6

AUSTRALIA

Sub-sector focus: coal and seam gas

6.1 Overview

Extractive industries are routinely described as *"the backbone of the Australian economy"*. Mining contributes approximately 6% to Australia's GDP and mineral exports make up approximately 35% of Australia's total export value. As one of the largest global producers of global iron ore, coal, nickel, uranium, diamonds, gold, and zinc, and as an OECD country situated in Oceania, Australia faces a number of socio-political complexities around its resources. The reason for this is over 65% of Australia's runoff is in the three drainage divisions located in the sparsely populated tropical north. In contrast, most large urban cities are situated in southern regions with irrigated agriculture principally located in the Murray Darling Basins with only 6% of the national run-off. So while Australia has significant water resources, the majority of its population and agricultural activities are concentrated where water resources are most limited.[74] While water scarcity is an issue for much of Australia, because of the location of most mining operations, water is not constraining mining expansion in Australia at present.

To compound an already complex issue, Australia is also one of the most hydrologically-variable countries in the world, experiencing both extreme droughts and extreme floods. In 2010, severe floods in Queensland led to operations in 90% of coal mines either partially or wholly shut down. This resulted in lower export volumes and, in turn, pushed up the international coal price.

As can therefore be expected, access to water is an extremely political issue in Australia and the country has undertaken several iterations of water reforms in response to the rising demand for water resources. The majority of mining operations in Australia compete with agricultural and other industrial operations for access to water, although the response of mining operations has generally been to acquire water for operations when required. Although not all mining takes place in highly water scarce regions, Australia has strict environmental regulations.

Institutionally, Australia has a strong water regulatory regime. As a result of intense water scarcity, Australia has pioneered a number of water policies and standards for mining, agriculture, and other industries which have served as international benchmarks. Australia has established a number of sophisticated systems for managing water supplies and risk especially following experiences in the Murray Darling Basin. However a number of concerns continue to emerge for operators in Australia as climate variability begins to become more extreme.[75] Extractive industries therefore face a number of water-related challenges as they navigate this complex space.[76] This briefing focuses on two sub-sectors in Australia:

(1) **Coal.** Coal provides 85% of Australia's electricity production. Australia is also the largest coal exporter in the world. Approximately half of the coal mined in Australia is exported, the majority to destinations in eastern Asia, including Japan. In addition, Australia has the largest sea-borne coking coal reserves in the world. Australian coal is mined primarily in Queensland, New South Wales and Victoria where impacts of climate variability have had a significant impact on mining operations.

(2) **Seam Gas.** Coal Seam Gas (CSG) is a natural gas found in coal deposits. Coal seam gas is used in the same way as any other form of natural gas for cooking and heating as well as in industrial processes and electricity generation. With advances in technology, CSG has developed into a key transition fuel, helping to lower Australia carbon emissions as it moves toward a low carbon future. CSG now makes up a significant proportion of Australia's natural gas supply. Exploration for CSG in Queensland began in 1976 in the Bowen Basin, but the CSG industry did not really start to grow until the early 1990's and

commercial production began in Queensland as recently as 1996. In short, CSG extraction is a relatively new technology.

