AUSTRALIAN ALLIANCE TO SAVE ENERGY

Creating an Energy-Efficient Australia

Doubling Australia's energy productivity by 2030

Re-energising the **mining sector** to improve its competitiveness

10 June 2015

Consultation Draft (Version 1.3)

Executive Summary Only

The full text of this paper, including references, is available at 2xEP.org.au

2XEP
Doubling Australia's Energy Productivity

Thanks

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Executive summary

Australia's capacity to capture the next wave of mining investment and to secure future export revenues in an environment of strong supply competition depends critically on regaining national competitiveness.

(Minerals Council of Australia, 2014a)

The Australian Energy Productivity (2xEP) Roadmap initiative commenced in July 2014. The Australian Alliance to Save Energy (A2SE) is working on the program with the support of governments, businesses, industry associations and thought leaders from a range of institutions.

Energy productivity is a declared policy priority for federal and state governments. Improving energy productivity is about increasing the economic value added per unit of energy used and dollar of energy spent. In a period of rapidly increasing energy prices in Australia, a holistic approach to energy productivity can make a major contribution to Australia's overall productivity and competitiveness.

This report provides an overview of issues that need to be addressed to substantially enhance energy productivity in the mining sector. It also provides a starting point for discussion with stakeholders in the mining sector and the development of the Mining Sector 2xEP Roadmap, to address the opportunities, barriers, policy recommendations and implementation for 2xEP in the mining sector.

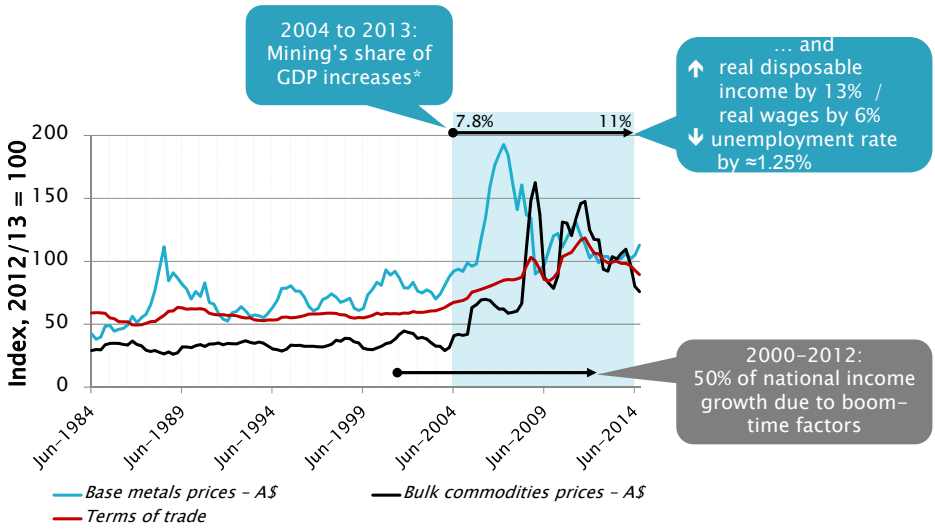
Why focus on energy productivity in mining?

Economic productivity in many sectors of the Australian economy, including mining, has been flat or declining in recent years. The long-term decline in base and precious metal ore grade is one of the key drivers of this trend in mining. This also has a direct impact on the energy intensity of production and is therefore the energy productivity of the mining sector.

Australia is also amongst the bottom half of all G20 countries with regard to both economic value per unit of energy input and rate of growth in energy productivity (World Bank, n.d.). If the decline in economic and energy productivity is not addressed, Australia's long-term competitiveness is at risk.

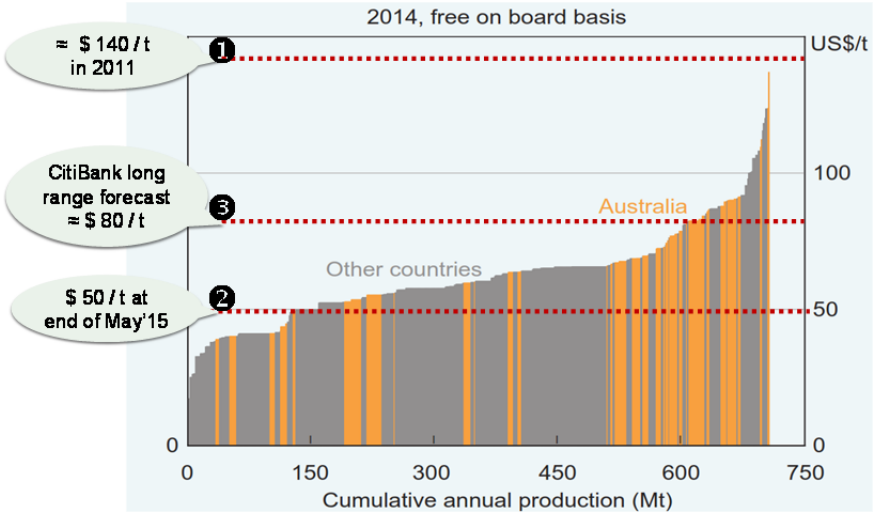
Mineral resources are critical to future global development as well as the performance of the Australia's economy and the living standards of our people. The sector has such a dominant influence on the Australian economy and energy demand that addressing economic (including energy) productivity, without considering developments in the mining sector, would be ineffectual.

