



Northern  
Territory  
Government

# energyNT|2012

*Energy activities for the Northern Territory, Australia*



AUSTRALIA'S  
*Northern Territory*

# energyNT|2012

**Department of Mines and Energy, Minerals and Energy group**  
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*Cover photo:*

*Falcon Oil & Gas Australia Pty Ltd's Shenandoah-1A Fraccking Operations, EP 98, Beetaloo sub-Basin. Panorama constructed from photos courtesy of Falcon Oil & Gas Australia Pty Ltd.*

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## Executive Summary

The Northern Territory is experiencing a remarkable era of oil and gas exploration growth. The expansion of the industry in the Territory is significant in that the 'Majors' of the oil and gas sector are showing increasing confidence in its oil and gas potential by entering into joint ventures or taking up acreage in their own right.

The interest in petroleum acreage in the NT can only be described as frantic over the last two to three years, with 2012 emerging as one of the most important growth periods, measured not only by the number of petroleum tenure applications but by increased levels of granted tenure, all of which has ensured that exploration for oil and gas continued to ramp up in the Territory. More than 85% of the Territory is either under application or granted tenure, with nearly 40 exploration permits granted by the end of 2012. 'On ground' activities have concentrated mainly on unconventional oil and gas (shale), particularly in the Beetaloo Sub-basin (McArthur Basin) and in the greater McArthur, Amadeus and Pedirka basins.

There has also been increased interest and activity in the Bonaparte and Victoria basins, where there have been a number of aerial surveys flown.

Of significant interest to many in the oil and gas sector is the flowing of conventional oil from the new Surprise field in the Amadeus Basin, which has been the first 'new' oil discovery in the Territory in several decades.

## Administration of Petroleum Activities in Commonwealth Offshore Areas

Commencing 1 January 2012, responsibility for administering and regulating petroleum activities (including petroleum transmission pipeline operations) in Commonwealth offshore areas was transferred from the NT Government to the National Offshore Titles Administrator (NOPTA) and the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). Activities in Commonwealth offshore areas of the Territory are therefore not included in this report.

## Activities in NT Onshore and Coastal Waters

Dredging commenced on the ship basin for the Ichthys gas processing facility in Darwin Harbor. The facility will include two LNG trains (with room to expand to 6 trains), a liquefied petroleum gas processing facility and a condensate separation plant. Gas from the Ichthys field in the Browse Basin to the west of Darwin will be supplied through an 890 km-long 42" gas pipeline. The plant is expected to be operational and shipping LNG by the end of 2016.

## Petroleum

The main exploration and production highlights for 2012 were:

- Hess Australia (Beetaloo) Pty Ltd completed its 2011–2012 seismic program, acquiring a total of 3477 line km of 2D data in the Beetaloo Sub-basin of the McArthur Basin.
- Armour Energy Ltd completed its AMAC 2D seismic survey in the McArthur Basin, acquiring 54.38 line km of 2D data.
- Armour Energy Ltd drilled 3 exploration wells in the McArthur Basin. Cow Lagoon-1 and Glyde-1ST1 flowed gas, and were completed and suspended. Kilgour North-1 watered out and was plugged and abandoned.
- Central Petroleum Ltd successfully completed approximately 6 months of extended production testing of the Surprise-1 Re-entry HST1 exploratory well in the Amadeus Basin. The well is currently suspended, pending an application for a Production License.
- PetroFrontier (Australia) Pty Ltd re-entered, fracture stimulated and flow tested its MacIntyre-2H and Owen-3H wells in the Georgina Basin. Both wells were suspended after H<sub>2</sub>S gas was encountered during the flow tests.
- PetroFrontier (Australia) Pty Ltd re-entered its Baldwin-2HST1 well in the Georgina Basin, but encountered operational problems, causing it to suspend the well.
- Santos Ltd reported a 19% increase in oil production from its Mereenie field between 2011 and 2012.

Proposed and upcoming onshore activities for 2013 include the following:

- Beach Energy Ltd – airborne geophysical survey over the Bonaparte Basin.
- Pangaea Resources Pty Ltd – airborne geophysical survey over the Beetaloo Sub-basin.
- Santos Ltd – Mereenie field appraisal and development. Phase 1 of the project includes the drilling of 12 wells. This project will continue through 2014 and potentially into 2015. The primary aim of the project will be to appraise and develop Pacoota oil reservoirs in the central and western areas of the Mereenie field.
- Central Petroleum Ltd – further exploration in the Amadeus Basin.
- Falcon Oil and Gas Australia Pty Ltd – 2D seismic survey in the Beetaloo Sub-basin.

### **Licensed pipelines**

Ichthys Gas Export Pipeline: engineering design work was substantially progressed for the NT waters and onshore portions of this 890 km pipeline, to be constructed between the Ichthys gas field in the Browse Basin and the Ichthys LNG plant in Darwin Harbor, in preparation for the commencement of dredging work in Darwin Harbour in Q4 2013.

Amadeus Gas Pipeline: significant maintenance and system upgrade projects were carried out on this pipeline, including repairs to corrosion damage, the replacement of coatings on underground pipes at scraper stations and the Darwin City Gate, and the installation of additional cathodic protection infrastructure.

### **Geothermal**

Areas in the Northern Territory were made available for geothermal exploration in February 2011. There are currently two active geothermal permits, GEP 27829 and GEP 27831, held by Western Desert Resources Ltd and Crossland Diamonds Pty Ltd respectively.

### **About energyNT**

energyNT focuses on petroleum, pipeline and geothermal energy activities in the NT's onshore and coastal waters (to the 3 nautical mile limit) areas. Enquiries on petroleum activities in Commonwealth offshore areas, previously administered by the Northern Territory, should be directed to NOPTA and NOPSEMA.

## 2012 Activities

### NT Onshore and Coastal Waters

#### PETROLEUM

#### Permits/Titles/Work Programs

##### Onshore

The NT onshore area is over 1.35 million km<sup>2</sup> (Figure 1) and as of December 2012, there were 40 active exploration permits, 2 retention licenses and 3 production licenses, from which hydrocarbons have been produced since the early 1980s. Table 1 contains a list of Onshore Titles and Titleholders.

