"In Pursuit of the Common Code" Classification and Reporting of Petroleum Resources Using SPE Standards

By John R. Etherington
Independent Consultant

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Mr. Etherington is a Calgary-based consultant advising industry on petroleum resources assessment and reporting since 2000. He previously spent 32 years with Mobil Oil in Canada, USA, and international Exploration and Producing assignments including five years in Mobil's central resources audit group. John served on the SPE Oil and Gas Reserves Committee with primary responsibility for drafting the 2007 Petroleum Resources Management System (PRMS).

He was an SPE Distinguished lecturer in 2006 and has conducted training on resources assessment using PRMS and SEC guidelines for over 1600 geoscientists and engineers from 46 countries. John represented the SPE on the Technical Advisory Group to United Nations resources classification committee and is a member of the SPEE Reserves Definitions Committee.

He is a registered petroleum geologist with the AAPG and the Association of Professional Engineers and Geoscientists of Alberta. He holds BSc and MSc degrees in geology.

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Agenda

- Why we need a standard!
- Development of Petroleum Classifications
- Petroleum Resources Management System **(PRMS)**
- PRMS Major Principles
- Summary

> PRMS Implementation Status

> PRMS Update Project

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What is it all about?

Its all about predicting future supply of oil and gas!

"The quantity of usable resources is not fixed but changes with progress in science, technology, and exploration and with shifts in economic conditions." (V. McKelvey).

We need an international standard!

To provide consistency in communicating expected results in terms of estimated quantities of marketable petroleum products and their monetary value associated with fields, properties and projects!

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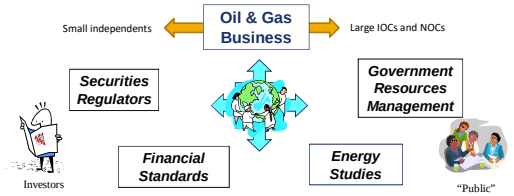
Who Uses this Information?



All stakeholders require complete, consistent and reliable information on future production and associated cash flow estimates associated with petroleum exploration and development projects.

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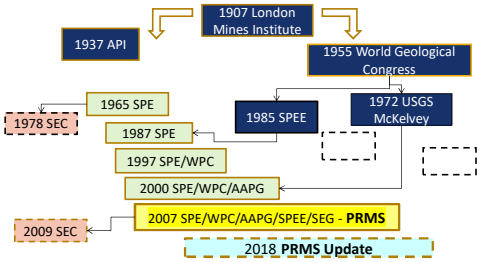
Who Provides the Standards?



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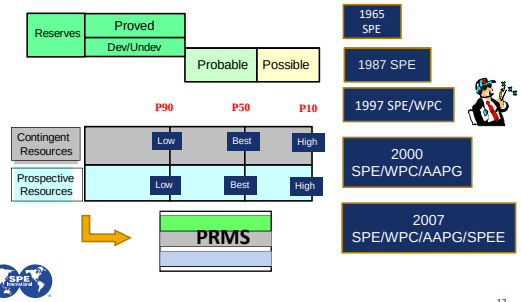
SPE and Partners – Building a Standard



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Who is the OGRC?

SPE Oil & Gas Reserves Committee

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OGRC Members: Experts in resource assessment and reporting
International representation ⟹ (USA, Canada, France, Spain, Russia, Australia, Saudi Arabia, India)

OGRC Observers / PRMS Co-sponsors:

- World Petroleum Council (**WPC**)
- American Association of Petroleum Geologists (**AAPG**)
- Society of Petroleum Evaluation Engineers (**SPEE**)
- Society of Exploration **Geophysicists** (**SEG**)
- *European Association of Geoscientists & Engineers (**EAGE**)*
- *Society of Petrophysicists and Well Log Analysts (**SPWLA**)*

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What is PRMS?

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PRMS is a framework for classifying and categorizing estimates of all petroleum reserves and resources.

PRMS provides an industry consensus on basic principles and high level guidelines that, if adopted, will improve assessment consistency *… and help companies manage their business.*

What PRMS is Not!

PRMS was not written as public disclosure rules – issuers should continue to comply with regulatory requirements for external reporting.

PRMS is not a text book on detailed evaluation techniques.

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PRMS Supports Asset Management "Cradle to Grave"

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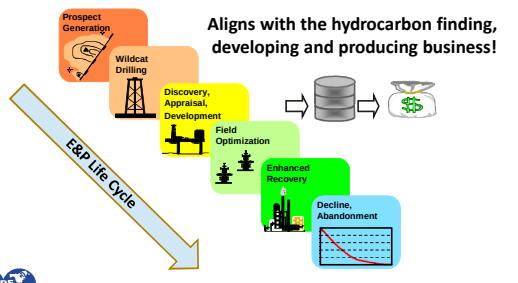

Aligns with the hydrocarbon finding, developing and producing business!

