

ICCS Regulatory Review: Recent US Actions

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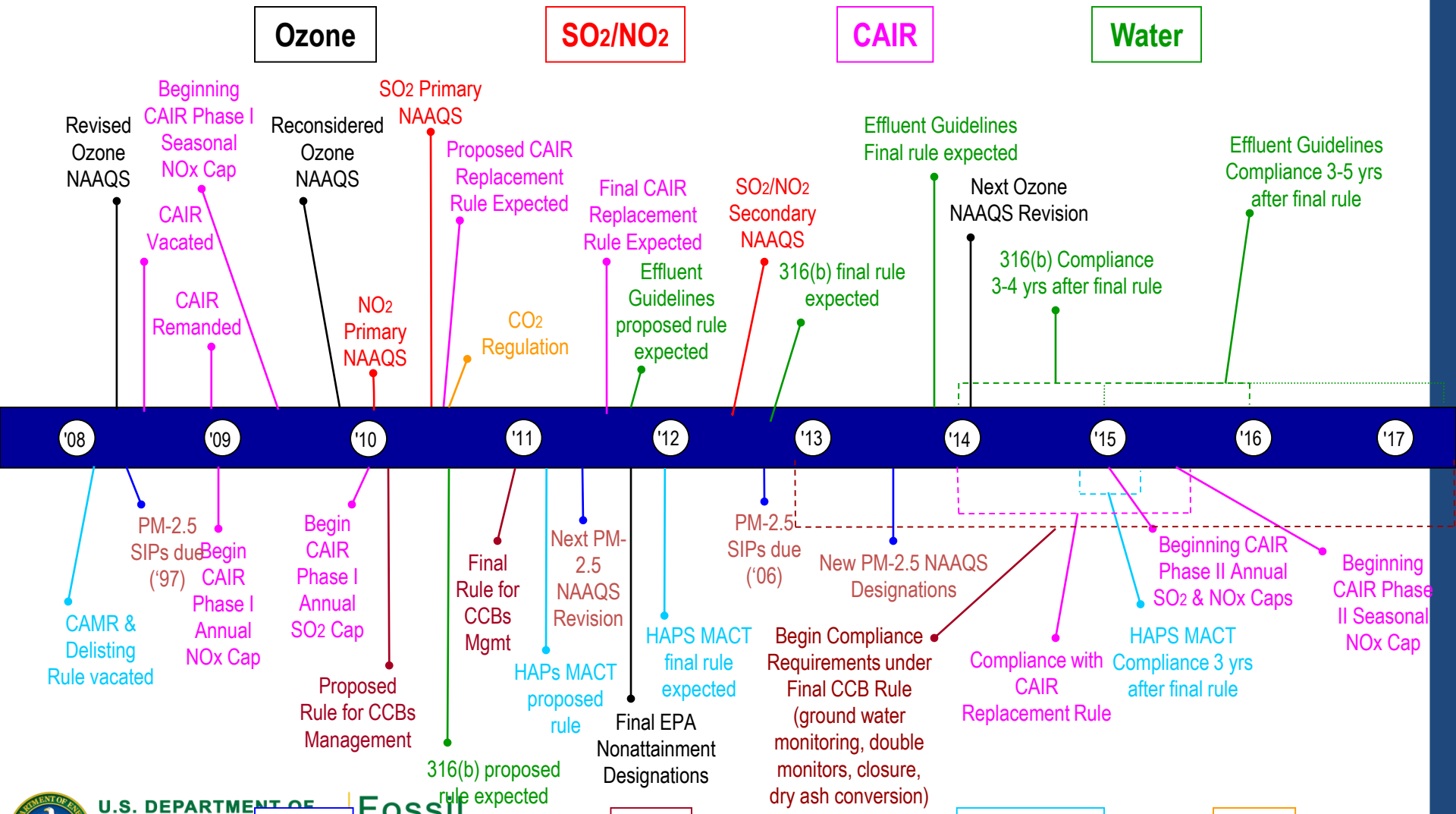
Agenda:

- EPA Regulations:
  - Greenhouse Gas, New Plants
  - Greenhouse Gas, Existing Plants
  - Regulatory Compliance Timeline
  - Class II and Class VI Updates and Considerations
- US Project Status
- R&D Status
- Moving Forward

The EPA Regulatory Train Wreck: Regulatory Timeline for Coal-Fueled Power Plants



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New Fossil Baseload: [111(b)] (As Proposed)