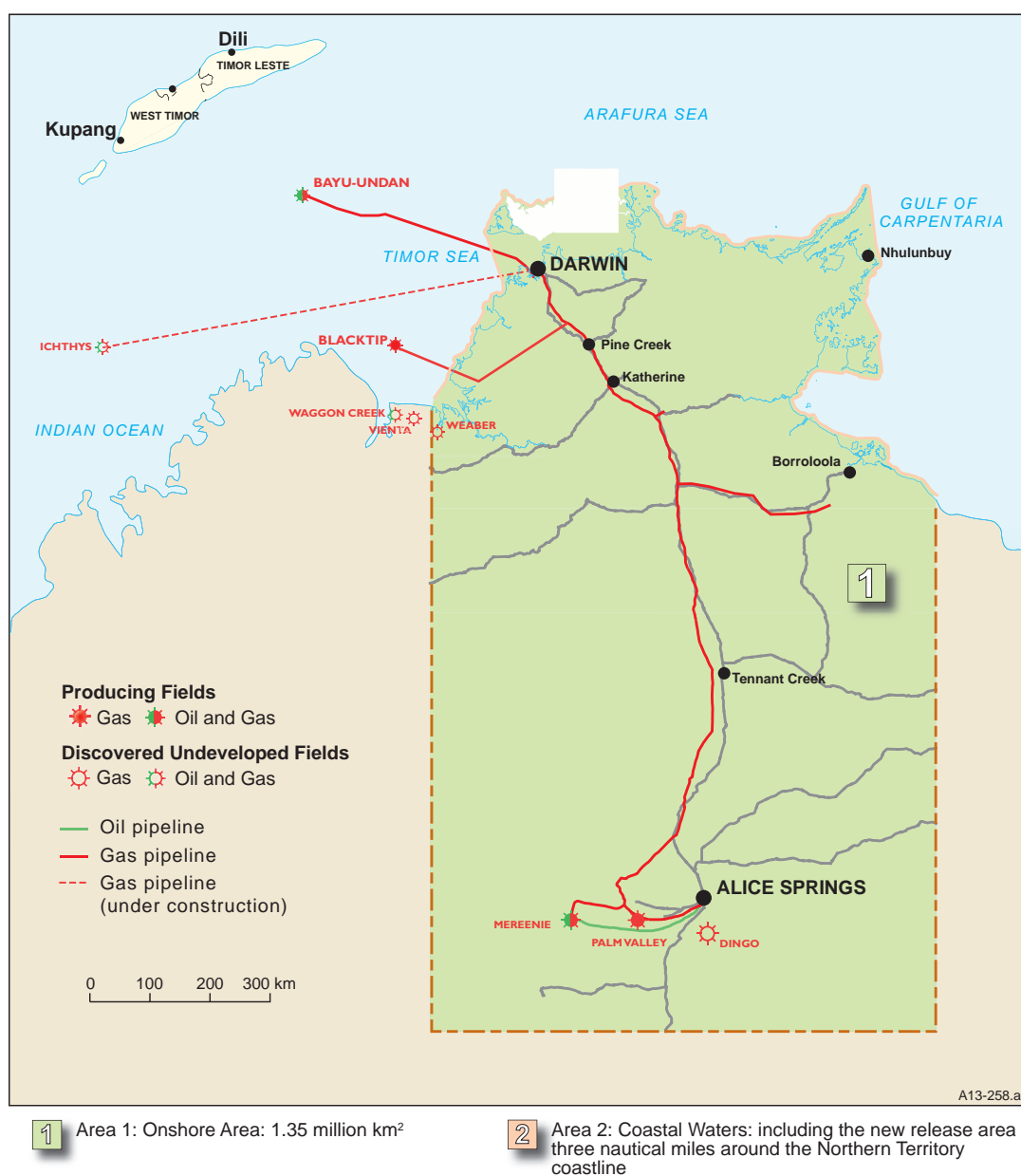


Figure 1. Areas Administered by the Northern Territory Department of Mines and Energy in 2012.

Title	Title holder	Date awarded
EP 76	Falcon Oil & Gas Australia Limited	08-Mar-01
EP 82	Helium Australia Pty Ltd	02-Sep-05
EP 93	Merlin Energy Pty Ltd	01-Nov-04
EP 97	Rawson Resources Ltd	23-May-11
	Merlin Energy Pty Ltd	
EP 98	Falcon Oil and Gas Australia Pty Ltd	04-Feb-04
EP 99	Falcon Oil and Gas Australia Pty Ltd	04-Feb-04
EP 103	PetroFrontier (Australia) Pty Ltd	21-Nov-06
	Texalta Australia Pty Ltd	
EP 104	PetroFrontier (Australia) Pty Ltd	21-Nov-06
	Texalta Australia Pty Ltd	
EP 105	Merlin Energy Pty Ltd	28-Sep-07
EP 106	Merlin Energy Pty Ltd	28-Sep-07
EP 107	Merlin Energy Pty Ltd	28-Sep-07
EP 112	Frontier Oil & Gas Pty Ltd	21-Jul-05
EP 115	Frontier Oil & Gas Pty Ltd	17-Aug-07
EP 117	Falcon Oil and Gas Australia Pty Ltd	14-Mar-06
EP 118	Frontier Oil & Gas Pty Ltd	21-Jul-05
EP 125	Ordiv Petroleum Pty Ltd and Oil and Gas Exploration Limited	07-Dec-05
EP 126	Territory Oil and Gas Pty Limited and Beach Petroleum (NT) Pty Ltd	15-Jun-11
EP 127	PetroFrontier (Australia) Pty Ltd	14-Dec-07
	Baraka Petroleum Limited	
EP 128	PetroFrontier (Australia) Pty Ltd	14-Dec-07
	Baraka Petroleum Limited	
EP 134	Tri-star Energy Company	26-Feb-06
EP 135	Territory Oil and Gas Pty Limited and Beach Petroleum (NT) Pty Ltd	23-Aug-12

Title	Title holder	Date awarded
EP 136	Sweetpea Petroleum Pty Ltd and Paltar Petroleum Limited	23-Aug-12
EP 138	Territory Oil and Gas Pty Limited and Beach Petroleum (NT) Pty Ltd	23-Aug-12
EP 143	Sweetpea Petroleum Pty Ltd and Paltar Petroleum Limited	28-Aug-12
EP 156	Oilco Pty Ltd	11-Nov-11
EP 161	Tamboran Resources Pty Ltd	25-May-12
EP 162	Tamboran Resources Pty Ltd	21-Aug-12
EP 163	Tamboran Resources Pty Ltd	14-May-10
EP 171	Amour Energy Pty Ltd	29-Jun-11
EP 174	Armour Energy Pty Ltd	11-Dec-12
EP 176	Amour Energy Pty Ltd	20-Jun-11
EP 189	Tamboran Resources Pty Ltd	21-Aug-12
EP 190	Armour Energy Pty Ltd	11-Dec-12
EP 200	Wiso Oil Pty Ltd	16-Feb-12
EP 205	Wiso Oil Pty Ltd	16-Feb-12
EP 207	Wiso Oil Pty Ltd	16-Feb-12
EP 222	Wiso Oil Pty Ltd	22-Aug-12
EP 231	Paltar Petroleum Limited	05-Sep-12
EP 234	Paltar Petroleum Limited	05-Sep-12
EP 237	Paltar Petroleum Limited	05-Sep-12
RL1	Onshore Energy Pty Ltd	05-Nov-07
RL2	Magellan Petroleum (NT) Pty Ltd	04-Feb-09
OL3	Magellan Petroleum (NT) Pty Ltd	06-Nov-03
OL4	Santos AQNT Pty Ltd, Santos Limited	06-Nov-02
OL5	Santos AQNT Pty Ltd, Santos Limited	06-Nov-02