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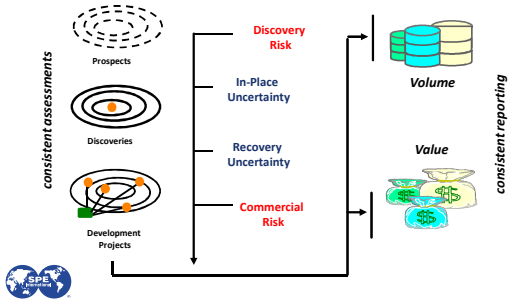
Its all about Risk and Uncertainty



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The PRMS Document (March 2007)

http://www.spe.org/industry/reserves.php

Discussion of Principles

- Section1. Basic Principles & Definitions
- Section 2. Classification and Categorization Guidelines
- Section 3. Evaluation and Reporting Guidelines
- Section 4. Estimating Recoverable Quantities

23 pages

Resources Definitions & Guidelines

- *Table I: Classes & Sub-classes*
- *Table II: Resources Status Modifiers*
- *Table III: Category Definitions & Guidelines*

6 pages

Auxiliary Definitions

- Appendix A: Glossary

18 pages

Available in English, Spanish, Chinese and Russian.
See also: Guidelines for Application of PRMS (2011)

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PRMS – Major Principles

1. The System is **"Project–Based".**
2. Classification is based on project's **chance of commerciality**. Categorization is based on **recoverable uncertainty**.
3. Base case uses **best estimate quantities recoverable** under evaluator's **forecast of future conditions**.
4. Provides **granularity for project management**.
5. Estimates based on **deterministic and/or probabilistic** methods.
6. Applies to both conventional and **unconventional resources**.
7. Reserves /resources are estimated in terms of the **sales products.**
8. Net Resources are allocated based on **contractual entitlement.**

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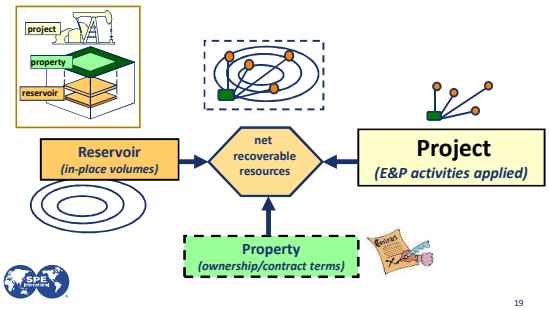
Principle #1

The System is "Project–Based"



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What is a Project?

- A **development project** is typically a single engineering activity with a distinct beginning and end, which, when completed, results in the production, processing or transportation of crude oil or natural gas. Each project has an investment decision.
- An **appraisal project** is designed to gather additional information to be used in a development investment decision.
- An **exploration project** is designed to gather information on reservoir(s)' potential to yield a development project ... and thus a decision for additional investment.

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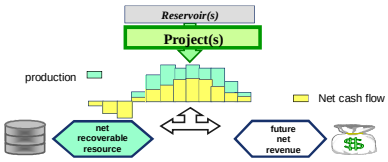
Project Links Volume and Value



Each project applied to a specific reservoir(s)' development under defined conditions generates a unique production and cash flow schedule at each level of certainty.

The time integration of these schedules taken to the project's technical, economic, or contractual limit defines the estimated recoverable resources and associated future net cash flow forecast for each project.

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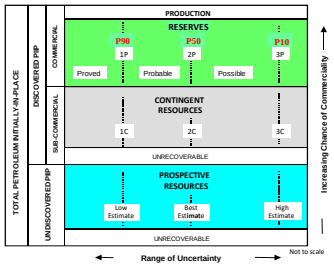
Principle #2

PRMS Framework - Classification/Categorization Matrix



Classify **projects** based on **chance of commerciality**

Categorize based on **uncertainty** in recoverable quantities associated with a **project**

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Resources Classification in PRMS

Two Risk Hurdles

Reserves

Chance of Commercial Development

Contingent Resources

Chance of Discovery

Prospective Resources

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What are "Prospective Resources"?

PROSPECTIVE RESOURCES are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from undiscovered accumulations by application of future development projects.

Prospective Resources have both an associated chance of discovery and a chance of development.

Chance of Discovery (Pg)< 1.0 (e.g. 40%)
Chance of Development (assuming discovery) (Pd)< 1.0 (e.g. 60%)

Chance of Commerciality = Pg X Pd (e.g. 40% * 60% = 24%)

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What constitutes a "discovery"?

One petroleum accumulation or several petroleum accumulations for which one or several exploratory wells have established through testing, sampling and/or logging the existence of a significant quantity of potentially moveable hydrocarbons.

