PRMS Update

Gaffney Cline

Presented by
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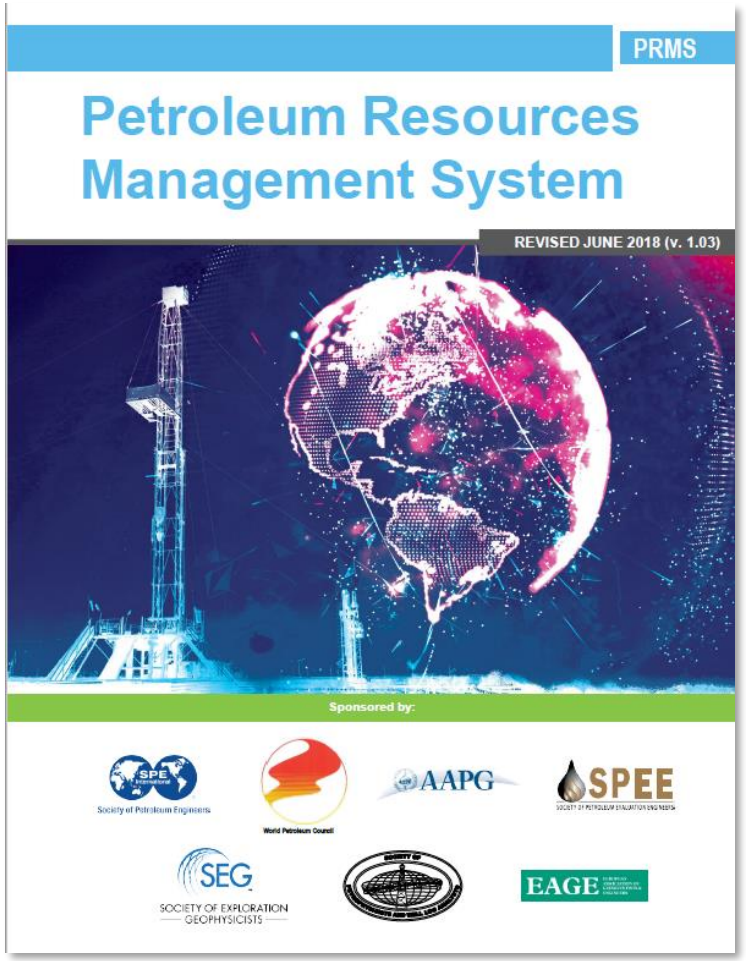
Readers are urged to obtain independent advice on any matter relating to the interpretation of reserves and resources definitions and guidance



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PRMS Update

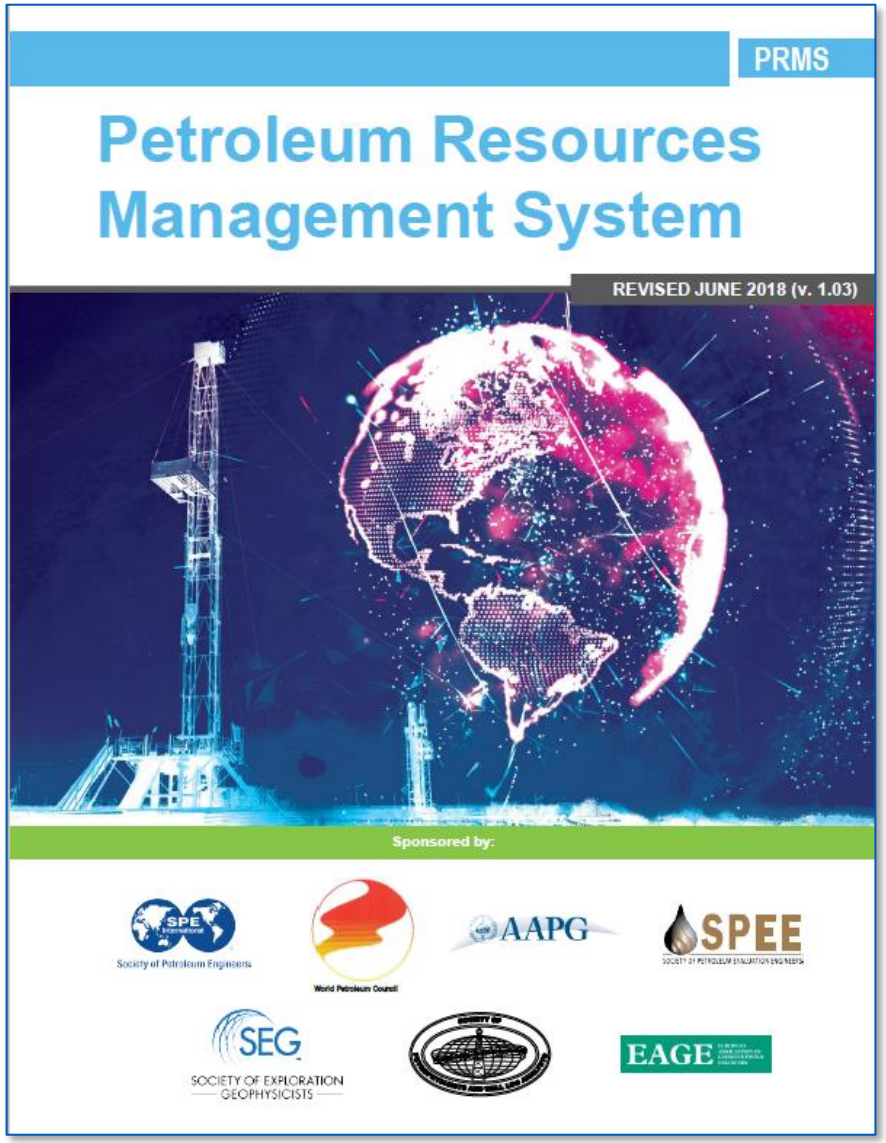
The PRMS has seen broad acceptance across the globe as the *de facto* standard for reserves and resources evaluations

