



Navigating the Changing World of Reserves and Resources in the Context of the PRMS

20 - 21 AUGUST 2024 | BRISBANE, AUSTRALIA

Established Technology, Technology under Development, Currently available Technology - PRMS 2018 concepts...For the Project

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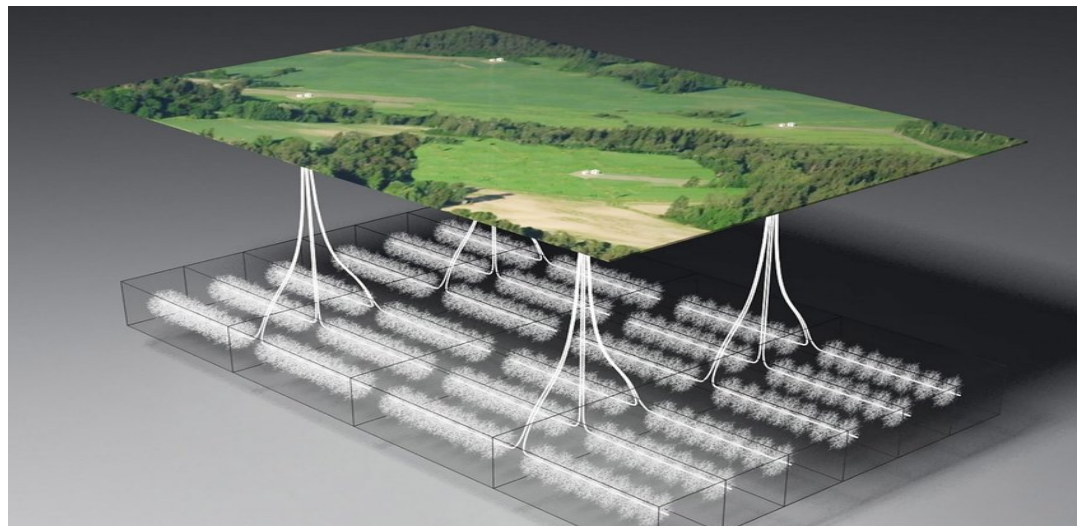
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Recovery Technology



- The choice of the recovery technology (equivalent to **recovery process**) for evaluating a PRMS project is an vital decision
- Due consideration must be given to the **level of understanding** of the technology as applicable to the reservoir under evaluation
- This decision, and the **evidence** to support that decision, becomes even more important once a discovery has been made
- The selection of an applicable recovery process for the evaluation is not a matter of assuming it will be applicable without considering specific requirements and **demonstrating** the resource can meet or exceed those requirements





Recovery Technology in PRMS 2018



PRMS 2018 now defines the following terms in relation to recovery technology – but both should say “**for the Project**”

Established Technology (EsT)	2.1.1	<i>Methods of recovery or processing that have proved to be successful in commercial applications.</i>
Technology Under Development (TUD)	2.1.1	Technology that is currently under <i>active development</i> and that has not been demonstrated to be commercially viable. There <i>should be sufficient direct evidence</i> (e.g., a test project/pilot) to indicate that the technology <i>may reasonably be expected</i> to be available for commercial application.

No PRMS definition for **Experimental Technology (ET)** or **Reliable Technology**



Currently available technology



Currently available technology (CAT) is referenced but not defined in PRMS, however it can be inferred that **CAT comprises EsT and TUD**:

PRMS 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

Discussion Points:

(1) TRR has its founding in what resources a nation could rely on in times of emergency.

Would all projects requiring TUD be something that a nation could rely on in times of emergency?

(2) If unreasonable improvements in commercial conditions or technology are required to commercialise such projects, then they should be Unrecoverable.

Not all TUD projects meet the threshold for CR's



Frequently Asked Question 6.4



Both prior points supported by **FAQ 6.4** -> PRMS improvement:

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: [Oct. 2022] 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 can be implemented to recover petroleum and is inferred to comprise Established Technology and some technologies that may reasonably be expected to be available for commercial application but still classified as Technology Under Development due to lack of commercial viability.