- ❖Prefer … but does not require a flowing well test
- ❖Can be based on samples and well logs (and analogs)
- ❖"Potentially" moveable (accommodates unconventionals)
- ❖Does not have to be "commercial"

But it does require a well!

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What are "Contingent Resources"?

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 viable markets, or where commercial recovery is dependent on technology under development, or where evaluation of the accumulation is insufficient to clearly assess commerciality.

Discovered 

Commercial  Chance of Development < 1.0

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What are "Reserves"?

Reserves are a specific subset of resources.

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:

1. **Discovered**
2. **Recoverable**
3. **Commercial**
4. **Remaining**

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"As of a Given Date"

- The resources estimates and allocation to classes and categories changes with new data/interpretations and changes in conditions and are reported **"as of a given date".**
- Typically annually at the fiscal year-end but interim updates are commonly required
- Example changes:
  - Contingent Resources are reclassified to Reserves.
  - Probable are recategorized to Proved.
  - Proved Reserves are Produced.

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Commercial Criteria for Reserves

Discovered recoverable volumes (Contingent Resources) may be considered commercially producible, and thus Reserves, if the entity claiming commerciality has demonstrated firm intention to proceed with development and such intention is based upon:

- ❑ **reasonable timetable** for development
- ❑ project meets **defined investment and operating criteria** (see #3)
- ❑ there will be a market
- ❑ production and transportation facilities available
- ❑ resolved all legal, contractual, environmental & other social contingencies

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Timetable for Development

- A reasonable time frame for the initiation of development depends on the specific circumstances and varies according to the scope of the project. **Five years is recommended as a benchmark.**
- ***Exceptions to 5 year guidance***
  - *Gas cap waiting on associated oil depletion (if there is a gas market)*
  - *Major projects with longer development schedules*
  - -------
- Justifications for exceptions should be clearly documented

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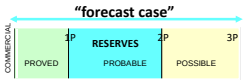
Principle #3

Base case uses best estimate/forecast of future conditions

Project investment decisions are based on:
Best estimate of recovery under the evaluator's view of **"Forecast Conditions"** = those assumed to exist during the project's implementation

Conditions include:

- Prices and costs
- Technology available
- Environmental standard
- Fiscal terms
- Regulatory constraints



Same Conditions for Proved & Unproved

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What is Economic? $$$

- Under PRMS, a project is considered to be economic if its **"best estimate"** case has a **positive net present value** under the organization's **forecast price case** and standard discount rate, or at least has a positive undiscounted cash flow.
- There may be external requirements (regulatory disclosure or bank loan rules) that the low technical estimate (standalone) is economic under current/constant prices. If this criterion is not met, evaluators should report 2P and 3P without Proved.
- As costs are incurred and development proceeds, the low estimate may eventually satisfy external requirements and Proved Reserves may be assigned.

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Principle #4

Provide granularity for project management.

Project Maturity Sub-classes

Reserves Status ⟷ **Economic Status**

May be applied separately or in combination

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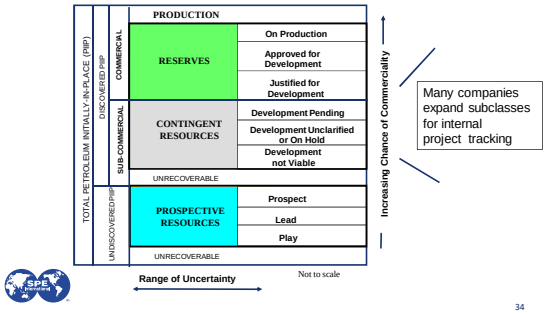
Project Maturity Sub-classes



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Economic Status

Economic *(Reserves) – yields a positive cash flow under current fiscal conditions*

Marginal Economic *(Contingent Resources)*
technically feasible projects that are projected to be economic under reasonably forecasted improvements in fiscal conditions

Sub-Marginal Economic *(Contingent Resources)*
technically feasible development projects but economics would not be satisfied under current or reasonably forecasted improvements in fiscal conditions.

Economics Undetermined *– evaluations incomplete*

Economic projects may have other contingencies that prevent classification as reserves (e.g. regulatory, legal, environmental and social conditions)

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Reserves Status

Recoverable quantities may be subdivided based on the funding and operational status of wells and associated facilities into:

Developed Reserves are expected quantities to be recovered by **existing** wells and facilities - equipment has been installed or the **cost to do so is relatively minor**

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

Developed Non-Producing Reserves include shut-in & behind pipe reserves
- production can be initiated or restored with **relatively minor costs**

Undeveloped Reserves are expected quantities to be recovered through future investments

- new wells on undrilled acreage in known accumulations
- where a **relatively major cost** is required to recomplete an existing wells or install facilities

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Principle #5

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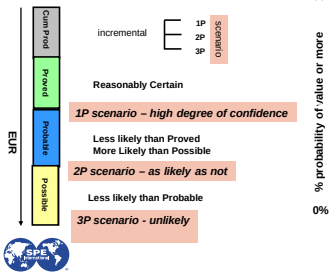
Estimates based on deterministic and/or probabilistic methods.