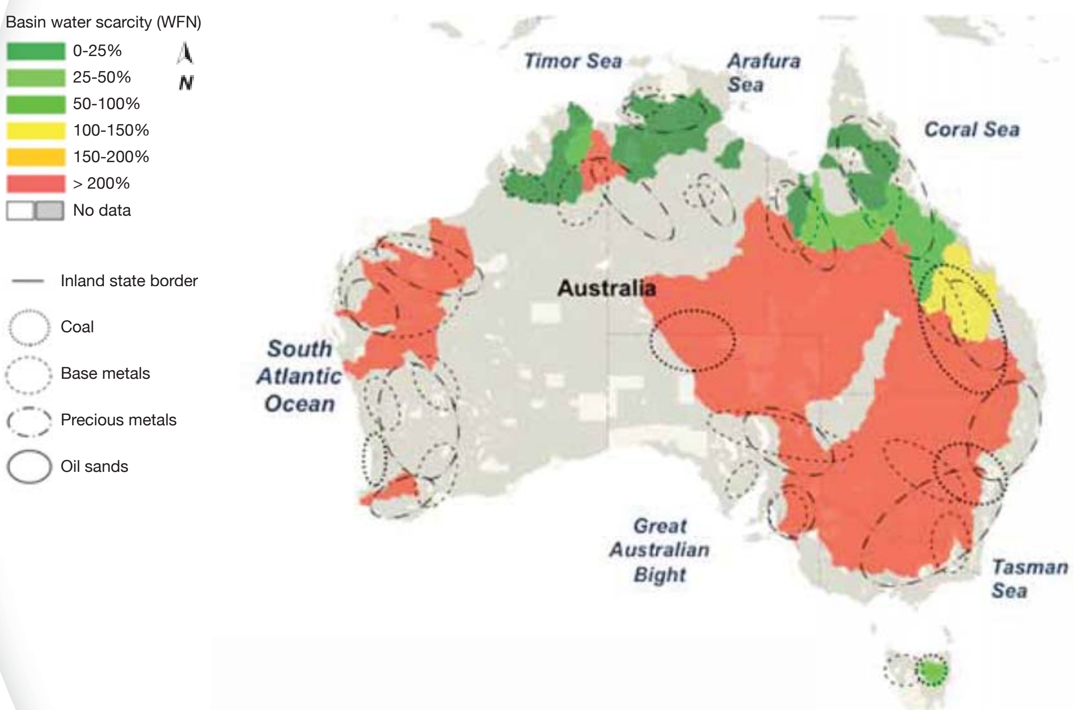
To extract CSG, a steel-encased hole is drilled into the coal seam below ground. As the pressure within the coal seam declines due to natural production or the pumping of water from the coal-bed, both gas and underground water come to the surface through tubing. Often this can be very large amount of water which can mean other users loose access to that water. The gas is sent to a compressor station and into natural gas pipelines. The water is released into streams or used for irrigation. The water typically contains dissolved solids such as sodium bicarbonate and chloride and it is necessary to treat the water before it is released. Often there is too much water and it is released on too regular a basis for it to be useful for irrigation.

Associated with CSG is the fracking method. Fracking involves pumping water, sand and chemicals to fracture the coal seams and bring their mixture of gas and saline water to the surface. Not all coal seams need fracking to make gas flow. However, it has been observed that fracking requires a water supply and, in turn, can contaminate adjacent groundwater or high-quality water can be lost from underground aquifers as it seeps into fracked coal seams.

Geographical distribution of coal mining and seam gas in Australia in the context of water scarcity.

Figure 5:

Average annual blue water scarcity for Australia

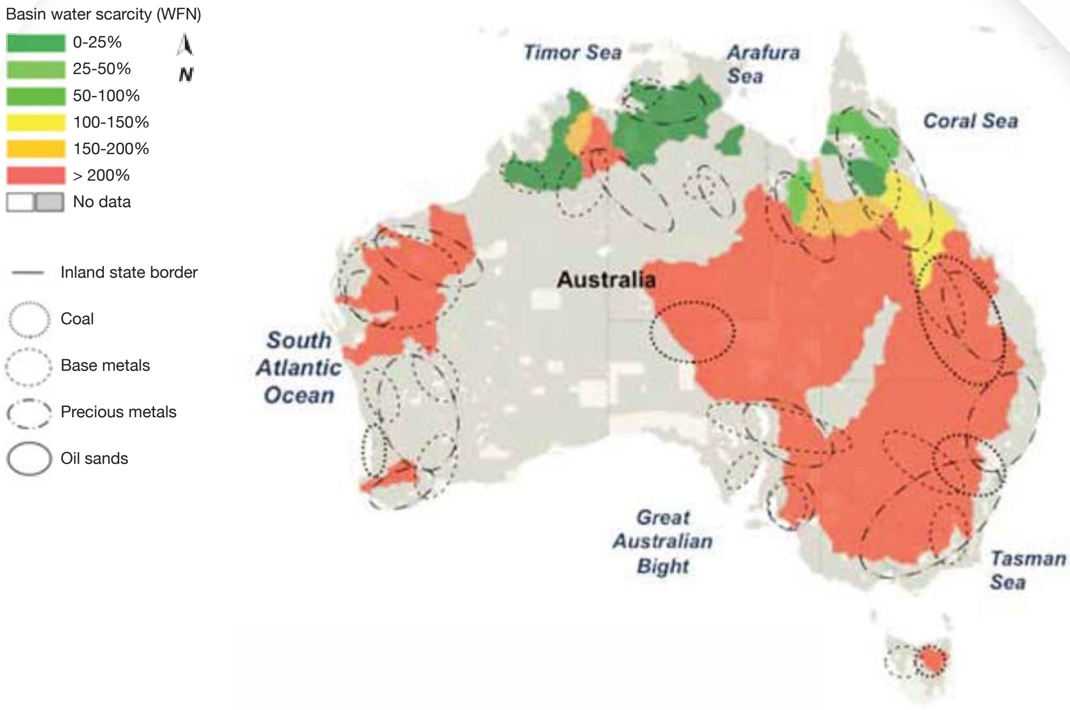


Description: Annual average of the twelve monthly blue water scarcity values per basin, equally weighted. Blue water scarcity is defined as the ratio of blue water footprint (based on consumption rather than withdrawal) to blue water availability – where the latter is taken as natural runoff minus environmental flow. Blue water resources are surface water and ground water and are based on data from 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2).

Figure 6:

Maximum monthly blue water scarcity for Australia



Description: Blue water scarcity in the month with the highest scarcity level - defined as the ratio of blue water footprint to blue water availability – where the latter is taken as natural runoff minus environmental flow. >100% means that consumption is higher than availability in that particular month. Blue water resources are surface water and ground water and are based on data from 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

6.2 Case Study 4: Weather extremes lead to water challenges for extractives

Australia has one of the most variable hydrological systems of any country in the world. It experiences both intense drought and intense flooding. Recent climatic events in Queensland have demonstrated the need to understand what these extremes may be, in order to respond to climatic variability in the future. This translates into profound physical risks for extractive industries and others including financial institutions.

The state of Queensland has typified the Australian hydrological situation over the last 10 years – a severe drought from 2000 to 2007 has been followed most recently by successive years of flooding and record-breaking rainfall.[77] These extremes have had dramatic impacts on coal mining operations within the Bowen Basin, which is the largest source of seaborne coking coal in the world.

Over 7 years (2001-2007), the Bowen Basin experienced a multi-year drought, which saw allocations from some government-owned raw water supply infrastructure reduced. This represented physical risk exposure across several mining assets all located in the same Basin, which threatened mining production levels and highlighting the vulnerability of mining operations to climatic variability. The greatest risk to operations is due to insufficient raw water for the various activities on site, but particularly for processing coal. Mining companies have responded by gearing up to build water infrastructure in order to have more secure water supplies.

Following the 7-year drought, the 2010/2011 wet season saw huge flooding in the wider state of Queensland. The magnitude of the flooding was so great that it caused 85% of mines to be partially or fully non-operative.

Within Australia, variability in climatic conditions has not typically been considered when planning or developing a new mine. Similarly, existing mines have generally given little or no consideration to their ongoing water management strategies – the approach has historically been one of adaptation to the emerging risks of a variable climate as they arise, rather than planning for and mitigating the potential risks in advance. This has served to compound the risk associated with climate variability in Australia.

