ICCS Regulatory Review: Recent US Actions

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May 19th, 2015
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

- **Ozone**
  - Revised Ozone NAAQS
  - Beginning CAIR Phase I Seasonal NOx Cap
  - NOx Primary NAAQS
  - Revised CAIR Phase I Annual SO2 Cap
  - Proposed Rule for CCBs Management
  - 316(b) proposed rule expected

- **SO2/NO2**
  - CAIR Vacated
  - Reconsidered Ozone NAAQS
  - SO2 Primary NAAQS
  - Final Rule for CCBs Mgmt
  - Final EPA Nonattainment Designations
  - 316(b) final rule expected

- **CAIR**
  - CAIR Remanded
  - Effluent Guidelines Final rule expected
  - Proposed CAIR Replacement Rule Expected
  - Final CAIR Replacement Rule Expected
  - Effluent Guidelines proposed rule expected
  - SO2/NO2 Secondary NAAQS
  - PM-2.5 SIPs due (’06)

- **Water**
  - Effluent Guidelines Compliance 3-5 yrs after final rule
  - CAIR Remanded
  - Effluent Guidelines Final rule expected
  - CAIR Vacated
  - HAPS MACT final rule expected
  - Final PM-2.5 NAAQS Designations
  - New PM-2.5 NAAQS Designations
  - Compliance with CAIR Replacement Rule
  - HAPS MACT Compliance 3 yrs after final rule
  - PM-2.5 SIPs due (’06)

- **Ash**
  - Proposed Rule for CCBs Management
  - Final EPA Nonattainment Designations
  - Final Rule for CCBs Mgmt
  - Final EPA Nonattainment Designations

- **Hg/HAPS**
  - Compliance with CAIR Replacement Rule
  - HAPS MACT Compliance 3 yrs after final rule

- **CO2**
  - CO2 Regulation
  - Final EPA Nonattainment Designations
  - Compliance with CAIR Replacement Rule
  - HAPS MACT Compliance 3 yrs after final rule
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

<table>
<thead>
<tr>
<th>Building Block</th>
<th>Strategy EPA Used to Calculate the State Goal</th>
<th>Maximum Flexibility: Examples of State Compliance Measures</th>
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</table>
| 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 state
• Can be translated into mass-based standard
• States can tailor their approach
• CCS Retrofits can be used as compliance
  – No plants are required to retrofit with CCS
Underground Injection Control (UIC) Well Classes

Class I wells - Isolate hazardous, industrial and municipal wastes through deep injection

Class II wells - Inject oil and gas production wastes

Class III wells - Minimize environmental impacts from solution mining operations

Class IV wells - Prevent ground water contamination by prohibiting the shallow injection of hazardous waste except as part of authorized cleanup activities

Class V wells - Manage the shallow injection of other fluids to prevent contamination of drinking water resources

Class VI wells - Minimize environmental impacts from geologic sequestration

Class VII wells - Manage the shallow injection of other fluids to prevent contamination of drinking water resources

In your community, there may be industrial waste disposal wells, storm water drainage wells, large-capacity septic systems, and other Class V wells. They are regulated and are not allowed to endanger drinking water resources.

All large-capacity cesspools are banned. New motor vehicle waste disposal wells are banned nationwide. Existing motor vehicle waste disposal wells in source water protection areas or other sensitive ground water areas must close or receive a permit.
Proposed Implementation Timeline

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<tbody>
<tr>
<td>State submits Negative Declaration</td>
<td>by June 30, 2016 State submits negative declaration</td>
<td>EPA publishes FR notice</td>
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<tr>
<td>State submits complete implementation Plan by June 30, 2016</td>
<td>by June 30, 2016 State submits plan</td>
<td>EPA reviews plan and publishes final decision within 12 months on approval/disapproval</td>
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<td>State submits initial Plan by June 30, 2016 and request 1-year extension</td>
<td>by June 30, 2016 State submits initial plan and request for 1-year extension</td>
<td>EPA reviews initial plan and determines if extension is warranted</td>
<td>by June 30, 2017 State submits complete plan</td>
<td>EPA reviews plan and publishes final decision within 12 months on approval/disapproval</td>
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<tr>
<td>State submits initial multi-state Plan by June 30, 2016 and request 2-year extension</td>
<td>By June 30, 2016 State submits initial multi-state plan and request for 2-year extension</td>
<td>EPA reviews initial plan and determines if extension is warranted</td>
<td>by June 30, 2017 State submits progress report of plan</td>
<td>by June 30, 2018 States submits multi-state plan</td>
<td>EPA reviews plan and publishes final decision within 12 months on approval/disapproval</td>
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Emission Guideline Promulgation
June 1, 2015

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)
FutureGen: Area of Review
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
Power to the Grid: 2014
Gasifiers Starting Up
W.A. Parrish, TX
NRG/PetraNova project

Broke Ground January 2015!
### Brief history and roadmap for CCS

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<tr>
<th>CCS R&amp;D</th>
<th>Then CCS Program Initiated (1997)</th>
<th>Now Progress to Date</th>
<th>Future (2030) Broad Commercial Deployment</th>
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</table>
| • 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