

AUSTRALIAN COAL ACTION PLAN

The Australian Government recently announced its Clean Energy Future (CEF) Plan which provides the overall framework for emissions abatement, including methane abatement, in Australia through to 2050. This will implement a carbon pricing mechanism from 1 July 2012. Following the implementation of a carbon pricing mechanism, Australia will be in a position to more fully develop a comprehensive Action Plan in the context of its engagement with the Global Methane Initiative (GMI).

PRIORITIES FOR PARTICIPATING IN GMI

The implementation of a carbon pricing mechanism will provide an incentive for business' to engage in activities that will reduce their carbon dioxide equivalent (CO₂-e) emissions. From 2015, following the move to a flexible carbon pricing mechanism, Australian companies will be able to purchase carbon permits, or invest internationally, to offset their carbon price liabilities. This will provide an avenue for Australian companies to engage in clean development mechanism (CDM) projects including methane abatement. The carbon price and associated policies will also provide an incentive for companies to invest in methane abatement technologies.

Coal Industry

Coal is one of Australia's largest export industries. It is an expanding industry and has strong growth prospects to 2020. Higher coal prices since 2004 have supported investment in underground operations including new mines, the natural extension of open cut operations into underground resources and the reopening and modernisation of existing underground mines.

CURRENT AUSTRALIAN POLICY

Clean Energy Future Plan

On 10 July 2011 the Prime Minister announced the CEF Plan, which will make a major contribution towards reducing Australia's greenhouse gas emissions to achieve target levels of at least 5 per cent of 2000 levels by 2020 and 80 per cent of 2000 levels by 2050. Further information is available at <http://www.cleanenergyfuture.gov.au/>

Reducing Australia's fugitive emissions profile is a key element of the CEF Plan and will make a major contribution towards reducing Australia's greenhouse gas emissions by 80 per cent of 2000 levels by 2050.

The CEF Plan will establish a carbon pricing mechanism on 1 July 2012. Around 500 facilities with emissions over 25,000 tonnes per annum (tpa) of CO₂-e will be covered, including stationary energy, industrial processes, fugitive emissions (other than from decommissioned coal mines), and emissions from non-legacy waste. Natural gas retailers will be responsible for emissions from the use of natural gas by their customers. The carbon price will not apply to agricultural emissions, light on-road vehicles or on-site use of fuel by the agriculture, forestry and fisheries industries.

In implementing the CEF plan, the Australian Government recognised that a small number of existing Australian coal mines are highly emissions-intensive and will face significant costs

with the implementation of a carbon price. In response, the Government has developed a transitional assistance package for the Australian coal industry that recognises the adjustment challenges faced by the industry - the Coal Sector Jobs Package (CSJP) and the Coal Mining Abatement Technology Support Package (CMATSP).

Coal Sector Jobs Package

The CSJP will provide \$1.264 billion over 6 years for targeted transitional assistance to the most emissions-intensive mines to ease their transition to the introduction of a carbon price; thereby supporting jobs and the local communities that rely on these mines.

Key Elements

- \$1.264 billion over five years;
- \$218.8 million available in 2011-12 as an upfront pre-payment prior to the introduction of a carbon pricing mechanism in 2012-13;
- Assistance to be paid to eligible mines based on a formula with pro-rating to reflect total available funding; and
- Eligible mines are those mines that have an emissions-intensity in 2008-09 above 0.1 tonne of carbon dioxide equivalent (CO₂-e) per tonne of saleable coal produced.

Coal Mining Abatement Technology Support Package

The sustainable development and future viability of the coal mining sector under greenhouse constraints is linked to the development and deployment of new technologies to reduce fugitive methane emissions from coal mines. The CMATSP will provide \$70 million over five years to supplement and support the coal industry's own research activities aimed at developing safe abatement related technologies and processes. This funding will be directed at three areas:

- Research, development and pilot deployment of abatement and measurement and verification technologies in the coal sector;
- Urgent work on safety and regulatory issues associated with the introduction of coal sector abatement technologies, including work with State and Territory Governments on safety requirements associated with the development and deployment of new abatement related technologies, equipment and processes; and
- Assistance to small and medium coal sector participants to develop abatement plans or undertake feasibility studies to reduce emissions from current and proposed mines.

