

OPEN-CUT COAL MINING IN AUSTRALIA'S HUNTER VALLEY: SUSTAINABILITY AND THE INDUSTRY'S ECONOMIC, ECOLOGICAL AND SOCIAL IMPLICATIONS

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This article questions the sustainability of open-cut coal mining in the Hunter Valley region of Australia. The issue of sustainability is examined in relation to the economic, ecological and social implications of the Hunter Valley's open-cut coal mining industry. The article demonstrates that critical social and ecological ramifications have been overshadowed by the open-cut coal mining industry's importance to the economy of the Hunter region and of New South Wales.

Introduction

The mining of coal has had a long history in the Hunter Valley, beginning in 1791, when convict labourers were involved in mining at Newcastle.¹ This article seeks to explore open-cut coal mining in the Hunter Valley in relation to the issue of sustainability. The longevity of coal mining in the Hunter Valley does not negate questions about its future sustainability. Is it possible for an industry based on the extraction of finite resources to be sustainable? This article examines the issue of sustainability in relation to the economic, ecological and social dimensions of the Hunter Valley's open-cut coal mining industry.

The economic implications of open-cut coal mining in the Hunter Valley

Coal mining has developed in the Hunter Valley to provide a critical energy supply to Australia and other coal-dependent economies, particularly in Asia. While coal is fundamental to the current structure of Australia's domestic energy requirements, it is also crucial to the national economy as a key export commodity. In 2011-12, an estimated 3.1 per cent of Australia's gross domestic product (GDP), approximately A\$43 billion, was attributed to Australia's 'coal economy', which includes coal mining and associated services and industries. The 'broader coal economy', defined as the coal economy's contribution combined with the spending of wages earned in the coal economy, generated close to A\$60 billion, or 4.2 per cent of Australia's GDP in 2011-12.²

Nearly 95 per cent of Australia's thermal coal exports come from the open-cut mines in the Hunter Valley, which are transported to the East Asian markets of Japan, South Korea and Taiwan.³ Demand from Asia for New South Wales coal has continued to increase, with China in 2012-2013 consuming almost 31 million tonnes. During the 2012-2013 financial year, Japan, the largest consumer of New South Wales coal, increased its consumption by 12 per cent. Demand from China in the same period had risen 30 per cent, while South Korean demand for New South Wales coal in 2012-2013 increased 19.6 per cent.⁴

The Hunter Valley may be described as a 'coal economy'. The region has more than 40 open-cut coalmines, six coal-fired power stations, and three export coal loaders. At present, mining leases extend over 64 per cent of the Upper Hunter Valley floor, an area of 1280 square kilometres. Mining operations cover 16 per cent of this designated area, nearly 315 square kilometres. The Hunter Valley's coal economy is evident beyond the mining sites, in the region's infrastructure, where coal is transported through an integrated

¹ Jim Comerford, *Coal and Colonials: The Founding of the Australian Coal Mining Industry* (United Mineworkers Federation of Australia, Sydney, 1997) 251.

² Sinclair Davidson and Ashton de Silva, cited in Minerals Council of Australia, *Coal Hard Facts* <http://www.minerals.org.au/file_upload/files/resources/coal/Coal_Hard_Facts.pdf>.

³ World Coal Institute, *Coal Facts* (2009) <<http://www.worldcoal.org/resources/coalstatistics/>>.

⁴ Angela Macdonald-Smith, 'Hopes of comeback for NSW coalmining industry', *The Sydney Morning Herald* (Sydney), 20 January 2014, 24.



network of railways, roads and coal washeries. Coal mining industry is serviced by businesses supplying and maintaining mining equipment.

However, the Hunter Valley's coal economy has its limitations. The coal is mined, transported and, primarily, exported; there is no 'value-adding' stage that may further contribute to the regional economy. Open-cut coal mining in the Hunter Valley is an extractive not a productive process. The extractive process is capital-intensive and requires massive capital investment both during the establishment phase and in the day-to-day operations of the region's open-cut coalmines.

