

MAY 2012

PETROLEUM

IN WESTERN AUSTRALIA

WESTERN AUSTRALIA'S DIGEST OF PETROLEUM EXPLORATION, DEVELOPMENT AND PRODUCTION



Contents

A sign to a well site in the Canning Basin
(Photo courtesy of New Standard Energy)



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Cover Photo: Moon pool on Jack Bates
drilling rig which was used to drill most the
wells for Hess Australia's Equus development
in the Northern Carnarvon Basin
(Photo courtesy of Kai Maha Photography)

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WESTERN AUSTRALIA

Opportunities to Explore

BIDS INVITED FOR ACREAGE



PETROLEUM ACREAGE

Northern Carnarvon Basin

There is one release area in the highly prospective offshore Northern Carnarvon Basin. The release area is 878 km² in size. The primary reservoir objective is the Early Cretaceous Birdrong Sandstone, as well as reservoirs within the Permian and Triassic successions of the offshore Peedamullah Shelf.

Amadeus Basin

There is one release area of 6,576 km² in Western Australian portion of the Amadeus Basin adjoining the Northern Territory border. The sub-salt Neoproterozoic 'Gillen' petroleum system is likely to be most significant for the release area, assuming preservation of a salt seal over traps in the area.

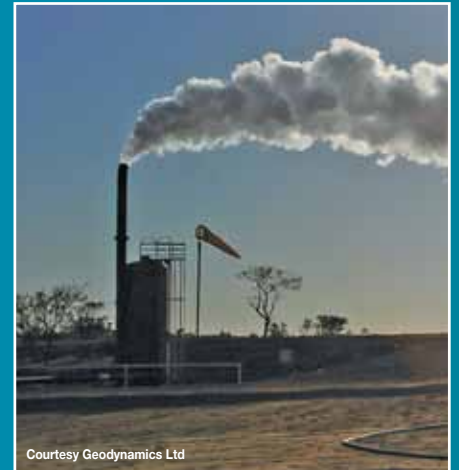
Officer Basin

There are three release areas within the central Western Australian Officer Basin. They cover 18,306 km², 22,476 km² and 22,694 km² respectively. The Officer Basin resembles Neoproterozoic successions in Oman and Russia that contain commercial hydrocarbon resources. The Neoproterozoic Buldya Group contains oil and gas shows (Kanpa 1/1A, NJD 1), local source intervals, potential reservoir sandstones and potential salt and shale seals.

Perth Basin

There are two release areas of 559 km² and 297 km² in the onshore northern Perth Basin. The northern Perth Basin has numerous seismic lines, wells, and has had oil and gas production from Permian and Jurassic reservoirs. Two gas pipelines pass to the east of the release area. A sealed highway runs south to the State capital Perth and the Kwinana oil refinery.

**Work program bids close
1 November 2012.**



Courtesy Geodynamics Ltd

GEOHERMAL ACREAGE

Acreage is available at any time for the whole of the State not covered by permits or applications. Application is by a Geothermal Special Prospecting Authority (GSPA) with Acreage Option (AO).

Companies are invited to apply for areas each with size up to 160 5'x5' graticular blocks.

Companies interested in geothermal acreage are allowed to bid for multiple areas and are expected to drill at least one well to a depth of 400 m during the first two years of obtaining a geothermal title.

FURTHER INFORMATION

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Acreage release packages contain relevant information about the release areas, land access and how to make a valid application for an Exploration Permit.

Geothermal acreage information is available from DMP on the web at: www.dmp.wa.gov.au/acreage_release

Acreage release CD packages are available from DMP and a web version is also available: www.dmp.wa.gov.au/acreage_release



Hon. Norman Moore MLC
Minister for Mines and Petroleum

Minister's Message

I recently announced I would be retiring from politics shortly after the State election in March next year. Therefore, in my penultimate Minister's Message, I would like to reflect on the changes I have seen in the petroleum industry since first entering parliament back in 1977.

At that time, Western Australia's petroleum industry was just starting to show the signs of its enormous potential. Petroleum was the fifth most valuable sector in the State, behind iron ore, alumina, nickel and mineral sands, and was valued at \$46 million.

Petroleum exploration in Western Australia has been going on since the early 1900s, however, it is the last 30 years which have seen significant exploration, production and marketing developments.

The first discovery of oil in the State was at Rough Range in the 1950s, but it wasn't until 1964 that the first commercial quantities of oil were found at Barrow Island.

When I first entered parliament the North West Shelf had already been a focus for offshore exploration for a number of years. However, it wasn't until 1984 that it started supplying gas to the domestic market, and a further five years until it started LNG exports.

Initially gas discoveries predominated, however, several major oil discoveries in the 1980s changed the perception that the North West Shelf was entirely gas-prone. The North West Shelf Joint Venture project has gone on to become the largest resource development project in Australian history.

This one project has forever changed the face of the petroleum industry in Western Australia. Since then, Western Australia has become well established nationally and internationally as a significant hydrocarbon bearing area.

Certainly the value of the industry to Western Australia's economy reflects its increasing importance. Last financial year the petroleum sector (crude oil, condensate, LNG, natural gas, LPG butane and propane) was Western Australia's second largest resource sector after iron ore and accounted for \$23.2 billion of total sales.

WA's gas discoveries to date represent close to 80 per cent of Australia's identified conventional natural gas resources. The State is the major oil and gas producer in Australia, with production coming from the Bonaparte, Canning, Carnarvon and Perth basins.

The growth of the industry is set to continue with a number of projects coming online in the next few years. This includes Gorgon, Wheatstone, and Pluto, which are under construction. These three projects alone have an estimated value of more than \$100 billion.

The most recent project to come online was Apache's Devil Creek project. This one billion dollar project was officially opened in February and is the State's third domestic natural gas processing hub — the first new one in more than 15 years. The project has the potential to increase WA's domestic gas supply by 20 per cent and the two-train plant is designed to process 5.66 million cubic metres (200 million cubic feet) of gas per day from the Apache-operated Reindeer field.

One of the next significant areas for growth in WA's petroleum industry could be onshore. WA's onshore shale gas resources have been estimated by the US Energy Information Administration to total 8,155 Gm³ (288 Tcf). According to the Department of Mines and Petroleum this is double the amount of known natural gas reserves currently estimated, most of which is offshore. While shale gas is in its infancy in WA, it looks like this sector will have high potential.

The industry has also seen significant reforms to improve safety outcomes across the sector. The most recent change was the introduction of the *Petroleum and Geothermal Energy Safety Levies Act 2011*, which ensures that safety regulatory services are fully funded by industry and used to enhance leading industry practice through continuous improvement processes.

There is no possible way I could have foreseen just how far the petroleum industry in WA would progress when I first entered parliament 35 years ago. I believe the industry will continue to find and develop new resources and along with mining, continue to be a foundation of the State's continued development. ■



Bill Tinapple

Executive Director
Petroleum Division

Executive Director's Message: Potential Economic Impact of Unconventional Gas and Oil for Western Australia

Western Australia stands to gain a big economic boost from unconventional gas and oil over the next few years. Given that unconventional gas and oil development is much more equipment and labour intensive than conventional gas and oil, this will result in direct economic impacts. Another benefit is that unconventional gas and oil is less likely to be operated on a fly-in-fly-out basis and therefore will lead to more regional development.

Of course, growth of unconventional gas and oil will depend on getting the regulatory framework right. DMP is endeavouring to do this. Following an independent review, environment and resource management regulations are being drafted. We are in the early stages of the unconventional gas and oil industry in WA, and there is an opportunity to learn from other jurisdictions to adapt our regulatory framework to keep pace with industry developments and lessons learned.

The economic impact of the unprecedented unconventional gas and oil development in North America was highlighted at the 2012 North American Prospect Expo (NAPE) in Houston at the NAPE Business Conference. Shale gas production has increased to 34 per cent of gas production at low gas prices, thus providing competitive advantages for the economies. In 2010 unconventional resources activity added 600,000 jobs in North America. This is projected to continue to climb to reach 1.6 million by 2035. In 2010, the contribution to the United States gross domestic product (GDP) was \$76 billion and this is projected to grow to \$231 billion by 2035.¹

As a result of lower gas prices, averaging US\$2.70 per mcf, there has been a shift to exploring for liquids, crude oil and gas condensate. This has been reflected in the rig count in North America. One year ago there were 793 oil rigs, 903 gas rigs and 968 horizontal rigs. Now there are approximately 1,208 oil rigs, 790 gas rigs, and 1,172 horizontal rigs.

Unconventional oil is expected to continue its growth, and show ongoing growth beyond the 72.5 million litres per day (456,212 barrels per day) average produced for 2011 in the United States. This will help to offset the liquids balance of trade deficit. There was even talk of the United States becoming energy self sufficient.

Estimates are that by 2016 liquid output from unconventional sources will rise to 477 million litres per day (3 million barrels per day).² There has been a renaissance in 2011 for export of

refined petroleum products. The United States was a net exporter for the first time in decades (Fig. 1).

While unconventional gas and oil resources in WA are not projected to be as large as in North America, proportionately the economic impact is expected to be large. For example, the Energy Information Administration estimate of technically recoverable shale gas for North America was 35,396 Gm³ (1,250 Tcf), while for WA the estimate was 8,155 Gm³ (288 Tcf).³

Assuming that WA is 10 years behind development of unconventional gas and oil in North America and that the economic impact is proportional to shale gas reserves, I estimate that WA could have an additional 138,000 jobs created in 2020 as a result of unconventional gas and oil, as well as a contribution to the State's economy of \$17.5 billion. In parallel with projections for North America, economic impacts would be expected to continue to grow, and nearly triple by 2045. ■

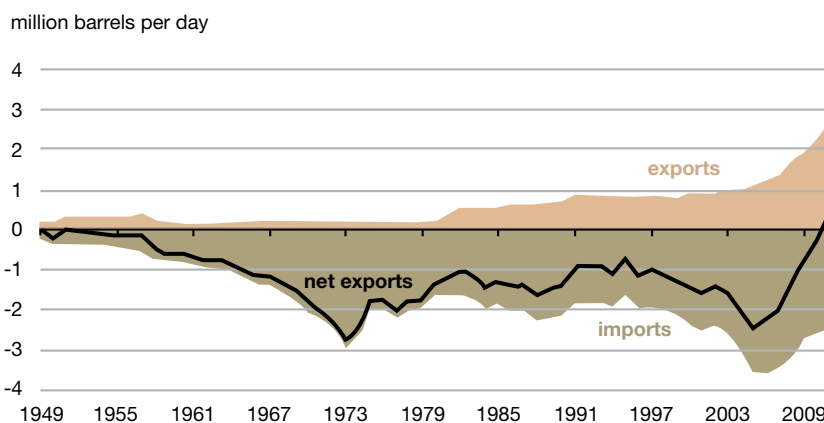
References

¹ Dr. Peter Stark, "Anatomy of the Oil and Gas Supply Renaissance", IHS-CERA, NAPE Business Conference, 22 February 2012.

² "US production of refined products entering new era", *Oil and Gas Journal*, 5/3/2012.

³ "World Shale Gas Resources", US Energy Information Administration, 5 April 2011.

US Energy Information Administration, *Petroleum Supply Monthly*, 7 March 2012.



Source: U.S. Energy Information Administration, *Petroleum Supply Monthly*.

Notes: Net exports equal gross exports minus gross imports. Negative net export values indicate net imports.

MARCH 7, 2012

Figure 1 | Annual U.S. net exports of total petroleum products, 1949-2011

Petroleum Exploration, Development and Production Activity in Western Australia in 2011

Karina Jonasson

Petroleum Resource Geologist
Resources Branch

This article summarises petroleum activities in Western Australia in the 2011 calendar year.

Exploration highlights

In 2011 a total of 54 wells were drilled in Western Australia, with activity in the Bonaparte, Browse, Canning, Carnarvon and Perth basins. Ten wells were drilled onshore, comprising three new field wildcat wells (NFW) and two appraisal wells in the Canning Basin and four NFW and one appraisal well in the Perth Basin. Offshore, 44 wells were drilled — two NFW in the Bonaparte Basin, one NFW in the Browse Basin, and 19 NFW, 11 appraisal wells and 11 development wells in the Carnarvon Basin.

A total of 3,881 line km from 2D seismic and 27,788 km² from 3D and 4D seismic surveys were carried out in 2011. Of this, 577 line km and 276 km² of data were acquired in onshore basins.

In addition to the discoveries reported in the first part of 2011 in the September 2011 edition of the PWA, which were Red Gully 1, Zola 1, Finucane South 1A, Orthrus 2, Balnaves Deep 1, Martin 1 and Laverda North 1, there were both oil and gas discoveries made in the second half of the year. Onshore, Buru made an oil discovery in the Canning Basin at Ungani 1 ST1. Offshore, Chevron was successful with Acme West 1 and 2, and Vos 1. Woodside made further discoveries at Laverda North 2, Tidepole East 1, and Opel 1.



Buru's Ungani 1 – a surprise oil discovery in the Canning Basin
(Photo courtesy of Buru Energy)

In July 2011 ConocoPhillips farmed into New Standard Energy's Goldwyer shale project in the Canning Basin, for US\$109.5 million, receiving a 75 per cent share in the project in return. The agreement includes drilling and coring of three vertical wells within Goldwyer permits EP 443, EP 450, EP 451, EP 456 and application areas 1/09-0, 2/09-0 and 5/09-0. The US Energy Information Administration and Advanced Well Technologies have both independently identified the Canning Basin as having in excess of 5,500 Gm³ (200 Tcf) of recoverable unconventional gas based on the Goldwyer Formation play alone. In addition, the recently identified Laurel unconventional prospect has the potential to uncover a major basin centered gas accumulation.

Production highlights

In 2011, oil, gas and condensate production came from 63 fields in Western Australia, down from 73 in 2010. Production ceased from Artreus, Beharra Springs North, Gipsy, Gudrun, Legendre North, Legendre South, Lloyd, Tarantula, Woodada, Xyris and Yadarino. Production from Van Gogh was off and on through the year with the field back on line in August after repairs to the FPSO. Production resumed at Agincourt after a significant hiatus, and Halyard was brought online in the second half of the year. Both are operated by Apache Energy. Two other new fields, Pluto and Reindeer, produced minor amounts of hydrocarbons during start up and commissioning phases. Production by field and cumulative production statistics can be found in Table 1 at the back of the publication.

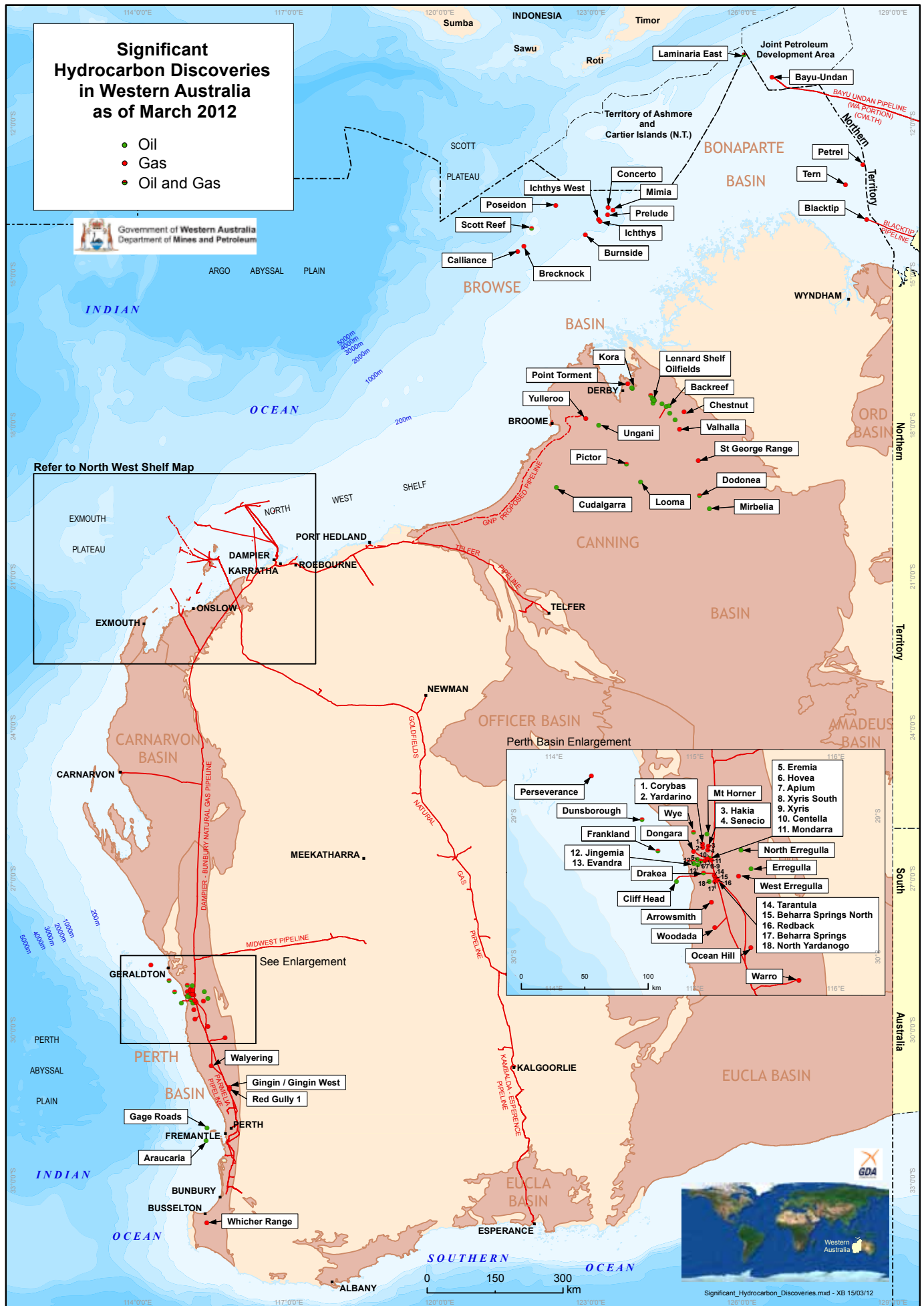


Figure 1 | Significant hydrocarbon discoveries in Western Australia

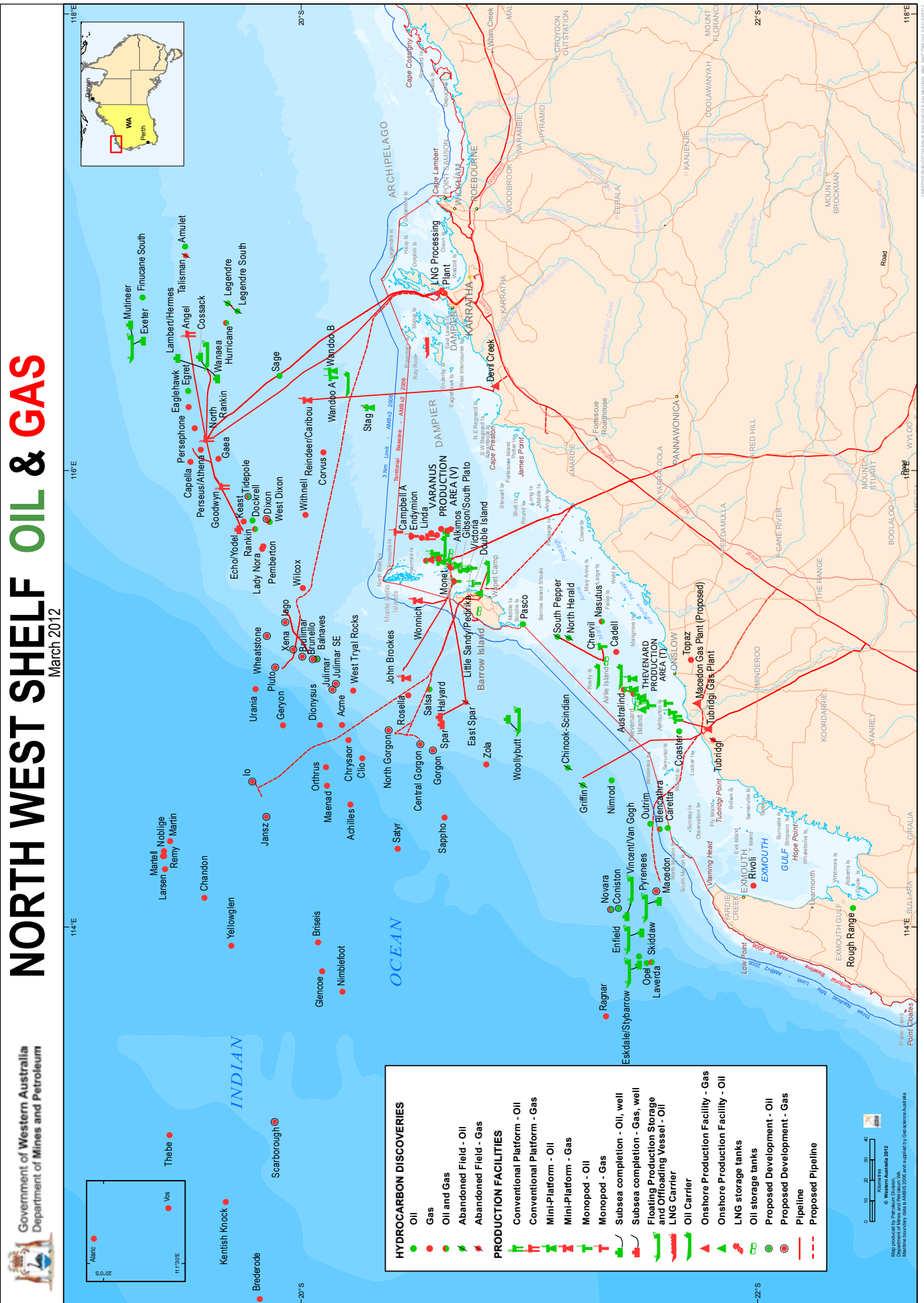


Figure 2 | North West Shelf production facilities and significant hydrocarbon discoveries

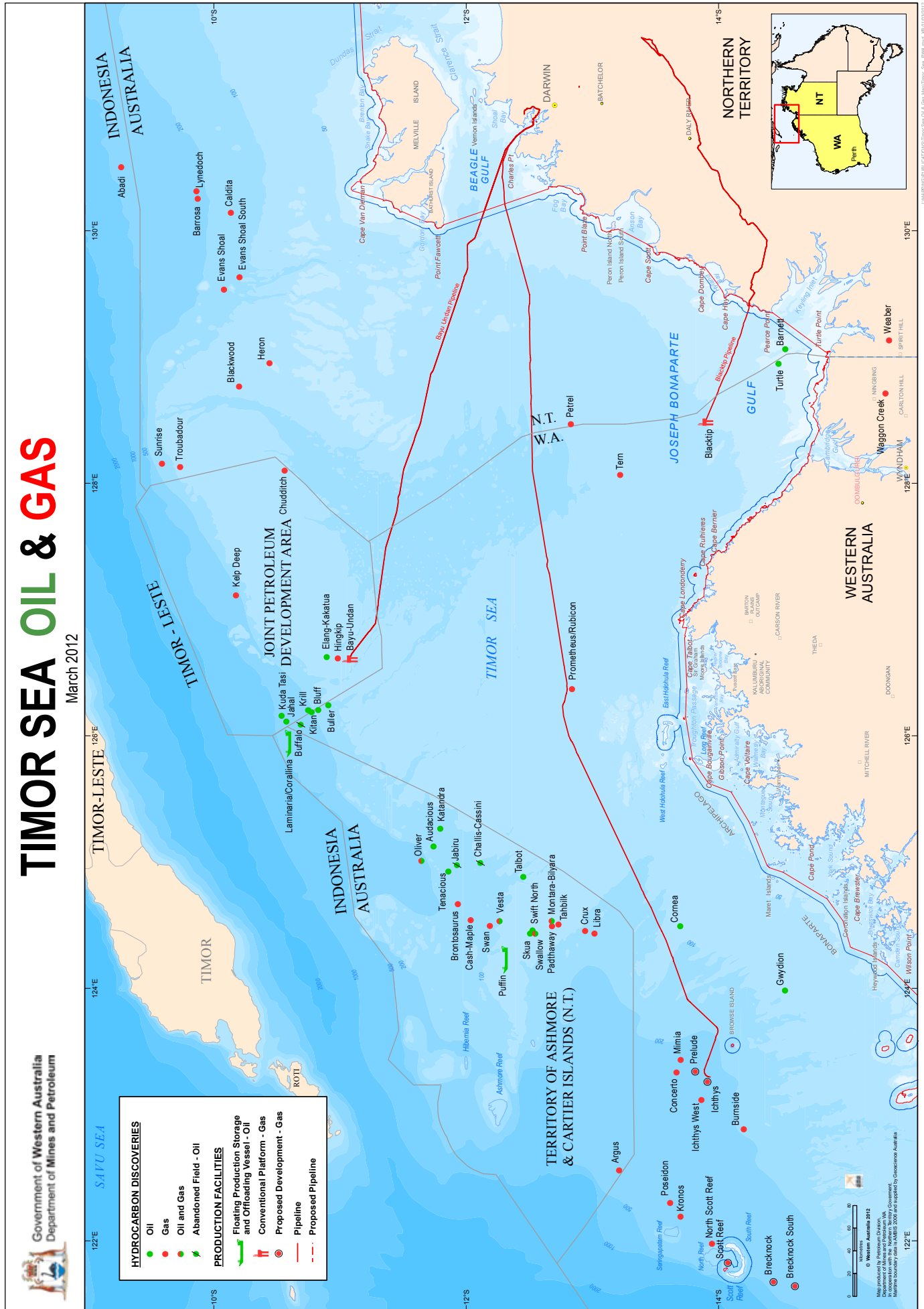


Figure 3 | Timor Sea production facilities and significant hydrocarbon discoveries

Development highlights

Recent oil discoveries in the Northern Carnarvon Basin by Woodside may be brought into production sooner rather than later with Woodside considering an FPSO on the Cimatti and Laverda oilfields. Laverda alone has been estimated to contain over 15.9 GL (100 MMbbl), after the discovery of a new oil pool at Laverda North in 2011.

The waters off the North West coast of Australia hold world class gas reserves as evidenced by the spate of developments given the green light in 2011. The Balnaves, Wheatstone, Julimar and Brunello developments were all approved in 2011.

The Balnaves oilfield is located in Licence WA-49-L and is operated by Apache. Oil is reservoired in the Mungaroo Formation in a separate reservoir beneath the large gas reservoirs of the Brunello gasfield. Drilled in 2009, the Balnaves 1 discovery well is part of a series of gas exploration and appraisal wells in the Julimar-Brunello complex. The discovery well encountered 20 m of net oil pay in the B20 sand — a light, high-quality oil accumulation at a depth of 3,231 to 3,261 m.

Apache plan to develop the field through two horizontal production wells connecting to an FPSO via subsea tie-backs. One water injection well will be used to maintain reservoir pressure, while gas will be re-injected into another reservoir to produce through the Wheatstone LNG project. Apache will lease the *Armada Claire* FPSO for Balnaves' development. Production is scheduled for 2014.

Chevron's Wheatstone Project received conditional environmental approval from the EPA to proceed in June and the Final Investment Decision (FID) was announced in October 2011. Also in April 2011, Shell became a joint venture partner in the project. Chevron will construct a two train LNG facility at Ashburton North site 12 km west of Onslow, with an initial capacity of 8.9 million tonnes of gas per annum. It will gradually expand to 25 million tonnes of LNG annually. The upstream portion of the development will include drilling, subsea equipment, processing platform and export pipeline. First gas on Wheatstone LNG is scheduled for 2016.

Apache's Julimar and Brunello fields will supply natural gas into the Wheatstone project under an agreement signed in 2010 between Chevron and Apache Julimar Pty Ltd and KUFPEC Australia Pty Ltd. Also supplying the project will be Chevron's own Iago and Wheatstone fields.

In addition, the NWS Venture has sanctioned the first phase of the Greater Western Flank gas project, with the plan to tie in a dozen gasfields to the Goodwyn A platform over the next few years.

Early in 2012, INPEX and its joint venture partner Total announced FID on the Ichthys development. Santos also reached FID with its Fletcher Finucane oil development project in the Carnarvon Basin. First oil is expected in 2013 as the development is tied back to Santos' FPSO at Mutineer-Exeter.