The allocation of funding across each of these elements will be determined following consultation with industry stakeholders, but the bulk of funding will be used to support research, development and demonstrations. The Australian Government requires co-funding on a dollar for dollar basis for the first two elements and two industry dollars per government dollar under the third element. This level of funding is a significant boost to generic coal industry research funding currently available for developing coal mining methane abatement

technologies and together with levered funding will support a substantial targeted research and development program. Funding will not be sufficient to support full scale demonstration projects but should be sufficient to support small to medium scale field trials of key technologies.

Key Elements

- \$70m over 5 years (2012-13 to 2016-17);
- \$10m available in first year for projects (2012-13); and
- Activities and projects supported under the CMATSP are required to have matching contributions on a 1:1 ratio for research and development or a 2:1 ratio for assistance provided to mines to develop abatement plans.

The assistance being provided through the CSJP and the CMATSP is transitional over the period to 2016/17. It is designed to assist industry in the transition to a carbon price and, in conjunction with the overall CEF Plan, provide an incentive for coal mines to reduce their fugitive CO₂-e emissions.

AUSTRALIAN COAL RESERVES AND PRODUCTION

Summary

2009 Total Coal Production:

- **Black Coal:** 481 million tonnes (raw), 347 million tonnes (saleable)
- **Brown Coal:** 68.3 million tonnes

Source: Australian Atlas of Mineral Resources, Mines and Processing Centres (AIMR), Geoscience Australia

Number of Mines: 2009 – 126 mines (42 underground, 84 open cut)

- **Black Coal:** 119 black coal mines (77 open cut and 42 underground)
- **Brown Coal:** 7 open cut mines

Source: Australian Black Coal Mining Summary 2009, Coal Information Services Pty Ltd

Number of mines supporting Waste Coal Mine Gas (WCGM) electricity generation:

(As of April 2009) 9 projects with total installed capacity of 215 Mw had existing WCGM electricity generation projects. 6 proposed WCGM projects.

Coal Resources

Australia is rich in energy resources with significant petroleum, natural gas, and coal reserves. Australia is the fourth largest producer, the largest exporter, and has the fourth largest reserves of black coal in the world, and the world's largest recoverable resource of brown coal.

