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**Commercializing technologies:
The buyer's perspective, experience from
the Clean Air Act**

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Key priorities for power generators purchasing technology

- Reliability
 - Minimal impact to asset availability
- Economic viability
 - Mechanism for recovering capital investment over expected time horizon
 - Lowest Evaluated Cost
 - Factoring in risk contingencies

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The Clean Air Act

- Original CAA passed in 1970
 - New source performance standards for power plants established emission rates
 - SO₂, NO_x, PM “Criteria” Pollutants
 - Existing coal plants “grandfathered” for NO_x, SO₂
- Clean Air Act Amendments (CAAA) in 1990
 - New source performance standards updated
 - Existing sources subject to requirements
 - SO₂, NO_x, PM
 - SO₂ trading started in 1995

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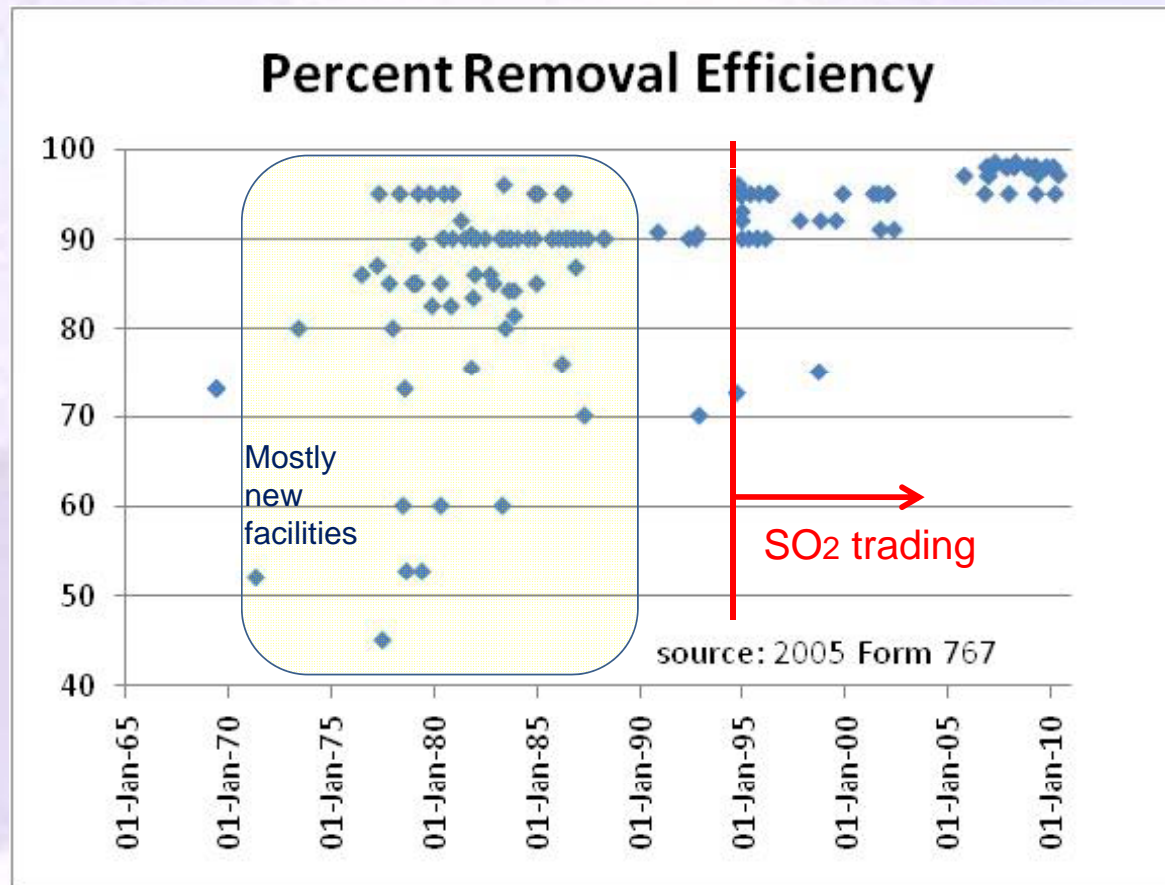
CAAA Power Plant Experience - SO₂ Control on Existing Units

- Scrub or switch fuels
- Fuel switching was the most widely used approach from 1990-2000 for existing units
 - About 640 generating units switched fuels
 - 47 generating units scrubbed
- Most widely used scrubber technology is limestone wet scrubbers - now being deployed much more widely due to more stringent rules.
- Closer look at scrubber technology over time.

