

***Panax Geothermal Limited***  
*(renamed **Raya Group Limited** from 6 May 2013)*  
ABN 89 122 203 196

## Annual Report

*24 July 2013 – 23 July 2014*

*Geothermal Exploration Licence  
GEL 223 – Term 2 Licence Year 2*

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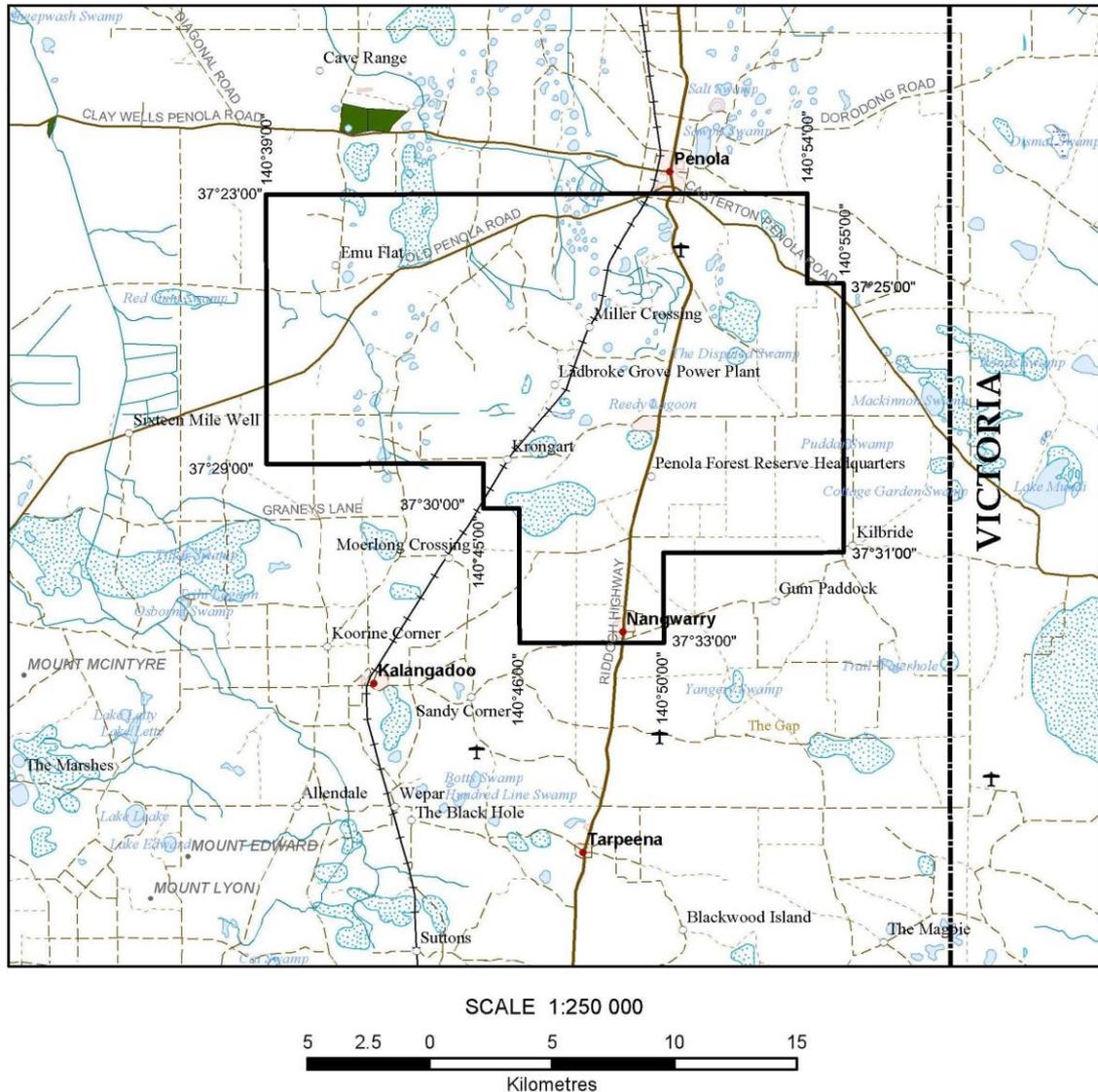
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# 1 Introduction

The map below outlines the location of Geothermal Exploration Licence 223 that is held by Osiris Energy Limited, which is owned by the Raya Group Limited.

## GEL 223



This report details the work conducted on GEL 223 during the year 24th July 2013 to 23 July 2014 in accordance with Regulation 33 of the Petroleum and Geothermal Energy Act/Regulations 2000.

The Licence year which applies is as follows:

- GEL 223 Term 2 Year 2

## 2 Permit Summary

For the duration of the licence year, the licensee for Geothermal Exploration Licence (GEL) number 223 was:

Licence	Owner/s	Interest
GEL 223	Osiris Energy Limited	100%

Osiris Energy Limited is 100% owned by the Raya Group Limited.

