# Third Quarter Activities Report

For period ending 30 September 2015



23 October 2015

# GLNG successfully delivered on time and within budget. 2015 LNG sales volumes surpass 1 million tonnes

Santos today announced that its year-to-date equity share of LNG sales volumes exceeded 1 million tonnes during the third quarter.

LNG sales volumes have more than doubled in 2015 and growth is expected to continue in the fourth quarter following GLNG shipping its first cargo from Curtis Island last week.

Third quarter production of 14.5 million barrels of oil equivalent (mmboe) was 4% higher than the corresponding quarter and 10% higher in the year-to-date.

Santos Managing Director and Chief Executive Officer David Knox said both PNG LNG and Darwin LNG delivered strong production in the quarter and GLNG would make an excellent addition to that profile.

"The delivery of GLNG is one of the most significant milestones in our company's history. It marks Santos' transition from a domestic gas company to an important Asian LNG player," Mr Knox said.

"The *Seri Bakti* which is carrying the first cargo from GLNG will arrive in South Korea in the coming days. GLNG is the final piece of our robust LNG portfolio, which will provide a strong source of revenue for decades to come."

More broadly, Mr Knox said the company was continuing to successfully drive its cost reduction program.

"We said that we would produce more for less and this quarter's figures are a strong reflection of that. Year to date production is up 10% while capex is down 55% and unit production costs are down 15%."

Sales revenue fell 24% with the average realised oil price of A\$71 per barrel down 38% compared to the corresponding quarter last year.

Capital expenditure guidance for 2015 has been lowered by a further 10% to \$1.8 billion. Production guidance for 2015 is narrowed to 57 to 59 mmboe (previously 57 to 64 mmboe). All other guidance is maintained.

Santos announced on 21 August 2015 that it would conduct a thorough strategic review of all options to restore and maximise shareholder value. The strategic review is ongoing, and will continue to consider all proposals which deliver appropriate value and certainty for shareholders.

#### Comparative performance at a glance

<b>Corresponding period</b>	Q3 2015	Q3 2014	Change
Production (mmboe)	14.5	14.0	+4%
Sales (mmboe)	16.2	16.8	-4%
Average realised oil price (A\$/bbl)	71.01	115.12	-38%
Sales revenue (\$million)	808	1,060	-24%
Capital expenditure (\$million)	388	952	-59%



Quarterly comparison	Q3 2015	Q2 2015	Change	
Production (mmboe)	14.5	14.3	+1%	
Sales (mmboe)	16.2	15.7	+3%	
Average realised oil price (A\$/bbl)	71.01	82.59	-14%	
Sales revenue (\$million)	808	786	+3%	
Capital expenditure (\$million)	388	358	+8%	
Year-to-date comparison	2015	2014	Change	
Production (mmboe)	42.8	39.0	+10%	
Sales (mmboe)	47.1	45.7	+3%	
Average realised oil price (A\$/bbl)	74.96	121.77	-38%	
Sales revenue (\$million)	2,418	2,947	-18%	
Capital expenditure (\$million)	1,312	2,938	-55%	

Sales gas, ethane and sales gas to LNG production of 64.9 petajoules for the quarter was 7% higher than the corresponding quarter, reflecting a 30% increase in sales gas to LNG volumes. Total sales gas, ethane and LNG sales revenue decreased by 5% to \$460 million for the quarter due to lower LNG prices and lower third party volumes partially offset by higher LNG volumes and higher domestic gas prices.

Quarterly crude oil production of 2.1 million barrels was 16% higher than the previous quarter, primarily due to the return of Mutineer Exeter/Fletcher Finucane production on 14 July after extended maintenance. The average oil price for the quarter was A\$71 per barrel, 14% lower than the previous quarter and 38% lower than the corresponding quarter, reflecting lower global oil prices partially offset by a weaker Australian dollar. Total crude oil sales revenue of \$267 million for the quarter was 3% lower than the previous quarter reflecting the fall in commodity price offset by higher sales volumes.

#### 2015 Guidance

Production guidance for 2015 is narrowed to 57 to 59 mmboe (previously 57 to 64 mmboe). The key influences on annual production have been lower than expected domestic gas nominations from GLNG, combined with the unscheduled maintenance of both the Mutineer-Exeter/Fletcher Finucane and Chim Sáo FPSO's during the second quarter and August respectively. These factors have been partially offset by strong performance from PNG LNG where the plant has consistently operated above nameplate capacity.

