

**RESERVE AND CONTINGENT RESOURCE STATEMENT  
FOR THE PUESTO GUARDIAN AREA, ARGENTINA**

**AS OF JULY 31, 2014**

**PREPARED FOR**

**PRESIDENT ENERGY PLC**

**DECEMBER 2014**

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RW/AB-14-2012/LT2395

December 5, 2014

Mr. Miles Biggins  
Commercial Director  
**President Energy PLC.**  
17 Hannover Square, W1S 1BN, London  
(W1J 5LF) United Kingdom

**Crude Oil Reserves and Contingent Resources Statement  
Puesto Guardián Area, Argentina  
as of July 31, 2014**

Dear Mr. Biggins,

This reserve statement has been prepared by Gaffney, Cline & Associates (GCA) and issued on December 5, 2014 at the request of President Energy PLC. (President), operator of and 100% interest participant in the Puesto Guardián concession in the Northwest Basin of Argentina. This report is intended solely for President's internal use unless otherwise consented to in advance by GCA.

This report relates specifically and solely to the subject matter as defined in the scope of work in the Proposal for Services and is conditional upon the assumptions described herein, with the exception of the effective date of the audit that was changed to July 31, 2014 as requested by President. The report must be considered in its entirety.

GCA has conducted an independent audit examination as of July 31, 2014, of the crude oil volumes expected to be produced in the area. On the basis of pertinent technical and other information made available to GCA concerning this property unit, we hereby provide the reserve and contingent resource statements in the following tables:

**Statement of Crude Oil Reserves  
Puesto Guardián Area, Northwest Basin, Argentina  
as of July 31, 2014**

<b>Reserves</b>	<b>Gross (100%) Sales Volumes (MMBbl)</b>	<b>Company Gross (WI) Reserves (MMBbl)</b>	<b>Company Net (NRI) Reserves (MMBbl)</b>
Proved			
Developed	1.8	1.8	1.5
Undeveloped	7.3	7.3	6.3
<b>Total Proved</b>	<b>9.1</b>	<b>9.1</b>	<b>7.8</b>
Probable	5.0	5.0	4.3
Possible	3.4	3.4	3.0

**Statement of Crude Oil Contingent Resources  
Puesto Guardián Area, Northwest Basin, Argentina  
as of July 31, 2014**

<b>Classification</b>	<b>Gross (100%) Sales Volumes (MMBbl)</b>
1C	3.2
2C	5.7
3C	7.6

Concession contract extensions could be obtained through negotiations with the Argentine government. Future royalty and taxation rates will be part of the negotiation and cannot be predicted at present. Therefore, Net Company Contingent Resources attributed to contract extensions were not estimated in this report.

The Puesto Guardián area produces crude oil and solution gas from the Cretaceous Yacoraite carbonate formation and its embedded sandstone layers. At present, it produces 293 bopd, with GOR of 880 scf/Bbl and 85% water cut from six active wells. The cumulative oil production is 16.9 MMBbl. The concession area comprises six producing fields named Puesto Guardián, Cañada Grande, Dos Puntitas, Pozo Escondido, Pozo Escondido Este and Martínez del Tineo. Statements of reserves and contingent resources for each field are provided in Appendix I.

The gas production is being used in the field and is not estimated as reserve or resource. Future gas production not used will be vented or in the case of the Martinez del Tineo field, re-injected in one well. Water production will be re-injected in six wells to be drilled one in Cañada Grande, three in Pozo Escondido and three in Martinez del Tineo.

Proved developed producing oil reserves were estimated for the extrapolation of the present production by decline curve analysis. These reserves correspond to three wells producing in the Puesto Guardian field and one well in each of the Puesto Escondido, Puesto Escondido Este and Dos Puntitas fields.

Reserves and Contingent Resources were assigned according to a development plan presented by President. This development plan consists of workovers and the drilling of new wells between 2015 and 2021.

Reserves were estimated to August 2026, when the current concession contract ends. Volumes estimated beyond the contract expiry were classified as Contingent Resources. According to new legislation, owners of concession contracts will have the right to negotiate successive extensions (with no limits as to duration) to these contracts with the provincial governments, In this case, President will be able to negotiate a 25 to 35 year extension after the present contract deadline. This legislation was still under discussion at the effective date of this audit but considered as highly likely to be passed (and in fact was approved before the issuing of this report),

Based on this contingency GCA included a 35 year production extrapolation between 2026 and 2060 as Contingent Resources. Appendix I provides tables of reserves and contingent resources by field.

The PRMS and Application Guidelines documents define and describe the certainty criteria required for categorization of reserves and Contingent Resources. For simplicity the terms used in these definitions (eg: Proved, Probable, Possible) have been applied to projects (wells, workovers, etc.) as is commonplace in the industry. The levels of certainty for the volume estimates from the wells described here are as presented in the definitions. While individual wells and workovers have been categorized as mentioned above, incremental Probable and Possible volumes have been included for Proved wells and incremental Possible volumes for Probable wells.

### **Puesto Guardian Field**

Proved developed non-producing reserves correspond to a reactivation workover for well PG-13. Proved undeveloped reserves correspond to two fracture jobs for wells PG-14 and PG-4, and a drilling campaign for three wells between 2017 and 2019. A fourth location that is scheduled to be drilled in 2019 was qualified as Probable, and a fishing job for well PG-6 was considered Possible. President will also convert well PG-11 to water injector to improve recovery in its area of influence in the southern part of the field.

### **Cañada Grande Field**

Proved developed non-producing reserves correspond to two reactivation workovers for wells CG-12 and CG-8. Proved undeveloped reserves correspond to one sidetrack to well CG-6 in the north that is scheduled for 2015. A sidetrack for well CG-15 in the south was considered in a separate accumulation and classified as Prospective. GCA did not estimate its volume.

### **Dos Puntitas Field**

Four reactivations of existing wells were included as Proved developed non-producing reserves. Drilling locations were scheduled for 2015 – 2021. They comprise three Proved undeveloped side-tracks of existing wells targeting the carbonate reservoir and one Proved undeveloped, one Probable and one Possible new locations targeting the A6 sandstone and the carbonate reservoirs. An additional location north of the field that is scheduled to be drilled in 2020 was considered Prospective. GCA did not estimate its volume.

### **Pozo Escondido Field**

Four existing wells will be reactivated. Production estimation from well PE-8 was categorized as Proved developed non-producing. The other three wells will be fractured, with one well allocated as Proved undeveloped and two wells as Probable reserves. For the drilling campaign between 2016 and 2021, GCA qualified all twelve locations as Proved undeveloped.

### **Pozo Escondido Este Field**

Two wells will be drilled between 2016 and 2018. Both have been qualified as Proved undeveloped. They have dual targets to the A6/A5 sandstones and the carbonate reservoir.

