Australia Coal Sector Update to the 20th Session of the Global Methane Initiative (GMI) Coal Subcommittee

22 October 2014
Geneva, Switzerland
Department of Industry

Global Methane Initiative

Australian Coal Sector Update

In 2013-14:

- Australian black coal production reached 432 Mt (184.4Mt - metallurgical and 247.6Mt thermal coal), an 8 per cent increase on 2012-13 production
- Six per cent of the world's coal production
- Coal exports increased to 375.1Mt, worth $41 billion
- 26% of world trade
- Second largest coal exporter (after Indonesia)
- 28.5Mt CO_2-e emissions from Australian coal mines, 5.3% of net emissions.
- 64% of Australia's electricity generation from coal

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CMM Project Outlook

- Australian Government Direct Action Plan (replaced Clean Energy Future Plan)
- 5 percent reduction on 2000 levels of CO_2-e emissions by 2020
- Includes $2.55 billion Emissions Reduction Fund
  - Australian Government will purchase lowest cost abatement from a wide range of sources through reverse auction
  - Financial incentive for businesses, households and landowners to proactively reduce emissions
- GMI Partner Country Action Plan and Coal Sector Action Plan in process of being updated

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Coal Methane Abatement Projects

- Five Projects - Funded by Government and Industry ($35.5million government funds / $81million total value)
- Projects support the development and demonstration of technologies to safely reduce fugitive methane emissions from coal mines
- Knowledge sharing through the GMI

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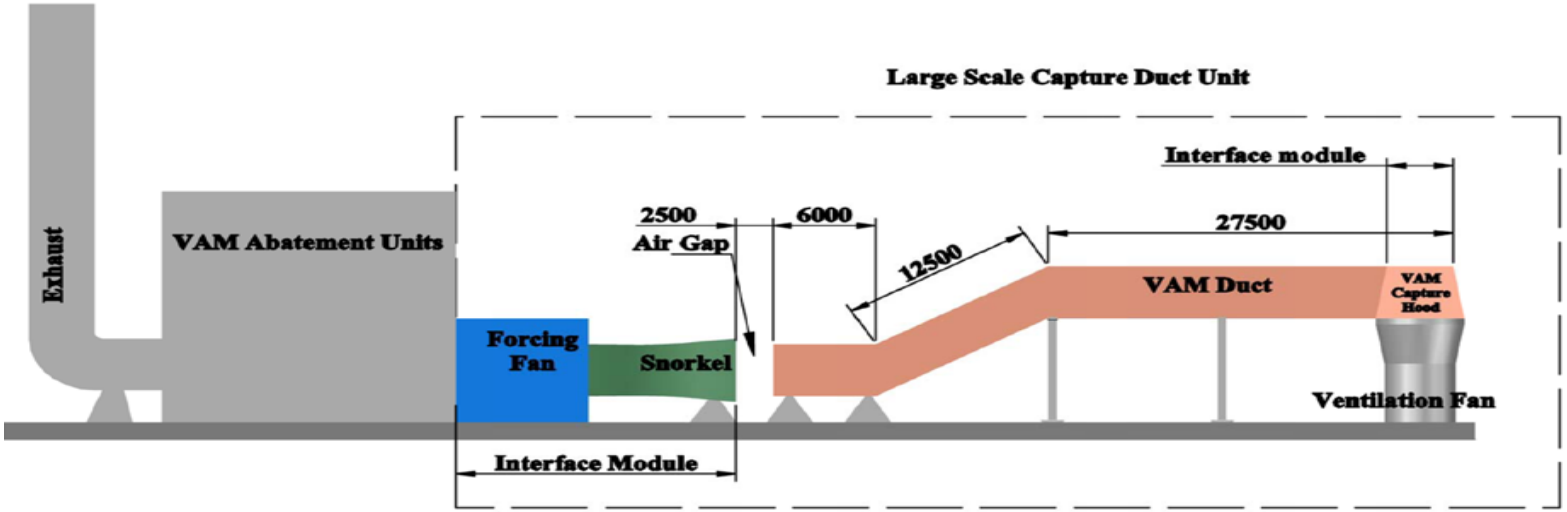
University of Newcastle
VAM Abatement Safety Project

