19 December 2011

Mr Tyson Self
Manager Access Projects
Economic Regulation Authority
PO Box 8469
PERTH BC WA 6849

Dear Mr Self

MID WEST ENERGY NFIT

Thank you for the opportunity to comment on the Draft Determination on Western Power's application for a New Facilities Investment Test (NFIT) for the Mid West Energy Project (Southern Section).

This is a critical piece of enabling infrastructure for the Mid West which is poised to become Australia's next iron ore province, with a project investment pipeline of more than $10 billion. CME's strong view is that an augmented electricity network for the Mid West will deliver significant economic returns to the Mid West and the State, and represents an important government investment.

CME has serious concerns that the protracted process for the approval of this project – a critical piece of enabling infrastructure – is undermining this enormous potential. We hope that the regulatory requirements for this project can be met and construction can begin as soon as possible.

CME and the Resources Sector

CME is the peak resources sector representative body in Western Australia funded by its member companies who generate 95 per cent of all mineral and energy production and employ 80 per cent of the resources sector workforce in the State.

The Western Australian resources sector is diverse and complex covering exploration, processing, downstream value adding and refining of over 50 different types of mineral and energy resources. The sector plays a significant role in locating, analysing, and developing water resources in regional and remote areas.

In 2010-11, the value of Western Australia's mineral and petroleum production reached $101 billion, and accounted for 95 per cent of Western Australia's total merchandise exports and 41 per cent of Australian merchandise exports. Furthermore, royalty payments to the state government totalled $4.8 billion for the 2010-11 year.

The prospects for future growth are strong, with $1.59 billion invested in minerals exploration in Western Australia in 2010-11, accounting for 54 per cent of total national investment. This exploration is translating into significant further development, with the value of resource projects either committed or under construction at $138 billion.

The Mid West and Resource Sector Growth

The Mid West is an established mining region, with a long history of producing gold, copper, mineral sands and nickel. In 2010-11, the value of resources production in the region was $2.679 billion, with gold making the largest contribution at $763 million, followed by iron ore at $677 million. With more than $10 billion in capital investment planned for the region, principally in magnetite iron ore projects but also in uranium and other commodities, this figure is set to grow substantially in the coming years – generating jobs for Western Australians and royalties for the State.

A key responsibility of government is ensuring that infrastructure planning and investment is commensurate with the pace and the cumulative impact of development. CME recognises that in meeting this obligation government must have close regard to risk – particularly in the context of investment in capital assets, such as electricity networks, which deliver significant new capacity which may not be fully utilised in the immediate term.

It is therefore important to note that CME is receiving consistent feedback from member companies and other stakeholders that the region's electricity network not only represents a constraint on future growth given the electricity needs of magnetite iron ore operations, but is also inadequate for current needs, with major reliability concerns (particularly during periods of hot weather). The Western Australian Planning Commission (WAPC) has also made this point in its draft Mid West Regional and Infrastructure Framework, where it characterises the electricity network as 'severely constrained'.

CME recently commissioned WorleyParsons to undertake an assessment of the infrastructure requirements of the Mid West in light of resource sector developments. This report highlighted the resource sector's ongoing and real commitment to the Mid West and the strong international support for the projects. Indeed it found that while the Global Financial Crisis may have contributed to a perception of uncertainty about the projects, and led to a drop in impetus in addressing the region's infrastructure needs, the projects continue to make strong progress towards becoming operational.

This will translate into a step change in the level of economic activity in the Mid West and a significant increase in energy demand. This is supported by the forecasts contained in CME's State Growth Outlook, released in April 2011, which found that upcoming minerals and energy projects in the Mid West are likely to require approximately 0.8 GW of additional electricity by 2015. This incremental demand represents over an order of magnitude greater than the current electricity demand in the region and highlights the need for an expanded electricity network which draws on the generating capacity and associated efficiencies of the South West Interconnected System (SWIS).

CME would also hope that the indirect benefits that the Mid West Energy Project will deliver, its status as a State-building initiative, and the inter-relationship between the delivery of this project and decisions about private sector investment is recognised in the regulatory and government processes.

We would be pleased to provide any further information or meet with the ERA to discuss the Mid West Energy Project. Jessica Martin, Project Officer Infrastructure, is managing this matter and can be contacted by telephone on 08 9220 8527 or email at j.martin@cmewa.com.

Yours sincerely

[redacted]

Reg Howard-Smith
Chief Executive

WorleyParsons
resources & energy

EcoNomics

CHAMBER OF MINERALS AND ENERGY/GERALDTON IRON ORE ALLIANCE

MID WEST REGION INFRASTRUCTURE

A RESOURCES INDUSTRY VIEWPOINT

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17-Dec-10

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PROJECT 301012-01240-EO37 - MID WEST REGION INFRASTRUCTURE

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	P Frewer	M Anderson	N/A	02-Nov-2010	N/A	
B	Issued for Client review	P Frewer	M Anderson	N/A	22-Nov-2010		N/A

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EXECUTIVE SUMMARY

This report examines the future infrastructure needs of The Mid West Region of Western Australia.

The report presents an industry viewpoint on these future infrastructure needs. It examines regional growth drivers and comments on the need for a more comprehensive approach to predicting growth. The report describes and summarizes key studies and presents the key requirements of projects in the region and timing.

The first section of the report is an overview of the region, its growth drivers and, in particular, comments on the population forecasts which have been traditionally used to "predict and provide" infrastructure and related planning needs. The report argues that these models are not valid for growing resource regions. This section also has a summary of the operational and construction workforces of major projects.

The second section briefly describes and summarizes the major resources projects in the region. These projects have been extensively documented in a number of other reports. There is a summary of the nature and timing of these projects and how they will affect future infrastructure demand and provision.

The third section of the report makes recommendations on the resources sectors strategic priorities on infrastructure provision in the Mid West region.

The fourth section details the nature extent and timing of specific infrastructure to support major iron ore projects in the region.

SUMMARY OF MAJOR PRIORITIES

General

- The Western Australian Planning Commission should maintain an up to date database of committed and emerging projects and their respective construction and operational workforces in the Mid West Region to ensure that aggregate demand for local and regional services is established.
- The development of FIFO project workforces should be included in planning for future infrastructure.
- A social impact assessment should be undertaken of the cumulative impact of these workforces on the region, identify local economic development opportunities and any regional synergies.

- A joint Industry/ Government forum should be established to meet on a regular basis and monitor the progress and implications of major project development in the Mid West.
- There is need for an integrated project management approach to be taken to ensure the coordination of delivery of these projects between government and industry
- Oakajee Port
- Finalise approvals and planning of the port area
- Finalise planning, acquisition and development of the port access corridors including northern rail line to Jack Hills, Oakajee to Narngulu stages 1 and 2 and extend to Rudds Gully Road
- Secure the budget for land acquisition and compensation for transport and infrastructure corridors
- Develop a transition plan for the migration of port operations and throughput from Geraldton to Oakajee port
- Commence feasibility studies and associated planning for Stage 2 expansion of Oakajee port to 100mtpa throughput as soon as possible
- Industrial land at Oakajee port has been identified for Port related uses is supported. Identify land for general cargo handling and storage as well as a fuel farm with appropriate access and buffers.
- Finalise water, wastewater and power and other servicing needs of the port and provide relevant infrastructure
- Develop the regional road network to ensure safe and efficient access to North West Coastal highway

Geraldton Port

- Continue and expand annual funding for maintenance dredging of the harbour basin and channel from $2.5m to $5.0m
- Prepare a five year dredging program and spoil disposal plan
- Improve power capacity at the port to allow for planned increased throughput tonnages
- A staged master plan for the port should be developed which addresses the following :
  - The extension of the northern breakwater to reduce wave refraction into the harbour basin and improve usage of Berth 1
  - Consideration of Berth 6 being lengthened to provide berths for 2 Panamax size vessels
  - Upgrading of the current ship loader
  - Upgrading of rail and train unloading facilities in the port to enable improved throughput

  - Future piloting and port related services
  - Transitional arrangements to Oakajee port.
  - Rail

- Finalise the rail network planning for northern and southern rail lines
- Expedite rail corridor definition and land acquisition in proximity to Oakajee port including the Oakajee to Narngulu corridor
- Ensure rail planning considers the potential expansion of existing projects and new projects, including those emerging in the Yilgarn which may require access to Oakajee Port
- Ensure that consideration of land requirements for rail corridors includes the need for future passing loops and related infrastructure.
- Ascertain future rail transport needs of emerging projects
- Consider the establishment of a supply hub at Weld Range for operational supplies
  - Roads
- Regional Roads Development Strategy 2007 should be reviewed and updated to take in account increased resources project activity across the region and associated travel demand from direct and indirect traffic
- The planning, design and development schedules for major road infrastructure to service Oakajee and surrounding areas including Oakajee Narngulu Infrastructure Corridor needs to be reviewed to ensure timely and coordinated delivery to support the port operations
- Roads in the southern area servicing current iron ore production areas should be monitored for increased traffic and managed
- Evaluation of future high wide load demand around Geraldton and Oakajee Ports should be made and incorporated into future road planning
- Major highway routes should be monitored for increased inter-regional and sub-regional traffic to ensure road capacity is maintained and enhanced
- Energy
- Develop, in consultation with industry, a Mid West Region Energy Strategy including future demand and supply for electricity, gas, renewable energy and demand management
- Expedite the final approvals for the Perth- Eneabba 330kV powerline and associated infrastructure
- Expedite the process to secure approvals for the 330kV powerline extension to Geraldton and associated infrastructure

- Develop a strategy for the import, storage and distribution of fuel for major projects in the region
- Integrate energy corridors into planning for other services at Oakajee including Oakajee to Narngulu
- Water
- The Mid West Regional Water Plan should be commenced as a matter of urgency. Industry should be engaged during this process.
- Consideration should be given in future water allocation plans to establishing priority for high value water uses such as minerals processing
- A water trading regime for the region should be formalized in areas where there may be constraints on water allocation from existing sources or current allocation limits are near or fully allocated.
- The exploration and identification of future viable water resources should be expedited
- Planning for future water pipeline easements should be undertaken at a strategic level to identify any possible synergies with other infrastructure including power lines.
- Public drinking water supplies for town sites should be carefully monitored as growth in demand occurs from residential and workers accommodation
- Industrial Land
- Ensure all planning and development requirements for Oakajee Industrial area are finalised
- Planning for the importation and storage of construction and operational needs of resource projects should be undertaken as matter of priority. A dedicated area with suitable buffer requirements should be identified
- Industrial land demand in regional towns in proximity of resource projects should be monitored. Planning and development requirements should be addressed to ensure proactive land supply.
- Monitor the emergence of large science and technology projects in the region to ensure land is available to support these types of industries

Square Kilometre Array

- Undertake a comprehensive and independent environmental, social and economic impact study to describe, evaluate and justify the radio quiet zone, assess its impacts and develop management strategies
- Management and mitigation strategies should identify where costs and benefits accrue and how costs will be allocated. The above study should incorporate community consultation including the mining and pastoral industry, indigenous communities and local government.

1. BACKGROUND AND INTRODUCTION

The Mid West region of Western Australia is experiencing significant growth pressures from a number of existing and future resources and energy projects in the region. The emergence of the Mid West as a major minerals and energy province has been in a number of phases but in recent years the demand from international markets for iron ore and other minerals has rapidly escalated. Currently there are over $12billion worth of projects being planned in the region. In turn these projects will generate thousands of jobs during both the construction and operational phases.

The report originated from a request by the Geraldton Iron Ore Alliance (GIOA) and the Chamber for Minerals and Energy WA (CME) to review the future infrastructure needs of the Mid West region based on the outlook for the minerals and resources sector. The report will examine the current state of infrastructure projects in the region and private, State and Federal government funding for these projects.

The report also makes some strategic recommendations about planning and development for infrastructure in the region. It advocates a proactive approach to the region's planning rather than a reactive approach. Successful regional development is based on a strong and clear commitment to planning and more importantly its implementation. Planning also needs to be an inclusive process whereby all parties are in broad consensus as to the nature, scale and trajectory of the region's development, how its impacts will be managed and a clear action plan for implementation.

The brief for this report evolved from the circulation by the Western Australian Planning Commission of a table of potential infrastructure projects for the Mid West. Although the table is quite lengthy it needs to address the current drivers of growth in the Mid West region and represent the full picture of the current drivers of industry in the region. As an input to the review GIOA and CME want to ensure the resources and energy sector views on infrastructure needs are clearly stated.

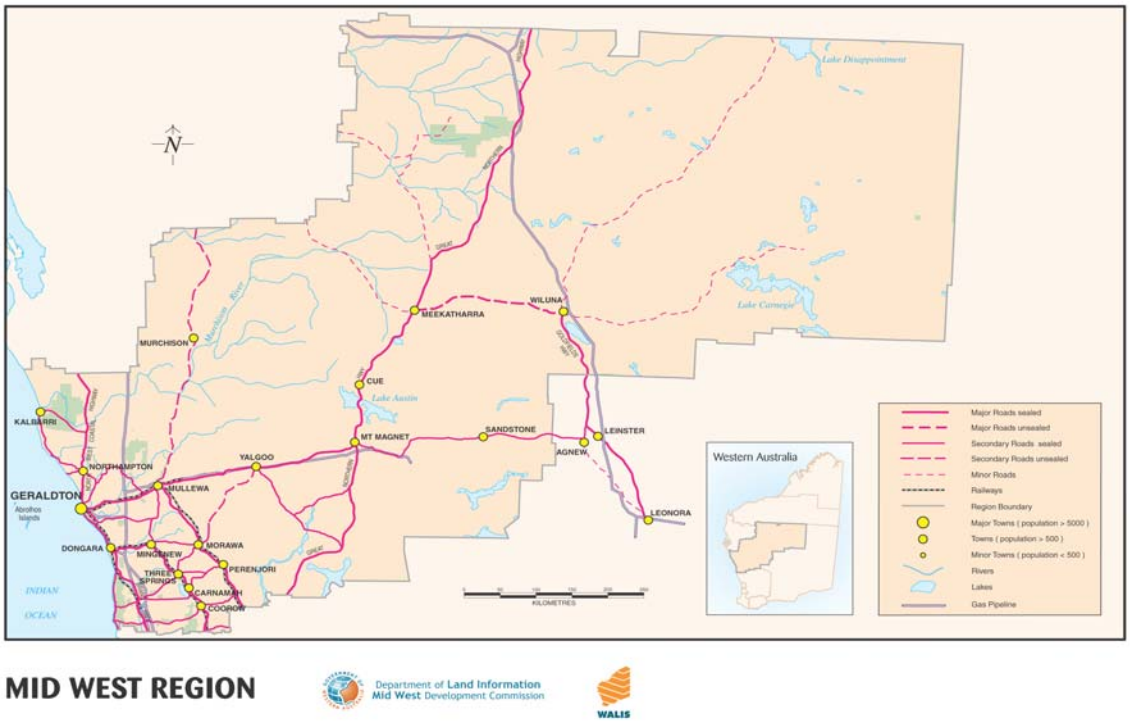
1.1 The Mid West Region – current situation

The Mid West of Western Australia is a large region covering 20% of the State (nearly 500,000 sq kms) It consists of 18 local government areas from the coast to the eastern boundary of the Shire of Wiluna, a distance of over 1000 kms. The major centre is Geraldton/Greenough with smaller rural service centres concentrated in the SW of the region. Freehold agricultural land is located along the higher rainfall areas along the coast and inland for approximately 100-150kms. The inland areas are mainly leasehold pastoral land or crown land of varying tenures and have a few small towns. Land use intensity generally decreases from the southwest of the region to the north east.

In 2006 census the total regional population was 51855 (ABS statistics). The 2009 Estimated Residential Population (ERP) by ABS was 54984 giving an approximate regional population density of

1 person per 10 square kilometers. In 2009 the main centre of Geraldton/Greenough had an ERP of 37895 or 69% of total region. This centre is currently experiencing an annual growth rate of approximately 2%.

However, growth has been sporadic and only 5 local governments in the region had population growth in the 2001-2006 census period (only 4 from 1998-2008). Inland towns are very dispersed with small populations and limited infrastructure. Twelve local governments out of 18 in the region have less than 1000 population and two local governments have the smallest populations in WA – Murchison 111 and Sandstone 133 residents.



Map 1 Mid West Region

(Source: Mid West Development Commission)

Economic activity in the region has traditionally been based on rural production including wheat, wool and cattle as well as minerals. Western Australia's first railway was built from Northampton to Geraldton in the 1860's to transport lead from mines at Ajana. Iron Ore was also mined and exported from the Koolanooka area in the 1960's for a limited period.

Although recently there has been a focus on the iron ore industry in the Mid West region, there are other significant minerals products in the region. These include gold, copper, mineral sands processing and nickel. There is an emerging uranium industry in the far west of the region around

Wiluna. Gold production is, in fact, more valuable to the region on most recent (2009-10) Department of Minerals and Energy statistics, but is expected to be overtaken by iron ore in the next few years. (See Table 1 and Appendix 1)

Table 1 Mid West Region value of mineral production 2008-9

Gold	781,368,623
Iron ore **	388,664,693
Copper, Lead and Zinc	386,253,828
Heavy Mineral Sands, Chromite	264,276,243
Nickel and Cobalt	203,705,215
Construction Materials, Talc and other	124,431,528
Crude Oil and Condensate	61,745,299
Silver	43,657,987
Natural Gas	26,106,812
Total	2,280,210,228

**NOTE Iron ore increased in value from $190m in 2007-08

(Source: Department of Mines and Petroleum Mineral Statistics)

Iron ore is also important from an infrastructure point of view in that it is a high bulk relatively low value (per tonne) product. It requires a substantial transport infrastructure to move the product from minesite to port. Added to this, much of the iron ore resource in the Mid West region is magnetite rather than hematite. Hematite is also referred to as direct shipping ore as it requires only physical crushing, screening and where necessary, a blending process. Magnetite on the other hand requires a conversion process which needs substantial amounts of water and power to produce a saleable product. This product is also a high bulk commodity which requires significant infrastructure to support its production and export.

By comparison gold and uranium are high value, low bulk commodities which generate relatively small transport demands.

1.2 Major Iron Ore projects

- The previous sections highlight the growth drivers and planning of infrastructure in the Mid West region. Current major project development can be seen in four phases in the region.

- The first phase is the current and committed projects using Geraldton Port. These are Mt Gibson Iron (Tallering Peak), Sinosteel MidWest (Koolanooka), Gindalbie (Karara) and Crosslands (Jack Hills). Currently these projects account for 5.3 million tonnes of iron ore exports. Mt Gibson's Extension Hill hematite project is well advanced with exports due in 2011. Asia Iron Extension Hill magnetite project is also due to commence operations in 2013.
- The second phase will involve the foundation customers of Oakajee Port which will establish at the port when port operations are due to commence in 2014. These projects are Crosslands (Jack Hills Expansion), Gindalbie (Karara) and Sinosteel MidWest (Weld Range).
- The third phase will involve expansion of existing projects and some new projects from 2013/4-2017. These include Crosslands (Jack Hills), Golden West Resources (Wiluna West) and Asia Iron Extension Hill expansion. These projects will utilise both Geraldton and Oakajee Ports.
- The fourth phase is longer term projects which are still mainly in the exploration phase. These include Sinosteel MidWest (Jack Hills/Koolanooka Magnetite) and Crosslands (Weld Range).
- Each of these projects will have its own distinct supply chain and infrastructure needs. The supply chains for these projects involve both imports of materials required in the production process as well as exports of processed minerals. Planning for these projects needs to incorporate a cumulative view of the supply chains as well as a single project perspective.

Map 2 Major iron ore projects in the Mid West region

(Source: GIOA)

In a geographical sense there is a group of southern iron ore projects which are located to the east and south east of Geraldton. These projects are generally closer to the existing and future port infrastructure, road and rail. The infrastructure requirements of these projects build on and link into existing road and rail networks although there is still substantial private investment required. The second group is located to the north east of Geraldton and are more remote from the coast. Public infrastructure in this area is generally very poor and projects rely on private (project level) infrastructure. Of note at present is the upgraded road constructed by Crosslands from their project area at Jack Hills to Cue.

1.3 Other Mid West potential projects

Apart from the major iron ore projects, there are a number of other minerals which are have mining potential. These are listed in Appendix 1.

1.4 Mid West – future forecast population and workforce growth

The population of the Mid West region is currently forecast by the WAPC to grow quite slowly. The major growth area is seen as the coastal fringe in particular Geraldton.

Current population growth is forecast to grow from 52000 to 68000 in 2030. This gives an annual average growth rate of just over 1 percent (see Figure 1). New figures based on the 2006 census are due to be released in the near future. However, given the inherently low rate of increase in natural population growth it is anticipated these projections will not change significantly.

A recent industry report 'State Growth Outlook' by the CME was based on industry's views of its future requirements for people, water and energy across Western Australia. The figures were disaggregated to a regional level and give a snapshot of future resource industry workforce requirements using 2009 as a base (see Figure 2).

The CME report states:

> *Total projected additional population in the Mid West driven by the minerals and energy sector (direct, indirect and family) is forecast to increase by 8,000 by 2014*.
>
> *Additional minerals and energy sector direct employment is forecast by to grow by 5,800 by 2014 over 2007 requirements, 70% of which is expected to be FIFO, primarily sourced from the Perth-Peel region.*

The report also identifies construction and operational regional workforce demand of between 6-7000 above 2007 levels. These figures can be regarded a conservative as the survey did not cover all projects in the region. These figures are currently being updated and should be available in early 2011.

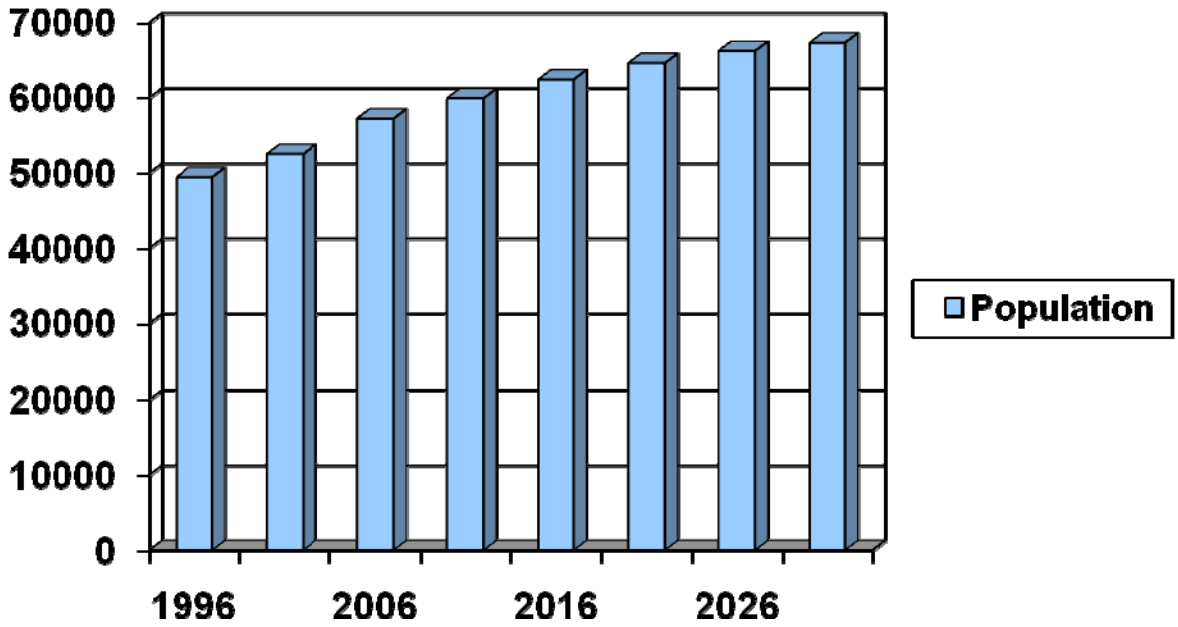


Figure 1 Population projections for the Mid West region

(Source WAPC WA Tomorrow)

Another recent report for GIOA by ECS (October 2010) has proposed a new set of workforce projections. These figures include construction as well as operations workforce. The figures project to 2030 and indicate a maximum of nearly 8000 construction workforce in the region in 2012-13 and an operations workforce of 4500 in 2020 and 6400 by 2025. Again these figures may be conservative because they only relate to iron ore projects (see Figure 2 and Figure 3).

The CME and ECS figures are quite close in the quantum of growth they are predicting. This gives a relatively high degree of validation and confidence to the figures as the basis of future forecasts.

Figure 2 Mid West Region: Total Construction Workforce (source: ECS 2010)

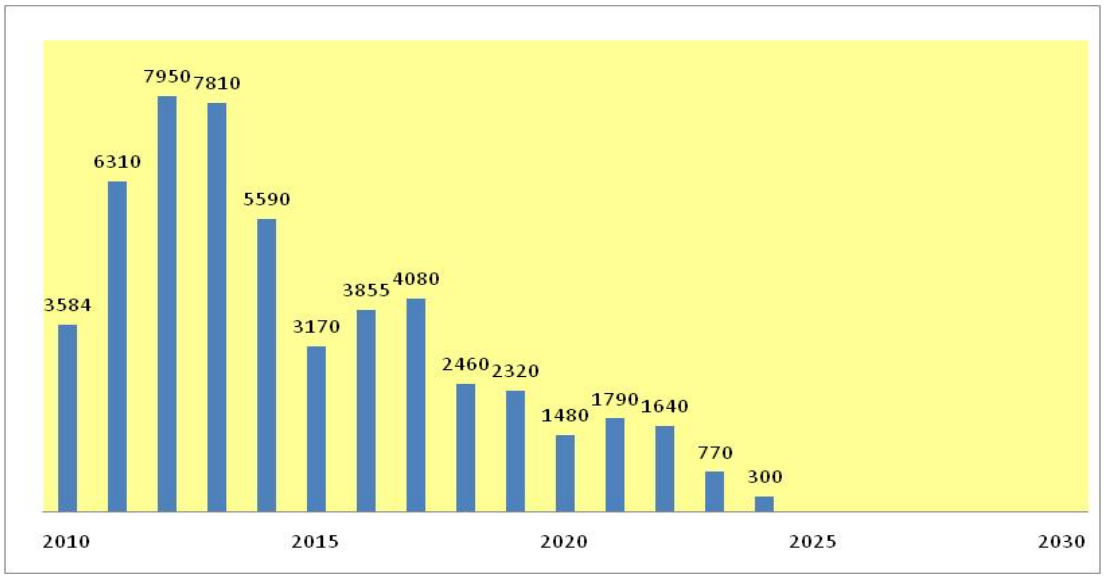
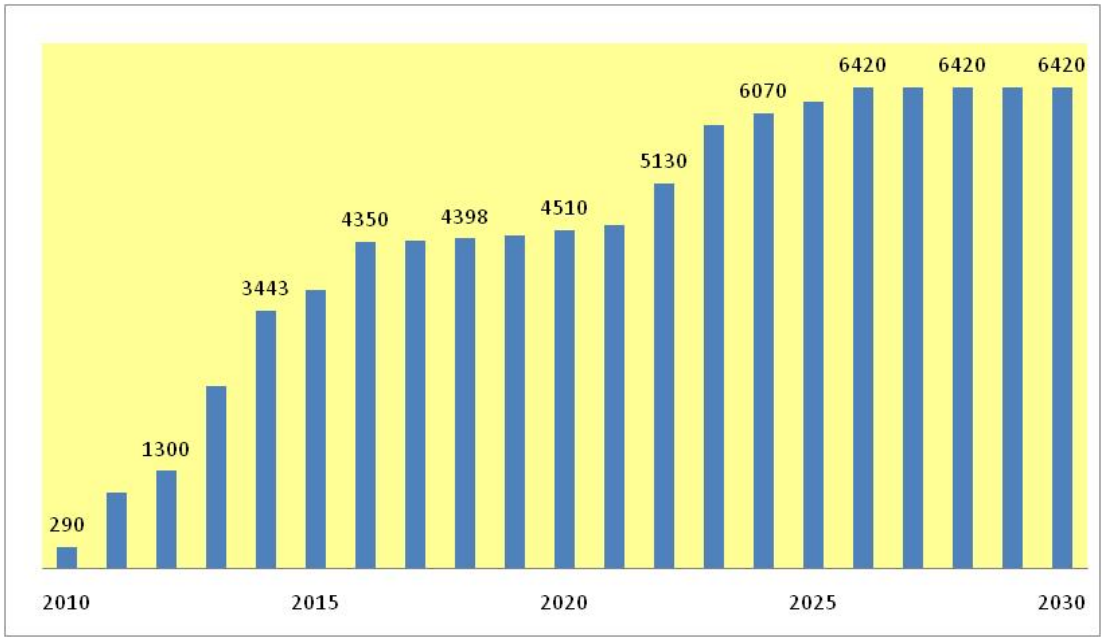


Figure 3 Mid West Region: Total Operations Workforce – Iron Ore projects (source: ECS 2010)



As part of this project interviews were undertaken with most major companies and the following construction and operational workforce of individual projects and their year of requirement were identified. This table assumes that Oakajee port and rail will be operational by 2014.

Table 2 Major Mid West projects operational and construction workforce needs

Company/Project	Construction Workforce	Year/s	Operational Workforce	Year
Sinosteel Midwest Corporation				
Koolanooka/Blue Hills (Hematite)	Complete	2009	100	current
Koolanooka (Magnetite)	2000	2018-2020	1000	2020*
Weld Range	1000	2012-14	700	2014
Jack Hills	400	2018-2020	150	2020*
Robinson Range	400	2015-17	150	2017
Crosslands				
Jack Hills	complete	2006	330	current
Jack Hills Stage 2 Expansion	2500	2012-14	870	2014
Weld Range	tbd			
Gindalbie Metals Ltd				
Karara	1500	2008-2011	400	2011

Golden West Resources Ltd Wiluna West	 80+contractors	 2011-13	80 400	2011-13 2014
Asia Iron Holdings Extension Hill	 2000	 2011-2013	 650	 2013
Mt Gibson Iron Tallering Peak Extension Hill	 Complete 150	 2010-2011	 150 100	 Ongoing 2011

From the above figures it can be seen that the use of traditional demographic models do not readily give an understanding of the nature of regional population and workforce. This is a fundamentally important point as these figures are frequently used by Government to justify infrastructure demand and investment. They may be appropriate when predicting townsite resident populations but they do not give an accurate indication of aggregate regional demand for services including transport and social infrastructure from overall numbers of people on the region.

Although fly in/fly out (FIFO) is a dominant source of labour supply, it is the nature of the FIFO which can vary in its origin and destination. For instance, although Perth will be the dominant source of FIFO workforce there will be some FIFO (and drive in drive out) from regional centres such as Geraldton and hence are part of the regional workforce. The location of workers accommodation is also important as there are proposals for both remote workers accommodation which are relatively self contained as well as accommodation which will located in the proximity of, or within, existing townsites. The latter form is becoming more common as mining companies work with local government on stimulating local towns and economies in both the Mid West and the Pilbara. These extensions to townsites should also be taken into account in structure planning, zoning proposals and infrastructure demand.

Many companies have also made commitments to local employment, including indigenous workforce programs, as part of their development planning. There are also indirect regional employment benefits from local purchasing preference policies made by companies in the region.

The numbers of workers related to both construction and workforce will also be greater than the resident population of most of the local government areas in which the projects are operating. These areas have low levels of capability and local infrastructure to absorb even low levels of growth.

Overall there should be consideration of a social impact assessment of the cumulative regional impacts of planned and projected growth to identify social infrastructure needs and local opportunities for economic development.

1.5 Conclusions

1. The Western Australian Planning Commission should maintain an up to date database of committed and emerging projects and their respective construction and operational workforces in the Mid West Region to ensure that aggregate demand for local and regional services is established. These figures should supplement the population projections made by the WAPC. The revised and updated data from the State Growth Outlook study by the Chamber of Minerals and Energy will be available in early 2011.

2. The development of FIFO project workforces should be included in planning for future infrastructure. A social impact assessment should be undertaken of the cumulative impact of these workforces on the region identify local economic development opportunities and any regional synergies.

2. REGIONAL INFRASTRUCTURE PRIORITIES

There are number of studies which address the future infrastructure requirements of the Mid West region. These studies take either a comprehensive or sectoral view of the region and provide good baseline information. However, many of these documents are now dated because of the rate of existing and planned change and development which has occurred since they were compiled.

2.1 Mid West Infrastructure Analysis WAPC 2008

The report is an extensive review of future infrastructure needs for the Mid West. It includes an extensive schedule for the provision of infrastructure to support the region's growth which is currently being reviewed by the WAPC Mid West Region Planning Committee.

The scope of the report covers:

- **transport**: public transport, aviation, ports and roads;
- **water**: potable supply and distribution, alternative sources and sewerage;
- **energy**: electricity distribution, alternative generation, gas supply and distribution and policy factors;
- **communications**: telecommunications, policy issues, ie broadband network;
- **social and community**: health, education, social services, housing and community infrastructure;
- **land supply**: industrial and residential land supply; and
- **settlement**: settlement capacity and revitalisation.

The report raises some key issues:

1. Heavy rail transport is critical for some large mining projects and the development of a robust rail network will be instrumental to the prosperity of current and future resource projects

2. Establishment of rail and infrastructure corridors, including detailed alignment planning, land acquisition and assembly

3. Future water supply and associated infrastructure requirements for the hematite and magnetite projects are uncertain

4. Power supply has been identified as inadequate by several local government authorities. This has the potential to act as an impediment to additional growth and development without ongoing attention

5. Parts of the road network throughout the region require upgrades based on current condition and with ongoing and increased numbers of heavy vehicles, this will be exacerbated

6. Uncertainty regarding the full scale of resource operations, and actual population growth rates, means that the demonstrated need for government investment will remain a contentious issue

7. Strategic planning support has not kept pace with the increased volume of statutory planning applications

8. A number of inland towns have declining populations and are hoping to gain economic growth as a spin-off from resource development in the region. It is not clear how growth in this sector will influence these towns.(p vii)

With regard to public/private infrastructure the report says:

"There is mounting need for the Mid-West infrastructure solution to be managed and implemented using methodologies which integrate both private and public contribution."(p vi)

The report goes on to make the following observation on planning and infrastructure provision:

"*A more realistic medium-term development projection would be to ensure that the existing core transport infrastructure, particularly rail*, *roads, port, and social infrastructure, are upgraded and maintained, and further strategic planning for the urban and industrial growth is undertaken. It is also recommended that processes to acquire land for necessary infrastructure corridors proceed as a priority."(emphasis added)*

Industry response and comment

- The report is a comprehensive review of the region's infrastructure needs and is generally well written and presented and is to be commended. Similarly the WAPC and Department of Planning's recent commitment to update the document is strongly supported.The observations and sentiments made in the introduction of the report regarding project uncertainty were justified at the time of publication (2008) when a number of Mid West projects were less advanced than they are today. The intervening period in 2008/9 when the Global Financial Crisis occurred probably reinforced the perception of uncertainty of these projects and may have contributed to a drop in impetus in addressing the region's infrastructure needs. However, the economic recovery and pace of projects proceeding is now much more rapid than envisaged pre -GFC. The issue is that there is a need for planning and development to be

commensurate with the pace of change and the cumulative impact of this change. However, in the Mid West region industry has demonstrated an ongoing and real commitment to project development which is robust. International support for these projects has been demonstrated for several years and remains strong. In turn this gives an increasing level of confidence that projects will develop. It is important that planning for these projects retains its impetus.

- It is acknowledged that not all projects will occur at the planned time and stages which are originally envisaged. The real cost of planning is quite low when compared to the very high opportunity cost of not being ready for future growth and development in the region. Planning processes are part of company timelines for gaining approvals and are part of a project's critical path. It is essential that timely delivery of planning outcomes match critical paths of major projects.
- The planning requirements and lead time for major infrastructure and development is usually about 5 years. As such the timelines proposed in the report for the planning and delivery of infrastructure to support these projects are now substantially behind the schedules proposed in 2008.
- Although work is proceeding on the provision of major corridors for future infrastructure they are not finalised and the future planning and acquisition requirements are substantially behind the original schedule. There is a need to ensure that the planning and development for growth in the Mid West is properly resourced.
- The issues which require attention such as power, water, transport and land planning and acquisition are still far from resolved. This relates to some individual projects and planned expansions as well as the cumulative regional impact.
- Many projects have refined their future workforce needs in the construction as well as operations phase. These should provide a firmer basis for planning for the growth. The issue is that much of the labour force will be provided through fly in/fly out operations from the Perth Metropolitan area as well as drive in/drive out from within the region. The southern group of projects which are closer to the main population centres of Geraldton/ Greenough and coastal towns are more likely to use regional based workforce.
- Regardless it is important to recognise that the traditional demographic models of births/deaths, in migration/ out migration used in urban population modelling do not generally apply in regions which are experiencing rapid resource project growth (see section 2).
- A typical project cycle will occur generally in three phases.
- Exploration phase with up to 100/200 employees on site.
- Construction phase with up to 2000 employees on site. If the project involves major linear infrastructure, these employees can be spread over many work sites for hundreds of kilometres.

- Operational workforce of about 500-1000. These can also be spread from minesite to port depending on the nature of the operations.
- In turn these staged workforces place demand on regional infrastructure. They demand housing and accommodation, water, power and are major users of the transport network both for work related and other trips. Underestimating these requirements could lead to problems in the provision of these basic regional development needs.
- One area which has been overlooked in the development of projects is the ongoing operational needs of projects once construction has concluded. These include power and maintenance needs of the plant such as fuel and equipment for processing plants which can put thousands of tonnes of goods onto the transport system every year, as well as the day to day supplies for workers accommodation such as food, laundry and other consumables. Each project has supply chains which rely on the timely and efficient supply of goods and services to minesites which require transport access. The cumulative impacts of these supply chains on the port, road and rail system need to be clearly established and planned for. For instance one mid size iron ore project estimates for one year its imported diesel fuel requirements will be 20000 tonnes.
- In future, population projections for resources regions should also include the concept of the number of people who work and reside in the particular region (see section 2).
- The observation that strategic planning has not kept up with demand for statutory planning requirements is also valid. At present the WAPC has established a regional planning committee for the Mid West which is preparing a regional planning framework. However, the identification of critical regional needs and projects should be accelerated to react to and plan for rapidly emerging regional needs in the Mid West. The observation made in the report regarding the need for strategic planning is supported but this must be associated with an action plan to address short and medium term planning, infrastructure and land access and development issues.
- The proactive identification of local and regional infrastructure needs is important in order to describe any synergies and efficiencies which could result from their future provision.
- It is important to acknowledge that the Mid West region has a geographically skew population distribution and hence a skew distribution of regional infrastructure. Some of the growth drivers of the region are mainly away from the coast where the current population is concentrated and there is generally very poor infrastructure in the inland areas. It is this issue which most resource projects are facing.
- The public/private funding mix of infrastructure needs which the WAPC report mentioned has not emanated in the Mid West. The State's infrastructure spend is focused on the Oakajee port common user infrastructure and social infrastructure in the coastal towns (see section 4). There is little or no commitment to inland towns except for some small scale funding under the Local Government Grants from Royalties for Regions.

- Generally the ongoing interface between State and local government and industry in the Mid West could be improved. There are a plethora of government agencies involved in Mid West development which needs a clearer high level mandate to facilitate and coordinate major projects. Although there are some initiatives such as the WAPC regional planning committee (with one representative from industry and a new MWDC initiative to prepare a regional investment plan) there is no regular forum in which ongoing, constructive engagement can occur in the Mid West. Industry has formed the Geraldton Iron Ore Alliance to assist in presenting a collective voice to Government from the Mid West iron ore industry. Similarly the Chamber of Minerals and Energy has a Mid West regional council consisting of a broad range of resource industry interests. The issue is that neither of these groups have a structured forum to interact with senior government officials on an ongoing basis. The consequence of this is that planning is made more difficult because Government does not have up to date information on the status of resource projects and their infrastructure and land requirements. There is need for an integrated project management approach to be taken to ensure the coordination of delivery of these projects between government and industry.

2.2 Roads 2025 Regional Road Development Strategy 2007 Main Roads WA

The RRDS provides an inventory of State and local roads across the Mid West region. It establishes the future development and maintenance needs for these roads.

There are a number of issues associated with the report. These are:

- The study implies a 'business as usual' approach which appears to rely on linear projections and forecasts of economic growth on products such as grains and livestock.
- Because of the nature of transport and traffic demand generated by major projects they tend to increase demand by stepped increments rather than linear increases.
- However, the future needs analysis is descriptive and may not represent the total quantitative traffic demand from the region's resource projects.
- Future regional traffic demand will have a high proportion of heavy vehicles which will have a significant impact on future road use including traffic numbers and types of vehicles. This includes intra regional as well as inter regional traffic.
- The road and traffic needs of all future projects and their various phases need to be established in future modeling. Traffic network needs will vary depending on the phase of the project and a whole of project view needs to be taken to predict future traffic needs and road requirements. All projects will require substantial imports of fabricated products and operational goods such as fuel, processing goods and explosives. At present both Geraldton and Fremantle are points of import for these goods.

- Several projects will develop extensive and lengthy dedicated haul roads for their purpose. In turn, these roads may induce further traffic on public roads for support vehicles and other traffic associated with projects.
- The report does not address the potential future requirements for a high wide load road corridor for Oakajee and/or Geraldton ports. These should be investigated as the construction modules for many of the major projects are shipped to the ports in the Mid West area. At present, there is evidence that it is easier to ship high wide loads into Fremantle and transport by road to the Mid West.

2.3 Minerals Council of Australia: Vision 2020 Project: the Australian Minerals Industry's Infrastructure Path to Prosperity ACIL Consulting May 2009

This report is an extensive national review of the resources and energy sector's infrastructure requirements to 2020. The report identified over 20 minerals regions in Australia and included the Mid West of Western Australia. The report summarises the main resources in each region, major projects, current infrastructure and planned infrastructure needs. It addresses water, energy, roads, rail, ports, land and social infrastructure.

The report develops a growth scenario for the region and relates this to future infrastructure needs. Table 3 summarises the report's recommendations.

In early 2010, based on this report, the Chamber of Minerals and Energy submitted to the WA State Government an extensive submission on the infrastructure needs to support the State's resources industry. This report is unpublished but reflects many of the priorities listed in the MCA report.

Table 3Summary of infrastructure requirements under growth scenario to 2020 for the Mid West growth region (source ACIL 2009 : p105)

Infrastructure class	Current and future gaps	Upgraded and additional infrastructure required
Roads	• Regional roads and some highways are inadequate to support major minerals growth	• Upgrades of highways and regional roads are required to accommodate construction traffic, minerals transport and traffic associated with movement of workers and community members
Rail	• Current rail infrastructure is inadequate to transport large tonnages of iron ore and not sufficiently extensive to service more than 25 Mtpa	• Rail infrastructure and rolling stock upgrades required for first stage iron ore exports through Geraldton port • For production over 25Mtpa, new rail lines are required to transport ore from north and east minesites to the Oakajee port
Ports	• Geraldton Port inadequate to cope with more than about 15 Mtpa • Maximum capacity of Geraldton after upgrades well below potential production	• New rail unloading, shipping berths and loading facilities are required at Geraldton Port to handle increased tonnages (up to 25Mtpa) • Oakajee Port to be developed as dedicated bulk port

Ore pipelines	• No slurry pipelines yet exist to transport magnetite ore	• Pipelines for transport of magnetite slurry from minesites to Geraldton port and/or Narngulu
Energy	• Electricity supply capacity falls well below needs of future mining • Gas pipeline capacity currently below future demand	• Major new capacity in transmission and generation is necessary to provide the energy for new minerals projects • Capacity increase for Dampier to Bunbury pipeline, other potential pipelines and feeder line upgrades to support mining and industry developments
Water	• No comprehensive, integrated plan for water	• Prepare comprehensive regional water plan to ensure efficient supply and use of water for mining and other users
Community infrastructure	• Community infrastructure in smaller towns inadequate to service populations that mining could attract	• Enhanced community infrastructure to service increased populations in towns

Land and infrastructure corridors	• Land use planning not yet adequate to service needs of communities and mining industry	• Developed land will be required for the industrial estate at Oakajee, new residential subdivisions, new and expanded industrial estates • Infrastructure corridors will be required for new and future rail lines, slurry pipelines, gas pipelines and electricity transmission lines, utilities to service urban development

2.4 Major Projects Summary Mid West Region of WA Mid West Development Commission

The Mid West Development Commission keeps a register of Major Projects in the Mid West including resources and energy projects, tourism and urban development projects. It provides a useful descriptive summary of current projects in the region and is mainly an inventory. It was last updated in late 2009 and is available on the Commission's website.

2.5 Current Planning initiatives in the region

Currently the Federal and State Governments are undertaking some regional planning projects in order to provide overall direction and a planning framework for the region.

These are:

- The Western Australian Planning Commission (WAPC) and the Department of Planning (DoP) are undertaking a regional planning framework project for the Mid West and have formed a regional planning committee to oversee this task.
- The Mid West Development Commission is preparing a Regional Investment Plan in order to identify and support a range of Mid West projects (both infrastructure and non infrastructure) to service the region's growth.
- The Mid West Development Commission also has a Strategic Infrastructure Committee which has a role in coordinating infrastructure planning and delivery in the region.
- The Mid West Gascoyne Regional Development Australia Working Group has developed an "Interim Plan" plan for both these regions which in turn details a series of other plans for the region.

2.6 Conclusions

There has been a significant amount of work undertaken over the last few years identifying the Mid West region's growth and increasingly there is consistency between the forecasts of infrastructure needs. The progress of many of the region's major projects has developed rapidly since the recovery from the global financial crisis. In fact, many of the projects in the region continued to plan and develop during this period and several are now well advanced in their feasibility studies. It is apparent that some of the infrastructure projects in the region are behind the schedules envisaged in the above reports. That, in itself, is not a problem as long as the remaining response time is adequate to plan and deliver project requirements to meet commercial and market requirements. Projects are moving from the planning phase into delivery and lead times to meet critical paths requirements are getting shorter.

In the Mid West there is a need for improved coordination between industry and government on a more formal and ongoing basis. The establishment of an industry/ government roundtable would be an appropriate model. This group would consist of senior representatives of major resource projects as well as senior government and local government officials. This would be mutually beneficial in order for the region to achieve its full development potential. Ongoing engagement with government would also assist project proponents gaining a better understanding of project approval and regulatory requirements. Similarly, the government would be more aware of industry requirements and timelines for major projects and their cumulative impacts. The development of an integrated project management schedule for all major regional resource projects is highly desirable.

3. MID WEST- FUTURE STRATEGIC INFRASTRUCTURE PRIORITIES

3.1 Oakajee Port and Rail

The establishment of Oakajee Port and Rail project is fundamental to the region's growth and development. The Port is located 25km north of Geraldton and will complement and enhance the region's ability to export bulk products. The new port will be able to take Cape size vessels which is at present is a major constraint on Geraldton port operations. Oakajee port's initial capacity of 45 million tonnes will service the foundation customers.

The port will be associated with 570km of rail to service the northern group of projects and a short spur to link up to the southern projects and the existing rail network. The port is also backed by an industrial area of over 1000ha which is being developed by Landcorp.

The timing of OPR's development approvals is a vital issue to potential customers. A draft feasibility study in 2007 established the feasibility of the project and the final bankable feasibility report is due in March 2011. Operations of the project are due to commence in 2014.

The workforce requirements for the project are 2000 during construction from 2011-2014 and 330 operations staff.

The port has its own demand for infrastructure. Access to the port is fundamental for both road and rail. Linkages to the hinterland need to be identified, planned, acquired and developed as a priority. Rail access corridor planning for the northern projects has yet to be finalised. There is also a concept of Oakajee to Narngulu infrastructure corridor which needs to be finalized

Infrastructure Priorities

- Finalise approvals and planning of the port area.
- Finalise planning, acquisition and development of the port access corridors including northern rail line to Jack Hills, Oakajee to Narngulu stages 1 and 2 and extend to Rudds Gully Road.
- Secure the budget for land acquisition and compensation for transport and infrastructure corridors.
- Finalise water, wastewater and power and other servicing needs of the port and provide relevant infrastructure.
- Develop a transition plan for the migration of port operations and throughput from Geraldton to Oakajee port.

- Develop the regional road network to ensure safe and efficient access to North West Coastal highway.
- Commence feasibility studies and associated planning for Stage 2 expansion of Oakajee port to 100mtpa throughput as soon as possible.
- Industrial land at Oakajee port has been identified for Port related uses which is supported. However there is a need for land to be identified for general cargo handling and storage as well as a fuel farm with appropriate access and buffers.
- Clarification of the funding commitment from State and Federal Governments for common user infrastructure needs to occur. The nature of this funding will have a substantial impact on port user charges and need urgent attention.

3.2 Geraldton Port

Geraldton port is currently the major gateway to the Mid West region for both exports and imports. The port handles significant amount of grain and minerals exports totaling over 9.0 million tonnes. The harbour basin and channel were deepened in the early 2000s to take Panamax ships.

