The economic gains from streamlining the process of resource projects approval

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About the author

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Executive summary

1. The average timeline for a mining project to gain approval in Australia has increased significantly in recent years. A major contributor to this trend has been regulatory overlap and duplication for project proponents. As the Productivity Commission (2013, 13) points out, 'Australia's federal system of government, where responsibilities for matters (such as environmental protection) span all levels of government, gives rise to overlap and duplication, which the Commission considers can be greatly reduced without lowering the quality of environmental outcomes'.

2. Streamlining the approval processes in the mining sector not only increases the productivity and competitiveness of the Australian mining sector, but also has positive flow-on effects on the broader economy. The greater the reduction in the average timeline for approvals, the larger the increase in mineral exports, investment and employment, and therefore the higher the average growth rate of national income.

3. Three scenarios have been developed in this study to estimate the economic gains from streamlining approval processes for resource projects in Australia. The reference case simulates a case without improvement. Scenario 1 simulates a case with a one-year reduction in the average approval time. Scenario 2 simulates a case with a two-year reduction in the average approval time.

4. The modelling results show that by 2025, Australia's real GDP would be 1.5 per cent higher, or $32 billion higher in today's dollars, if the average delay in project approvals is reduced by one year. This GDP gap will further increase to 2.4 per cent, or 51 billion in today's dollars if the average delay is reduced by two years. Over the 12 years from 2014 to 2025, the cumulative real GDP gains would be $160 billion and $280 billion respectively. If a 3 per cent discount rate is applied, the cumulative real GDP gains over the projection period would be $120 billion and $220 billion respectively.

5. The modelling results show that streamlining approval processes would reduce the costs of the minerals mining (excluding oil and gas) sector, which in turn, would improve the global competitiveness of the sector and help gain market share over overseas competitors. Between 2014 and 2025, coal and iron ore export growth rates are projected to increase by 0.6 percentage points a year and 1.0 percentage point a year respectively if the approval times are reduced by one year. These figures could increase by 1.0 percentage point a year and 1.5 percentage points a year respectively if approval times are reduced by two years.

6. Higher production growth rates require more investment in the sector. Minerals mining and infrastructure investment is projected to increase by $46 billion in total over the 12-year period from 2014-2025, if the approval times are reduced by one year. The total

increase in minerals mining and infrastructure investment would be around $82 billion, if the approval times are reduced by two years.

7. Streamlining the approval processes in the mining sector not only increases the productivity and competitiveness of the Australian mining sector, but also has positive flow-on effects on the broader economy.

8. The research identified a delay of 12 months as a tipping point at which up to a third of planned mining projects would be cancelled, leading to significant reduction in creation of jobs, investment, revenue and royalties.

9. The contribution of the minerals mining (excluding oil and gas) sector to the Australian economy is increasing year by year. In 2013, the mineral mining sector contributed around 8.4 per cent of Australia's gross domestic product (GDP). Under the reference case, this figure is projected to reach 10 per cent by 2025. The share would climb 0.21 percentage points if the approval timelines were to be reduced by one year and 0.32 percentage points if the approval timelines were to be reduced by two years.

10. Higher employment growth helps ease pressure arising from Australia's increasingly ageing population. The model shows that if approval timelines were to be reduced by one year, then an average of 32,000 additional jobs would be created across the entire economy over the 12-year period and more than 69,000 jobs by 2025. The number of additional jobs across the economy would be nearly doubled if the approval timelines were to be reduced by a further year; that is, 57,500 over the 12-year period and more than 108,000 by 2025. Most of the jobs created are outside the minerals mining sector, induced by the flow-on effects of increased mining investment and production. These employment projections are based on the assumption of a semi-flexible labour market where real wages and employment respond equally to economic shocks. They have already taken account of the real wage increases under a relatively tight labour market.

1. Background

Over recent years, a range of analytical work has sought to identify the scale and impact of delays in the processing of applications for major resource projects. Research for the Minerals Council of Australia (MCA) by Port Jackson Partners in 2012 showed that the average Australian thermal coal project experienced an additional 1.3 years' delay relative to those elsewhere (3.1 years compared with 1.8 years for the rest of the world). Project delays in Australia have increased over the past decade, with the gap relative to other countries likely to be higher now than it has been for some time.

In 2013, the Productivity Commission's inquiry into Major Project Development Assessment Processes provided new evidence on the scale and costs associated with project delays. Glencore noted in its submission, for example, that approval timeframes for major projects in Australia increased from 7 months on average in 2002 to 18-36 months in 2012.

Modelling undertaken by PricewaterhouseCoopers on behalf of the NSW Minerals Council concluded that delays and uncertainty are crucial factors that negatively affect investment decisions made by the mining industry. The research identified a delay of 12 months as a tipping point at which up to a third of planned mining projects would be cancelled, leading to significant reduction in creation of jobs, investment, revenue and royalties. In a scenario where projects were delayed by 12 months or more the potential losses to NSW alone over the next 20 years were estimated to be:

- 6,445 direct jobs in mining and 22,400 indirect jobs would not be created;
- $10.3 billion in investment in 2013 dollars would be forgone; and
- the NSW government would miss out on $600 million per year in direct revenue from mining royalties.

The Abbott Government has committed to sharply reducing unnecessary approvals-related delays that have emerged over the past decade. Specifically, the Abbott Government has committed to the development of a 'one-stop shop' approach that would put an end to duplicative federal and state approval processes. As the Productivity Commission (2013, 13) points out, 'Australia's federal system of government, where responsibilities for matters (such as environmental protection) span all levels of government, gives rise to overlap and duplication, which the Commission considers can be greatly reduced without lowering the quality of environmental outcomes'.

The focus in this research is to seek to quantify the economic gains of the reduction in approvals-related delays in Australia's mining sector. The magnitude of the gains will depend on four key factors:

- the additional investment brought into the mining sector following the streamlining reform;
- (ii) the opportunity to win a larger share of production in the global market;
- (iii) the linkage of the mining sector to the broader economy; and
- (iv) the average reduction of the approval timeline.

To quantify the potential gains, two streamlining scenarios with different lengths of reduction in approvals-related delays are developed in this study. The first scenario assumes the average approval timeline for a new mining project in Australia is reduced by one year while the second scenarios assumes the average approval timeline for a new mining project is reduced by two years. The results from these scenarios are compared to a reference case that describes a situation where there is no improvement in the current approval processes. The differences in GDP and other economic indicators from 2014 to 2025 for the streamlining scenarios compared to the reference case will be the focus of this analysis.

