

Ryder Scott Canada Reserves Conference



Petroleum Resources Management System Ongoing Considerations and Potential Changes

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Disclaimer

The views expressed in this presentation are solely the personal opinions of the speaker and do not necessarily reflect those of any persons, companies, professional societies or institutions mentioned herein.

Issues presented within are provisional and will change and are provided to encourage thought and industry discussion.

Petroleum Resources Management System

The PRMS system provides a project based resource management framework for government, regulators, financial lending institutions, other stakeholders and oil and gas companies.

The majority of disclosure standards are based on PRMS principals.

- TSX, SEC, HKSE, LSE, ASX, etc.
- **PRMS Principles and Definitions were last updated in 2007**
- Prepared by the Society of Petroleum Engineers OGRC with co-sponsorship from the SPE, SPEE, WPC, AAPG and subsequently by SEG
- Input from the SPE, SPEE, WPC, AAPG
- **Industry recognized a need to modernize and update PRMS**

PRMS Update Sub-Committee

~16 volunteers with considerable reserves experience were selected from the SPE Oil and Gas Reserves Committee, representing the various technical disciplines required for resource evaluation.

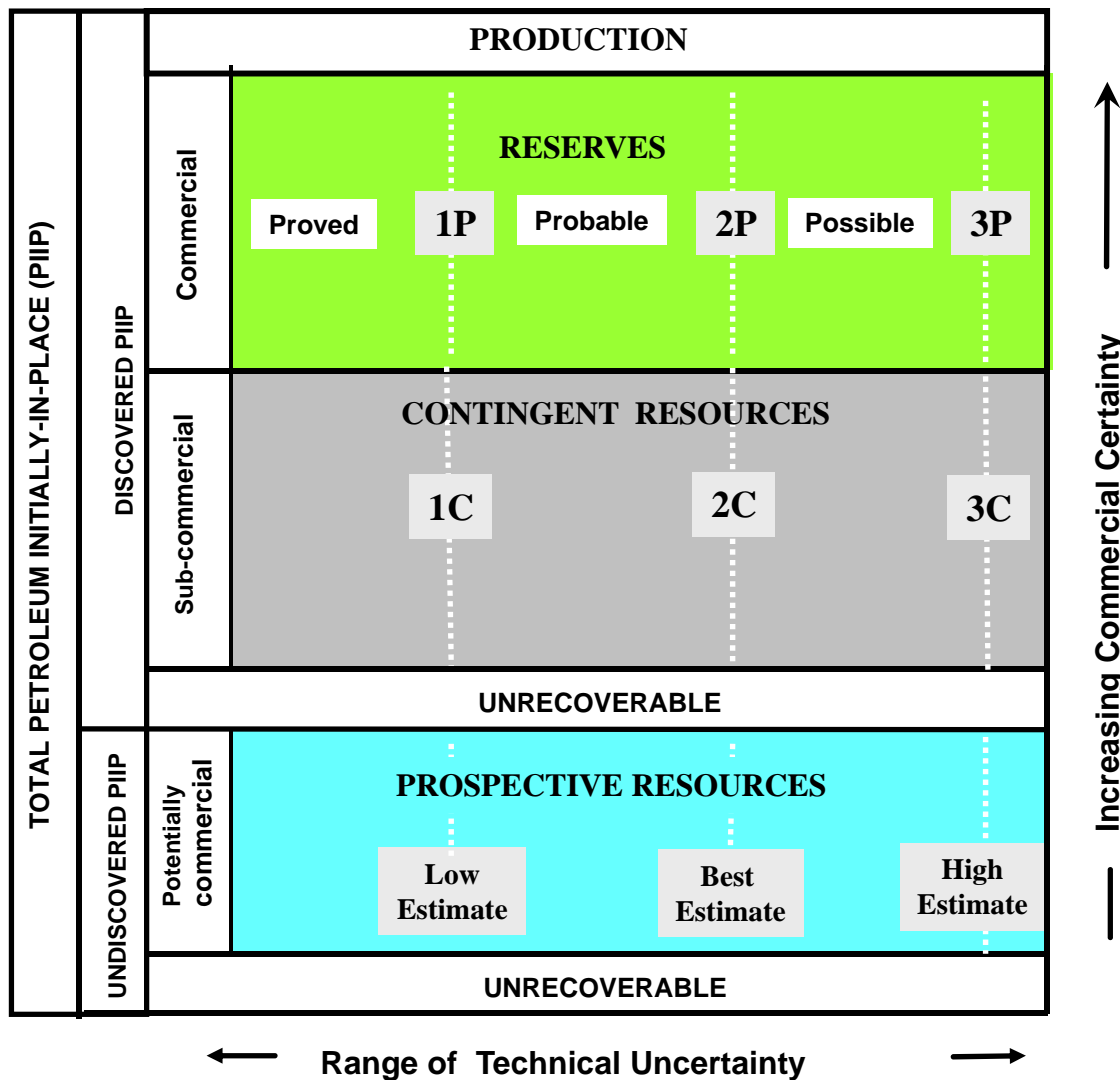
PRMS Definitions are being updated (currently 46 pages) to reflect current principles and best evaluation/reporting practices. COGEH and the PRMS Application Guidelines have been reviewed.

The committee has been at work for more than a year and has constructed a conceptual framework concerning principles and additional concepts. Draft wording is under discussion.

This presentation summarizes some of the key considerations discussed by the PRMS update sub-committee during this process.

I am a committee member and this presentation represents my views.

