitting the access and use of pore space for GCS on federal and privately-owned lands

Other CO2 Injection/Storage Regulatory Considerations - US

- Federal Underground Injection Control (UIC) Program under the Safe Drinking Water Act (SDWA) administered by EPA
  - Class VI UIC wells -CO2 Injection for Geologic Sequestration
  - Class II UIC wells -CO2 Injection for Enhanced Oil Recovery (EOR)
- EPA's Clean Air Act Greenhouse Gas Reporting Program
  - ✓Subpart PP -covers CO2 capture facilities (apart from injection/storage)
  - ✓Subpart UU -covers CO2injection for EOR and other uses (apart from geologic sequestration)
  - ✓Subpart RR -more stringent requirements for CO2injection for permanent geologic sequestration
- Offshore
  - ✓Marine Protection, Research and Sanctuaries Act
  - ✓Outer Continental Shelf Lands Act (OCSLA) -if on Outer Continental Shelf



UIC Class VI wells inject CO2 for long-term storage to reduce emissions to the atmosphere.

EPA developed specific criteria for Class VI wells:

- Extensive site characterization requirements
- Injection well construction requirements - withstanding contact with CO2 over the life of a GS project
- Injection well operation requirements
- Monitoring requirements for all aspects of well integrity, CO2 injection and storage, and groundwater quality during the injection operation and afterwards
- Financial responsibility requirements assuring the availability of funds for the life of a GS project (including post-injection site care and emergency response)
- Reporting and recordkeeping requirements that provide project-specific information

Class II Oil and Gas Related Injection Wells

- Class II wells are used only to inject fluids associated with oil and natural gas production.
- Class II fluids are primarily brines (salt water) that are brought to the surface while producing oil and gas.
- It is estimated that over 2 billion gallons of fluids are injected in the United States every day.
- Most oil and gas injection wells are in Texas, California, Oklahoma, and Kansas.

- Class II wells fall into one of three categories.

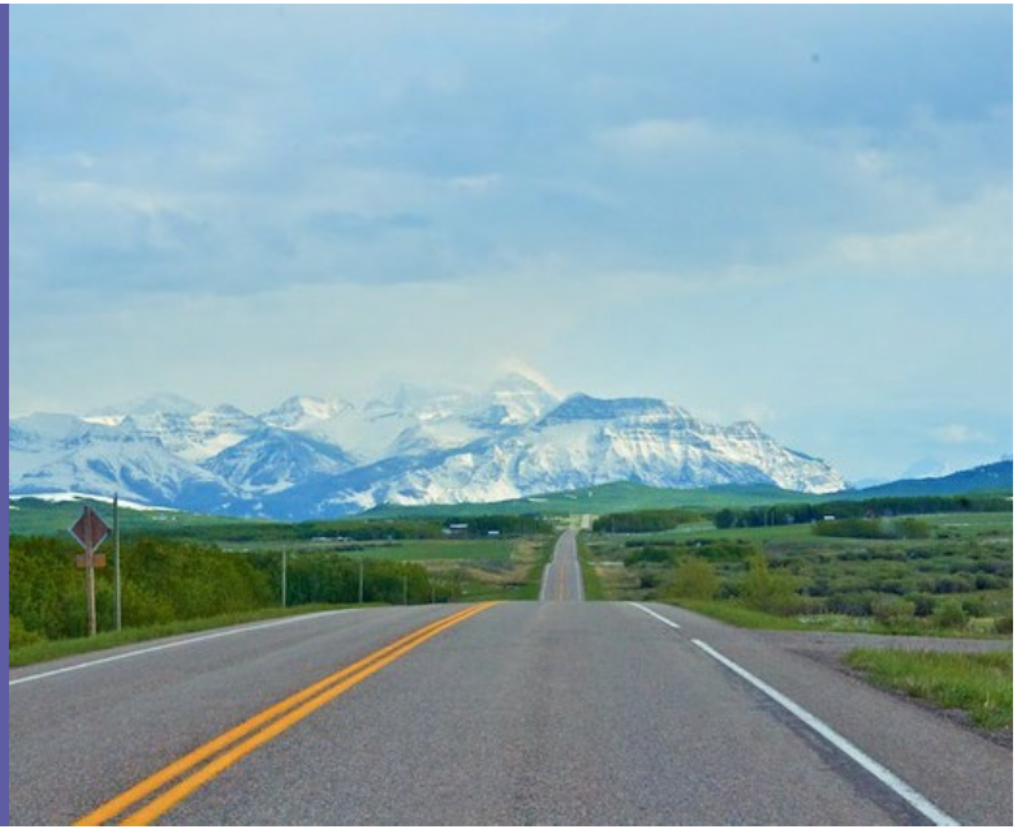
    - Disposal wells
    - Enhanced recovery wells
    - Hydrocarbon storage wells

