

Research program: IOR/EOR

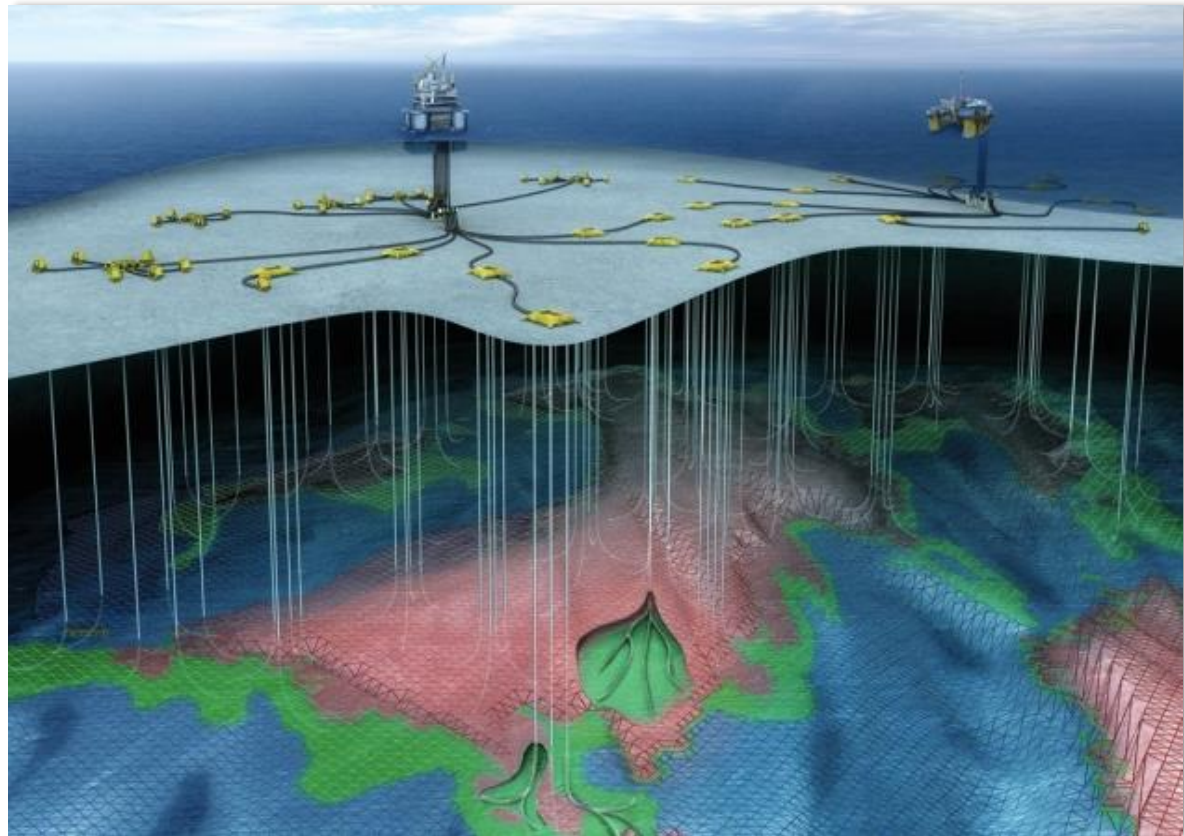
ERC-RPM

Engineering Research Center in Reservoir and Production Management

Workshop, 7th of June 2017

Contents

- Challenges
- Technology Solutions
- Statoil Expectations



Challenges

Call of Proposal – Enhance Oil Recovery

- Increase knowledge and reduce risk of existing IOR/EOR technologies.
- Evaluate methods to increase the recovery factor of reservoirs with advanced studies.
- Low cost solutions

SCOPE:

- Polymer studies
- Water diversion
- Gas injection



Improving hydrocarbon recovery

Natural depletion



Oil

Water injection
Gas injection



Oil Water

Thermal,
Chemical
Miscible gas
WAG
Other



Oil Water Gas Surfactant Foam

PRIMARY RECOVERY
*Pressure depletion;
no injection at all.*

SECONDARY RECOVERY
*Injection of fluids for pressure
maintenance*

TERTIARY RECOVERY
*Injection of fluids to further
improve recovery:
advanced recovery methods*

IMPROVED OIL RECOVERY (IOR)
All measures beyond current plans to improve expected oil/gas recovery. Can include all mechanisms.