Update issued in 2018

- Current version is 1.03 (includes errata only, no update)

After publication, the intent was to issue three sets of documents to enhance the understanding of the PRMS, which is mainly a principles-based document

- **FAQs**
  - Web-based responses to common questions
- **Application Guidelines**
  - Update of the 2011 guidelines which related to the 2007 PRMS
  - Published (for purchase) in 2022
- **Worked examples**
  - To provide more detailed usage guidance for specific situations
  - Some were included in the guidelines, others pending



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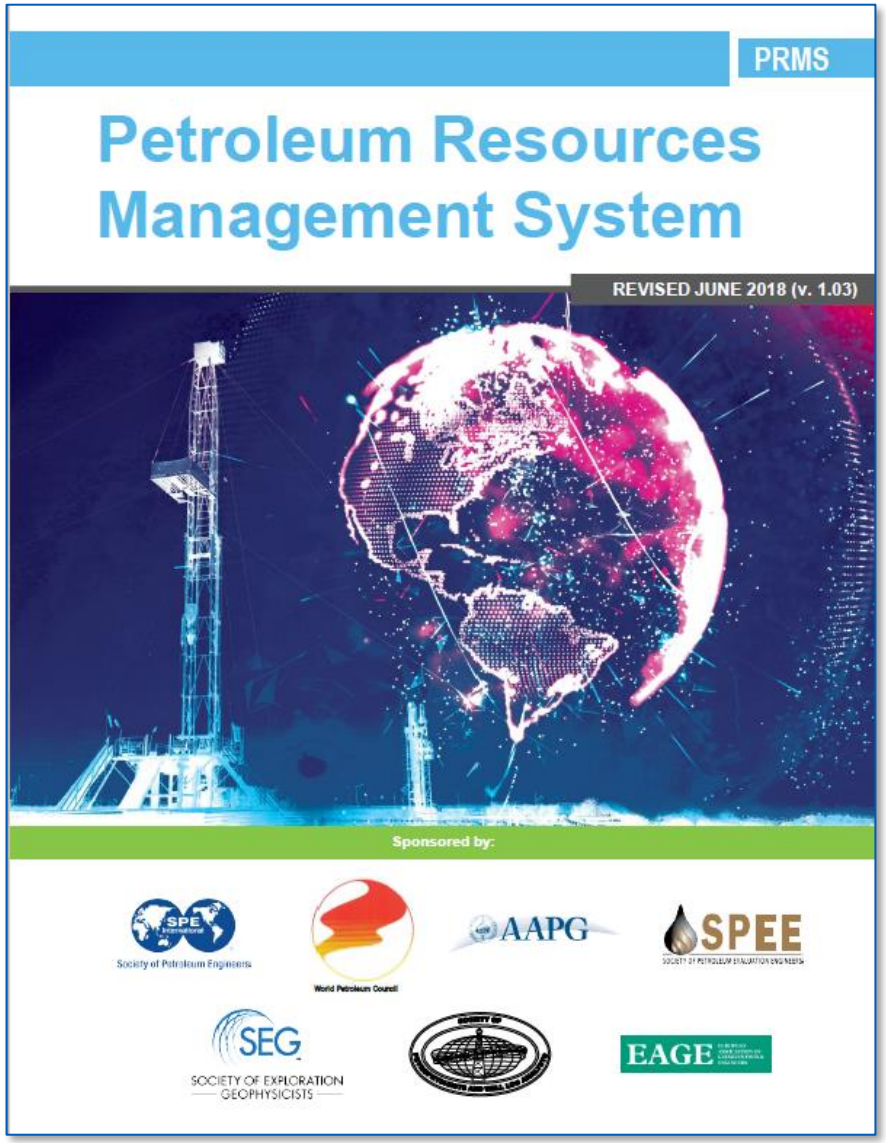
Today's Discussion

