CCOP EPPM Program: Workshop on UNFC Resource Classification

Overview PETRONAS Definitions and Guidelines for Classification of Petroleum Resources

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Presentation Outlines

• Petroleum Resources Classifications
  • Objective
  • Reference
  • Resource Applications
  • Users of system

• Petroleum Initially In-Place
  • Discovered Resources
  • Undiscovered Resources

• Discovered Resources:
  • Estimated Ultimate Recovery,
  • Reserves
  • Production
  • Reserves: Proved, Probable and Possible

• Discovered Resources: Contingent Resources
  • Definitions of Contingent Resources
  • Criteria for Contingent Resources Category

• Undiscovered Resources: Prospective Resources
PETRONAS PETROLEUM RESOURCES CLASSIFICATIONS

FIELD

TOTAL RESOURCES

PROSPECT - LEAD

IN-PLACE

RECOVERABLE

DISCOVERED RESOURCES

ESTIMATED ULTIMATE RECOVERY (EUR)

CUMULATIVE PRODUCTION

RESERVES

CONTINGENT RESOURCES (CR)

PROVED

PROVED + PROBABILE

PROVED + PROBABILE + POSSIBLE

LOW ESTIMATE (1C) P90%

BEST ESTIMATE (2C) P50%

HIGH ESTIMATE (3C) P10%

DEVELOPED

UNDEVELOPED

UNDEVELOPED

PROSPECTIVE RESOURCES (PR)

UNDISCOVERED RESOURCES

LOW ESTIMATE (1U) P90%

BEST ESTIMATE (2U) P50%

HIGH ESTIMATE (3U) P10%

ASSOCIATED WITH THE GEOLOGICAL RISKS
# PETRONAS PETROLEUM RESOURCES CLASSIFICATIONS

## Production

### Reserves
- **1P**: PV. (Proved)
- **2P**: PV. + Prob. (Proved + Probable)
- **3P**: PV. + Prob. + Poss. (Proved + Probable + Possible)

### Contingent Resources (CR)
- **1C**: Low Estimates.
- **2C**: Best Estimates.
- **3C**: High Estimates.

### Unrecoverable

## Prospective Resources (PR)
- **1U**: Low Estimates.
- **2U**: Best Estimates.
- **3U**: High Estimates.

## Range of Uncertainty

## Project Status
- **On Production**
- **Under Development**
- **Planned for Development**
- **Development Pending**
- **Development on Hold**
- **Development Not Viable**

## Petronas Status Categories
- **Category #1 – #2**: Viable + Committed
- **Category #3 – #6**: Viable + Non-committed
- **Category #7 – #8**: Non-viable

## Project Maturity
- **Prospect**
- **Lead**
- **Play**

## Total Petroleum Initially In-Place

## Discovered Petroleum Initially In-Place

## Sub-Commercial

## Commercial

## Range of Uncertainty

## SPE

## PETRONAS
PETRONAS Resource Classification was established with the objective to ...

... Standardize and establish coherency in petroleum resource definition, classification and reporting for an overall management of the resources and reserves portfolio
PETRONAS Definitions and Guidelines For Classification of Petroleum Resources

- the resource definitions and guidelines for this classification are in compliance with the definitions and classification adopted by internationally recognized organization such as SPE, WPC, AAPG in particular the petroleum reserves definitions promulgated by the SPE/WPC March 1997 and petroleum resources classifications and definitions promulgated by the SPE/WPC/AAPG in Feb 2000.
TECHNICAL APPLICATIONS

1. Prospect Evaluation
2. Block Assessment
3. Work Program & Budget
4. Project Identification
5. Field Development Plan
6. Facility Plan
7. Appraisal Plan
8. R&D Promotion
9. IOR / EOR Project

BUSINESS APPLICATIONS

1. Corporate worth
2. Fund raising (credit rating)
3. Stock exchange reporting
4. Sales contracts (LNG buyers)
5. Earning basis
6. Investment decision (FDP)
7. Corporate financial outlook
8. Equity determination
9. Petroleum arrangement (economic evaluation, PSC terms)
..... are defined as the total estimated quantities of petroleum* at a specific date to be contained in, or that have been produced from known accumulations, plus those estimated quantities in accumulations yet to be discovered

In these definitions, the quantities estimated to be initially-in-place are defined as Total Petroleum Initially-In-place, comprising Discovered Petroleum–initially-in-place and Undiscovered Petroleum –initially-in-place
is the total quantity of petroleum that is estimated to exist originally in naturally occurring reservoir.