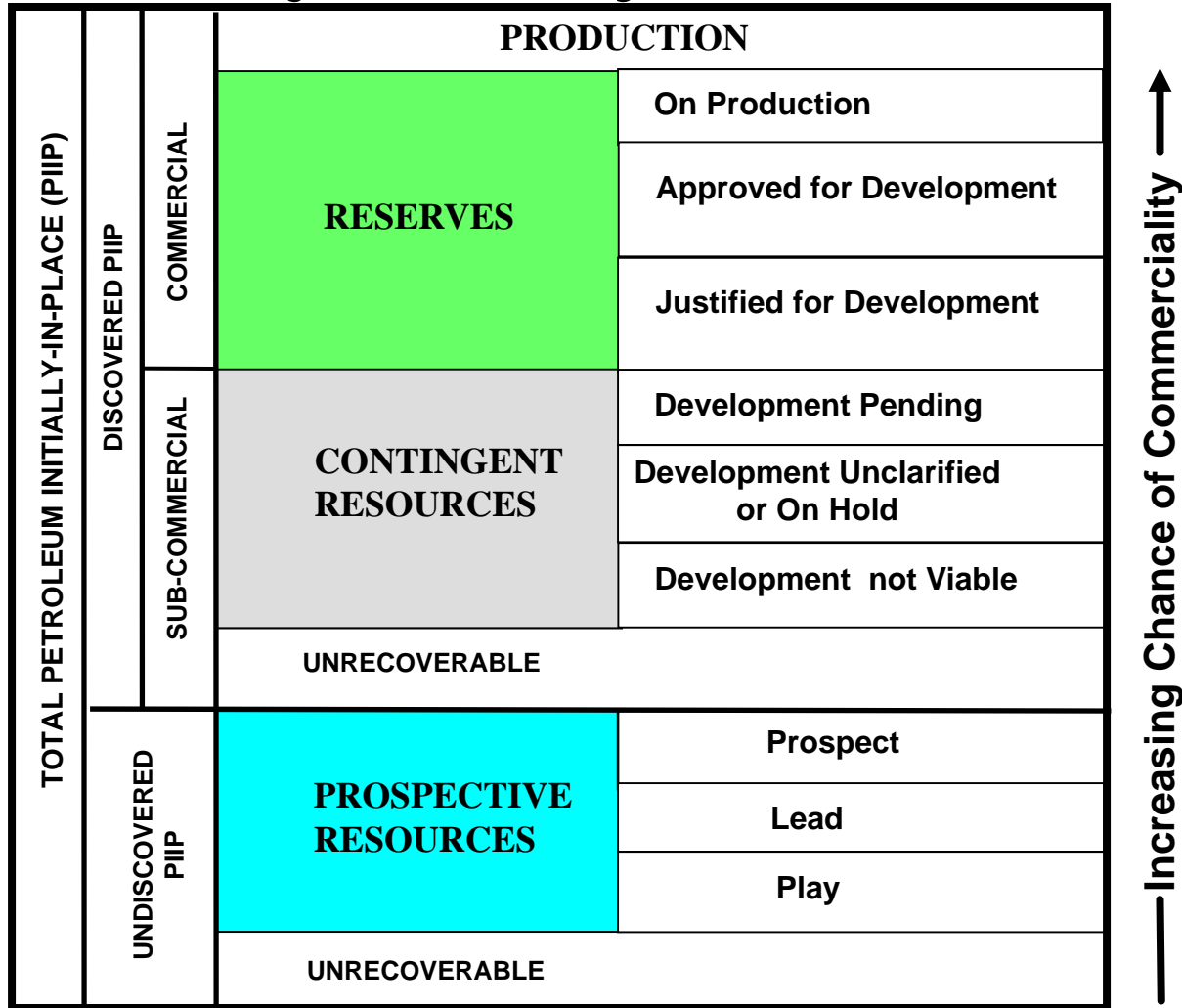
2007 PRMS – Petroleum Resources System



The PRMS is a project based system and provides a methodology to organize oil and gas projects on the basis of commercial maturity and confidence of technical recoveries.

