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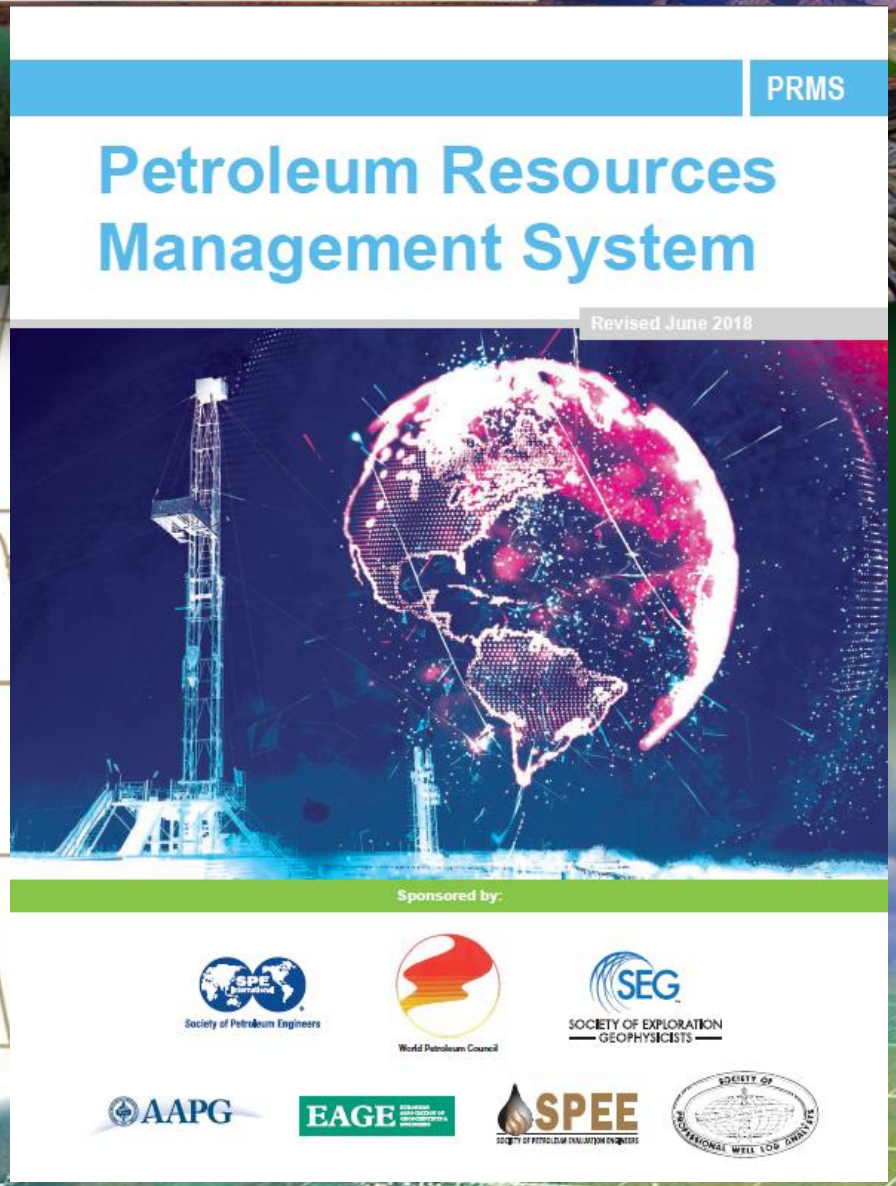

What's New with PRMS 2018

Dan Olds

Ryder Scott Petroleum Consultants

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A Quick Review

WHAT IS PRMS?

- SPE's Petroleum Resources Management System (PRMS) is a classification system that can accommodate prospective resources, contingent resources, and reserves.
- Resources denotes all quantities of petroleum naturally occurring in the Earth's crust.
- Reserves would be that subset that has been estimated to be commercially recoverable for new projects or economically produced by existing projects.
- Extraction and recovery of the petroleum quantities is defined by a development project.
- PRMS allows the consideration of risk of geologic discovery, the technical uncertainties, and the chance of achieving commercial maturity of a project.
- The use of a consistent classification system enhances comparisons between projects and facilitates portfolio management.
- Goal is to communicate the confidence of the commercial recovery of a project's resources and the range of potential outcomes.

WHAT IS PRMS – PROSPECTIVE RESOURCES

- Prospective resources are those volumes estimated to be potentially recoverable from undiscovered accumulations, by application of future development projects.
  - Prospective resources have a chance of geologic discovery (P_g) and a chance of development (P_d).
  - Chance of commerciality (P_c), which is the result of the multiplication of these two factors, represents the “chance that a project will be committed for development and reach commercial maturity”.
  - They can be further categorized by the range of uncertainty associated with the recoverable estimates (U1, U2, U3) and may be sub-classified based on project maturity (Play, Lead, Prospect).

WHAT IS PRMS – CONTINGENT RESOURCES

- Contingent resources are those volumes that are potentially recoverable from discovered accumulations by the application of development projects.
  - The projects for contingent resources have an associated chance of development.
  - Contingent resources can be categorized by the range of uncertainty associated with the estimates (C1, C2, C3) and further sub-classified based on project maturity and/or economic status (Development Not Viable, Development Unclarified, Development on Hold, Development Pending).
  - Projects with contingent resources must be commercial to be upgraded to reserves

WHAT IS PRMS – 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: discovered, recoverable, commercial, and remaining (as of the evaluation's effective date) based on the development project(s) applied.

Reserves are further categorized in accordance with the range of uncertainty (proved, probable, and possible) and should be sub-categorized based on project maturity (justified for development, approved for development or on production) and/or characterized by development and production status (producing, shut in, behind pipe, undeveloped)

RESERVE CATEGORIES - PROVED

- **Proved Reserves** - are those quantities of Petroleum that, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be commercially recoverable from known reservoirs and under defined technical and commercial conditions. 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.

RESERVE CATEGORIES - PROBABLE

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.

RESERVE CATEGORIES - POSSIBLE

- ***Possible Reserves*** are those additional Reserves that 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) Reserves, 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.

PRMS FIGURE 1.1

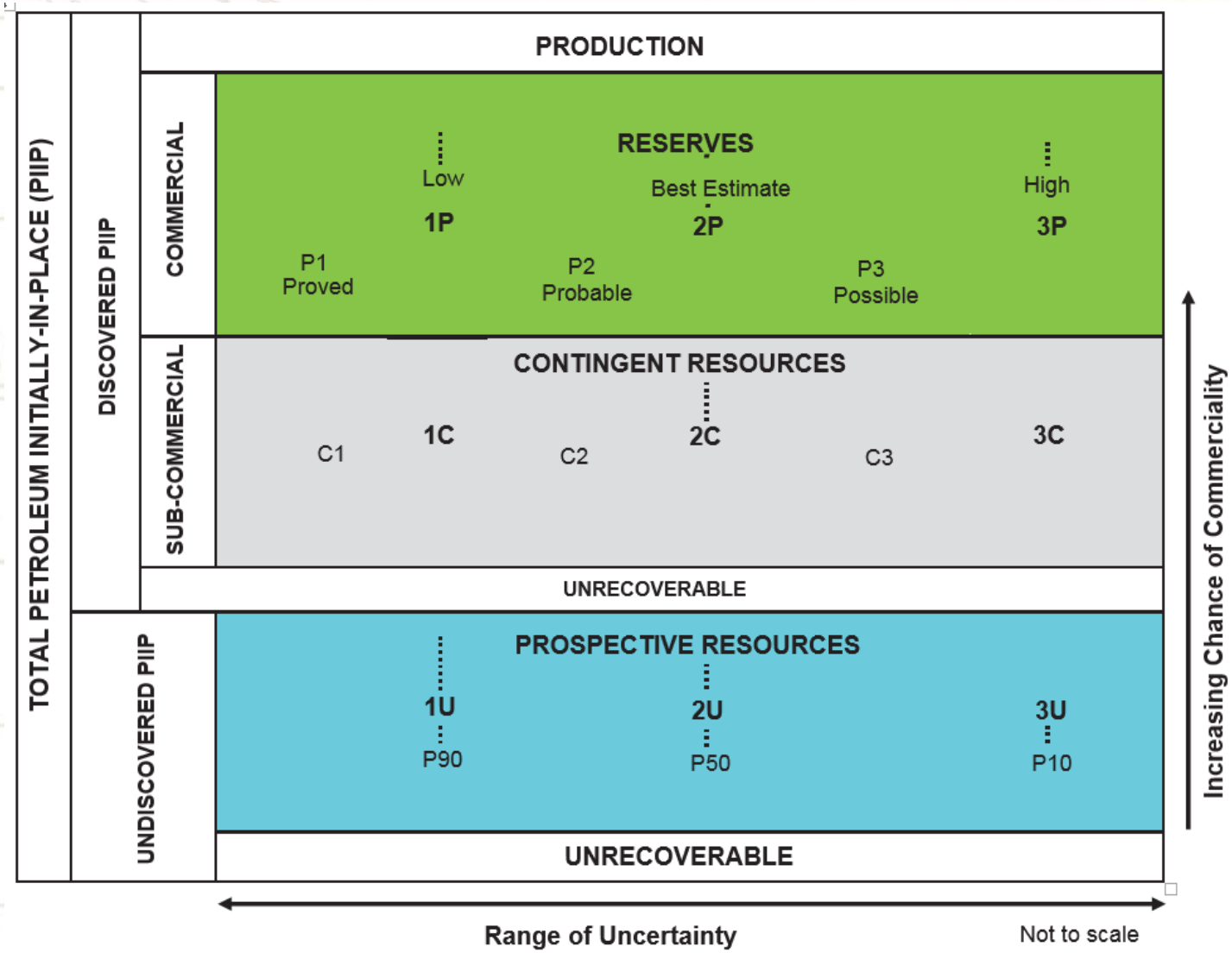


Figure 1.1—Resources classification framework

PRMS FIGURE 2.1

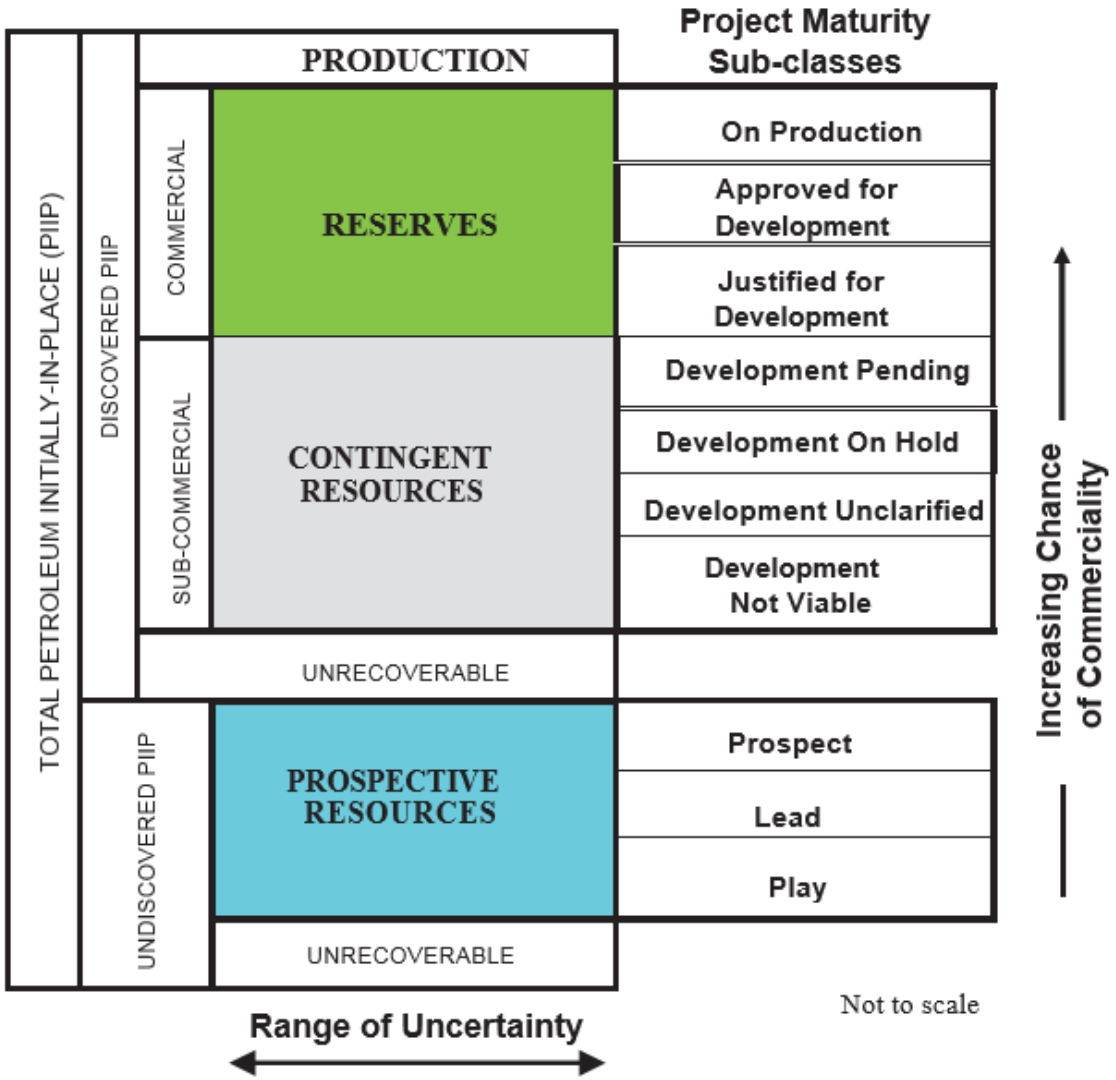


Figure 2.1—Sub-classes based on project maturity

CONTINGENT RESOURCES

- There can be a wide range in the chance of development for contingent resources.
- Development Not Viable would be the lowest chance of development. An example might be hydrocarbons that require prices far in excess of anticipated price outlooks, excessive capital to develop or gain market access, advanced technology, etc. There would be no current plans to develop.
- Development Unclarified could be situations where development is thought to be feasible, but more information would be required in order to formulate a viable development plan.
- Development on Hold could be situations where the technological means of development is fairly certain, but the project is not progressing due to other uncertainties.
- Development Pending would be a project that is being advanced and is expected to be sanctioned in the foreseeable future.