- $12.5 million (Australian Government) $27 million (Total project value)
- Demonstration of a large-scale VAM capture duct complete with safety control measures and supporting design and testing information
- Understanding the underlying scientific and engineering principles behind methane ignition, deflagration and detonation



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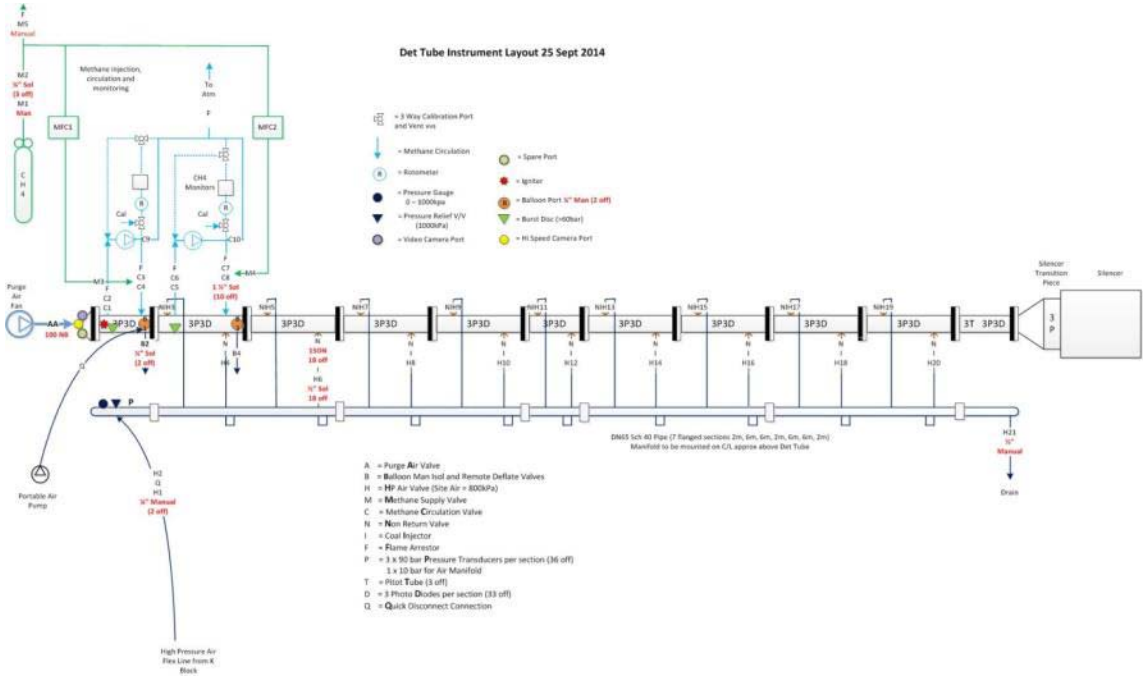
VAM Abatement Safety Project

Construction of detonation tube underway

Application:

- Examine flame and shock wave velocities in methane and coal dust environments
- Examination of pressure profiles from the methane explosion
- Investigation of the separation between the shock and flame
- Investigation of shock wave mitigation system

