Report from Australian

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Cooperative Research Centre for Greenhouse Gas Technologies

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Cambridge, MA
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Outline of presentation

• Cooperative Research Centres – CRC’s
• Cooperative Research Centre for Greenhouse Gas Technologies – CO2CRC
• Australia interest in CCS
• Current and recent projects
• Major announcements
  – NEWS!
Australian Energy Consumption by Fuel

Year


Peta joules

Black coal
Brown coal
Net crude oil
Natural gas
Renewables
## Australian Electricity Generation

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Australia’s future energy use

Australia’s energy usage will continue to increase. Its response to greenhouse concerns will include:

• Increased use of renewables
• Fuel switching
• Greater energy efficiency
• Enhanced carbon sinks
  – forests
  – decreased land clearance

AND

Ongoing use of low cost fossil fuels accompanied by CO₂ capture and storage technologies
  – especially geosequestration
Australian CCS activities
2004-2006
Activity on many fronts

• CO2CRC capture and storage research programs continue at pace
• Involvement in pilot project in Australia and around the world
  – Otway Basin Pilot Project
  – Frio Brine project
• Government and industry groups initiating major funding for CCS
  – Low Emissions Technology Demonstration Fund (LETDF) – Federal Govt
  – Energy Technology Innovation Strategy (ETIS) – Vic Govt
  – Qld Govt
  – COAL21 – Coal Industry Low emissions Strategy
• Major regional reviews
  – Latrobe Valley CO2 Storage Assessment (LVCSA)
  – Perth
  – SE Qld
  – NSW
• Significant engagement in regulatory and legislative review for CCS
• Government reviews across a wide
  – Senate review of Future Fuels – CCS for Coal to Liquids etc
  – House of Representatives review of Geosequestration
  – House of Representatives review of Nuclear power
Specific Projects

• Otway Basin Pilot Project
• Latrobe Valley CO$_2$ Storage Assessment
Regions being studied for potential pilot projects

- Sedimentary basins
- Regions currently being studied for potential pilot projects
- Regions currently being studied for CO₂ storage potential

- Bowen - Surat Basin
- Perth Basin
- Sydney Basin
- Otway Basin
- Gippsland Basin
Otway Basin Pilot Project - OBPP

Buttress
Naylor-1

Perth Basin
Bowen - Surat Basin
Sydney Basin
Otway Basin
Gippsland Basin
Research Project Concept
Pilot Project Objectives

• To demonstrate that CO₂ capture and storage is a viable, safe, secure option for greenhouse gas abatement by:
  – Concentrating CO₂ from a gas stream
  – Safely transporting CO₂ from source to sink
  – Safely injecting CO₂ into subsurface reservoirs
  – Safely storing CO₂ in the subsurface
  – Model and monitor stored CO₂ and confirm effectiveness
  – Develop optimal monitoring and verification configurations
  – Develop best practice CCS project management
  – Build and maintain effective Risk Register
  – Safely remove facilities and restore sites

• And:
  – Communicating to all stakeholders that this has been done
  – Conducting the pilot project within approved time and budget (CO2CRC)
  – Capturing all research outcomes (CO2CRC)
Monitoring Technology Options

- Data acquisition programs and frequency of time-lapse measurements
  - Implications and tradeoffs vs completion design
  - Prioritization of relative importance of each measurement to ease decision making

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Major regional reviews

- LVCSA
- Perth
- SE Qld
- NSW
LVCSA Overview

- **Objectives**
  - Medium to high level techno-economic study for CCS of Latrobe Valley CO2 emissions
  - Framework for engagement of stakeholders
  - ‘Pre-feasibility’ study of implementation of CCS in Victoria
  - Provide context for Govt policy and funding decisions
Monash Energy Foundation - World Class Source-Sink Match

Onshore
- World’s thickest coal
- Australia’s cheapest power
- Australia’s largest CO2 plume
- Emissions constrained future

Offshore
- Australia’s largest oil-fields
- Outstanding reservoirs
- Depletion constrained future
Emissions Reduction and Regional Development Objectives

- Store onshore CO₂ in offshore reservoirs - capacity 50 Mt/year
- Virtual elimination of Australia’s largest emissions source - 60Mt/year
- Remove emissions constraint on coal utilisation
- Sustain regional economic growth
- Extend coal use to liquid fuels and ultimately hydrogen
- Replace depleted domestic oil and transport fuel supply
Long-Term Monash Energy Pathway to Low Emissions
Selected Site Scenarios