In future Geraldton Port will complement the operations of Oakajee Port. It is vital for the future development of the Mid West region that Geraldton Port is retained and where possible enhanced. Although there is a planned cap on iron ore exports through the port of 12 mtpa to be implemented in 2014, iron ore export operations will continue after the commencement date of Oakajee. The current plans are for operations of Crosslands and Karara are due to move to Oakajee, and for Asia Iron and Mt Gibson Extension Hill operations will remain at Geraldton. The current Sinosteel MidWest output from Koolanooka is due to finish by 2015 and its future output from Weld range will be exported through Oakajee.

Geraldton Port will also continue to export significant tonnages of grain, other minerals and fuel. One issue which needs to be addressed is the support requirements for major projects. One Mid West iron ore project has estimated that it will require 20000t of diesel fuel, 22000t of grinding balls for ore processing and 25000t of explosives per year to service its operations. Given the number of projects which are due to proceed it is important that accurate forecasts of this demand are obtained.

Given the diversity of operations, the need for maintenance of operations and coordination with product delivery it is important that the functional integrity of Geraldton Port is maintained.

Infrastructure Priorities

- Continue and expand annual funding for maintenance dredging of the harbour basin and channel from $2.5m to $5.0m.
- Prepare a five year dredging program and spoil disposal plan.
- Improve power capacity at the port to allow for planned increased throughput tonnages.
- A staged master plan for the port should be developed which addresses the following :
  - the extension of the northern breakwater to reduce wave refraction into the harbour basin and improve usage of Berth 1
  - consideration of Berth 6 being lengthened to provide berths for 2 Panamax size vessels
  - Upgrading of the current ship loader
  - Upgrading of rail and train unloading facilities in the port to enable improved throughput
  - Future piloting and port related services
  - Transitional arrangements to Oakajee port
  - This plan should be endorsed by government and appropriate funding of common user infrastructure secured

3.3 Rail

The existing narrow gauge rail network in the South West of the region was developed for grain haulage. The rail has lower weight capacity, poor grades and alignment, and is not generally suitable for large, heavily laden iron ore trains. The network connects many of the small regional towns in the area and will remain for grain haulage. The State Government has recently committed funding to upgrade this network throughout the South West of the State. Separate from this, some of the southern group of projects will privately develop dual gauge lines to allow connection to the narrow gauge system to Geraldton and the standard gauge network to Oakajee.

The 570km standard gauge northern line from Oakajee will focus on Weld Range and Jack Hills. The line will be a single line with passing loops as required. Potentially there could be a spur to the Wiluna West project.

The expansion of the regional rail network will be mainly a matter for project proponents but the Government has a central role in determining in the final route selection and assistance with land acquisition processes. Proponents are currently planning their rolling stock needs to determine narrow and standard gauge requirements.

It is important that the capacity of the future rail system is designed to ensure that the open access regime which is part of its current design criteria is achieved. As such planning needs to take into account future project expansions as well as new projects. This includes emerging projects in the Yilgarn area of the Northern Goldfields which may consider Oakajee Port a more viable option than Esperance as a point of export. There are currently a group of iron ore projects in this area which may have an influence on future rail and port capacity. There may also be demand from other minerals as markets improve for base metals and nickel.

A related matter for rail haulage is the significant tonnages of mine supplies which will be required to service the operational needs of the region's projects. These need to be considered on a whole of region basis and there may be capacity to backload these goods by rail from Oakajee and Geraldton Ports to the inland. This would require some planning of logistic chains but would potentially take some heavy vehicle traffic from the regional roads. There may be potential for a supply hub to be developed at Weld Range for the existing and proposed northern projects.

Infrastructure Priorities

- Finalise the rail network planning for northern and southern rail lines.
- Expedite rail corridor definition and land acquisition in proximity to Oakajee port including the Oakajee to Narngulu corridor.
- Ensure rail planning considers the potential expansion of existing projects and new projects, including those emerging in the Yilgarn which may require access to Oakajee Port.
- Ensure that consideration of land requirements for rail corridors includes the need for future passing loops and related infrastructure.
- Consider the establishment of a supply hub at Weld Range for operational supplies.
- Ascertain future rail transport needs of emerging projects.

3.4 Roads

The Mid West regional road system has recently benefited from some recent significant improvements to the network. The southern road network has seen the opening of Indian Ocean Drive, which is a major coastal route between Perth and Geraldton. This road will have a major benefit in this part of the region of segregating heavy vehicle traffic which will use Brand Highway from general and recreational traffic.

The Southern Access corridor to Geraldton Port has also been completed with the upgrade to the Geraldton-Mullewa road link including the airport. Road capacity in this area will be increasingly important as the southern group of iron ore projects expand their operations.

However, there is a need to ensure roads in the area are closely monitored. Projects such as Koolanooka, Karara and Extension Hill will increase traffic for both haulage and operational supply needs. These projects are developing their own haul roads to link into the local and State road network. There are issues that the current routes from some projects to Geraldton Port are indirect and may need to be upgraded or new routes planned. For instance Sino MidWest are examining options to upgrade the road from Koolanooka through Allanooka to Geraldton Port which will cut 20km from the trip. Generally the roads in the Shires of Mingenew, Three Springs, Perenjori, Morawa, Mullewa, Irwin and Chapman Valley need to be monitored to ensure their safe and efficient operation.

Although much of the transport task in the Mid West region is focused on the export of primary production, there will be a potential rise in imports through the regional ports. There is potential for large manufactured modules for resource processing plants to be imported from overseas. This will require consideration of the need for high wide load corridors to be established from both Geraldton and Oakajee ports. A needs assessment of this type of traffic should be undertaken to ensure that future land reservations and road construction can accommodate this traffic.

The Northern group of projects will generate demand for long lengths of dedicated haul roads. Crosslands currently have developed a road from Jack Hills to Cue. New haul roads are planned for Sinosteel Midwest Jack Hill project and potentially for Golden West Resources Wiluna West project. Again these northern projects will generate traffic demand on major roads such as the Geraldton Mt Magnet road and Great Northern Highway. The Meekatharra-Wiluna section of Goldfields Highway remains unsealed and is a major issue for traffic movements in this part of the region. The development of resources projects in this part of the region will increase traffic demand. Traffic will also increase as Eastern States traffic moves through the region on its way to the Pilbara.

Infrastructure Priorities

- Regional Roads Development Strategy 2007 should be reviewed and updated to take in account increased resources project activity across the region and associated travel demand from direct and indirect traffic.
- The planning, design and development schedules for major road infrastructure to service Oakajee and surrounding areas including Oakajee Narngulu Infrastructure Corridor needs to be reviewed to ensure timely and coordinated delivery to support the port operations.
- Roads in the southern area servicing current iron ore production areas should be monitored for increased traffic and managed.
- Evaluation of future high wide load demand around Geraldton and Oakajee Ports should be made and incorporated into future road planning.
- Major highway routes should be monitored for increased inter-regional and sub-regional traffic to ensure road capacity is maintained and enhanced.

3.5 Energy

Growth in energy demand in the region is significantly driven by the development of major projects. The 2009 CME study of energy demand forecast a quadrupling of regional energy demand from 200GWh/a to over 800GWh/a by 2020. Substantial amounts of this growth are due to the first and second wave of iron ore projects. In a paper delivered to the State Energy Initiative consultation forum in late 2010, it was estimated that between 2012 and 2020 there could be up to 10 times increase in electricity demand to 16,000GWhr including both SWIS connected and stand alone sites. The latter figure includes the Cashmere Downs project. (Matt Duxbury, Asia Iron, August 2010). Karara and Extension Hill magnetite projects, connected to the SWIS represent 2000GWhr by quarter 1 2013.

The major population centres in the Mid West region are mainly serviced by Western Power through the South West Integrated System. This system services the rural towns and the City of Geraldton/ Greenough.

The major issue for the expansion of the SWIS is the extension of the 330kV power line from Pinjar near Perth to Eneabba as well as the delivery of a 330/132kV terminal at Three Springs and a 330kV line from Eneabba to Karara minesite. This is an essential link in the State's energy network and will form the backbone of the region's energy transmission system. The business case for this line is being finalised and funding of $318million has been allocated for the project in the forward estimates of the State budget. It is due to commence in 2011-2012. Karara iron ore project expansion and Extension Hill magnetite projects are dependent on this line being extended. A final decision on the powerline project is expected in early 2011. There will be substantial private investment to link the minesites to the SWIS.

Stage 2 of the project involves an extension of the 330kV line to Moonyoonooka near Geraldton. Western Power expects the need for this line may not eventuate until 2015-16 based on historical growth. (WPC Nov 2010 Major Augmentation Proposal for the Regulatory Test submitted to the Economic Regulation Authority) However, the associated loads of committed mining projects will likely increase demand substantially above the historical trend and will precipitate earlier action, as these loads can only be offered as non-firm network connections. Oakajee alone will require system reinforcement to Geraldton. The consequent general growth in population, business and infrastructure associated with the mining development in the region is not included in the historical load projection. It therefore can be concluded that Geraldton is in urgent need of transmission network reinforcement.

There is currently an application with Infrastructure Australia which is pending. Western Power also notes that the expansion of wind power capacity in the area could further support 330kV being required. Further planning and consultation is required for the project.

The region also has solar energy potential and there are a number of projects which are examining the feasibility of medium to large scale solar or solar hybrid power.

The Dampier to Bunbury Natural Gas Pipeline traverses the region and a 352 km pipeline lateral currently services areas east of Geraldton to Windimurra. This will require expansion to service Jack Hills Stage 2. Subject to availability, there is potential for gas to be utilised by other regional projects.

The Northern Perth Basin also has existing gas reserves which are potential regional energy sources.

Demand issues in the region need to be carefully monitored. Many of the resources projects in the region are energy intensive and require substantial infrastructure. Oakajee port will also be a major energy user and will have an impact on future regional energy demand. There are relatively long lead times for linear infrastructure to be planned and this needs to be taken into account in future demand projections.

Most of the emerging projects in the more remote parts of the region will rely on self supply of energy. This will lead to a number of diesel fuel based generation systems at each of the minesites. The future establishment of major magnetite projects in the region will lead to substantially increased energy demand in the region. In turn this will cause a wider range of energy options being examined. This includes the use of gas from the Dampier to Bunbury gas pipeline and its spur from Geraldton to Windimurra and the Goldfields gas pipeline. The capital cost of constructing gas laterals from each of the major pipelines is high and requires a commensurate level of energy demand and long term projects to justify the cost. .Expansion of the DBNGP is a relatively simple technical matter, as incremental capacity can be achieved by additional looping and compression. However, incremental expansion requires sufficient new contracted capacity with a 15 year undertaking to underwrite the expansion. Expansions have typically been of the order of 50 to 100TJ/day

It can be argued that there is a need for a regional energy solution to the Mid West region's future needs. There are some vagaries of future energy demand but the solution is not in regarding each project in isolation but as part of a larger network of electricity and gas infrastructure. The real issue is not planning adequately for emerging demand and having an energy deficit in the region based on poor forecasting and a resultant lack of infrastructure.

Infrastructure Priorities

- Develop, in consultation with industry, a Mid West Region Energy Strategy including future demand and supply for electricity, gas, renewable energy and demand management as well as transmission planning.
- Expedite the final approvals for the Perth- Eneabba 330kV powerline and associated infrastructure.
- Expedite the process to secure approvals for the 330kV powerline extension to Geraldton and associated infrastructure.
- Develop a strategy for the import, storage and distribution of energy for major projects in the region.

- Integrate energy corridors into planning for other services at Oakajee including Oakajee to Narngulu.

3.6 Water

The demand for water in the Mid West is accelerating at a rapid rate. As development proceeds, the demand is growing. The Chamber of Minerals and Energy projections for the region indicted an growth in demand of 5% per year to 2020. This will account for an extra 47GL of water required in this period. Nearly all of this extra water demand (98%) will be from self supply sources developed by the mining industry (CME, 2009). These figures include aggregate water demand and relate to all classes of water.

Water resources across the Mid West region are highly variable. The complex geology and arid interior influences both ground water and surface water availability and reliability. Many of the groundwater aquifers in the region are relatively small because of the fractured geology. Although there are some limited areas of fresh water in inland areas it is mainly brackish to saline. Near the coast some aquifers are fully or near fully allocated and there is competition for water between the mining and the agricultural sector. Townsite supplies tend to rely on local aquifers for their water supply or supplementation from small surface catchments.

The water allocation limits from a number Mid West aquifers are reaching their limits. Some of these will require further investigation but others are fully allocated.

Because of these reasons some mining projects have had difficulties in accessing water for their projects. Most projects use water for construction, processing and dust suppression and workers accommodation which require several gigalitres of water each year. Given the variability of supply sources there may be multiple potential sources for each project for “fit for purpose” water.

The major current source for existing projects is groundwater. These sources can be quite remote from existing mining operations. For instance, the Karara project plan to operate a bore field 140 kms west of the minesite. Other projects face similar distances to secure suitable water for their operations.

There are also situations where some mines dewater large amounts of water of variable quality. Disposal and use of this water can be a significant environmental issue. The most desirable situation is where mine dewatering becomes part of the project water cycle and is potentially reused.

For some projects desalination is the only viable solution to water supply. This is usually more expensive than groundwater and can be applied for potable water needs.

One major iron ore project in the southern group proposes to use a slurry pipeline to transport its product to Geraldton Port. The current water requirements for this project are 5.5GL. Given the

nature of water supply solutions needed for the iron ore projects, there are potentially many separate easements required for both water supply and slurry pipelines for the projects. Where possible, there needs to be an overall strategy for these pipelines which may increase efficiencies and potentially reduce costs.

Overall water is a critical issue for the future development of mining projects in the Mid West. The direction of water reform is for water to be utilised for its highest and best use and this is strongly supported by the mining industry. Comparatively the value added by the mining sector to water is more than ten times that of most agricultural products (CME, 2010).

Many Mid West projects have expansion potential beyond their initial development stage and there are a number of new projects scheduled. These future development projects need an active water planning and allocation regime. The identification and management of future viable water resources in the region is a priority.

Infrastructure Priorities

- The Mid West Regional Water Plan should be commenced as a matter of urgency. Industry should be engaged during this process.
- Consideration should be given in future water allocation plans to establishing priority for high value water uses such as minerals processing.
- A water trading regime for the region should be formalized in areas where there may be constraints on water allocation from existing sources or current allocation limits are near or fully allocated.
- The exploration and identification of future viable water resources should be expedited.
- Planning for future water pipeline easements should be undertaken at a strategic level to identify any possible synergies with other infrastructure including power lines.
- Public drinking water supplies for townsites should be carefully monitored as growth in demand occurs from residential and workers accommodation.

3.7 Industrial Land

The Mid west region is serviced by a number of general and light industrial areas. The Narngulu industrial area south east of Geraldton is the region's major general industrial area. The WAPC recently released a strategic land use plan for the area (May 2010) and recommended:

- (Narngulu) include additional land comprising 152 ha to the south and 5 ha in the Narngulu townsite in the general industry zone.
- Reduce the size of the existing noxious and hazardous industry zone as recommended by the Narngulu industrial estate study.

- Include most of the land in the buffer inside a general farming zone, and include in development areas, to provide for the orderly subdivision and development of the land as and when additional industrial land is required.
- Review the zoning provisions in the general industry zone to ensure that they accommodate the type of development appropriate for the area.
- Formalise the Narngulu buffer to prohibit further residential development, including consideration of impacts on landowners.

The report noted that currently, 41 per cent (289.05 ha) of the Narngulu industrial estate is vacant. There is a need for additional industrial land to provide for a range of lot sizes for a variety of light industrial, general industrial and commercial purposes.

Narngulu is generally well serviced by transport links to Geraldton, Oakajee the eastern hinterland and to the south. The proposed Oakajee corridor will be essential for the future functioning of both these areas.

Webberton is also located near Geraldton and at present, 78.8 ha (27.5 per cent) of industrial zoned land in the Webberton industrial estate is vacant. This area can accommodate light and service commercial industries.

Oakajee Industrial Area is central to the future development of large scale resources export and processing industry in the region and is discussed in Section 3.1. It is critical that all necessary approvals, land acquisition and servicing requirements are delivered to meet resource project timelines.

The issue of imports to service the Mid West's future needs should not be underestimated. The amount of materials required during the construction and operational phases of projects will amount to hundreds of thousands of tonnes per year. Planning for the port access needs for future high wide load corridors for construction modules and bulk imports (handling, storage and transport)for fuel, explosives and other materials is essential and is a high priority.

Most townsites in the region have small areas of light industrial areas servicing local needs. Some towns have opportunities to benefit from major projects in their proximity. In particular the northern Wheatbelt towns could become the source of local service industries to support the mining industry. Some of this activity has already commenced, particularly with engineering and maintenance services. Industrial land supply in this area needs to be proactive to ensure that development and employment opportunities are secured as they arise.

Infrastructure Priorities

- Ensure all planning and development requirements for Oakajee Industrial area are finalised.

- Planning for the importation and storage of construction and operational needs of resource projects should be undertaken as matter of priority. A dedicated area with suitable buffer requirements should be identified.
- Industrial land demand in regional towns in proximity of resource projects should be monitored. Planning and development requirements should be addressed to ensure proactive land supply.
- Monitor the emergence of large science and technology projects in the region to ensure land is available to support these types of industries.

3.8 Square Kilometre Array

The Square Kilometre Array in the Upper Gascoyne Region is the world's most advanced radio telescope installation supported by an international consortia. Australia and South Africa are currently bidding for the location of the facility. The Australian site for the project is a key in the bid for the project. The site has to have key characteristics including radio quietness and very low population. The Gascoyne site is part of a very long east-west baseline of telescopes extending 5500km across to New Zealand.

The site's radio quiet requirements have an impact on Mid West resources projects. The rail line to Jack Hills has been modified to skirt the southern and eastern edges of the site's quiet zone. These have been protected under Federal Telecommunications legislation. A discussion paper on proposed regulations controlling radio frequency emissions has recently been released for discussion. The paper proposes to expand the radio quiet zone to 260km which may have an impact on future mining operations in the area.

Industry needs to have greater certainty on the justification for the expanded radio quiet zone, its potential impacts and management requirements, Effective telecommunications are vital to the areas development and there is an opportunity to develop an integrated telecommunications strategy recogisning the constraints imposed by the SKA. The resources industry supports the SKA initiative but there needs to be a full environmental, social and economic impact evaluation to justify the nature and extent of the SKA radio quiet requirements.

Infrastructure Priorities

- Undertake a comprehensive and independent environmental, social and economic impact study to describe, evaluate and justify the radio quiet zone, assess its impacts and develop management strategies.
- Management and mitigation strategies should identify where costs and benefits accrue and how costs will be allocated.
- The above study should incorporate community consultation including the mining and pastoral industry, indigenous communities and local government.

4. INFRASTRUCTURE NEEDS OF MAJOR MID WEST PROJECTS

The mining industry in WA operates in international markets and in order to be successful has to be globally competitive. The supply chains for mining and resource projects are extensive and extend far beyond the Mid West region. The nature of the system means that it is essential that the competitiveness and efficiency of these systems are world class.

It is important that these supply chains are understood in order to identify and remedy any problems in the system. A weakness in one part of the logistics chain can have significant adverse impacts on the ability for companies to successfully access markets. The efficiency and effectiveness of infrastructure upon which the mining industry depends is vital to the region's success.

The major iron ore projects in the region have a total investment value of nearly $14billion. In addition the development of Oakajee Port and Rail adds $4billion for a total of nearly $18billion (see Figure 4). Much of this spend is on offsite infrastructure to support the region's development. This investment is estimated to be between $6-$7 billion. Companies will also contribute significant revenue to the State and Federal Government through their taxes and charges throughout the life of their operations (see section 4.1).

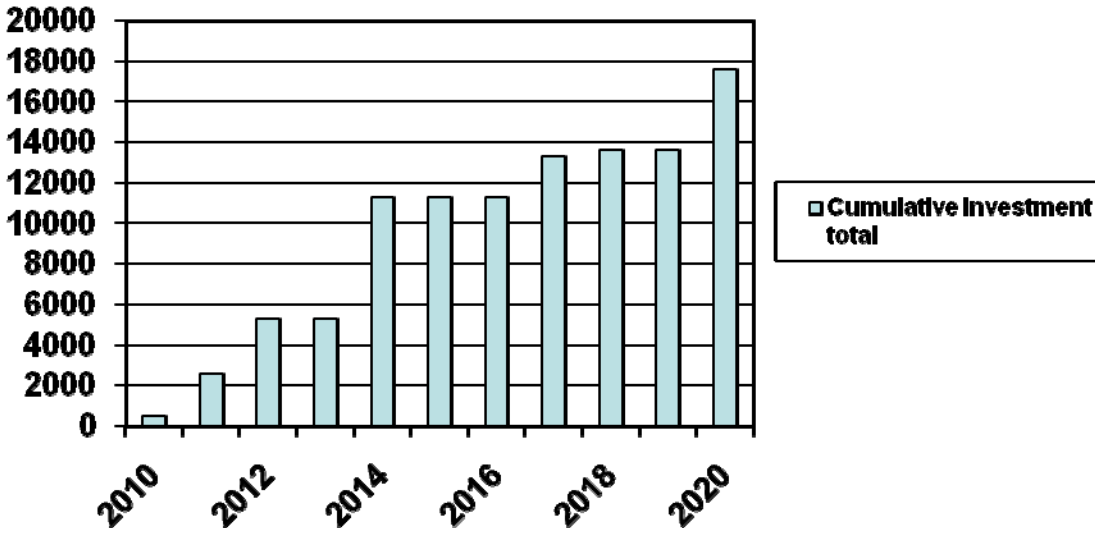


Figure 4 Cumulative investment expenditure in the Mid West Region (including OPR)

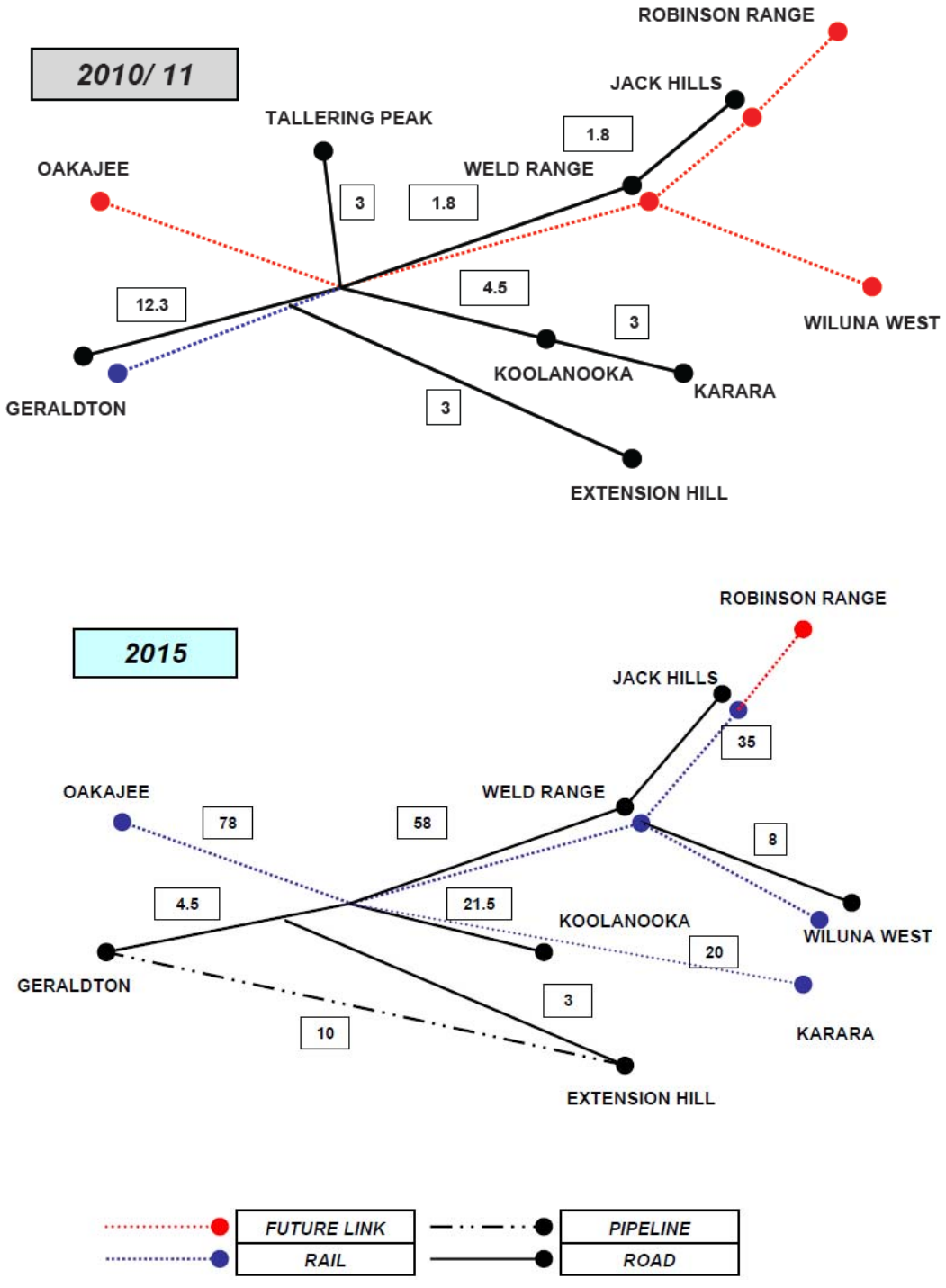
Table 4 Summarises project development phases and anticipated production volumes.

This timing will have a significant impact on the timing of infrastructure provision. There is considerable lead time for major infrastructure to be planned, constructed and to become fully operational. Although individual projects will exert demand on the local and regional transport and infrastructure systems, the cumulative impacts also have to be considered.

Company and Name of Project	Production by Year (Millions of Tonnes)										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sino Midwest Corporation											
Koolanooka/Blue Hills (Hematite)	1.5	1.5	1.5	1.5	1.5	1.5					
Weld Range						15	15	15	15	15	15
Robinson Range								5	5	5	5
Jack Hills (Hematite)											5
Jack Hills (Magnetite)											
Koolanooka (Magnetite)											25
Total	1.5	1.5	1.5	1.5	1.5	16.5	15	20	20	20	50
Golden West Resources											
Wiluna West			3	3	10	8	10	10	10	10	10
Total	0	0	3	3	10	8	10	10	10	10	10
Gindalbie											
Karara		3	10	11	16	20	20	24	28	28	32
Warriedar	TBD										
Total	0	3	10	11	16	20	20	24	28	28	32

Crosslands											
Jack Hills	1.5	1.5	2	2	35	35	35	35	35	35	35
Weld Range											
Total	1.5	1.5	2	2	35	35	35	35	35	35	35
Asia Iron											
Extension Hill				2	8	10	10	15	30	30	30
Minga Well/ Koolanooka South/ Mingenew Coal	TBD										
Total	0	0	0	2	8	10	10	15	30	30	30
Mt Gibson Iron											
Tallering Park	3	3	3	3							
Extension Hill	3	3	3	3	3	3	3	3	3	3	3
Total	6	6	6	6	3	3	3	3	3	3	3
Grand Total	9	12	22.5	25.5	73.5	92.5	93	107	126	126	160

Figure 5: Cumulative Tonnages on Road and Rail segments in millions of tones.



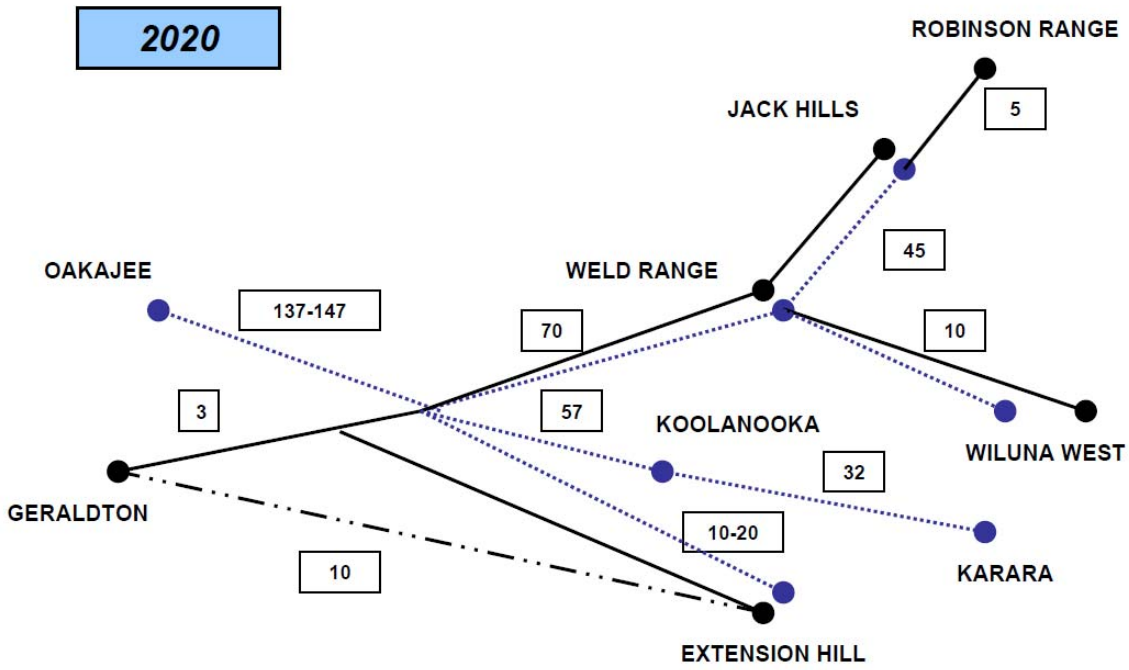


Figure 6 is a summary of projected mine production from major Mid West projects to 2020

Figure 5 illustrates the cumulative impact on the regional road and rail system from these iron ore tonnages for 2010/11, 2015 and 2020. The figures are the most up to date estimates from companies involved in iron ore projects in the Mid west. These predications demonstrate the need for detailed planning of Stage 2 of Oakajee Port and associated infrastructure to be commenced in the near future.

Table 6 documents the individual infrastructure needs of each project and indicative timing. The project specific infrastructure will be provided by the private sector but there are common use components which are the State's responsibility. Whilst all projects will need new or expanded infrastructure many will also connect to the State's existing road, rail and to a lesser extent energy system. In turn, it is important that the capacity of these systems to absorb growth is maintained and enhanced. As such, the funding for key infrastructure maintenance and operations should be commensurate with the demand on the infrastructure. In particular this applies to port, road. rail, water and energy systems.

These needs have to be seen as priorities for the mining sector in the Mid West region.

The backbone of future development in the Mid West is Oakajee port and rail and this complex project's timely establishment of operations is vital to the success of the region.

Table 5 Current project status and projected production

Project name	Value of project	Current project status	BFS Completion date	Start/finish date of project development	Current production	Future production target and ramp up
Sinosteel Midwest Corporation Koolanooka/Blue Hills (Haematite)	$25m	In production	2006/7		1.0 mtpa	1.5 mtpa 2012
Weld Range	$2.0bn	Front End Engineering Design	June 2010	2011-2015		15 mtpa 2015
Koolanooka (Magnetite)	$4.0bn	Ranks behind Weld Range and Jack hills	c2020	2020-2022		25 mtpa 2022
Jack Hills	c$150m	Exploration/concept design	c2020	2020-2021		5-10mtpa 2020
Robinson Range	c$150m	Exploration	2019-2020	2020-2022		5-10 mtpa 2020
Crosslands Jack Hills		In production			1.8 mtpa	

Stage 2	$2.0bn	BFS in prep	May 2011	2011-2014		35 mtpa 2014-2015
Weld Range		Exploration				
Gindalbie Metals Ltd Karara	$1.975m	Under Construction	Sept 2007	2009-2011	3.0 mtpa DSO 8.0 mtpa	20 mtpa 2010-2016
Warriedar		Exploration				
Golden West Resources Ltd Wiluna West	$750m	Approvals and concept design	June 2012	2012-2014		10 mtpa 2014-2016
Asia Iron Holdings Extension Hill Magnetite	$2.0bn	Approvals and concept design	Feb 2006	Front End Engineering Design		8 mtpa 2011-2013 30 mtpa 2013-17
Minga Well		Exploration				
Mt Gibson Tallering Peak		In production	Completion 2013	3 mtpa		
Extension Hill	$73m	Under construction	2009	2009-2011		3 mtpa June 2011

Table 6 Priority infrastructure requirements of Mid West Projects

Project	Rail	Road	Pipeline	Water	Energy	Housing and accommodation
SinoSteel Midwest Corporation Koolanooka/Blue Hills (Haematite)	NA	Minesite to Geraldton Potential road upgrade Allanooka – Geraldton		Local borefield Small extension required	Self supply - diesel generators	FIFO/DIDO Workers accommodation 75 units
Weld Range	Oakajee Northern Spur Possible supply hub	Geraldton- Mt Magnet Rd for supplies		Local borefield Mine dewatering	On site power station/ potential gas spur line	FIFO Workers accommodation Construction 1000 units 2012-14 Operations 800 units 2014
Koolanooka (Magnetite)	New rail to Oakajee	Local/State road upgrades for		Local borefield	SWIS link to Karara –	Some local DIDO FIFO/local workers

		supply traffic			Eneabba line /power station/gas lateral	accommodation 1000 units 2017-18
Jack Hills	Oakajee Northern Spur from Weld Range	Dedicated haul road to Weld Range Geraldton- Mt Magnet Rd for supplies		tbd	Self supply- diesel generation	FIFO Workers Accommodation 120 units 2018-20
Robinson Range	Oakajee Northern Spur from Weld range	Dedicated haul road to Weld Range		tbd	Self supply- diesel generation	FIFO Workers Accommodation 120 units 2020-22
Crosslands Jack Hills		Dedicated haul road to Cue. Cue - Mt Magnet-Geraldton		Borefield	Self supply –gas generation	FIFO current operations Workers Accommodation 330 units
Stage 2 Jack Hills	Oakajee Northern Spur	Road access to Oakajee and Geraldton Ports for supplies	Depending on water source - borefield pipeline. Potential to co-	Borefield/ Desalination	On site gas power station	FIFO Workers accommodation Construction 2500 Operations 1200

			locate with gas lateral.			2014-15
Gindalbie Metals Ltd Karara	Karara- Morawa new road Complete 2011 Morawa-Geraldton	Karara-Tilley new rail connection Tilley-Geraldton existing rail upgrade		Local borefield expansion	SWIS extension Karara – Eneabba 330kV	Current accommodation 150 units Three Springs Future 700 units across 3 villages 2012-14
Golden West Resources Ltd Wiluna West Stage 1	Haul road Minesite to Leonora. Export through Esperance	Existing rail		Local borefield	Self supply – diesel generation	FIFO Workers accommodation 80 units plus contractors 2011-12
Stage 2	New link to Weld	Possible rail link		Borefield	Dependent on	400 units – land to be

	Range	to Weld Range		expansion	processing option at Weld Range	identified at Wiluna 2014-15
Asia Iron Holdings Extension Hill Magnetite	Minesite to Geraldton-Oakajee via Perenjori-Mingenew	Possible rail to Oakajee Stage 2	140 km pipeline from Tathra borefield Slurry pipeline from minesite to Geraldton Port	Borefield –Tathra	330kV line from Three Springs, Possible gas extension	Stage 1 FIFO construction 2000 units Operations Stages 1 and 2 - 650 units 2014 Some housing may be established in Dalwallinu
Mt Gibson Tallering Peak	Minesite to Geraldton port	NA		Local borefield	Self supply	Workers accommodation
Extension Hill	Minesite to Perenjori	Rail existing line Perenjori - Geraldton		Local borefield	132kV line from Three Springs	Workers accommodation Construction 150 units Operations 100 units 2011

4.1 Current State and Federal Funding Commitments to the Region

Following the operational establishment of Oakajee Port and rail it is estimated by Economics Consulting services in a study undertaken for the Geraldton Iron Ore Alliance that, in the first 20 years, the Mid west projects will produce $90B in revenue, pay State royalties of approximately $6billion and pay $12billion in Federal taxes. The latter figure does not include Federal revenue from the proposed Minerals Resource Rent Tax.

The State's current commitment to capital works infrastructure funding in the region is shown in Table 6 which are derived from the 2010-2011 State Budget Statements. The majority of funding is dedicated to the State's contribution to Oakajee Port common user infrastructure and future commitments to the Pinjar-Eneabba 330kV powerline. The Commonwealth Government is providing matching funds of $339 million to Oakajee Port. The basis of this funding has to be clarified as the funding model and payback period will have a substantial impact on port operating costs and hence on port user charges.

There are other funding sources from the State in the form of Royalties for Regions, but these are mainly for smaller local projects and are not focused on major capital works.

It is apparent that the majority of future infrastructure investment in the region will be derived from the private sector. Although there are aspects of infrastructure investment which are solely related to private development requirements, there are a number of projects which will contribute to broader public benefits. This will apply particularly to the transport, energy and water sectors.

The application of public/private partnering opportunities in the Mid west are yet to emerge. Given the public benefits which will accrue from some of the proposed investment and the ongoing revenue streams from industry to government it would seem appropriate for the public sector to contributes directly or indirectly to these some of these costs. There area a number of ways in which this could occur and this matter requires further consideration and negotiation.

The proposed industry government working group (see section 2.6) could examine this issue of public and private infrastructure investment in the region and identify opportunities for delivery models which recognize private and public expenditure, potential synergies and offsets.

Table 7 WA State Budget and Forward Estimates

Project	Total Expenditure $'000	Expenditure to date	Expenditure 2010-11 $'000	Expenditure 2011-12 $'000	Expenditure 2012-13 $'000	Expenditure 2013-14 $'000
Oakajee Port	339,000	-	-	-	$339,000	
North Country Reinforcement line	318,900	-	47,100	244,000	27.800	
Dongara High School	18.600		18.600			
Geraldton Southern Access corridor	2,700		2,700			
Geraldton water supply	10,300					

Table 8 Value of selected major current and planned private infrastructure capital investment in the Mid West region

Project	Year	Water $M	Year	Energy $M	Year	Port $M	Year	Road $M	Year	Rail $M	Year	Pipeline $M
Crosslands	2012-14	560.0	2012-2014	770.0			2006-7	43				
Sinosteel												
Koolanooka	2005-10	0.2			2005-10	5	2005-10	1.5	2005-10	17.5		
Koolanooka Magnetite	2016-20	100.0	2016-20	100.0			2016-20	50.0	2016-20	150.0		
Weld Range	2012-14	20.0	2012-14	50.0			2012-14	100.0				
Robinson Range	2023	5.0	2023	1.0			2023	40.0				
Jack Hills	2022	5.0	2022	1.0			2022	25.0				
Asia Iron Extension Hill	2012-13	200.0	2012/2013	200.0							2013	500
Golden West Wiluna West	2012	1.0	2014	0.5			2011	1.0	2014	600.0		
Gindalbie Karara	2010-11	50.0	2010-11	200.0	2010-11	200.0	2010-11	15.0	2010-11	150.0		
Oakajee Port and Rail (Port/Rail includes water,energy etc)					2012-14	2000			2012-14	2000		
Total		**941.2**		**1322.5**		**2205**		**275.5**		**2917.5**		**500**

5. REFERENCES

Chamber of Minerals and Energy (2009)	State Growth Outlook
Economics Consulting Services (2010)	Mining Expansion in the Mid West: Social and Economic Benefits Report for the Geraldton Iron ore Alliance October 2010
Geraldton Iron Ore Alliance (undated)	Iron Ore Mining and its Benefits to the Mid West
Main Roads of Western Australia (2007)	Roads 2025 Regional Road Development Strategy
Mid West Development Commission (2009)	Major Projects in the Mid West region
Minerals Council of Australia (2009)	Vision 2020 Project: The Australian MineralsIndustry's Infrastructure Path to Prosperity
Western Australian Planning Commission (2008)	Mid West Infrastructure Analysis November 2008

Interviews with senior representatives from Crosslands, SinoSteel MidWest Corporation, Asia Iron, Karara Mining, Golden West Resources and relevant Government agencies.

Appendix 1 - Other Mid West Minerals Projects

Other Mid West Minerals Projects

Accent Resources

Accent Resources is undertaking pre-feasibility and engineering studies for its Magnetite Range project located in the Mt Gibson Range. Based on a >390Mt maiden JORC compliant indicated resource, an operation producing 5Mtpa concentrate for 20 years is indicated.

Atlas Iron

Atlas Iron is conducting exploration activity over its extensive landholding in the Midwest region. The company has identified two hematite projects, at Jack Hills and Weld Range, with exploration targets of 15 to 20Mt at 60 to 66%Fe for each project.

Base Resources

Base Resources is preparing to explore its Poona East, Murgoo, and Wandarrie Well projects with its nominated targets being iron ore, gold, and uranium. The company expects to finalize Aboriginal heritage agreements with native title applicants by end 2010 which will enable grant of the exploration tenements.

Emergent Resources

Emergent Resources is in the exploration phase at its Beyondie Iron project, 160km south of Newman, which is based on a significant magnetite resource. Exploration is ongoing and in June 2010 the company announced discovery of 25 to 45Mt hematite within the project.

Ferrowest Ltd

Ferrowest's Yalgoo Iron project contemplates 20 year production of 1.5Mtpa of magnetite concentrate from a mine near Yalgoo. The concentrate would be processed at Eradu 60km east of Geraldton to produce for export 1Mtpa merchant pig iron. The company is targeting construction to start in Q2 2012 and plant commissioning in Q2 2014. The company is also undertaking early exploration for its Western Hematite project based on various outcrops over a 15km strike length in the same area as the magnetite resource.

Giralia Resources

Giralia Resources holds the Beebyn iron ore project in the north-eastern Weld Range. A JORC compliant hematite iron ore resource of 7.2Mt @57.2%Fe was announced in December 2007 based on drilling in the western half of the prospect.

Hampton Hill Mining

Hampton Hill Mining has exploration tenements at Weld Range including a prospect at Ryansville. Exploration is targeting lenses of hematite buried beneath surficial sediments.

Jupiter Mines

Jupiter Mines is investigating several iron ore prospects in the Central Yilgarn including a potential hematite project at Mount Mason and a magnetite prospect at Mount Ida. Further exploration is required to define the extent of the resources.

Mount Gibson Iron

The company's 3Mtpa Tallering Peak hematite export operation is expected to continue until at least 2013. New hematite operations at Extension Hill, in the Mt Gibson Ranges are due to commence in June 2011 with output of 3Mtpa for 5 years. Both operations are based on trucking ore part way then transferring to rail for delivery to Geraldton Port.

Quest Minerals

Quest Minerals is undertaking metallurgical testing and resource estimation work at its Victory Bore prospect south of Sandstone. The work has identified an exploration target of 250Mt magnetite associated with vanadium and titanium mineralisation.

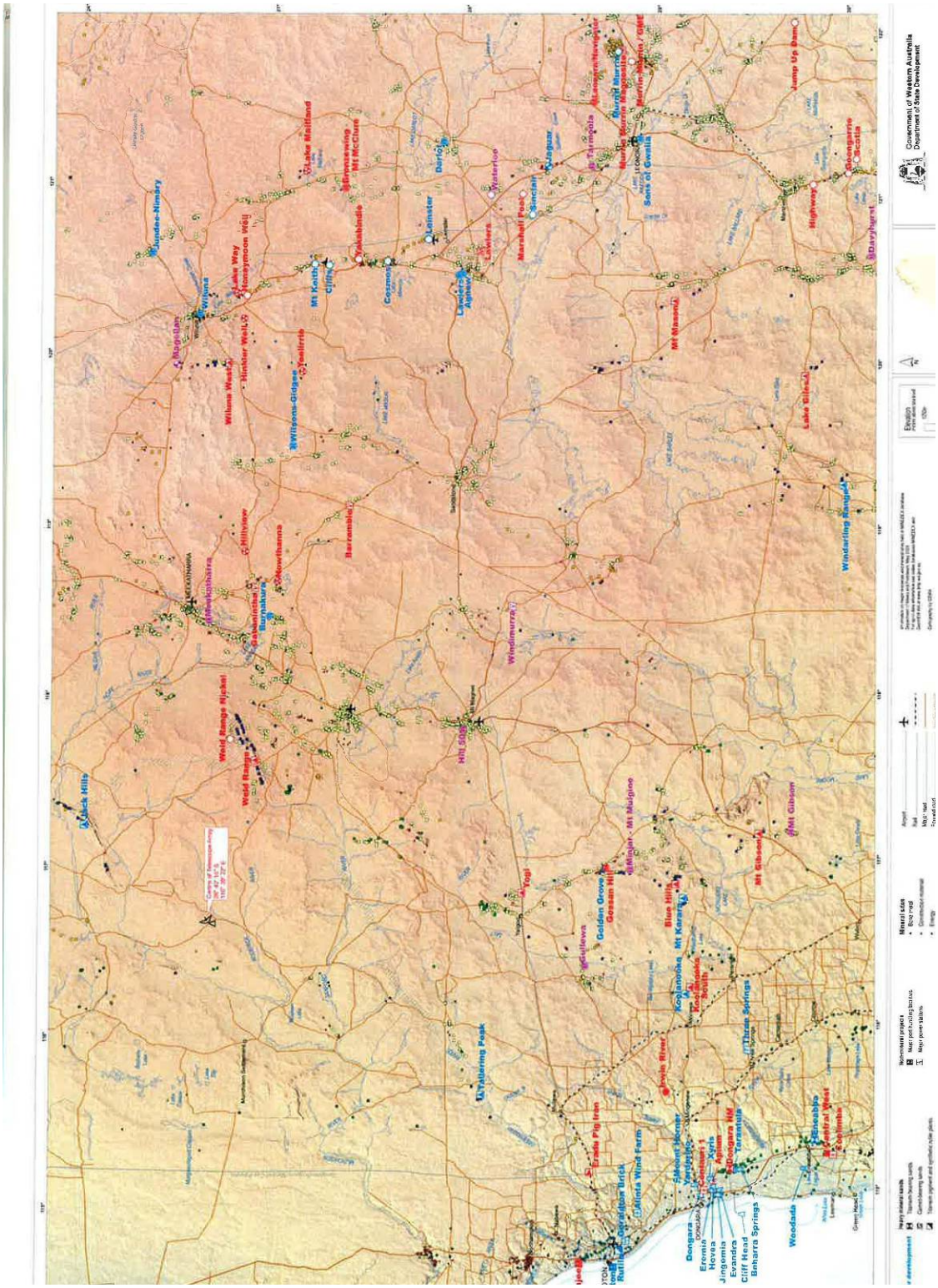
Royal Resources

Royal Resources is in joint venture with Gindalbie Metals in the Warriedar prospect and is investigating other iron ore prospects at Windaning, and Tallering.

Cashmere Iron

The company is exploring its Cashmere Downs Iron project approximately 150km southeast of Mount Magnet. At March 2010 Cashmere Iron had identified more than 800Mt of magnetite and almost 200Mt of hematite, with further exploration and drilling in progress to better define the extent of the resource.

CHAMBER OF MINERALS AND ENERGY/GERALDTON IRON ORE ALLIANCE
MID WEST REGION INFRASTRUCTURE
A RESOURCES INDUSTRY VIEWPOINT



WA State Growth Outlook 2011

The Chamber of Minerals and Energy of Western Australia

April 2011

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Section One

Study Background

The Chamber of Minerals and Energy (CME) is the peak resources sector representative body in WA. The role of CME is to champion the WA resources sector and assist it in achieving its vision to lead the world in sustainable practice through innovation and to underpin Australia's position in the global economy.

In 2008, CME commissioned PwC Consulting to complete a study to provide an integrated outlook of industry and government development plans in the minerals and energy sector, focused on the key growth enablers of people, energy and water to aid policy development.

The overall objectives of the 2008 study were to:

- Develop a demand outlook for the three growth enablers: people; energy; and water and identify potential demand/supply gaps;
- Provide a basis for identifying potential implications arising from current growth plans; and
- Provide valuable input into industry and government planning and to better position industry and government to capture opportunities from WA's growth.