In this study, a computable general equilibrium (CGE) model is utilised to analyse the different economic outcomes under each scenario. The details of this modelling framework are briefly discussed in Appendix 1. The current Australian investment pipeline and the economic rationale underlying the assumptions of the scenario design are examined in the following section. The modelling results for 2014 to 2025 are presented in the final section.

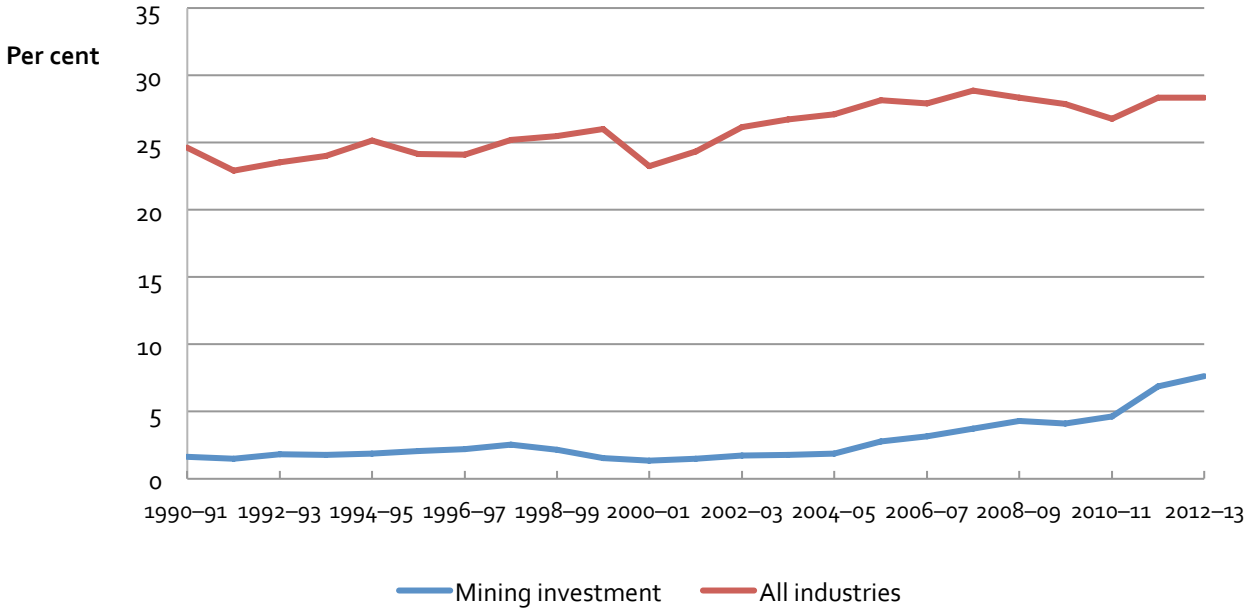
2. Mining investment and scenario descriptions

This section examines the current mining investment pipeline in Australia, followed by a description of the major assumptions used in the scenario design. The construction of various scenarios in this paper is to quantify the economic gains of the reduction in approvals-related delays in the minerals mining sector.

2.1. Mining investment in Australia

Mining investment in Australia (including oil and gas) has risen significantly in recent years, not just in dollar or real terms, but also as a proportion of GDP. As a share of GDP, Australia's mining investment has risen from less than 2 per cent in 2004-05 to around 7.6 per cent in 2012-13. The large increase in mining investment was driven by a broad-based, significant rise in commodity prices, dated from around 2004, after a long period of subdued market conditions in the sector. The rise in commodity prices in the latest mining boom is the result of strong demand for resources by emerging economies, with China being the most significant. The strong increase in mining investment in recent years also helped push the total investment to GDP ratio in Australia to nearly 30 per cent, up from the levels of around 25 per cent before the mining boom.

Figure 1: The investment to GDP ratio in Australia



Source: ABS 2013

As at early 2014, the Bureau of Resources and Energy Economics (BREE) identified 272 mining projects in Australia's investment pipeline with a total value of between $494 billion and $520 billion, of which $265 billion to $291 billion were at either the 'publicly announced stage' or the 'feasibility stage' and pending regulatory approvals. More than 50 per cent of the total value of these projects, including projects at the 'committed stage' where all regulatory approvals have been granted, were oil and gas projects. A total of 70 minerals mining and related infrastructure projects were reported and these projects, and their stage of development, are outlined in Table 1.

Table 1: Minerals mining and infrastructure projects in Australia's investment pipeline

	Publicly Announced		Feasibility Stage		Committed	
	No. of Projects	**Range A$m**	**No. of Projects**	**Value A$m**	**No. of Projects**	**Value A$m**
Aluminium, bauxite, alumina	2	0 – 500	2	1,650	0	0
Coal	13	14958 - 16708+	47	51,130	10	6,524
Copper	5	6873 - 7873+	8	3,154	2	343
Gold	8	990-1,740	13	2,451	2	320
Mining infrastructure	12	20,150 – 25,400+	14	22,897	9	9,411
Iron ore	13	19,589 – 29,839+	20	28,748	5	11,928
Lead, zinc, silver	0	0	3	487	4	2,389
Nickel	3	1,500– 3,000	7	5,243	0	0
Other commodities	9	1,626 -2,876	22	8,003	2	845
Uranium	5	1,750-3,500	2	575	0	0
Total	**70**	**67,436 – 91,436+**	**138**	**124,338**	**34**	**31,760**

Source: BREE (2014a)

Mining output in Australia is expected to grow in the next several years as new production facilities gradually come on stream. While in the short term the growth rates may not be highly sensitive to any immediate streamlining actions, in the medium term the growth rates would be heavily influenced by the speed of processing regulatory approvals. If all projects in the investment pipeline were to progress as planned, data from BREE (2014a) suggest that iron ore capacity would increase by 364Mt by 2018 with a potential of adding another 299Mt after 2018. Coal capacity would increase by at least 361 Mt by 2018 with a potential of adding another 102 Mt after 2018 (Table 2).