- **FAQs**
  - Review of some key questions and responses
- **Application Guidelines**
  - Mention of changes
- **Extension of PRMS to non-hydrocarbons**
  - Highlight the main potential new uses of the PRMS
- **Worked Examples**
  - Not published yet – first may be:
    - Chance of Development
    - Economic vs. commercial



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What are the PRMS FAQs?

- Following the publication of the updated PRMS in 2018, the OGRC decided that it would be helpful to provide additional guidance to users in response to enquiries received from the public
- Questions were posed at workshops and other forums and gathered by a small group of volunteers
- Organized by the SPE OGRC and supported by the co-sponsoring organizations of the PRMS

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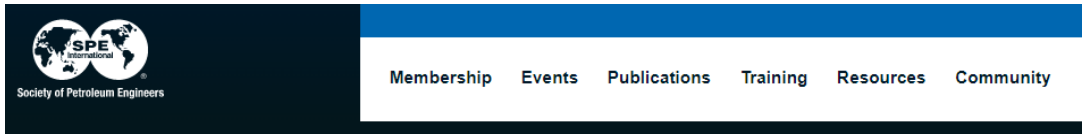
Where can I find the FAQs?

https://www.spe.org/en/industry/reserves/



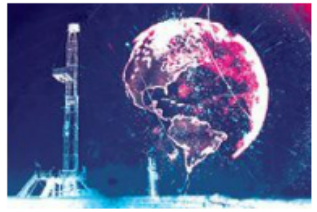
No charge

Petroleum Reserves and Resources Definitions

The Society of Petroleum Engineers (SPE) Oil and Gas Reserves Committee, made up of international oil and gas experts, partners with several industry related societies to provide publicly available resources for the consistent definition and estimation of hydrocarbon resources. As part of this work, SPE offers documents including the Petroleum Resource Management System (PRMS), the PRMS Application Guidelines, as well as a map to other systems, and standards for reserves estimating and auditing.

For questions related to PRMS, please email ogr@spe.org.

Petroleum Resources Management System



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

The Oil and Gas Reserves Committee has completed the revision of the Petroleum Resources Management System (PRMS) and the SPE Board approved it in June 2018. The updated PRMS is a consensus of input collected from consulting and financial firms, government agencies, and E&P companies. The process included a 90-day public comment period, and required input and approval by six sponsoring societies: the World Petroleum Council, the American Association of Petroleum Geologists, the Society of Petroleum Evaluation Engineers, the Society of Exploration Geophysicists, the European Association of Geoscientists and Engineers, and the Society of Petrophysicists and Well Log Analysts.

- Download a PDF of the 2018 PRMS, the 2018 PRMS Errata and the 2022 PRMS Errata

Key Changes from PRMS 2007 to PRMS 2018

The 2018 PRMS update maintains the foundation principles contained in the PRMS 2007 and addresses many of the points in need of clarification that have been collected over the years. This document describes the key changes.

- PRMS 2018 Key Changes (pdf)

Translations

- PRMS 2018 русский v. 1.0 (pdf) and русский Errata (pdf)
- PRMS 2018 Español v. 1.0 (pdf)

PRMS Frequently Asked Questions (FAQs)

The FAQs document presents questions received with answers prepared by the OGRC and reviewed by the other Sponsors of the PRMS, offering guidance on the interpretation and usage of the PRMS.