The term Established Technology is a defined term in the PRMS and refers to methods that have proved to be commercial.

- A project may only be considered for Reserves if its recovery technology is “Established Technology **for the project.**”
- If the recovery technology has not been demonstrated as “Established Technology for the Project”, then Reserves cannot be recognized. The Contingent Resources classification **may be considered** only if the requirements of Technology Under Development are met.



Case Study – Helicopter on Mars (1/2)



Project: Use a helicopter to assist exploration on Mars

Is helicopter flight technology EsT? Yes

Is it EsT for the Project? No

Is there direct evidence that it may work? Perhaps initially No (so is “experimental technology”, but after study and tests in somewhat analogous situations Possibly

Is there a plan that shows that it may reasonably be expected to achieve the require Project? Yes

Is it under active development? Yes

Requirements of TUD met? Yes or No?

At the initial **Effective Date** of recognising application of the technology for the project on Mars, what is the **range of potential outcomes**?

Low estimate: Helicopter does not get off the Mars surface

Best estimate: Helicopter gets off the Mars surface, but fails to fulfil project requirements and perhaps is unable to return to base

High estimate: Helicopter fulfils Project requirements



With this initial range of outcomes, the team consider the **range of uncertainty of outcomes is too wide to proceed** with a Mars launch with the state of the technology of the helicopter at this Effective Date.

- As the process continues and in the **incremental success** of that process, **at each Effective Date**, the Low estimate improves toward the High estimate. At some point the range of outcomes is considered acceptable to include the use of a helicopter for the Project as TUD. In other words, **until the Team are confident that the helicopter can get off the ground, they do not claim TUD**
- For the Project, the **flight technology only becomes EsT for the Project when it is commercially used on Mars**



- > The **range of uncertainty in outcomes reflects the range as if the project was implemented based on the information at that Effective Date**, because that is “what you have”. The range reflected is not “what you hope to have” (i.e it is not the success case).



Reliable Technology (RT)



The term **EsT** is **not the same** as the SEC term “Reliable Technology”

Reliable Technology (RT) is defined *as a grouping of one or more technologies (including computational methods) that has been field tested and has been demonstrated to provide reasonably certain results with consistency and repeatability in the formation being evaluated or in an analogous formation*

EsT is a subset of RT:

- EsT only deals with the **recovery technology** applied in the project
- RT relates to **all aspects of technology** in relation to resource assessment e.g. seismic, reservoir simulation, geological models and statistics





RT – implications for EsT and TUD



To achieve the required technical maturity of the recovery technology for reserves to be assigned to the project, **many of the principles for RT can be assumed to be required by the EsT for it to be “EsT for the Project”**.

- **Must have been field tested (i.e., theory alone is insufficient)**
- **Must provide reasonably certain results**
- **Must be consistent**
- **Must be repeatable**





EsT and TUD per AG22 (and AG11) (1/2)



The **AG22** does not adequately address Recovery Technology -

The following guidelines should be used to distinguish these Contingent Resources from those significant quantities that should be classified as Discovered Unrecoverable:

*(1) The technology **has been demonstrated to be commercially viable in analogous reservoirs**; in this case, the Discovered Recoverable quantities may be classified as Contingent Resources.*

Why is the emphasis on **analogy** rather than direct evidence?

*(2) The technology **has been demonstrated to be commercially viable in other reservoirs that are not analogous**, and a pilot project will be necessary to demonstrate commerciality for this reservoir.*

*- If a pilot project is conducted and deemed technically successful, then Discovered Recoverable quantities from the **full project** may be classified as Contingent Resources.*

What is meant by the “**full project**”? How does this tie in to the TUD process?