Coal-Fired Units: less than 1,100 lbs CO_2/MWh [~500 gCO_2 / kWh]

Reference: New Super Critical: 1,800-2,000 lbs CO_2/MWh [800-900 gCO_2 / kWh]

Coal may comply with ~ 40% capture

NGCC: 1,000 lbs CO_2/MWh [453 gCO_2 / kWh]
Gas CT: 1,100 lbs CO_2/MWh [500 gCO_2 / kWh]

- Compliance is on a 12 month rolling basis
- Captured CO_2 may be sent for geologic storage
- EOR may be used with appropriate reporting (Subpart RR)

Timeline:
Proposed Regulation: November, 2013
Final Regulation expected Summer, 2015

Note: 111(b) must be final before 111(d) is final!

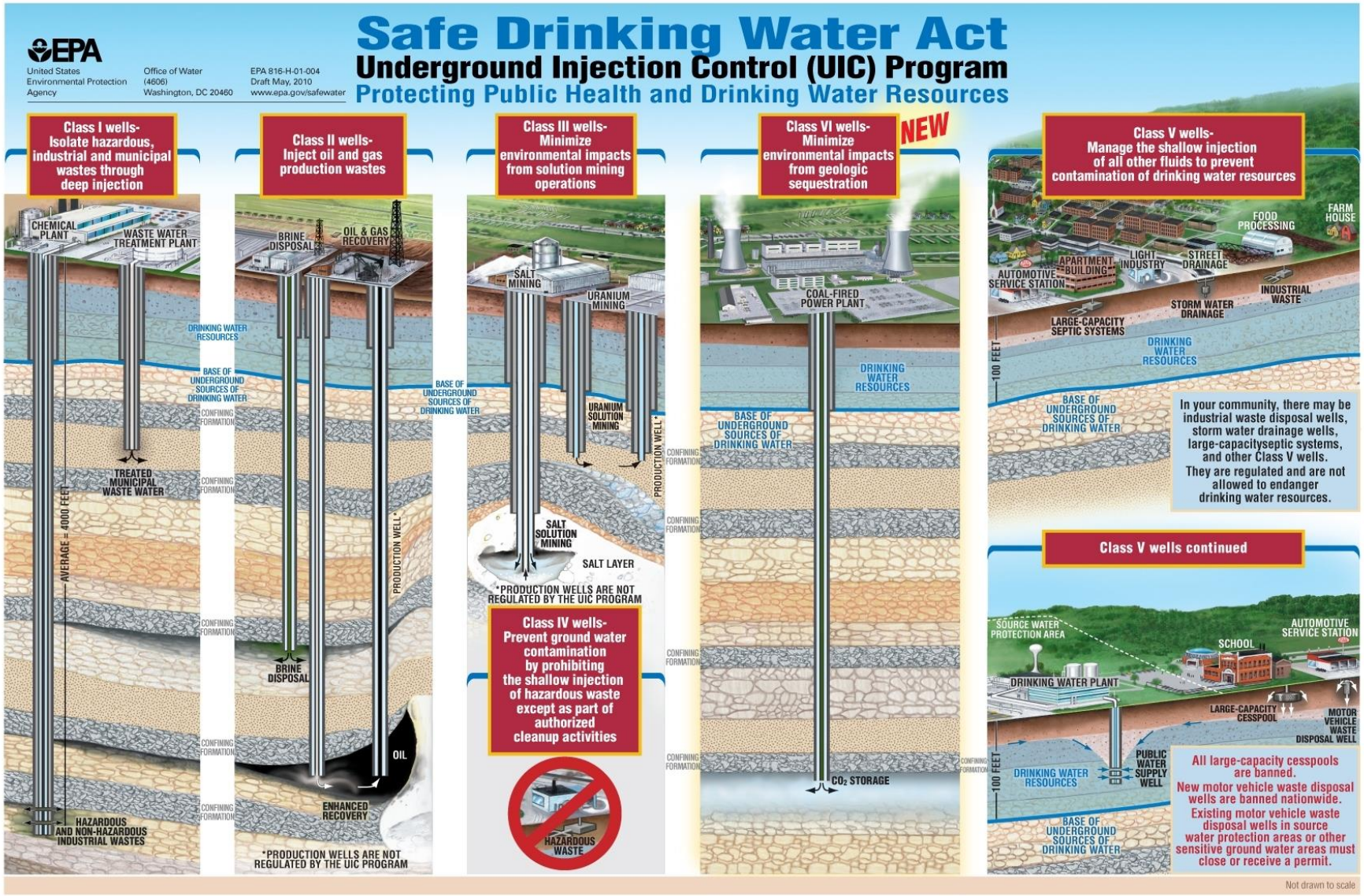
Clean Power Plan: The Building Blocks

Building Block	Strategy EPA Used to Calculate the State Goal	Maximum Flexibility: Examples of State Compliance Measures
1. Make fossil fuel-fired power plants more efficient	Efficiency Improvements	Efficiency improvements Co-firing or switching to natural gas Coal retirements Retrofit CCS (e.g.,WA Parish in Texas)
2. Use lower-emitting power sources more	Dispatch changes to existing natural gas combined cycle (CC)	Dispatch changes to existing natural gas CC
3. Build more zero/low-emitting energy sources	Renewable Energy Certain Nuclear	New NGCC Renewables Nuclear (new and up-rates) New coal with CCS
4. Use electricity more efficiently	Demand-side energy efficiency programs	Demand-side energy efficiency programs Transmission efficiency improvements Energy storage

Existing Fossil Baseload [111(d)]

- Building blocks define emission rate for each states
- Can be translated into mass-based standard