CONTINGENT RESOURCES TO RESERVES

- In order to promote a project from resources to reserves, it must be demonstrated that the project's best estimate case meets these criteria:
  - There is a technically mature, feasible development plan;
  - Financing is either in place or high likelihood of being available when needed;
  - The time frame for development is reasonable – generally 5 years;
  - Reasonable expectation of positive economics that meet the investment criteria using the forecast conditions (prices, capital costs, operating costs, etc.)
  - Access to market for production and ability to handle all produced streams
  - Evidence of production facilities and evacuation routes;
  - Evidence that legal, contractual, environmental, regulatory, and governmental approvals are in place or forthcoming, together with resolving any social and economic concerns.

The New PRMS

THE PROCESS

- The PRMS update project started in 2013, with the first draft available in 2016.
- The final draft was submitted to the entire SPE OGRC on May 15, 2018.
- OGRC members were asked to approve the draft before forwarding to the SPE Board of Directors for final approval.
- Concurrently, the draft was circulated among the sister societies for their approval
- The document was unanimously approved by the OGRC, the sister societies and the SPE Board of Directors in June 2018.
- Publically released on July 10, 2018 at http://www.spe.org/industry/reserves.php

WHAT HAS CHANGED?

- No major changes – but a lot of little changes. Goal was to limit changes to areas requiring clarification and focus on key principles.
- Look and feel:
  - Introduction of Paragraph numbers (all sections except for Preamble) to make it easy to find or cite a specific portion - PRMS 2007 just had section numbers.
  - For all terms defined in the glossary, the first use in the text is hyperlinked.
  - 2007 PRMS glossary of 182 terms included 50 terms that were not actually used in the body of the PRMS. For 2018, the glossary includes only terms actually used in the body of the PRMS. So the 50 unused terms have been dropped, but 63 new terms were added.

PRESENTATION STANDARDS

- Sections from PRMS are preceded with the paragraph number or indicated as from the glossary or from the preamble.
- Commentary is prefixed with a bullet point.
- New concepts are denoted with 

.
- There has been extensive re-wording in many sections of PRMS. In many instances, there is no material change from 2007 despite the rewording. In some situations, there have been minor or subtle revisions. These types of changes have not been indicated as 

.
- In some cases, equivalent PRMS 2018 sections and PRMS 2007 sections are shown together to help illustrate the changes. Sections of each that are identical are <u>underlined</u>.
- In PRMS, the first use of words defined in the glossary are hyperlinked. The hyperlinks have been removed from this presentation to avoid confusion, but terms are *italicized*.

1.0.0.2 QUANTITIES VERSUS VOLUMES

1.0.0.2 The technical estimation of petroleum resources quantities involves the assessment of quantities and values that have an inherent degree of uncertainty. Quantities of petroleum and associated products can be reported…

- 2007 PRMS used “volumes” and “quantities” somewhat interchangeably.
- Use of “quantities” acknowledges the mass component element in hydrocarbon production, particularly where liquid production is recorded in tons or (metric) tonnes or gas production in terms of energy content (Btu or Joule).
- Section 1.0.0.2 notes that quantities of petroleum can be reported in volume, mass, or energy.

PETROLEUM RESOURCES CLASSIFICATION FRAMEWORK

1.1.0.3 Figure 1.1 graphically represents the PRMS resources classification system. The system classifies projects into discovered and undiscovered and defines the *recoverable resources* classes: *Production*, *Reserves*, *Contingent Resources*, and *Prospective Resources*, as well as Unrecoverable Petroleum.

1.1.0.4 The horizontal axis reflects the *range of uncertainty* of estimated quantities potentially recoverable from an *accumulation* by a project, while the vertical axis represents the *chance of commerciality*, P_c, which is the chance that a project will be committed for development and reach commercial producing status.

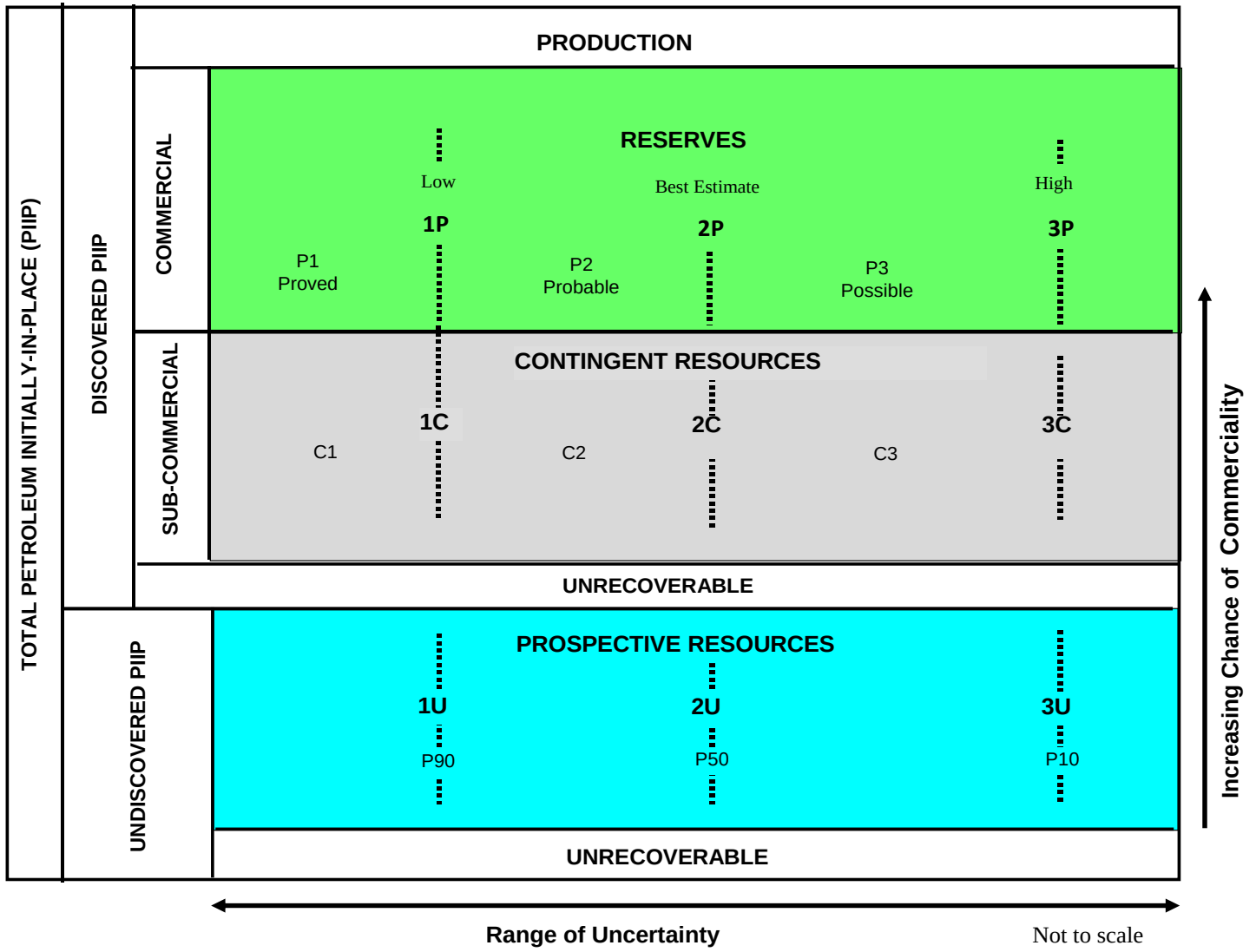


FIGURE 1.1 – 2007 VERSION & 2018 VERSION

2007

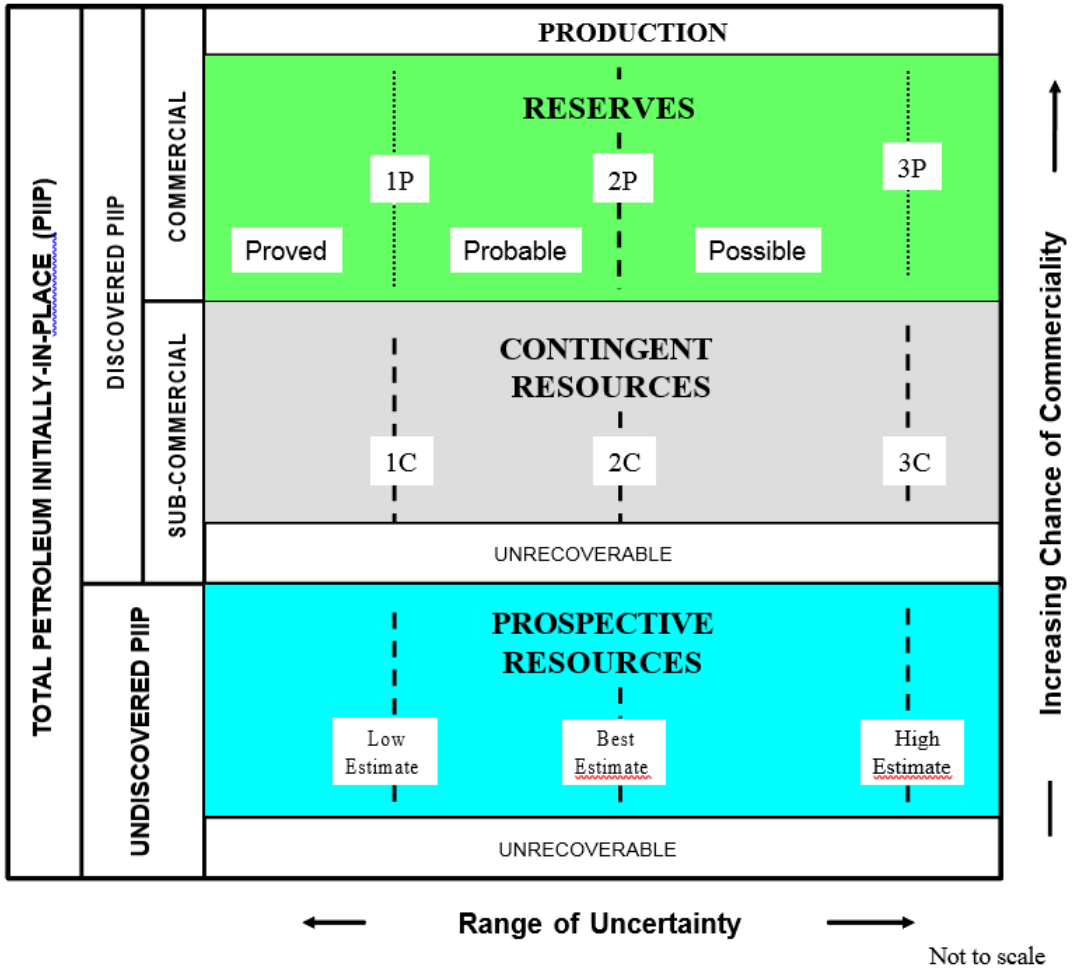
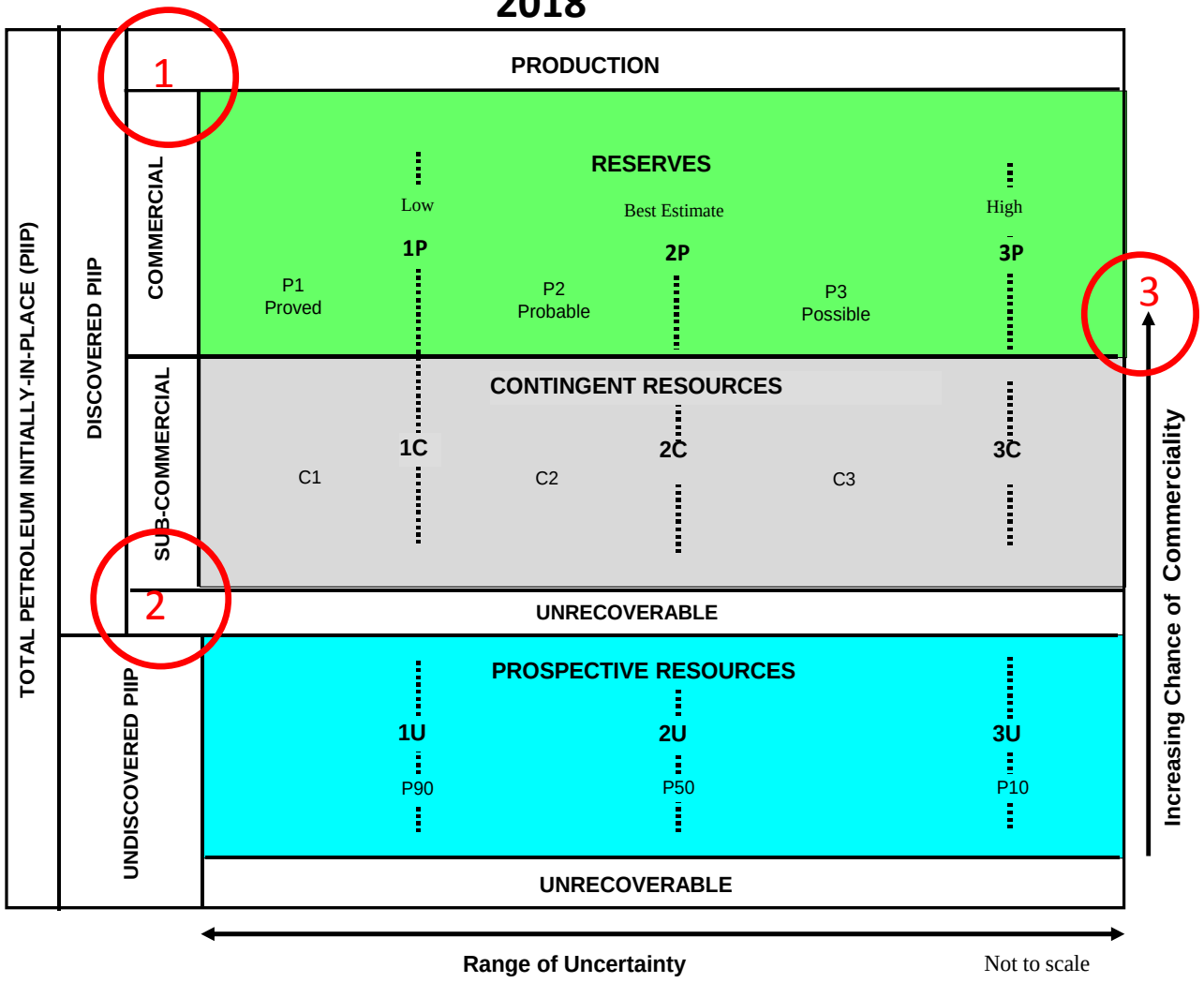


