Comments on
“A Research Program for Promising Retrofit Technologies”

Edward S. Rubin
Department of Engineering and Public Policy
Department of Mechanical Engineering
Carnegie Mellon University
Pittsburgh, Pennsylvania

For discussion at the

MIT Symposium on Retro-Fitting of Coal-Fired Power Plants
for CO₂ Emission Reductions
Cambridge, Massachusetts
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USDOE Carbon Capture R&D
(76 projects in early 2007)

8 technology areas

$205M over 3.3 yrs, avg

(Source: NETL, 2007)
### Back in the 1980’s

#### What’s Hot …

<table>
<thead>
<tr>
<th>In-Duct Injection</th>
<th>Limestone Injection Multi-Stage Burners (LIMB)</th>
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<tr>
<td>Copper Oxide Process</td>
<td>NOXSO Process</td>
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<td>LIDS</td>
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<td>PFBC</td>
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<td>Slagging Combustors</td>
<td>Dry Scrubbing</td>
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What’s Not

A utility company view of post-combustion SO$_2$ capture systems

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Significant declines in cost as FGD technology is deployed

Experience Curve for Wet Limestone FGD Systems

(Based on 90% SO₂ removal, 500 MW plant, 3.5%S coal)

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U.S. Patenting Activity in SO₂ Control Technology

Regulatory policies stimulated innovations that reduced emissions ...

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How to Get “Over the Horizon Technology”

• Create a market for CCS—performance standards can do this (other policy approaches also may, or may not)

• Pursue continual improvements to current technology (not just R&D on new “breakthrough” options)

• Give it some time (a decade or more)

• Even with better, cheaper capture systems, CCS retrofits will not make economic sense for many existing subcritical units
Innovations in post-combustion NOx control coincided with strict emission regs

Patenting Activity Index for Flue Gas NOx Control

Index for U.S. remained flat over this period at ~1
Historical Cost Reductions for Post-Combustion NOx Control

Experience Curve for SCR Systems

Cost reduction = 12% per doubling of installed capacity

(Based on 80% NOx removal, 500 MW plant, medium S coal)

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