As illustrated below, the mining sector now accounts for about 11% of GDP. During the recent extended commodity price boom the sector contributed significantly to increased disposable income and employment (BREE, 2014b, Downes, Hanslow, & Tulip, 2014). In fact 50% of national income growth over the period 2002 to 2012 are attributable to factors associated with the commodity price boom (Gruen, 2012).



The commodity price boom supported an increase in the average profit margin of miners from 10% in 2001/02 to 43% in 20011/12. Mining companies increased their capital investment over this period, from 14% of operating cost to an aggregate sector Capex:Opex ratio of 40%. Since then the decline in the commodity prices resulted in a sharp drop in both the aggregate profit margin and Capex:Opex ratio of the sector (ABS, 2014a, 2014d, 2014g; RBA, 2014a).

The prevailing market conditions amplify the intrinsic challenge faced by the resources industry, i.e. making long-term capital commitments when medium term revenue projections are volatile at best. Currently, long range price projections suggest that prices will remain subdued for some time as illustrated[1] with reference to thermal coal below. Unless Australian sites in the third and fourth quartile move down the production cost curve, the negative impact on the Australian economy, rural communities and investors could be significant (RBA, 2014b; Kannan, 2015).



A lower Australian dollar will not be a major factor as US dollar strength also

[1] Cost curves, reproduced from the RBA, August 2014 Statement on Monetary Policy (RBA, 2014b)

impacts the currencies of other major producers. Given that diesel is a major cost to many mines, the drop in oil prices could improve the performance of sites, but on a per tonne basis the impact on coal (for example) is only expected to translate to a $US1.80 per tonne drop in costs (Macdonald-Smith, 2015). In some regards, the drop in oil prices could make Australian producers less competitive on a CFR-basis (i.e. cost inclusive of freight), pushing them higher up the cost curve. As highlighted in a 2015 Bloomberg report, the drop in bunker fuel prices wiped out the price advantage of leading Australian iron ore producers over Brazil's Vale SA, which could land a tonne of iron ore cheaper than its Australian rivals in China (Riseborough & Spinetto, 2015). Energy cost can therefore be a determinant of the relative competiveness of Australia's resource sector on the global stage, especially at a time when global demand is weakening.

Energy cost represents between 10–20% of operating cost on most mine sites (Energetics, 2014). At a company level, institutional investors are increasingly taking note of how miners manage their energy (Smith, 2013). However, energy is a manageable cost, with demonstrable savings of 5–30% in energy use across core processes such as comminution and haulage. The mining services, equipment and technologies sub-sector (METS), identified by the Commonwealth as one of the five Australian Industry Growth Centres can be a key competitive differentiator for Australia in the global mining services market (Australian Government, 2014).

Investment in energy efficient equipment and processes could have capital and labour productivity benefits. Improved energy productivity also provides a hedge against future price rises, with 100% of diesel, the main energy source in mining, expected to be imported in the near future (Blackburn, 2014).

Mining remains a major employer and large energy user, and the response of the sector to improving productivity, including energy productivity, will shape its future competitiveness and, to a large extent, that of Australia.

The 2xEP initiative

In response to these factors, the A2SE 2xEP initiative proposes doubling energy productivity across the Australian economy by 2030 from $222 real GDP (2010$) per unit of energy input (primary energy measured in GJ) in 2010 to $444 in 2030. This target is in line with other major economies, and needs to be achieved to avoid entrenching the competitive disadvantage that has emerged in recent years.