EsT and TUD per AG22 (and AG11) (2/2)



- *If a **pilot project is conducted and deemed technically unsuccessful**, then all quantities should be classified as **Discovered Unrecoverable**.*

*(3) The technology has not been demonstrated to be commercially viable but is currently **under active development**, and there is **sufficient direct evidence** (e.g., from a test project in an analogous reservoir) to indicate that it **may reasonably be expected to be available for commercial application**. In this case, Discovered Recoverable quantities from the full project may be classified as Contingent Resources.*

Definition of TUD – although not referenced.

*(4) The technology has not been demonstrated to be viable and is **not currently under active development**; in this case, all quantities should be classified as Discovered Unrecoverable.*

The technology **MUST** (not should) be Unrecoverable in this situation



Role of a Pilot Project(s) (1/2)



- A pilot project is a small-scale test or **trial operation used to assess technology**, including recovery processes, for commercial application in a specific reservoir
 - The pilot needs to be designed to reduce the uncertainty in key reservoir parameters, test various completion/drilling technologies, and assess project development issues
 - In a particular area (e.g “full project area”) multiple pilots may be required
 - The purpose of the pilot project is to **demonstrate commercial production potential** – but may also be required to **demonstrate technical viability**
 - A pilot may even be required to **claim discovery**
- > It is a key aspect of a TUD process**



Role of a Pilot Project (2/2)



Key issue: refer Dilhan Ilk AG22 Ch10 10.1.1:

- “...A significant difference between conventional and unconventional reservoirs is the evaluation of recovery efficiency. In addition to the importance of **completion effectiveness** plays a more important role in determining the recovery factor reservoir quality, for unconventional reservoirs, compared to conventional reservoirs. In general, recovery must be considered as a function of the development plan combined with a specific completion design/technology...”

The **range of outcomes** is dependent on:

- Underlying geological and reservoir uncertainty, AND,
- Uncertainty of effectiveness in the applied recovery technology

→ **Data gathering and pilots via a TUD process is required to deal with these**

→ **Estimates per PRMS should take these into account**

→ **Traditional Deterministic Incremental Method struggles to do this**



Experimental Technology (1/2)



Experimental Technology is **NOT** a defined term in PRMS 2018

- **it should be!** Why?
- Unless a recovery technology can be technically verified as applicable to a project, then it is neither EsT nor TUD
- Applicability with the definition of **Unrecoverable Resources**

*“Those quantities of discovered or undiscovered PIIP that are assessed, as of a given date, to be unrecoverable by the currently defined project(s). **A portion of these quantities may become recoverable in the future as commercial circumstances change, technology is developed, or additional data are acquired.** The remaining portion may never be recovered owing to physical/chemical constraints represented by subsurface interaction of fluids and reservoir rocks.”*

- Must **NOT** be associated with recoverable resources per PRMS.