## **Martinez del Tineo Field**

Reactivation of two wells was considered Proved developed non-producing reserves. For the drilling campaign between 2015 and 2020 of fourteen locations, GCA qualified six as Proved undeveloped and eight as Probable.

## **Commercial and Economic tests**

The commerciality and economic tests for the July 31, 2014 reserves volumes were based on President's future scenario of crude oil, which gives a realized constant price of US\$77.20/Bbl. Royalty is 14%, provincial IIBB tax is 2% and Bank tax is 0.6%, all applied to gross income.

Recent historical operating expense data were used as the basis for operating cost projections. The projection of costs was estimated through cost drivers as US\$3.96 million per year fixed, US\$2.90/Bbl of oil produced mainly related to transportation and an additional US\$2.10/Bbl of Pozo Escondido and Pozo Escondido Este production related to internal crude trucking.

Capital expenditures include drilling costs, related facilities, and other minor investments. GCA has found that President has projected sufficient capital investments and operating expenses economically to produce the projected volumes. Estimated abandonment costs include the abandonment of all existing and future wells and facilities.

## **BASIS OF OPINION**

This document must be considered in its entirety. It reflects GCA's informed professional judgment based on accepted standards of professional investigation and, as applicable, the data and information provided by the Client, the limited scope of engagement, and the time permitted to conduct the evaluation.

In line with those accepted standards, this document does not in any way constitute or make a guarantee or prediction of results, and no warranty is implied or expressed that actual outcome will conform to the outcomes presented herein. GCA has not independently verified any information provided by or at the direction of the Client, and has accepted the accuracy and completeness of this data. GCA has no reason to believe that any material facts have been withheld from it, but does not warrant that its inquiries have revealed all of the matters that a more extensive examination might otherwise disclose.

The opinions expressed herein are subject to, and fully qualified by, the generally accepted uncertainties associated with the interpretation of geoscience and engineering data and do not reflect the totality of circumstances, scenarios and information that could potentially affect decisions made by the report's recipients and/or actual results. The opinions and statements contained in this report are made in good faith and in the belief that such opinions and statements are representative of prevailing physical and economic circumstances.

This assessment has been conducted within the context of GCA's understanding of the effects of petroleum legislation and other regulations that currently apply to these properties. However, GCA is not in a position to attest to property title or rights, conditions of these rights including

environmental and abandonment obligations, and any necessary licenses and consents including planning permission, financial interest relationships or encumbrances thereon for any part of the appraised properties.

In performing this study, GCA is not aware that any conflict of interest has existed. As an independent consultancy, GCA is providing impartial technical, commercial and strategic advice within the energy sector. GCA's remuneration was not in any way contingent on the contents of this report. In the preparation of this document, GCA has maintained, and continues to maintain, a strict independent consultant-client relationship with the Client. Furthermore, the management and employees of GCA have no interest in any of the assets evaluated or related with the analysis performed as part of this report.

Staff members who prepared this report are professionally-qualified with appropriate educational qualifications and levels of experience and expertise to perform the scope of work set out in the Proposal for Services.

GCA has not undertaken a site visit or an inspection because it was not considered relevant for the purpose of this report. As such, GCA is not in a position to comment on the operations or facilities in place, their appropriateness and condition, and whether they are in compliance with the regulations pertaining to such operations. Further, GCA is not in a position to comment on any aspect of health, safety or environment of such operation.

It should be clearly noted that the Net Present Values (NPV) contained herein do not represent a GCA opinion as to the market value of the subject property, nor any interest in it.

In the preparation of this report, GCA has used the Petroleum Resources Management System (PRMS) approved by the Society of Petroleum Engineers, the World Petroleum Council, the American Association of Petroleum Geologists and the Society of Petroleum Evaluation Engineers in March 2007 (see Appendix III).

There are numerous uncertainties inherent in estimating reserves and resources, and in projecting future production, development expenditures, operating expenses and cash flows. Oil and gas reserve engineering and resource assessment must be recognized as a subjective process of estimating subsurface accumulations of oil and gas that cannot be measured in an exact way. Estimates of oil and gas reserves or resources prepared by other parties may differ, perhaps materially, from those contained within this report.

The accuracy of any reserve or resource estimate is a function of the quality of the available data and of engineering and geological interpretation. Results of drilling, testing and production that post-date the preparation of the estimates may justify revisions, some or all of which may be material. Accordingly, reserve or resource estimates are often different from the quantities of oil and gas that are ultimately recovered, and the timing and cost of those volumes that are recovered may vary from that assumed.

Crude oil volumes appearing in this report have been quoted at stock tank conditions. Typically, these volumes have been referred to in millions of barrel increments (MMBbl). Natural gas volumes have not been reported. Produced gas is consumed in field operations or vented. In the future, the produced gas will be re-injected.

GCA's review and audit involved reviewing pertinent facts, interpretations and assumptions made by President or others in preparing estimates of reserves or resources. GCA performed procedures necessary to enable it to render an opinion on the appropriateness of the methodologies employed, adequacy and quality of the data relied on, depth and thoroughness of the reserves and resources estimation process, classification and categorization of reserves and resources appropriate to the relevant definitions used, and reasonableness of the estimated reserves and resources.

It is GCA's opinion that the estimates of total remaining recoverable hydrocarbon liquid volumes as of July 31, 2014 are, in the aggregate, reasonable and the reserves and resources classification and categorization is appropriate and consistent with the definitions and guidelines for reserves and resources.

GCA concludes that the methodologies employed by President in the derivation of the volume estimates are appropriate, and that the quality of the data relied on, and the depth and thoroughness of the estimation process are adequate.

Reserves are those quantities of petroleum that are anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions. Reserves must further satisfy four criteria; they must be discovered, recoverable, commercial, and remaining (as of the evaluation date) based on the development project(s) applied. Reserves are further categorized in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by development and production status. All categories of Reserve volumes quoted herein have been determined within the context of an economic limit test (pre-tax and exclusive of accumulated depreciation amounts) assessment prior to any NPV analysis.

Contingent Resources are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations, but the applied project(s) are not yet considered mature enough for commercial development due to one or more contingencies. Contingent Resources may include, for example, projects for which there are currently no evident viable markets, or where commercial recovery is dependent on technology under development, or where evaluation of the accumulation is insufficient to clearly assess commerciality. Contingent Resources are further categorized in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by their economic status.

It must be appreciated that the Contingent Resources reported herein are unrisks in terms of economic uncertainty and commerciality. There is no certainty that it will be commercially viable to produce any portion of the Contingent Resources.

The reserve volumes have not been reduced for fuel usage in the field. Net Revenue Interest reserves and Contingent Resources are net of Royalties.