ACTIVITY BY BASIN

Bonaparte Basin

Onshore at Waggon Creek 1 in EP 386, Advent Energy achieved flow rates of over 28,315 m³/d (1 MMscf/d) of gas from two intervals in the Milligans Formation after re-entering and completing the well, which was originally drilled in 1995 by Amity Oil. The company also tested Vienta 1 in the same permit achieving a flow rate of 53,802 m³/d (1.9 MMcf/d) initially, reducing to 15,008 m³/d (0.53 MMcf/d) after an hour's flow. Advent Energy plans further production testing during the 2012 dry season.

Offshore, Total E & P Australia drilled two wells in WA-304-P, Durville 1 and Laperouse 1. One 3D and three 2D surveys were carried out by Octanex in the offshore Bonaparte Basin.

Browse Basin

Woodside's Omar 1 was the only drilling activity in the Browse Basin as the company continues its search for gas. The well has been listed as a dry hole. One 2D 7,232 line km and three 3D surveys totalling 10,392 km² were carried out in the Browse Basin.

Canning Basin

Five wells were drilled in the Canning Basin in 2011. In July, the Valhalla 2 well was a successful appraisal of a significant gas accumulation in EP 371. Preliminary analysis indicates the presence of a wet gas charged section

of tight and possible conventional gas reservoirs across a Laurel Formation interval of at least 1,300 m. A possible new conventional play type has been identified in the Laurel carbonates.

Buru's Pictor East 1 well has been reported to have found a hydrocarbon column in the Nita Carbonates based on wireline logs and pressure data. The well was drilled in August 2011 in EP 431.

In September 2011 New Standard Energy announced a farm-in deal with ConocoPhillips who will spend up to US\$109.5 million in covering the exploration costs of a Goldwyer liquids-rich shale gas project in the Canning Basin. The US Energy Information Administration (EIA)¹ had reported the Goldwyer Formation contains 6,484 Gm³ (229 Tcf) of recoverable gas resources.

In October 2011, Buru Energy's Ungani 1 well discovered light oil (~37 degrees API gravity) in dolomitised limestones of the Carboniferous Laurel Formation. The well was drilled to a total depth of 2,324 m and encountered 57 m of net oil pay in the "Ungani Dolomite". During an 8 hour test, the well flowed at a peak rate of 262 kL/d (1,647 bbl/d). The original target was gas. This is the first significant oil discovery in the Canning Basin since the 1980s and Buru believes it to be a new oil play in the basin. Buru estimates a potential 3.18 GL (20 MMbbl) recoverable oil volume. The Ungani 2 well was drilled to 2,800 m TD to appraise the discovery. Cores were cut and the well flowed up to 163 kL/d (1,026 bbl/d) with 55 per cent oil cut on well test. The well was shut in ahead of a production test to be followed by an extended production test in 2012. Buru also plans to acquire additional seismic over the structure in early 2012.

In 2011 Buru conducted a 184 km² 3D seismic survey at Yulleroo and two 2D surveys covering several other permits in the Canning Basin covering 466 km².

Carnarvon Basin

Offshore in the Carnarvon Basin, Chevron's deep water gas discoveries at Acme West 1 (with 115 m of net gas pay) and Acme West 2 (with 56 m of net gas pay) follow from the Acme discovery announced in August 2010. Acme 1 found a record 273 m of net gas pay for Chevron in WA-205-P in 925 m water depth not far from where Clio was discovered in 2006.

The Acme discoveries will underpin the Wheatstone LNG project. Chevron also found 138 m net gas pay in Vos 1 in WA-439-P in 1,484 m of water. The well was drilled to a total depth of 3,798 m.

Woodside continued drilling in the Greater Laverda area with the aim of finding further oil reserves for a potential standalone development. Laverda North 1 and 2 discovered 10 and 18 m of oil bearing sands, respectively. Opel 1 encountered oil in a separate fault block on the western flank of the Laverda field in WA-36-R. Opel 2 was a successful appraisal the Laverda oil accumulation. Woodside, as operator of the NWSV, also announced a gas discovery on the Greater Western Flank at Tidepole East 1, which was drilled in a separate fault block east of Tidepole 1, in November–December 2011.

Seventeen 3D seismic surveys were carried out in the offshore Carnarvon Basin, totalling approximately 20,420 km². Another two were 4D surveys, one at Stybarrow and the other at Enfield for a total of 386 km².

Perth Basin

In March 2011 Red Gully 1 flow tested 339,802 m³/d (12 MMcf/d) gas and 132 kL/d (832 bbl/d) of condensate. The testing of the well resulted in the largest gas and condensate flow recorded from a Jurassic reservoir in onshore Western Australia. In May, Latent Petroleum's well Warro 4 had excellent gas shows. No new wells were drilled in the second half of 2011 in the Perth Basin. Latent also conducted a 3D survey in the Warro area in 2011. Two other 2D surveys were carried out in the onshore Perth Basin.

EXPLORATION ACTIVITY BY COMPANY

(Compiled from information provided by companies; where there is no report from a WA operating company, it is due to them not submitting one).

Australian Worldwide Exploration Ltd (AWE)

Denison 3D Reprocessing Trails

AWE's geoscience team continued its onshore regional prospectivity project. Progress was made in reassessing the oil prospectivity within AWE's acreage. This included the reprocessing of the existing Denison 3D data by Fugro Multi Client Services. The initial focus

of the reprocessing was to improve the imaging of oil prospects in the L1/L2 licence area to the south of Hovea (covering the Drakea area and the area to the north of Beharra Springs). If significant data quality improvement can be obtained, most of the existing 3D data in L1/L2 as well as in EP 320 and L11 will be reprocessed. The testing phase is expected to be completed in May 2012.

Irwin/Redback 3D Acquisition

The Redback-Irwin 3D seismic survey is planned to commence in early 2012. Pre-survey activities are in progress, including landowner and government liaison and environmental approvals. The survey will cover an area to the east of the existing 3D coverage (and will include portions of the L1/L2 permits). This area is expected to cover around 250 km² in total. The cost of the survey in the L1/L2 area is expected to be around \$6 to \$7 million.

Application to Fracture Stimulate the Senecio Well

During August 2011 AWE's Senecio 2 fracture stimulation program was prepared for submission to the Department of Mines and Petroleum. Then the project was referred to the Environmental Protection Authority (EPA) by a third party, and following submission in late October 2011, the Environmental Protection Authority notified that it would "not assess" the Senecio 2 hydraulic fracture stimulation project. Two weeks later, the Appeals

Convenor notified AWE that the Environmental Protection Authority's decision had been appealed by a third party. In line with normal procedures, AWE made a submission to the Appeals Convenor. On 2 March 2012, the Minister for Environment dismissed the appeals, upholding the EPA decision not to formally assess this proposal.

Application to Fracture Stimulate the Woodada Deep Well

The Woodada Deep hydraulic fracture stimulation project, which had received all necessary approvals, was subsequently referred to the Environmental Protection Authority by a third party. In early September 2011 the Environmental Protection Authority made its decision to "not assess" the Woodada Deep 1 hydraulic fracture stimulation program, following which, its decision was opened for a two week public appeal period. Prior to the end of the two week period, an appeal against the decision was made by a third party. On 2 March 2012, the Minister for Environment dismissed the appeals, upholding the EPA decision not to formally assess this proposal.

Xyris and Apium Mapping

In early 2011 the re-mapping of the Xyris and Apium area was completed. This resulted in the identification of a number of prospects and leads. The future drilling of these prospects is now dependent on the 3D reprocessing trials.



Woodada Deep 1 pre spud
(Photo courtesy of AWE)

Looking Ahead

Shale Gas Initiative

AWE has identified a shale gas resource across its onshore Perth Basin acreage of 368 to 566 Gm³ (13 to 20 Tcf) gas in place in the Carynginia Shale.

The next phase of activity in AWE's shale gas exploration program in the Perth Basin will involve the fracture stimulation of the Arrowsmith 2 well in EP 413 (AWE 44.25 per cent). This well was drilled during June 2011 by Weatherford Rig 826. The fracture stimulation program is planned to be immediately followed by the multistage fracture stimulation of the Woodada Deep 1 well (AWE 100 per cent). Woodada Deep 1 was drilled and cored during April 2010 by Ensign Rig 5. These two fracture stimulation programs will look to gain further technical data on the shales in the area and test the productive capacity of several potential reservoir zones at both locations.

Site preparations are complete for the Arrowsmith 2 and Woodada Deep 1 fracture stimulations. Core and wireline log analysis of the Arrowsmith 2 well has also been completed. The analysis of the shale intervals (Carynginia, Irwin River Coal Measures, and Kockatea formations) and the tight sand target in the High Cliff Sandstone indicates that all four units are suitable for hydraulic fracture stimulation.



Woodada 14 wellhead being prepared as a frac monitoring well (Photo courtesy of AWE)

Tight Gas Initiative

The Senecio 1 well was originally drilled in October 2005 by ARC Energy within the onshore Perth Basin L2 permit. The Dongara Sandstone was perforated and the cleanup flow rate was estimated at up to 70,792 m³/d (2.5 MMscf/d), which subsequently declined to 33,980 m³/d (1.2 MMscf/d) during the 10 hour test period.

While the rig was on location, Senecio 2 was drilled as a sidetrack to Senecio 1. The sidetrack was designed to penetrate the Dongara and Wagina Sandstones at a relatively high angle to maximise formation contact. Cleanup flow rates were estimated at between 45,307 to 104,772 m³/d (1.6 and 3.7 MMscf/d) from the Dongara Sandstone during the six hour cleanup period. It was subsequently determined that fracture stimulation would be required to achieve commercial production rates.

In early 2011 the Senecio gasfield was remapped by the AWE geology and geophysics team taking into account the potential deeper gas/water contact and likely greater net pay. The P50 OGIP was significantly upgraded from previous estimates.

Based on the well flow rates and the potential size of the gas resource, a proof-of-concept fracture stimulation was designed. This first required a workover of the Senecio well to prepare it for stimulation, which was carried out in August 2011. The workover replaced the existing 2-7/8" string with a frac-capable 3-1/2" string. The well is now fully prepared for hydraulic fracture stimulation. The Irwin 3D seismic acquisition will also cover the Senecio field and will be used to determine future development plans.

Buru Energy Ltd

2011 Exploration Program

Buru had significant exploration success in 2011, making the first new field onshore oil discovery in Western Australia in 10 years at Ungani 1ST1, which was successfully appraised by the Ungani 2 well, and identifying the Valhalla Laurel Formation regional wet gas accumulation at Valhalla 2 (subsequently successfully appraised at Valhalla North 1) (Fig 4).

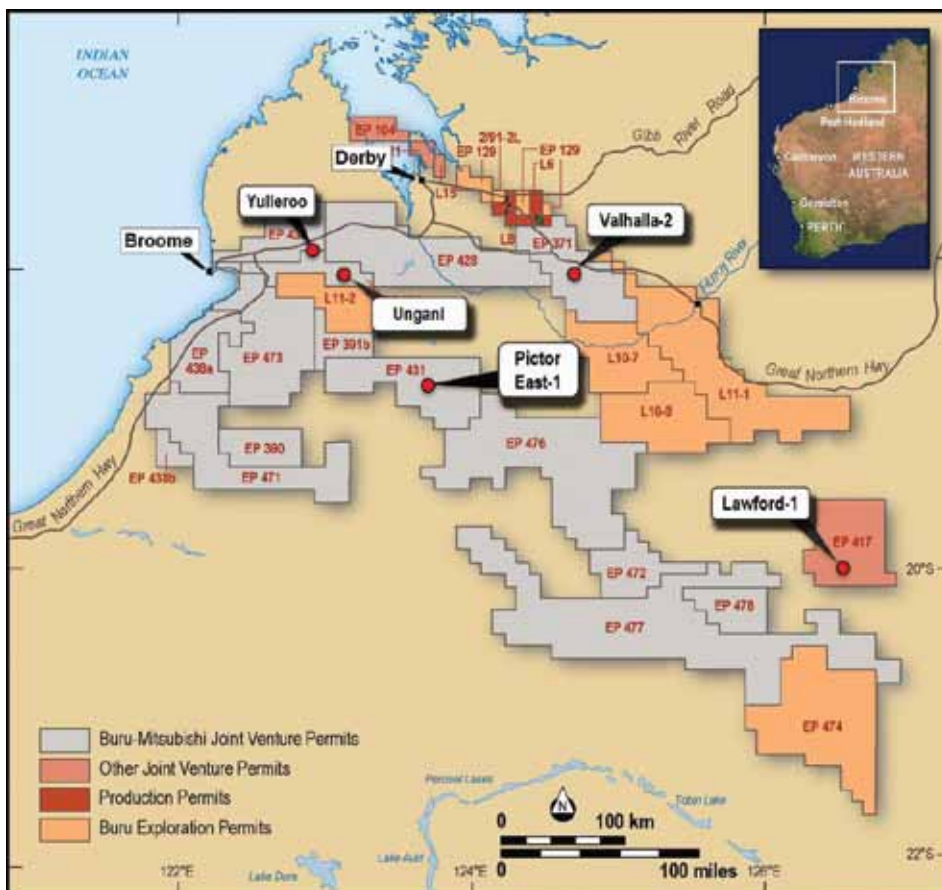


Figure 4 | Buru's 2011 exploration program

The 2011 program itself was one the largest exploration programs ever conducted in the Canning Superbasin with the company drilling five wells, acquiring 185 km² of new 3D seismic over the Yulleroo wet gasfield as well as 467 km of new 2D seismic over the most prospective parts of the Canning Superbasin. Both the Ungani and Valhalla discoveries will be further appraised during 2012. Pictor East 1 also confirmed a hydrocarbon column in the Nita Carbonates and is being considered for appraisal in 2012.

2012 Appraisal and Exploration Program

Buru's 2012 Appraisal Program is designed to confirm the extent of the oil discovery at Ungani and the wet gas accumulations at the Yulleroo field and in the Valhalla area (Fig. 5). It is expected to include the following:

- Valhalla Accumulation – two appraisal wells designed to identify the extent of the wet gas accumulation and to provide further details of the nature and characteristics of the reservoir. The first of these, Valhalla North 1, completed drilling in March 2012 and confirmed the regional extent of the Valhalla Laurel Formation wet gas accumulation. The Paradise 1 well will also be deepened as part of the appraisal of the Valhalla accumulation which, if successful, will confirm a very significant extension of the regional Valhalla Laurel Formation wet gas accumulation.
- Yulleroo field – two appraisal wells drilled on locations identified by the Yulleroo 3D seismic acquired in 2011 to further delineate the size of the Yulleroo structure and form the basis of an independent reserves classification for the field.
- Ungani field – a 3D seismic survey to delineate the size and shape of the structure to be followed by further appraisal and production wells that will form the basis for an independent reserves classification and the full development of the field, FID for which is currently expected in early 2013. The company will also be conducting an extended production test in early 2012 to assist in refining the current range of a potential 794,936 to 3,179,746 KL (5 to 20 MMbbl) of recoverable oil in the Ungani oilfield.

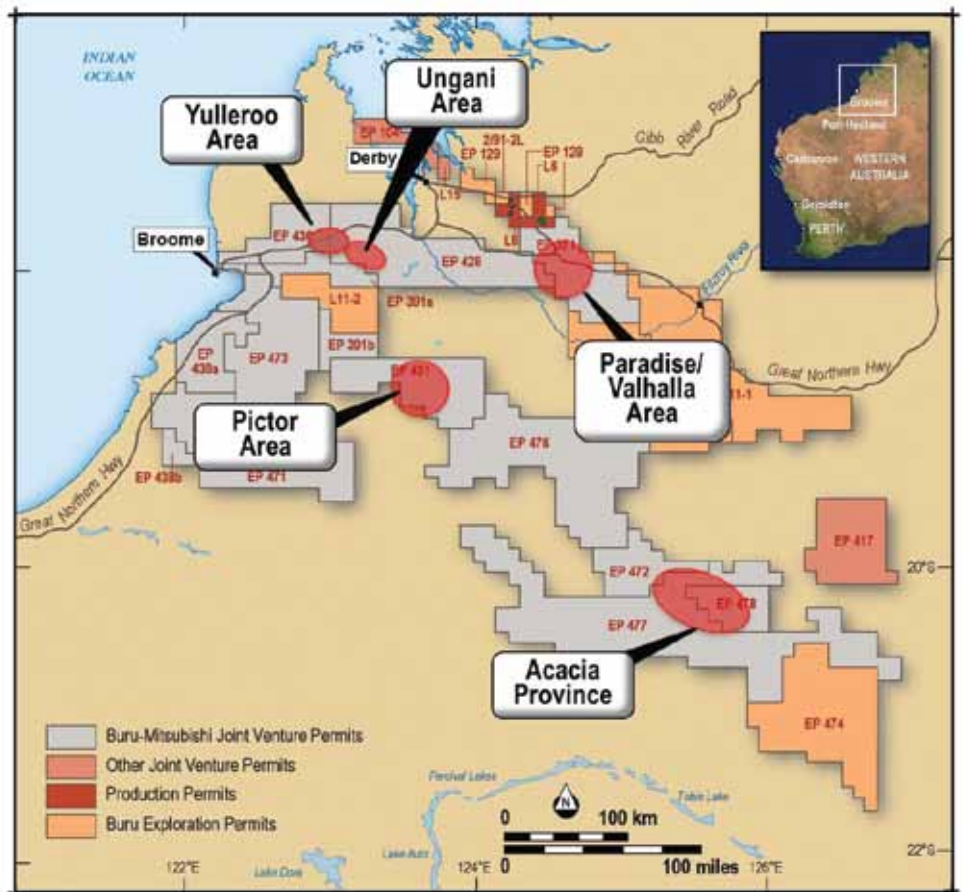


Figure 5 | Buru's 2012 appraisal and exploration program

Buru is also considering a further well to appraise the hydrocarbon accumulation identified at the Pictor East 1 well. Depending on the results of the Yulleroo and Valhalla appraisal wells, a program of hydraulic fracture stimulation ("fracking") may be undertaken at some or all of the Yulleroo and Valhalla appraisal wells to further evaluate the reservoir properties of those accumulations. Any fracking activities will be undertaken in a manner that minimises the impact on the environment and meets APPEA's Western Australian Onshore Gas Code of Practice for Hydraulic Fracturing.*

In addition to its 2012 Appraisal Program, Buru will be drilling two exploration wells in the Acacia Province in the southern part of its permits. The final prospects to be drilled are yet to be confirmed, however all prospects under consideration for drilling in 2012 are targeting conventional structures with the potential to hold in the order of 7.9 GL (50 MMbbl) of oil, if hydrocarbons are present. These wells will also provide valuable data about the Goldwyer shale play, which is believed to be prospective for oil in this area.

* Editor's note: Any fracking activities in Western Australia need to meet the regulatory requirements of the Department of Mines and Petroleum and other relevant agencies.

Buru is also considering additional exploration wells in 2012 to test follow ups to the Ungani discovery and new plays identified as part of Buru's ongoing geotechnical evaluation of the Canning Superbasin.

An extensive ongoing program of seismic acquisition and desktop technical analysis designed to continue to identify new play types, prospects and leads will complement these drilling programs.

ConocoPhillips Australia Pty Ltd

ConocoPhillips' Bayu-Undan gas condensate development is located in the Timor Sea joint petroleum development area (JPDA) between Timor-Leste and Australia, and linked by a 500 km subsea pipeline to the ConocoPhillips operated Darwin LNG facility. In Queensland, ConocoPhillips operates the downstream component of Australia Pacific LNG, a joint venture with Origin Energy and Sinopec, producing coal seam gas from the Bowen and Surat Basins in Queensland. Final investment decision for the first of the two train 9.0 Mtpa Australia Pacific LNG project was approved in July 2011, and marketing of volumes

for the second train was completed in December 2011, with sanctioning expected in 2012. ConocoPhillips is also a participant in Greater Sunrise. Exploration interests include exploration permits offshore Western Australia in the Browse Basin, the Caldita/Barossa discoveries offshore Northern Territory, and the recent farm-in to onshore Canning Basin permits.

2011 Activity

ConocoPhillips (operator) and Karoon Gas are joint venture participants in Browse Basin Exploration Permits WA-314-P, WA-315-P and WA-398-P. Following 2009/2010 drilling and seismic acquisition operations in the permits, the main focus of activity during 2011 has been preparation for the next phase of drilling and interpretation of the Poseidon 3D seismic survey over WA-315-P and WA-398-P. All regulatory approvals have been secured to commence the exploration drilling program, which will comprise a total of five to eight wells within the three permits. Drilling is due to commence in Q1 2012 and continue into 2013, using the semi-submersible rig *Transocean Legend*.

In September, ConocoPhillips completed agreements with New Standard Energy to farm in to the Goldwyer project exploration tenements onshore Canning Basin in Western Australia. Drilling in the permits is due to commence in 2012.

Eni Australia Limited

Eni Australia is a subsidiary of Eni SpA, a large successful international oil and gas company with its head office in Milan. During the past decade, Eni Australia has worked hard to establish itself and expand its interests in Australasia by concentrating mainly on acquiring and exploring offshore frontier permits.

In WA Eni participates in six exploration permits (three operated), three Production Licence areas (all operated) and one Retention Lease (operated).

Exploration

WA-362-P and WA-363-P

In the Carnarvon Basin in permit areas WA-362-P and WA-363-P, after completion of about 4,000 km² of 3D seismic, in 2011 Eni drilled two wells, one in each permit. Gawain 1 and Galahad 1 were drilled in about 2,000 m water depth by the *Saipem 10000* drill ship.

Eni is operator of the permits (40 per cent equity) on behalf of partners OMV (40 per cent) and Octanex NL (20 per cent).

These two blocks are the most northerly permits in the Carnarvon Basin. During 2011, a commitment well was drilled in each of these permits – Gawain 1 in WA 362-P and Galahad 1 in WA-363-P. The data collected from the drilling program is subject to ongoing extensive interpretation and will be valuable in assessing further exploration of these two frontier blocks.

The water depth for Gawain is nearly 2,000 m, making it one of the deepest water wells ever to be drilled in offshore Australia. Currently, an application for renewal and compulsory 50 per cent relinquishment of each block is with the relevant authority, with further geological and geophysical studies planned for 2012.

WA-386-P and WA-387-P

Eni is a participant (30 per cent) in these Carnarvon Basin, OMV operated permits (30 per cent) with partner Octanex NL (40 per cent). Revision of regional technical studies is currently underway to assist the Joint Venture to ascertain whether the remaining prospectivity of WA-386-P and WA-387-P warrants further field work.

WA-208-P

Eni holds an 18.66 per cent interest in the Santos (37.31 per cent) operated WA-208-P together with Apache (34.03 per cent) and Beach (10 per cent). This permit has a commitment well, Hoss 1, due to be spudded in May 2012. The operator has applied for a Retention Lease over the Hurricane prospect in the NE of the permit, if granted, a further appraisal well on the structure, Hurricane 3, will be drilled back to back with Hoss 1. The results from these two wells will ascertain the future of this permit which will expire in 2014.

WA-313-P and WA-34-R

Eni is the operator (100 per cent) of this permit in the southwest area of the Bonaparte Basin, adjacent to the Eni operated Blacktip gasfield. The permit area contains the previous Polkadot and Penguin gas discovery wells, believed to hold a small gas discovery.

Eni has recently completed reprocessing of 2D seismic over the permit, and intends to further explore the prospectivity of this in the near future. Eni also holds a Retention Lease WA-34-R which has been renewed for five years to expire at the end of 2015.

Finder Exploration

Finder Exploration Pty Ltd ("Finder") is a private oil and gas exploration company based in West Perth with a primary focus on capturing and de-risking prospective exploration acreage on the North West Shelf of Australia. Finder currently participates in 12 Exploration Permits covering a total of ~42,200 km² of which Finder operate nine permits (Fig. 6).



Canning Basin acreage held by New Standard Energy and farminee ConocoPhillips
(Photo courtesy of New Standard Energy)

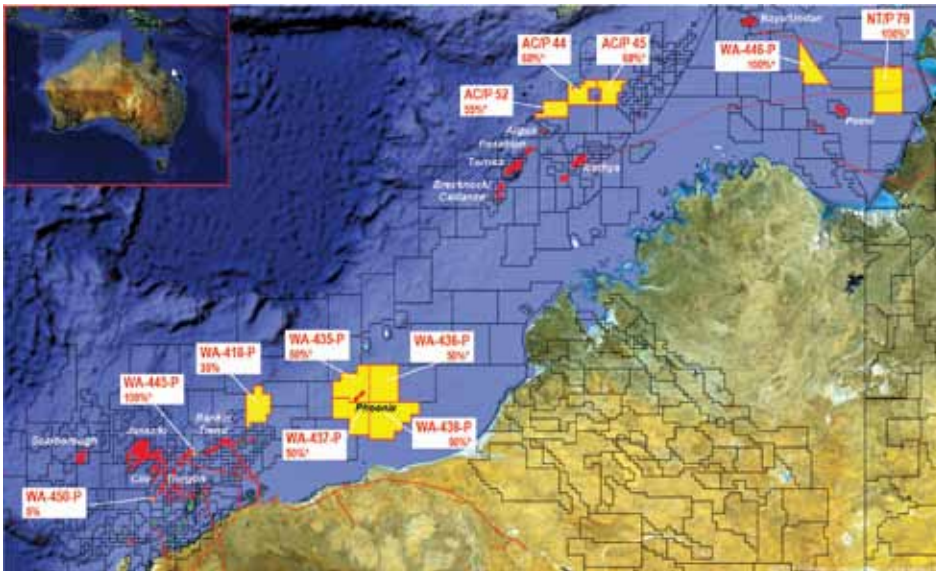


Figure 6 | FINDER's Australian Acreage

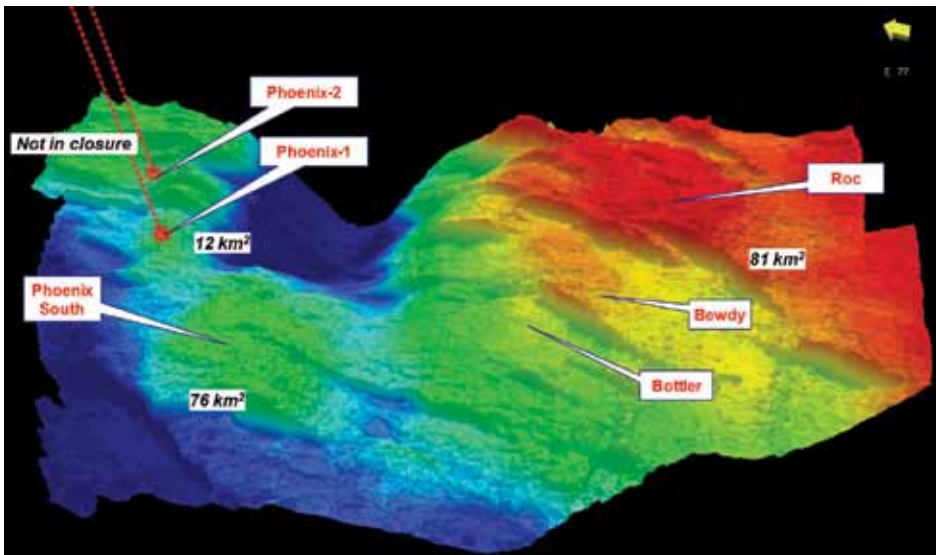


Figure 7 | 3D visualisation of the Phoenix 3D seismic survey (Near top gas depth surface)

Eight of these 12 permits are within the Commonwealth waters offshore Western Australia.

Finder is a fast growing and dynamic company with a track record of success in developing exploration acreage, initially adding value through our regional knowledge and databases and sufficiently de-risking opportunities with the use of new 3D seismic data to attract investment from major oil and gas players. Over the next two years Finder expects to drill a number of its most advanced prospects, capping off a sustained period of intensive geological and geophysical work where Finder has delivered ~5,500 km² of new 3D seismic data over eight of their Exploration Permits.