Extension of PRMS Principles to Non-Hydrocarbons

The OGRC (Oil & Gas Reserves Committee) has become aware of other situations where PRMS principles have been considered for, or even applied to, non-hydrocarbon situations. This statement from the committee addresses uses of the PRMS principles in non-traditional situations.

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FAQs Disclaimer

- *These FAQs cannot anticipate every combination of circumstances that may occur*
- *The guidance and examples provided within the FAQs are for general situations*
- *Additional information about the situation could materially modify the guidance*
- *In all cases, the guidance provided herein should never be interpreted to cause a violation of the principles that are the basis of PRMS*

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FAQ Topics Covered

1. Communications with the SPE Oil and Gas Reserves Committee (OGRC) (3 questions)
2. Production (1 question)
3. Reserves (11 questions)
4. Contingent Resources (9 questions)
5. Prospective Resources (2 questions)
6. Miscellaneous Topics (16 questions)
    - Flare, Vent and Consumed in Operations (CiO) 2
    - Recoverable Hydrocarbons 1
    - Technology 3
    - Economics 1
    - In-Place 1
    - Aggregation 2
    - Production Sharing Contracts 3
    - Abandonment, Decommissioning, and Restoration (ADR) 3

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FAQs Related to Reserves

3.1. Question: What is the minimum chance of development permissible for the Justified for Development sub-class? (The y-axis arrow on Fig. 1.1 and 2.1 ends at the boundary with FID)

Answer: The Justified for Development subclass requires a "reasonable expectation" (high degree of confidence) that the project will proceed having met all commercial criteria (no known contingencies)

When using probabilities, the chance of commercial development must be 90% or greater (frequently evaluated at 100%)

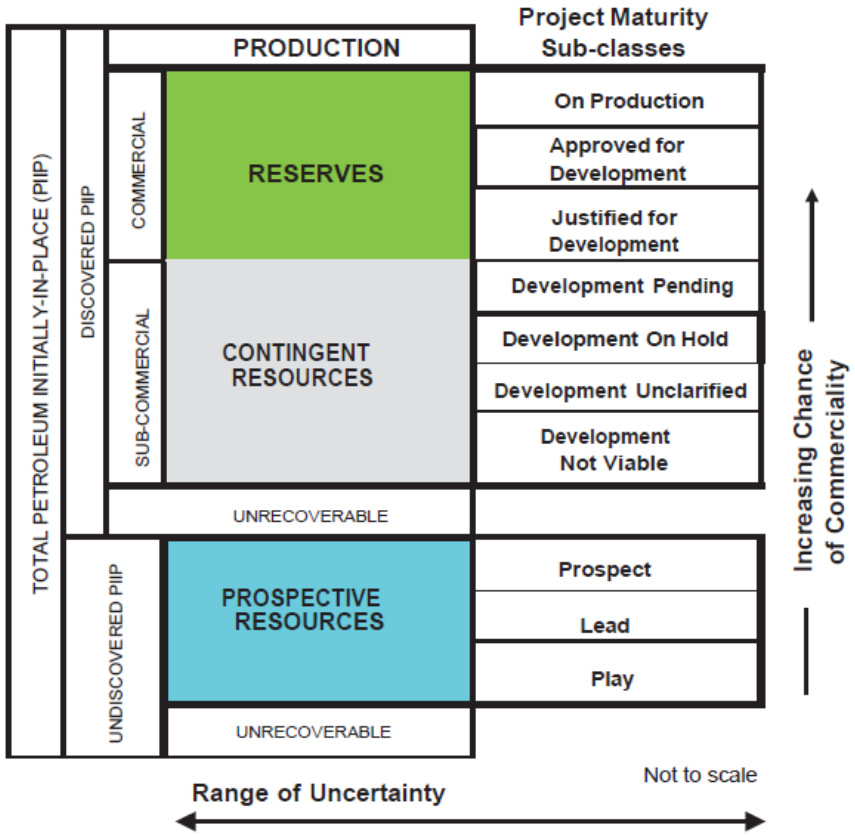

Figure 2.1—Sub-classes based on project maturity

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FAQs Related to Reserves

3.3. Question : 1P = 0 and P1 + P2 = 2P. If the 1P (or P1) is uneconomic when using the deterministic incremental method, what is 2P? Is it P1 + P2 or is it 0 + P2 (which does not add up)?