Capital expenditure guidance is lowered by a further 10% to \$1.8 billion for 2015, reflecting cost savings and deferral of development activity. All other guidance is maintained.

	2015		
Item	Previous guidance	Updated guidance	
Production	57-64 mmboe	57-59 mmboe	
Production costs	\$14.2-14.6/boe	No change	
Depreciation, depletion & amortisation (DD&A) expense	\$17.5-18.0/boe	No change	
Capital expenditure (including exploration and evaluation) <sup>1</sup>	\$2 billion	\$1.8 billion	

<sup>&</sup>lt;sup>1</sup> Capital expenditure guidance excludes capitalised interest, which is forecast at approximately \$150 million.

Further detail of 2015 year-to-date capital expenditure, including exploration and evaluation expenditure, is reported in the table on page 8 of this report.



# 1. Production (Santos share)

	Q3 2015	Q3 2014	Q2 2015	2015 YTD	2014 YTD	Full-year 2014
Sales gas and ethane (PJ)	<u> </u>	- 1	<del>-</del>			
Cooper	16.0	16.8	16.1	47.0	45.8	63.3
Carnarvon	13.5	11.9	13.2	40.5	39.7	54.2
Indonesia	5.8	6.1	6.2	17.6	18.6	25.1
Otway	3.5	4.5	3.4	10.4	12.5	16.0
Denison/Scotia/Spring Gully/Combabula	3.1	3.3	3.6	10.0	9.3	12.4
GLNG domestic	1.7	1.7	1.2	4.7	6.2	7.9
Vietnam	0.7	0.6	1.1	3.0	2.3	3.2
Other <sup>1</sup>	0.5	-	0.4	1.1	-	0.4
Total production (PJ)	44.8	44.9	45.2	134.3	134.4	182.5
Total production (mmboe)	7.7	7.7	7.8	23.1	23.1	31.4
Sales gas to LNG (PJ)						
PNG LNG	15.1	12.5	15.0	44.1	19.4	34.0
Darwin LNG	4.8	3.0	4.9	14.6	12.9	16.5
GLNG <sup>2</sup>	0.2	-	0.1	0.3	-	-
Total production (PJ)	20.1	15.5	20.0	59.0	32.3	50.5
Total production (mmboe)	3.4	2.7	3.5	10.1	5.6	8.7
Condensate (000 barrels)						
PNG LNG	364.6	347.5	365.4	1,064.7	532.7	915.6
Cooper	223.3	274.5	225.0	692.0	760.7	1,036.9
Bayu-Undan	163.3	137.7	191.5	545.3	617.1	695.4
Carnaryon	140.5	120.6	136.3	413.4	392.0	533.4
Amadeus	12.7	11.5	10.6	32.5	30.8	41.0
Other <sup>3</sup>	3.9	6.0	3.4	11.8	15.2	19.7
Total production (000 barrels)	908.3	897.8	932.2	2,759.7	2,348.5	3,242.0
Total production (mmboe)	0.9	0.8	0.9	2.7	2.2	3.0
LPG (000 tonnes)		•	•			
Cooper	31.3	32.2	27.5	84.6	93.5	128.4
Bayu-Undan	9.0	7.7	10.6	30.0	34.3	39.0
Total production (000 tonnes)	40.3	39.9	38.1	114.6	127.8	167.4
Total production (mmboe)	0.3	0.4	0.3	0.9	1.1	1.4
Crude oil (000 barrels)						
Cooper	737.4	795.2	723.0	2,169.0	2,410.7	3,230.6
Vietnam	450.0	756.2	685.1	1,909.4	2,051.2	2,822.0
Mutineer-Exeter/Fletcher Finucane	491.5	257.8	-	577.3	988.8	1,443.6
Stag	209.0	323.3	200.1	589.2	814.4	1,085.5
Barrow	123.2	126.3	122.9	363.6	406.8	526.7
Indonesia	45.3	39.8	44.7	122.3	120.5	168.2
Amadeus	44.6	63.1	65.8	174.0	156.5	225.6
Other <sup>4</sup>	43.9	24.8	12.2	65.6	72.4	92.5
Total production (000 barrels)	2,144.9	2,386.5	1,853.8	5,970.4	7,021.3	9,594.7
Total production (mmboe)	2.2	2.4	1.8	6.0	7.0	9.6
Total						
Production (mmboe)	14.5	14.0	14.3	42.8	39.0	54.1
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 $<sup>^{\</sup>rm 1}\,{\rm Amadeus}$  and Gunnedah

<sup>&</sup>lt;sup>2</sup> GLNG production is Santos' interest of the sales gas to LNG produced from the GLNG upstream fields at Fairview and Roma. Santos portfolio gas produced for the Horizon contract is attributed to the field of production.

