

Options for Coal under the Clean Power Plan & the Carbon Standards for New Units

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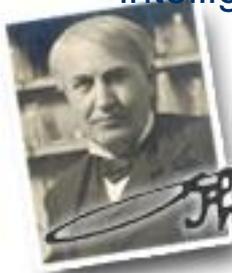
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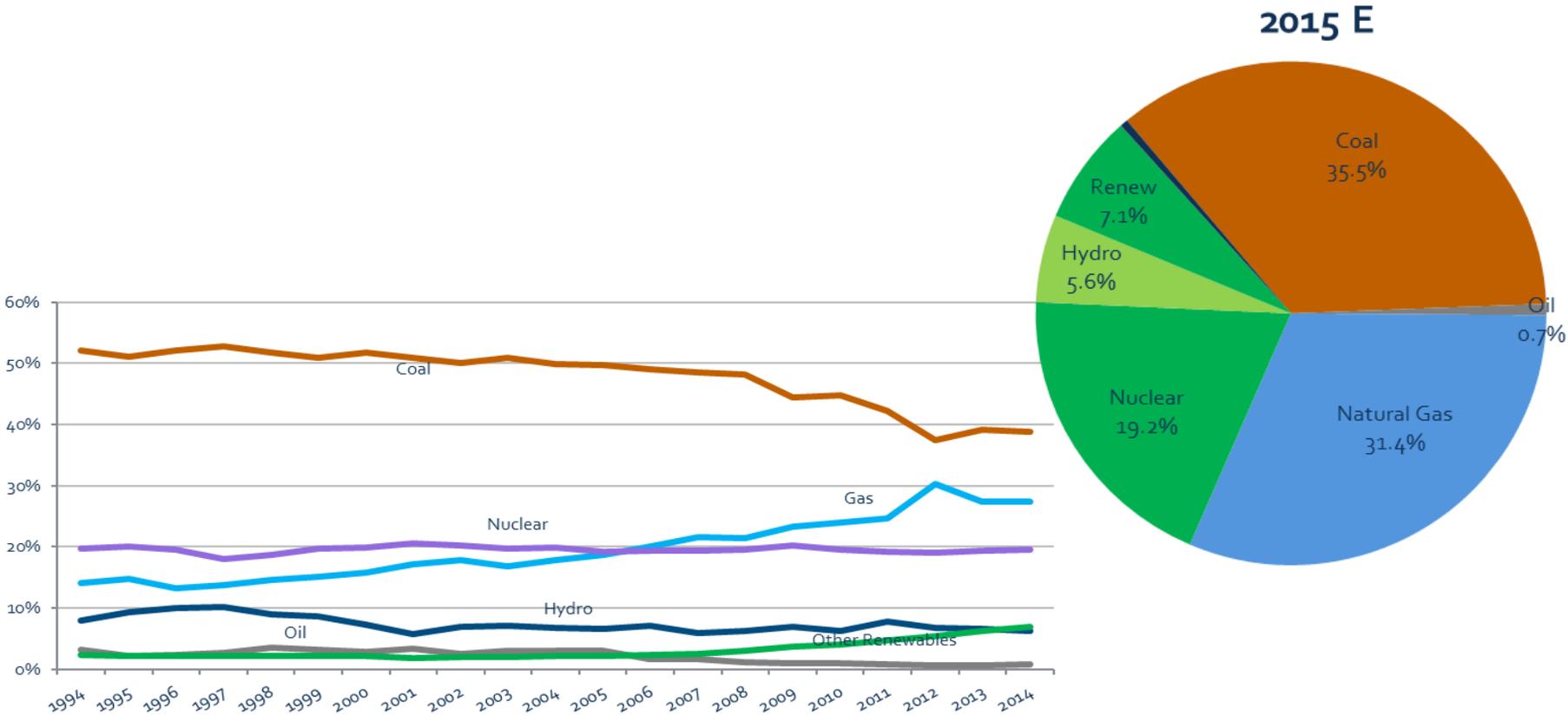
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Current Share of Electricity Generation



Current Generation Trends (January-July 2015)