30 m Long
Detonation Tube
0.5 m Diameter with
2 Stage Silencer



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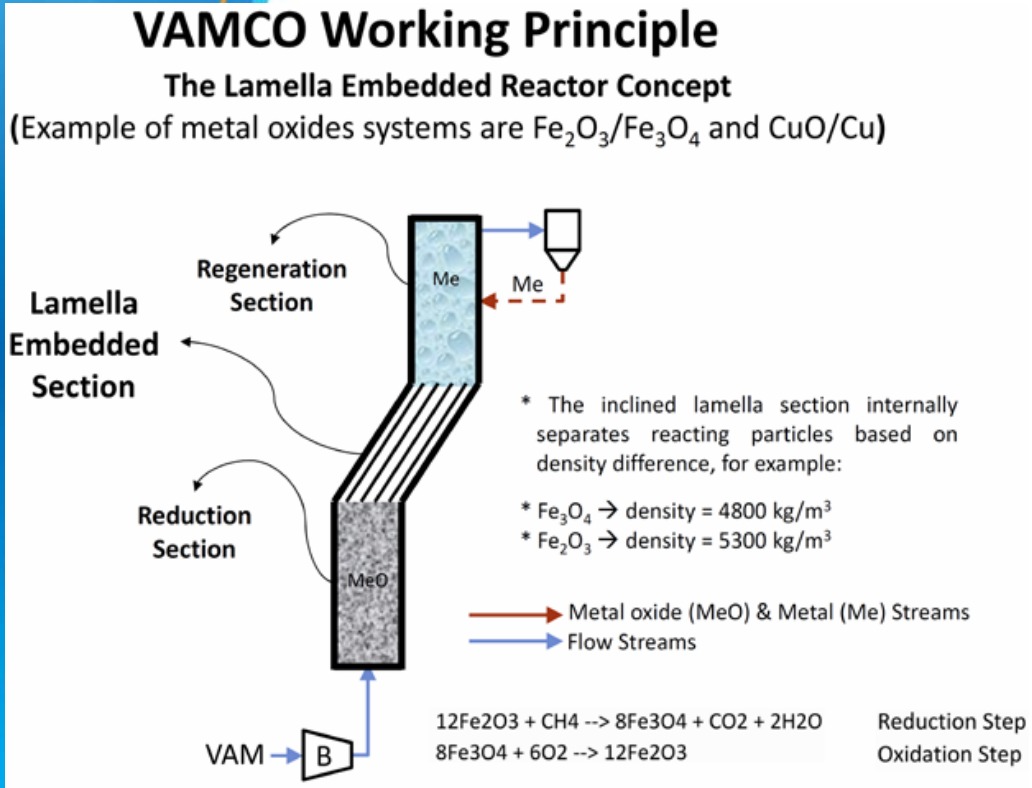
Chemical Looping VAM Abatement



- $2.7 million (Govt funds)
  $8.5 million (Total value)
- Mitigates VAM flows with methane concentrations between 0.005% and 2.0%
- 1 m^3/s VAMCO prototype and then a 10 m^3/s pilot-scale demonstration unit

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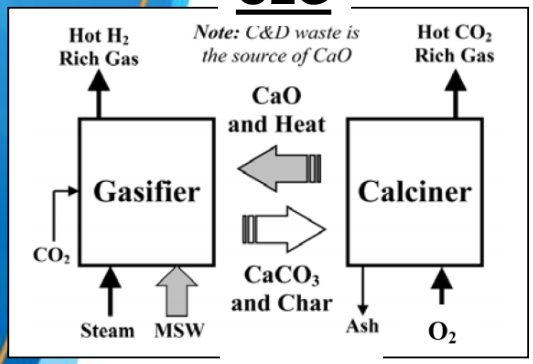
Chemical Looping VAM Abatement

Advanced Chemical Looping Applications

CLG



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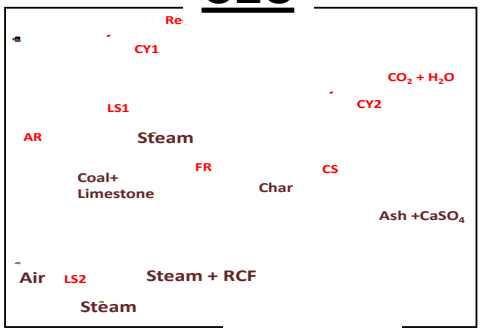

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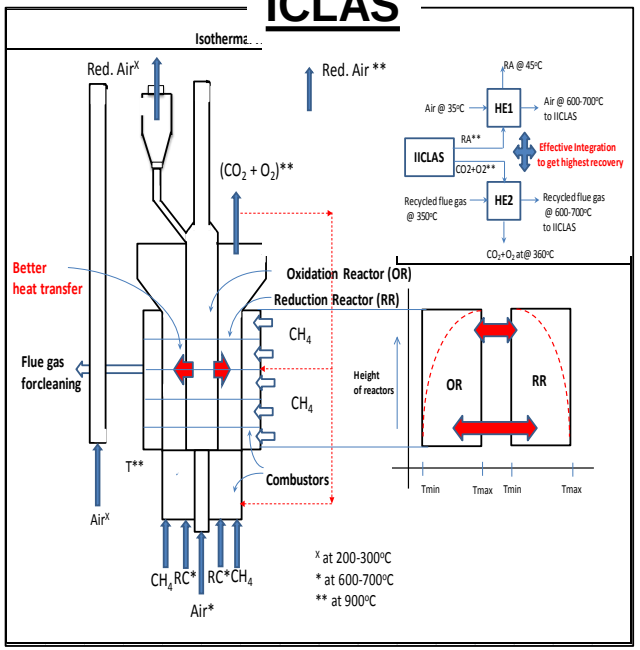