**Table 1. NT Onshore Petroleum Titles.**

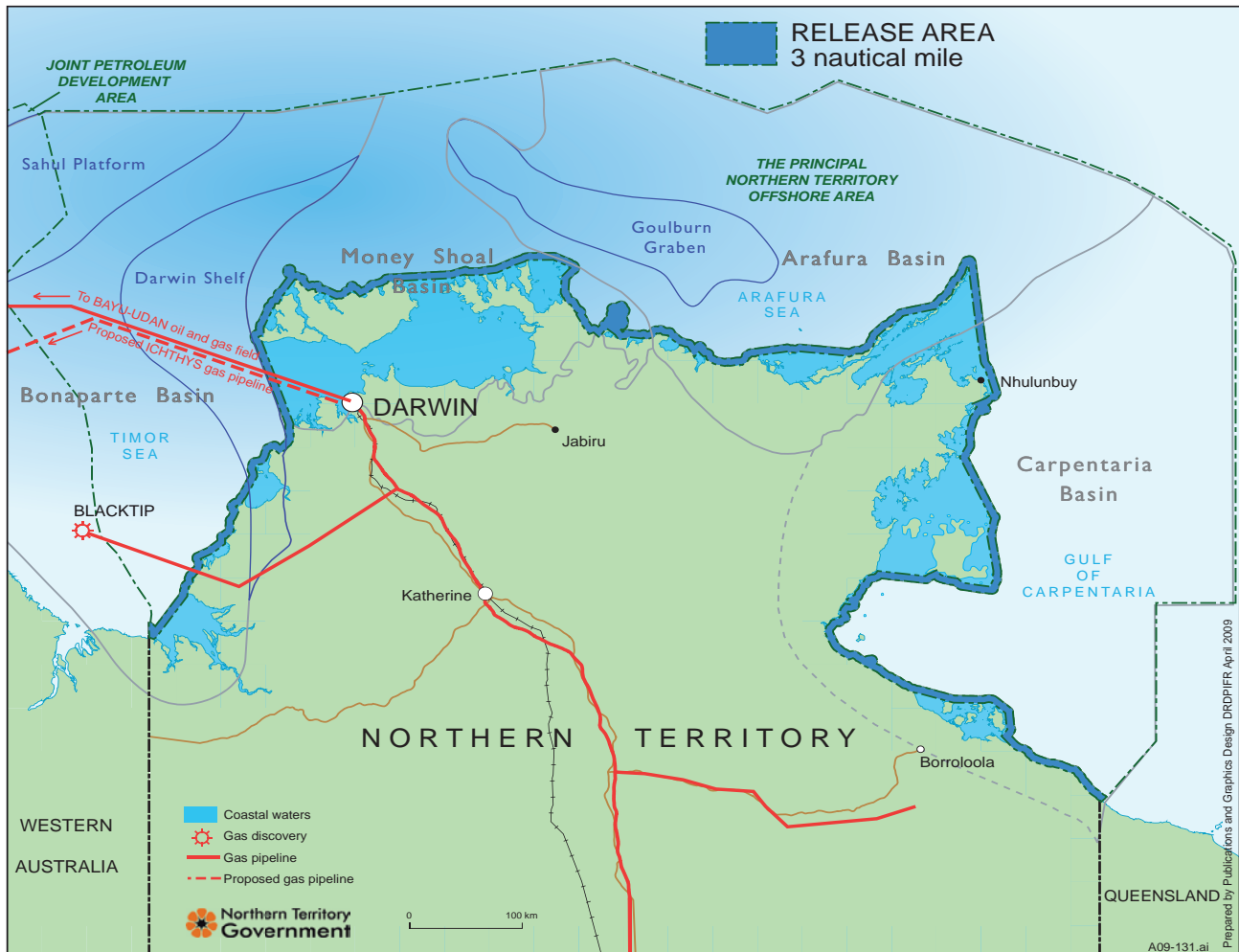
The total minimum nominated exploration expenditure work program for onshore titles for the period 2012–2015 is estimated at A\$116.494M for petroleum exploration. The work commitment for the period includes the drilling of 16 wells and the acquisition of 3269 line km of 2D seismic data. Expenditure for onshore petroleum exploration activities in the Northern Territory in 2012 was approximately \$55.7M, including \$33.2M from the 16 new permits granted in 2012.

Sixteen titles were granted in 2012 ([Table 1](#)) and 15 applications were received. There are now 40 active exploration permits (EP), 2 retention leases (RL) and 3 operating licenses (OL) in the NT onshore area.

### Coastal Waters

The NT Coastal Waters area includes all waters between the mean low water mark and a line 3 nautical miles seaward of the Australian Territorial Sea Baseline ([Figures 1, 2, 3](#)). This area was first released for applications in 2009 and is approximately 15 000 km<sup>2</sup>. Unlike Commonwealth Waters, acreage in Coastal Waters is not released for competitive tender, but is available for application at any time. No applications were received and no permits granted in 2012.





**Figure 2.** Northern Territory Coastal Waters – (includes the 3 nautical mile wide Release Area)

## Exploration operations

### Seismic surveys

There were two 2D seismic surveys undertaken in onshore areas of the Northern Territory in 2012:

- In April 2012, Armour Energy Ltd commenced a 54 line km 2D seismic acquisition program over EP 171 in the McArthur Basin (**Figure 4**).
- In July 2011, Hess Australia (Beetaloo) Pty Ltd commenced a 3600 line km 2D seismic acquisition program over Falcon Oil and Gas Australia Ltd's exploration permits EP 76, EP 98 and EP 117 in the Beetaloo Sub-basin, principally south and east of Daly Waters where 470 line km of data were acquired prior to the wet season, mainly in EP 98 in 2011. The rest of the survey was completed in November 2012 (**Figure 5**). Falcon Oil and Gas Australia Ltd is the permit holder while Hess Australia (Beetaloo) Pty Ltd is its farm-in partner.

### Drilling and well testing

In 2012, a total of five new wells were drilled, one well was re-entered and an extended production test was conducted on one well. Out of the five new wells, four were suspended and one was plugged and abandoned (**Table 2**).