Oil Initially-In-place and Gas Initially-In-place are defined in the same manner.
DISCOVERED RESOURCES

• ESTIMATED ULTIMATE RECOVERY
• RESERVES
• PRODUCTION
PETRONAS PETROLEUM RESOURCES CLASSIFICATION

INCREASING CHANCE OF COMMERCIALITY

TOTAL PETROLEUM INITIALLY IN-PLACE

- DISCOVERED PETROLEUM INITIALLY IN-PLACE
  - COMMERCIAL
    - PRODUCTION
      - RESERVES
        - 1P
        - 2P
        - 3P
      - PV.
      - PV. + PROB
      - PV. + PROB + POSS.
    - CONTINGENT RESOURCES (CR)
      - 1C
      - 2C
      - 3C
      - LOW ESTIMATES
      - BEST ESTIMATES
      - HIGH ESTIMATES
    - UNRECOVERABLE
  - SUB-COMMERCIAL
    - PROSPECTIVE RESOURCES (PR)
      - 1U
      - 2U
      - 3U
      - LOW ESTIMATES
      - BEST ESTIMATES
      - HIGH ESTIMATES
    - UNRECOVERABLE

RANGE OF UNCERTAINTY
Discovered Resources

The total estimated in place quantities of petroleum at a specific date to be contained in known accumulations, plus those quantities already produced from there from.

Undiscovered Resources

The total estimated in place quantities of petroleum at a specific date to be contained in accumulations yet to be discovered. The estimated potentially recoverable portion of undiscovered Petroleum-Initially-In-place is classified as Prospective Resources.
Estimated Ultimate Recovery (EUR)

..... is defined as **those quantities of petroleum** which are estimated, on **a give date**, to be **potentially recoverable** from an accumulation, plus **those quantities already produced** there from

Estimated Ultimate Recovery is the sum of Cumulative Production plus Reserves
Estimated Ultimate Recovery (EUR)

…… is defined as *those quantities of petroleum* which are estimated, on a *give date*, to be *potentially recoverable* from an accumulation, plus *those quantities already produced* there from

Estimated Ultimate Recovery is the sum of Cumulative Production plus Reserves
Cumulative Production (Np)

..... is defined as the total quantities of petroleum that have been produced at a specific date
Reserves

.... are defined as *those quantities of petroleum* which are anticipated to be *commercially recoverable* from *known accumulations* from a *given date forward*
Proved Reserves

..... are defined as *those quantities of petroleum* which, by analysis of geological and engineering data, can be estimated with *reasonable certainty* to be *commercially recoverable* from a *given date* forward, from *known reservoirs* and under *current economic conditions, operating methods* and *government regulations*. 
Proved Developed Reserves

..... are those Proved Reserves that are expected to be recovered through existing wells and facilities and by existing operating methods. Improved recovery reserves can be considered as proved Developed Reserves only after an improved recover project has been installed and favorable response has occurred or is expected reasonable degree of certainty.
Proved Undeveloped Reserves

..... are those proved reserves that are expected to be recovered from future wells and facilities, including future improved recovery projects which are anticipated with a high degree of certainty in reservoirs which have previously shown favorable response to improved recovery projects.
Unproved Reserves

..... are defined based on geological, geophysical and engineering data similar to that used in estimates of Prove reserves; but technical, contractual, economic, or regulatory uncertainties preclude such reserves being classified as Proved.
Probable Reserves

..... are defined as those Unproved Reserves which analysis of geological, geophysical and engineering data suggests are more likely than not to be recoverable.
Possible Reserves.

..... are defined as those Unproved reserves which analysis of geological and engineering data suggests are less likely to be recoverable than Probable reserves
DISCOVERED RESOURCES

• CONTINGENT RESOURCES
PETRONAS PETROLEUM RESOURCES CLASSIFICATION

TOTAL PETROLEUM INITIALLY IN-PLACE

DISCOVERED PETROLEUM INITIALLY IN-PLACE

COMMERCIAL

PRODUCTION RESERVES

1P
PV.