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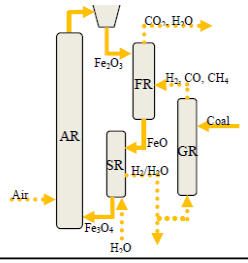

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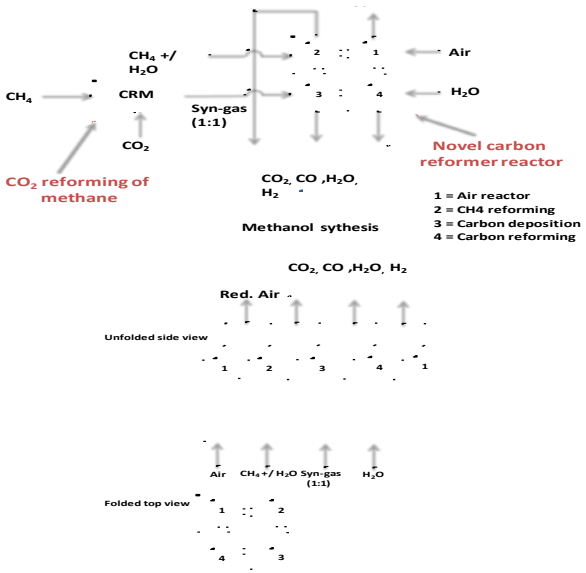
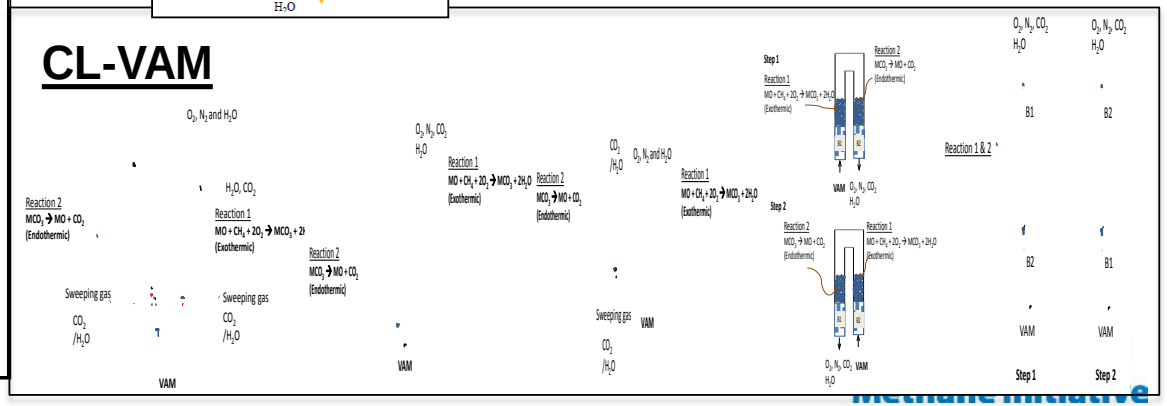