In assessing a likely market value, it would be necessary to take into account a number of additional factors including reserves risk (i.e., that Proved and/or Probable and/or Possible Reserves may not be realized within the anticipated timeframe for their exploitation); perceptions of economic and sovereign risk; potential upside, such as in this case exploitation of reserves beyond the Proved and the Probable level; other benefits, encumbrances or charges that may pertain to a particular interest; and, the competitive state of the market at the time.

GCA has explicitly not taken such factors into account in deriving the NPVs presented herein.

## **NOTICE**

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Yours sincerely,  
**GAFFNEY, CLINE & ASSOCIATES**



Project Manager – Roberto Wainhaus  
Lead Reservoir Engineer



Reviewer – David K Morgan  
Technical Director

## **Appendices**

- Appendix I: Reserves and Contingent Resources by Field
- Appendix II: Summary Concession Cash Flows
- Appendix III: Petroleum Resource Management System (PRMS) Definitions
- Appendix IV: Glossary

## **APPENDIX I**

### **Reserves and Contingent Resources by Field**

**President Energy PLC. Reserves and Contingent Resources  
as of July 31, 2014  
Puesto Guardian Area**

**Gross Reserves**

	Proved					Probable (MBbl)	Possible (MBbl)
	Developed			Undeveloped (MBbl)	Total (MBbl)		
	Producing (MBbl)	Non-Producing (MBbl)	Total (MBbl)				
	(MBbl)	(MBbl)	(MBbl)	(MBbl)	(MBbl)		
Cañada Grande	0	325	325	261	586	56	32
Dos Puntitas	134	313	447	1,203	1,650	883	743
Martinez del Tineo	0	162	162	1,174	1,336	1,966	1,405
Pozo Escondido	140	58	198	2,733	2,931	1,335	647
Pozo Escondido Este	40	0	40	830	870	193	193
Puesto Guardian	409	207	616	1,139	1,755	568	411
<b>Total</b>	<b>723</b>	<b>1,065</b>	<b>1,788</b>	<b>7,340</b>	<b>9,128</b>	<b>5,001</b>	<b>3,431</b>

**Net Reserves**

	Proved					Probable (MBbl)	Possible (MBbl)
	Developed			Undeveloped (MBbl)	Total (MBbl)		
	Producing (MBbl)	Non-Producing (MBbl)	Total (MBbl)				
	(MBbl)	(MBbl)	(MBbl)	(MBbl)	(MBbl)		
Cañada Grande	0	280	280	224	504	48	28
Dos Puntitas	115	269	384	1,035	1,419	759	639
Martinez del Tineo	0	139	139	1,010	1,149	1,691	1,208
Pozo Escondido	120	50	170	2,350	2,520	1,148	556
Pozo Escondido Este	34	0	34	714	748	166	166
Puesto Guardian	352	178	530	980	1,510	488	353
<b>Total</b>	<b>621</b>	<b>916</b>	<b>1,537</b>	<b>6,313</b>	<b>7,850</b>	<b>4,300</b>	<b>2,950</b>

**Gross Contingent Resources**

	1C	2C	3C
	(MBbl)	(MBbl)	(MBbl)
Cañada Grande	112	119	125
Dos Puntitas	628	976	1,313
Martinez del Tineo	806	2,239	3,357
Pozo Escondido	711	1,136	1,337
Pozo Escondido Este	261	323	385
Puesto Guardian	660	953	1,091
<b>Total</b>	<b>3,178</b>	<b>5,746</b>	<b>7,608</b>

GCA Engineer:	RW	Reviewer:	DKM
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**APPENDIX II**

**Summary Concession Cash Flows**

**President Energy PLC. Net Interest Reserve Cashflow as of July 31, 2014**  
**Puesto Guardian Area**

**Proved Developed Reserves**

Year	Oil Sales	Gross Income	IIBB+Bamk Taxes	Operating Expenses	Capital Expenditures	Abandon-ment Cost	Net Cashflow	10% Discounted Cashflow
	(MBbl)	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$
2014	37	2,853	74	1,800			979	959
2015	168	12,975	337	4,625	4,320		3,693	3,452
2016	202	15,589	405	4,729	800		9,654	8,204
2017	208	16,073	418	4,730			10,925	8,440
2018	176	13,555	352	4,602			8,601	6,040
2019	149	11,538	300	4,503			6,734	4,299
2020	129	9,933	258	4,426			5,249	3,046
2021	112	8,635	225	4,364			4,046	2,135
2022	97	7,461	194	4,306			2,962	1,421
2023	84	6,512	169	4,262			2,081	907
2024	74	5,703	148	4,225			1,329	527
2025	66	5,132	133	4,199			799	288
2026	35	2,720	71	2,437			213	70
2027						4,350	(4,350)	(1,296)
<b>Total</b>	<b>1,537</b>	<b>118,678</b>	<b>3,086</b>	<b>53,208</b>	<b>5,120</b>	<b>4,350</b>	<b>52,915</b>	<b>38,492</b>

**Total Proved Reserves**

Year	Oil Sales	Gross Income	IIBB+Bamk Taxes	Operating Expenses	Capital Expenditures	Abandon-ment Cost	Net Cashflow	10% Discounted Cashflow
	(MBbl)	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$
2014	37	2,853	74	1,800			979	959
2015	323	24,964	649	5,148	21,898		(2,731)	(2,553)
2016	705	54,446	1,416	6,860	50,614		(4,444)	(3,776)
2017	971	74,964	1,949	8,068	45,404		19,542	15,096
2018	1060	81,839	2,128	8,750	28,697		42,265	29,682
2019	1155	89,201	2,319	9,452	37,976		39,453	25,188
2020	923	71,230	1,852	8,049	13,879		47,450	27,540
2021	785	60,614	1,576	7,507	9,158		42,373	22,357
2022	579	44,666	1,161	6,506			36,999	17,747
2023	452	34,907	908	5,914			28,085	12,247
2024	369	28,484	741	5,536			22,207	8,803
2025	322	24,889	647	5,316			18,926	6,820
2026	168	12,979	337	3,071			9,571	3,136
2027						7,650	(7,650)	(2,278)
<b>Total</b>	<b>7,850</b>	<b>606,036</b>	<b>15,757</b>	<b>81,976</b>	<b>207,626</b>	<b>7,650</b>	<b>293,028</b>	<b>160,968</b>