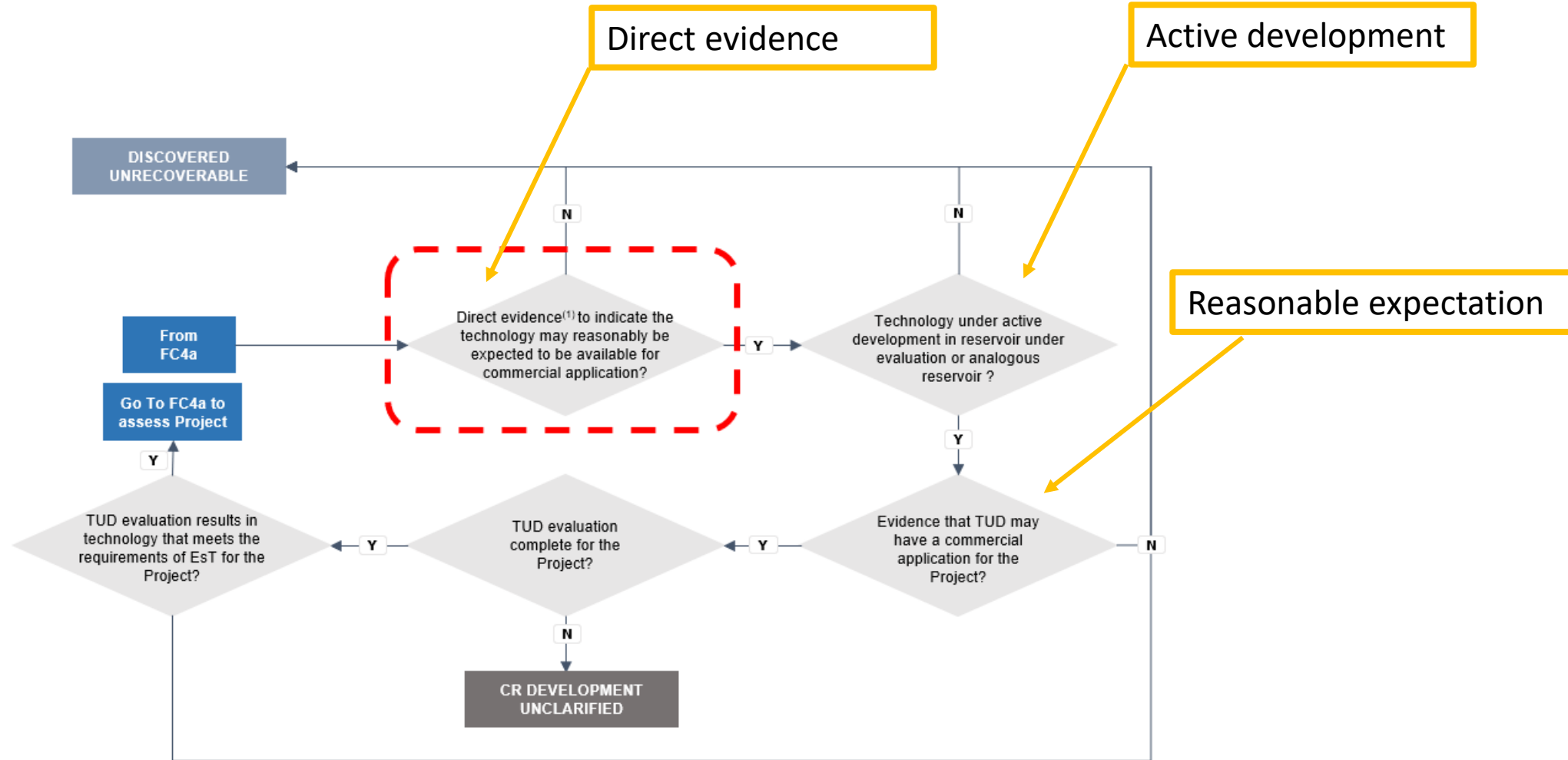
Experimental Technology (2/2)



- Experimental Technology (ET) is referred in the Canadian Oil and Gas Evaluation Handbook 2018 (COGEH)
- ET is a technology that is being **field tested to determine the technical viability** of applying a recovery process or process improvement project to unrecoverable Discovered PIIP **in a subject reservoir**.
- Estimates of resources associated with ET must be classified as **unrecoverable** even though produced volumes might be reported.
- An ET project is designed to assess the technical validity of a recovery process for discovered resources. Neither Reserves nor Contingent Resources may be assigned.



Flowchart for TUD





Take Aways



- Clarification of the PRMS definition of EsT and TUD – **for the Project**
- Consistency of language and explanation on usage is recommended in the AG
- The **range of uncertainty** in recoverable estimates reflects the range as if the project was implemented based on the information at that **Effective Date** (i.e it is not the TUD success case)
- Recommend PRMS introduce a **definition for Experimental Technology**
- A pilot project may often be required **before** TUD can be claimed to assess the technical viability, **and as part** of the TUD process to assess commerciality – particularly for **unconventional** projects
- **Discovery or TUD alone may not** be sufficient to claim contingent resources