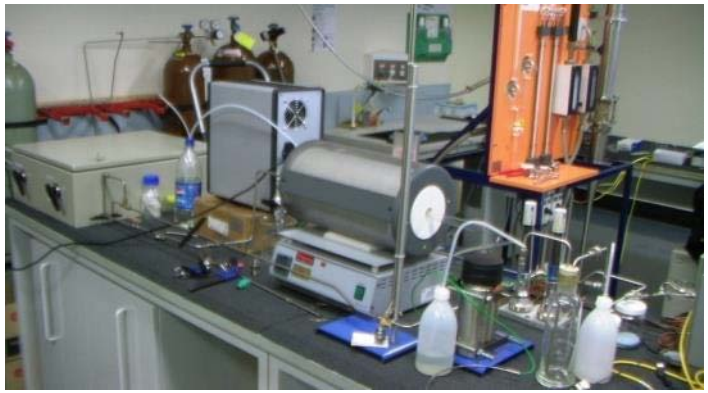
CL-VAM



Chemical Looping VAM Abatement

Chemical Looping Research Facilities

Bench-scale cold-flow setup



Bench-scale fixed-bed setup

500 kW demonstration unit

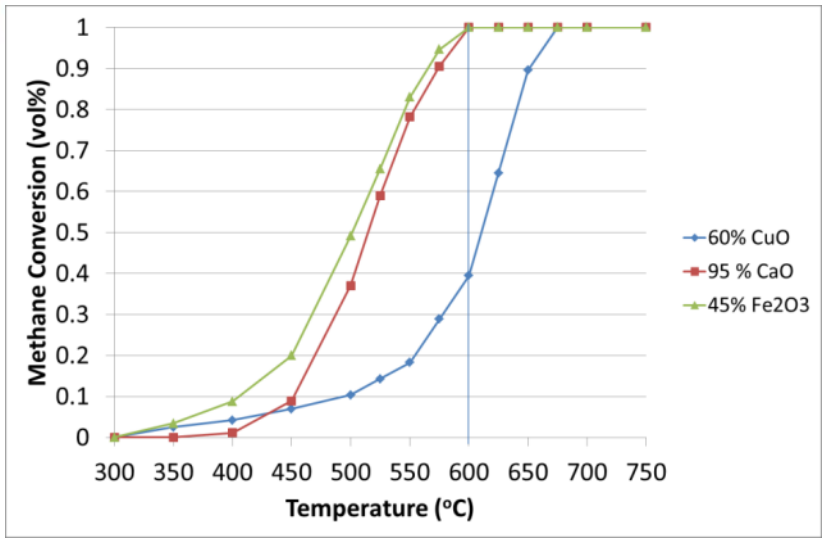
10 kW pilot-plant

Chemical Looping VAM Abatement

Experimental Results

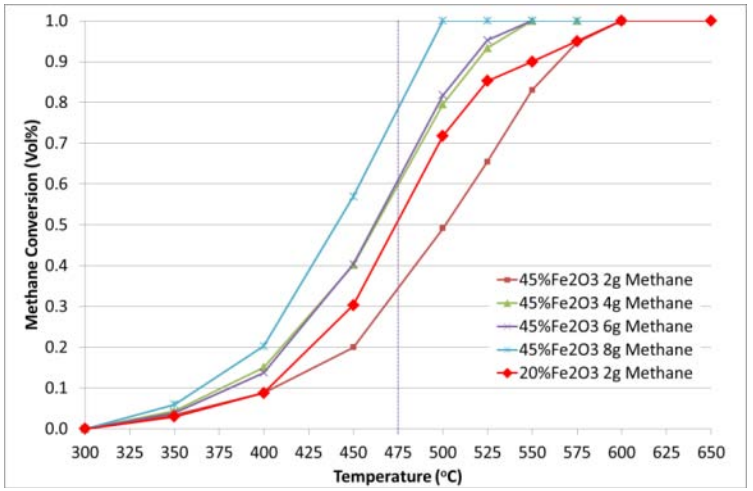
VAM oxidation temperature can be dropped by 250-400 °C

Comparison of different materials

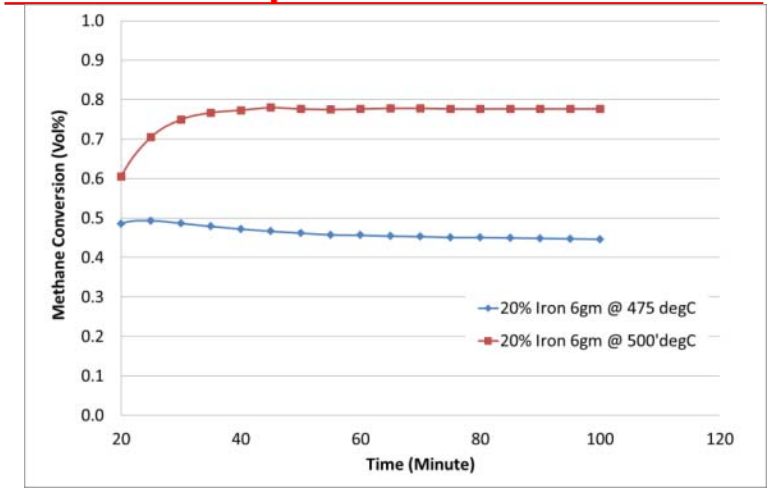


Fe-Al_2O_3 found to be the most reactive material !!!