While it might be tempting to rely on the numbers in Table 2, this paper does not use them directly to model output projections. There are several reasons for this. First, it should be noted that these production capacity calculations are based on the projects identified by BREE in its report published in April 2014. Although the capacity increases in the short run are based on companies' best estimates, they are not the upper or lower bounds of the additional production capacity for each commodity in the medium to long run. Theoretically, production capacity could increase further if more projects are announced after April 2014. On the other hand, the output capacity additions could also be lower if there were to be significant delays in the existing projects or some projects turn out to be infeasible. Therefore, potential capacity increases shown in Table 2 can only be considered as approximate numbers for the next several years with larger uncertainty further into the future.

Table 2: Potential output capacity additions from future new mineral projects

		2014	2015	2016	2017	2018	2019	2019+	Unknown
Thermal coal	Mt	13	40	89	116	15	40	18	18
Coking coal	Mt	10	32	33	10	3	0	3	23
Iron ore	Mt	63	94	51	63	93	0	0	299

Source: BREE (2014a)

Second, potential capacity increases shown in Table 2 should not be interpreted as predictions of actual additional output for the future. On the one hand, there are large uncertainties as to when projects might be completed. BREE generally make substantial changes to the timelines at each six monthly update of its major projects list. On the other hand, further into the future project numbers in the list fall entirely driven by missing information, as many mining companies have not made concrete plans for projects beyond 2018. Therefore, lower or zero new capacity additions after 2018 does not imply fewer new projects will be undertaken in the future. Third, production is not driven by supply only. Global demand, particularly from Asia, is extremely important for any output forecasts or projections. Data in Table 2 simply represent aggregated company information that may not have taken global demand into account. Finally, in terms of supply, projects at the 'publicly announced stage' or the 'feasibility stage' today should not be treated in the same way as projects at the 'committed stage'.

In light of all these considerations, this paper makes use of a dynamic model of the world economy that takes full account of global demand and calculates the results of economic decisions sequentially in one-year time steps. (Details will be discussed in the next section.)

2.2. Description of scenarios

Three scenarios, including a reference case, are developed in this section to illustrate the economic implications of streamlining approval processes for minerals mining projects (excluding oil and gas) in Australia. Each scenario, replicating a different average timeline for obtaining approvals, is run separately within BAEGEM to illustrate the economic outcomes from 2014 to 2025. Oil and gas industry projects are included in BAEGEM but they are treated equally across all scenarios so that a separate assessment of the impact of approvals delays in the metals and coal mining industries can be made. The main assumptions of the three scenarios can be summarised as follows:

- Reference case: A scenario representing no improvement in approval processes
    i. All minerals mining projects at the 'committed stage' in the BREE (2014a) investment pipeline will progress as planned without delay. Investment and production flows of 'committed' projects are reflected in BAEGEM.

    ii. All minerals mining projects at the 'publicly announced stage', the 'feasibility stage' and any unknown projects are modelled at an aggregated level with their completion dates influenced by projected global demand, the flow of investment and the decision of policymakers between 2014 and 2025. In other words, the completion dates of projects at the 'publicly announced stage' or the 'feasibility stage' are not modelled directly according to information in BREE (2014a) in which global demands were not considered.

    iii. The mining investment (including oil and gas) to GDP ratio in Australia gradually falls to 3.5 per cent in the long run.

    iv. Export volumes for the period from 2014 to 2018 are taken from the most recent commodity forecasts in BREE (2014b). Export volumes after 2018 are determined by BAEGEM.

- Scenario 1: The average timeline for obtaining approvals is reduced by one year
    i. The average timeline for obtaining all necessary approvals for resource projects is reduced by one year from 2014.

    ii. Assumptions on the progress of projects at various stages are exactly the same as that in the reference case except that the projects completed by 2020 under the reference case are completed by 2019. Projects at the 'publicly announced stage' or the 'feasibility stage' are not modelled individually.

    iii. The mining investment to GDP ratio is modelled endogenously by BAEGEM – that is, its value is determined within the model rather than being taken as given.

iv. Export volumes from 2014 to 2025 are determined by BAEGEM with a constraint that the export volumes for 2019 in this scenario are equal to the export volumes for 2020 under the reference case.

- Scenario 2: The average timeline for obtaining approvals is reduced by two years

  i. The average timeline for obtaining all necessary approvals for resource projects is reduced by two years from 2014.

  ii. Assumptions on the progress of projects at various stages are exactly the same as that in the reference case except that the projects completed by 2020 under the reference case are completed two years earlier, that is, by 2018. Projects at the 'publicly announced stage' or the 'feasibility stage' are not modelled individually.

  ii. The mining investment to GDP ratio is modelled endogenously by BAEGEM.

  iii. Export volumes from 2014 to 2025 are determined by BAEGEM with a constraint that the export volumes for 2018 in this scenario are equal to the export volumes for 2020 under the reference case.

Under these scenarios, mining output is not predetermined by the capacity additions as shown in Table 2. In fact, particularly for medium to long term projections, mining output should not be modelled entirely by some potential industrial supply data aggregated from various sources. As shown in Table 2, medium-term information from 2020 to 2025 is unavailable while short term information from 2014 to 2017 is subject to optimistic assumptions. The robustness of the modelling results could be compromised if the global demands, particularly from fast growing economies, are not considered. For this reason, a global CGE model with full consideration of the interactions between demand, supply and prices is used in this paper.

A key assumption for scenarios 1 and 2 is that the export volume achieved in 2020 under the reference case will be achieved earlier by one and two years respectively. This assumption is supported by the scenario design where approval processes for resource projects are cut by one or two years from 2014, leading to a shorter timeframe in bringing production on stream. This is consistent with the finding by Deloitte (2014) that Australia has strong global advantage in mining and has exceptional potential to win a larger share of global markets.

Under the reference case, it is assumed that growth in mining exports from 2018 to 2020 is generated from projects listed under the 'publicly announced stage' or the 'feasibility stage' in BREE (2014a), or projects that have not been listed. If the average timeline for obtaining all

necessary approvals is cut by one year, as represented by scenario 1, the projects driving the growth in mining exports in 2020 under the reference case would be put into production one year earlier in 2019. Likewise, if the average timeline for obtaining all necessary approvals is cut by two years, as represented by scenario 2, the projects driving the growth in mining exports in 2019 and 2020 under the reference case would be put into production two years earlier in 2018. This assumption is consistent with BREE (2014a) that all projects listed under the 'committed stage' are due to be completed in or before 2017, and all capacity additions after 2017 are attributable to projects without regulatory approvals in 2014. Streamlining the approval processes would bring these projects forward and also bring investment forward.