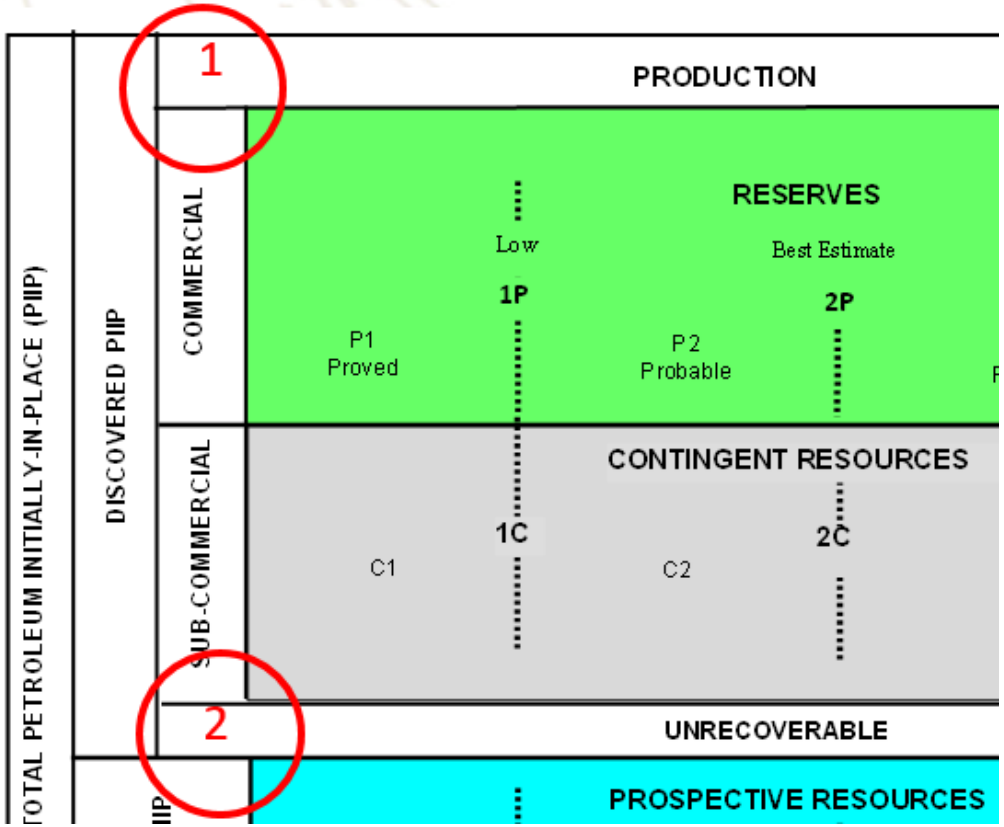
Figure 1-1: Resources Classification Framework.

2018



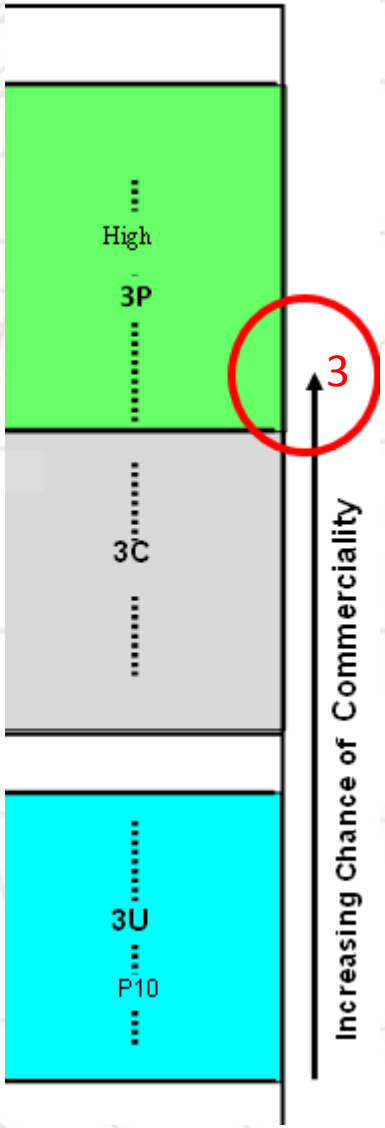
CHANGES TO FIGURE 1.1 – MASS BALANCE ISSUES

- 1 – Production box is not part of Commercial Reserves anymore but still a part of Discovered PIIP.
- 2 – Unrecoverable is not part of sub-Commercial Contingent resources anymore but still a part of Discovered PIIP.

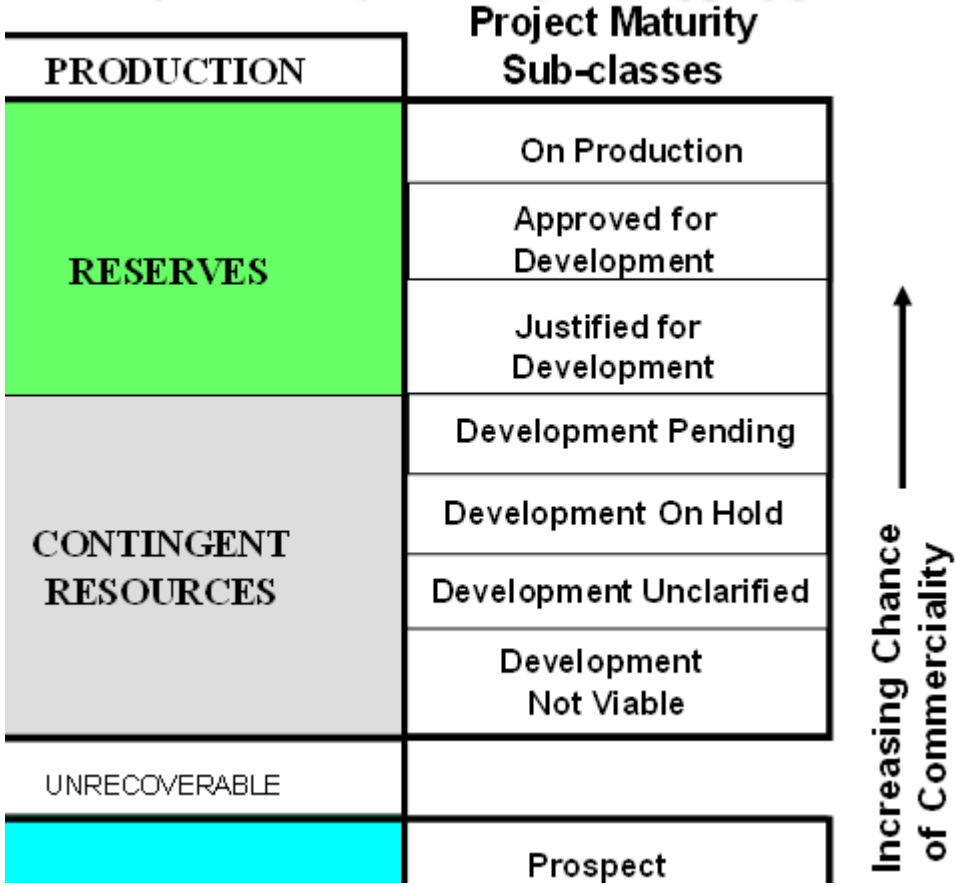


NEW

CHANGES TO FIGURE 1.1 - COMMERCIALITY



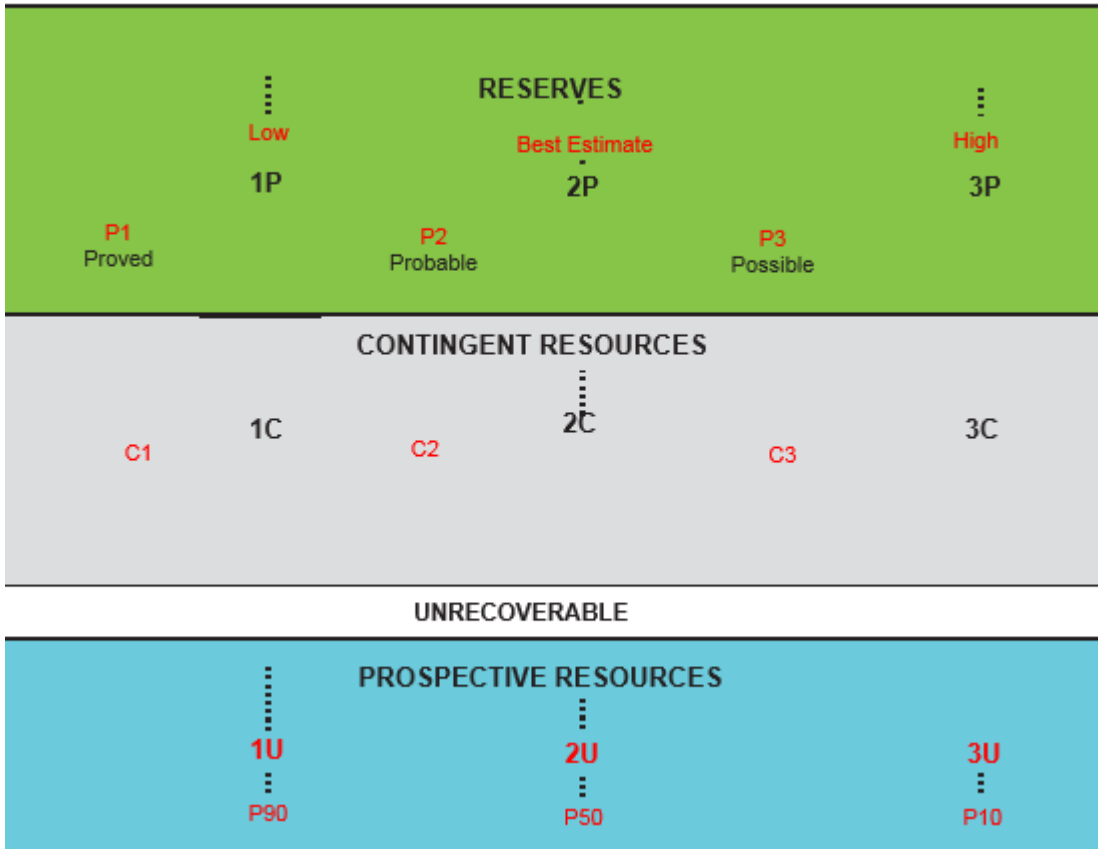
- 3 – the arrow for Increasing Chance of Commerciality does not continue to the top of the Commercial Reserves box to avoid implying that, although Approved for Development (AfD) has been achieved, there are still additional levels of commerciality to be satisfied.
- It is implied that it stops when achieving Approved for Development (Figure 2.1), rather than stopping at Justified for Development, where there is a firm intent to proceed with the project but Final Investment Decision has not occurred.



NEW

CHANGES TO FIGURE 1.1 - NOMENCLATURE

- Note many changes to the labels:
  - Low, Best, and High moved to the top, as these concepts apply to Reserves, Contingent Resources, and Prospective Resources.
  - Incremental volumes of P1, P2, P3, C1, C2, C3 included.
  - Prospective labeled as 1U, 2U, & 3U, and P90, P50, P10 instead of Low, Best, and High Estimates.
  - Some of these are new terms to PRMS, we will discuss further in 2.2.0.2 and 2.2.2.2.
- Although Low/Best Estimate/High moved to Reserves and P90/P50/P10 moved to Prospective Resources, they can be used in any of the classes.



NOMENCLATURE MATRIX (RSC)

Deterministic Estimate	Low	Best	High	Continuous / Cumulative, can apply to any class, usually associated with Prospective Resources
Probabilistic Estimate	**P90**	**P50**	**P10**	**Continuous / Cumulative, can apply to any class, used with Probabilistic approach**
Reserves Category	**Proved**	**Probable**	**Possible**	**Discrete / Incremental**
Abbreviation	P1	P2	P3	Discrete / Incremental
Low Estimate of Reserves	1P			Continuous / Cumulative
Best Estimate of Reserves		2P		Continuous / Cumulative
High Estimate of Reserves			3P	Continuous / Cumulative
Contingent Resources Category	**C1**	**C2**	**C3**	**Discrete / Incremental**
Low Estimate of Contingent Resources	1C			Continuous / Cumulative
Best Estimate of Contingent Resources		2C		Continuous / Cumulative
High Estimate of Contingent Resources			3C	Continuous / Cumulative
Prospective Resources Category	U1	U2	U3	Discrete / Incremental terms UNDEFINED*
Low Estimate of Prospective Resources	1U			Continuous / Cumulative
Best Estimate of Prospective Resources		2U		Continuous / Cumulative
High Estimate of Prospective Resources			3U	Continuous / Cumulative

*2.2.2.4: …No specific terms are defined for incremental quantities within Prospective Resources.

1.1.0.6 A 1. ***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: discovered, recoverable, commercial, and remaining (as of the evaluation's *effective date*) based on the development project(s) applied.

Glossary **Defined Conditions** - Forecast of conditions to exist and impact the project during the time period being evaluated. Forecasts should account for issues that impact the commerciality, such as economics (e.g., hurdle rates and commodity price); operating and capital costs; and technical, marketing, sales route, legal, environmental, social, and governmental factors.

- Defined Conditions was not explicitly defined in 2007, as it was thought to be self-evident.

1.1.0.6 A 2. Reserves are recommended as sales quantities as metered at the *reference point*. Where the *entity* also recognizes quantities *consumed in operations* (CiO) (see Section 3.2.2), as Reserves these quantities must be recorded separately. Non-hydrocarbon quantities are recognized as Reserves only when sold together with hydrocarbons or CiO associated with petroleum production. If the non-hydrocarbon is separated before sales, it is excluded from Reserves.

1.1.0.6 A 3. Reserves are further categorized in accordance with the range of uncertainty and should be sub-classified based on project maturity and/or characterized by development and production status.

RESERVES - 2018 VERSUS 2007

1.1.0.6 A 1. ***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: discovered, recoverable, commercial, and remaining (as of the evaluation's *effective date*) based on the development project(s) applied.

1.1.0.6 A 2. Reserves are recommended as sales quantities as metered at the *reference point*. Where the *entity* also recognizes quantities *consumed in operations* (CiO) (see Section 3.2.2), as Reserves these quantities must be recorded separately. Non-hydrocarbon quantities are recognized as Reserves only when sold together with hydrocarbons or CiO associated with petroleum production. If the non-hydrocarbon is separated before sales, it is excluded from Reserves.