**Proved plus Probable Reserves**

Year	Oil Sales	Gross Income	IIBB+Bamk Taxes	Operating Expenses	Capital Expenditures	Abandon-ment Cost	Net Cashflow	10% Discounted Cashflow
	(MBbl)	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$
2014	37	2,853	74	1,800			979	959
2015	379	29,242	760	5,362	26,548		(3,428)	(3,204)
2016	959	74,068	1,926	8,022	53,034		11,086	9,421
2017	1387	107,110	2,785	9,859	57,662		36,804	28,431
2018	1529	118,039	3,069	10,738	42,647		61,586	43,250
2019	1680	129,678	3,372	11,639	49,814		64,853	41,404
2020	1535	118,502	3,081	10,464	27,829		77,128	44,764
2021	1386	107,023	2,783	9,983	9,158		85,100	44,901
2022	1012	78,127	2,031	8,254			67,842	32,541
2023	787	60,784	1,580	7,248			51,955	22,655
2024	640	49,420	1,285	6,608			41,527	16,462
2025	550	42,482	1,105	6,210			35,167	12,673
2026	267	20,651	537	3,505			16,609	5,441
2027						9,900	(9,900)	(2,949)
<b>Total</b>	<b>12,150</b>	<b>937,978</b>	<b>24,387</b>	<b>99,689</b>	<b>266,692</b>	<b>9,900</b>	<b>537,309</b>	<b>296,749</b>

**Proved plus Probable plus Possible Reserves**

Year	Oil Sales	Gross Income	IIBB+Bamk Taxes	Operating Expenses	Capital Expenditures	Abandon-ment Cost	Net Cashflow	10% Discounted Cashflow
	(MBbl)	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$	MUS\$
2014	37	2,853	74	1,800			979	959
2015	434	33,478	870	5,573	27,198		(163)	(153)
2016	1118	86,284	2,243	8,699	53,034		22,307	18,955
2017	1598	123,341	3,207	10,763	57,662		51,709	39,945
2018	1773	136,890	3,559	11,795	42,647		78,890	55,402
2019	1947	150,309	3,908	12,756	49,814		83,830	53,519
2020	1903	146,904	3,819	11,901	27,829		103,355	59,986
2021	1898	146,550	3,810	11,986	16,837		113,917	60,105
2022	1403	108,344	2,817	9,743			95,784	45,944
2023	1073	82,802	2,153	8,328			72,321	31,536
2024	859	66,301	1,724	7,427			57,150	22,655
2025	729	56,249	1,462	6,877			47,910	17,266
2026	329	25,417	661	3,762			20,995	6,878
2027						10,350	(10,350)	(3,083)
<b>Total</b>	<b>15,100</b>	<b>1,165,723</b>	<b>30,309</b>	<b>111,410</b>	<b>275,021</b>	<b>10,350</b>	<b>738,633</b>	<b>409,914</b>

GCA Engineer: RW      Reviewer: DKM

## **APPENDIX III**

### **Petroleum Resource Management System (PRMS) Definitions**

**Society of Petroleum Engineers, World Petroleum Council, American Association of Petroleum Geologists and Society of Petroleum Evaluation Engineers**

**Petroleum Resources Management System**

**Definitions and Guidelines (1)**

**March 2007**

**Preamble**

Petroleum resources are the estimated quantities of hydrocarbons naturally occurring on or within the Earth's crust. Resource assessments estimate total quantities in known and yet-to-be-discovered accumulations; resources evaluations are focused on those quantities that can potentially be recovered and marketed by commercial projects. A petroleum resources management system provides a consistent approach to estimating petroleum quantities, evaluating development projects, and presenting results within a comprehensive classification framework.

International efforts to standardize the definition of petroleum resources and how they are estimated began in the 1930s. Early guidance focused on Proved Reserves. Building on work initiated by the Society of Petroleum Evaluation Engineers (SPEE), SPE published definitions for all Reserves categories in 1987. In the same year, the World Petroleum Council (WPC, then known as the World Petroleum Congress), working independently, published Reserves definitions that were strikingly similar. In 1997, the two organizations jointly released a single set of definitions for Reserves that could be used worldwide. In 2000, the American Association of Petroleum Geologists (AAPG), SPE and WPC jointly developed a classification system for all petroleum resources. This was followed by additional supporting documents: supplemental application evaluation guidelines (2001) and a glossary of terms utilized in Resources definitions (2005). SPE also published standards for estimating and auditing reserves information (revised 2007).

These definitions and the related classification system are now in common use internationally within the petroleum industry. They provide a measure of comparability and reduce the subjective nature of resources estimation. However, the technologies employed in petroleum exploration, development, production and processing continue to evolve and improve. The SPE Oil and Gas Reserves Committee works closely with other organizations to maintain the definitions and issues periodic revisions to keep current with evolving technologies and changing commercial opportunities.

The SPE PRMS document consolidates, builds on, and replaces guidance previously contained in the 1997 Petroleum Reserves Definitions, the 2000 Petroleum Resources Classification and Definitions publications, and the 2001 "Guidelines for the Evaluation of Petroleum Reserves and Resources"; the latter document remains a valuable source of more detailed background information.,

These definitions and guidelines are designed to provide a common reference for the international petroleum industry, including national reporting and regulatory disclosure agencies, and to support petroleum project and portfolio management requirements. They are intended to improve clarity in global communications regarding petroleum resources. It is expected that SPE PRMS will be supplemented with industry education programs and application guides addressing their implementation in a wide spectrum of technical and/or commercial settings.

It is understood that these definitions and guidelines allow flexibility for users and agencies to tailor application for their particular needs; however, any modifications to the guidance contained herein should be clearly identified. The definitions and guidelines contained in this document must not be construed as modifying the interpretation or application of any existing regulatory reporting requirements.

The full text of the SPE PRMS Definitions and Guidelines can be viewed at:  
[www.spe.org/specma/binary/files/6859916Petroleum\\_Resources\\_Management\\_System\\_2007.pdf](http://www.spe.org/specma/binary/files/6859916Petroleum_Resources_Management_System_2007.pdf)

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1 These Definitions and Guidelines are extracted from the Society of Petroleum Engineers / World Petroleum Council / American Association of Petroleum Geologists / Society of Petroleum Evaluation Engineers (SPE/WPC/AAPG/SPEE) Petroleum Resources Management System document ("SPE PRMS"), approved in March 2007.

## **RESERVES**

***Reserves are those quantities of petroleum anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions.***

Reserves must satisfy four criteria: they must be discovered, recoverable, commercial, and remaining based on the development project(s) applied. Reserves are further subdivided in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by their development and production status. To be included in the Reserves class, a project must be sufficiently defined to establish its commercial viability. There must be a reasonable expectation that all required internal and external approvals will be forthcoming, and there is evidence of firm intention to proceed with development within a reasonable time frame. A reasonable time frame for the initiation of development depends on the specific circumstances and varies according to the scope of the project. While 5 years is recommended as a benchmark, a longer time frame could be applied where, for example, development of economic projects are deferred at the option of the producer for, among other things, market-related reasons, or to meet contractual or strategic objectives. In all cases, the justification for classification as Reserves should be clearly documented. To be included in the Reserves class, there must be a high confidence in the commercial producibility of the reservoir as supported by actual production or formation tests. In certain cases, Reserves may be assigned on the basis of well logs and/or core analysis that indicate that the subject reservoir is hydrocarbon-bearing and is analogous to reservoirs in the same area that are producing or have demonstrated the ability to produce on formation tests.