Answer: If the low-case quantities fail the Reserves qualification test then 1P = 0, while if the best-estimate quantities pass the commerciality test this will allow 2P Reserves recognition

Uneconomic low case quantities are not classified as 1C as this would be a “split classification” and the PRMS does not allow a portion of the project in Contingent Resources and the other portion in Reserves

Deterministic incremental example

Scenario	Category Tested for	Technical Assessment (TA)	Reserves after economics test
1) Low case passes economics	P1	5	5
	P2	2	2
Reserves	1P = P1 = 5 2P = P1 + P2 = 7		
2) Low case fails and best estimate passes economics	P1	5	0
	P2	2	7
Reserves	1P = P1 = 0 2P = P1 + P2 = 7		
3) Low case and best estimate fail economics	P1	5	0
	P2	2	0
Reserves	1P = P1 = 0 2P = P1 + P2 = 0		

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FAQs Related to Reserves

3.11. Question: Project scope in Reserves. Can the same project have different work programs underlying its various Reserves categories? (e.g., 1P with 1 well and tie-in to existing 3rd party facility, 2P assuming 5 wells and tie-in, and 3P with 8 wells and standalone facility construction)

Answer: There can be variations in the number of wells to be drilled between 1P, 2P, and 3P

However, changing the surface facility for the 3P scenario has a different facility scope than what is in the 2P development decision in the field development plan that was the technical basis of the project's commerciality investment decision

The feasibility to implement the 3P scope is not aligned with 2P and thus is not allowed.

The 3P can only recognize the high side of the 2P project

A new investment decision for the upside scope will be a separate project and that project will be in Contingent Resources

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FAQs Related to Contingent Resources

4.1. Question: Contingent Resources sub-classes. Why is the sub-class "On Hold" considered more mature than the sub-class "Unclarified?"

Answer: Evaluators are to review the chance of commerciality on an individual project basis

A project "On Hold" typically will have a development scope but is not being advanced where justification as a commercial development may be subject to a significant delay

In the "Development Unclarified" sub-class, the project scope (i.e., size, well count, facilities, development type, etc.) are typically still under additional evaluation for refinement and selection

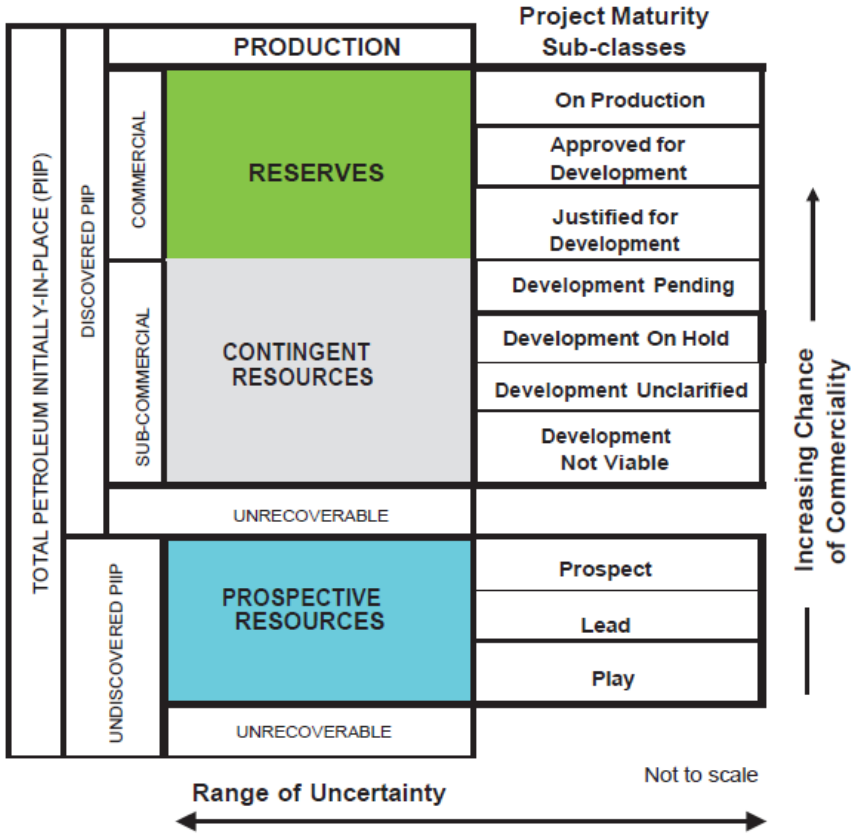

Figure 2.1—Sub-classes based on project maturity

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FAQs Related to Contingent Resources

4.3. Question: Economic limit consideration in Resources. Should Contingent Resources (or Prospective Resources) be subjected to an economic limit test?