- States can tailor their approach
- CCS Retrofits <u>can</u> be used as compliance
  - No plants are required to retrofit with CCS

Underground Injection Control (UIC) Well Classes



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Proposed Implementation Timeline

2015 | 2016 | 2017 | 2018 | 2019 | 2020

Emission Guideline Promulgation
June 1, 2015

State submits Negative Declaration

- by June 30, 2016 — State submits negative declaration
- EPA publishes FR notice

State submits complete implementation Plan by June 30, 2016

- by June 30, 2016 — State submits plan
- EPA reviews plan and publishes final decision within 12 months on approval/disapproval

State submits initial Plan by June 30, 2016 and request 1-year extension

- by June 30, 2016 — State submits initial plan and request for 1-year extension
- EPA reviews initial plan and determines if extension is warranted
- by June 30, 2017 — State submits complete plan
- EPA reviews plan and publishes final decision within 12 months on approval/disapproval

State submits initial multi-state Plan by June 30, 2016 and request 2-year extension

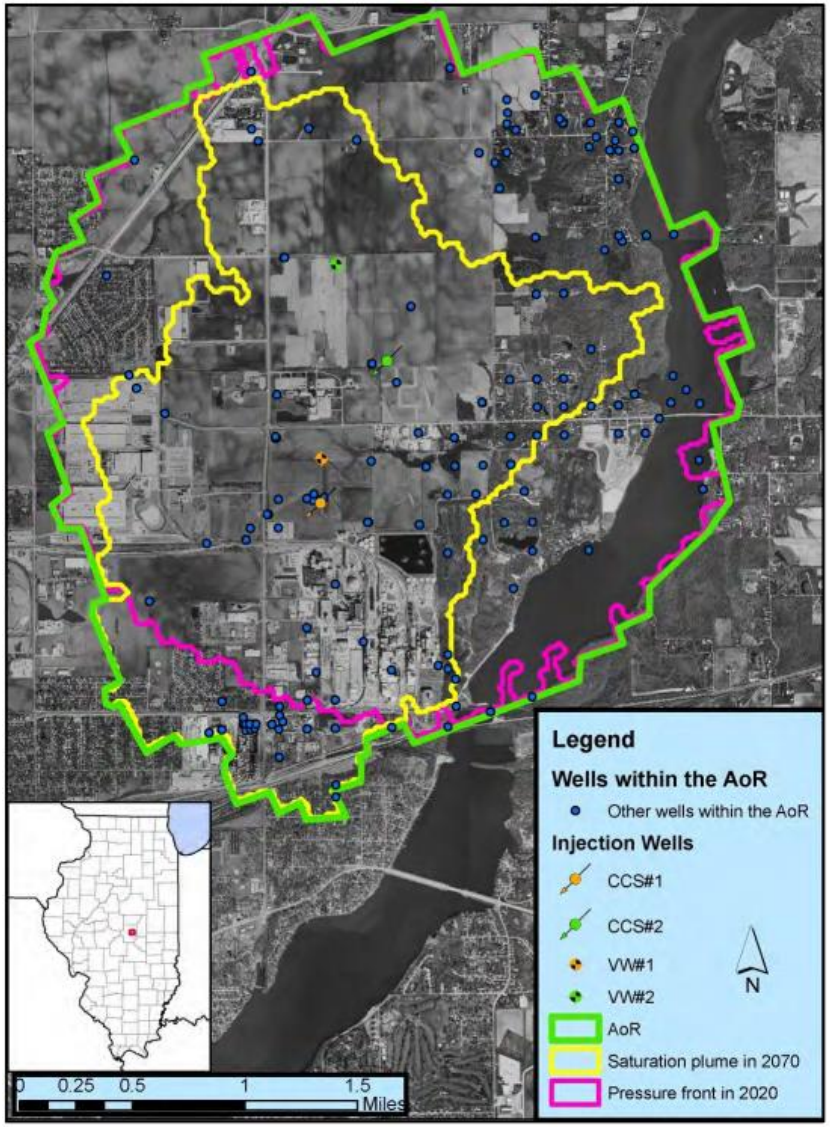
- By June 30, 2016 — State submits initial multi-state plan and request for 2-year extension
- EPA reviews initial plan and determines if extension is warranted
- by June 30, 2017 — State submits progress report of plan
- by June 30, 2018 — States submits multi-state plan
- EPA reviews plan and publishes final decision within 12 months on approval/disapproval