Fe_2O_3/Al_2O_3 experiments



Continuous operation for 100 minutes



Glencore Coal Australia

Methane Capture and Abatement Optimisation

Milestone 1 (3 mths)

Site Characterisation

- Site characterisation of
  - Geology & hydrogeology
  - Strata properties
  - Gas reservoir parameters
  - Mining and drainage experience
- Project detailed planning and monitoring design

Milestone 2 (10 mths)

Monitoring and measurement

- Drilling
- Instrumentation installation
- Monitoring
- Measurements
- Tests
- Data analysis

Milestone 3 (10 mths)

Fundamental modelling study

- Coupled strata, gas and water responses to mining
- Goaf gas flow dynamics
- Gas drainage mechanisms
- Key factors affecting drainage performance

Milestone 4 (11 mths)

Approach development

- Identification of
  - gas emission sources
  - drainage targets
  - key factors
- Drainage approach development
- Site trial design

Mostly completed

Milestone 5 (18 mths)

Site trial

- Site trial implementation
- Performance monitoring and tests

Milestone 6 (27 mths)

Approach refinement

- Site trial evaluation
- Integrated analysis of all project data
- Drainage design approach refinement

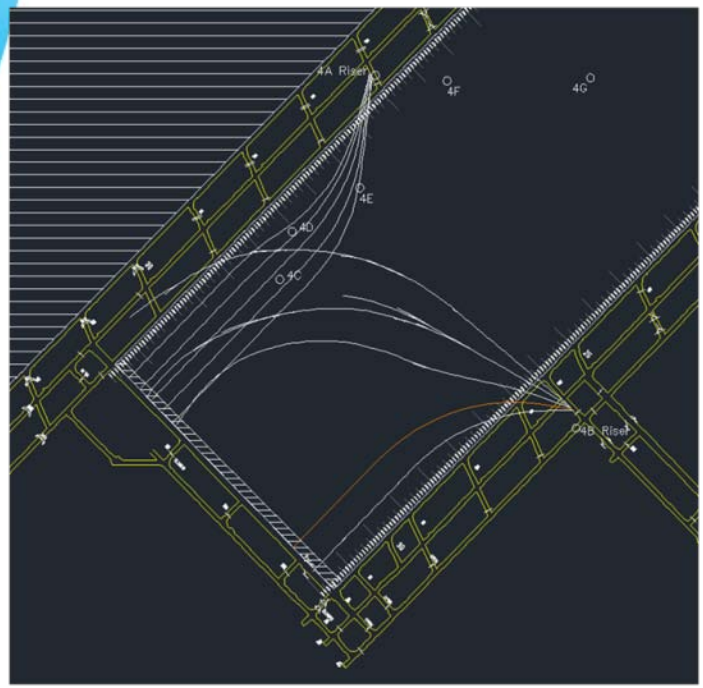
Milestone 7 (30 mths)

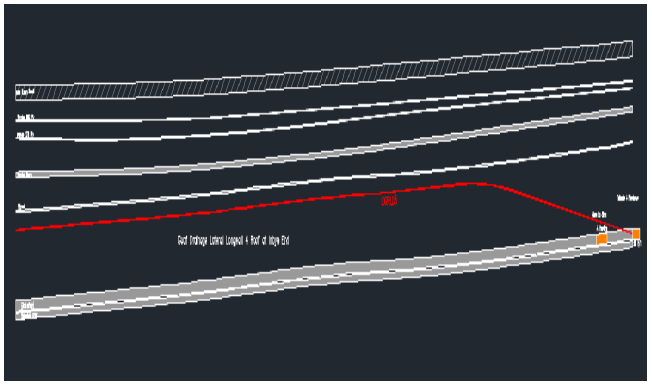
Summary and dissemination

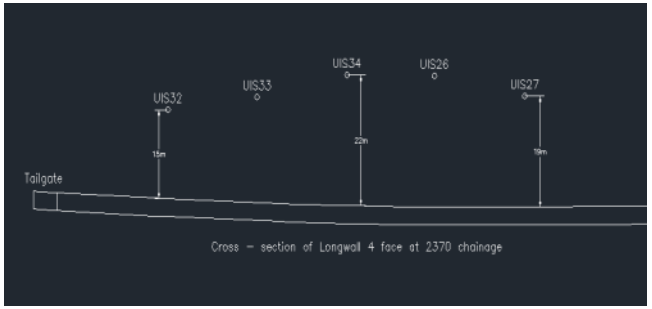
- Preparation of project final report
- Knowledge sharing