3. Reference case

Australian real GDP is assumed to grow by 2.9 per cent a year from 2014 to 2018 and 2.6 per cent a year from 2019 to 2025 (Table 3). By 2025, the size of Australia's economy is projected to increase to $2,170 billion in 2014 dollars, up from $1,580 billion in 2013. Meanwhile, China's GDP is assumed to grow at 6.9 per cent a year from 2014 to 2018 and 5.9 per cent a year from 2019 to 2025.

Table 3: The mining investment to GDP ratio in Australia, reference case

Reference case		2013-2018	2018-2025
Australia's GDP	CAGR[a]	2.85	2.60
China's GDP	CAGR	6.9	5.9
Employment	CAGR	1.0	1.0
Thermal coal exports	CAGR	4.5[b]	2.0
Metallurgical coal exports	CAGR	2.5[b]	2.2
Iron ore exports	CAGR	7.8[b]	2.7
Other minerals mining exports	CAGR	3.5[b]	2.1

[1]CAGR is compound annual growth rate, [b] sourced from BREE (2014b)

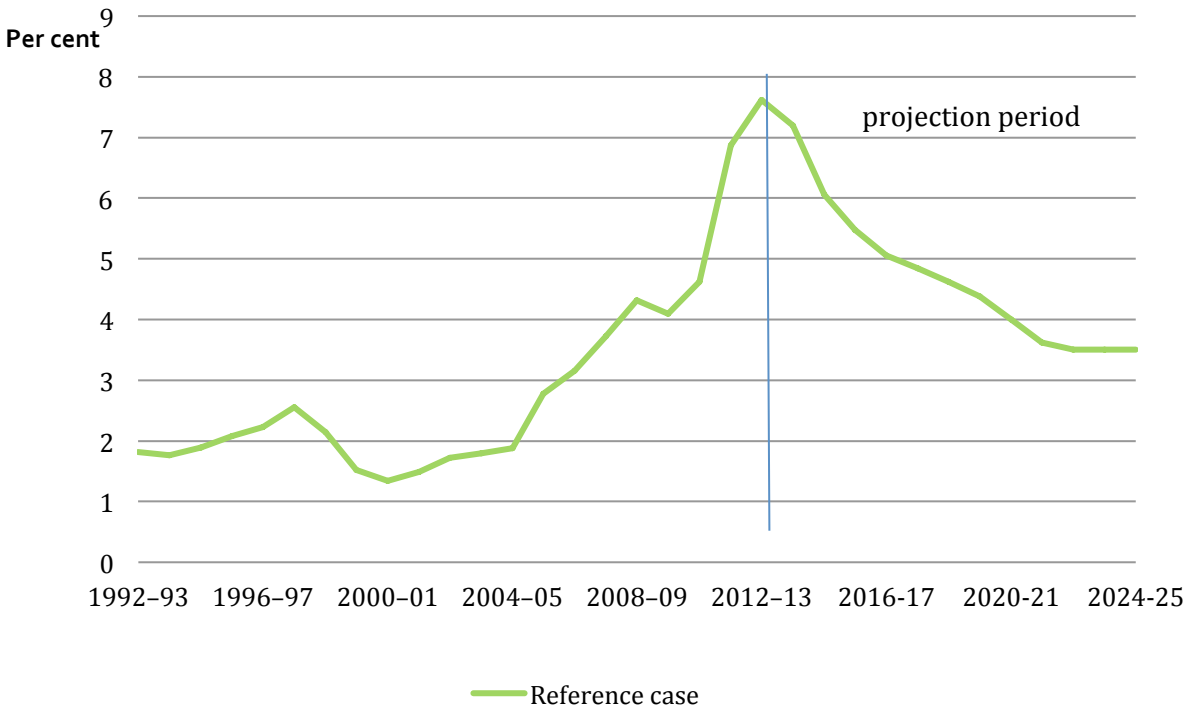
Source: BAEGEM, BREE (2014b)

In the labour market, total employment in Australia is assumed to grow by 1.0 per cent a year from 2014 to 2025. This employment growth rate is consistent with the recent employment growth rates in Australia, supported by strong population growth. In the export market, mining exports growth from 2013 to 2018 are sourced from BREE (2014b). After 2018, mining exports are determined endogenously by BAEGEM. Lower GDP growth rates in Australia and China, compounded by the assumption of lower capital investment over the projection period, drive the minerals export growth rates after 2018 to within the range of 2-3 per cent a year (Table 3).

Under the reference case, the mining investment to GDP ratio (including oil and gas) decreases from the peak of 7.6 per cent in 2012-13 (Figure 2). From 2013-14 to the middle of the next decade, the mining investment to GDP ratio declines gradually as Gorgon and several mega LNG projects at Gladstone are due to be completed in the next several years. In the long run, it is

assumed that the mining investment to GDP ratio falls to a long-run average of 3.5 per cent. This percentage is likely to be the lower bound in the medium term as mining investment, or gross fixed capital formation as it is referred to by the Australian Bureau of Statistics (ABS), includes not only fixed capital formation for new projects, but also fixed capital formation for existing projects. With the mining output to GDP ratio continuing to climb in the medium term, it is highly unlikely that the mining investment to GDP ratio would drop back to a level of around 2 per cent as experienced in the early 2000s.

Figure 1: The mining investment to GDP ratio in Australia, reference case



Source: BAEGEM

4. Alternative scenarios

Modelling results from 2014 to 2025 on mineral exports, mineral production, minerals mining investment, GDP, gross value added (GVA) and employment are reported in this section. Results for thermal coal, metallurgical coal and iron ore are reported separately to highlight their importance in the current investment pipeline.

4.1 Mineral exports

Mineral exports are projected to increase if the average timeline for obtaining approvals is reduced by one or two years. The greater the reduction in the average timeline, the larger the increase in mineral exports. By 2025, iron ore exports are projected to reach 1134 Mt under scenario 1 and 1200 Mt under scenario 2 (Table 4). In percentage terms, iron ore exports are projected to grow by 8.3 per cent a year from 2014 to 2018 and 4.0 per cent a year from 2019 to 2020 if the average timeline is reduced by one year (scenario 1). The average annual growth rates

would increase further to 8.9 per cent and 4.4 per cent respectively if the average timeline is reduced by two years (scenario 2).

