Carbon Capture and Storage (CCS): An appropriate technology for New Zealand?

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Carbon Capture and Storage

Overview

• Timeframe for GHG reductions
  – Globally
  – For New Zealand

• Status of CCS
  – Current implementation
  – Future prospects

• Is CCS applicable for New Zealand?
  – Compare CCS against other options
Global anthropogenic GHG emissions

Data from IPCC – 4th Assessment Report (2007)
**Timeframe - Global Context**

Global anthropogenic GHG emissions

- F-gases
- \( \text{N}_2\text{O} \) from agriculture and others
- \( \text{CH}_4 \) from agriculture, waste and energy
- \( \text{CO}_2 \) from deforestation, decay and peat
- \( \text{CO}_2 \) from fossil fuel and other sources

- **30-60% reduction from 2000 emissions**

- **Temperature increase**: 2.4 – 2.8 °C
- **Sea level rise**: 0.5 – 1.7 m

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New Zealand anthropogenic GHG emissions (gross)

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74-85% reduction from 2000 emissions

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Sea level rise 0.5 – 1.7 m

Coal fired electricity
Gas fired electricity
Other large point sources
Transport, Commercial, Residential, Small Industrial

Status of CCS

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- Sleipner – Natural gas field, 1 Mt/yr
- In Salah – Natural gas field, 1-1.5 Mt/yr
- Weyburn – Oil field, CO$_2$ from a synfuels plant, 1-1.8 Mt/yr
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  Total stored = 5 Mt-CO$_2$/yr
  Large point sources = 14 000 Mt-CO$_2$/yr
  NG sweetening = 50 Mt-CO$_2$/yr
Status of CCS

• Partial capture has been implemented on some coal fired power plants

Warrior Run – 5% of CO₂ captured, on-sold to the beverage/food industry

Shady Point – 2-3 % of CO₂ captured, on-sold to the beverage/food industry
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• Energy penalty issues

Status of CCS – Future prospects

• “FutureGen” - as cited by the IPCC
• Funded in by the US Department of Energy and consortium of energy companies
• Details of plant
  – 275 MW_e IGCC,
  – US $1.5 billion,
  – hydrogen co-production
Status of CCS – Future prospects

- Feb 2003
  - Announced by President G. W. Bush
  - 5 year design and build, 5 year testing operation

- Dec 2007
  - Site selected, Mattoon, Coles County, Illinois

- Jan 2008
  - DOE announces it will pull funding (citing cost escalations) – effectively mothballing the project

- July 2008
  - DOE announces “Restructured FutureGen”
  - Goal to “establish the technical feasibility…of producing electricity from coal with very low…emissions”
  - Commissioning of the plant is not required until 2015
  - Expected to run for 3 – 5 years
  - Only 80% capture
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- Achieve 7% of required reductions from 2024

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- Woody biomass – require 434 000 ha
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- Proven technology
- Permanent solution

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- CCS - inappropriate for New Zealand
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CCS - inappropriate for New Zealand
Additional Information

NZ application – current research

• Fast follower of capture technology
• Require storage research
• Australian CO2CRC Otway Project –
  – FRST and Solid Energy contributing funding
  – CO$_2$ separated from natural gas re-injected into field
  – Total stored to be = 0.1 Mt (4.9 Mt from Huntly in 2006)
• Storage Investigations by GNS
  – 14 Mt-CO$_2$ in Huntly, 300 Mt-CO$_2$ in Maui
  – Large coal resources are in Southland
Additional Information

OxyFuel combustion capture

World's first carbon capture pilot fires up clean-coal advocates

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Shouldn't there be a generator?
Where does the electricity come from to drive the processes shown?
Additional Information

OxyFuel combustion capture

A standard $1600\text{MW}_e$ coal fired power station

30MW$_{th}$ coal plant

SOURCE: Vattenfall / World Coal Institute