Lowest evaluated cost!

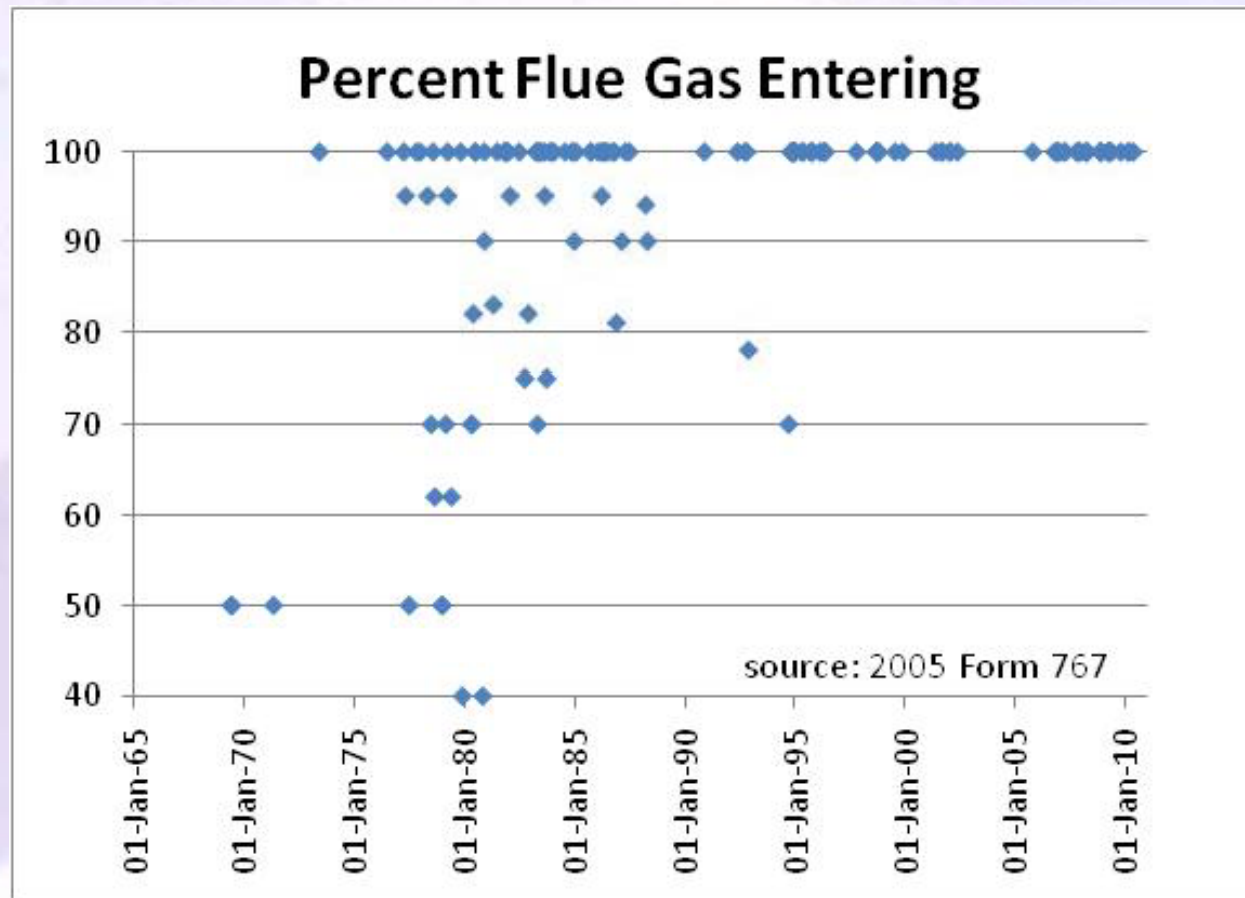
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Wet scrubber efficiencies have improved