The Bedout Sub-basin (WA-435-P, WA-436-P, WA-437-P and WA-438-P)

- Finder 50 per cent

The Phoenix field in the Bedout Sub-basin is a good example of Finder's niche exploration work. Phoenix 1 was a gas discovery drilled by BP in the early 1980s, but had no follow-up activity until two to three years ago. Finder and its Joint Venturer, Carnarvon Petroleum, acquired a new 1,100 km² 3D seismic survey across the gas discovery and related prospects (Fig. 7). From its regional assessment the JV recognised the excellent reservoir quality encountered in the Keraudren 1 well, just 12 km to the south of the 3D survey area, de-risking the

reservoir in the Roc and Phoenix South Prospects. The JV has completed their interpretation of the greater Phoenix area and commenced their farmout process early in 2012. Prospective farminees look at the Phoenix opportunity with nearby infrastructure and capacity in the existing LNG trains plus the potential for burgeoning domestic gas market.

WA-445-P

- Finder 100 per cent

In 2011 Finder completed ~500 km² of pre-stack depth reprocessing of the 3D seismic data which was also taken through seismic inversion confirming the Mungaroo "E" / "AA" sand sub-crop play. The permit is just inboard of the Wheatstone gas discovery and just outboard of both Woodside's Echo/ Yodel liquids-rich gas condensate field and the Lady Nora oil discovery.

WA-446-P

- Finder 100 per cent

This permit is within the Bonaparte Basin, between the Petrel and Bayu-Undan gasfields. Finder finished processing the 2D seismic program in 2011 along with significant associated 2D reprocessing with a view to extending the play trend.

WA-450-P

- Finder 5 per cent

The most recent block Finder was awarded was WA-450-P in May 2010. Following award Finder farmed out and handed over operatorship to Apache Northwest late in 2010. Late in 2011 Japan Australia LNG (MIMI) also farmed into this Joint Venture and the permit has a firm well commitment that Finder expects to be drilled Q4 2012.

WA-418-P

- Finder 35 per cent

The WA-418-P JV (Apache and Finder) will take delivery of 1,519 km² of the Fugro Zeebries MC3D survey in Q2 2012. The intent of the forward technical work plan is the interpretation and G&G work to progress the identified prospects and leads to "drill-ready".

Latent Petroleum Pty Ltd

Latent Petroleum Pty Ltd is a wholly owned subsidiary of Transerv Energy Ltd and is operator of the Warro Joint Venture (WJV) with Alcoa of Australia. The Warro gasfield is located in EP 321 and EP 407 approximately 200 km northeast of Perth. Discovered in 1977, the field had two existing wells from that period at the time of purchase by Latent in 2007, and in 2009 Warro 3 was drilled and stimulated successfully.

In March 2011, the WJV acquired approximately 90 km² of 3D seismic over the field, approximately 40 per cent of this in National Park and Nature Reserve following three years of environmental studies and approval processes. Commencing in April, Warro 4 was completed and stimulated in August 2011. Gas flows were established from both the stimulated intervals but extraneous water production reduced the quantities of gas produced. The test and 3D seismic results are under review by experts in tight gas in the USA.

Warro 5 is expected to commence in the second half of 2012 and will depend on equipment availability in Western Australia for the drilling and stimulation process. The 3D seismic data will aid in the placement of Warro 5 and avoidance of naturally occurring fractures.

New Standard Energy

New Standard Energy is an emerging oil and gas explorer and producer, which has a core focus on Western Australia onshore unconventional shale and tight gas prospects in the Canning and Carnarvon basins. 2011 was a pivotal year for New Standard, as the company has progressed from a relatively unknown explorer to a major player in the unconventional field in Western Australia.

New Standard is strategically positioned within the rapidly emerging shale gas industry, through its ownership of one of the largest gas exploration acreages in Australia*. New Standard's Western Australian portfolio comprises three projects contained within two onshore basins; the Canning and Carnarvon basins. The Goldwyer and Laurel Projects are both located within the Canning Basin, while the Merlinleigh Project is situated within the onshore Carnarvon Basin and spans approximately 1.4 million acres (5,500 km²) (Fig. 8).



Warro 4 well pre spud
(Photo courtesy of Latent Petroleum)

In September 2011 New Standard partnered with oil and gas super major ConocoPhillips, through a farm-out agreement, on its flagship Goldwyer Project (Fig. 9). Located in the Canning Basin, and with a gross acreage in excess of 11 million acres (48,000 km²), the Goldwyer Project has the potential for liquids rich shale gas and other tight gas opportunities.

**Source: Euroz Securities – Shale Oil & Gas Sector Review June 2010. "NSE has the largest Australian shale acreage position we know of."*



Figure 8 | Western Australian Project Locations

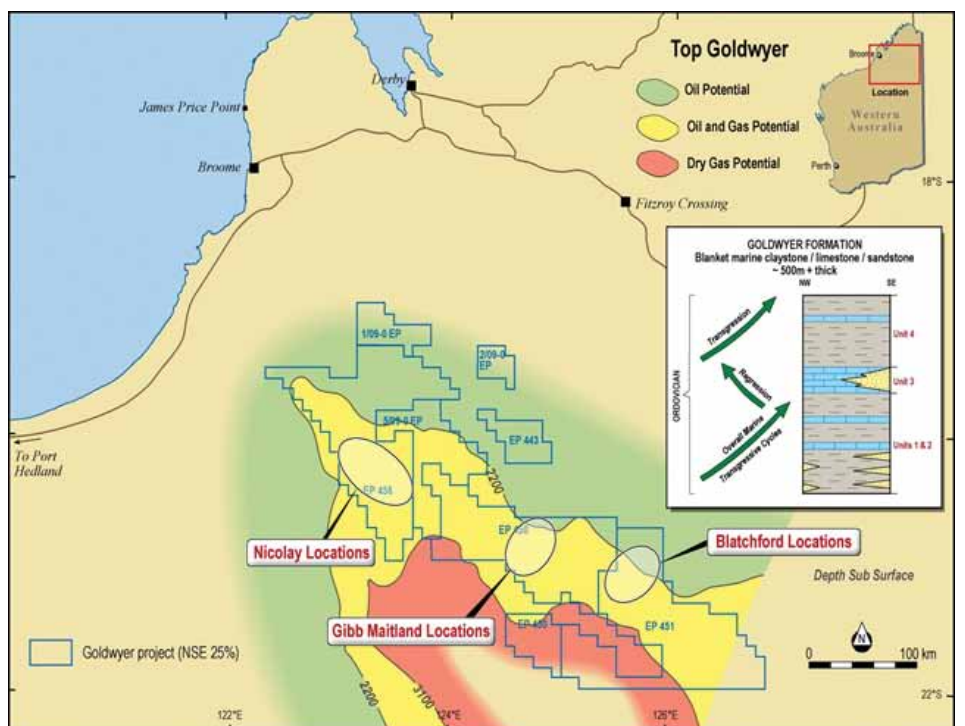


Figure 9 | Goldwyer Project Area



The deepening of Lawford 1 well in 2011
(Photo courtesy of New Standard Energy)

Following the completion of extensive basin modelling in the Goldwyer, New Standard has identified potential drill targets in liquids rich maturity windows which it intends to target in a three well drilling campaign in 2012 alongside farm-in partner ConocoPhillips. The terms of the farm-in agreement have been separated into four phases of exploration and development, for which ConocoPhillips will invest up to \$109.5 million for a 75 per cent stake in the project.

The first phase of the project designates New Standard as the operator, after which ConocoPhillips has the right to assume operatorship. Working closely together on all technical aspects of the project, it is anticipated that drilling will commence in mid-2012.

The second major Canning Basin project, the Laurel Project has advanced significantly courtesy of drilling success at Ungani, Yulleroo and Valhalla, experienced by Buru Energy and Mitsubishi during 2011. The Laurel play is an exciting emerging regional resource play that also has conventional

prospectivity. New Standard has a significant interest in a major land holding of 1.3 million gross acres across both EP 417 and the Seven Lakes SPA area and has met the work commitments on EP 417 courtesy of the deepening of the Lawford 1 well in 2011. This land holding represents a large option over an exciting secondary opportunity in the Canning Basin.

The company's Merlinleigh Project is an under-estimated yet exciting project with the important benefit of being located alongside the Dampier to Bunbury Natural Gas Pipeline, and in close proximity to the development regions of the Pilbara and Mid-West, in Western Australia.

Following the completion of a geochem program in 2011, prospective gas windows and drill prospects have been identified within the Merlinleigh permit areas. New Standard has focused on increasing the technical understanding of the conventional and unconventional targets as well as advancing its Native Title negotiations in this area during 2011. Sitting alongside major gas

infrastructure, the Merlinleigh Project is strongly positioned as a major drawcard in New Standard's portfolio, with a clear path to mid-term commercialisation.

2012 Planned Activities

2012 is set to be a big year for the progression of New Standard's portfolio. The Goldwyer Project occupies the company's primary focus with an extensive exploration drilling program scheduled. Alongside farm-in partner ConocoPhillips, New Standard plans to drill three vertical exploration wells within different permits areas of their Goldwyer Project, reaching target depths between 3,200 m and 3,800 m. Each vertical well will be cored and logged, with each undergoing a detailed core lab analysis. New Standard will also undertake formation evaluation tests on each well to determine the maturity of each individual zone.

Assuming Native Title agreements can be reached, New Standard is also positioning itself to pursue further activity on its Merlinleigh Project – with on ground activity potentially emerging in late 2012.

Octanex NL

Exploration activities – 1 July to 31 December 2011

Carnarvon Basin / Dampier Sub-basin

Permits WA-323-P and WA-330-P are operated by Santos Offshore Pty Ltd, who acquired the new 720 km² Winchester 3D seismic survey. Santos has made a commitment to drill the Winchester prospect in the second half of 2012.

Southern Bonaparte Basin

All six permits, WA-407-P, WA-420-P, WA-421-P, WA-422-P, WA-440-P and WA-441-P, are operated by a subsidiary of Octanex NL. Two new 2D seismic surveys were acquired in WA-421-P (Kingfisher, of 959 km), WA-440-P (Hawk, of 653 km) and WA-441-P (Falcon, of 556 km). A new 3D seismic survey commenced in WA-422-P (Rissa, of 331 km² completed post 31 December 2011). Rissa will be followed by new 3D surveys in WA-420-P (Tamar, of 501 km²) and WA-407-P (Ascalon, of 325 km²).

OMV Australia Pty Ltd

As at the end of 2011, OMV Australia Pty Ltd (OMV Australia) had interests in six Exploration Permits and a Retention Lease located in the offshore Carnarvon Basin within the area administered by the Western Australian Department of Mines and Petroleum as detailed in the table below.

OMV Australia withdrew from WA-362-P and WA-363-P effective from 21 December 2011 and its 40 per cent interest in each permit will be assigned to the remaining Joint Venture parties.

Review of 2011 Exploration Activities

WA-290-P

Operations on the Zola 1/ST1 exploration and sidetrack wells were completed in April 2011. The 805 km² Cambozola appraisal 3D seismic survey was acquired over a portion of WA-290-P and adjacent permits from May to June 2011.

WA-320-P

A multi-survey reprocessing project consisting of a ~880 km² area of a merged volume of vintage 3D seismic data was conducted during 2011.

The permit was renewed for a new term of five years that commenced on 21 October 2011. Preparations for a 400 km² 3D seismic reprocessing project were ongoing at the end of the report period.

WA-358-P

Multi-survey reprocessing projects consisting of 730 km² and 1,380 km² areas of merged volumes of vintage 3D seismic data were conducted during 2011.

Advice was received in December 2011 that an application to renew the permit for a new term of five years was agreed and the formal renewal process was ongoing at the end of the report period.

WA-362-P and WA-363-P

The Gawain 1 and Galahad 1 wells were drilled in WA-362-P and WA-363-P respectively in 2011. Details reported by the operator (Eni Australia).

OMV Australia withdrew from WA-362-P and WA-363-P effective from 21 December 2011.

WA-386-P and WA-387-P

Seismic interpretation and technical studies were conducted.

WA-391-P

Seismic interpretation and technical studies were conducted.

Planned Exploration Activities for 2012

The planned exploration activities for 2012 include, as follows:

WA-320-P

Conduct 3D seismic reprocessing project.

WA-358-P

Interpretation of reprocessed 3D seismic data and technical studies to be conducted.

WA-386-P and WA-387-P

Technical studies to be conducted to determine and support the forward exploration work program.

WA-391-P

Technical studies to be conducted determine and support the forward exploration work program.

Title	OMV Interest	Operator	Joint Venture Parties
R5	50%	Apache Oil Australia	Apache Oil Australia
WA-290-P	20%	Apache Northwest	Apache Northwest JX Nippon Oil & Gas Exploration (Australia) Santos Offshore Tap (Shelfal)
WA-320-P	66.67%	OMV Australia	Tap (Shelfal)
WA-358-P	100%	OMV Australia	
WA-386-P	30%	OMV Australia	Eni Australia Exmouth Exploration
WA-387-P	30%	OMV Australia	Eni Australia Exmouth Exploration
WA-391-P	100%	OMV Australia	

Santos

Finucane South 1 (Carnarvon Basin, WA-191-P)

In May, Santos drilled the Finucane South 1 well in WA-191-P, and wireline logs and testing confirmed a net oil column of 18 m in excellent quality reservoir sands in the Angel Formation.

Finucane South 1 is located approximately 7 km to the south of the Fletcher oilfield and approximately 16 km from the existing oil production facilities at Mutineer Exeter. Both Finucane South and Fletcher are located within WA-191-P.

In January 2012, Santos announced the final investment decision approving the development of the Fletcher Finucane oil project which will involve a three well tie-back to the existing Santos-operated floating production, storage and offloading facility at Mutineer Exeter. Santos is operator of Fletcher Finucane.

Mutineer 4 and Exeter 4 workovers (Carnarvon Basin, WA-26-L and WA-27-L)

Workovers were successfully completed on the Mutineer 4 and Exeter 4 wells within the Mutineer-Exeter oil project, with the replacement of the down-hole pumps leading to an increase in production.

Petrel 7 (Bonaparte Basin, WA-6-R & NT/RL1)

In August, Santos drilled the Petrel 7 appraisal well in WA-6-R & NT/RL1. The results from the appraisal and testing operation have yet to be finalised.

Seismic survey Carnarvon Basin, WA-323 P and WA-330-P

In November, 720 km² of new 3D data within and adjacent to the WA-323-P and WA-330-P permits was acquired. The data is now being processed and is expected to be completed before the end of Q2 2012.

2012 Proposed Operated Activities

Santos has a very active program planned for 2012 with the proposed drilling of five operated wells.

Winchester 1 (Carnarvon Basin, WA-323-P)

This proposed exploration well will test a Triassic horst block at the southern end of the Rankin Trend.

Fletcher Finucane development wells (Carnarvon Basin, WA-191-P)

Three development wells are planned for the Fletcher Finucane oil project.

Crown 1 (Browse Basin, WA-274-P)

This proposed exploration well will be the first drilled in that part of WA-274-P. It will test one of a number of robust structural prospects identified on 3D seismic data. The Crown prospect is on trend with the recent discoveries Poseidon and Kronos and success at Crown will high-grade other prospects in the block.

Shell Development (Australia) Pty Ltd

Shell is a global, integrated energy company with operations in more than 90 countries and territories. Shell's businesses include oil and gas exploration and production, refineries and chemical plants, processing and marketing of liquefied natural gas (LNG) and gas-to-liquid (GTL) products, marketing and shipping of oil products and chemicals, and renewable energy sources, such as biofuels.

Shell's Australian upstream business is headquartered in Perth and is focused on the exploration and development of integrated gas with products including LNG, condensates and liquefied petroleum gas (LPG) and domestic gas marketed to local and overseas customers.



The Petrel 7 appraisal well was drilled for the proposed floating Bonaparte LNG project, operated by GDF SUEZ Bonaparte in joint venture with Santos
(Photo courtesy of Santos)

LNG is a particular focus for Shell in Australia, contributing to their position amongst international oil companies as the world's largest producer of LNG. Currently, as well as being a 24 per cent shareholder of Woodside and a 50 per cent owner of the Arrow Energy coal seam gas business in Queensland, Shell's upstream interests in Australia include a one-sixth share in the North West Shelf LNG Joint Venture, a 25 per cent share in the Gorgon Joint Venture and a 6 per cent interest in the Wheatstone Project. Shell also holds equity interests in a number of other discovered gas resources and is a participant in the Browse, Evans Shoal and Sunrise joint ventures.

Shell operates the Prelude Floating LNG (FLNG) development based on discovery of the Prelude and Concerto gasfields off the northwest coast of Australia in 2007. Shell announced in May 2011 that it would develop these fields using the world's first FLNG facility. This groundbreaking technology, which has been developed by Shell, will process the gas at the site of the gasfield, reducing the cost and environmental footprint of development.

Operated exploration activities planned for 2012 include the Palta 1 gas exploration well, located in the Carnarvon Basin off the North West Cape of Western Australia.

With its non-operated and operated activities in Australia's LNG industry, Australia is key to Shell's LNG growth aspirations globally. Shell is looking at some \$30 billion of investment in Australia over the next five years, making Shell one of Australia's largest investors.

Strike Energy Limited

Strike Energy, in conjunction with Cottesloe Oil and Gas Pty Ltd and WHL Energy Limited, was awarded one new permit during 2011, WA-460-P in the Exmouth Sub-basin. Strike has a 33.33 per cent interest and is operator for the joint venture.

WA-460-P covers 81 km² and is located on the northern boundary of WA-384-P which contains the large Palta Prospect. Strike believes that up to 20 per cent of the prospect (or 2.5 Tcf) lies within WA-460-P. Shell Development (Australia) Pty Ltd is scheduled to drill the Palta 1 well in 2012.



Artist's drawing of Shell's floating LNG vessel
(Photo courtesy of Shell)

The WA-460-P joint venture is required to reprocess 92 km of 2D seismic and to acquire 9.5 km of 2D seismic and 81 km² of 3D seismic within the first three permit years. This work will be conducted after the drilling of Palta 1.

No drilling or seismic activities were conducted in Strike Energy's other operated permits, EP 110, EP 325 and EP 424, all located in the Carnarvon Basin, during 2011.

Woodside Energy Ltd Exploration

Woodside continued an active exploration campaign in 2011 to support Pluto expansion; the proposed Browse LNG Development; Woodside's foundation North West Shelf (NWS) business; and Woodside's producing oil assets. Woodside drilled nine exploration wells, of which six encountered hydrocarbons.

In 2011, Woodside acquired or purchased over 12,400 km² of 3D seismic data to explore recently acquired acreage and mature existing prospects. Woodside acquired seven new Australian Exploration Permits, taking their total number of Australian exploration licences to 33.

In 2012 Woodside will drill a further six wells in Australia and acquire or purchase more than 12,000 km² of new 3D seismic data from a combination of new proprietary acquisition and multi-client purchases.

2011 Drilling Results

WA-404-P, Greater Pluto, Central Hub: Woodside 100 per cent (operator)

Two exploration wells were drilled in WA-404-P during 2011. Martin 1 was finalised during early 2011 with the well encountering gas within the objective Triassic Mungaroo Formation. Kelt 1 failed to encounter hydrocarbons.

WA-434-P, Greater Pluto, Claudius hub: Woodside 100 per cent (operator)

Two wells were drilled in WA-434-P. Cadwallon 1 encountered gas in the primary objective; however the discovery is sub-commercial. Genseric 1 failed to intersect hydrocarbons.

WA-36-R, Laverda Retention Lease: Woodside 60 per cent (operator)

Opel 1 was drilled to test a prospect adjacent to the Laverda oilfield. Opel 1 successfully encountered gas and oil within the primary objective Macedon sands.

**WA-34-L, Pluto Production
Licence: Woodside 90 per cent
(operator)**

Xeres 1 was drilled to test a fault block adjacent to the Eris gas accumulation within the Pluto Production Licence. Xeres 1 successfully encountered gas within the primary objective Mungaroo Formation.

**WA-397-P, Browse Basin:
Woodside 50 per cent (operator)**

Omar 1 was drilled to evaluate the gas bearing potential of the Plover Formation. Encouraging gas shows were encountered, however reservoir quality was poor and the well has been classified as a dry hole.

**WA-3-L, North West Shelf
Venture: Woodside
15.78 per cent (operator)**

Seraph 1 successfully appraised the Angel gasfield, and drilling then continued to evaluate deeper exploration potential. Seraph encountered gas within the primary exploration objective and two secondary objectives. Reservoir quality was poorer than predicted and as a result, commerciality for the discovery is yet to be determined.

**WA-5-L, North West Shelf
Venture: Woodside
15.78 per cent (operator)**

Tidepole East 1 was drilled to evaluate the hydrocarbon bearing potential of a faulted terrace adjacent to the Tidepole gasfield. Tidepole East 1 encountered gas, with discovered volumes expected to be produced via the Greater Western Flank Project at a future date.

PRODUCTION AND DEVELOPMENT ACTIVITY BY COMPANY

Australian Worldwide Exploration Ltd (AWE)

Corybas Field Development

During March 2011 approval was granted by the DMP to produce the Corybas field. The extended production test recommenced on 6 March 2011. Corybas gas is being processed at the Dongara production facility. With regard to the field's full development, it has been decided to wait on the new Irwin 3D seismic data before making the commitment.

Eni Australia Limited Woollybutt (WA-22-L and WA-25-L)

The Woollybutt oilfield is located in the WA-25-L Production Licence in the Carnarvon Basin and contains two separate lobes. The field has been in production since 2003 and has produced an estimated 5.5 GL (35 MMbbl). Production during 2011 declined to around an average of 470.7 kL/d (2,961 bbl/d) and is expected to decline further ahead of field decommissioning and abandonment commencing in 2012.

Eni is operator of the field with 65 per cent equity on behalf of Joint Venture Partners Mobil Australia Resources Co Pty Ltd (20 per cent) and Tap West Pty Ltd (15 per cent).

Blacktip (WA-33-L)

The Blacktip gasfield is located in the Production Licence WA-33-L. Production from the Blacktip field commenced in September 2009 through two subsea wells tied back to a normally unmanned well head platform (WHP) connected to an onshore gas plant (OGP) via a 110 km pipeline. The OGP is located at Yelcherr, near the town of Wadeye in the Northern Territory.

Corybas well test package
(Photo courtesy of AWE)



The Blacktip gasfield provides gas to the Northern Territory's Power Water Corporation (PWC) for power generation in the NT. The Gas Sale Agreement, concluded in 2006, is for the supply of gas over a 25 year period, commencing at 23 PJ per annum rising to 38 PJ per annum over the life of the contract.

By December 2011, the Blacktip field was supplying all of the NT's gas for domestic power generation, production from the field during 2011 being regulated by the buyer's gas demand, following a gas nomination of more than 22 PJ per year. The onshore gas plant has a design production capacity of 44 PJ per annum. The Blacktip Project is 100 per cent owned and operated by Eni.

OMV

No development activities were carried out in any of OMV Australia's permits during 2011.

Woodside Energy Ltd

Overall, Woodside's worldwide production was 11.1 per cent lower than 2010 production, with less than one-third of this change due to natural field decline from Woodside operated fields. The remainder was due to one-off occurrences such as divestments, contract expiry, weather, project redevelopment shut-ins and higher planned maintenance.

Woodside's total Western Australian production in 2011 was 85,800 TJ of pipeline natural gas, 2,533,709 tonnes of LNG, 143,154 tonnes of LPG and 4,050,670 kL of oil (see Production summary table).

Woodside once again achieved world-class reliability from the North West Shelf Karratha Gas Plant, including 98 per cent LNG reliability and 99.9 per cent reliability of supply into the domestic gas market.

The production outlook for Woodside's oil assets was boosted by the successful start-up of the new *Okha* floating production storage and offloading (FPSO) vessel, which will produce about 4,769 kL/d (30,000 bbl/d) when reaching steady state operations.

In 2012 Woodside will achieve some major production milestones, including first production from the Pluto LNG Project. Pluto will produce 2.7–3.3 GL of

oil equivalent (17-21 MMboe) (Woodside share) in 2012, and at full capacity will add 15,898 kL of oil equivalent (100,000 boe) per day to Woodside's operated production. Woodside will aim for continued high reliability production during major refurbishment of NWS LNG Train 2 and installation and commissioning of the North Rankin B platform.

Projects / Developments

North West Shelf

The A\$1.8 billion (A\$600 million Woodside share) North West Shelf Oil Redevelopment Project included the replacement of critical subsea infrastructure and the conversion of the *Okha* to a floating production storage and offloading facility (FPSO), which replaced the *Cossack Pioneer* FPSO.

Production commenced in September 2011 into the *Okha* FPSO facility, with three offtakes completed in the year. The *Okha* FPSO is expected to produce around 4,769 kL/d (30,000 bbl/d) when reaching steady state operations.

The North Rankin Redevelopment Project will recover low pressure gas from the North Rankin and Perseus

gasfields and is expected to cost approximately A\$5 billion (A\$840 million Woodside share). At year end, overall progress was 87 per cent complete and remains on schedule and budget for completion in 2013.

In September 2011 the North Rankin B (NRB) jacket was launched and positioned 100 metres from the existing North Rankin A (NRA) platform. In Indonesia, the NRA-NRB bridges were completed for sail-down to the North West Shelf in early 2012.

In December 2011 the NWS Project participants approved development of the first phase of the Greater Western Flank (GWF) Project, which will develop the Goodwyn GH and Tidepole fields via a subsea tie-back to the existing Goodwyn A platform. This represents the next major development for the North West Shelf Project.

Subsequent phases of GWF will be developed at a later stage. The GWF area consists of 16 fields estimated to hold up to 85 Gm³ (3 Tcf) of recoverable gas and up to 15.9 GL (100 MMbbl) of recoverable condensate.

2011 Australian Production Summary¹

Asset	FY 2011
NWS Pipeline Natural Gas ² Production	85,800 TJ
NWS Liquefied Natural Gas (LNG) Production	2,533,709 t
NWS Condensate Production	1,274,384 kL (8,015,637 bbl)
NWS Oil Production	148,392 kL (933,362 bbl)
NWS Liquefied Petroleum Gas (LPG) Production	143,154 t
Laminaria–Corallina Oil Production	273,232 kL (1,718,581 bbl)
Mutineer–Exeter Oil Production	262,216 kL (164,894 bbl)
Enfield Oil Production	659,517 kL (4,148,239 bbl)
Stybarrow Oil Production	621,283 kL (3,907,757 bbl)
Vincent Oil Production	811,646 kL (5,105,098 bbl)

1 Compared to 2010, production volumes from all of Woodside's assets (worldwide) were 11 per cent lower. The decrease was driven by increased planned maintenance (NWS Oil Redevelopment and North Rankin Redevelopment Project related activities), field decline (Enfield, Laminaria-Corallina, NWS condensate) as well as divestments and contract expiry (assets outside of WA). These reductions were partially offset by a higher contribution from Stybarrow.

2 Woodside's equity share is 50 per cent of the first 414 TJ per day and 16.67 per cent for all gas produced above this amount.

Australia Oil

The start-up of two infill wells (VNB-H5 and VNB-H6) in September 2011 significantly boosted production from the Vincent oilfield. A third infill well at Vincent (VNB-H7) will be brought online in the first half of 2012. In December 2011, Woodside jointly purchased the *Ngujima-Yin* FPSO with co-venturer Mitsui E&P Australia Pty Ltd. This acquisition will facilitate plans to extend the field life at Vincent and allow continued reliability and availability improvements from the facility. Woodside plans to assume full operatorship in late 2012.

Development of the Cimatti accumulation, located to the northwest of the Enfield oilfield, progressed in 2011. Woodside selected a development concept for Cimatti based on a tie-back to the *Nganhurra* FPSO. In 2012 Woodside will finalise basis of design for Cimatti and proceed with front-end engineering and design (FEED) in preparation for a final investment decision targeted for early 2013.

Pluto LNG

2011 saw Pluto attain a number of milestones as the project neared completion. In March, commissioning gas from the Dampier to Bunbury Natural Gas pipeline was introduced into the onshore plant. In April, pipeline gas was used to pressurise offshore pipelines in readiness for production from the Pluto reservoir.