1.1.0.6 A 3. Reserves are further categorized in accordance with the range of uncertainty and should be sub-classified based on project maturity and/or characterized by development and production status.

PRMS 2007 (§1.1, ¶9) **: 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: 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.

CONTINGENT RESOURCES 1.1.0.6 B

1.1.0.6 B *Contingent Resources* are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations, by the application of development project(s) not currently considered to be commercial owing to one or more contingencies. Contingent Resources have an associated *chance of development*. 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 range of uncertainty associated with the estimates and should be sub-classified based on project maturity and/or *economic* status.

2007 PRMS (§1.1 ¶10)**: 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. 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.

1.1.0.6 D PROSPECTIVE RESOURCES

1.1.0.6 D **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 geologic discovery and a chance of development. Prospective Resources are further categorized in accordance with the range of uncertainty associated with recoverable estimates, assuming discovery and development, and may be sub-classified based on project maturity.

PRMS 2007 (§1.1, ¶12)**: 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. Prospective Resources are further subdivided in accordance with the level of certainty associated with recoverable estimates assuming their discovery and development and may be sub-classified based on project maturity.

- Minor word changes

1.1.0.7 REMAINING RECOVERABLE RESOURCES

1.1.0.7 The sum of Reserves, Contingent Resources, and Prospective Resources may be referred to as "remaining recoverable resources." Importantly, these quantities should not be aggregated without due consideration of the technical and commercial risk involved with their classification. When such terms are used, each classification component of the summation must be provided.

2007 PRMS (§1.1, ¶15): In specialized areas, such as basin potential studies, alternative terminology has been used; the total resources may be referred to as Total Resource Base or Hydrocarbon Endowment. Total recoverable or EUR may be termed Basin Potential. The sum of Reserves, Contingent Resources, and Prospective Resources may be referred to as "remaining recoverable resources." When such terms are used, it is important that each classification component of the summation also be provided. Moreover, these quantities should not be aggregated without due consideration of the varying degrees of technical and commercial risk involved with their classification.

- Despite rewording, section is essentially unchanged from 2007.

1.1.0.8 OTHER TERMS

1.1.0.8 A Estimated Ultimate Recovery (EUR) is not a resources category or class, but a term that can be applied to an accumulation or group of accumulations (discovered or undiscovered) to define those quantities of petroleum estimated, as of a given date, to be potentially recoverable plus those quantities already produced from the accumulation or group of accumulations. For clarity, EUR must reference the associated technical and commercial conditions for the resources; for example, proved EUR is *Proved Reserves* plus prior production.

- Clarified that EUR needs a descriptor associated with its use, such as “proved EUR, “3P EUR”, etc. 

1.1.0.8 B ***Technically Recoverable Resources*** (TRR) are those quantities of petroleum producible using currently available technology and industry practices, regardless of commercial considerations. TRR may be used for specific Projects or for groups of Projects, or, can be an undifferentiated estimate within an area (often basin-wide) of recovery potential.

- Defined as those quantities that are technically producible regardless of commercial considerations.
- Intent is for Discovered quantities that are pending development or evaluations of producing projects, where economic evaluation or commercial assessment has not been completed.
- Provides an acceptable nomenclature to the often-heard but always-incorrect “technical reserves”.

TECHNICAL FORECAST

Glossary: **Technical Forecast:** The forecast of produced resources quantities that is defined by applying only technical limitations (i.e., well-flow-loading conditions, well life, production facility life, flow-limit constraints, facility uptime, and the facility's operating design parameters). Technical limitations do not take into account the application of either an economic or license cutoff. (See also Technically Recoverable Resources).

- Technical Forecast is a defined term that is new from PRMS 2007
- It is intended to describe the forecast associated with Technically Recoverable Resources.

TECHNICALLY RECOVERABLE RESOURCES EXAMPLE

- An example use of TRR would be to characterize a project's potential prior to having the economic evaluation or commercial conditions applied.
- In normal work flows, decline curve projections of producing wells are prepared as a first step of performing an evaluation – the "technical forecast". Prices and operating costs are often not applied until later in the evaluation. For example, the evaluator may be waiting until year-end prices are available. Since an economic limit cannot be determined at this point, the evaluator typically sets a reasonable ending rate based on technical constraints such as the reservoir abandonment pressure or the well's maximum water cut, or analogy based on nearby wells or the evaluator's experience in the area.
- The technical forecast projection, unconstrained by the economic limit, would represent the TRR volume of the well – the expected recovery under current technology if economics were ignored.
- The reserves determined by applying the economic and /or commercial factors (i.e. economic limit) would either be a subset of the TRR or equal to the TRR. The categorization of those reserves, i.e. proved, probable or possible, would depend on the uncertainty level of the projections.

PROJECT IS A KEY ELEMENT

- Once Petroleum Initially-In-Place has been identified, a project is necessary in order to recover the resources.

Glossary **PROJECT:** A defined activity or set of activities that provides the link between the petroleum accumulation's resources sub-class and the decision-making process, including budget allocation. A project may, for example, constitute the development of a single reservoir or field, an incremental development in a larger producing field, or the integrated development of a group of several fields and associated facilities (e.g. compression) with a common ownership. In general, an individual project will represent a specific maturity level (sub-class) at which a decision is made on whether or not to proceed (i.e., spend money), suspend, or remove. There should be an associated range of estimated recoverable resources for that project. (See also Development Plan.)

DEVELOPMENT PLAN

2018 Glossary **DEVELOPMENT PLAN**: The design specifications, timing, and cost estimates of the appraisal and development project(s) that are planned in a field or group of fields. The plan will include, but is not limited to, well locations, completion techniques, drilling methods, processing facilities, transportation, regulations, and marketing. The plan is often executed in phases when involving large, complex, sequential recovery and/or extensive areas.

2007 Glossary **Development Plan**: The design specifications, timing and cost estimates of the development project including, but not limited to, well locations, completion techniques, drilling methods, processing facilities, transportation and marketing (See also Project).

- Definition largely unchanged.

PROJECT / DEVELOPMENT PLAN

- The Project or Development Plan is the means by which the resources will be extracted. Resources that have been discovered but without a Project to extract them are Discovered but Unrecoverable.
- The future development costs, operating expenses, production rates, and overall recovery depend on the type of Project adopted. Without the Project, it is impossible to prepare an economic evaluation, make a commercial assessment, or recognize reserves.

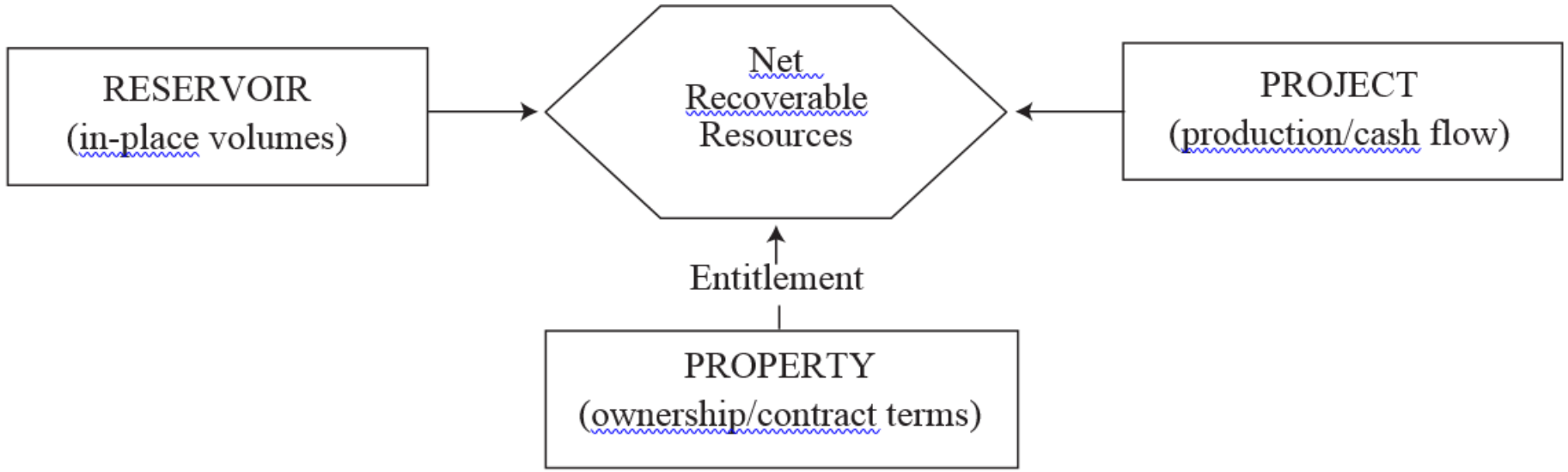


Figure 1.2 from ¶1.2.0.2

COMMERCIALITY 2.1.2.1

Glossary **Commercial**: A project is commercial when there is evidence of a firm intention to proceed with development within a reasonable time-frame. Typically, this requires that the best estimate case meet or exceed the minimum evaluation decision criteria (e.g., rate of return, investment payout time). There must be a reasonable expectation that all required internal and external approvals will be forthcoming. Also, there must be evidence of a technically mature, feasible development plan and the essential social, environmental, economic, political, legal, regulatory, decision criteria, and contractual conditions are met.

2.1.2.1 Discovered recoverable quantities (Contingent Resources) may be considered commercially mature, and thus attain Reserves classification, if the *entity* claiming commerciality has demonstrated a firm intention to proceed with development. This means the entity has satisfied the internal decision criteria (typically rate of return at or above the weighted average cost-of-capital or the hurdle rate). Commerciality is achieved with the entity's commitment to the project and all of the following criteria:

2.1.2.1 A: Evidence of a technically mature, feasible *development plan*.

2.1.2.1 B: Evidence of financial appropriations either being in place or having a high *likelihood* of being secured to implement the project.

2.1.2.1 C: Evidence to support a reasonable time-frame for development.

2.1.2.1 D: A reasonable assessment that the development projects will have positive economics and meet defined investment and operating criteria. This assessment is performed on the estimated *entitlement* forecast quantities and associated cash flow on which the investment decision is made (see Section 3.1.1, Net Cash-Flow Evaluation).

ELEMENTS OF COMMERCIALITY

2.1.2.1 E: A reasonable expectation that there will be a *market* for forecast *sales* quantities of the *production* required to justify development. There should also be similar confidence that all produced streams (e.g., oil, gas, water, CO_2) can be sold, stored, re-injected, or otherwise appropriately disposed.

2.1.2.1 F: Evidence that the necessary production and transportation facilities are available or can be made available.

2.1.2.1. G: Evidence that legal, contractual, environmental, regulatory, and government approvals are in place or will be forthcoming, together with resolving any social and economic concerns.

FIVE YEAR DEVELOPMENT TIME-FRAME 2.1.2.3 & 2.1.3.6.4

2.1.2.3 To be included in the Reserves class, a project must be sufficiently defined to establish both its technical and commercial viability as noted in Section 2.1.2.1. There must be a reasonable expectation that all required internal and external approvals will be forthcoming and 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 five years is recommended as a benchmark, a longer time-frame could be applied where justifiable; for example, development of economic projects that take longer than five years to be developed or are deferred to meet contractual or strategic objectives. In all cases, the justification for classification as Reserves should be clearly documented. ***ESSENTIALLY UNCHANGED FROM 2007***

2.1.3.6.4 Where Reserves remain Undeveloped beyond a reasonable time-frame or have remained Undeveloped owing to postponements, evaluations should be critically reviewed to document reasons for the delay in initiating development and to justify retaining these quantities within the Reserves class. While there are specific circumstances where a longer delay (see Section 2.1.2, Determination of Commerciality) is justified, a reasonable time-frame to commence the project is generally considered to be less than five years from the initial classification date. ***ESSENTIALLY UNCHANGED FROM 2007***

- Clarified that the "5 year Reasonable Time-Frame" (RTF) timing starts with the initial classification date. NEW
- Does not provide for treating proved reserves different from Probable or Possible Reserves – this is unchanged from 2007.
- Discussions of 5 year RTF only address Reserves. By inference (and intention), the 5 year RTF does not apply to Contingent Resources projects.

FINAL INVESTMENT DECISION

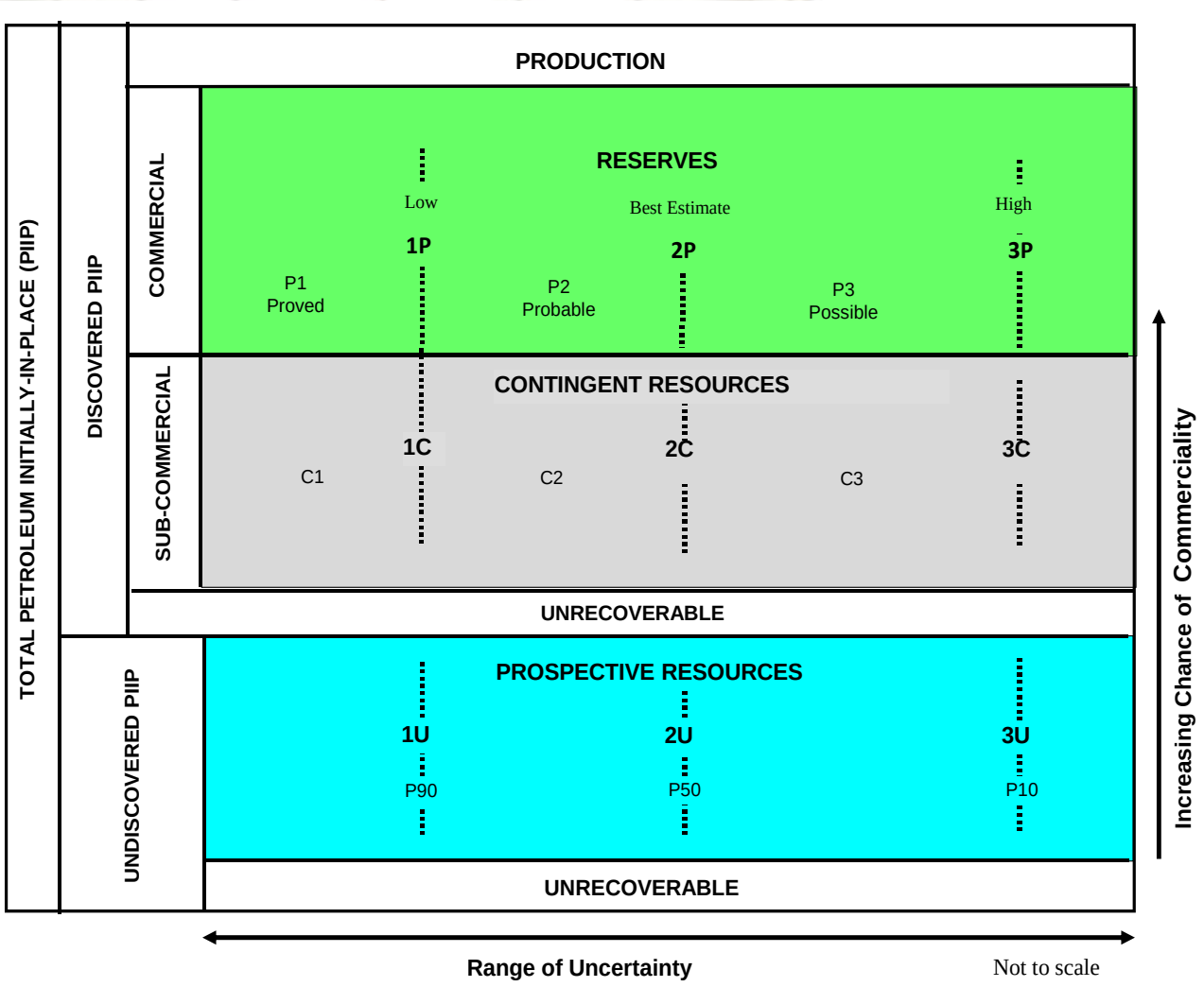
2.1.2.4 While PRMS guidelines require financial appropriations evidence, they do not require that project financing be confirmed before classifying projects as Reserves. However, this may be another external reporting requirement. In many cases, financing is conditional upon the same criteria as above. In general, if there is not a reasonable expectation that financing or other forms of commitment (e.g., farm-outs) can be arranged so that the development will be initiated within a reasonable time-frame, then the project should be classified as Contingent Resources. If financing is reasonably expected to be in place at the time of the final investment decision (FID), the project's resources may be classified as Reserves.