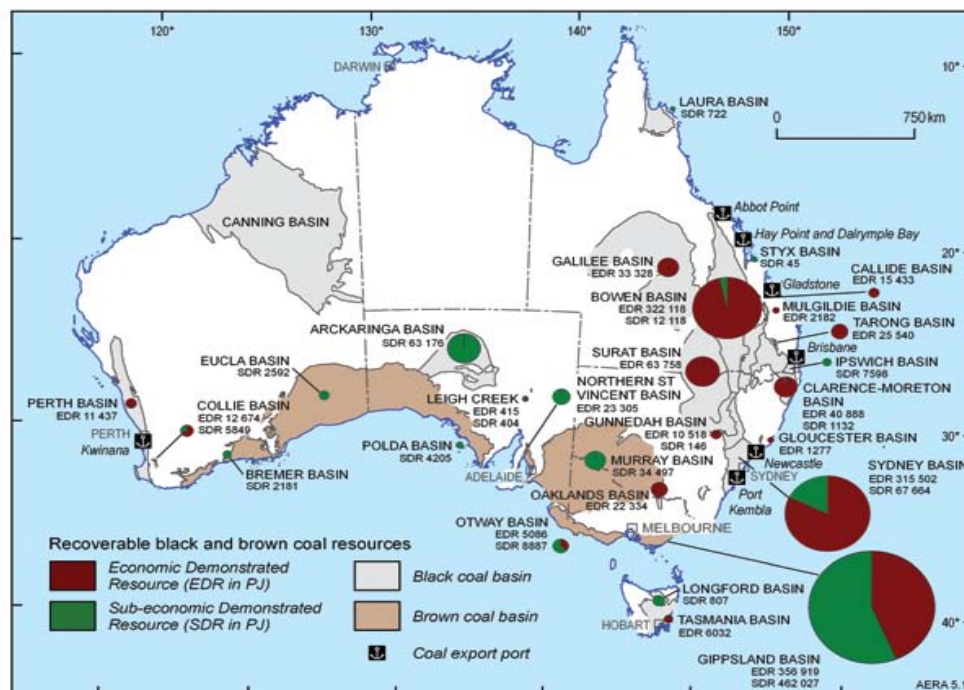


Figure 1 – Australia's total recoverable resources of black and brown coal as at December 2008. Source: Australian Energy Resource Assessment 2010

Australia has large deposits of both brown and black coal (see Figure 1 above). Black coal reserves are located mainly on the east coast in the states of Queensland and New South

Wales (NSW) but important deposits are also being mined in Western Australia. Most brown coal deposits are in Victoria with some in South Australia.

Current estimates show that Australia has sufficient black coal reserves to last about 100 years at current rates of production. Recoverable economic demonstrated resources (EDR) in 2009 increased 11.5% to 43.8 gigatonne (Gt) due mainly to significant increases in a number of Australian coal fields being opened up to mining (www.ga.gov.au AIMR 2010). Australia has 7% of the world's recoverable black coal EDR and ranks fifth behind the USA (31%), Russia (22%), China (14%) and India (8%) (www.ga.gov.au AIMR 2010). Queensland (58%) and New South Wales (38%) have the largest share of recoverable black coal EDR in Australia.

In 2009 the EDR of brown coal was 37.1 Gt (www.ga.gov.au AIMR 2010). Australia produces about 7% of the world's brown coal and is ranked as the fifth largest producer together with China and Greece, after Germany (21%), Russia (10%), Turkey (9%) and the USA (8%).

Australia's brown coal resources generally have very low methane content. The focus of this paper and Australia's coal sector engagement with the GMI is based on black coal.

Black Coal Production

In 2009-10 Australia produced 361.3 million tonnes (Mt) of saleable black coal. Coal production grew strongly over the decade with production up over 47 per cent from 245.5 Mt in 2000¹. Most of this growth was from open cut operations with production of saleable production of black coal from open cut operations increasing. The number of open cut mines increased from 60 to 77 over this period.

The Australian black coal industry is export orientated. Domestic consumption of black coal in 2009-10 was around 20 per cent of saleable production. Electricity generation accounted for 87 per cent of domestic consumption.

Australia is the world's largest exporter of black coal with the World Coal Association estimating that Australia accounted for over 27 per cent of world coal trade of 1,083 Mt in 2010, including over 57 per cent of world trade in metallurgical coal.

In 2009-10 Australia exported 292.2 Mt of black coal to over 37 destinations. Of this 135 Mt was steaming coal and 157.2 Mt was metallurgical used in steel making. Exports were valued at \$A36.4 billion in 2009-10 of which \$A24.5 billion was for metallurgical coal and \$11.8 billion for steaming coal².

Coal Forecast

Growth prospects for the Australian black coal industry remain strong reflecting the underlying strength of the world coal market.

In its March Australian Commodities, the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) projected that Australian coal exports would total 455 million tonnes in 2015-16, compared with 292 million tonnes in 2009-10.

¹ Source: Resource and Energy Quarterly, September Quarter 2011, Bureau of Resources and Energy Economics.

² ABS Coal Export Database.

As at April 2011 there were 19 coal mine projects at an advanced stage of development (committed or under construction) at a total capital cost of \$9.7 billion and production capacity of 56.5 million tonnes.

In the six months to April 2011 there were 10 coal mine projects that moved to an advanced stage at a total value of \$5.6 billion and a potential production capacity of 32 million tonnes.

Over the 24 months to April 2011, a total of 20 coal mine projects have been added to the advanced list. These projects have a total capital cost of \$8.3 billion and a potential production capacity of 65 million tonnes.