At a mining sector level an appropriate 2030 energy productivity target, relative to the current trajectory, needs to be set by the industry. Many mining companies are familiar with targets of this nature, having already set and achieved targets to improve the productive use of energy. For example, BHPBilliton achieved a 15% improvement in energy intensity over the period 2006–2012, exceeding its target of 12% (BHPBiliton, 2014).

For companies, an energy productivity target is in many regards 'easier' to achieve than an energy efficient equivalent, since some of the improvement is driven by increased value of production output. This is evident from the performance of the mining industry over the recent past as illustrated below (Stadler,2015). In this way the energy productivity metric 'recognises' the shareholder value imperative of growing outputs faster than inputs. Since the energy productivity metrics are sensitive to both commodity and energy prices, it can be a volatile measure. Therefore, the metric is best presented as a

moving average over at least 3–years as presented in the table below for the mining industry (i.e. resources sector, excluding oil and gas production). The relative performance on the secondary metric, compared to other key commodity export nations has not been assessed yet. Such a comparison would reveal the trend in relative energy price competitiveness of Australian miners.

Energy productivity trends	2009/10	2010/11	2011/12	2012/13	Average annual change
Primary metric: Real Revenue ($2010) / Primary energy (GJ)	255	286	292	299	4.06%
Secondary metric: Nominal Revenue $ / Nominal $ energy spend	19	20	20		1.72%

In order to double energy productivity from a 2010 base year, the industry would need to broadly maintain the current pace of improvement in energy productivity (i.e. 4% vis-à-vis a target of 3.5 % per annum. This is a significant challenge given that the improvement over the last four years was recorded at a time of historically high commodity prices and direct federal government policy support for energy efficient investments. Maintaining energy productivity at current levels may be challenging in itself, given the decline in ore grade and the forecast weakness in global commodity prices (Minerals Council of Australia, 2014a).

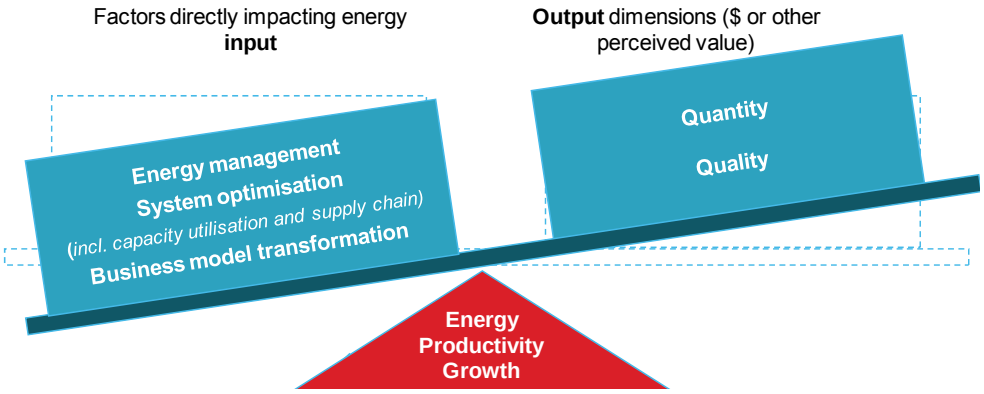
It is envisaged that an appropriate voluntary 2030 energy productivity target will be established for the mining sector, by the sector. A2SE will consult with a diverse range of stakeholders about what this target should be. The determination of optimal pathways to achieve the target could be different for sub-sectors or groups within the sector. Views of the industry will also be sought about the best approach for tracking progress towards such a voluntary target, as well as what collaborative action the industry could take to support a significant improvement in energy productivity including with regard to action by government to reduce or remove barriers to achieving such a target.

Potential strategies for improving energy productivity.

Since energy productivity is a ratio of economic output per unit of energy (primary energy or cost as illustrated in the table below), the potential to achieve a voluntary energy productivity target could be influenced by adopting complementary strategies that:

- increase economic output; and/or
- reduce the relative demand for energy.

Energy ‘productivity’ is not simply energy ‘efficiency’ by a different name. Energy efficiency, which generally focuses on using less energy to deliver the same output, is, however, an important element of one of the four key strategies, as illustrated below.



