

THE FUTURE ECONOMIC ENVIRONMENT PROSPECTS FOR THE PILBARA

ANNEX TO THE COST OF DOING
BUSINESS IN THE PILBARA



FEBRUARY 2019

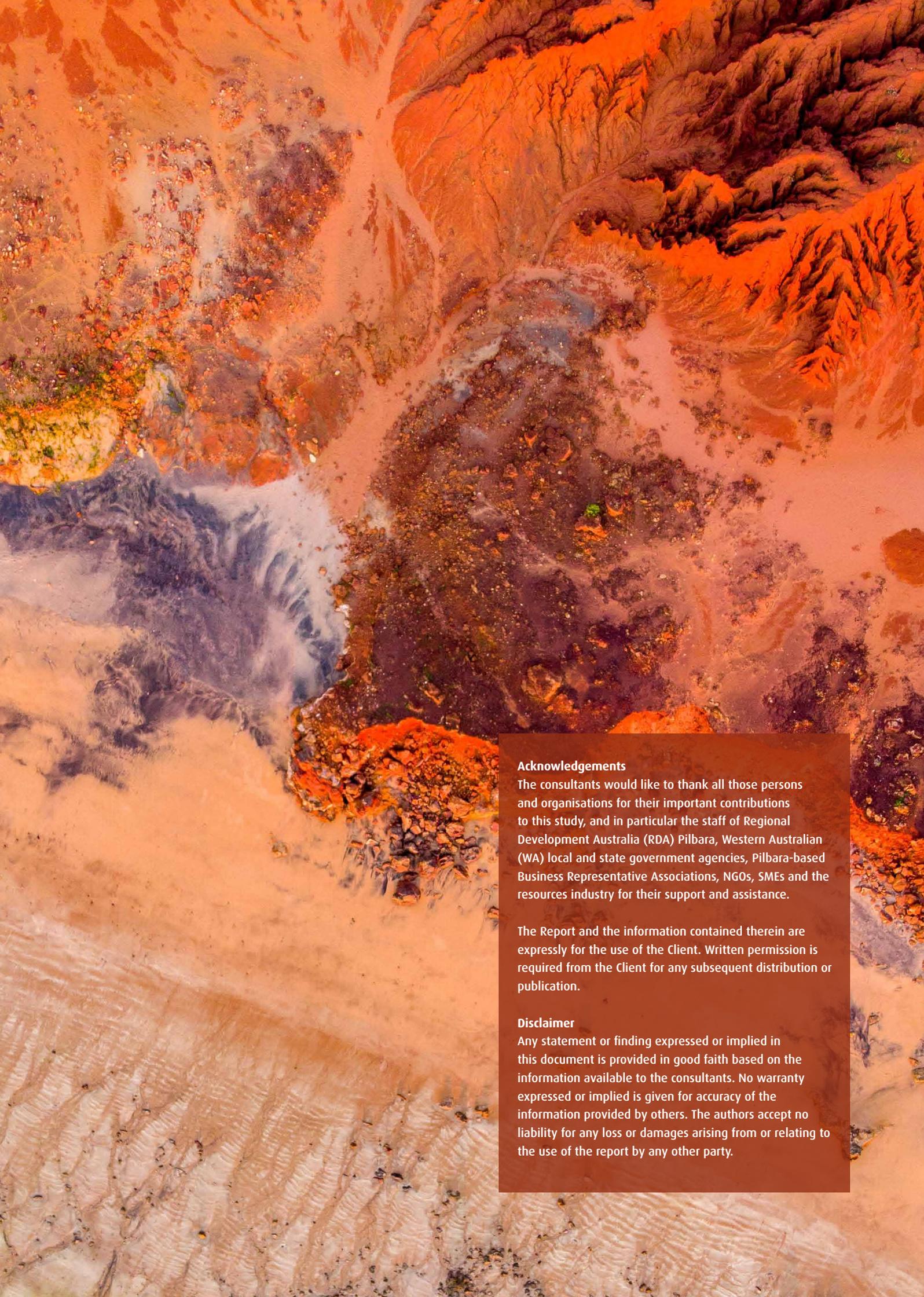


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Acknowledgements

The consultants would like to thank all those persons and organisations for their important contributions to this study, and in particular the staff of Regional Development Australia (RDA) Pilbara, Western Australian (WA) local and state government agencies, Pilbara-based Business Representative Associations, NGOs, SMEs and the resources industry for their support and assistance.

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Forward

Regional Development Australia (RDA) Pilbara between 2013 and 2015 undertook the production of the Cost of Doing Business in the Pilbara report. In 2018 a new report in the series was published. As is detailed in that report much has changed in the intervening years both in the Pilbara and in the wider economic environment.

As its name states the Cost of Doing Business in the Pilbara report focuses on analysing the key costs that impact on operating an enterprise in the Pilbara and comparing these costs both within the main centres in the Pilbara and with Perth.

Underpinning this analysis is that the Pilbara does not operate in isolation to the rest of WA or Australia, and in turn that Australia is impacted upon by economic developments in the global context.

In addition resource industry volatility is a major issue within the Pilbara and therefore having some understanding of the future economic trends helps enterprises to prepare for future economic and investment cycles.

As a supporting document to the Cost of Doing Business in the Pilbara, RDA Pilbara has prepared a review of the major economic production drivers impacting on the Pilbara. The review focuses on the major recent mining resource developments that are underway or in the pipeline, as well as diversification opportunities in industries such as lithium and fertiliser production. The review also summarises what is happening at the ports and local infrastructure, which provide critical support to the major and emerging industries.

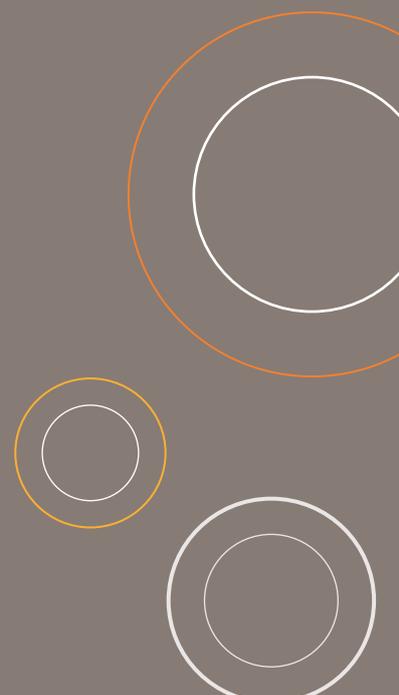
This is an exciting time for the Pilbara as it continues to adjust to the impact of the boom at the beginning of this decade, which was followed by the slowdown and stabilisation of costs while at the same time considerable socio-economic infrastructure came on-stream in the main urban centres.

RDA Pilbara has been a strong advocate of economic diversification and supporter of the SME and NGO sectors as key pillars for the sustainable future of the Pilbara. It is the intention of this report to provide useful information to those who seek to invest in the future of the economic engine of Western Australia.