Australia's energy consumption is dominated by coal, coal accounts for around three quarters of Australia's electricity generation with coal-fired power stations located in every mainland state. Over 80 per cent of all coal consumed in Australia is used by the domestic electricity generation industry.

Mine Ownership

All mines in Australia are privately owned. As of the end of 2009 this amounted to 126; 84 of which were open-cut mines; and the remaining 42 were underground operations (Australian National Greenhouse Accounts, National Inventory Report 2009). In February 2010, the NSW Government made the decision to operate the Cobbora Coal Project to provide coal for state owned power stations. In April 2011 it was announced that the project has been put on hold for an indefinite period.

Many Australian black coal producers are members of the Australian Coal Association (ACA), predominantly with operations based in NSW and Queensland.

AUSTRALIAN ENERGY CONSUMPTION

Australia generates about 2.4 per cent of the world's energy production, and is a major supplier to world markets exporting more than three quarters of its energy output. Australian domestic energy consumption depends on coal 41 per cent, oil 35 per cent, gas 19 per cent, and renewables 5 per cent (Australian Energy Resource Assessment 2010).

AUSTRALIAN COAL SEAM GAS (CSG)

Coal Seam Gas (CSG) is a naturally occurring methane gas which is formed during the coalification process (where organic matter is converted into coal). The methane is usually mixed with carbon dioxide, other hydrocarbons and nitrogen. CSG is also referred to as Coal Seam Methane (CSM) or Coal Bed Methane (CBM). Methane that is produced or released as part of coal mining operations is referred to as Coal Mine Methane (CMM).

CBM uses in Australia are the same as for conventional gas in both domestic and business settings. CBM is also used to generate electricity. Water is produced as a by-product of CBM production and any beneficial re-use of the water is dependent on a number of factors including its quality, cost of treatment required and pipeline infrastructure. Water of suitable quality can be used for town water, aquaculture, recharging aquifers, wetlands, and recreational lakes or at mining operations and power stations. Poor quality water may be contained in storage ponds.

In December 2009, the proven and probable (2P) reserves of CSG in Australia were 26132 Petajoules (PJ) a 61.5% increase over the 2008 2P reserves of 16179PJ with a resource life of

more than 130 years. The majority of Australian CSG reserves are in Queensland and NSW. (Geoscience Australia, 2010)

In 2009, CSG production was 195PJ, which is a 41% increase on the 2008 production of 138.5PJ. Queensland produced 189PJ (or 97%) from the Bowen Basin (117PJ) and Surat Basin (72PJ). In New South Wales, 5.8PJ was produced from the Sydney Basin (5.6PJ) and Gunnedah Basin (0.2PJ).

FUGITIVE EMISSIONS FROM COAL MINING

In 2009 Australia’s fugitive methane emissions from fuel sources, predominantly coal mining and the production of gas, accounted for 7.3 per cent (39.7 Mt CO₂-e) of Australia’s emissions profile. Of this, fugitive methane emissions from coal mining account for 72.4 per cent (28.7 Mt) of fugitive emissions from fuel sources or 5.2 per cent of Australia’s net emissions.³ In 2009 fugitive emissions accounted for 90 per cent, or 31.8 Mt, of the total greenhouse gas emissions from coal mining. In the absence of a plan to cut greenhouse gas emissions, fugitive emissions from fuel are expected to grow by 25 per cent between 2010 and 2020. .