In comparison with the reference case, the additional growth rates for scenario 1 are 0.5 per cent a year from 2014 to 2018 and 1.3 per cent a year from 2019 to 2025. The additional growth rates for scenario 2 are 1.1 per cent a year from 2014 to 2018 and 1.7 per cent a year from 2019 to 2025. Faster growth in mineral exports under scenarios 1 and 2 is associated with a cost reduction in Australia's minerals mining sector, which in turn helps improve the global competitiveness of Australian mineral exports. Under scenario 1, the average cost reduction for iron ore is 2.6 per cent over the projection period. The equivalent average cost reduction increases to 3.9 per cent if the average timeline for obtaining approvals is reduced by two years.

Table 4: Mineral exports, 2013-2025

Reference case		2013	2014	2015	2018	2020	2025
Thermal coal	Mt	188	195	202	235	246	271
Metallurgical coal	Mt	170	174	182	192	201	224
Iron ore	Mt	579	687	749	842	889	1015
Scenario 1		**2013**	**2014**	**2015**	**2018**	**2020**	**2025**
Thermal coal	Mt	188	195	203	240	253	286
Metallurgical coal	Mt	170	176	183	196	208	247
Iron ore	Mt	579	689	756	864	929	1134
Scenario 2		**2013**	**2014**	**2015**	**2018**	**2020**	**2025**
Thermal coal	Mt	188	196	205	246	259	294
Metallurgical coal	Mt	170	177	184	201	216	259
Iron ore	Mt	579	691	764	889	969	1200

Source: BAEGEM, BREE (2014b)

The increases in coal exports are relatively modest in comparison with iron ore exports. By 2025, coal exports are projected to reach 533 Mt under scenario 1 and 553 Mt under scenario 2 (Table 4). In percentage terms, coal exports are projected to grow by 4.0 per cent a year from 2014 to 2018 and 2.9 per cent a year from 2019 to 2020 if the average timeline is reduced by one year. The average annual growth rates would increase further to 4.5 per cent and 3.0 per cent respectively if the average timeline is reduced by two years. In comparison with the reference case, the additional growth rates for scenario 1 are 0.4 per cent a year from 2014 to 2018 and 0.8 per cent a year from 2019 to 2025. The additional growth rates for scenario 2 are 0.9 per cent a year from 2014 to 2018 and 1.0 per cent a year from 2019 to 2025.

4.2 Production

Minerals mining production from 2014 to 2025 tracks the export projections closely as most of the mining output in Australia is sold on international markets, particularly to Asia. By 2025, iron ore production is projected to reach 1143 Mt under scenario 1 and 1208 Mt under scenario 2 (Table 5). Of these production volumes, 1134 Mt from scenario 1 and 1200 Mt from scenario 2 are exported (Table 4), leaving less than one per cent of production for domestic consumption.

Table 5 : Production in Australia by scenario, 2013-2025

Reference case		2013	2014	2015	2018	2020	2025
Thermal coal	Mt	243	251	257	291	302	327
Metallurgical coal	Mt	174	178	186	197	205	228
Iron ore	Mt	596	703	763	854	901	1,026
Scenario 1		**2013**	**2014**	**2015**	**2018**	**2020**	**2025**
Thermal coal	Mt	243	251	259	297	309	343
Metallurgical coal	Mt	174	180	187	200	213	251
Iron ore	Mt	596	704	770	876	941	1,143
Scenario 2		**2013**	**2014**	**2015**	**2018**	**2020**	**2025**
Thermal coal	Mt	243	251	262	303	316	352
Metallurgical coal	Mt	174	181	189	205	220	264
Iron ore	Mt	596	706	778	901	980	1,208

Source: BAEGEM, BREE (2014b)

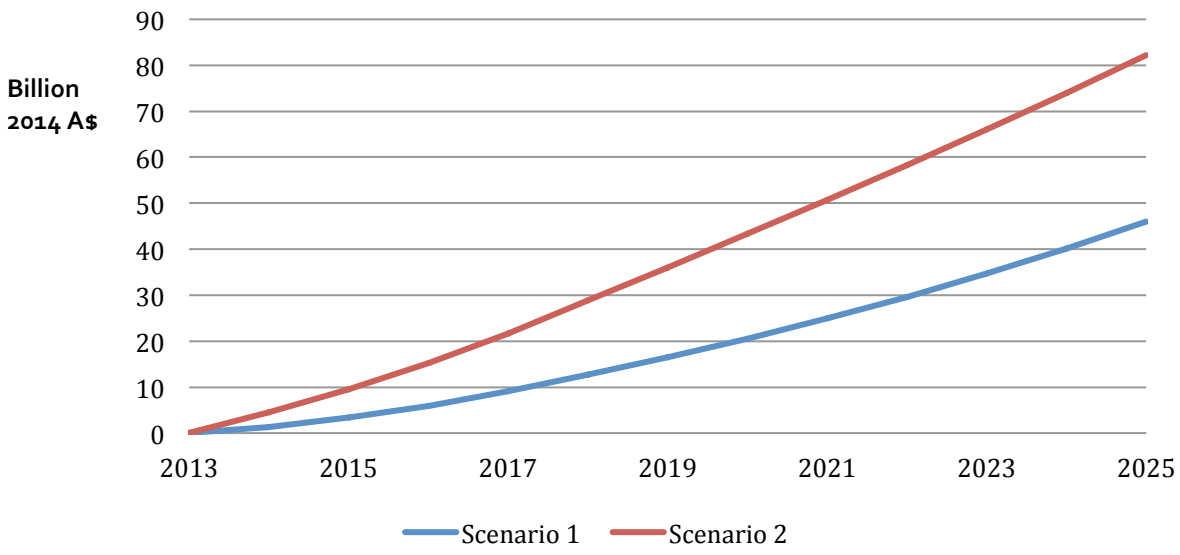
In the case of coal, the reduction in the average timeline for obtaining approvals does not produce any significant impacts on the sales to the domestic market. As shown in Table 5, thermal coal production is projected to reach 343 Mt under scenario 1 and 352 Mt under scenario 2 by 2025, compared with 327 Mt under the reference case. Subtracting the export quantities from table 4, thermal coal production for the domestic market becomes 57 Mt for scenario 1 and 58 Mt for scenario 2, compared with 56 Mt for the reference case. In comparison with the effects on exports, streamlining approval processes in the mining sector would not have significant impacts on domestic demand for two reasons. First, lowering the production costs of coal by streamlining approval processes increases the competitiveness of domestically produced coal and helps Australian producers win a larger share of the global market but this impact is limited in the domestic market simply because the approvals process for all competing projects will have been changed in the same positive way. Second, the cost reduction resulting from streamlining approval processes in the mining sector is not large enough to turn around the global competitiveness of Australia's manufacturing sector on its own because mining inputs into the manufacturing sector contribute only a small proportion of the total cost base of the sector. Higher production rates under scenarios 1 and 2 are overwhelmingly driven by export markets