CONTENTS

FORWARD	1
1. OVERVIEW	4
2. IRON ORE: THE OUTLOOK FOR PRICES, INVESTMENTS AND PRODUCTION	8
3. LNG: THE OUTLOOK FOR PRICES, INVESTMENTS AND PRODUCTION	12
4. LITHIUM: PRODUCTION AND DEVELOPMENT	14
5. FERTILISER: INVESTMENTS	15
6. GOLD PRODUCTION	16
7. RENEWABLE ENERGY INVESTMENTS	17
8. PORTS DEVELOPMENTS	18
9. LOCAL INFRASTRUCTURE INVESTMENTS	20
10. AQUACULTURE AND AGRICULTURE INVESTMENTS	22
ABBREVIATIONS & REFERENCES	24



I. Overview

The business environment in the Pilbara is improving and may well improve further in the short to medium term. Taking into account the strong likelihood of further capital investments in the Liquefied Natural Gas (LNG) sector, increased volumes of iron ore production and expenditure on replacement mines, together with expanding activities in lithium, gold and fertiliser opportunities the overall scenario is positive. However, it is unlikely that costs in the Pilbara will moderate further and in fact they may increase as competition for labour, goods and services increases. Some costs will be at elevated levels in comparison to the rest of Western Australia (WA) and Australia.

There are both downside and upside risks to the forecasts. The main downside risks include failure of policy in the United States of America (USA), Europe, China and Japan to further address debt problems; rising rates of inflation in the USA leading to further interest rate hikes, which will cool down economic growth starting in 2019; rising interest rates in other major economies; geo-political risks; the risk of trade friction; and the possibility of a sharp fall in growth rates in China, leading to reduced demand for commodities. The upside opportunity is that the current strength in the global economy continues with further increases in commodity demand and growing consumer and business confidence, particularly in the USA.

The economy and the business environment of WA and the Pilbara are very dependent on two main drivers. These are developments in the global economy, in particular those of the USA, the European Union (EU), China, Japan and other countries in Asia and commodity markets, principally iron ore and liquefied natural gas. These drivers have a major impact on economic growth, investments, population growth, employment and incomes and influence both the demand for goods and services and the cost structure for doing business in WA and the Pilbara.

The strong performance of the global economy and commodity markets over the short term (2018 to 2019) will be supportive of the WA economy and the Pilbara. In the medium term slower rates of economic growth are likely and a general global slowdown is possible. This is the major risk to economic activity and investment decision making in the Pilbara. However, a high level of investment has already been committed by the major players in the resources sector in the Pilbara and there are specific and positive factors in the LNG market that could lead to further significant investments over the medium and longer term.

Key Features and Assumptions¹:

- Aggregate growth in emerging market and developing economies is projected to remain reasonably firm.
- The upswing in global investment and trade continued in the second half of 2017. At 3.8%, global growth was the fastest since 2011. However, global growth for 2018 is estimated to have declined to 3.7% while the forecast is for 3.5% in 2019 and 3.6% in 2020.
- While upside and downside risks to the short-term outlook are broadly balanced, risks beyond the next several quarters clearly lean to the downside. Downside concerns include a possibly sharp tightening of financial conditions, waning popular support for global economic integration, growing trade tensions and risks of a shift toward protectionist policies, and geopolitical strains.
- International Monetary Fund (IMF) GDP growth forecasts for 2018 and 2019 for the regions and countries in the world that have the most impact (direct or indirect) on commodity markets for the Pilbara are shown below:

Region/Country	2018	2019
USA	2.9	2.7
Euro area	2.4	2.0
ASEAN - 5	5.3	5.4
China	6.6	6.4
Japan	1.2	0.9
South Korea	3.0	2.9
India	7.4	7.8

Table 1: Projected GDP Growth Rates Main Economies 2018 to 2019 (%)

- **The EU and USA economies** combined are still very much larger than any single country or region anywhere else in the world. They are major importers of goods and services and in turn this has an impact on prices along the supply chain for commodities.
- **In the USA** growth is projected to remain robust in the short term, before a cyclical downturn begins within the next two years.

- **In the EU** growth will remain moderate until the broader global economy starts to weaken in tandem with changes in the USA. In the short term it can be anticipated that imports will remain at a high level. In the medium term the level of imports will flatten out and may even fall.
- **The economic model for the Chinese economy** is changing with reduced capital investment in infrastructure and increased consumption and tertiary services. There are substantial risks to growth in China. The very high rates of growth over the last six years have been fuelled by stimulus measures initiated in 2008/9 at a cost of US\$ 595 billion. The country has a 282% Debt to GDP ratio. China had US\$ 2 trillion debt in 2000 and currently it has reached US\$ 28 trillion.
- Growth in China is projected to moderate from 6.9% in 2017 to 6.6 % in 2018 and 6.4% in 2019. Over the medium term, growth is expected to gradually slow to 5.5% with continued rebalancing from investment to consumption. Longer term it is likely that growth in China will fall to somewhere between 3-4% as the economy matures. This has important implications for the Australian economy.
- **Japan's medium-term prospects** remain moderate, mainly due to unfavourable demographics and a trend decline in the labour force.
- Although overall growth in **Asia and the Pacific** is moderating the region is still outperforming other regions and this may continue over the medium term. Growth is projected to pick up in some countries and in all major economies in Asia growth is anticipated to be above 3% and more of the order of 5-6%.
- Of particular importance to the Pilbara is the increase in the manufacturing role of countries in **South East Asia**, which may become the world's leading manufacturing centre². Average GDP growth could even accelerate to 6-8% per annum, although it has to be recognised that if there is an overall global slowdown this will have a negative impact on all regions. Annual intra-regional trade could reach US\$ 1 trillion and G4 trade (US, Europe, Japan and China) could reach US\$3.7 trillion per annum. However, a slowdown in China and a trade war will have a negative impact on the economies of the region.
- Faster rates of growth are expected to continue in **India**, which could become an increasingly important market for Australian exports.
- The strengthened global economy has resulted in higher commodity prices starting in 2016/17. The IMF's broader commodity price index is expected to rise about 12% in 2018 relative to its 2017 average (bringing the cumulative increase from 2016 to about 29%) and then to fall about 4% in 2019. Metal prices are expected to strengthen by 13% in 2018, following a 22% increase in 2017 spurred by stronger global demand, and remain broadly stable thereafter.
- Over the last few years the Australian dollar (A\$) has depreciated substantially against the US\$ and the Euro. This is decidedly advantageous for Australian exporters. Over the next two to three years it is possible that the Australian dollar may fall even further relative to the US\$.



As a consequence of these economic and price influences, it has been clear that the investment outlook for both iron ore and LNG has strengthened in the Pilbara due to a number of factors. Moreover, within the resources sector there is more diversification, with investments in lithium, a substantial increase in gold exploration, and possibilities for investment in a large-scale solar power system, large fertiliser ventures and copper exploration.

In Australia in general, and in the Pilbara in particular, the resources sector has transitioned from a period of high investment to a period of strong increases in production, which has already supported significant increases in export volumes of iron ore and LNG. According to the WA Department of Mines, Industry Regulation and Safety³, while investment levels seen during the peak of the commodity cycle are unlikely to be repeated in the near future, continuity of employment and royalties in WA are secure at current levels of production and planned levels of investment. Interest and investment in new sectors, such as lithium, continues to improve, and established industries such as gold and iron ore remain steady.