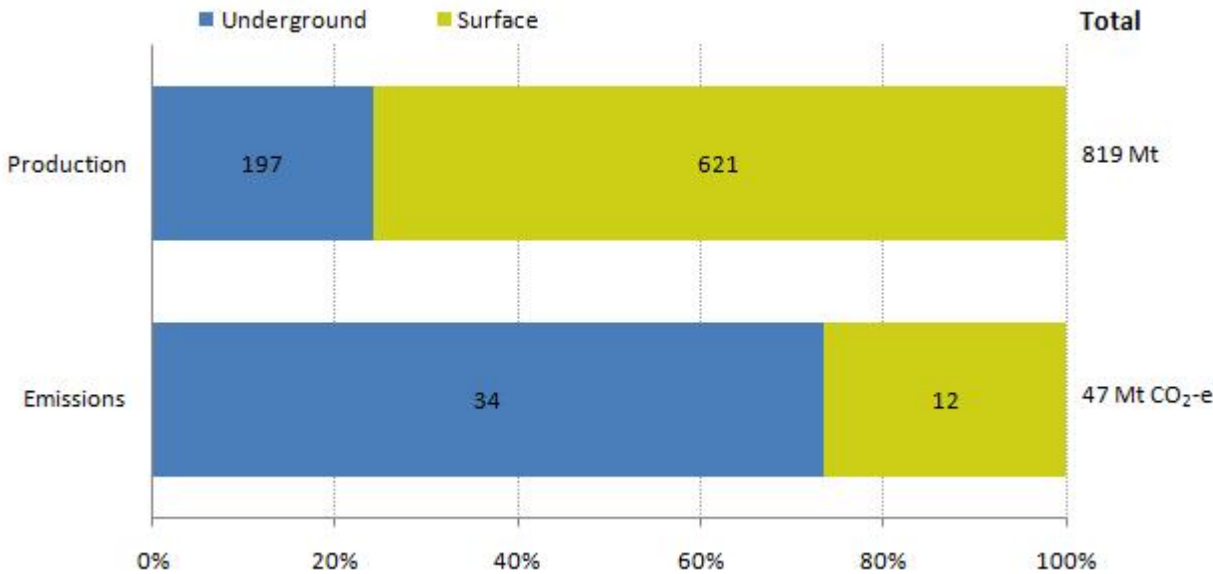


Figure 2 - Production and emissions from underground and surface mines 2020.
Source: WoodMackenzie 2010, DCCEE Analysis

Fugitive emissions from coal mining covers fugitive emission from the production, transport and handling of coal and emissions from decommissioned mines. Estimates of fugitive emissions from underground coal mines include releases of both CO₂ gases and methane gases. In some basins and at some depths CO₂ can account for half of the volume of measured greenhouse gas emissions from underground coal mines.

Fugitive emissions are estimated using a variety of methods. The default method for open cut operations are based on emission factors that have been calculated on a state by state basis. The emission factors are 0.007 tonnes of CO₂-e/tonne of raw coal for brown coal open cuts in Victoria and South Australia, 0.017 for black coal in Queensland and Western Australia, and 0.045 in New South Wales. Methodologies involving direct measurement of emissions are used to estimate fugitive emission from underground mines. Emission decay curves are

³ Source: National Greenhouse Gas Inventory (June quarter 2010)

applied to previous gassy and non-gassy operations to estimate emissions from decommissioned mines. Further details on these methodologies are available at <http://www.climatechange.gov.au/~media/publications/greenhouse-acctg/national-greenhouse-accounts-factors-july-2011.pdf>

Emissions from coal mining tend to fluctuate on an annual basis depending on the volume of coal mined and the share of production from mines with varying gas contents. Between 1990 and 2009, fugitive methane emissions from coal mining increased by almost 50 per cent. This is well below the 112 percent growth in coal production over this period reflecting shifts in production towards surface operations and less gassy mines, and the deployment of technologies such as waste coal mine gas power stations.

As indicated in Figure 2 above, Australia's coal production is projected to grow at an average rate of 4 per cent per year between 2009 and 2020. By 2020, projections show that Australia's emissions may amount to as much as 47 Mt CO₂-e per annum.

REGULATORY FRAMEWORK

Each State in Australia has its own legal framework for regulating CMM/CBM capture and use, resource ownership, leases and licensing. A range of measures are being considered to streamline legislation to simplify and to reduce the burdens of compliance.

Queensland

In November 2002, the Queensland Government released a new regulatory regime to address issues that arise where CSG and coal exploration and production activities may occur under different tenures granted over the same area. To formalise the measures, a new Petroleum and Gas (Production and Safety) Act was passed in 2004 to replace the Petroleum Act of 1923.