<sup>&</sup>lt;sup>3</sup> Otway, Indonesia and Queensland

<sup>&</sup>lt;sup>4</sup> Queensland and PNG



# 2. Sales volumes and sales revenue (Santos share)

	Q3 2015	Q3 2014	Q2 2015	<b>2015 YTD</b>	2014 YTD	Full-year 2014
Sales gas and ethane <sup>1</sup>						
Sales – own product (PJ)	42.8	45.3	40.2	122.4	126.8	171.1
Sales – third party (PJ)	3.8	9.1	4.9	14.7	24.1	35.9
Total sales (PJ)	46.6	54.4	45.1	137.1	150.9	207.0
Average gas price (A\$/GJ)	5.50	4.87	5.23	5.37	4.89	4.97
Total sales revenue (\$million)	256	265	237	736	738	1,028
LNG <sup>2</sup>		•	•	•		
Sales – own product (tonnes)	332.6	247.4	348.0	1,013.0	471.7	766.5
Sales – third party (tonnes)	-	-	-	-	-	-
Total sales (tonnes)	332.6	247.4	348.0	1,013.0	471.7	766.5
Average LNG price (A\$/tonne)	614.38	879.06	495.27	643.90	830.76	859.21
Average LNG price (US\$/tonne)	445.18	814.27	387.30	490.26	764.71	778.18
Total sales revenue (\$million)	204	218	172	652	392	659
Condensate						
Sales – own product (000 barrels)	881.8	771.2	907.3	2,661.8	2,043.3	2,991.1
Sales – third party (000 barrels)	8.0	28.8	24.6	52.7	100.2	136.3
Total sales (000 barrels)	889.8	800.0	931.9	2,714.5	2,143.5	3,127.4
Average condensate price (A\$/bbl)	61.15	98.20	78.19	68.42	100.12	101.39
Average condensate price (US\$/bbl)	44.31	90.97	61.15	52.09	92.16	91.83
Total sales revenue (\$million)	55	78	73	186	214	317
LPG						
Sales – own product (000 tonnes)	44.8	30.3	45.2	125.0	112.8	163.8
Sales – third party (000 tonnes)	1.7	1.4	1.4	5.6	5.8	8.8
Total sales (000 tonnes)	46.5	31.7	46.6	130.6	118.6	172.6
Average LPG price (A\$/tonne)	563.96	902.15	620.28	605.26	924.69	897.20
Average LPG price (US\$/tonne)	408.65	835.66	485.06	460.84	851.18	812.60
Total sales revenue (\$million)	26	29	29	79	110	155
Crude oil						
Sales – own product (000 bbls)	2,178.8	2,690.7	2,025.7	6,179.9	7,571.7	10,363.0
Sales – third party (000 bbls)	1,574.7	1,394.1	1,304.6	4,018.5	4,688.5	6,083.1
Total sales (000 bbls)	3,753.5	4,084.8	3,330.3	10,198.4	12,260.2	16,446.1
Average crude oil price (A\$/bbl)	71.01	115.12	82.59	74.96	121.77	114.21
Average crude oil price (US\$/bbl)	51.45	106.63	64.58	57.08	112.08	103.44
Total sales revenue (\$million)	267	470	275	765	1,493	1,878
Total						
Sales – own product (mmboe)	13.9	13.8	13.5	40.4	36.7	51.3
Sales – third party (mmboe)	2.3	3.0	2.2	6.7	9.0	12.4
Total sales volume (mmboe)	16.2	16.8	15.7	47.1	45.7	63.7
Third party product purchases (\$million)	116	225	128	355	612	786
Sales – own product (\$million)	666	848	644	2,013	2,230	3,105
Sales – third party (\$million)	142	212	142	405	717	932
Total sales revenue (\$million)	808	1,060	786	2,418	2,947	4,037

 $<sup>^{\</sup>rm 1}$  Domestic sales gas and ethane  $^{\rm 2}$  Includes PNG LNG, Darwin LNG and GLNG sales.