2P
PV. + PROB

3P
PV. + PROB + POSS.

CONTINGENT RESOURCES (CR)

1C
LOW ESTIMATES

2C
BEST ESTIMATES

3C
HIGH ESTIMATES

UNRECOVERABLE

UNRECOVERABLE

PROSPECTIVE RESOURCES (PR)

1U
LOW ESTIMATES

2U
BEST ESTIMATES

3U
HIGH ESTIMATES

RANGE OF UNCERTAINTY
Contingent Resources (CR)

are defined as those quantities of petroleum which are estimated on a given date, to be potentially recoverable from known accumulation but which are not currently considered to be commercially recoverable. The reasons for non-commerciality could be economic, political, environmental or technological.

- Hydrocarbon quality (API, CO2, H2S etc)
- Small fields
- Reservoir with inconclusive data
- Location
- Adverse parameters
- Geological complexity

• Production Sharing Contract (PSC)
• Development concept

• Under unitization

• HSE regulation
**Contingent Resources (CR)...**

- Some ambiguity may exist between the definitions of CR and Unproved Reserves
- Subject to degree of commitment to be developed or placed on production

- Accumulations – currently no viable market or commercial recovery is dependent on the development of new technology, or early evaluation

- If Probabilistic, P90%, P50% and P10%

- If deterministic, technical definitions same as reserves except they are not currently producible. Low Estimate = Proved Reserves, Best and High Estimate = Unproved Reserves
Contingent Resources may include:

- Accumulation being held in inventory such as marginal fields.
- Accumulations that will probably be commercially recoverable in the near future/short term (non-commercial subject to size, location, technology and economics
- Accumulation that have no plans for development in near future
- Non-producing reservoirs due to:
  a. Adverse parameter i.e. very low porosity development, low permeability
  b. Unfavorable petroleum parameters i.e. gravity, viscosity
  c. Extreme non-hydrocarbon content, i.e. CO₂, H₂S.
- IOR – changes characteristics of the fluid in the reservoir through injection or steam, gas or chemicals.
UNDISCOVERED RESOURCES

• PROSPECTIVE RESOURCES
Undiscovered Resources

Are defined as the total estimated in-place quantities of petroleum at a specific date to be contained in accumulations yet to be discovered.

Prospective Resources (PR) are defined as those quantities of petroleum which are estimated, on a given date, to be potentially recoverable from Undiscovered accumulations.

Undiscovered Resources

- Total In-place quantities of petroleum
- A specific date
- To be contained in accumulations
- Yet to be discovered
Prospective Resources (PR)
... are defined as those quantities of petroleum which are estimated on a given date to be potentially recoverable from undiscovered accumulations.

Prospective Resources (PR)
- Estimated quantities of petroleum
- Estimated on a given date
- To be potentially recoverable (apply RF)
- From undiscovered accumulations
- Reporting: Un-risked P90%, P50%, P10% as 1U, 2U & 3U or LE, BE & HE
- Geological Risk, Pg should be given alongside each estimate
Prospective Resources (PR)

- Reporting: Deterministic (LE, BE and HE) & Probabilistic (P90%, P50% & P10%)

- PR should be risked for probability of geological success, Pg – the chance of the geological model being correct. Pg is established based on technical assessment.

- Prospective Resources should imply an UNRISKED estimate

- In principle the technical definitions for these categories are the same as for reserves in terms of reflecting a range of uncertainties. However, PR represent undiscovered volumes.
  - LE/P90% should be derived using the highest confidence data & HE/P10% estimate derived from the least confidence data.
**SUMMARY OF RESOURCE CLASSIFICATION**

**ESTIMATED ULTIMATE RECOVERY (EUR)**
- Discovered
- EUR = Np + Reserves
- Commercial: current economic conditions, regulations, practice
- Producing fields
- Firm development

**CONTINGENT RESOURCES**
- Discovered
- Currently not producible: economic, political, environmental or technological reasons
- Adverse Reservoir: tight, geo-presures
- Extreme fluid parameters: heavy crude
- Insufficient / Inconclusive data

**PROSPECTIVE RESOURCES**
- Undiscovered
- Unproven trap
- Deeper reservoir in producing field

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**BLOCK 1**

**BLOCK 2**

**BLOCK 3**