where reduction in delays helps Australian producers gain market share over overseas competitors.

4.3 Minerals mining and infrastructure investment

Minerals mining and infrastructure investment is projected to increase under scenarios 1 and 2, relative to the reference case, as streamlining the approval processes would encourage more investment into the sector. In BAEGEM, the size of minerals mining and infrastructure investment in each year is driven by the production increase in the sector (Table 5). The faster the production growth rates, the larger the investment will be required ahead of production. This linkage is reflected in scenario 1 where minerals mining and infrastructure investment is projected to increase by $46 billion in total over the projection period, or around $3.8 billion each year from 2014 to 2025 (Figure 3). This annual average increase is equivalent to 3.0 per cent of the total mining investment in 2013.

Figure 3: Additional minerals mining investment from 2013, relative to the reference case



Source: BAEGEM

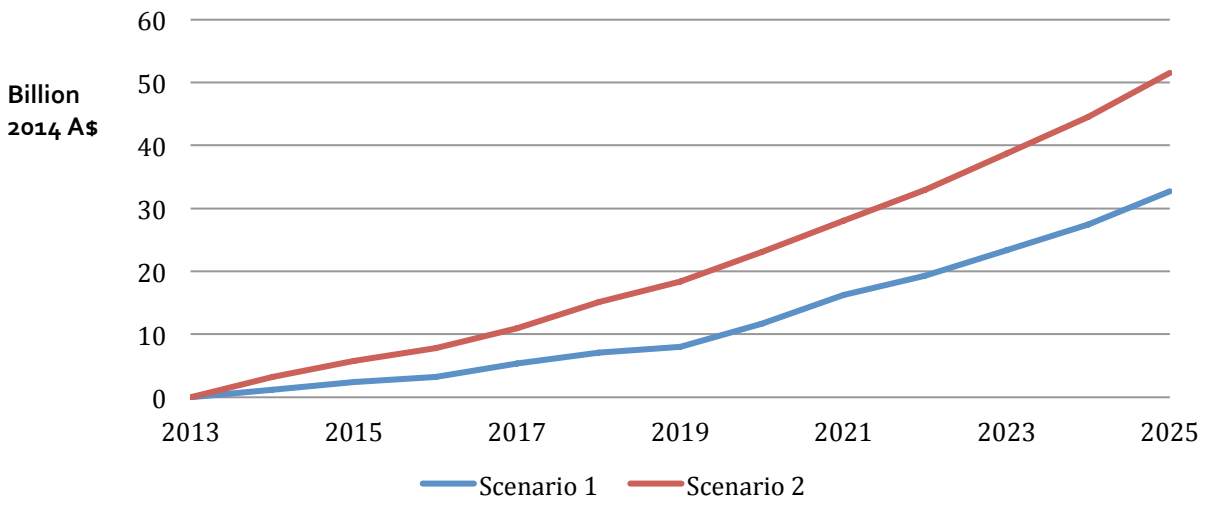
Under scenario 2, the total additional mining investment over the projection period would increase further to $82 billion, or around $6.9 billion each year. This annual average increase is approximately 5.4 per cent of the total mining investment in 2013. Nearly all of the additional investment would be spent on capacity expansion for export markets.

4.4 Gross value added and gross domestic product

Australia's economic performance can be further improved if approvals-related delays are reduced. The modelling results from BAEGEM show that the shorter the approval process, the higher the average GDP growth rate over the projection period (Figure 4). If the average delay is reduced by one year (scenario 1), Australia's average GDP growth rate from 2014 to 2018 would

increase by 0.08 percentage points a year to 2.93 per cent a year while the average GDP growth rate from 2019 to 2025 would increase by 0.16 percentage points a year to 2.76 per cent a year. If the average delay is reduced by two years (scenario 2), Australia's average GDP growth rate from 2014 to 2018 would increase by 0.17 percentage points a year to 3.02 per cent a year while the average GDP growth rate from 2019 to 2025 would increase by 0.22 percentage points a year to 2.82 per cent a year.