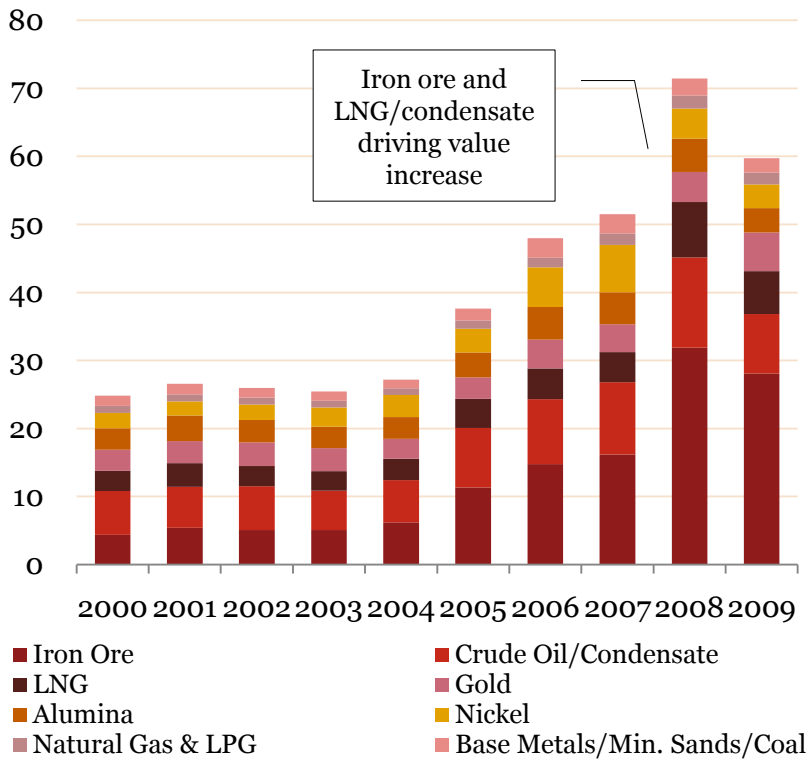
The current study seeks to update the outlook for the resources industry and refine the implications discussion after 24 months of significant turmoil and change for the WA, Australian and international economies.

The body of the report comprises six sections:

- ***Section One: Study Background*** provides context around the minerals and energy industry, along with the approach taken in the study.
- ***Section Two: Executive Summary*** outlines state-wide survey outcomes and key regional trends along with the relevant potential implications and opportunities for each growth enabler.
- ***Sections Three through Five*** are individual sections on each growth enabler. Each section commences with a state view, providing historical context and survey outcomes and trends. Survey outcomes on a regional basis follow on from the state view and each section closes with a discussion on potential implications and opportunities arising from the growth.
- ***Section Six: Appendix*** contains supporting information.

Historic Value of the WA Minerals and Energy Industry

Value of WA Minerals & Energy Industry
$b, 2000-2009



The value of the minerals and energy sector tripled between 2000 ($26.2b) and 2008 ($73.1b). More recently, the Global Financial Crisis, which saw the global economy dive into recession in late 2008 and early 2009, contributed to a reduction in the output of the sector in WA, with the value falling to $61.0b in 2009.

The outlook for WA's minerals and energy sector remains positive, with global markets recovering and access to capital increasing. Preceding the Global Financial Crisis, proposed investment in minerals and energy projects stood at ~$100b (June 2008[1]) and has now climbed to over $200b of committed and proposed projects in 2011 (see following page). The State Growth Outlook aims to provide valuable information to enable government and industry to effectively capture these opportunities.

Iron ore continues as the highest value sector, followed by the petroleum sector.

As an integral driver of the WA economy, the minerals and energy sector provides thousands of direct and indirect employment positions and generates a significant revenue stream, supporting growth across the state and the country.

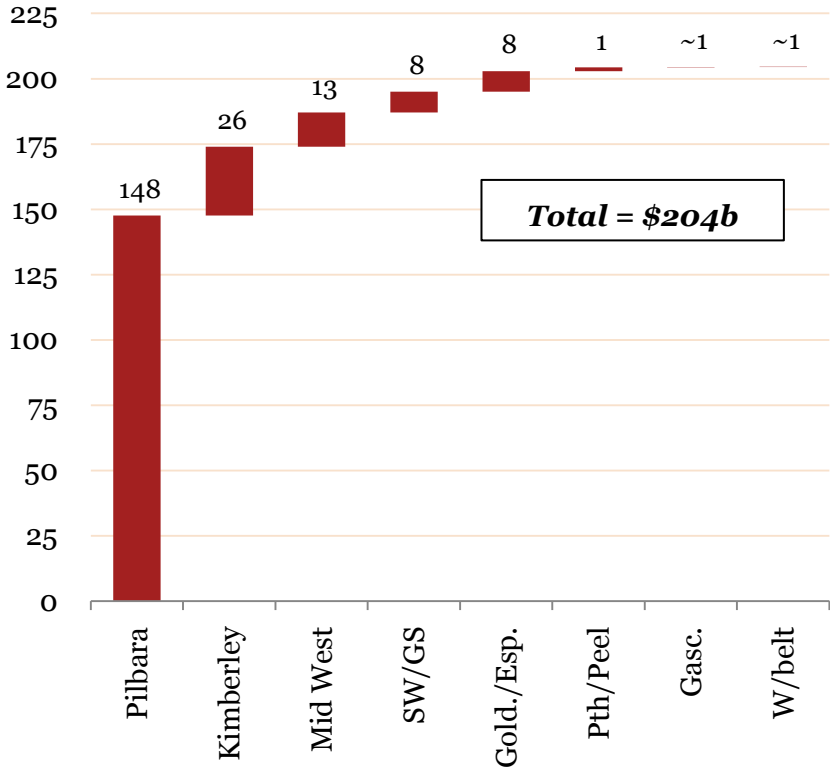
1. Western Australian Mineral and Petroleum Statistics Digest 2009, Department of Mines and Petroleum, page 2

Source: Chart data from 2009 Statistics Digest, Department of Mines and Petroleum

Upcoming Projects in the WA Minerals and Energy Industry

Upcoming Project Capital Expenditure

$b, By Project Region



The outlook for the sector in WA is one of substantial growth, with over $200b of planned mining and energy (and relevant infrastructure) projects across the state.

Over 50 discrete projects are currently under consideration or further advanced in WA across bulk commodities, oil and gas and precious metals.

Over 60% of this spend is related to oil, gas and condensate projects. Iron ore and associated infrastructure comprise the second largest spend, with capital intensive magnetite projects increasing average project spend for iron ore.

The majority of the capital expenditure is related to projects in the Pilbara, Kimberley and the Mid West.

With over $200b of upcoming projects, WA remains an investment destination, continuing to develop economic benefits for the state as well as the national economy.

Note: publicly available information only. Does not include capex estimates not publicly disclosed or for projects not far enough advanced.

Source: Chart data from Prospect Magazine Sep 2010, Abare Minerals and Energy Project List Dec 2010 (includes projects under construction, under consideration and less advanced in feasibility status.

Approach Followed in This Study

The approach was similar to that developed in the previous Growth Outlook; a three stage process:

1. Collecting direct survey data and publicly available information from minerals and energy companies with upcoming projects;
2. Consulting with key government and other agencies on the supply outlook for each of the three growth enablers; and
3. Validating results and identifying potential implications and opportunities with various reference groups.

The demand outlook was derived from a comprehensive survey of contributing CME members and selected non-members representing over 70% of the upcoming capital spend in the industry. The survey covered projected demand for people, energy and water, and accompanying project information such as annual production rates and capital expenditure where available. To ensure completeness, the direct survey data was supplemented with publicly available data on upcoming projects not surveyed.

To account for the fact that not all proposed projects eventuate, individual probabilities were assigned to each project, based on: time to construction; outlook for the commodity; greenfields vs. brownfields; and the company's operations profile. The aggregate probability for all projects was adjusted to line up with historic project realisation rates[1].

The demand outlook was developed under unconstrained supply of all resources.

The supply outlook was developed in consultation with numerous government and private agencies, providing data where available (list of contributing agencies outlined in *Section 7.2 Methodology*).

Three reference groups (CME People Strategies Committee, CME Energy Reference Group and CME Water Issues Group) were consulted throughout the project to: validate data quality; identify implications and opportunities; and to ensure alignment with objectives.

1. Historic realisation over 4 year period to 2008 was ~ 80% based on retrospective analysis of "Historical Projects List", CCI, 2008 and "Prospect Magazine", DOIR 2004-2008

Section Two

Executive Summary

Key Survey Outcomes Relating to People

State Overview

- The workforce required for current growth plans in the minerals and energy sector is expected to reach a peak of almost 119,500 persons in 2012 – some 43,800 above the 2009 sector workforce of approximately 75,600.
- This profile is consistent with the forecast developed in the 2008 Growth Outlook Study, however the peak in 2012 is forecast to be much sharper.
- The construction workforce will peak in 2012 and then reduce by 2015 as operations are commissioned. The majority of this incremental construction workforce in 2012 is to be met though fly-in-fly-out (FIFO) arrangements (92%).
- Unlike the construction workforce, the operating workforce will continue to increase over the period with the state requiring an additional 27,000 operations staff (above 2009) by 2015.
- It is expected that 81% of the total additional FIFO workforce will choose to be based in the Perth/Peel region and 11% are expected to be interstate FIFO.
- The new minerals and energy workforce will increase demand for services both in the public and private sector. It is estimated that over the period to 2020, an additional 30,000 to 50,000 people will be employed in other related industry sectors as a result of increased minerals and energy activity.

High Growth Regions

- Areas of highest labour growth are the Pilbara, Mid West, and Perth/Peel regions.
- The majority of incremental minerals and energy workforce will be driven by projects in the Pilbara region. Current planned projects suggest an additional 34,000 workers in 2012 in the region, nearly 27,000 of which are construction workers, declining to an additional 21,000 in 2015 (above 2009).
- The Mid West will require an additional 7,500 workers by 2012, 5,700 of which will be new construction workers, experiencing the highest labour force growth rate of any region.
- While there is limited local increase in minerals and energy labour demand in the Perth/Peel region, the total incremental FIFO demand sourced from the region is expected to be great, peaking at around 30,000 in 2012, remaining at around 16,500 by 2015.

Workforce Supply Outlook

- Based on current ABS population projections and current rates of participation in the sector, there is a forecast deficit in workforce requirements going forward. It is evident that the workforce demand cannot be met based solely on forecast migration and current workforce participation rates.

Growth and Competitiveness

- The ability to respond to the rapid and high demand for labour in the sector will be a determining factor in the on-time delivery of minerals and energy projects. The effects of the Global Financial Crisis granted industry and government 'breathing space', however we are now transitioning to a period of greater demand than just prior to the crisis and are again confronted by the same (or more acute) circumstances and policy settings we faced at that time.
- There is a need to continue to promote increased interstate labour agility as a means of meeting the future labour demand, however the current cost of living in WA reduces the attractiveness of relocating to the state.
- The ability to effectively draw on international workforce to meet incremental labour demands, particularly for short-term construction workers, will be key to maintaining growth in the sector. This will be important as new projects in the eastern states impact on the interstate labour pool.
- To respond to the forecast labour demand, continued efforts are required to increase workforce participation in the sector, focusing on under-represented groups such as indigenous and women, to supplement FIFO and migration programs.
- The upcoming period of high minerals and energy growth presents the opportunity of increased economic benefits to the state and, in particular, to regional areas of WA.
- We will see continued community investment from minerals and energy companies.
- The challenge to maintain and grow skills diversity in the state to ensure that WA remains a vibrant city to live in for families and young professionals will continue.
- Alternative labour sources will be required to ensure the total labour pool in WA is not drained as resources are drawn to the minerals and energy sector and away from other industries and the public sector.

Environment and Liveability

- Population increase will place increasing demands on social and hard infrastructure in Perth and regional towns, requiring advanced planning and investment. These amenity and service standards are crucial to attracting the labour needed to support growth in the minerals and energy sector.

Key Findings Relating to Electricity

State Overview

- The estimated electricity growth rate over the period to 2020 is 6.9% per annum; substantially higher than the long term electricity growth forecast from ABARE (2.1% per annum out to 2030).
- Total electricity consumption in WA could increase by approximately 70% by 2015 – driven by projects in the minerals and energy industry.
- Minerals and energy electricity demand to 2015 is expected to increase by approximately 0.6 GW[1] per year. By 2015 this incremental demand could be equivalent to 3.6 GW. The majority of the demand is expected to be met through self generation (over 80%).
- The majority of incremental self generated minerals and energy demand is expected to be fuelled by domestic gas (approximately 80%).
- In the area serviced by the South West Interconnected System (SWIS), around half of total new generation demanded by the minerals and energy industry is to be purchased, as opposed to outside the SWIS, where only 7% is likely to be purchased.

High Growth Regions

- The majority of new electricity generation required by the sector is for projects in the Pilbara region (66%) and the Mid West region (22%).
- Total incremental electricity demand in the Pilbara due to minerals and energy projects is expected to reach almost 12,000 GWh/a or 2.2 GW by 2015, predominantly self generated and gas fired.
- Upcoming minerals and energy projects in the Mid West region are likely to require approximately 770 MW additional electricity by 2015, around half of which could be purchased.

Network Outlook

- Horizon Power is seeking to further develop the North West Interconnected System (NWIS) to increase system efficiency. Their estimated system-wide savings range from 8-11% over the nearest competitive option.
- The SWIS is currently forecast to be capacity constrained in the Mid West region, however completion of the proposed Mid West Energy Project *(see section 4.3.1 for explanation of the project)* would allow sufficient capacity within the system to meet the demands of minerals and energy projects.
- Additionally, the SWIS will require 720 MW additional generation capacity by FY15 and 2,275 MW by FY21.

1. Equivalent GW estimated at 0.6 load factor

Key Findings Relating to Domestic Gas

State Overview

- Natural gas demand for WA is expected to increase from an estimated 356 PJ/a in 2009, to 581 PJ/a in 2020.
- Activity in the minerals and energy sector over the period to 2020 will drive the majority of gas demand, however new electricity generation (not specific to minerals and energy projects) expected to be gas fired will also drive high levels of other industry demand.
- Incremental minerals and energy demand is expected to increase by 80 PJ/a (218 TJ/d) by 2015 – a 45% increase based on 2009 estimated consumption.
- Overall, the incremental natural gas demand is predominantly used for electricity generation (94%), with relatively minimal use in industrial process and mobile plant.

High Growth Regions

- The incremental natural gas demand from minerals and energy projects will predominantly be consumed in the Pilbara (an incremental 70 PJ/a by 2015).
- The Mid West region will also exhibit significant incremental demand over this period, however less than may be expected as more companies have chosen diesel fired self generation in this region, while others are expecting to use purchased electricity where the source of generation is not yet known.

Supply Outlook

- The current projections by the Department of Mines and Petroleum suggest domestic gas supply will, at a minimum, increase by around 500 TJ/d by 2016.
- Using these figures from the Department of Mines and Petroleum, it appears the forecast supply is sufficient to meet forecast demand.

Note: Incremental gas demand includes gas required for industrial process and mobile plant, along with gas required for self generated electricity. Therefore does not account for companies sourcing purchased electricity which may or may not be gas fired.

Growth and Competitiveness

- Higher electricity generation costs in the Pilbara may strengthen the economic case for development of the NWIS and an effective electricity market in this region.
- However, development of the NWIS presents a coordination challenge and is unlikely to occur in the absence of leadership by government and/or industry.
- Delivery on the overall infrastructure needs of WA, including energy infrastructure needs, will require cooperation between industry and the State and Federal governments.
- The greenfields nature of the Mid West region provides an opportunity for coordinated development of shared infrastructure. However, the costs, timeframes and regulatory framework for investment in transmission and generation infrastructure may delay projects and/or increase the viability of self generation.

Growth and Competitiveness (continued)

- There is rapidly increasing demand for gas but indications are that the supply and demand balance will be addressed by operation of the market.
- Rapidly increasing demand for energy will place considerable upwards pressure on energy prices resulting in higher energy costs for business.
- CME and many other groups have called for the development of a state energy strategy to provide a clear framework for the development and operation of the Western Australian energy market.

Environment and Liveability

- Electricity prices for the entire electricity market, including in other business sectors and residential electricity supplies, are set to increase significantly over the coming years.
- The technical, regulatory and commercial barriers to the introduction of widespread networked generation makes the introduction of renewables more challenging.

Key Findings Relating to Water

State Overview

- Irrigated agriculture and mining (excluding minerals processing) and energy sectors dominate water use in the state, with a total of 35% and 28% respectively. These sectors, along with increasing total residential consumption, have driven recent demand increases.
- Total water demand in WA is expected to increase at an overall growth rate of 4% per annum, from 2,500 GL/a in 2009 to 3,820 GL/a by 2020.
- Incremental minerals and energy water use is expected to reach 422 GL/a by 2015.
- There is a high level of dewatering expected to occur over the next few years: around 1,000 GL over the 6 year period approximately 760 GL of which is likely to be non consumptive.
- Survey responses indicate that almost 50% of 'new' minerals and energy dewatering taking place between 2010 and 2015 would be re-injected into aquifers and 23% supplied to third parties.

High Growth Regions

- The majority of the new minerals and energy water use in the state will be located in the Pilbara, with an average annual growth rate over the period to 2015 of 13% in this region.
- Other high growth areas include the Mid West region (growth of 5% per annum) and Perth/Peel region (growth of 9% per annum).

Water Availability

- The high volumes of water use expected over the coming years due to minerals and energy projects means that allocation limits within the Pilbara region will need to be revisited in order to meet forecast levels of growth.
- The current groundwater allocation limit for the aggregate region (431 GL/a) is adequate for incremental water use in the Mid West, however uneven distribution of groundwater throughout the region is likely to lead to localised areas of scarce water resources.
- Current forecasts from the Water Corporation suggest a likely demand-supply imbalance going forward if current water usage trends are not reduced. The Water Corporation is also undertaking work on source development to meet this shortfall.

Growth and Competitiveness

- Barriers currently exist in making better use of water from mine dewatering. To assist the minerals and energy sector in making better use of dewatering water, the Department of Water is working with the Department of Mines and Petroleum to improve opportunities for third party access.
- Increasing water scarcity will stimulate demand for a water market but cost pressures alone will not be sufficient to form a market. Significant regulatory changes are likely to be required to develop an effective water market in WA.
- To meet future water demands more effectively, we need to see increased collaboration and coordination within the sector, and with government.
- In addition to increased collaboration, technology and innovation within the water supply industry will assist in meeting future water demands.
- Competition between the minerals and energy industry and other water intensive industries will inevitably increase as water becomes more scarce.
- Whilst the aggregate Mid West area has sufficient underground water availability to support minerals & energy project growth, quality and quantity of water is not evenly distributed throughout the region, leading to difficulty in securing supply for specific projects.
- Investment in securing water supply in the Pilbara will be required to meet demands from the minerals and energy sector within the next 5 years.

Environment and Liveability

- Reduction in sustainable groundwater yields due to declining rainfall in the Perth/Peel and Great Southern/South West regions will require contingency planning and increased cooperation between the public and private sector to ensure water use demands are continued to be met.
- Further work is needed to better understand the cumulative and downstream impact of groundwater abstraction including dewatering, both in terms of the continual draw down of resources and discharging to rivers and creeks.
- Increased residential population in the Perth/Peel region will further increase water demand in an already water constrained region.
- As the scarcity of water increases, the cost of water is likely to increase, further increasing the cost of living in WA.

Contents

Section Three

People

3.1 Summary

Key findings relating to People

State Overview

- The workforce required for current growth plans in the minerals and energy sector is expected to reach a peak of almost 119,500 persons in 2012 – some 43,800 above the 2009 sector workforce of approximately 75,600.
- This profile is consistent with the forecast developed in the 2008 Growth Outlook Study, however the peak in 2012 is forecast to be much sharper.
- The construction workforce will peak in 2012 and then reduce by 2015 as operations are commissioned. The majority of this incremental construction workforce in 2012 is to be met though FIFO arrangements (92%).
- Unlike the construction workforce, the operating workforce will continue to increase over the period with the state requiring an additional 27,000 operations staff (above 2009) by 2015.
- It is expected that 81% of the total additional FIFO workforce will choose to be based in the Perth/Peel region and 11% are expected to be interstate FIFO.
- The new minerals and energy workforce will increase demand for services both in the public and private sector. It is estimated that over the period to 2020, an additional 30,000 to 50,000 people will be employed in other related industry sectors as a result of increased minerals and energy activity.

High Growth Regions

- Areas of highest labour growth are the Pilbara, Mid West, and Perth/Peel regions.
- The majority of incremental minerals and energy workforce will be driven by projects in the Pilbara region. Current planned projects suggest an additional 34,000 workers in 2012 in the region, nearly 27,000 of which are construction workers, declining to an additional 21,000 in 2015 (above 2009).
- The Mid West will require an additional 7,500 workers by 2012, 5,700 of which will be new construction workers, experiencing the highest labour force growth rate of any region.
- While there is limited local increase in minerals and energy labour demand in the Perth/Peel region, the total incremental FIFO demand sourced from the region is expected to be great, peaking at around 30,000 in 2012, remaining at around 16,500 by 2015.

Workforce Supply Outlook

- Based on current ABS population projections and current rates of participation in the sector, there is a forecast deficit in workforce requirements going forward. It is evident that the workforce demand cannot be met based solely on forecast migration and current workforce participation rates.

3 People – 3.1. Summary – 3.1.2 Comparison with 2008 Survey

- The 2008 Growth Outlook Study forecast relatively slow growth over 2008-2010, with some regions even reducing headcount over this period. There was a sharp upturn forecast for 2011, with incremental demand peaking in 2012. The total workforce forecast for 2012 was 38,000 above 2007 workforce. This profile, particularly the sharp upturn in 2011, is consistent with the results from the current State Growth Outlook, however an even sharper peak in 2012 is now forecast with almost 44,000 new workers expected above 2009 workforce.
- On a regional basis, a greater peak is expected in the Pilbara, similarly in the Mid West, with the current survey capturing plans for iron ore projects that have emerged or advanced since the previous survey.
- There is lower growth forecast for the Goldfields/Esperance region in the current survey as this region was affected more severely than anticipated during the Global Financial Crisis. Therefore some of the future demand in this region is simply offsetting the closures in 2009 where the workforce decreased from 19,000 in 2008 to 14,400. There are positive signs for the region's nickel industry with a number of operations recommencing production.
- The outcomes of the current survey suggest a higher proportion of FIFO workforce going forward than was identified in the 2008 survey, increasing from 72% to 85% of incremental workforce. Both surveys however showed a reduction in the FIFO workforce used over time with the transition to operations.
- The source of FIFO was mostly consistent in both surveys, i.e. 82% from Perth/Peel and 10% interstate compared with 81% Perth/Peel and 11% interstate in the current survey. The major difference in outcomes has been the omission of international FIFO; the 2008 survey suggested 5% would be sourced internationally, however negligible international FIFO was suggested in the current survey. This 'gap' has been made up by an increased number of Great Southern/South West FIFO workers in the future.
- Overall, the workforce profile is comparable, however there is a higher peak forecast for 2012, culminating in a more severe workforce availability outlook.

Note: Comparisons have been made with 2008 Constrained Growth Outlook, which considered the effects of the Global Financial Crisis by applying a scaling factor to the original data collected from industry participants.

Growth and Competitiveness

- The ability to respond to the rapid and high demand for labour in the sector will be a determining factor in the on-time delivery of minerals and energy projects. The effects of the Global Financial Crisis granted industry and government 'breathing space', however we are now transitioning to a period of greater demand than just prior to the crisis and are again confronted by the same (or more acute) circumstances and policy settings faced at that time.
- There is a need to continue to promote increased interstate labour agility as a means of meeting the future labour demand, however the current cost of living in WA reduces the attractiveness of relocating to the state.
- The ability to effectively draw on international workforce to meet incremental labour demands, particularly for short-term construction workers, will be the key to maintaining growth in the sector. This will be important as new projects in the eastern states impact on the interstate labour pool.
- To respond to the forecast labour demand, continued efforts are required to increase workforce participation in the sector, focusing on under-represented groups such as indigenous and women, to supplement FIFO and migration programs.
- The upcoming period of high minerals and energy growth presents the opportunity of increased economic benefits to the state and, in particular, to regional areas of WA.
- We will see continued community investment from minerals and energy companies.
- The challenge to maintain and grow skills diversity in the state to ensure that WA remains a vibrant city to live in for families and young professionals will continue.
- Alternative labour sources will be required to ensure the total labour pool in WA is not drained as resources are drawn to the minerals and energy sector and away from other industries and the public sector.

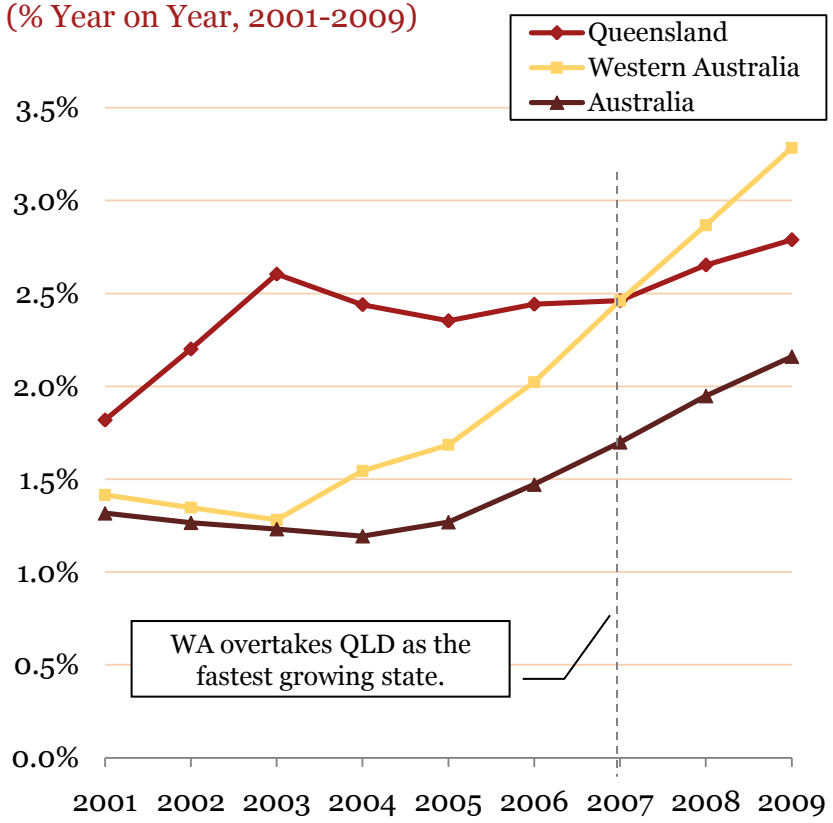
Environment and Liveability

- Population increase will place increasing demands on social and hard infrastructure in Perth and regional towns, requiring advanced planning and investment. These amenity and service standards are crucial to attracting the labour needed to support growth in the minerals and energy sector.

3.2 State Overview

Historic Population Growth in Australia

Australian Population Growth
(% Year on Year, 2001-2009)



In 2007, year on year population growth in WA surpassed 2.5% and has since become the fastest growing state in the country.

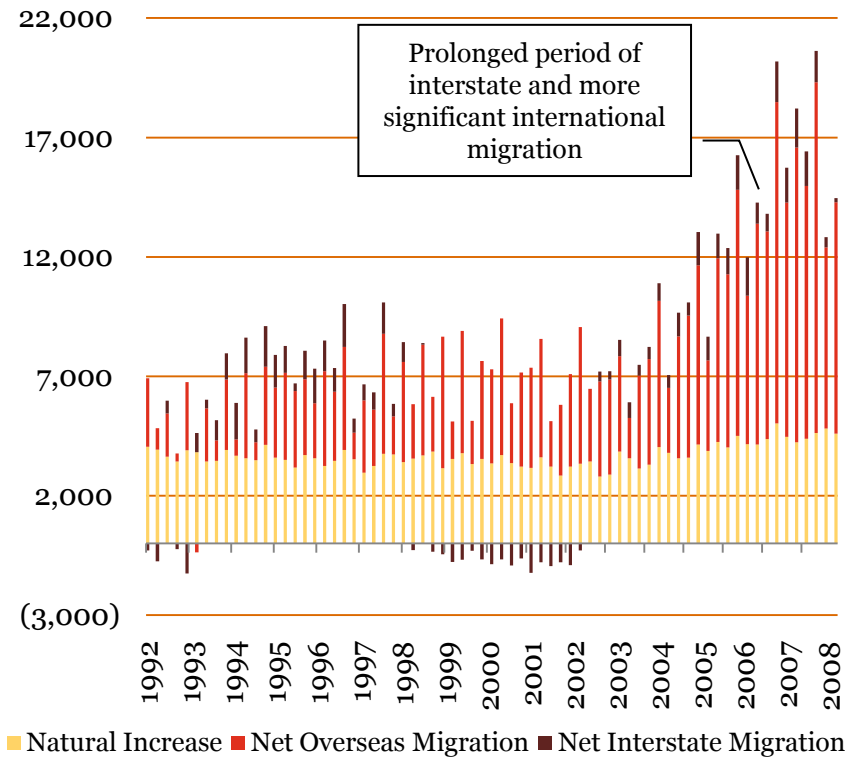
Historically, WA has trailed only Queensland as the fastest growing state in Australia.

Since March 2000, Australia's population has increased by almost 3.1 million to approximately 22.2 million in December 2009 with the population of WA reaching approximately 2.2 million or 10% of the total. While WA constitutes only 10% of the total population, 13% of the national net population increase has occurred within the state.

Source: ABS, Australian Demographic Statistics, Cat 3101.0

Sources of WA Population Growth

WA Population Change Components
(Quarterly, 1990 to 2009)



The population increase in WA has primarily been driven by unprecedented levels of net overseas migration, and secondly by high levels of interstate migration.

The rapid population increase in WA has been driven by unprecedented levels of net overseas migration and net interstate migration not seen since the mid 1990's.

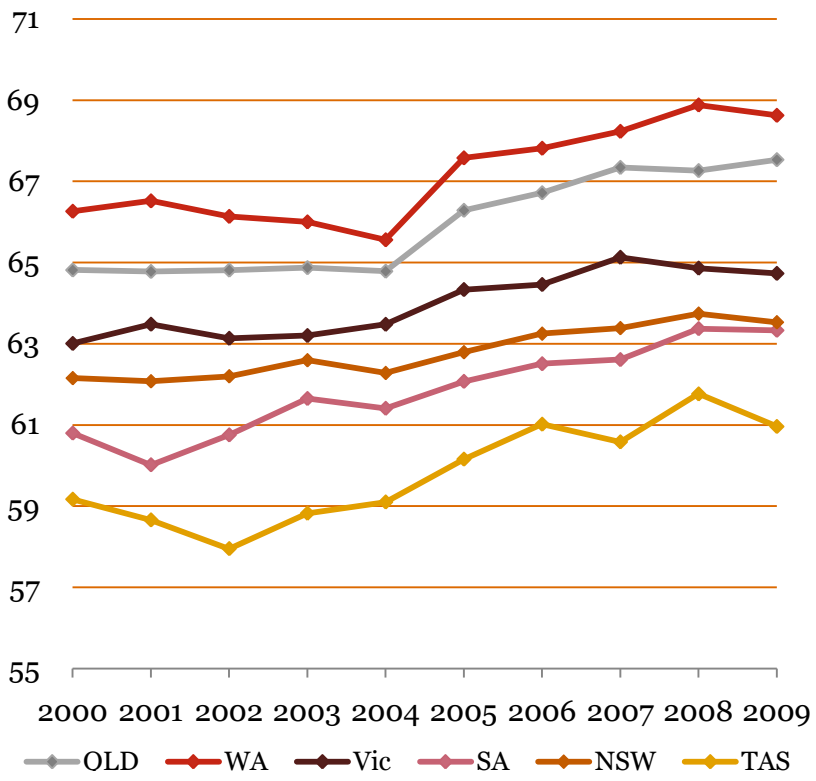
Since 2004, the total population increase in WA has been more than 291,000 comprising: 60% net international migration; 32% natural increase; and net interstate migration of 8%.

The recent high level of net migration to WA coincides with the continued demand for labour driven by the minerals and energy sector and other state development. Also of note is the growth in natural increase since the lower rates experienced in the early 2000's.

Source: ABS, Australian Demographic Statistics, Population Change Components States and Territories, Australia Cat: 3101.0

Comparative Workforce Participation Rates

Workplace Participation Rates
(%, annual average, by State)



WA has the highest workforce participation rate of any state in Australia and therefore may provide limited scope for increase in the future.

Workforce participation is an important driver of available workforce in WA. Recent economic growth in WA, underpinned by strong growth in the minerals and energy sector, has stimulated an increase in participation rates. Workforce participation rates in the state increased from 66.5% in 2000 to around 68.2% in 2008 and 2009, remaining above all other states, reflecting the employment opportunities arising from strong economic growth in the state.

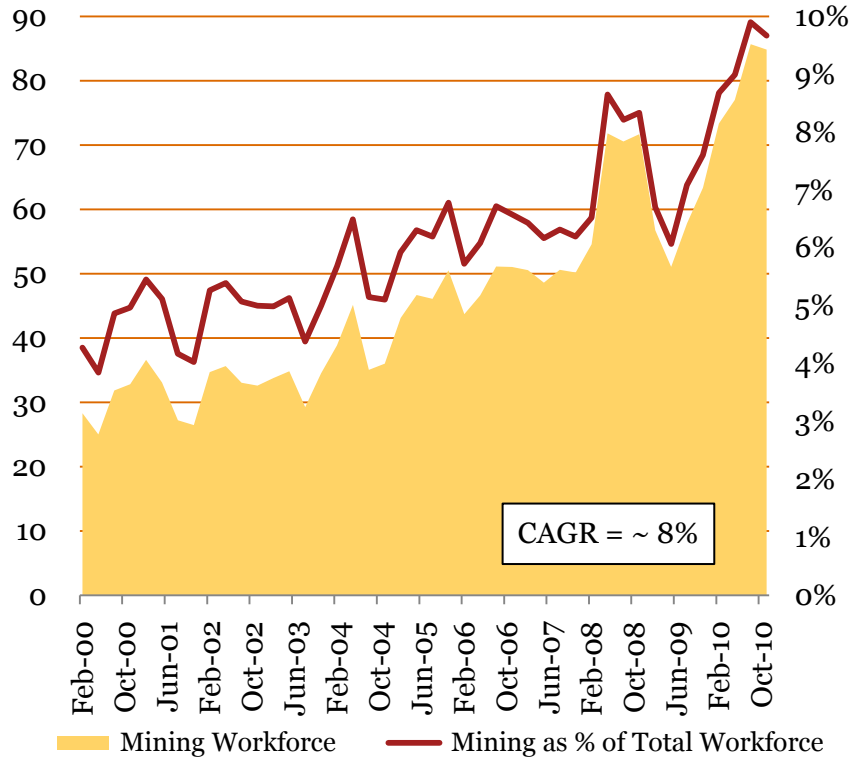
While workforce participation rates in WA are comparatively high, some groups may be underrepresented, such as women and aboriginal people.

For example, while QLD has a slightly lower overall participation rate than WA, it has a higher female participation rate than WA (61% for QLD vs. 59% for WA).

Source: ABS Cat.: 6202.0 Labour Force, Australia, Labour Force Status

Growth in Mining[1] Employment

Historic Mining Employment
(000's Employed LHS, % Total Workforce RHS)



Over the past 10 years the mining[1] workforce has grown significantly – both in absolute terms and relative to other industries, now accounting for almost 10% of the total workforce in WA.

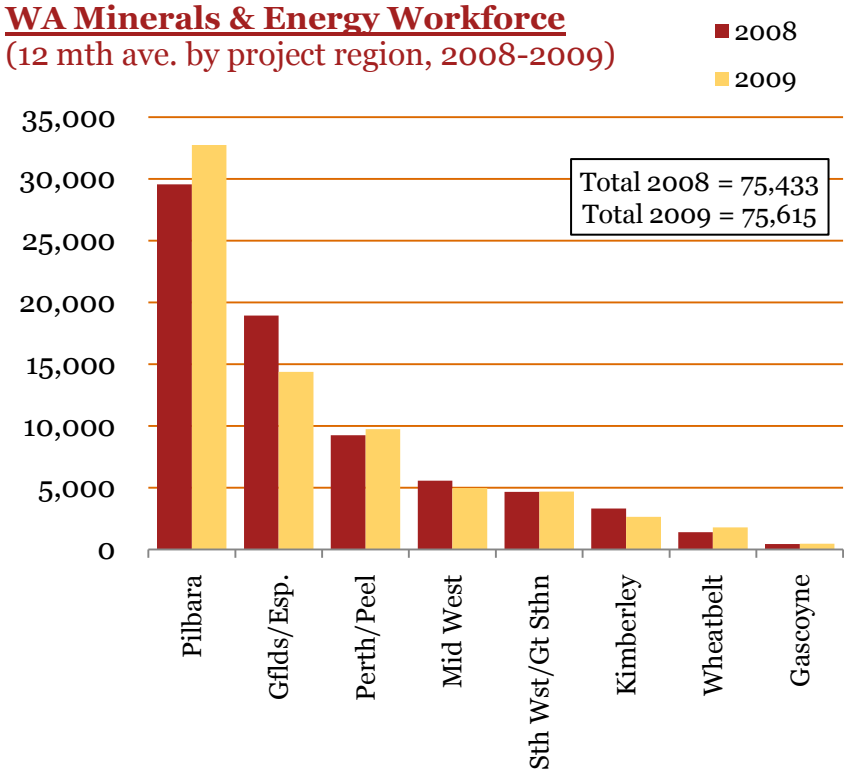
Analysis of mining[1] employment over time demonstrates the very strong growth in the industry. In 2000, mining[1] accounted for only 4.3% of the total workforce in WA and in late 2010 (November), accounted for nearly 10% of the total workforce in WA.

The mining[1] workforce was seriously affected during the Global Financial Crisis, with a significant drop in employment in the months after November 2008. During this period, the decrease in mining[1] as a proportion of the total workforce in WA shows the sector was hit harder than WA in general; however the industry has seemingly recovered faster than other industries, now reaching employment levels above those prior to the Global Financial Crisis.

1. Not all mining employment is reflected in the mining industry classification used by the Australian Bureau of Statistics and is therefore only used for trend analysis throughout this study. E.g. contractors employed in site preparation and removing overburden at a mine site on a contract or fee basis are listed under Site Preparation Services. Employees engaged in liquefying natural gas, production of pig iron, hot briquetted iron, alumina, the smelting and refining of metals are included in Manufacturing.

Source: Chart data from ABS Statistics Cat:6291.0.55.003 Labour Force, Australia, Detailed, Quarterly

Minerals and Energy Workforce – Regional Breakdown



The average number of people employed in the minerals and energy sector remained constant between 2008 (75,433) and 2009 (75,615).

This amounted to 9.0% and 9.2% of the total Western Australian workforce in 2008 and 2009 respectively.

The majority of the workforce is employed on operations in the Pilbara, with approximately 30,000 and 33,000 working in the region in 2008 and 2009.

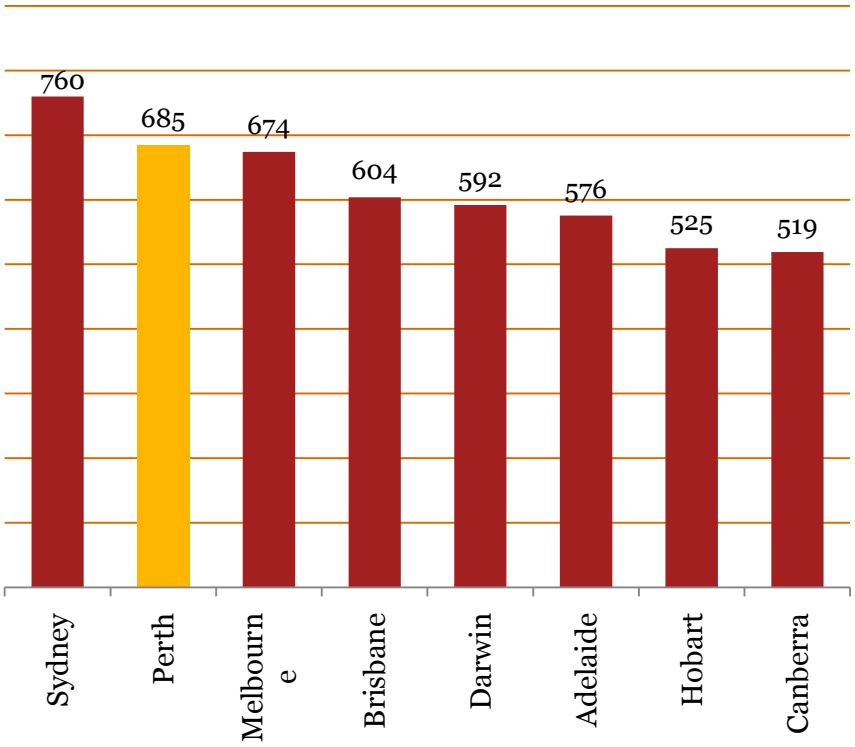
The second largest workforce is located in the Goldfields/Esperance region with around 19,000 employed in 2008, falling to around 14,000 in 2009. Workforce reductions in this region occurred as the drop in commodity prices over the period caused numerous nickel producers to exit from live operations or drastically reduce production. In addition, many upcoming nickel projects have been placed on hold, to be reviewed periodically for economic viability.

Whilst production from nickel operations decreased significantly in 2009, most other commodities increased workforce, most notably iron ore, gold, and petroleum.

Source: Department of Mines and Petroleum (DMP) Workforce Statistics 2009. There may exist minimal differences in the petroleum workforce statistics from the DMP (does not include third party contractors for some sites) however the data is comparable to that collected in the State Growth Outlook.

Comparative Housing Affordability in Australia

Housing Affordability, Australia
(Median Price / Weekly Wage, Jun 2010)



House prices in Perth, relative to salary, are the second highest in Australia.

This upward trend in relative house prices has been increasing in WA for the past few years. This trend is only expected to continue as WA population increases and desirable land becomes more scarce.

Additionally, the Pilbara remains the most expensive region to rent a house in Australia, where median rents sit at $1,650/week[1].

RP's December quarterly analysis of the rental market suggested Pilbara median rents were more than four times more expensive than Perth median rents.

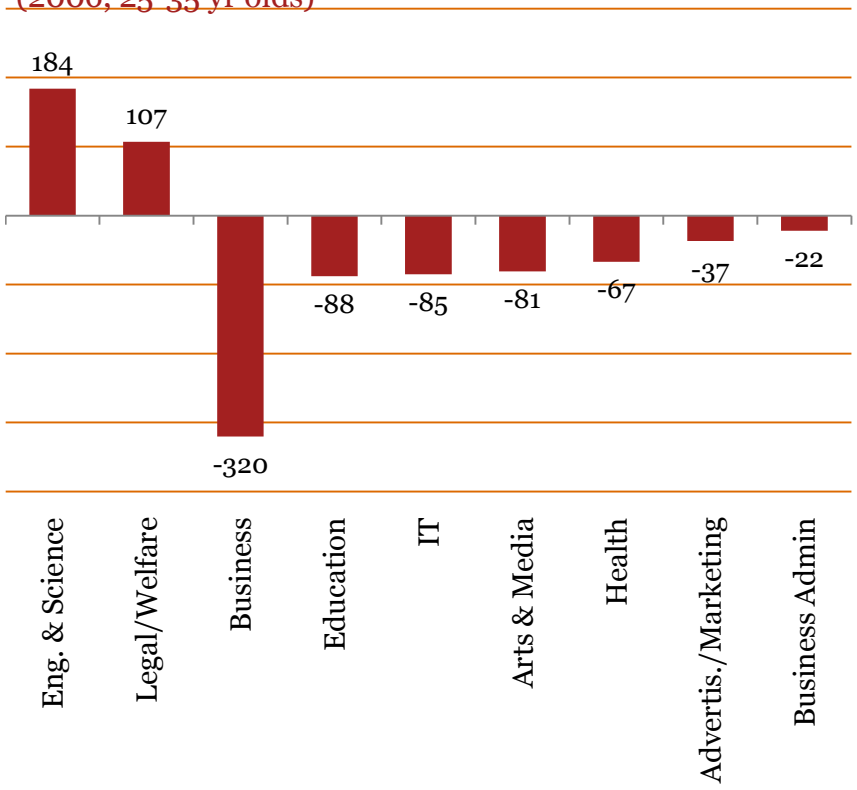
This affects the ability of the minerals and energy sector in drawing permanent interstate and international workers into the state, and specifically into the Pilbara.

1. RP Data, Dec 2010.

Source: ABS - 6416.0 House Price Indexes: Eight Capital Cities.

Net Movement of Young Professionals in to WA

Net Movement in Tertiary Educated: WA
(2006, 25-35 yr olds)



Perth is experiencing a skills drain across its young tertiary educated professionals.

Whilst we have been able to attract people to fill technical roles in engineering and science due to demand from the minerals and energy sector, we have seen a net loss of young professionals in the areas of business, education, arts and the media in WA.

Additionally, according to surveys conducted in Australia and the US[1] the overwhelming majority of people who had recently moved cities had made the decision based on where they would like to live, not work.

1. ABS Housing Intentions Survey, "CEOs for Cities" (2006)

Source: Form, "Comparative Capitals" (August 2008)

WA Population Outlook – Population Change Components

ABS Population Change Components 2009-2020	Natural Increase Assumption	Interstate Migration Assumption	Overseas Migration Assumption
Series A	245,000	61,000	395,000
Series B	203,000	28,000	287,000
Series C	170,000	-5,500	225,000

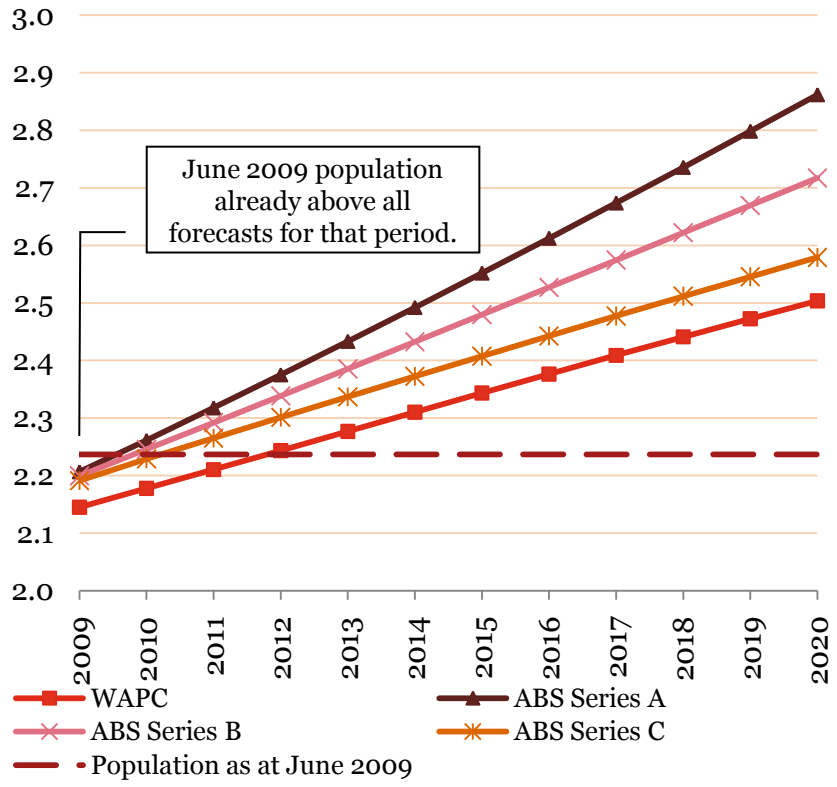
The Australian Bureau of Statistics (ABS) projects interstate and overseas migration over the period of 2009-2020 of between 220-456,000 (or approximately 20-41,000 per year).

The ABS releases three series based on differing assumptions regarding interstate and overseas migration and also fertility rates. Series A is the most aggressive of the projections, suggesting a population in WA of 2.86 million by 2020, with significantly high rates of interstate and overseas migration. Series B and C forecast a population of 2.72 and 2.58 million respectively, with lower levels of migration and natural increase (a net decrease in interstate migration is presented in Series C). Series B is relatively consistent with recent population trends in the state.

Source: ABS Demographic Projections by Change Component Cat 3222.0 Table 12

WA Population Outlook

Western Australian Population Outlook
(Millions, 2009 – 2020)



The current ABS population projections for WA forecast a 2020 population of between 2.58 and 2.86 million (representing a compound annual growth rate of between 1.5 and 2.3%) with net overseas and interstate migration ranging from 219,500 to 456,000 over this period.

There is no consensus population outlook for WA although the outlooks developed by the Western Australian Planning Commission (WAPC) and the ABS are widely endorsed.