### **On Production**

*The development project is currently producing and selling petroleum to market*

The key criterion is that the project is receiving income from sales, rather than the approved development project necessarily being complete. This is the point at which the project “chance of commerciality” can be said to be 100%. The project “decision gate” is the decision to initiate commercial production from the project.

### **Approved for Development**

*All necessary approvals have been obtained, capital funds have been committed, and implementation of the development project is under way.*

At this point, it must be certain that the development project is going ahead. The project must not be subject to any contingencies such as outstanding regulatory approvals or sales contracts. Forecast capital expenditures should be included in the reporting entity’s current or following year’s approved budget. The project “decision gate” is the decision to start investing capital in the construction of production facilities and/or drilling development wells.

### **Justified for Development**

*Implementation of the development project is justified on the basis of reasonable forecast commercial conditions at the time of reporting, and there are reasonable expectations that all necessary approvals/contracts will be obtained*

In order to move to this level of project maturity, and hence have reserves associated with it, the development project must be commercially viable at the time of reporting, based on the reporting entity’s assumptions of future prices, costs, etc. (“forecast case”) and the specific circumstances of the project. Evidence of a firm intention to proceed with development within a reasonable time frame will be sufficient to demonstrate commerciality. There should be a development plan in sufficient detail to support the assessment of commerciality and a reasonable expectation that any regulatory approvals or sales contracts required prior to project implementation will be forthcoming. Other than such approvals/contracts, there should be no known contingencies that could preclude the development from proceeding within a reasonable timeframe (see Reserves class). The project “decision gate” is the decision by the reporting entity and its partners, if any, that the project has reached a level of technical and commercial maturity sufficient to justify proceeding with development at that point in time.

## **Proved Reserves**

Proved Reserves are those quantities of petroleum, which by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be commercially recoverable, from a given date forward, from known reservoirs and under defined economic conditions, operating methods, and government regulations.

If deterministic methods are used, the term reasonable certainty is intended to express a high degree of confidence that the quantities will be recovered. If probabilistic methods are used, there should be at least a 90% probability that the quantities actually recovered will equal or exceed the estimate. The area of the reservoir considered as Proved includes:

- (1) the area delineated by drilling and defined by fluid contacts, if any, and
- (2) adjacent undrilled portions of the reservoir that can reasonably be judged as continuous with it and commercially productive on the basis of available geoscience and engineering data.

In the absence of data on fluid contacts, Proved quantities in a reservoir are limited by the lowest known hydrocarbon (LKH) as seen in a well penetration unless otherwise indicated by definitive geoscience, engineering, or performance data. Such definitive information may include pressure gradient analysis and seismic indicators. Seismic data alone may not be sufficient to define fluid contacts for Proved reserves (see “2001 Supplemental Guidelines,” Chapter 8). Reserves in undeveloped locations may be classified as Proved provided that the locations are in undrilled areas of the reservoir that can be judged with reasonable certainty to be commercially productive. Interpretations of available geoscience and engineering data indicate with reasonable certainty that the objective formation is laterally continuous with drilled Proved locations. For Proved Reserves, the recovery efficiency applied to these reservoirs should be defined based on a range of possibilities supported by analogs and sound engineering judgment considering the characteristics of the Proved area and the applied development program.

## **Probable Reserves**

Probable Reserves are those additional Reserves which analysis of geoscience and engineering data indicate are less likely to be recovered than Proved Reserves but more certain to be recovered than Possible Reserves.

It is equally likely that actual remaining quantities recovered will be greater than or less than the sum of the estimated Proved plus Probable Reserves (2P). In this context, when probabilistic methods are used, there should be at least a 50% probability that the actual quantities recovered will equal or exceed the 2P estimate. Probable Reserves may be assigned to areas of a reservoir adjacent to Proved where data control or interpretations of available data are less certain. The interpreted reservoir continuity may not meet the reasonable certainty criteria. Probable estimates also include incremental recoveries associated with project recovery efficiencies beyond that assumed for Proved.

## **Possible Reserves**

Possible Reserves are those additional reserves which analysis of geoscience and engineering data indicate are less likely to be recoverable than Probable Reserves

The total quantities ultimately recovered from the project have a low probability to exceed the sum of Proved plus Probable plus Possible (3P), which is equivalent to the high estimate scenario. When probabilistic methods are used, there should be at least a 10% probability that the actual quantities recovered will equal or exceed the 3P estimate. Possible Reserves may be assigned to areas of a reservoir adjacent to Probable where data control and interpretations of available data are progressively less certain. Frequently, this may be in areas where geoscience and engineering data are unable to clearly define the area and vertical reservoir limits of commercial production from the reservoir by a defined project. Possible estimates also include incremental quantities associated with project recovery efficiencies beyond that assumed for Probable.

## **Probable and Possible Reserves**

*(See above for separate criteria for Probable Reserves and Possible Reserves.)*

The 2P and 3P estimates may be based on reasonable alternative technical and commercial interpretations within the reservoir and/or subject project that are clearly documented, including comparisons to results in successful similar projects. In conventional accumulations, Probable and/or Possible Reserves may be assigned where geoscience and engineering data identify directly adjacent portions of a reservoir within the same accumulation that may be separated from Proved areas by minor faulting or other geological discontinuities and have not been penetrated by a wellbore but are interpreted to be in communication with the known (Proved) reservoir. Probable or Possible Reserves may be assigned to areas that are structurally higher than the Proved area. Possible (and in some cases, Probable) Reserves may be assigned to areas that are structurally lower than the adjacent Proved or 2P area. Caution should be exercised in assigning Reserves to adjacent reservoirs isolated by major, potentially sealing, faults until this reservoir is penetrated and evaluated as commercially productive. Justification for assigning Reserves in such cases should be clearly documented. Reserves should not be assigned to areas that are clearly separated from a known accumulation by non-productive reservoir (i.e., absence of reservoir, structurally low reservoir, or negative test results); such areas may contain Prospective Resources. In conventional accumulations, where drilling has defined a highest known oil (HKO) elevation and there exists the potential for an associated gas cap, Proved oil Reserves should only be assigned in the structurally higher portions of the reservoir if there is reasonable certainty that such portions are initially above bubble point pressure based on documented engineering analyses. Reservoir portions that do not meet this certainty may be assigned as Probable and Possible oil and/or gas based on reservoir fluid properties and pressure gradient interpretations.