The main flare tower became operational in October, allowing major commissioning activities to begin. This was followed by offshore ready for start-up in November. In early January 2012 Site A (jetty, storage and loading facilities) was declared ready for start-up. During the first quarter of 2012 final preparations for LNG production are being carried out.

In June 2011 the date for first LNG cargo was revised to March 2012 following a regular review of project progress. The cost of the project was revised to A\$14.9 billion (100 per cent project) including estimates for cargo mitigation.

Browse LNG

FEED for the Browse LNG Development was substantially completed in 2011, and a Field Development Plan submitted to regulators in December. Invitations to tender for major infrastructure were issued in the second half of 2011, and bids will be received in the first half of 2012.

In June 2011, Woodside entered into a native title agreement with the Goolarabooloo Jabirr Jabirr people and the WA Government. The agreement paves the way for the State to establish the Browse LNG Precinct near James Price Point, about 60 km north of Broome. The agreement will provide a significant package of tangible initiatives and benefits to Indigenous people in the Kimberley, subject to positive FID.

In December 2011 Woodside advised that it was seeking amendments to its Browse Basin Retention Leases, including a request to vary the condition relating to readiness for a final investment decision. The Browse Joint Venture has written to the Joint Authority requesting variations to the Retention Lease conditions such that a final investment decision may be considered in the first half of 2013. ■

Reference

¹ "World Shale Gas Resources", US Energy Information Administration, 5 April 2011.



The Pluto LNG plant's main flare tower is now operational
(Photo courtesy of Steve Keogh)

Awards of Petroleum Exploration Permits

Richard Bruce

Exploration Geologist
Resources Branch



Well test in the Browse Basin
(Photo courtesy of Neil Tyers)

Commonwealth Award of Petroleum Exploration Permits

These new permits result from the second round of the 2010 Acreage Release that closed on 12 May 2011.

Commonwealth award information was sourced from Western Australia's online Petroleum and Geothermal Register and from the December 2011 Australian Petroleum News.

Total indicative value of work commitments for all of the following Commonwealth permits is \$722.5 million.

In November 2011 permits WA-459-P through WA-467-P were granted (nine permits).

WA-459-P (released as W10-1) in the Northern Bonaparte Basin of Western Australia has been awarded to *Santos Offshore Pty Ltd*. The company proposed a guaranteed work program comprising geotechnical studies, 300 km 2D seismic survey and 865 km 2D seismic reprocessing to an estimated value of \$3.49 million. The secondary program consists of one exploration well and geotechnical studies to an estimated value of \$20.4 million. There were two other bids for this area.

WA-460-P (released as W10-25) in the Exmouth Sub-basin of the Carnarvon Basin has been awarded to *Cottesloe Oil and Gas Pty Ltd*, *Strike Energy Limited* and *WHL Energy Limited*. The companies proposed a guaranteed

work program comprising geotechnical studies, 92 km 2D reprocessing, 9.5 km new 2D seismic surveying and 81 km² new 3D seismic surveying to an estimated value of \$1.2 million. The secondary work program consists of one exploration well and geotechnical studies to an estimated value of \$60.2 million. There was one other bid for this area.

WA-461-P (released as W10-23) in the Exmouth Sub-basin of the Carnarvon Basin has been awarded to *Woodside Energy Ltd* and *Mitsui E&P Australia Pty Limited*. The companies proposed a guaranteed work program comprising licensing of 480 km² of new multi-client 3D seismic data, 395 km² 3D seismic reprocessing, 157 km² new 2D surveying and geotechnical studies to an estimated value of \$7.8 million. The secondary work program consists of 480 km² 3D seismic reprocessing, geotechnical studies and one exploration well to an estimated value of \$36.9 million. There were two other bids for this area.

WA-462-P (released as W10-4) in the Rowley Sub-basin of the Roebuck Basin off Western Australia has been awarded to *Woodside Energy Ltd* and *Shell Development (Australia) Pty Ltd*. The companies proposed a guaranteed work program of 3,585 km² new 3D seismic surveying, geotechnical studies and an exploration well to an estimated value of \$58.1 million. The secondary work program consists of 2,000 km² 3D seismic reprocessing, geotechnical studies and an exploration well to an

estimated value of \$37.9 million. There were three other bids for this area.

WA-463-P (released as W10-24) in the Exmouth Sub-basin of the Carnarvon Basin has been awarded to *Woodside Energy Ltd* and *Mitsui E&P Australia Pty Limited*. The companies proposed a guaranteed work program comprising of licensing of 283 km² of new multi-client 3D seismic data, 217 km² 3D seismic reprocessing, 104 km of new 2D seismic surveying and geotechnical studies to an estimated value of \$5.4 million. The secondary work program consists of 283 km² 3D seismic reprocessing, geotechnical studies and an exploration well to an estimated value of \$36.7 million. There were three other bids for this area.

WA-464-P (released as W10-5) in the Rowley Sub-basin of the Roebuck Basin off Western Australia has been awarded to *Woodside Energy Ltd* and *Shell Development (Australia) Pty Ltd*. The companies proposed a guaranteed work program of 3,595 km² new 3D seismic surveying and four exploration wells to an estimated value of \$163.2 million. The secondary work program consists of 2,000 km² 3D reprocessing, geotechnical studies and one exploration well to an estimated value of \$37.9 million. There were three other bids for this area.

The Ocean Shield in the Northern Carnarvon Basin
(Photo courtesy of Diamond Offshore Netherlands BV)



WA-465-P (released as W10-8) in the Beagle Sub-basin of the Carnarvon Basin has been awarded to *Woodside Energy Ltd.* The company proposed a guaranteed work program of geotechnical studies and 1,211 km² 3D seismic surveying to an estimated value of \$9 million. The secondary work program consists of an exploration well and geotechnical studies to an estimated value of \$37.9 million. There was one other bid for this area.

WA-466-P (released as W10-3) in the Rowley Sub-basin of the Roebuck Basin off Western Australia has been awarded to *Woodside Energy Ltd* and *Shell Development (Australia) Pty Ltd.* The companies proposed a guaranteed work program of 3,590 km² 3D seismic surveying and three exploration wells to an estimated value of \$128.2 million. The secondary work program consists

of 2,000 km² 3D seismic reprocessing, geotechnical studies and an exploration well to an estimated value of \$37.9 million. There were three other bids for this area.

WA-467-P (released as W10-9) in the Beagle Sub-basin of the Carnarvon Basin has been awarded to *Woodside Energy Ltd.* The company proposed a guaranteed work program of 351 km² of new 3D seismic surveying and geotechnical studies to an estimated value of \$3.8 million. The secondary work program consists of one exploration well and geotechnical studies to an estimated value of \$36.5 million. There were three other bids for this area.

State Award of Petroleum Exploration Permits

Since the end of June 2011 to the start of February 2012 no petroleum exploration permits were awarded in State areas. ■

State Areas Released for Petroleum Exploration May 2012

Richard Bruce

Exploration Geologist
Resources Branch



Looking towards the summit of Sir Frederick Range, Western Amadeus Basin
(Photo courtesy of Roger Hocking GSWA)

DMP continues to promote the petroleum potential of Western Australia's vast sedimentary basins using a specific area release system in our State Waters and onshore areas.

A CD package accompanies the acreage release and contains information about the prospectivity of release areas, available data listings, land access, and how to make a valid application for an Exploration Permit.

In May 2012, DMP released a total of seven blocks (Fig. 1). This release comprised one block in the offshore Northern Carnarvon Basin, one block in the Amadeus Basin, three blocks in the Officer Basin, and two blocks in the Perth Basin.

The 872 km² block L12-1 in the highly productive offshore Northern Carnarvon Basin is located in the Barrow Sub-basin and offshore Peedamullah Shelf. The primary reservoir objective is the Early Cretaceous Birdrong Sandstone, as well as reservoirs within the Permian and Triassic successions of the offshore Peedamullah Shelf.

Release area L12-2 is 6,576 km² in the Western Australian portion of the Amadeus Basin adjoining the Northern Territory border. Although the western Amadeus Basin is almost totally unexplored, recent Geological Survey of Western Australia fieldwork has greatly improved stratigraphic correlations with the Northern Territory allowing a

preliminary assessment of prospectivity. The sub-salt Neoproterozoic 'Gillen' petroleum system is likely to be most significant for the release area, assuming preservation of a salt seal over traps in the area. Existing aeromagnetic and gravity data sets should be useful for defining prospective structures for follow up seismic surveys.

In the Officer Basin release areas L12-3, L12-4 and L12-5 are respectively 18,309 km², 22,504 km² and 22,704 km² in size. From a global perspective, the Officer Basin resembles Neoproterozoic successions in Oman and Russia that contain commercial hydrocarbon resources. The Neoproterozoic Buldya Group contains oil and gas shows (Kanpa 1/1A, NJD 1), local source intervals, potential reservoir sandstones and potential salt and shale seals. Thicker basin fill in the northern half of L12-4 and L12-5 shows seismic evidence of halotectonic activity, which has the potential to create a variety of trap styles. These areas are significantly underexplored for hydrocarbon resources (with only minor phases of exploration in the 1960s and 1980s).

There are two release areas, 559 km² and 297 km², located in the onshore northern Perth Basin. The region has a thick Lower Triassic source and seal interval, as well as likely source intervals in the Lower Jurassic. The release areas mainly lie within trough areas; the Dandaragan Trough is the main hydrocarbon-generative kitchen of the

basin. The northern Perth Basin has numerous seismic lines, wells, and oil and gas production. Two gas pipelines pass in the vicinity of the release areas. A sealed highway connects to the State capital Perth and the Kwinana oil refinery.

Work program bids for the release areas close at 4pm on Thursday 1 November 2012.

Should you require any further information or assistance, please contact Richard Bruce (08 9222 3314) of DMP's Petroleum Division or Alan Millar (08 9222 3841) of the Geological Survey of Western Australia. All enquiries will be dealt with in strictest confidence. ■



Inzeria initia, a Neoproterozoic stromatolite of the Bitter Springs Formation in the Board Ridges, Western Amadeus Basin
(Photo courtesy of Heidi Allen, GSWA)

Petroleum and Geothermal Environment Regulations

Eric Cormack

Senior Legislation and Policy Officer
Petroleum Division



Ducks in flight near the Sundown oilfield, Canning Basin
(Photos courtesy of Buru)

The Department of Mines and Petroleum intends to introduce the following State petroleum and geothermal environment regulations:

- *Petroleum and Geothermal Energy Resources (Environment) Regulations 2012;*
- *Petroleum (Submerged Lands) (Environment) Regulations 2012; and*
- *Petroleum Pipelines (Environment) Regulations 2012.*

The regulations are required because the *Petroleum and Energy Legislation Amendment Act 2010*, which received Royal Assent on 28 October 2010, extended the regulation making provisions in the *Petroleum and Geothermal Energy Resources Act 1967*, the *Petroleum (Submerged Lands) Act 1982* and the *Petroleum Pipelines Act 1969* to adopt the Commonwealth system of requiring title holders to produce an environment plan prior to conducting operational activities.

The regulations are based on the *Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* which originally commenced in 1999.

The object of the regulations is to ensure that petroleum or geothermal energy activities in the State are carried out in:

- a manner consistent with the principles of ecologically sustainable development; and
- accordance with an environment plan that;
 - demonstrates that the environmental impacts and environmental risks of the activity will be reduced to as low as is reasonably practicable; and
 - has appropriate environmental performance objectives and environmental performance standards; and
 - has appropriate measurement criteria for determining whether those objectives and standards have been met.

Exposure drafts were prepared for each of the three Regulations and these were posted on DMP's website in December 2011 as part of a comprehensive stakeholder and public consultation process which closed 29 February 2012.

As an aid to understanding the draft regulations, DMP has also produced draft guidelines for the regulations, titled *"Guidelines for the Preparation and Submission of an Environment Plan"*. These guidelines are based on the document written by DMP for the Commonwealth petroleum environment regulations in 2008, but tailored to reflect onshore activities.

Written submissions were invited on the exposure drafts of the regulations and the guidelines and 11 responses were received. Feedback received has been addressed and significant enhancements have been made to the three Regulations and the Guidelines. The legislative amendments are currently being drafted by the Parliamentary Counsel's Office and it is anticipated that the package of Regulations and Guidelines will be in place by 30 June 2012.

The draft regulations also deliver on a public commitment made by DMP in response to the Hunter Review titled *"Regulation of Shale, Coal Seam and Tight Gas Activities in Western Australia"*, which recommended improvements to legal enforceability of the State's petroleum regulatory framework. ■



Potential for Geothermal Energy in the Pilbara Region from Hot Dry Rock (HDR) Geothermal Systems

Mike Middleton

Senior Energy Geotechnologist
Resources Branch



Pilbara landscape
(Photo courtesy of Dreamstime.com)

Introduction

The Pilbara region of Western Australia contains some of the State's most significant mineral deposits. However, difficulties can arise for the development of these mineral resources due to the remoteness and lack of economic energy supply. The energy supply for mines at remote locations in this region is commonly sourced by diesel-powered generators, although, some mines are supplied with gas from the North West Shelf. Geothermal energy may provide an economic alternative, or additional, energy supply, if access to deep radiogenic granites ("hot granites") is available. Geothermal energy is generally obtained from hot granites using the Hot Dry Rock (HDR) geothermal process, sometimes called Engineered Geothermal Systems (EGS).

HDR geothermal systems are one of three ways that are considered viable for using geothermal energy in Australia. The three systems are (1) near-surface heat pumps, (2) Hot Sedimentary Aquifers (HSA), and (3) HDR (Figure 1). The HSA system is currently being explored by a number of companies as a possible system for both power generation and air conditioning in Western Australia.

A HDR system is being exploited in the Cooper Basin by the geothermal company Geodynamics Limited. The HDR system entails injecting cool water into hot fractured rocks at depths of

about four kilometres, allowing the water to percolate through the hot rocks (which heats the water), and then extracting the hot water for geothermal energy applications (see Figure 1). Geothermal explorers commonly seek temperatures in excess of 200 °C for such systems. The hot water is fed into various types of turbines for electricity generation; the efficiency

of electricity generation is dependent on the temperature of the fluid being introduced into the turbine.

New generations of turbines, called Kalina Cycle and Variable Phase turbines (Welch and Boyle, 2009; Welch *et al.*, 2010), are permitting the use of lower temperature geofluids for electricity generation.

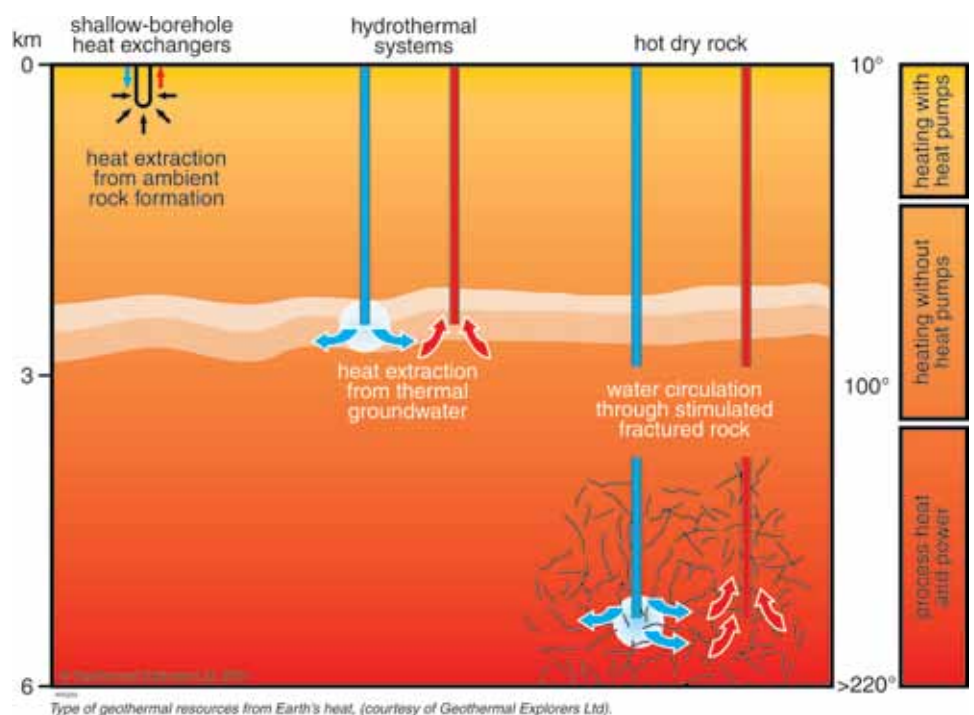


Figure 1 | Types of geothermal resources from the Earth's heat. All systems show extraction wells (red) and injection wells (blue). The HDR system is the third system and entails injecting cool water into fractured hot dry rocks (Courtesy of Geothermal Explorers Ltd)

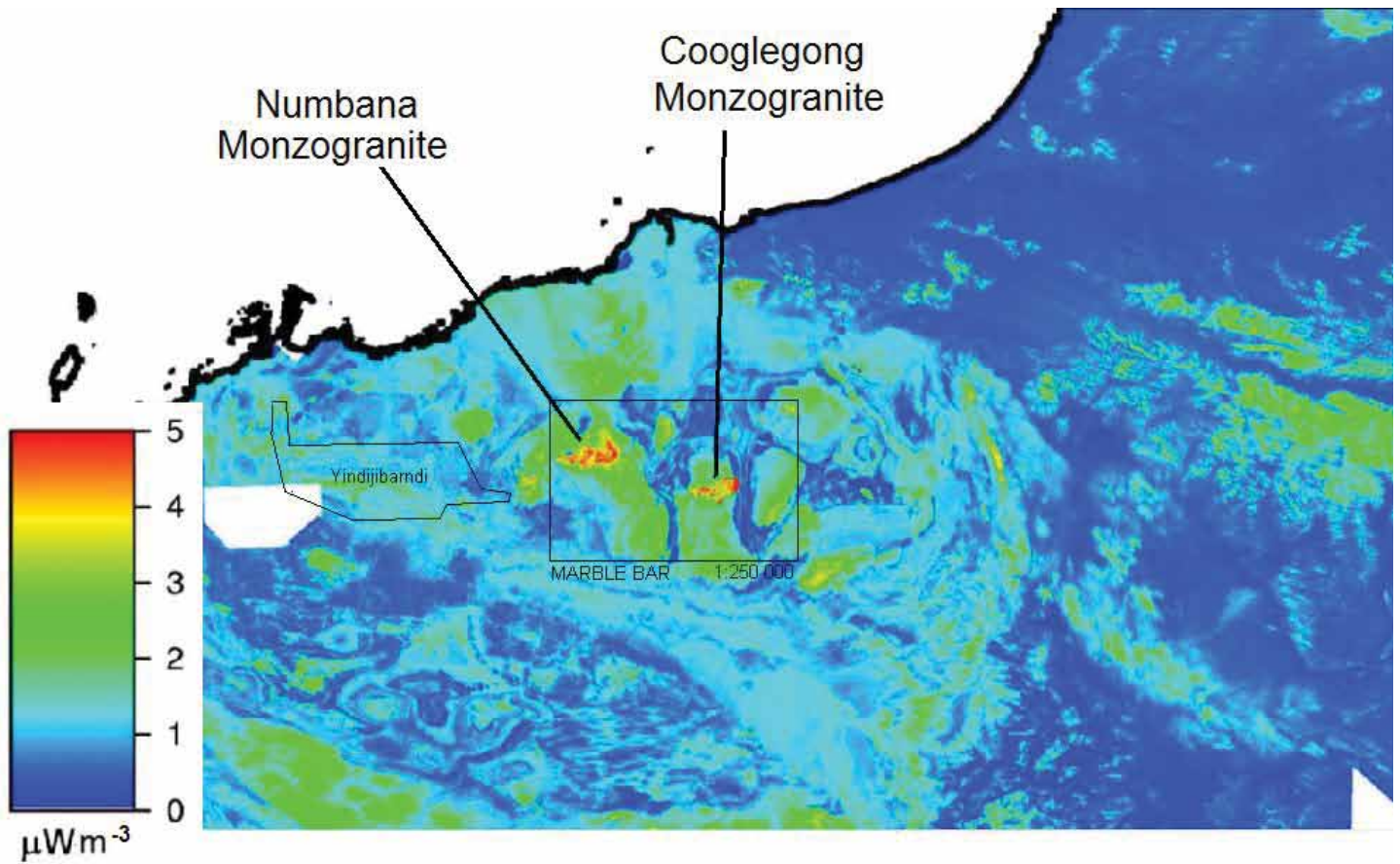


Figure 2 | Heat generation map of Pilbara hot granite zones (Minty *et al.*, 2009). The locations of the Numbana and Coolegong Monzogranites are shown

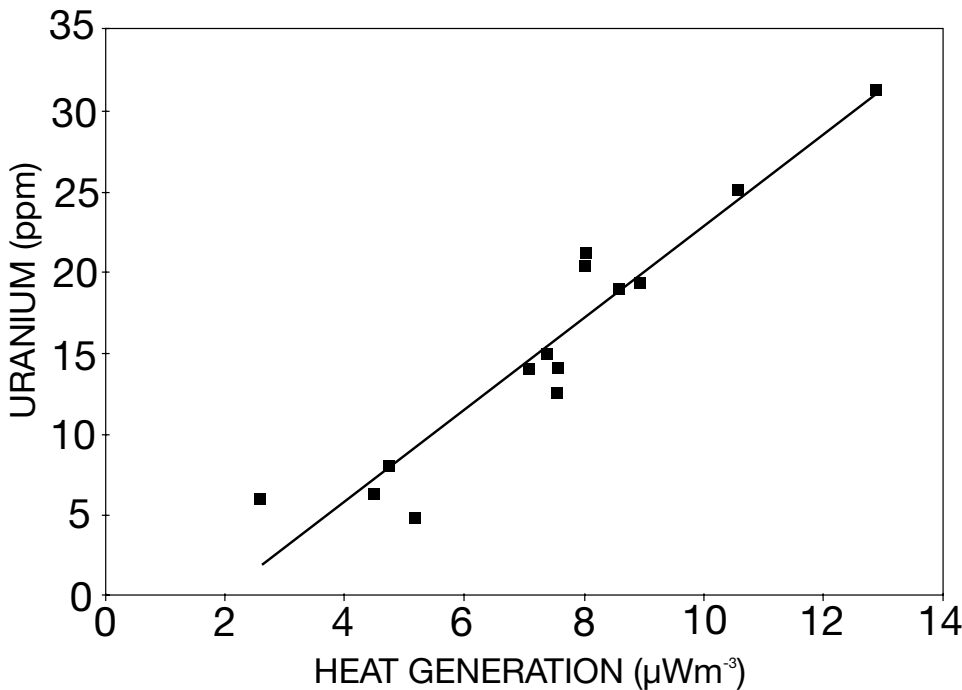


Figure 3 | Ao vs U for Coolegong and Numbana Monzogranites. A very good linear relationship is apparent

shows the approximate radiogenic heat generation of surface rocks on the Marble Bar 1:250 000 map sheet. The map is generated from calibrated uranium (U), thorium (Th) and potassium (K) elemental abundances determined from airborne radiometric surveys (Budd *et al.*, 2011). The U, Th and K abundances are converted to approximate radiogenic heat generation by a method described by Kappelmeyer and Haenel (1974).

Two particularly high regions of radiogenic heat generation can be discerned in Figure 2. The two hot regions identified are within the Numbana and Coolegong monzogranite intrusions. These intrusions are late-stage, highly fractionated granites (Van Kranendonk, 2011), known to possess high U and Th concentrations, which crop out at the surface. Figure 3 shows a plot of uranium versus radiogenic heat generation of samples of the Numbana and Coolegong Monzogranites (data courtesy of the Geological Survey of Western Australia). An excellent linear trend is observed between the uranium and heat generation.

A stand-alone Variable Phase turbine has been designed to generate about one megawatt (MW) of electricity with input fluid temperatures of about 110 °C, although greater generation efficiencies are obtained at higher temperatures.

Pilbara Applications

The new generation of turbine may hold significant implications for generating power at Pilbara mine sites. The key ingredient is the proximity of a hot granite to a mine location. Figure 2

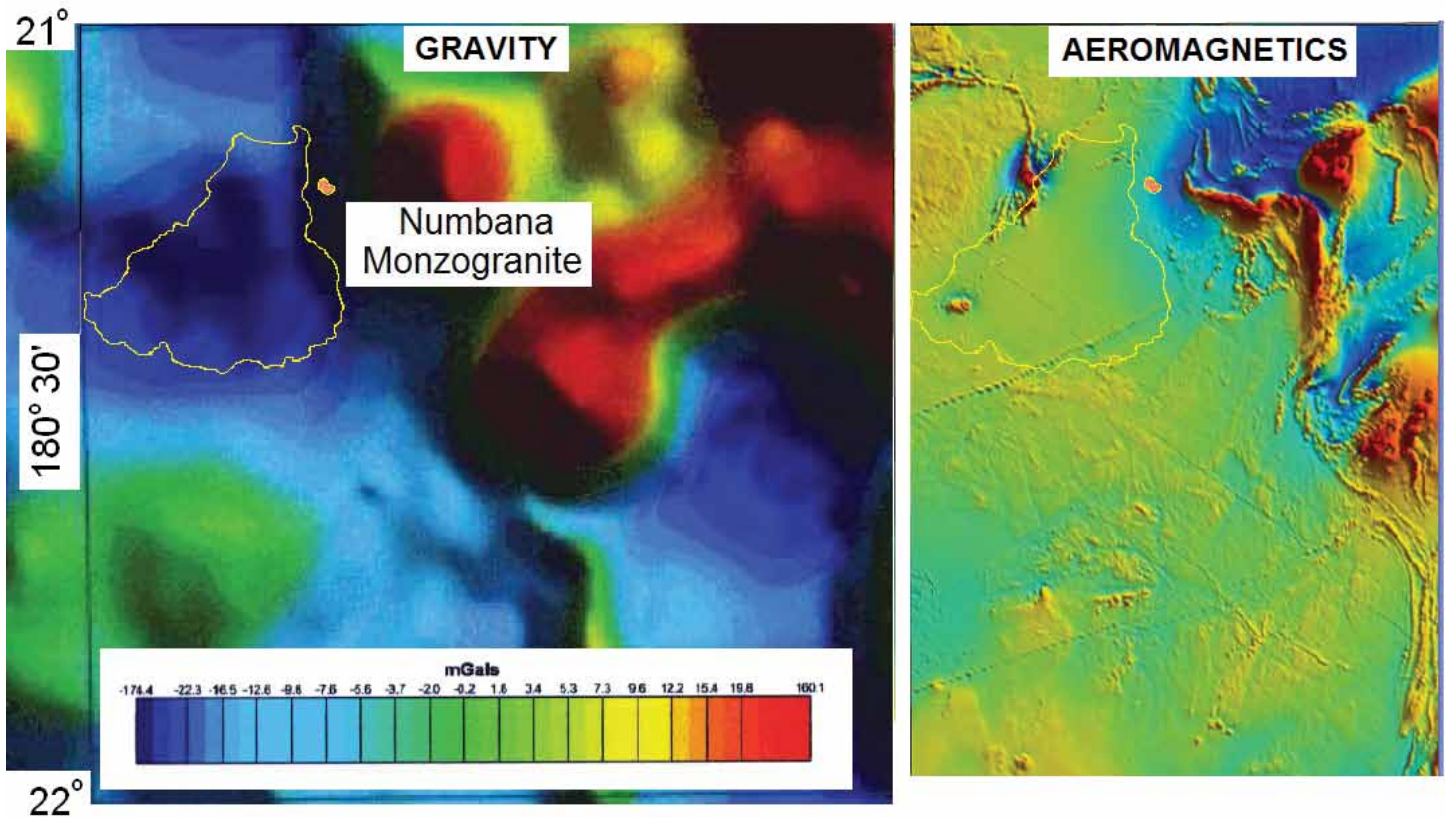


Figure 4 | Gravity and aeromagnetic maps of the western part of the Marble Bar 1:250,000 sheet. The outline of the surface outcrop of the Numbana Monzogranite is shown. The gravity contours are in units of mgal (1 mgal or milligal is equivalent to a gravity acceleration of 0.00001 m/s)

A linear regression curve through these data shows that: $U = 2.2 A_o - 5.4$, where U is uranium concentration (ppm) and A_o is radiogenic heat generation (μWm^{-3}); the coefficient of linear regression (R^2) is 0.92. The heat generation of the rock samples is generally higher than the values observed from the airborne data, and this is commonly observed, as discussed by Middleton (2012). These data suggest that the radiogenic heat generation in the monzogranites of the Pilbara Craton may be as high as $13 \mu\text{Wm}^{-3}$, which is the hottest so far observed in Western Australia.