### 3. Activity by area

Comparisons between periods for gas, condensate, LNG and LPG production are made between the current quarter and the same quarter from the previous year, as production is heavily influenced by seasonal factors. Conversely, comparisons for crude oil are made with the immediate previous quarter, as oil production rates are not generally subject to seasonal variations. Both comparisons are available in the table on page 3.

#### Cooper Basin

#### Gas and gas liquids

Year-to-date sales gas and ethane production is up 3% on 2014 levels. Production in the third quarter of 16.0 PJ was 5% lower than the corresponding quarter, reflecting lower raw gas capacity due to the deferral of development activity, slightly offset by lower downtime and lower fuel, flare and vent. 10 new gas wells were brought on-line in the quarter. First gas was supplied to GLNG under the Horizon contract in early October. Condensate and LPG production was 19% and 3% lower as a result of lower raw gas production and lower condensate yields due to recent development in drier gas fields.

In South Australia, drilling of the Swan Lake campaign was completed with Swan Lake-12 successfully drilled, cased and suspended. The 5-well Tirrawarra campaign continued with four wells (Tirrawarra-85 to 88) successfully drilled, cased and suspended. In addition Beanbush-2 was successfully drilled, cased and suspended.

In Queensland, Mt Howitt-3DW1 was successfully drilled, cased and suspended. This completed the four well Windorah development campaign. A 5-well NFE campaign was also commenced with Whanto-4 and Whanto South West-1 successfully drilled, cased and suspended. In addition Bolah-2 was also successfully drilled, cased and suspended.

The PEL 570 Permian Source Rock (Deep Coal) play opener well, Washington-1, was cased and suspended awaiting fracture stimulation at the end of the quarter. Early well results validate the predicted model for this area, with the full comprehensive wireline logging data acquired successfully. The geological and engineering information collected on this project has significantly increased confidence in further appraisal drilling in the area.

#### **Crude oil**

Crude production was 2% higher than the previous quarter due to lower downtime and recent new drill projects on-line, offsetting natural field decline.

In South Australia, the 5-well Limestone Creek campaign was completed with Hobbes-3, Biala-16, Seccante-2, Calamia East-1 and Jena-23 all successfully drilled, cased and suspended.

In Queensland, Cocinero-3 was successfully drilled, cased and suspended.

#### Carnaryon

Gas and condensate production of 13.5 PJ and 140,500 barrels respectively were both higher than the corresponding quarter due to higher customer nominations. Total oil production of 823,700 barrels was significantly higher than the previous quarter with the return to production of Mutineer-Exeter/Fletcher Finucane following extended maintenance of the FPSO.

#### **PNG LNG**

During the quarter PNG LNG operated at an annualised rate of approximately 7.4 mtpa, 7% above nameplate capacity of 6.9 mtpa. A high-rate test performed during September further increased production volumes for the quarter. Gross gas production was 108.1 PJ (Santos share 14.6 PJ), measured at the inlet of the LNG plant. 26 LNG cargoes were shipped during the third quarter. Gross condensate production for the quarter was 2.7 mmbbls (Santos share 364,600 barrels), measured at the Kutubu entry point.

Gross gas production from SE Gobe of 4.2PJ (Santos share 0.4 PJ) was purchased by the PNG LNG project in the third quarter.



#### Bayu-Undan/Darwin LNG

Gross gas production of 56.5 PJ was 67% higher than the corresponding quarter due to the planned shutdown in third quarter 2014. Similarly, gross condensate production increased by 31% and LPG was up 32% on the corresponding quarter.

Darwin LNG continued to perform strongly, with high operating efficiency and excellent cost performance. 15 LNG cargoes were shipped during the quarter.

Santos' net entitlement to production in the third quarter was 4.8 PJ of gas, 163,300 barrels of condensate and 9,000 tonnes of LPG, all higher than the corresponding quarter.

#### Indonesia

Santos' net entitlement to gas production of 5.8 PJ was 5% lower than the corresponding period primarily due to Maleo field decline and lower Oyong production, partially offset by higher Peluang and Wortel gross production and contractor entitlement. Combined Oyong and Wortel gross gas production for the quarter averaged 62 TJ/day, while combined gross production from Maleo and Peluang averaged 64 TJ/day. Oyong oil production for the quarter was 45,300 barrels.