The key strategies to enhance energy productivity are summarised below:

- 'Traditional' energy management – e.g. improving energy efficiency through better management of energy use including the implementation of innovative energy-use technologies, electrification, on site renewable energy and demand-management programs, as well as best practice in data management and benchmarking energy management to facilitate decision making with regard to energy productivity.
- Systems optimisation – e.g. focusing on energy aspects of the mining and downstream minerals processing sector, such as the re-engineering of materials handling and mining processes, as well as industry supply-chain capacity-optimisation strategies. These changes may be implemented for reasons of broader productivity improvement, but greater value can be realised by bringing a deliberate energy competency and focus to them.
- Business model transformation – e.g. focussing on the energy aspects of fundamental longer-term change in the business of mining – relating to the design, development and operation of mining, as well as trading and asset management.
- Value creation or preservation – e.g. focussing on increased throughput, beneficiation, and/or improving quality of ore shipped to smelters to reduce downstream energy consumption and air pollution associated with removing impurities during smelting (Pearse, 2014).

Opportunities to improve energy productivity in the mining industry

Australia is a global leader in mining-technology innovation and the sector has already made significant investments in improving the productive use of energy, as reported under the Energy Efficiency Opportunity (EEO) program.

In spite of significant investment in energy efficiency, many unexploited energy productivity opportunities remain across the mining value chain, in mining, materials movement, comminution (intelligent blasting, mine-to-mill), ore sorting, classification or pre-concentration, reprocessing and product recovery. Industry best practice and many of the innovative new technologies that could transform the energy productivity of the sector have not yet been broadly adopted (Department of Industry 2012; Napier-Munn, Drinkwater, & Ballantyne, 2012).

The Coalition for Eco Efficient Comminution (CEEC) estimates that a 15% improvement in energy productivity is possible by adopting best-practice energy management in comminution without investing in new equipment.

Furthermore, investing only in new comminution technologies could deliver a further 10% to 30% reduction in energy used in this process, accounting for approximately 36% of total mine site energy (Ballantyne & Powell, 2014b; Brent et al., 2013). There are also significant enabling technologies to assist improving the energy productivity of materials movement/handling and minerals separation (Department of Industry, 2012). Mining companies are also investing in new forms of on-site energy generation, including diesel/solar hybrid systems (Vorrath, 2014). Investment by underground mines in energy efficient ventilation systems also has occupational health and safety benefits by reducing diesel fumes inhaled by miners.

The optimisation of production processes by adopting lean manufacturing principles, as well as the evolution of new business models based on autonomous mining, truckless mines and the use of 'big data' across the whole value chain from exploration to processing also holds promise for supporting significant energy productivity improvement in the sector. However, the extent to which the Australian mining industry considers energy as part of the evolving operating and business models is not evident.

Given the energy intensity of many mining processes and lessons from other sectors, ensuring energy is a central tenet in the design and operation of these new models will have a major influence on their success and the sustainability benefits. On-site renewable energy solutions could in certain cases help improve energy productivity by 2030. The intent is to explore the role of on-site renewables in the 2xEP Roadmap in a separate cross sector report.

Benefits from 2xEP for mining

As price takers, with very limited value added or product differentiation by producers, miners have two key strategies for optimising operating income: minimising costs and maximising throughput. Energy is already a significant cost to many mining companies. However, the convergence of declining ore grade, falling international commodity prices and declining profit margins across many Australian mining sectors since 2012–13 (ABS, 2014d) makes energy an increasingly important cost to be managed in the industry.

The benefits of a significant improvement in mining energy productivity will depend on the voluntary target and actions agreed by the industry, but could include:

- Energy efficiency improvements and cost savings for mining companies. These will significantly improve profitability and also reduce emissions.
- Improved capacity utilisation and throughput.
- Multiple dividends in terms of reduced maintenance and labour costs/unit of output, with a likely multiplier of up to 2.5 times the benefits directly attributed to energy savings.

Mining program objectives

A successful outcome from an A2SE 2xEP Roadmap process will be a realistic, but challenging, energy productivity target and plan developed by the industry, with the support of a broad spectrum of industry representatives to lead changes in the sector and their individual businesses to achieve the target. It is envisaged that an A2SE 2xEP roadmap will comprise:

- Definition of pathways to significantly enhance energy productivity, with

reference to the different subsectors and scale of operations.

- Identification of opportunities to collaborate to enhance Australia's leadership position in mining and mining services.
- Mechanisms to create greater awareness and adoption of emerging R&D innovations that can help mining sub-sectors achieve a step change in energy efficiency.
- Strategies to overcome barriers to adoption of new, more efficient processing technologies
- The initiation of new, or the strengthening of existing, programs to support businesses to achieve 2xEP.
- Recommendations adopted by federal and state governments to enact policy changes to facilitate these activities and support 2xEP in mining.

These outcomes could be achieved through a collaborative process, involving miners, researchers and industry associations, with government engagement to accelerate innovation, transformation and value adding in the sector.