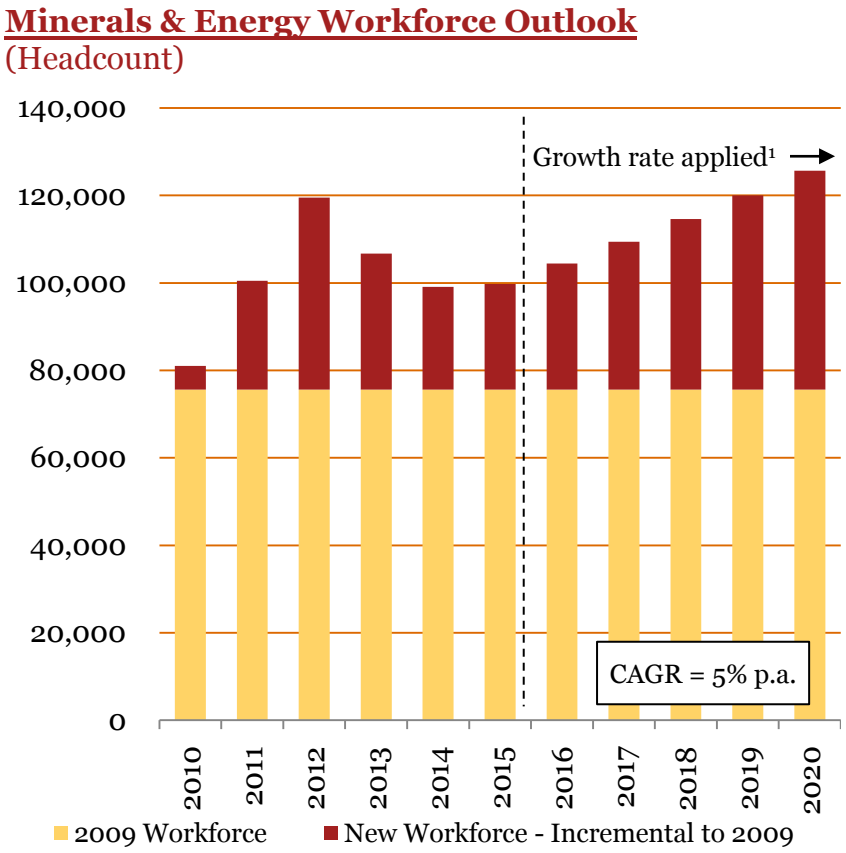
The WAPC projections were completed in 2005, and projected a population for WA of 2.5 million to be reached in 2020. This is now outdated, as the estimated resident population for WA in June 2009 is higher than that forecast for 2012. The WAPC is currently undergoing a review of their projections, therefore the ABS population projections are utilised in this study.

To put this into perspective, since 2000, WA has averaged annualised population growth of 1.9 per cent[1].

1. Chamber of Minerals and Energy Submission to "Infrastructure to Support Western Australia's Growth" February 2010.

Source: Chart data from Department for Planning and Infrastructure (2005) WA Tomorrow, ABS ERP by State Cat, 3201.0 Table 5, ABS Demographic Projections by Change Components, Cat 3222.0 Table 14

Minerals and Energy Workforce Outlook – WA



The workforce required for current growth plans in the minerals and energy sector is expected to reach a peak of almost 119,500 persons in 2012 – some 43,800 above the 2009 sector workforce of approximately 75,600.

This incremental demand will in effect be even greater due to natural attrition in the sector. This natural attrition effect is likely to be more pronounced in WA given the relatively high median age of our population by national standards[2].

The rapid labour demand in this sector is driven by the current environment of strong commodity prices, prompting the construction of new projects, along with the recommissioning of projects previously shut down under Global Financial Crisis conditions.

A forecast easing of labour intensive construction projects will see employment in the sector dropping in 2014 and 2015, although remaining well above current levels.

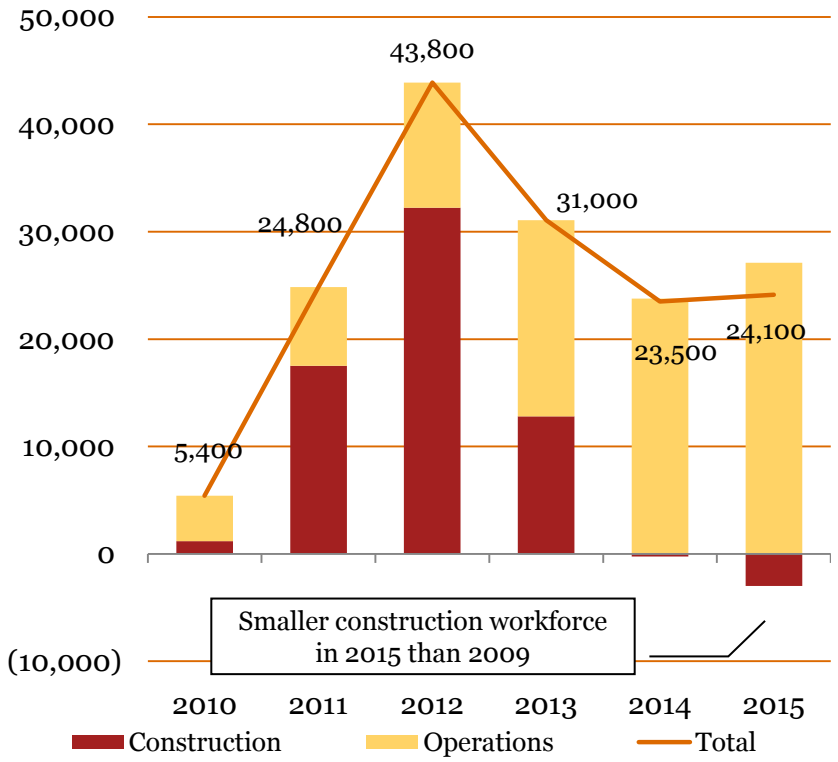
Total workforce in this sector is expected to be 100,000 in 2015. This rapid increase in labour demand will prove challenging for the sector and government to address. This will be discussed further in *Section 3.4 Implications and Opportunities*.

1. Growth extrapolated after 2015 as period extends beyond the typical planning period of most companies.
2. Chamber of Minerals and Energy Submission to "Infrastructure to Support Western Australia's Growth" February 2010.

Source: State Growth Outlook. Baseline minerals and energy workforce provided by the Department of Mines and Petroleum (DMP). There may exist minimal differences in the petroleum workforce statistics from the DMP however the data is comparable to that collected in the State Growth Outlook.

Minerals and Energy Workforce Outlook – Construction vs. Operations Workforce

New Workforce Breakdown
(Headcount, incremental to 2009)



The peak of 43,800 new workers in the minerals and energy industry predominantly constitutes new construction workers. An additional 32,000 construction workers will be required by 2012.

If current growth plans from the minerals and energy industry are realised on schedule, this would see the incremental construction workforce halve in 2013 to around 13,000. 2014 and 2015 would see an additional decrease in construction workforce to below 2009 levels.

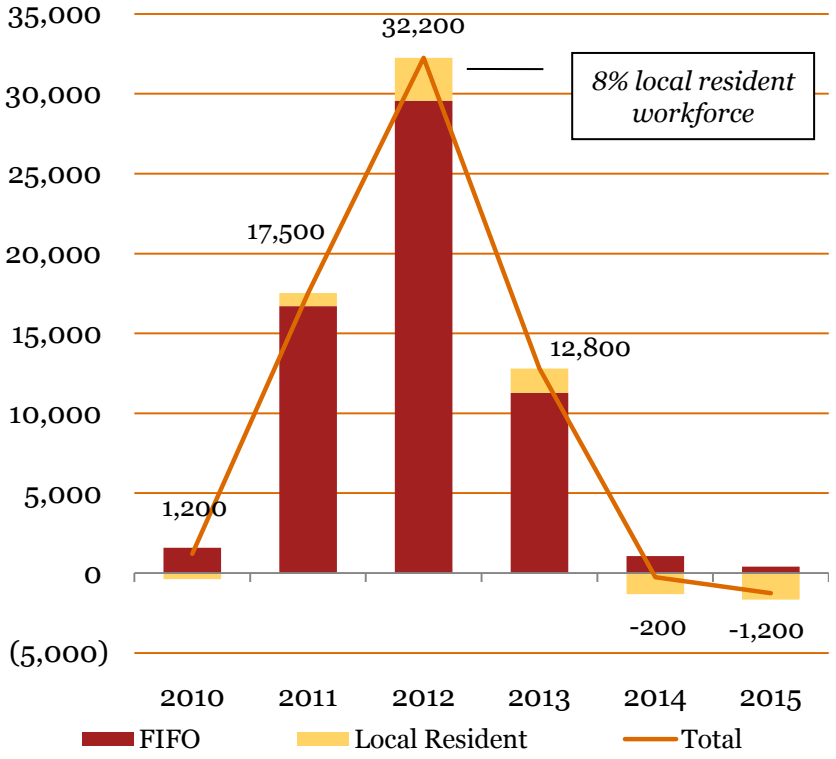
The peak in demand for construction workers is short term, and is largely driven by a small number of large oil and gas projects, along with numerous greenfield and brownfield iron ore projects.

Unlike the construction workforce, the operating workforce will continue to increase over the period with the state requiring an additional 27,000 operations staff (above 2009 levels) by 2015.

Source: State Growth Outlook.

Construction Workforce – FIFO vs. Local Resident

Construction Workforce Breakdown
(Headcount incremental to 2009)



Source: State Growth Outlook.

As can be seen in the workforce breakdown (left), the majority of incremental construction workforce is to be met through FIFO arrangements (92%).

At the height of demand for construction workers there will be an additional 29,600 FIFO construction workers (92%), and 2,700 local resident construction workers (incremental to 2009).

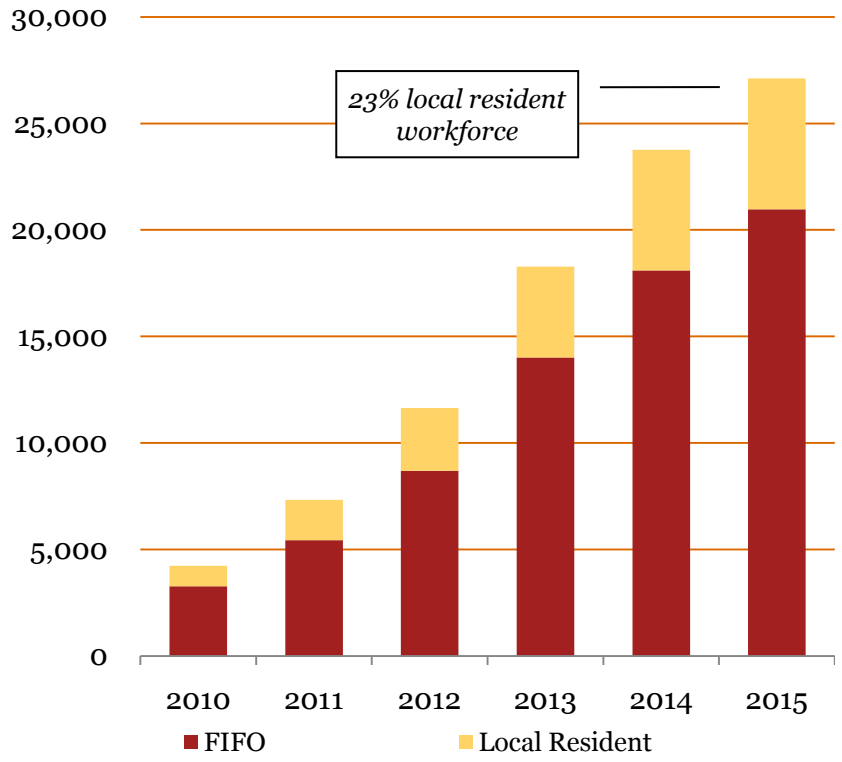
The remoteness of projects often makes it difficult to establish a residential workforce. FIFO also remains a popular lifestyle choice, which suits many workers and their families.

The short term nature of the required construction workforce will mean that a FIFO arrangement will be most appropriate for the majority of employees, companies and towns during the construction period.

FIFO replaces the need for major coordinated investment and construction in areas of high workforce demand. It allows companies to be agile as long lead times associated with accommodating local residents (vs. FIFO) are not required. However, initiatives such as Royalties for Regions are now seeing significant investment in population centres, in proximity to major projects. These strategies, along with individual company contributions to social infrastructure, aim to improve the amenity and liveability of these locations, strengthening options for a residential workforce.

Operations Workforce – FIFO vs. Local Resident

Operations Workforce Breakdown
(Headcount incremental to 2009)



The operating workforce in WA will continue to grow as new assets are commissioned, with the expectation of an additional 27,000 operations personnel required in the industry by 2015.

The largest year on year increase in workforce is expected to occur in 2013, with an additional 5,600 operations employees required in this year over the previous year. This corresponds to the largest drop in construction workforce.

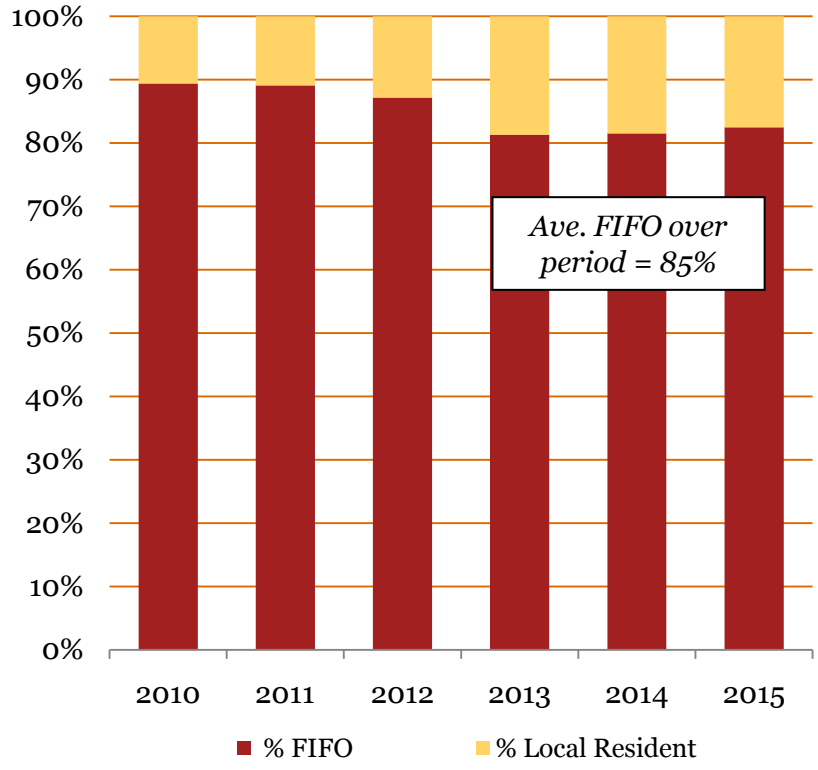
Whilst the additional operations workforce required over the next 5 years will largely be FIFO, there is a much greater proportion of local residents (23%) than is planned for the construction workforce (8%).

The more permanent nature of this workforce better supports the provision of housing and associated amenities required in a permanent place of residence.

Source: State Growth Outlook.

Incremental Workforce – FIFO vs. Local Resident Trend Over Time

FIFO vs. Local Resident Over Time
(% of workforce incremental to 2009)



The proportion of new workforce that is FIFO will slowly decrease from nearly 90% in 2010 to approximately 81% in 2015.

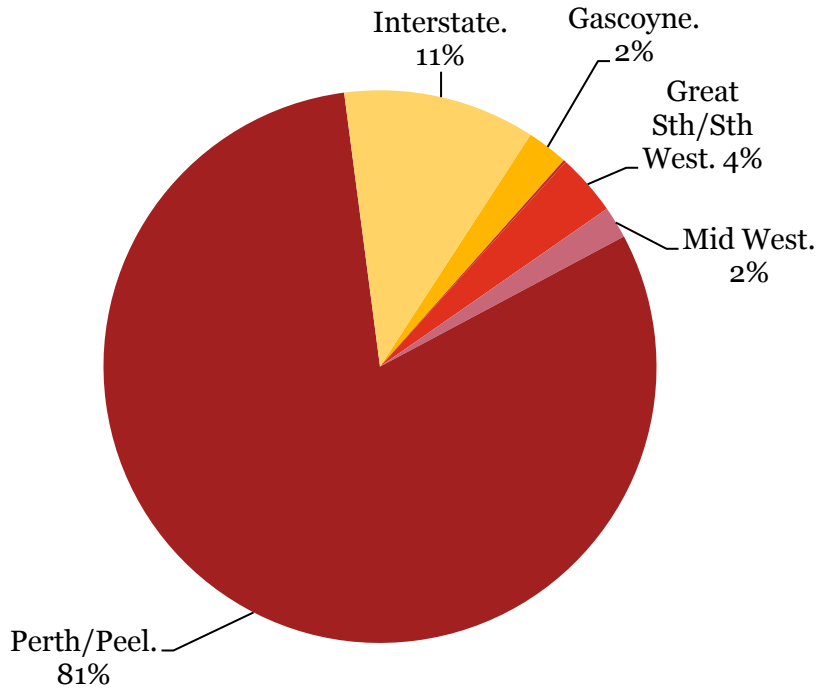
The graph to the left outlines the combined construction and operations workforce profile. It demonstrates that in 2010 and 2011, of the total additional workforce, just under 90% will be sourced through FIFO. As the short-term construction workforce begins to reduce and operations workforce steadily climbs, the effect is an overall decrease in FIFO workers as a proportion of total.

The average FIFO workforce contingent over the 6 year period is high, standing at 85% (based on incremental workforce to 2009).

Source: State Growth Outlook.

Total Workforce – Source of FIFO

Source of New FIFO: 2010-2015
(By place of residence, incremental to 2009)



1. Above 2009 workforce

Source: State Growth Outlook.

It is expected that 81% of the total additional FIFO workforce will choose to be based in the Perth/Peel region.

This represents an increase of over 17,000 employees per year over the period.

Of the FIFO workforce, 4% is to be based in the Great Southern/South West. The 2% FIFO sourced from the Mid West predominantly constitutes workers who will FIFO (and drive-in-drive-out) of Geraldton.

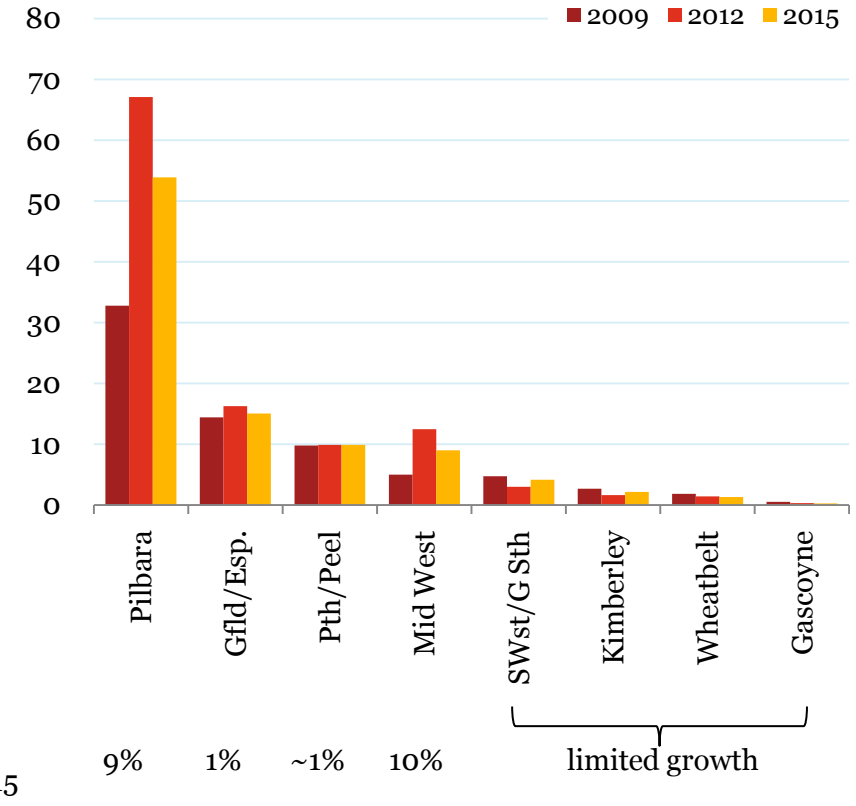
The survey highlighted a large number of interstate FIFO workers are expected (11% of total), or around 2,200 per year.

Queensland, NSW and Victoria were identified as the main sources of interstate FIFO. The ability to rely on interstate FIFO as a source of employment is likely to become increasingly difficult with the increased demand for construction workforce as Queensland rebuilds. This will be discussed in greater detail in Section 3.4 *Implications and Opportunities*.

As limited international FIFO was highlighted in the survey, it is expected that workers would be recruited internationally, relocating to the Perth/Peel and Great Southern/South West region and operate on a FIFO basis from this region.

Minerals and Energy Workforce Growth by Project Region

Minerals & Energy Workforce Growth
(Thousands, by Project Region)



The majority of the minerals and energy workforce required over the coming years will be required for projects located in the Pilbara: 34,000 in 2012 and 21,000 in 2015 (above 2009 workforce).

This would be a 65% increase on the 2009 Pilbara workforce by 2015.

In terms of annual percentage growth, the Mid West region is expected to experience the highest growth with 10% per annum to 2015 expected.

Currently the Mid West minerals and energy workforce is around 5,000 or just under 7% of the total state minerals and energy workforce. With the rapid growth expected in the region, this is likely to grow to over 9% of the total minerals and energy workforce by 2015.

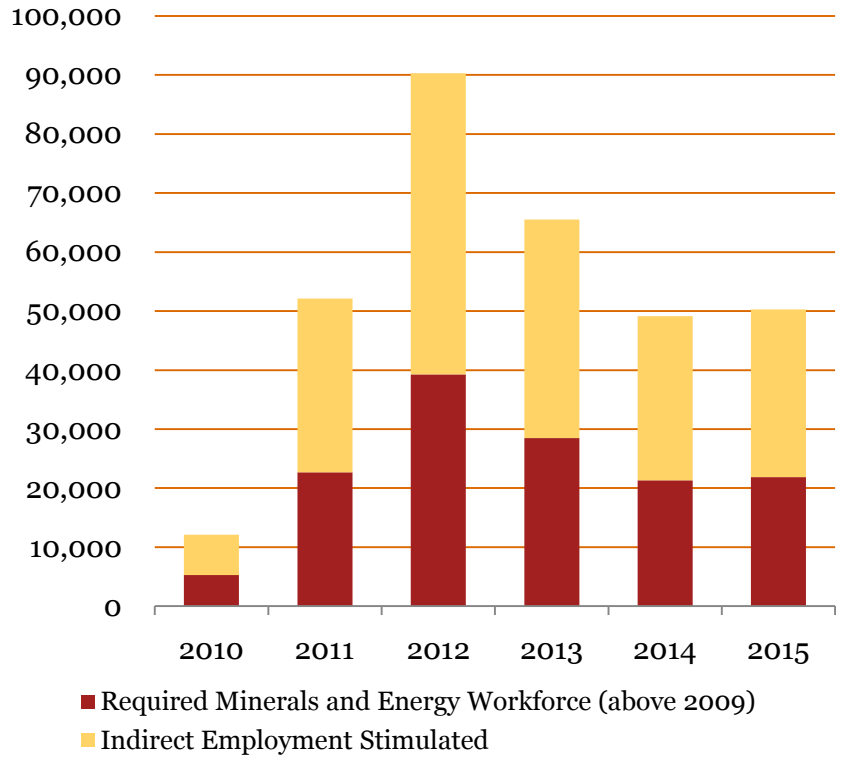
While the percentage growth in the Goldfields/Esperance region is minimal (~1% per annum), this still represents a total increase to 2015 of 700 workers in the sector.

Limited additional growth is expected in the remaining regions, with some regions (Gascoyne, Wheatbelt) expected to see a decrease in the total workforce as labour intensive construction projects are commissioned and other operations ramp down.

Source: State Growth Outlook. Baseline minerals and energy workforce provided by the Department of Mines and Petroleum (DMP). There may exist minimal differences in the petroleum workforce statistics from the DMP however the data is comparable to that collected in the State Growth Outlook.

Minerals and Energy Stimulated Employment

Minerals & Energy Driven Workforce
(Headcount incremental to 2009)



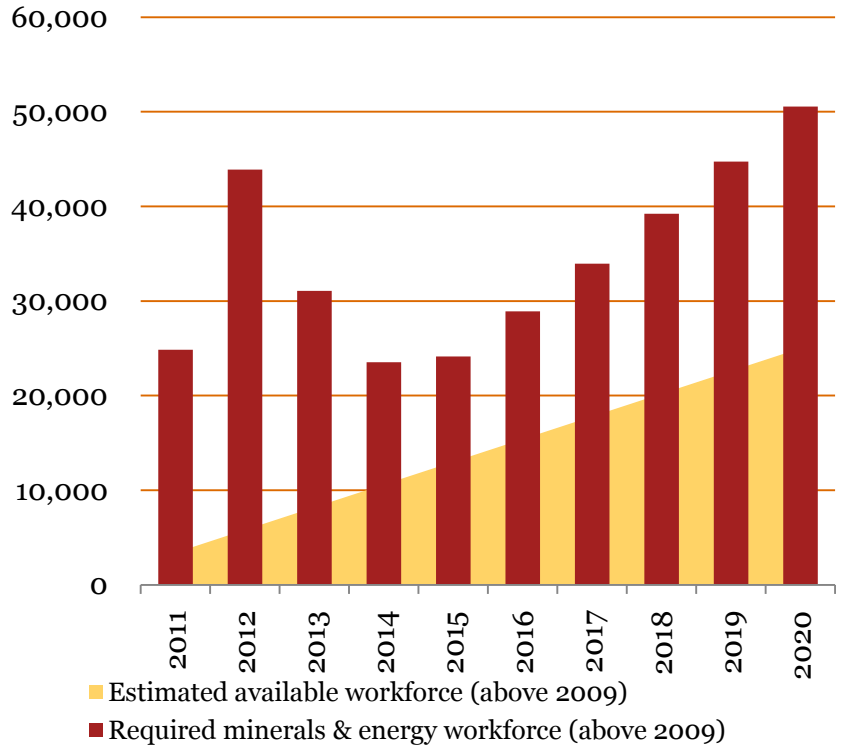
The new minerals and energy workforce will increase demand for services in both the public and private sector. It is estimated that over the period, an additional 30-50,000 people would be employed in other related industry sectors every year as a result of increased minerals and energy activity.

These additional employment impacts would be required to support increased activity in the minerals and energy sector in services such as transport and engineering.

Note: Agreed indirect multiplier used in 2009 Growth Outlook (average of 1.3 indirect workers per minerals and energy employee). Excludes expected interstate FIFO employees

Minerals and Energy Workforce and Likely Available Workforce in WA

Minerals & Energy Workforce Outlook
(Headcount, 2009-2020)



It is evident that the workforce demand cannot be met based solely on forecast migration and current workforce participation rates.

Based on current ABS population projections and current rates of participation in the sector, there is a forecast deficit in the future workforce requirements.

The future available labour force will be influenced by three key factors:

- The population outlook for WA (can be influenced by migration);
- The workforce participation rate (WA already exceeds all states); and
- The ability to draw employees from other sectors.

The workforce outlook (left) highlights that unless there is a significant and rapid change to the labour force drivers, there will exist a workforce deficit that could delay minerals and energy projects.

This will be discussed in greater detail in *Section 3.4 Implications and Opportunities*.

Note: Incremental population calculated as projected population over the age of 15 less current population over the age of 15.
Note: Implied workforce calculated as incremental population multiplied by current participation rate of 68% and no unemployment.
Note: Available minerals and energy workforce calculated as implied workforce multiplied by current proportion of WA workforce involved in minerals & energy sector assumed to remain constant at 9.2% (2009).

Source: Demand from State Growth Outlook. Supply outlook based on ABS Series B population outlook and calculated using the inputs described above. THE ABS population outlook is detailed on page s 31 and 32 of this report.

3.3 Regional Overview

Overview of High Growth Regions

Growth in the Pilbara Region

The projects driving growth in this region are: oil and gas; iron ore and associated infrastructure; and copper.

Current planned projects suggest an additional 34,000 workers in 2012 in the region, declining to an additional 21,000 in 2015.

Over the period to 2015, 90% of the incremental workforce in the Pilbara is expected to be FIFO.

In 2015, there is expected to be the largest contingent of local resident workers in the region: 3,100 above 2009 workforce.

Growth in the Goldfields Esperance Region

The workforce peak in the Goldfields/Esperance region is likely to occur in 2013, with a total of 16,300 minerals and energy workers in the region (approximately 2,400 above 2009 workforce).

New workers in the Goldfields/Esperance region are largely to be local resident (56% of new workforce).

Growth in the Mid West Region

Major projects driving the labour demand within this area include: iron ore and relevant infrastructure (both hematite and magnetite); gold; and uranium.

The planned projects for the Mid West region require an additional 7,500 workers in 2012 above the 5,000 in the region in 2009.

The total workforce in the region is expected to be 9,000 in 2015, representing an 80% increase on the 2009 workforce.

Over the period to 2015, 83% of the incremental workforce in the Mid West is expected to be FIFO, including some FIFO/DIDO from Geraldton.

Growth in the Perth/Peel Region

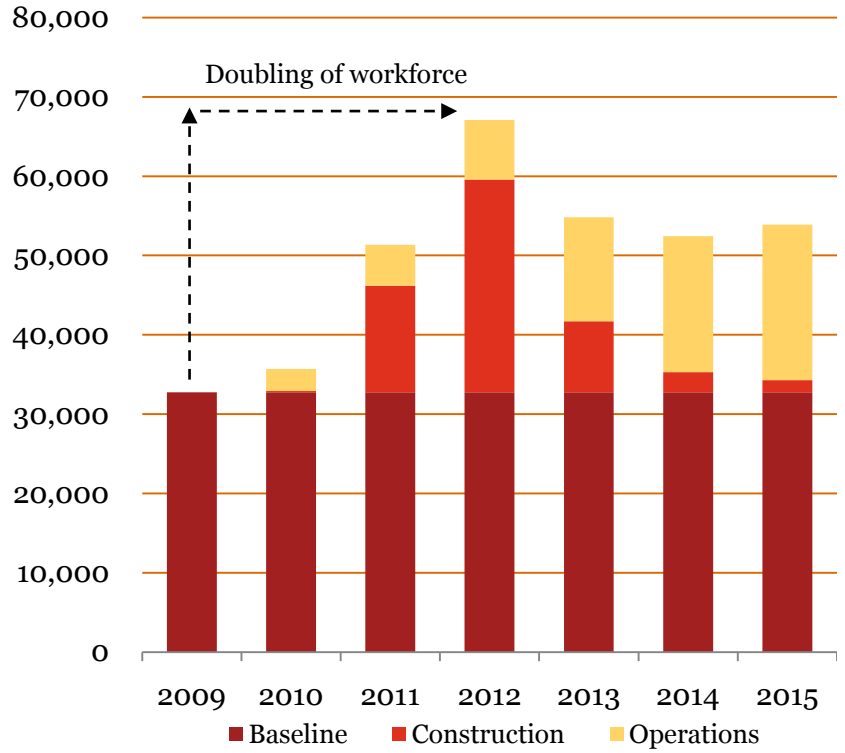
Limited local increase in minerals and energy labour demand, however incremental FIFO demand sourced from Perth/Peel region is expected to peak at around 30,000 in 2012, remaining at around 16,500 by 2015.

The indirect employment stimulated could mean a total of approximately 70,000 additional workers employed as a result of minerals and energy projects by 2012.

Note: Majority of figures quoted as incremental to 2009 demand.

Pilbara – Total Minerals and Energy Workforce

Pilbara Minerals and Energy Workforce
(Headcount, 2009 – 2015)



The majority of incremental minerals and energy workforce will be driven by projects in the Pilbara region. Current planned projects suggest an additional 34,000 workers in 2012 in the region, declining to an additional 21,000 in 2015 (above 2009).

This increase implies a doubling of the workforce over the short term to 2012, settling to a 65% increase in 2009 workforce by 2015 (or a total of 67,000 in 2012 and 54,000 in 2015).

An intense period of construction drives the peaked profile, with a construction workforce of 27,000 required in 2012, reducing to an additional 1,500 above 2009 construction workforce by 2015.

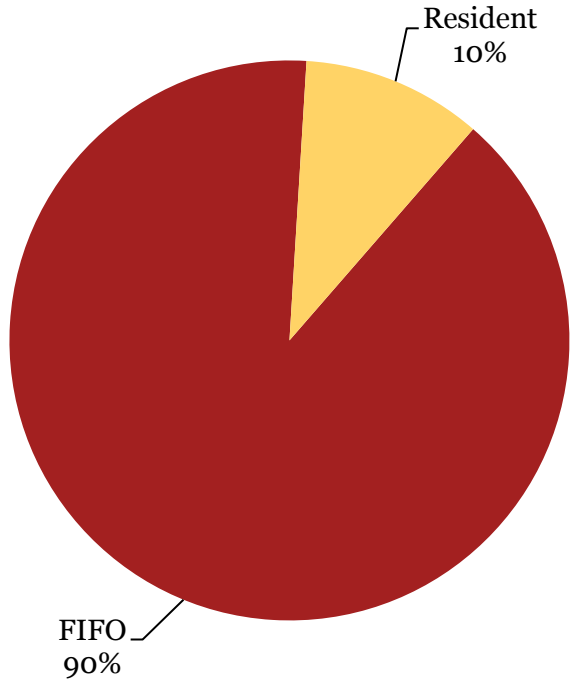
The operations workforce in the region will steadily increase over the period, with the region likely to require an additional 19,000 operations workers by 2015.

The projects driving this workforce profile are oil and gas, iron ore and associated infrastructure and copper.

Source: State Growth Outlook. Baseline minerals and energy workforce provided by the Department of Mines and Petroleum (DMP). There may exist minimal differences in the petroleum workforce statistics from the DMP however the data is comparable to that collected in the State Growth Outlook.

Pilbara – FIFO and Local Resident Workforce

FIFO vs. Resident
(Total incremental over period 2010-2015)



Over the period to 2015, 90% of the incremental workforce in the Pilbara is expected to be FIFO.

The make up of the FIFO workforce is predominantly Perth/Peel: over 75%. Additionally, there is a high proportion of interstate FIFO workers expected: 15% over the period. This is a higher proportion of interstate FIFO workers than other regions, due to the availability of direct flights to the Pilbara from Brisbane, Melbourne and Sydney.

It is also expected that some FIFO workers will be sourced from the Gascoyne region, as the local resident workforce in this region declines over the period.

In 2015, there is expected to be the largest contingent of local resident workers in the region; some 3,100 above the 2009 workforce.

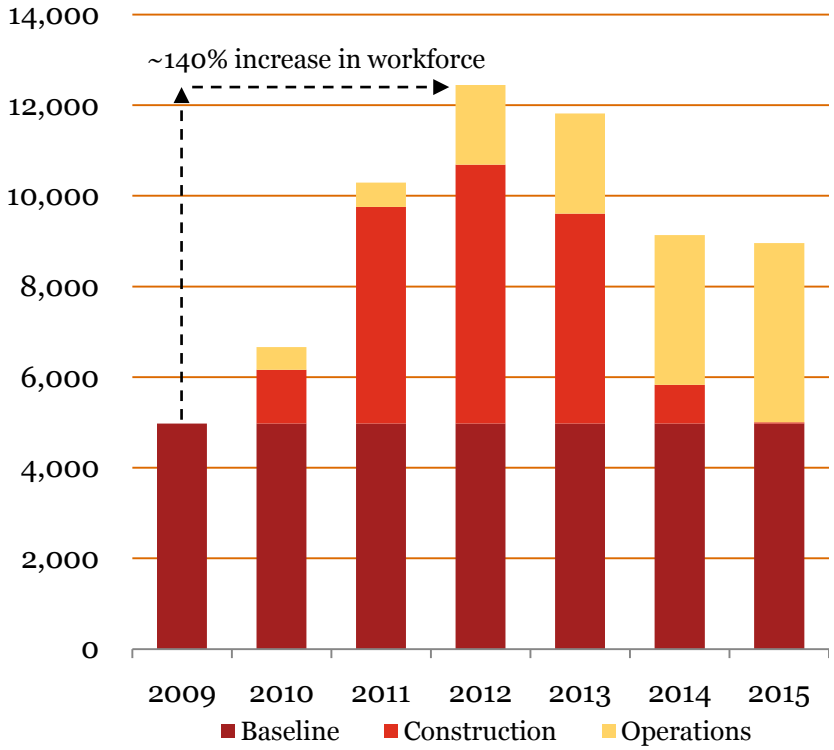
It is estimated that this local resident workforce would have an associated 'family' impact in the area of 7,500[1].

1. The family multiplier used is 2.4. This was accepted and used for the 2008 CME Growth Outlook Study and used in the PICC study "Planning for resources growth in the Pilbara: revised employment and population projections to 2020".

Source: State Growth Outlook

Mid West – Total Minerals and Energy Workforce by Project Region

Mid West Minerals & Energy Workforce
(Headcount, 2009 – 2015)



The planned projects for the Mid West region require an additional 7,500 workers in 2012 above the 5,000 in the region in 2009.

2012 will see the peak workforce in the Mid West region – additional 5,700 construction and 1,700 operations workers. The peak in construction in the Mid West is spread over a longer period, with high levels of construction required from 2011 to 2013.

The total workforce in the region is expected to be 9,000 in 2015, representing an 80% increase on the 2009 workforce.

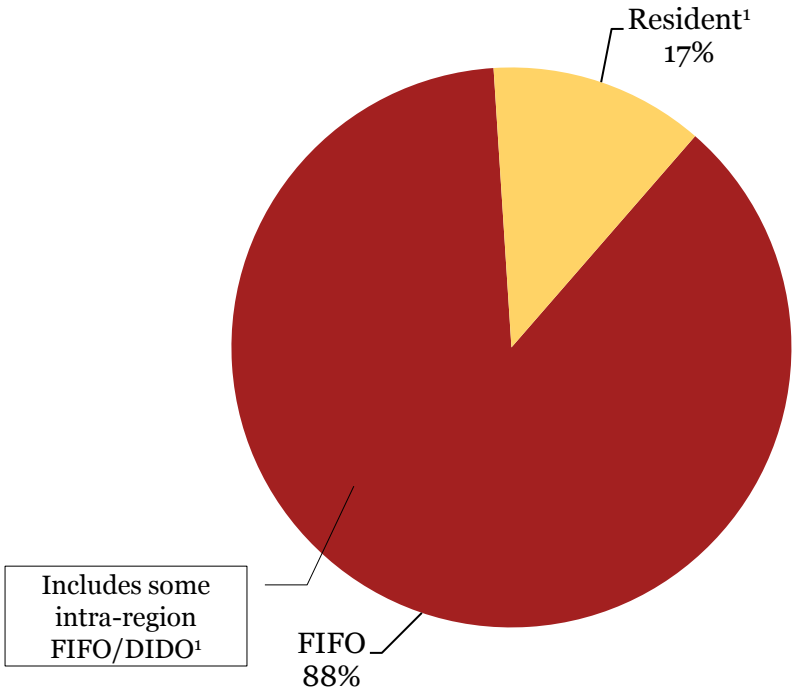
By 2015, the 'new' workforce will almost solely consist of operations workforce as almost all the current planned projects have been commissioned.

Major projects driving the labour demand within this area include: iron ore and relevant infrastructure (both hematite and magnetite), gold and uranium.

Source: State Growth Outlook. Baseline minerals and energy workforce provided by the Department of Mines and Petroleum (DMP). There may exist minimal differences in the petroleum workforce statistics from the DMP however the data is comparable to that collected in the State Growth Outlook.

Mid West – FIFO and Local Resident Workforce

Mid West – FIFO vs. Resident
(Total incremental over 2010-2015)



Over the period to 2015, 83% of the incremental workforce in the Mid West is expected to be FIFO.

The make up of the FIFO workforce is predominantly Perth/Peel (86%) and 5% of the Mid West FIFO contingent is likely to be sourced from interstate. Additionally, around 4% is to be sourced from the Great Southern/South West region.

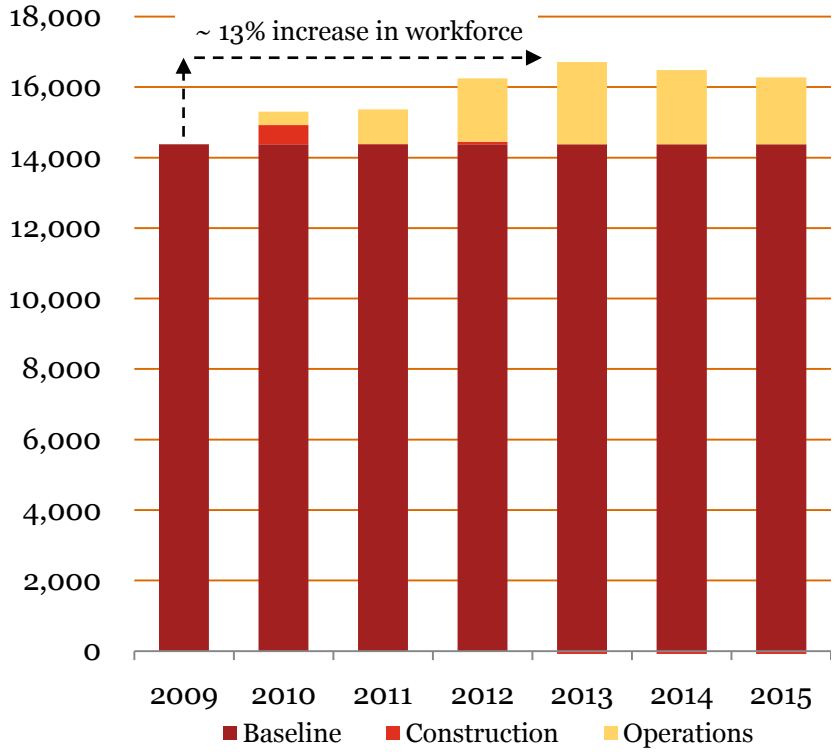
The non-resident workforce will include some (around 5%) FIFO and DIDO out from Geraldton to the project sites.

Note: Local resident classified as proximate to site i.e. not requiring a flight or significant commute.

State Growth Outlook

Goldfields/Esperance – Total Minerals and Energy Workforce

Gold/Esp. Minerals &Energy Workforce
(Headcount, 2009 – 2015)



The workforce peak in the Goldfields/Esperance region is likely to occur in 2013, with a total of 16,300 minerals and energy workers in the region.

This peak is an additional 2,100 minerals and energy workers in the region, or a 13% increase on 2009 employment.

The increased workforce consists mainly of operations personnel.

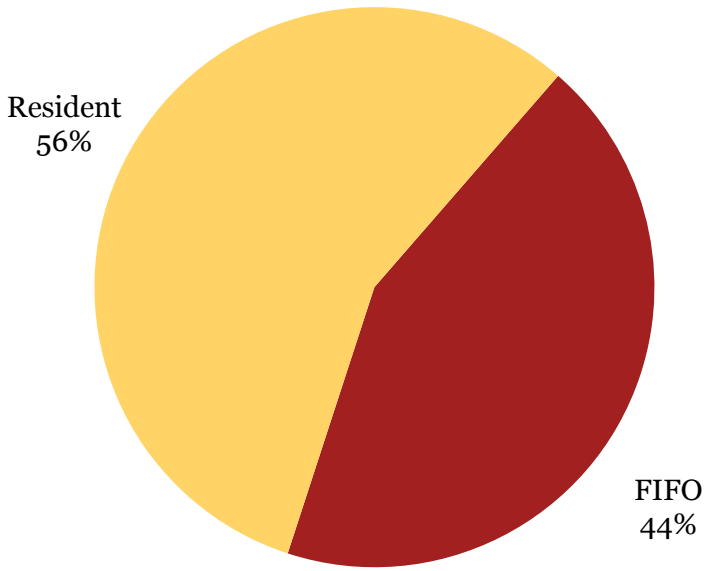
The 2009 construction workforce was fairly significant, including labour intensive gold and nickel projects, therefore incremental construction workforce beyond 2010 is minimal.

Additionally, this region is expected to provide a small FIFO workforce for high growth regions.

Source: State Growth Outlook. Baseline minerals and energy workforce provided by the Department of Mines and Petroleum (DMP). There may exist minimal differences in the petroleum workforce statistics from the DMP however the data is comparable to that collected in the State Growth Outlook.

Goldfields/Esperance – FIFO and Local Resident Workforce

Gold/Esp. – FIFO vs. Resident
(Total incremental over 2010-2015)



New workers in the Goldfields/Esperance region are largely to be local resident (56% of new workforce).

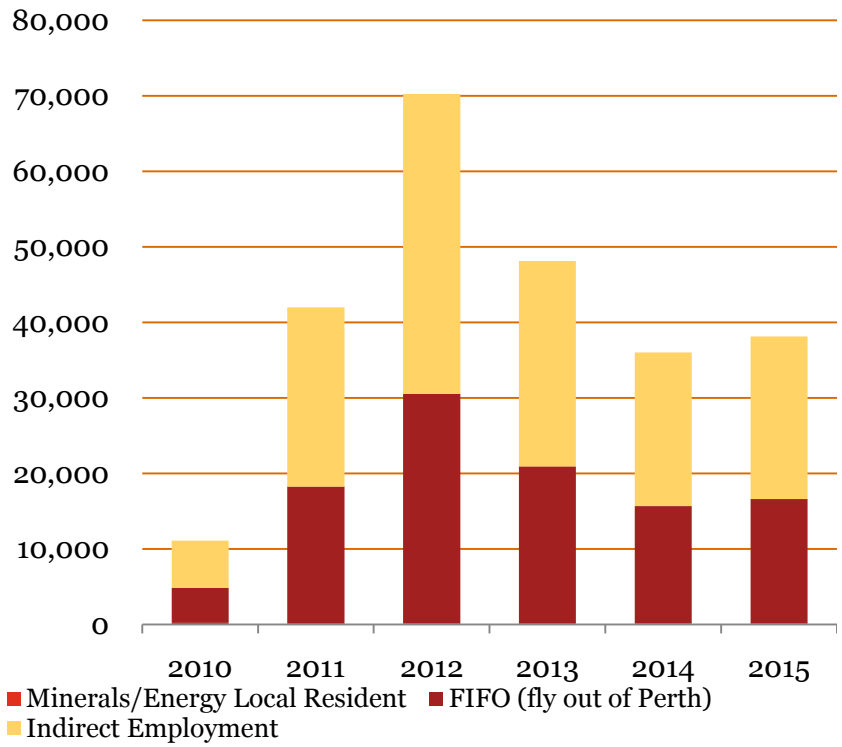
The local resident proportion of the workforce is much greater in this region, partly due to the greater proportion of operations to construction workers, but secondly because the region is more established with more developed infrastructure than other high growth areas.

Nearly all FIFO workers will be sourced from the Perth/Peel region.

Source: State Growth Outlook

Perth/Peel – Total Minerals and Energy Workforce

Perth/Peel Minerals & Energy & Associated Indirect Employment
(Headcount, above 2009 levels)



The indirect employment stimulated could mean a total of approximately 70,000 additional workers employed as a result of minerals and energy projects by 2012 (30,000 direct FIFO out of Perth and 40,000 indirect workers).

As a result of the high level of FIFO workers from Perth, much of the indirect labour will be generated in the Perth/Peel region: up to 40,000 indirect workers by 2012, settling to around 22,000 in 2015.

This high level of indirect employment demonstrates the need for a steady supply of skilled workers not only for direct employment in the mining sector, but also for supporting sectors.

A steady supply of workers in the minerals and energy sector would reduce the labour pull from other sectors.

Note: Agreed indirect multiplier used in 2009 Growth Outlook (average of 1.3 indirect workers per minerals and energy employee). Excludes expected interstate FIFO employees.

Source: State Growth Outlook

Other Regions

Great Southern/South West

There is an increase in workforce expected for the region, peaking in 2012 and 2013 with an additional 1,600 and 1,400 persons in these years respectively. Over the period there is a transition from construction workforce to operations workforce by 2015. The construction workforce will reduce to below 2009 levels, however operations workforce is likely to increase by around 1,000. All local resident.

Additionally, some FIFO (around 1,400 in 2012) is expected from this region direct from Busselton to the Pilbara and Mid West is expected.

Gascoyne

Limited incremental demand over the period. Due to completion of labour intensive construction projects (oil and gas), workforce in the area is expected to decrease to slightly lower levels than 2009.

As such, the Gascoyne region is viewed as a potential source of FIFO employees during this period of high industry growth.

Wheatbelt

The ramp down and eventual shut down of some minerals and energy operations means there is expected to be a slight reduction in the overall industry workforce by 2015.

Kimberley

Ramp down and eventual shut down of some minerals and energy operations, means there is projected to be a slight education in the overall industry workforce by 2015.This is likely to change rapidly however with the extensive opportunities for resources development in the Kimberley.

3.4 Implications and Opportunities

3.4.1 Growth and Competitiveness

3.4.2 Environment and Liveability

Meeting the High Demand for Labour

The ability to respond to the rapid and high demand for labour in the sector will be a determining factor in the on-time delivery of minerals and energy projects. The effects of the Global Financial Crisis granted industry and Government 'breathing space', however we are now transitioning to a period of greater demand than just prior to the crisis and are again confronted by the same (or more acute) circumstances and policy settings we faced at that time.

Current plans show additional labour requirements in the sector will reach an additional 44,000 over the next few years, over and above additional workforce required to replace natural attrition. This will be an extraordinary challenge, requiring improvements on current migration and other programs.

The challenge is likely to be exacerbated given the recent flood and earthquake devastation that hit Queensland and New Zealand where construction workers will be in high demand.

There is a need to continue to promote increased interstate labour agility as a means of meeting the future labour demand, however the current cost of living in WA reduces the attractiveness of relocating to the state.

In recent years, skilled interstate migration has not provided a large component of the supply solution for minerals and energy workforce demand. This source requires renewed focus, with the opportunity to recruit from states experiencing high unemployment.