The level of capital investment required has determined that transnational corporations dominate coal mining in the Hunter district. Through consortia or on an individual basis, transnational mining corporations own 38 of the open-cut coalmines operating in the Hunter Valley. Among the ownership of these mines are transnational corporations with Anglo-Australian origins, and transnationals based in the United States, Canada, India, Japan, Korea, and China. The global mining and metals corporations, notably Xtrata, Rio Tinto, Anglo Coal, BHP Billiton and Peabody, dominate the coal mining operations in the Upper Hunter. The largest Chinese state-owned coal corporation, Shenhua Energy, is a major investment partner in the corporate coal consortia operating in the Hunter Valley and expanding into the Gunnedah Basin.⁵

A number of the transnational corporations mining coal in the Hunter Valley have, due to the enormous capital investment required, opted to gain advantage by establishing partnerships and consortia. These arrangements have enabled the corporations involved to reduce duplication in transport, to achieve lower transaction costs through rationalisation and concentrating operations, and to increase capital accumulation through the intensification of labour productivity.

The vast scale of the Hunter Valley's open-cut coalmines is such that some may be more accurately described as 'mega mines'. The Wambo mine, named after a demolished 1880 homestead, and largely owned by a subsidiary of the American energy corporation, Peabody, is located 30 kilometres west of Singleton. Nearly five kilometres long with a width of two-and-a-half kilometres, the Wambo mine is a combined open-cut and underground mine. The coal output of the open-cut section of the Wambo mine was 2.6 million tonnes in 2011. It is expected by Peabody to yield far greater quantities of future 'saleable coal'.⁶

Open-cut coal mining has eliminated some of the Hunter Valley's geological features. The largest mine in the Hunter region is BHP Billiton's Mount Arthur, four kilometres from township of Muswellbrook. Geologically, there is no longer a Mount Arthur. It has been transformed into a mine site seven kilometres long, three kilometres wide and 250 metres deep, surrounded by hills of coal waste, which will eventually be 'environmentally remediated' by the global miner. The mine has yielded 15 million tonnes of coal each year since 2004. As its tenement is extended, 30 million tonnes of coal is expected to be extracted annually.⁷

Once located near Singleton, Anvil Hill has been transfigured into the Xtrata mine known as Mangoola, which has an output of 10 million tonnes of coal yearly. Geographically, the Hunter Valley towns of Muswellbrook and Singleton are being encircled by open-cut coal mines owned by Rio Tinto, Xtrata and other transnational mining corporations, kilometres beyond the town limits.

The issue of the sustainability of open-cut coal mining in the Hunter Valley is a complex one, even when considered solely in relation to the question of its economic sustainability. In broad terms, coal is a finite not a renewable resource, and mining may continue as long as there is coal to be won from the earth. However, for the Hunter Valley's open-cut coal mining industry, characterised by the control of transnational mining corporations and the focus on exports, key economic considerations are as important as the region's coal seams. The demand for coal, the costs of investment, transport and labour, the export price, and the profitability of mining operations in the region are paramount. The economic sustainability of open-cut coal mining in the Hunter Valley may be determined by whether the mines can deliver continuing rates of profit maximisation for the transnational corporations that have invested in the region. The mines have very high cost structures. As Australia's waning mineral resources boom has demonstrated in other parts of the country, mines may be closed solely due to declining profits, irrespective of the quantities of minerals in

⁵ Ian Kirkwood, 'Chinese Giant's \$600 Million Bid', *The Newcastle Herald* (Newcastle), 20 July 2008.

⁶ Peabody Pacific, *Wambo Report 2011* <<http://www.peabodyenergy.com>>.

⁷ BHP Billiton, *Home* <<http://www.bhpbilliton.com/bb/ourBusinesses/metallurgical>>.



existence at the mine site. In May 2014, 500 workers from the Camberwell open-cut mine and the Glennies Creek underground mine near Singleton were sacked due to poor coal prices.⁸

Although the Hunter Valley may presently be described as a 'coal economy', the economic sustainability of the Hunter region's open-cut coal mining industry is not assured, particularly when the issue of government support for the industry is considered. In the Hunter Valley, the existing infrastructure of railways, roads, port facilities and coal loaders were leased by the New South Wales government to the transnational mining corporations to form the logistics of an integrated coal chain to 'service' the transport of the coal for export. Subsidies and low royalties were provided by the state government on the transported coal. In 2012, a federal government grant of \$885 million was spent on the rail infrastructure of the Hunter Valley to increase the capacity and speed of the delivery of the coal to the coal loaders. The diesel fuel and electrical power which drives the machinery of the global coal mining companies, like the coal loader leases, are directly subsidised by the federal and New South Wales governments.⁹

