

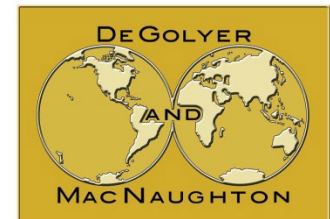
GEO INDIA 2022

PRMS Guidelines and Terminology

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October 2022

Jaipur, Rajasthan, India



Worldwide Petroleum Consulting

PRMS Applications Guidelines Document

PRMS AG has been updated recently to reflect on updated PRMS (2018)

Petroleum Resources Management System

Revised June 2018

2018 PRMS

- Major industry changes required updating the 2007 PRMS
- Latest PRMS release in June 2018
- Notable additions in unconventional reservoirs

2011 PRMS AG

- Published in November 2011
- Included two new chapters, one of them in unconventional resources estimation

2022 PRMS AG Update

- Update to reflect 2018 PRMS
- Overhaul of 2011 chapter on unconventional resources
- Publication expected before the end of the year



Guidelines for Application of the Petroleum Resources Management System

November 2011

Sponsored by:

Society of Petroleum Engineers (SPE)
American Association of Petroleum Geologists (AAPG)
World Petroleum Council (WPC)
Society of Petroleum Evaluation Engineers (SPEE)
Society of Exploration Geophysicists (SEG)



Outline to the PRMS Guidelines Presentation

This presentation is organized into the following sub-sections

- Introduction to the Petroleum Resources Management System (PRMS) Guidelines
- Reserves vs. Resources
- Reserves
 - Proved
 - Probable
 - Possible
- Resources
 - Contingent resources
 - Prospective resources
- Standards for estimating and reporting reserves and resources

Introduction to the PRMS Guidelines

Guidelines for the application of PRMS

■ Purpose of PRMS

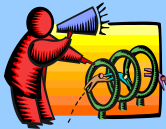
- Provide a consistent approach to estimating petroleum quantities, evaluating development projects, and presenting results within a comprehensive classification framework

■ PRMS Guidelines Revised June 2018

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

PRMS Guidelines

Definitions considered in creating PRMS guidelines



*Securities
Disclosures*



*Government
Reporting*

*International
Standards*

1. **US Securities and Exchange Commission (SEC-1978)**
2. **UK Statement of Recommended Practices (SORP-2001)**
3. **Canadian Security Administrators (CSA -2002)**
4. **Russian Ministry of Natural Resources (RF-2005)**
5. **China Petroleum Reserves Office (PRO-2005)**
6. **Norwegian Petroleum Directorate (NPD-2001)**
7. **United States Geological Survey (USGS-1980)**
8. **United Nations Framework Classification (UNFC-2004)**

Presentation, SPE/WPC/AAPG/SPEE Petroleum Reserves and Resources Classification, Definitions & Guidelines, Jan. 8, 2007

PRMS Guidelines

1.0 Basic Principles and Definitions

- 1.0.0.1 A classification system of petroleum resources is a fundamental element that provides a common language for communicating both the confidence of a project's resources maturation status and the range of potential outcomes to the various entities. The PRMS provides transparency by requiring the assessment of various criteria that allow for the classification and categorization of a project's resources.
- The evaluation elements consider the risk of geologic discovery and the technical uncertainties together with a determination of the chance of achieving the commercial maturation status of a petroleum project.

Petroleum Resources Management System, (revised June 2018)

PRMS Guidelines

1.0 Basic Principles and Definitions (con't)

- 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 in terms of volumes (e.g., barrels or cubic meters), mass (e.g., metric tonnes) or energy (e.g., Btu or Joule). These quantities are associated with exploration, appraisal, and development projects at various stages of design and implementation. The commercial aspects considered will relate the project's maturity status (e.g., technical, economical, regulatory, and legal) to the chance of project implementation.

Petroleum Resources Management System, (revised June 2018)

PRMS Guidelines

1.0 Basic Principles and Definitions (con't)

- 1.0.0.3 The use of a consistent classification system enhances comparisons between projects, groups of projects, and total company portfolios. The application of PRMS must consider both technical and commercial factors that impact the project's feasibility, its productive life, and its related cash flows.

Petroleum Resources Management System, (revised June 2018)

PRMS Guidelines

PRMS allows for “Project-Based” estimates of reserves

- PRMS allows reserves to be estimated at the “project” level
- The estimator defines the project
- Project level estimates allow leases, fields, or reservoirs to be combined to determine if the project is commercially producible
 - To justify the capital costs of shared facilities or infrastructure
 - To allow for the synergy of combining multiple smaller activities to justify commerciality that might otherwise be uneconomic when each activity is evaluated individually

PRMS Guidelines

"Project-Based" System

- Often a Field or Reservoir
- Can be Broad: (A Field)
- Can be Narrow: (A Group of Wells)
- Strengths
 - Establish a Common Basis
 - Forces Honesty on Commerciality
 - Theoretically Pure
- Weaknesses
 - Real World: Many 'Projects'
 - Can Confuse Presentation

PRMS Guidelines

Commerciality requires commitment and positive economics



Project must yield a **positive net present value** using the evaluator's assumed conditions and discount rate

Project development must be initiated within a reasonable time frame (~ 5 years)

All exceptions should be clearly documented

Undeveloped reserves should be developed within a reasonable timeframe. While 5 years is a benchmark, a longer timeframe could be applied under certain circumstances

Presentation, SPE/WPC/AAPG/SPEE Petroleum Reserves and Resources Classification, Definitions & Guidelines, Jan. 8, 2007

Presentation Outline

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- Introduction to the Petroleum Resources Management System (PRMS) Guidelines
- Reserves vs. Resources
- Reserves
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 - Probable
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- Resources
 - Contingent resources
 - Prospective resources
- Standards for estimating and reporting reserves

PRMS Description

A Good Place to Learn About Nomenclature

- Resources are In Three ‘Classes’

- Discovery Status and Commercial Maturity

- Classes are Sorted by Category

- Uncertainty Range

- Key Delimiters

- Discovery
- Commerciality

- Flexibility

- Probabilistic/Deterministic
- Economic Parameters Must be ‘Reasonable’

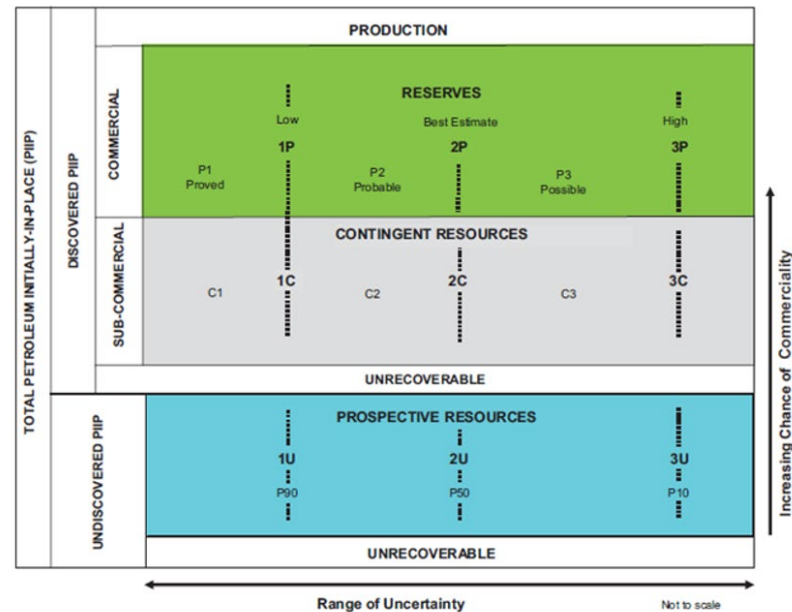


Figure 1.1—Resources classification framework

Categorize

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PRMS Guidelines

Classification is based on project maturity/chance of commerciality

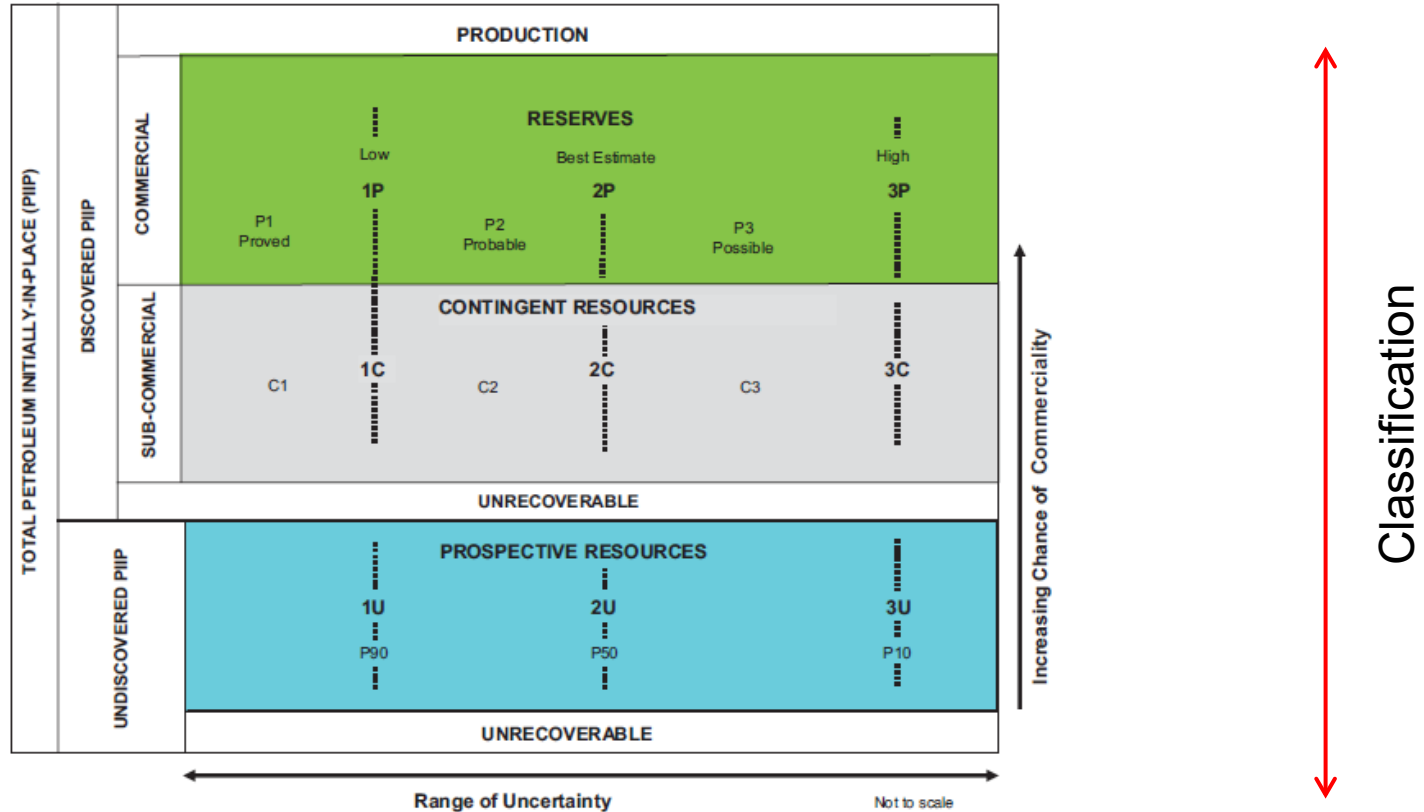


Figure 1.1—Resources classification framework

After SPE, Petroleum Resources Management System, June 2018

Resources System Overview

Classes of Petroleum

- Resources classes include:
 - Production*
 - Reserves
 - Contingent Resources
 - Prospective Resources
 - Unrecoverable Petroleum*

- Once Discovered Then...
- Is it Commercial?
 - Definition is Broad
 - Companies Tend to Define
 - PRMS Says ('Reasonable Expectation'):
 - Economic Evaluation Meets Established Criteria
 - Reasonable Timetable for Development
 - Market, Legal, Transportation
 - Maturity/Commitment Also Required
- Commercial=Reserves
- Not Commercial=Contingent Resources