The current cost of living in WA, in particular housing affordability, reduces the attractiveness of WA as a place to live for potential interstate immigrants. As a result, the majority of the interstate workforce will be FIFO for those who do not wish to relocate themselves or their family to WA.

However it is understood there may be limited capacity for this as Queensland undergoes growth in LNG and some areas of the state rebuild after devastating floods.

Meeting the High Demand for Labour

The ability to effectively draw on international workforce to meet incremental labour demands, particularly for short-term construction workers, will be the key to maintaining growth in the sector. This will be important as new projects in the eastern states impact on the interstate labour pool.

Currently, international labour is utilised through employer sponsored visas like 457s and labour agreements. Processing times for visas and labour agreements remain a concern for industry.

It is crucial that the current skilled migration program is flexible enough to meet the skilled labour requirements of the sector, while continuing to ensure an appropriate pathway to employment is provided for all such the workers. There is an opportunity to use the Pilbara as a testing ground for new models for temporary migration.

Direct international access to the Pilbara through an international airport hub would further enhance the ability to draw on international labour to meet growing demands. In addition, the availability of regular interstate flights as opposed to privately chartered flights, for those who do not wish to relocate to Perth, would assist in meeting the immediate workforce demand.

To respond to the forecast labour demand, continued efforts are required to increase workforce participation in the sector, focusing on under-represented groups such as indigenous and women, to supplement FIFO and migration programs.

Measures such as investment in education and training, and the promotion of careers in the minerals and energy sector across the board is needed to meet demand in the sector.

WA currently has the highest participation rate in Australia, so opportunities to increase this may be limited. However companies are focused on raising participation within specific groups such as women and the indigenous population.

There is a high level of commitment of active involvement and participation by both communities and companies to increase indigenous employment in the sector. Companies within the sector are working hard to engage indigenous employees and indigenous organisations. Further details on initiatives within indigenous communities are available in the Chamber of Minerals and Energy's publication: "Partners in Progress – Indigenous Participation in Western Australia's Resources Sector Progress, Success and Challenges".

Increased Economic Benefits

The upcoming period of high minerals and energy growth presents the opportunity of increased economic benefits to the state and, in particular, to regional areas of WA.

Activity in the minerals and energy sector plays an important role in supporting the economy of our state, and in particular, regional areas of WA. The Department of Mines and Petroleum collected over $3b in royalties alone in the 2010 financial year.

Royalties for Regions (a program which sees the equivalent of 25 per cent of the state's mining and onshore petroleum royalties be returned to the state's regional areas each year as an additional investment in projects, infrastructure and community services) continues to provide economic support to the regional towns and communities with significant minerals and energy activity. Initiatives range from the $250m Pilbara Cities initiative, to the Mid West Regional Flying Doctors Initiative costing around $700,000.

Additionally, there are indirect/flow on economic benefits likely to touch all Western Australians.

We will see continued community investment from minerals and energy companies.

The minerals and energy sector is committed to community development. There are currently wide ranging community initiatives funded and supported by the industry, across areas of education and training, indigenous initiatives and infrastructure programs.

As growth in the sector continues, we will see continued investment in such community initiatives.

Growth and Competitiveness – Challenges to Maintaining and Growing Skills Diversity

The challenge to maintain and grow skills diversity in the state to ensure that WA remains a vibrant city to live in for families and young professionals will continue.

While Perth is an attractive place to live, the city is facing competition from other capital cities for labour, especially for young qualified professionals.

Whilst we have been able to attract technical skills in engineering and science due to minerals and energy driven demand, we have seen a net migration from WA of young professionals in areas of business, education, arts and media.

Additionally, according to surveys conducted in Australia and the US[1] the overwhelming majority of people who had recently moved cities had made the decision based on where they would like to live, not work. This demonstrates that continued investment in both social and hard infrastructure in WA will be necessary to grow skills diversity in the state.

Alternative labour sources will be required to ensure the total labour pool in WA is not drained as resources are drawn to the minerals and energy sector and away from other industries and the public sector.

If additional labour sourcing alternatives are not introduced, wages in the minerals and energy sector will continue to rise, drawing resources away from other industries, along with the public sector.

Between 2005 and 2010, wage inflation in the minerals and energy sector has increased well above the average. Annual percentage growth in the labour price index over the period 2005-2010 was 3.8% across all industries, with 5.2% for mining and 4.4% for construction[2].

1. ABS Housing Intentions Survey, CEOs for Cities, 2006
2. Source: ABS, 6345.0 - Labour Price Index, Australia, Dec 2010

Challenges to Managing Continued Population Growth

Population increase will place increasing demands on social and hard infrastructure in Perth and regional towns, requiring advanced planning and investment. These amenity and service standards are crucial to attracting the labour needed to support growth in the minerals and energy sector.

WA has recently experienced the highest population growth of all cities in Australia. Much of this growth has been absorbed in Perth's outer suburbs. According to the 2006 Census, Perth has the second lowest inner city population density of Australia's capital cities and its metropolitan density overall is less than that of Sydney, Melbourne and Adelaide. This continued expansion of low density growth will place further pressure on civil infrastructure such as roads, public transport.

The minerals and energy sector will continue its commitment to communities within WA, however managing this population growth will also require continued commitment to both planning and investment from Government.

Contents

Section Four
Energy

4.1 Summary

Key Findings Relating to Electricity

State Overview

- The estimated electricity growth rate over the period to 2020 is 6.9% per annum; substantially higher than the long term electricity growth forecast from ABARE (2.1% per annum out to 2030).
- Total electricity consumption in WA could increase by approximately 70% by 2015 – driven by projects in the minerals and energy industry.
- Minerals and energy electricity demand to 2015 is expected to increase by approximately 0.6 GW[1] per year. By 2015 this incremental demand could be equivalent to 3.6 GW. The majority of the demand is expected to be met through self generation (over 80%).
- The majority of incremental self generated minerals and energy demand is expected to be fuelled by domestic gas (approximately 80%).
- In the area serviced by the SWIS, around half the total new generation demanded by the minerals and energy industry is to be purchased, as opposed to outside the SWIS, where only 7% is likely to be purchased.

High Growth Regions

- The majority of new electricity generation required by the sector is for projects in the Pilbara region (66%) and the Mid West region (22%).
- Total incremental electricity demand in the Pilbara due to minerals and energy projects is expected to reach almost 12,000 GWh/a or 2.2 GW[1] by 2015, predominantly self generated and gas fired.
- Upcoming minerals and energy projects in the Mid West region are likely to require approximately 770 MW[1] additional electricity by 2015, around half of which could be purchased.

Network Outlook

- Horizon Power is seeking to further develop the NWIS to increase system efficiency. Their estimated system-wide savings range from 8-11% over the nearest competitive option.
- The SWIS is currently forecast to be capacity constrained in the Mid West region, however completion of the proposed Mid West Energy Project *(see section 4.3.1 for explanation of the project)* would allow sufficient capacity within the system to meet the demands of minerals and energy projects.
- Additionally, the SWIS will require 720 MW additional generation capacity by FY15 and 2,275 MW by FY21.

1. Equivalent GW estimated at 0.6 load factor

Key Findings Relating to Domestic Gas

State Overview

- Natural gas demand for WA is expected to increase from an estimated 356 PJ/a in 2009, to 581 PJ/a in 2020.
- Activity in the minerals and energy sector over the period to 2020 will drive the majority of the gas demand, however new electricity generation (not specific to minerals and energy projects) expected to be gas fired will also drive high levels of other industry demand.
- Incremental minerals and energy demand is expected to increase by 80 PJ/a (218 TJ/d) by 2015 – a 45% increase based on 2009 estimated consumption.
- Overall, the incremental natural gas demand is predominantly used for electricity generation (94%), with relatively minimal use in industrial process and mobile plant.

High Growth Regions

- The incremental natural gas demand from minerals and energy projects will predominantly be consumed in the Pilbara (incremental 70 PJ/a by 2015).
- The Mid West region will also exhibit significant incremental demand over this period, however less than may be expected as more companies have chosen diesel fired self generation, while others are expecting to use purchased electricity where the source of generation is not yet known.

Supply Outlook

- The current projections by the Department of Mines and Petroleum suggest domestic gas supply will, at a minimum, increase by around 500 TJ/d by 2016.
- Using these figures from the Department of Mines and Petroleum, it appears the forecast supply is sufficient to meet the demand.

Note: Incremental gas demand includes gas required for industrial process and mobile plant, along with gas required for self generated electricity. Therefore does not account for companies sourcing purchased electricity which may or may not be gas fired.

Electricity

- The current survey forecasts a similar demand profile to that in the 2008 Growth Outlook Study: limited growth in 2008-2010 with step change increases in demand in 2011, 2012 and 2013.
- The latest survey forecasts a significant additional increase in new electricity demand – around 3,800 GWh/a or approximately 0.7 GW[1] more than estimated in the previous study by 2015. This 'new' generation resides predominantly in the Mid West with the advancement and emergence of energy intensive magnetite projects since 2008.
- Similar to the trends for people and water, electricity demand in the Goldfields/Esperance is forecast to be less in the current survey, due to negative growth exhibited over 2009 not completely forecast in 2008. Conversely, 2014 and 2015 demand in the Great Southern/South West has increased since the last survey.
- There has been a slight increase in the proportion of self generated demand since the previous survey, along with an increase in the proportion of diesel fuelled self generation, particularly in the Mid West.
- In terms of supply, significant progress has occurred on transmission networks within the SWIS, however limited progress has been made on identifying new sources of self generation – still requiring 1,500 MW new generation and demand side management capacity by FY18.

Natural Gas

- A similar growth rate in minerals and energy demand was modelled in this survey (just slightly increased). A greater increase in demand since the previous survey may have been expected, however a significant portion of the 'new' electricity demand is diesel generated, or expected to be purchased, for which a fuel source is yet to be identified.
- On a regional basis, the Mid West and Pilbara regions are expecting a greater demand increase than was originally forecast.
- Overall, there is a similar demand/supply outlook in the current survey, with supply expected to meet demand. The 'high' supply outlook has increased, incorporating lower depletion levels from producing gas fields.

1. Equivalent GW estimated at 0.6 load factor

Note: Comparisons made with 2008 Constrained Growth Outlook, which considered the effects of the Global Financial Crisis by applying a scaling factor to the original data collected from industry participants.

Growth and Competitiveness

- Higher electricity generation costs in the Pilbara may strengthen the economic case for development of the NWIS and an effective electricity market in this region.
- However, development of the NWIS presents a coordination challenge and is unlikely to occur in the absence of leadership by Government and/or industry.
- Delivery on the overall infrastructure needs of WA, including energy infrastructure needs, will require cooperation between industry and the State and Federal governments.
- The greenfields nature of the Mid West region provides an opportunity for coordinated development of shared infrastructure.
- However, the costs, timeframes and regulatory framework for investment in transmission and generation infrastructure may delay projects and/or increase the viability of self generation.

Growth and Competitiveness (continued)

- There is rapidly increasing demand for gas but indications are that the supply and demand balance will be addressed by the operation of the market.
- Rapidly increasing demand for energy will maintain upwards pressure on energy prices resulting in higher energy costs for business.
- CME and many other groups have called for the development of a state energy strategy to provide a clear framework for the development and operation of the WA energy market.

Environment and Liveability

- Electricity prices for the entire electricity market, including in other business sectors and residential electricity supplies, are set to increase significantly over the coming years.
- The technical, regulatory and commercial barriers to the introduction of widespread networked generation makes the introduction of renewables more challenging.

4.2 State Overview – Electricity

Electricity Market in WA

The two interconnected systems existing in WA are the South West Interconnected System (SWIS) and the North West Interconnected System (NWIS). WA does not form part of the National Electricity Market (the NEM) due to the geographic diversity and the physical separation from remaining States in the country.

The SWIS supplies to ~ 840,000 retail customers in the South West, with 5,134 MW of installed generation capacity, 6,000km transmission lines and 85,000km distribution lines. The SWIS is ruled and operated by the government entity of the Independent Market Operator (IMO). Comparatively, the NWIS is less expansive, centring on the industrial towns of Karratha and Port Headland. The NWIS has an installed generation capacity of 500 MW. Beyond the SWIS and NWIS, there are 29 non-interconnected distribution systems operating in WA.

WA Electricity System

Sources of Generation in WA

60% of the state's installed generation capacity is fuelled by natural gas and 35% by coal with the remainder fuelled by liquids and renewables .

In FY09, renewable energy accounted for an estimated 3.1% of the State's electricity consumption and 5% in the SWIS with the predominant source of renewable generation being wind, followed by hydro and bio-energy.

The percentage of renewable generation in FY09 (3.1%) was a slight decrease on the previous year (3.8% in FY08) due to an overall increase in electricity demand, with no renewable energy generators commissioned.

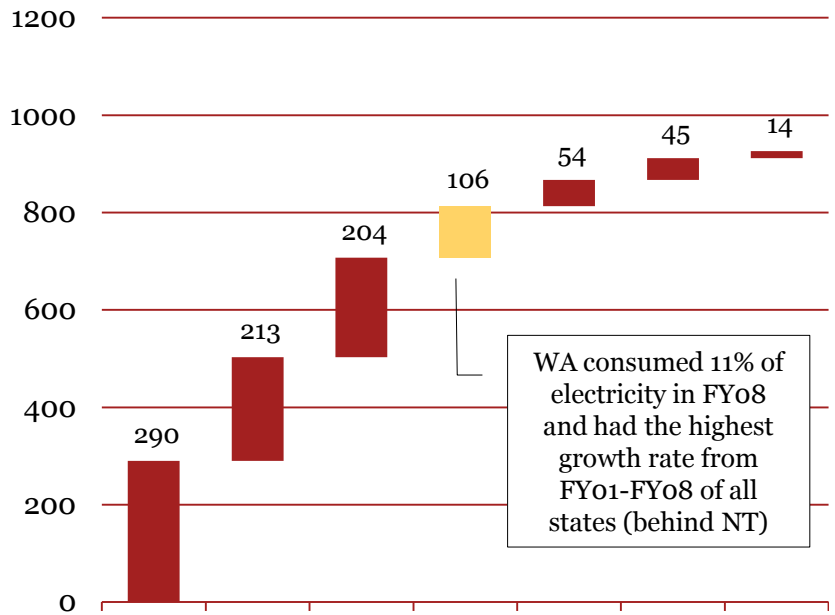
Electricity Consumption in WA FY09

	Electricity Consumed (GWh)	Renewable Energy Consumed (GWh)	Proportion Consumed from Renewable Energy
SWIS	15,113	755	5.0%
Regional Grids (Horizon)	831	81	9.7%
Private (or other) Electricity	15,399	143	0.9%
Total WA Consumption	31,343	979	3.1%

Source: Electricity from Renewable Energy, Office of Energy 2010

Electricity Consumption by State

Electricity Consumption in Australia
(PJ, FY08)



In FY08 WA accounted for 11% of the electricity consumption in Australia, relatively consistent with the proportion of the total population residing in Australia (10% as at December 2009).

NSW, Victoria and Queensland dominated Australian electricity consumption with a total of 75% between the three states. WA accounted for 11% of the electricity consumption in Australia, relatively consistent with the proportion of the total population residing in Australia (10% as at December 2009).

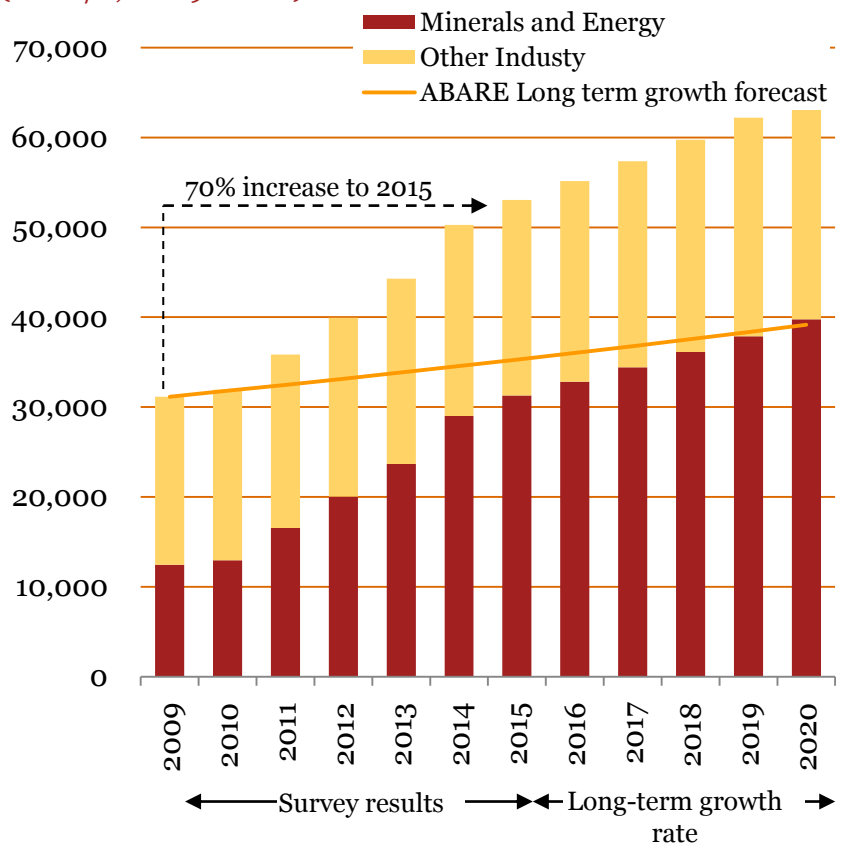
Growth in electricity consumption in WA has been steady at around 5% per annum (CAGR) since FY81.

This has been a more rapid growth than most other states, particularly since FY01, where growth in electricity consumption was exceeded only by the Northern Territory (the smallest recorded consumer in the country).

Source: "Energy Consumption by Fuel", ABARE Energy Statistics 2009

Total Electricity Consumption

Forecast Total Electricity Consumption
(GWh/a, 2009-2020)



Total electricity consumption in WA could increase by ~ 70% by 2015 – driven by projects in the minerals and energy industry.

Incremental electricity required in the state over the next 5 years is likely to reach 22,000 GWh, or ~ a 70% increase on current consumption.

Unlike labour demand which is expected to peak in 2012/2013, electricity demand is expected to continue to grow steadily throughout the period to 2020.

The estimated electricity growth rate over the period to 2020 is 6.9% per annum; substantially higher than the long term electricity growth forecast from ABARE (2.1% out to 2030).

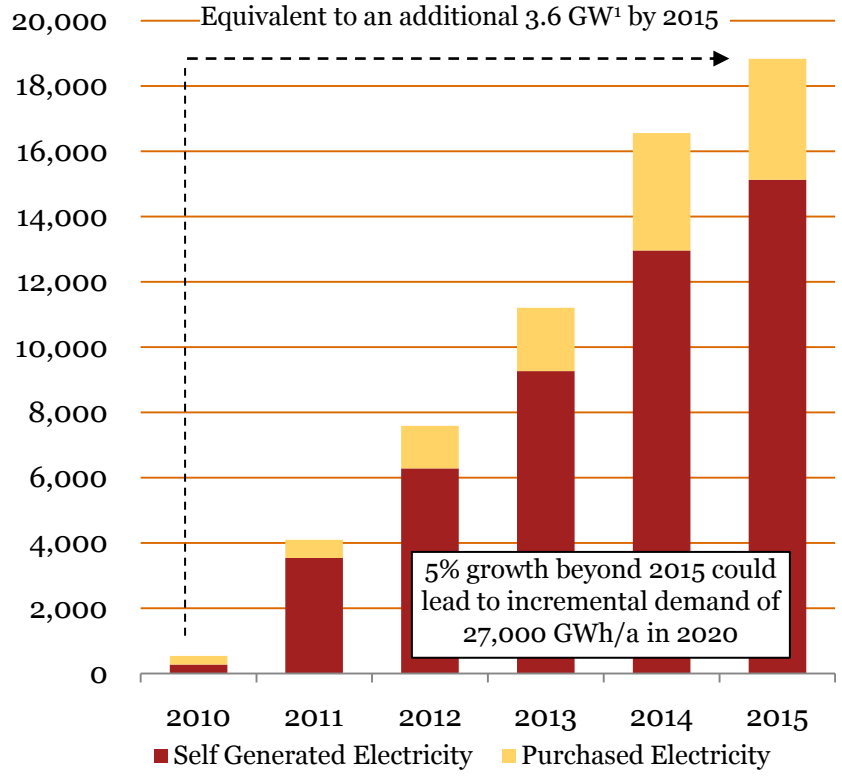
It is expected that electricity demand growth would be front loaded, with step change growth between 2010 to 2015, coinciding with the commissioning of new minerals and energy projects. Annual growth over this period in the sector is expected to be a high ~ 16%, returning to a more modest growth of 5% per annum, in line with long term historic growth rates.

Note: Growth extrapolated after 2015 as period extends beyond the typical planning period of most companies. Annual growth rate of 5% assumed based on ABARE Energy Statistics Table F5: WA Energy Consumption by Industry and Fuel Type over FY01 – FY08.

Source: State Growth Outlook. Baseline electricity consumption from "Electricity from Renewable Energy", Office of Energy 2010. Minerals and Energy baseline estimated from historic consumption rates of ~ 40% of total state (ABARE Energy Statistics Table F5).

New Minerals and Energy Electricity Generation

Minerals and Energy Electricity Demand
(GWh/a, Incremental to 2009)



Minerals and energy electricity demand to 2015 is expected to increase by approximately 0.6 GW¹ per year. By 2015 this incremental demand could be equivalent to 3.6 GW¹.

Incremental electricity required by the sector over the next 5 years could reach 18,800 GWh/a. This is equivalent to the forecast total sent out energy in the SWIS for FY11 ("Statement of Opportunities", IMO, July 2010).

By 2020, this incremental demand from the sector could total 27,000 GWh/a.

The majority of the demand is expected to be met through self generation (over 80%).

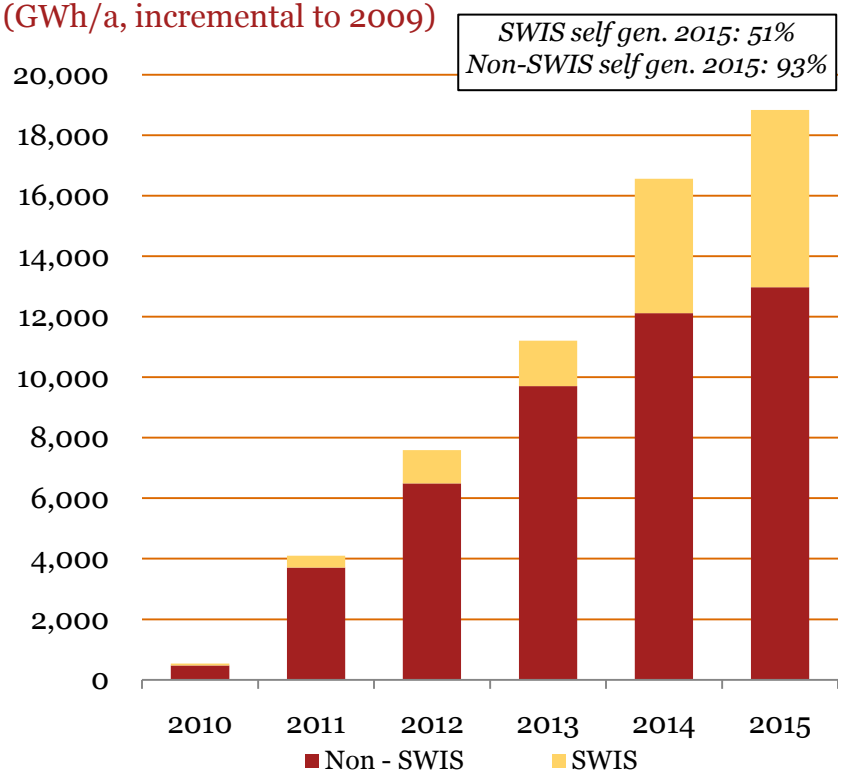
Due to the isolated nature of these minerals and energy projects, the electricity demand in the sector will predominantly be self generation. Opportunities for coordinated development in high growth areas such as the Pilbara will be discussed in *Section 4.6 Implications and Opportunities*.

1. Equivalent GW estimated at 0.6 load factor

Source: State Growth Outlook.

Location of New Demand – SWIS Area and Beyond

Electricity Demand by Project Area: SWIS area vs. Non-SWIS area
(GWh/a, incremental to 2009)



In the area serviced by the SWIS, around half of total new generation demanded by the minerals and energy industry is to be purchased, as opposed to outside the SWIS, where only 7% is likely to be purchased.

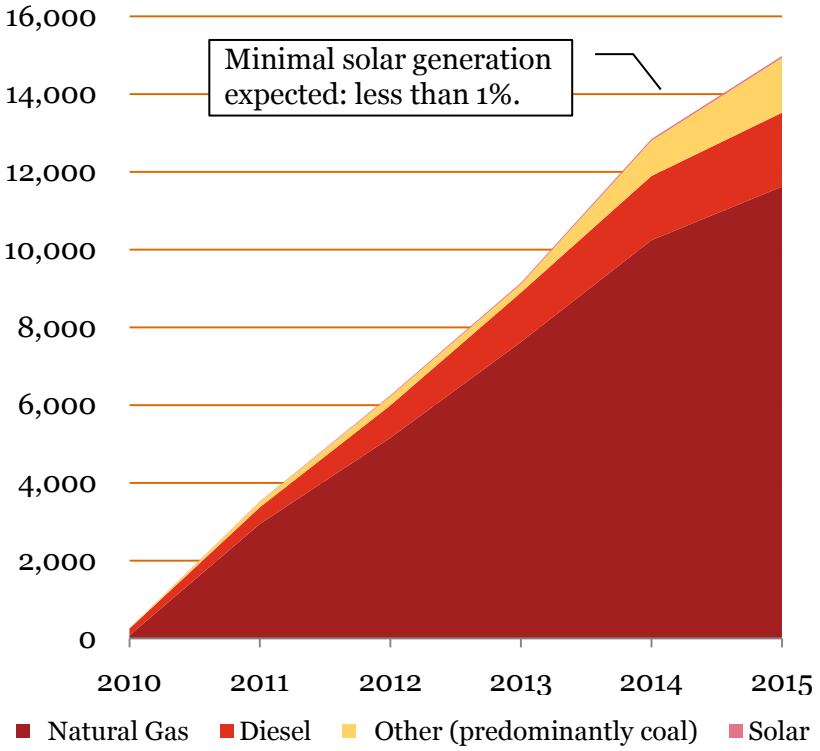
The existence of the SWIS has presented the opportunity for companies with projects in this area to purchase electricity from the network. High levels of coordinated planning and development from both government and industry has capitalised on this opportunity, with large scale projects opting for purchased, rather than self generated electricity. Not only does interconnected electricity generation mean capital productivity improvement, it also allows for greater use of renewables.

Note: Total electricity consumption by geographical area – SWIS includes projects located in the area of the South West Interconnected System – not necessarily connected to the grid. Purchased equals all electricity purchased whether it be from the grid or other third parties.

Source: State Growth Outlook

Fuel Source for New Self Generation in the Minerals and Energy Sector

Source of New Self Gen Electricity
(GWh/a, Incremental to 2009, 2010-2020)



The majority of incremental self generated demand is expected to be fuelled by domestic gas (approximately 80%).

Additionally, around 13% of the new self generated demand is likely to be met through diesel and coal and renewables are expected to fuel the remaining required generation.

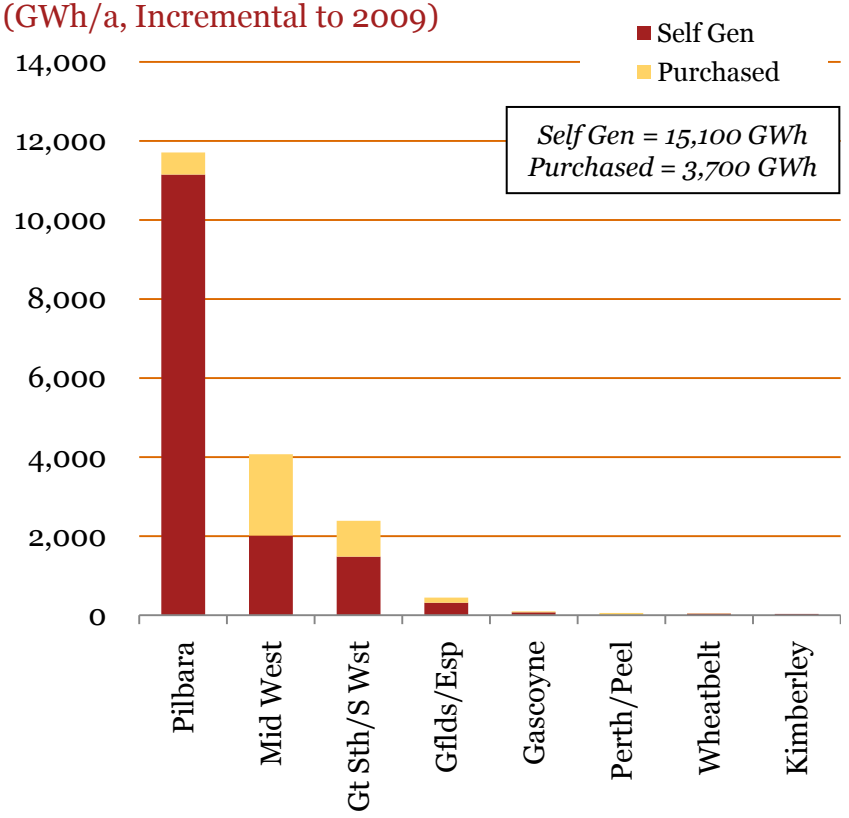
Some participants expected to meet a small portion of their self generated electricity demand through solar energy, however this constituted <1% of the total incremental demand.

There are significant technical, regulatory and commercial barriers to the uptake of renewable energy for self generated electricity in remote un-networked areas. Therefore we are likely to see its implementation in large-scale grid generation rather than isolated generation.

Source: State Growth Outlook

New Minerals and Energy Generation by Region

Electricity Generation by Region – 2015
(GWh/a, Incremental to 2009)



The majority of new electricity generation required by the sector is for projects in the Pilbara region (62%) and the Mid West region (22%).

The large number of iron ore expansions and greenfields projects to be developed in the Pilbara, along with associated infrastructure projects, drive the majority of this new electricity demand in the region. The Mid West region is driven by fewer, yet more energy intensive magnetite projects.

Demand in the Great Southern/South West and Goldfields/Esperance regions accounts for 15% of new electricity demand from the sector, and is driven by nickel, gold, iron ore and coal/urea projects.

Electricity generation in the Pilbara is planned to be predominantly self generated, contrasted with the Mid West and Great Southern regions where much of the demand will be met through purchased electricity due to the prevalence of the SWIS.

State Growth Outlook

4.3 Regional Overview – Electricity

Overview of High Growth Regions

Growth in the Pilbara Region

- Total incremental electricity demand in the Pilbara (due to minerals and energy projects) is expected to reach almost 12,000 GWh (or approximately 2.2 GW) by 2015.
- Electricity generation in the Pilbara is planned to be predominantly self generated, contrasted with the Mid West and Great Southern regions where much of the demand will be met through purchased electricity.
- The majority of new self generated electricity in the Pilbara will be fuelled through natural gas.
- While current plans suggest limited self generated renewable electricity in the Pilbara, there are renewable initiatives, both public and private generation, under consideration for the region.

Growth in the Mid West Region

- Upcoming minerals and energy projects in the Mid West region are likely to require approximately 0.8 GW additional electricity by 2015.
- Of the additional 4,000 GWh/a (approximately 0.8GW) additional electricity demand required by 2015, half of this could be purchased.
- Self generated electricity within this region will be fuelled through two sources: gas and diesel, almost in equal parts.
- Country North (Mid West) area of the SWIS is reaching capacity, requiring significant near term investment in transmission infrastructure to meet demand from minerals and energy projects.

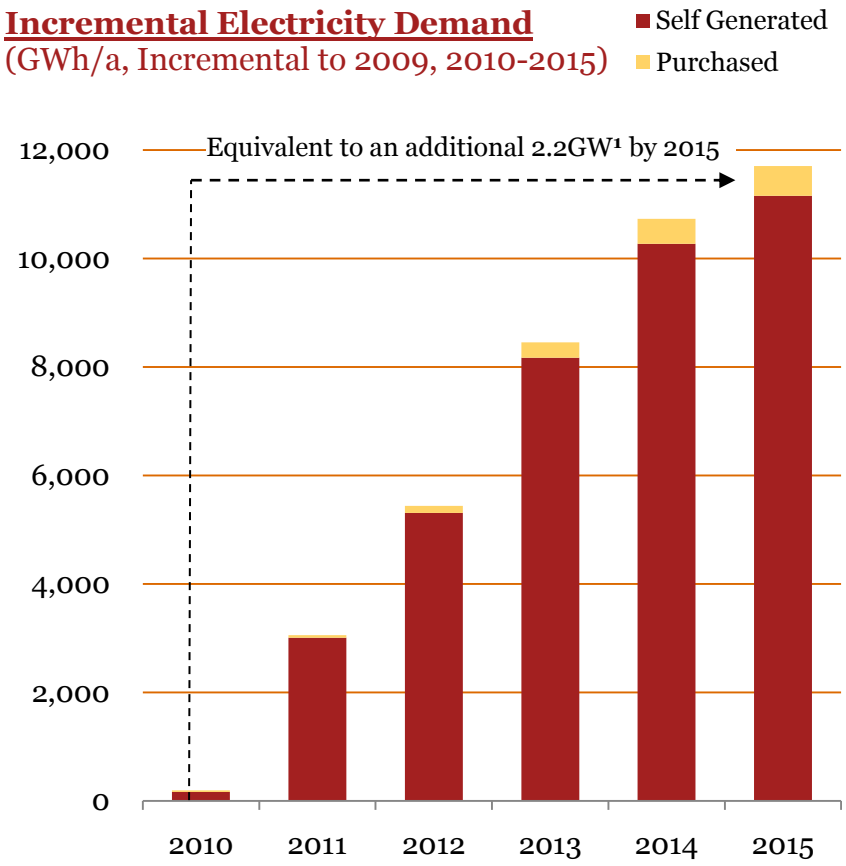
Growth in the Great Southern/South West Region

- Incremental electricity generation in the Great Southern/South West region is expected to reach over 450 MW by 2015.
- The self generated electricity within this region is predominantly coal generation with a small amount of incremental natural gas and diesel generation.

Note: Converted using a load factor of 0.6.

Pilbara – New Electricity Demand: Self Generation Vs. Purchased

Incremental Electricity Demand
(GWh/a, Incremental to 2009, 2010-2015)



Total incremental electricity demand in the Pilbara (due to minerals and energy projects) is expected to reach almost 12,000 GWh by 2015.

This incremental demand is equivalent to 2.2 GW by 2015 or just over 0.35 new GW[1] per annum. This new demand is a sizeable increase, equivalent to around 2/3 of the current SWIS.

Survey results indicate that electricity development in the Pilbara is forecast to continue in the same method as it has to date with each stakeholder developing in the most efficient manner to meet their specific needs, in the absence of any certainty around a networked solution.

Current plans suggest that of the ~ 12,000 GWh/a incremental electricity required in 2015, over 11,000 GWh/a is expected to be self generated.

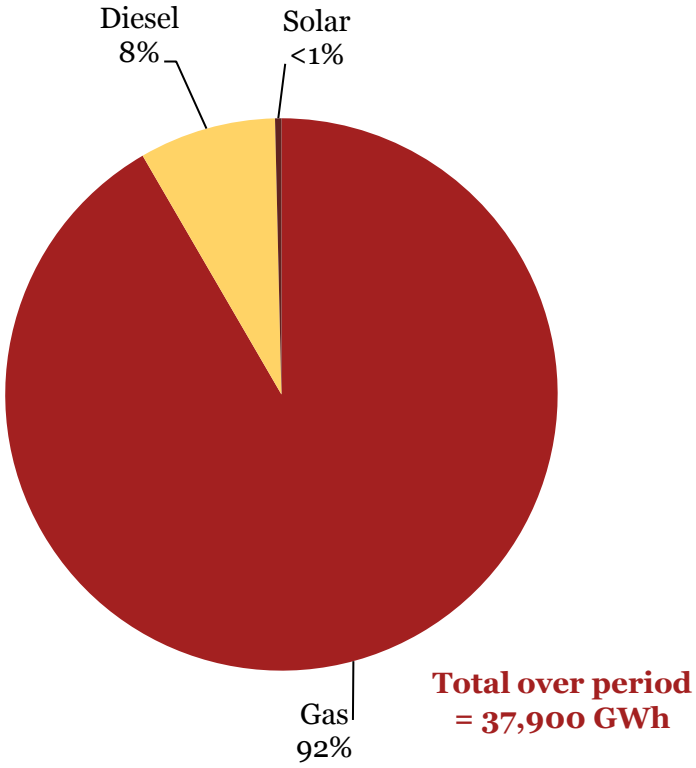
Minimal other industry demand expected in the region.

1. Equivalent GW converted at a 0.6 load factor.

Source: State Growth Outlook

Pilbara – Self Generation by Fuel Type

Pilbara Self Generated Electricity
(%, Incremental GWh/a to 2009, 2010-2015)



The majority of new self generated electricity in the Pilbara will be fuelled through natural gas.

Currently, both cost and access to natural gas in the Pilbara lead to it being the prominent source of fuel in the region (over 90% of new generation).

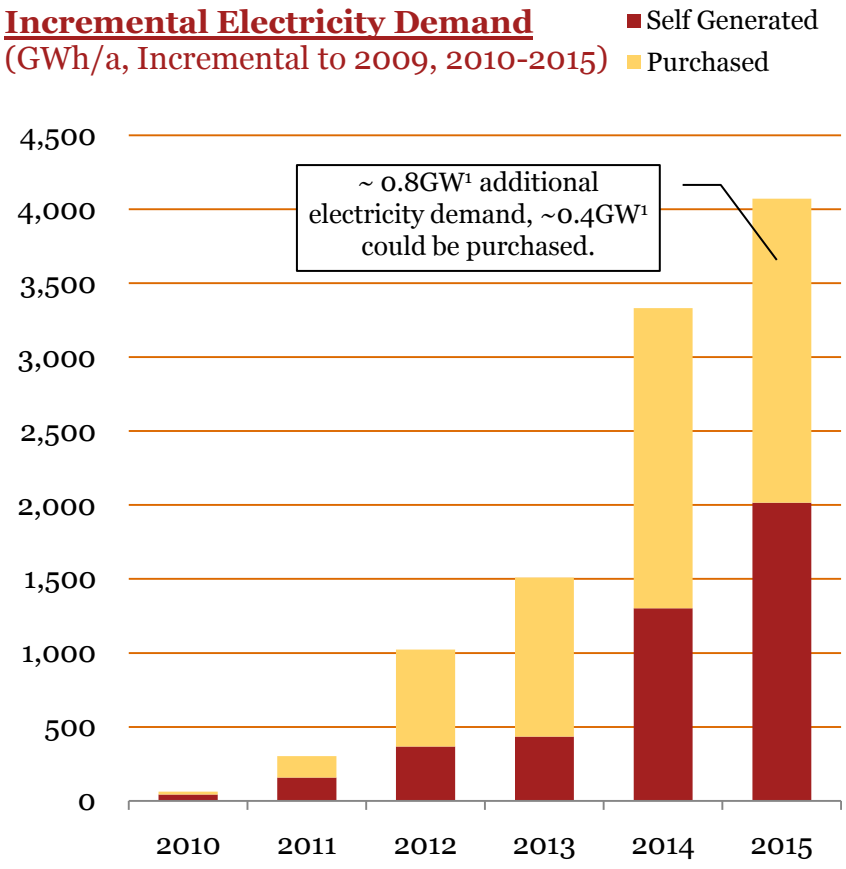
Diesel is listed as the primary generation fuel for some projects, as well as for back up generation. Total diesel generation represents 8% of new minerals and energy generation in the region.

While current plans suggest limited self generated renewable electricity in the Pilbara, there are renewable generation initiatives, both public and private, under consideration for the region.

Source: State Growth Outlook

Mid West – New Electricity Demand: Self Generation Vs. Purchased

Incremental Electricity Demand
(GWh/a, Incremental to 2009, 2010-2015)



Upcoming minerals and energy projects in the Mid West region are likely to require approximately 0.8 GW[1] additional electricity by 2015.

This incremental demand represents over an order of magnitude greater than the current electricity demand in the region.

The unprecedented electricity growth in this region is due to the emergence of energy intensive magnetite projects, along with associated infrastructure (ports and rail).

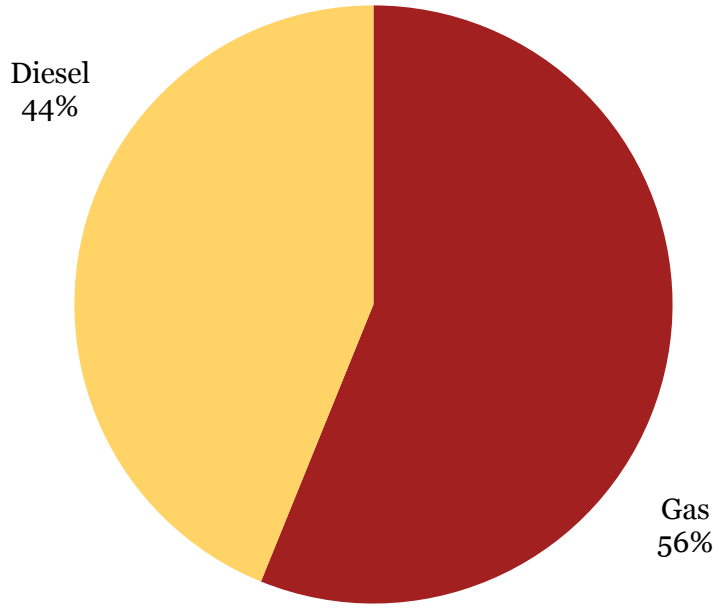
Of the additional 4,000 GWh/a (approximately 0.8 GW) additional electricity demand required by 2015, half could be purchased if current development plans are executed.

1. Equivalent GW converted at a 0.6 load factor.

Source: State Growth Outlook

Mid West – Self Generation by Fuel Type

Mid West Self Generated Electricity
(%, Incremental GWh/a to 2009, 2010-2015)



Total over period = 4,400 GWh

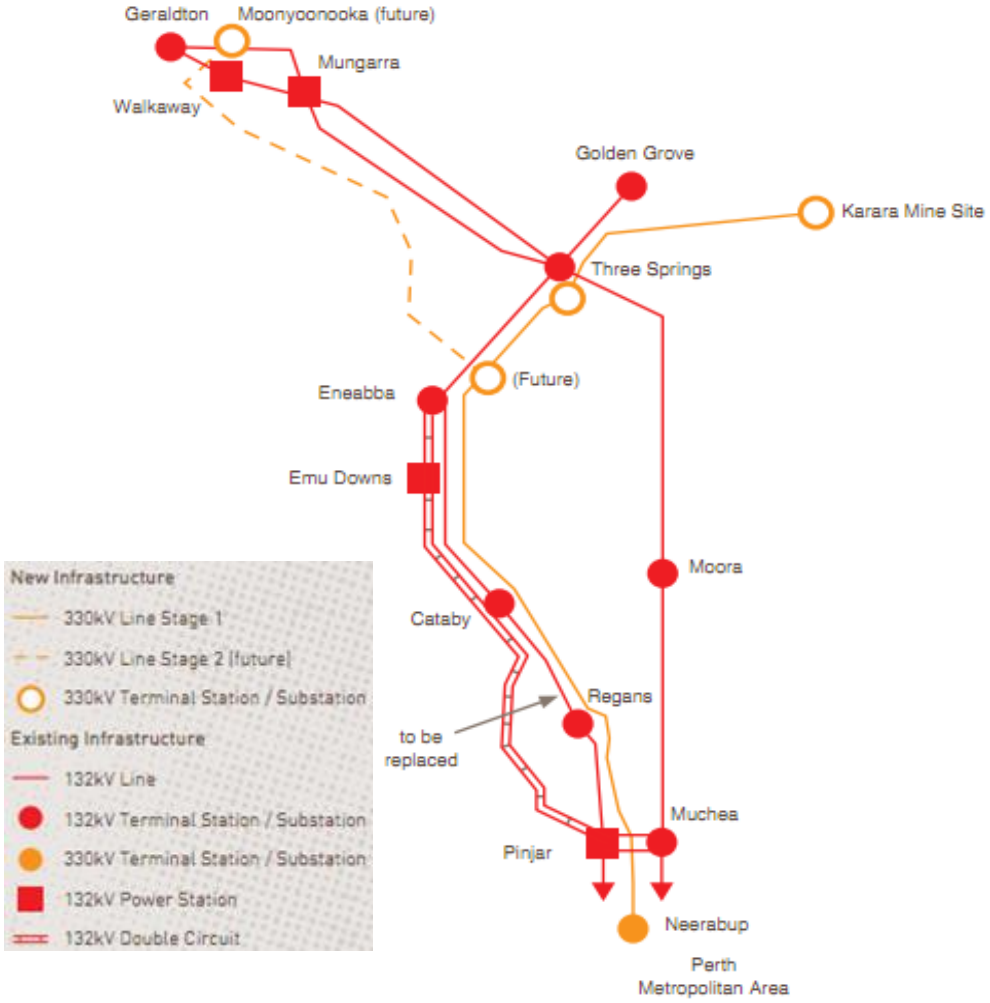
Self generated electricity within this region will be fuelled through two sources: gas and diesel, almost in equal parts.

Gas will provide fuel for 56% of new self generation in the Mid West, with diesel providing the remainder.

Source: State Growth Outlook

Mid West Energy Project

Mid West Energy Project Proposal



Source: Western Power Annual Planning Report 2011/2012

The Country North (Mid West) area of the SWIS is reaching capacity, requiring significant near term investment in transmission infrastructure to meet upcoming demand from minerals and energy projects.

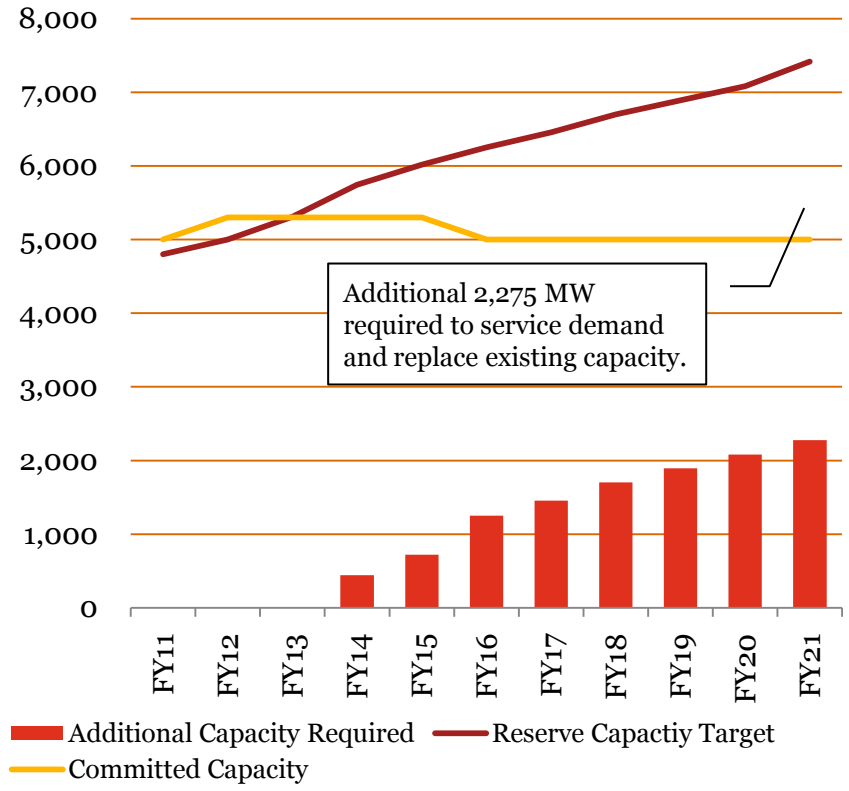
Underlying load growth is expected to render the system at full capacity by 2011/12.

A coordinated approach between Western Power and selected minerals and energy companies has lead to the proposed Mid West Energy Project which would supply power to new mine sites.

The Mid West Energy Project will provide a double circuit 330 kV line (initially operated as one 330 kV and one 132 kV circuit) from Neerabup to Eneabba where it will connect to a 330 kV line to supply proposed mining loads. Anticipated timing is for completion of the southern section in March 2013. A 330/132 kV terminal station will also be established at Three Springs as part of this proposal.

SWIS – Generation Capacity

Supply – Demand Balance – SWIS
(MW, FY11-FY21)



Based on current committed capacity and known plant retirements, there will be an additional approximately 720 MW capacity required in the SWIS by FY15, increasing to approximately 2,275 MW by FY21.

IMO believes the capacity requirements can be met with new generation and Demand Side Management (DSM) investment. IMO has received expressions of interest for 644 MW by FY13, which would exceed the reserve capacity target for that year.