Whether transnational mining corporations would continue their operations in the Hunter Valley without these forms of direct government assistance is unknown. Nonetheless, the extent of government support provided to the Hunter region's coal-mining industry raises the issue of whether the return on government investment is adequate. Rents and royalties paid to the state government by the transnational mining corporations are calculated only on the coal that is mined and exported, rather than being calculated in relation to the profits generated by the extractive enterprise. Although coal royalties for New South Wales in 2009 were almost \$1 billion this comprised less than 1 per cent of the total state revenue, estimated at \$577 billion.¹⁰

The granting of approval for mining leases and contracts with transnational corporations to extract coal in the Hunter region has been viewed as critical to the New South Wales economy. The mining contracts issued by the state government can be extended over both time and land required by the mining corporations. The granting of mining contracts and leases is the responsibility of the state Minister for Mines and Energy who has to consider the environmental impact of the mining project. The potential for multinational mining corporations to withdraw and concentrate their mining operations elsewhere may be viewed as an important, though intangible, factor in mining contract deliberations. For example, the future of Rio Tinto's Warworth mine and Anglo American's Drayton mine, which employ 2300 workers, are reportedly at risk because of difficulties with the state planning approval processes.¹¹ The extension, scale and intensity of open cut coal mining in the Hunter Valley has often directly overridden the property rights of many dairy farmers, cattle raisers, horse breeders, wine-makers and domestic residents of the Hunter Valley, without any compensation, and deprived them of their livelihood.¹² The New South Wales government has only belatedly considered the need for legislation to protect such interests from the expansion of mining operations. However, the New South Wales government's 2013 introduction of protections for Hunter Valley wineries and horse studs concerned coal seam gas operations specifically, not mining in general.¹³ In contrast to the restrictions imposed on coal seam gas enterprises, the New South Wales government amended planning legislation in November 2013 to make the economic benefits of a mining project the 'principal consideration' in assessing new mining proposals and the expansion of existing mines.¹⁴

The importance of the Hunter Valley's coal mining industry to the economy of New South Wales has increased substantially from the 1990s. Investment in coal mining in the Hunter Valley constituted an average of 6 per cent of total private business investment in New South Wales during the 1990s. By 2011, it constituted 20 per cent and increased to 27 per cent in 2012. The expansion of coal mining since 2009 was vital

⁸ 'Integra Lays Off 500 Coal Miners Near Singleton in NSW Hunter Valley, Blames Coal Prices', *ABC News*, 16 May 2014, <<http://www.abc.net.au/news/2014-05-16/500-hunter-valley-coal-miners-laid-off/5458280>>.

⁹ Paul Cleary, *Mine-Field: The Dark Side of Australia's Resources Rush* (Black Inc, Collingwood, 2012) 50-3; Stuart Rosewarne and Linda Connor, 'Coal Curse: The Black Side of the Subsidised Coal Boom', *The Conversation*, 3 July 2012, <<https://theconversation.com/coal-curse-the-black-side-of-the-subsidised-resources-boom-7801>>.

¹⁰ 'Budget Statement 2010-11', (New South Wales Government, 2010) <http://www.budget.nsw.gov.com.au/budget_papers_2011/bp2/2010-11_budget_paper>.

¹¹ Macdonald-Smith, above n 4.

¹² Cleary, above n 9, 52-63; Guy Pearce, David McKnight and Bob Burton, *Big Coal: Australia's Dirtiest Habit* (New South Publishing, Sydney, 2013) 34-43; Sharyn Munro, *Rich Land, Wasteland: How Coal is Killing Australia* (Macmillan, Sydney, 2012) 62-79.

¹³ 'CSG blocked from Hunter wineries, horse studs', *ABC News*, 19 February 2013, <<http://www.abc.net.au/news/2013-02-19/csg-blocked-from-hunter-wineriestc-horse-studs/4526702>>.

¹⁴ Environmental Defenders Office NSW, 'Economic Benefits' Hold Sway in Changes to NSW Mining Policy', <http://www.edonsw.org.au/economic_benefits_hold_sway_in_changes_to_nsw_mining_policy>.



to the state's economic performance because other sources of investment were weak or declining in this period.¹⁵ However, the Hunter region's coal mining industry, as the recipient of considerable government support in the form of subsidies, could also be seen as a beneficiary of the decline of other sources of investment.