Our analysis on the factors influencing the Pilbara business outlook indicates a more positive environment than that of the last few years. There are more supportive market and investment factors in the forecasts and the prospects for diversity have increased to an extent. The Australian dollar exchange rate is another positive feature in determining the health of the economy of the Pilbara going forward. The A\$ was at parity with the US\$ during the period of the resources boom. This has been followed by a sharp fall with a current exchange rate of some US\$ 0.71 to the Australian dollar and it is possible that the A\$ will fall further. Also, resource companies have made dramatic cost reductions as a result of which margins have increased.

Net profit for the world's top 40 miners surged 126% to US\$ 61 billion in 2017⁴ and was forecast to rise to US\$ 76 billion in 2018, which includes BHP Billiton Ltd, Rio Tinto, South32, Fortescue Metals Group (FMG) and Newcrest Mining, which collectively lifted their revenue in 2017 by 23% to US\$ 600 billion.

The resources companies in the Pilbara are well positioned to take advantage of cost cutting measures and the high-quality iron ore producers, such as BHP Billiton Ltd and Rio Tinto have the added advantage that higher quality grades have a price premium. Low average free-on-board (FOB) costs estimated to be of the order of US\$ 21 per tonne at present, gives Australian producers a competitive advantage and will have an impact on future investment decisions.

Economic activity in the Pilbara may well pick up significantly in the short and medium term. Australia is projected to become the world's largest exporter of LNG, in addition to iron ore and coal. Australia's earnings from resources and energy commodities are projected to increase at an average annual rate of 6% a year to total \$240 billion (in 2014/15 dollar terms) in 2019/20. A substantial part of the earnings will come from the Pilbara.

The scale of investments in the near and medium term are substantial and will open up business opportunities for small and medium size enterprises as well as larger organisations. The total commitment is estimated to be some \$16 billion, with possible investments of about \$70 billion over the medium term.

In addition to estimated capital costs in the different sectors, analysts⁵ also point to plans by the Pilbara's big three to spend billions more in "sustaining capital" needed to keep increasingly sophisticated processing plants running and logistics functioning at optimum efficiency.

The impact of the investments will be to increase the value of the Pilbara economy from an already high base, and increase employment and incomes. However, industry leaders are also expecting cost increases.

In addition to the major projects there is extensive prospecting for gold, several infrastructure projects are underway or planned, there are a number of local government initiatives planned or under construction, and there are possible investment opportunities in sectors such as tourism, agriculture and aquaculture.

Category	Committed/ Underway	Proposed*
Iron Ore		
BHP Billiton Ltd	4.8	
Rio Tinto	3.5	
Fortescue Metals Group	1.7	
Balla Balla Infrastructure Group		5.7
API West Pilbara		6.8
LNG		
Chevron	5.1	
Woodside Petroleum	4	30
Lithium		
Pilgangoora mine		0.3
Energy		
Solar Power		20
Fertiliser Investments		
Ammonia		4.3
Potash		0.2
Salt	0.35	
Total	19.45	67.3

* These are indicative of major projects under consideration

Table 2: Summary of Estimated Total Investments by Major Projects in the Short to Medium Term in the Pilbara (\$ billion)





2. Iron Ore: The Outlook for Prices, Investments and Production

IRON ORE PRICES

The investment cycle in the Pilbara has followed the price movements of the last decade, which are shown in the figures below.

Year	2012	2013	2014	2015	2016	2017	2018
Price	128	135	97	56	58	72	69

Table 3: Average Iron Ore Prices 2012 to end 2018 (at nominal US\$/dmt)⁶



Figure 1: Iron Ore Average Prices 2012 to August 2018 (62% fines)

Following the peaks reached in 2011/12, the benchmark price of iron ore held up well in 2013. In the Pilbara firmness in the price led to Rio Tinto deciding to proceed with its third phase of increased investment and output from existing mines by some 70 mtpa to a total of about 360 million tonnes. BHP Billiton Ltd has a target production level of 290 to 300 mtpa, FMG has a target of up to 155 mtpa, Roy Hill will produce up to 55 mtpa and other producers have been increasing output. Other producers around the globe have also increased production, such as the Brazilian giant, Vale. The larger producers have met, or are just about to meet their expanded production targets and have significant cost advantages due to the scale of their operations and their superior ore grades.

Iron ore prices in the first half of 2018, and although well below historic highs, have held up quite well. At the beginning of 2019 the prices have firmed to about US\$ 75 a tonne but may trend downwards within the next year as the global economy slows down. World Bank projections indicate future prices over the next decade to average between US\$ 55 and US\$ 65 per tonne (62% fines). Upside price opportunities for the more immediate forecast include more robust global demand as well as production shortages. Supply could be curtailed by a slower ramp-up of new

capacity, further sanctions against metal exporters, and policy changes in China. Downside risks are dominated by slower growth, the easing of pollution-related policies, and the reintroduction of idle capacity in China. Under this scenario decisions on further development will probably be delayed.

In response to falling prices after 2013 iron ore miners around the world turned their focus to cutting production costs and improving productivity. This focus is expected to continue through the medium term, and in the current climate of stronger competition provide more downwards pressure on prices to suppliers of goods and services.

Changes to relative prices for the different qualities of iron ore favour the major producers in the Pilbara, who have comparatively high quality ore bodies. The price differences have been accentuated in China by a push that began in late 2015 to reduce excess capacity and meet more stringent environmental standards. This, in turn, has seen discounts for lower-grade ore blow out from 10-15% to 25-30 % and even 40%. Higher-grade ore is commanding a significant premium. Conversely producers with lower ore grades are at a disadvantage. The price differences for different grades is illustrated by prices in early May 2018 of about \$85.20 a tonne for 65% fines, a price of \$66.83 a tonne for 62% fines and a price of \$39.40 a tonne for 58% fines.

Supplies from Australia and Brazil are expected to continue driving higher cost producers out of the market, easing some of the oversupply that has been prevalent, but creating a lower price environment for suppliers of goods and services. Allied to cost reduction programmes it is well known that the major miners are on the way to containing employment levels through technological advances.

IRON ORE PRODUCTION AND INVESTMENTS

Western Australia is the largest iron ore producer and exporter in the world, accounting for 38% of global production and 53% of global seaborne exports in 2016. The Pilbara region accounted for 94% of Australia's iron ore exports in 2016. The iron ore industry is a large part of Western Australia's economy, accounting for 65% of the value added by its mining industry and 15% of its gross state product in 2015/16. The iron ore industry remains globally competitive with high quality reserves, low cost production and established, long-term markets in China, Japan, Korea and Taiwan. Western Australia had an estimated 63 billion tonnes of iron ore resources in 2015/16. At 2015/16 production rates, this resource could sustain production for another 76 years.

China produced 832 million tonnes of steel in 2017, and is not likely to push beyond 900 million tonnes over the next few years, which means that not much more iron ore will be required than is currently taken. Australian iron ore exports are not likely to increase much given base case production targets and continued pressure from Vale in Brazil, which has high ore grades, even though rising oil price increases and shipping costs act slightly in Australia's favour.

China's domestic supply of iron ore has fallen from rates around 400 million tonnes per year five or six years ago to about 200 million tonnes and there may still be an opportunity to gain further market share in this regard. The more bullish scenario for Chinese steel production, and Australian iron ore by association, lies in China's "One Belt One Road" policy, which could see Chinese steel production exceed expectations by supplying to infrastructure projects in the central Asian nations at the heart of the policy⁷. "If they [China] do half of what they're planning to do [with One Belt One Road], the increased demand for steel is huge and we will benefit from it."

