Petroleum Resources Management System For Efficient and Transparent Hydrocarbon Accounting

Petroleum Resources Management System (PRMS) is a system developed for consistent and reliable definition, classification, and estimation of hydrocarbon resources. PRMS is sponsored and approved by six professional bodies in the oil and gas industry namely: Society of Petroleum Engineers (SPE), the World Petroleum Council (WPC), the American Association of Petroleum Geologists (AAPG), the Society of Petroleum Evaluation Engineers (SPEE), the Society of Exploration Geophysicists (SEG), and the European Association of Geoscientists and Engineers (EAGE). PRMS has emerged the Global Standard for Petroleum Reserves and Resources Reporting as it provides a common reference for the international petroleum industry, including national reporting standards and regulatory disclosures, and support petroleum project and portfolio management requirements. This paper x-rays the core elements of PRMS. The aim is to draw the attention of industry practitioners, investors and financials to PRMS document and provide clarity as it relates to geosciences, reservoir engineering and commerciality of oil and gas projects.

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Petroleum Resource Management System (PRMS)

Outline

1. Rationale for PRMS
2. Resources Vs Reserves
3. Opportunity Maturation Stages
4. Uncertainty Scenarios
5. Resource Classification
6. Acceptable Analytical Procedure for Estimating Recoverable
7. Commercial Evaluation and Reporting Guidelines

Petroleum Resources Management System (PRMS)

The Petroleum Resources Management System (PRMS) is a system developed for consistent and reliable definition, classification, and estimation of hydrocarbon resources.

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)

As the technologies employed in petroleum exploration and exploitation continue to evolve and improve, the PRMS is revised periodically to keep pace with evolving technologies and changing commercial opportunities. The latest revision was issued in June 2018

PRMS - Sponsors

Society of Petroleum Engineers (SPE)

World Petroleum Council (WPC)

American Association of Petroleum Geologists (AAPG)

Society of Petroleum Evaluation Engineers (SPEE)

Endorsed by Society of Exploration Geophysicists (SEG)

Rationale for PRMS

PRMS create a common set of evaluation and reporting standard to ensure:

1. Consistency
2. Transparency
3. Reliability
4. Comparability between projects and
5. Provide a common reference for the international petroleum industry, including national reporting and regulatory disclosure.

Stakeholders Reference Document

PRMS is created as a reference document for industry stakeholders including:

- Oil and gas Companies (IOCs, NOCs and small Independents)
- Employees
- Government Agencies
- Public
- Securities Regulators
- Investors
- Financial Institutions

All stakeholders require consistent, reliable and transparent reporting of future production, reserves and associated cashflow.

Resources Vs Reserves

Resources encompass all quantities of petroleum (recoverable and unrecoverable) naturally occurring on or within the Earth's crust, discovered and undiscovered, plus those quantities already produced. Further, it includes all types of petroleum whether currently considered "conventional" or "unconventional

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 further satisfy four criteria:

1. They must be discovered
2. Recoverable
3. commercial, and
4. Remaining (as of a given date) based on the development project(s) applied.

Estimated Ultimate Recovery (EUR): Those quantities of petroleum which are estimated, on a given date, to be potentially recoverable from an accumulation, plus those quantities already produced therefrom.

Undeveloped Reserves

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

1. New wells on undrilled acreage in known accumulations,
2. Deepening existing wells to a different (but known) reservoir,
3. 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 recomplete an existing well or install production or transportation facilities for primary or improved recovery projects.

Develop Reserves

- **Developed Reserves** are expected to be recovered from existing wells including reserves behind pipe. ***Improved recovery 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. Developed Reserves may be further sub-classified as Producing or Non-Producing.
- **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** 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 the 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.

Proved, Probable and Possible Reserves - Uncertainty

Incremental category of estimated recoverable volumes associated with a defined degree of uncertainty

Proved Reserves: 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. Often referred to as 1P, also as “Proven.”

Probable: Those additional Reserves that 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.

Possible: Those additional reserves which analysis of geoscience and engineering data suggest 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.