PRMS Guidelines

Reserves vs. Contingent/Prospective Resources

■ Reserves

- Quantities of petroleum from known (drilled) discoveries that are estimated to be commercially producible from a given date forward under defined conditions

■ Contingent Resources

- Quantities of petroleum from known (drilled) discoveries that are potentially recoverable, but are not currently considered commercially recoverable due to one or more contingencies

■ Prospective Resources

- Quantities estimated to be potentially recoverable from undiscovered (undrilled) accumulations by application of future development projects

Path from Resources to Reserves

Full Spectrum of Inventory Can Be Managed

Surface expression

2-D/3-D Seismic Data

Geophysical Evaluation

Leads

Prospects

Prospective Resources

Drill Well - Discovery

Contingent Resources

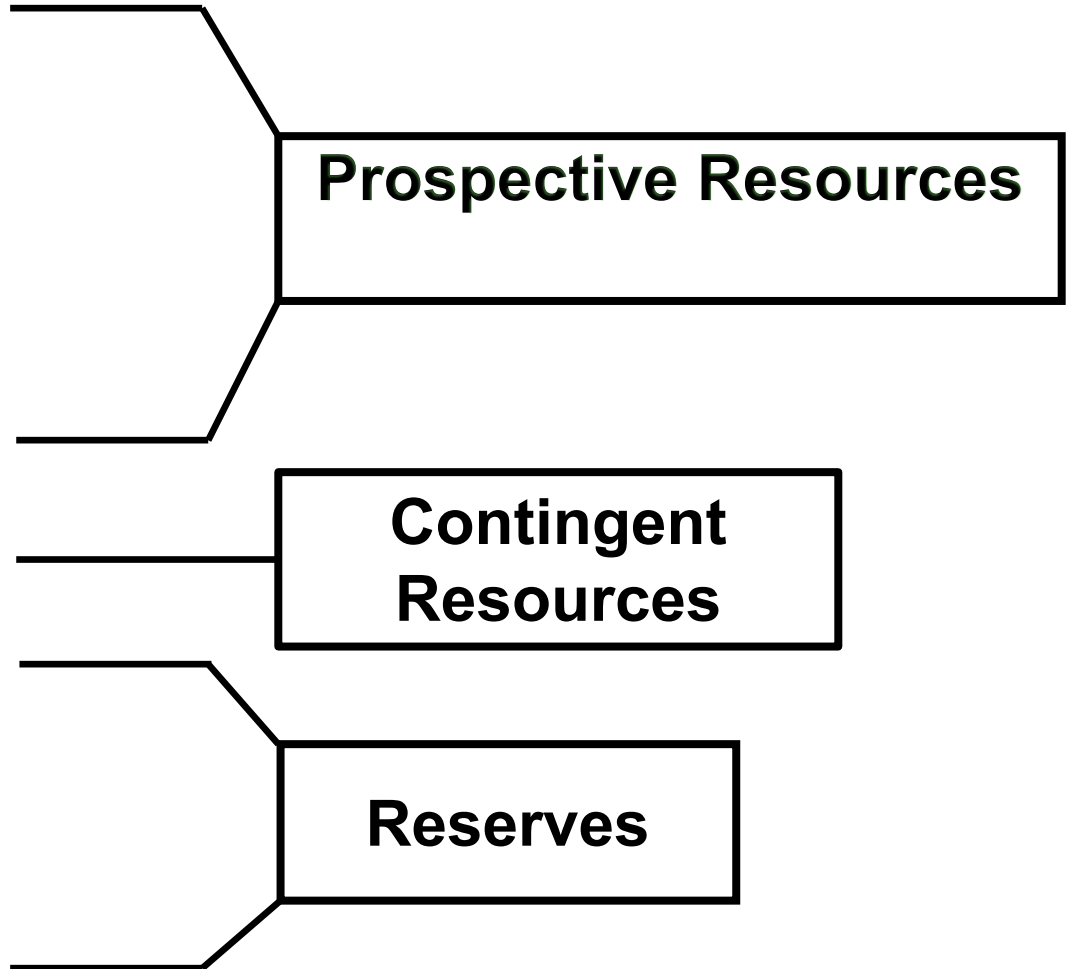
Appraisal well(s)

Market Analysis

Economic Evaluation

Field Development

Reserves



- PRMS
 - Reserves
 - Proved*
 - Probable*
 - Possible*
 - Contingent Resources
 - 1C, 2C, 3C
 - Prospective Resources
 - Low, Best, High

PRMS

Separate Classification & Categorization

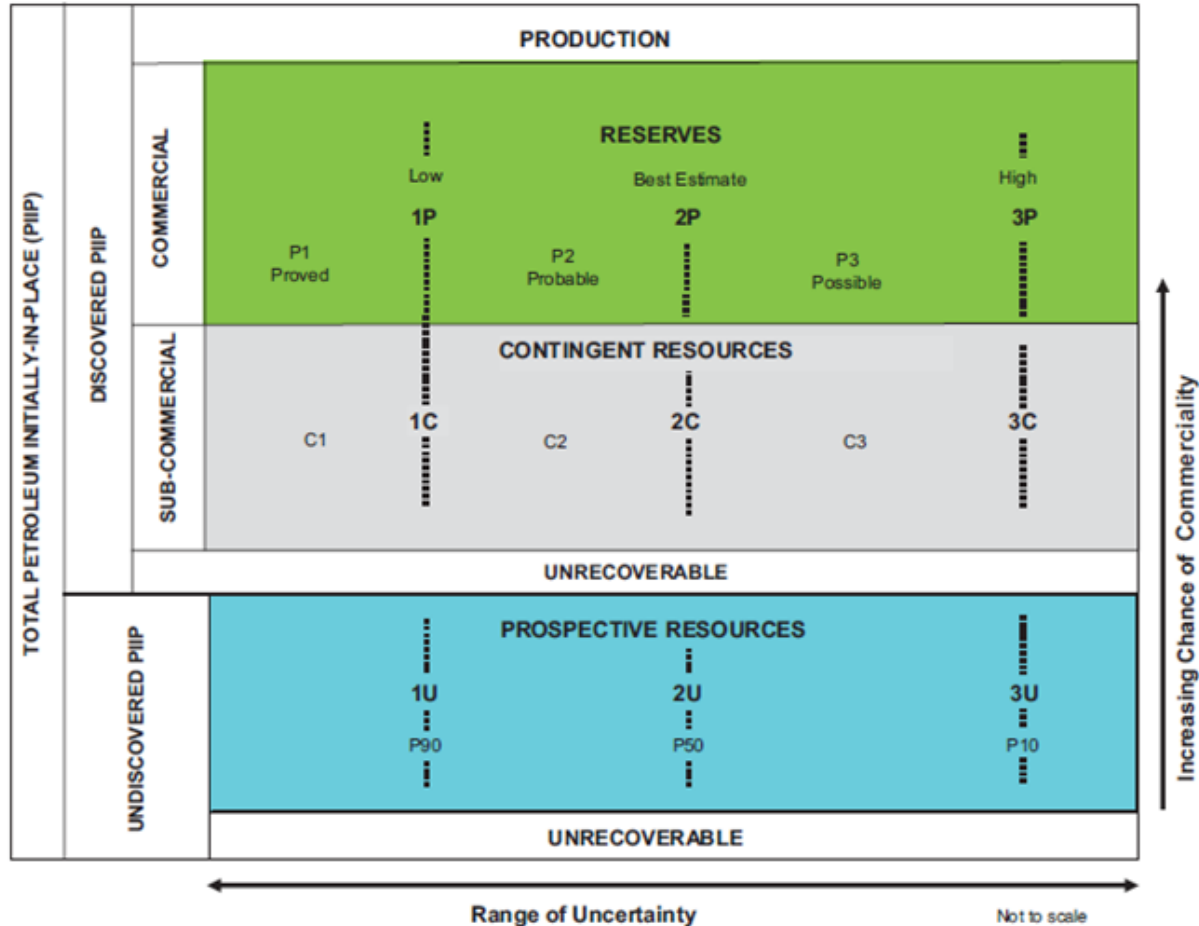


Figure 1.1—Resources classification framework

Categorize

Classify

- Proved
 - ❑ Reasonable certainty
 - ❑ At least a 90% probability
- Probable
 - ❑ More likely than not to be recoverable
 - ❑ At least a 50% probability
- Possible
 - ❑ Less likely to be recoverable
 - ❑ At least a 10% probability

- 1C
 - ❑ Reasonable certainty
 - ❑ At least a 90% probability
- 2C
 - ❑ More likely than not to be recoverable
 - ❑ At least a 50% probability
- 3C
 - ❑ Less likely to be recoverable
 - ❑ At least a 10% probability

- Despite Apparent Equivalency, Not Always a Direct Transfer
- Multiple Contingencies
 - ❑ 1C not viable but 2C and 3C are viable
 - ❑ Ownership/Unitization
 - ❑ Development Approval
- Hurdle to Reserves
 - ❑ Positive Cashflow
 - ❑ Minimum ROR
 - ❑ Company Approval Gate



- Always Probabilistic
- Low Case-1U
 - At Least a 90% Probability, P90
- Best Case-2U
 - Not Mean nor 'Expected', P50
 - At Least a 50% Probability
- High Case-3U
 - At Least a 10% Probability, P10
- Risked/Unrisked

- Project Maturity
- Reserves Status
 - Developed
 - Undeveloped
- Economic Status
 - Under Current or Reasonably Forecasted Conditions
 - Reserves All Economic
 - Contingent Resources
 - Economically Viable (economic but not committed)
 - Economically Not Viable (not economic)

- **Project Maturity**
- **Reserves Status**
 - Developed
 - Undeveloped
- **Economic Status**
 - Under Current or Reasonably Forecasted Conditions
 - Reserves All Economic
 - Contingent Resources
 - Economically Viable (economic but not committed)
 - Economically Not Viable (not economic)

■ Reserves

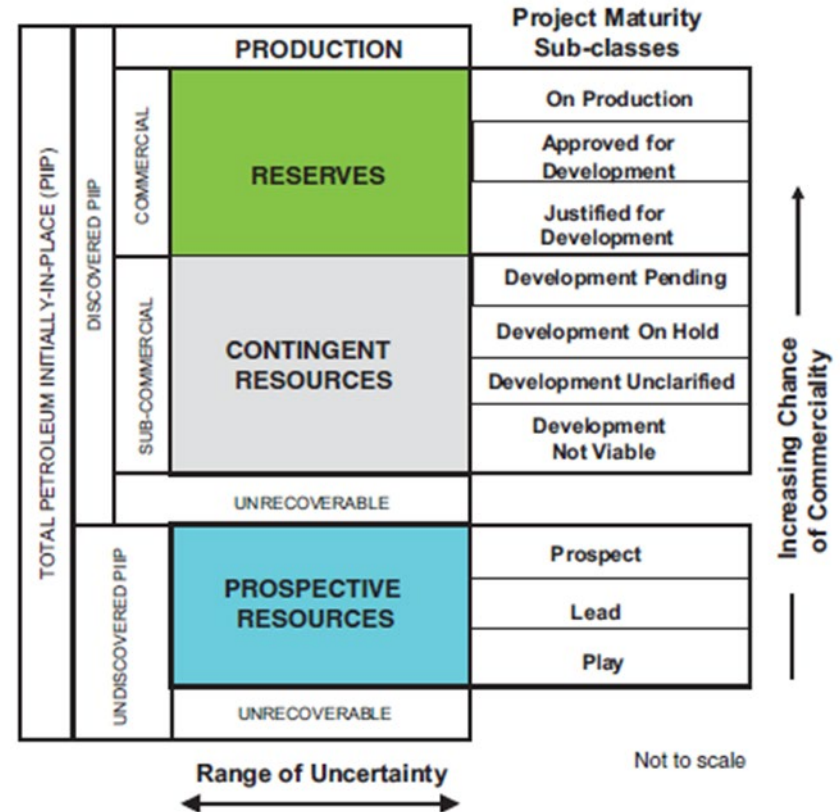
- ❑ On Production
- ❑ Approved for Development
- ❑ Justified for Development