ENHANCED OIL RECOVERY (EOR)
All advanced recovery methods

Technology Solutions

Polymer studies

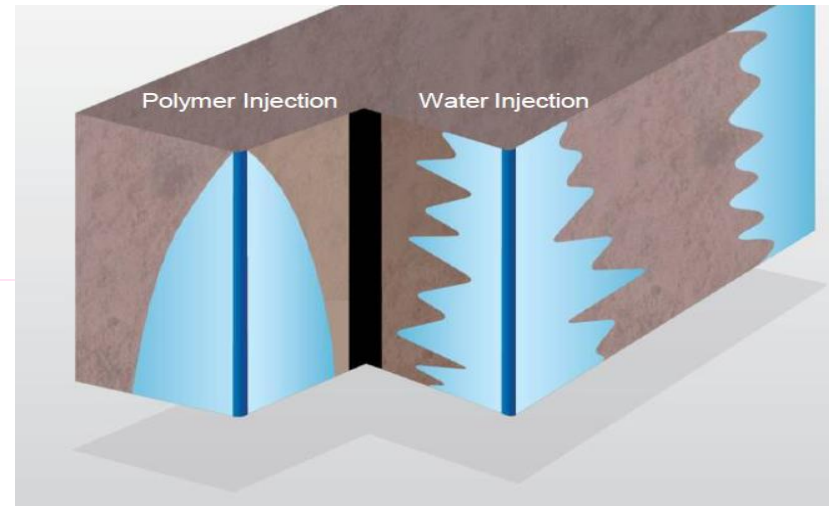
Challenge

Reservoir simulations:

- Significant remaining gaps, modelling fingering phenomena in heavy-oil reservoirs with or without presence of polymers.
- Upscaling

Environment:

- Environmental aspects, risk and ecosystem understanding
- long term behavior of polymers in the environment (issues related to degradation (UV-degradation, bio-degradation)).



Statoil technology needs

- Lab and field experiments of long term behaviour of polymers in the environment.
- Understand and model polymer sweep efficiency.
- Experiments to study impact of polymer flooding on injectivity
- New technologies that enable the detection of filter cake in injector wells and quantification of filter cake properties

Technology Solutions

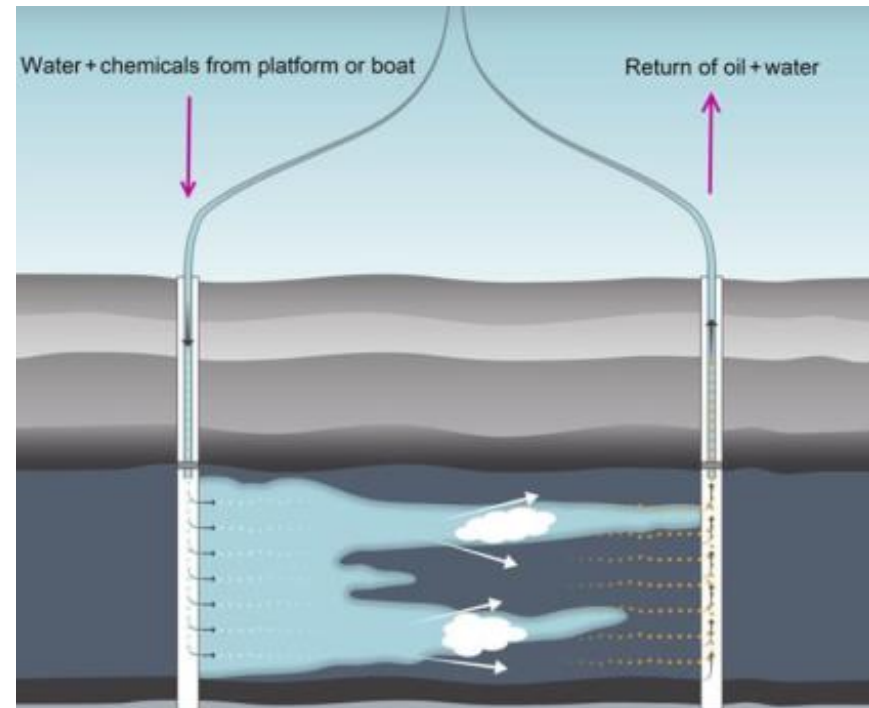
Deep water diversion

Challenge

- Conformance control in carbonate fracture reservoirs
- IOR/EOR in heavy oil and carbonate fields
- High cost chemicals
- Salt tolerant chemicals.
- Efficient modeling (temperature, activation, efficiency)