Contingent Resources Vs Prospective Resources

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 are a class of discovered recoverable resources.***

Prospective Resources:

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

Play, Lead and Prospect – Opportunity Maturation Stages

- **Play:** Is 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.
- **Lead:** Is 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.
- **Prospect:** Is associated with a potential accumulation that is sufficiently well defined to represent a viable drilling target.

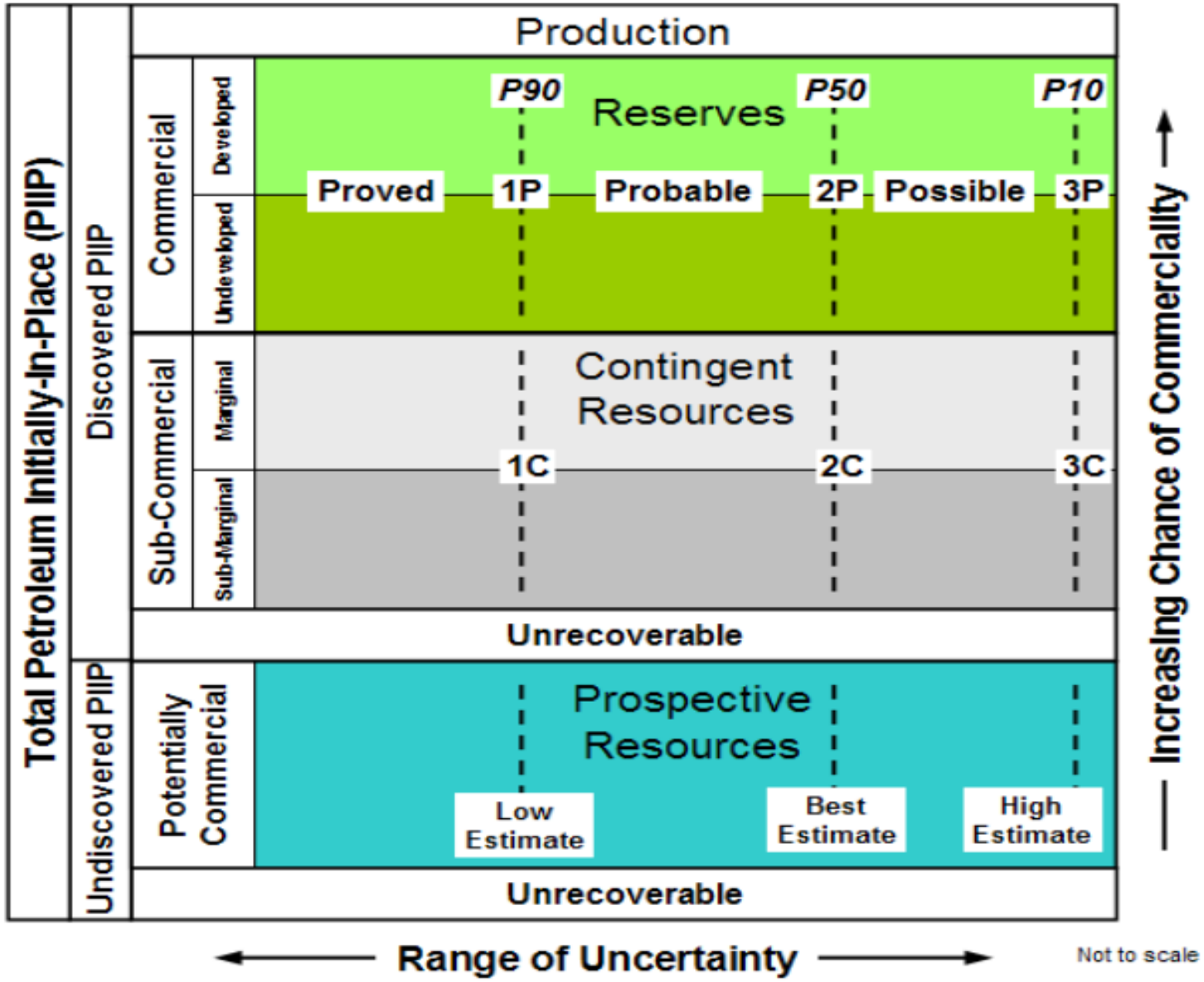
Uncertainty Scenarios

PRMS classification identifies 3 categories of uncertainty scenarios reflecting the low, best, and high estimate of future recoverable volumes.