■ Contingent Resources

- ❑ Development Pending
- ❑ Development on Hold
- ❑ Development Unclassified
- ❑ Development Not Viable

■ Prospective Resources

- ❑ Prospect, Lead, Play



- Project Maturity
- Reserves Status
 - Developed
 - Undeveloped
- Economic Status
 - Under Current or Reasonably Forecasted Conditions
 - Reserves All Economic
 - Contingent Resources
 - Economically Viable (economic but not committed)
 - Economically Not Viable (not economic)

- Can Be Applied to Any Reserves Category
- Developed
 - From Existing Wells and Facilities
 - Producing: Open and Producing at Time of the Estimate
 - Non Producing: Temporarily Shut-In and Behind Pipe
 - Discerning Between Inconsequential Work and Development Can Be Difficult
 - Cost Is Typical Delimiter
- Undeveloped
 - Expected to be Recovered from Future Investments

- Project Maturity
- Reserves Status
 - Developed
 - Undeveloped
- Economic Status
 - Under Current or Reasonably Forecasted Conditions
 - Reserves All Economic
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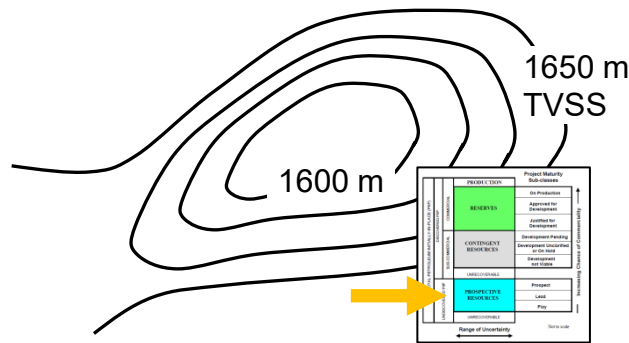
- Contingent Resources
 - Economically Viable (economic but not committed)
 - Notional Development Plans
 - Economically Not Viable (not economic)
 - Undetermined
 - Too Early for Evaluation
 - Parameters are Too Uncertain
 - Caution: Potential to be Misleading
 - Regulators Tend to Limit

PRMS Guidelines

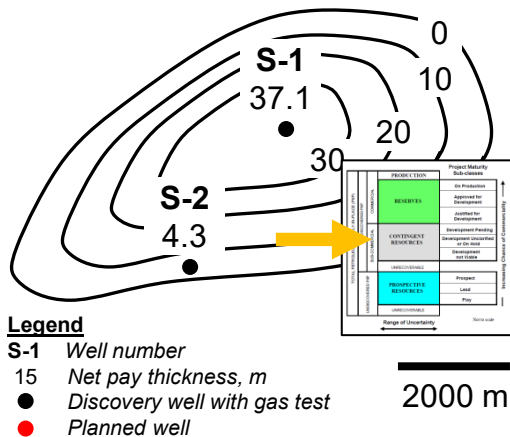
Resources vs. Reserves: Example

Resources

Prospective



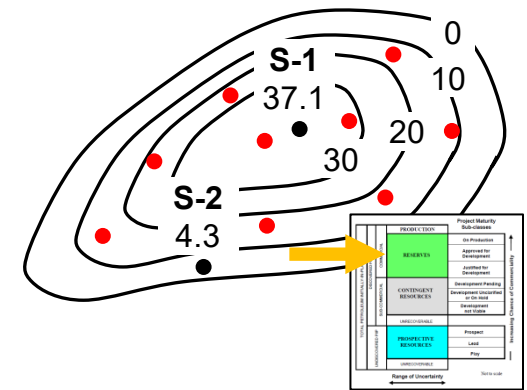
Contingent



Legend

- S-1 Well number
- 15 Net pay thickness, m
- Discovery well with gas test
- Planned well

Reserves



- Does not have discovery well

- Has discovery well

- Has discovery well

- Does not have development plan,
- or is not economic,
- or does not have sales market,
- or does not have legal right to sell production
- Or has other contingency

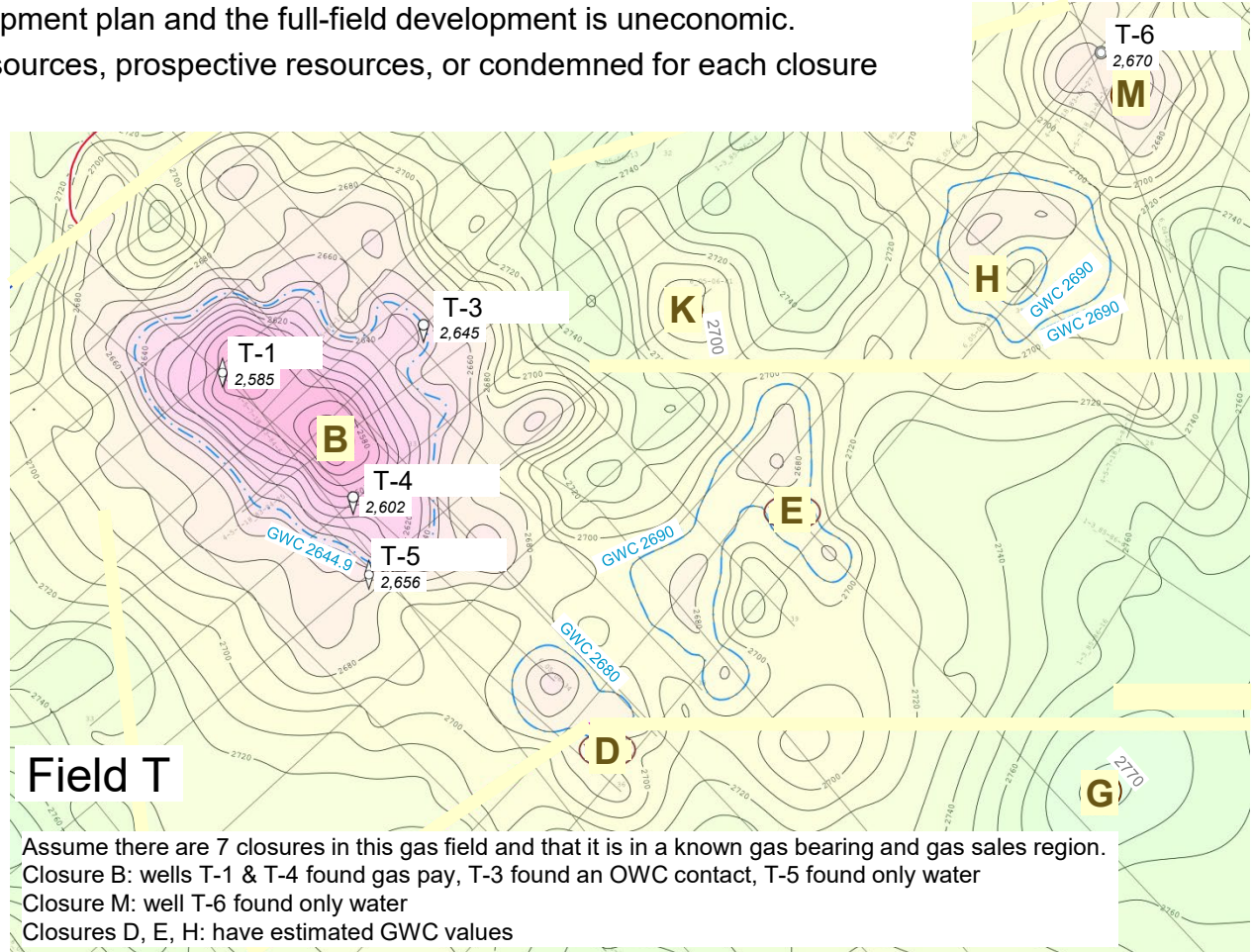
- Has committed development plan
- Is economic to develop
- Has sales market
- No legal issues selling production
- Has no other contingencies

PRMS Guidelines

Example 1: Resources vs. Reserves

Assume there is no approved development plan and the full-field development is uneconomic. Determine if reserves, contingent resources, prospective resources, or condemned for each closure below.

- B:
- D:
- E:
- G:
- H:
- K:
- M, “below” well T-6:
- M, “above” well T-6:



Answers: reserves none; contingent B; prospective H, E, D, K, G, M “above” well T-6; condemned M “below” well T-6

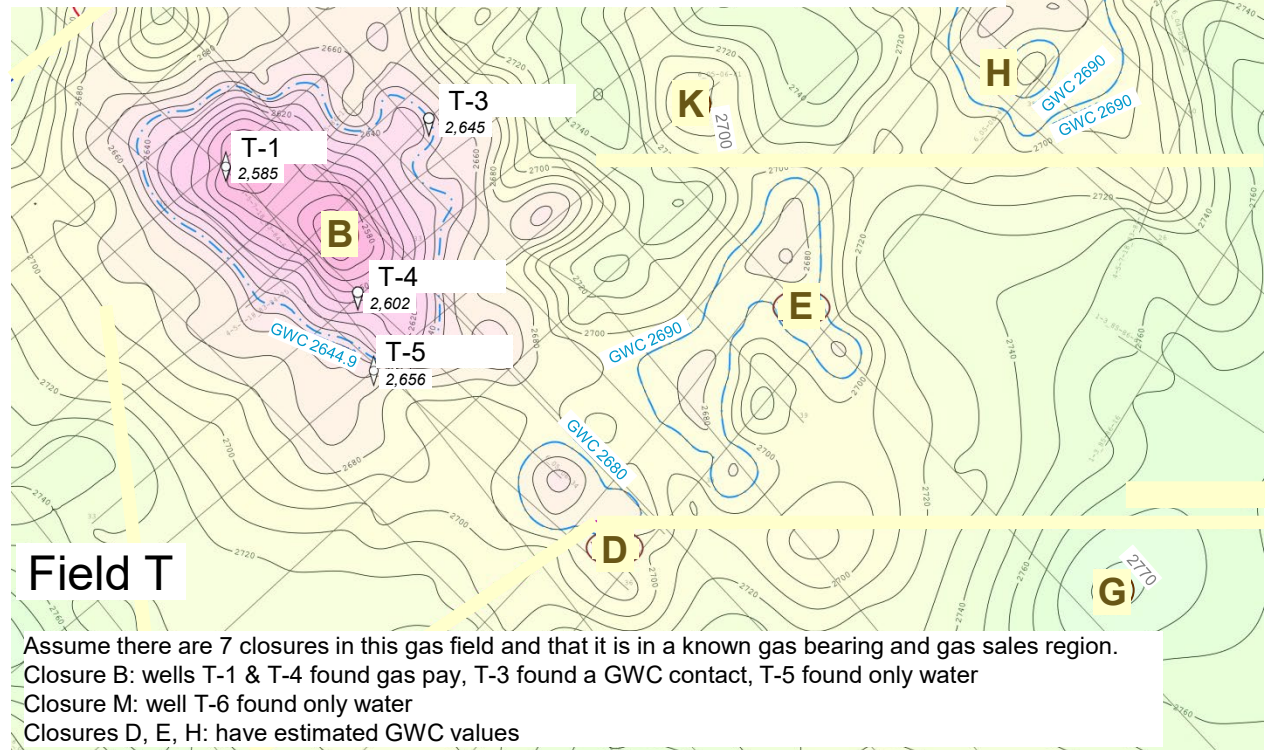
PRMS Guidelines

Example 2: Resources vs. Reserves

Now assume the board of directors “guarantees” each closure will be drilled, the approved full-field development plan is economic, and the geophysicists say a new seismic study gives “90% confidence” in the structure model.