We now look a little more closely at the Numbana Monzogranite in order to estimate temperatures that may be observed within the granite batholiths of the region. Middleton (2012) discussed a method to do this, and the same procedure is followed in this article. The major unknown in determining temperature at depth is the depth-extent of the radiogenic batholiths. It is a common belief that the late-stage monzogranites may only be about three kilometres thick. To test this, the gravity and magnetic signature of the Numbana Monzogranite was examined (Figure 4).

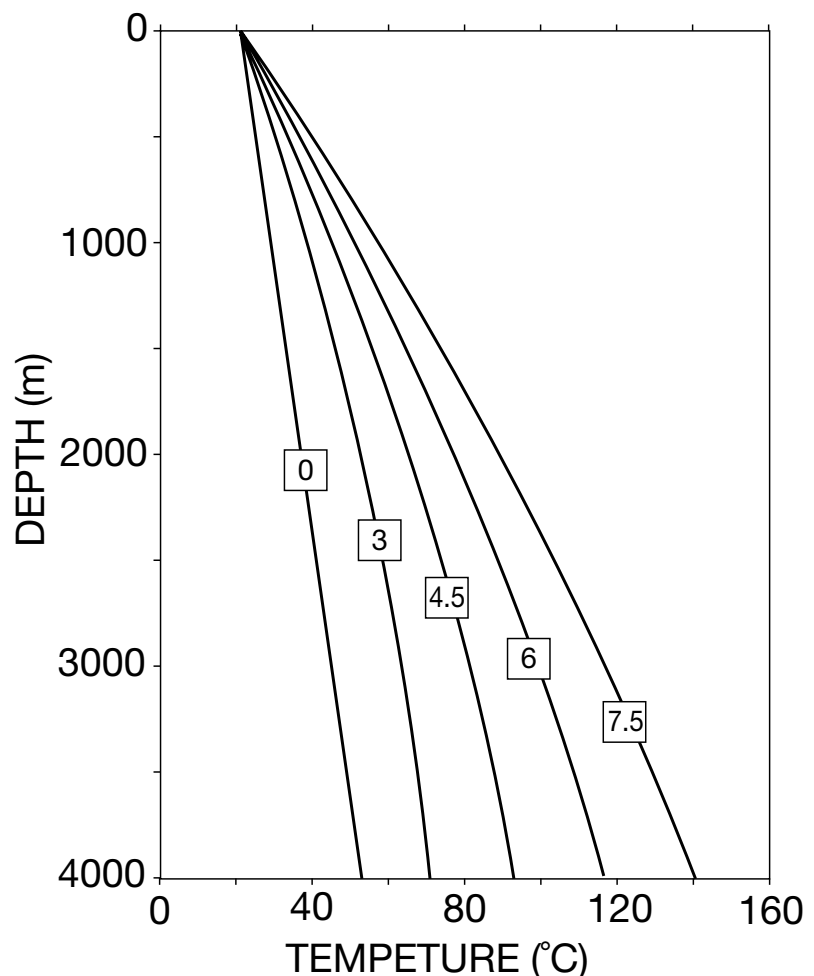


Figure 5 | Temperature versus depth for granite batholiths varying in depth extent from 0 to 7.5 km; the heat generation within each batholiths is $12 \mu\text{Wm}^{-3}$

The outline of the outcropping Numbana batholith is shown superimposed on the aeromagnetic and gravity anomaly maps of the region near the batholith. It can be surmised that the outcrop of the granite body is well defined by the aeromagnetic data, but any attempt to determine the depth extent from these magnetic data will not be reliable. However, the gravity anomaly data (Lockwood, 2004) shows more promise. Maps shown in Lockwood (2004) suggest that a gravity anomaly of about 100 to 125 mgal may be associated with the Numbana Monzogranite, despite being intruded through a suite of older granites. This anomaly may be used to approximate the depth extent of the Numbana Monzogranite itself, assuming a simple cylindrical geometry and a density difference between the Numbana Monzogranite body and surrounding granites of between 0.05 and 0.10 gcm⁻³ (50 – 100 kg m⁻³). Within the ranges of the assumed parameters, the depth-extent of the Numbana Monzogranite may be as large as 7.5 km. More study is recommended to refine this geophysical model of the Numbana Monzogranite further.

Based on this information, we can use the methodology described by Middleton (2012) to model the possible ranges of temperatures that may be encountered within the Numbana batholiths. Figure 5 shows a plot of temperature versus depth for five batholiths models, where the depth extent (vertical thickness) of the batholiths varies between 0 and 7.5 km, and a radiogenic heat generation within the granite body of 12 μWm⁻³, which is within the range of heat generation values observed in Figure 3. The models suggest that one may encounter temperatures as high as 140 °C at about 4,000 m depth.

In consideration of commercial geothermal energy production in the region, the modelled temperatures support current concepts of low-temperature electricity generation with geothermal energy based on the HDR scenario, where it is generally accepted that temperatures well in excess of 220 °C are required for electricity generation. Nevertheless, the new generation of low-temperature, organic-Rankine-cycle turbines, and adsorption chillers, which operate in the vicinity of 100 to 120 °C, could place some remote regions of the Pilbara in an advantageous economic perspective for alternative energy supply close to an existing mining market. ■

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WA Joint Authority Functions Continue Following Transfer of Designated Authority Functions to the Commonwealth

Hazel Harnwell

Manager Project Coordination and Information Management
Strategic Business Development Branch



On 1 January 2012, the role of the Designated Authority (DA) ceased to exist with the introduction of the newly created National Offshore Petroleum Titles Administrator (NOPTA). Because of the regulatory change, the role of the Joint Authority (JA) member in Western Australia has also changed.

NOPTA is a branch of the Commonwealth Department of Resources Energy and Tourism (RET) and is now responsible for managing and administering offshore titles under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGSA). Although the Petroleum Division has a reduced role in dealing with offshore activities adjacent to Western Australia it continues to support the WA Minister for Mines and Petroleum who is the WA member of the Joint Authority. The Western Australian JA still plays a major role in ensuring that titles and activities under the OPGGSA are managed in a way that is not detrimental to interests that may impact on Western Australia.

On average, the WA JA makes approximately 300 decisions annually under the OPGGSA. This is in addition to ongoing State activities (which remain unchanged) performed under the *Petroleum Pipelines Act 1969* (PPA69), *Petroleum (Submerged Lands) Act 1982* (PSLA82) and *Petroleum and Geothermal Energy Resources Act 1967* (PGERA67).

As the delegate for the WA JA, the Petroleum Division is responsible for:

- receiving information and advice from NOPTA;
- providing fully informed advice on title approvals to the WA member of the JA for JA decisions including:
 - Exploration Permits
 - Field Development Plans
 - Production Licences
 - Pipeline Licences
 - Retention Leases, and
 - variations to work program conditions
- ensuring that the State Minister is kept fully informed and advised on all policy matters relating to Commonwealth offshore activities;
- ensuring the effective transition of responsibilities and knowledge to NOPTA; and
- ensuring that Commonwealth offshore activities do not adversely impact State areas.

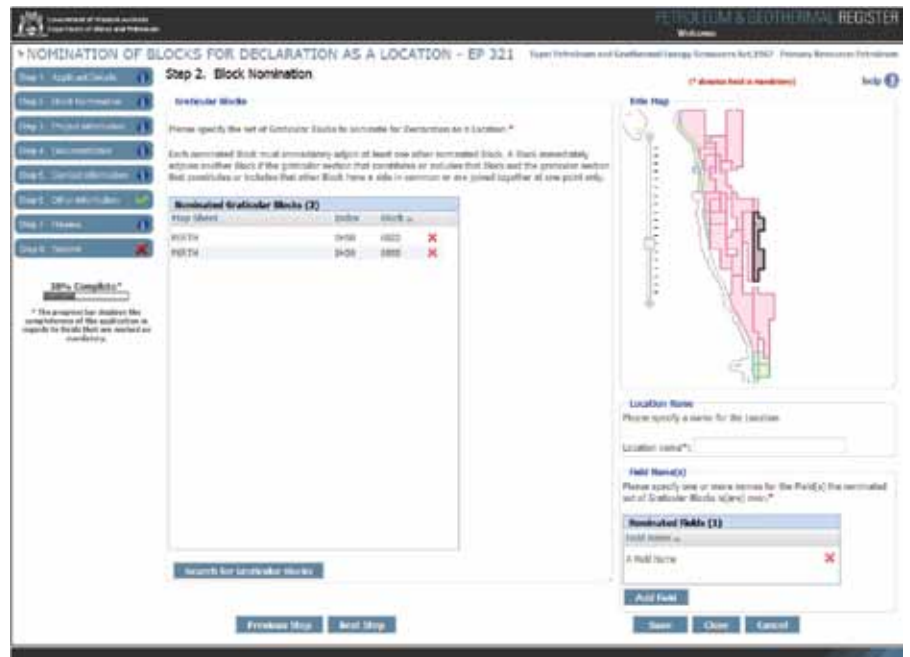
The handover of data and regulatory responsibility from DMP to NOPTA is going smoothly with minimal impact on State approvals.

Following a successful external audit in February this year, the Petroleum Division retained its ISO accreditation and certification was renewed for a further three years. This demonstrated that even during the initial transition period standards were maintained to a high level. ■

What's New with the Petroleum and Geothermal Register (PGR)

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Manager Project Coordination and Information Management
Strategic Business Development Branch



Screen capture showing the Declaration of Location page from the Petroleum & Geothermal Register (PGR)

In response to the regulatory changes for Commonwealth offshore activities, the Information Services Branch of DMP has been steadfastly working behind the scenes to modify PGR to accommodate changes resulting from the handover of regulatory responsibility to NOPTA. These changes involved 'turning off' online functionality for Commonwealth activities and developing new internal functionality to enable the Petroleum Division to perform Joint Authority functions.

To minimise the impact to industry, PGR has continued to display some Commonwealth titles information until such time as NOPTA's National Electronic Approvals Tracking System (NEATS) goes online.

The PGR Project Team has adopted a more streamlined approach for delivering new functionality to PGR. Highly efficient and skilled team members, cutting edge technology and invaluable expertise from the business areas, have enabled new features to be introduced in shorter timeframes.

Although some resources were diverted to deal with changes due to the Commonwealth transition, PGR development has continued and a new Location Management module went live on 15 March 2012. This module provides industry with the ability to lodge applications online for:

- Declaration of Location
- Extension of Location
- Variation of Location
- Revocation of Location

Later this year further new modules will be introduced into PGR. These are:

- Native Title – this module will allow for Native Title cases to be recorded and managed in PGR and linked to the assessment of an application for a title.
- Online lodgement of an Exploration Permit out of a Special Prospecting Authority.
- Bidding System - this module will:
 - allow bids for Exploration Permits to be lodged, paid for and received online;
 - show when a bid becomes successful;
 - show when formal assessment of an Exploration Permit application has commenced and allow industry to track the progress of the application;
 - link successful bids to Exploration Permit applications and related future titles; and
 - integrate with the PGR Finance Module for online payments.

A paramount consideration in developing the Bidding System module has been to maintain the confidentiality of applicants. This has been addressed and robust testing will be undertaken to ensure that there are no breach of confidentiality risks prior to the module going online.

Once introduced the Petroleum Division will be able to report on how long the bidding process took from the preparation and selection of acreage to the point of acceptance or refusal of a bid. The Division will also be able to report on the overall length of time taken to finalise an application from the time of lodgement of a bid to the approval of an Exploration Permit.

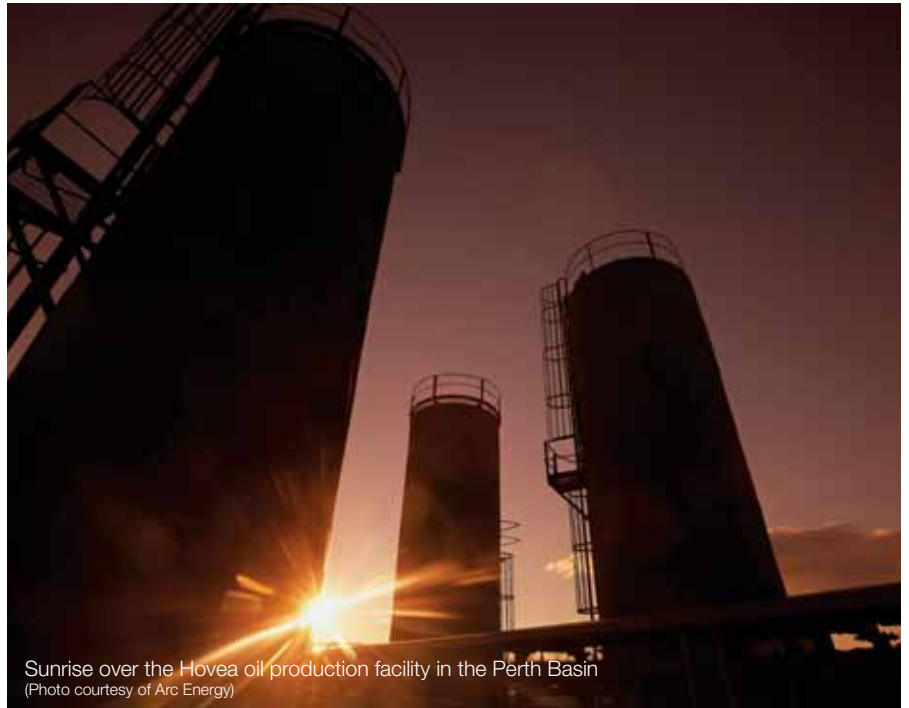
PGR's ongoing development has only been possible due to the dedication of staff from the Petroleum Division and Information Services Branch who continually strive to make it a system that is easy to use for both internal and industry users. Positive feedback confirms that PGR is meeting the business needs of both industry and DMP.

The Executive Director Petroleum Division, Bill Tinapple, said that it has been a sterling effort by all concerned to continue to enhance PGR despite competing and additional workloads due to the transition. For each new module staff is required to rigorously test the new functionality ensuring that it works as expected and is easy to use. ■

Shale – A New Energy Dawn?

Jason Medd

Principal Policy Officer
Petroleum Division



Sunrise over the Hovea oil production facility in the Perth Basin
(Photo courtesy of Arc Energy)

Previously, the discovery of thick shale deposits during exploration oil and gas drilling was considered a nuisance to drillers. Fast forward to today, shales are now actively drilled and appraised for gas and oil production in many parts of the world.

Shale gas production in the United States now accounts for 34 per cent of total gas production in the country. In the space of several years, the US has progressed from being a potential net gas importer to a potential gas export nation. LNG receiving terminals recently completed in the US Gulf coast are now being considered for conversion to LNG export facilities. This drive for export markets has been spurred by high prices for LNG in Asia and the persistent historic low price of gas in the US domestic market, around \$2 per mmBTU's, driven by the flood of shale gas.

Shale Oil

Shale resources are not all about gas. The North American Bakken and Tyler shale deposits in the Williston Basin, covering North Dakota, Montana and crossing over the border into Canada in Manitoba are rich with shale oil. Current shale oil production in North Dakota is in excess of 55 million litres (530,000 barrels) per day and growing rapidly. The North Dakota Department of Mineral Resources estimates that production could eventually top 159 million litres (1 million barrels) per day in the State alone.

Shale oil production in North Dakota will soon overtake oil production in Alaska, to make the State the second largest oil producer, behind Texas, in the United States. The Eagle Ford Shale in South Texas is also highly promising for shale oil and gas, where ConocoPhillips is a significant title holder.

Current information indicates that very large areas of the Canning Basin and the onshore Carnarvon Basin in Western Australia are prospective for shale oil. The realisation of this resource potential in Western Australia and other areas within Australia could have a profound impact to Australia's energy security, particularly liquid fuels.

What does this mean for WA?

According to the recent US Energy Information Administration (EIA) report¹ into world shale gas reserves, WA was noted as having the fifth largest shale gas resource in the world.

The EIA report, based on the Canning and Perth basins alone, estimated a technically recoverable shale gas reserve of 8,155 Gm³ (288 Tcf) of gas, or twice the recoverable gas resource of offshore Western Australia. This exceeds the coal seam gas resources in Australia that are the foundation of the various LNG export projects in Queensland currently underway or planned.

Exploration and appraisal on Western Australian shale resources is expected to increase significantly, with drilling and hydraulic stimulation applications pending for AWE, Norwest Energy, Buru Energy and New Standard Energy.

Interest in Western Australian shales by large international companies is rising, with the recent farm-in of ConocoPhillips with acreage in the Canning Basin held by New Standard Energy consisting of a \$110 million exploration and appraisal program in this area. The ConocoPhillips funded program consists of four discrete phases of work, the first includes the completion of three exploration wells and detailed core analysis. The results of the first phase of this work will inform the design of the subsequent three phases.

Hess have also expressed interest in the Canning Basin, with recent applications for two Special Prospecting Areas (SPA) with Acreage Options (AO) in the southern Canning Basin. The work commitment associated with these SPAs include the completion of nearly 15,000 km of aerial gravity and magnetic surveys. In addition to these two SPAs, Hess has also acquired Kingsway Oil Ltd, which was the holder of several large Exploration Permits neighbouring the SPAs. These acquisitions provide Hess with a continuous exploration area covering most of the southern half the Canning Basin.



Storage tanks at Hovea
(Photo courtesy of Arc Energy)

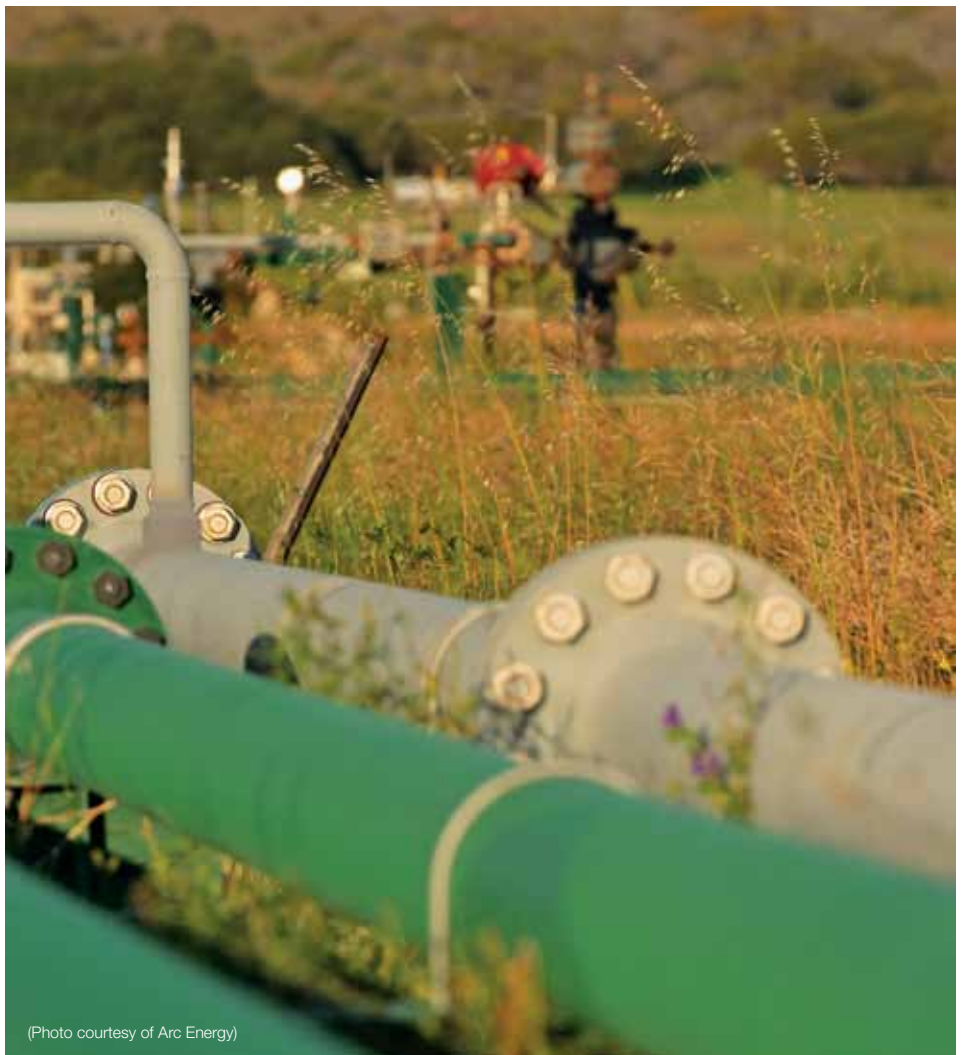
Regulation

Shale resource development faces a number of hurdles. Controversy has arisen around shale gas development in the US, particularly around hydraulic fracture stimulation or fracing, which is essential to create economic flows of gas to shale gas wells. Fracing is not new and is a technique that has been commonly employed for conventional and unconventional petroleum activities for over 60 years.

DMP is actively engaged in continuous regulatory improvement for the petroleum and geothermal energy sector including unconventional energy. A significant part of this process draws on the lessons learned nationally and internationally through company and regulator engagement. DMP is committed to world's best practice standards for shale developments and a transparent regulatory regime to encourage investment in the State, whilst protecting the environment and other resources, to grow this resource to the benefit of the people of WA and Australia. ■

Reference

¹ "World Shale Gas Resources",
US Energy Information Administration,
5 April 2011.



(Photo courtesy of Arc Energy)

Petroleum and Geothermal Energy Safety Levies

Alan Gooch

Director Petroleum Safety
Resources Safety Division



Background

To enhance the role of Resources Safety as a leading practice safety regulator, the State Government determined that the necessary resources will be funded through the phased implementation of cost recovery from the relevant industry sectors. This was announced in September 2009, beginning with mines safety (implemented in April 2010), and followed by petroleum safety then dangerous goods safety.

The objectives in developing cost recovery principles for petroleum and geothermal energy safety are to ensure, to the greatest possible extent, a fair and equitable distribution of the cost of administering onshore petroleum and geothermal energy safety regulation, with minimal administrative burdens for industry and the regulator.

A number of cost recovery methods were examined. Throughout development of the levies, consultation has occurred via the Australian Petroleum Production and Exploration Association Ltd (APPEA), Australian Pipeline Industry Association (APIA) and petroleum industry representatives on Ministerial Advisory Panel for Best Practice Safety Regulation. The models were modified as a direct result of this consultation.

The approach selected was based on cost recovery framework used for offshore petroleum by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), which is already accepted by industry.

This follows industry requests for greater alignment between State and Commonwealth legislation.

The levies and classification

The Safety Management System Levy applies to a Safety Management System in force (SMS), and is charged for regulatory services rendered in relation to listed occupational safety and health laws under the *Petroleum and Geothermal Energy Resources Act 1967*.

The Safety Case Levy applies to a Safety Case in force (SC), and is charged for regulatory services rendered in relation to listed occupational safety and health laws under the *Petroleum Pipelines Act 1969*.

The CEO classifies each operation taking into account a number of factors, the classifications in turn give rise to a rating that is used to calculate the levy according to the formula in the regulations. The details of the classification process have been published in guidelines rather than being included in the regulations.

Information contained in the SC or SMS on the complexity and risk of an operation are considered, as this indicates the resources required to regulate the operation. The levies will be assessed at the end of each quarter, from the date the SC or SMS is in force.

The levies will continue to apply while the SC or SMS is in force and the date from which the SC or SMS ceases to be in force will be agreed between the CEO and the licensee/operator and used as the end date for the levies.

Formal objections to classifications can only be made to the CEO upon receipt of a levy assessment/reassessment notice, through the objections process specified in the levy legislation. If a significant change to the operation occurs the operator or licensee is required under current safety legislation to notify the department. Following this, the CEO may review a levy classification decision.

An Agency Special Purpose Account, named the Petroleum and Geothermal Energy Safety Levies Account, will house the levy funds accrued as well as any penalty amounts. Legislation restricts use of moneys in the account to the costs and expenses accrued for the administration of listed OSH laws in the State petroleum legislation and the administration of the Levies Act.