Other CO2 Injection/Storage Regulatory Considerations - US

- Federal lands -Bureau of Land Management, National Park Service, U.S. Geological Survey, etc.
- State requirements (specific to state)

- Other Considerations
  - ✓Potential for review under NEPA or state-equivalent
  - ✓Environmental justice
  - ✓Stakeholder engagement

THE CANADA & ALBERTA CONTEXT



Developing CO2 storage and use for underground spaces- Alberta

- Considerable technical expertise in managing and regulating storage and disposal projects
- Several natural gas storage projects, and EOR activity…
- Suitable geological conditions for CO2 disposal in saline aquifers and depleted reservoirs

Developing a framework for CCS projects- typical groups of issues:

1. property rights (including pore space ownership)
2. Regulatory and permitting issues e.g. the choice of regulator and adaptation of existing rules
3. Liability issues (and especially the question of the possible transfer of long-term liability), and
4. the interface between CCS projects and carbon trading schemes.

Legal and Policy developments…

- Prior to the Alberta CCS Act there was
  - ✓considerable uncertainty on the ownership of pore space for disposal purposes between the owner of the mineral estate and the owner of the surface estate.
- The mineral estate in Alberta is generally owned by the Province
  - ✓About 20% of mineral lands are owned by private parties.

❖Does the severed mineral estate from a previous land grant carry with it pore space rights?

- where the mineral estate had been severed (i.e., where the Province had sold the surface but reserved the mines and minerals) does the surface rights owner obtain all rights (including pore space rights) not expressly retained by the mineral owner?

- The law responded to this uncertainty by vesting pore space ownership for disposal purposes in the Province and at the same time pre-empting any claim to compensation.

Alberta Mines and Minerals Act (MMA) 2000 as amended by the Carbon Capture and Storage Statutes Amendment (CCS Act) 2010

- The MMA grants the Government of Alberta with authority to administer, allocate, and enter into agreements with respect to minerals.
- It applies to all mines and minerals and related natural resources belonging to the Crown including wells, mines, quarries, and minerals.

CCS Act amendments

1. declaring that all pore space in Alberta is owned by the province;
2. enabling the Minister to enter into an agreement granting the right to inject CO2 into pore space within Alberta for storage purposes;
3. enabling assumption by the province of certain obligations on the issuance of a closure certificate; and
4. creating a Post-Closure Stewardship Fund drawn from fees paid by lessees, to cover certain post-closure costs.

Legal and Policy to Commercialization Prospects

- In June 2020, the Alberta Carbon Trunk Line (ACTL) system became fully operational

  ✓the world's newest integrated, large-scale CCUS system

  ✓It includes participation from multiple partners to capture industrial emissions and deliver CO2 to mature oil and gas reservoirs in Central Alberta for EOR and permanent storage.

  ✓At full capacity, the pipeline can transport up to 14.6 million tonnes of CO2 per year

  - ❖ represents approximately 20% of all current oil sands emissions or
  - ❖is equal to the impact of capturing the CO2 from more than 2.6 million cars in Alberta.

NORWEGIAN CONTEXT

A constitutional monarchy and representative parliamentary democracy

- Executive power is vested formally in the king but is exercised through the government, headed by the prime minister.
- Legislative power is held by the Storting (the Norwegian parliament).
- As a member of the European Economic Area (EEA), Norway shares
  - ✓ internal market legislation with the EU and
  - ✓ has therefore implemented several EU directives and regulations related to energy.
  - ✓ Participates in the EU Emissions Trading Scheme

Norway contd.

- As a general requirement, the emissions limits are based on best available technology as defined nationally or in the EU, assessed individually for each facility.

- The CO2 tax on petroleum sector activity on the Norwegian continental shelf was introduced in 1991.
- In 2005, Gassnova was established by the Norwegian government as a state-owned enterprise with the mandate to drive investment in CCS technologies.

- The government also adopted a CCS strategy in 2014-2015.
  - ✓Led to the Longship project
    - ❖transporting CO2 from emissions points by truck, then shipping to an onshore gathering station.
    - ❖CO2 is then piped around 100 km offshore to the storage site where it is injected.
    - ❖The state is playing the role of a market maker, serving as an intermediary between capture and storage operators.