Determine if reserves, contingent resources, prospective resource, or condemned for each closure below.

- B:
- D:
- E:
- G:
- H:
- K:
- M, “below” well T-6:
- M, “above” well T-6:



Answers: reserves B; contingent none; prospective H, E, D, K, G, M “above” well T-6; condemned M “below” well T-6

PRMS Guidelines

Categorization based on level of uncertainty

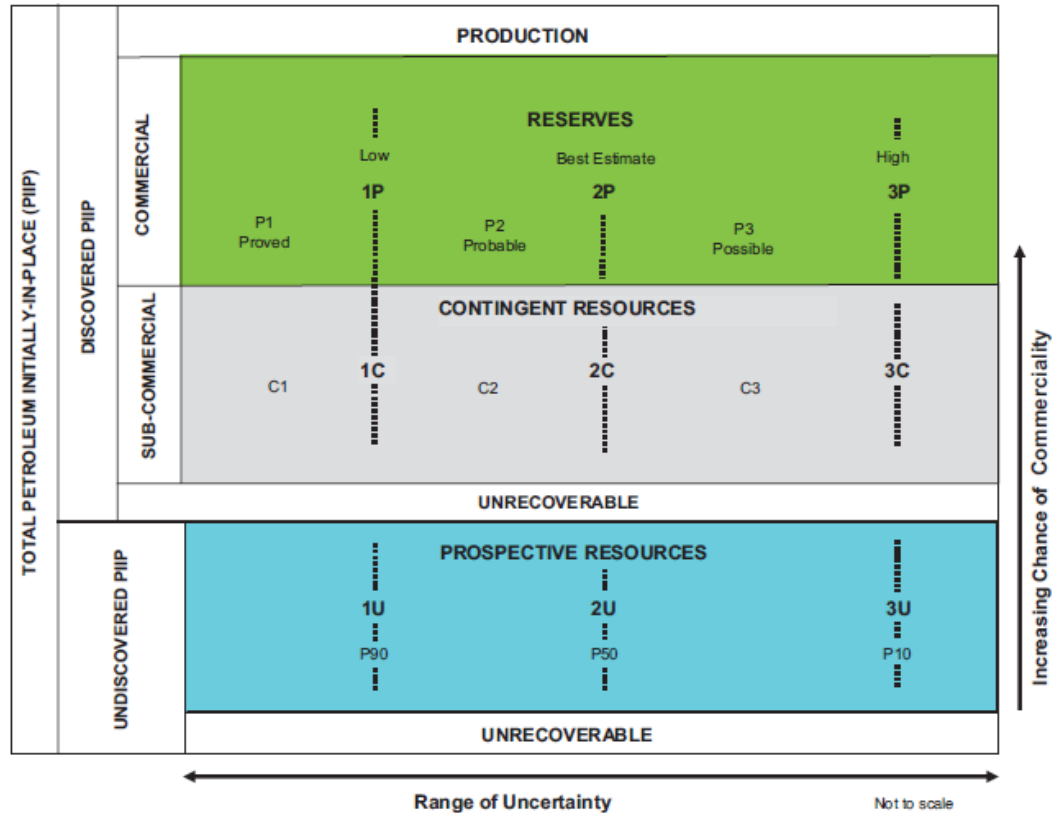


Figure 1.1—Resources classification framework

After SPE, Petroleum Resources Management System, June 2018



Categorization

Presentation Outline

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PRMS Guidelines

By definition, reserves are commercial

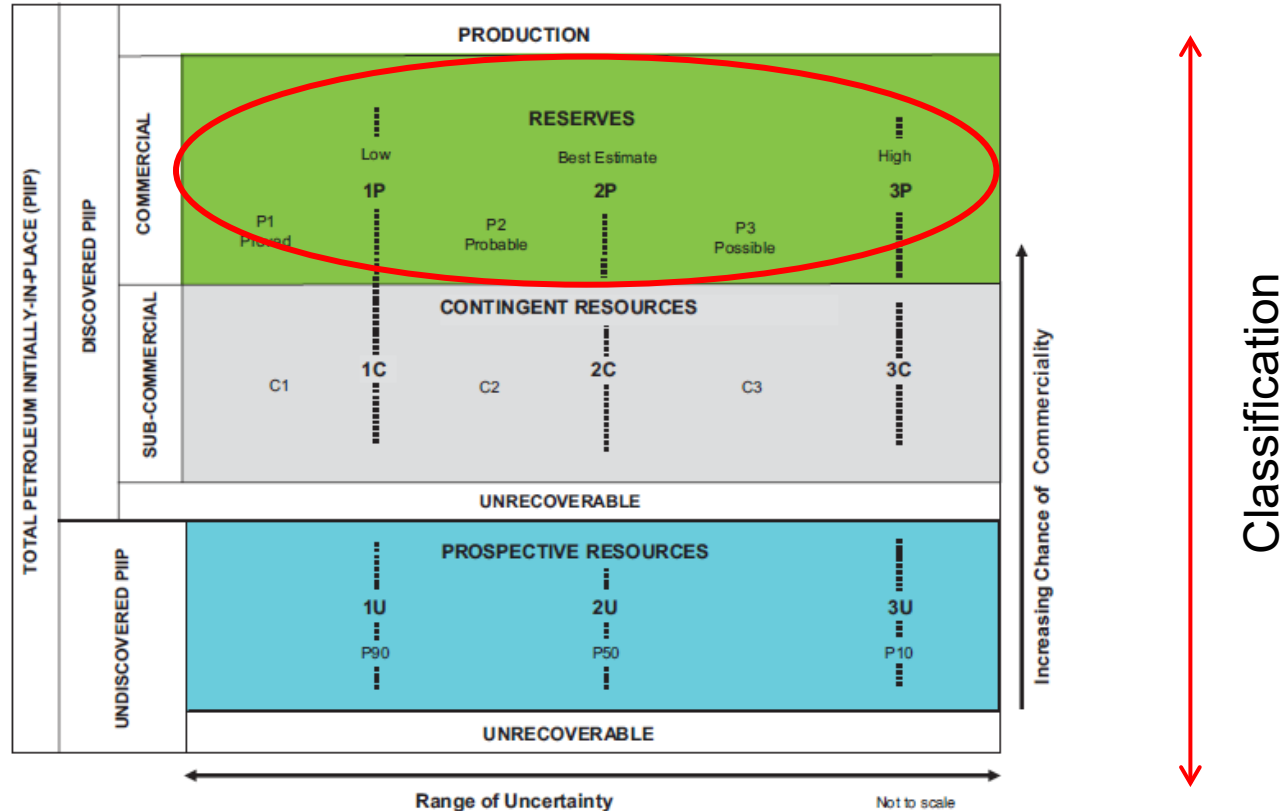


Figure 1.1—Resources classification framework

After SPE, Petroleum Resources Management System, June 2018

Categorization

PRMS Guidelines

Reserves Categories: Uncertainty of estimate defines category

■ Proved

- ❑ Reasonably certain – a high degree of confidence (>90%)
- ❑ Much more likely to increase than decrease
- ❑ Probabilistic – 90% probability (P90)

■ Probable

- ❑ The “best technical estimate” or “most likely case”
- ❑ As likely to increase as decrease
- ❑ Probabilistic – 50% probability (P50)

■ Possible

- ❑ Low level of certainty – a low degree of confidence (>10%)
- ❑ Much more likely to decrease than increase
- ❑ At least a 10% chance that actual recovery will equal or exceed the estimate
- ❑ Probabilistic – 10% probability (P10)

PRMS Guidelines

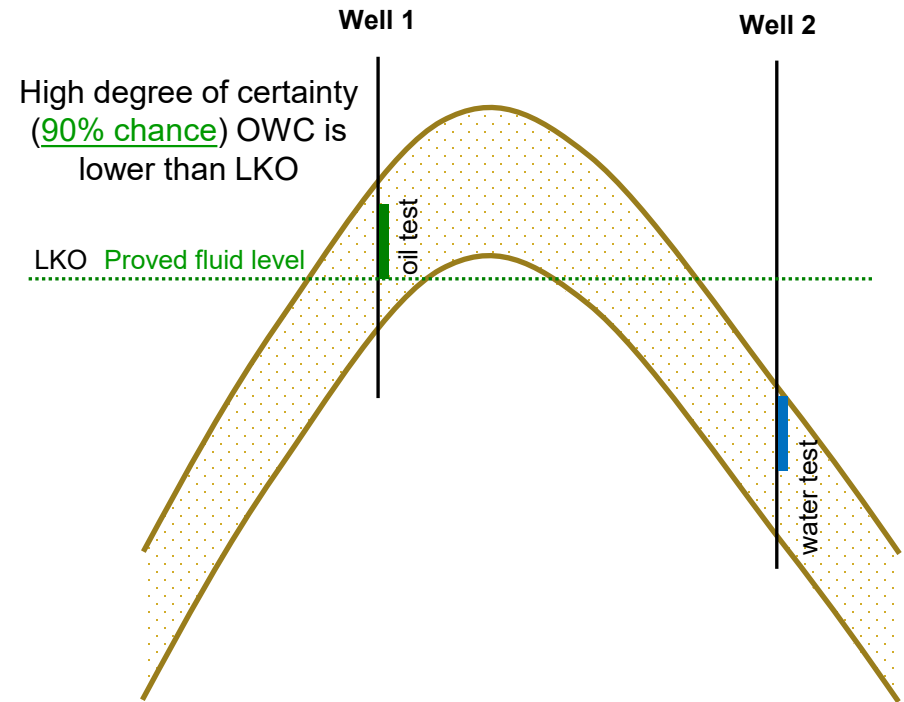
Proved Reserves

■ Proved

- ❑ From known (discovered) reservoirs
- ❑ Recoverable quantities
- ❑ From a given date forward
- ❑ Reasonable certainty
 - A high degree of confidence
 - At least a 90% certainty that actual recovery will equal or exceed estimate
- ❑ Commercially recoverable
- ❑ May not extend beyond license expiration unless extension is reasonably certain
 - A long and clear record of automatic extensions
- ❑ Gas sales contract
 - Signed or
 - Under negotiation
 - ❑ Signing is reasonably certain
 - ❑ Duration and quantity of sales known

■ Example: Fluid contact depth

- ❑ LKO - lowest known oil (well logs or tests)



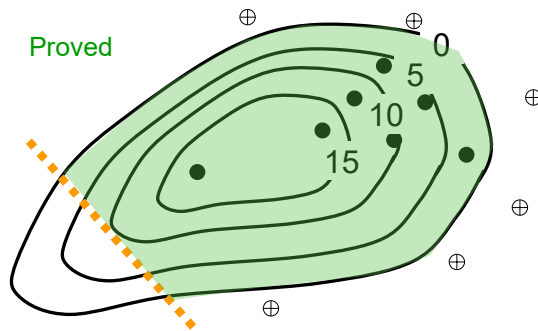
PRMS Guidelines

Proved Reserves

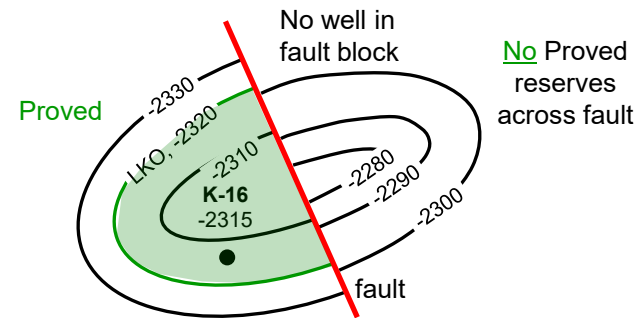
■ Proved (at least a 90% certainty)

- Mapped areas defined by production, tests, or conclusive log/core data having reasonable certainty of economic production
- No proved reserves across faults
- Reasonably certain production trends

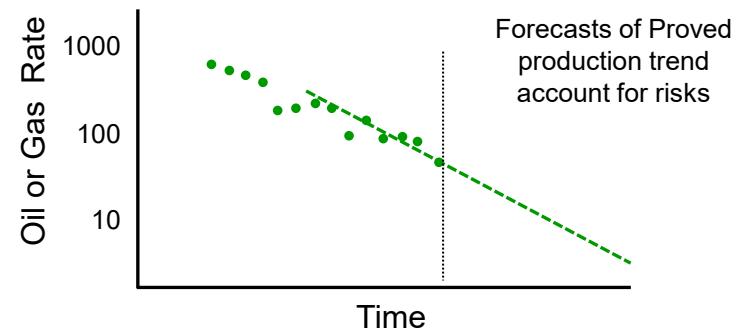
■ Example 1: Areas defined by well control and conclusive data



■ Example 2: No Proved across faults



■ Example 3: Performance trends



PRMS Guidelines

Proved sub-categories determined by economics and well status

- Once volumes determined to be Proved, then a question of economics/well status

- ❑ Still needs 90% confidence
- ❑ Major vs. minor capital expenditure
- ❑ Is there cumulative production associated with the well?