The ecological consequences of the Hunter Valley's open-cut coal mining industry

Open-cut coal mining is characterised by the blasting, drilling and excavation of the mine site in order to extract the coal. The mining process is destructive of the immediate environment, and it cannot be considered to be ecologically sustainable. It is debateable whether open-cut mining sites can ever be environmentally 'rehabilitated'. It would be contentious to suggest that the contribution of Hunter Valley coal mining to state revenue outweighs the industry's environmental impact, yet that interpretation appears to be endorsed by state policy. The New South Wales government determined in February 2013 that approval for corporate mining projects would be based on 'the principal consideration of its economic benefit'.¹⁶

The Minerals Council of New South Wales has emphasised that mining uses only a relatively small area of land within the state. The Minerals Council cites New South Wales government figures on land use which estimate that mining (undefined) accounts for only 0.1 per cent of New South Wales land, whereas agriculture, conservation, and housing use 76 per cent, 7.6 per cent, and 1.8 per cent respectively. However, there is potential for mining to expand its current land use. While mining cannot yet occur in national parks, private coal and mineral titles extend to 22 per cent of land throughout New South Wales.¹⁷ Mining may presently occupy only a small area of land in New South Wales, but open-cut coal mining in the Hunter Valley has produced ecological consequences that must be given attention.

The intensity and scale of open-cut coal mining in the Upper Hunter, through operations including blasting, excavating, shovelling, drilling, loading, transporting and dumping, creates a continuous discharge of inhalable dust and other air-borne particles which shroud the mine sites or are carried by the wind into the surrounding region. Water is constantly sprayed onto the coal load as it is gouged from the earth before its carriage by 380 tonne haulage trucks and coal trains, comprising 100 cars per train, to any three of the coal loaders situated at Newcastle Port or the power stations in the Lower Hunter. Over 80 per cent of the coal is delivered to the site of the export coal loaders, where it is continually hosed before being dumped into the hull of docked super tankers. Despite its watering, the coal in transit from the mines to the loaders or power stations releases particle dust.

Transnational mining corporations involved in open-cut coal mining in the Upper Hunter have been granted high-security water licences from the New South Wales government. During a drought, power stations and coalmines have first priority over water. Open-cut coal mining requires 80 to 115 litres of water for each tonne of coal extracted.¹⁸

The large scale, highly mechanised open-cut coal mining operations of the Hunter region require a continuous supply of water to limit the air pollution of the coal load as it is mined and transported, and to settle the coal waste, overburden and tailings at the mine site. The demand for water for coal mining has adversely impacted upon other water users in the Hunter Valley. Some farms near mining sites have seen their water supplies diminished. With the expansion of coal mining in the Singleton Shire, more than 400 dairy farms, already confronting the pressures of a supermarket duopoly and declining dairy prices, disappeared from the district after their water supplies plummeted. Mining corporations purchased the properties as they further extended their operations in the Shire.¹⁹

Where open-cut coal mining has depleted water sources in parts of the Hunter Valley, in some areas coal mining operations have compromised the quality of local water supplies. Wastewater from the mine sites has polluted the surrounding land and river system of the region. Pumped and tanked water on properties

¹⁵ Harry Perlich, 'Economic Notes: Australia's Two-Speed Economy', (2013-2014) 72(Summer) *Journal of Australian Political Economy* 110.

¹⁶ Michael Tubbs, *The Dictatorship of Capital* (Boolarong Press, Salisbury, Queensland, 2013) 66.

¹⁷ New South Wales Mining, *Land Use Facts: Myths About Mining* <<http://landusefacts.com/myths-about-mining.html>>.

¹⁸ Munro, above n 12, 297.