Glossary **Final Investment Decision (FID)**: Project approval stage when the participating companies have firmly agreed to the project and the required capital funding.

FID

- "Final Investment Decision" was not used in 2007 PRMS. Not used by the SEC in their 2009 update, but used in their CD&I of October, 2009.
- 2007 PRMS (§2.1.2, ¶2): …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.

CHANCE OF COMMERCIALITY (P_C)



2.1.3.2 As a project moves to a higher level of commercial maturity in the classification (see Figure 1.1 vertical axis), there will be an increasing *chance* that the accumulation will be commercially developed and the project quantities move to Reserves.

CHANCE OF COMMERCIALITY

2.1.3.2 …For Contingent and Prospective Resources, this is further expressed as a chance of commerciality, P_c, which incorporates the following underlying chance component(s):

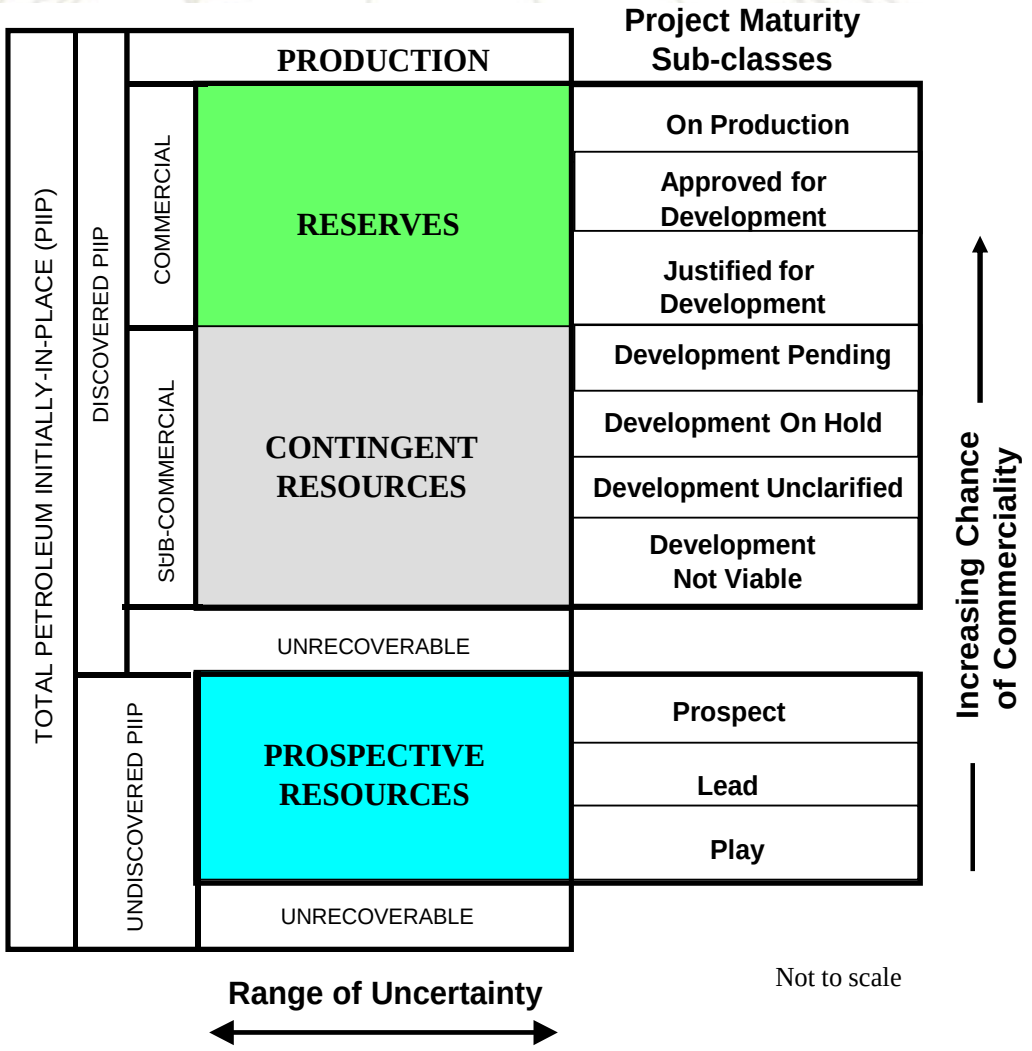
2.1.3.2 A The chance that the potential accumulation will result in the discovery of a significant quantity of petroleum, which is called the "*chance of geologic discovery*," P_g. NEW

2.1.3.2 B Once discovered, the chance that the known accumulation will be commercially developed is called the "*chance of development*," P_d.

2.1.3.3 There must be a high degree of certainty in the chance of commerciality, P_c, for Reserves to be assigned; for Contingent Resources, $P_c = P_d$; and for Prospective Resources, P_c is the product of P_g and P_d. NEW

2.1.3.4 Contingent and Prospective Resources can have different project scopes (e.g., well count, development spacing, and facility size) as development uncertainties and project definition mature. NEW

PROJECT MATURITY SUB-CLASSES



2.1.3.5.3 Resources sub-class maturation is based on those actions that progress a project through final approvals to implementation and initiation of production and product sales. The boundaries between different levels of project maturity are frequently referred to as project “decision gates.”

PROJECT MATURITY SUB-CLASSES 2007 VS 2018

2007 Version

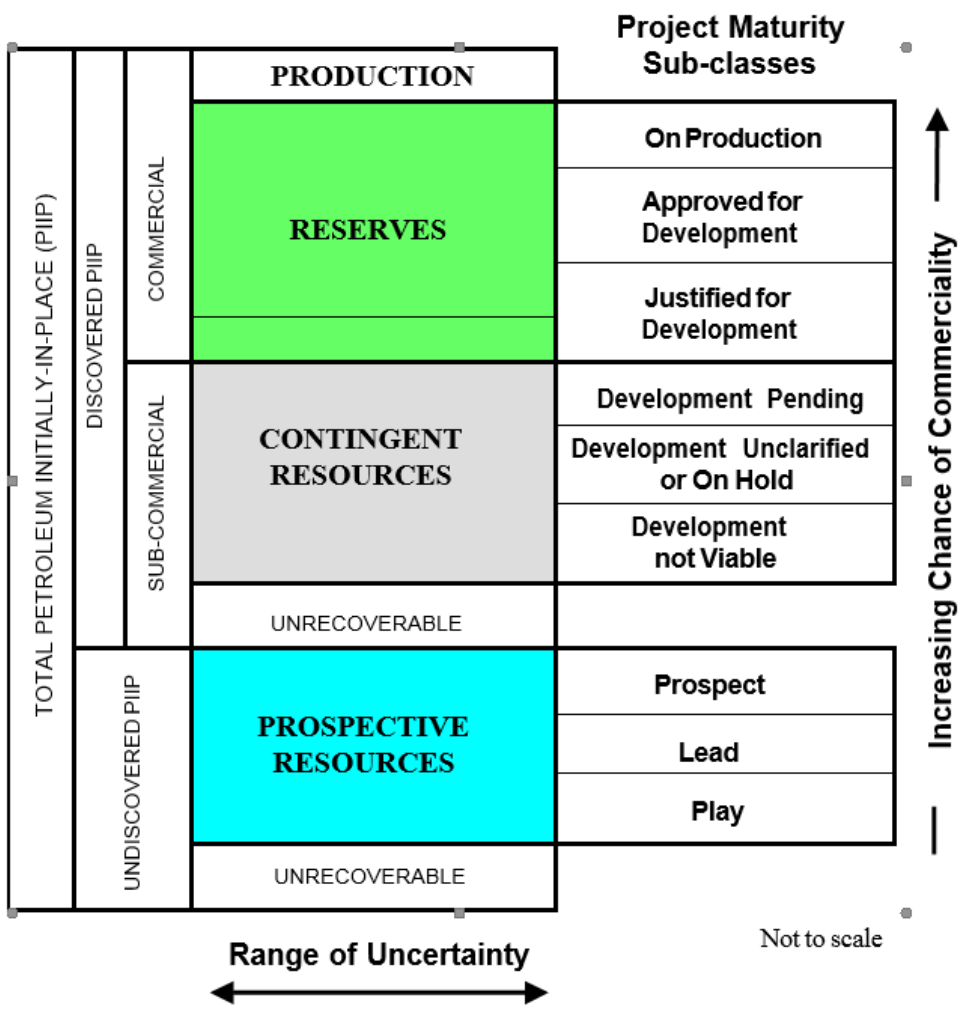
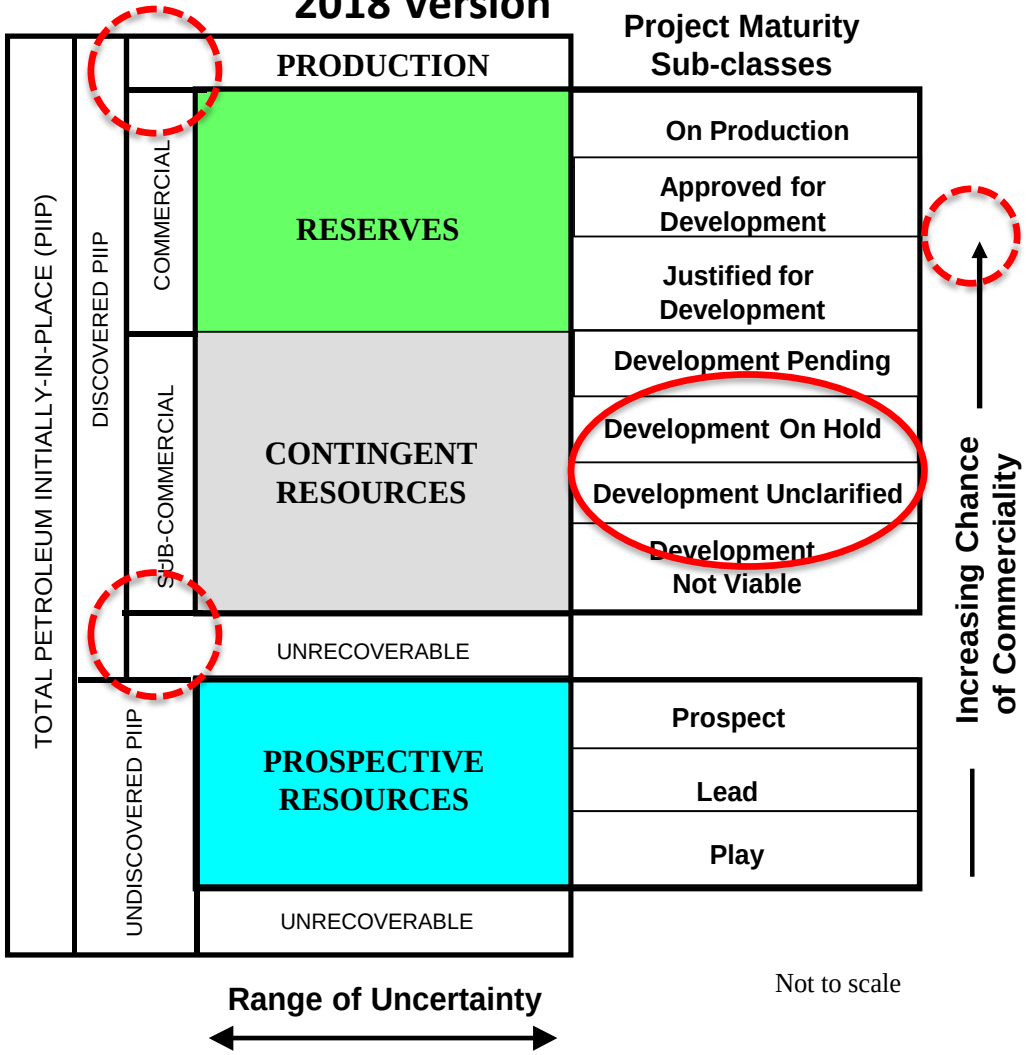


Figure 2-1: Sub-classes based on Project Maturity.

2018 Version



IS IT STILL RESERVES?

2.1.3.5.7 Where commercial factors change and there is a significant risk that a project with Reserves will no longer proceed, the project shall be reclassified as Contingent Resources.

- This is certainly not a new concept in PRMS, but is a good example of more explicit guidance. All projects need to be tested at each evaluation to ensure that reserves don't need to be downgraded.