- Capacity Additions
 - lowest ever recorded in the past decade - 700 MW/monthly average
 - natural gas, wind and solar made up almost all of the new additions
- Capacity Retirements
 - announcements for 20,000 MW to be retired in 2015, 15,500 MW are coal
 - 11,500 MW of coal have already retired this year
- New Capacity Announcements
 - plans to build 20,297 MW of new generating capacity, roughly equal to 2014 announcements
 - natural gas (53%), wind and solar (23% each)

Trends in Coal

- Over 71 GW of coal retirements publicly announced, 2010-2022
- Over 36 GW of coal has been retired, 2010-July 2015
- 15 GW of new coal brought online, 2010-July 2015
- Only one new coal plant announced since 2010: W.A. Parish, TX

Final CPP: The Big Picture

- Compliance (“mandatory period”) starts in 2022
- Reductions requirements phased in more slowly
- State goals are more consistent
 - Range of final goals 771 to 1305 lb CO₂/MWh
 - Less stringent goals got more so; and vice versa
- State borders effectively removed for compliance
 - Assuming states allow for trading (credits or allowances)
 - Reductions can be achieved anywhere
- Reliability considered more explicitly
 - Part of state plan design
 - Inclusion of reliability safety valve (RSV)

The Final CPP: Things to Keep in Mind

- Compliance focus is clearly on UNITS not states
- States' main job: apply emissions limits to units and decide whether to allow trading
 - Units decide how and when to achieve reductions (or procure/buy ERCs or emission allowances)
 - EPA assumes that a national trading system will emerge

The Final Clean Power Plan Structure

- Final CPP contains “guidelines” for states to regulate CO₂ emissions from existing fossil-based EGUs
- Established uniform national emission rates for coal-based units (including IGCCs) and NGCCs

| | Interim Goals (2022-2029) lb CO ₂ /MWh | Final Goals (2030 and on) lb CO ₂ /MWh |
|-------------------------|---|---|
| Coal-based units | 1534 | 1305 |
| NGCCs | 832 | 771 |

The Final Clean Power Plan: Key Terms and Concept

- Allowance: the right to emit one ton of CO₂
- Mass-based system: units required to surrender allowances to cover their mass emissions at the end of each step period
- ERC: one zero-emissions MWh
- Rate-based system: units required to acquire ERCs sufficient to average measured emission rate to assigned emission rate by end of each step period

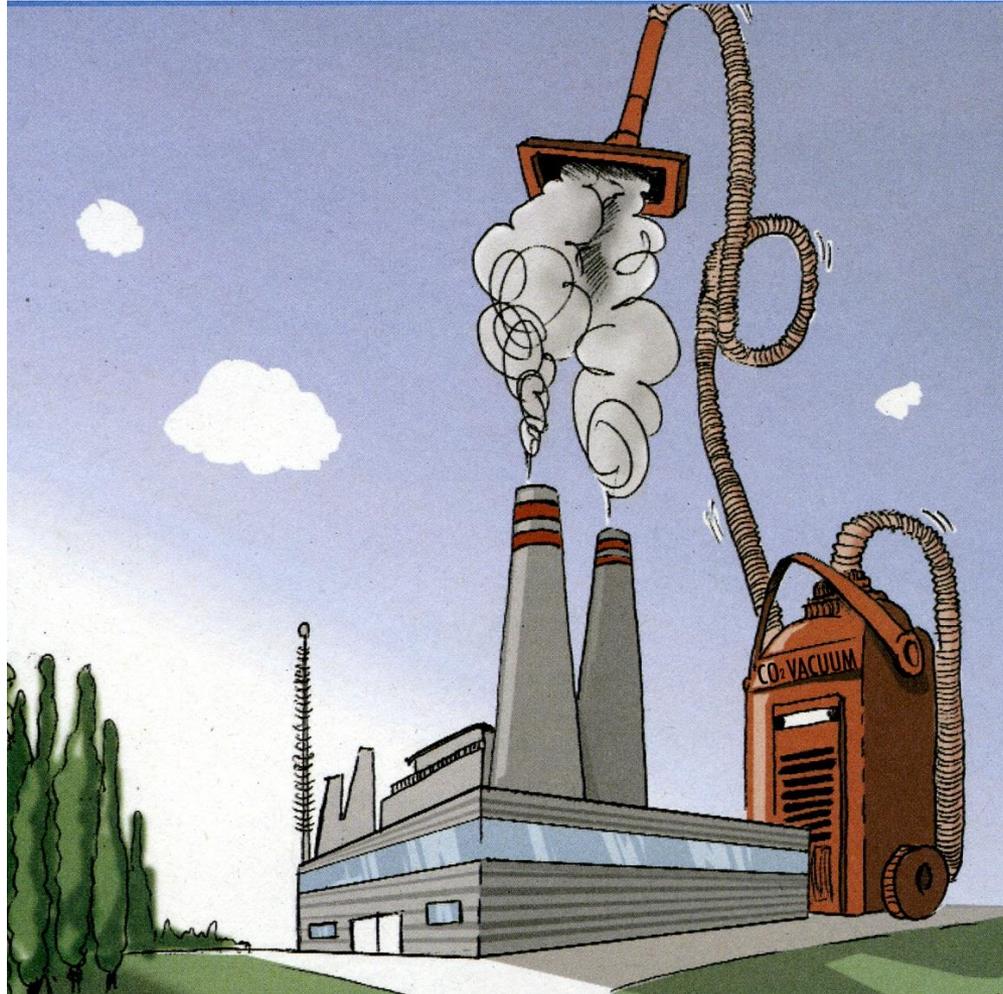
Which Compliance Activities Can Be Allocated Allowances or Generate ERCs?^{1,2}