## **Developed Reserves**

*Developed Reserves are expected quantities to be recovered from existing wells and facilities.*

Reserves are considered developed only after the necessary equipment has been installed, or when the costs to do so are relatively minor compared to the cost of a well. Where required facilities become unavailable, it may be necessary to reclassify Developed Reserves as Undeveloped. Developed Reserves may be further sub-classified as Producing or Non-Producing.

### **Developed Producing Reserves**

*Developed Producing Reserves are expected to be recovered from completion intervals that are open and producing at the time of the estimate.*

Improved recovery reserves are considered producing only after the improved recovery project is in operation.

### **Developed Non-Producing Reserves**

*Developed Non-Producing Reserves include shut-in and behind-pipe Reserves*

Shut-in Reserves are expected to be recovered from:

- (1) completion intervals which are open at the time of the estimate but which have not yet started producing,
- (2) wells which were shut-in for market conditions or pipeline connections, or
- (3) wells not capable of production for mechanical reasons.

Behind-pipe Reserves are expected to be recovered from zones in existing wells which will require additional completion work or future re-completion prior to start of production. In all cases, production can be initiated or restored with relatively low expenditure compared to the cost of drilling a new well.

## **Undeveloped Reserves**

*Undeveloped Reserves are quantities expected to be recovered through future investments:*

- (1) from new wells on undrilled acreage in known accumulations,
- (2) from deepening existing wells to a different (but known) reservoir,
- (3) from infill wells that will increase recovery, or
- (4) where a relatively large expenditure (e.g. when compared to the cost of drilling a new well) is required to
  - (a) recomplete an existing well or
  - (b) install production or transportation facilities for primary or improved recovery projects.

## **CONTINGENT RESOURCES**

***Those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations by application of development projects, but which are not currently considered to be commercially recoverable due to one or more contingencies.***

Contingent Resources may include, for example, projects for which there are currently no viable markets, or where commercial recovery is dependent on technology under development, or where evaluation of the accumulation is insufficient to clearly assess commerciality. Contingent Resources are further categorized in accordance with the level of certainty associated with the estimates and may be sub-classified based on project maturity and/or characterized by their economic status.

### **Development Pending**

*A discovered accumulation where project activities are ongoing to justify commercial development in the foreseeable future.*

The project is seen to have reasonable potential for eventual commercial development, to the extent that further data acquisition (e.g. drilling, seismic data) and/or evaluations are currently ongoing with a view to confirming that the project is commercially viable and providing the basis for selection of an appropriate development plan. The critical contingencies have been identified and are reasonably expected to be resolved within a reasonable time frame. Note that disappointing appraisal/evaluation results could lead to a re-classification of the project to “On Hold” or “Not Viable” status. The project “decision gate” is the decision to undertake further data acquisition and/or studies designed to move the project to a level of technical and commercial maturity at which a decision can be made to proceed with development and production.

### **Development Unclassified or on Hold**

*A discovered accumulation where project activities are on hold and/or where justification as a commercial development may be subject to significant delay.*

The project is seen to have potential for eventual commercial development, but further appraisal/evaluation activities are on hold pending the removal of significant contingencies external to the project, or substantial further appraisal/evaluation activities are required to clarify the potential for eventual commercial development. Development may be subject to a significant time delay. Note that a change in circumstances, such that there is no longer a reasonable expectation that a critical contingency can be removed in the foreseeable future, for example, could lead to a reclassification of the project to “Not Viable” status. The project “decision gate” is the decision to either proceed with additional evaluation designed to clarify the potential for eventual commercial development or to temporarily suspend or delay further activities pending resolution of external contingencies.

### **Development Not Viable**

A discovered accumulation for which there are no current plans to develop or to acquire additional data at the time due to limited production potential.

The project is not seen to have potential for eventual commercial development at the time of reporting, but the theoretically recoverable quantities are recorded so that the potential opportunity will be recognized in the event of a major change in technology or commercial conditions. The project “decision gate” is the decision not to undertake any further data acquisition or studies on the project for the foreseeable future.

### **PROSPECTIVE RESOURCES**

***Those quantities of petroleum which are estimated, as of a given date, to be potentially recoverable from undiscovered accumulations.***

Potential accumulations are evaluated according to their chance of discovery and, assuming a discovery, the estimated quantities that would be recoverable under defined development projects. It is recognized that the development programs will be of significantly less detail and depend more heavily on analog developments in the earlier phases of exploration.

#### **Prospect**

A project associated with a potential accumulation that is sufficiently well defined to represent a viable drilling target.

Project activities are focused on assessing the chance of discovery and, assuming discovery, the range of potential recoverable quantities under a commercial development program.

#### **Lead**

A project associated with a potential accumulation that is currently poorly defined and requires more data acquisition and/or evaluation in order to be classified as a prospect.

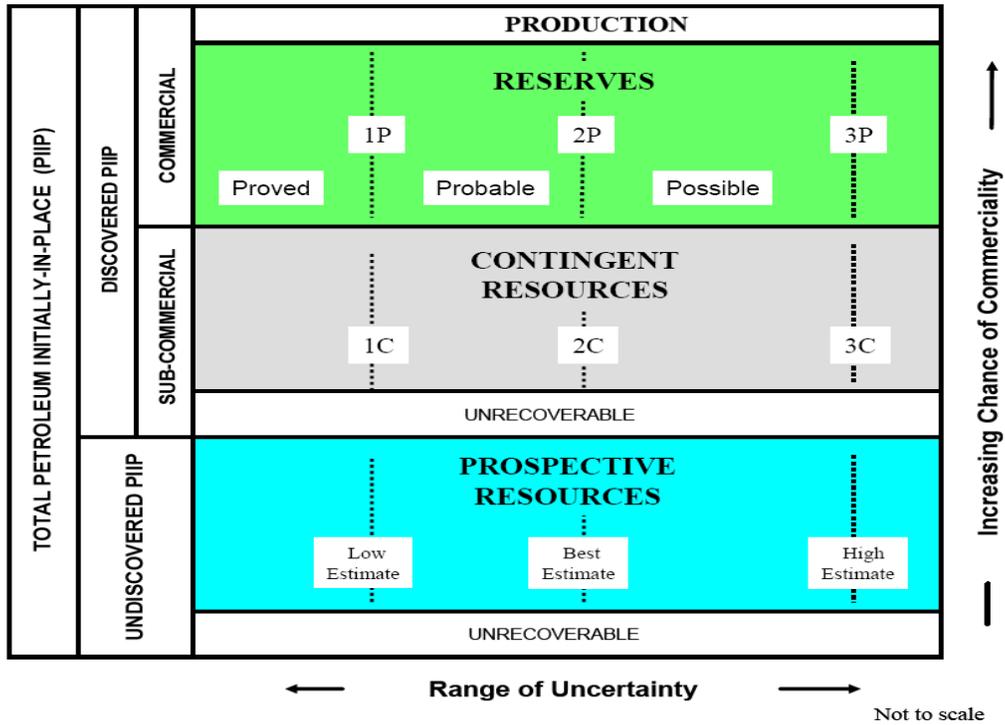
Project activities are focused on acquiring additional data and/or undertaking further evaluation designed to confirm whether or not the lead can be matured into a prospect. Such evaluation includes the assessment of the chance of discovery and, assuming discovery, the range of potential recovery under feasible development scenarios.