Liability for payment of the levies

The person liable for payment is the operator/licensee occupying the position at the end of the quarterly period and defined as the registered holder. The operator/licensee is responsible for any other commercial arrangements with other title holders, contractors, suppliers and customers. The department will initially assign a person liable for each operation, however this can be adjusted later as required. ■

Table 1. 2011 Production by Field and Cumulative Production as at 31 December 2011

Field	Operator	2011 Production by Field			Cumulative Production			Permit
		Oil	Condensate	Gas	Oil	Condensate	Gas	
		kL	kL	10 ³ m ³	kL	kL	10 ³ m ³	
Agincourt	Apache	7,816	70	2,774	532,884	4,050	30,683	TL/1
Albert	Apache	8,372	56	1,674	70,121	96	8,041	TL/6
Angel	Woodside	0	2,388,899	8,078,987	0	7,160,823	24,063,508	WA-3-L
Apium	AWE	0	31	2,338	0	385	32,941	L1
Bambra	Apache	44,308	38,629	423,039	353,416	153,279	1,269,754	TL/1
Barrow Island	Chevron	292,823	0	27,460	50,589,474	0	5,343,409	L1H
Blacktip	Eni	0	10,954	606,534	0	22,050	1,250,722	WA-33-L
Blina	Buru Energy	978	0	0	297,795	0	0	L6
Boundary	Buru Energy	220	0	0	20,963	0	0	L6
Cliff Head	Roc Oil	174,103	0	817	1,838,201	0	8,213	WA-31-L
Corybas	AWE	0	37	4,448	0	216	11,577	L2
Cossack	Woodside	29,304	0	757	12,877,611	0	385,734	WA-9-L
Cowle	Chevron	4,491	0	1,675	535,757	0	91,303	TL/4
Crest	Chevron	157	0	462	275,211	108	63,148	L12, L13
Crosby	BHP Billiton	1,127,653	0	61,126	3,036,273	0	133,316	WA-42-L
Dongara	AWE	1,127	0	20,718	194,221	49,681	12,909,840	L1, L2
Double Island	Apache	13,539	77	4,798	705,717	2,903	56,600	TL/9
Echo/Yodel	Woodside	0	143,523	158,395	0	10,891,375	13,725,948	WA-23/24-L
Enfield	Woodside	1,098,813	0	113,426	10,221,972	0	875,735	WA-28-L
Eremia	AWE	1,508	0	1,565	244,014	0	14,600	L1
Eskdale	BHP Billiton	80,977	0	140,094	479,877	0	408,404	WA-32-L
Exeter	Santos	40,513	0	281	2,553,642	0	5,278	WA-27-L
Goodwyn	Woodside	0	1,023,606	5,152,944	0	45,323,059	134,008,701	WA-5-L
Halyard	Apache	0	46,419	381,116	0	46,419	381,116	WA-13-L
Harriet	Apache	23,261	869	10,676	8,223,500	61,086	1,503,127	TL/1
Hermes	Woodside	359,977	0	22,444	13,041,458	0	867,312	WA-16-L
Hovea	AWE	10,926	0	3,367	1,168,641	251	103,837	L1
Jingemia	Origin	17,993	0	1,731	733,006	0	35,541	L14
John Brookes	Apache	0	130,450	2,300,669	0	875,778	14,256,540	WA-29-L
Laminaria East	Woodside	18,234	0	1,903	1,567,649	70,625	28,437	WA-18-L
Lee	Apache	4	902	7,327	4	108,395	714,849	TL/1
Little Sandy	Apache	1,232	11	655	93,463	467	13,956	TL/6
Macedon	BHP Billiton	0	0	16,725	0	0	33,486	WA-42-L
Mohave	Apache	7,324	138	3,606	162,376	369	30,435	TL/6
Mount Horner	AWE	48	0	0	298,141	0	0	L7
Mutineer	Santos	287,103	0	1,973	6,331,621	0	14,927	WA-26-L
North Alkimos	Apache	1,390	4	859	12,634	98	22,682	TL/6
North Rankin	Woodside	0	574,250	5,622,741	0	25,271,883	199,153,425	WA-1-L
Pedirka	Apache	6,458	54	3,497	333,396	1,308	40,698	TL/6
Perseus	Woodside	0	1,986,441	10,888,405	0	24,157,408	119,385,927	WA-1-L
Ravensworth	BHP Billiton	2,340,147	0	135,777	2,964,712	0	259,920	WA-42-L
Redback	Origin	0	127	113,928	0	142	125,103	L11
Roller	Chevron	38,797	0	14,141	7,156,359	0	770,034	TL/7
Rose	Apache	0	190	1,658	0	205,069	999,129	TL/1
Saladin	Chevron	60,973	0	20,834	15,529,297	0	1,761,885	TL/4
Searipple	Woodside	0	56,936	53,137	0	1,290,013	1,276,824	WA-1-L
Simpson	Apache	2,407	3,243	2,664	846,498	12,271	87,062	TL/1

Table 1. 2011 Production by Field and Cumulative Production as at 31 December 2011

Field	Operator	2011 Production by Field			Cumulative Production			Permit
		Oil	Condensate	Gas	Oil	Condensate	Gas	
		kL	kL	10 ³ m ³	kL	kL	10 ³ m ³	
Skate	Chevron	0	0	215	266,950	8,873	178,182	TL/7
South Plato	Apache	480	6	216	702,912	899	51,691	TL/6
Stag	Apache	396,032	0	8,983	8,956,222	0	407,704	WA-15-L
Stickle	BHP Billiton	914,784	0	65,655	2,458,238	0	170,287	WA-42-L
Stybarrow	BHP Billiton	1,161,179	0	67,575	7,569,638	0	455,757	WA-32-L
Sundown	Buru Energy	1,241	0	0	73,508	0	0	L8
Van Gogh	Apache	1,024,832	0	139,597	2,903,118	0	296,612	WA-35-L
Victoria	Apache	4,710	54	1,542	57,132	429	9,977	TL/6
Vincent	Woodside	1,352,271	0	172,030	4,305,031	0	907,720	WA-28-L
Wanaea	Woodside	55,672	0	12,549	39,241,582	0	8,423,159	WA-11-L
Wandoo	Vermillion	473,740	0	40,133	13,097,233	0	1,046,644	WA-14-L
West Cycad	Apache	5,973	182	5,168	214,793	527	35,804	TL/9
West Terrace	Buru Energy	394	0	0	39,522	0	0	L8
Wonnich	Apache	0	27,783	340,794	0	466,721	4,686,000	TL/8
Woollybutt	Eni	164,058	0	4,505	5,467,936	0	154,434	WA-25-L
Yammaderry	Chevron	467	0	10,212	858,223	0	117,938	TL/4
Cumulative production for developed fields currently not producing					46,945,988	3,311,131	29,041,439	
Total		11,658,809	6,433,941	35,283,319	276,447,930	119,498,187	582,547,055	

Table 2a. Petroleum Reserves Estimates by Basin as at 31 December 2010 (metric units)

Basin	Oil		Sales Gas		Condensate	
	GL		Gm ³		GL	
Category 1	P50	P90	P50	P90	P50	P90
Bonaparte	0.000	0.000	22.791	10.452	0.401	0.184
Northern Carnarvon	67.907	34.727	1,115.299	867.415	78.213	57.629
Perth	1.224	0.689	0.275	0.126	0.006	0.006
Total	69.13	35.42	1,138.37	877.99	78.62	57.82
Category 2	P50	P90	P50	P90	P50	P90
Bonaparte	0.000	0.000	60.698	34.118	1.650	0.957
Browse	0.000	0.000	447.750	267.289	57.540	34.620
Northern Carnarvon	4.129	2.217	766.544	437.410	39.316	20.114
Total	4.13	2.22	1,274.99	738.82	98.51	55.69
Category 3	P50	P90	P50	P90	P50	P90
Browse	0.000	0.000	406.659	301.754	99.125	73.423
Northern Carnarvon	3.790	2.350	261.716	184.435	20.913	13.615
Total	3.79	2.35	668.38	486.19	120.04	87.04
Category 4	P50	P90	P50	P90	P50	P90
Bonaparte	0.000	0.000	14.425	0.446	0.074	0.022
Browse	0.000	0.000	34.902	16.247	3.388	1.261
Carnarvon	41.388	22.909	436.638	272.571	17.268	10.324
Perth	0.000	0.000	5.500	5.500	0.000	0.000
Total	41.39	22.91	491.47	294.76	20.73	11.61
GRAND TOTAL	118.44	62.89	3,573.20	2,397.76	317.89	212.16

Table 2b. Petroleum Reserves Estimates by Basin as at 31 December 2010 (field units)

Basin	Oil		Sales Gas		Condensate	
	MMbbl		Tcf		MMbbl	
Category 1	P50	P90	P50	P90	P50	P90
Bonaparte	0.000	0.000	0.804	0.369	2.525	1.163
Northern Carnarvon	427.127	218.431	39.386	30.632	491.944	362.481
Perth	7.700	4.339	0.004	0.009	0.042	0.040
Total	434.83	222.77	40.19	31.01	494.51	363.68
Category 2	P50	P90	P50	P90	P50	P90
Bonaparte	0.000	0.000	2.143	1.204	10.378	6.025
Browse	0.000	0.000	15.812	9.439	361.915	217.753
Northern Carnarvon	25.974	13.947	27.070	15.447	247.295	126.518
Total	25.97	13.95	45.03	26.09	619.59	350.30
Category 3	P50	P90	P50	P90	P50	P90
Browse	0.000	0.000	14.361	10.656	623.479	461.817
Northern Carnarvon	23.838	14.781	9.242	6.513	131.539	85.637
Total	23.84	14.78	23.60	17.17	755.02	547.45
Category 4	P50	P90	P50	P90	P50	P90
Bonaparte	0.000	0.000	0.015	0.509	0.469	0.143
Browse	0.000	0.000	1.232	0.573	21.310	7.936
Carnarvon	260.327	144.097	15.419	9.625	108.616	64.936
Perth	0.000	0.000	0.194	0.194	0.000	0.000
Total	260.33	144.10	16.86	10.901	130.40	73.02
GRAND TOTAL	744.97	395.60	125.68	85.17	1,999.51	1,334.45

NOTES

Canning Basin reserves are too small to measure.

Category 1 comprises current reserves of those fields which are producing hydrocarbons or have been declared commercial (FFDP approved and FID).

Category 2 comprises estimates of recoverable reserves which are held under Retention Leases and have not yet been declared commercially viable.

Category 3 comprises estimates of contingent resources which are held in other licences and have been declared commercially viable but may or may not have a FFDP and have not yet reached FID.

Category 4 comprises estimates of contingent resources which are held in other licences and have not yet been declared commercially viable and are not held under a Retention Lease.

Reserves estimates for 2011 have not yet been submitted by industry to DMP.

Table 3. Seismic Surveys in Western Australia 2011 Calendar Year — Statistical Summary

		2D (line km)	3D (km ²)
Bonaparte Basin	Onshore		
	Offshore	1,648	183
Browse Basin	Onshore		
	Offshore	1,656 (a)	10,392
Canning Basin	Onshore	466	184
	Offshore		
Carnarvon Basin	Onshore		
	Offshore		1 6,937 (b)
Perth Basin	Onshore	111	92
	Offshore		
Subtotal	Onshore	577	276
	Offshore	3,304	27,512
Total		3,881	27,788

The above table lists the quantity of 2D seismic (line km) and 3D seismic (km²) acquired during the calendar year. For surveys that commenced before 1/1/2011 only acquisition after this date is included.

(a) Vampire Non-Exclusive 2D M.S.S. commenced 2010

(b) Endeavour MC3D Multiclient M.S.S., Enfield M5 4D M.S.S., Phoenix MC3D M.S.S., Salsa 3D M.S.S. and Zeebries MC3D M.S.S. commenced 2010

Table 5 is a listing of surveys operating in the calendar year and includes all data gathered prior to 31/12/2011.

Table 4. Petroleum Wells in Western Australia 2011 Calendar Year — Statistical Summary

		NFW	EXT	DEV	Subtotal	Total
		Wells	Wells	Wells	Wells	Wells
Bonaparte Basin	Onshore					2
	Offshore	2			2	
Browse Basin	Onshore					1
	Offshore	1			1	
Canning Basin	Onshore	3	2		5	5
	Offshore					
Carnarvon Basin	Onshore					41
	Offshore	19	11	11	41	
Perth Basin	Onshore	4	1		5	5
	Offshore					
Subtotal	Onshore	7	3		10	54
	Offshore	22	11	11	44	
Total		29	14	11	54	

Table 5. Seismic Surveys in Western Australia Operating 2011 Calendar Year

Survey Name	Class	On Off	Title	Operator	Commenced	Completed	2D Line km @ 31/12/2011	3D km ² @ 31/12/2011
Bonaparte Basin								
Rissa 3D M.S.S.	3D	Off	WA-422-P	Octanex	19/12/11			183
Falcon 2D M.S.S.	2D	Off	WA-440-P	Octanex	22/11/11	29/11/11	557	
Hawk 2D M.S.S.	2D	Off	WA-441-P	Octanex	17/11/11	27/11/11	511	
Kingfisher 2D M.S.S.	2D	Off	WA-420-P, WA-421-P	Octanex	10/11/11	16/11/11	580	
Browse Basin								
Aurora MC3D M.S.S.	3D	Off	SL/10-1	PGS	27/12/10	30/06/11		9,625
Byron 3D M.S.S.	3D	Off	WA-396-P, WA-397-P	Woodside	25/04/11	7/05/11		562
Tridacna 3D OBC M.S.S.	3D	Off	WA-30-R R1, TR/5 R1	Woodside	31/07/11	14/11/11		205
Vampire Non-Exclusive 2D M.S.S.	2D	Off	1SL/10-1	Searcher Seismic	1/11/10	1/02/11	7,232	
Canning Basin								
Yulleroo 3D S.S.	3D	On	EP 391 R2, EP 428, EP 436	Buru	17/07/11	20/08/11		184
Athos 2D S.S.	2D	On	EP 473, EP 438	Buru	25/08/11	15/09/11	299	
Commodore East 2D S.S.	2D	On	EP 390 R2, EP 471	Buru	18/09/11	29/09/11	167	
Carnarvon Basin								
Cambozola 3D M.S.S.	3D	Off	WA-290-P R1	Apache	22/05/11	27/06/11		964
Chamois 3D M.S.S.	3D	Off	WA-261-P R2	Apache	16/03/11	9/04/11		257
CVSAN11 Winchester 3D M.S.S.	3D	Off	WA-323-P R1	Santos	22/10/11	21/11/11		707
Endeavour MC3D Multiclient M.S.S.	3D	Off	3SL/10-1	Western Geco	6/12/10	11/03/11		1,851
Enfield M5 4D M.S.S.	4D	Off	WA-28-L	Woodside	28/12/10	12/01/11		305
Gazelle 3D M.S.S.	3D	Off	WA-399-P	Apache	28/02/11	11/03/11		135
Kultarr 3D M.S.S.	3D	Off	WA-334-P R1	Apache	11/04/11	19/04/11		229
Mary Rose MC3D M.S.S.	3D	Off	WA-2-SPA	TGS Nopec	6/11/11			3,620
Movida 3D M.S.S.	3D	Off	WA-389-P	Woodside	10/03/11	2/04/11		1,613
Orcus 3D M.S.S.	3D	Off	WA-450-P	Apache	9/02/11	20/05/11		266
Phoenix MC3D M.S.S.	3D	Off	11SL/10-1	Fugro	9/12/10	16/02/11		1,212
Pomodoro 3D M.S.S.	3D	Off	WA-426-P	Apache	16/01/11	9/02/11		317
Salsa 3D M.S.S.	3D	Off	WA-384-P	Shell	28/12/10	5/02/11		300
Sovereign 3D M.S.S.	3D	Off	WA-383-P	Chevron	6/04/11	21/04/11		1,014
Stybarrow 4D Monitor M.S.S.	4D	Off	WA-32-L	BHPB	2/05/11	19/05/11		82
Wheatstone MAZ 3D M.S.S.	3D	Off	WA-17-R, WA-39-R	Chevron	16/11/11			906
Zeebries MC3D M.S.S.	3D	Off	5SL/10-1	Fugro	3/12/10	3/05/11		3,816
Zeester MC3D M.S.S.	3D	Off	WA-3-SPA	Fugro	13/12/11			1,124
Zeus MC3D M.S.S.	3D	Off	10-SL1/10-1	Fugro	6/09/11	3/12/11		2,089
Perth Basin								
Warro 3D S.S.	3D	On	EP 407 R1	Latent Petroleum	16/03/11	28/03/11		92
Garibaldi 2D S.S.	2D	On	EP 430, EP 454	Empire	1/04/11	12/04/11	88	
Warradarge S.S.	2D	On	DR 11	Westralian Gas and Power	29/08/11	28/09/11	23	

Class – Classification

2D – 2D Reflection, 3D – 3D Reflection, 4D – 4D Reflection, MC – multiclient

Table 6. Petroleum Wells in Western Australia Operating 2011 Calendar Year

Well Name	Class	Offshore	Title	Operator	Latitude
Bonaparte Basin					
Durville 1	NFW	Y	WA-403-P	Total	-11.520664
Laperouse 1	NFW	Y	WA-403-P	Total	-11.778556
Browse Basin					
Omar 1	NFW	Y	WA-397-P	Woodside	-15.065825
Canning Basin					
Lawford 1 Deepening	EXT	N	EP 417 R1	Buru	-19.992722
Ungani 2	EXT	N	EP 391 R2	Buru	-17.990583
Pictor East 1	NFW	N	EP 431	Buru	-18.770639
Ungani 1	NFW	N	EP 391 R2	Buru	-17.990444
Valhalla 2	NFW	N	EP 371 R1	Buru	-18.067814
Carnarvon Basin					
GOR-B 3	DEV	Y	WA-37-L	Chevron	-20.519800
GOR-C 1	DEV	Y	WA-37-L	Chevron	-20.407877
GOR-C 3	DEV	Y	WA-37-L	Chevron	-20.519956
GOR-E 1	DEV	Y	WA-37-L	Chevron	-20.408104
GOR-F 1	DEV	Y	WA-37-L	Chevron	-20.408339
Stag 36H ST2	DEV	Y	WA-15-L	Apache	-20.295517
Stag 38H	DEV	Y	WA-15-L	Apache	-20.288897
Stag 39H	DEV	Y	WA-15-L	Apache	-20.289862
Stag 40H WI ST1	DEV	Y	WA-15-L	Apache	-20.290031
VN-B 7H	DEV	Y	WA-28-L	Woodside	-21.433447
VN-B 5H L2 ST1	DEV	Y	WA-28-L	Woodside	-21.433700
VN-B 6H L3	DEV	Y	WA-28-L	Woodside	-21.433927
Acme West 2	EXT	Y	WA-205-P R3	Chevron	-20.204244
Bravo 2	EXT	Y	WA-390-P	Hess	-20.034312
Chandon 3	EXT	Y	WA-268-P R2	Chevron	-19.597942
Chester 2	EXT	Y	WA-390-P	Hess	-20.480061
Chrysaor 2	EXT	Y	WA-15-R R1	Chevron	-20.140911
Glencoe 2H	EXT	Y	WA-390-P	Hess	-20.082453
Laverda East 1	EXT	Y	WA-36-R	Woodside	-21.518978
Laverda North 1	EXT	Y	WA-36-R	Woodside	-21.512422
Laverda North 2	EXT	Y	WA-36-R	Woodside	-21.512422
Mentorc 2	EXT	Y	WA-390-P	Hess	-20.483429
Noblige 2	EXT	Y	WA-404-P	Woodside	-19.409778
West Tryal Rocks 4A	EXT	Y	WA-5-R R3	Chevron	-20.235992
Acme West 1	NFW	Y	WA-205-P R3	Chevron	-20.204243
Balnaves Deep 1	NFW	Y	WA-356-P	Apache	-20.082837
Cadwallon 1	NFW	Y	WA-434-P	Woodside	-19.915220
Crusader 1	NFW	Y	WA-35-L	Apache	-21.397076
Finucane South 1	NFW	Y	WA-191-P R5	Santos	-19.304783
Fullswing 1	NFW	Y	WA-412-P	Japan Energy	-19.387607
Galahad 1	NFW	Y	WA-363-P	Eni	-17.766997
Gawain 1	NFW	Y	WA-362-P	Eni	-18.172822
Genseric 1	NFW	Y	WA-434-P	Woodside	-19.912260
Hannah 1	NFW	Y	TP/8 R3	Apache	-20.806583
Kelt 1	NFW	Y	WA-404-P	Woodside	-19.231999
La Rocca 1	NFW	Y	WA-388-P	Apache	-19.243957

Longitude	Gnd Elev/ Water Depth	RT/ KB	Spud Date	TD Date	Rig Release Date
127.116439	109	25	7/01/11	2/03/11	12/03/11
127.306222	122	25	14/03/11	14/05/11	25/05/11
121.292265	379	26	19/03/11	18/05/11	29/05/11
126.630917	293	298	28/09/11	23/10/11	27/10/11
123.014030	55	61	2/11/11	13/12/11	
123.725917	143	148	9/08/11	28/08/11	2/09/11
123.164111	55	61	13/08/11	24/09/11	18/10/11
124.767833	110	116	6/06/11	17/07/11	31/07/11
114.823844	199	29	13/07/11	2/10/11	
114.849121	217	29	10/11/11		
114.824006	199	29	15/07/11	18/08/11	
114.849525	217	29	7/11/11		
114.849602	217	29	7/11/11		
116.258725	49	61	16/12/10	21/01/11	29/01/11
116.273050	48	60	31/07/11	4/09/11	18/09/11
116.275266	49	60	25/07/11	10/09/11	18/09/11
116.246086	48	60	27/11/11	10/12/11	
114.033257	393	23	12/03/11		
114.033393	393	23	2/03/11	1/06/11	2/08/11
114.032688	392	23	28/02/11	3/05/11	2/08/11
114.799081	948	22	14/09/11	28/09/11	16/10/11
113.625869	1,088	29	22/04/11	2/05/11	17/05/11
114.156267	1,208	22	2/03/11	20/03/11	1/04/11
113.905583	1,126	22	5/06/11	3/08/11	16/08/11
114.886656	920	22	3/04/11	29/04/11	16/05/11
113.832117	1,117	22	19/08/11		
113.871772	80	26	22/09/11	5/10/11	15/10/11
113.863008	809	32	9/12/10	7/04/11	23/04/11
113.863008	809	32	14/04/11	15/04/11	23/04/11
113.739542	1,134	29	12/03/11	10/04/11	19/04/11
114.343436	1,324	32	17/08/11	20/09/11	4/10/11
115.028789	139	22	18/05/11	22/06/11	24/07/11
114.799082	948	22	27/07/11	7/09/11	16/10/11
115.176164	135	22	18/03/11	16/04/11	27/04/11
111.614616	2,007	32	8/10/11	12/11/11	21/11/11
114.022591	428	22	11/02/11	10/03/11	16/03/11
116.758364	133	25	3/05/11	23/05/11	30/05/11
116.303554	134	22	19/12/10	24/01/11	7/02/11
115.749233	1,577	25	25/04/11	15/05/11	26/05/11
115.006972	1,963	25	12/02/11	12/04/11	22/04/11
111.764725	1,882	32	23/11/11	2/12/11	9/12/11
115.657211	21	39	10/11/11	17/11/11	21/11/11
114.425936	1,445	32	1/07/11	5/08/11	16/08/11
115.686296	407	22	30/04/11	25/05/11	6/06/11

Table 6. Petroleum Wells in Western Australia Operating 2011 Calendar Year

Well Name	Class	Offshore	Title	Operator	Latitude
Martin 1	NFW	Y	WA-404-P	Woodside	-19.425812
Opel 1	NFW	Y	WA-36-R	Woodside	-21.514095
Opel 2	NFW	Y	WA-36-R	Woodside	-21.514095
Ragnar 1A	NFW	Y	WA-430-P	Woodside	-21.335484
Seraph 1 ST1	NFW	Y	WA-3-L R1	Woodside	-19.472756
Tidepole East 1	NFW	Y	WA-5-L R1	Woodside	-19.768437
Vos 1	NFW	Y	WA-439-P	Chevron	-20.387104
Xeres 1	NFW	Y	WA-34-L	Woodside	-19.915387
Zagreus 1	NFW	Y	WA-40-L	Chevron	-20.135336
Zola 1	NFW	Y	WA-290-P R1	Apache	-20.811342
Perth Basin					
Warro 4	EXT	N	EP 407 R1	Latent	-30.171806
Arrowsmith 2	NFW	N	EP 413 R2	Norwest Energy	-29.613253
Dibblers 1	NFW	N	EP 437	CalEnergy	-29.109417
Dunnart 1	NFW	N	EP 437	CalEnergy	-29.156694
Red Gully 1	NFW	N	EP 389 R1	Empire	-31.180491
Redhill South 1	NFW	N	TP/15 R1	Norwest Energy	-29.296547

Classification

DEV Development Well

EXT Extension Well

NFW New Field Wildcat

Longitude	Gnd Elev/ Water Depth	RT/ KB	Spud Date	TD Date	Rig Release Date
114.376125	1,343	32	14/12/10	13/03/11	24/03/11
113.842368	841	32	6/12/10	21/10/11	7/11/11
113.842368	840	26	26/10/11	27/10/11	7/11/11
113.608994	1,160	26	10/11/11		
116.630108	84	23	6/08/11	10/09/11	12/11/11
115.895634	109	23	18/11/11	6/12/11	19/12/11
111.830590	1,484	22	20/10/11	14/11/11	28/11/11
115.251087	190	32	27/04/11	20/05/11	18/06/11
114.116322	1,189	29	27/05/11	26/06/11	8/07/11
114.712135	285	25	1/12/10	9/04/11	27/04/11
115.733167	279	286	11/04/11	5/05/11	11/05/11
115.120678	42	50	30/05/11	18/06/11	
114.906056	15	18	21/01/11	3/02/11	8/02/11
114.937667	42	45	5/12/10	11/01/11	16/01/11
115.826323	177	184	6/01/11	11/02/11	2/03/11
114.926067	2	7	28/02/11	19/03/11	22/03/11

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

OFFSHORE PETROLEUM AND GREENHOUSE GAS STORAGE ACT 2006 Access Authority			
Title	Registered Holders		
WA-1-AA	Fugro Multi Client Services Pty Ltd	WA-209-P R3	Santos Offshore Pty Ltd
WA-2-AA	Chevron (TAPL) Pty Ltd		* Apache Northwest Pty Ltd
	Chevron Australia Pty Ltd	WA-214-P R3	Santos (BOL) Pty Ltd
WA-3-AA	Goldsborough Energy Pty Ltd		* Apache Northwest Pty Ltd
WA-4-AA	Goldsborough Energy Pty Ltd	WA-253-P R2	Chevron (TAPL) Pty Ltd
WA-5-AA	Octanex N.L.		* Chevron Australia Pty Ltd
	Santos Offshore Pty Ltd	WA-254-P R2	Apache Northwest Pty Ltd
	Strata Resources Pty Ltd		FAR Ltd
WA-6-AA	Goldsborough Energy Pty Ltd		Pan Pacific Petroleum NL
WA-7-AA	TGS-Nopec Geophysical Company Pty Ltd		Senex Energy Limited
WA-8-AA	National Oil Corporation Pty Ltd		Sun Resources NL
WA-9-AA	Goldsborough Energy Pty Ltd	WA-255-P R2	Woodside Energy Ltd
WA-10-AA	Goldsborough Energy Pty Ltd		* BHP Billiton Petroleum (Australia) Pty Ltd
WA-11-AA	Apache Northwest Pty Ltd	WA-261-P R2	Apache Northwest Pty Ltd
WA-12-AA	Fugro Multi Client Services Pty Ltd		Bow Energy Ltd
WA-13-AA	TGS-Nopec Geophysical Company Pty Ltd		Strike Energy Limited
		WA-268-P R2	Chevron (TAPL) Pty Ltd
			Chevron Australia Pty Ltd
			Mobil Australia Resources Company Pty Limited
			Shell Development (Australia) Proprietary Limited
		WA-269-P R2	Japan Australia LNG (MIMI) Pty Ltd
			Woodside Energy Ltd
		WA-271-P R2	Mitsui E&P Australia Pty Limited
			* Woodside Energy Ltd
		WA-274-P R1	Chevron Australia (WA-274-P) Pty Ltd
			Inpex Browse Ltd
			* Coveyork Pty Limited
		WA-275-P R2	BHP Billiton Petroleum (North West Shelf) Pty Ltd
			BP Developments Australia Pty Ltd
			Chevron Australia Pty Ltd
			Shell Development (Australia) Proprietary Limited
			Woodside Energy Ltd
		WA-281-P R1	Beach Energy Limited
			Chevron Australia (WA-281-P) Pty Ltd
			Inpex Browse Ltd
			* Santos Offshore Pty Ltd
		WA-285-P R2	Inpex Browse Ltd
			Total E & P Australia
		WA-290-P R1	Nippon Oil Exploration (Dampier) Pty Ltd
			OMV Australia Pty Ltd
			Santos Offshore Pty Ltd
			Tap (Shelfal) Pty Ltd
			* Apache Northwest Pty Ltd
		WA-302-P R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
		WA-313-P R1	Eni Australia B.V.
		WA-314-P	ConocoPhillips (Browse Basin) Pty Ltd
			Karoon Gas Browse Basin Pty Ltd
		WA-315-P	ConocoPhillips (Browse Basin) Pty Ltd
			Karoon Gas Browse Basin Pty Ltd
		WA-320-P R1	Tap (Shelfal) Pty Ltd
			* OMV Australia Pty Ltd
		WA-323-P R1	Octanex N.L.