Deterministic Methods



Reasonably Certain

1P scenario – high degree of confidence

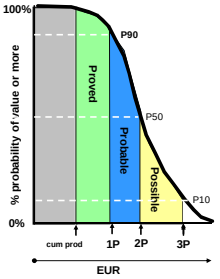
Less likely than Proved
More Likely than Possible

2P scenario – as likely as not

Less likely than Probable

3P scenario - unlikely

Probabilistic Methods



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Principle #6

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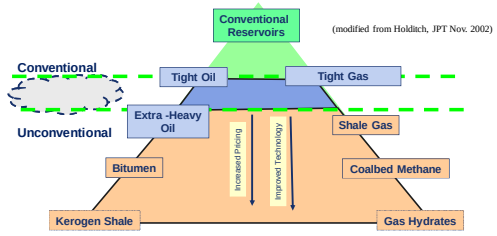
Applies to both conventional and unconventional resources.



While the detailed assessment methodology varies …
the basic principles of PRMS still apply

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Conventional vs. Unconventional Reservoirs

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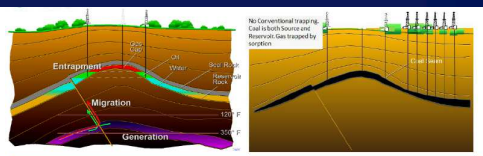

Conventional	Unconventional
Hydrodynamic emplacement and trapping	Trapping not hydrodynamic
Controlled by local structure and stratigraphy ▪ Well defined limits (e.g. seal and fluid contact) ▪ Discrete fields	Controlled by regional stratigraphy ▪ Poorly defined limits ▪ "Continuous" or "Dispersed" Accumulations
Un-stimulated Production	Little Primary Production (except for some CBM)

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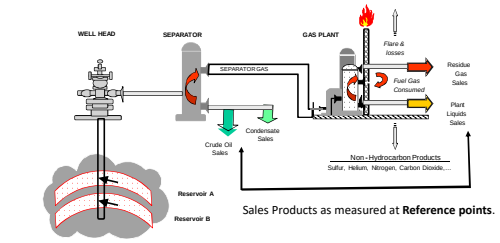
Principle #7

Reserves /resources are estimated in terms of the sales products



Sales Products as measured at **Reference points**.

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Reference Points

Resource quantities are estimated in terms of the "lease sales" products measured in their condition as accepted at the custody transfer (or reference) point.

"The Reference Point may be defined by relevant accounting regulations in order to ensure that the Reference Point is the same for both the measurement of reported sales quantities and for the accounting treatment of sales revenues.

This ensures that sales quantities are stated according to their delivery specifications at a defined price. "

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Principle #8

Resources Entitlement and Recognition

- Hydrocarbons are "owned" by the host government or by private mineral rights holders
- Entities may acquire the right to explore for, extract, and market all, or a portion, of the recoverable hydrocarbon quantities.
- Entities may claim entitlement to future marketable volumes based on the contract terms.
- Entities may claim Reserves … subject to accounting and disclosure rules on reserves recognition.

Net resources are estimates of an entity's entitlement to marketable quantities derived from a reservoir by applying a development project taken to its economic, technical or contractual limit.

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Are we there yet?

- **Have we achieved a global common code?**
- Pretty close … PRMS provides the building blocks which will allow greater harmonization and consistency in the area of petroleum resources evaluation and reporting.

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PRMS 2007 Adoption Status

PRMS is implicitly or explicitly referenced by:

Securities Regulators
USA (SEC)
Canada (CSA)
Hong Kong (HKEX)
Australia (ASX)
UK (LSE-AIM)
Singapore
Argentina
Brazil
(ESMA)

Oil & Gas Companies

PRMS

Financial
IASB

Government Reporting

BOEM
ANP
EBN
CNH

UNFC
OPEC

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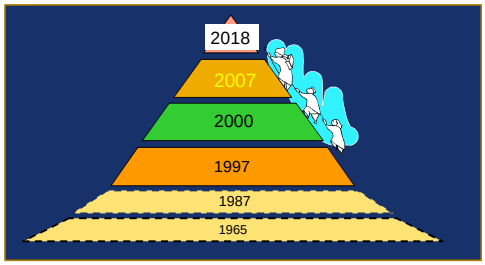
The Journey Continues…



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PRMS Update Project

Process and Status

Final Approval
March 2018

Submit for SPE board and partner approval

Project Initiated
Sept 2014

90-Day Industry
Review Period
Ended Nov 14, 2017

Incorporate Feedback -
OGRC & Partner Reviews

We are Here!

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Questions?

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