- Proved Developed (PD)

- ❑ Recovered from existing wells and facilities
- ❑ Any required costs are minor compared to cost of a new well
- ❑ Still needs 90% confidence

- Proved Developed (PD) (con't)

- ❑ May be further sub-categorized
 - Proved Developed Producing (PDP): well is producing/has produced – has associated cum
 - Proved Developed Nonproducing (PDNP): well is not producing and only requires a low cost work over to produce – no associated cum

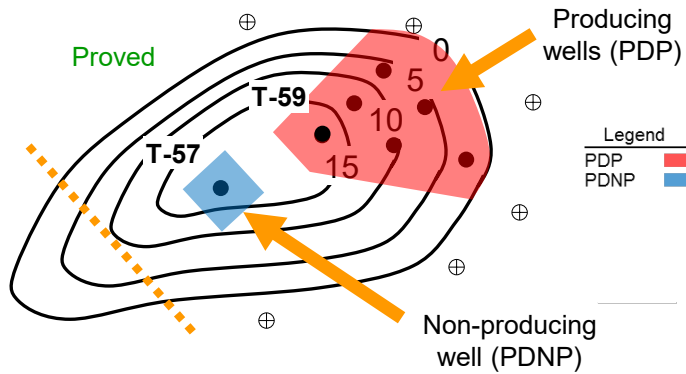
- Proved Undeveloped (PUD)

- ❑ Recovered from Proved areas that have no current wells
- ❑ Requires a major cost compared to PDNP
- ❑ Still needs 90% confidence

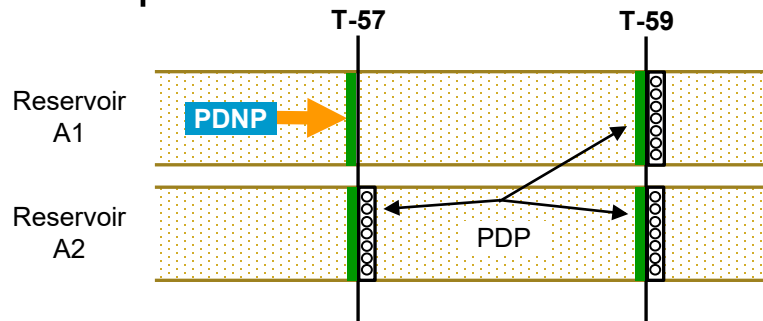
PRMS Guidelines

Examples of the sub-categories of proved developed reserves

■ Example 1: Areal



■ Example 2: Vertical



PDNP can be assigned to areas with non-producing wells that might require...

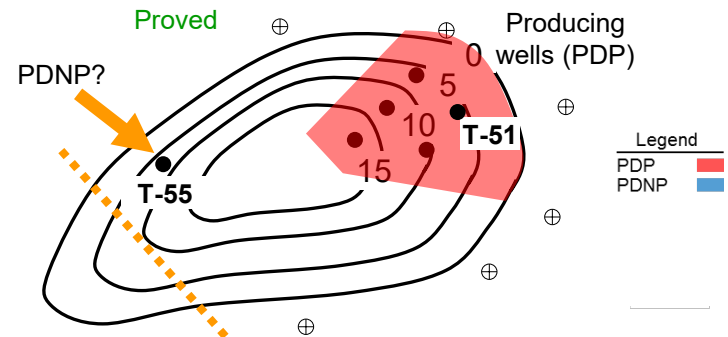
- Future work over
- Re-stimulation
- Fracture treatment
- Change of equipment
- Mechanical procedures
- Minor capital expenditure in order to become profitable

PRMS Guidelines

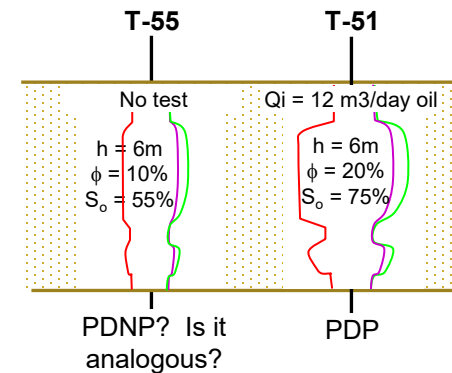
Example: PDNP in area of nearby well?

- When can reserves be PDNP?
 - ❑ Still need 90% confidence...
 - ❑ Is there an analogy?
 - Well parameters “as good as or better than...”
 - ❑ Is there a plan to complete well?
 - ❑ Is it economic?
- Based on well log data, does the area around well T-55 have PDNP reserves?
 - ❑ Why or why not?

- Candidate for PDNP?



- Data: well logs for the two above wells

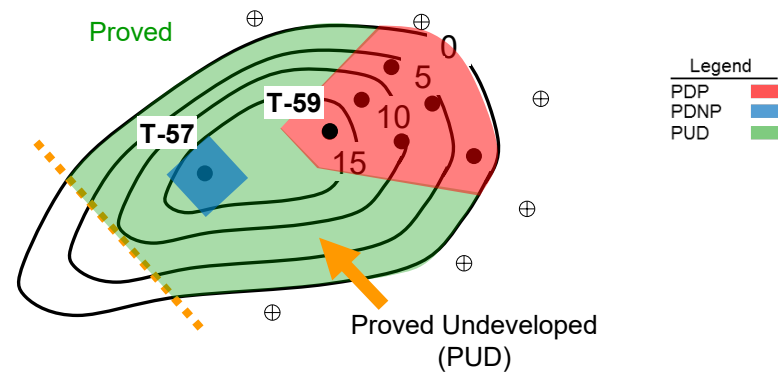


PRMS Guidelines

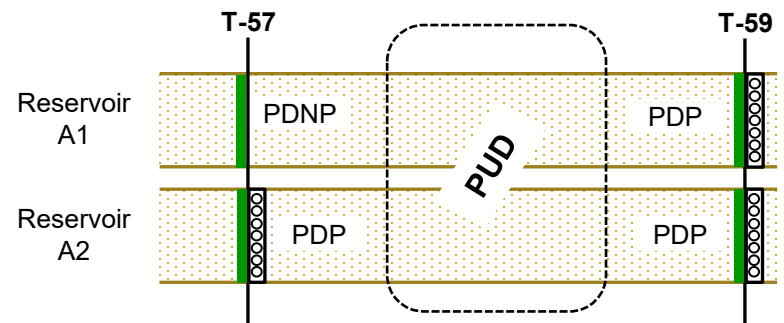
Proved Reserves Sub-Categories: Proved Undeveloped

- **Proved Undeveloped (PUD)**
 - Recovered from Proved areas that are undrilled or drilled areas that require major capital expenditure
 - Requires a major cost compared to PDNP
 - Still needs 90% confidence

■ Example 1: Areal



■ Example 2: Vertical



PRMS Guidelines

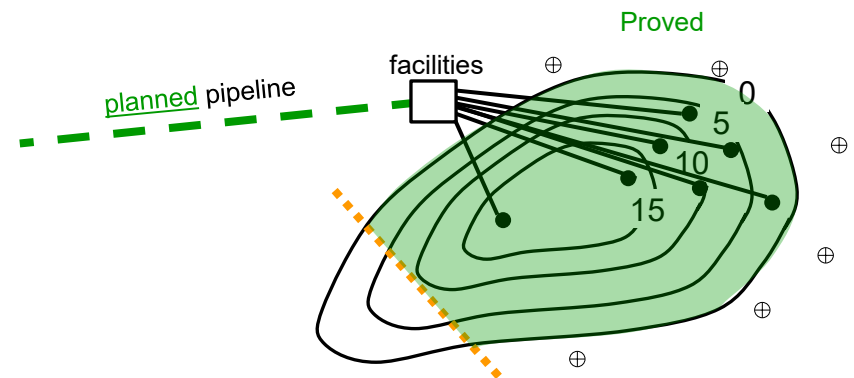
Example: PUD... All large capital projects

■ Proved Undeveloped (PUD)

- ❑ Proved quantities that require significant capital cost (still needs 90% confidence)
 - Offset-drilling areas
 - Deepening existing wells to deeper, proved reservoirs
 - Improved recovery projects
 - Infill drilling projects
 - Installation of production facilities
 - Planned gas compression
 - Installation of pipelines
 - High-cost work over of existing well
 - All large capital projects

■ Example: Pipeline installation

- ❑ The main wells in a field have been drilled, and production facilities installed
- ❑ There is a committed plan to install an expensive export pipeline, but the pipeline has not yet been built



- If all the above areas in the example field are “Proved”, are they PDNP or PUD?

PRMS Guidelines

PUD vs. PDNP Guidelines

- Capital costs for PDNP are minor relative compared to new well costs
- International companies generally specify <50% of new well costs as a maximum PDNP cost
- If drilling a new well costs \$2.0MM...
 - and a sidetrack drill costs \$0.2MM, can the sidetrack be called PDNP?
 - what if the sidetrack drill costs \$1.0MM, can the sidetrack be called PDNP?

PRMS Guidelines

Proved Reserves: Additional points

- Gas reserves require...
 - ❑ Signed contract (or existing gas sales), or...
 - ❑ Contract under serious and earnest negotiations, and...
 - Signing is reasonably certain (at least 90% certain)
 - Duration, quantity, and sales price are known with 90% certainty
- Proved reserves (of any sub-category) may not extend beyond license expiration unless extension is reasonably certain
 - ❑ A long and clear record of automatic extensions
- PRMS allows reporting of non-hydrocarbon products if they are sold economically
 - ❑ Sulfur
 - ❑ Helium
- Commercially recoverable
 - ❑ Meets internal economic hurdles (positive FNR, PV@10%, etc.)
 - ❑ May use escalated prices and costs to make estimates

PRMS Guidelines

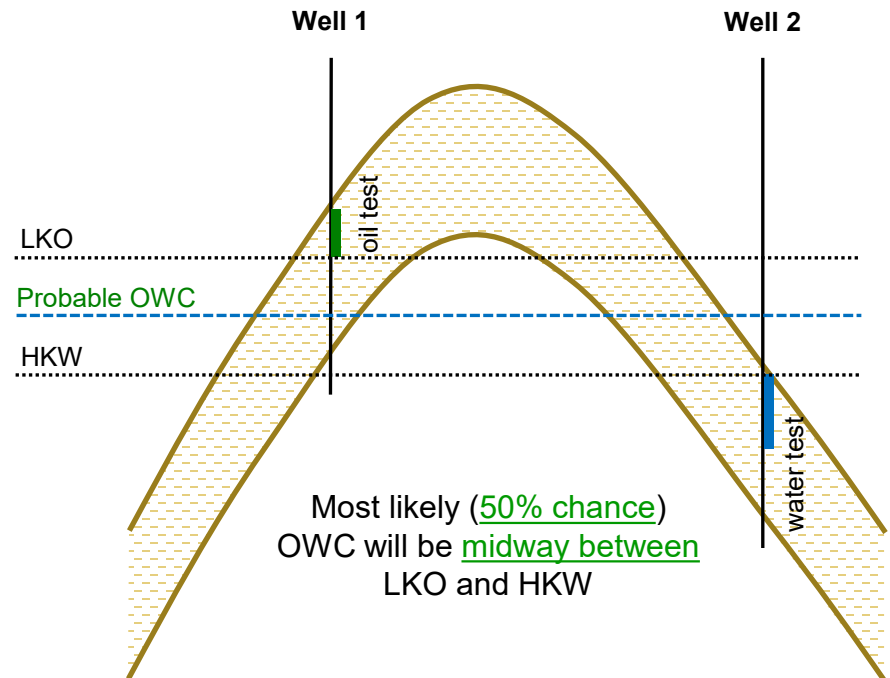
Probable Reserves

■ Probable

- Same general requirements as proved except degree of certainty
- More likely than not to be recovered
 - At least a 50% certainty that actual recovery will equal or exceed estimated proved-plus-probable reserves
 - “Best technical estimate” or “most likely case”