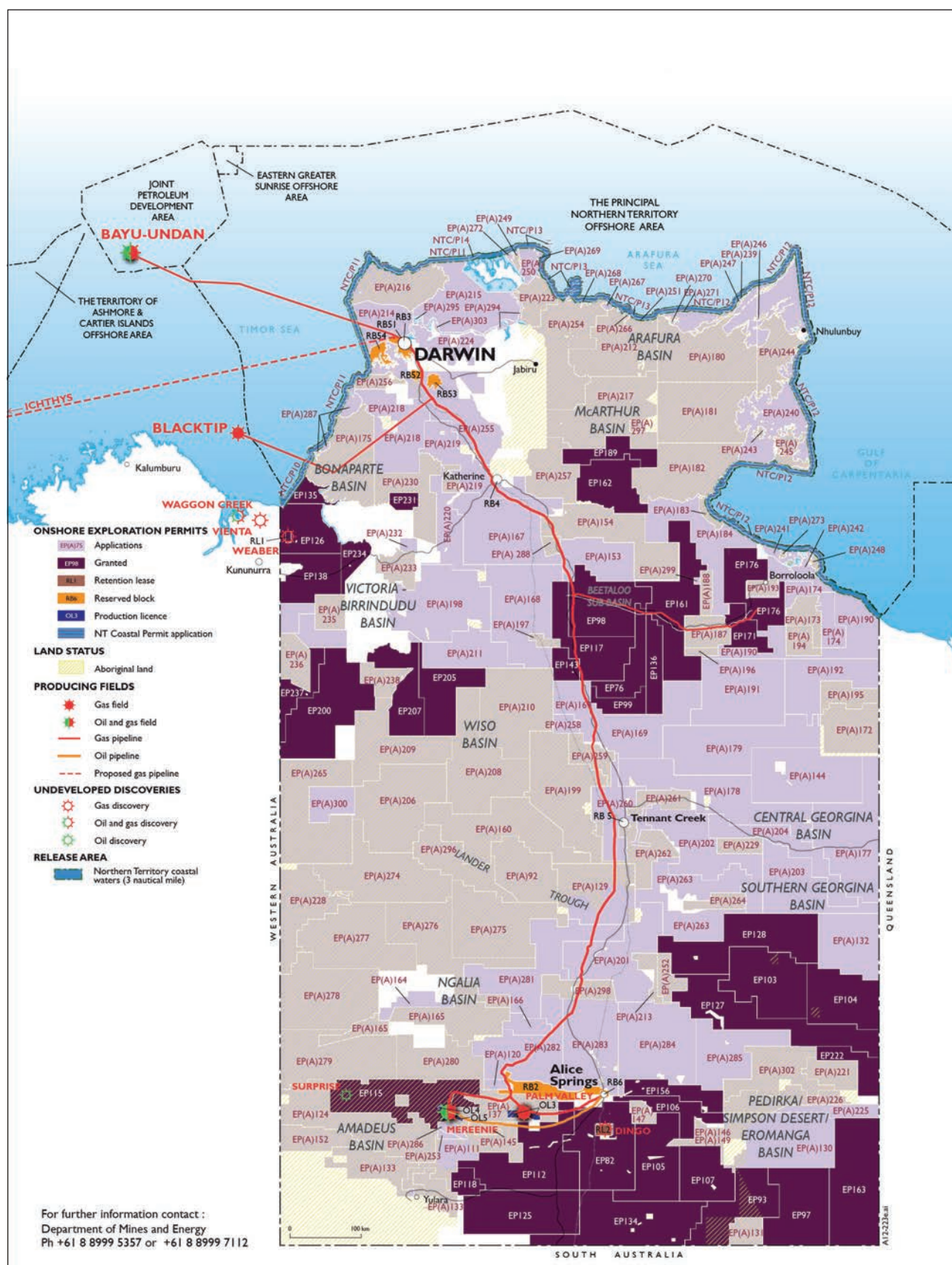
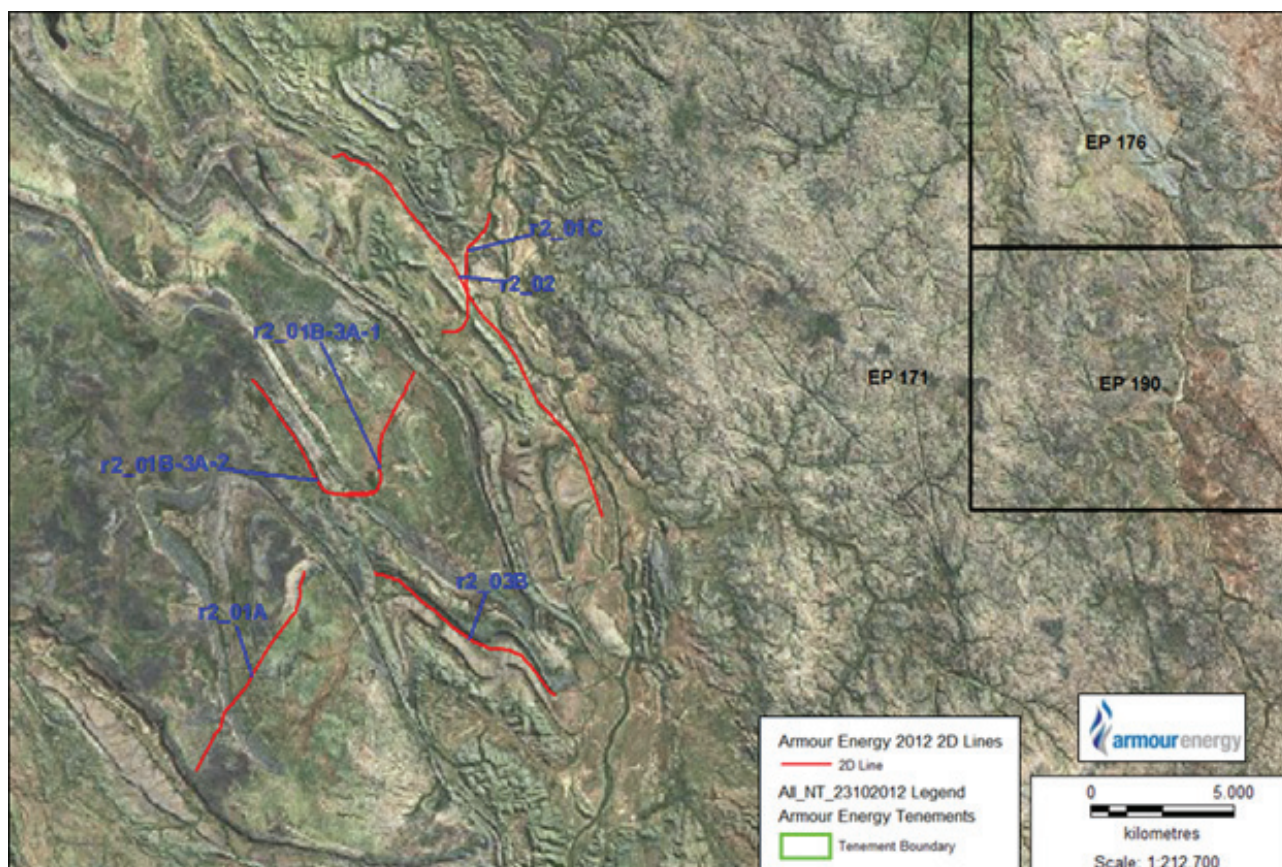


Figure 3. Petroleum operations and development in 2012.



