Senate Inquiry into management of the Murray Darling Basin – impact of mining coal seam gas

Murray Scott 2011 August 16

This submission to The Rural Affairs and Transport References Committee, addresses just one clause of its Terms of Reference:

• the social and economic benefits or otherwise for regional towns and the effective management of relationships between mining and other interests; and

Summary:

My submission is focussed on the extraction model adopted by the mining industry for coalseam gas production. The detrimental impacts of this model are well known from the United States where it was developed for shale gas, and from Australian experience particularly in Queensland. This model, notoriously depicted in the film “Gaslands” has been imposed apparently without challenge as the industry standard as if there was no alternative way to produce the gas.

The impact on the Murray Darling catchment and recharge zones for the Great Artesian Basin is significant because of the scale proposed for Gaslands-style gas production. Its development is extensive partly because the coalseam gas resource is relatively sparse, but also because of the growth rate and scale of production proposed. The digestion of local operating experience cannot keep pace to inform reporting, technological and regulatory standards.

A similarly frantic pace of development is occurring in coal production, for which the open cuts and longwalls are less extensive but locally even more damaging than this Gaslands entnaglement. It looks very much as if these industries recognise a narrow window of opportunity to make money before global greenhouse gas control measures place limits on burning fossil fuels of all kinds. That myopic “gold-rush” approach will cost the Australian economy dearly with impaired agricultural efficiency, depleted and/or contaminated aquifers, abandoned mines and a web of leaky gas infrastructure. This unsustainable burst of development will delay implementation of genuinely low emission technologies and subsequently require more rapid and drastic emission reductions if the Cancun target of less than 2^{o} global temperature rise is to be met.

This submission calls attention to an alternative model for coalseam gas extraction, demonstrated by current safety gas drainage operations for underground collieries eg. the BHP-Billiton's Appin-Tower Power Project. Please find attached the file “ A potential alternative to damaging longwall and coalseam gas 2100Aug13.pdf”, a version of which has been submitted to the NSW Parliamentary Inquiry into Coal Seam Gas. Earlier submissions on this theme can be viewed or downloaded from
http://users.tpg.com.au/mjscott//Contents.html

This alternative model is not directly applicable for areas of the Murray Darling basin which are not yet burdened with underground mines, nor match the rate and scale of current gas industry developments. Applied to existing coalfields however it would avoid the need to develop Gaslands networks over extensive agricultural lands while delivering adequate supplies of gas to replace retiring coal fired power generators. It would avoid the most damaging aspects of the Gaslands model while also offering a socially responsible way to taper off the unsustainable growth of coal production.

For these reasons I offer the proposal for the Committee's consideration.

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Coal Mine Gas : A Potential alternative to longwall coal and surface coalseam gas mining and a genuinely transitional resource.

Murray Scott 2011 August 13

Overview:

Coal mine gas (CMG) drainage has long been employed to reduce the hazards of outburst and explosion in gassy underground mines. Horizontal boreholes are drilled ahead of the advancing coal face and gas is collected in underground pipelines, to be disposed of usually by flaring to reduce the greenhouse impact of its methane content, or simply venting to the atmosphere. Borehole leakage and gas seeping from previously mined areas is swept up in ventilation airflows. Too dilute to burn, this significant flow of fugitive greenhouse gas emissions is usually vented to the atmosphere.

In some mines, notably BHP's Appin-Tower complex in the Southern Coalfield of NSW , the collected gas is used in large diesel engines to generate electric power , in that case 90MW [1] . As well as the valuable concentrated gas pumped directly from the coal seam, these engines also draw in ventilation air, usefully consuming dilute methane otherwise vented to the atmosphere.

A technical assessment of gas drainage technology is required to explore the feasibility of extending it to convert damaging longwall mines to gas mines, extracting fuel gas from surrounding and underlying coal seams. The concept entails horizontal boreholes and collection pipelines in underground drives at the periphery of existing mine workings. It is anticipated that such underground gas extraction technologies could replace longwall operations, stop subsidence and avoid the damaging surface impacts of conventional (Gaslands) coalseam gas (CSG) operations.

The viability of this proposal rests on the resolution of technical and economic issues as follows. The subsequent non-technical discussion attempts to illustrate potential benefits from the perspective of climate action, agriculture, nature conservation, water catchment and aquifer protection, mining communities and the mining industry.

Some technical questions to be resolved, more probably to follow.