Answer: Resources include quantities from projects that do not meet all Reserves criteria and economics may be one of the criteria not met

Thus, the economic limit may or may not be taken into account for the Contingent Resources assessment

Entities that are maturing a project in the Contingent Resources Development Pending sub-class and intend to move the project into the Reserves class will have economics included in the entity's assessment of project commercial viability

In preparing to decide to drill Prospective Resources projects in the Prospect sub-class, a risk assessment with economics is typically evaluated to support investment decision

Entities may assign less-mature projects with no economic evaluation (or which are non-commercial) to Contingent and Prospective Resources sub-classes that reflect their remaining contingencies

Evaluators should state whether or not they have applied an economic limit test

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FAQs Related to Prospective Resources

5.2. Question: Risked and unrisked Prospective Resources. Do Prospective Resources refer to unrisked (without considering the P_g, chance of geological success) quantities in the PRMS, or are risked figures also allowed?

Answer: The PRMS requires reporting unrisked 1U, 2U, and 3U quantities

Entities should determine the Pg and Pd of the project for use in the evaluation assessment and decision making

If a risked value is reported, which is a modification to the PRMS allowed in the Preamble, then reporting the P_g and P_d is required and the unrisked 1U, 2U, and 3U quantities are to be included as well

The evaluator needs to clearly indicate whether risked or unrisked figures are reported

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FAQs Related to Miscellaneous Topics
Recoverable Hydrocarbons

6.3. Question: Recoverable or Unrecoverable. How do we reconcile the concept of "recoverable hydrocarbons," and then say the resource is "Discovered Unrecoverable?"

Answer: The PRMS covers the discovery aspect and the assessment of "potentially recoverable hydrocarbons" and discusses the situation in which no viable development project can be identified with either established technology or technology under development

If the evaluator determines that no feasible development plan may exist, then the discovered in-place quantities are regarded as unrecoverable in the classification system

The definition of Discovered Unrecoverable is "*discovered petroleum in-place resources that are evaluated, as of a given date, as not [being] able to be recovered by the commercial and sub-commercial projects envisioned*"

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FAQs Related to Miscellaneous Topics
Technology

6.4. Question: Use of technology terminology. What is “currently available technology” (as in the TRR definition)? Is this “Established Technology” only or can it also include “Technology Under Development”?

Answer: Currently available technology is not a defined term in the PRMS

Its usage in the PRMS recognizes known methods and practices, as of the Effective Date, that comprise Established Technology and some technologies that may reasonably be expected to be available for commercial application but still classified as Technology Under Development

- The term “Established Technology” is a defined term in the PRMS and refers to methods that have proved to be commercial (required for Reserves)
- The Contingent Resources classification may be considered only if the requirements of “Technology Under Development” are met

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FAQs Related to Miscellaneous Topics
Technology

6.5. Question: Technically Recoverable Resources (TRR). Is cumulative production included in TRR? We assume yes, but the PRMS does not state this in the definition of TRR

Answer: TRR does not include prior production

TRR describes the technically, potentially recoverable quantities (as of the Effective Date) before considering commercial criteria

The addition cumulative production to the TRR is the Technical Estimated Ultimate Recovery

6.6. Question: How does the update to the PRMS improve clarity in Estimated Ultimate Recovery terminology?

Answer: Estimated Ultimate Recovery is typically calculated on a 100% basis (and either in raw production terms, or recoverable quantities at the Reference Point depending on the purpose of the evaluation) and uses descriptors associated to the resources' recovery (technical and confidence range, or class and category) for the stakeholder's understanding