2007 PRMS – Petroleum Resources System

Project maturity subclass



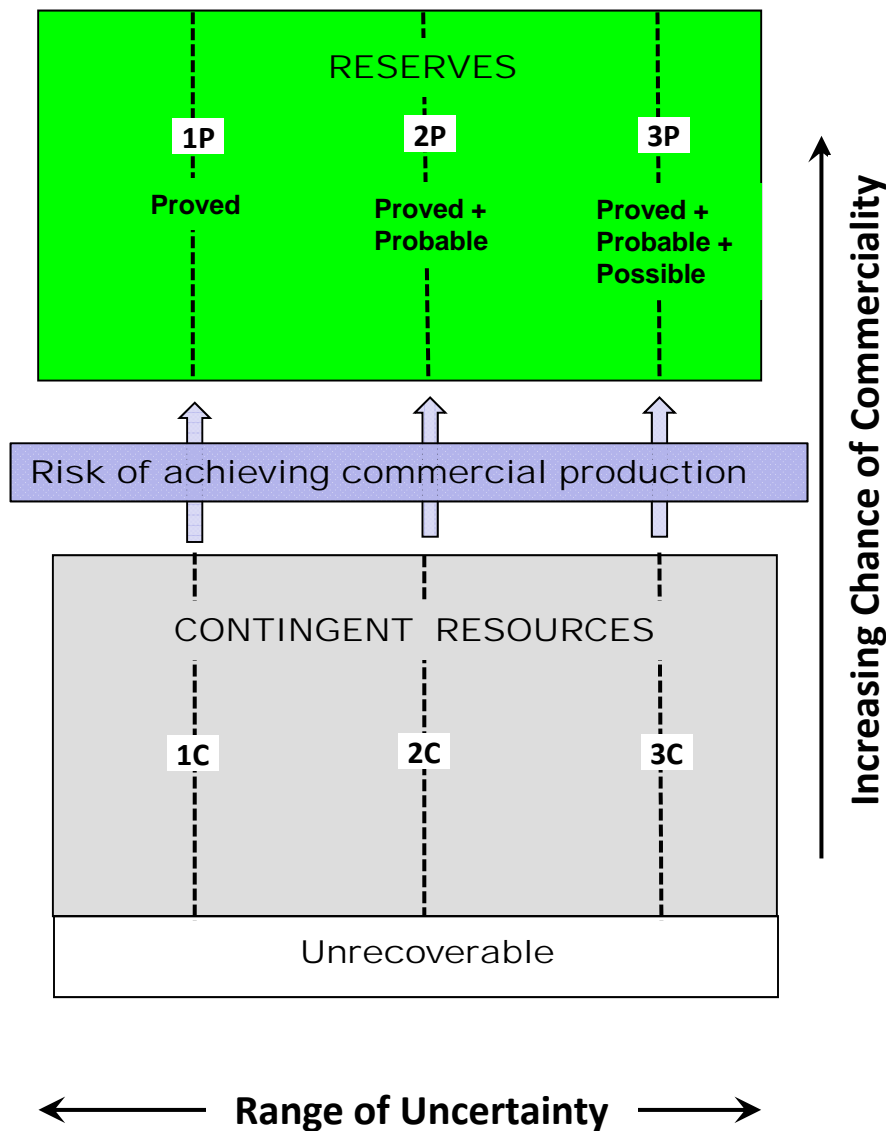
— Increasing Chance of Commerciality —↑

Range of Uncertainty



Not to scale

Contingent Resource Categories and Alignment with Reserves



Without new technical information, there should be no change in the distribution of technically recoverable volumes and their categorization boundaries when conditions are satisfied sufficiently to reclassify a project from Contingent Resources to Reserves.

Categories of proved reserves (1P) and contingent resources (1C) have the same levels of confidence.

PRMS Update – Committee Considerations

Some of the ongoing discussions include:

- What is economic, commercial?
- How should fuel gas and process gas be considered for reserves?
- Inclusion of unconventional resource concepts (discovery, flow test requirements, etc.)
- Should “standalone” possible reserves be contingent resources?
- How should scenario and incremental evaluation methods be interpreted? What has changed?
- Should resources be required to be broken-out by project maturity subclass?

What Does Economic Mean?

Under current definitions, proved reserves do not exist if they are uneconomic, even if the company is developing the project and the expected case used for economic valuation meets company investment thresholds.

Shouldn't reserves be a reflection of economic investment decisions and company commitments?

The view is that committed oil and gas investments that are economic on a 2P basis should include the project's range of reserves (1P/2P/3P) without requiring a test of the separate categories.

This means that the proved reserve cash flow would not need to be positive, provided that development commitment exists, **the 2P case meets investment thresholds**, and reserves meet other definitions.

“Proved Economic”?

Once a Project meets **commercial criteria** (including economics) based on its Best Estimate of recoverable resources, **then all associated resource estimates become classified as reserves.**

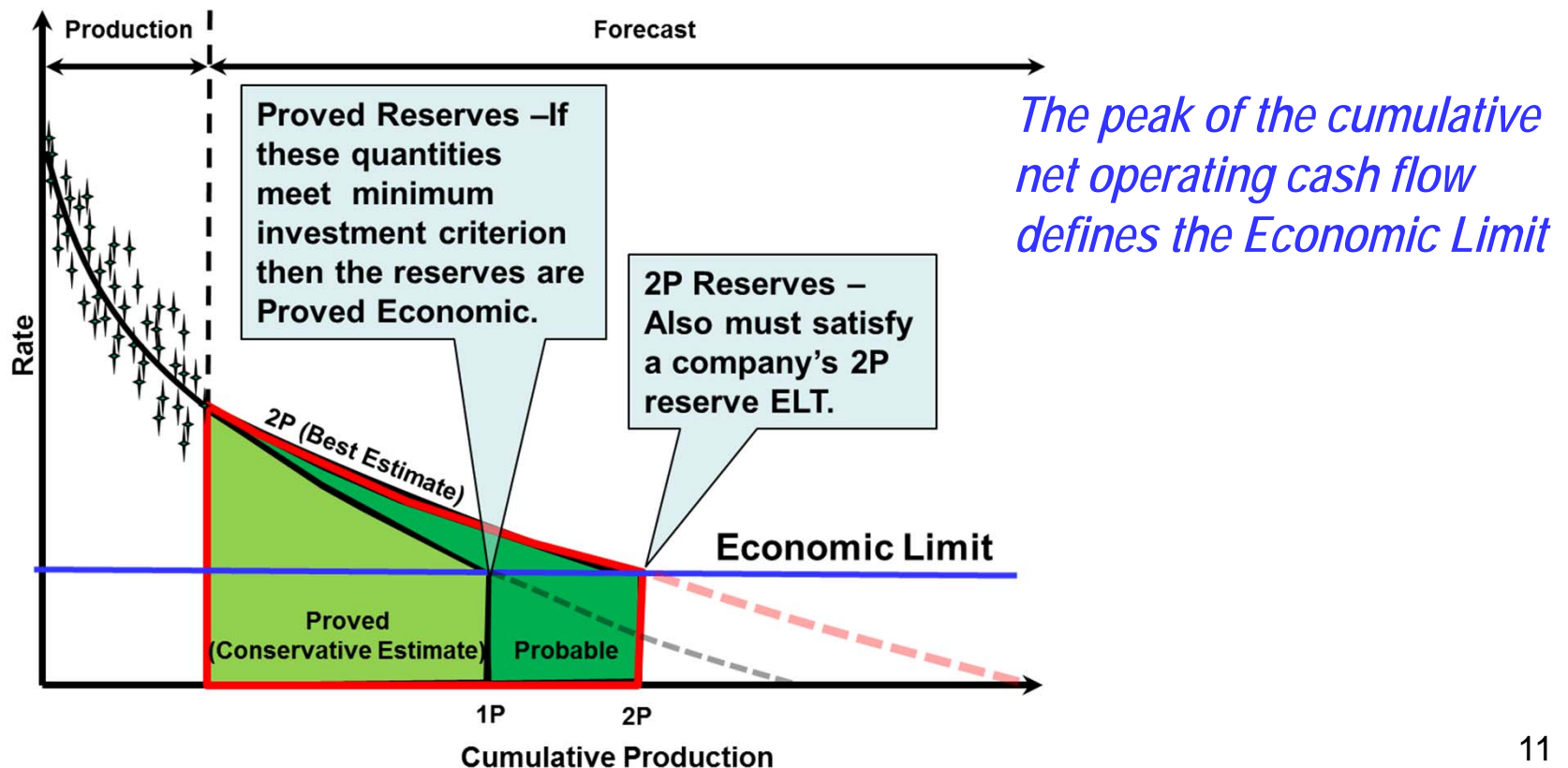
“Proved” and “Proved Economic” both in existence in the 2007 PRMS have been highlighted to clarify when Proved reserves are economic.