OFFSHORE PETROLEUM AND GREENHOUSE GAS STORAGE ACT 2006 Exploration Permit			
Title	Registered Holders (*denotes Nominee)		
WA-1-P R7	Apache Northwest Pty Ltd		
	Santos Limited		
WA-18-P R6	Bonaparte Gas & Oil Pty Limited		
	Santos Limited		
	* GDF SUEZ Bonaparte Pty Ltd		
WA-28-P R7	BHP Billiton Petroleum (North West Shelf) Pty Ltd		
	BP Developments Australia Pty Ltd		
	CNOOC NWS Private Limited		
	Chevron Australia Pty Ltd		
	Japan Australia LNG (MIMI) Pty Ltd		
	Shell Development (Australia) Proprietary Limited		
	Woodside Energy Ltd		
WA-155-P R5	Apache Permits Pty Ltd		
	BHP Billiton Petroleum (Australia) Pty Ltd		
	Inpex Alpha Ltd		
WA-191-P R5	Kufpec (Perth) Pty Ltd		
	Nippon Oil Exploration (Dampier) Pty Ltd		
	Santos Limited		
	Tap (Shelfal) Pty Ltd		
WA-192-P R5	Apache Northwest Pty Ltd		
WA-202-P R4	Apache Northwest Pty Ltd		
WA-205-P R4	Chevron (TAPL) Pty Ltd		
	Shell Development (Australia) Proprietary Limited		
	* Chevron Australia Pty Ltd		
WA-208-P R3	Apache Northwest Pty Ltd		
	Beach Energy Limited		
	Eni Australia Limited		
	Santos Limited		
	Santos Offshore Pty Ltd		

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

	Santos Offshore Pty Ltd	WA-362-P	Eni Australia Limited
	Strata Resources Pty Ltd		Exmouth Exploration Pty Ltd
WA-330-P R1	Octanex N.L.		Octanex N.L.
	Santos Offshore Pty Ltd		Strata Resources N.L.
	Strata Resources Pty Ltd		* OMV Australia Pty Ltd
WA-334-P R1	Tap (Harriet) Pty Ltd	WA-363-P	Eni Australia Limited
	* Apache Northwest Pty Ltd		Exmouth Exploration Pty Ltd
WA-335-P	Apache Northwest Pty Ltd		Octanex N.L.
	Kufpec Australia Pty Ltd		Strata Resources N.L.
	* BHP Billiton Petroleum (North West Shelf) Pty Ltd		* OMV Australia Pty Ltd
WA-341-P R1	Inpex Browse Ltd	WA-364-P R1	Chevron Australia (WA-364-P) Pty Ltd
	Total E & P Australia		Shell Development (Australia) Proprietary Limited
WA-342-P R1	Auralandia N.L.	WA-365-P R1	Chevron Australia (WA-365-P) Pty Ltd
	Coldron Pty Ltd		Shell Development (Australia) Proprietary Limited
	Cornea Energy Pty Ltd	WA-366-P R1	Chevron Australia (WA-366-P) Pty Ltd
	Cornea Oil & Gas Pty Ltd		Shell Development (Australia) Proprietary Limited
	Cornea Petroleum Pty Ltd	WA-367-P R1	Chevron Australia (WA-367-P) Pty Ltd
	Cornea Resources Pty Ltd		Shell Development (Australia) Proprietary Limited
	Moby Oil & Gas Limited	WA-371-P	Shell Development (Australia) Proprietary Limited
	Octanex N.L.	WA-374-P	Mobil Australia Resources Company Pty Limited
WA-343-P	Inpex Browse Ltd		Shell Development (Australia) Proprietary Limited
	Total E & P Australia		* Chevron Australia (WA-374-P) Pty Ltd
WA-344-P R1	Inpex Browse Ltd	WA-375-P	Goldsborough Energy Pty Ltd
	Total E & P Australia		Torrens Oil & Gas Pty Ltd
WA-346-P R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd	WA-376-P	Goldsborough Energy Pty Ltd
WA-347-P R1	Kansai Electric Power Australia Pty Ltd		Torrens Oil & Gas Pty Ltd
	Tokyo Gas Pluto Pty Ltd	WA-377-P	Nexus Energy WA377P Pty Ltd
	Woodside Burrup Pty Ltd	WA-378-P	Mitsui E&P Australia Pty Limited
WA-348-P R1	Kansai Electric Power Australia Pty Ltd		PTTEP Australasia (Ashmore Cartier) Pty Ltd
	Tokyo Gas Pluto Pty Ltd		Toyota Tsusho Gas E&P Browse Pty Ltd
	* Woodside Burrup Pty Ltd		Woodside Energy Ltd
WA-350-P R1	Kansai Electric Power Australia Pty Ltd	WA-379-P	Arcadia Petroleum Limited
	Tokyo Gas Pluto Pty Ltd		Cathay Petroleum International Limited
	Woodside Burrup Pty Ltd	WA-380-P	Arcadia Petroleum Limited
WA-351-P R1	Apache Northwest Pty Ltd		Cathay Petroleum International Limited
	BHP Billiton Petroleum (North West Shelf) Pty Ltd	WA-383-P	Shell Development (Australia) Proprietary Limited
	Tap (Shelfal) Pty Ltd		* Chevron Australia (WA-383-P) Pty Ltd
WA-356-P	Apache Julimar Pty Ltd	WA-384-P	Diamond Resources Exmouth Pty Ltd
	Kufpec Australia (Julimar) Pty Ltd		* Shell Development (Australia) Proprietary Limited
WA-357-P	Inpex Alpha Ltd	WA-385-P	Shell Development (Australia) Proprietary Limited
	* Apache Northwest Pty Ltd	WA-386-P	Eni Australia Limited
WA-358-P	OMV Australia Pty Ltd		Exmouth Exploration Pty Ltd
WA-359-P	Cue Exploration Pty Ltd		* OMV Australia Pty Ltd
	Exoil Limited	WA-387-P	Eni Australia Limited
	* Apache Northwest Pty Ltd		Exmouth Exploration Pty Ltd
WA-360-P	Cue Exploration Pty Ltd		* OMV Australia Pty Ltd
	North West Shelf Exploration Pty Ltd	WA-388-P	Apache Northwest Pty Ltd
	Petrobras International Braspetro BV - PIB BV		Bharat PetroResources Limited
	Rankin Trend Pty Ltd		Gujarat State Petroleum Corporation Limited
WA-361-P R1	Cue Exploration Pty Ltd		Hindustan Petroleum Corporation Ltd
	Mineralogy Pty Ltd		Oilex Limited
	North West Shelf Exploration Pty Ltd		Sasol Petroleum Australia Ltd

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

	Videocon Industries Ltd	WA-421-P	Goldsborough Energy Pty Ltd
WA-389-P	Cue Exploration Pty Ltd	WA-422-P	National Oil Corporation Pty Ltd
	Woodside Burrup Pty Ltd	WA-423-P	Diamond Resources Australia Pty Ltd
WA-390-P	Hess Exploration Australia Pty Limited		PTTEP Australia Offshore Pty Ltd
WA-391-P	OMV Australia Pty Ltd		* Murphy Australia Oil Pty Ltd
WA-392-P	Chevron Australia (WA-392-P) Pty Ltd	WA-424-P	IPM WA 424P Pty Ltd
	Mobil Australia Resources Company Pty Limited	WA-425-P	Mitsui E&P Australia Pty Limited
	Shell Development (Australia) Proprietary Limited		SK Innovation Co., Ltd
WA-394-P	Shell Development (Australia) Proprietary Limited		* Hunt Oil Australia Permit 425 Holding Company Pty Ltd
WA-396-P	Mitsui E&P Australia Pty Limited	WA-426-P	Apache Northwest Pty Ltd
	PTTEP Australasia (Ashmore Cartier) Pty Ltd	WA-427-P	Apache Northwest Pty Ltd
	Toyota Tsusho Gas E&P Browse Pty Ltd		Kufpec (Perth) Pty Ltd
	Woodside Energy Ltd	WA-428-P	Mitsui E&P Australia Pty Limited
WA-397-P	Mitsui E&P Australia Pty Limited		Woodside Energy Ltd
	PTTEP Australasia (Ashmore Cartier) Pty Ltd	WA-429-P	Mitsui E&P Australia Pty Limited
	Toyota Tsusho Gas E&P Browse Pty Ltd		Woodside Energy Ltd
	Woodside Energy Ltd	WA-430-P	Mitsui E&P Australia Pty Limited
WA-398-P	ConocoPhillips (Browse Basin) Pty Ltd		Woodside Energy Ltd
	Karoon Gas Browse Basin Pty Ltd	WA-431-P	Mitsui E&P Australia Pty Limited
WA-399-P	Carnarvon Petroleum Limited		SK Innovation Co., Ltd
	Jacka Resources Limited		* Hunt Oil Australia Permit 431 Holding Company Pty Ltd
	Rialto Energy Limited	WA-432-P	Mitsui E&P Australia Pty Limited
	* Apache Northwest Pty Ltd		Woodside Energy Ltd
WA-402-P	Petronas Carigali (Australia) Pty Ltd	WA-433-P	Mitsui E&P Australia Pty Limited
	Total E & P Australia		Woodside Energy Ltd
WA-403-P	Petronas Carigali (Australia) Pty Ltd	WA-434-P	Woodside Energy Ltd
	Total E & P Australia	WA-435-P	Carnarvon Petroleum Limited
WA-404-P	Woodside Energy Ltd		Finder Exploration Pty Ltd
WA-405-P	Reliance Exploration & Production DMCC	WA-436-P	Carnarvon Petroleum Limited
WA-407-P	Goldsborough Energy Pty Ltd		Finder Exploration Pty Ltd
WA-408-P	Total E & P Australia	WA-437-P	Carnarvon Petroleum Limited
WA-409-P	Cue Exploration Pty Ltd		Finder Exploration Pty Ltd
	Rankin Trend Pty Ltd	WA-438-P	Carnarvon Petroleum Limited
	* Apache Northwest Pty Ltd		Finder Exploration Pty Ltd
WA-410-P	Chevron Australia (WA-410-P) Pty Ltd	WA-439-P	Chevron Australia (WA-439-P) Pty Ltd
	Inpex Browse Ltd		Shell Development (Australia) Proprietary Limited
	Santos Offshore Pty Ltd	WA-440-P	Goldsborough Energy Pty Ltd
WA-411-P	Beach Energy Limited	WA-441-P	Goldsborough Energy Pty Ltd
	Inpex Browse Ltd	WA-442-P	Ansbachall Pty Limited
	Santos Offshore Pty Ltd		Tangiers Petroleum Limited
WA-412-P	Japan Energy E&P Australia Pty Ltd	WA-443-P	Carnarvon Petroleum Limited
WA-413-P	Hunt Oil Australia Permit 413 Holding Company Pty Ltd	WA-444-P	Chevron Australia (WA-444-P) Pty Ltd
WA-414-P	Mitsui E&P Australia Pty Limited		Mobil Australia Resources Company Pty Limited
	* Hunt Oil Australia Permit 414 Holding Company Pty Ltd		Shell Development (Australia) Proprietary Limited
WA-415-P	Woodside Energy Ltd	WA-445-P	Finder No 2 Pty Limited
WA-416-P	Woodside Energy Ltd	WA-446-P	Finder No 1 Pty Limited
WA-417-P	Woodside Energy Ltd	WA-447-P	Mitsui E&P Australia Pty Limited
WA-418-P	Finder Exploration Pty Ltd		Woodside Energy Ltd
	* Apache Northwest Pty Ltd	WA-448-P	Japan Australia LNG (MIMI) Pty Ltd
WA-419-P	Emerald Gas Pty Ltd		Woodside Energy Ltd
WA-420-P	Goldsborough Energy Pty Ltd		

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

WA-449-P	Mitsui E&P Australia Pty Limited Woodside Energy Ltd	WA-3-PL	Inpex Alpha Ltd Mobil Exploration & Producing Australia Pty Ltd
WA-450-P	Finder No 4 Pty Limited * Apache Northwest Pty Ltd		* BHP Billiton Petroleum (Australia) Pty Ltd
WA-451-P	Woodside Energy Ltd	WA-4-PL	BHP Billiton Petroleum (North West Shelf) Pty Ltd BP Developments Australia Pty Ltd
WA-452-P	Riverina Energy Ltd		Chevron Australia Pty Ltd
WA-453-P	Apache Energy Limited		Japan Australia LNG (MIMI) Pty Ltd
WA-454-P	MEO Australia Ltd		Shell Development (Australia) Proprietary Limited
WA-455-P	Chevron Australia (WA-455-P) Pty Ltd		* Woodside Energy Ltd
WA-456-P	Chevron Australia (WA-456-P) Pty Ltd	WA-5-PL	Apache East Spar Pty Ltd Apache Kersail Pty Ltd
WA-457-P	Flow Energy Limited		Santos (BOL) Pty Ltd
WA-458-P	Flow Energy Limited		* Apache Oil Australia Pty Ltd
WA-459-P	Santos Offshore Pty Ltd	WA-6-PL	Apache Northwest Pty Ltd Santos (GLOBE) Pty Ltd
WA-460-P	Cottesloe Oil and Gas Pty Ltd Strike Energy Limited WHL Energy Limited		Santos Offshore Pty Ltd
WA-461-P	Mitsui E&P Australia Pty Limited Woodside Energy Ltd	WA-7-PL	Apache Northwest Pty Ltd Santos Limited
WA-462-P	Shell Development (Australia) Proprietary Limited Woodside Energy Ltd	WA-8-PL	ConocoPhillips Pipeline Australia Pty Ltd ENI GAS & POWER LNG AUSTRALIA B.V. Inpex DLNGPL Pty Ltd
WA-463-P	Mitsui E&P Australia Pty Limited Woodside Energy Ltd		Santos Timor Sea Pipeline Pty Ltd TEPCO Darwin LNG Pty Ltd
WA-464-P	Shell Development (Australia) Proprietary Limited Woodside Energy Ltd		Tokyo Gas Darwin LNG Pty Ltd
WA-465-P	Woodside Energy Ltd	WA-9-PL	BHP Billiton Petroleum (North West Shelf) Pty Ltd BP Developments Australia Pty Ltd Chevron Australia Pty Ltd
WA-466-P	Shell Development (Australia) Proprietary Limited Woodside Energy Ltd		Japan Australia LNG (MIMI) Pty Ltd Shell Development (Australia) Proprietary Limited
WA-467-P	Woodside Energy Ltd		* Woodside Energy Ltd
OFFSHORE PETROLEUM AND GREENHOUSE GAS STORAGE ACT 2006 Infrastructure Licence		WA-10-PL	BHP Billiton Petroleum (North West Shelf) Pty Ltd BP Developments Australia Pty Ltd Chevron Australia Pty Ltd
Title	Registered Holders (* denotes Nominee)		Japan Australia LNG (MIMI) Pty Ltd Shell Development (Australia) Proprietary Limited
WA-1-IL	Kansai Electric Power Australia Pty Ltd Tokyo Gas Pluto Pty Ltd Woodside Burrup Pty Ltd		* Woodside Energy Ltd
WA-2-IL	Shell Development (Australia) Proprietary Limited	WA-11-PL	Apache Northwest Pty Ltd Santos (BOL) Pty Ltd
OFFSHORE PETROLEUM AND GREENHOUSE GAS STORAGE ACT 2006 Pipeline Licence		WA-12-PL	ARC (Offshore PB) Limited AWE Oil (Western Australia) Pty Ltd Cienco Energy Australia Pty Ltd Roc Oil (WA) Pty Limited
Title	Registered Holders (* denotes Nominee)	WA-13-PL	BHP Billiton Petroleum (North West Shelf) Pty Ltd BP Developments Australia Pty Ltd Chevron Australia Pty Ltd
WA-1-PL	BHP Billiton Petroleum (North West Shelf) Pty Ltd BP Developments Australia Pty Ltd Chevron Australia Pty Ltd Japan Australia LNG (MIMI) Pty Ltd Shell Development (Australia) Proprietary Limited * Woodside Energy Ltd		Japan Australia LNG (MIMI) Pty Ltd Shell Development (Australia) Proprietary Limited Woodside Energy Ltd
WA-2-PL	BHP Billiton Petroleum (North West Shelf) Pty Ltd BP Developments Australia Pty Ltd Chevron Australia Pty Ltd Japan Australia LNG (MIMI) Pty Ltd Shell Development (Australia) Proprietary Limited * Woodside Energy Ltd	WA-14-PL	BHP Billiton Petroleum (North West Shelf) Pty Ltd BP Developments Australia Pty Ltd Chevron Australia Holdings Pty Ltd Japan Australia LNG (MIMI) Pty Ltd

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

	Shell Development (Australia) Proprietary Limited		BP Developments Australia Pty Ltd
	Woodside Energy Ltd		CNOOC NWS Private Limited
WA-15-PL	Eni Australia B.V.		Chevron Australia Pty Ltd
WA-16-PL	Kansai Electric Power Australia Pty Ltd		Japan Australia LNG (MIMI) Pty Ltd
	Tokyo Gas Pluto Pty Ltd		Shell Development (Australia) Proprietary Limited
	Woodside Burrup Pty Ltd		Woodside Energy Ltd
WA-17-PL	Kansai Electric Power Australia Pty Ltd	WA-4-L R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	Tokyo Gas Pluto Pty Ltd		BP Developments Australia Pty Ltd
	Woodside Burrup Pty Ltd		CNOOC NWS Private Limited
WA-18-PL	Apache Northwest Pty Ltd		Chevron Australia Pty Ltd
	Santos Offshore Pty Ltd		Japan Australia LNG (MIMI) Pty Ltd
WA-19-PL	Chevron (TAPL) Pty Ltd		Shell Development (Australia) Proprietary Limited
	Chevron Australia Pty Ltd		Woodside Energy Ltd
	Chubu Electric Power Gorgon Pty Ltd	WA-5-L R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	Mobil Australia Resources Company Pty Limited		BP Developments Australia Pty Ltd
	Osaka Gas Gorgon Pty Ltd		CNOOC NWS Private Limited
	Shell Development (Australia) Proprietary Limited		Chevron Australia Pty Ltd
	Tokyo Gas Gorgon Pty Ltd		Japan Australia LNG (MIMI) Pty Ltd
WA-20-PL	Chevron (TAPL) Pty Ltd		Shell Development (Australia) Proprietary Limited
	Chevron Australia Pty Ltd		Woodside Energy Ltd
	Chubu Electric Power Gorgon Pty Ltd	WA-6-L R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	Mobil Australia Resources Company Pty Limited		BP Developments Australia Pty Ltd
	Osaka Gas Gorgon Pty Ltd		CNOOC NWS Private Limited
	Shell Development (Australia) Proprietary Limited		Chevron Australia Pty Ltd
	Tokyo Gas Gorgon Pty Ltd		Japan Australia LNG (MIMI) Pty Ltd
WA-21-PL	Apache East Spar Pty Ltd		Shell Development (Australia) Proprietary Limited
	Apache Kersail Pty Ltd		Woodside Energy Ltd
	Apache Oil Australia Pty Ltd	WA-8-L R1	Kufpec (Perth) Pty Ltd
	Santos (BOL) Pty Ltd		Santos Limited
WA-22-PL	Ichthys LNG Pty Ltd		Tap (Shelfal) Pty Ltd
WA-23-PL	Apache PVG Pty Ltd	WA-9-L	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	BHP Billiton Petroleum (Australia) Pty Ltd		BP Developments Australia Pty Ltd
			CNOOC NWS Private Limited
			Chevron Australia Pty Ltd
			Japan Australia LNG (MIMI) Pty Ltd
			Shell Development (Australia) Proprietary Limited
			Woodside Energy Ltd
		WA-10-L	Inpex Alpha Ltd
			Mobil Exploration & Producing Australia Pty Ltd
			* BHP Billiton Petroleum (Australia) Pty Ltd
		WA-11-L	BHP Billiton Petroleum (North West Shelf) Pty Ltd
			BP Developments Australia Pty Ltd
			CNOOC NWS Private Limited
			Chevron Australia Pty Ltd
			Japan Australia LNG (MIMI) Pty Ltd
			Shell Development (Australia) Proprietary Limited
			Woodside Energy Ltd
		WA-12-L	Mobil Australia Resources Company Pty Limited
			* BHP Billiton Petroleum (Australia) Pty Ltd
		WA-13-L	Apache East Spar Pty Ltd
			Apache Kersail Pty Ltd
			Santos (BOL) Pty Ltd

**OFFSHORE PETROLEUM AND GREENHOUSE GAS STORAGE ACT 2006
Production Licence**

Title	Registered Holders (* denotes Nominee)
WA-1-L R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	BP Developments Australia Pty Ltd
	CNOOC NWS Private Limited
	Chevron Australia Pty Ltd
	Japan Australia LNG (MIMI) Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Woodside Energy Ltd
WA-2-L R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	BP Developments Australia Pty Ltd
	CNOOC NWS Private Limited
	Chevron Australia Pty Ltd
	Japan Australia LNG (MIMI) Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Woodside Energy Ltd
WA-3-L R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

	* Apache Oil Australia Pty Ltd		Japan Australia LNG (MIMI) Pty Ltd
WA-14-L	Vermillion Oil & Gas Australia Pty Ltd		Shell Development (Australia) Proprietary Limited
WA-15-L	Santos Offshore Pty Ltd		Woodside Energy Ltd
	* Apache Northwest Pty Ltd	WA-31-L	ARC (Offshore PB) Limited
WA-16-L	BHP Billiton Petroleum (North West Shelf) Pty Ltd		AWE Oil (Western Australia) Pty Ltd
	BP Developments Australia Pty Ltd		Cieco Energy Australia Pty Ltd
	CNOOC NWS Private Limited		Roc Oil (WA) Pty Limited
	Chevron Australia Pty Ltd	WA-32-L	BHP Billiton Petroleum (Australia) Pty Ltd
	Japan Australia LNG (MIMI) Pty Ltd		Woodside Energy Ltd
	Shell Development (Australia) Proprietary Limited	WA-33-L	Eni Australia B.V.
	Woodside Energy Ltd	WA-34-L	Kansai Electric Power Australia Pty Ltd
WA-17-L	ConocoPhillips Australia Gas Holdings Pty Ltd		Tokyo Gas Pluto Pty Ltd
	* Mobil Australia Resources Company Pty Limited		Woodside Burrup Pty Ltd
WA-18-L	Talisman Oil & Gas (Australia) Pty Ltd	WA-35-L	Apache Permits Pty Ltd
WA-20-L	Apache Northwest Pty Ltd		Inpex Alpha Ltd
	Santos Limited	WA-36-L	Chevron (TAPL) Pty Ltd
WA-22-L	Mobil Australia Resources Company Pty Limited		Chevron Australia Pty Ltd
	Tap West Pty Ltd		Chubu Electric Power Gorgon Pty Ltd
	* Eni Australia Limited		Mobil Australia Resources Company Pty Limited
WA-23-L	BHP Billiton Petroleum (North West Shelf) Pty Ltd		Osaka Gas Gorgon Pty Ltd
	BP Developments Australia Pty Ltd		Shell Development (Australia) Proprietary Limited
	CNOOC NWS Private Limited		Tokyo Gas Gorgon Pty Ltd
	Chevron Australia Pty Ltd	WA-37-L	Chevron (TAPL) Pty Ltd
	Japan Australia LNG (MIMI) Pty Ltd		Chevron Australia Pty Ltd
	Shell Development (Australia) Proprietary Limited		Chubu Electric Power Gorgon Pty Ltd
	Woodside Energy Ltd		Mobil Australia Resources Company Pty Limited
WA-24-L	BHP Billiton Petroleum (North West Shelf) Pty Ltd		Osaka Gas Gorgon Pty Ltd
	BP Developments Australia Pty Ltd		Shell Development (Australia) Proprietary Limited
	CNOOC NWS Private Limited		Tokyo Gas Gorgon Pty Ltd
	Chevron Australia Pty Ltd	WA-38-L	Chevron (TAPL) Pty Ltd
	Japan Australia LNG (MIMI) Pty Ltd		Chevron Australia Pty Ltd
	Shell Development (Australia) Proprietary Limited		Chubu Electric Power Gorgon Pty Ltd
	Woodside Energy Ltd		Mobil Australia Resources Company Pty Limited
WA-25-L	Mobil Australia Resources Company Pty Limited		Osaka Gas Gorgon Pty Ltd
	Tap West Pty Ltd		Shell Development (Australia) Proprietary Limited
	* Eni Australia Limited		Tokyo Gas Gorgon Pty Ltd
WA-26-L	Kufpec Australia Pty Ltd	WA-39-L	BP Exploration (Alpha) Ltd
	Nippon Oil Exploration (Dampier) Pty Ltd		Chevron (TAPL) Pty Ltd
	Woodside Energy Ltd		Chevron Australia Pty Ltd
	* Santos Limited		Chubu Electric Power Gorgon Pty Ltd
WA-27-L	Kufpec Australia Pty Ltd		Mobil Australia Resources Company Pty Limited
	Nippon Oil Exploration (Dampier) Pty Ltd		Osaka Gas Gorgon Pty Ltd
	Woodside Energy Ltd		Shell Development (Australia) Proprietary Limited
	* Santos Limited		Tokyo Gas Gorgon Pty Ltd
WA-28-L	Mitsui E&P Australia Pty Limited	WA-40-L	BP Exploration (Alpha) Ltd
	* Woodside Energy Ltd		Chevron (TAPL) Pty Ltd
WA-29-L	Apache Northwest Pty Ltd		Chevron Australia Pty Ltd
	Santos (BOL) Pty Ltd		Chubu Electric Power Gorgon Pty Ltd
WA-30-L	BHP Billiton Petroleum (North West Shelf) Pty Ltd		Mobil Australia Resources Company Pty Limited
	BP Developments Australia Pty Ltd		Osaka Gas Gorgon Pty Ltd
	CNOOC NWS Private Limited		Shell Development (Australia) Proprietary Limited
	Chevron Australia Pty Ltd		Tokyo Gas Gorgon Pty Ltd

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

WA-41-L	Apache Northwest Pty Ltd
	Santos Offshore Pty Ltd
WA-42-L	Apache PVG Pty Ltd
	BHP Billiton Petroleum (Australia) Pty Ltd
WA-43-L	Apache PVG Pty Ltd
	Inpex Alpha Ltd
	* BHP Billiton Petroleum (Australia) Pty Ltd
WA-44-L	Shell Development (Australia) Proprietary Limited
WA-45-L	Apache East Spar Pty Ltd
	Apache Kersail Pty Ltd
	Apache Oil Australia Pty Ltd
	Santos Offshore Pty Ltd
WA-46-L	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
WA-47-L	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
WA-48-L	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
	Shell Development (Australia) Proprietary Limited
WA-49-L	Apache Julimar Pty Ltd
	Kufpec Australia (Julimar) Pty Ltd

**OFFSHORE PETROLEUM AND GREENHOUSE GAS STORAGE ACT 2006
Retention Lease**

Title	Registered Holders (* denotes Nominee)
WA-1-R R4	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	* Esso Australia Resources Pty Ltd
WA-5-R R3	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
	Chubu Electric Power Gorgon Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Osaka Gas Gorgon Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Tokyo Gas Gorgon Pty Ltd
WA-6-R R2	Bonaparte Gas & Oil Pty Limited
	GDF SUEZ Bonaparte Pty Ltd
	Origin Energy Bonaparte Pty Limited
	Santos Limited
WA-7-R R2	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	BP Developments Australia Pty Ltd
	CNOOC NWS Private Limited
	Chevron Australia Pty Ltd
	Japan Australia LNG (MIMI) Pty Ltd
	Shell Development (Australia) Proprietary Limited
	* Woodside Energy Ltd
WA-9-R R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	BP Developments Australia Pty Ltd
	CNOOC NWS Private Limited
	Chevron Australia Pty Ltd
	Japan Australia LNG (MIMI) Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Woodside Energy Ltd

WA-10-R R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	BP Developments Australia Pty Ltd
	CNOOC NWS Private Limited
	Chevron Australia Pty Ltd
	Japan Australia LNG (MIMI) Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Woodside Energy Ltd
WA-14-R R2	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
	Chubu Electric Power Gorgon Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Osaka Gas Gorgon Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Tokyo Gas Gorgon Pty Ltd
WA-15-R R2	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
	Chubu Electric Power Gorgon Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Osaka Gas Gorgon Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Tokyo Gas Gorgon Pty Ltd
WA-19-R R1	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
	Chubu Electric Power Gorgon Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Osaka Gas Gorgon Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Tokyo Gas Gorgon Pty Ltd
WA-20-R R1	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
	Chubu Electric Power Gorgon Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Osaka Gas Gorgon Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Tokyo Gas Gorgon Pty Ltd
WA-21-R R1	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
	Chubu Electric Power Gorgon Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Osaka Gas Gorgon Pty Ltd
	Shell Development (Australia) Proprietary Limited
	Tokyo Gas Gorgon Pty Ltd
WA-22-R R1	BP Exploration (Alpha) Ltd
	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Shell Development (Australia) Proprietary Limited
	* Chevron Australia Pty Ltd
WA-23-R R1	BP Exploration (Alpha) Ltd
	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Shell Development (Australia) Proprietary Limited
	* Chevron Australia Pty Ltd