Norway's Pore Space Regulation

- Regulations relating to the exploitation of subsea reservoirs on the continental shelf for storage of CO2 and relating to the transportation of CO2 on the continental shelf, 2014

  ❖rules for surveying and exploration for subsea reservoirs for storage of CO2, as well as exploitation, transportation and storage of CO2

  ❖***Section 1-2: Ownership of subsea reservoirs for storage of CO2***

  ✓The Norwegian State has the proprietary right to subsea reservoirs on the continental shelf for exploitation of said reservoirs for storage of CO2 and has an exclusive right to management of said reservoirs.

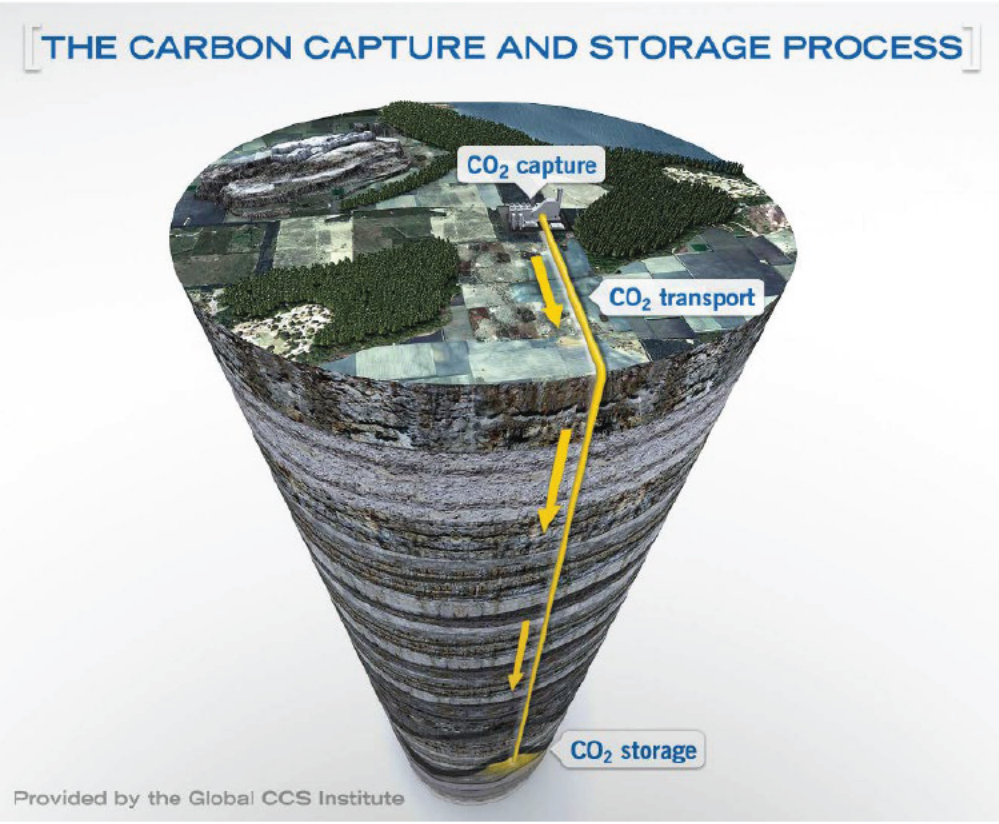
  ❖***Section 4-1.***

  - Licence for exploitation of subsea reservoirs for injection and storage of CO_2

    ✓The King in Council may, under certain specific conditions, grant a licence for the exploitation of a subsea reservoir for injection and storage of CO_2 (exploitation licence). The licence shall indicate the area comprised by the licence through the indication of longitudes and latitudes, as well as a stratigraphic delineation of the geological unit(s) comprised.

Exploitation of subsea reservoirs for injection and storage of CO_2

- An exploitation licence in Norway
  - ✓may be granted to one or more body corporates jointly
  - ✓shall be granted on objective, published and non-discriminatory criteria.
  - ✓The duration shall be stipulated upon granting.
  - ✓The duration of the licence presumes that the subsea reservoir is put to use through development and storage within a deadline set upon granting.



Natural resources other than subsea reservoirs for storage of CO_2, etc.