- “Proved” exists when the 2P case meets minimum investment evaluation criteria of the 2P Economic Limit Test (ELT).
- “Proved Economic” exists when the Proved Reserves meet minimum investment evaluation criteria.

Economic Limit Test:

The Economic Limit occurs when beyond a given date, the net operating cash flows are negative.

Economic Limit Tests (ELT) must be conducted for each uncertainty level (Low, Best and High as one of the criteria to qualify the production profiles for Proved, Probable and Possible)



Implications: Changes to “economic” definition

- Low/best/high cases become a reflection of project commitment and can include uneconomic proved reserves providing the project's 2P case is economic.
- Allows for low/best/high cases of committed (2P) economic investment to be stochastically or probabilistically added.
- If the 2P case is uneconomic the project can not be considered to provide reserves.
- Compared to present definitions, on a company aggregate basis, proved reserves quantities will increase, but economic value of those reserves will decrease.

Products Consumed in Operations

In some jurisdictions, definitions preclude the booking of fuel or products consumed in operations as reserves.

Though fuel or consumed products are part of production they are often ignored or precluded as being reserves.

In the last few years many companies include fuel as part of reserves.

The view is a need to provide a consistent approach to identify consumed products so reserves can remain comparable.

Implications: Inclusion of Consumed Products

- Where claimed as reserves, such fuel quantities should be reported separately from sales.
- By including consumed products as reserves, the relationship between in-place volumes and reserves is maintained.
- Provides a more direct link between production and reserves.
- Processing and lifting costs based upon production volumes become more comparable and intuitive.

Characteristics of Resource Plays

(SPEE Definition – Not PRMS)

1. *Wells exhibit a repeatable statistical distribution of estimated ultimate recoveries*
2. *Offset well performance is not a reliable predictor of undeveloped location performance*
3. *A continuous hydrocarbon exists that is regional in extent*
4. *Free hydrocarbons (non-sorbed) are not held in place by hydrodynamics*

Source: SPEE Monograph 3, Page 3

Understandings and Implications:

- Limited historical data and few analogues.
- Traditional evaluation techniques may not be relevant (e.g. petrophysical analysis).
- Porosity and water saturation may be of limited use.
- Production mechanisms differ- Unconventional reservoirs generally require stimulation.
- Reserves and production can be highly variable from well to well and more difficult to predict

Resource Recognition – Understanding Risks

The principle risk for resource recognition differs:

For **conventional reservoirs** - chance of discovery

- Are the hydrocarbons there?

For **unconventional reservoirs** - chance of development

- Can the known hydrocarbons be recovered commercially?

Implications of Continuous Resource Play

- Unconventional resources may require PRMS to provide more extensive definitions relating to **commercial requirements**:
 - Spatially across (horizontally) and within (vertically) the resource play and also what constitutes development commitment.
 - For Discovery, since the extent of accumulation that is economically producible can be unpredictable.
- The ability to potentially recover commercial quantities is required for discovery.
- Does PRMS need to require different relationships for unconventional resources (e.g. testing, distances from control points, economics or analytic proofs?)

I believe that conventional and unconventional resources require the same definitions. Unconventional is not unique.

What is Considered “Discovered”?

Penetration by a well is a prerequisite for the classification of *Discovered*

The accumulation must be **Known** – demonstrated existence of hydrocarbon by flow testing or log/core data which is a good analogy to a nearby and geologically comparable known accumulation.

- Nearby = Same depositional environment, same diagenetic and structural processes

Flow tests for unconventional reservoirs/hydrocarbons may be problematic as they cannot be tested by primary flow and may require extensive stimulation and pilot testing before flow may be demonstrated.

Log and Core data demonstrates the presence of hydrocarbon but, *in absence of flow data, would not satisfy the Known criterion.*

Discovery

The presence of hydrocarbon is not evidence of flow. For discovery, are both the presence of hydrocarbon and proof that it is movable (e.g. will flow) required?