#### **Play**

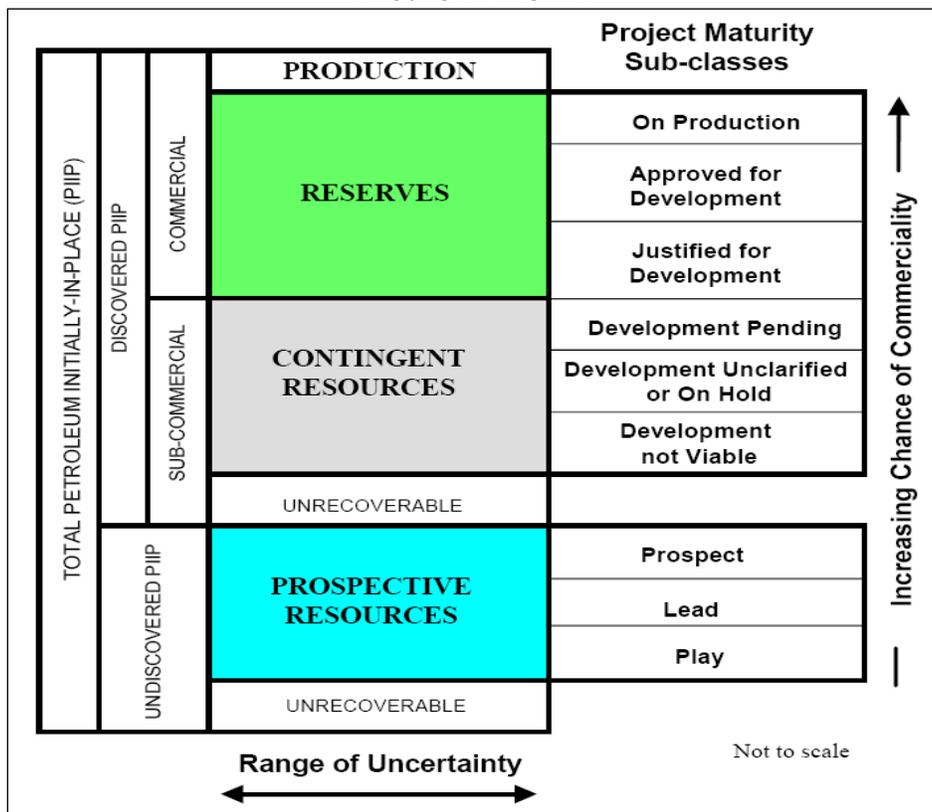
A project associated with a prospective trend of potential prospects, but which requires more data acquisition and/or evaluation in order to define specific leads or prospects.

Project activities are focused on acquiring additional data and/or undertaking further evaluation designed to define specific leads or prospects for more detailed analysis of their chance of discovery and, assuming discovery, the range of potential recovery under hypothetical development scenarios.

RESOURCES CLASSIFICATION



PROJECT MATURITY



## **SEC DEFINITIONS FOR OIL AND GAS RESERVES**

### **Proved Oil and Gas Reserves**

Proved oil and gas reserves are the estimated quantities of crude oil, natural gas and natural gas liquids which geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions, i.e., prices and costs as of the date the estimate is made. Prices include consideration of changes in existing prices provided only by contractual arrangements, but not on escalations based upon future conditions.

- (i) Reservoirs are considered proved if economic producibility is supported by either actual production or conclusive formation tests. The area of a reservoir considered proved includes (A) that portion delineated by drilling and defined by gas-oil and/or oil-water contacts, if any; and (B) the immediately adjoining portions not yet drilled, but which can be reasonably judged as economically productive on the basis of available geological and engineering data. In the absence of information on fluid contacts, the lowest known structural occurrence of hydrocarbons controls the lower proved limit of the reservoir.
- (ii) Reserves which can be produced economically through application of improved recovery techniques (such as fluid injection) are included in the "proved" classification when successful testing by a pilot project, or the operation of an installed program in the reservoir, provides support for the engineering analysis on which the project or program was based.
- (iii) Estimates of proved reserves do not include the following: (A) oil that may become available from known reservoirs, but is classified separately as "indicated additional reserves"; (B) crude oil, natural gas and natural gas liquids, the recovery of which is subject to reasonable doubt because of uncertainty as to geology, reservoir characteristics, or economic factors; (C) crude oil, natural gas, and natural gas liquids that may occur in undrilled prospects; and (D) crude oil, natural gas and natural gas liquids that may be recovered from oil shales, coal, gilsonite and other such sources.

### **Proved Developed Oil and Gas Reserves**

Proved developed oil and gas reserves that can be expected to be recovered through existing wells with existing equipment and operating methods. Additional oil and gas expected to be obtained through the application of fluid injection or other improved recovery techniques for supplementing the natural forces and mechanisms of primary recovery should be included as "proved developed reserves" only after testing by a pilot project or after the operation of an installed program has confirmed through production response that increased recovery will be achieved.

### **Proved Undeveloped Reserves**

Proved undeveloped oil and gas reserves are reserves that are expected to be recovered from new wells on undrilled acreage, or from existing wells where a relatively major expenditure is required for recompletion. Reserves or undrilled acreage shall be limited to those drilling units offsetting productive units that are reasonably certain of production when drilled. Proved reserves for other undrilled units can be claimed only where it can be demonstrated with certainty that there is continuity of production from the existing productive formation. Under no circumstances should estimates for proved undeveloped reserves be attributable to any acreage for which an application of fluid injection or other improved recovery technique is contemplated, unless such techniques have been proved effective by actual tests in the area and in the same reservoir.