RESERVES STATUS

2.1.3.6.1 Once projects satisfy commercial maturity (criteria given in Table 1), the associated quantities are classified as Reserves. These quantities may be allocated to the following subdivisions based on the funding and operational status of wells and associated facilities within the *reservoir* development plan (Table 2 provides detailed definitions and guidelines):

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

> ***2.1.3.6.1 A 1 Developed Producing Reserves*** are expected to be recovered from *completion intervals* that are open and producing at the time of the estimate.
>
> ***2.1.3.6.1 A 2 Developed Non-Producing Reserves*** include shut-in and *behind-pipe Reserves* with minor costs to access.

2.1.3.6.1 B Undeveloped Reserves are quantities expected to be recovered through future significant investments.

Minor word changes, but essentially unchanged from 2007. The new addition of "minor costs to access" is in keeping with the Developed status. Again, a point of clarity from 2007.

MINOR / SIGNIFICANT COST RULE 2.1.3.6

2.1.3.6.2 The distinction between the “minor costs to access” Developed Non-Producing Reserves and the “significant investment” needed to develop Undeveloped Reserves requires the judgment of the evaluator taking into account the cost environment. A significant investment would be a relatively large expenditure when compared to the cost of drilling and completing a new well. A minor cost would be a lower expenditure when compared to the cost of drilling and completing a new well.

- The PRMS does not make a recommendation as to what the threshold between minor and significant should be. That is left to the entity to determine.
- Entities should have a clear policy on this issue.

2.1.3.7 ECONOMIC STATUS

2.1.3.7.1 Projects may be further characterized by economic status. All projects classified as Reserves must be commercial under *defined conditions* (see Section 3.1, Assessment of Commerciality Assessment). Based on assumptions regarding future conditions and the impact on ultimate economic viability, projects currently classified as Contingent Resources may be broadly divided into two groups:

- ***Economically Viable Contingent Resources*** are those quantities associated with technically feasible projects where cash flows are positive under reasonably forecasted conditions but are not Reserves because it does not meet the commercial criteria defined in Section 2.1.2.
- ***Economically Not Viable Contingent Resources*** are those quantities for which development projects are not expected to yield positive cash flows under reasonable forecast conditions.

2.1.3.7 ECONOMIC STATUS

- PRMS 2007 (§2.1.3.3, ¶1) presented the same concept, but used different terms:
  - Marginal Contingent Resources → Economically Viable Contingent Resources
  - Sub-Marginal Contingent Resources → Economically Not Viable Contingent Resources
- Although new terms are presented, overall intent is unchanged.

BEST ESTIMATE IS BASIS FOR RESERVES ASSESSMENT

2.1.3.7.2 The best estimate (or P50) *production forecast* is typically used for the economic evaluation for the commercial assessment of the project. The low case, when used as the primary case for a project decision, may be used to determine project economics. The economic evaluation of the project high case alone is not permitted to be used in the determination of the project's commerciality.

2.2.2.10 A conservative (low-case) estimate may be required to support financing. However, for project justification, it is generally the best-estimate Reserves or Resources quantity that passes qualification because it is considered the most realistic assessment of a project's recoverable quantities. The best estimate is generally considered to represent the sum of Proved and Probable estimates (2P) for Reserves, or 2C when Contingent Resources are cited, when aggregating a field, multiple fields, or an entity's resources.

2.1.3.7.4 **The project's low-case scenario is tested to ensure it is economic, which is required for *Proved Reserves* to exist** (see Section 2.2.2, Category Definitions and Guidelines). It is recommended to evaluate the low case and the high case (which will quantify the 3P Reserves) to convey the project downside risk and upside potential. The project development scenarios may vary in the number and type of wells, facilities, and infrastructure in Contingent Resources, but to recognize Reserves, there must exist the reasonable expectation to develop the project for the best-estimate case.

- Emphasis added above.
- Although this was the intent of PRMS 2007, it was not clearly understood.

SCALED DEVELOPMENT PLAN

2.1.3.7.4 The project's low-case scenario is tested to ensure it is economic, which is required for *Proved Reserves* to exist (see Section 2.2.2, Category Definitions and Guidelines). It is recommended to evaluate the low case and the high case (which will quantify the 3P Reserves) to convey the project downside risk and upside potential. **The project development scenarios may vary in the number and type of wells, facilities, and infrastructure in Contingent Resources, but to recognize Reserves, there must exist the reasonable expectation to develop the project for the best-estimate case**.

- Emphasis added above
- 2.1.3.7.4 clarifies that the development plan assumed for the 2P scenario may vary for the low and high cases. For conventional projects, the main difference is generally only the number of wells.
- This was not clearly stated in PRMS 2007.

WHAT ABOUT 1P RESERVES?

- If the Best Estimate case (2P) is commercial, then 2P reserves can be recognized.
- For Proved Reserves to be recognized, it must be shown that the Low Estimate case is economic. If it is not economic, then the project cannot report 1P or Proved reserves – only 2P reserves!
- The High Estimate case by itself cannot be used to recognize reserves. In other words, if the 3P case is commercial but the 2P case is not commercial, you cannot book reserves.*

* The stand alone possible case can be an exception, see next slide.

STAND ALONE POSSIBLE?

- Generally speaking, the 2P case must be commercial in order to recognize reserves.
- One exception is the situation of “stand alone possible.”
- Sometimes, particularly in unconventional plays, it can be demonstrated that certain undeveloped locations may be considered to be proved, probable, or possible undeveloped based on data from wells located in the nearby vicinity but not located on the same lease as the prospective undeveloped location.
- In this situation, it is permissible to have a possible undeveloped location (assuming it meets commercial conditions) although there is no accompanying “best estimate” case as a part of that specific project.

2.2.2.8 C …Stand-alone Possible Reserves must reference a commercial 2P project (e.g., a lease adjacent to the commercial project that may be owned by a separate entity), otherwise stand-alone Possible is not permitted.

NEW DESCRIPTIVE TERMS FOR THE CATEGORIES

2.2.0.2 The uncertainty in a project's recoverable quantities is reflected by the 1P, 2P, 3P, Proved (*P1*), Probable (*P2*), Possible (*P3*), *1C*, *2C*, *3C*, *C1*, *C2*, and *C3*; or *1U*, *2U*, and *3U resources categories*. The commercial chance of success is associated with *resources classes* or sub-classes and not with the resources categories reflecting the range of recoverable quantities.

- New Terms: P1, P2, P3, C1, C2, C3, 1U, 2U, 3U 

- Note:
  - Classify: to assemble by order, such as Reserves, Contingent Resources, Prospective Resources. For PRMS, the classification addresses the maturity of the project.
  - Category: to divide into groups, such as low, best, high, proved, probable, etc. For PRMS, the categorization addresses the uncertainty of volumes.

2.2.2.2 Use of consistent terminology (Figures 1.1 and 2.1) promotes clarity in communication of evaluation results. For Reserves, the general cumulative terms low/best/high forecasts are used to estimate the resulting 1P/2P/3P quantities, respectively. The associated incremental quantities are termed Proved (P1), Probable (P2) and Possible (P3).

2.2.2.3 For Contingent Resources, the general cumulative terms low/best/high estimates are used to estimate the resulting 1C/2C/3C quantities, respectively. The terms C1, C2, and C3 are defined for incremental quantities of Contingent Resources.

2.2.2.4 For Prospective Resources, the general cumulative terms low/best/high estimates also apply and are used to estimate the resulting 1U/2U/3U quantities. No specific terms are defined for incremental quantities within Prospective Resources.

SPLIT CONDITIONS 2.2.0.3 & 2.2.2.7

2.2.0.3 There must be a single set of defined conditions applied for resource categorization. Use of different commercial assumptions for categorizing quantities is referred to as "*split conditions*" and are not allowed. Frequently, an entity will conduct project evaluation sensitivities to understand potential implications when making project selection decisions. Such sensitivities may be fully aligned to resource categories or may use single parameters, groups of parameters, or variances in the defined conditions.

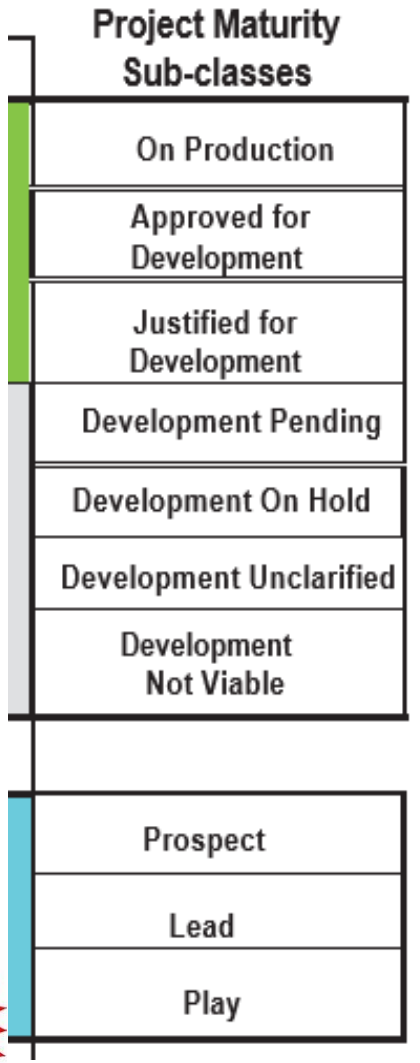
2.2.2.7 All evaluations require application of a consistent set of forecast conditions, including assumed future costs and prices, for both classification of projects and categorization of estimated quantities recovered by each project (see Section 3.1, Assessment of Commerciality).

- What are we trying to say here?
- The economic and commercial assumptions used to evaluate a certain scenario should be the same for all categories.
- Example:
  - use the same price scenario for the low, best and high / 1P, the 2P, and the 3P cases for a single project.
  - Use the same discount rate / hurdle rate criteria to test commerciality.

SPLIT CLASSIFICATION 2.2.0.4

2.2.0.4 Moreover, a single project is uniquely assigned to a sub-class along with its uncertainty range. For example, a project cannot have quantities classified in both Contingent Resources and Reserves, for instance as 1C, 2P, and 3P. This is referred to as *"split classification."*

- A single project is uniquely assigned to a sub-class along with its uncertainty range.
- An accumulation or field may have several separate projects in its development plan.

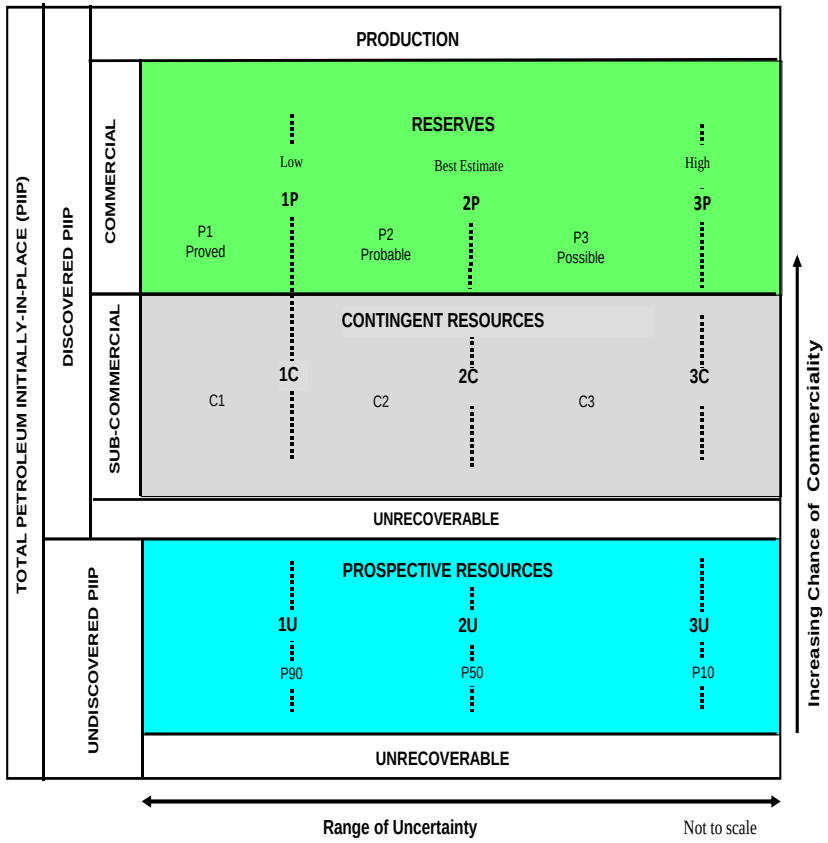


ARE THREE ESTIMATES ALWAYS REQUIRED?

2.2.1.3 In some projects, the range of uncertainty may be limited, and the three scenarios may result in resources estimates that are not significantly different. In these situations, a single value estimate may be appropriate to describe the expected result.

VOLUMES MOVE VERTICALLY THROUGH THE MATRIX

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



- In other words, resource quantities progress vertically upward towards reserves. Once reserve status has been achieved, reserve quantities should move from right to left.

RESERVE DEFINITIONS LARGELY UNCHANGED

2.2.2.8 A: Proved Reserves are those quantities of Petroleum that, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be commercially recoverable from known reservoirs and under defined technical and commercial conditions. 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.

PRMS 2007: 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.

RESERVE DEFINITIONS LARGELY UNCHANGED

2.2.2.8 B: 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.

PRMS 2007: 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.

- **No change from the 2007 definition**

RESERVE DEFINITIONS LARGELY UNCHANGED

2.2.2.8 C: Possible Reserves are those additional Reserves that 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) Reserves, 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 that are located outside of the 2P area (not upside quantities to the 2P scenario) may exist only when the commercial and technical maturity criteria have been met (that incorporate the Possible development scope). Stand-alone Possible Reserves must reference a commercial 2P project (e.g., a lease adjacent to the commercial project that may be owned by a separate entity), otherwise stand-alone Possible is not permitted.

PRMS 2007: Possible Reserves are 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) Reserves, which is equivalent to the high estimate scenario. In this context, 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.

2.3.1.2 Facilities that are either beyond their operational life, placed out of service, or removed from service cannot be associated with Reserves recognition. When required facilities become unavailable or out of service for longer than a year, it may be necessary to reclassify the Developed Reserves to either Undeveloped Reserves or Contingent Resources. A project that includes facility replacement or restoration of operational usefulness must be identified, commensurate with the resources classification.

LEARNING CURVE FOR UNCONVENTIONALS

2.4.0.5 A fundamental characteristic of engagement in a repetitive task is that it may improve performance over time. Attempts to quantify this improvement gave rise to the concept of the manufacturing progress function commonly called the "***learning curve***." The learning curve is characterized by a decrease in time and/or costs, usually in the early stages of a project when processes are being optimized. At that time, each new improvement may be significant. As the project matures, further improvements in time or cost savings are typically less substantial. In oil and gas developments with high well counts and a continuous program of activity (multi-year), the use of a learning curve within a resources evaluation may be justified to predict improvements in either the time taken to carry out the activity, the cost to do so, or both. While each development project is unique, review of analogs can provide guidance on such predictions and the range of associated uncertainty in the resulting recoverable resources estimates (see also Section 3.1.2 Economic Criteria).