The large iron ore miners will be spending about \$25 billion on replacement mines that will also expand capacity slightly and will extend the life of their Pilbara iron ore operations, leading to increases in construction and operational work forces. About \$9.5 billion will be spent in the next four years including BHP Billiton Ltd's \$4.7 billion South Flank mine, Fortescue Metals Group's \$1.7 billion Eliwana development and Rio Tinto's planned \$3.5 billion spend on a mine at Koodaideri. South Flank will create about 2,500 construction jobs, Eliwana about 1,900 and Koodaideri about the same number. There will also be minor extensions to existing mines, spending to improve the capacity and performance of the thousands of kilometres of rail lines that cross the Pilbara, and at least \$3 billion worth of structural, mechanical piping and electrical work needed to keep increasingly sophisticated processing plants running. For example, Rio Tinto will spend \$1.5 billion a year maintaining its iron ore operations over the next four years.



In more detail the main investments in iron ore that have been flagged to date are as follows:

- **BHP Billiton Ltd** guidance for the 2018 financial year indicates record production of 272 and 274 million tonnes of iron ore and the company announced in June 2018 that a \$4.49 billion investment in its South Flank iron ore mine, 130 kilometres from Newman, will replace its existing production from its Yandi mine, which is reaching the end of its useful life.
- **Rio Tinto**⁸ has completed construction of the Silvergrass mine and now has given the go-ahead for the Koodaideri project, 110 kilometres from Newman, from 2019, to replenish and maintain the quality of its Pilbara iron ore blend at a cost of \$3.5 billion. The projected cost of US\$ 13.4 per tonne indicates just how successful the cost cutting drive of the company has been over the last few years. Since 2012, Rio Tinto has reduced costs by some US\$ 8.3 billion. Rio Tinto prides itself on its pioneering approach to new technologies, to deliver faster and better processes, cleaner and greener outcomes. There are many examples, from automated trucks and trains, to remote operated drills and drones. Rio Tinto has also announced an increase to its Pilbara iron ore reserves in Western Australia. Iron ore shipments for 2017 met guidance at 330.1 million tonnes.
- **Fortescue Metals Group** now produces 170 million tonnes of iron ore per annum with a low cost base. The company has grown to be one of the largest global iron ore producers and owns the fastest heavy haul railways in the world. The company is now supplying 17% of China's seaborne iron ore and expanding into Japan, South Korea and India. Despite this, the growing grade-price gap is forcing FMG to seriously consider the economics of its higher-grade Iron Bridge magnetite joint venture project south of Port Hedland. The company expects to make a decision on the project next year. Fortescue has given the go-ahead to develop a new mine and rail project in the Pilbara. The \$1.7 billion Eliwana mine, some 90 kilometres north-west of Tom Price, will include development of 143 kilometres of rail, a new dry ore processing facility and other associated infrastructure. Eliwana, which will replace Fortescue's depleting Firetail mine, is expected to operate at 30 million tonnes per annum (mtpa) with capacity for up to 50 mtpa over a mine life of at least 24 years. It is expected to create up to 1,900 jobs during construction and 500 full-time jobs once operational.
- **Roy Hill** posted a profit of \$331 million in 2016/17 and will start using driverless trucks as it looked to boost efficiencies to exceed its 55 mtpa capacity.
- **The CITIC Pacific Sino Iron project** is the largest magnetite mining and processing operation in Australia and is one of China's largest investments in the Australian resources sector. At peak construction 4,000 people were employed building the project. In full operation there will be between 800 – 1,000 permanent positions. The Sino Iron project will generate around \$75 billion in direct revenue.
- **The Balla Balla Infrastructure Group's (BBIG)** \$5.6 billion integrated iron ore project in the Pilbara is on track for development after the WA government validated the state agreement in 2017. If a Final Investment Decision (FID) is made the project is expected to create 3,300 construction jobs and 910 operational positions. The company will maximise local employment opportunities within the Pilbara, with plans to bus workers in from Karratha and other towns, The project plans to use custom-built, innovative barges to transfer ore from the port onto ships, which both reduces costs and the need for dredging.
- **Ferro Metals Australia Pty Ltd** proposes to mine up to 10.1 mtpa of magnetite ore to produce 6 mtpa of ore concentrate over a 15 year mine life. The magnetite concentrate would be conveyed to Port Hedland from the mine via a 110 kilometre slurry pipeline located alongside the existing Pilbara Energy Pipeline (PEPL). The concentrate would be dewatered at a purpose-built facility located at Utah Point in the Port Hedland Port area, prior to shipping overseas.
- **Brockman Mining Limited and Mineral Resources** have formed a Joint Venture to develop the Marillana Iron Ore project with high quality Pilbara iron by as early as the third quarter in 2019. Marillana is the largest single deposit outside the control of the major producers in the Pilbara. The resource will support a minimum 20 year mine life. The partners may decide to commence initial production through the development of a smaller scale trucking operation.
- **Atlas Iron** has increased estimates of its known reserves substantially and believes that these reserves are sufficient for the company to compete with larger operators in the future in terms of scale. However, the iron ore price downturn has resulted in a cautious approach to production levels and financial restructuring, and Gina Reinhart's Redstone has recently acquired a controlling stake in the company.

A further recent development has been the flurry of exploration activity for copper in the Paterson Province area of the east Pilbara by the major and minor mining companies. Both Rio Tinto and FMG have increased their tenement holdings in the area. If current explorations do prove massive copper reserves this could be another important mining diversification boost for the region.





3. LNG: The Outlook for Prices, Investments and Production

LNG PRICES

As with iron ore the recently completed very large capital investment in LNG was designed when LNG prices were at a peak. Historic prices for LNG⁹ are shown below to place current price levels and trends in perspective. As anticipated in previous RDA Pilbara reports, LNG prices have improved considerably over the last two years and this trend is likely to continue as demand strengthens globally.

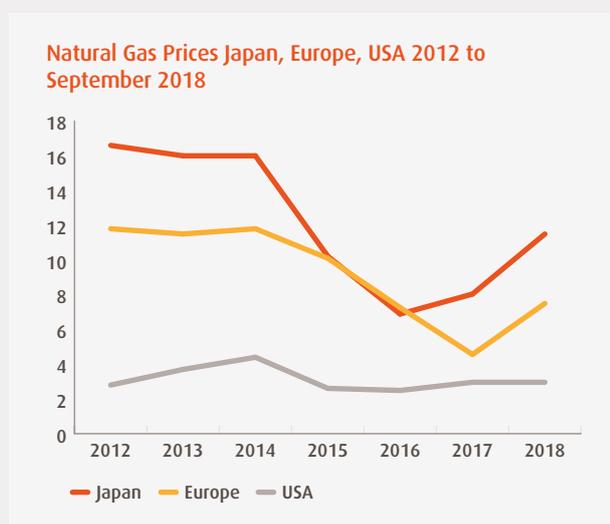


Figure 2: LNG Prices (Europe, USA, Japan 2012 to September 2018) (US\$/mmbtu)

Since there is currently no globally integrated market for natural gas, pricing mechanisms vary by regional market. Internationally traded natural gas has also been largely indexed to crude oil prices such as North Sea Brent or Japan customs-cleared crude (JCC) because of the liquidity and transparency of crude oil prices and the substitutability of natural gas and petroleum products in certain markets. Although there is a trend towards decoupling of LNG pricing to oil prices the price of LNG will probably be related to oil prices for the foreseeable future. The price of oil has increased sharply over the last two years and further price increases are not out of the question. LNG and oil are in competition, with the global share of LNG to petroleum consumption expected to increase over time.