**Figure 4.** Armour Energy Ltd's 2D seismic program 2012.

## Appraisal and development operations

### Central Petroleum Ltd

Central Petroleum Limited completed an Extended Production Test (EPT) on its oil discovery well, Surprise 1 Reentry H ST1 in EP 115 in the western Amadeus Basin. The company is now assessing the results of the EPT and drafting its field appraisal and development plans for possible future production.

### Armour Energy Ltd

Armour Energy Ltd drilled three wells in their EP 171 and EP 176 permits within the McArthur Basin. Two of the wells, Glyde-1ST1 and Cow Lagoon-1 discovered gas, whereas Kilgour North-1 encountered water. Armour is planning further exploration to help appraise the gas discoveries and progress the project into possible production.

### Santos Ltd

Santos commenced planning to further appraise and develop its conventional oil resources in the Mereenie Field (OL4 and OL5) within the Amadeus Basin. The project is known as the Mereenie Appraisal and Development Drilling (MADD) project.

## Production operations

### Oil

The Northern Territory's total onshore oil production comes from the Santos-owned and -operated Mereenie field in the Amadeus Basin, to the west of Alice Springs. To December 2012, Mereenie produced 0.228 mmbbl of oil (**Figure 6**), a 19% increase over the 0.184 mmbbl produced in 2011.



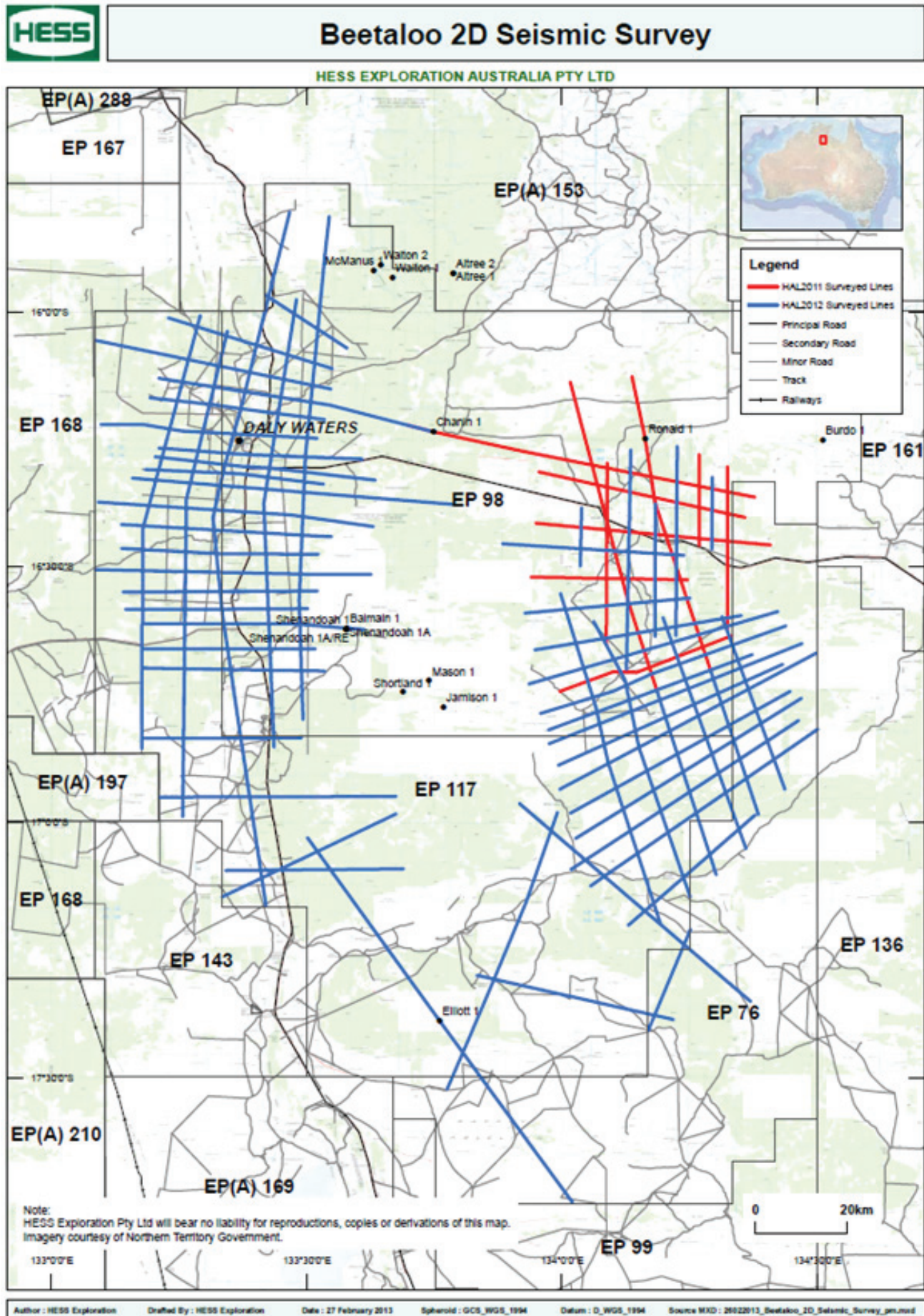


Figure 5. Hess Australia (Beetaloo) Pty Ltd's 2D seismic program 2011–2012.