Recent amendments to legislation in Queensland have established a clear distinction between resources administered under the Mineral Resources Act of 1989 and those covered by the Petroleum and Gas (Production and Safety) Act of 2004. In Queensland, a Mining Lease for coal does not provide rights to the inherent coal seam gas. CMM production now comes under the Petroleum and Gas (Production and Safety) Act, 2004, and requires a Production License which can co-exist with a Mining Lease covering the same area.

New South Wales

In NSW, a Mining Lease or Exploration License is required before mining operations commence.

The Mining Act of 1992 is the principal legislation governing mineral exploration in NSW. Under the Mineral Resources Act 1989 (NSW), where CMM is produced as a by-product of coal mining, there is no provision for payment of royalties on VAM, or on pre-drainage or post-drainage methane that is flared. Waste methane flaring in NSW has been standard practice, but further legislative changes to the Mineral Resources Act, 1989 now require that pre- and post-drainage methane is used or flared rather than simply being vented.

In July 2010 the NSW Government formed a Ministerial sub-committee to lead the development of a Coal and Gas Strategy for NSW. This Strategy will enable the potential interaction between coal and CSG to be properly considered and managed.

ONGOING ACTIVITIES

Extensive research work has been carried out over the years, in Australia and internationally, on coal seam gas characterisation, gas emission estimations, pre-drainage, outburst control, directional drilling and post-drainage technologies. In 2010, the Australian Coal Association Research Program (ACARP) undertook a strategic review of gas management options for reduced GHG emissions.

The Australian coal sector is undertaking and supporting the research, development and demonstration of technologies and processes to address fugitive methane emissions. This includes company specific research programs and industry wide research programs funded through company contributions to the ACARP and the COAL21 Fund managed by Australian Coal Association Low Emissions Technology (ACALET).

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is also undertaking its own and industry supported research in this area, ranging from surface and underground coal mine fugitive emission estimation and measurement methods, through CMM capture or drainage maximisation techniques, to VAM mitigation and utilisation technologies. In some cases work in this area is supported under previous programs of the Australian Government. For instance funding provided under the former Greenhouse Gas Abatement Program (GGAP) supported a number of coal waste mine gas power station projects. These include several power stations using engine generators that run on drainage gases and the Westvamp power station that is trialling ventilation air methane (VAM) oxidation technology supplied by Megtec. Trials of CSIRO's Vamcat VAM oxidation technology in China are being funded under the Climate Action Partnership program.

The level of funding provided under CMATSP is a significant additional contribution when compared to the Australian coal industry's own generic research program run under the Australian Coal Association Research Program (ACARP) or research funding provided under the industry's COAL21 Fund. ACARP is funded through a voluntary five cent per tonne levy on black coal production with ACARP currently investing \$14 million a year in research projects or \$70 million over a five year period. However only a share of this (around 10 percent or \$1.5 million in 2009-10) is used to support projects to address fugitive greenhouse emissions.

Under COAL21 the industry is raising \$1 billion through a voluntary levy over ten years to fund the development of low emission coal technologies. Most of this funding is earmarked for low emissions coal use demonstration projects, but \$75 million has been committed to the Australian National Low Emissions Coal Research and Development (ANLEC R&D) for research. Addressing fugitive emissions from coal mining is not among the research priorities for ANLEC R&D. However, subject to securing the necessary agreements of the NSW and Queensland State Governments, other COAL21 Funding could be used to support the demonstration of coal mining emission abatement technologies.

It is intended that the research funding provided under the CMATSP will build on existing research efforts with support to be targeted at areas that are critical in bringing forward the commercial availability of key emission abatement technologies and processes.

Australian Waste Coal Mine Gas Projects

WestVAMP Power Plant

In 2007 Illawarra Coal's \$30 million WestVAMP power plant, located at West Cliff Mine, became the world's first power plant to generate electricity using the extremely diluted methane gas found in mine ventilation air. In the first six months of operation the plant abated 125,000 tonnes of CO₂-e and exported 20 gigawatt hours of electricity to West Cliff Mine. WestVAMP will utilise 20 per cent of West Cliff's available mine ventilation air to achieve a reduction in greenhouse gas emissions of 250,000 tonnes CO₂-e per year.