#### Otway/Gippsland

Sales gas production of 3.5 PJ was 22% lower than the corresponding quarter due to natural well decline. Production from the Casino hub was 2.9 PJ of sales gas and 1,900 barrels of condensate. Minerva production was 0.6 PJ of sales gas and 1,600 barrels of condensate.

#### Vietnam

Gross oil production from the Chim Sào and Dua fields was 15,800 barrels per day, 34% lower than the previous quarter due to Chim Sào operations being shut down for most of August for repairs to the firewater system on the FPSO swivel. Production recommenced on 29 August. Santos' net entitlement to oil production from the combined fields was 450,000 barrels. Net entitlement gas production was 0.7 PJ.

#### Denison/Scotia/Spring Gully/Combabula

Sales gas production of 3.1 PJ was down 6% on the corresponding quarter. Production from Combabula continues to ramp up in line with APLNG nominations.

#### **GLNG**

GLNG produced first LNG on 24 September, on schedule and within budget. The first LNG cargo left Curtis Island on 16 October. Refer page 7 for further details.

Santos' share of sales gas production for the quarter of 1.9 PJ was lower than the corresponding quarter primarily due to lower domestic gas nominations. The Fairview and Roma fields were produced to meet domestic and LNG plant nominations with the remaining production injected into storage. Santos' share of commissioning gas delivered to the LNG plant on Curtis Island was 0.2 PJ for the quarter with third party supply providing additional gas for commissioning.

Santos reports GLNG production as the company's interest of the sales gas produced from the GLNG upstream fields. Consistent with the treatment of PNG LNG and Darwin LNG, Santos' share of quantities of LNG produced by the GLNG plant are not included in Santos' reported production. Santos portfolio gas produced for the GLNG project under the Horizon contract is attributed to the field of production. All third party purchased gas is not included in Santos' reported production.

#### Narrabri

All five Bibblewindi appraisal pilot wells were on-line at the end of the quarter and delivering gas to the Wilga Park Power Station near Narrabri. Santos received NSW Government approval for phase 2 of work at the Leewood water facility north of the Pilliga. This will include the construction of facilities to treat produced water from the appraisal process so it can be reused for irrigation. Work on phase 2 is expected to commence in late 2015. The Environmental Impact Statement for the proposed Narrabri Gas Project is being finalised.



### 4. Development projects

#### GLNG project (Santos 30%, operator)

Sanctioned in January 2011, GLNG included the development of CSG resources in the Bowen and Surat Basins in south-east Queensland, construction of a 420-kilometre underground gas transmission pipeline to Gladstone, and two LNG trains with a combined nameplate capacity of 7.8 mtpa on Curtis Island. The project has an estimated gross capital cost of US\$18.5 billion from the final investment decision to the end of 2015 when the second train is expected to be ready for start-up, based on foreign exchange rates which are consistent with the assumptions used at FID (A\$/US\$ 0.87 average over 2011-15).

LNG production from Train 1 commenced on 24 September 2015, on schedule and within budget. The first shipment of LNG, carried by the Malaysian-owned LNG carrier *Seri Bakti*, departed on 16 October 2015 for South Korea.

During the quarter, the next phase of upstream development was sanctioned with the approval of the Roma West 2B project. Phase 2B involves additional Roma wells plus 140 TJ/day of incremental compression capacity at the existing Roma Hub 2. Drilling of the first Phase 2B wells is expected to commence before the end of the year. All land access, cultural heritage and environmental approvals are in place for the Phase 2B project.

The hot tap on the gas transmission pipeline for the Meridian interconnect was successfully completed during the quarter, and gas is now flowing from the Meridian joint venture.

On Curtis Island, work on the second train is continuing to progress well, with Train 2 expected to be ready for start-up by the end of the year and first LNG in the second quarter of 2016.



Seri Bakti carrying the first LNG cargo departed GLNG on 16 October 2015



# 5. Capital expenditure

Total exploration, evaluation and development expenditure is summarised in the table below.