¹⁹ Cleary, above n 9, 60-1.



around the open cut coalmines has been contaminated with high levels of lead, arsenic, mercury, nickel and zinc. The water cannot be used for drinking, bathing or for livestock, plants or on pastures. Remaining residents only drink bottled water.²⁰ Water supply, use and disposal are self-regulated by the separate coal-mining corporations. The soil and water pollution from coal mining has led to the deterioration and closure of many dairy farms, wineries and cattle runs in close proximity to the mines. Both the air and water pollution of the mines has deprived these farmers, vigneron and graziers of maintaining their livelihood as producers.²¹

Sulfidic mine waste in intensive mining regions causes dust, salinity, hydrology changes to creeks, soil erosion and toxic seepage. Waste rock dumps can fill valleys or obscure them from view or may create entirely different landforms. The 'mega-industrial scale of modern mining ... brings with it mega-scale environmental risks', especially sulfidic mine waste pollution, which may defy all efforts at rehabilitation.²²

Mine waste, particle dust, and water contamination are critical aspects of the localised ecological impact of the Hunter Valley's open-cut coal mining industry. However, the industry is also exacerbating the global problem of climate change. In 2012, Australia exported to Asian markets nearly 330 million tonnes of coal, 54 per cent of which was steaming coal, from the open-cut mines of the Upper Hunter. It is estimated that, when burned, that amount of coal will produce a billion tonnes of carbon dioxide, which is the major contributor to global climate change.²³ With the advent of the massive scale and intensity of open cut coal mining in the Upper Hunter there have been, regionally, higher average temperatures, shorter drier winters, lower annual rainfall, more intense bushfires and severe storms.²⁴ Ecologically, coal mining in the Hunter Valley is neither locally nor globally sustainable.

The social consequences of open-cut coal mining in the Hunter Valley

It is difficult to obtain accurate figures on the number of people employed directly and indirectly by open-cut coal mining in the Hunter Valley because underground and open-cut employment statistics are usually combined. Open-cut coal mining in New South Wales employed 11 350 people in 2011, but figures on the proportion of those working in Hunter Valley mines were not specified.²⁵ Most of the Hunter region's residents are excluded from the coal boom's benefits or have to endure its consequences. A social paradox of the Hunter Valley, where income derived from mining is high, is its equally high rate of unemployment, underemployment and poverty, particularly among the long-term residents of the region not directly associated with the mining industry.²⁶ A June 2014 report by the Australia Institute concluded that the coal mining industry accounts for only five per cent of employment within the Hunter Valley.²⁷

The open-cut mining operations in the Upper Hunter have had significant social ramifications related to the long hours of shift work required of its employees. There are considerable differences between the shift work pattern of underground coalmines and that of the Hunter Valley's open-cut coalmines. In the underground coalmines, work was performed by rotating three crews over 24 hours. Employees of the Hunter region's open-cut mines no longer work an eight-hour day. Instead they work rotating twelve-hour shifts each day, seven days a week. If both the change of shift and the journey to and from work were calculated as part of their working day, it may be 15 or 16 hours rather than 12, as most drive to the mine site from the Central Coast or the Lower Hunter. The mining corporations need two crews to carry out the work.

²⁰ Munro, above n 12, 17, 24, 81, 297.

²¹ Geoffrey R Evans, 'Transformation from "Carbon Valley" to a "Post-Carbon Society" in a Climate Change Hot Spot: The Coalfields of the Hunter Valley, New South Wales, Australia' (2008) 13(1) *Ecology and Society* 1; Munro, above n 12, 86-114; G Ray, 'How One Hunter Mine Left a Farm Dry as a Bone', *Newcastle Herald*, (Newcastle) 9 February 2005, 6; G Ray, 'Streams at Risk of Vanishing', *The Newcastle Herald*, (Newcastle) 9 July 2007, 9; Cleary, above n 9, 53-63.

²² Gavin M Mudd, 'Australia's Mining Legacies', (2013) 124 *Arena Magazine* 19.

²³ Ian Lowe, 'Coal Exports Add Fuel to Climate Disaster', *The Sydney Morning Herald* (Sydney), 5 December 2012, 9.

²⁴ Evans, above n 21, 1-39.

²⁵ New South Wales Minerals Council, *NSW Mining 2012: A Snapshot*, 15, <<http://www.nswmining.com.au/NSWMining/media/NSW-Mining/Publications/NSW-Mining-2012-A-Snapshot-FINAL.pdf>>.

²⁶ Hunter Valley Research Foundation, *Hunter Region Economic Indicators, March Quarter, 2007*, (Newcastle, 2007), <<http://hvrhf.com.au/download-publications/economic-indicators>>; Geoff Evans, 'Hunter Coal: Nobody Knows What we are Going Through so this State Can be Rich' (Mineral Policy Institute, Sydney, 2005) <http://www.mpi.org.au/campaigns/climate/hunter_coal/>.