ASSESSMENT OF COMMERCIALITY 3.1

3.1.0.1 Commercial assessments are conducted on a project basis and are based on the entity's view of future conditions. The forecast commercial conditions, technical feasibility, and the entity's decision to commit to the project are several of the key elements that underpin the project's resources classification. Commercial conditions include, but are not limited to, assumptions of an entity's investment hurdle criteria; financial conditions (e.g., costs, prices, fiscal terms, taxes); partners' investment decision(s); organization capabilities; and marketing, legal, environmental, social, and governmental factors. Project value may be assessed in several ways (e.g., cash flow analysis, historical costs, comparative market values, key economic parameters) (see Section 2.1.2, Determination of Commerciality). The guidelines herein apply only to assessments based on cash-flow analysis. **Moreover, modifying factors that may additionally influence investment decisions, such as contractual or political risks,* should be recognized so the entity may address these factors if they are not included in the project analysis.** NEW

PRMS 2007 (§3.1 ¶1) Investment decisions are based on the entity's view of future commercial conditions that may impact the development feasibility (commitment to develop) and production/cash flow schedule of oil and gas projects. Commercial conditions include, but are not limited to, assumptions of financial conditions (costs, prices, fiscal terms, taxes), marketing, legal, environmental, social, and governmental factors. Project value may be assessed in several ways (e.g., historical costs, comparative market values); the guidelines herein apply only to evaluations based on cash flow analysis. **Moreover, modifying factors such contractual or political risks that may additionally influence investment decisions are not addressed**. (Additional detail on commercial issues can be found in the "2001 Supplemental Guidelines," Chapter 4.)

* Order of sentence reversed

ECONOMIC EVALUATION / COMMERCIAL ASSESSMENT

- The OGRC sub-committee noted that there is significant confusion around the concepts of economic and commercial.

Glossary **Economic:** A project is economic when it has a positive undiscounted cumulative cash flow from the effective date of the evaluation, the net revenue exceeds the net cost of operation (i.e., positive cumulative net cash flow at discount rate greater than or equal to zero percent).

Glossary **Commercial:** A project is commercial when there is evidence of a firm intention to proceed with development within a reasonable time-frame. Typically, this requires that the best estimate case meet or exceed the minimum evaluation decision criteria (e.g., rate of return, investment payout time). There must be a reasonable expectation that all required internal and external approvals will be forthcoming. Also, there must be evidence of a technically mature, feasible development plan and the essential social, environmental, economic, political, legal, regulatory, decision criteria, and contractual conditions are met.

ECONOMIC EVALUATION / COMMERCIAL ASSESSMENT

- To aid in the distinction, we discuss the concepts in terms of first doing the **economic evaluation** to determine whether the project has positive cash flow. If it does have positive cash flow, the project is "economic".
- Then we do the **commercial assessment.** There are two aspects of the commercial assessment:
  - 1) The financial metrics, where you consider all of the costs and revenues of the project, and determine whether the project generates sufficient cash flow to satisfy the entity's financial requirements / meet the entity's hurdle rate. In other words, does it provide a sufficient rate of return to justify the project?
  - 2) Commercial conditions other than financial: There must be a reasonable expectation that the other (non-financial) issues have been addressed:
    - Is there a firm intent to proceed in a reasonable time frame?
    - Are all required financing arrangements and approvals in place or expected to be forthcoming?
    - Is there a reasonable expectation that the essential social, environmental, political, legal, regulatory, contractual, marketing conditions, etc. have been or will be met?

- First step – the Economic Evaluation
  - we prepare our cash flow analysis using our forecasted production schedule and the forecasted economic scenario conditions - product prices, costs, inflation, etc.
  - If we have at least $1 of positive cash flow, then the project is economic.

WORKFLOW: ECONOMIC TO COMMERCIAL

- Second step – the Commercial Assessment
- The first part of the Commercial Assessment is to determine whether the project meets the required financial requirements. One of the key differences between Economic and Commercial is that while a project only needs to have $1 of positive cash flow (i.e. positive NPV, or a rate of return greater than zero) to be economic, a commercial project is one that achieves the entity's minimum financial criteria (i.e. hurdle rate). The minimum financial criteria is set by the entity and may consider rate of return, payout time, return on capital, or any other pertinent financial metric.
- Entities typically demand a rate of return that at least covers their Weighted Average Cost Of Capital, but ideally provides some incremental return over and above the WACOC. This minimum ROR is typically referred to as the hurdle rate.
- A cash flow forecast that uses a discount rate equal to the hurdle rate and shows zero or higher NPV at that discount rate achieves or exceeds the hurdle rate.

WHAT IS MINIMUM FINANCIAL CRITERIA?

- A project can be economic if it generates positive cash flow, i.e. at least $1 of profit.
- Nobody would invest in a project that would only return $1.
- At a minimum, a project should provide a return greater than the “risk free rate”. U.S. treasury bonds are generally considered to be the lowest risk investment, and a one year bond is currently yielding about 2.3%.
- Since most companies invest a combination of equity and debt (borrowed money), they need a return sufficient to pay the interest on the debt portion. This is often called the “Weighted Average Cost of Capital”. Since the current prime rate is 4.75%, this means that most companies are paying more than 4.75% interest on their debt.
- The company should generate enough profit to pay for their overhead and potentially other projects that were not successful.
- Generally, the minimum rate of return / hurdle rate that oil and gas companies require is 10% or more.

COMMERCIALITY BASED ON 2P

- The commercial assessment may be applied to the 2P or Best Estimate forecast case. (2.1.3.7.2)
- Any 1P reserves associated with the project must be economic to be considered as reserves.
- If the 1P volumes are not economic, then the project only has 2P reserves. Recognition of 2P reserves does not elevate uneconomic 1P volumes to proved reserves status.

3.1.2 ECONOMIC CRITERIA

3.1.2.1 Economic determination of a project is tested assuming a zero percent discount rate (i.e., undiscounted). A project with a positive undiscounted cumulative net cash flow is considered economic. Production from the project is economic when the revenue attributable to the entity interest from production exceeds the cost of operation. A project's production is ***economically producible*** when the net revenue from an ongoing producing project exceeds the net expenses attributable to a certain entity's interest. The ADR costs are excluded from the economically producibility determination. A project is commercial when it is economic **AND** it meets the criteria discussed in Section 2.1.2.

- A project's production is economically producible when the net revenue from an ongoing producing project exceeds the net expenses attributable to a certain entity's interest.
- As long as the revenue from the production is greater than the operating expenses associated with that production, then this producing project is said to be Economically Producible.

- Once a project has been implemented and production has started, does it have to remain commercial?
- What if it is just economic?

PROJECT IMPLIES CAPITAL INVESTMENT

Glossary: Project ….In general, an individual project will represent a specific maturity level (sub-class) at which a decision is made on whether or not to proceed **(i.e., spend money),** …

- Projects have an associated capital investment, and we do the commercial assessment to determine if the project meets our investment requirements, i.e. provides a sufficient rate of return to make the project attractive.
- Generally, the capital investment occurs at the beginning of the project, prior to production.
- Once production has been achieved, there is usually only minimal capital investment, and in many cases, there may be no further capital investment.
- The capital investments made prior to our evaluation date have become sunk costs.

RECAPPING THE ISSUES 1 OF 2

- Once a project has been implemented, the investment costs become sunk costs and are no longer relevant to recognizing reserves in the current (or future) time periods.
- At this point, the reserves must be Economically Producible. The concept of commerciality does not apply to Economically Producible.
- In other words, you have spent the capital, and now your revenue must be greater than the operating expenses. Hopefully, there will be enough revenue to not only cover the operating costs, but to pay back the capital investment costs also. But a payback of capital invested is not a part of Economically Producible. You do not have to achieve a return on capital / hurdle rate once production starts, just cover your operating costs.

ADR – NEW ISSUE?

- PRMS has adopted the term ADR – Abandonment, Decommissioning, and Reclamation as a more comprehensive term to replace abandonment. 

- PRMS 2007 (§3.1.1, second bullet point) discusses that cash-flow-based resource evaluations shall reflect….estimated costs associated with the project…including environmental, abandonment, and reclamation costs.

- So really just a clarification of prior guidance; a new term but no new requirements are being imposed.

ABANDONMENT, DECOMMISSIONING AND RECLAMATION 3.1.2.4

3.1.2.4 All costs, including future ADR liabilities, are included in the project economic analysis unless specifically excluded by contractual terms. ADR is not included in determining the economic producibility or for determining the point the project reaches the economic limit (see Section 3.1.3, Economic Limit). ADR costs are included for project economics but are not included in judging economic producibility or determining the economic limit (see Section 3.1.3, Economic Limit). ADR costs may also be reported for other purposes, such as for a property sale/acquisition evaluation, future *field* planning, accounting report of future obligations, or as appropriate to the circumstances for which the resource evaluation is conducted. The entity is responsible for providing the evaluator with documentation to ensure that funds are available to cover forecast costs and ADR liabilities in line with the contractual obligations.

- ADR costs are included in the project economic analysis unless specifically excluded by contractual terms.*
- ADR not considered in determining economic producibility or economic limit.

3.1.2.8 SUNK COSTS

3.1.2.8 There may be circumstances in which the project meets criteria to be classified as Reserves using the *best estimate* (*2P*) forecast but the low case is not economic and fails to qualify for Proved Reserves. In this circumstance, the entity may record 2P and *3P* estimates and no Proved Reserves. As costs are incurred in future years (i.e. become *sunk costs*) and development proceeds, the *low estimate* may eventually become economic and be reported as Proved Reserves. Some entities, according to internal policy or to satisfy regulatory reporting requirements, will defer reclassifying projects from *Contingent Resources* to Reserves until the low estimate case is economic.

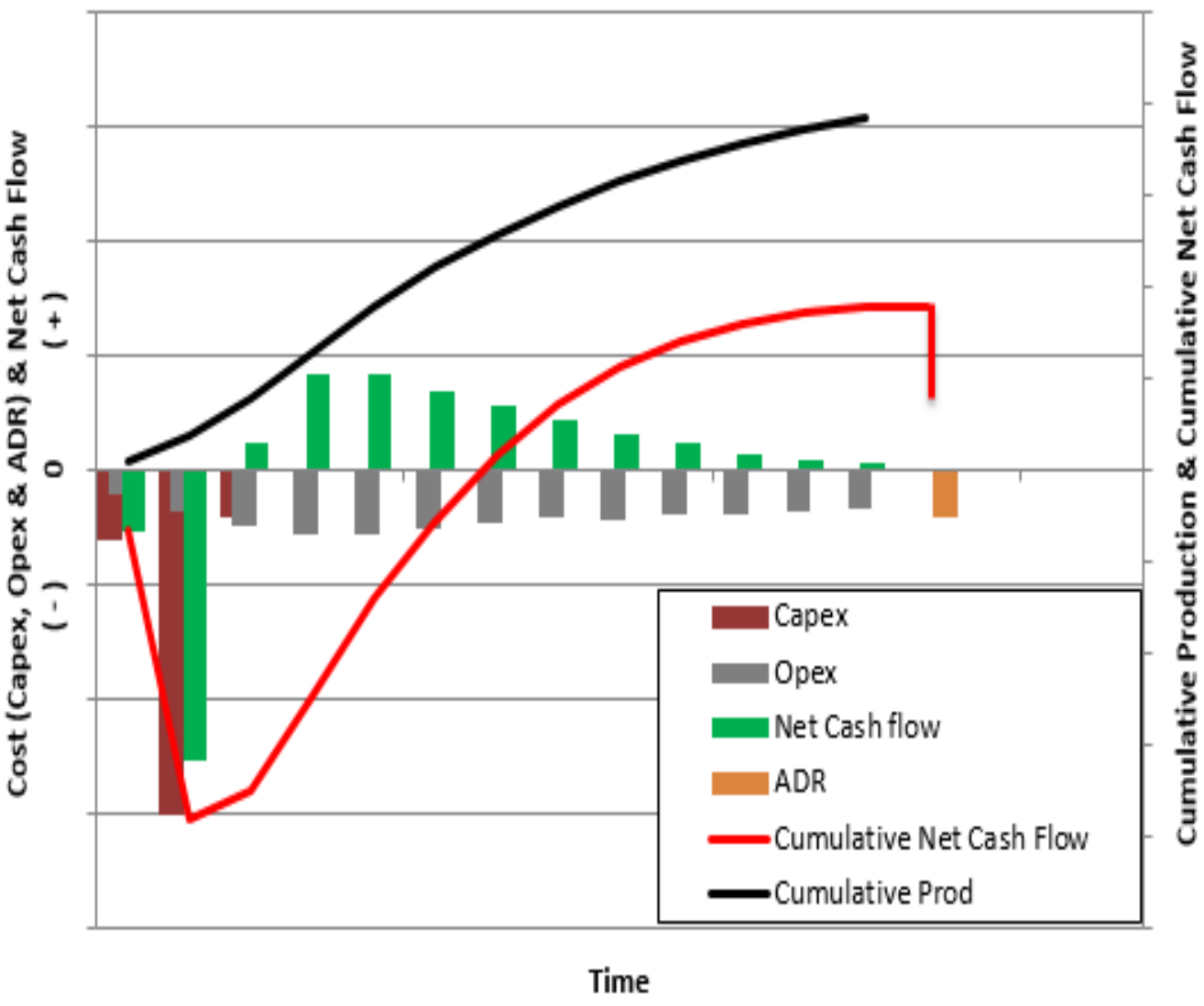
- Paragraph is substantially the same as 2007's (§3.1.2 ¶5), but sunk costs introduced.

SUNK COSTS NOW DEFINED

GLOSSARY **Sunk Cost**: Money spent before the effective date and that cannot be recovered by any future action. Sunk costs are not relevant to future business decisions because the cost will be the same regardless of the outcome of the decision. Sunk costs differ from committed (obligated) costs, where there is a firm and binding agreement to spend specified amounts of money at specific times in the future (i.e., after the effective date).

- Evaluations are point forward. Prior capital costs are sunk costs and not included in the cash flow analysis.
- Sunk costs are money spent before the Effective Date and not recoverable by any future action.
- Committed costs are those where there is a firm obligation to spend the money, but the money will be spent after the Effective Date. Therefore committed costs are not sunk costs until they are actually spent.