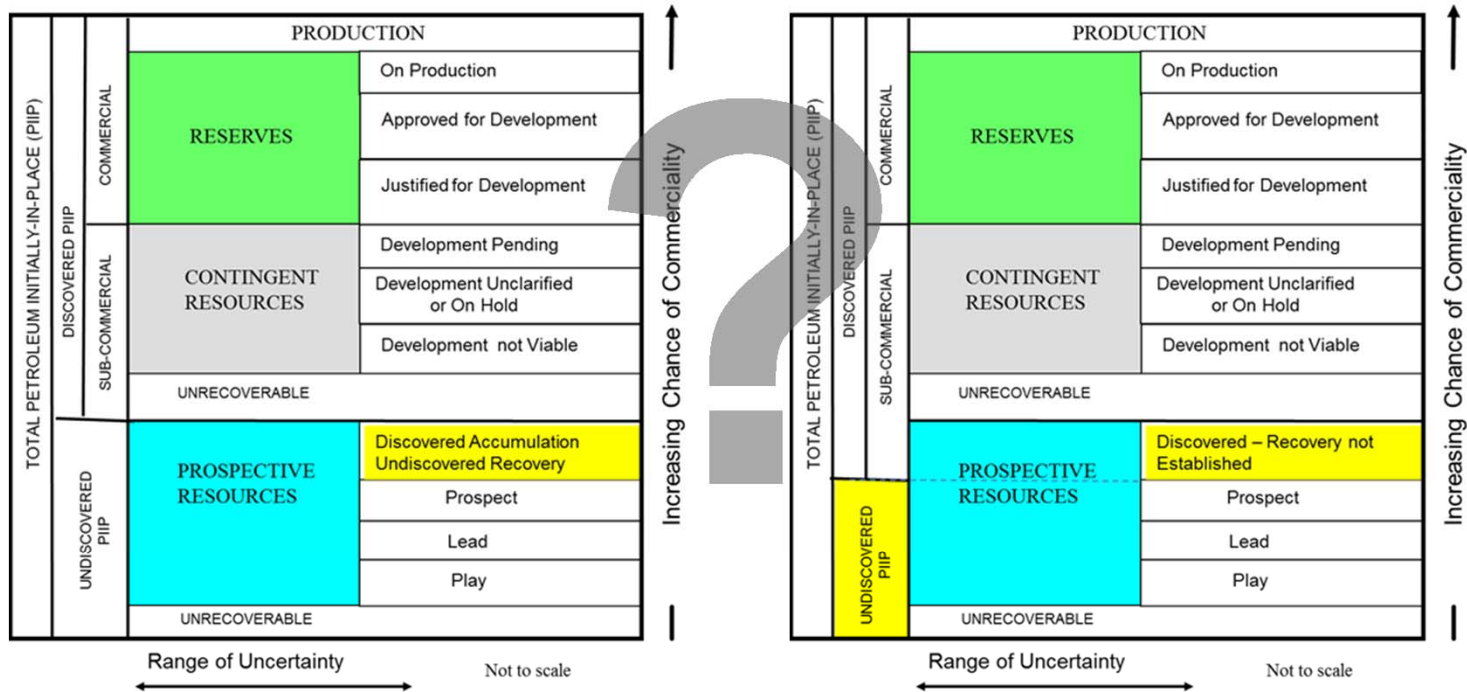
Questions that need to be considered:

- Should "Discovered" relate to "existence and recovery" or "existence" only?
- Should the Discovery Test definition be changed to include "potentially recoverable" instead of "potentially moveable" ?
- How does the concept of technology maturity (experimental, under development etc.) relate to the discovery test?
- For tight gas and shale gas can you have a discovery without fracture stimulation?

Discovery

Is a recovery project required for “Discovery”?

My thoughts: Perhaps the PRMS resource classification framework needs to be modified?



How far from penetration can Discovery extend?

- Is it different for unconventional resources?

Commercial Threshold Required for Reserves

*“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 timeframe for the initiation of development... 5 years is recommended as a benchmark...”*

(Source - PRMS)

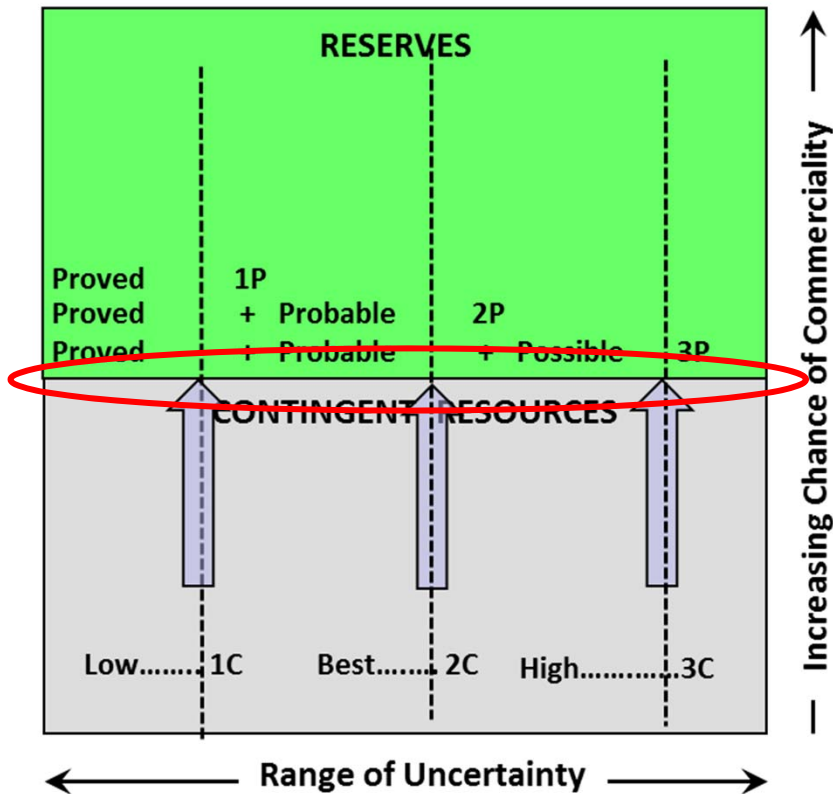
In PRMS the commercial threshold required for reserves recognition is subject to a number of considerations (some are company specific).

In Canada, COGEH recognizes different thresholds for each reserves classification. The thresholds can be qualitative and subjective.