Compliance period begins
2020

Class VI Update

- "6" Permits Granted
- ADM: Drilling Injection well
- FutureGen Project Cancelled (4 wells)
  - Continuing through permit appeals process
  - May use injection site in the future
- EPA Developing Guidance: II-VI Transition
  - Focus: Protection of Underground Sources of Drinking Water (USDWs)
  - Summer 2015 Publication
- EPA Memo: "Geologic storage can be done through EOR in a Class II Well"

ADM: Area of Review (AoR)



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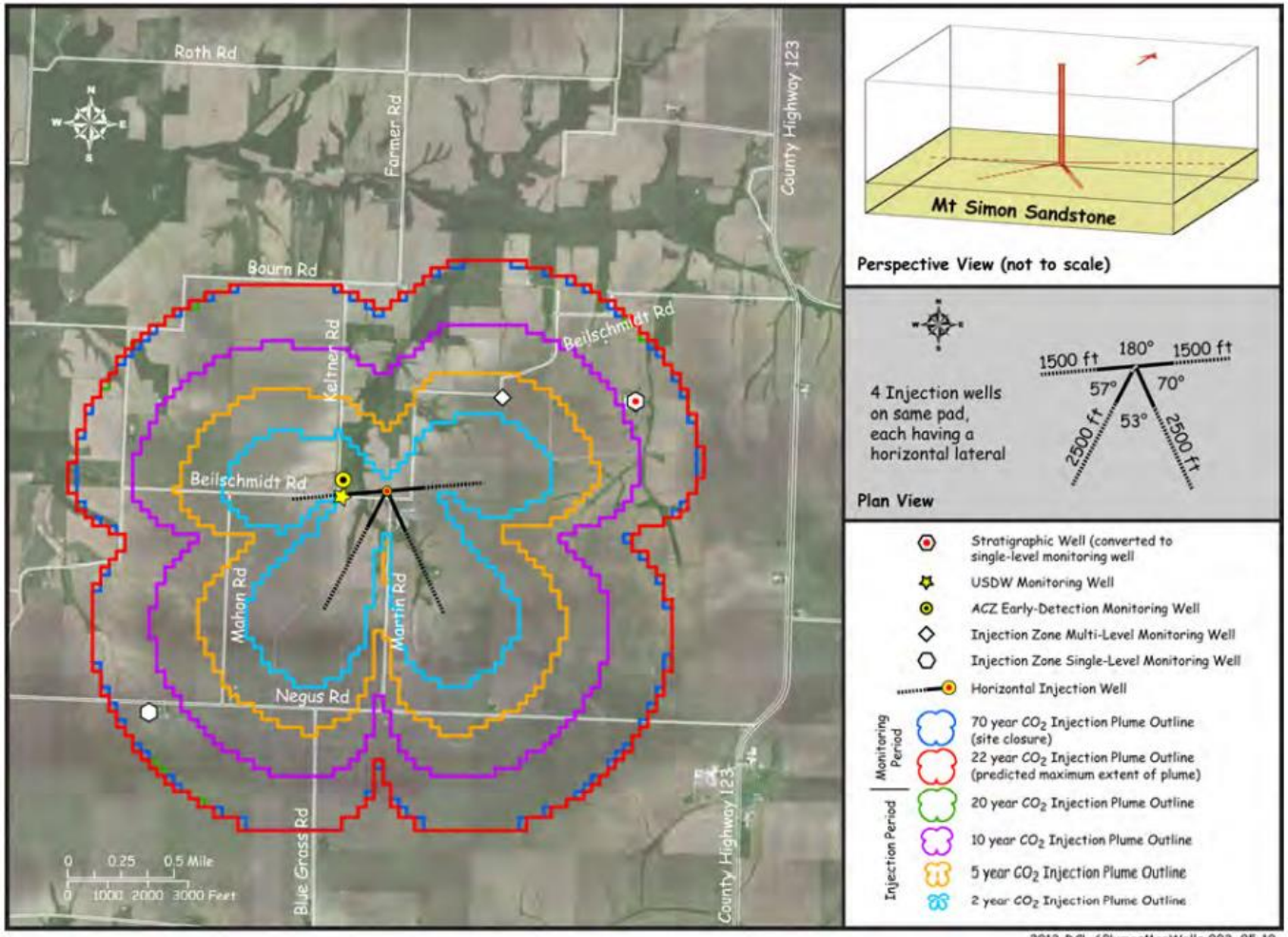
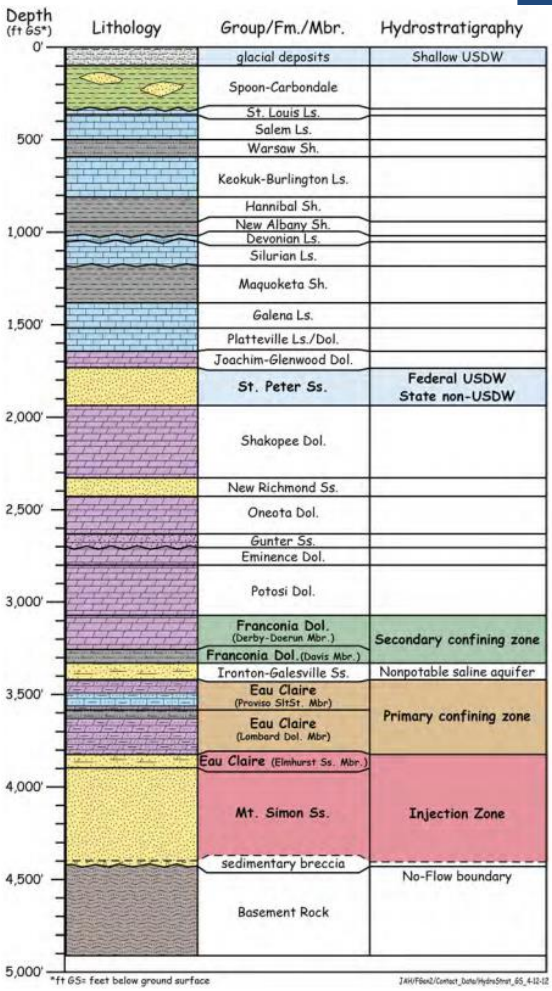
FutureGen: Area of Review