NET CASH FLOW DIAGRAM



Included at 3.1.2.5 to help illustrate the concepts of cash flow over time.

3.1.3 ECONOMIC LIMIT

3.1.3.1 The economic limit is defined as the production rate at the time when the maximum cumulative net cash flow occurs for a project. The entity's *entitlement* production share, and thus *net entitlement* resources, includes those produced quantities up to the earliest truncation occurrence of either technical, license, or economic limit.

3.1.3.4 Interim negative project net cash flows may be accommodated in periods of development capital spending, low product prices, or major operational problems provided that the longer-term cumulative net- cash-flow forecast determined from the effective date becomes positive. These periods of negative cash flow will qualify as Reserves if the following positive periods more than offset the negative.

PRMS 2007 (§3.1.3, ¶1): Economic limit is defined as the production rate beyond which the net operating cash flows from a project, which may be an individual well, lease, or entire field, are negative, a point in time that defines the project's economic life…

PRMS 2007 (§3.1.3, ¶2): Interim negative project net cash flows may be accommodated in short periods of low product prices or major operational problems, provided that the long-term forecasts must still indicate positive economics.

- Defining EL as the maximum cumulative net cash flow clarifies the situation where cash flows may temporarily go negative but is expected to return to positive, and the positive more than compensates for the negative. Although PRMS 2007 did not use the term "cumulative", it does discuss the accommodation of negative periods if expected to be followed by positive periods that result in long-term positive economics – which is essentially the condition of maximum cumulative net cash flow. The net result is that there is no change to the 2007 definition of economic limit.
- The SEC view expressed in private discussions is that EL is reached at the first point where cash flows go negative.

MULTIPLE ECONOMIC LIMITS?

3.1.3.4 Interim negative project net cash flows may be accommodated in periods of development capital spending, low product prices, or major operational problems provided that the longer-term cumulative net-cash-flow forecast determined from the effective date becomes positive. These periods of negative cash flow will qualify as Reserves if the following positive periods more than offset the negative.

PRMS 2007 (§3.1.3, ¶2): Interim negative project net cash flows may be accommodated in short periods of low product prices or major operational problems, provided that the longer-term forecasts must still indicate positive economics.

- Basic premise expanded and clarified.

UNECONOMIC PRODUCTION 3.1.3.5

3.1.3.5 In some situations, entities may choose to initiate production below or continue production past the economic limit. Production must be economic to be considered as Reserves, and the intent to or act of producing sub-economic resources does not confer Reserves status to those quantities. In these instances, the production represents a movement from Contingent Resources to Production. However, once produced such quantities can be shown in the reconciliation process for production and revenue accounting as a positive technical revision to Reserves. No future sub-economic production can be Reserves.

UNECONOMIC PRODUCTION IS NOT RESERVES!

- Clarified position that the intent or act of producing sub-economic resources does not confer Reserve status, it is a movement from Contingent Resources to Production.
- There are many instances where projects with no reserves are producing. The resulting production creates problems for the accountants. There is a misconception in industry that if a project is producing, the production counts as reserves. Accounting systems assume that if there is production, then there must be reserves
- *"However, once produced such quantities can be shown in the reconciliation process for production and revenue accounting as a positive technical revision to Reserves. "* is an accommodation for the accountants to clarify that (as far as we are concerned) they can treat the volumes as reserves.
- Note that it does not say they are reserves. They start as contingent resources and move straight to production, and they can be reconciled as a positive revision to reserves.
- This concept is further reinforced by the last sentence, *"No future sub-economic production can be Reserves."*

3.3 RESOURCES ENTITLEMENT AND RECOGNITION

- Expansion of the discussion in 2007 PRMS.
- 3.3.0.3 includes the basic components necessary for recognition:

3.3.0.3 The ability for an entity to recognize Reserves and Resources is subject to satisfying certain key elements. These include (a) having an economic interest through the mineral lease or *concession* agreement (i.e., right to proceeds from sales); (b) exposure to market and technical *risk*; and (c) the opportunity for reward through participation in *exploration*, *appraisal*, and development activities. Given the complexities of some agreements, there may be additional elements that must be considered in determining entitlement and the recognition of Reserves and Resources.

4.1.1 ANALOGS

- Section re-worded but concept is unchanged.

4.1.1.2 Analogous reservoirs, as used in resources assessments, are defined by similarities of features and characteristics that include but are not limited to the following:

A. Reservoir deposition and structure (e.g., lithology, depositional environment, diagenetic history, natural fractures, chemical/mineral composition, geometry, mechanical history, and structural deformation).

B. Petrophysical properties (e.g., *net pay* and gross thickness, porosity, saturation, permeability, heterogeneity, and net-to-gross ratio).

C. Reservoir conditions (e.g., depth, temperature and pressure, and size of the petroleum *accumulation* and aquifer).

D. Fluid properties (e.g., original fluid type, composition, density, and viscosity).

E. Drive mechanisms.

F. Development plan (e.g., well spacing, well type and number, *completion* methods, artificial lift, development and operating costs, facility type and constraints, and processing).

4.1.1.3 The above list is not exhaustive and the comparative analog characteristics must be relevant to the key characteristics of the project.

4.1.1.4 It is not necessary for all parameters to match to consider a reservoir as an analog. The evaluator should consider the specifics of each application and its suitability in providing insight to assist in the estimation of *recoverable resources*.

QRA / QRE

- The 2007 PRMS did not discuss the requirements for a **Qualified Reserve Auditor** or a **Qualified Reserve Evaluator**. These terms were defined in the "*Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserves Information*" (last revised 2007).
- Glossary now includes definitions for Qualified Reserve Auditor and Qualified Reserve Evaluator.
- A Qualified Reserve Auditor is now defined as having a minimum of ten years experience instead of five years.
- A Qualified Reserves Evaluator now has a minimum of five years of practical experience instead of three years.
- A new "*Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserves Information*" is expected to be released shortly to conform to these changes.

The End

dan_olds@ryderscott.com

- Examples

EXAMPLE: GAS STREAM ISSUES

- Your gas reservoir is 20% nitrogen and 80% methane, and the gas you deliver to the sales point can contain no more than 2% inerts. Your gas treating facilities typically remove 99% of the impurities.
- If your project that you will produce 1 bcf of gas from the reservoir, what volume can you book as reserves?
  - A. 1 bcf
  - B: 0.98 bcf (1 bcf less the 2% allowable inerts)
  - C: 0.80 bcf (remove all of the 20% inert portion)
  - D: 0.998 bcf (1 bcf less 99% of 20% inerts)

TRR EXAMPLE

- An average gas well in Field X will cease producing at around 20 mcfd, when liquid loading kills the well.
- If we were to install a siphon string, the wells should produce down to 5 mcfd.
- Under current economic conditions, the economic limit is 40 mcfd.
- If the average well is producing 100 mcfd, and exhibits a 20% exponential decline, what would the TRR volume be for an average well?
  - A: 100 mcfd to 20 mcfd at 20% equals 277,144 mcf
  - B: 100 mcfd to 5 mcfd at 20% equals 329,108 mcf
  - C: 100 mcfd to 40 mcfd at 20% equals 207,858 mcf

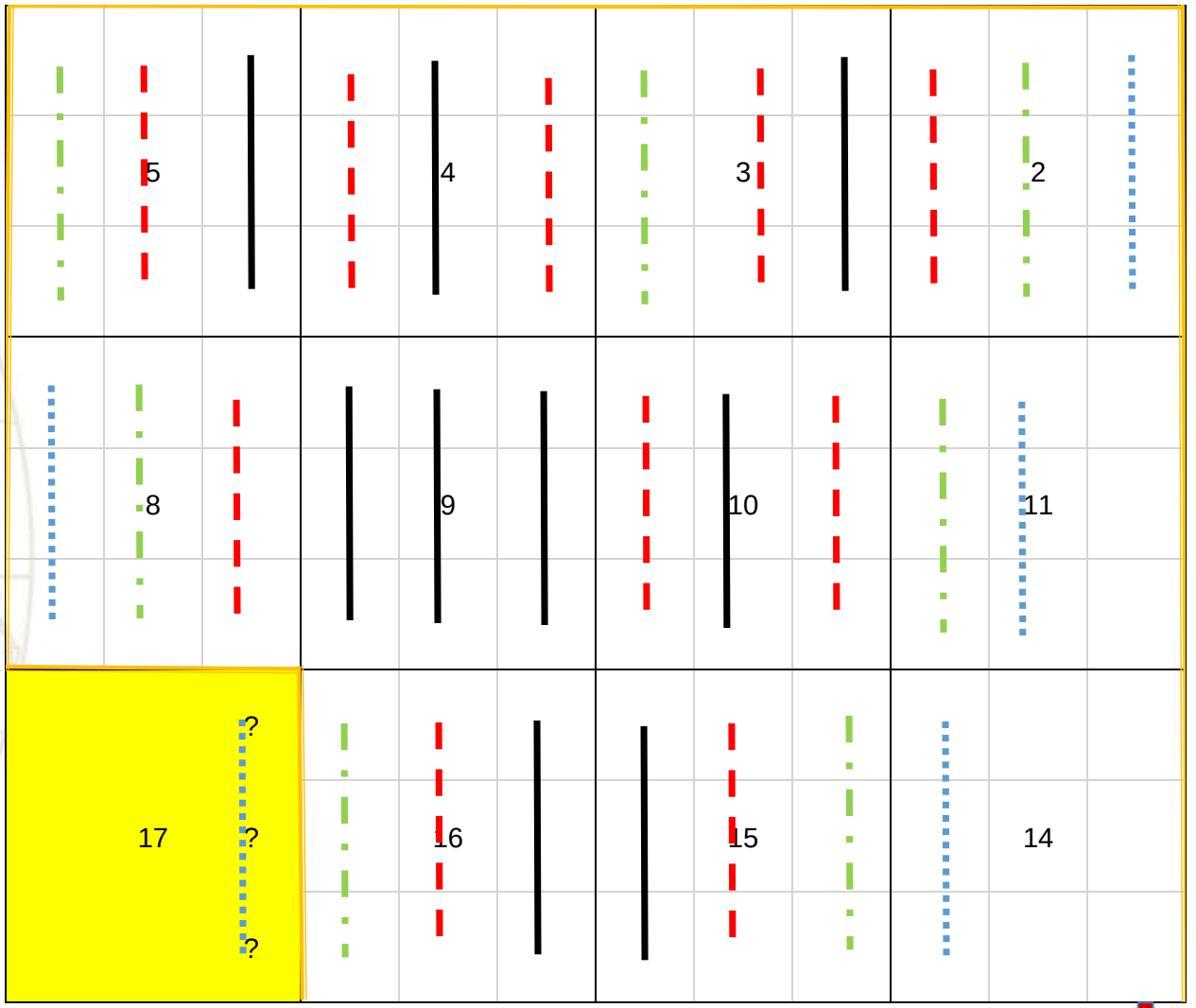
- A gas field with 10 wells needs a compressor. The cost of the compressor is $2 million.
- When the wells were drilled, the average drilling and completion cost was $2 million per well. Using current costs, it would take about $4 million to drill and complete a well in the field.
- How should the expected reserve increase from the compression project be booked?

EXAMPLE – STAND ALONE POSSIBLE

Producing	
Proved Undeveloped	
Probable Undeveloped	
Possible Undeveloped	

You just picked up a lease on section 17. From public data, you can see the performance of their producing wells and it supports …

Can you book a Possible Undeveloped location as shown? If so, what are the requirements?



SPLIT CONDITIONS - EXAMPLES

- In some situations, terms of the concession require the sale of some quantities into the local market, while excess volumes can be exported.
- This can result in prices in the low, best, and high cases that are quite different from each other.
- Is this a split condition?

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- Is this a split condition?
  - No, because the underlying price assumptions are the same, it is just the weighted average may be different in each case.
- In another example, proved reserves are evaluated at SEC prices, while non-proved reserves are evaluated under the PRMS forecast prices, which include escalations.
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  - No, because the underlying price assumptions are the same, it is just the weighted average may be different in each case.
- In another example, proved reserves are evaluated at SEC prices, while non-proved reserves are evaluated under the PRMS forecast prices, which include escalations.
- Is this a split condition?
  - No. Regulatory requirements dictate the prices used for the proved reserves used in SEC filings, whereas reserves not filed with the regulatory authority should use the PRMS forecast prices.

SPLIT CLASSIFICATION - EXAMPLE

- A certain project shows a remaining economic life of 15 years, but the PSC expires in 10 years.
- Our PSC does not address contract extensions. There is no track record of extensions being granted in this country, and we have not initiated any discussions with the government about the possibility of an extension.
- As such, we have no basis to assume that a contact extension may be granted. Any volumes past the expiration can only be considered as contingent resources.
- Is this a violation of the split classification rule to have proved producing reserves and contingent resources?
- If so, what is the solution?
- Remember, an accumulation or field may have several separate projects in its development plan.

- A gas field in a remote location has TRR volumes of 1 BCF.
- The license expires in 5 years.
- The local market can only take 100 mmcf annually, and your field can deliver that rate.
- What are the low case, best case, and high case reserve or resource estimates?

EXAMPLE 1P VERSUS 2P VERSUS 3P

- You have an offshore discovery well with a successful test.
- Based on the test and available data, your estimates of oil in place are as follows:
  - Low Estimate case: 200 million barrels, technically recoverable resources of 30 mmb.
  - Best Estimate case: 325 million barrels, technically recoverable resources of 81 mmb.
  - High Estimate case: 700 million barrels, technically recoverable resources of 250 mmb.
- A notional development plan has been developed for the project, and your manager has asked you what reserves might be booked if the development was approved today.

EXAMPLE 1P VERSUS 2P VERSUS 3P

You prepare economics and the results are as follows:

	ROR	Notes
Low Case	0%	negative cash flow, does not break even
Best Estimate	5%	positive cash flow, does not meet hurdle rate
High Case	25%	positive cash flow, exceeds hurdle rate

What reserves could be book to the project based on the above results, and in what category?

COMMERCIAL OR ECONOMIC?

- A new project must be commercial to have reserves
- A new project that is economic may not be commercial.
- A new project that is commercial is also economic.
- A new project that is economic but not commercial may have contingent resources.
- A new project that is economic but not commercial may become commercial in the future when enough capital investment has been expended (i.e. become sunk costs) such that the future cash flows achieve the hurdle rate.