



Potential Impacts of Proposed Environmental Regulations on the ERCOT System

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Background

- **ERCOT was asked by the Public Utility Commission of Texas to review the potential impacts of pending environmental regulations on generation resources and transmission system reliability in the ERCOT region.**
- **Four pending regulations were evaluated:**
 - Clean Air Act – new emission limits for Hazardous Air Pollutants (HAP);
 - Clean Water Act – Section 316(b), regarding new requirements for cooling-water intake structures;
 - Clean Air Transport Rule (CATR); and,
 - Coal Combustion Residuals (CCR) Disposal regulations.
- **ERCOT's Study is documented in a report, available at the following link:**
http://www.ercot.com/content/news/presentations/2011/ERCOT_Review_EPA_Planning_Final.pdf

Rule Requirements

- **Aggregate compliance requirements are still not clear**
 - Two of the four regulations have been proposed (HAP and 316[b]); these may be finalized as early as this fall.
 - Based on initial descriptions of the pending Transport Rule, Texas would only be regulated for peak season NOx emissions.
 - Compliance deadlines are not known at this time.
- **Based on a review of the proposed regulations, the following retrofit requirements were assumed for this analysis:**
 - Lignite-fired plants would be required to have at least a wet limestone scrubber, a baghouse with activated carbon injection, and selective non-catalytic reduction equipment
 - Sub-bituminous plants would be required to have at least dry sorbent injection and a baghouse with activated carbon injection
 - Due to the uncertainty of the implementation of Section 316(b) requirements, the analysis was conducted with and without a requirement for closed-loop cooling tower systems

Retrofit Technology Costs

Cost estimates for environmental control technologies were obtained from EPA reports and other published studies. The costs used for the ERCOT analysis are listed in the table below.

| Control Technology | Cost Estimate (\$/KW) |
|--|-----------------------|
| Wet Limestone Scrubber | 450 - 573 |
| Dry Sorbent Injection | 39 |
| Selective Non-catalytic Reduction | 10 |
| Baghouse with Activated Carbon Injection (ACI) | 197 - 316 |
| Closed-Loop Cooling Tower | 200 |

For control technologies with a range of costs, the higher costs per KW are representative of smaller generating units. Economies of scale reduce the costs of these technologies for larger generating units.

Methodology

- **Given the upgrade requirements described above, the economic value of coal and older (pre-2000) gas-steam generation was evaluated using a system dispatch model (forecasted system conditions for the year 2017 were modeled). Units that did not return sufficient market revenue to justify expected retrofit costs were assumed to be retired.**
- **Four market scenarios were evaluated:**
 - With current forecasted spot natural gas prices (\$5.10/MMBtu [in 2017 dollars]) and with higher gas prices (\$8.00/MMBtu)
 - With and without a carbon emissions fee of \$25/ton
- **Each scenario was evaluated with and without a per-unit requirement for closed-loop cooling tower systems**

Generation Analysis Results

The amounts of generation capacity that were found to be uneconomic are listed in the following table:

| Forecasted Generation Retirements | | Cooling Towers not required | | Cooling Towers required | |
|-----------------------------------|-----------------------------------|-----------------------------|----------|-------------------------|----------|
| | | Coal (MW) | Gas (MW) | Coal (MW) | Gas (MW) |
| Low gas price (\$5.10/MMBtu*) | No carbon emissions cost | 0 | 0 | 1,200 | 8,100 |
| | Carbon emissions cost (\$25/ton*) | 4,400 | 0 | 5,600 | 8,100 |
| High gas price (\$8/MMBtu*) | No carbon emissions cost | 0 | 0 | 0 | 8,100 |
| | Carbon emissions cost (\$25/ton*) | 0 | 0 | 0 | 8,100 |

* 2017 Dollars

Transmission Analysis Results

- **The potential retirements of gas-steam generation caused by closed-loop cooling tower requirements would result in significant loss of generation capacity in the Dallas-Fort Worth and Houston areas.**
- **Both regions would require significant transmission infrastructure improvements in order to maintain system reliability.**
- **Redevelopment of these brownfield generation sites would likely significantly reduce system costs.**

Discussion

- The regulations evaluated in this study are not yet finalized, and the analysis described is based on assumptions (provided above) regarding expected compliance strategies. Additional retrofit requirements would likely lead to additional generation retirements.
- The analysis indicates that the coal fleet has sufficient economic value to justify investments to achieve expected compliance requirements. However, the imposition (or perceived risk) of a carbon emissions fee could result in the retirement of marginal coal generation.
- Older gas steam units are not expected to produce sufficient revenue to justify investment in new control technologies.
- Much of the retired generation would likely be replaced with new generation capacity. However, new generation investment will require sufficient energy prices (including potential hours of scarcity pricing) to provide adequate incentive.
- Even if there is sufficient market interest in new generation capacity, system reliability may be at risk if the timing of the new regulatory requirements is such that there is insufficient lead-time for favorable market conditions to become apparent.



Questions