Ongoing

Methane Capture and Abatement Optimisation
Optimal Gas Drainage Design and Trial at LW4







- Optimal gas drainage design was implemented as a trial in LW4, based on site monitoring, measurement, and numerical studies.
- Underground lateral boreholes, consisting of 5 roof holes and 5 floor holes, were designed to replace surface vertical goaf wells and trialled in the first 500m of LW4 extraction.

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Methane Capture and Abatement Optimisation

Result: Increased CMM Capture & Reduced CMM Emissions

Longwall 3 Specific Gas Emissions from real time monitoring						
Week Ending	Longwall Retreat	Longwall Tonnes	Total seam gas m3	SGE	l/s aver.	Capture Efficiency
23/06/2013	6	11,140	226,785.1	20.4	375.0	0.0%
30/06/2013	30	60,388	723,379.8	12.0	1196.1	13.9%
7/07/2013	48	93,603	2,111,893.1	22.6	3491.9	17.0%
14/07/2013	66	130,715	2,600,429.6	19.9	4299.7	39.5%
21/07/2013	40	93,642	2,968,358.3	31.7	4908.0	36.9%
28/07/2013	35	70,126	2,005,781.9	28.6	3316.4	7.2%
4/08/2013	71	143,010	2,723,121.4	19.0	4502.5	37.0%
11/08/2013	50	107,718	3,343,867.9	31.0	5528.9	47.7%
18/08/2013	68	139,851	3,547,650.6	25.4	5865.8	50.0%
25/08/2013	105	217,981	3,966,521.7	18.2	6558.4	57.4%
1/09/2013	90	199,170	4,229,919.6	21.2	6993.9	59.4%
8/09/2013	93	185,241	4,068,782.5	22.0	6727.5	62.5%
15/09/2013	95	184,833	3,905,168.2	21.1	6457.0	61.6%
22/09/2013	99	224,859	3,902,172.7	17.4	6452.0	67.6%
29/09/2013	81	151,041	3,436,049.7	22.7	5681.3	71.8%
6/10/2013	80	184,193	3,231,376.1	17.5	5342.9	64.5%
13/10/2013	97	214,695	3,645,109.0	17.0	6027.0	62.2%
20/10/2013	99	211,289	3,384,164.7	16.0	5595.5	68.8%
27/10/2013	99	201,731	3,854,714.9	19.1	6373.5	68.0%
3/11/2013	96	203,860	3,816,564.4	18.7	6310.5	64.8%
10/11/2013	93	190,647	3,799,572.7	19.9	6282.4	64.0%
17/11/2013	77	171,318	3,802,011.7	22.2	6286.4	62.9%
24/11/2013	90	204,253	3,450,259.0	16.9	5704.8	68.1%

Longwall 4 Specific Gas Emissions from real time monitoring						
Week Ending	Longwall Retreat	Longwall Tonnes	Total seam gas m3	SGE	l/s aver.	Av. Capture Efficiency
22/06/2014	72	121,555	982,559	8.1	1625	51.4%
29/06/2014	92	166,440	1,531,120.7	9.2	2531.6	80.0%
6/07/2014	87	180,437	1,618,237.6	9.0	2675.7	79.0%
13/07/2014	106	209,436	1,800,573.2	8.6	2977.1	70.0%
20/07/2014	95	193,000	2,051,527.4	10.6	3392.1	70.2%
27/07/2014	96	201,000	2,328,688.9	10.6	3850.3	61.8%
3/08/2014	118	224,522	2,356,483.8	10.5	3896.3	68.6%
10/08/2014	101	214,586	2,240,978.7	10.4	3705.3	62.0%
17/08/2014	103	206,782	2,315,413.6	10.4	3828.4	62.1%
24/08/2014	88	187,272	1,803,763.8	11.2	2982.4	59.6%
31/08/2014	140	283,156	2,278,634.7	8.0	3767.6	65.4%
7/09/2014	138	282,806	2,179,147.7	7.7	3603.1	64.9%

Trial period

- Gas capture efficiency overall was improved from 60% to 80% with optimised gas drainage method, resulting in significant reduction of methane emission to the atmosphere.
- Increase in gas capture efficiency for start-up area was dramatic.