Figure 4: Real GDP gains, relative to the reference case

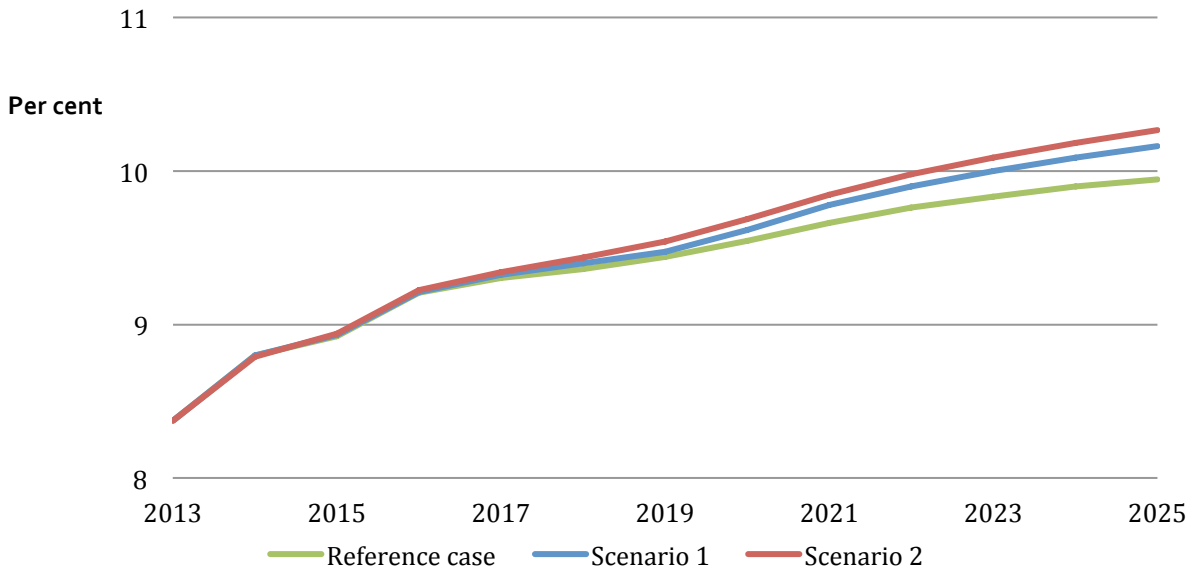


Source: BAEGEM

The rise in GDP growth rates in scenarios 1 and 2 is driven by three factors: increasing mining investment, increasing mining production and flow-on effects from the mining sector to the non-mining sectors. By 2025, Australia's real GDP would be 1.5 per cent higher, or $32 billion higher in today's dollars, if the average delay is reduced by one year. This GDP gap will further increase to 2.4 per cent, or 51 billion in today's dollars, if the average delay is reduced by two years (Figure 4). Over the 12 years from 2014 to 2025, the cumulative real GDP gains would be $160 billion and $280 billion respectively. If a 3 per cent discount rate is applied, the cumulative real GDP gains over the projection period would be $120 billion and $220 billion respectively.

Under the reference case, the gross value added by the minerals mining sector (excluding oil and gas) will increase faster than the rest of the economy. By 2025, minerals mining sector output will contribute around 10 per cent of the economy, up from 8.4 per cent in 2013 (Figure 5). Faster growth in the minerals mining sector is driven by strong growth in iron ore production.

Figure 5: Contribution of the minerals mining sector to Australian GDP



Source: BAEGEM

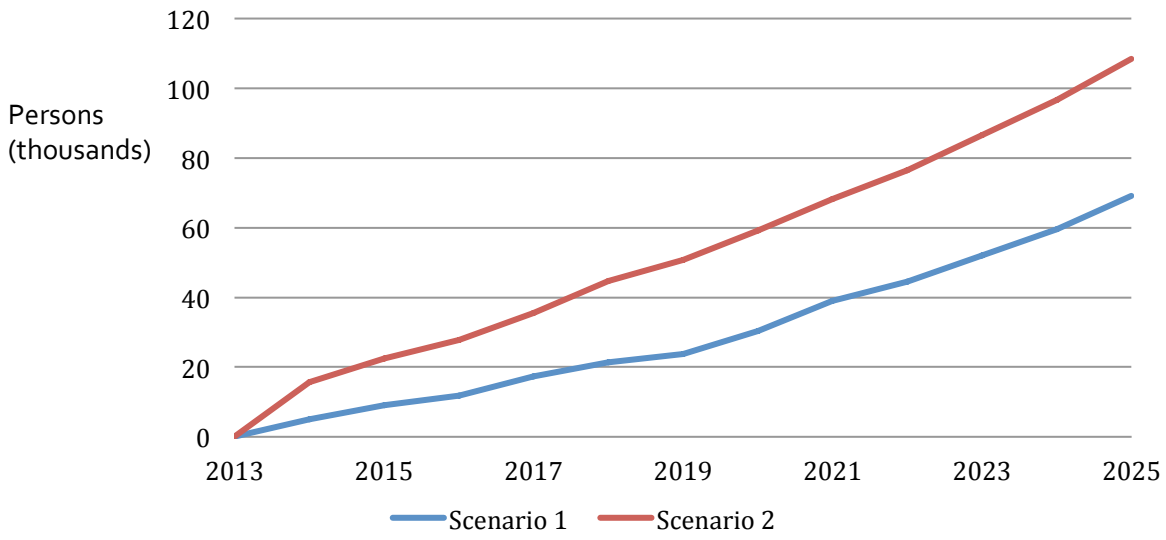
The share of minerals mining output in the Australian economy will be higher under scenarios 1 and 2, driven by increased output. By 2025, the share of minerals mining output in the economy is projected to be 0.21 percentage points higher under scenario 1 and 0.32 percentage points higher under scenario 2 (Figure 5).

4.5 Employment

Under the reference case, the total employment in Australia is projected to reach 12.63 million persons by 2025, up from 11.5 million in 2013. The total employment would increase further if approvals-related delays are reduced by one or two years. Under scenario 1, Australia is projected to gain an average of 32,000 jobs over the projection period and more than 69,000 jobs by 2025 (Figure 6). The average number of jobs created would increase to around 57,500 over the 12-year period and more than 108,000 by 2025 if the average timeline for obtaining necessary approvals is reduced by 2 years. Most of the jobs created are outside the minerals mining sector.

The job creation in scenarios 1 and 2 is the direct result of real GDP gains over the projection period, which is driven by the increase in mining investment, increase in mining production and flow-on effects from the mining sector to the other sectors of the economy. Most of the jobs created in the initial three to four years are driven by additional mining investment and flow-on effects while production effects would become more prominent after 2018.