In addition to normal market factors that may result in even higher prices in the near future the "Biggest change in oil market history"¹⁰ may rise over the next two years with crude prices set to rise ahead of a shipping revolution. On January 1, 2020, the International Maritime Organisation (IMO) will enforce new emissions standards designed to significantly curb pollution produced by the world's

ships. Global benchmark Brent crude is anticipated to climb to \$90 a barrel by 2020 as new international shipping laws overhaul the types of fuels produced by refiners. The IMO's rules will ban ships using fuel with sulphur content higher than 0.5%, compared to 3.5% at present, unless ships are fitted with equipment to clean up their sulphur emissions.

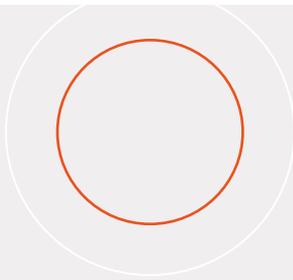
The main natural gas market for Australia is in Asia. In previous reports in the series on the Cost of Doing Business in the Pilbara we forecast the fall in prices of LNG in Asia in the period 2012 to 2018 and a likely rise in the price thereafter. This has taken place and prices may well rise further. Although increased supplies, particularly from the USA, remain a threat, analysts anticipate that rising demand will continue to result in higher future prices. In Asia, most natural gas is imported as LNG. While the price is indexed to crude oil on a long-term contractual basis, there has been an increase in spot and short-term trading in recent years. Consequently, geopolitical pressure on oil prices also impacts LNG prices.

The Asia Pacific market accounts for around three-quarters of global LNG trade and one-third of the global natural gas trade. Moreover, increased gas and LNG demand growth in Asia will largely be driven by China, where energy demand is increasing rapidly, with an emphasis on cleaner energy due to environmental concerns. During the LNG construction period in the Pilbara prices fell sharply after 2014, however, much of the production is going into the market at a time of rising prices and this trend is likely to continue. Spot prices in Asia moved above \$11 per mmbtu in June and September 2018.

The supply of LNG has undergone very rapid expansion over the last few years, particularly in Australia and the USA, which has become a large exporter. However, the rate of increased supplies is declining as major projects such as Gorgon and Wheatstone reach maximum capacity. On the other hand demand has increased substantially and it is possible that this trend will continue. Investment in new LNG globally has not kept up with growth in demand in 2017, global LNG demand increased by around 30 mtpa, but only one new LNG project, for 3.4 mtpa, was approved.

The current lower A\$ to US\$ exchange rate is beneficial to Australian producers on the price side. Looking further ahead natural gas prices are projected to remain firm in the three main geographical markets through to 2030.

There are upside risks to the projections, including geopolitical risks to supply and further increases in consumption in China. Recently Chevron¹¹ said "it expects global demand to be nearly 600 mtpa by 2035, while supply could be just about half of that". Woodside is optimistic about demand for its LNG. A recent Woodside



presentation to analysts predicted annual LNG demand would grow 4% a year until 2035.

LNG INVESTMENTS AND PRODUCTION

The Reserve Bank of Australia notes that around half of the estimated capex in the LNG and mining sectors over the next few years reflects spending by the LNG sector, as replacement gas fields are being considered at the two oldest Australian offshore LNG operations. These resource-replacement projects account for almost half of estimated LNG capex over the next five years, because offshore LNG projects tend to involve the infrequent development of very large offshore gas fields with long production lives.

Conditions for increased investment are likely to be more favourable over the next two decades. In addition, the expertise available to LNG producers in Australia is now second to none globally and the infrastructure built over the last eight years (roads, ports, railway, processing facilities) is such as to allow for expansion without some of the costs that are usually associated with new investments, and proven LNG reserves are very large.

The combined impact of higher prices and a more competitive operational cost structure is reflected in information supplied by Chevron indicating that the gigantic Gorgon and Wheatstone LNG projects “are now enjoying cash margins of more than US\$ 30 a barrel at a US\$ 50 price, and production from the \$111 billion mega-projects is expected to increase this year”. Chevron chief executive Mike Wirth told Wall Street analysts recently that the US major two Australian LNG projects were “becoming strong cash generators with cash margins of more than US\$ 30 per barrel at a US\$ 50 Brent price.”

Main developments in the pipeline in the Pilbara include:

Chevron and its partners in the Gorgon LNG venture have committed a large amount of investment funds, anticipated to be of the order of some \$5.1 billion, to add to supplies of natural gas for processing on Barrow Island. The investment will create hundreds of jobs for West Australians with a construction workforce of about 700 local people in 2021 and possibly some 1,400 over the course of the project. Financial and employment benefits are expected to flow through to Australian service suppliers. Chevron has also started production at its second very large LNG project, the US\$ 34 billion Wheatstone venture near Onslow with increasing rates of production. Gorgon and

Wheatstone are major contributors to the rapid expansion in LNG exports by Australian operators, which is vying to become the world’s biggest producer of LNG.

Woodside business priorities in 2018 in WA are to deliver near-term production growth from committed projects and to progress major developments. These include:

- Scarborough Final Investment Decision (FID) ready in 2020
- Browse FID ready in 2021

The conceptual framework for developing these projects, which will dramatically increase the supply of natural gas to existing processing facilities on the Burrup Peninsula and North West Shelf, is described by Woodside as “Unlock the Burrup Hub and maximise the value of existing infrastructure”. “The Browse and NWS Joint Venture partners have concluded a deal for bringing Browse gas through the Karratha Gas Plant. Woodside anticipates Browse being final investment decision-ready in 2021. At Pluto, thorough groundwork on options for expanding production, which we are now able to use in our development planning for Scarborough, taking account of our increased equity and the certainty this delivers”.

The capital cost of developing the Browse and Scarborough opportunities is likely to be more than \$30 billion. Woodside expects to spend US\$ 11 billion on developing the Scarborough project after raising the capacity of its planned second train, or processing plant, at the Pluto liquefied natural gas facility to between 4.5 million tonnes and 5 million tonnes a year, up from between 2 million tonnes and 3.3 million tonnes a year.

Shell led consortium: Shell’s Prelude Floating liquefied natural gas (FLNG), the world’s largest offshore facility, is set for completion and start up in 2018. The construction of the giant facility started back in 2012. Once completed, it will produce 3,6 million tonnes of LNG annually by using natural gas from the offshore Prelude and Concerto Gas Fields located approximately 475 kilometres North-northeast of Broome. Although outside of the Pilbara the technology used and the expertise available to other operators is valuable.

4. *Lithium: Production and Development*

Lithium is a key ingredient in the manufacture of lithium ion batteries used in electric vehicles, large battery storage units, and electronic devices like mobile phones and laptop computers. Western Australia is tipped to produce more than half of the world's lithium supply as new mines come online and the world's appetite for the materials used to make batteries for electric vehicles grows. Most of the world's hard rock mines are in WA. Lithium mining and processing in WA started quite recently at a time of very rapid price increases.