The Australian Government contributed \$6 million to the project through the Greenhouse Gas Abatement Program.

German Creek Power Station

Energy Developments Ltd is pioneering the collection and combustion of Waste Coal Mine Gas (WCMG) an environmentally-damaging greenhouse gas at its 32 megawatt (MW) German Creek Power plant in the Bowen Basin Queensland. The company is applying its expertise in low calorific fuels to capture and combust WCMG. Not only preventing the harmful gasses from escaping but using them to fuel a 23 MW power station. The WCMG captured and burnt from the plant abates and displaces about 1 million tonnes of CO₂-e each year. The environmental impact of the German Creek plant is equivalent to taking 260,000 cars off the road and is capable to generate enough electricity to power 33,000 homes.

Moranbah North Power Station

Moranbah North Power Station is located in the Bowen Basin Queensland and is generating up to 14 MW. The company is applying its expertise in low calorific fuels to capture and combust. Not only preventing the harmful gasses from escaping but using them to fuel a 45 MW power station. The WCMG captured and burnt from the plant abates and displaces about 1.3 million tonnes of CO₂-e each year. The environmental impact of the German Creek plant is equivalent to taking 350,000 cars off the road and is capable to generate 48,000 homes a year.

Oaky Creek Power Station

Oaky Creek Coal Mine Gas Power Station is located within the Oaky Creek Coal Mine in the lower Bowen Basin. The power station was commissioned in 2006 and holds 16 containerised spark ignition gas generators with a capacity of 20 MW. The Power Plant is one of the largest waste coal mine gas facilities in Australia. The plant is designed for bypass gas venting in the event that all engines are not operating or there is a trip to the generating facility. The Power Plant is estimated to deliver greenhouse gas abatement of up to 2.6 million tonnes of CO₂-e over the current Kyoto period (2008-2012).

Teralba

Teralba Power Station is located within the Teralba Colliery near Newcastle. Teralba is a closed mine and has been under care and maintenance for the last few years. As such the waste coal mine gas is declining. Initially 8 units were installed with the ability to be relocated once the gas declined, currently there are 4 units on site. The current capacity at Teralba is 4 MW and there is sufficient gas harvested from the sealed mine to maintain the capacity well into the future. A gas transfer system is used to pick up the waste coal mine gas from the existing mine vent shaft. The gas is filtered, compressed and cooled before being fed into a manifold system feeding each of the four adjacent units allowing the plant to run 24 hours per day.

Tahmoor

Tahmoor Waste Power Station is located at Tahmoor Colliery south of Sydney in the Picton area. The power station currently holds 7 containerised spark ignition gas generators with a total capacity of 7 MW. The plant uses the waste mine gas directly from the existing coal mine's extraction plant which receives only minimal treatment because it is a low grade waste coal at this particular site. Electricity generated is supplied into the local grid under a long term off take contract.

Glennies Creek

Glennies Creek Power Station is located within the Glennies Creek Colliery near Singleton. The power station currently has a capacity of 10 MW and was commissioned in November 2007. Similarly to Oaky Creek Power Station, the gas is drawn from surface well heads draining the gas and sending it through to the power station. Glennies Creek Power Station is located in a declared mine subsidence area and the station has been built with components that allow for potential differential ground. The plant has also been designed to allow for future expansions.

FUTURE SUPPORT FOR GMI

Future funding support from Australia will is likely to be through our carbon pricing scheme which, from 2015, will allow Australian companies to offset up to 50 per cent of their domestic greenhouse liabilities by funding offshore projects that earn emission credits. CDM projects which include many methane abatement projects will be automatically covered by these arrangements.

The carbon price and associated policies will also provide an incentive for companies to invest in methane abatement technologies. Once the CEF Plan and associated legislation has been more fully developed, and the carbon pricing mechanism implemented, the Australian Government will be better placed to develop a comprehensive Action Plan, which will include future support to be provided to the GMI.

Australia will be looking to the GMI to facilitate Australian access to methane abatement projects from 2015.