²⁷ The Australia Institute, 'Seeing Through the Dust: Coal in the Hunter Valley Economy' (June 2014) <<http://www.tai.org.au/content/seeing-through-dust-coal-hunter-valley-economy>>.



Under such a work regime, the cost of labour is reduced as its exploitation is intensified. Over a sustained period, this work pattern may induce chronic fatigue and prove uneconomic.²⁸

The long, concentrated work shifts of the mining employees are rewarded with high rates of pay and may facilitate their 'drive-in-drive-out' timetables. Nevertheless, such work patterns allow extractive capital to maximise labour power over a concentrated time and avoid any responsibility for social problems generated by it away from the work site. Apart from its propensity to necessitate prolonged physical and mental fatigue, this shift work pattern impacts upon mining workers' social relationships. When they are not working or travelling to and from work, they may be merely recovering from their work. The potential social pathologies of alcohol abuse, drug use or domestic violence associated with the 'work-life balance' of mining workers residing in Singleton was noted in a recent local government report. Studies on both the drive-in-drive-out and fly-in-fly-out work-life cycle of mining workers confirm the generation of these problems.²⁹

While the shift work pattern may have adverse consequences, the Hunter region's open-cut mining employees may be exposed to other hazards during their work. The mine sites are the epicentres of the air pollution from coal dust, where exposure is immediate and constant. Safety equipment, work wear, air conditioning and the constant watering of the coal load and coal waste cannot prevent either exposure to or inhalation of particle dust. There has not been adequate research or advocacy on the short- and long-term effects of this air pollution on the health of employees at the Hunter Valley's open-cut coalmines. Although some community studies of particle dust exposure have been conducted in the region, there is no published research on the dust exposure of the Hunter Valley's open-cut mining employees.

Although noise levels are monitored and regulated, the operations of industrial open-cut mining create and perpetuate continuous noise. The blasting, excavating and drilling generate 'blast overpressure' or high-energy impulse noise as in explosive detonations similar to the firing of heavy weapons. Exposure to waves of high-energy impulse noise can result in injury to the auditory, respiratory and gastrointestinal systems. Likewise, infrasound or low rumbling noise below the threshold of human hearing caused by open cut mining also may adversely affect heart rate, balance, sleep and overall health. For mining employees and residents living near the mines, coal roads and the coal train line are subjected to constant levels of both high-energy impulse noise and infrasound. Only anecdotal evidence about their consequences has been recorded. Unlike the effects of particle dust on the health of those living in the Upper Hunter, there are no published studies of noise and community health.³⁰

A fundamental operation in open cut coal mining is the blasting, with explosives, of the coal seam from other rock strata. The blasting is a high-impulse noise, exposure to which may permanently damage the hearing, breathing and the digestive system of workers at the site. Continuous high impulse noise levels are also created by the drilling, digging, loading, hauling and dumping of the diesel-powered machinery used at the mine site or in the transportation of the coal. Although mining employees wear safety equipment, the industrial noise levels at the mine site are not considered an unavoidable health risk.³¹

Industrial noise is not confined to the immediate vicinity of the Hunter region's open-cut mine sites. The noise from convoys of haulage trucks carrying and dumping their loads into the 100-car coal trains occurs throughout the day and night. For residents in the Upper Hunter who live near the coal roads and the rail lines, industrial noise levels are a problem that has not been adequately addressed by either the government or the mining corporations.³²

The particle dust generated by coal mining has been linked to serious health consequences. Air pollution particles from cars, wood smoke and coal mining caused 1400 deaths and 2000 hospitalisations annually in New South Wales according to a 2011 State of the Environment report. Asthma Australia said research into the health effects of coal mining in Australia 'lagged behind the rest of the developed world' and the exist-

²⁸ Cleary, above n 9, 148-152.

²⁹ Kerry Carrington, Russell Hogg, John Scott and Alison McIntosh, 'Inquiry into the Use of "Fly-In, Fly-Out" (FIFO)/Drive-In, Drive-Out (DIDO) Workforce Practices in Regional Australia', (Submission to the APH House of Representatives Inquiry, Number 95, Canberra: Standing Committee on Regional Affairs), 9 October 2011, <<http://www.aph.gov.au>>; Kerry Carrington, Russell Hogg, and Alison McIntosh, 'The Resource Boom's Underbelly: Criminological Impacts of Mining Development', (2011) 44(3) *Australian and New Zealand Journal of Criminology*, 335.

