Preventing Carbon Lock-in

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Investments Today Drive Impacts Tomorrow

- Investments drive emissions
- Emissions drive concentrations
- Concentrations drive temperature forcing
- Forcing drives impacts
Carbon Lock-in
New Fossil Units 2003-2030

Source: IEA, WEO2004

Lifetime Carbon
Coal = 145 GtC
Gas = 63 GtC
Oil = 2 GtC
New Fossil Plant Emissions Rival Historic Totals

Billion tonnes Carbon
Source: ORNL, CDIAC; IEA, WEO 2004
Annual Carbon Commitment

Lifetime Emissions of Annual New Fossil Investment

Source: new fossil capacity, IEA, WEO 2004
New Coal Build by Decade

Incremental new coal capacity by decade

Source: IEA, WEO 2004
BAU Means Carbon Lock-In
IEA New Coal Forecast

Source: IEA, WEO 2004
BAU Means Carbon Lock-In
IEA New Coal Forecast

BAU CCS schedule won't produce usable results before 2020. Result: 1205 out of 1391 GW of forecast new coal plants will likely be built with conventional coal technology.
Combine EERE & CCS to Prevent Lock-In

• IEA Alternative Policy Scenario reduces new coal build with policies to promote energy efficiency and renewable energy.

• CO2 Capture & Storage (CCS) initiative for new coal starting 2011.
IEA Alt. Policy Scenario

- Efficiency reduces total generation in 2030 by 13%.
- Renewable and nuclear generation in 2030 increase by 37% and 14% respectively.
- This reduces coal generation by 28% and reduces new coal build by 43% from 1391 GW to 793 GW.
Fund CCS for New Coal in Developing Countries

- Industrialized countries (Annex II, OECD, G8, G8+) agree to finance incremental costs of IGCC with CCS for 10 years (2011-2020) in developing countries.

- Ramp in coverage: 2011=20% of new build; 20% increase each year.

- Cover full incremental cost of electricity (levelized capital and operating costs) for IGCC/CCS to 2020.
Funding CCS for New Coal in Developing Countries

163 GW out of 200 GW uses CCS with funds

New Coal Capacity from IEA, WEO 2004
What About Industrialized Countries?

Applying the same CCS deployment schedule in industrialized countries results in another 33 GW of CCS capacity (out of 41 GW coal forecast).
Preventing Carbon Lock-In
Combining EERE and CCS

GW

EERE in IEA Alternative Scenario Delays New Coal Build

year
Preventing Carbon Lock-In
Combining EERE and CCS

Source: IEA, WEO 2004
Lifetime Carbon From Next 1391 GW Coal

<table>
<thead>
<tr>
<th>Case</th>
<th>Gt C</th>
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<tbody>
<tr>
<td>BAU</td>
<td>145</td>
</tr>
<tr>
<td>PEE - 2300</td>
<td>129</td>
</tr>
<tr>
<td>EPEE + CCS</td>
<td>42</td>
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Costs

• IEA: Energy capital costs are the same for reference and alternative scenario. ($2.1 trillion switches from supply to demand side).

• NRDC/Princeton:
  – CCS for LDC 2011-2020 with learning $5.1 billion/year levelized discounted
  – Without learning = $7.6 billion/year.
  – Global program costs = $6.1 billion with learning; $9.2 billion without learning.
Costs of CCS Fund

- Levelized discounted costs = $5-7.6 billion/yr
- Compare 2003 G7 ODA = $50 billion
- But compare GEF = $3 billion for four yrs.

Costs derived from Foster Wheeler Study for IEA GHG Programme, May 2003
More on Costs

- $5.1-7.6 billion LDC program = 0.4-0.6 mills/kwh if applied to OECD generation. (learning v. no learning).

- $6.1-9.2 billion global program = 0.5-0.8 mills/kwh. (learning v. no learning).

- CCS program costs are significantly less with EERE programs implemented. Without EERE, CCS for LDC costs $7.7-12 billion/year and global CCS program costs $12.6-18.9 billion/yr. (learning v. no learning).
U.S. Emissions: Business as Usual

After Pacala and Socolow, 2004; ARI CarBen3
U.S. Emissions: Electricity efficiency

After Pacala and Socolow, 2004; ARI CarBen3 Scenario
U.S. Emissions: Other end-use efficiency

After Pacala and Socolow, 2004; ARI CarBen3
After Pacala and Socolow, 2004; ARI CarBen3
U.S. Emissions: Other transport efficiency

After Pacala and Socolow, 2004; ARI CarBen3
After Pacala and Socolow, 2004; ARI CarBen3
U.S. Emissions: Carbon capture & storage

After Pacala and Socolow, 2004; ARI CarBen3 Spreadsheet

Electricity end-use efficiency
Other end-use efficiency
Passenger vehicle efficiency
Other transport efficiency
Renewables
CCS & Supply efficiency

1.8
2.6
0.9

GtC

1970 1990 2010 2030 2050
U.S. stabilization triangle

After Pacala and Socolow, 2004; ARI CarBen3

Biggest Emitters 2000-2025

Top six = 66%

Cumulative CO2 Emissions 2000-2025, EIA, IEA 2002
Warming Won’t Wait. Will We?

Since 1979, more than 20% of the Polar Ice Cap has melted away.
Appendix

Details of IEA Alternative Policy Scenario
**Figure 11.4:** Net Natural Gas Imports in Selected Regions in the Reference and Alternative Scenario, 2030

![Bar chart showing net natural gas imports in selected regions for the Reference and Alternative Scenario, 2030.](chart)

- **OECD North America:** Reference Scenario: 150 bcm, Alternative Scenario: 100 bcm
- **OECD Europe:** Reference Scenario: 400 bcm, Alternative Scenario: 500 bcm
- **OECD Asia:** Reference Scenario: 100 bcm, Alternative Scenario: 150 bcm
- **China:** Reference Scenario: 50 bcm, Alternative Scenario: 100 bcm

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Figure 11.6: Cumulative Reduction Energy-Related CO₂ Emissions in the Alternative Scenario*, 2002-2030

* Compared with the Reference Scenario

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Figure 11.7: Reduction in Energy-Related in CO2 Emissions in the Alternative Scenario* by Contributory Factor, 2002-2030

* Compared with the Reference Scenario

- End-use efficiency gains
- Fuel switching in end uses
- Changes in the fossil-fuel mix in power generation
- Increased nuclear in power generation
- Increased renewables in power generation

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Figure 11.8: Difference in Cumulative Energy Investment between the Reference and Alternative Scenarios by Region, 2003-2030
Figure 11.11: Reduction in Demand for Fossil Fuels in the Alternative Scenario* by Region, 2030

* Compared with the Reference Scenario
Figure 11.13: Change in Energy Demand in the Alternative Scenario in the Largest Non-OECD Countries*, 2030

* Compared with the Reference Scenario

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Figure 11.18: Oil Demand for Transport in the Reference and Alternative Scenarios by Region

- OECD:
  - 2002: 1200 Mtoe
  - 2030 Reference: 1600 Mtoe (+44%)
  - 2030 Alternative: 1850 Mtoe (+159%)

- non-OECD:
  - 2002: 400 Mtoe
  - 2030 Reference: 520 Mtoe (+26%)
  - 2030 Alternative: 720 Mtoe (+127%)
Figure 11.20: Reduction in Electricity Demand in the Residential and Services Sectors in the Alternative Scenario*, 2030

* Compared with the Reference Scenario