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Tax Credits

- Proposed: $2 Billion Investment Tax Credit (ITC)
- > 75% Capture of CO_2
- Up to 30% of capital investments

- Sequestration Tax Credit:
  - $50 / metric ton, Saline Storage
  - $10 / metric ton, Enhanced Oil Recovery
  - Guaranteed for 20 years of operation
    - Replaces 45Q: $20 / $10, 75 Million Metric Tons available

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Power to the Grid: 2014 Gasifiers Starting Up

W.A. Parrish, TX
NRG/PetraNova project

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Broke Ground January 2015!

Brief history and roadmap for CCS

	Then CCS Program Initiated (1997)	**Now** Progress to Date	**Future (2030)** Broad Commercial Deployment
CCS R&D	• Niche commercial efforts • 1930's and 1970's tech for capture • Little known for storage	• Much knowledge gained • Major tech development • Tools being developed and tested	• "Commercial toolbox" developed • Dramatic cost reductions • 1000's of sites worldwide
Storage Infrastructure/ Field Tests	• Little known outside of oilfield services • Sleipner project initiated	• Increased visibility; • Knowledge gained and lessons learned • 12 large projects world-wide	• Market frameworks in place • Novel regulatory mechanisms • Turnkey operation

CCS: A Critical Crossroads

Success of the demos

- Serial # 1 in operation 2013-2018
- A deep and rich set of public learning

Regulatory Certainty

- CCS Required for New Plants
- Drivers in place for Existing Plants
- UIC Program, Existing Permits providing certainty

Financial Support

- Strong Tax incentives
- EOR is common; New approaches providing value