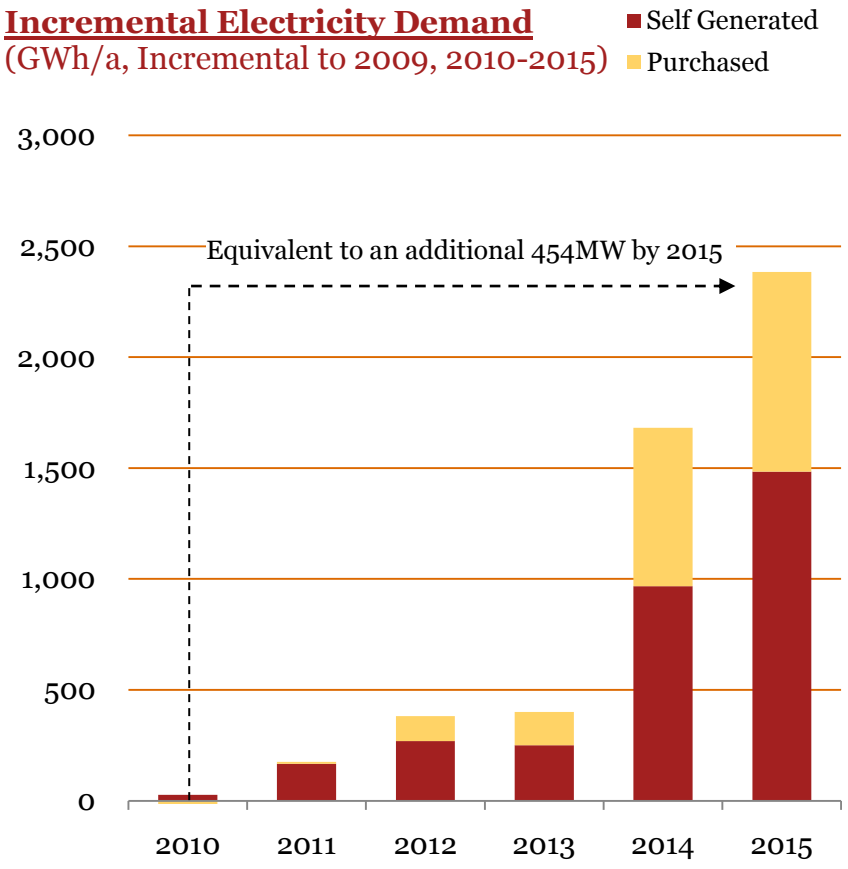
More than 2,000 MW of new capacity is expected to be required over the coming decade to meet load growth. Given that the Reserve Capacity Mechanism has incentivised the delivery of more than 2,000 MW of new generation and DSM capacity in the last five years, this level of required investment would appear to be achievable.

Note: Reserve capacity target is sufficient to include minerals and energy demand as modelled in the State Growth Outlook.

Source: "Statement of Opportunities, 2010", Independent Market Operator

Great Southern/South West – New Electricity Demand: Self Generation Vs. Purchased

Incremental Electricity Demand
(GWh/a, Incremental to 2009, 2010-2015)



Incremental electricity demand in the Great Southern/South West region is expected to reach over 450 MW by 2015.

This incremental demand is predominantly driven by two large scale projects expected to be commissioned in 2014. One project plans to utilise grid electricity, and one project will generate electricity on site.

Around 2/3 incremental demand is expected to be self generated, with the remaining to be purchased electricity.

The self generated electricity within this region is forecast to be fuelled predominantly by coal generation with a small amount of incremental natural gas and diesel generation.

1. Equivalent GW converted at a 0.6 load factor.

Source: State Growth Outlook

Other Regions

Perth/Peel

Whilst there is increased activity in the region, requiring additional demand for other growth enablers e.g. water, these projects are not overly energy intensive. Incremental demand (to 2009) is expected to be around 60GWh/a or equivalent to around 11 MW.

Goldfields/Esperance

With numerous new projects in this region, additional electricity consumption reaches 625 GWh/a in 2014. This drops to ~ 440 GWh/a by 2015 or equivalently 84 MW, as some currently producing assets ramp down. Of this 440 GWh/a, 316 is self generated, predominantly through diesel.

52% of this incremental generation is expected to be purchased as opposed to self generation.

Gascoyne

Limited incremental electricity generation is required in this region due to minerals and energy projects.

Kimberley

Limited incremental electricity generation is projected in this region due to minerals and energy projects, however this could change rapidly given the extensive opportunities for resources development in the Kimberley.

Wheatbelt

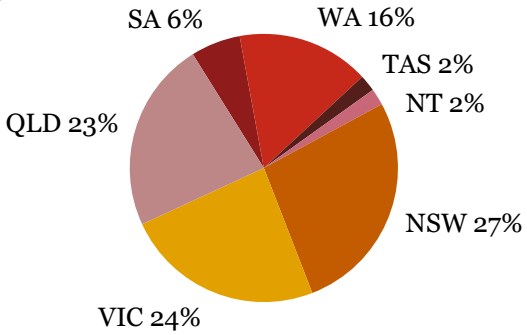
Limited incremental electricity generation is required in this region due to minerals and energy projects.

1. All equivalent loads calculated at load factors of 0.6.

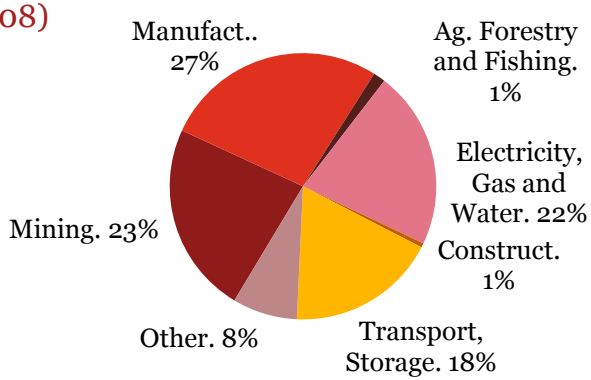
4.4 State Overview – Gas

Energy Consumption in WA by Activity

Energy Consumption in Aus – by State
(PJ, FY08)



WA Energy Consumption by Activity
(PJ, FY08)



While WA constitutes 10% of the Australian population, the state is responsible for 16% (920 PJ/a) of the country's total energy consumption.

This highlights the energy intensive economy of WA and the extent of value added processing undertaken in the state.

Energy consumption in WA due to mining and manufacturing has increased from 35% in the 1980's to 50% in FY08, now the largest consumers of energy.

The mining industry leverages this energy use to produce 89% of WA's exports[1].

Other energy intensive sectors within the state include electricity, gas and water and transport and storage.

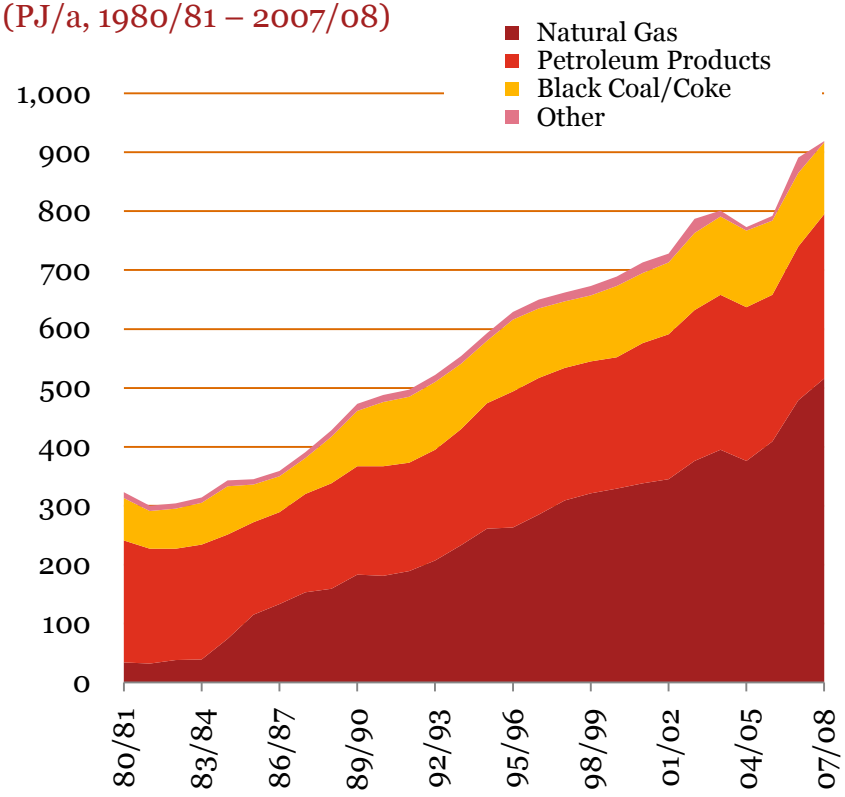
1. As stated in the Department of Mines and Petroleum Statistics Digest.

Note: Mining and Energy demand estimated from FY08 reported natural gas consumption for the mining and relevant manufacturing industry as just over 50% of state total (ABARE Energy statistics 2010 with approximately 2/3 of energy consumed in manufact. is attributed to mining related processing.)

Source: ABARE Energy Statistics 2008 Net Energy Consumption, Table C5.

Historic Energy Consumption

WA Energy Consumption by Fuel Type
(PJ/a, 1980/81 – 2007/08)



Total energy consumption in WA has increased at a CAGR of 4% over the 28 years to FY08.

More recently, there has been an increase of 6% per annum in the state from FY01 to FY08.

The energy demand in WA is increasingly being met through natural gas over coal/coke and oil products. The incremental demand has primarily been to fuel electricity generation.

Demand for natural gas has increased at around 10.6% CAGR since FY81 and now constitutes over 56% of energy consumption in WA.

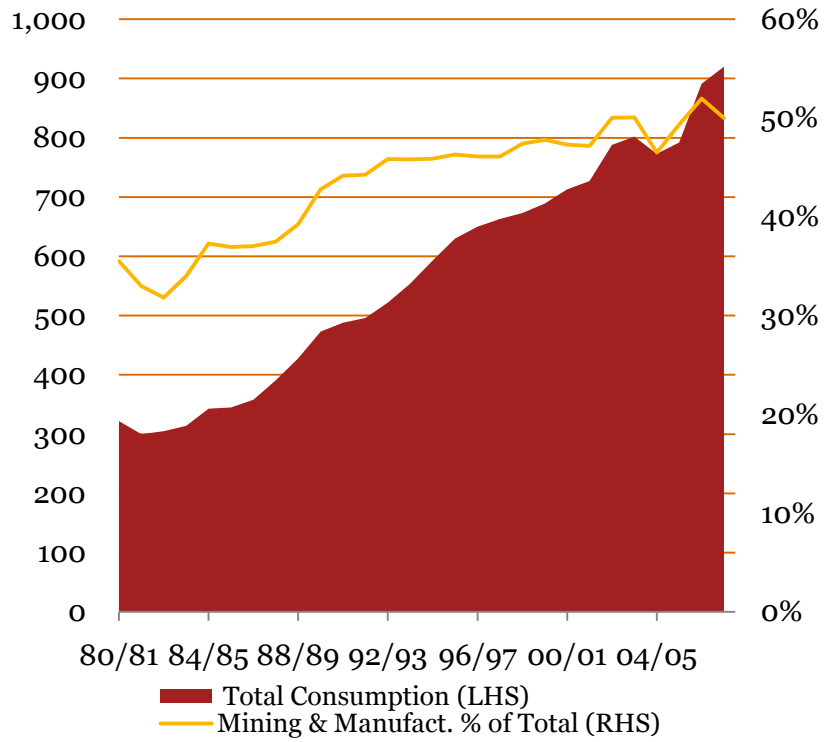
More recently, in the 7 years to FY08 demand has increased at 6.2% per annum. This is equivalent to a 53% increase in the total natural gas consumed in FY01.

Note: 'Other' constitutes renewables and electricity less production of derived fuels

Source: ABARE Energy Statistics 2008 Net Energy Consumption, Table C5.

Historic Mining and Manufacturing Energy Consumption

Resources Energy Consumption in WA
(PJ/a LHS, % mining & manuf. RHS)



Energy consumption in WA due to mining and manufacturing has increased from 35% in 1980's to 50% in FY08, now the largest consumers of energy.

Demand for natural gas in this industry has increased from just 0.5 PJ in 1980/81 to 158.7PJ in 2007/08. This is a long term growth rate of 23% per annum.

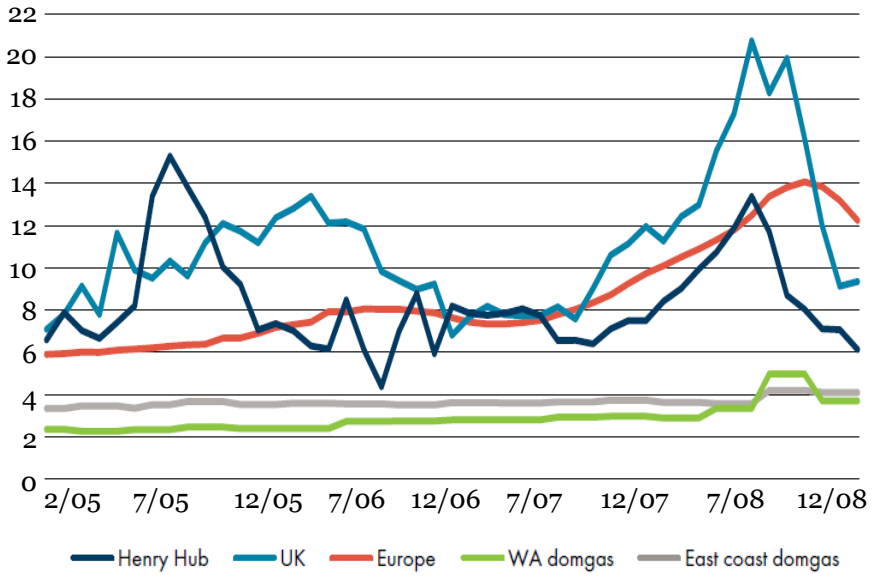
More recently, natural gas consumption in the mining industry alone (not including minerals processing) has increased from 67.4 PJ in 2000/01 to 158.7 PJ in 2007/08; equivalent to a 13% increase year on year .

1. Mining and Energy demand estimated from FY08 reported natural gas consumption for the mining and relevant manufacturing industry as just over 50% of state total (ABARE Energy statistics 2010 with approximately 2/3 of energy consumed in manufact. is attributed to mining related processing.) Note: "Mining" as categorised by ABS does not include all activities associated with minerals and energy sector e.g. minerals processing, and is therefore only used in trend analysis.

Source: ABARE Energy Statistics 2008 Net Energy Consumption, Table C5.

Domestic Gas Market in WA

Average Natural Gas Prices
(US $/Gj)



Historically, realised domestic gas prices in WA have been low by international standards however prices are now trending upwards.

Domestic gas prices in WA remained relatively low until 2006 when rising production costs and strong gas demand places upward pressure on prices.

Source: Argus Monthly LNG, EnergyQuest and DMP. Available in "The Western Australian Gas Market Fact Sheet", APPEA

Natural Gas Transmission Pipelines

Pipeline	Length (km)	Capacity (TJ/d)	Constructed	Owner
Dampier to Bunbury	1854	785	1984	DUET Group
Goldfields Gas	1427	150	1996	APA Group
Parmelia	445	70	1971	APA Group
Pilbara Energy	219	188	1995	Epic Energy
Midwest Pipeline	353	20	1999	APA Group, Horizon Power
Telfer Pipeline	443	25	2004	Energy Infrastructure Investments
Kambalda to Esperance	350	6	2004	ANZ Infrastructure
Kalgoorlie to Kambalda	44	20		APA Group

WA's gas transmission system contains three main pipelines: the Dampier to Bunbury (DBNGP), the Goldfields and the Parmelia pipelines.

The DBNGP supplies the majority of natural gas from the Carnarvon Basin to the South West, currently supplying 785 TJ/d. The two remaining major transmission lines are the Goldfields (150 TJ/d) and Parmelia (70 TJ/d) which transport gas from both the Carnarvon and Perth basins. Other pipelines are outlined in the table (left).

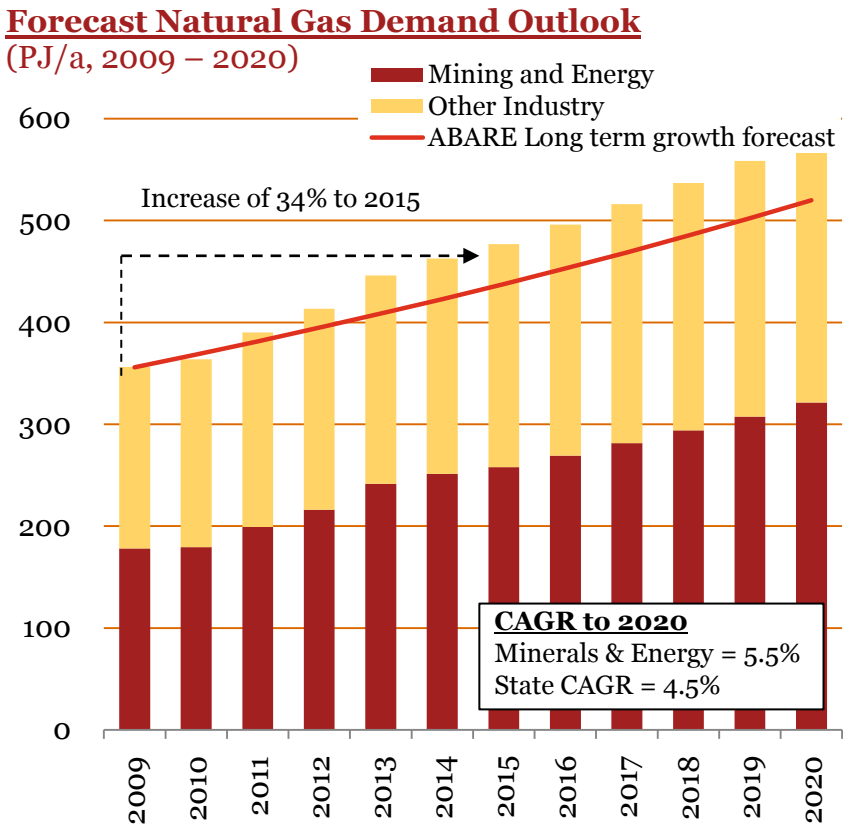
The majority of the pipelines are operating at full capacity and may come under pressure in the short term due to the increased gas demand.

Options to increase capacity exist, such as looping and compression, however lead times can be up to 30 months.

The WA Government has developed a proposal to broaden the specification of the DBNGP (applying from Jan 1, 2012).

Source: State of the Energy market 2009, Australian Energy Regulator

Forecast Total Natural Gas Demand Outlook



Natural gas demand for WA is expected to increase from an estimated 356 PJ/a in 2009, to 581 PJ/a in 2020.

This represents an 'all industries' growth rate of 4.5% over the period, higher than the 3.4% per annum growth to 2029/30 in the recent Australian Energy Projections to 2029-30 by ABARE.

Growth is estimated to be front-ended, with 5% annual growth over the period 2009-2015. Beyond this 3.8% per annum growth is expected.

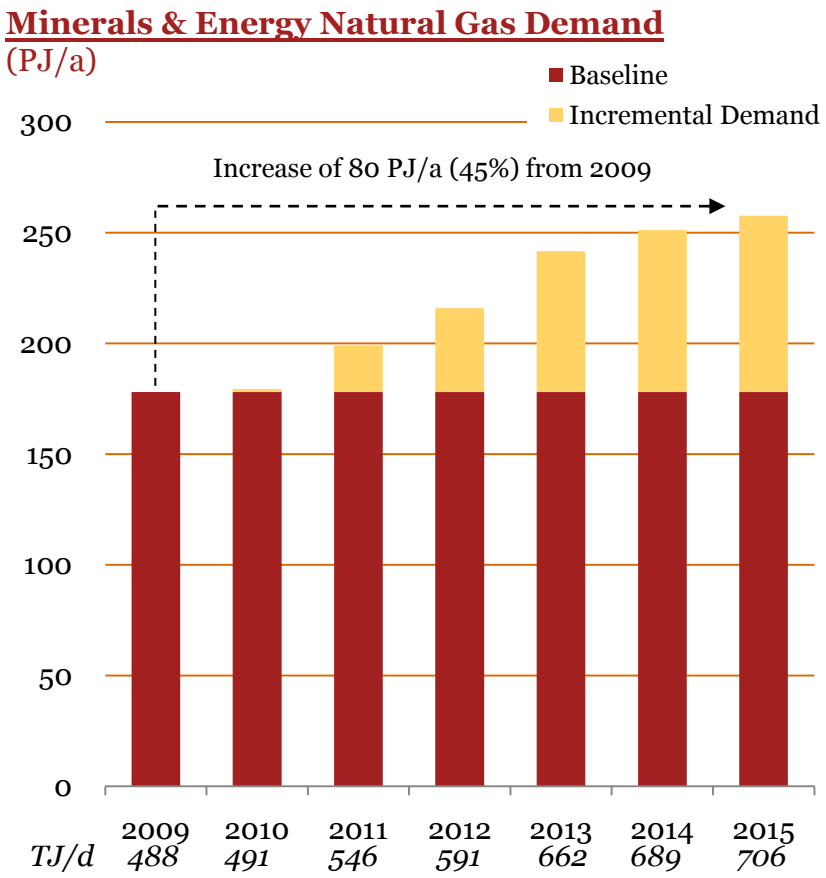
Activity in the minerals and energy sector over the period to 2020 drives the gas demand, however new electricity generation (not specific to minerals and energy projects) expected to be gas fired drives high levels of other industry demand.

Over the period to 2020, minerals and energy demand is expected to increase by 5.5% per year, with other industry demand expected to increase by 3.5% per year.

Note: Long term historic growth rates applied beyond 2015 based on natural gas consumption in WA over the period FY98 – FY08 where minerals and energy and associated manufacturing consumption increased by 4.5% p.a. while other industries increased by 2.7% p.a. (however assumed slightly higher going forward).

Source: 2009 Mining and Energy demand estimated from FY08 reported natural gas consumption for the mining and relevant manufacturing industry as just over 50% of state total (ABARE Energy statistics 2010 with approximately 2/3 of energy consumed in manufact. is attributed to mining related processing.)

Forecast Minerals and Energy Natural Gas Demand



Incremental minerals and energy demand is expected to increase by 80 PJ/a (218 TJ/d) by 2015 – a 45% increase based on 2009 estimated consumption.

This is equivalent to a 45% increase, or annual growth rate of 6.4% per annum to 2015. Comparatively, the historic growth rate for the industry was 4.5% over the 10 year period to 2008. After 2015 demand growth would be expected to trend towards historic levels.

This demand growth incorporates self generation likely to be fuelled by natural gas, along with natural gas consumed for industrial process and mobile plant.

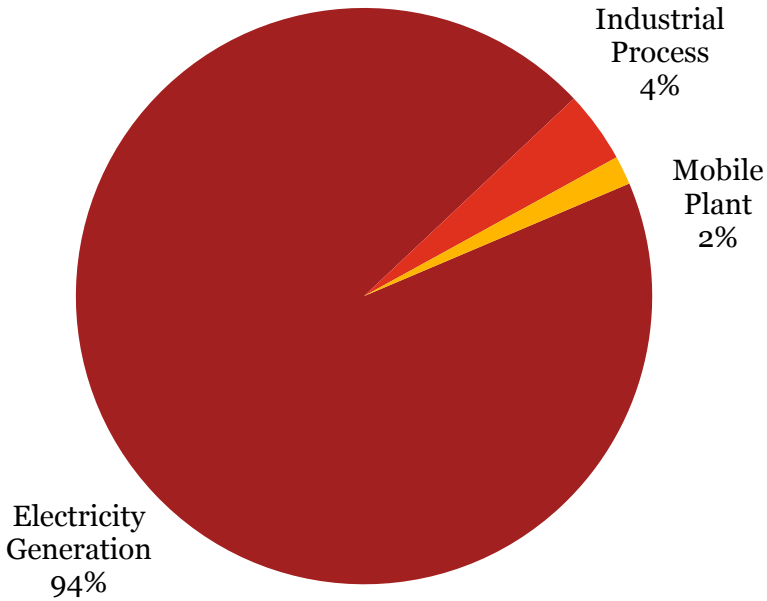
There will be additional natural gas demand driven by minerals and energy projects in the form of incremental purchased electricity demand. Assumptions around this have been made, and this growth is captured in other industry (electricity generation) demand growth.

Note: Source: 2009 Mining and Energy demand estimated from FY08 reported natural gas consumption for the mining and manufacturing industries as ~ 52% of state total (ABARE Energy statistics 2010). Approximately 2/3 of energy consumed in manufacturing is attributed to energy intensive mining related processing.

Source: Incremental demand from State Growth Outlook

Minerals and Energy Natural Gas Demand by Use

Minerals & Energy Incremental Gas Demand by Use
(Statewide, 2010-2015 in PJ)



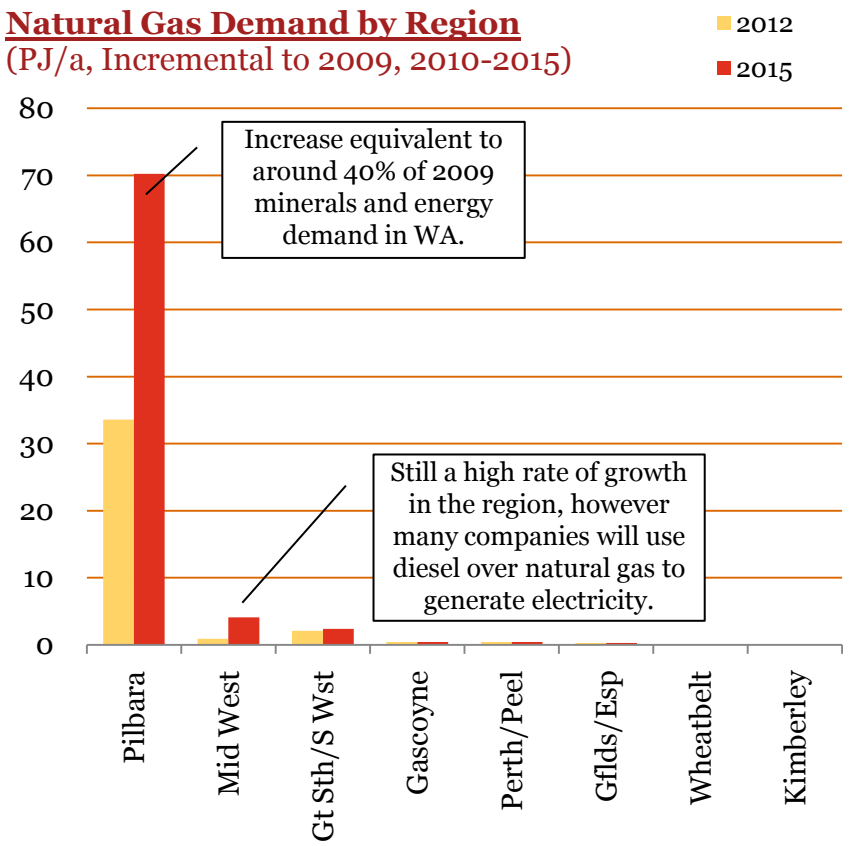
Total over period = 276.4 PJ

Overall, the incremental natural gas demand over the period 2010-2015 is predominantly used for electricity generation (94%), with relatively minimal use in industrial process and mobile plant.

The current price and availability of natural gas relative to diesel means it is likely to continue as the preferred fuel for isolated electricity generation.

Source: State Growth Outlook

Incremental Natural Gas Demand by Region



The incremental natural gas demand from minerals and energy projects will predominantly be consumed in the Pilbara.

Incremental natural gas demand in this region is likely to increase by 70 PJ/a by 2015, or 192 TJ/a. This is equivalent to around 40% of the entire minerals and energy natural gas consumption in WA in 2009.

The Mid West region will also exhibit significant incremental demand over this period, however less than may be expected as more companies have chosen diesel fired self generation, while others are expecting to use purchased electricity where the source of generation is not yet known.

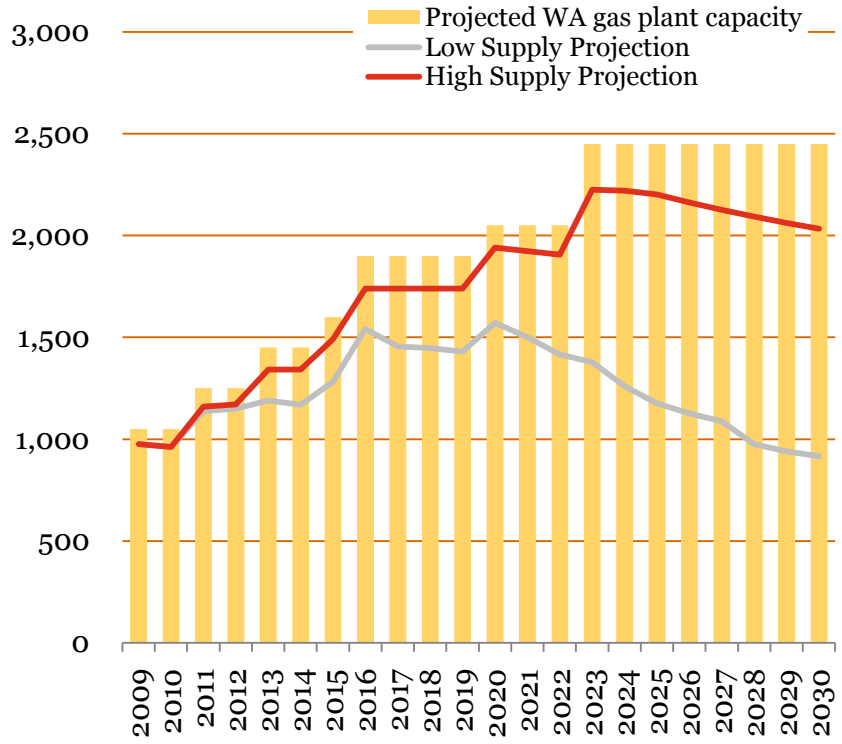
Mid West incremental natural gas consumption in the industry is expected to reach 6PJ/a by 2015 (equal to more than 16 TJ/d).

1. Incremental gas demand includes gas required for industrial process and mobile plant, along with gas required for self generated electricity. Therefore does not account for companies sourcing purchased electricity which may or may not be gas fired.

Source: State Growth Outlook

WA Gas Supply

Forecast Domestic Gas Supply
(TJ/d, 2009 – 2030)



The current projections by the Department of Mines and Petroleum suggest domestic gas supply will, at a minimum, increase by around 500 TJ/d by 2016.

A key difference between the supply projections is that in the "high" supply case North West Shelf domestic gas production is maintained at 600 TJ/d to 2030, whilst in the "low" case, NWS production is at 600 TJ/d in 2011 declining to less than 300 TJ/d by 2030.

The Department of Mines and Petroleum suggests that WA will have sufficient capacity in its domestic gas production facilities to meet the anticipated growth in demand over the next 20 years, so the challenge is in finding and developing new gas fields to feed in to these facilities.

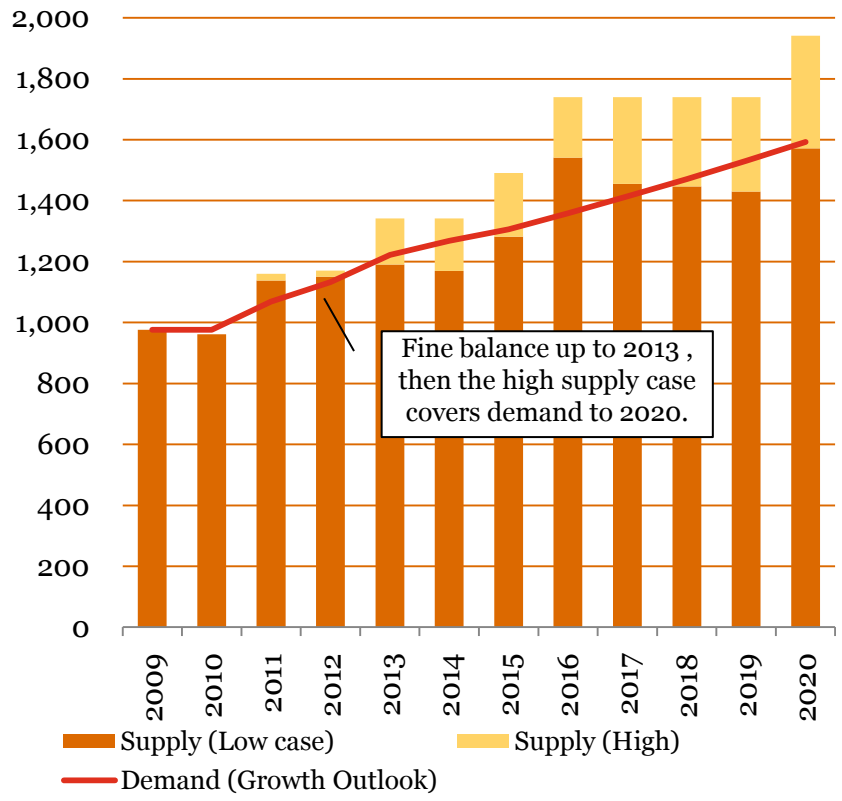
As can be seen in the graph to the left, while plant capacity remains high beyond 2020, gas supply in both scenarios declines. This is when production from a number of known gas fields will decline and future gas supply going forward will depend on the rate at which new gas fields are discovered and developed.

Note: See *6.3 Gas Supply Outlook* in the appendix for assumptions underpinning potential gas supply.

Source: Department of Mines and Petroleum 2011, submission to the Strategic Energy Initiative 2031.

Natural Gas Demand and Supply Outlook

Forecast Gas Demand/Supply Outlook
(TJ/d, 2009 – 2020)



Domestic gas supply is likely to meet demand through the period to 2020.

As limited new sources of supply are expected to come online before 2014, there will be a fine demand-supply balance and prices are likely to rise during this period, however prices in this period will depend on size and length of the individual contact.

If only the low natural gas supply case is realised, this will not meet forecast levels of demand before new supply comes online in 2016. This will influence demand for other fuels such as diesel with greater environmental consequences, along with cost effects of alternative sources of generation.

Finding and developing new gas fields will be required to meet increasing demand beyond 2020.

Note: See *6.3 Gas Supply Outlook* in the appendix for assumptions underpinning potential gas supply.

Source: Supply outlook from Department of Mines and Petroleum submission to the State Energy Initiative

4.5 Regional Overview – Gas

Overview of High Growth Regions

Growth in the Pilbara Region

- Incremental natural gas demand from the minerals and energy sector in the Pilbara region is expected to reach over 70 PJ/a by 2015.
- Electricity generation is the primary driver of domestic gas demand in this region.

Growth in the Mid West Region

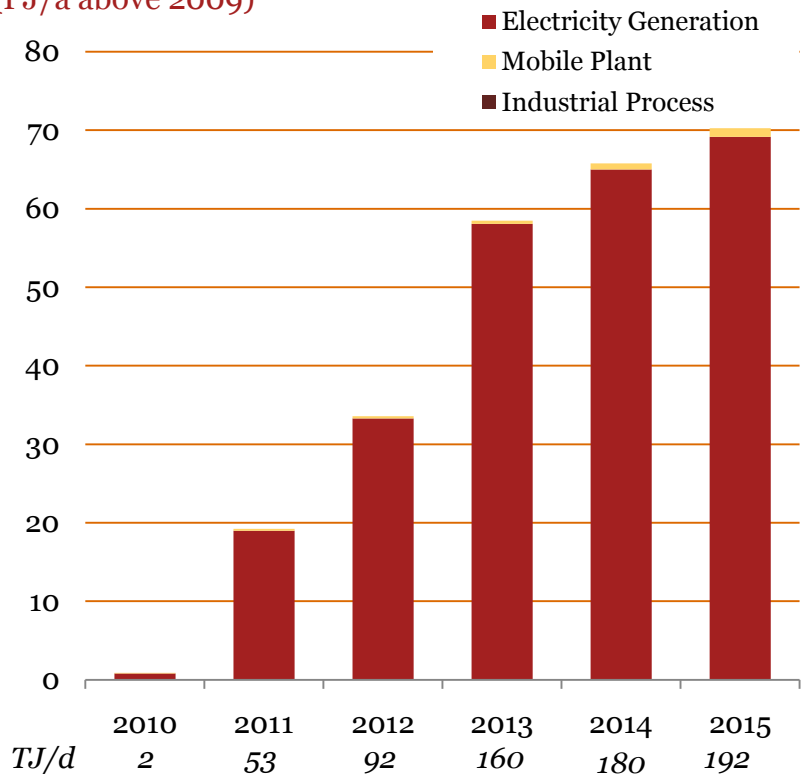
- Incremental natural gas demand from the minerals and energy sector in the Mid West region is expected to reach over 6 PJ/a by 2015.
- While electricity generation is the primary driver of domestic gas demand in this region, there is expected to be greater relative demand for mobile plant and industrial process in this region.

Growth in the Great Southern/South West

- Incremental natural gas demand from the minerals and energy sector in the Great Southern/South West region is expected to near 2.5 PJ/a by 2015.
- Unlike other regions in WA, industrial process is the primary driver of domestic gas demand.

Pilbara Natural Gas Demand

Natural Gas Demand by Use – Pilbara
(PJ/a above 2009)



Incremental natural gas demand from the minerals and energy sector in the Pilbara region is expected to reach 70 PJ/a by 2015.

This incremental demand is equivalent to over 40% of the estimated 2009 minerals and energy natural gas demand in WA.

Current (unconstrained) plans suggested the largest step change increase is expected in 2013, as large scale iron ore projects are commissioned.

Electricity generation is the primary driver of domestic gas demand in this region.

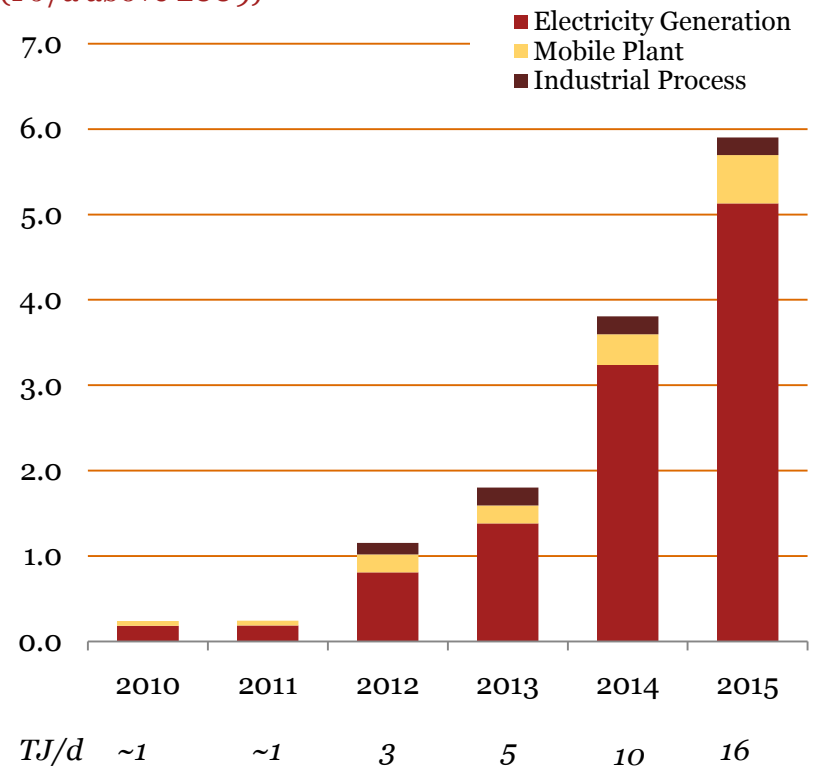
Incremental demand from mobile plant and industrial process is expected to comprise 1.5 PJ/a by 2015.

Note: Incremental gas demand includes gas required for industrial process and mobile plant, along with gas required for self generated electricity. Therefore does not account for companies sourcing purchased electricity which may or may not be gas fired.

Source: State Growth Outlook

Mid West Natural Gas Demand

Natural Gas Demand by Use – Mid West
(PJ/a above 2009)



Incremental natural gas demand from the minerals and energy sector in the Mid West region is expected to reach 6 PJ/a by 2015.

This incremental demand is equivalent to almost 16 TJ/d.

Current (unconstrained) plans suggested the largest step change increase is expected in 2014, as large scale iron ore projects with gas fired self generated electricity are commissioned.

While electricity generation is the primary driver of domestic gas demand in this region, there is expected to be greater relative demand for mobile plant and industrial process in this region.

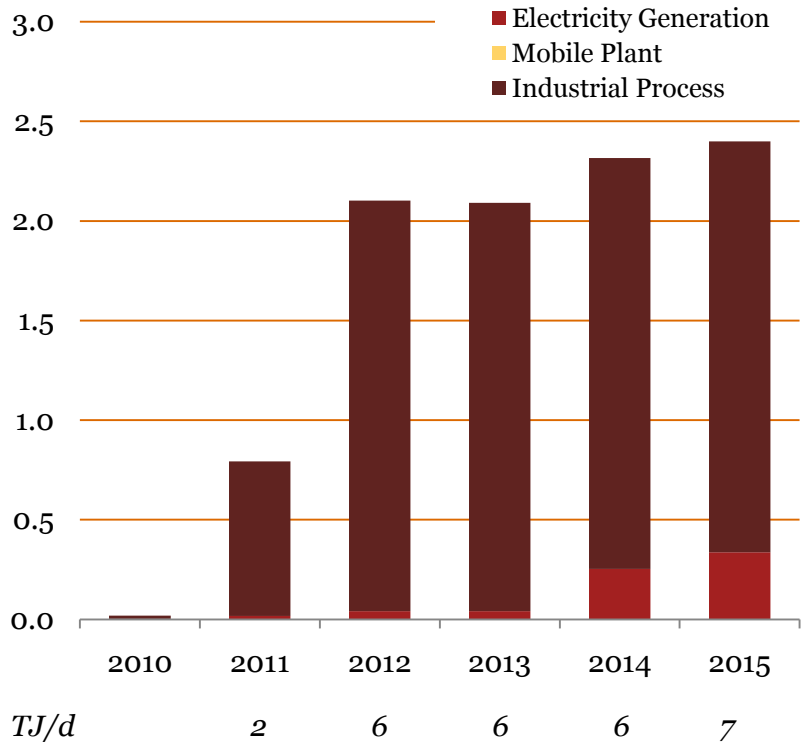
Incremental demand from mobile plant and industrial process is expected to reach 0.7 PJ/a by 2015.

Note: Incremental gas demand includes gas required for industrial process and mobile plant, along with gas required for self generated electricity. Therefore does not account for companies sourcing purchased electricity which may or may not be gas fired.

Source: State Growth Outlook

Great Southern/South West Natural Gas Demand

Natural Gas Demand by Use – GSth/SW
(PJ/a above 2009)



Incremental natural gas demand from the minerals and energy sector in the Great Southern/South West region is expected to near 2.5 PJ/a by 2015.

This incremental demand is equivalent to 7 TJ/d.

Unlike other regions in WA, industrial process is the primary driver of domestic gas demand.

There is limited natural gas demand due to self generated electricity at this stage.

Note: Incremental gas demand includes gas required for industrial process and mobile plant, along with gas required for self generated electricity. Therefore does not account for companies sourcing purchased electricity which may or may not be gas fired.

Source: State Growth Outlook

Other Regions

Perth/Peel

Limited growth in natural gas demand due to minerals and energy activity is expected for this region. The small amount of growth that is expected will be used for both electricity generation and industrial process. There will be increased residential demand in the region due to population growth.

Goldfields/Esperance

There is an increase in self generated electricity in this region leading to a small amount of incremental domestic gas consumption. However this is minimal as most electricity generation in the region (self generated) will be diesel sourced.

Gascoyne

Demand due to minerals and energy growth is expected to be negligible in this region.

Kimberley

There is limited projected growth in natural gas demand due to minerals and energy growth in this region. However this could change rapidly given the extensive opportunities for resources development in the Kimberley.

Wheatbelt

Demand due to minerals and energy growth is expected to be negligible in this region.

4.6 Implications and Opportunities

Coordinated Development of the NWIS

Higher electricity generation costs in the Pilbara may strengthen the economic case for development of the NWIS and an effective electricity market in this region.

The proponents of an extended NWIS identified the following benefits:

- Capital and operating efficiencies;
- Reduced carbon emissions;
- Increased opportunities for risk management in electricity supplies;
- Increased opportunities for innovative energy procurement strategies;
- Increased opportunities for energy efficiency initiatives, such as electrification of rail; and
- Increased opportunities for electricity generation by renewables.

However, development of the NWIS presents a coordination challenge and is unlikely to occur in the absence of leadership by government and/or an industry contribution.

The current high commodity prices and advanced state of many projects have created a relatively near-term demand for new energy. The long and uncertain lead time to establish an extended NWIS to meet these needs makes this option unattractive relative to self generation for the current wave of projects.

Without certainty around common user infrastructure planning, companies will continue to invest in self owned and operated infrastructure to meet energy demand.

Delivery on the overall infrastructure needs of WA, including energy infrastructure needs, will require cooperation between industry and the State and Federal governments.

Early identification of energy (and other) infrastructure needs will assist government and infrastructure businesses in the planning of capital works and will facilitate regulatory approvals and financing.

Coordinated Development of the Mid West Region

The greenfields nature of the Mid West region provides an opportunity for coordinated development of shared infrastructure.

Concurrent development of several new mining developments and the Oakajee Port and Rail infrastructure provides an opportunity for planning of power transmission development.

A key challenge is that investment is required ahead of sometimes uncertain demand in some cases to ensure supply is available when required.

However, the costs, timeframes and regulatory framework for investment in transmission and generation infrastructure may delay projects and/or increase the viability of self generation.

The regulatory framework for investment in transmission infrastructure gives rise to first-mover disadvantages for new electricity customers in a region where transmission investment is required. The first new user to connect may be liable for large capital contributions to finance the investment, which could affect the viability of projects or make self generation more commercially attractive.

New transmission lines have a five to six year lead time for planning, approvals and construction. Self generation has the potential advantages of:

- Avoided network costs and delays; and
- Increased efficiency and lower carbon footprint where co-generation or tri-generation is used.

Domestic Gas Supply and Energy Price Outlook

There is rapidly increasing demand for gas but indications are that the supply and demand balance will be addressed by the operation of the market.

As limited new sources of supply are expected to come online before 2014, there will be a fine demand-supply balance during this period, however as new sources of supply come on stream beyond this, it appears there will be sufficient gas to meet demand within the state.

Rapidly increasing demand for energy will maintain upwards pressure on energy prices resulting in higher energy costs for business.

Both gas and electricity prices will continue to trend upwards with rapidly increasing demand.

In the Pilbara region, incremental demand for electricity over the next few years will more than double, driving investment in new generation. While most new generation is likely to be developed as isolated, self generation by major mining companies, the high level of demand is likely to stretch the capacity of the electricity industry to build new generation plant, putting upward pressure on the unit cost of generation capacity.

The Federal Government's proposal to introduce a carbon price, via an interim carbon tax that transitions to an emissions trading scheme, will also contribute to the cost of energy in WA. Given the uncertainty about the details of this proposal, including in relation to the emissions reduction target/s, the interim fixed price, treatment of emissions intensive trade exposed industries, and compensation arrangements, it is difficult to quantify the extent of the impact on prices.

Reducing overall state emissions, while sustaining strong growth in the minerals and energy sector, will require significant investment in the deployment of energy efficient technologies and renewable energy generation.

State Energy Strategy

CME and many other groups have called for the development of a state energy strategy to provide a clear framework for the development and operation of the Western Australian energy market.

Such a strategy should focus on achieving the following outcomes for the state:

- Competitive markets and efficiency to ensure energy supplies are delivered cost effectively;
- Security and reliability of supply through providing investment certainty and competitive pricing;
- Diversity of fuel sources, technologies and locations; and
- Sustainability through innovation and flexibility to adapt to emerging constraints over time.

CME notes that since the publication of the first State Growth Outlook, the State Government has initiated the Strategic Energy Initiative or Energy2031 as a response to this call for an overarching policy, the stated purpose being to provide a coordinated direction and vision for WA's energy future. It is imperative that these strategic plans and policies are translated into concrete measures to deliver real outcomes.

Environment and Liveability

Electricity prices for the entire electricity market, including in other business sectors and residential electricity supplies, are set to increase significantly over the coming years.

The upward pressure on electricity prices will add to steep increases in prices for residential and small-business customers. This will present challenges to the WA Government in managing increases in regulated retail electricity prices for residential customers.

Resultant cost of living increases in WA may have flow-on effects to labour markets through affecting the attractiveness of WA as a place to live for potential immigrants.

The technical, regulatory and commercial barriers to the introduction of widespread networked generation makes the introduction of renewables more challenging.

While minerals and energy companies are moving to more sustainable energy generation technologies, such as cogeneration, renewable self generation faces technical, regulatory and commercial challenges.