Any work undertaken in either GEL 223 or the new geothermal tenement GEL 611 will count to meeting the other tenements work program, essentially that the two licences would have a common work program. GEL 611 and GEL 223 have common anniversary dates.

Table 1 outlines the work program commitments for the licence's five year term.

**Table 1. Reconciliation of Licence Years and Work Program**

Licence dates	Year	Minimum Work Program
24 July 2012 – 23 July 2013	Year 1	<ul style="list-style-type: none"> <li>Geological and geophysical studies</li> </ul>
24 July 2013 – 23 July 2014	Year 2	<ul style="list-style-type: none"> <li>Geological and geophysical studies</li> </ul> <p><i>(Year 2 work program may be conducted anywhere within the boundaries of GELs 223 and 611)</i></p>
24 July 2014 – 23 July 2015	Year 3	<ul style="list-style-type: none"> <li>Geological and geophysical studies</li> </ul> <p><i>(Year 3 work program may be conducted anywhere within the boundaries of GELs 223 and 611)</i></p>
24 July 2015 – 23 July 2016	Year 4	<ul style="list-style-type: none"> <li>Drill one well</li> </ul> <p><i>(Year 4 work program may be conducted anywhere within the boundaries of GELs 223 and 611)</i></p>
24 July 2016 – 23 July 2017	Year 5	<ul style="list-style-type: none"> <li>Geological and geophysical studies</li> </ul> <p><i>(Year 5 work program may be conducted anywhere within the boundaries of GELs 223 and 611)</i></p>

The following table displays the minimum work program (after all variations) and the actual work completed up until the end of the current licence period.

**Table 2. Work program and Work completed  
(as of end of current reporting period) by licence year.**

<b>Licence dates</b>	<b>Licence Year</b>	<b>Minimum Work Program</b>	<b>Actual Work Undertaken</b>
24 July 2012 – 23 July 2013	Year 1	<ul style="list-style-type: none"> <li>• Geological and geophysical studies</li> </ul>	<ul style="list-style-type: none"> <li>• Geological and geophysical studies</li> </ul>
24 July 2013 – 23 July 2014	Year 2	<ul style="list-style-type: none"> <li>• Geological and geophysical studies</li> </ul>	<ul style="list-style-type: none"> <li>• Geological and geophysical studies</li> </ul>
24 July 2014 – 23 July 2015	Year 3	<ul style="list-style-type: none"> <li>• Geological and geophysical studies</li> </ul>	
24 July 2015 – 23 July 2016	Year 4	<ul style="list-style-type: none"> <li>• Drill one well</li> </ul>	
24 July 2016 – 23 July 2017	Year 5	<ul style="list-style-type: none"> <li>• Geological and geophysical studies</li> </ul>	

### **3 Regulated Activities**

#### **Drilling and Related Activities**

*The Mud Pits at the Salamander 1 site were emptied and the mud was disposed of into an approved dump site. The Pit area was then remediated. Samples of soil from the area under the two Pit areas were taken and this confirmed no contamination. A Report was issued after the end of this Reporting Year.*

*Under the Well Management Plan, regular well head inspections and wellhead pressure readings have been taken and submitted to DSD (Attachment 2).*

#### **Seismic Data Acquisition**

*No regulated activities undertaken in the licence reporting period*

#### **Seismic Data Processing and Reprocessing**

*No regulated activities undertaken in the licence reporting period.*

#### **Geochemical, Gravity, Magnetic and other surveys**

*No regulated activities undertaken in the licence reporting period.*

#### **Processing, inversion and Interpretation**

*No regulated activities undertaken in the licence reporting period*

#### **Post-survey activities**

*No regulated activities undertaken in the licence reporting period*

#### **Production and Processing**

*No regulated activities undertaken in the licence reporting period*

#### **Pipeline/Flowline Construction and Operation**

*No regulated activities undertaken in the licence reporting period*

### **Preliminary Survey Activities**

*No regulated activities undertaken in the licence reporting period*

### **4 Non-regulated Activities**

Raya Group is a participant in a Study, an ARENA (Australian Renewable Energy Agency) Measure, to develop a better understanding of issues which impact Reservoir quality in geothermal wells in both the Otway and Cooper Basins is being undertaken by the South Australian Centre for Geothermal Energy Research at the University of Adelaide and the CSIRO. The Study is also using Raya Group data and Raya Group provided technical expertise when required.

This ARENA Measure entitled Reservoir Quality in Sedimentary Geothermal Resources aims to analyse why the two geothermal wells drilled in Hot Sedimentary Aquifers (HSA) reservoirs in the Cooper Basin and the Otway Basin respectively achieved fluid flow rates which were significantly lower than expected. As the Study is also analysing the results of other wells in the two Basins, the results of the Study will have relevance for all the geothermal tenement areas in both the Cooper and Otway Basins.