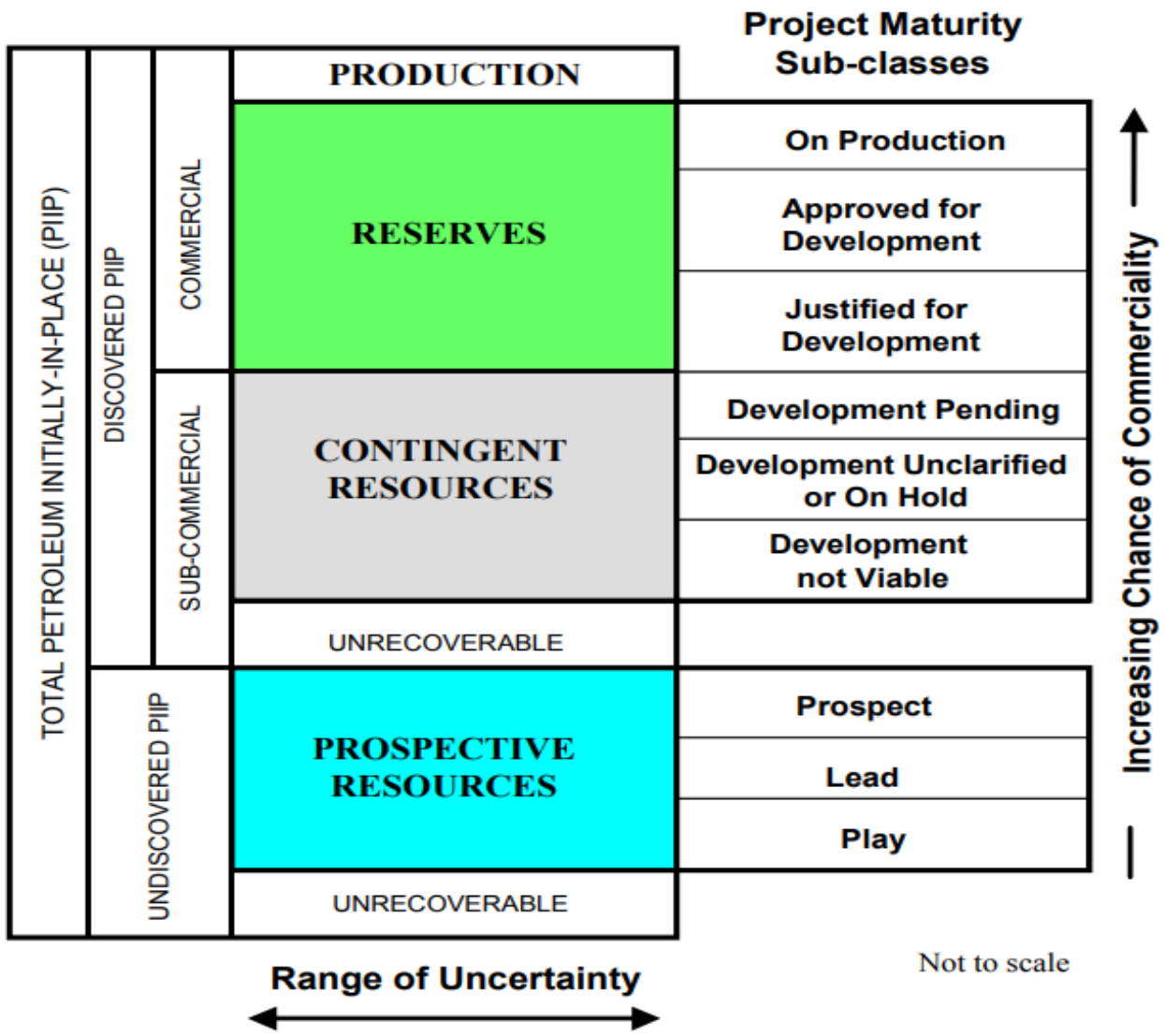
1. **Reserves:** Proved (1P), Proved + Probable (2P) or Proved + Probable + Possible (3P)
2. **Contingent Resources:** 1C, 2C or 3C
3. **Prospective Resources:** Low Estimate (1U), Best Estimate (2U) or High Estimate (3U)