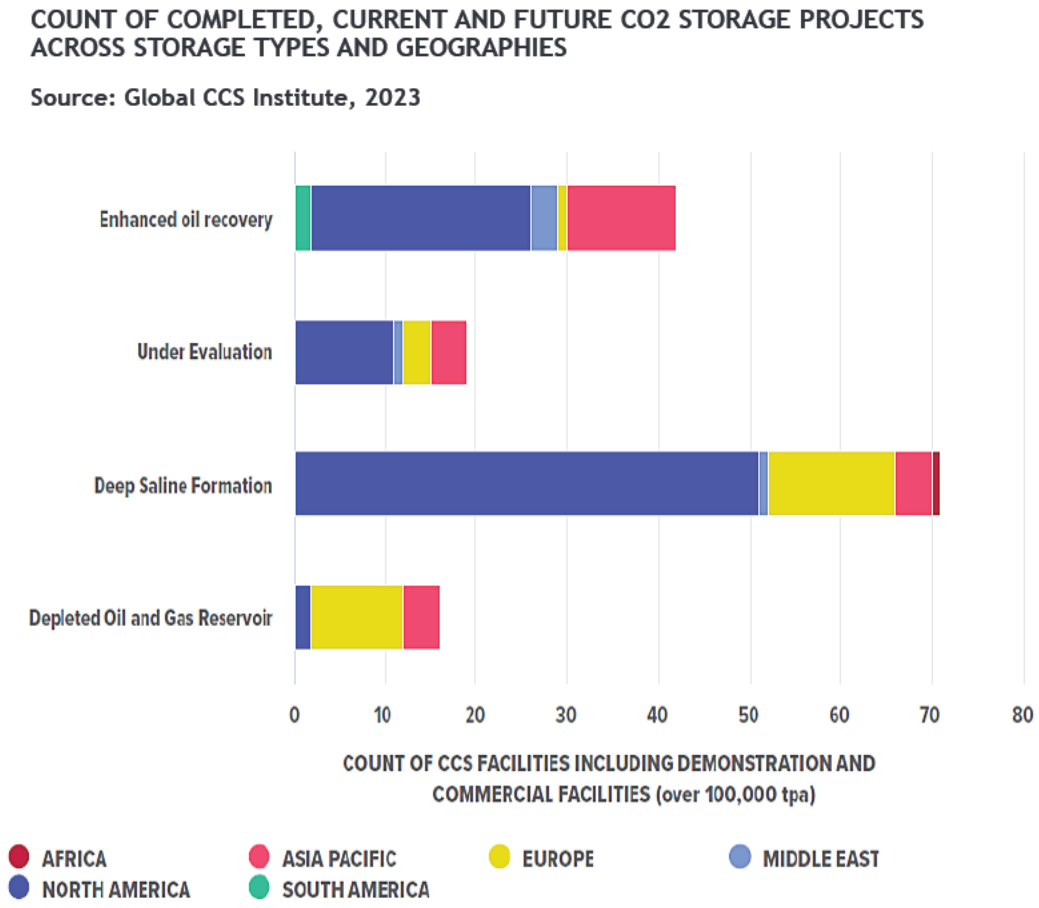
- An exploration licence or a licence for exploitation of a subsea reservoir for injection and storage of CO_2 ***shall not prevent parties other than the licensee from being allowed to conduct surveys for and recovery of other natural resources*** in the area when this does not cause an unreasonable disadvantage for the exploration or injection and storage of CO_2…

Prudent storage of CO_2

- Storage of CO_2, shutdown of the storage location and post-operation shall take place in line with prudent technical and sound financial principles and such that the risk of leaks during transport of CO_2 and from the storage location is avoided insofar as possible. In order to achieve this, the licensee shall continuously assess technical solutions and implement necessary measures.

Global Storage Sites and Importance of Access and Regulatory Certainty…

- Global storage capacity about 40 mtpa must grow to btpa to meet climate targets
- Deep saline formations are the most common type of CO2 storage reservoir
- Historically, most CO2 has been used for EOR
- CO2 injected for EOR is ultimately trapped in the pore space that previously held the oil
- Land ownership, possession, or the potential to use pore spaces pursuant to a license are essential factors



Conclusion- the role of law and regulation…

1. To provide the industry with the legal and regulatory certainty required to encourage investment of large sums of capital.
2. To provide regulatory assurance that CCS projects will contribute to mitigation by ensuring careful site selection and characterization with a view to permanent geological sequestration.
3. To provide the public with the assurance that these projects will be handled safely, taking into account concerns such as the potential effects of CO2 injection on sources of potable groundwater.