SPE Workshop

Early Monetisation Projects

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Eastern & Oriental Hotel
Penang, Malaysia
LOCATE THE REMAINING OIL - LTRO

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LEAP ENERGY
• Common LTRO workflows
• Improved LTRO:
  – Contacts based
  – Displacement based
• Managing uncertainties – way of controlling the risks
• Rapid analysis and opportunities search - making fast decisions
• LTRO Examples
• Conclusions
**LTRO workflows**

**Fluid contact tracking method**
- Applicable for fields with aquifer/gas cap where the main driving mechanisms – contacts rising (movement)

**Displacement driven saturation mapping method**
- Suitable for fields with intensive areal displacement due to aquifer influx and/or injection activities
Contacts tracking

**STATIC MODEL**

**ALLOCATED PRODUCTION**

**RESERVOIR PROPERTIES, LOGS & INITIAL FLUID CONTACTS**

**FLUIDS CONTACTS MOVEMENT COMPUTATIONAL ENGINE**

- **Plot new contacts & derive OWC / GOC per well or per layer**
- **Reiterate with Static model to calculate volumes in place**
- **Build remaining oil maps**

**Approaches:**

- 2 phase (WOC or GOC only) & 3 phase (WOC & GOC)
- Segregated flow / High perm segregated flow / Diffuse method
Displacement driven saturation mapping

MATCHED in the run:
- Volumetrics (Oil produced & Current In-Place)
- Saturations @ wells (WCT derived)
- Observed saturations @ wells (Logs derived)
**Uncertainties management**

**HIGH / MID / LOW CASE SCENARIOS CAN BE Addressed AT THE SAME TIME FOR THE BEST OPPORTUNITIES UNDERSTANDING**

**PRODUCTION ALLOCATION UNCERTAINTY**

- **Allocation Process**
- **Allocation Datasets**
- **A Set of Scenarios**

**STATIC DATA UNCERTAINTY**

- **Layered Properties Maps Variations**
- **Scenarios Output – Opportunities Assessment**

- Fast calculation method allows many iterations / cases to run
- Automated match on the fly - no further HM required
- Rapid opportunities assessment based on calculated maps & defined criteria
- Rank opportunities
Opportunities identification

**BEHIND PIPE | INFILL**

**BEHIND-PIPE OPPORTUNITY IDENTIFICATION**
- Automatically interrogates the available well stock vs. predicted Oil saturation at present time
- Seriatim of opportunities generated for multi-criteria ranking

**INFILL OPPORTUNITIES IDENTIFICATION USING ADVANCED, MULTI-CRITERIA FILTERING**
- Within specific area/radius
  - Target oil volume
- Suitable range of water saturation
- Constraints on net thickness and other reservoir properties
- Comparing the targets from different layers (maps) for joined opportunities
LTRO Example 1 - comparison with simulator

**Absolute saturation error distribution**
red – negative, blue – positive, white - zero

- 20 years
- 30 years
- 40 years
- 50 years

**Relative saturation error**
- ~15%
- ~30%

**Saturation @ wells**

- Sw 20 years
- Sw 30 years
- Sw 40 years
- Sw 50 years

**Saturation maps**

- Simulator saturation
- Displacement driven optimised saturation (new workflow)

- 20 years
- 30 years
- 40 years
- 50 years
LTRO Example 2 – field case
Conclusions

• An integrated LTRO workflow has been presented
• Workflow advantages:
  – Rapid remaining oil maps calculation
  – Auto-matching the general field observations
  – Managing uncertainties (ex. Production allocation, G&G...)
  – Easy to analyse new opportunities:
    • Infill
    • Behind pipe
  – Multiple scenarios concept for managing the risks

Thank you!