Commercial Threshold Required for Reserves

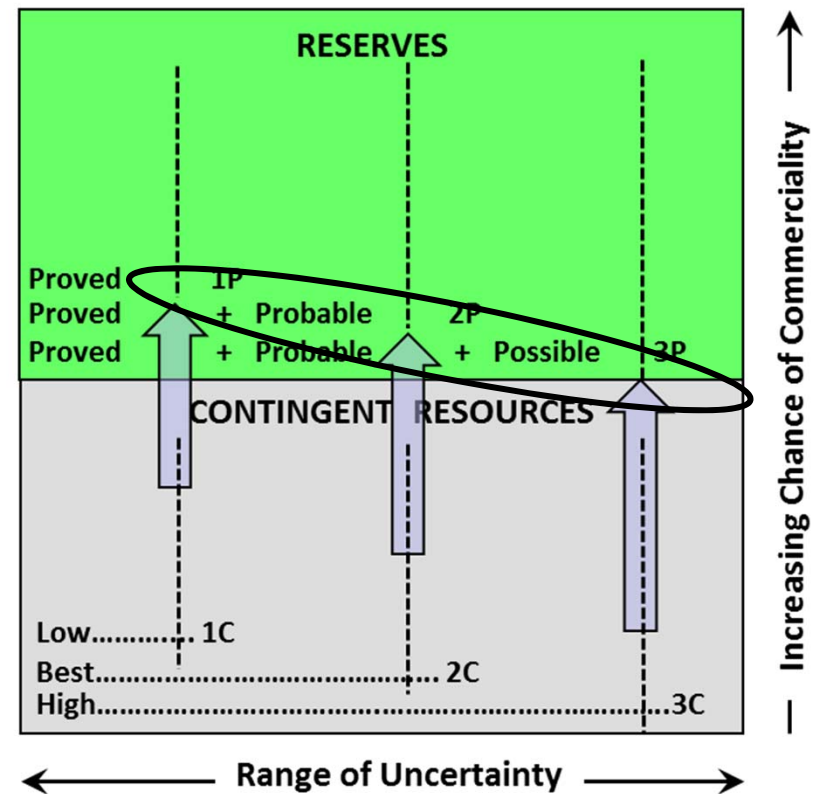
Draft PRMS

Consistent commercial thresholds across categories



COGEH

Different commercial thresholds across categories



The Canadian approach differs from the PRMS Committee

Implications of Consistent Commercial Threshold

Use of a consistent commercial threshold across reserves categories:

- Allows statistical addition/aggregation of reserves across categories.
- Creates inconsistency with SEC??: The SEC regulations contemplate situations where commercial conditions preclude the booking of proved reserves, but the reserves should be considered as probable (CDI 117.02). PRMS would address the Proved Economic category (with other SEC criteria for constant case).
- COGEH definitions and related reserves estimates would differ from PRMS.
- The SEC/COGEH commerciality definitions for proved reserves may be interpreted as being more restrictive - requiring a separate SEC/COGEH estimate (e.g. effectively re-establishing split conditions as is presently used by some).

Standalone Possible Reserves

Proposed principle: For a property where no proved or probable reserves have been assigned, possible reserves cannot be assigned because the 2P case used for economic valuation does not meet the required commercial thresholds required for reserves. **The quantities must be ~Contingent Resources.**

CSA staff Notice 51-327(f): The CSA believes that generally, possible reserves should not be disclosed as standalone. Standalone possible reserves are likely resource estimates – not reserves (unless there are very special circumstances).

Implications of not Allowing Standalone P3

Reserves evaluation practices of some will need to be adjusted to ensure they align with current and proposed definitions.

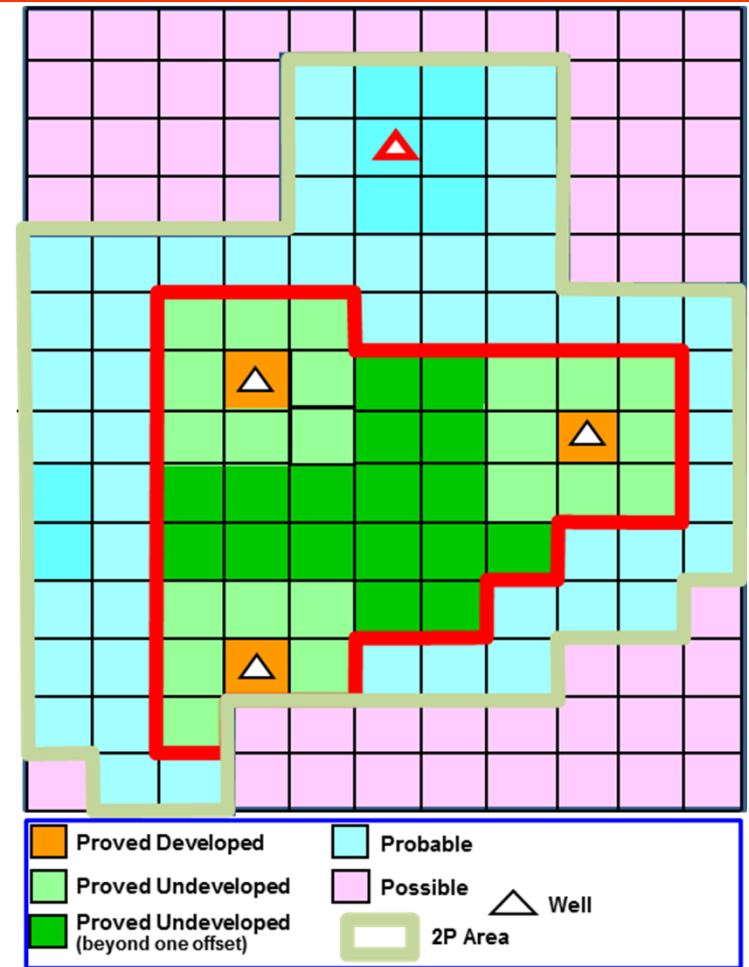
Possible reserves cannot be considered as potential upside such that the project only generates possible reserves. Reserves are a reflection of the range associated with the 2P case and cannot be thought of as Proved, Probable and everything else as Possible upside case(s).

If the expected case (2P) cannot be recognized due to an economic impediment or contingency, then the 3P case, even if economic, would have a low statistical probability of economic producibility making it difficult to demonstrate project commitment. **Under the proposed definitions if the 2P case is not economic, P3 cannot exist.**

Scenario and Incremental Methods

Most evaluations are completed using a **scenario** based method where reserves are estimated on a 1P/2P/3P (cumulative) basis - allowing probabilistic measurement of confidence levels.