As lithium became one of the world's hottest markets in recent years, Australia has grown its market share of raw lithium production from about 13% in 2000 to 50% in 2017. It was estimated that Australia would supply 62% of the world's lithium in 2018 on the back of three new mines and large, hard-rock lithium raw material mines will be competitive and possibly the lowest cost of supply for the battery market, including in the hydroxide category. The shift toward lithium hydroxide has extra importance for Australia and could set the lithium boom apart from the previous commodity booms. Lithium miners are increasingly focused on beneficiating their raw materials on Australian soil, which results in a higher-grade product. Downstream processing of lithium is looking viable. With 80% of the world's beneficiation capacity located in China, customers in Korea and Japan are keen to support Australia facilities in a bid to diversify their supply of lithium hydroxide.

The growing use of Lithium-ion batteries in electric vehicles has, more than any other factor, driven a quadrupling in the price of lithium delivered to China over the past four years, with significant increases in lithium revenues and employment.

A taskforce to investigate how WA can cash in on global lithium and battery minerals opportunities has been formed by the State government with downstream processing of lithium and other battery minerals in WA possibly creating thousands of highly skilled, high-paying jobs. A strategy would also be developed to position WA as a world leader in new energy materials. Lithium and other commodities found in WA such as nickel, cobalt, manganese, graphite and copper are key ingredients in the lithium-ion batteries that drive electric cars. Several companies have already announced plans to process lithium and other minerals into higher-value battery precursor materials such as lithium hydroxide, lithium carbonate and nickel sulphate. The establishment of the taskforce coincides with the release of a preliminary report by Regional Development Australia, which makes a case for WA becoming a "Lithium Valley" for new energy similar to the way Silicon Valley in the USA is known as the global hub of the tech sector. A sharp expansion in lithium production is expected, with more than \$3 billion worth of projects in the pipeline.

In the Pilbara the Pilgangoora mine south of Port Hedland will be one of the world's largest lithium producers with the first shipments of concentrate occurring in 2018. Pilbara Minerals is in a position to more than double its capacity with a production rate rising from 2 mtpa to 5 mtpa. Under the plan, construction on stage two began in the fourth quarter of 2016 with commissioning in the final quarter of 2019. 100% of the projected lithium oxide production from Pilgangoora is already subject to either binding off-take agreements or Memorandums of Understanding (MOU) with major off-take partners in China, Japan, the Americas and Europe.



5. Fertiliser: Investments

Yara Pilbara Fertilisers Pty Ltd (YPFPL) operations known collectively as Yara Pilbara own and operate a liquid ammonia plant located on the Burrup peninsula in Western Australia. YPFPL is the exclusive marketer of ammonia manufactured at the liquid ammonia plant. It is one of the largest ammonia production facilities in the world. YPFPL is in the final stages of constructing a technical ammonium nitrate (TAN) plant adjacent to the existing liquid ammonia plant and Yara intends to build a demonstration plant to produce ammonia using solar power, near its existing world-scale plant in the Pilbara, in Western Australia. Yara hopes to finish the engineering design and begin construction so that it can complete the project and begin production of carbon-free ammonia in 2019.

Vikas Rambal-led Perdaman has spent \$200 million proving up a \$4.3 billion fertiliser plant that is planned to be built on the Burrup Peninsula after Woodside Petroleum has said that they will supply the gas needed to create a giant urea factory. More than 2,000 jobs would be created during the three-year construction of the two-million-tonne-a-year plant near Karratha. There will be about 200 full-time workers, who would be sourced from the Pilbara. It would

be Australia's first urea export project. However, while critical to the plant's success, the gas MOU does not guarantee the project will get the green light. Perdaman will now focus on securing relevant State Government approvals and securing customers and finalising finance.

Several WA-based potash producers are attempting to harness the State's vast salt lakes to produce sulphate of potash, a high-value fertiliser used in cultivating chloride-sensitive crops such as fruits, vegetables, nuts, tea, coffee and tobacco. German chemical company K+S, a leading potash supplier is developing a \$350 million, 3.5 mtpa salt project near Onslow, with first production expected by 2021 or 2022. Potash producer Kalium Lakes has signed a term sheet with K+S to supply product from stage one of its flagship Beyondie sulphate of potash project, 160 kilometres south-east of Newman. The agreement is a precursor to a binding offtake agreement covering 75,000 tpa over an initial 10 years, subject to due diligence by K+S. The agreement also helps boost the case for funding at an estimated cost between \$124 and \$220 million.



6. Gold Production

There are three existing gold mines in the Pilbara, Telfer and Nullagine in the East Pilbara, and Paulsen in the West Pilbara and an ongoing gold exploration flurry in the Pilbara due partly to the Canadian listed company Novo Resources and partner Artemis Resources discovery of gold nuggets at the Purdy's Reward project, about 45 kilometres south of Karratha.

Novo has been staking the area around Comet Well and Purdy's Reward and now has a 100% interest in about 6,000 square kilometres of mineral rights around Karratha. Novo has described the find as a major new discovery and compared the style of mineralisation with South Africa's fabulous Witwatersrand gold reef in South Africa, although the company does caution that a lot more exploration is required. It is Novo's new conception of the gold as being hosted in conglomerates that has really sparked this latest gold rush. Some 16 ASX listed companies are currently undertaking exploration activities in the Pilbara.



7. Renewable Energy Investments

A Pilbara Solar Export Pre-Feasibility Study has been prepared. The north west of Western Australia has been identified internationally as one of the best global locations for large scale solar photovoltaic generation. The intent of the Pre-Feasibility Study is to draw attention to the potential of solar power generation as a key driver of economic diversification in the Pilbara and to determine whether more research is warranted for the development of an export-scale renewable energy project in the region. To investigate this opportunity, the Pilbara Development Commission supported a Pre-Feasibility Study to evaluate the potential to export solar generated power from the Pilbara to the proposed ASEAN grid via a subsea direct current interconnector. Key findings include:

- It is technically feasible to build a gigawatt scale facility in the Pilbara and deliver the energy generated, via a high voltage direct current (HVDC) cable to Indonesia; and
- Solar energy generation, storage and HVDC costs are declining and if present trends continue, the commercial case for connection to Indonesia will be well established within five to 10 years.

Also, in the renewable energy sector an Asian Renewable Energy Hub's \$20 billion plan for Pilbara's sun and wind to power

southeast Asia is of great interest. The Pilbara's wind and sun could be powering cities and villages from Bali to Singapore from a massive expanse of solar panels and wind turbines backed by an international consortium of energy companies. The proposal includes plans for up to 1,200x300 m high wind turbines, which would generate up to 5,000MW, with a further 2,400MW from solar panels.

The hub is backed by CWP Energy Asia that is already a prominent investor in Australian wind farms, privately owned Intercontinental Energy, set up in 2014 to develop large-scale intercontinental renewable energy, both with 45% equity, and Danish wind turbine manufacturer Vestas with 10%. InterContinental Energy managing director Alexander Tancock said the critical step in developing the project was finding the best site. "We spent two years investigating the entire north-west coast of Australia, and found this incredible location," he said. The hub would be located on 6,400 square kilometres of the East Pilbara, according to a proposal lodged with the Environmental Protection Authority. The consortium is targeting a final investment decision in 2020, construction starting three years later and a fully operational project by 2029. They estimate the hub will create 3,000 construction jobs and 400 jobs during operations.