■ Example: Fluid Contact Depth

- Midway between LKO and HKW
- From well logs or tests

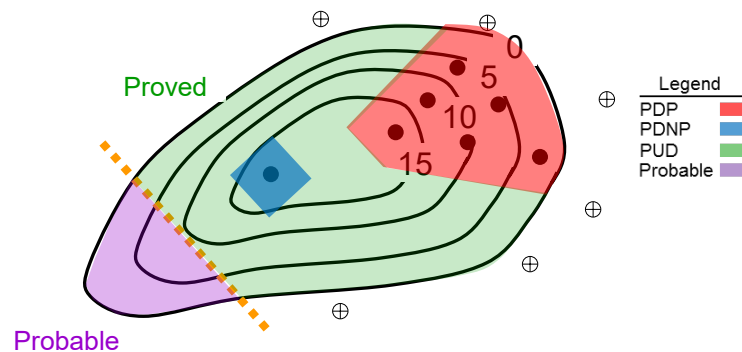


PRMS Guidelines

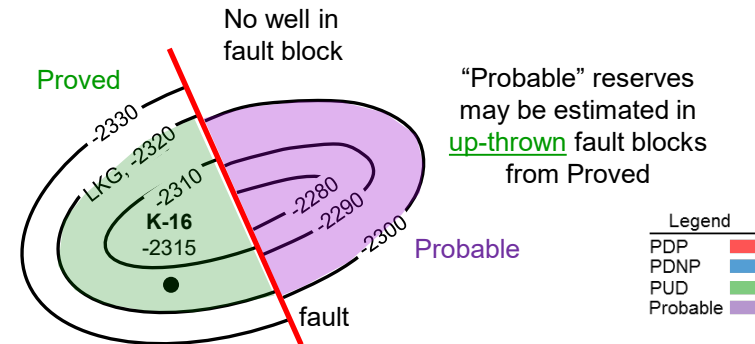
Probable Reserves

- **Probable** (at least 50% certainty)
 - Normal “step-out” drilling from non-proved areas
 - Mapped pay, but no well tests or analogs
 - Across faults, but up-thrown
 - Alternative performance interpretation

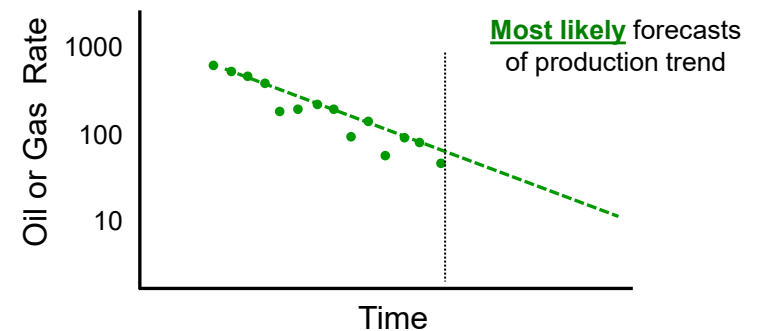
- **Example 1: Areas with limited/lower quality data**



- **Example 2: Up-thrown fault blocks**



- **Example 3: Performance trends**



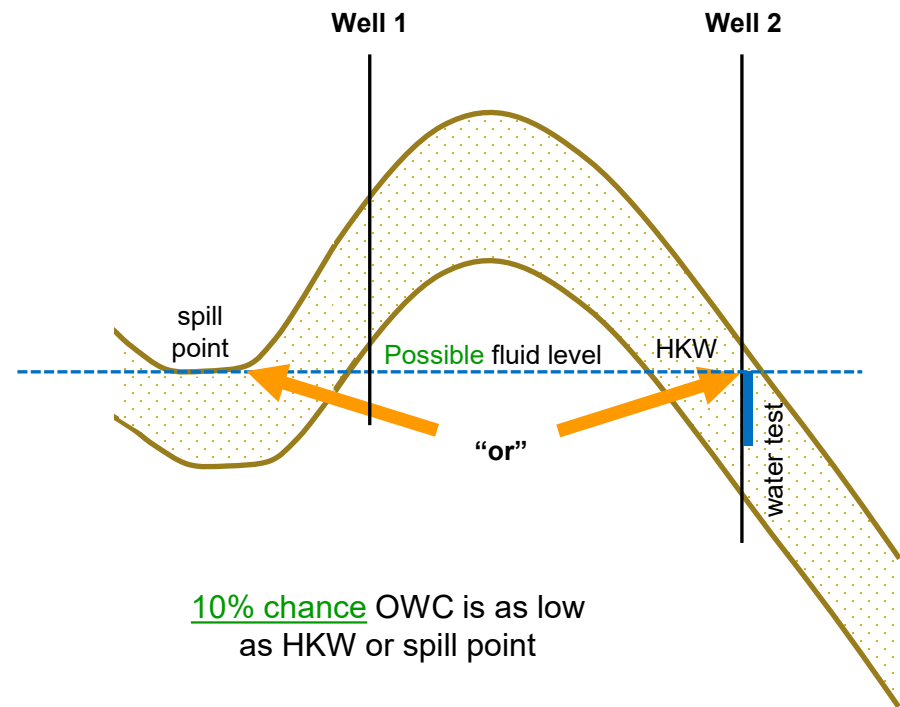
Possible Reserves

■ Possible

- Same general requirements as proved and probable except degree of certainty
- Less certain than probable
 - At least a 10% certainty that actual recovery will equal or exceed estimated proved-plus-probable-plus-possible reserves

- Example: Fluid contact depth

- ❑ HKW - Highest known water (well logs or tests)
- ❑ Spill point (structure map)



10% chance OWC is as low as HKW or spill point

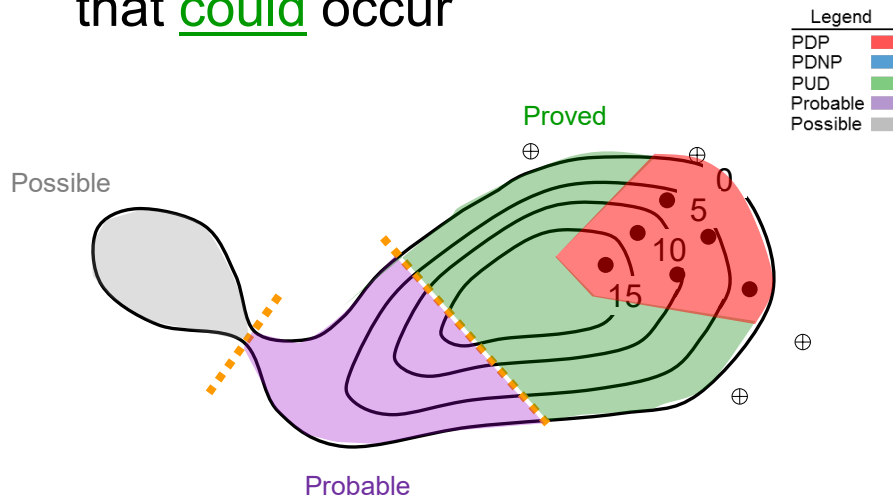
PRMS Guidelines

Possible Reserves

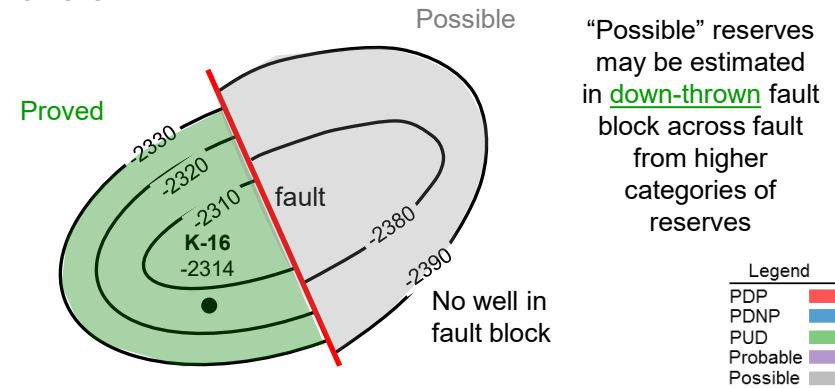
■ Possible (at least a 10% certainty)

- Geologic mapping that could occur
- Across faults but down-thrown
- Considerable technical uncertainty

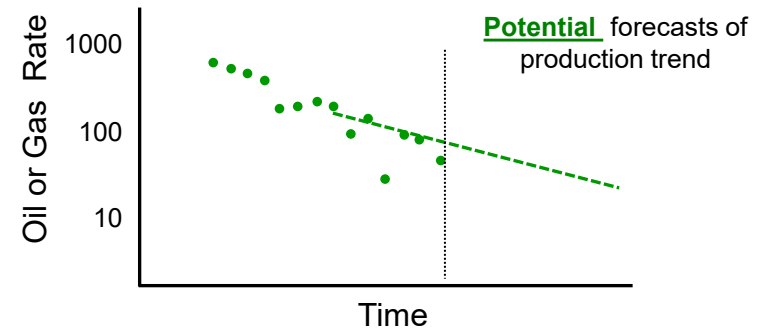
■ Example 1: Areas with mapping that could occur



■ Example 2: Down-thrown fault block



■ Example 3: Performance trends



PRMS Guidelines

Categorization of improved recovery projects

■ Improved Recovery Projects

- ❑ Adding energy to reservoir to increase recovery efficiency
- ❑ Commonly applied to oil reservoirs
- ❑ Due to uncertainty of success, may be categorized as proved, probable or possible reserves, or contingent resource

■ Improved Recovery Methods

- ❑ Waterflooding
- ❑ Pressure support
- ❑ Gas flooding (miscible or immiscible)
- ❑ Polymer flooding
- ❑ Thermal recovery

■ Proved

- ❑ Successfully field tested (response)
- ❑ Analogous or same reservoir
- ❑ Committed/approved
- ❑ Economic

■ Probable

- ❑ Not field tested
- ❑ Committed/approved
- ❑ Economic

■ Possible

- ❑ Conceivable
- ❑ Committed/approved
- ❑ Economic

PRMS Guidelines

Review of common Reserves acronyms

Reserve Estimations

- Proved (P1)
 - PDP: Proved Developed Producing
 - PDNP: Developed Non-Producing
 - PD: Proved Developed (PDP + PDNP)
 - PUD: Proved Undeveloped
 - TP: Total Proved (PD + PUD)
- Probable (P2)
- Possible (P3)

Projections and Economics

- Proved Developed (PD)
- Total Proved (1P)
- Proved-plus-Probable (2P)
- Proved-plus-Probable-plus-Possible (3P)

Presentation Outline

This presentation is organized into the following sub-sections

- Introduction to the Petroleum Resources Management System (PRMS) Guidelines
- Reserves vs. Resources
- Reserves
 - Proved
 - Probable
 - Possible
- Resources
 - Contingent resources
 - Prospective resources
- Standards for estimating and reporting reserves