In some cases an **incremental** based method is used where proved, probable and possible reserves are separately estimated.



Proved Developed: 3 wells

Undeveloped area

Proved: 39 well locations

Probable: 54 well locations

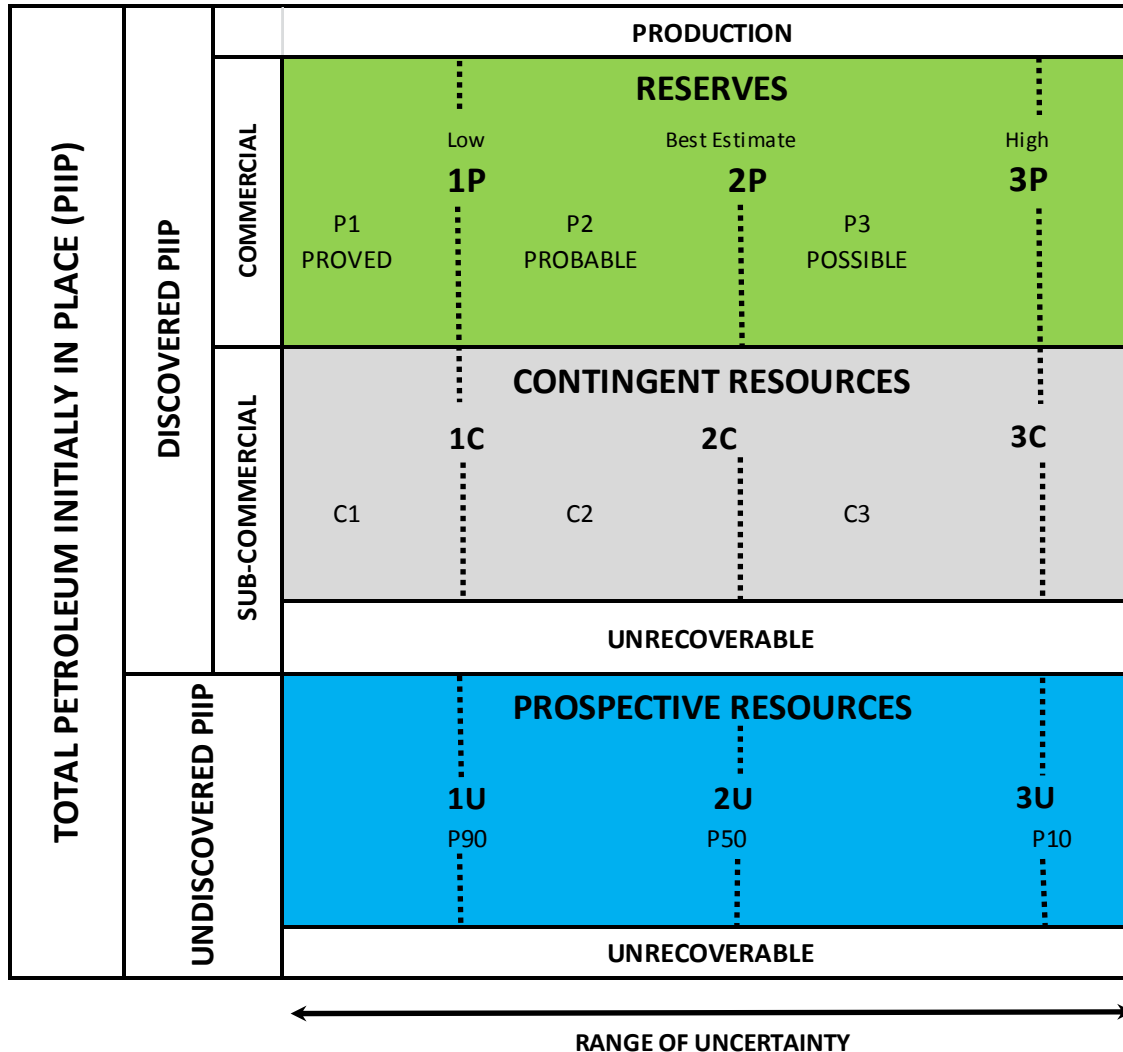
Possible: 120 well locations (not shown) 26

Implications - Incremental Method

- In the incremental method the use of a single deterministic best estimate applied to the High, Moderate, Low area/segment (as used by some in the past) is not recommended.
 - It is recommended that a range of estimates (Low, Best, High) be applied to the Proved, Probable and Possible areas.
- Standalone Possible reserves generated by incremental method are Contingent resources. It is unlikely that these are Reserves.
 - Possible exists as part of the technical uncertainty range in the High and Moderate areas/segments (i.e. the high case in these two areas) and must be reviewed for level of confidence in Low area/segment.
- Project definition (and approval if it exists) must be clear and unique, regardless of method used.

PRMS Classification Diagram – Discussion

Should the PRMS Classification diagram be changed?