Figure 6: Employment gains in the Australian economy

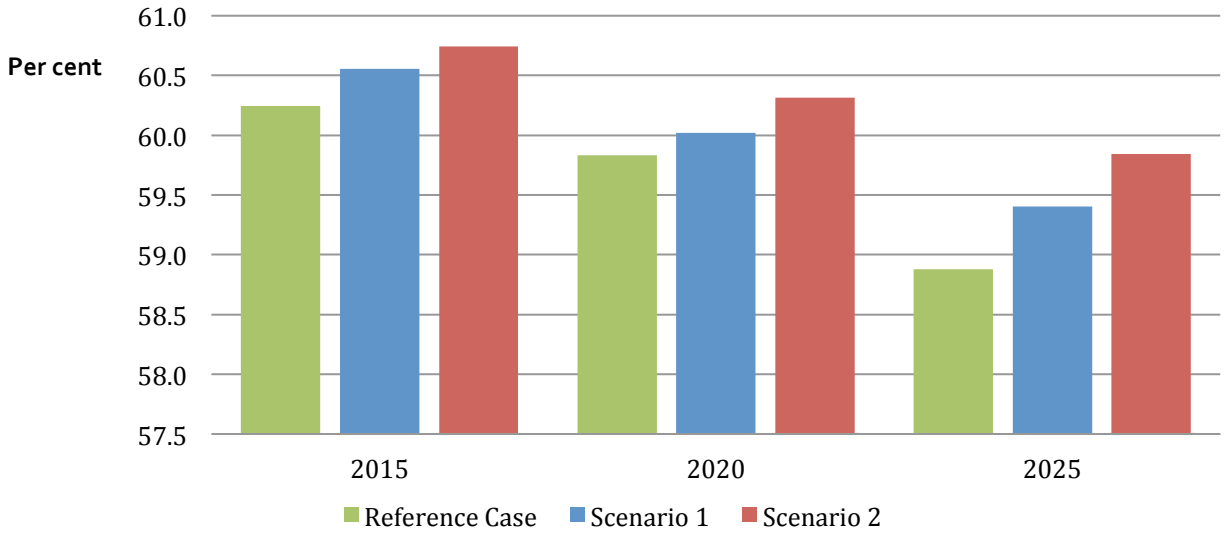


Source: BAEGEM

Higher employment growth helps ease pressure arising from Australia's increasingly ageing population. The employment ratio, calculated as the ratio of total employed persons to the total population aged 15 and above, is projected to decrease from 61.3 per cent in 2013 to 58.9 per cent in 2025 if no improvement is made on the current approval processes (Figure 7). Note that the projected falling employment ratio is entirely driven by the trend of population ageing in Australia, not by economic growth. If the population aged 65 and above are excluded, the employment ratio would increase from 72.0 per cent to 75.6 per cent.

If the average timeline for obtaining approvals is reduced by one year, the increase of over 69,000 jobs by 2025 would translate into pushing up the employment ratio by 0.3 percentage points. Reducing the average timeline by another year would push up the employment ratio another 0.2 percentage points (Figure 7).

Figure 7: Employment to population ratio, aged 15 and above



Source: BAEGEM

In this paper, the employment projection is based on an assumption of a semi-flexible labour market where real wages and employment respond equally to economic shocks. As such, 50 per cent of the increased labour compensation resulting from the real GDP gain would be attributed to new employment while the remaining 50 per cent of the increased labour compensation would be attributed to the real wage increase for existing workers. If the potential productivity gains of the existing workers is less than that specified in the assumption or the labour market is not as tight as the assumption made in this paper, job creation would be higher than the current estimates.

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Appendix 1: The modelling framework

A.1. BAEconomics' General Equilibrium Model (BAEGEM)

The modelling framework used in this study is BAEGEM, BAEconomics' general equilibrium model of the world economy (Mi and Fisher 2014). BAEGEM is a recursively dynamic CGE model, in which economic variables are traced through time and results are computed one period at a time. (In fully intertemporal CGE models, by contrast, results are computed simultaneously for all periods.) The model is solved in one-year time steps. For each time step, BAEGEM simulates the dynamics of a large numbers of key economic indicators, such as capital and labour productivity, prices and output of goods and services, trade and investment flows between economies, and the use of labour, capital, land and natural resources.

The core model code of BAEGEM is built around the concepts of the GTAP model (Hertel 1997). The full model code is constructed, using the core model as its base, with four interlinked modules, including: the government module; the greenhouse gas emissions module; the technology mix module; and the energy module. The development of these modules is aimed to increase the capability of BAEGEM to analyse domestic and international policies, and the impacts of economic shocks.

As with other CGE models, BAEGEM simulates the structure of whole economy, and analyses the economy as a complete system of interdependent economic agents, which include industries, households, investors, governments, importers and exporters. The quantities and prices of inputs and goods purchased by each economic agent are solved simultaneously within the model by a system of economic equations.

The microeconomic equations in BAEGEM ensure that economic behaviour of each representative agent inside the model is consistent with fundamental economic theories. For example, households maximise utility (subject to budget constraints) while industries produce the optimal level of output that minimises costs under perfect competition. The macroeconomic equations in BAEGEM ensure that the most important economic identities and constraints are respected during each simulation time step. For example, GDP measured by the income and expenditure approaches are the same, and use of capital and labour cannot exceed the supply of primary factors.

Economic variables solved by BAEGEM are derived from a rigorous, coherent economic framework. CGE models are best for analysing policies or economic shocks where the impacts are

spread throughout the economy, for example changes in taxes/subsidies or tariffs; technological change; change in factor supplies; and change in mining investment. For this reason, BAEGEM is chosen in this paper to model the effects of streamlining the approval processes of resource projects as investment flow to the economy will be heavily influenced by any decisions that alter existing policies.

A.2. BAEGEM database

The BAEGEM database is based on a number of sources. The social accounting matrix (SAM) of the BAEGEM database is based on the GTAP v8 database with a base year of 2007. A social accounting matrix is a framework for organising information about income, expenditure and financial flows in the economy.

The GTAP v8 database covers 129 countries/regions across the world and 57 commodity groups. For the purpose of enhancing the capability of modelling individual mining commodities, the commodity groups in BAEGEM have been expanded to 71. Disaggregated mining commodities (in addition to those already included in the GTAP v8 database) include black (thermal) coal, brown coal, coking coal, iron ore, bauxite, alumina, copper ore, gold, uranium, titanium and zirconium.

For each industry, BAEGEM contains a detailed industry cost structure and bilateral trade information in the database. These data are pivotal for modelling substitution between commodities and competition between economies. It also contains data on government expenditure, sources of tax revenue, each country's net income, ownership of physical assets, population and employment. The usage of these data by BAEGEM ensures that some of the most important economic identities and constraints are respected over the projection period.

The long term population and demographic projections are sourced from the *World Population Prospects: The 2012 Revision* (UN 2013). The Australian labour force participation and employment data are sourced from *Labour Force, Australia* (ABS 2014).

In the present study, with the focus on the mining sector, the BAEGEM database was aggregated into 18 regional/national economies and 26 production sectors. Each production sector in BAEGEM produces a unique commodity. The major destinations of Australia's resource exports such as China, Japan, Korea, Taiwan and India are modelled individually.