Injection Scenarios

- Injection at several sites along regional migration pathways, sequentially & simultaneously, ramping up volume to 50 Mt/y
  1. Kingfish Field: 15 Mt/y for 40 years
  2. Fortescue Field: 15 Mt/y for 40 years
  3. Basin centre & northern gas fields: 20 Mt/y for 40 years
Capital Cost of Base Cases

Real (2005) Storage Capital Cost (A$MM)

- Remediation
- Injection
- Pipelines
- Compression
Real (2005) Storage Cost and CO2 Avoided

- Real storage cost per tonne of CO2 avoided (A$/t)
- Mass of CO2 Avoided (MMt)

- Remediation
- Injection
- Pipelines
- Compression

CO2 Avoided

A - B1 - B2 - C1 - C2
The findings from the project indicate that:

- the existing oil and gas fields could store more than two billion tonnes of CO2 once depleted;
- the regional seal rock is of good quality to store CO2;
- the geology, chemistry and hydrology are favourable for CO2 storage;
- CO2 will migrate very slowly through the reservoir rock over tens to hundreds of years;
- the unit cost of storage is low by world standards;
- risks are low and can be readily managed by proponents; and
- the targeted offshore injection sites are favourable for geosequestration.
Major Australian Initiatives (1)

• LETDF
  – $500 million funding on 1:2 basis for low emission technologies, including CCS
  – First announcements made
  – Many projects submitted in confidence - a range of technologies widely known including
    • Oxyfuels project
    • 3 gasifier proposals, both air and oxygen blown
    • Coal seam storage projects
    • Post combustion demonstrations

• ETIS
  – $120 million for power generation reduction projects
    • Demonstrations linked to LETDF
    • Research funds for both coal and renewables projects
Major Australian Initiatives (2)

• Qld Clean Coal Fund
  – State government funding
  – $300 million funding for low emission technologies from coal, including CCS
  – Fund recently announced and details being developed

• COAL21
  – Coal industry fund
  – $300 million funding for clean coal technologies, including CCS
  – Fund recently announced and details being developed

• Total $ 1.2 million
Breaking News

• Initial LETDF project announcements
  – $A 1.4 billion

• First tranche – Wed 25th Oct
  – World’s largest Solar power plant
  – Repowering of lignite power plant

• Second tranche – Mon 30th Oct
  – Oxyfuels plant
  – Power plant associated with ECBM

• More to come
Project details

- World’s largest Solar Power Plant

- $A 420 million  ($A 75 million Govt funds)

- Solar Systems Pty Ltd
  - Boeing

- 154 MW power plant in Western Victoria

- Demonstrating renewables with drive for significant reduction in COE
Project details

- ECBM Power Plant

- $A 445 million ($A 75 million Govt funds)

- Fairview Power
  - Santos
  - General Electric
  - CSIRO
  - CO2CRC

- 100 MW power plant in Queensland, sited adjacent to coal seams stimulated by CO₂ captured from exhaust flue gas

- Demonstrating
  - Power from coal bed methane
  - New drilling technology for cheaper distribution of CO2 and collection of methane
  - Sequestration of CO2 in coal seams
Project details

• Oxyfuel retrofit demonstration

• $A 180 million ($A 50 million Govt funds)

• CS Energy
  – IHI
  – CCSD
  – CO2CRC

• 30 MW power plant in Queensland

• Demonstrating
  – Oxyfuels separation of CO2
  – Future sequestration
Project details

- Lignite Power Plant repowering, drying and capture

- $A 369 million total project costs
  - (Leveraging $A 80 million Govt funds)

- International Power
  - Alstom (EPC contractor and combustion technology provider)
  - RWE (Coal drying technology provider)
  - Process Group (EPC contractor for CO₂ capture plant)
  - CO2CRC (Technology support for CO₂ capture plant)

- 200 MW boiler retrofit in Latrobe Valley (1/8 of plant)

- Demonstrating
  - RWE steam fluidised bed drying for 60% moisture lignite
  - 100% firing of dried coal
  - 25/50 tpd CO₂ post combustion capture
Technology roadmap for a low emission electricity and the hydrogen economy
Technology roadmap (Level 2) showing pilot (5-10,000 tonnes), demonstration (50-100,000 tonnes) & commercial projects.
Conclusions

• Australia has been, and continues to be, active in the area of geosequestration
• The original roadmapping done through the work of the APCRC in the GEODISC program and now through the CO2CRC is beginning to bear fruit
• Government and industry organisations are putting forward considerable funding to advance the demonstration of the associated technologies with significant announcements imminent
• The CO2CRC has been active in its research and pilot plant activities and continues to examine the large scale and regional opportunities that will be needed as the technology becomes more widely accepted

• Thank you and I welcome questions