The Global CCS Institute

Our Vision for CCS:
CCS is an integral part of a low-carbon future

OUR MISSION
To accelerate the development, demonstration and deployment of CCS globally.

1. Fact-based, influential advice and advocacy
2. Authoritative knowledge sharing

- We are an international membership organisation.
- Our diverse international membership consists of:
  - Governments
  - Global corporations
  - Small companies
  - Research bodies
  - Non-government organisations.
- Specialist expertise covers the CCS/CCUS chain.
Key Messages from the Global CCS Institute

CCS is a vital component of a low-carbon future

CCS is established and already reducing emissions

Strong policy support is required globally
Key Message #1

CCS is a vital component of a low-carbon future
Fossil fuel demand growing and reserves robust

Fossil fuel proved reserves: 6 trillion barrels of oil equivalent
Reserves to production ratio: ~75 years

Source: IEA World Energy Outlook, 2015 (New policies scenario)

Source: BP Statistical Review of World Energy 2015
Mitigation costs more than double in scenarios with limited availability of CCS

Percentage increase in total discounted mitigation costs (2015-2100) relative to default technology assumptions – median estimate

<table>
<thead>
<tr>
<th>2100 concentrations (ppm CO₂eq)</th>
<th>no CCS</th>
<th>nuclear phase out</th>
<th>limited solar/wind</th>
<th>limited bioenergy</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>138%</td>
<td>7%</td>
<td>6%</td>
<td>64%</td>
</tr>
<tr>
<td></td>
<td>4 / 11</td>
<td>8 / 11</td>
<td>8 / 11</td>
<td>8 / 11</td>
</tr>
</tbody>
</table>

Symbol legend – fraction of models successful in producing scenarios (numbers indicate number of successful models)

- All models successful
- Between 80 and 100% of models successful
- Between 50 and 80% of models successful
- Less than 50% of models successful

 CCS contributes 13% of cumulative reductions

Portfolio of low carbon technologies thought 2050 in a 2DS world compared to ‘business as usual’

Source: IEA, Energy Technology Perspectives (2015).
When expectations collide

- ‘Business as usual’ is incompatible with climate change objectives
- ‘Business as usual’ leads to a rising average global temperature

“A 4°C world is so different from the current one that it comes with high uncertainty and new risks that threaten our ability to anticipate and plan for future adaptation needs.”

World Bank Group President Jim Yong Kim, November 2012

- Renewable technologies are not the sole answer to mitigating the rise
  - Decarbonising power without CCS could cost up to US$2 trillion more than with CCS. In Europe, it will cost additional €1.2 trillion to reach the EU’s CO₂ reduction target without CCS (CCS for Industry, ZEP 12 November 2015)
  - In industrial processes, which account for 25% of CO₂ emissions, there is no alternative to CCS to achieve deep emission cuts

- The longer the delay in climate change action, the greater the need for net negative emissions technologies like BECCS
Key Message #2

CCS is established and already reducing emissions
Large-scale CCS projects by region or country

<table>
<thead>
<tr>
<th>Region</th>
<th>Early planning</th>
<th>Advanced planning</th>
<th>Construction</th>
<th>Operation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Americas</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>China</td>
<td>5</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Europe</td>
<td>2</td>
<td>4</td>
<td>-</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Gulf Cooperation Council</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Rest of World</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>11</td>
<td>7</td>
<td>15</td>
<td>45</td>
</tr>
</tbody>
</table>

North America (with 13 in the US and 6 in Canada), China (with 9) and UK (with 5) have the most projects.
Much to look forward to over the next 18 months

Number of projects

- Projects to enter operation - currently under construction
- Projects in the Operate stage

<table>
<thead>
<tr>
<th>Year</th>
<th>Projects to enter operation</th>
<th>Projects in the Operate stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>2011</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>2012</td>
<td>8</td>
<td>8</td>
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<td>2013</td>
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<td>2014</td>
<td>13</td>
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<td>2015</td>
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<tr>
<td>2016</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>2017</td>
<td>15</td>
<td>7</td>
</tr>
</tbody>
</table>
Large-scale projects expected to become operational by 2017

A global portfolio of operating CCS projects is emerging.

A significant task within one generation

**Global Status of CCS: 2015**

45 large-scale CCS projects - combined capture capacity of 80 Mtpa*:

- 22 projects in operation or construction (40 Mtpa)
- 11 projects in advanced planning, five nearing FID (15 Mtpa)
- 12 projects in earlier stages of planning (25 Mtpa)

4,000 Mtpa of CO₂ captured by CCS by 2040 (IEA 450 Scenario)**

*Mtpa = million tonnes per annum

**Source: IEA, Energy Technology Perspectives (2015).
Key Message #3

Strong policy support is required globally
Strong policy drives investment

- Scale of renewables investment is instructive
- CCS has not enjoyed commensurate policy support
- EOR has provided impetus in North America
- Policy parity is essential
- How do we get CCS onto a similar curve?

**Clean energy investment between 2004-2013**

<table>
<thead>
<tr>
<th>USD billion</th>
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<tbody>
<tr>
<td>2000</td>
</tr>
<tr>
<td>1600</td>
</tr>
<tr>
<td>1200</td>
</tr>
<tr>
<td>800</td>
</tr>
<tr>
<td>400</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1929</td>
</tr>
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</table>

**Data source:** Bloomberg New Energy Finance as shown in IEA presentation “Carbon Capture and Storage: Perspectives from the International Energy Agency”, presented at National CCS week in Australia, September 2014.
A plan for CCS – Actions to stimulate momentum

- Industry and government must move at least five advanced projects ‘across the finish line’ in 2016

- Strong policy action - Policy parity

- This includes:
  - Providing predictable and enduring policy arrangements
  - Implementing effective and cost-efficient CCS law and regulation
  - Incentivising early storage site identification and characterisation
  - Re-doubling R&D efforts to reduce costs and increase efficiency
  - Encourage efficient development of hub and cluster arrangements
The Global Status of CCS: 2015

The Institute’s key publication

Access the Summary Report at:

www.globalccsinstitute.com/status2015
PLR recent analysis:

- The costs of CCS and other low-carbon technologies in the US: 2015 update
- Policy indicator: 2015 update
- Legal and regulatory indicator

http://www.globalccsinstitute.com/publications