	Q3 2015	Q3 2014	Q2 2015	2015 YTD	2014 YTD	Full-year 2014
Capital expenditure (\$million)						
Exploration	32	93	69	232	272	323
Evaluation	31	61	-	71	180	292
Development and other PP&E	277	748	269	882	2,312	2,980
Capitalised interest	48	50	20	127	174	236
Total capital expenditure	388	952	358	1,312	2,938	3,831
Exploration and evaluation expensed (\$mi	llion)					
Exploration	1	20	109	161	93	162
Evaluation	7	21	5	20	41	69
Total current year expenditure	8	41	114	181	134	231
Write-off of amounts capitalised in prior years	5	-	8	26	9	25
Total expensed	13	41	122	207	143	256

# 5.1 Exploration activity

No exploration wells were drilled in the third quarter.

### 5.2 Seismic activity

The table below details seismic activity during the third quarter and status.

Permit	Basin/area	Survey	Туре	km/km²	Status
PEL 513	Cooper – SA	Kyanite VSP	Walkaway VSP	n/a	100% complete
PEL 570	Cooper – SA	Delaware 3D	Onshore 3D	108.43 km²	27% complete (396.5 km² overall)
JPDA 03-12 & JPDA 03-13	Timor Sea JPDA	Loriko 3D	Compressive Sensing 3D GeoStreamer	851 km <sup>2</sup>	34% complete



# 6. Drilling summary

### 6.1 Appraisal/evaluation wells

The table below details wells drilled during the third quarter and their status.

Well name	Basin/area	Target	Santos %	Well status	
Beanbush-2	Cooper – SA	Gas	72.32	C&S, successful gas	
Biala-16	Cooper – SA	Oil	60.60	C&S, successful oil	
Calamia East-1	Cooper – SA	Oil (NFE)	66.6	C&S, successful oil	
Hobbes-3	Cooper – SA	Oil	60.60	C&S, successful oil	
Washington-1*	Cooper – SA	Gas (NFE)	35	C&S, successful gas	
Bolah-2	Cooper – QLD	Gas	60.06	C&S, successful gas	
Whanto-4	Cooper – QLD	Gas (NFE)	60.06	C&S, successful gas	
Whanto South West-1	Cooper – QLD	Gas (NFE)	60.06	C&S, successful gas	

<sup>\*</sup>Santos is carrying 75% of the well cost

### 6.2 Development wells

The table below details development wells drilled during the third quarter and their status.

Well name	Basin/area	Target	Santos %	Well status
Jena-23	Cooper – SA	Oil	66.6	C&S, successful oil
Seccante-2	Cooper – SA	Oil	100	C&S, successful oil
Swan Lake-12	Cooper – SA	Gas	66.6	C&S, successful gas
Tirrawarra-85	Cooper – SA	Gas	66.6	C&S, successful gas
Tirrawarra-86	Cooper – SA	Gas	66.6	C&S, successful gas
Tirrawarra-87	Cooper – SA	Gas	66.6	C&S, successful gas
Tirrawarra-88	Cooper – SA	Gas	66.6	C&S, successful gas
Cocinero-3	Cooper – QLD	Oil	55.0	C&S, successful oil
Mt Howitt-3DW1 <sup>^</sup>	Cooper – QLD	Gas	66.06	C&S, successful gas
Angore-A2#	Papuan – PNG	Gas	13.50	Drilling

<sup>^</sup> Spudded during second quarter 2015 # Not operated by Santos



### 7. Abbreviations and conversion factors

Abbreviation	ons	<b>Conversion factors</b>	
C&C	cased and completed	Sales gas and ethane, 1 PJ	171.937 boe x 10 <sup>3</sup>
C&S	cased and suspended	Crude oil, 1 barrel	1 boe
CSG	coal seam gas	Condensate, 1 barrel	0.935 boe
DW	deepened well	LPG, 1 tonne	8.458 boe
FPSO	floating production, storage & offloading	LNG, 1 PJ	18,040 tonnes
GJ	gigajoules		
LNG	liquefied natural gas		
mmbbl	million barrels		
mmboe	million barrels of oil equivalent		
mmbtu	million British thermal units		
mmscf	million standard cubic feet		
mtpa	million tonnes per annum		
P&A	plugged and abandoned		
ра	per annum		
PJ	petajoules		
PSC	production sharing contract		
ST	side track		
Т	tonnes		
TJ	terajoules		
VSP	vertical seismic profile		