The risks experienced are therefore not merely physical. And there is risk in the limited understanding of climatic variability, its impacts on operations, and in the lack of planning to mitigate these risks. Drought presents sustained prolonged risk to operations, which could shut down production for periods ranging from a month to years. High rainfall events, on the other hand, result in short-term production losses but also more immediate, operationally focused management and compliance issues associated with discharging the water off-site and the costs of associated pollution impacts.[78]

In order to manage the potential risk to operations posed by extreme climate change, better understanding is required of the extremes of climatic variability for the existing and new operations and the mitigating triggers for action when challenged with climatic extremes. This greater understanding enables the range of options that may be available to be assessed, both within the mine site itself (in terms of onsite water management) and for external water sources and associated infrastructure.

6.3 Case Study 5: The Queensland Water Act requires offsetting water impacts

Queensland's Water Act provisions require companies to 'make good' any impacts mining operations might have on ground water resources. When there is little understanding of the potential effects of operations being undertaken – such as those involved in extracting Coal Seam Gas (CSG) - this potentially represents a 'blank cheque order' for the future.

Coal Seam Gas (CSG) extraction can have several impacts, including a lower water table, challenges associated with water disposal once it is extracted and ground water pollution through fracking. The actual impact of any CSG extraction will depend on the hydrology of the particular groundwater systems and yet these impacts are generally not well understood.

Despite this limited understanding of the impacts of CSG operations, approvals for CSG extraction in Australia are being provided.

The Australian National Water Commission's policy on CSG water allocations is they should be managed along with other water users as part of a water planning process, which ensures sustainable outcomes. The state of Queensland, however, has departed from this approach and has instigated new legislation, which requires companies to 'make good' explanation any impacts on groundwater for agricultural users or the environment.[79]

The practicality of 'making good' the loss of groundwater where levels have dropped significantly, is highly questionable. Given approvals are being provided without a full understanding of the impacts of extraction, this legislation is effectively providing for an "after the fact" cleanup order which will potentially be both extremely expensive and involve uncertainty around the costs involved. Affected users are cattle farmers who use the ground water to water their cattle or crops. Also, there are also ground water springs, which have high environmental value.

The cost associated with open-ended requirements such as the 'make good' provisions of the Queensland Water Act could be very significant to address. Financial institutions considering CSG projects should be fully informed of the potential costs of addressing legislative requirements and incidents in the future.

These liabilities will not only extend over the life of the projects (in the order of 30 years) but potentially decades further as the full impacts on groundwater are realized.

There is high uncertainty involved when proper impact assessment and management conditioning is deferred to post-approval management plans. This will mean many environmental requirements will only be fully specified once financing has already been approved and construction is underway.

It is advisable for a preliminary economical and technical feasibility study to be prepared in conjunction with a preliminary appraisal to identify and assess potential environmental and social issues associated with production activities. It is also important to develop a 'closure plan', and to determine the need for mitigation and protective measures and the costs that would be associated with these measures. The state of Queensland, with its 'make good' legislation, has transferred the risk of depleting groundwater to mining companies and institutions that finance their operations.

Based on the case studies, two major areas of concern emerge:

1. **Impact of climate change on water stress:** Australia experiences very large swings in seasonal hydrology and will see much more extreme variability in the future due to climate change.
2. **Changing regulatory structures for new technology:** While Australia has a robust institutional structure for existing technologies, CSG extraction involves new technology that is not yet well understood and therefore regulated.

	Asset management	**Corporate finance**	**Project finance**
Climate related water risk	Value of dividends and of the share price jeopardized as a result of extreme climate events	Risk profile changes due to unpredictability and a lack of understanding of climate events	Inability to repay loans in particular year as a result of mine closure from climate events
Changing regulatory structure	Profitability structures of investments change as additional regulatory costs emerge.	Risk profile changes as a result of potential changes to regulatory structure	Impositions of additional regulatory costs severely impact cash flow and debt service
Water allocation risk	Share price fluctuates as a result of risk of significant water curtailment in the region	Overall risk profile changes given significant curtailments for a number of projects	Curtailment forces long term downsizing in operations leading to decreased asset value and revenues.