1. What is the practical limit in range for horizontal drilling of gas production boreholes, ie. the radius around an existing underground working from which gas could be extracted?
2. How does that radius compare with the spacing of boreholes in conventional surface-drilled gas production?
3. It is understood that gas production from a coal seam involves dewatering the coal between adjacent boreholes. In an underground operation comprising gas production boreholes extending radially from the mine perimeter, would it be practical to sequentially inject the water produced in dewatering one section of the seam into another part of the same or underlying seams?
4. In an underground gas mine as described above, could a system of sequential dewatering be designed to contain all foul water underground within the coal seams from which it came?
5. In seams requiring hydraulic fracturing and dewatering to release gas, what percentage dilatation and contraction of the seam is involved and how would the resulting disturbance of overlying strata compare with that from longwall mining the same seams?
6. If water was pumped from one seam or area of a seam to another, how would the hydrological impact on overlying aquifers compare with that of longwall mining?
7. To contain and usefully consume the dilute gas in mine ventilation air for local electricity generation, a corresponding volume of concentrated fuel gas is required. What size gas field would typically yield sufficient gas to provide a saleable surplus for other uses?

8. What is the expected production lifetime of a coalseam gasfield?
9. At what threshold price for CO2 equivalent emissions would the cost of fugitive gas pollution alone justify converting a typical gassy mine from coal to gas production?
10. How would the economics of that conversion change if additional (discounted) tax credit was given for the greenhouse burden of previously approved coal production forgone?

Perspectives for evaluating underground coal mine gas extraction.

For the environmentalist, farmer, water catchment or land manager :

CMG is the same stuff as that extracted in CSG operations but the deployment of drilling and pumping machinery, access roads and collection pipelines completely underground avoids a large part of the environmental damage associated with the "Gaslands" paradigm of CSG extraction. The annexation of land, the network of roads, pipelines, pumping facilities and continued maintenance traffic notoriously disrupts agricultural land management. And despite assurances of reliability, the proliferation of gas bores also elevates the overall risk of gas and water leakage around boreholes, causing contamination of aquifers and gas fire hazard.

For managers of conservation areas and water catchments, a surface Gaslands-style road and pipeline network creates additional problems of erosion, stream siltation, weed and pathogen infestation. Despite stringent wash-down procedures, repeated access by vehicles and workers over the life of the gasfield multiplies an allegedly low risk of infestation from vehicles, tools, boots and clothing to near certainty. The difficulty and cost of clearing infestations of weeds or phytophthora fungus from existing roadsides and disturbed areas underlines the economic penalty for such intrusion. The 2010 discovery of Myrtle rust fungus infestation in eastern Australia adds further urgency to controlling access to conservation and water catchment areas.

Regarding the proposed alternative of underground coalseam gas production, the crucial question for land managers is whether foul water drained from a coalseam can be managed underground in a way that does not pollute aquifers or surface streams. By avoiding boreholes drilled through overlying aquifers and isolating strata, horizontal drilling within the coal seam promises to avoid much of the risk of aquifer contamination.

Subject to confirmation by mining engineers on these and other questions listed, horizontal drilling technologies appear to afford access to gas resources extending several kilometers around existing collieries. If so for example, the Helensburgh Metropolitan mine in the Southern Coalfield might be adapted to extract gas from under the Woronora catchment, on which invasive surface CSG operations are currently planned by APEX Energy. This is in a Special Catchment Area, for setting foot in which a person can be fined $11,000. By providing an income and employment alternative to continued longwall mining, underground gas extraction might also avoid the planned undermining of the Woronora reservoir.

For climate activists and greenhouse gas regulation agencies:

According to industry and Government growth projections, coalseam gas fuel is not viewed as a "transition" to a low-carbon future but an additional source of carbon fuel, further exacerbating global greenhouse gas accumulation. Even while pleading "insignificant Australia" (producing 5.8% of world coal consumption) as an excuse for climate inaction, coal companies have been clamouring for government investment in port and rail infrastructure and promising ever-increasing shareholder returns for projected growth in production. Fig 15 and 16 of [2]. Leaving aside oil and gas consumption, just burning the available coal worldwide would itself greatly exceed the global capacity to absorb CO_2 within the Cancun target limit of 2^{o} temperature rise [3] . As its pollution cost is progressively recognised through carbon pricing schemes to exceed the cost of alternatives, burning coal can no longer be considered an economic energy resource. Quite apart from climate effects, longwall and open cut coal mines are amongst the most destructive of industries to landscapes, agriculture, water supplies and community health. They must inescapably close down over the 21st century as Indian and Chinese industries mature and existing contracts, capital and workforce retire. Continued recruitment of workers into this unsustainable industry is callously irresponsible but unless transitional employment opportunities are demonstrated, the votes of coalfield communities will block the necessary changes. Underground gas mining connects several important incentives to clear that blockage.