| Compliance Activity | Mass-based Approach | | Rate-based Approach | |
|---|---------------------|----------------|---------------------|----------------|
| | State Plan | Federal Plan | State Plan | Federal Plan |
| Carbon Capture and Storage (CCS) | | | | |
| • New units with CCS | Yes ³ | No | Yes ³ | No |
| • Existing units with CCS | Yes | Yes | ? ⁴ | ? ⁵ |
| Coal Unit Retirements | | | | |
| • After 2012 and before 2022 | Yes | ? ⁶ | No | No |
| • During the interim compliance period | Yes | Yes | No | No |
| Heat Rate Improvements | Yes | No | ? ⁸ | No |

Endnotes for Compliance Checklist

- 1 - In general, EPA limits compliance to reductions achieved during the interim period (2022-2029) that result from activities and tools “installed” after 2012. The regulatory text for the final 111(d) guidelines and the proposed federal plan generally limit eligibility for allowances and ERCs to “resources which increased electrical generation nameplate capacity...installed or implemented after January 1, 2013.” The relationship between “installed” and “operating” is not clear at this time.
- 2 - Based on initial discussions with EPA, this document includes the broadest interpretation of a state’s authority to allocate allowances to a wide range of entities. However, portions of the regulatory text included in the final guidelines could be interpreted to limit states to allocating allowances only to those entities that would satisfy the eligibility requirements for creating ERCs. This document will be updated if future discussions with EPA indicate that state allocation authority is more limited.
- 3 - A state could allocate allowances to a new unit that installs CCS, or could designate CCS as an eligible resource that can create ERCs, but must demonstrate that reductions are being achieved at existing affected units as a result (i.e., that overall emissions are not increasing as a result; EPA refers to this potential phenomena as “leakage”).
- 4 - All existing affected units will be assigned an emission rate. If the unit operates below its assigned rate through the installation of CCS, ERCs representing the difference between the unit’s assigned rate and the achieved rate could be generated.
- 5 - Steam-electric generating units will be assigned the uniform national emission rate. If the unit emits less than its assigned rate through the installation of CCS, ERCs representing the difference between the assigned rate and the achieved rate could be generated.
- 6 - EPA proposes to issue allowances for the first step period (2022-2024) based on historic generation in 2010-2012. This implies that a unit that generated electricity in 2010-2012 could be allocated allowances in the first step period even if it was not operating in 2022. It is not clear whether these units could be allocated allowances for subsequent step compliance periods. EPA is taking comment on these issues in the context of the federal plan.
- 8 - A unit achieving a better emission rate than that assigned to it as the result of a heat rate improvement could earn ERCs

CO₂ Capture and Storage: Not Nearly this Simple



United Nations Environment Program , “Can carbon dioxide storage cut greenhouse emissions? A simplified guide to the IPCC’s ‘Special Report on Carbon Dioxide Capture and Storage.’” (Geneva, 2006), p. 18.