Well name	Operations	Operator	Permit	Operations summary	Drill Rig	Spud/start date	Rig release/end date	Total depth (m-MD)	Comments
Baldwin 2HST1	Exploration (Focusing on Unconventional Hydrocarbons)	PetroFrontier (Australia) Pty Ltd	EP103	Re-entered; Suspended.	SS20108-Schramm TX200	3/08/11	15/10/11	1952.5	<i>Drilled and suspended in 2011. Re-entered in 2012 and attempted to fracture stimulate, but encountered operational problems. Well suspended.</i>
Cow Lagoon 1	Exploration (Focusing on Unconventional Gas)	Armour Energy Ltd	EP176	Drilled; Suspended.	Lucas 85	11/05/12	17/06/12	1804.9	<i>Encountered gas flow. Well suspended awaiting further assessment.</i>
Glyde 1ST1	Exploration (Focusing on Conventional Gas)	Armour Energy Ltd	EP171	Drilled; Suspended.	Lucas 85	27/07/12	16/08/12	840	<i>Encountered gas flow. Well suspended as a potential producer.</i>
Kilgour North 1	Exploration (Focusing on Unconventional and Conventional Gas)	Armour Energy Ltd	EP171	Drilled; Plugged & Abandoned.	Lucas 85	23/06/12	15/07/12	1142.8	<i>Target zones wet. Increase in water. Well plugged and abandoned.</i>
MacIntyre 2H	Exploration (Focusing on Unconventional Hydrocarbons)	PetroFrontier (Australia) Pty Ltd	EP127	Re-entered; Fracture Stimulated; Tested; Suspended.	Ensign Rig 918	6/06/12	30/06/12	1916	<i>Well suspended when H<sub>2</sub>S was encountered during testing.</i>
Owen 3H	Exploration (Focusing on Unconventional Hydrocarbons)	PetroFrontier (Australia) Pty Ltd	EP104	Drilled; Fracture Stimulated; Tested; Suspended.	Ensign Rig 918	8/07/12	2/08/12	2153	<i>Well suspended when H<sub>2</sub>S was encountered during testing.</i>
<b>Surprise 1 Re-entry HST1</b>	Exploration (Conventional Oil Discovery)	Central Petroleum Ltd	EP115	Extended Production Test; Suspended.	n/a - Well Testing	20/06/12	11/12/12	2853	<i>Completed approximately 6-months of Extended Production Testing. Well suspended awaiting further assessment.</i>

**Table 2.** NT Drilling and Well Testing Activities.

Production should continue to increase during 2013 as Santos refocuses on the oil side of its operations. Shipment of oil from Mereenie to South Australia continues to be by truck, but the viability of refurbishing the pipeline is being reassessed in light of the impending increases in production.

## Gas

The NT's onshore gas production ([Table 3](#)) comes from the Mereenie and Palm Valley fields in the Amadeus Basin, to the west of Alice Springs. In 2012, 1.499 bscf of gas was produced from the fields ([Figure 7](#)). Mereenie produced 1.205 bscf in 2012, compared to 1.212 bscf in 2011, whereas Palm Valley produced 0.294 bscf in 2012 compared to 1.697 bscf in 2011.

Gas produced at Mereenie currently consists exclusively of solution gas associated with oil production. At present, the gas is being reprocessed and reinjected into the main oil production reservoir to assist in maintaining pressure.

Gas from Palm Valley, which is owned and operated by Magellan Petroleum Australia Ltd, was supplied to Power and Water Corporation in Alice Springs for power generation until 16 January 2012, when the contract ended. However, Magellan has been able to continue with limited production through working arrangements with Santos Ltd.

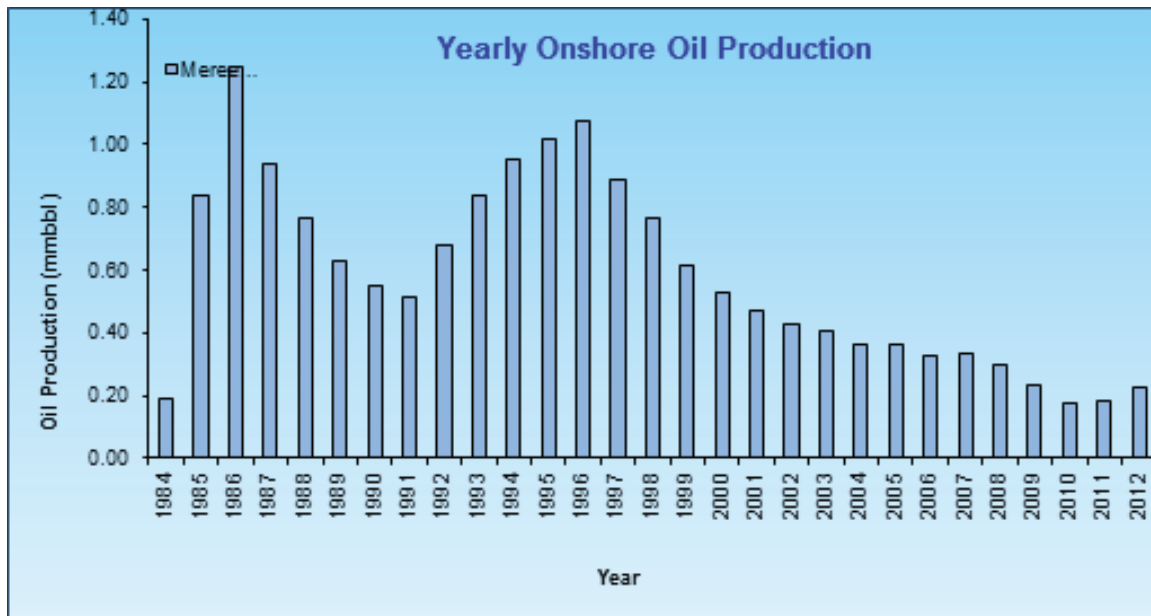


Figure 6. Northern Territory oil production for period 1984–2012.

### Upcoming and proposed operations

#### Pangaea Resources Pty Ltd

- Proposed 2D seismic survey in the Bonaparte Basin.
- Possible drilling of exploration wells for both conventional and unconventional hydrocarbons.

#### Santos Ltd

- Commence Mereenie Appraisal and Development Drilling (MADD) project in the Mereenie field (Amadeus Basin) to appraise and develop the conventional oil resources. Phase 1 of the work program will commence in 2013 with the drilling of 12 wells.