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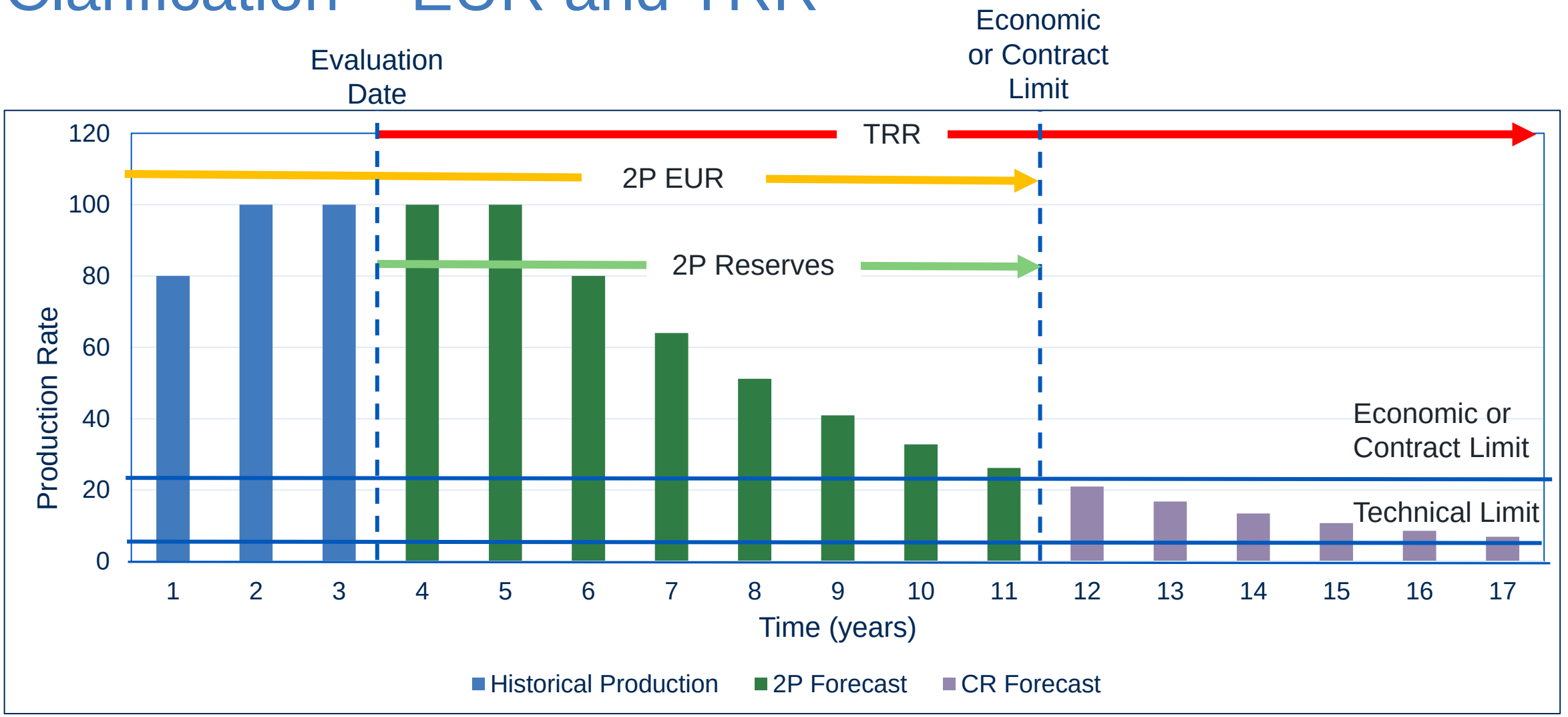
Clarification – EUR and TRR



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FAQs Related to Miscellaneous Topics
Aggregation

6.9. Question: Aggregation. Can resources be added up, provided they are in the same category, as long as a proper breakdown is also presented reflecting the different risk profiles (e.g., 2PD + 2PUD + 2C + 2U = Recoverable Resources Best Estimate)?

Answer: A mandatory requirement of the PRMS is that the Prospective Resources, Contingent Resources, and Reserves are separate prior to any aggregation

Providing “risked” quantities is intended to convey a realistic outcome

> *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*

Representing that Contingent and Prospective Resources are either “risked” (along with each classes risk percentage) or “unrisked” is required

The chance of commerciality (P_c) is equal to the probability of development (P_d) for Contingent Resources.

P_c for Prospective Resources is the product of P_g and P_d

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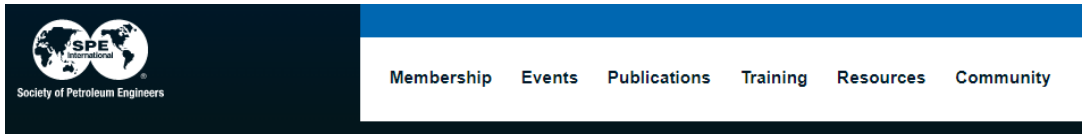
Where can I find the Application Guidelines?

https://www.spe.org/en/industry/reserves/



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Reserves Classification Guidelines

In 2022, the SPE Oil and Gas Reserves Committee (OGRC) released Guidelines for Application of the Petroleum Resources Management System (AG). The document replaces the 2011 "Guidelines for Application of the Petroleum Resources Management System."