Interagency CCS Task Force

“There are no insurmountable technological, legal, institutional, or other barriers that prevent CCS from playing a role in reducing GHG emissions.” August 2010

Large-Scale Storage Challenges

- While enhanced oil recovery (EOR) has been used at large scale for decades, there have been relatively few sites where large amounts of CO₂ have been injected into geologic formations
- Monitoring, permitting and long-term care programs will need to be developed so that large-scale storage sites can be constructed and environmental protection assured
- Legal liability is associated with large-scale geologic sequestration due to the long time frame

Legal Liability

- Civil liability where third parties who have suffered harm seek compensation or court order
- Administrative liability where authorities are given powers to serve some form of enforcement or clean-up order
- Emissions trading liability where an emissions trading regime provides a benefit for CO₂ storage and an accounting mechanism is in place should there be subsequent leakage
 - *Legal liability and carbon capture and storage: a comparative perspective, GCCSI, October 2014*

CO₂ Pipeline Challenges

- While the challenges for siting a CO₂ pipeline are similar to those for siting a natural gas pipeline, there is no federal eminent domain authority available for CO₂ pipelines – more cost and time associated with right-a-way acquisition
- Would FERC authority be more appropriate than STB authority – may require legislation
- Ownership of pipeline – utility? injection operator?

Challenges to Class II and Class VI CO₂ Injection Permits

- Administrative litigation against the EOR owner/operator of Class II wells on the grounds that Class II permits are inadequate to protect underground sources of drinking water (USDWs); resolved in favor of the EOR operator
- Administrative litigation alleging that Class VI permits issued to FutureGen 2.0 are inadequate to protect USDWs; resolved in favor of FutureGen
- Unresolved litigation pending against EPA's conditional exclusion for geologically sequestered CO₂ under the Resource Conservation & Recovery Act; case turns on whether CO₂ injected and stored via Class II well is a hazardous waste, a critical topic for utilities, pipelines and EOR owners/operators that may be subject to the proposed GHG NSPS

Conflicting Regulation/Guidance between EPA Air Office and Water Office

- 9 guidance documents to support the Class VI rule have been issued – 8 have been finalized, one has not been completed
- Guidance for transitioning a Class II well to a Class VI well, released for comment in December 2013, received numerous pushback from industry – EPA released a Memo on April 23, 2015, that outlines principles related to this transition that addressed many, but not all, of the concerns
- EPA Air Office has different requirements for Class II and Class VI GHG reporting

111(b) CO₂ Emissions Standards for New Coal-based EGUs

- BSER: highly efficient supercritical PC w/ partial CCS sufficient to achieve 1,400 lb/MWh
- Alternative compliance option: IGCC, co-firing w/ natural gas or pre-combustion slipstream capture
- Storage and reuse of captured CO₂ must be conducted according to existing EPA rules

Observations on 111(b) and Coal-based EGUs

- Final rule assumes that a SC/PC will be able to comply with standard by capturing and storing 16% to 23% of the CO₂ emissions (varies by coal rank)
- Final Rule states that a SC/PC could comply with the standard by co-firing with 40% natural gas and that this would be less expensive than installing and operating CCS; EPRI studies and other analyses indicate that the co-firing rate of 45% to 60%+ would probably be necessary to approach the standard rate
- Final rule would enable CO₂-EOR owners/operators purchasing NSPS-regulated CO₂ to continue to inject under Class II; however, they would be required to opt into subpart RR of the GHG Reporting Program, which includes the requirement for federally approved Monitoring, Reporting and Verification.

Takeaways

- The existence of so much litigation around the Class II and Class VI regimes is detrimental to investment and deployment
- There's a lot of uncertainty as to what rules apply
- The potential for RCRA liability, which imposes cradle-to-grave monitoring, manifesting and disposal requirements, could easily scare investors away
- The lack of clarity around long-term liability for stored CO₂ creates additional uncertainty as to who is responsible long-term for any storage site
- The generator of the CO₂ cannot be held liable, especially if this is going to result in possible CAA violations
- These challenges with large-scale storage combined with the current economic hurdle for CCS make for an uncertain path forward for coal

Questions

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