A frustration for climate activists is that while coal companies report and to some extent reduce the emission of fugitive greenhouse gasses, they disown responsibility for the far greater greenhouse burden of the product, coal. That is Somebody Else's Problem, either here or overseas. Australia's carbon tax/trading will to some extent influence local coal consumption but a price signal on exports awaits an international carbon trading system. When coal mines are exhausted or abandoned, who takes responsibility for paying for, or preventing, their continued fugitive gas emissions? Conversion to economic operation as gas mines is proposed as one possible step toward addressing the technological, economic and social problems entailed.

In promoting conversion of coal mines to gas production, one must recognise investments already made by companies in preparation for Government-approved future coal production. While needing careful oversight to avoid scams, restructuring of the industry to abandon approved coal production would be greatly assisted by compensation for revenue forgone in the form of emission permits or tax credits, discounted for changes in market outlook. By thus imposing a potential liability on Governments for approving coal mines, such compensation would also force politicians to reconcile development and greenhouse gas reduction policies that are now blatantly incompatible.

Conventionally burned gas is not a long term energy solution but efficient gas-fuelled co-generation technologies offer significant medium term greenhouse gas abatement. Gas and other sources of carbon, including waste plastic, can also potentially replace coking coal for smelting steel [4] [5]. In the longer term, hydrocarbon gas can be converted by solar thermal pyrolysis into pollution-free hydrogen fuel and solid carbon materials such as carbon nanotubes or fibres or a range of intermediate organic compounds useful for construction materials, process chemicals or pharmaceuticals etc. Gas production however can only qualify as a transitional technology if it replaces, rather than augments, the production of coal or oil, and significantly reduces the greenhouse gas burden for a given end-use benefit.

For Mining companies and coalfield communities.

With the advent of emissions tax / trading in Australia, fugitive gas emissions from coal and gas mining operations must be accounted and paid for, reportedly in some cases threatening the economic viability of collieries [6]. Simply abandoning gassy mines however does not solve the pollution problem, as once enclosing strata are dewatered and/or cracked by longwall operations, gas will continue to leak indefinitely from goaf and exposed coal faces through disused shafts and rock fractures, as demonstrated by burning bubbles in the Nepean and Cataract Rivers in the Rivers SOS video “Rivers of Shame”.

Much of the capital and workforce skills invested in gassy mines might be salvaged by continuing to operate such mines for underground gas production along the lines of BHP-Billiton's Appin-Tower Power project but augmented by intensive drilling into surrounding and underlying seams. Conversion to underground gas production for current or abandoned gassy mines in sensitive agricultural and water catchment areas, eg. in the Southern Coalfield, the Hunter Valley or even under the Sydney CBD, could similarly prevent further impacts of surface CSG operations and/or longwall subsidence, while potentially fulfilling the promise of coalseam gas as a transitional fuel: transitional for companies, mining communities, technology and the Australian economy.

It is not suggested that underground gas mining would create the same income, profits or growth as boom-time coal or CSG extraction but it would keep mines open, reduce carbon tax imposts, contain fugitive gas responsibly, afford continued employment for coalfield communities and provide investors an orderly transition to other projects. Boom-and-bust mine closures in an unsustainably growing coal industry will not. That was conceded by BHP-Billiton CEO Marius Kloppers in stating that "Australia will need to look beyond just coal towards the full spectrum of available energy solutions" [7] . He might have added that "coal has a future beyond burning", recognising that before being displaced by oil in the 20th century, coal was the mainstay of the chemical industry. With improved, cleaner chemical technologies, hopefully in conjunction with solar thermal energy, coal may again assume that role as oil prices rise. It will hopefully never again be consumed at the present rate.

References:

[1] http://www.nswmin.com.au/Media-Speeches-and-Info/Case-Studies/default.aspx)
[2] http://www.abare.gov.au/publications_html/energy/energy_06/coal_exports.pdf
[3] http://www.pik-potsdam.de/news/press-releases/archive/2009/on-the-way-to-phasing-out-emissions-more-than-50-reductions-needed-by-2050-to-respect-2b0c-climate-target
[4] http://www.asiapacificpartnership.org/pdf/Projects/Steel/SOACT-Handbook-2nd-Edition.pdf
[5] http://www.science.unsw.edu.au/vsahajwalla-research
[6] http://www.australiancoal.com.au/resources.ashx/Announcements/56/DocumentFile/ABC9A4EF07C0D09A302F121340D5D2A1/ACA_Report_10_06_11.pdf
[7] http://www.smh.com.au/business/bhp-boss-dumps-on-future-of-coal-20100915-15cpk.html