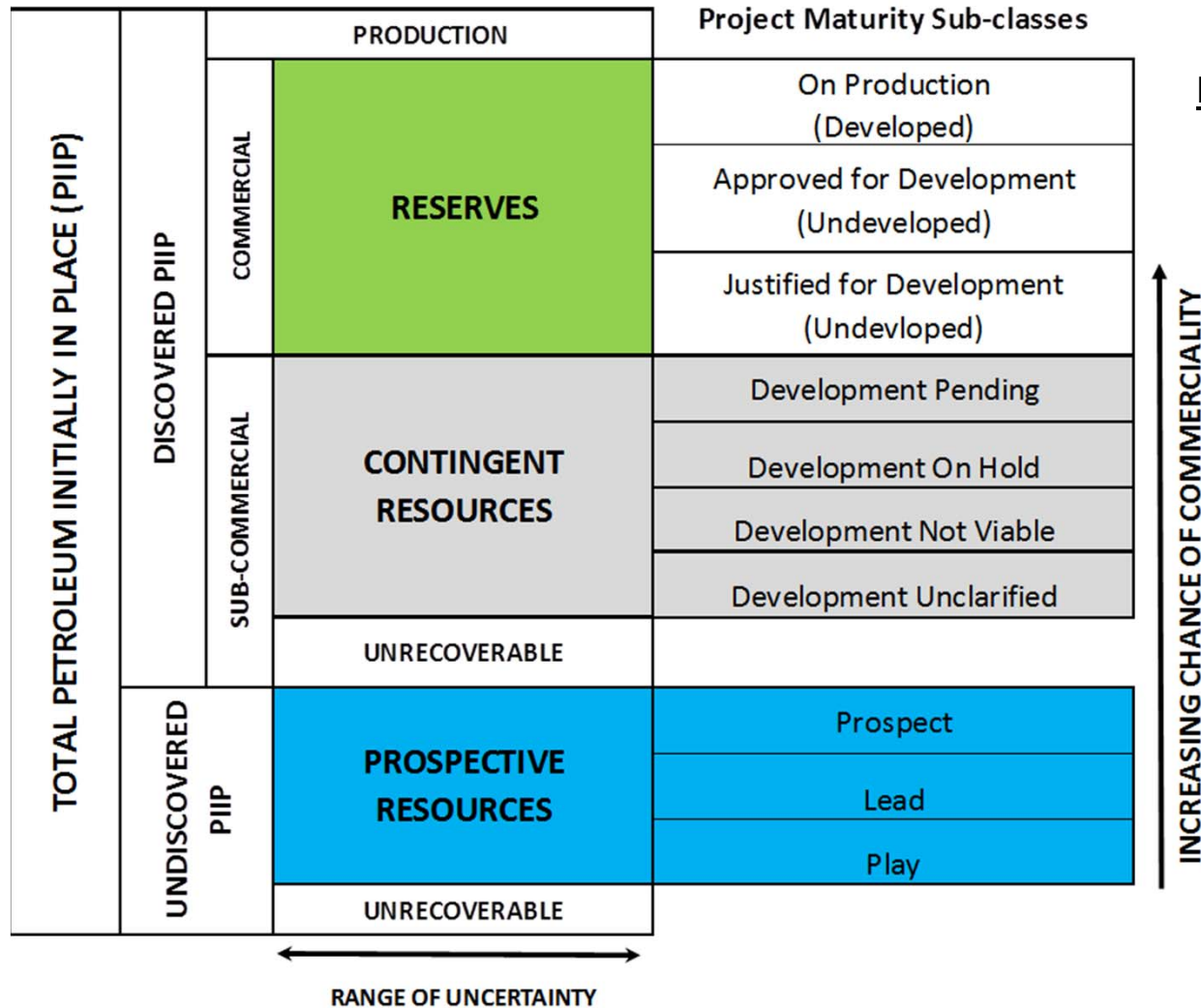


PRMS Committee considerations:

- Shortened “increasing chance of commerciality” arrow as it achieved when reaching Reserves (not final production)
- Added P1, P2 and P3
- Added C1, C2 and C3
- Added 1U, 2U and 3U in referencing a relation to Low, Best and High in Prospect /Contingent and Reserves as there is a qualification to arrive at the appropriate resource classification

PRMS Classification Diagram - Discussion

Should project maturity sub-classes be changed?



PRMS Committee considerations:

- Split Development On Hold from Development Unclassified
- Shortened the “increasing chance of commerciality” arrow as it achieved when reaching Reserves is 90% and Approved for Development is 100% (not final production)

PRMS Glossary update

The current PRMS glossary definitions are not extensive and additional definitions are proposed. Following are a few of them:

- Analogous Recovery Process
- Chance of Commerciality
- Chance of Development
- Consumed in Operation
- Incremental Method
- Resource Type
- Scenario Method
- Technical Cut-off

Principles for Resource Recognition: Cut-offs and Recovery Factors

- Contingent Resources are often estimated using analogs, which are based upon physical data and actual results.
- Recovery factors are typically based upon in-place volumes of moveable (producibile) oil and gas. Immoveable hydrocarbons should not be included.
- Moveable oil and gas can be difficult to estimate in unconventional reservoirs since mobility can be related or dependent upon the improved recovery technique, its affect and the amount of reservoir affected.
- If petrophysical cut-offs are too low, in-place volumes can become too large and require recovery factors to compensate for the unproductive reservoir included in the estimate.

Best practice is to align petrophysical cut-offs with productive reservoir.

Additional Comments

The 2007 definitions were drafted to help clarify the need for evaluation staff to ensure that technical and commercial uncertainty is used to categorize and classify (respectively) resources.

	Incorrect use of PRMS	Correct use of PRMS
PUDS	Drilling 0 - 5 years from evaluation date (commitment not considered)	Drilling within appropriate development spacing distance, project implementation within ~ 5 years, development commitment exists.
Probable Reserves	Drilling 6 - 10 years from evaluation date	Drilling at distances which meet 2P confidence threshold, project implementation within ~5 years, development commitment.
Possible Reserves	Drilling 11 - 15 years from evaluation date	These are likely contingent resources.

Drilling date is a commercial consideration (vertical axis) and is typically unrelated to the confidence of technical recovery (horizontal axis).

PRMS Update – Next Steps

The first draft of the PRMS update has taken considerably more time than anticipated. The committee is comprised of volunteers and spread across many continents; consensus on many principles is time consuming.

The committee plans to have a first draft completed by May/June.

The draft will be provided to members of the sponsoring organizations (SPE, SPEE, WPC, AAPG) for discussion/feedback

The comments/feedback will then need to be considered by the committee and updates will be made.

Consideration to other users of PRMS (LSE, ASX, HKSE, etc.) may be required.

Three month public consultation/comment period.

My belief is that the update may not be complete for 1 year (at least).

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