Key considerations in the revision address the following:

Expanded Scope - When the 2011 AG was published, assessment guidelines for unconventionals were still in their formative stage. The chapter on Unconventional Resources presents the current best practices for the assessment of these challenging reservoirs. The chapter includes numerous illustrative example applications for the user's benefit.

Additional Examples - Numerous example applications added to all of the chapters.

Cross-referenced Chapters - The material in one chapter integrates with similar material in other chapters, and there are many cross-references between the chapters to present consistency of application.

Revised Glossary - Includes terms from the 2018 PRMS as well as terms presented only within the AG itself. This includes terminology related to seismic interpretation, which was lacking in the 2011 version.

New Chapters - Includes new chapters on Petrophysics and Reservoir Simulation which are extremely important domains that have become even more salient since the 2011 AG. The chapter on Petrophysics was considered especially important due to the first-time inclusion of the phrase "net pay" in the 2018 PRMS.

- Purchase Guidelines for Application of the PRMS (Individual Use Only)
- Purchase Annual Institutional License for Reuse
- If you or your organization would like to deliver the Guidelines for PRMS document externally in training courses or customized documentation, please send an email to permissions@spe.org for further instructions.

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Application Guidelines

Update of 2011 guidelines (which was an update of the 2001 document)

- 221 pages

Released in July 2022

- 375 pages
- Two new chapters
  - Petrophysics
  - Reservoir simulation

90-minute overview by Charles Vanorsdale

https://webevents.spe.org/products/introduction-to-the-petroleum-resources-management-system-prms-application-guidelines

Available for purchase from the SPE bookshop for $25 (member price)

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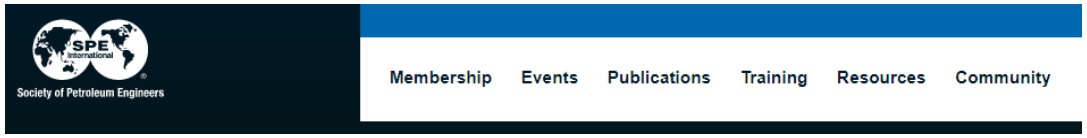

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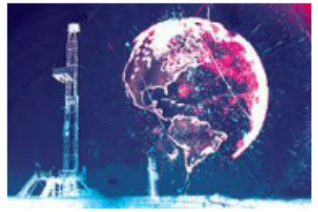

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No charge

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Extension of PRMS Principles to Non-Hydrocarbon/Non-Traditional Situations (August 2022)

OGRC

- PRMS principles can be applied to certain situations, considering the similarities in exploration, evaluation, and exploitation processes throughout the life-cycle of a project

- No objection to the application of the PRMS to these situations that result in the extraction of non-hydrocarbon resources, as long as
  - It is made clear that, while such application is outside the scope of the PRMS, PRMS principles have been followed
  - Relevant subject matter experts are involved

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Extension of PRMS Principles to Non-Hydrocarbon/Non-Traditional Situations (August 2022)

Gaseous Extraction

- **Carbon dioxide**: natural CO_2 reservoirs, used for EOR
- **Helium**: extracted from natural gas or natural nitrogen accumulations
- **Hydrogen**: naturally occurring hydrogen reservoirs - demand increasing

Solution Extraction

- Extraction of trace elements contained in brine solutions, such as bromine or lithium

For both of the above cases, fundamental physics and processes mirror those applicable in the oil and gas industry

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Extension of PRMS Principles to Non-Hydrocarbon/Non-Traditional Situations (August 2022)

Geothermal Water/Heat Sources

- Naturally occurring hot water or steam sources used in heating or electricity generation
- Where water is reinjected to be heated again, the reservoir heat is the resource that is being extracted

Water/steam production and the depletion of heat follow reservoir engineering principles

Synthetic Gas Production

- Underground coal seam gasification (UCG) projects convert the coal in situ to a synthetic gas that is produced to the surface
- Synthetic gas may be primarily methane, or it may be primarily hydrogen and carbon monoxide

PRMS principles can be applied in a manner similar to that commonly used for synthetic crude oil projects in oil shale/bitumen mining situations

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Thank You

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