CSIRO CMM Research

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The Commonwealth Scientific and Industrial Research Organisation (CSIRO)

- Is Australia’s national science agency and largest scientific enterprise
- Has an annual budget of more than $1.3 billion
- Employs 6,500 staff
Australian Coal Industry Overview

Secure, reliable and competitive supplier

World’s largest exporter – about 28% of world coal market in 2008-09

2009-2010 coal production statistics
  raw black coal: 471Mt
  saleable black coal: 366Mt

2008-09 exports: 261Mt ($A55 billion)

Black and brown coal account for 80% of Australia’s electric power (with black coal accounting for 57%)
Total fugitive emissions from coal mining 29 Mt CO2-e during 2009 which is about 5% of national total GHG emissions (DCCEE, 2011)

Sources of coal mining fugitive emissions:

- 61% underground mining operations
- 31% open-cut mining
- 8% post-mining and decommissioned mines
CSIRO CMM Research - Key Areas

• Surface and underground coal mine gas emission measurement and estimation methods

• CMM capture or drainage maximisation

• VAM mitigation and utilisation
Coal mine emissions are traditionally expressed in terms of specific emissions: volume of gas emitted per tonne of coal extracted ($m^3/t$), Emission Factor (EF).

- **Tier 1** – Generic EF for mining
  - very rough (~0.5 to 1 $m^3/t$)

- **Tier 2** – Basin specific
  - improved but preliminary

- **Tier 3** – Mine specific
  - reasonably accurate.
Measurement Techniques For Underground Mines

- Pitot probe
  - Accurate measurements
  - Significant velocity profile

![Graphs of velocity measurements on 20 May, 21 May, 22 May, and 23 May.](image)
Developing ECBM for Enhanced Methane Capture

• CUCBM (China), CSIRO and JCOAL are carrying out an ECBM field trial under the Asia Pacific Partnership

• Targeted coal seams are at ~500m, at Liulin Gas Block, Luliang City, Shanxi Province

• The injection well is a multi-lateral horizontal well with ~3.5km length

• Field trial to be completed before the end of 2011
CSIRO Surface Goaf Gas Drainage

Techniques

- Design of optimal drainage systems (number of holes, size, and location)
- Equipment selection and drainage operations

Outcomes

- 50% - 200% increase in gas capture
- Production increase in Australian mines
Integrated Coal and Methane Extraction

CSIRO Software COSFLOW

Mining induced strata fracture/deformation

Change in permeability and reservoir pressure

Caved, fractured and deformed zones

Ground Water Flow

Change in reservoir pressure and relative permeability

Gas diffusion and flow

Vertical Displacement

Change in effective stress
Multi-Seam Gas Flow and Emission Simulation - COSFLOW
Integrated Coal and Methane Extraction of Deep and Multi-Seams

Overburden strata fluid pressure monitoring during mining at Huainan China
VAMCAT Technology

- A new lean burn catalytic combustion gas turbine system, which can be powered with about 1% methane in the air
- Developed for the mitigation and utilisation of low concentration methane in mine ventilation air and poor drainage gas
VAM Capture Research

Goal
To develop an innovative technology of concentrating mine ventilation air methane (VAM) to high concentrations of $\geq 30\%$, or to levels that meet the requirements of lean-burn gas turbines.

Innovative technology
Nano-structured carbon fibre composite adsorbents, fabricated in honeycomb monoliths, enable the CH$_4$ capture in a dry process, high dust environment with low pressure drop.
Lab scale study results

Adsorption breakthrough: more than 95% of the methane captured from both simulated VA.

Adsorption breakthrough test with simulated VAM1 & VAM2
Closure

- CSIRO has undertaken a wide range of CMM research over the last 20 years

- CSIRO has successfully developed advanced CMM technologies and delivered significant benefits to the coal industry

- Several key new CSIRO CMM and VAM technologies will be trialled at mine sites over the next few years
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Thank you