METHANE TECHNOLOGIES FOR MITIGATION AND UTILISATION

TECHNOLOGY	CONTACTS	DESCRIPTION
Drilling		
Surface to inseam (coal seams below the surface)	Wilkie creek, Xstrata Newlands, Xstrata Grasstree, Anglo Coal	Coal seam methane is drained from the virgin seam several years in advance of mining. Usually vertical holes are drilled approximately one kilometre a part and directional drilling technology is used to drill horizontally through the coal seam to connect the vertical wells. Firstly water is drained from the coal seam followed by a constant supply of >90% methane.
Surface to inseam (coal seams exposure in high wall mining)	Dawson Seamgas Moura Mine German Creek Anglo Coal Australia Anglo Coal Australia Pty Ltd Phone +61 7 3834 1333 www.anglocoal.com.au	Coal seam methane is drained from exposed high walls with a series of horizontal wells into both highwall and underground seams several years in advance of coal mining. Approximately 3 PJ of coal mine methane per year is supplied from this colliery to the regional transmission line. A gas processing plant located on site dehydrates and compresses the gas before delivering it to the pipeline. Methane concentration is >90%.
Pre drainage (in seam, underground coal mining)	Appin, BHPB German creek, Anglo Coal Newlands, Xstrata West cliff, BHPB	In seam drilling involves drilling a series of holes into the coal seam in a fan formation. These holes, approximately 250 -290 meters long, are drilled from underground roadways as connected through a drainage pipe network. Methane concentration varies from 60-80%.
Post drainage (post mining/goaf, underground coal mining)	Appin, BHPB Dartbrook, Anglo Coal West Cliff, BHPB Central Colliery, Anglo Coal	Methane is collected from the goaf following long wall operations. This results in drainage gas with a concentration of approximately 40-70% methane.

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Technologies for using high concentration drainage gas from the above activities has a methane content of greater than 30 per cent and can be therefore used by conventional technologies including gas engines.

Gas Flaring	Shell Central Colliery Shell Coal Tel 07 3834 1215 www.shell.com.au http://www.greenhouse.gov.au /challenge/members/success-stories/shell.html	A flaring facility at the Central colliery burns methane converting it into CO2 and water. In addition to providing immediate greenhouse gas savings, the flare will complement any future more productive use of the gas by burning excess gas from other processes.
Gas Engines	Envirogen Okay Creek Tahmoor Colliery Teralba and Billambi Mines Energy Developments German Creek Coal Mine http://www.greenhouse.gov.au/ggap/ successfulprojects/teralba_northgoonyella.html	Conventional gas engines

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Drainage Gas Purification for pipeline/town gas			
There are four basic processes that are commonly used for gas purification activities:			
• Solvent Adsorption – sometimes referred to as Selective Absorption– This process uses specific solvents that have different absorption capacities with respect to different gas species.	• Pressure Swing Adsorption – The principles of operation of this process are essentially the same as Solvent Adsorption. The key difference is that in the PSA process, the adsorbent is a solid and cannot easily be made to flow away from the adsorption vessel to a regeneration vessel.	• Cryogenic Separation – This process involves a sequence of compression, flash vaporisation and heat exchange stages to cool the gas stream until it liquefies, then uses a distillation separator to, in this case, separate a nitrogen-rich gas stream from a methane-rich liquid stream.	• Membrane Separation

Ventilation Air Methane Mitigation and Utilisation via Thermal Oxidation.		
PF Power Stations	Power Coal (The proposed project ceased)	If ventilation air can be delivered to a large fuel consumer, such as a coal-fired power station boiler, it can readily replace ambient air for all or part of the combustion air requirements. However, in general, power stations are not convenient to all gassy mines and this limits the suitability of this technique.
Gas Engine Power Station	Appin Gas Engine Power Plant (ventilation air supply ceased due to gas cleaning economic issue)	Used as combustion air for gas engines

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Hybrid Waste Coal/Methane Combustion in Kiln	ComEnergy Phone 61-7-3878 7622 Email Info@ComEnergy.com.au www.comenergy.com.au	CSIRO has been developing a coal mine waste methane/coal utilisation technology, with the aim of not only mitigating mine methane and waste coal, but to also recover energy for power generation.
Hybrid Waste Coal Methane Combustion in Fluidised Bed	A proposed concept, no real development on this yet.	Fluidised beds suspend solid fuels on upward blowing jets of air during the combustion process. The result is a turbulent mixing of gas and solids. The tumbling action, much like a bubbling fluid, provides for high chemical reaction rates and heat transfer.
VOCSIDIZER	BHP Billiton and MEGTEC Systems Westcliff Colliery http://www.bhpbilliton.com/bb/newsCentre/newsAtBhpBillitonDetail.jsp?id=News/2004/News@BHPBilliton290604.html	WestVAMP, which is located alongside existing surface facilities at West Cliff Colliery, is based upon VOCSIDIZER™ technology developed by Swedish emission control specialist MEGTEC System AB. This coverts low concentration methane to carbon dioxide (CO_2) and water vapour though an oxidation, or flameless combustion, process. High efficiency heat exchangers recover the large levels of thermal energy released to produce high quality steam. This steam is used to drive a conventional steam turbine to generate electricity.

Recuperative lean-burn gas turbine	The development ceased.	EDL technology is a recuperative gas turbine, which uses heat from the combustion process to preheat the air containing methane to the auto-ignition temperature (in the range of 700-1000 degrees Celsius), with the combusted gas being used to drive a turbine.

Ventilation Air Methane Mitigation and Utilisation via Catalytic Oxidation		
Catalytic Monolith Reactor	For VAM mitigation purpose CSIRO Exploration and Mining	Catalytic monolith reactor technology uses a honeycomb type monolithic reactor which is a type of reactor in common use due to its outstanding characteristics of very low pressure drop at high mass flows, high geometrical area, and high mechanical strength. Monoliths consist of a structure of parallel channels with walls coated by a porous support containing catalytically active particles.
Catalytic lean-burn gas turbine	VAMCAT CSIRO with the support of the Australian Greenhouse Office and China's Shanghai Jiaotong University and Huainan Coal Mining Group will construct the first pilot-scale demonstration unit at a coal mine in China.	There are several lean –burn gas turbines being developed in the world. These include CSIRO lean-burn catalytic turbine and Ingersoll-Rand microturbine with a catalytic combustor. In general, the catalytic turbine intakes a very lean fuel/air mixture, and compresses it, and combusts it in a catalytic combustor. The turbine operates at low temperatures, so does not use combustion air for dilution and internal cooling, thus allowing the air intake to contain methane.

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Enriching dilute methane	
This technology is currently under development by the Commonwealth Scientific Industrial Research Organisation with the assistance of the Australian Coal Association Research Program.	Concentrators have been applied to several industries to capture volatile organic compounds. A concentrator of this type could be used to enrich methane in mine ventilation air to levels that meet the requirements of lean-burn methane utilisation technologies, such as catalytic and recuperative gas turbines. This involves taking the 0.1-0.9 % methane stream and increasing the methane to a concentration of greater than 20 %.