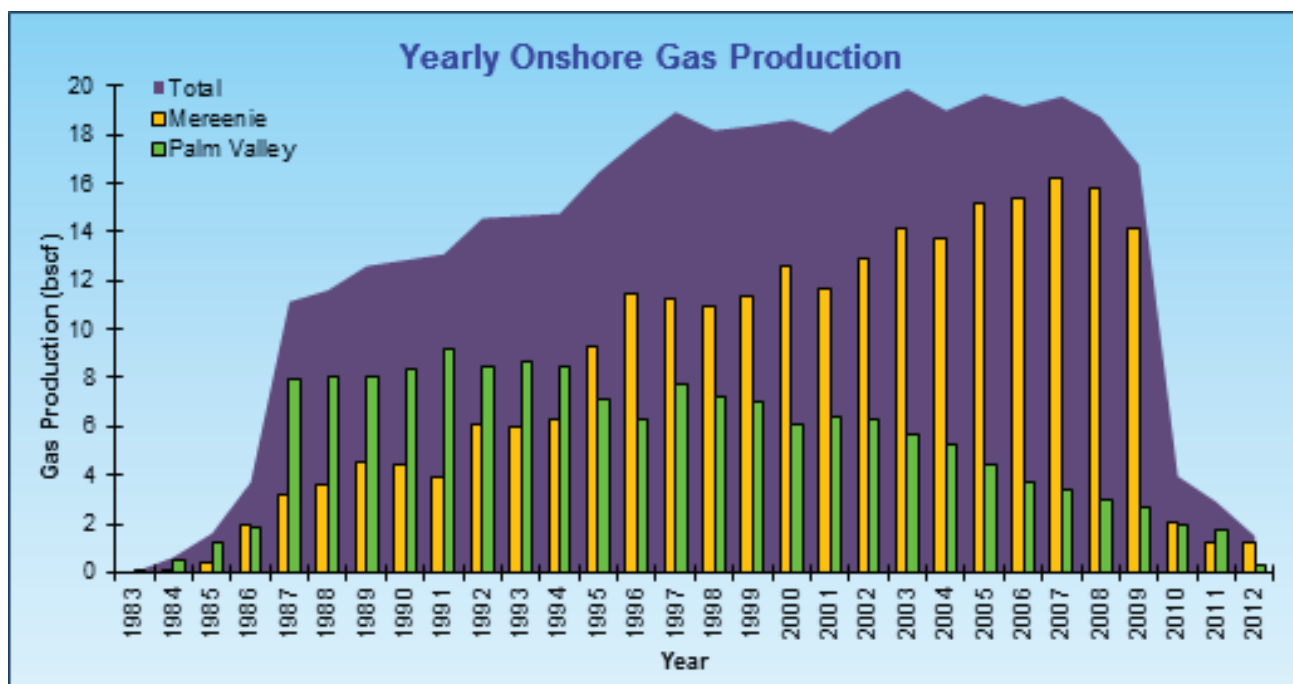


Figure 7. Northern Territory gas production for period 1983–2012.

YEAR	OIL PRODUCTION (MMBBL)		GAS PRODUCTION (BSCF)		
	Mereenie	TOTAL	Mereenie	Palm Valley	TOTAL
1983				0.029	0.029
1984	0.187	0.187	0.125	0.519	0.644
1985	0.835	0.835	0.365	1.259	1.624
1986	1.246	1.246	1.919	1.804	3.723
1987	0.941	0.941	3.207	7.928	11.135
1988	0.765	0.765	3.587	8.023	11.610
1989	0.631	0.631	4.560	8.043	12.603
1990	0.547	0.547	4.453	8.391	12.844
1991	0.514	0.514	3.944	9.147	13.091
1992	0.676	0.676	6.121	8.450	14.571
1993	0.838	0.838	5.972	8.687	14.659
1994	0.956	0.956	6.339	8.424	14.763
1995	1.018	1.018	9.297	7.148	16.445
1996	1.073	1.073	11.491	6.263	17.754
1997	0.886	0.886	11.208	7.724	18.932
1998	0.766	0.766	10.911	7.267	18.178
1999	0.614	0.614	11.387	6.981	18.368
2000	0.530	0.530	12.558	6.053	18.611
2001	0.469	0.469	11.652	6.430	18.082
2002	0.431	0.431	12.867	6.248	19.115
2003	0.407	0.407	14.161	5.718	19.879
2004	0.366	0.366	13.771	5.220	18.991
2005	0.366	0.366	15.209	4.448	19.657
2006	0.324	0.324	15.413	3.754	19.167
2007	0.336	0.336	16.202	3.371	19.573
2008	0.301	0.301	15.759	2.973	18.732
2009	0.236	0.236	14.123	2.639	16.762
2010	0.173	0.173	2.051	1.922	3.973
2011	0.184	0.184	1.212	1.697	2.909
2012	0.228	0.228	1.205	0.294	1.499
TOTAL	16.844	16.844	241.069	156.854	397.923

**Table 3.** Northern Territory Oil and Gas Production Data (1983–2012).

### **Falcon Oil and Gas Australia Pty Ltd**

- 2D seismic survey in the Beetaloo Sub-basin (McArthur Basin).

### **Hess Australia (Beetaloo) Pty Ltd**

- Drilling of up to five exploration wells within the Beetaloo Basin, focusing on unconventional and conventional hydrocarbons.

## **Licensed pipelines**

There are 19 current licenses under the NT's *Energy Pipelines Act*: 13 operational pipelines (11 gas, one condensate and one LPG; [Table 4](#)), two mothballed pipelines (one oil and one gas), two decommissioned gas pipelines and two sections of the yet-to-be-constructed 890 km-long Ichthys Project gas export pipeline from



Operating petroleum pipelines licensed under the NT Energy Pipelines Act (PLs) and the NT Petroleum Submerged Lands Act (NTCPs)						
License No.	Onshore/Offshore	Name	Product	Length (km)	Nominal Diameter (mm)	Year Constructed
PL1	Onshore	Palm Valley to Alice Springs (incl. laterals)	Gas	156	200/150/50	1983 - 2011
PL4	Onshore	Amadeus Basin Pipeline (incl. laterals)	Gas	1628	350/300/250/100	1986
PL7	Onshore	Central Energy Pipeline	Gas	10	100	1988
PL10	Onshore	Elliot Pipeline	Gas	4	60	1990
PL15	Onshore	Channel Island LPG Pipeline	Gas	<1	150	1992
PL17	Onshore	McArthur River Mine Pipeline	Gas	333	150	1995
PL18	Onshore	Berrimah Pipeline	Gas	19	150	1996
PL20	Offshore	Bayu-Undan to Darwin Pipeline	Gas	92	660	2005
NTCP-1	Offshore	Bayu-Undan to Darwin Pipeline	Gas	7	661	2005
PL21	Onshore	Bonaparte Gas Pipeline	Gas	286	300	2008
PL22	Onshore	Weddell Interconnect Pipeline	Gas	1	300	2007
PL23	Offshore	Blacktip Gas Export Pipeline	Gas	3	450	2008
NTCP-2	Offshore	Blacktip Gas Export Pipeline	Gas	5	451	2008
PL24	Offshore	Blacktip Condensate Pipeline	Condensate	3	300	2008
NTCP-3	Offshore	Blacktip Condensate Pipeline	Condensate	6	301	2008
PL25	Onshore	Wickham Point Interconnect Pipeline	Gas	10	300	2008
PL26	Offshore	Ichthys Gas Export Pipeline	Gas	~90	1050	To commence 2014
NTCP-4	Offshore	Ichthys Gas Export Pipeline	Gas	~7	1050	To commence 2014
PL27	Onshore	Ichthys Gas Export Pipeline	Gas	~4	1050	To commence 2014

**Table 4.** Northern Territory Operating Pipelines.

the Ichthys gas field in the Browse Basin to the Ichthys LNG plant in Darwin Harbour, construction of which is scheduled to commence in Q2 2014.