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

WA-24-R R1	BP Exploration (Alpha) Ltd		Santos Limited
	Chevron (TAPL) Pty Ltd	WA-41-R	Beach Energy Limited
	Mobil Australia Resources Company Pty Limited		Kufpec Australia Pty Ltd
	Shell Development (Australia) Proprietary Limited		Santos Offshore Pty Ltd
	* Chevron Australia Pty Ltd	WA-42-R	Chevron (TAPL) Pty Ltd
WA-27-R R1	Bonaparte Gas & Oil Pty Limited		Chevron Australia Pty Ltd
	Santos Limited		Shell Development (Australia) Proprietary Limited
	* GDF SUEZ Bonaparte Pty Ltd	WA-43-R	Apache Northwest Pty Ltd
WA-28-R R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd	WA-44-R	BHP Billiton Petroleum (Australia) Pty Ltd
	BP Developments Australia Pty Ltd		Woodside Energy Ltd
	Chevron Australia Pty Ltd	WA-45-R	Apache Northwest Pty Ltd
	Shell Development (Australia) Proprietary Limited		Kufpec (Perth) Pty Ltd
	* Woodside Energy Ltd		Pan Pacific Petroleum (South Aust) Pty Ltd
WA-29-R R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd		Santos Offshore Pty Ltd
	BP Developments Australia Pty Ltd		Tap (Harriet) Pty Ltd
	Chevron Australia Pty Ltd	WA-46-R	Apache Northwest Pty Ltd
	Shell Development (Australia) Proprietary Limited		Kufpec (Perth) Pty Ltd
	* Woodside Energy Ltd		Pan Pacific Petroleum (South Aust) Pty Ltd
WA-30-R R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd		Santos Offshore Pty Ltd
	BP Developments Australia Pty Ltd		Tap (Harriet) Pty Ltd
	Chevron Australia Pty Ltd		
	Shell Development (Australia) Proprietary Limited		
	* Woodside Energy Ltd		
WA-31-R R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd		
	BP Developments Australia Pty Ltd		
	Chevron Australia Pty Ltd		
	Shell Development (Australia) Proprietary Limited		
	* Woodside Energy Ltd		
WA-32-R R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd		
	BP Developments Australia Pty Ltd		
	Chevron Australia Pty Ltd		
	Shell Development (Australia) Proprietary Limited		
	* Woodside Energy Ltd		
WA-33-R R1	Apache Oil Australia Pty Ltd		
	Pan Pacific Petroleum (South Aust) Pty Ltd		
	Santos (BOL) Pty Ltd		
	Tap (Shelfal) Pty Ltd		
	WM Petroleum Limited		
WA-34-R R1	Encana International (Australia) Pty Ltd		
	Eni Australia B.V.		
	SK Innovation Co., Ltd		
	Tap (Shelfal) Pty Ltd		
WA-35-R	Japan Australia LNG (MIMI) Pty Ltd		
	Woodside Energy Ltd		
WA-36-R	Mitsui E&P Australia Pty Limited		
	* Woodside Energy Ltd		
WA-37-R	Inpex Ichthys Pty Ltd		
	Total E&P Ichthys		
WA-38-R	Apache Northwest Pty Ltd		
	Santos Offshore Pty Ltd		
WA-40-R	Bonaparte Gas & Oil Pty Limited		
	GDF SUEZ Bonaparte Pty Ltd		

OFFSHORE PETROLEUM AND GEOTHERMAL GREENHOUSE GAS STORAGE ACT 2006	
Special Prospecting Authority	
Title	Registered Holders (* denotes Nominee)
WA-1-SPA	Fugro Multi Client Services Pty Ltd
WA-2-SPA	TGS-Nopec Geophysical Company Pty Ltd
WA-3-SPA	Fugro Multi Client Services Pty Ltd
WA-4-SPA	TGS-Nopec Geophysical Company Pty Ltd
WA-5-SPA	PGS Australia Pty Ltd

PETROLEUM (SUBMERGED LANDS) ACT 1982	
Exploration Permit	
Title	Registered Holders (* denotes Nominee)
TP/7 R3	Apache Oil Australia Pty Ltd
	Pan Pacific Petroleum (South Aust) Pty Ltd
	Santos (BOL) Pty Ltd
	Tap (Shelfal) Pty Ltd
TP/8 R3	Apache Northwest Pty Ltd
	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
TP/15 R1	Bharat PetroResources Limited
	* Westranch Holdings Pty Ltd
TP/23 R1	Apache Northwest Pty Ltd
TP/24	Emerald Gas Pty Ltd

PETROLEUM (SUBMERGED LANDS) ACT 1982	
Pipeline Licence	
Title	Registered Holders (* denotes Nominee)
TPL/1 R1	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
TPL/2 R1	Kufpec Australia Pty Ltd

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

	Tap (Harriet) Pty Ltd		Chevron Australia Pty Ltd
	* Apache Northwest Pty Ltd		Japan Australia LNG (MIMI) Pty Ltd
TPL/3 R1	Apache Oil Australia Pty Ltd		Shell Development (Australia) Proprietary Limited
	Pan Pacific Petroleum (South Aust) Pty Ltd		* Woodside Energy Ltd
	Santos (BOL) Pty Ltd	TPL/16	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	Tap (Shelfal) Pty Ltd		BP Developments Australia Pty Ltd
TPL/4 R1	Apache Oil Australia Pty Ltd		Chevron Australia Pty Ltd
	Pan Pacific Petroleum (South Aust) Pty Ltd		Japan Australia LNG (MIMI) Pty Ltd
	Santos (BOL) Pty Ltd		Shell Development (Australia) Proprietary Limited
	Tap (Shelfal) Pty Ltd		* Woodside Energy Ltd
TPL/5 R1	Kufpec Australia Pty Ltd	TPL/17	Apache Northwest Pty Ltd
	Tap (Harriet) Pty Ltd		Santos (BOL) Pty Ltd
	* Apache Northwest Pty Ltd	TPL/18	ARC (Offshore PB) Limited
TPL/6 R1	Chevron (TAPL) Pty Ltd		AWE Oil (Western Australia) Pty Ltd
	Mobil Australia Resources Company Pty Limited		Cieco Energy Australia Pty Ltd
	Santos Offshore Pty Ltd		Roc Oil (WA) Pty Limited
	* Chevron Australia Pty Ltd	TPL/19	Kansai Electric Power Australia Pty Ltd
TPL/7 R2	Apache Oil Australia Pty Ltd		Tokyo Gas Pluto Pty Ltd
	Pan Pacific Petroleum (South Aust) Pty Ltd		Woodside Burrup Pty Ltd
	Santos (BOL) Pty Ltd	TPL/20	Apache Northwest Pty Ltd
	Tap (Shelfal) Pty Ltd		Santos Offshore Pty Ltd
TPL/8	Kufpec Australia Pty Ltd	TPL/21	Chevron (TAPL) Pty Ltd
	Tap (Harriet) Pty Ltd		Chubu Electric Power Gorgon Pty Ltd
	* Apache Northwest Pty Ltd		Mobil Australia Resources Company Pty Limited
TPL/9 R1	Chevron (TAPL) Pty Ltd		Osaka Gas Gorgon Pty Ltd
	Mobil Australia Resources Company Pty Limited		Shell Development (Australia) Proprietary Limited
	Santos Offshore Pty Ltd		Tokyo Gas Gorgon Pty Ltd
	* Chevron Australia Pty Ltd	TPL/22	Chevron (TAPL) Pty Ltd
TPL/10	Inpex Alpha Ltd		Chubu Electric Power Gorgon Pty Ltd
	Mobil Exploration & Producing Australia Pty Ltd		Mobil Australia Resources Company Pty Limited
	* BHP Billiton Petroleum (Australia) Pty Ltd		Osaka Gas Gorgon Pty Ltd
TPL/11	Chevron (TAPL) Pty Ltd		Shell Development (Australia) Proprietary Limited
	Mobil Australia Resources Company Pty Limited		Tokyo Gas Gorgon Pty Ltd
	Santos Offshore Pty Ltd	TPL/23	Apache PVG Pty Ltd
	* Chevron Australia Pty Ltd		BHP Billiton Petroleum (Australia) Pty Ltd
TPL/12	Apache East Spar Pty Ltd	TPL/24	Chevron (TAPL) Pty Ltd
	Apache Kersail Pty Ltd		Chubu Electric Power Gorgon Pty Ltd
	Santos (BOL) Pty Ltd		Mobil Australia Resources Company Pty Limited
	* Apache Oil Australia Pty Ltd		Osaka Gas Gorgon Pty Ltd
TPL/13	Apache East Spar Pty Ltd		Shell Development (Australia) Proprietary Limited
	Apache Kersail Pty Ltd		Tokyo Gas Gorgon Pty Ltd
	Apache Northwest Pty Ltd		
	Apache Oil Australia Pty Ltd		
	Kufpec Australia Pty Ltd		
	Santos (BOL) Pty Ltd		
	Tap (Harriet) Pty Ltd		
TPL/14	Kufpec Australia Pty Ltd		
	Tap (Harriet) Pty Ltd		
	* Apache Northwest Pty Ltd		
TPL/15	BHP Billiton Petroleum (North West Shelf) Pty Ltd		
	BP Developments Australia Pty Ltd		

PETROLEUM (SUBMERGED LANDS) ACT 1982 Production Licence	
Title	Registered Holders (* denotes Nominee)
TL/1 R1	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
TL/2 R1	Apache Oil Australia Pty Ltd
	Pan Pacific Petroleum (South Aust) Pty Ltd
	Santos (BOL) Pty Ltd

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

	Tap (Shelfal) Pty Ltd
TL/3 R1	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
	* Chevron Australia Pty Ltd
TL/4 R1	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
	* Chevron Australia Pty Ltd
TL/5	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
TL/6	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
TL/7	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
	* Chevron Australia Pty Ltd
TL/8	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
TL/9	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd

PETROLEUM (SUBMERGED LANDS) ACT 1982 Retention Lease	
Title	Registered Holders (* denotes Nominee)
TR/1 R2	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
TR/2 R1	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
TR/3 R1	Apache Northwest Pty Ltd
TR/4 R1	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
	* Chevron Australia Pty Ltd
TR/5 R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	BP Developments Australia Pty Ltd
	Chevron Australia Pty Ltd
	Shell Development (Australia) Proprietary Limited
	* Woodside Energy Ltd
TR/6	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd

PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967 Access Authority to Deviated Well	
Title	Registered Holders (* denotes Nominee)
ADW 8/90-1	Chevron (TAPL) Pty Ltd
ADW 10/92-3	Kufpec Australia Pty Ltd
ADW 12/91-2	Kufpec Australia Pty Ltd
ADW 8/90-1	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
ADW 12/91-2	Tap (Harriet) Pty Ltd
ADW 10/92-3	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
ADW 12/91-2	* Apache Northwest Pty Ltd
ADW 8/90-1	* Chevron Australia Pty Ltd

PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967 Drilling Reservation	
Title	Registered Holders (* denotes Nominee)
DR 9	Backreef Oil Limited
DR 11	Titan Energy Ltd

PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967 Exploration Permit	
Title	Registered Holders (* denotes Nominee)
EP 61 R7	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
	* Chevron Australia Pty Ltd
EP 62 R7	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
	* Chevron Australia Pty Ltd
EP 104 R5	Arc Energy Limited
	FAR Ltd
	Gulliver Productions Pty Ltd
	Indigo Oil Pty Ltd
	Pancontinental Oil & Gas NL
	Phoenix Resources PLC
EP 110 R4	Pancontinental Oil & Gas NL
	Strike Energy Limited
EP 129 R5	Buru Energy Limited
EP 307 R5	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
EP 320 R4	ARC (Beharra Springs) Pty Ltd
	* Origin Energy Developments Pty Limited
EP 321 R3	Latent Petroleum Pty Ltd
EP 325 R3	Advent Energy Ltd
	Bow Energy Ltd
	Rough Range Oil Pty Ltd
	Strike Energy Limited
EP 357 R3	Chevron (TAPL) Pty Ltd

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

	Mobil Australia Resources Company Pty Limited		Bounty Oil & Gas NL
	Santos Offshore Pty Ltd		Rough Range Oil Pty Ltd
	* Chevron Australia Pty Ltd	EP 436	Buru Energy Limited
EP 358 R2	Apache Northwest Pty Ltd	EP 437	CalEnergy Resources (Australia) Limited
	Kufpec Australia Pty Ltd		Key Petroleum (Australia) Pty Ltd
	Tap (Harriet) Pty Ltd	EP 438	Gulliver Productions Pty Ltd
EP 359 R2	Bounty Oil & Gas NL		Indigo Oil Pty Ltd
	Lansvale Oil & Gas Pty Ltd		* Buru Energy Limited
	Pace Petroleum Pty Ltd	EP 439	Falcore Pty Ltd
	Phoenix Resources PLC		Indigo Oil Pty Ltd
	Rough Range Oil Pty Ltd		Jurassica Oil & Gas Plc
EP 368 R3	Westranch Holdings Pty Ltd		Longreach Oil Limited
	* Empire Oil Company (WA) Limited		Vigilant Oil Pty Ltd
EP 371 R1	Buru Energy Limited		* Rough Range Oil Pty Ltd
EP 381 R3	Whicher Range Energy Pty Ltd	EP 440	Empire Oil Company (WA) Limited
EP 386 R3	Onshore Energy Pty Ltd	EP 441 R1	Apache Northwest Pty Ltd
EP 389 R1	ERM Gas Pty Ltd	EP 443	New Standard Onshore Pty Ltd
	Empire Oil Company (WA) Limited	EP 444	Rough Range Oil Pty Ltd
	Wharf Resources PLC	EP 447	GCC Methane Pty Ltd
EP 390 R2	Buru Energy Limited	EP 448	Gulliver Productions Pty Ltd
EP 391 R2	Buru Energy Limited		Indigo Oil Pty Ltd
EP 407 R1	Latent Petroleum Pty Ltd		United Orogen Limited
EP 408 R1	Whicher Range Energy Pty Ltd	EP 449	Kingsway Oil Limited
EP 412 R1	Bounty Oil & Gas NL	EP 450	New Standard Onshore Pty Ltd
	* Rough Range Oil Pty Ltd	EP 451	New Standard Onshore Pty Ltd
EP 413 R2	Arc Energy Limited	EP 453	Budside Pty Limited
	Bharat PetroResources Limited		Pobelo Pty Ltd
	Norwest Energy NL	EP 454	Empire Oil Company (WA) Limited
EP 416 R1	Allied Oil & Gas Plc	EP 455	Titan Energy Ltd
	ERM Gas Pty Ltd		* Arc Energy Limited
	* Empire Oil Company (WA) Limited	EP 456	New Standard Onshore Pty Ltd
EP 417 R1	Buru Energy Limited	EP 457	Rey Resources Ltd
	New Standard Onshore Pty Ltd		* Gujarat NRE Oil Limited
EP 424	Pancontinental Oil & Gas NL	EP 458	Rey Resources Ltd
	Strike Energy Limited		* Gujarat NRE Oil Limited
EP 426	Allied Oil & Gas Plc	EP 460	Falcore Pty Ltd
	ERM Gas Pty Ltd		Indigo Oil Pty Ltd
	Empire Oil Company (WA) Limited		Jurassica Oil & Gas Plc
	Westranch Holdings Pty Ltd		Longreach Oil Limited
EP 428	Buru Energy Limited		Vigilant Oil Pty Ltd
EP 429	Kingsway Oil Limited		* Rough Range Oil Pty Ltd
EP 430	Empire Oil Company (WA) Limited	EP 461	Falcore Pty Ltd
EP 431	Buru Energy Limited		Indigo Oil Pty Ltd
EP 432	Allied Oil & Gas Plc		Jurassica Oil & Gas Plc
	ERM Gas Pty Ltd		Longreach Oil Limited
	* Empire Oil Company (WA) Limited		Vigilant Oil Pty Ltd
EP 433 R1	Lansvale Oil & Gas Pty Ltd		* Rough Range Oil Pty Ltd
	Pace Petroleum Pty Ltd	EP 463	Emerald Gas Pty Ltd
EP 434 R1	Pace Petroleum Pty Ltd	EP 464	Exceed Energy (Australia) Pty Ltd
	Rough Range Oil Pty Ltd	EP 465	Australia Zhongfu Oil Gas Resources Pty Ltd
	* Lansvale Oil & Gas Pty Ltd	EP 466	Rough Range Oil Pty Ltd
EP 435 R1	Australian Oil Company No 3 Pty Limited	EP 467	ERM Gas Pty Ltd

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

EP 468	Officer Petroleum Pty Ltd	GEP 31	New World Energy Limited
EP 469	Warrego Energy Pty Ltd	GEP 32	New World Energy Limited
EP 470	Energetica Resources Pty Ltd	GEP 33	New World Energy Limited
EP 471	Buru Energy Limited	GEP 34	New World Energy Limited
EP 472	Buru Energy (Acacia) Pty Ltd	GEP 35	New World Energy Limited
	Buru Energy Limited	GEP 36	New World Energy Limited
EP 473	Buru Energy Limited	GEP 37	Greenpower Energy Limited
EP 474	Buru Energy Limited	GEP 38	Greenpower Energy Limited
EP 475	Energetica Resources Pty Ltd	GEP 39	Green Rock Energy Limited
EP 476	Arc Energy Limited	GEP 40	Green Rock Energy Limited
EP 477	Buru Energy (Acacia) Pty Ltd	GEP 41	Green Rock Energy Limited
	Buru Energy Limited	GEP 42	GT Power Pty Ltd
EP 478	Buru Energy (Acacia) Pty Ltd	GEP 43	Kagara Ltd
	Buru Energy Limited		

**PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967
Geothermal Exploration Permit**

Title	Registered Holders (* denotes Nominee)
GEP 1	The University of Western Australia * Green Rock Energy Limited
GEP 2	Green Rock Energy Limited
GEP 3	Green Rock Energy Limited
GEP 4	Green Rock Energy Limited
GEP 5	Granite Power Limited
GEP 6	Granite Power Limited
GEP 7	GT Power Pty Ltd
GEP 8	GT Power Pty Ltd
GEP 9	GT Power Pty Ltd
GEP 10	BHP Billiton Worsley Alumina Pty Ltd Green Rock Energy Limited
GEP 11	BHP Billiton Worsley Alumina Pty Ltd Green Rock Energy Limited
GEP 12	BHP Billiton Worsley Alumina Pty Ltd Green Rock Energy Limited
GEP 13	New World Energy Limited
GEP 14	New World Energy Limited
GEP 15	New World Energy Limited
GEP 16	New World Energy Limited
GEP 17	New World Energy Limited
GEP 18	New World Energy Limited
GEP 19	New World Energy Limited
GEP 20	New World Energy Limited
GEP 21	New World Energy Limited
GEP 22	AAA Energy Pty Ltd
GEP 23	Green Rock Energy Limited
GEP 24	Green Rock Energy Limited
GEP 25	Green Rock Energy Limited
GEP 26	Green Rock Energy Limited
GEP 27	Green Rock Energy Limited
GEP 28	Green Rock Energy Limited
GEP 29	Geothermal Energy Pty Ltd
GEP 30	New World Energy Limited

**PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967
Production Licence**

Title	Registered Holders (* denotes Nominee)
L 1 R1	APT Parmelia Pty Ltd Arc Energy Limited Origin Energy Developments Pty Limited
L 2 R1	Origin Energy Developments Pty Limited * Arc Energy Limited
L 4 R1	Arc Energy Limited
L 5 R1	Arc Energy Limited
L 6 R1	Buru Energy Limited
L 7 R1	Arc Energy Limited
L 8 R1	Buru Energy Limited
L 9 R1	BHP Billiton Petroleum (Australia) Pty Ltd
L 10 R1	Chevron (TAPL) Pty Ltd Mobil Australia Resources Company Pty Limited Santos Offshore Pty Ltd * Chevron Australia Pty Ltd
L 11	ARC (Beharra Springs) Pty Ltd * Origin Energy Developments Pty Limited
L 12	Chevron (TAPL) Pty Ltd Mobil Australia Resources Company Pty Limited Santos Offshore Pty Ltd * Chevron Australia Pty Ltd
L 13	Chevron (TAPL) Pty Ltd Mobil Australia Resources Company Pty Limited Santos Offshore Pty Ltd * Chevron Australia Pty Ltd
L 14	Arc Energy Limited Geary, John Kevin Norwest Energy NL Origin Energy Developments Pty Limited Roc Oil (WA) Pty Limited
L 15	Buru Energy Limited FAR Ltd Gulliver Productions Pty Ltd Indigo Oil Pty Ltd Pancontinental Oil & Gas NL

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

L 16	Rough Range Oil Pty Ltd
L 1H R2	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
	* Chevron Australia Pty Ltd

PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967
Retention Lease

Title	Registered Holders (* denotes Nominee)
R 1 R1	Arc Energy Limited
	FAR Ltd
	Gulliver Productions Pty Ltd
	Indigo Oil Pty Ltd
	Pancontinental Oil & Gas NL
	Phoenix Resources PLC
R 2 R1	BHP Billiton Petroleum (North West Shelf) Pty Ltd
	BP Developments Australia Pty Ltd
	Chevron Australia Pty Ltd
	Shell Development (Australia) Proprietary Limited
	* Woodside Energy Ltd
R 3 R1	Oil Basins Limited
R 4	Chevron (TAPL) Pty Ltd
	Chevron Australia Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
R 5	Apache Oil Australia Pty Ltd
	OMV Australia Pty Ltd

PETROLEUM PIPELINES ACT 1969
Pipeline Licence

Title	Registered Holders (* denotes Nominee)
PL 1 R1	APT Parmelia Pty Ltd
PL 2 R1	APT Parmelia Pty Ltd
PL 3 R1	APT Parmelia Pty Ltd
PL 5 R1	APT Parmelia Pty Ltd
PL 6 R3	Arc Energy Limited
PL 7 R1	Buru Energy Limited
PL 8 R1	Mitsui Iron Ore Development Pty Ltd
	Nippon Steel Australia Pty Limited
	North Mining Limited
	Sumitomo Metal Australia Pty Ltd
	* Robe River Mining Co Pty Ltd
PL 12 R1	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
PL 14 R1	Apache Oil Australia Pty Ltd
	Pan Pacific Petroleum (South Aust) Pty Ltd
	Santos (BOL) Pty Ltd
	Tap (Shelfal) Pty Ltd
PL 15 R1	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd

	Chevron Australia Pty Ltd
PL 16	BHP Petroleum (Ashmore Operations) Pty Ltd
PL 17	Kufpec Australia Pty Ltd
	Tap (Harriet) Pty Ltd
	* Apache Northwest Pty Ltd
PL 18	ARC (Beharra Springs) Pty Ltd
	* Origin Energy Developments Pty Limited
PL 19	BHP Petroleum (Ashmore Operations) Pty Ltd
PL 20	Inpex Alpha Ltd
	Mobil Exploration & Producing Australia Pty Ltd
	* BHP Billiton Petroleum (Australia) Pty Ltd
PL 21	Chevron (TAPL) Pty Ltd
	Mobil Australia Resources Company Pty Limited
	Santos Offshore Pty Ltd
	* Chevron Australia Pty Ltd
PL 22	Epic Energy (Pilbara Pipeline) Pty Ltd
PL 23	APT Parmelia Pty Ltd
PL 24	Alinta DEWAP Pty Ltd
	Southern Cross Pipelines (NPL) Australia Pty Ltd
	* Southern Cross Pipelines Australia Pty Limited
PL 25	Southern Cross Pipelines Australia Pty Limited
PL 26	Southern Cross Pipelines Australia Pty Limited
PL 27	Southern Cross Pipelines Australia Pty Limited
PL 28	Southern Cross Pipelines (NPL) Australia Pty Ltd
PL 29	Apache East Spar Pty Ltd
	Apache Kersail Pty Ltd
	Santos (BOL) Pty Ltd
	* Apache Oil Australia Pty Ltd
PL 30	Apache East Spar Pty Ltd
	Apache Kersail Pty Ltd
	Santos (BOL) Pty Ltd
	* Apache Oil Australia Pty Ltd
PL 31	Epic Energy (Pilbara Pipeline) Pty Ltd
PL 32	APT Pipelines (WA) Pty Limited
PL 33	APT Pipelines (WA) Pty Limited
PL 34	Newmont Yandal Operations Pty Ltd
PL 35	Plutonic Operations Limited
PL 36	Australian Pipeline Limited
PL 37	Norilsk Nickel Cawse Pty Ltd
PL 38	Epic Energy (Pilbara Pipeline) Pty Ltd
PL 39	Origin Energy Pipelines Pty Limited
PL 40	DBNGP (WA) Nominees Pty Limited
PL 41	DBNGP (WA) Transmission Pty Limited
PL 42	Apache East Spar Pty Ltd
	Apache Kersail Pty Ltd
	Apache Northwest Pty Ltd
	Apache Oil Australia Pty Ltd
	Kufpec Australia Pty Ltd
	Santos (BOL) Pty Ltd
	Tap (Harriet) Pty Ltd
PL 43	Western Power Corporation
	* APT Pipelines (WA) Pty Limited

Table 7. List of Petroleum and Geothermal Titles and Holders in Western Australia as at 4 January 2012

PL 44	APT Parmelia Pty Ltd		Shell Development (Australia) Proprietary Limited
PL 45	APT Parmelia Pty Ltd		Tokyo Gas Gorgon Pty Ltd
PL 46	APT Parmelia Pty Ltd	PL 85	Chevron (TAPL) Pty Ltd
PL 47	DBNGP (WA) Transmission Pty Limited		Chubu Electric Power Gorgon Pty Ltd
PL 48	Energy Generation Pty Ltd		Mobil Australia Resources Company Pty Limited
PL 52	APT Parmelia Pty Ltd		Osaka Gas Gorgon Pty Ltd
PL 53	APT Parmelia Pty Ltd		Shell Development (Australia) Proprietary Limited
PL 54	Western Power Corporation		Tokyo Gas Gorgon Pty Ltd
	* APT Pipelines (WA) Pty Limited	PL 86	Apache Northwest Pty Ltd
PL 55	Global Advanced Metals Wodgina Pty Ltd		Santos Offshore Pty Ltd
PL 56	Epic Energy (WA) One Pty Ltd	PL 87	Apache PVG Pty Ltd
PL 57	Australian Gold Reagents Pty Ltd		BHP Billiton Petroleum (Australia) Pty Ltd
PL 58	BHP Billiton Petroleum (North West Shelf) Pty Ltd	PL 88	Apache PVG Pty Ltd
	BP Developments Australia Pty Ltd		BHP Billiton Petroleum (Australia) Pty Ltd
	Chevron Australia Pty Ltd	PL 89	Crosslands Resources Ltd
	Japan Australia LNG (MIMI) Pty Ltd	PL 90	Apache PVG Pty Ltd
	Shell Development (Australia) Proprietary Limited		BHP Petroleum (Australia) Pty Ltd
	* Woodside Energy Ltd	PL 91	DBNGP (WA) Nominees Pty Limited
PL 59	Esperance Pipeline Co. Pty Limited	PL 92	Chevron (TAPL) Pty Ltd
PL 60	Gas Transmission Services WA (Operations) Pty Ltd		Chubu Electric Power Gorgon Pty Ltd
PL 61	APT Parmelia Pty Ltd		Mobil Australia Resources Company Pty Limited
PL 62	Kufpec Australia Pty Ltd		Osaka Gas Australia Pty Ltd
	Tap (Harriet) Pty Ltd		Shell Development (Australia) Proprietary Limited
	* Apache Northwest Pty Ltd		Tokyo Gas Gorgon Pty Ltd
PL 63	Gas Transmission Services WA (Operations) Pty Ltd	PL 93	Chevron (TAPL) Pty Ltd
PL 64	Arc Energy Limited		Chubu Electric Power Gorgon Pty Ltd
	Origin Energy Developments Pty Limited		Mobil Australia Resources Company Pty Limited
PL 65	Dalrymple Resources NL		Osaka Gas Gorgon Pty Ltd
	LionOre Australia (Wildara) NL		Shell Development (Australia) Proprietary Limited
PL 67	Hamersley Iron Pty Ltd		Tokyo Gas Gorgon Pty Ltd
PL 68	Gas Transmission Services WA (Operations) Pty Ltd		
PL 69	DBNGP (WA) Nominees Pty Limited		
PL 70	ARC (Offshore PB) Limited		
	AWE Oil (Western Australia) Pty Ltd		
	Cieco Energy Australia Pty Ltd		
	Roc Oil (WA) Pty Limited		
PL 72	EDL NGD (WA) PTY LTD		
PL 73	Redback Pipelines Pty Ltd		
PL 74	EDL LNG (WA) PTY LTD		
PL 75	EIT Neerabup Power Pty Ltd		
	ERM Neerabup Pty Ltd		
PL 76	APA Group		
PL 77	Sino Iron Pty Ltd		
PL 78	Hamersley Iron Pty Ltd		
PL 80	Latent Petroleum Pty Ltd		
PL 81	Apache Northwest Pty Ltd		
PL 82	Epic Energy (Pilbara Pipeline) Pty Ltd		
PL 83	WA Gas Networks Pty Ltd		
PL 84	Chevron (TAPL) Pty Ltd		
	Chubu Electric Power Gorgon Pty Ltd		
	Mobil Australia Resources Company Pty Limited		
	Osaka Gas Gorgon Pty Ltd		

Please consult DMP's online Petroleum and Geothermal Register for the most current information on Titles and Holdings.

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