	Low	**Best Estimate**	**High**
Reserves	1P	2P	3P
Contingent Resources	1C	2C	3C
Prospective Resources	1U	2U	3U

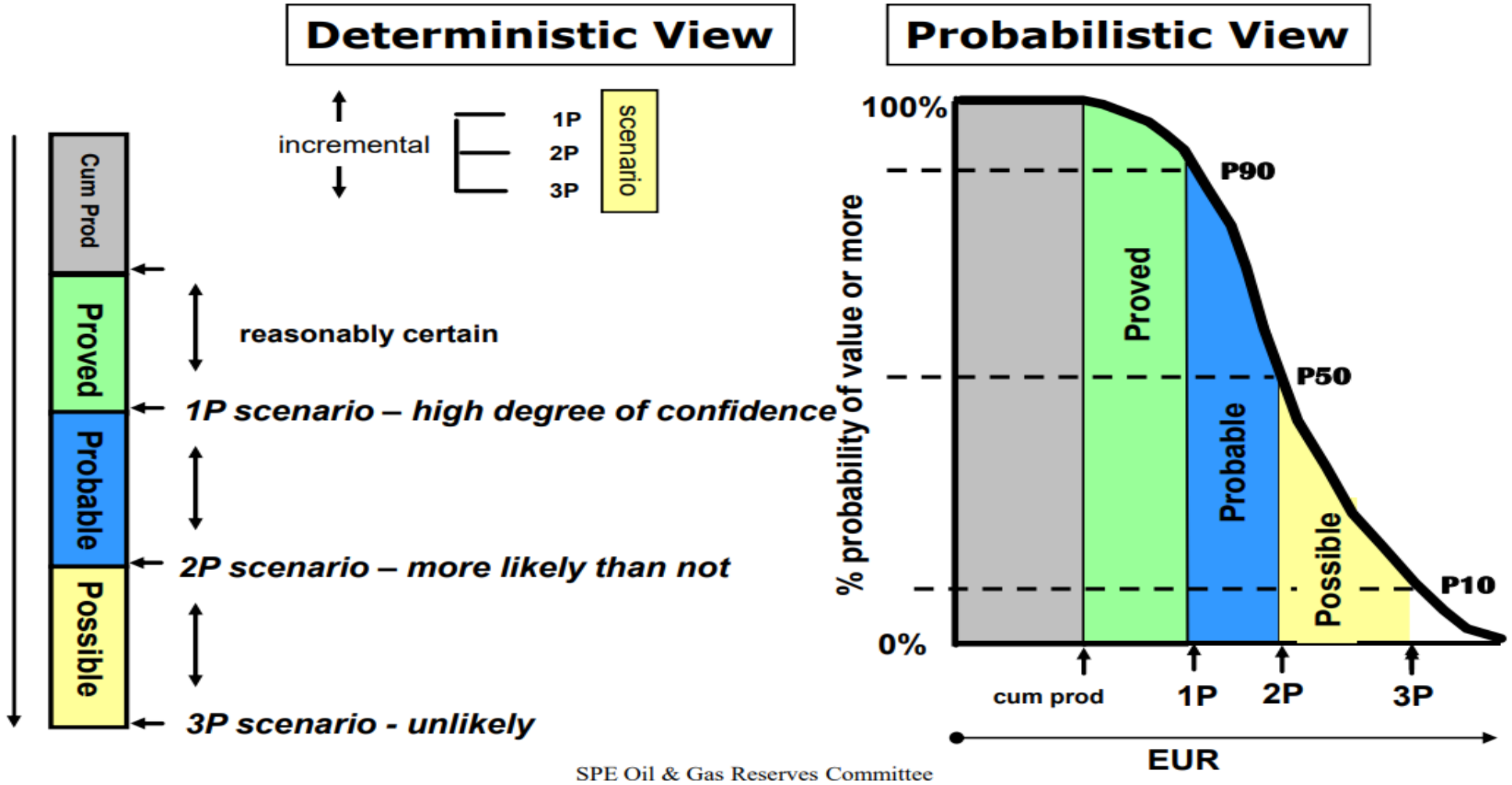
Resources Classification



Project Maturation Stages



Range of Uncertainty



SPE Oil & Gas Reserves Committee

Acceptable Analytical Procedure for Estimating Recoverable

Pre- and post discovery

1. Analogy
2. volumetric estimates,

After production commencement

1. material balance
2. Production Decline Analysis
3. Simulation Modelling etc).

Each of these procedures can utilize deterministic or probabilistic estimation methodology

Analogous reservoirs *have similar rock and fluid properties, reservoir conditions (depth, temperature and pressure) and drive mechanisms. Such reservoirs are at a more advanced stage of development than the reservoir of interest.*

Economic Interest and Economic Limit

- **An Economic Interest** is possessed in every case in which an investor has acquired any Interest in mineral in place and secures, by any form of legal relationship, revenue derived from the extraction of the mineral to which he must look for a return of his capital.
- **Economic limit** is defined as the production rate beyond which the net operating cash flows (after royalties or share of production owing to others) from a project, which may be an individual well, lease, or entire field, are negative.

Commerciality

A project is commercial when the essential social, environmental and economic conditions are met, including political, legal, regulatory and contractual conditions and commitment to develop and place the accumulation on production within a reasonable time frame, usually 5 years. A longer time frame could be applied where, development of economic projects are deferred at the option of the producer for, market-related reasons, local conditions, or to meet contractual or strategic objectives.

Royalty, Working, Net Working and Carried Interests

- **Royalty:** refers to payments that are due to the host government or lessor in return for lessee/contractor having access to the petroleum resources. Royalty can be in cash or kind depending on the agreement