PRMS Guidelines

Classification is based on project maturity/chance of commerciality

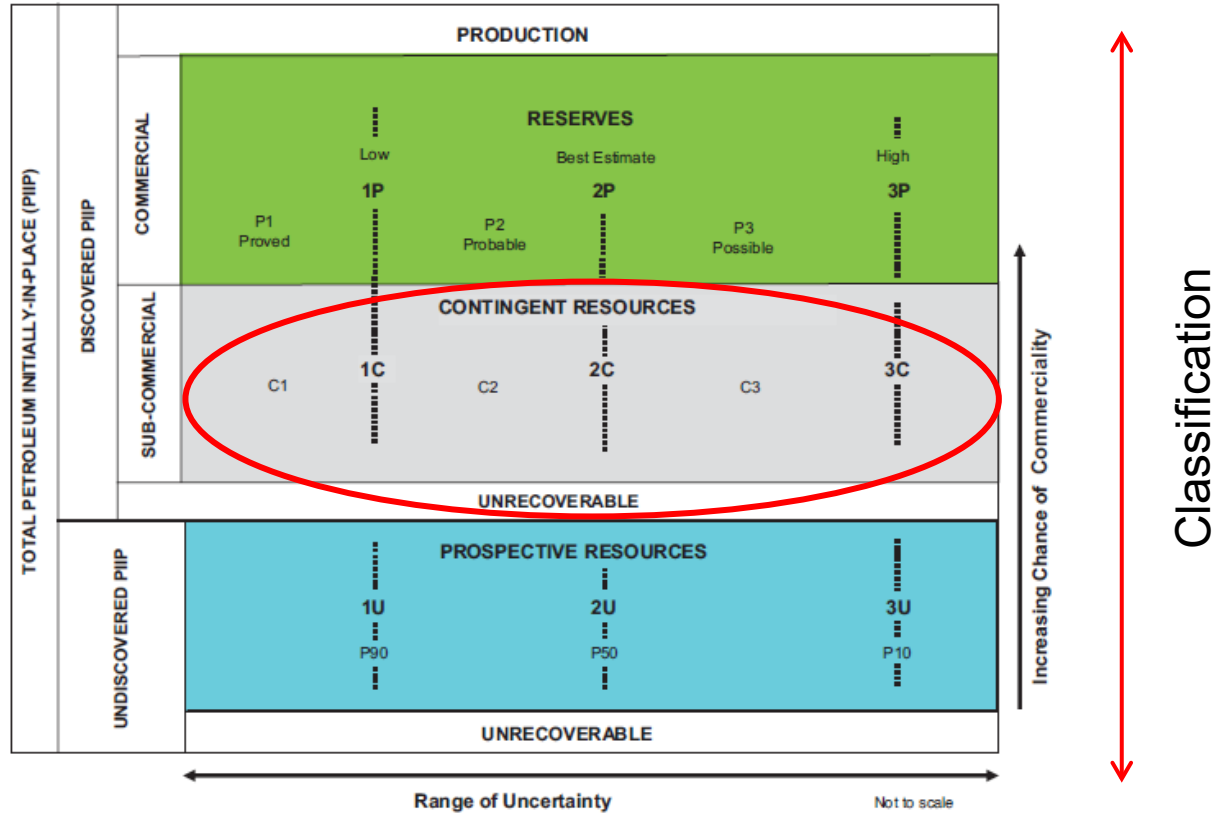


Figure 1.1—Resources classification framework

After SPE, Petroleum Resources Management System, June 2018

Categorization

PRMS Guidelines

Resource Categories: Contingent Resources

- From known (discovered/drilled) reservoirs
- Quantities of recoverable petroleum that are not currently considered commercially recoverable due to one or more contingencies
 - ❑ No internally approved development plan (no commitment of capital)
 - ❑ No government approval
 - ❑ No sales market or gas-sales contract
 - ❑ Development not economically viable
 - ❑ Development un-clarified or on hold (significant delay)
- Estimated from a given date forward
- When all of the contingencies are removed, these quantities will be upgraded directly to reserves

PRMS Guidelines

Resource Categories: Contingent Resources

- Categorized and reported as follows:
 - 1C = P90, low estimate...proved reserves with a contingency
 - 2C = P50, best estimate...proved-plus-probable reserves with a contingency
 - 3C = P10, high estimate...proved-plus-probable-plus-possible reserves with a contingency
- Deterministic or probabilistic
- Careful!!! When all of the contingencies are removed, contingent resources will move directly to reserves
 - C1 → Proved
 - C2 → Probable
 - C3 → Possible
- D&M generally uses deterministic estimates for contingent resources

PRMS Guidelines

Separate Classification and Categorization

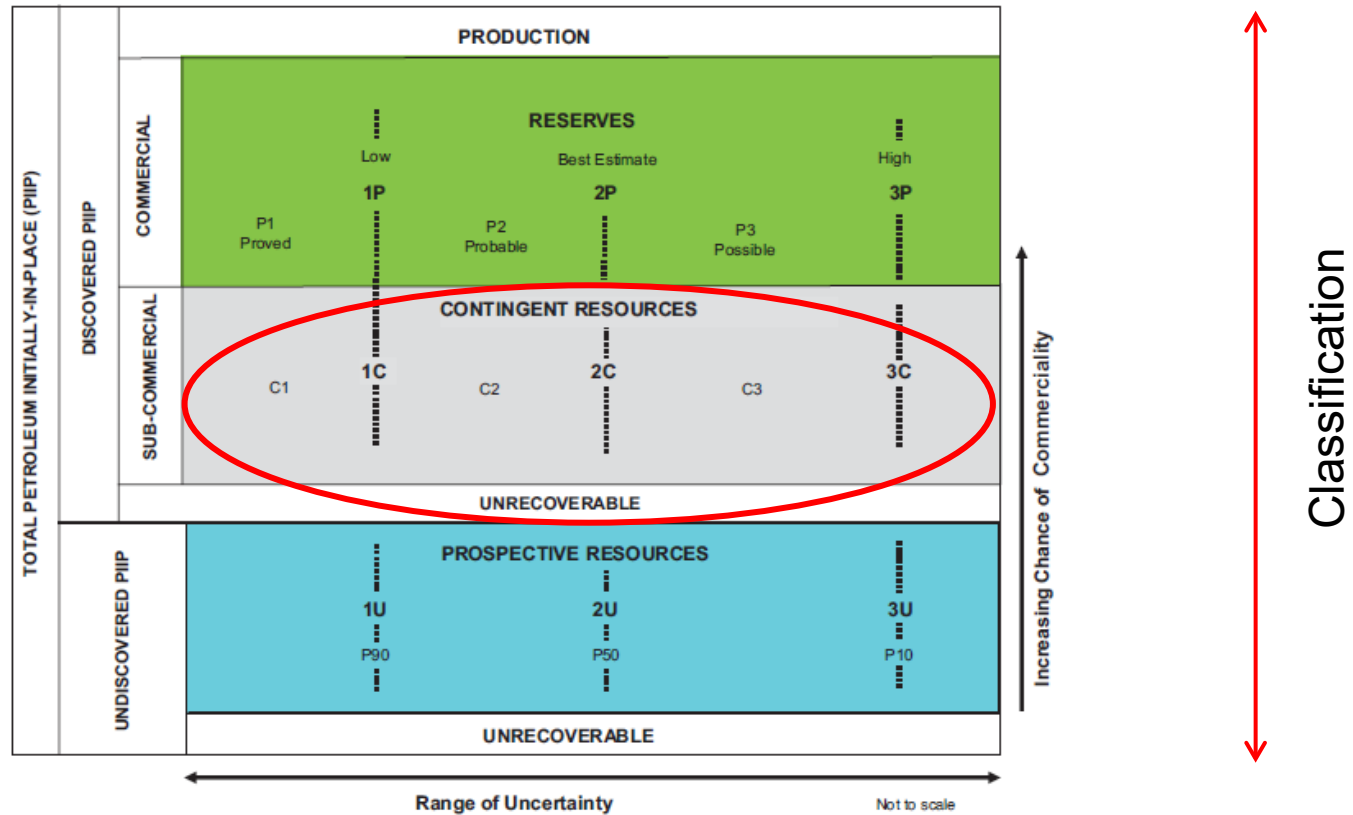


Figure 1.1—Resources classification framework

After SPE, Petroleum Resources Management System, June 2018

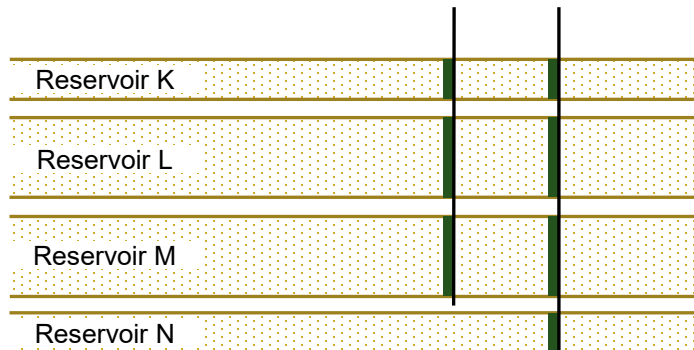
Categorization

PRMS Guidelines

Classification of volumes can change over time: Example: Development plans are not followed

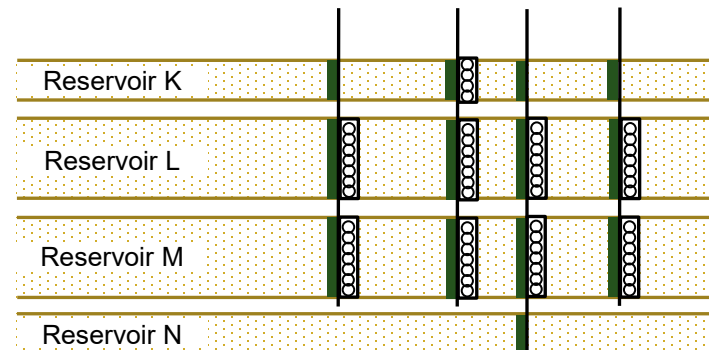
■ Example: Early time

- Reserves are estimated in an oil field based on log and test data
 - 2 major reservoirs (L, M)
 - 2 minor reservoirs (K, N)
- Because client plans to develop all four reservoirs, PUD reserves are estimated



■ Example: Later time

- Operator has only produced L and M, does not plan to drill N, and has uncertain plans for K
- What is status of oil reserves for K and N reservoirs?
 - PUD?
 - Reserves or Contingent Resources?