The use of discrete, un-networked electricity generation poses challenges developing a portfolio of generation options to include renewables. Networks allow renewable generation to be sited at optimal locations for scale and energy yield to supply power directly related to load demand.

Contents

Section Five

Water

5.1 Summary

Key Findings Relating to Water

State Overview

- Irrigated agriculture and mining (excluding minerals processing) and energy sectors dominate water use in the state, with a total of 35% and 28% respectively. These sectors, along with increasing total residential consumption have driven recent demand increases.
- Total water demand in WA is expected to increase at an overall growth rate of 4% per annum, from 2,500 GL/a in 2009 to 3,820 GL/a by 2020.
- Incremental minerals and energy water use is expected to reach 422 GL/a by 2015.
- There is a high level of dewatering expected to occur over the next few years: around 1,000 GL over the 6 year period approximately 760 GL of which is likely to be non consumptive.
- Survey responses indicate that almost 50% of 'new' minerals and energy dewatering taking place between 2010 and 2015 would be re-injected into aquifers, and 23% supplied to third parties.

High Growth Regions

- The majority of the new minerals and energy water use in the state will be located in the Pilbara, with an average annual growth rate over the period to 2015 of 13% in this region.
- Other high growth areas include the Mid West region (growth of 5% per annum) and Perth/Peel region (growth of 9% per annum).

Water Availability

- The high volumes of water use expected over the coming years due to minerals and energy projects means that allocation limits within the Pilbara region will need to be revisited in order to meet forecast levels of growth.
- The current groundwater allocation limit for the aggregate region (431 GL/a) is adequate for incremental water use in the Mid West, however uneven distribution of groundwater throughout the region is likely to lead to localised areas of scarce water resources.
- Current forecasts from the Water Corporation suggest a likely demand-supply imbalance going forward if current water usage trends are not reduced. The Water Corporation is also undertaking work on source development to meet the shortfall.

5 Water – 5.1 Summary – 5.1.2 Comparisons with 2008 Survey

- The outlook from the current survey produced comparable results to the 2008 Growth Outlook Study, however a steeper growth profile is now forecast. By 2015, an additional ~ 75GL/a of water use in the industry is expected (compared with the initial Growth Outlook Study).
- This increase is predominantly due to dewatering in the Pilbara which was not identified in the previous survey along with additional use in the Mid West.
- The high growth regions remain the same: Pilbara, Mid West and Perth/Peel, however more rapid growth in the Pilbara and Mid West is forecast.
- In terms of the source of water, demand will continue to be met predominantly through self extracted ground water (consistent with the 2008 Growth Outlook Study).
- Since the last survey, allocation limits in many regions have been increased by the Department of Water. However, even with this increase, the Pilbara demand is still expected to surpass the current allocation limit by 2014.
- The implications and opportunities presented in the previous Growth Outlook Study are still applicable to the current growth environment, however the Department of Water, along with other agencies such as the Department of Mines and Petroleum have made progress in these areas.

Note: Comparisons made with 2008 Constrained Growth Outlook, which considered the effects of the Global Financial Crisis by applying a scaling factor to the original data collected from industry participants.

Growth and Competitiveness

- Barriers currently exist in making better use of water from mine dewatering. To assist the minerals and energy sector in making better use of dewatering water, the Department of Water is working with the Department of Mines and Petroleum to improve opportunities for third party access.
- Increasing water scarcity will stimulate demand for a water market but cost pressures alone will not be sufficient to form a market. Significant regulatory changes are likely to be be required to develop an effective water market in WA.
- To meet future water demands more effectively, we need to see increased collaboration and coordination within the sector, and with government.
- In addition to increased collaboration, technology and innovation within the water supply industry will assist in meeting future water demands.
- Competition between the minerals and energy industry and other water intensive industries will inevitably increase as water becomes more scarce.
- Whilst the aggregate Mid West area has sufficient underground water availability to support minerals and energy project growth, quality and quantity of water is not evenly distributed throughout the region, leading to difficulty in securing supply for specific projects.
- Investment in securing water supply in the Pilbara will be required to meet demands from the minerals and energy sector within the next 5 years.

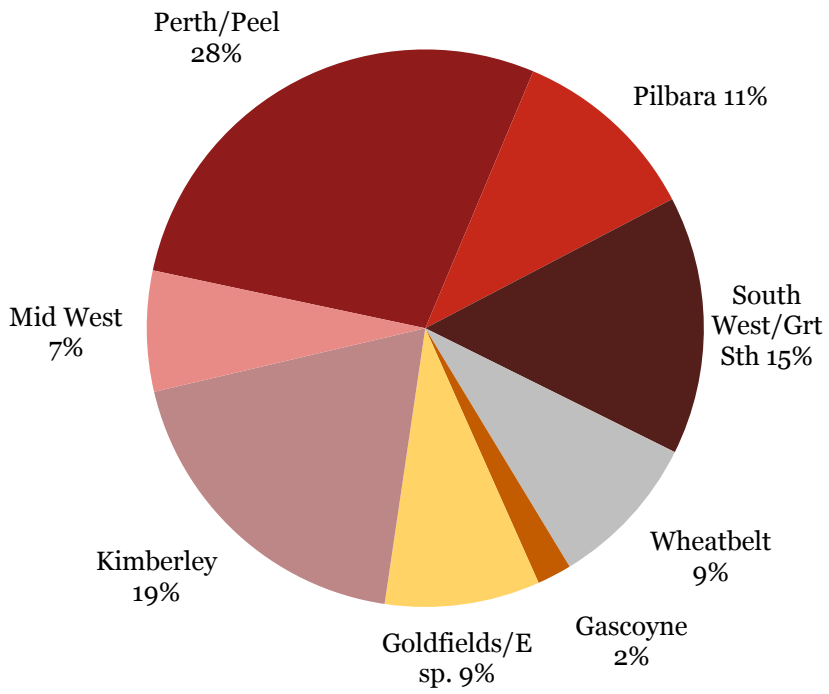
Environment and Liveability

- Reduction in sustainable groundwater yields due to declining rainfall in the Perth/Peel and Great Southern/South West regions will require contingency planning and increased cooperation between the public and private sector to ensure water use demands are continued to be met.
- Further work is needed to better understand the cumulative and downstream impact of groundwater abstraction including dewatering, both in terms of the continual draw down of resources and discharging to rivers and creeks.
- Increased residential population in the Perth/Peel region will further increase water demand in an already water constrained region.
- As the scarcity of water increases, the cost of water is likely to increase, further increasing the cost of living in WA.

5 . 2 State Overview

WA Water Use By Region

WA Water Use by Region – 2008



Total = 2,286 GL

In 2008, WA used 2,286 GL of Water (a 27% increase over 8 years).

The majority of water demand in WA is met through groundwater, which accounted for much of the increased demand over the 8 year period to 2008.

On a regional basis, the Metropolitan area (Perth) has the greatest water demand in the state, accounting for 24% of the total in 2008, dominated by private (dwelling) use. Peel accounts for an additional 4% of the state's water use.

The Kimberley and Pilbara regions also use significant levels of water with 19% and 11% respectively for 2008 due to the water intensive industries of agriculture and minerals and energy (respectively).

Total water use in the state is estimated at 2,286 GL for 2008, of which 1,494 GL was self supplied, and 792 GL obtained through an urban scheme or irrigated cooperative.

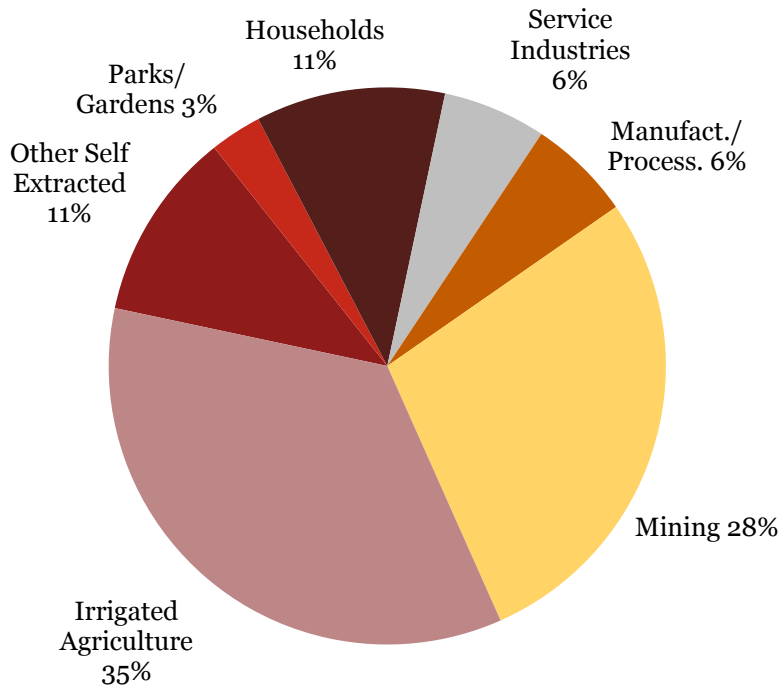
This includes estimated system losses of approximately 154 GL/a most of which occurs in the Ord River Scheme, where system losses amount to some 34% of the total scheme use. The urban supply system now has a very low system loss compared with international standards.

Note: Water Use includes all dewatering, even when discharged to rivers and creeks as it constitutes an abstraction of water from the environment.

Source: Estimated from "Water Futures for Western Australia 2008-2030", Department of Water.

WA Water Use By Activity

WA Water Use by Activity – 2008
(Includes system losses)



Total = 2,286 GL

Irrigated agriculture and mining (excluding minerals processing) and energy sectors dominate water use in the state, with a total of 35% and 28% respectively.

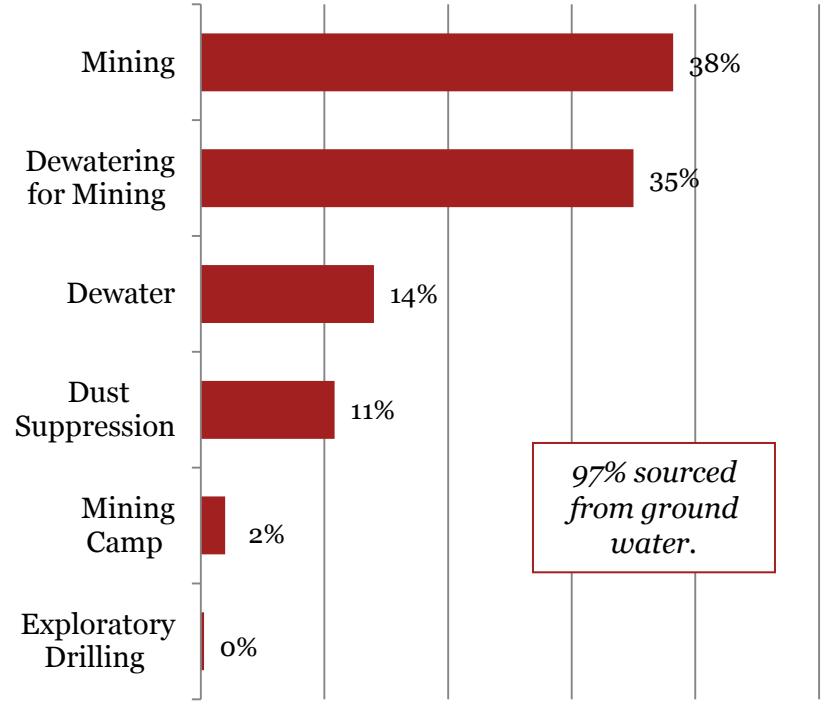
These sectors, along with increasing total residential consumption has driven recent demand increases.

Note: Water Use includes all dewatering, even when discharged to rivers and creeks as it constitutes an abstraction of water from the environment.

Source: Estimated from "Water Futures for Western Australia 2008-2030", Department of Water.

WA Water Use by Activity

WA Water Use in Mining by Activity
(2008)



Total = 762 GL

Water use within mining is broken up into 4 main activities: supply to camps, dust suppression, exploration and mine dewatering, with the mining process using the most water of all categories.

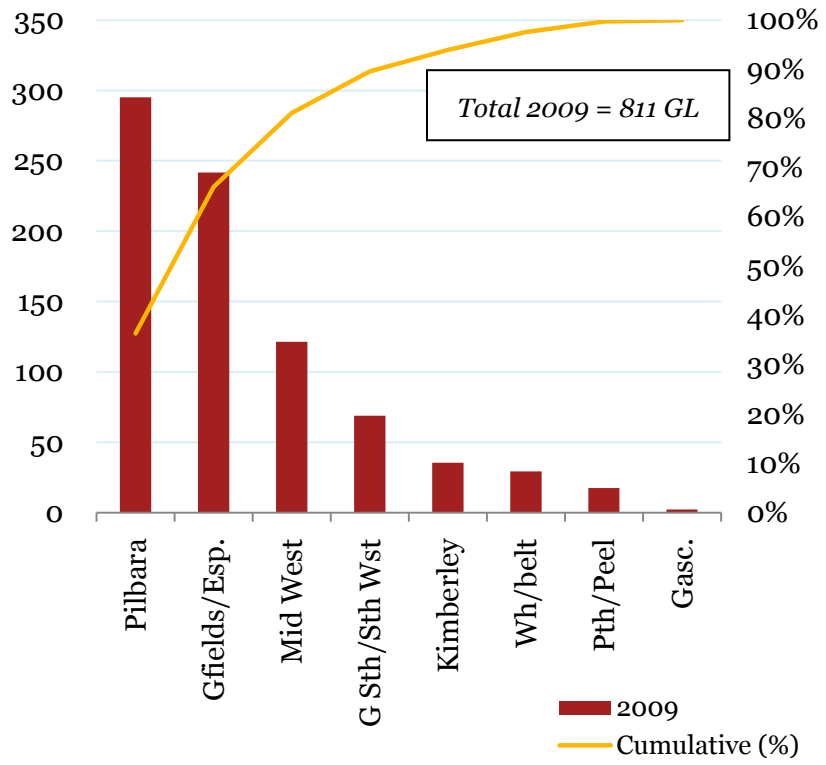
In fractured rock environments mines usually "create" water when large open pits are excavated or underground mines are pumped (dewatering), however this still constitutes an abstraction of water from the environment, regardless of whether the water is returned to the environment. Dewatering (total) constitutes 49% of water use by the industry.

In 2008, 97% of the water used in the minerals and energy industry was sourced from ground water.

Source: Estimated from "Water Futures for Western Australia 2008-2030", Department of Water.

Minerals and Energy Water Use By Region

Minerals & Energy Water Use by Region
(Scheme and Non-Scheme, GL/a, 2009)



In 2009, water use by the minerals and energy sector was estimated at 811 GL.

This includes all dewatering, even when discharged to rivers and creeks as it constitutes an abstraction of water from the environment.

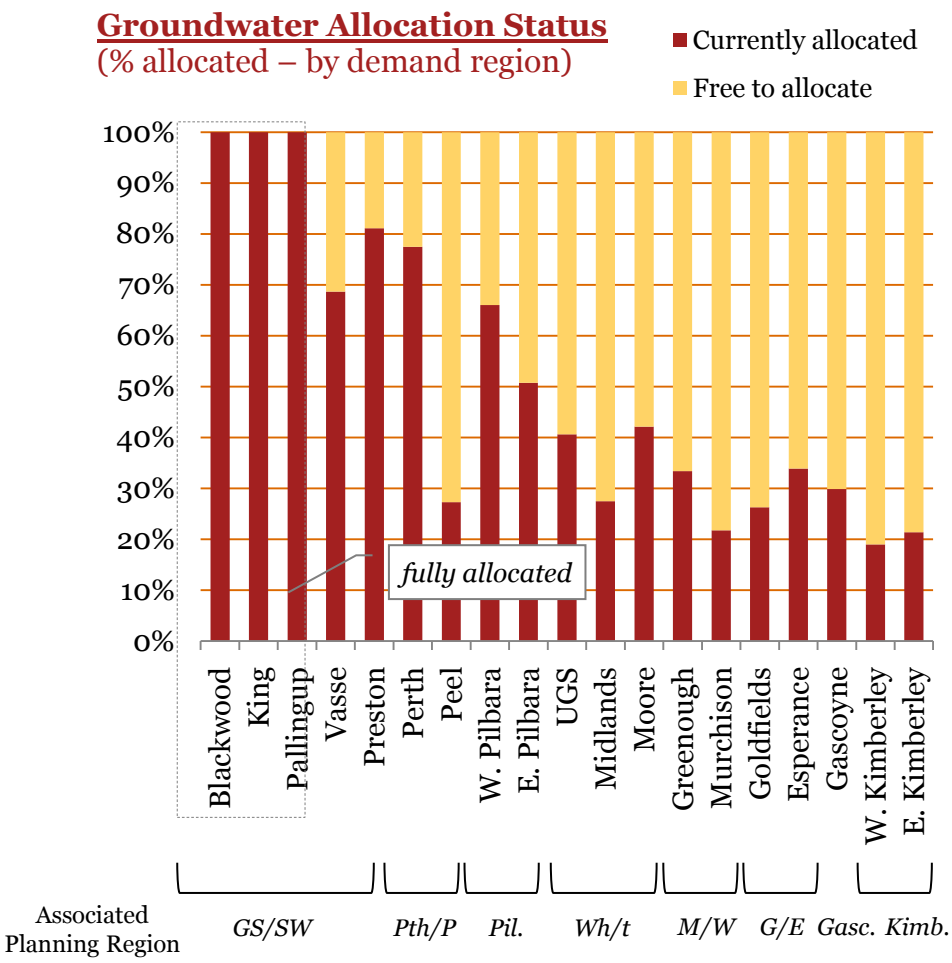
Together, the Pilbara and Goldfields/Esperance regions accounted for over 66% of industry water use in 2009.

The wide geographical spread of the minerals and energy industry means that the sector uses water in all regions. However the industry is not a dominant user in the Wheatbelt, Perth/Peel or Gascoyne regions.

1. Water Use includes all dewatering, even when discharged to rivers and creeks as it constitutes an abstraction of water from the environment.

Source: Estimated from "Water Futures for Western Australia 2008-2030", Department of Water.

Current Groundwater Allocations and Groundwater Availability



Three of the 19 demand regions[1] are currently over-allocated, whereby the current licensed water use exceeds the allocation limit, however, over allocation does not necessarily translate to over use in these regions as licensees often do not draw their full allocation and the Department of Water are able to monitor actual usage. All of these over-allocated regions are situated in the Great Southern/South West region.

The allocation limit is the amount of water that can be extracted annually from a water resource. The limits are based on a range of considerations including current knowledge of the water resource and current and forecast water demand. Allocation limits are usually set at conservative levels and generally less than sustainable yields.

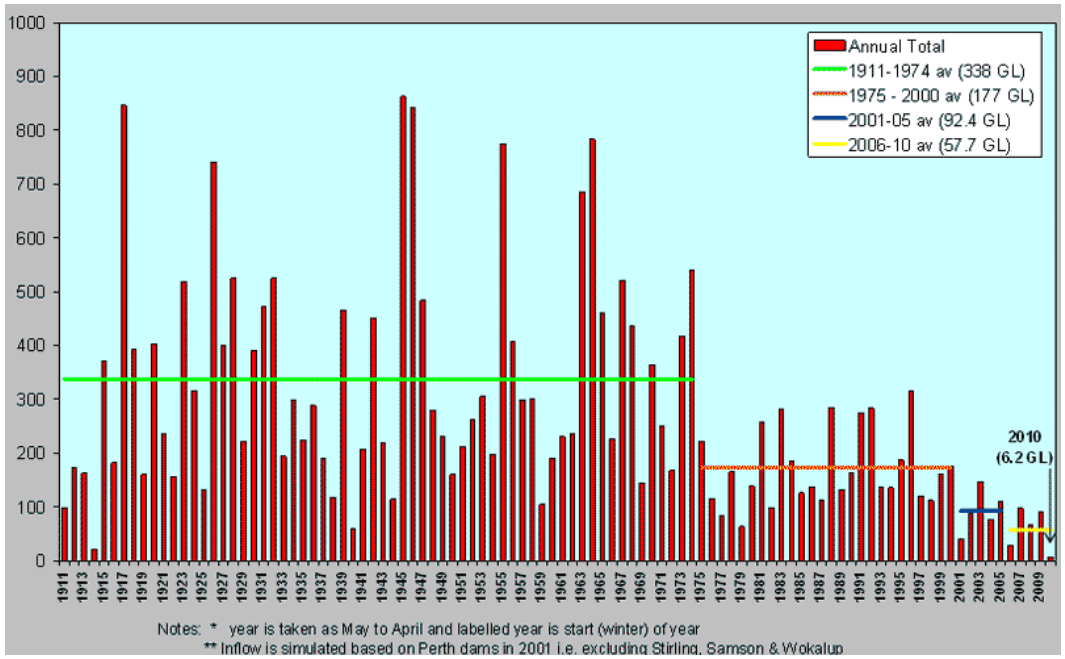
Four other demand regions are currently over 60% allocated, including the Perth region and the West Pilbara region.

Note: The Department of Water (DoW) segregates the State into 19 key groundwater demand regions. The associated planning region is listed below the graph.

Source: Department of Water Groundwater Allocation Report as at May 2010

Declining Rainfall in Perth/Peel and Great Southern/South West

Inflows to Perth Dams
(GL/a, 1911 – 2009)



Declining rainfall trends in the Perth/Peel and Great Southern South West regions are expected to continue, significantly impacting long term water availability (shown here on the left).

Perth/Peel and Great Southern/South West has experienced declining rainfall reducing surface run-off into dams and reduced filtration into groundwater aquifers:

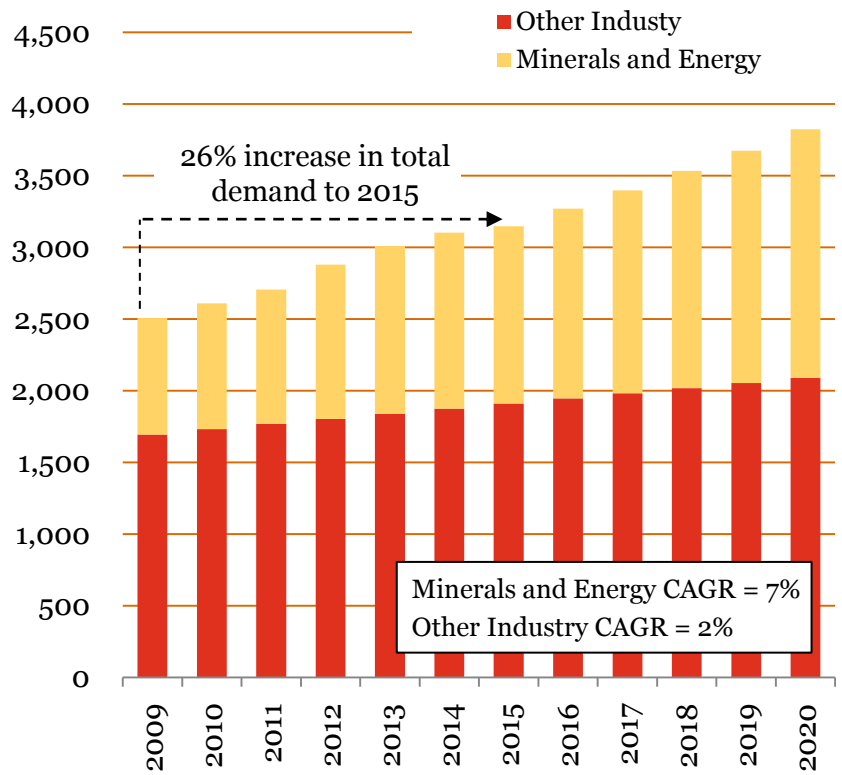
- Average annual inflows into Perth dams has reduced from 177 GL/a (1975-2000) to just 57.5 GL/a over the period 2006-2010.

Based on work completed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Bureau of Meteorology the area is expected to continue the trend of decreasing rainfall over the next 50 years due to climate change, significantly impacting groundwater availability.

Source: Water Corporation 27 October 2010

Total State Water Use

Forecast Total Water Use in WA
(GL/a, 2009 – 2020)



Total water demand in WA is expected to increase at an overall growth rate of 4% per annum, from 2,500 GL/a in 2009 to 3,820 GL/a by 2020.

This demand is driven by minerals and energy projects, with demand in this sector increasing at 7% per annum over the period to 2020. This is in line with historic growth for the state where between 2000-2007, minerals and energy sector water demand grew at a CAGR of approximately 7% and other industries at a CAGR of approximately 5.5%.

The Department of Water's other industry demand has been used here and is estimated to increase at 2% per annum to 2020.

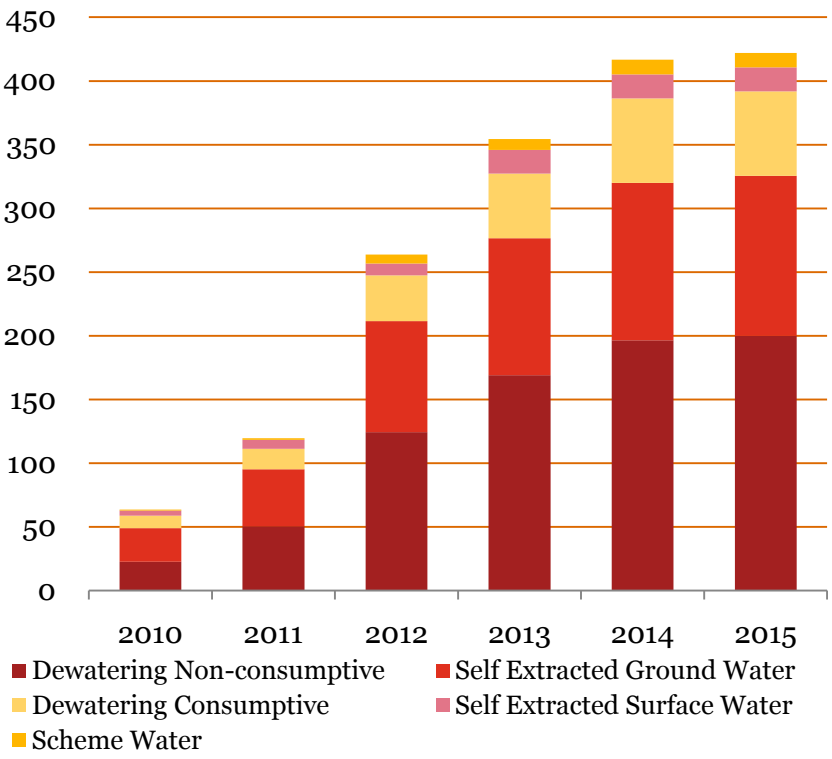
Other industry demand is driven by agriculture and, to a lesser extent, residential demand. This has been modelled with growth unconstrained by water availability and constant per capita residential demand. Similarly unconstrained growth has been assumed in minerals and energy demand numbers.

1. "Water Use" includes all dewatering, even when discharged to rivers and creeks as it constitutes an abstraction of water from the environment. Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.
2. Historic growth rate of 7% applied from 2016 as this extends beyond the normal planning horizons of many companies.

Source: Estimated from "Water Futures for Western Australia 2008-2030", Department of Water.

Incremental Minerals and Energy Water Use by Source

Minerals & Energy Water Use by Source
(GL/a, Incremental to 2009, 2010 – 2015)



Incremental minerals and energy water use is expected to reach 422 GL/a by 2015.

This represents a 45% increase upon current water use by the industry or a cumulative average growth rate of 7% each year.

The main source of consumptive water in the minerals and energy industry will continue to be self extracted ground water, providing 56% of incremental consumptive water use in 2015 (consumptive dewatering provides a further 30%).

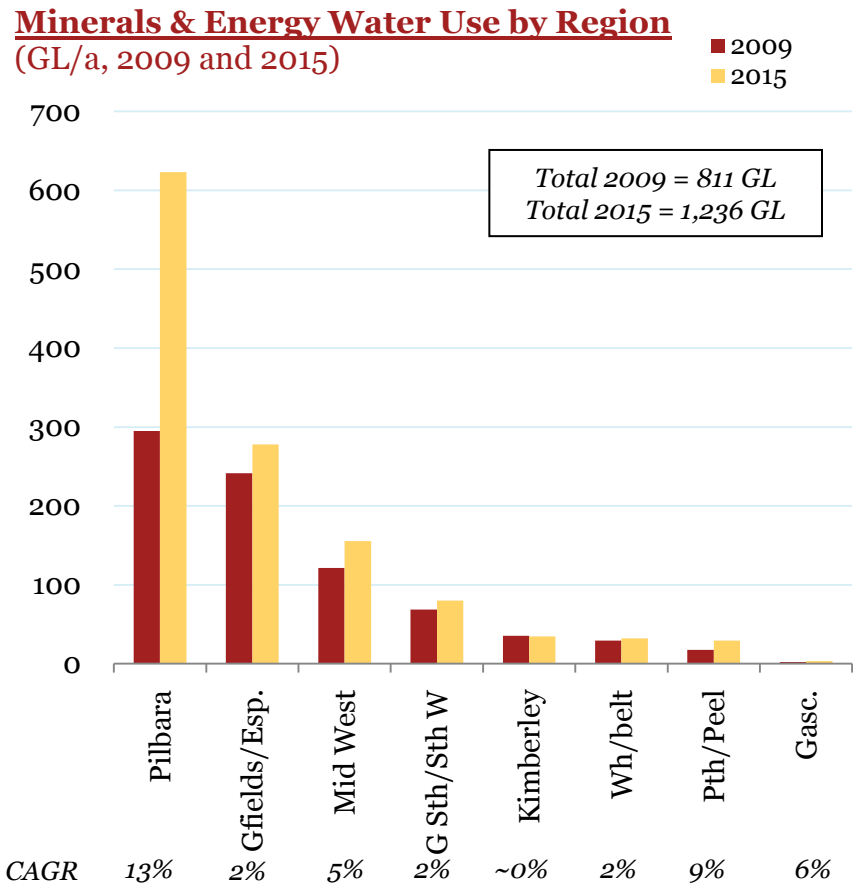
While only representing a small proportion of total water use in the industry, there will be step changes in scheme demand predominantly due to port construction and expansions and increased activity at mining camp sites.

There is a high level of dewatering expected to occur over the next few years: around 1,000 GL over the 6 year period ~ 760 GL of which is likely to be non consumptive.

1. Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA. Does not include saline water proposed to be used in some oil and gas projects and some iron ore projects.

Source: State Growth Outlook

Minerals and Energy Water Use By Region



The majority of the new minerals and energy water use in the state will be located in the Pilbara, with an average annual growth rate over the period to 2015 of 13% in this region.

Of the incremental 422 GL/a expected by 2015, approximately 325 GL/a will be used in upcoming projects in the Pilbara region.

Other high growth areas include the Mid West (growth of 5% per annum) and Perth/Peel (growth of 9% per annum) regions.

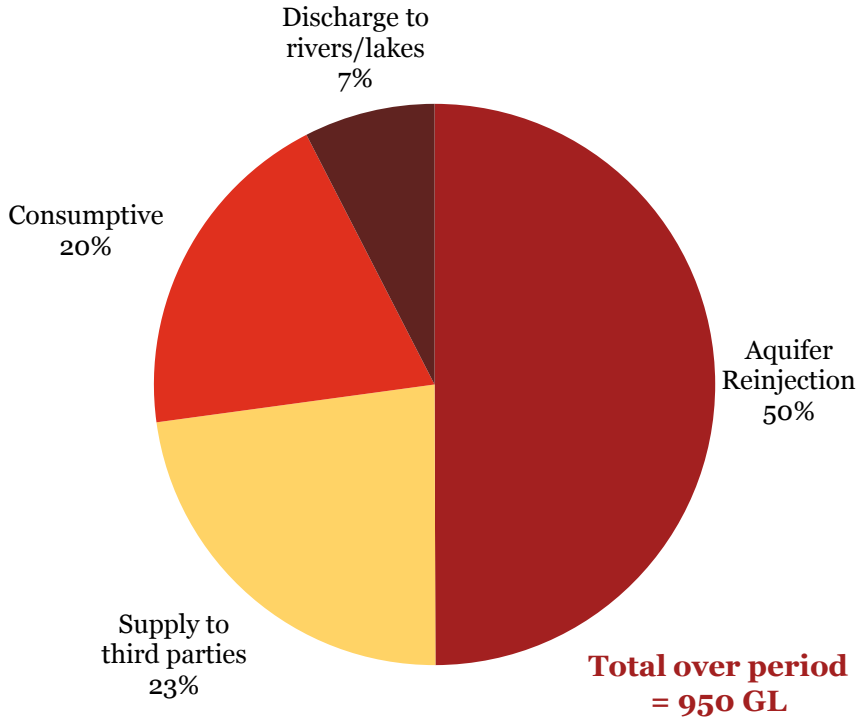
Additionally the 2% per annum growth expected in both the Goldfields/Esperance region and Great Southern/South West region will amount to at least an additional 47 GL/a.

1. Water Use includes all dewatering, even when discharged to rivers and creeks as it constitutes an abstraction of water from the environment.
2. Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: 2009 baseline estimated from "Water Futures for Western Australia 2008-2030", Department of Water.

Target Dewatering by End Use

Dewatering by End Use
(GL Incremental to 2009, survey responses only)



Survey responses indicated that almost 50% of 'new' dewatering taking place between 2010 and 2015 would be re-injected into aquifers.

Onsite consumptive dewatering use is expected to make up around 20% of total dewatering taking place over this period.

Survey responses indicated 23% of total dewatering may be supplied to third parties. The remaining will be discharged to rivers and creeks.

The legislation in place relating to the supply of water to third parties may present challenges to this level of supply to third parties. This will be discussed in greater detail in *Section 5.4 Implications and Opportunities*.

Note: Includes direct survey responses only.

Source: State Growth Outlook

5.3 Regional Overview

Key Regions

Growth in the Pilbara Region

- Water use across all industries in the Pilbara region is expected to increase by almost 12% per annum – a total increase of 95% from 2009 to 2015.
- In 2015, incremental water use by the minerals and energy sector in the Pilbara is 328 GL/a, totalling 623 GL/a (including a baseline of 295 GL/a).
- The majority of consumptive minerals and energy water use is met through dewatering (110 GL/a) and self extracted ground water (86 GL/a).
- The current allocation limits within the Pilbara are not likely to meet the high volumes of water use expected over the coming years due to minerals and energy projects.

Growth in the Perth/Peel Region

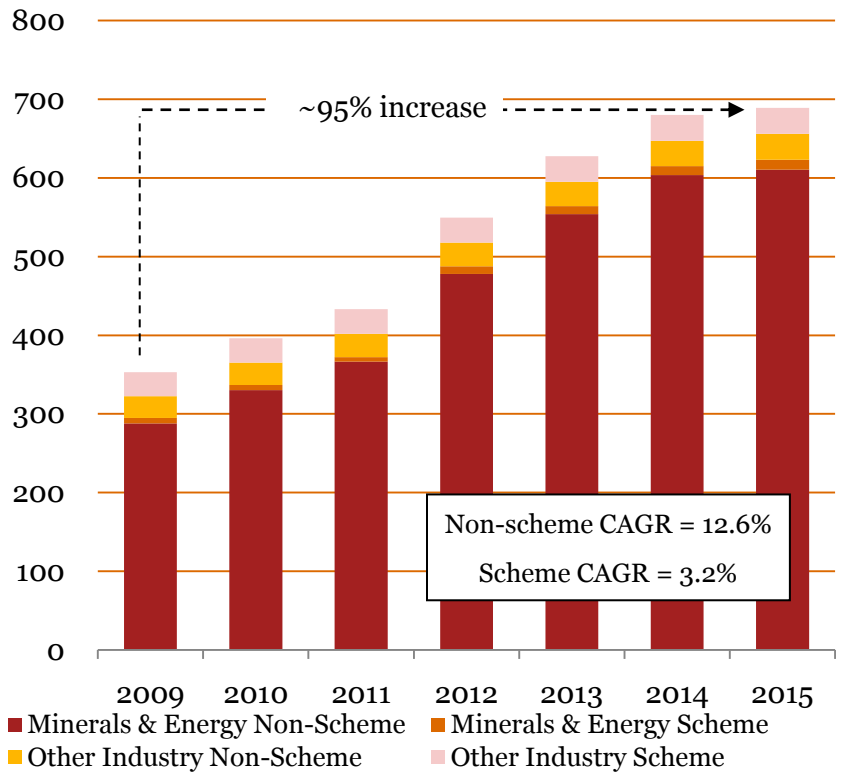
- Water use in the Perth/Peel region is expected to increase from an estimated 647 GL/a to 741 GL/a, or a 15% increase. Total increase driven by minerals and energy projects will reach 12 GL/a by 2015, totalling 29 GL/a.
- Although it appears there is available capacity in the groundwater allocations in the Perth/Peel Region, the region is already experiencing constraints.

Growth in the Mid West Region

- Water use in the Mid West region is expected to increase by nearly 3.5% per annum – a total increase of 25% from 2009 to 2015.
- Overall growth in the Mid West will be driven by the minerals and energy sector however, unlike some other regions, other industries also use a significant volume of water.
- In 2015, incremental water use by the minerals and energy sector in the Mid West is 34 GL/a, totalling 155 GL/a (includes base is 121 GL/a).
- The current groundwater allocation limit for the aggregate region (431 GL/a) is adequate for incremental water use in the Mid West, however uneven distribution of groundwater throughout the region is likely to lead to localised areas of scarce water resources.

Pilbara – Total Water Use Outlook

All Industry Water Use in the Pilbara
(GL/a, 2009 – 2015)



Water use across all industries in the Pilbara region is expected to increase by almost 12% per annum – a total increase of 95% from 2009 to 2015.

This demand is broken into scheme and non-scheme demand, where ground and surface water use will increase at 12.6% per annum and scheme is to increase at over 3% per annum.

Non-scheme water growth in this region is driven by residential consumption.

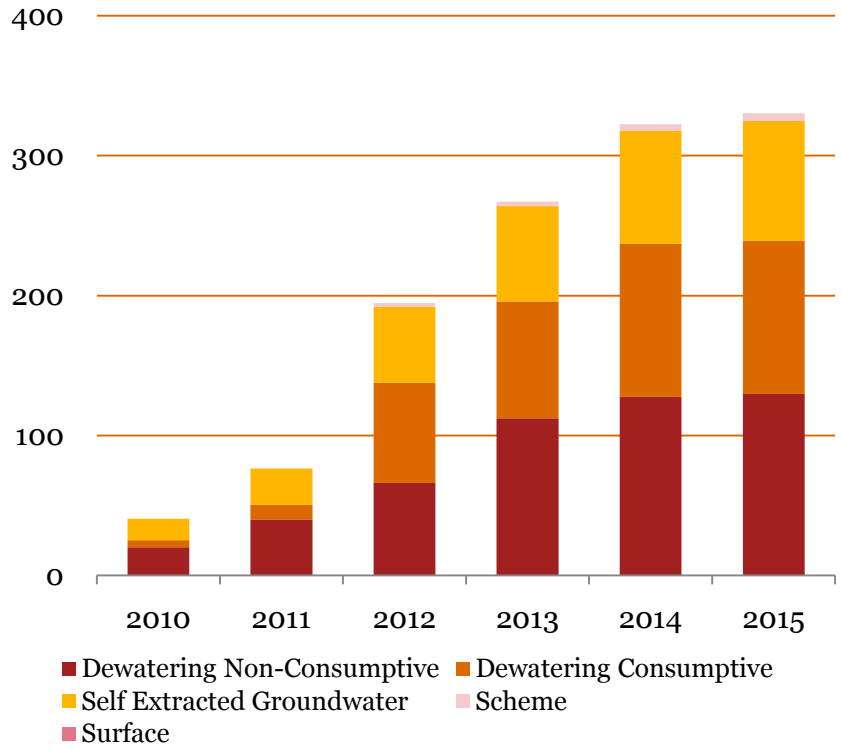
While there will be additional minerals and energy scheme demand, scheme demand growth will be driven by residential demand in the region with the likely commissioning of planning initiatives such as Pilbara Cities.

Note: Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: Other Industry Forecast and Baseline Demand from "Water Futures 2008-2030" Department of Water. Minerals and Energy Forecast from Growth Outlook Study

Pilbara – Minerals and Energy Water Use Breakdown

Minerals & Energy Water Use – Pilbara
(GL/a, Incremental to 2009)



In 2015, incremental water use by the minerals and energy sector in the Pilbara is 329 GL/a, totalling 624 GL/a (including a baseline of 295 GL/a).

Within the 329 GL/a water use, 200 GL/a is expected to be consumed, with the remaining 129 GL/a likely to be non-consumptive dewatering use; i.e. reinjected into aquifers or discharged to rivers and creeks.

The majority of consumptive minerals and energy industry water use is met through dewatering (110 GL/a) and self extracted ground water (86 GL/a).

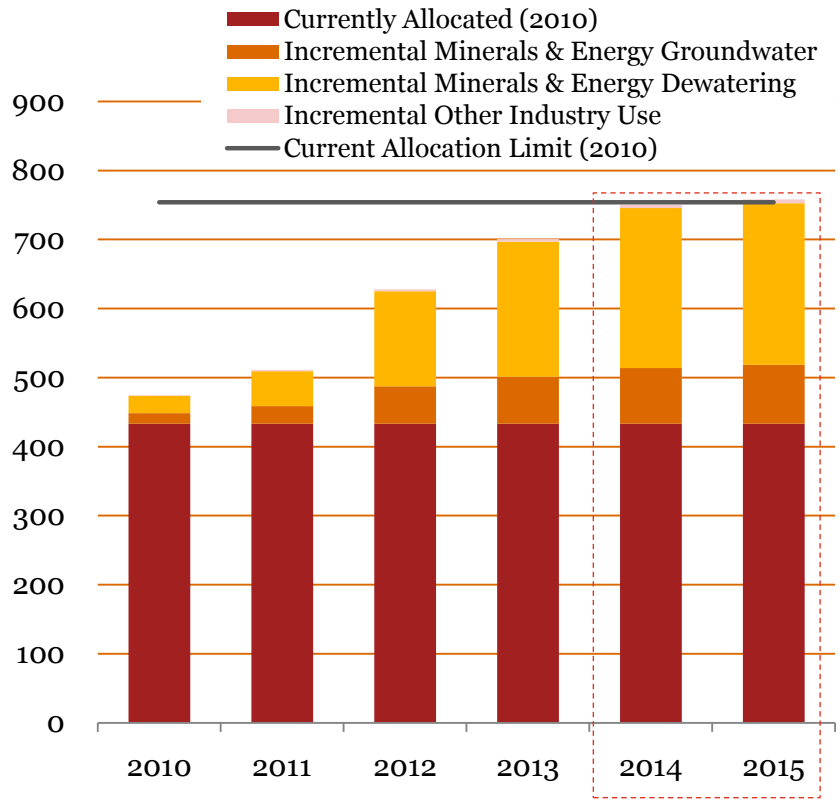
Scheme water consumption in the region will increase over the period by around 5 GL/a, predominantly for use in the construction and operation of associated iron ore mining infrastructure.

Note: Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: State Growth Outlook

Pilbara – Ground Water Availability

Groundwater Use & Current Allocation
(GL/a, 2009 – 2015)



The current allocation limits within the Pilbara are not likely to meet the high volumes of water use expected over the coming years due to minerals and energy projects.

It is predominantly dewatering activities to be undertaken over the next 5 years which will drive this demand increase.

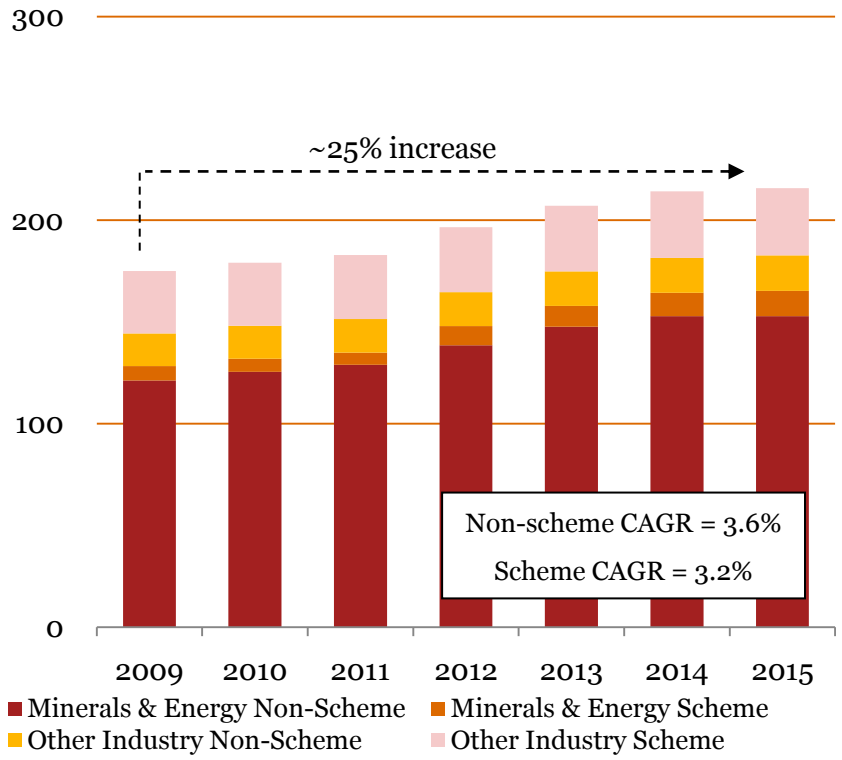
The increasing scarcity of water within this region will mean that new demands for urban scheme supply, to cater for growth of population, along with industry and commerce in the East and West Pilbara demand regions, will increasingly need to be met from coastal groundwater resources and/or desalination.

1. Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: State Growth Outlook

Mid West – Total Water Use Outlook

All Industry Water Use in the Mid West
(GL/a, 2009 – 2015)



Water use in the Mid West region is expected to increase by nearly 3.5% per annum – a total increase of 25% from 2009 to 2015.

This demand is broken into scheme and non-scheme demand, where ground and surface water use will increase at 3.6% per annum and scheme is to increase at over 3.2% per annum.

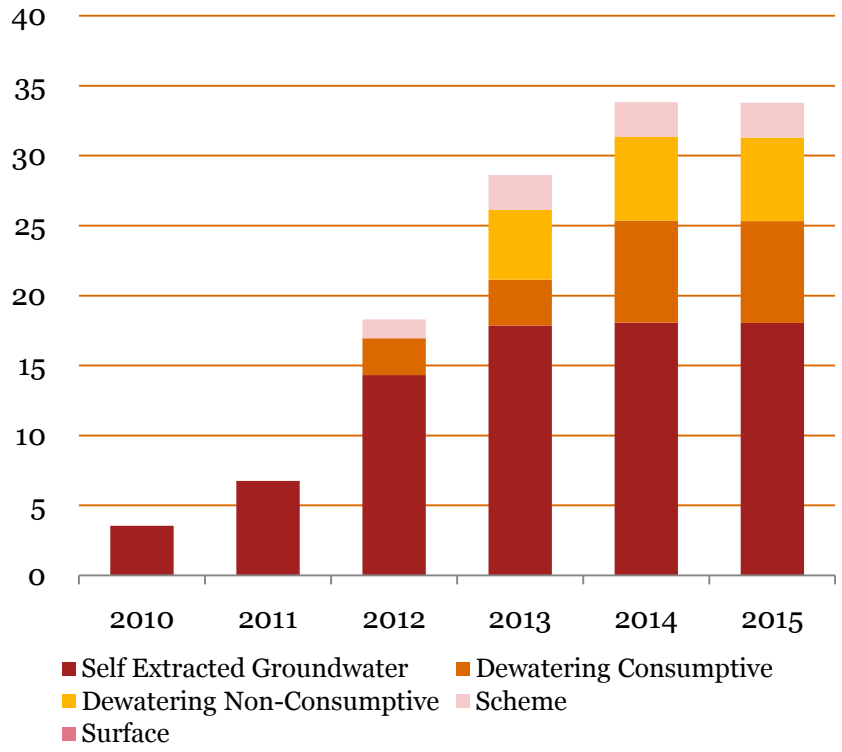
Overall growth in the Mid West will be driven by the minerals and energy sector however, unlike some other regions, other industries also use a significant volume of water.

Note: Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: Other Industry Forecast and Baseline Demand from "Water Futures 2008-2030" Department of Water. Minerals and Energy Forecast from Growth Outlook Study

Mid West – Minerals and Energy Water Use Breakdown

Mid West Minerals & Energy Water Use
(GL/a, Incremental to 2009)



In 2015, incremental water use by the minerals and energy sector in the Mid West is 34 GL/a, totalling 155 GL/a (includes base is 121 GL/a).

This represents a growth rate of 5% per annum This is a high growth rate, however not as high as the Pilbara region due to less expected dewatering.

Self extracted groundwater will provide the majority of minerals and energy demand, totalling 18 GL/a.