- **Working Interest:** A company's equity interest in a project before reduction for royalties or production share owed to others under the applicable fiscal terms.
- **Net Working Interest:** A company's working interest reduced by royalties or share of production owing to others under applicable lease and fiscal terms. This is Also called Net Revenue Interest.
- **Carried interest** is an agreement under which one party (the carrying party) agrees to pay for a portion or all of the pre-production costs of another party (the carried party) on a license in which both own a portion of the working interest.

Cash-Flow-Based Resources Evaluations

Project based Cash Flow Input Parameters should include:

1. Production Profile
2. Estimated Capital Costs
3. Estimated Operating Expenses
4. Estimated Environmental Liabilities (Safety, Abandonment)
5. Forecast Prices, inflation, etc.
6. Estimated Revenues
7. Project Life that should not exceed Entitlement Period
8. Appropriate Discount Rates to compute NPV

Future price conditions must be based on "reliable data" and should capture all past event

Barrel of Oil Equivalent or Crude Oil Equivalent

Converting gas volumes to the oil equivalent is customarily done on the basis of the nominal heating content or calorific value of the fuel.

Common industry gas conversion factors:

1 barrel of oil equivalent (BOE) = 5,600 standard cubic feet (scf) of gas

Some operators use 1 BOE = 5,620 scf derived from the metric unit equivalent 1 m^3 crude oil = 1,000 m^3 natural gas).

Conclusion

Like the International Financial reporting Standards (IFRS) which bring consistency to financial reporting, the Petroleum Resources Management System (PRMS) provides reliable, consistent and transparent definitions and classifications for comparability between projects and regulatory reporting.

PRMS should be adopted as reference document for industry players including regulators and lenders.

Thank you