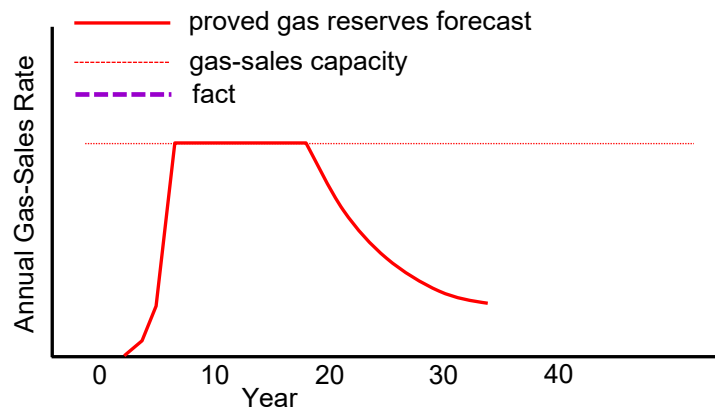


PRMS Guidelines

Classification of volumes can change over time: Example: Gas-sales plans are not followed

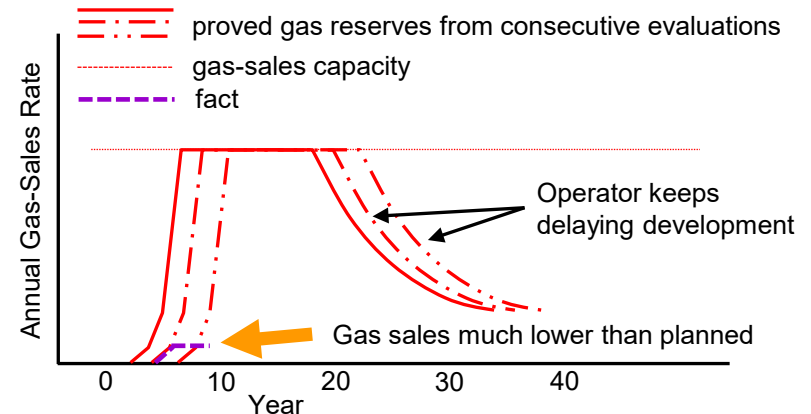
■ Example: Early time

- ❑ Operator has plans to develop an onshore gas field near an industrial complex
- ❑ PUD gas reserves were estimated based on earnest gas-sales “negotiations”, but no existing gas-sales contract



■ Example: Later time

- ❑ Operator has repeated low gas sales (much lower than planned), and says there is limited gas demand in the area (but it's not their fault)
- ❑ What is status of gas reserves?
 - PUD?
 - Reserves or Contingent Resources?



PRMS Guidelines

Classification is based on project maturity/chance of commerciality

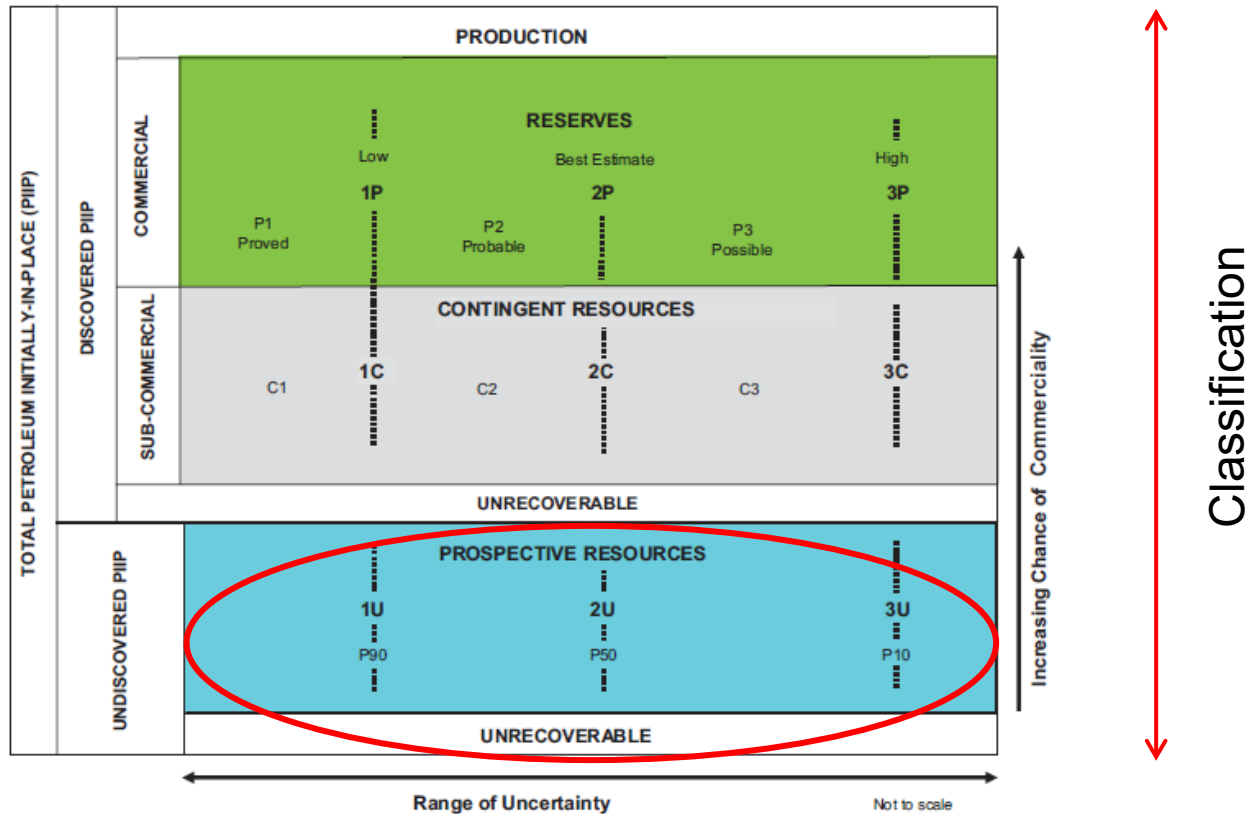


Figure 1.1—Resources classification framework

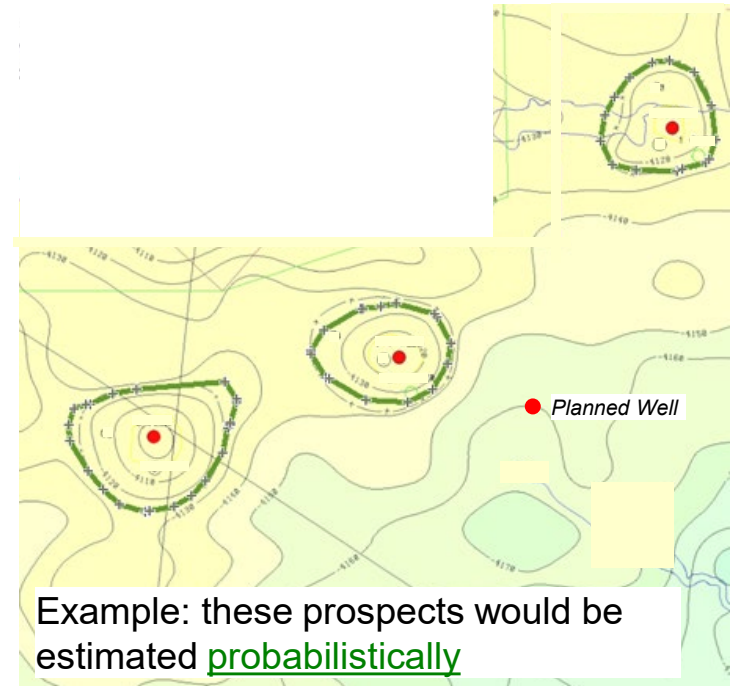
After SPE, Petroleum Resources Management System, June 2018

Categorization

PRMS Guidelines

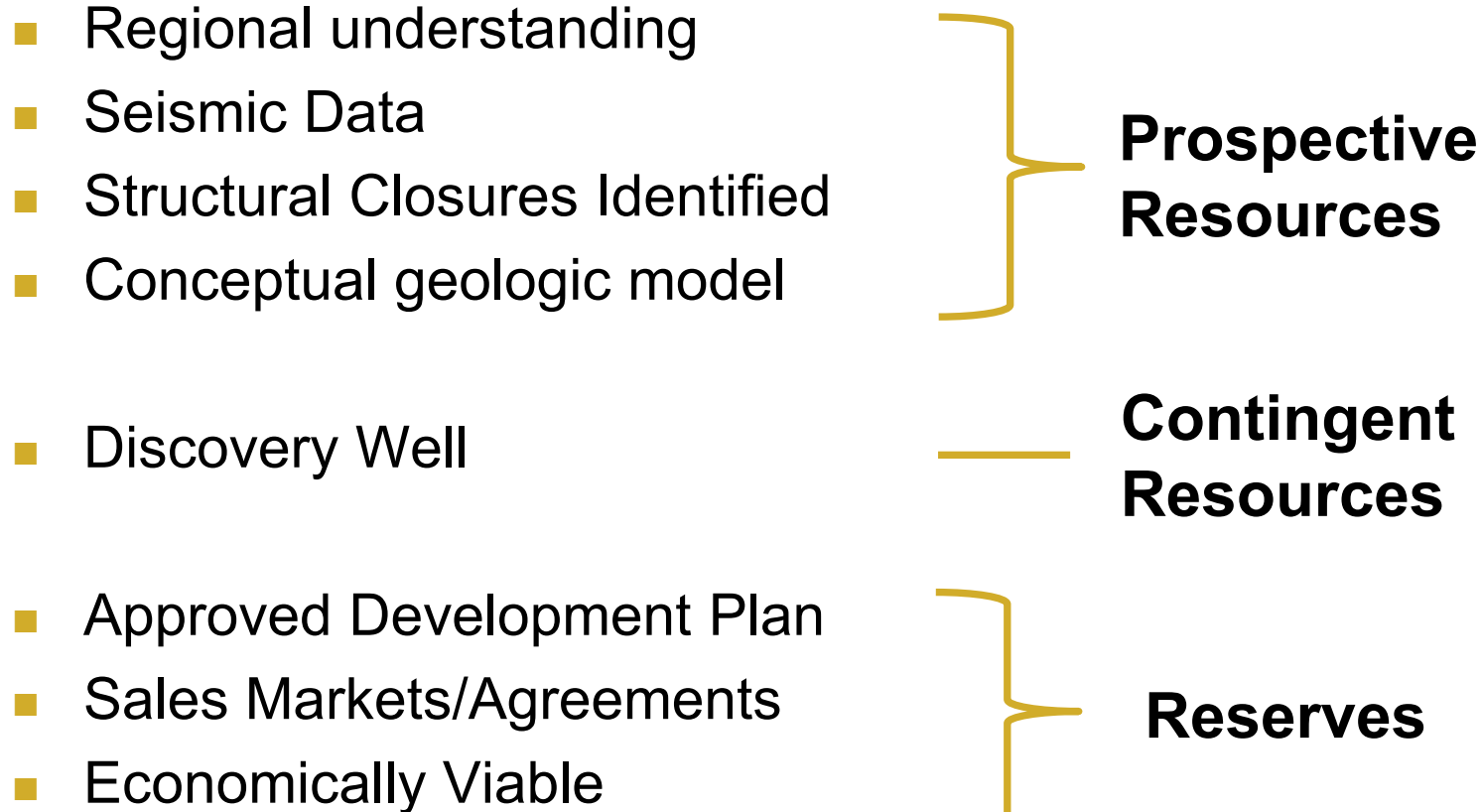
Resource Categories: Prospective Resources

- Potentially recoverable from undiscovered (undrilled) accumulations
 - Technical and commercial uncertainties
- Estimated from a given date forward
- Reported in a range
 - Low (P90)
 - Best (P50)
 - High (P10)
 - Mean
- Estimated using probabilistic methods
- Structures are typically based on seismic data
- Uncertainty must be quantified for Reservoir, Trap, Source, Migration



PRMS Guidelines

Path to Reserves



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PRMS Guidelines

Standards for Estimating and Auditing Reserves Information*

- SPE (Society of Petroleum Engineers) has its own standards for estimating and auditing reserves

- “Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserves Information”
 - ❑ 1977: originally issued
 - ❑ 2001: updated
 - ❑ 2007: revised (included modifications from the 2007 PRMS Reserves and Resources System)
 - ❑ 2018: revised (Firming up of various references and definitions)

- Sets standards for reserves estimators and auditors

* Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserves Information, Approved by SPE Board in June 2001, Revision as of February 19, 2007

PRMS Guidelines

Standards for Reserves Estimators and Reserves Auditors*

- Standards for Reserves Estimators and Reserves Auditors
 - ❑ Independence
 - ❑ Objectivity
 - ❑ Disclosure of conflicts of interest (e.g., owning stock the company)
 - ❑ Confidentiality
 - ❑ Should “decline an assignment for which he or she is not qualified”

* Standards Pertaining to the Estimating and Auditing of Oil and Gas Reserves Information, Approved by SPE Board in June 2001, Revision as of February 19, 2007

PRMS Guidelines

Typical D&M Reserves Evaluation Workflow