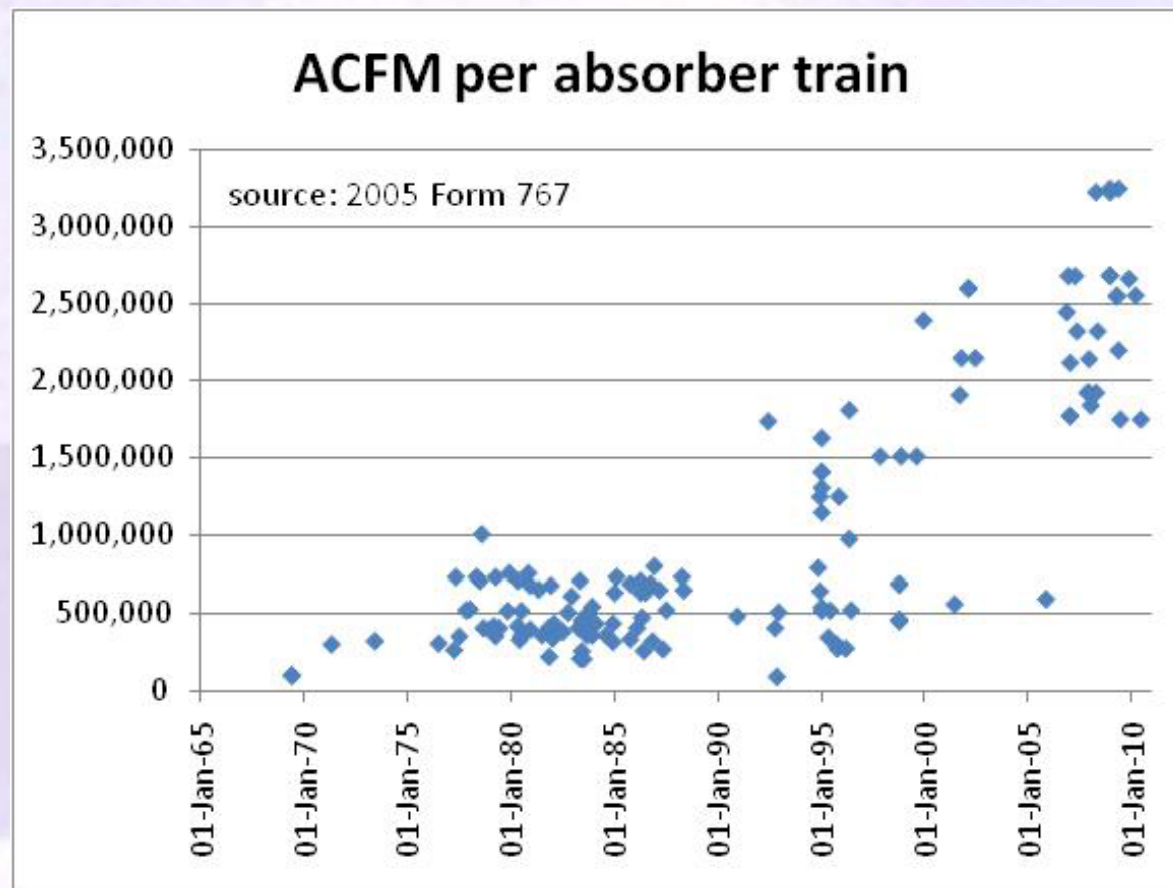
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Many early scrubbers bypassed flue gas



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Absorber size has increased dramatically



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Scrubber technology evolution

- Reliability Evolution
 - Improved materials, better chemistry control
 - Far more reliable - less need for redundancy or for bypass
- Performance Evolution
 - Much higher removal efficiencies and lower parasitic loads due to technology improvements
- Cost Evolution
 - Larger scale and less redundancy, reducing capital costs
 - Ongoing costs lowered
 - Less waste – high quality dewatered gypsum product
 - Lower energy consumption

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Key Takeaways

- Early deployments of technology will incorporate risk mitigation measures
- Early deployments of technology will not achieve the full performance potential of the technology
- Long-term, scale and technology improvements will be used to drive down cost and increase performance
- Trading programs mitigate risk for the buyer and incentivize efforts to maximize performance and use of economic scale.
- Sometimes a much cheaper option comes along that is “good enough” for the moment (ie, coal switching)

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Questions/Comments

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