A Confidential Report (**Technical report on activities completed to the end of Milestone 3: ARENA Measure: Reservoir quality in sedimentary geothermal resources**) on the work completed to the end of Milestone 3 was issued to the Study participants and a copy of this has been forwarded to DSD on 29 January 2014.

The following further work involving literature review and preliminary analysis of target formations was completed for Milestone 3 by the Study team with the involvement of Raya Group technical experts as required:

- i) Evaluations of the diagenetic history of neighbouring formations intersected by the two wells, Salamander-1 and Celsius-1.
- ii) Analysis of drill cuttings and core samples of wells adjacent to Salamander-1 and Celsius-1 wells.
- iii) Analysis of secondary mineral growth via QEMSCAN, petrological analysis and direct in situ experiments (these methods are considered superior to scanning electron microscopy and transmission electron microscopy).
- iv) Reconstruction of diagenetic reactions via petrographic methods including cathodoluminescence.
- v) Identification of rock mineralogy to ascertain reactive matrix minerals that impede porosity.
- vi) Recommendations and costing estimates for initial well index restoration.
- vii) Reservoir simulation and well productivity forecast based on numerical and analytical methods.

A Confidential Report (**Technical report on activities completed to the end of Milestone 4: ARENA Measure: Reservoir quality in sedimentary geothermal resources**) dated 30th April 2014 on the work completed to the end of Milestone 4 was issued to the Study participants and a copy of this was been forwarded to DSD on 5 September 2014. The Milestone 4 report contains:

- i) Diagenetic modelling results for the Pretty Hill Formation and the Hutton Sandstone:
- ii) assessment of diagenetic cements from well to well to identify systematic patterns of alteration critical to HSA.

- iii) thermal reconstruction of the target formations (basin history) via methods including fission track analysis and vitrinite reflectance where not already constrained.
- iv) identification of more favourable lithologies of consistent porosity.
- v) identification of favourable sedimentary depositional environments on the basis of initial chemical and porosity conditions for the targeting of future wells by predictive modelling.

A Confidential Report (**Technical report on activities completed to the end of Milestone 4a: ARENA Measure: Reservoir quality in sedimentary geothermal resources**) dated 30<sup>th</sup> June 2014 on the work completed to the end of Milestone 4a was issued to the Study participants and a copy of this was been forwarded to DSD on 5 September 2014.

The Milestone 4a report contains findings on the evolution of permeability in the target formations (the Hutton Sandstone and Pretty Hill Formation) and neighbouring formations within the Otway and Cooper Basins. The work was focussed on the following:

- i) Identification of stable isotope composition of cement phases to determine source, timing and temperatures of secondary fluids; and
- ii) Identification of ionic composition of cements to ascertain redox conditions

The Report also contains recommendations with regard to remediation of well formation damage based on analyses from Salamander 1 and Celsius 1 and adjacent wells.

A further and final Report will be issued on the 14<sup>th</sup> November 2014.

## **5 Compliance Issues**

### **Licence and Regulatory Compliance**

All material and significant licence, regulatory and SEO requirements have been fulfilled.

### **Regulatory Non-Compliance**

*Not applicable.*

### **Management System Audits**

*Not applicable.*

### **Report and Data Submissions**

	<b>Report/Data</b>	<b>Due Date</b>	<b>Date Submitted</b>	<b>Compliant?</b>
1	Year 1 Annual Report GEL 223	23rd September, 2013	5th November, 2013	Non Compliant (late submission)
2	Technical report on activities completed to the end of Milestone 3  ARENA Measure: Reservoir quality in sedimentary geothermal resources	31 <sup>st</sup> October 2013	29 <sup>th</sup> January 2014	
3	Technical report on activities completed to the end of Milestone 4  ARENA Measure: Reservoir quality in sedimentary geothermal resources	30 <sup>th</sup> April 2014	5 <sup>th</sup> September 2014	

4	Technical report on activities completed to the end of Milestone 4a  ARENA Measure: Reservoir quality in sedimentary geothermal resources	30 <sup>th</sup> June 2014	5 <sup>th</sup> September 2014	
5	Salamander 1 – email pursuant to the Well Management Plan	Regular pressure readings reports	Various	

**Incidents**

*There were no new incidents relating to health, safety, or community related matters.*

**Threat Prevention**

*There are no foreseeable threats to report in the permit year.*

**Future Work Program**

The Work Program for the Arena Measure is continuing during the current year and will be concluded by December 2014.

**6 Expenditure Statement**

Please refer to Appendix 1 for the expenditure statement for the current reporting period.

*THE ATTACHED FINANCIAL INFORMATION IS NOT FOR PUBLICATION*