Retrofit Post-Combustion CO2 Capture: Straw Proposal to Facilitate Discussion

March 2009

Key Assumptions

- Program goal is full-scale commercial demonstration of a few technologies rather than wide-spread commercial deployment.
- Focus on technologies that can be broadly applied
- Several technologies are potentially ready for full scale-up:
  - Amine (at least four distinct variations)
  - Chilled ammonia
  - Aqueous ammonia
- Five demonstrations are necessary to cover all promising technologies
- Independent “fatal flaw”/proof of concept analysis should precede funding.
- All commercial projects would sequester captured CO2 (through EOR or injection into suitable geologic formations).
Straw Proposal

<table>
<thead>
<tr>
<th>Action</th>
<th>Cost</th>
<th>Incentive $$ (NPV)</th>
<th>Schedule</th>
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</thead>
<tbody>
<tr>
<td>5 Interim scale (~40 MW) demonstrations</td>
<td>~$750 million</td>
<td>N/A</td>
<td>Planning/engineering – Nine months</td>
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<td>Construction – One and one-half years</td>
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<td>Operation/evaluation – One year?</td>
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<tr>
<td>5 full-scale (~600MW demonstrations)</td>
<td>~$8.0 billion</td>
<td>~$3.6 – 6.6 billion</td>
<td>Planning/engineering – One year</td>
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<td>(range assumes $10 ton CO2 2012 - $20 ton CO2 2012, w/7% annual increase)</td>
<td>Construction – Two and one-half years</td>
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<td>Operation/evaluation – Two years.</td>
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Program is conducted cooperatively with China and Australia

Time Line

- Program authorized and funded 1/10
- Interim project proposals complete 6/10
- Awards for interim projects 9/10?
- **Interim projects “on-line”** 3/11
- Full-scale project proposals complete 3/13
- Awards for full-scale projects 6/13
- **Full scale projects “on-line”** 12/16?

If technologies are ready for full scale up without interim scale demonstrations, full scale projects could be on-line by 12/13?
Some Questions for Discussion

• Are any other broadly applicable technologies ready for scale up to commercial application? Oxy-combustion?
• Is the interim scale-up step necessary?
• If there is an obvious limit to technology “train” size that would require multiple trains for a “full-scale” commercial demonstration, is a single train sufficient to support commercial deployment?
• Are five successful commercial demonstrations sufficient to support wide-spread deployment? Are five projects too many?
• Could current technologies “get ready” for full scale-up through actions other than interim-scale demonstration projects?
• Are the proposed times lines realistic?
• Is generator cost-sharing practical given technology risk, etc?
• What advantages could result from a cooperative program with China and Australia?
• What would be needed to establish a domestic incentives program that could take quick and efficient action?