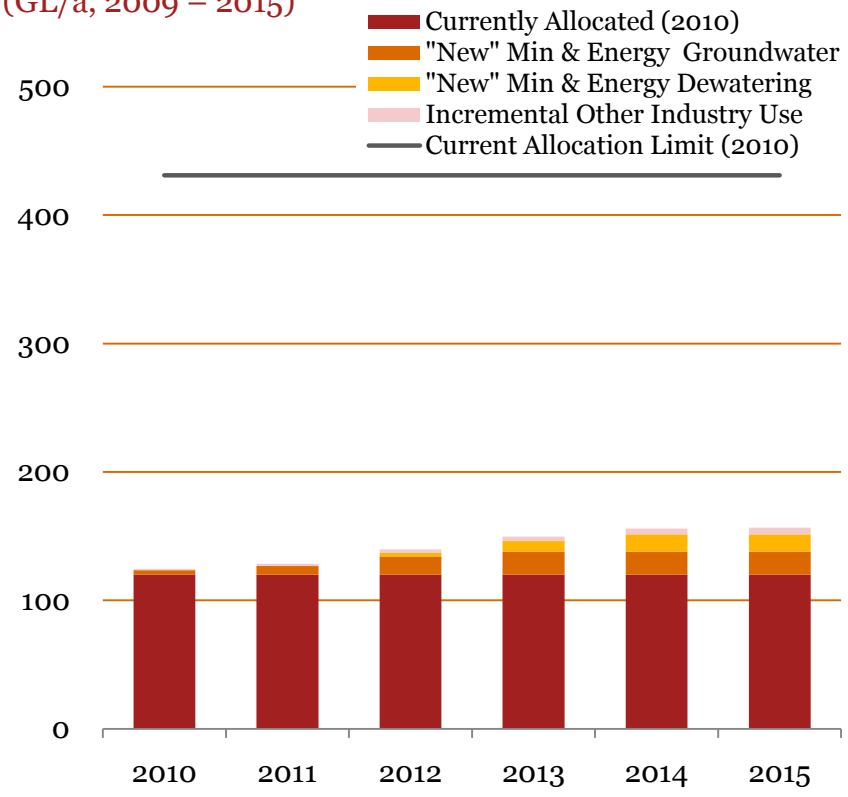
Additionally there is likely to be significant increase in scheme water use in the region due to iron ore and associated infrastructure projects.

Note: Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: State Growth Outlook

Mid West – Ground Water Availability

Groundwater Use and Allocation Limit
(GL/a, 2009 – 2015)



The current groundwater allocation limit for the aggregate region (431 GL/a) is adequate for incremental water use in the Mid West, however uneven distribution of groundwater throughout the region is likely to lead to localised areas of scarce water resources.

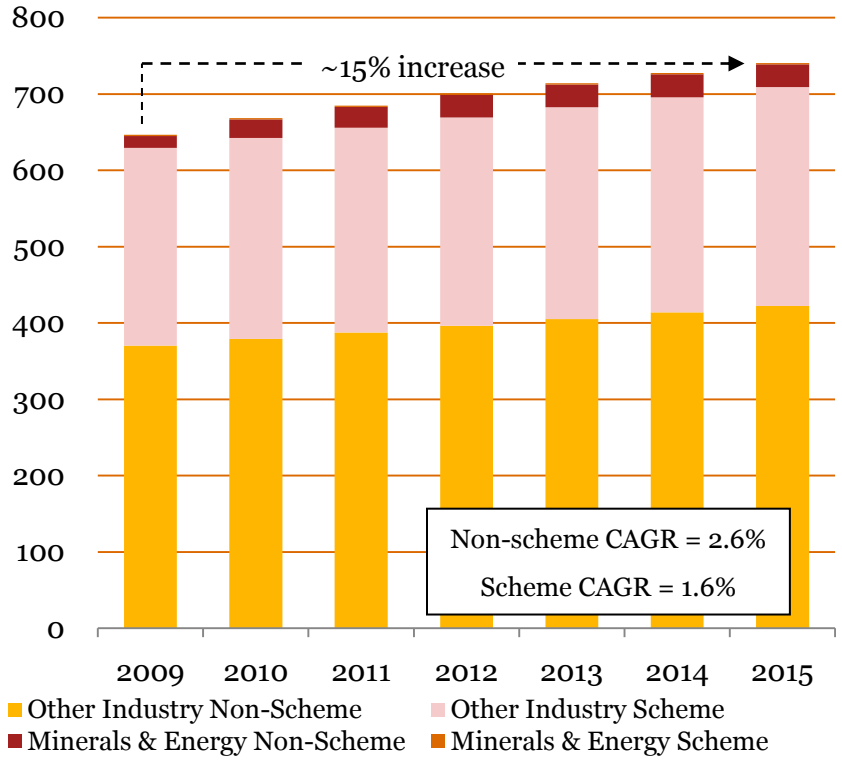
Projects in the Mid West may be required to source suitable water a long distance away from their operations. It is for this reason that securing future water supply for projects in the Mid West is a priority for the sector. This will be discussed in greater detail in *Section 5.4 Implications and Opportunities*.

Note: Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: Other Industry Forecast and Baseline Demand from "Water Futures 2008-2030" Department of Water. Minerals and Energy Forecast from Growth Outlook Study. Current Allocation Limit as at May 2010 from Department of Water.

Perth/Peel – Total Water Use Outlook

All Industry Water Use in Perth/Peel
(GL/a, 2009 – 2015)



Total water use in the Perth/Peel region is expected to increase from an estimated 647 GL/a to 741 GL/a, or a 15% increase.

Demand growth in this region will be driven by growth in residential demand.

While there is a high percentage growth rate from minerals and energy water use over the period to 2015, there is limited incremental demand (12 GL/a) from this industry.

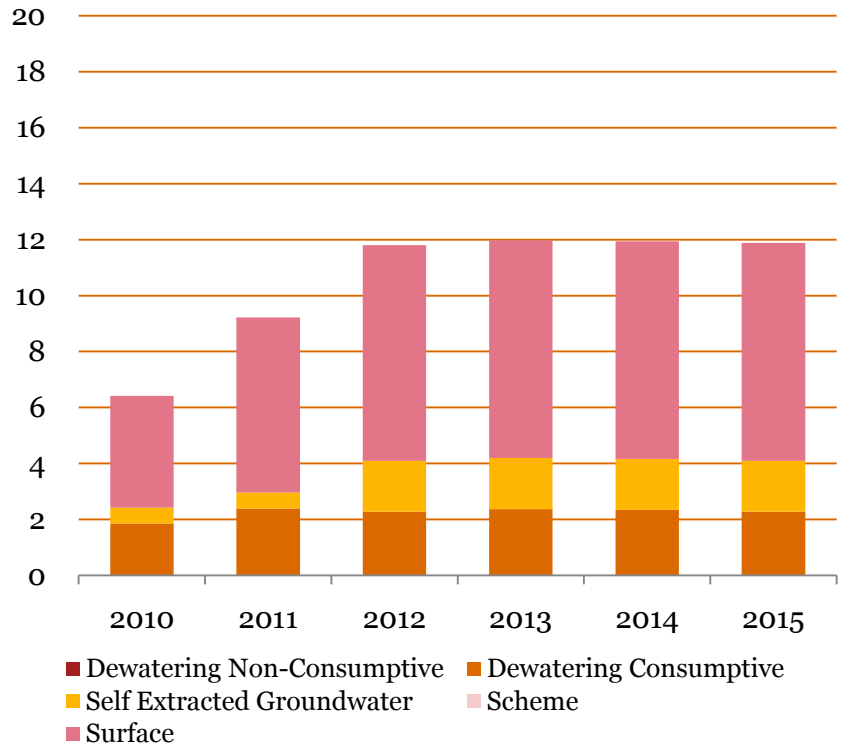
While minerals and energy projects are not directly inducing additional demand in the region, the increased residential population in the Perth/Peel region that migrate in response to growth in the sector will increase residential water demand in the region.

Note: Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: Other Industry Forecast and Baseline Demand from "Water Futures 2008-2030" Department of Water. Minerals and Energy Forecast from Growth Outlook Study

Perth/Peel – Minerals and Energy Water Use Breakdown

Perth/Peel Minerals & Energy Water Use
(GL/a, Incremental to 2009)



Total increase in water use in the Perth/Peel region driven by minerals and energy projects will reach 12 GL/a by 2015, totalling 29 GL/a.

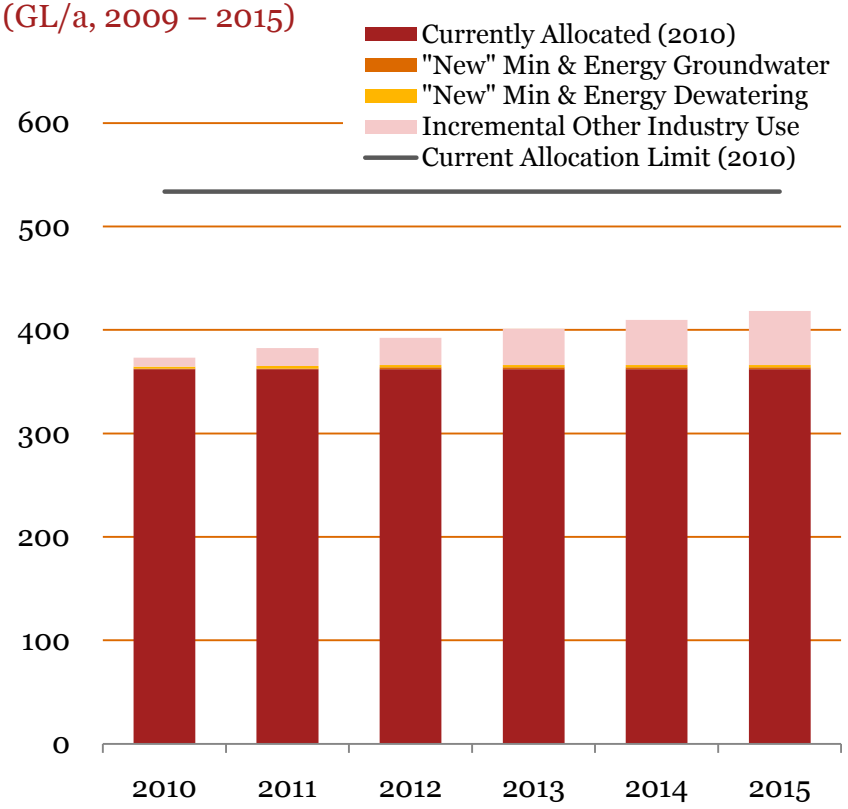
The majority of new water demand will be met through surface water abstraction, along with some consumptive dewatering use, and self extracted groundwater use.

1. Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: State Growth Outlook

Perth/Peel – Ground Water Availability

Groundwater Use and Allocation Limit
(GL/a, 2009 – 2015)



The current allocation limit for the Perth/Peel region is 533 GL/a, with 362 GL/a currently allocated.

Although it appears there is available capacity in the groundwater allocations in the Perth/Peel Region, the region is already experiencing constraints.

This is likely to be exacerbated due to the negative effects of declining rainfall on groundwater availability *(discussed in Section 5.2.1 Historic Water Usage Trends)*.

When looking on a more granular level, the Perth region alone is nearly 80% allocated. Perth currently imports around 40 GL from sources to its south and exports an estimated 27 GL to the Goldfields and agricultural areas.

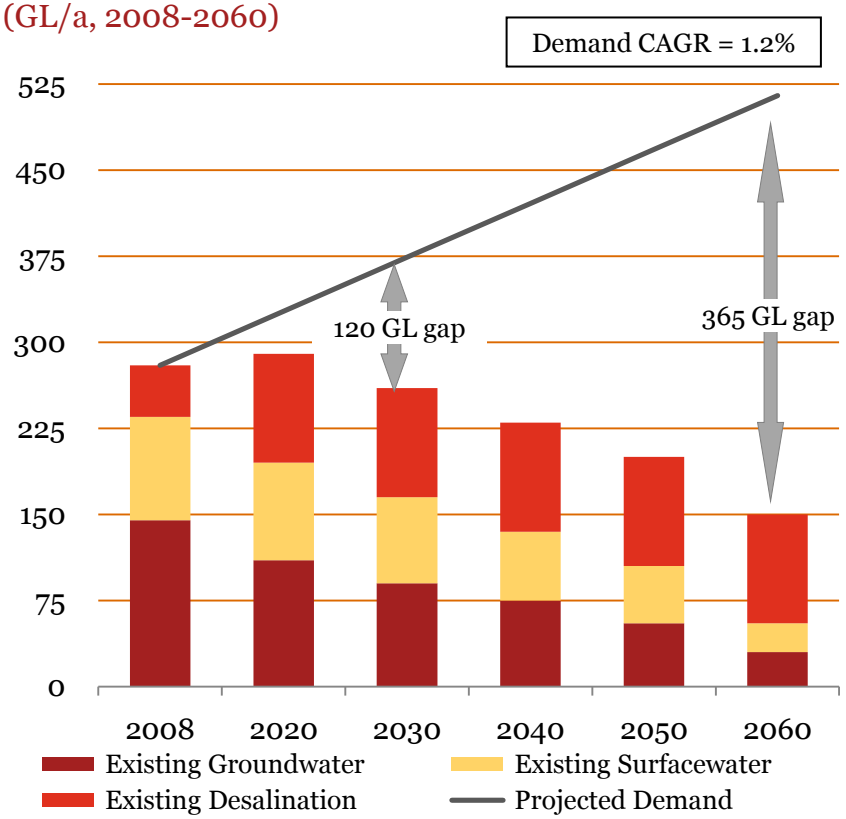
Increasing demand supports the need for significant gains in water use efficiency and the investigation of potential alternative sources including desalination and water reuse.

Note: Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: Other Industry Forecast and Baseline Demand from "Water Futures 2008-2030" Department of Water. Minerals and Energy Forecast from Growth Outlook Study. Current Allocation Limit as at May 2010 from Department of Water.

Long Term Outlook for the Perth Region

Long Term Water Availability – Perth
(GL/a, 2008-2060)



Current forecasts from the Water Corporation suggest a future demand-supply imbalance if current water usage trends are not reduced.

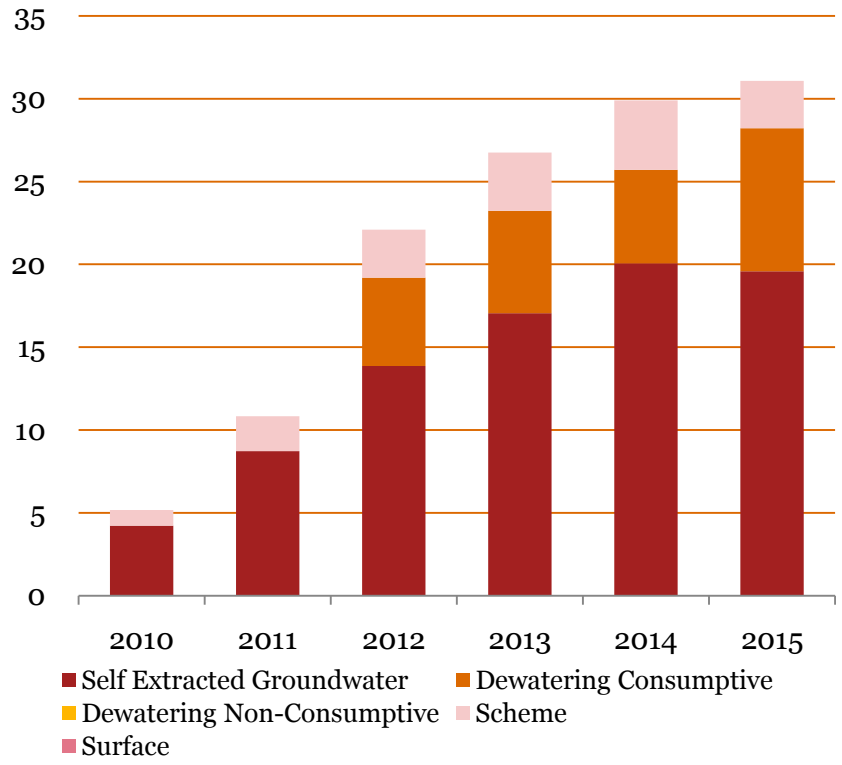
To address this future demand-supply imbalance, the Water Corporation has identified three areas of focus:

1. Reducing water use: 25% reduction target in per capita scheme water consumption over the next 50 years;
2. Increasing water recycling: from 6% to 60% recycling of all metropolitan wastewater from the current over the next 50 years; and
3. Developing new sources: with new source options to be identified, investigated and secured by 2060.

Source: "Water Forever: Towards Climate Resilience 2009", Water Corporation

Summary – Goldfields/Esperance

Gold/Esp. Minerals & Energy Water Use
(GL/a, Incremental to 2009)



While the growth rate in minerals and energy water use is not high for the period to 2015 (2% per annum), an additional 36 GL above 2009 water use will be required by 2015.

In 2009, Goldfields/Esperance region was responsible for around 30% of minerals and energy water use: 242 GL/a. By 2015, this is expected to increase to 278 GL/a. This incremental demand is driven predominantly by nickel, gold and rare earths operations.

The water demand will predominantly be met through self extracted groundwater, in addition to at least 7 GL/a consumptive dewatering per annum.

Note: Dewatering based only on responses from industry participants or where dewatering requirements where known through publicly available information. Not likely to represent total dewatering requirements for WA.

Source: State Growth Outlook

Summary of Other Regions

Great Southern/South West

Water availability will continue to be an issue in the area. While the current allocation limit for the region as a whole is not over allocated, nor will it be by 2015, individual areas are already over allocated.

Like the Perth/Peel region declining rainfall is expected to detrimentally affect the sustainable groundwater yields for the Great Southern/South West area in the long term.

There is some growth expected for the region in minerals and energy demand, up to an additional 16 GL/a by 2013, reducing to 11 by 2015.

In 2013, of the additional 16 GL/a, ~ 7 GL/a is non consumptive dewatering.

Gascoyne Region

Limited growth in water in minerals and energy industry driven water use.

Wheatbelt Region

The area is dominated by agriculture, with minerals and energy the second largest user of water by sector.

The incremental minerals and energy sector related water use is expected to be minimal for this region over the period 2009 – 2015: increasing from ~ 29 GL/a to 32 GL/a in 2015.

Kimberley Region

Water demand in the Kimberley region will largely remain stagnant over the period to 2015, with any incremental demand dropping off before 2015.

It is likely that total water use by the minerals and energy industry in the region will remain around 35 GL/a with a large portion of this met through the use of surface water at the Ord River.

Water use in this region is dominated by agriculture (~ 350 GL/a in 2009), with significant growth forecast for this industry in the region.

5.4 Implications and Opportunities

5.4.1 Growth and Competitiveness

5.4.2 Environment and Liveability

Barriers currently exist in making better use of water from mine dewatering. To assist the minerals and energy sector in making better use of dewatering water, the Department of Water is working with the Department of Mines and Petroleum to improve opportunities for third party access.

Currently much of the unconsumed dewatering water is discharged to rivers and creeks, however survey responses suggested that a significant amount of dewatering water will be supplied to third parties or reinjected in to aquifers.

There are, however, barriers to realising this target and continuing to make better use of water from dewatering, particularly supplying to third parties. The rights to supply to third parties is somewhat unclear under the Rights in Water and Irrigation Act (1914). Additionally, demand for water is often at considerable distance from dewatering supply leading to a high capital cost associated with supplying to third parties.

Further, in some cases, aquifer reinjection may not be technically feasible, and therefore the only option may be discharge to rivers and creeks.

Increasing water scarcity will stimulate demand for a water market but cost pressures alone will not be sufficient to form a market. Significant regulatory changes are likely to be required to develop an effective water market in WA.

Cost pressures alone will not be sufficient to form a water market in WA; legislative changes would be needed to facilitate trade within and between water using industries.

Adoption of the National Water Initiative principles would promote efficacy in any water market within WA.

To meet future water demands more effectively, we need to see increased collaboration and coordination within the sector, and with government.

Improved coordination and collaboration will be required both within the minerals and energy sector, and between industry and government.

The Department of Water is working to deliver greater up-front investment in water supply security. In doing so, the Department aims to be more proactive with regards to water supply issues. To complement this approach, the minerals and energy sector will need to take a broader, more considered approach to water management, focusing beyond their individual operations.

In addition to increased collaboration, technology and innovation within the water supply industry will assist in meeting future water demands.

For example, desalination will increasingly provide water supply for both industry and residential consumers and a number of innovations to reduce water consumption such as dry tailings management and alternative dust suppression technologies are being explored.

An opportunity exists for increased collaboration and coordination of both desalination requirements and desalination technologies from industry and government or other research agencies. Similar opportunities exist for cooperation and investment in demand-side management.

Competition between the minerals and energy industry and other water intensive industries will inevitably increase as water becomes more scarce.

This will be of particular issue going forward in the Mid West and Great Southern/South West regions.

The Department of Water is addressing increasing competition for water through developing a means to better reconcile/understand value for different water uses, alongside community education.

Whilst the aggregate Mid West area has sufficient underground water availability to support minerals and energy project growth, quality and quantity of water is not evenly distributed throughout the region, leading to difficulty in securing supply for specific projects.

As a result, exploration and identification of future viable water resources within the region should be expedited.

Opportunities exist for a Mid West Regional Water Plan, along with a water trading regime in areas where water resources are becoming scarce or are approaching a binding constraint to production.

Investment in securing water supply in the Pilbara will be required to meet demands from the minerals and energy sector within the next 5 years.

Water use from minerals and energy activities is expected to nearly double between 2009 and 2015. This would see an overuse of water within the region if groundwater allocation limits were not revisited. As a result, exploration and identification of future viable water resources within the region should be expedited.

The Department of Water is working to deliver greater up-front investment in water supply security, therefore it is expected that the future demand will be met sustainably.

Further work is needed to better understand the cumulative and downstream impact of groundwater abstraction including dewatering, both in terms of the continual draw down of resources and discharging to rivers and creeks.

The recent report commissioned by the National Water Commission: "A Framework for Assessing Potential Local and Cumulative Effects of Mining on Groundwater Resources" highlights recommendations to assist jurisdictions, mining companies and other groundwater users in better understanding and managing local and cumulative effects of mining on groundwater resources.

As the scarcity of water increases, the cost of water is likely to increase, further increasing the cost of living in WA.

Whilst the minerals an energy industry is likely to be in a position to absorb the increase in water costs going forward, other industries, including residential, may not have this capacity.

Additionally, increased residential population in the Perth/Peel region will further increase water demand in an already water constrained region.

Reduction in sustainable groundwater yields due to declining rainfall in the Perth/Peel and Great Southern/South West regions will require contingency planning and increased cooperation between the public and private sector to ensure water use demands are continued to be met.

While there is limited expected growth from the minerals and energy sector in these regions, the sector currently uses over 85 GL of water per annum in these regions.

Additionally, the increased residential population in these regions that migrate in response to growth in the sector will further increase residential water demand.

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6.0 Appendix

6 Appendix – 6.1 Glossary

Use of Acronyms

Acronym	Original Phrase
ABS	Australian Bureau of Statistics
CME	Chamber of Minerals and Energy
CAGR	Compound Annual Growth Rate
DIDO	Drive-in-drive-out
DSM	Demand Side Management
FIFO	Fly-in-fly-out
IGP	Industry Gross Product
IMO	Independent Market Operator
LNG	Liquefied Natural Gas
NWIS	North West Interconnected System
NWS	North West Shelf
SWIS	South West Interconnected System
WAPC	Western Australian Planning Commission

6 Appendix – 6.2 Methodology

Overall Study Methodology

The overall objectives of the study were to:

- Develop a demand outlook for the three growth enablers: people; energy; and water and identify potential demand/supply gaps;
- Provide a basis for identifying potential implications arising from current growth plans; and
- Provide valuable input into industry and government planning and to better position industry and government to capture opportunities from WA's growth.

Demand for the three key inputs (labour, energy and water) is expected to be driven by planned minerals and energy sector investments. The demand side data was sourced directly from the participating companies and focused on labour, energy and water requirements for each of their planned and relevant current projects through to 2020. To supplement publicly available information on non-surveyed projects, the data points were then used to infer the labour, energy and water demands for the non-surveyed projects to develop outlooks for all current planned projects for the state as of Dec 2009.

Supply side information was sourced from relevant government sectors and private industry. Analysis was then conducted on the quantum of key growth outputs for both supply and demand and also on a more granular level where required. The final study output examined the supply and demand outlook through 2020 and the identification of any gaps.

Four reference groups were consulted throughout the project to: validate data quality; identify implications and opportunities; and to ensure alignment with objectives. These reference groups (CME People Strategies Committee, CME Energy Reference Group, CME Water Issues Group and a Project Reference Group) comprised industry and government representatives, ensuring adequate representation of key stakeholders.

Details of the methodology are provided in the following pages:

Data Survey (1 of 6) – Project Data Sheet

Project Data Sheet

Project Name	Name
Project Location	Please select region
Principal Commodity	Please specify commodity
Project Status	Please select status
Expected Capex A$	-

Production Data

Material	Description	Units	Case	2009	2010	2011	2012	2013
Material Moved	Total material moved/ore mined	**Please select**	High					
			Expected					
			Low					
Material Produced	*Please specify product one (e.g. hematite, gold etc.)*	**Please select**	High					
			Expected					
			Low					
	Please specify product two (e.g. hematite, gold etc.)	**Please select**	High					
			Expected					
			Low					
	Please specify product three (e.g. hematite, gold etc.)	**Please select**	High					
			Expected					
			Low					
	Please specify product four (e.g. hematite, gold etc.)	**Please select**	High					
			Expected					
			Low					

Note: All data points collected out to 2020 (where applicable).

Source: State Growth Outlook

Data Survey (2 of 6) – People Data – Construction Workforce

People Data								
Construction Workforce								
Resource	Description	Units	Case	2009	2010	2011	2012	2013
Direct Workers	FIFO	Headcount	High					
			Expected					
			Low					
	Local Resident		High					
			Expected					
			Low					
Contracted Workers (where known)	FIFO	Headcount	High					
			Expected					
			Low					
	Local Resident		High					
			Expected					
			Low					
Source of FIFO Employees	Gascoyne	% of FIFO	n/a					
	Goldfields - Esperance							
	Great Southern/South West							
	Kimberley							
	Mid West							
	Perth/Peel							
	Pilbara							
	Wheatbelt							
	Interstate (please specify states if known)							
	International (please specify countries if known)							

Note: All data points collected out to 2020 (where applicable). Type of employee (labourers, managers, tradespersons & maintenance etc. asked, however not enough participants were able to provide a response to include the data in the report.

Source: State Growth Outlook

Data Survey (3 of 6) – People Data – Operations Workforce

Operating Workforce								
Resource	**Description**	**Units**	**Case**	**2009**	**2010**	**2011**	**2012**	**2013**
Direct Workers	FIFO	**Headcount**	High					
			Expected					
			Low					
	Local Resident		High					
			Expected					
			Low					
Contracted Workers (where known)	FIFO	**Headcount**	High					
			Expected					
			Low					
	Local Resident		High					
			Expected					
			Low					
Source of FIFO Employees	Gascoyne	**% FIFO**	n/a					
	Goldfields - Esperance							
	Great Southern/South West							
	Kimberley							
	Mid West							
	Perth/Peel							
	Pilbara							
	Wheatbelt							
	Interstate (please specify states if known)							
	International (please specify countries if known)							

Note: All data points collected out to 2020 (where applicable). Type of employee (labourers, managers, tradespersons & maintenance etc. asked, however not enough participants were able to provide a response to include the data in the report.

Source: State Growth Outlook

Data Survey (4 of 6) – Water Data

Water Data								
Resource	Description	Units	Case	2009	2010	2011	2012	2013
Scheme Water/Third party water	Consumption/processing	ML/a	High					
			Expected					
			Low					
Self Extracted Surface Water	Consumption/processing	ML/a	High					
			Expected					
			Low					
Self Extracted Groundwater	Consumption/processing	ML/a	High					
			Expected					
			Low					
Dewatering	Gross dewatering	ML/a	High					
			Expected					
			Low					
	End use of water (if known)	%	Consumption/processing					
			Aquifer Reinjection					
			Discharge to Rivers/creeks					
			Supply to Third Parties					
Saline/Hyper-saline Water	Consumption/processing	ML/a	High					
			Expected					
			Low					
Total Water Consumption	Scheme/third party water + surface water + groundwater + dewatering consumptive use	ML/a	High					
			Expected					
			Low					

Note: All data points collected out to 2020 (where applicable).

Source: State Growth Outlook

Data Survey (5 of 6) – Energy Data – Electricity

Energy Data								
Resource	Description	Units	Case	2009	2010	2011	2012	2013
Self Generated Electricity	Total Self Generated Electricity	MWh/a	High					
			Expected					
			Low					
	Total Self Generated Electricity Sales (i.e. sold to third party)	MWh/a	High					
			Expected					
			Low					
	Source of Self Generated Electricity (if known)	%	Natural Gas					
			Diesel					
			Solar					
			Wind					
			Geothermal					
			Hybrid					
			Other (e.g. biomass)					
Purchased (grid) Electricity	Total Demand for Purchased Electricity	MWh/a	High					
			Expected					
			Low					
	Source of Purchased Electricity (if known)	%	Natural Gas					
			Coal/Coke					
			Diesel					
			Solar					
			Wind					
			Geothermal					
			Hybrid					
			Other (e.g. biomass)					

Note: All data points collected out to 2020 (where applicable).

Source: State Growth Outlook

Data Survey (6 of 6) – Energy Data – Other Energy

Energy Data								
Resource	Description	Units	Case	2009	2010	2011	2012	2013
Natural Gas	Consumption from Distributed Supply	GJ/a	High					
			Expected					
			Low					
	Purpose of Use	%	Mobile Plant					
			Electricity Generation					
			Industrial Process					
Diesel	Consumption	ML/a	High					
			Expected					
			Low					
	Purpose of Use	%	Mobile Plant (incl. rail)					
			Electricity Generation					
			Industrial Process					
Coal	Consumption	GJ/a	High					
			Expected					
			Low					
	Purpose of Use	%	Mobile Plant					
			Electricity Generation					
			Industrial Process					
Other Sources	*Please Specify Source in Comment Section*	GJ/a	High					
			Expected					
			Low					
	Purpose of Use	%	Mobile Plant					
			Electricity Generation					
			Industrial Process					

Note: All data points collected out to 2020 (where applicable).

Source: State Growth Outlook

Definition of Regions

The eight key regions are:

- Kimberly
- Pilbara
- Gascoyne
- Midwest
- Wheatbelt
- Goldfields-Esperance
- Perth/Peel (combined)
- South West/Great Southern (combined)

Source: State Growth Outlook

Model Design Principles

An excel model was used to aggregate the raw data and provide a regional outlook for each of the growth enablers. The model was built based on the following principles:

- Incremental analysis: The model analysed the incremental changes in supply and demand, rather than absolute values, to eliminate potential errors arising from establishing baseline data. The demand outlook also includes projects that are expected to ramp/shut down during the period – it is adjusted based on an overlay of published end of LOM for major existing operations in the state.
- Internal project economics accepted: Technical solutions to issues such as power supply (make vs. buy) and labour sourcing (FIFO vs. residential) will be documented as per current project assumptions, on the basis that the project owners have made rational decisions based on project economics i.e. the focus is on the 'business as usual' case.
- Time series data: Data was captured in the form of a time series, the time series has a 12 month resolution up to 2020.
- Probability weighted outlook: History has shown that not all announced projects will be realised and in order to account for this, an individual probability was applied to each project in the pool.

An individual probability weighting was determined for each project, with the weighted average realisation for all projects based on historic project realisation rate.

The project probability weighting was based on 3 sets of factors which affect project realisation:

- External factors: The forecast CAGR of the relevant commodity price;
- Company specific factors: The capital expenditure of the project relative to the market capitalisation of the company, and whether the company has other projects in operation; and
- Project specific factors: The current status of the project and time to construction.

Note: projects under construction or in operation were assigned a probability of 1.

The aggregate probability-weighting was normalised to be in line with historic outcomes. (From 2003-2008, ~75%[1] of DOIR announced projects have either been developed or are currently being commissioned.)

1. Source: Based on analysis of Prospect Data, Prospect Magazine Department of Mines and Petroleum 2003-2008

Non-surveyed Data (1 of 2)

publicly available information, taken from project feasibility studies, public environmental reviews and other company announcements were used to populate the required data points for projects not directly surveyed. When this information was not available, a multiplier, based on the commodity output and region, was developed for each data point and commodity to infer a complete data capture template for every project that was not surveyed.

The inferring methodology is as follows:

- ***Labour multipliers:*** It was assumed that a commodity, regardless of region, would demand the same amount of labour per unit of production. Thus, for each commodity, a total labour demand multiplier per unit production was developed by dividing the total labour headcount by total production unit levels for each commodity for both construction and operation. It was assumed that the split between FIFO workers and local resident workers for the inferred projects would be determined by the region in which the project was located, as opposed to the commodity of the project. Thus, for each region, an average percentage of the workforce that was sourced locally was determined with remaining portion deemed FIFO (completed separately for construction and operation workforce). This region specific percentage was then applied to every project workforce within a region to determine the inferred FIFO contingent. The source of FIFO was determined for each region, based on survey responses only.

Multipliers continued:

- ***Energy multipliers:*** It was assumed that a commodity, regardless of region, will consume the same amount of electricity per unit of production. Thus, for each commodity (differentiating between hematite an magnetite for example), a total electricity demand per unit production multiplier was developed by dividing the total electricity demand (self generated and purchased) consumption by production levels for each commodity. This provided the total electricity demand per unit production for each commodity. It was assumed that the source of demand, either scheme or self generated, would be determined by the region (and associated infrastructure) in which the project was located, as opposed to the commodity of the project. Thus, for each region, an average percentage of the electricity demand that was met through self generation was determined with remaining portion deemed to be met by purchased supply. The fuel source for the self generated electricity was also determined by the project region. This was achieved by averaging the total energy for self generation consumed in a region and dividing by the relative amount that was fuelled by natural gas and that which was fuelled through diesel or coal/coke. The same multiplier methodology was used to determine gas and diesel requirements for industrial use and mobile plant.

Non-surveyed Data (2 of 2)

Multipliers continued:

- ***Water multipliers:*** It was assumed that a commodity, regardless of region, will consume the same amount of water per unit or production. Thus for each commodity, an 'intensity of use' multiplier was developed by dividing the total water consumption by production levels for each commodity, to give the total water demand per unit production of each commodity. It was also assumed that the relative portion of this demand that would be met from self extracted water, surface water and scheme would be determined by the project region. Thus a region specific multiplier was developed for each region that was used to apportion a percentage of the total water demand given by the intensity of use multiplier to each of the water sources: scheme; self extracted (including dewatering) and surface water.

Agencies Consulted on Supply/Planning Outlook

Informative supply side/planning discussions were conducted with the following groups, providing data where appropriate:

- Australian Bureau of Statistics
- Department of Mines and Petroleum
- Department for State Development
- Department of Water
- Horizon Power
- Independent Market Operator
- Office of Energy
- Water Corporation
- WA Planning Commission
- Western Power

DMP Gas Supply Outlook Assumptions

Project	Start-up	High Supply	Low Supply
North West Shelf (NWS)	Operational	600 TJ/d maintained to 2030.	600 TJ/d in 2011 declining to less than 300 TJ/d by 2030.
Varanus Island (includes gas supply from Halyard/Spar fields)	Operational	450 TJ/d maintained to 2020 declining to 300 TJ/d by 2030 assuming new fields are discovered to support this.	450 TJ/d in 2011 declining to less than 100 TJ/d by 2030.
Devil Creek gas plant	2011	110 TJ/d supplied for 13 years before declining to around 50 TJ/d by 2030 assuming new fields are discovered which extend supply to 2030.	110 TJ/d supplied for 13 years based on Reindeer development only.
Macedon processing facility	2013	170 TJ/d supplied for 12 years before declining to around 90 TJ/d by 2030 assuming new fields are discovered which extend supply to 2030.	145 TJ/d supplied for 12 years based on Macedon development only.
Gorgon	2015	150 TJ/d in 2015 followed by 300 TJ/d from 2020	150 TJ/d in 2015 followed by 300 TJ/d from 2020.
Wheatstone	2016	200 TJ/d maintained to 2030.	200 TJ/d maintained to 2030.
Pluto	2016	100 TJ/d maintained to 2030.	100 TJ/d maintained to 2030.
Browse	2023	190 TJ/d maintained to 2030.	
Scarborough	2023	190 TJ/d maintained to 2030.	
Unconventional gas (includes Warro project)	2012	10 TJ/d maintained to 2030.	

1. A key difference between the supply projections is based on the assumption that in the high supply case North West Shelf domestic gas production is maintained at 600 TJ/d to 2030. In contrast, the low supply case assumes that production from the North West Shelf is maintained at 600 TJ/d to 2020 before declining to 300 TJ/d by 2030. The high supply case also assumes that approximately 2350 PJ of gas will be discovered and supplied domestically over the outlook period partially underpinning the continued supply of gas from the Varanus Island, Devil Creek and Macedon gas processing facilities.

Source: ABS Demographic Projections by Change Component Cat 3222.0 Table 12

Pilbara – Development of the North West Interconnected System

Horizon Power is seeking to further develop the NWIS to increase system efficiency. Their estimated system-wide savings range from 8-11% over the nearest competitive option.

The proposed development aims to increase system efficiency by allowing the development of larger and more efficient plant and by reducing required spinning reserves. The development would also allow greater flexibility with regards to fuel choices (e.g. integration of renewables).

Horizon Power has developed forecasts for the diversified peak loads in the Pilbara for 2015 ranging from 1,600MW under a low case scenario to 3,300MW in a high case scenario (including baseline 2008 load).

Horizon Power estimates system-wide savings (both capex and opex) range from 8-11% over the nearest competitive option.

Additionally, there is a significant reduction in projected carbon emissions with the developed NWIS versus continued incremental/isolated development.

As would be expected with large scale coordinated development, there are significant challenges to this proposal which are discussed in *Section 4.6 Implications and Opportunities*.

Source: "Efficient Energy Infrastructure Investment in the Pilbara", Horizon Power

Trends in Exploration – Spend vs. Metres Drilled

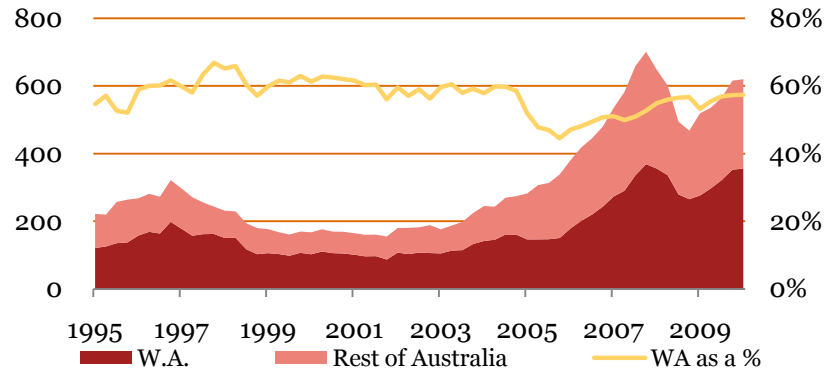
Exploration undoubtedly supports the long term sustainability of the minerals and energy sector. With the current production outlook for WA, it is critical for the sustainability of the industry and the WA economy that reserves are replenished through strong exploration activity.

Exploration spending in Australia has increased significantly since early 2000's; with WA contributing to at least 50% of the total spend (albeit at a reduced percentage of total spend in Australia since the late 1990's). Exploration expenditure dropped sharply during the global financial crisis; however there are early signs of recovery, with an upwards trend in spending from Q3 2009.

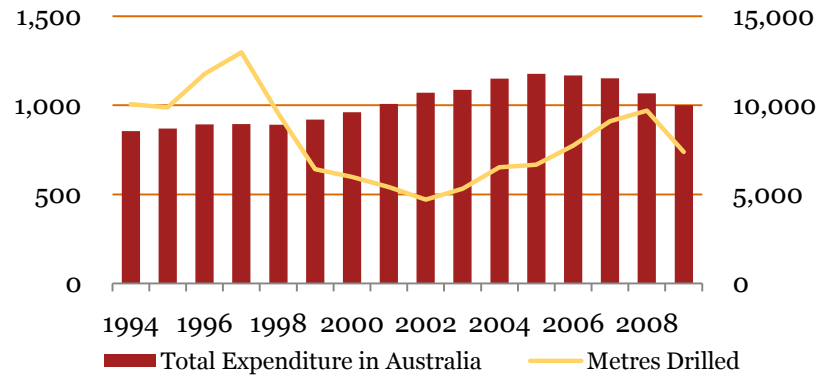
While absolute expenditure in exploration in WA and Australia has been increasing significantly, further analysis highlights the following trends:

- Increased exploration spend has not directly translated into greater exploration success;
- There has been a decreasing expenditure on greenfields exploration as a proportion of total spend; and
- Australia has not maintained its share of the world exploration spend since the early 1990's.

Quarterly Exploration Spend– Australia
($M Primary axis, WA as a % secondary axis)



Expenditure in Aus vs. Metres Drilled
($M Primary axis, km drilled secondary axis)

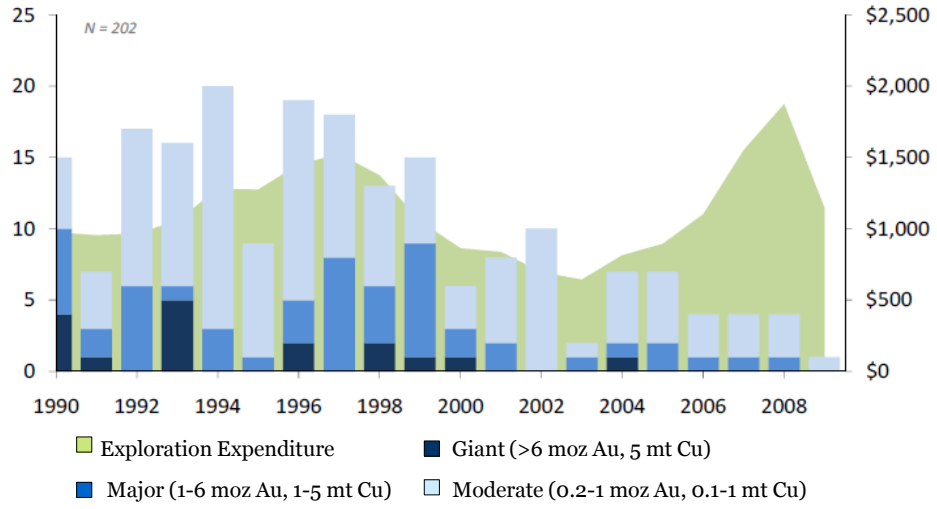


Note: Excludes petroleum spend

Source: ABS, Mineral and Petroleum Exploration, Australia Cat: 8412.0

Trends in Exploration – Exploration Spend vs New Discoveries

Exploration Spend Vs New Discoveries
(# Discoveries, A$m Expenditure)



Through a period of increasing exploration spend in Australia, there has been a significant reduction in the number of discoveries, along with a decreasing average discovery size.

The diagram on the left depicts this trend which has been evident since the late 1990's. Of particular note is the 'disappearance' of giant discoveries (greater than 6 moz Au, or greater than 5 mt Cu).

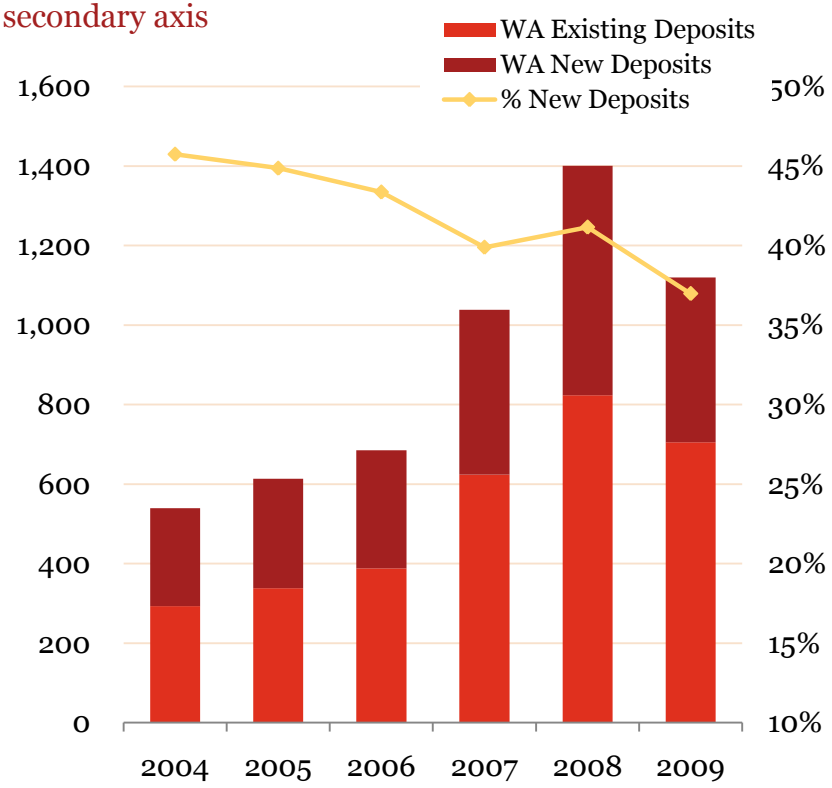
Note: excludes exploration on Bulk Minerals and Uranium

Source: Discovery data from MinEx Consulting October 2009 . Expenditure data from ABS (1990-1995), MEG (1996-2006)

Trends in Exploration – Spend on New and Existing Deposits

Expenditure New and Existing Deposits

$M primary axis, % spend on new deposits on secondary axis



In recent years, exploration spend in Australia has been increasingly allocated towards brownfield deposits.

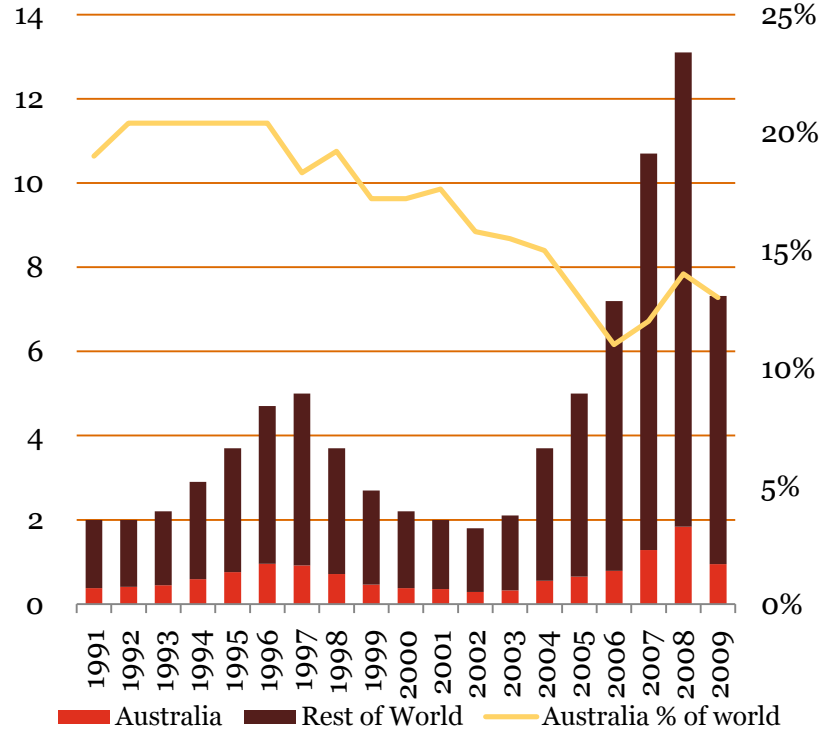
This has been a trend since the early 2000's and was exacerbated in 2009 – as the Global Financial Crisis took its toll. The increased focus on brownfields exploration in Australia has been a trend echoed globally and could partly be attributed to mineral companies seeking to prove up resources and increase production at existing operations in response to higher commodity prices. Many junior companies, which predominantly explore greenfields, dropped their exploration budgets significantly in response to the Global Financial Crisis which is likely to be a contributing factor to the recent spike in brownfields exploration.

Note: Excludes petroleum spend

Source: ABS, Mineral and Petroleum Exploration, Australia Cat: 8412.0

Trends in Exploration – Global Exploration Spend

Australian & Global Exploration Spend
(US$b, primary axis, % share Australia secondary axis)



On a global scale, in 2009 Australia's exploration spend accounted for nearly 13% of the global exploration budget. This was the 5th largest spend of any country in the world.

Comparatively, in the early to late 1990's, Australia was the largest ingle investor in exploration globally. Australian spending as a percentage of global spending declined from 1991 to 2002, before peaking again in 2008, partly driven through increased exploration expenditure on uranium deposits for which Australia contributes 19% of world uranium exploration budget. The comparatively better economic conditions in Australia during the Global Financial Crisis also contributed.

Currently, Canada and South America dominate world exploration spend.

Source: Metals Economics Group Corporate Exploration Strategies (World Exploration Trends)