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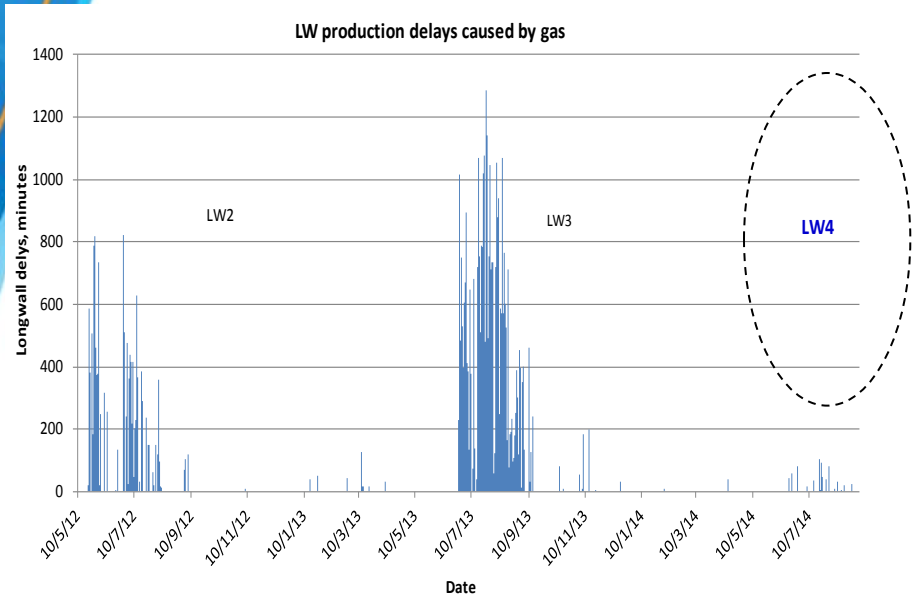
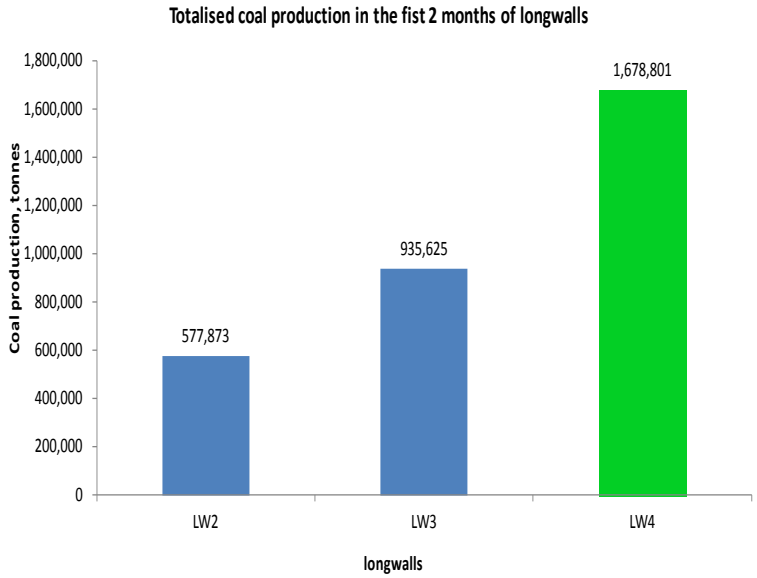
Methane Capture and Abatement Optimisation

Result: Improved Safety and Productivity





- Improved longwall gas control resulted in significant reduction of gas related coal production delays and remarkable increase of coal production in the initial mining stage (an increase of 79% from LW3).
- Longwall return CH4 concentration maintained consistently around 1% whereas previously concentration frequently exceeded 2%.

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