8. Ports Development

Port Hedland has undergone significant growth over recent years with export tonnage throughput increasing to more than 450 mtpa. This growth has transformed the Port of Port Hedland from a small regional port into one of the world's leading ports. Pilbara Port Authority (PPA) recognises the importance of planning for the future growth and development of the port, and in ensuring that there is sufficient land and infrastructure available to accommodate forecast trade and new trade opportunities, including opportunities from non-resources related industries. Projects of significance include the development of Lumsden Point, South West Creek and a multi user Outer Harbour when capacity is reached in the Inner Harbour. Dredging has commenced for Lumsden Point with completion anticipated by early 2019. Expressions of Interest have also been called for the development of the multi user berth and logistics hub.

Port of Dampier is a thriving multi-commodity port with an established supply base capability. This success has resulted in some congestion challenges and infrastructure that is at or near full capacity. Notwithstanding these limitations, there are opportunities for growth in the future including development of a general cargo logistics hub, enhanced supply base and marine services facilities, and expansion of the port's fuel and hydrocarbon importation and landside distribution facilities.

Port of Ashburton will be a multi-user port with an ultimate export capacity of 50 mtpa LNG, export capacity for other hydrocarbon-based products (including value-added processing), capacity for general cargo and fuel, and supply base activities to service offshore operations in the Carnarvon Basin. There are a number of opportunities that can be pursued and infrastructure that can be developed at the port, including the expansion of foundation LNG facilities, a second LNG project, export of processed gas and support for the offshore oil and gas sector and associated support industries.

Port of Anketell will be a multi-user 350+ mtpa bulk commodities export port with capacity for heavy industry exports, general cargo and fuel, and supply base activities to service offshore operations. The future development of the port reflects the State Government's intention that Anketell be developed as a multi-user, multi-commodity port, with a focus on the resources sector while supporting other industries. The proposed Port of Anketell provides

significant opportunities for producers of iron ore and other bulk mineral ores to access port facilities and export their products to international markets, as well as providing opportunities for non-resources related industries. The proposed port has the potential to alleviate pressure on port facilities and infrastructure at the Port of Dampier and offer alternate export solutions to producers in the West Pilbara. This would result in the employment of some 950 persons in its construction phase for a six month period and 150 in the operational phase. During the full construction phase the port project has the capacity to create about 4,000 new jobs and an operational workforce of around 900 personnel will be required. The port will be serviced by the Pilbara towns, especially Karratha, providing further business and development opportunities. It is understood that construction camp facilities are under discussion to "spread the benefits".

Port of Cape Preston East will be a multi-user bulk commodities export port servicing junior miners in the West Pilbara. PPA envisages two stages of development of the proposed Port of Cape Preston East for the export of iron ore and/or other bulk mineral ores. The foundation stage entails the development of port facilities for the export of up to 20 mtpa of iron ore and infrastructure necessary to support export operations. A transshipment system will be used to allow vessel access to deeper waters. The post-foundation stage will allow junior miners to expand facilities at the port to support the export of bulk mineral ores. Detailed descriptions of the land and infrastructure required to support these opportunities, along with concept plans will be presented in the Port of Cape Preston East Port Master Plan.

Port of Balla Balla will be a multi-user bulk commodities export port servicing miners in the East Pilbara. The foundation development will establish port export facilities for 35 mtpa of direct shipping ore and associated support infrastructure including rail, stockyards, conveyors, causeway and a jetty. Subsequent development will support the export of magnetite ore from a nearby mine. To accommodate development beyond the foundation project, land has been set aside to allow junior miners to establish infrastructure for bulk minerals export.





COROSSOL

9. Local Infrastructure Investments

There is ongoing investment and urban revitalisation taking place in the main towns in the Pilbara. Some of the key developments are described below:

KARRATHA

- The State Government committing \$50 million to fund Stage 3 of the Karratha-Tom Price Road, which will provide a vital link between Karratha and Millstream Chichester National Park, and places the **Karratha-Tom Price Road** project a step closer to connecting Karratha and Karijini National Park by sealed road. It will also facilitate Drive In Drive Out for workers on remote mine sites in the area. Completion of Stage 3 and 4 of the road will provide a safer, more efficient route, for residents, visitors and mine workers.
- The expansion of **Nickol West Park**, in Karratha, will enable the popular park to be used for organised sport with dedicated soccer and rugby facilities, and lighting towers. The expansion will also increase amenities with additional barbeques, picnic areas, toilets and walkways to meet the needs of the growing population.
- **The Karratha Foreshore Revitalisation:** Maitland Road Node project is part of the City of Karratha's strategic foreshore management plan to improve recreational facilities for residents and visitors. Shelters, parking, footpaths and improved pedestrian access will activate the popular stretch of coastline and enhance the level of protection for natural vegetation.
- **The Electrical and Instrumentation Training Centre** project involves the construction and fit out of a purpose-built facility at North Regional TAFE's **Karratha Campus** to improve access to training and skills development in the electrical trades with a focus on electrical engineering.
- Completion of the **Red Earth Arts Precinct** and **Karratha Health Campus** thereby, providing very significant community assets in the arts and health sectors for Karratha and its surrounds.
- The possible construction of an **upmarket hotel** in the CBD at a cost of about \$20 million.

PORT HEDLAND

- **Port Hedland International Airport Highway Precinct** development is a 30 hectares (ha) offering large development blocks primarily for storage laydown and maintenance yards for the bulk haulage industry.
- A **marina on the Spoilbank** is a long held vision of the Town of Port Hedland, which is now proceeding. The plan is to provide a high-quality mixed-use waterfront precinct that provides a recreational and entertainment focal point. Funding has been approved to undertake the development of the marina, associated land uses and caravan park. Total funding approved comprises \$112 million from the State Government, and \$40 million from the Town of Port Hedland.
- **Land Developments** including: The former hospital site into a mixed-use 3ha site. Possible development of a 40ha site on Athol Street with the vision is to create a master planned residential and commercial development with the potential to yield up to 700 homes. Possible mixed-use housing estate development on Styles Road. Ongoing revitalisation of the South Hedland Town Centre.
- Potential revitalisation of the **West End** to create an integrated precinct for industry, commercial and recreational usage.
- Whilst the Karratha **Electrical and Instrumentation Training Centre** facility is completed and in use, a feeder facility is being finalised at **TAFE's Pundulmurra Campus** in South Hedland.
- **The Boodarie Strategic Industrial Area** (Boodarie SIA) comprises 4,000ha of 'Strategic Industry' zoned land and is well located close to **Port Hedland** to promote and facilitate the processing of the State's natural resources in the Pilbara region. The estate is traversed by a number of regional services, including the APA Group gas pipeline, North-West Coastal Highway, Water Corporation infrastructure and numerous power-lines.