³⁰ Munro, above n 12, 10-19; Cleary, above n 8, 63-4; 69; Ann Finegan, 'Coming Soon (Near You) BIG MINING and the Question of Scale', (2012) 32(4) *Artlink*, 43.

³¹ Drew Cottle, 'Land, Life and Labour in the Sacrifice Zone: The Socio-Economic Dynamics of Open-Cut Coal Mining in the Upper Hunter Valley, New South Wales', (2013) 22 *Rural Society* 208.

³² Munro, above n 12, 8-9, 77.



ing modus operandi ‘rewarded polluters ... and asked little in return’. Monitoring was ineffective and little was done when breaches of national limits occurred.³³

A 2012 study by University of Sydney researchers on the health and social impact of particle dust caused by coal mining and coal burning on communities in the Hunter Valley registered high rates of cancer, heart, lung, liver and kidney disease as well as birth defects throughout the region.³⁴ An earlier study from 2008 had revealed that 113 tonnes of the toxic metals, 13 200 tonnes of sulphur dioxide and 62 000 tonnes of nitrogen oxides generated by coal mining and coal-powered electricity contaminated the air in the Hunter Valley via particle dust.³⁵

The installation of monitoring stations to measure and record coal dust levels in the Hunter Valley has not seen an improvement in air pollution levels. In 2013, the national standard for particle pollution levels was exceeded in Newcastle and the Hunter region on 171 occasions, which represented a 50 per cent increase on the region’s pollution level breaches during 2012. The problem was not confined to a specific mine site, as the 2013 air pollution breaches were recorded at 15 of the Environment Protection Authority’s 17 monitoring stations located in the Upper and Lower Hunter Valley. However, the levels of fine particle dust, which is microscopic and the most dangerous form of particle dust, are only recorded at five of the 17 monitoring stations in the Hunter Valley.³⁶

In addition to the respiratory and cardiovascular effects of coal dust exposure, it has been suggested that open-cut coal mining in the Hunter Valley may have psychological implications. Concentrated areas of the Upper Hunter have become like a moonscape through the operations of large-scale industrial mining. Residents who remain living near massive open-cut mine sites and their environmentally remediated areas are said to experience ‘solastalgia’: the pain endured when the place where one lives has been destroyed beyond recognition.³⁷

The health impact of open-cut coal mining raises serious questions about the social sustainability of the coal mining industry in the Hunter Valley. A 2011 medical study has been definitive in its assessment of the health impact of coal, both in terms of coal mining and the use of coal in energy production. The study, in reviewing evidence from Australia and overseas, concluded that not only is coal mining and the burning of coal harmful to physical and environmental health, which has a significant impact on local communities, but also that coal use must be phased out and replaced with non-polluting energy sources and technology.³⁸

Conclusion

From the 1990s to the present, the Hunter Valley has become increasingly economically dependent upon the operations of open-cut coal mining. Some existing rural enterprises such as dairy farms, cattle runs and vineyards, which are essential to the food supply and a balanced, diverse and sustainable regional economy, have been displaced as open-cut mining sites have been established and extended. Evidence of the social and ecological toll of open-cut coal mining in the Hunter Valley suggests that these costs must be more heavily weighed against the limited economic benefits the industry brings to the Hunter region.

³³ Amy Corderoy, ‘Particle Health Threat Triggers AMA Warning’, *The Sydney Morning Herald* (Sydney), 6 April 2013, 2.

³⁴ See Pearse, McKnight and Burton, above n 12, 26.

³⁵ N O’Malley, ‘Black Marks on the Health Chart’, *The Sydney Morning Herald* (Sydney), 19 March 2010, 12.

³⁶ Hunter Community Environment Centre, ‘Premier Urged to Control Air Pollution in 2014: 50% Increase in Air Pollution Breaches in Newcastle and the Hunter’ <<http://www.hcec.org.au>>.

³⁷ Glenn Albrecht et al, ‘Solastalgia: The Distress Caused by Environmental Change’, (2007) 15(1) *Australasian Psychiatry*, 95.

³⁸ William M Castleden, David Shearman, George Crisp and Phillip Finch, ‘The Mining and Burning of Coal: Effects on Health and the Environment’, (2011) 195(6) *The Medical Journal of Australia*, 333.