There are four current licenses under the NT's *Petroleum (Submerged Lands) Act*: three operational pipelines (two gas and one condensate; (Table 4), and a section of the Ichthys Project gas export pipeline scheduled for construction in 2014–2015.

During the year, significant maintenance and system upgrade projects were carried out on the Amadeus Gas Pipeline, including repairs to corrosion damage, replacement of the coating on underground pipes at scraper stations and the Darwin City Gate, and the installation of additional cathodic protection infrastructure. Engineering design work was substantially progressed for both the NT waters and onshore portions of the Ichthys Gas Export Pipeline in preparation for the commencement of dredging work in Darwin Harbour in Q4 2013.



## Geothermal

### ***Titles***

In 2012, there were two active geothermal permits ([Table 5](#)). These permits were granted in February 2011 for 5 years. GEP 27829 is operated by Western Desert Resources Ltd and is located in the McArthur Basin and GEP 27831 is operated by Crossland Diamonds Pty Ltd and is located in the southern Arunta Region.

### ***Exploration***

In 2012, the operators of the current permits completed the following measurements, assessments, analysis and modeling work as part of the Year 1 work program:

- Collation of published datasets.
- Assessment of petroleum wells data.
- Analysis, interpretation, modeling and assessment of geothermal potential.
- Measuring surface temperatures.

It is estimated that close to \$13M has been committed for geothermal exploration over the next three years.

Title	Title holder	Date awarded
GEP 27829	Western Desert Resources Ltd	23-Feb-11
GEP 27831	Crossland Diamonds Pty Ltd	23-Feb-11

**Table 5.** Northern Territory Geothermal Titles.

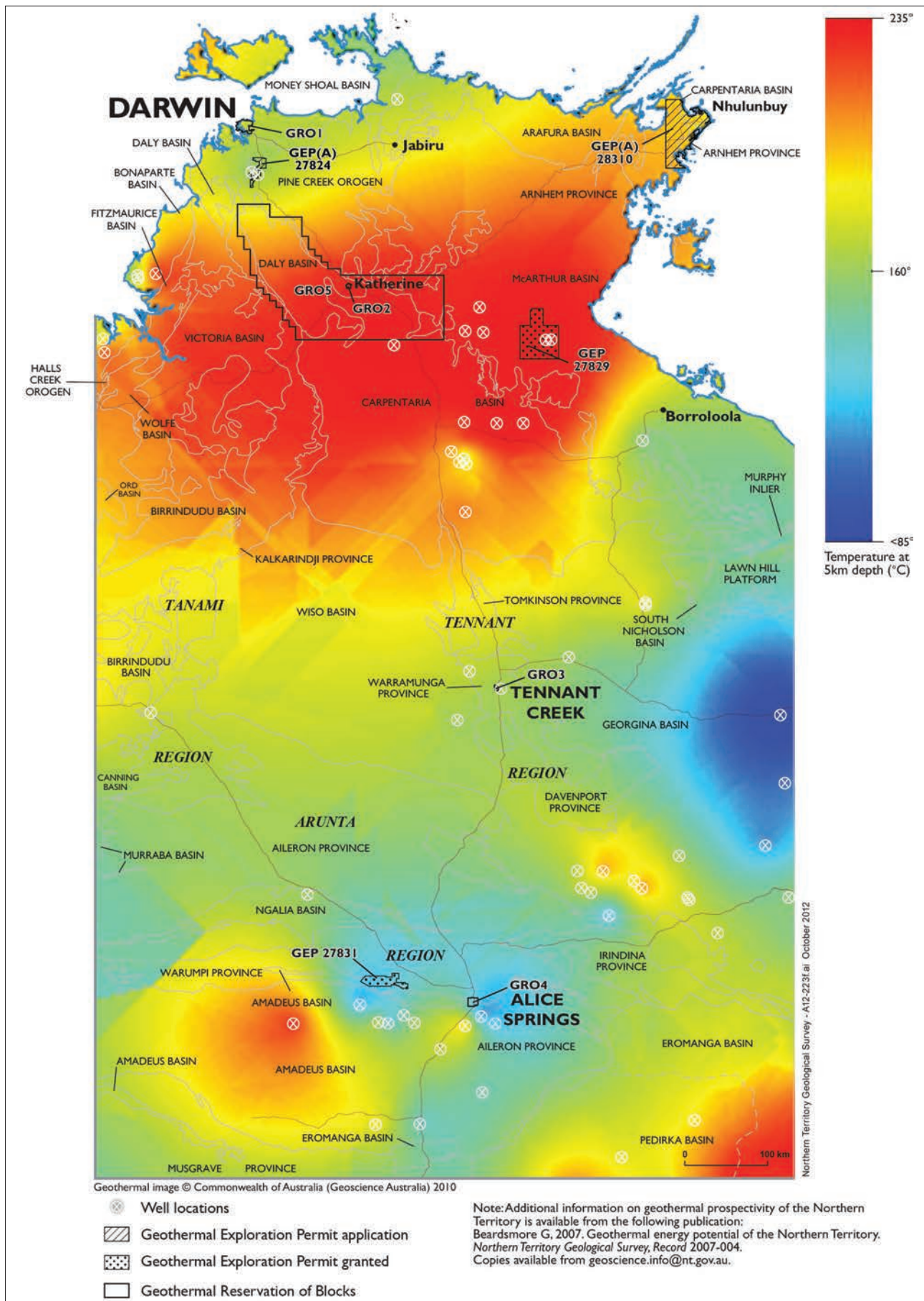


Figure 8. Geothermal exploration permits and applications in 2012

## Useful NT Government Contacts

### Energy Titles and Operations Administration and Regulation

#### *Energy Division, NT Department of Mines and Energy*

The Energy Division administers and regulates upstream petroleum activities, petroleum transmission pipelines and geothermal resource activities in Northern Territory onshore and coastal waters areas.

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### Energy Resource Development

#### *Industry Development and Investment, NT Department of Business*

This group facilitates development of:

- NT's oil and gas resources
- Darwin as a production hub and offshore petroleum supply base
- NT supply and service industries to support the region's oil and gas industry.

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## Acknowledgements

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