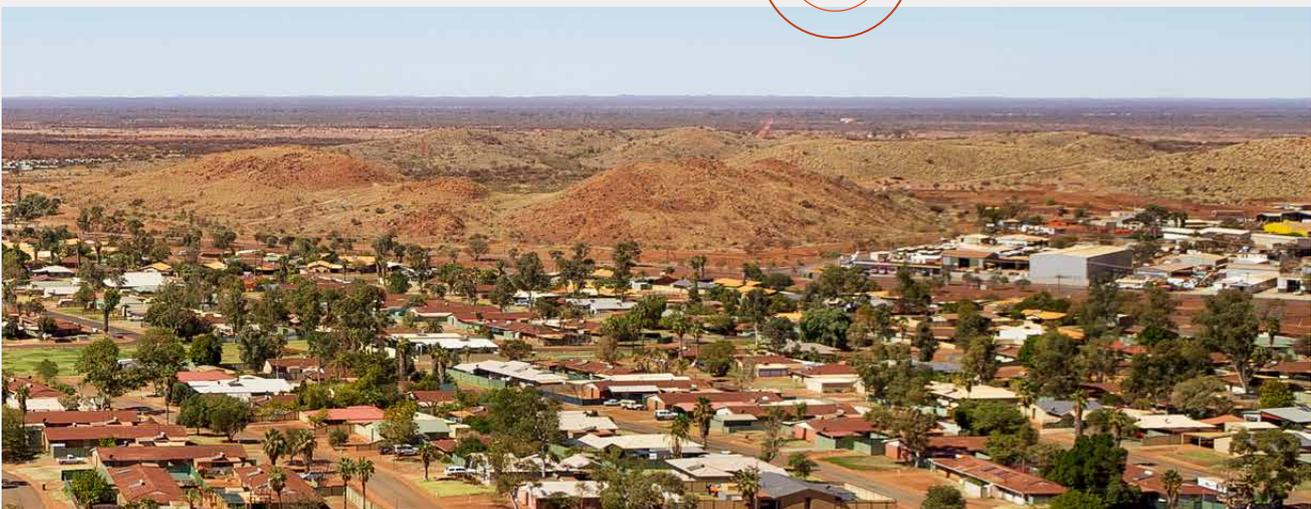
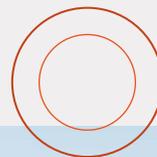
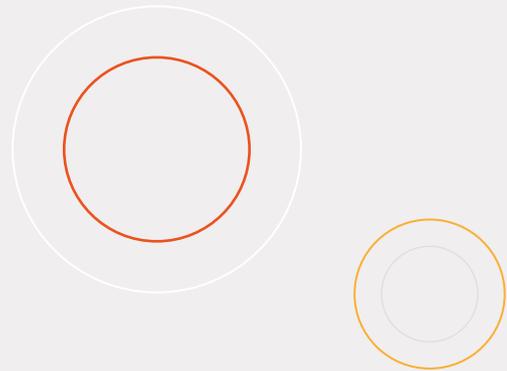


ONSLOW

- The **Ian Blair Memorial Boardwalk** stretches for a kilometre along the Onslow coastline through natural vegetation. The refurbishment project will replace aging timber boards with more durable plastic composite material as well as see the installation of a series of interpretive signage, which will share modern and historical stories of Onslow.
- The development of the **Ashburton North Strategic Industrial Area**, which will centre on the processing of LNG from offshore gas reserves, is set to have a significant impact on the town of Onslow and will provide the drive for a vibrant and sustainable future. Significant financial commitments from Chevron, BHP Billiton Ltd and the Western Australian Government are going towards ensuring Onslow develops into an attractive and well-serviced town. These contributions will deliver long term benefits to the Onslow community and help cater for the town's expected growth.
- **Planned new and upgraded infrastructure and services** will include:
 - new power station;
 - new desalination plant and upgraded water supply infrastructure;
 - new Shire of Ashburton administration centre that will include a town hall, council chamber, visitor centre and library;
 - new waste management facility and an upgraded wastewater facility;
 - the construction of a new Onslow hospital, which will better meet the town's increasing health service needs;
 - upgrades to Onslow Road, the main road into Onslow;
 - new Onslow airport, including runway, terminal and general landside facilities; and
 - new recreational facilities, including an outdoor basketball complex, skate park and swimming pool.

NEWMAN

- The **Newman Aquatic Centre Redevelopment** Plans project aims to improve sports and recreation will improve, maintain and enhance the quality of life of people in the East Pilbara.
- The **Newman Town Square** is a revitalisation of Newman's Town Centre continues with the construction of the new town square. In addition to the improved lifestyle amenities the new town square will provide local and visiting businesses access to pop-up retail and office spaces in the new business incubator facility. Royalties for Regions under the State Governments Pilbara Cities initiative is funding the \$40 million revitalisation project.



10. Aquaculture and Agriculture Investments

The Pilbara Rock Oyster Research and Development Project is intended to develop a commercial oyster industry in the region. The project will establish an oyster farm at Flying Foam Passage on the Burrup Peninsula, with the aim of producing up to 12,000 oysters during a two-year trial.

The Pilbara Hinterland Agricultural Development Initiative for desert irrigation for the East Pilbara focuses on the feasibility of agricultural production based on mine dewatering and groundwater. The WA Department of Primary Industries and Regional Development (DPIRD) is planning for the future of irrigated agriculture development in the Pilbara through the \$12.5 million Pilbara Hinterland Agricultural Development Initiative (PHADI). Irrigated agriculture has the potential to expand the economic base of the Pilbara and attract major capital investment. However, the feasibility of this potential opportunity needs to be better understood. A range of pre-feasibility reports has been published by the DPIRD.

Related to the above irrigation opportunities is the development of the Pilbara beef industry using irrigated fodder. This is currently being led by Pardoo Beef Corporation, which is focusing on high-value beef and aims to develop a major industry over the next decade at a cost of \$200 million.

A feasibility study for a Sahara Forest Project for a proposed horticulture and renewable energy scheme has indicated that a pilot 6ha of land could be developed adjacent to the Karratha airport with a capital cost of \$16 million investment. At the larger end of the scale, a 60ha project with a 20ha greenhouse at an indicative cost \$143 million of could be developed and would employ as many as 200 people. A full business case is planned to assess viability.





Abbreviations

ASX	Australian Securities Exchange
BBIG	Balla Balla Infrastructure Group
CBD	Central Business District
DPIRD	Department of Primary Industry and Regional Development
EU	European Union
FID	Final Investment Decision
FLNG	Floating liquefied natural gas
FMG	Fortescue Metals Group
FOB	Free-on-board
GDP	Gross domestic product
HVDC	High voltage direct current
IMF	International Monetary Fund
IMO	International Maritime Organisation
JCC	Japan customs-cleared crude
LNG	Liquefied Natural Gas
MOU	Memorandum of Understanding
NGO	Non-Government Organisation
NWS	North West Shelf Joint Venture
PEPL	Pilbara Energy Pipeline
PHADI	Pilbara Hinterland Agricultural Development Initiative
PPA	Pilbara Port Authority
SIA	Strategic Industrial Area
SME	Small and medium sized enterprises
TAN	Technical ammonium nitrate
USA	United States of America
WA	Western Australia
YPFPL	Yara Pilbara Fertilisers Pty Ltd

TERMS OF MEASUREMENT

A\$	Australian dollar
dmt	dry metric tonne
ha	hectare/s
mmbtu	million British thermal units
mtpa	million tonnes per annum
MW	megawatts
tpa	tonnes per annum
US\$	United States of America dollar

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Acknowledgements

RDA Pilbara would like to acknowledge Imani Development Austral Pty Ltd and thank them for the research and consultation involved in developing this Annex and the Cost of Doing Business in the Pilbara Reports and Turner Design for the layout design and presentation of the document.