## **APPENDIX IV**

### **Glossary**

**GLOSSARY**

**List of Standard Oil Industry Terms and Abbreviations**

ABEX	Abandonment Expenditure
ACQ	Annual Contract Quantity
°API	Degrees API (American Petroleum Institute)
AAPG	American Association of Petroleum Geologists
AVO	Amplitude versus Offset
A\$	Australian Dollars
B	Billion (10 <sup>9</sup> )
Bbl	Barrels
/Bbl	per barrel
BBbl	Billion Barrels
BHA	Bottom Hole Assembly
BHC	Bottom Hole Compensated
Bscf or Bcf	Billion standard cubic feet
Bscfd or Bcfd	Billion standard cubic feet per day
Bm <sup>3</sup>	Billion cubic metres
bcpd	Barrels of condensate per day
BHP	Bottom Hole Pressure
blpd	Barrels of liquid per day
bpd	Barrels per day
boe	Barrels of oil equivalent @ 6 Mcf/Bbl
boepd	Barrels of oil equivalent per day @ 6 Mcf/Bbl
BOP	Blow Out Preventer
bopd	Barrels oil per day
bwpd	Barrels of water per day
BS&W	Bottom sediment and water
BTU	British Thermal Units
bwpd	Barrels water per day
CBM	Coal Bed Methane
CO <sub>2</sub>	Carbon Dioxide
CAPEX	Capital Expenditure
CCGT	Combined Cycle Gas Turbine
cm	centimetres
CMM	Coal Mine Methane
CNG	Compressed Natural Gas
Cp	Centipoise (a measure of viscosity)
CSG	Coal Seam Gas
CT	Corporation Tax
DCQ	Daily Contract Quantity
Deg C	Degrees Celsius
Deg F	Degrees Fahrenheit
DHI	Direct Hydrocarbon Indicator
DST	Drill Stem Test
DWT	Dead-weight ton
E&A	Exploration & Appraisal
E&P	Exploration and Production
EBIT	Earnings before Interest and Tax
EBITDA	Earnings before interest, tax, depreciation and amortisation

EI	Entitlement Interest
EIA	Environmental Impact Assessment
EMV	Expected Monetary Value
EOR	Enhanced Oil Recovery
EUR	Estimated Ultimate Recovery
FDP	Field Development Plan
FEED	Front End Engineering and Design
FPSO	Floating Production, Storage and Offloading
FSO	Floating Storage and Offloading
ft	Foot/feet
Fx	Foreign Exchange Rate
g	gram
g/cc	grams per cubic centimetre
gal	gallon
gal/d	gallons per day
G&A	General and Administrative costs
GBP	Pounds Sterling
GDT	Gas Down to
GIIP	Gas initially in place
GJ	Gigajoules (one billion Joules)
GOR	Gas Oil Ratio
GTL	Gas to Liquids
GWC	Gas water contact
HDT	Hydrocarbons Down to
HSE	Health, Safety and Environment
HSFO	High Sulphur Fuel Oil
HUT	Hydrocarbons up to
H <sub>2</sub> S	Hydrogen Sulphide
IOR	Improved Oil Recovery
IPP	Independent Power Producer
IRR	Internal Rate of Return
J	Joule (Metric measurement of energy)   kilojoule = 0.9478 BTU)
k	Permeability
KB	Kelly Bushing
KJ	Kilojoules (one Thousand Joules)
kl	Kilolitres
km	Kilometres
km <sup>2</sup>	Square kilometres
kPa	Thousands of Pascals (measurement of pressure)
KW	Kilowatt
KWh	Kilowatt hour
LKG	Lowest Known Gas
LKH	Lowest Known Hydrocarbons
LKO	Lowest Known Oil
LNG	Liquefied Natural Gas
LoF	Life of Field
LPG	Liquefied Petroleum Gas
LTI	Lost Time Injury
LWD	Logging while drilling
m	Metres

M	Thousand
m <sup>3</sup>	Cubic metres
Mcf or Mscf	Thousand standard cubic feet
MCM	Management Committee Meeting
MMcf or MMscf	Million standard cubic feet
m <sup>3</sup> d	Cubic metres per day
mD	Measure of Permeability in millidarcies
MD	Measured Depth
MDT	Modular Dynamic Tester
Mean	Arithmetic average of a set of numbers
Median	Middle value in a set of values
MFT	Multi Formation Tester
mg/l	milligrams per litre
MJ	Megajoules (One Million Joules)
Mm <sup>3</sup>	Thousand Cubic metres
Mm <sup>3</sup> d	Thousand Cubic metres per day
MM	Million
MMBbl	Millions of barrels
MMBTU	Millions of British Thermal Units
Mode	Value that exists most frequently in a set of values = most likely
Mscfd	Thousand standard cubic feet per day
MMscfd	Million standard cubic feet per day
MW	Megawatt
MWD	Measuring While Drilling
MWh	Megawatt hour
mya	Million years ago
NGL	Natural Gas Liquids
N <sub>2</sub>	Nitrogen
NPV	Net Present Value
OBM	Oil Based Mud
OCM	Operating Committee Meeting
ODT	Oil down to
OPEX	Operating Expenditure
OWC	Oil Water Contact
p.a.	Per annum
Pa	Pascals (metric measurement of pressure)
P&A	Plugged and Abandoned
PDP	Proved Developed Producing
PI	Productivity Index
PJ	Petajoules (10 <sup>15</sup> Joules)
PSDM	Post Stack Depth Migration
psi	Pounds per square inch
psia	Pounds per square inch absolute
psig	Pounds per square inch gauge
PUD	Proved Undeveloped
PVT	Pressure volume temperature
P10	10% Probability
P50	50% Probability
P90	90% Probability
Rf	Recovery factor

RFT	Repeat Formation Tester
RT	Rotary Table
$R_w$	Resistivity of water
SCAL	Special core analysis
cf or scf	Standard Cubic Feet
cf/d or scfd	Standard Cubic Feet per day
scf/ton	Standard cubic foot per ton
SL	Straight line (for depreciation)
$s_o$	Oil Saturation
SPE	Society of Petroleum Engineers
SPEE	Society of Petroleum Evaluation Engineers
ss	Subsea
stb	Stock tank barrel
STOIP	Stock tank oil initially in place
$s_w$	Water Saturation
T	Tonnes
TD	Total Depth
$T_e$	Tonnes equivalent
THP	Tubing Head Pressure
TJ	Terajoules ( $10^{12}$ Joules)
Tscf or Tcf	Trillion standard cubic feet
TCM	Technical Committee Meeting
TOC	Total Organic Carbon
TOP	Take or Pay
Tpd	Tonnes per day
TVD	True Vertical Depth
TVDss	True Vertical Depth Subsea
USGS	United States Geological Survey
US\$	United States Dollar
VSP	Vertical Seismic Profiling
WC	Water Cut
WI	Working Interest
WPC	World Petroleum Council
WTI	West Texas Intermediate
wt%	Weight percent
1H05	First half (6 months) of 2005 (example of date)
2Q06	Second quarter (3 months) of 2006 (example of date)
2D	Two dimensional
3D	Three dimensional
4D	Four dimensional
1P	Proved Reserves
2P	Proved plus Probable Reserves
3P	Proved plus Probable plus Possible Reserves
%	Percentage