Statoil technology needs

- Lab analysis on new type of chemicals that are salt tolerant (avoid expensive pre-flush).
- Analysis of chemicals with alternative activation mechanisms to temperature.
 - E.g. time, salt, pH, etc.
- More efficient modelling (dual porosity modelling)



Technology Solutions

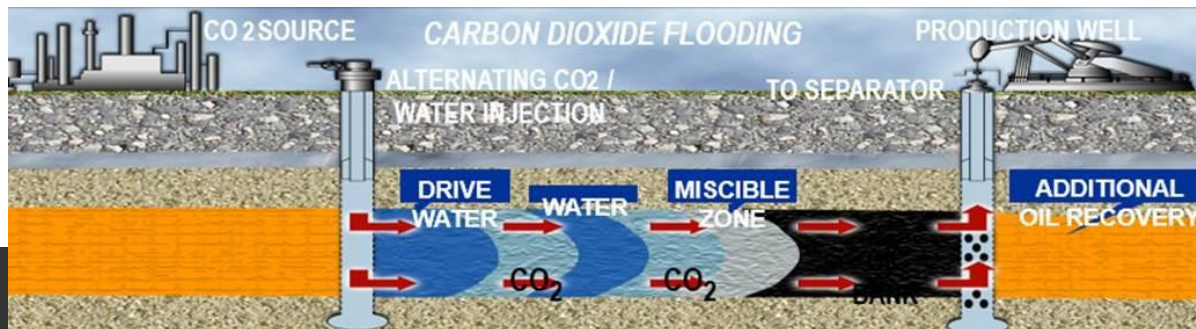
WAG and CO2 injection

Challenge

- Recovery:
 - Wettability effects (oil wet)
 - Flow functions in triple porosity reservoirs
 - Rock fluid interactions with injection (including scaling and souring)
 - Conformance control for CO2/gas injection
 - Modeling of gas injection processes
- Facilities
 - Cost effective transport of sufficient quantities of CO2 for IOR purposes
 - Material solution for pipeline and subsea equipment

Statoil technology needs

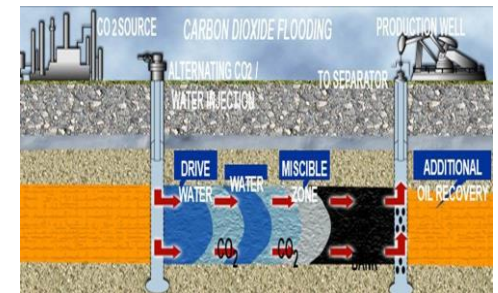
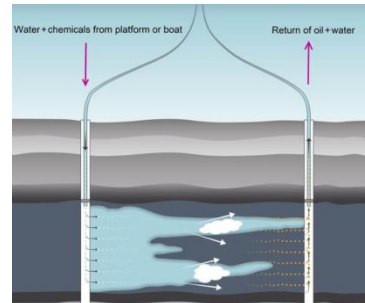
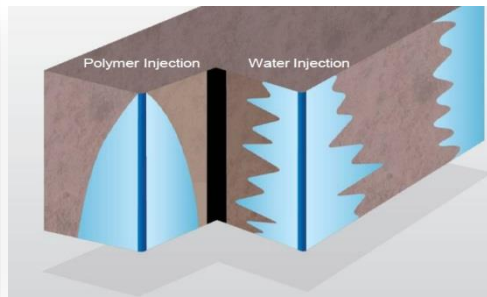
- Lab analysis and modelling of conformance control for gas injection (foam, nano technology)
- Modeling of:
 - Efficient upscaling methodology of dynamic parameters
 - Unstable displacement
 - 3-phase rel-perm, hysteresis & trapping
 - CO2 injection for EOR
- Documentation of integrity of facilities for sour service application



Statoil Expectations

Enhance Oil Recovery

- Develop EOR / IOR activities that contributes to unlock low recovery reservoirs, increasing recovery and decreasing water production from oil reservoirs
- Facilities that can transport sufficient amounts of CO2 in a cost effective and safe manner
- Reduce carbon emission is an objective of EOR / IOR activities (e.g., energy efficiency due to less produced water at topside)
- Activities should contribute for increasing probability of success and reduce technical and economical uncertainties in field implementations



There's never been a better
time for **good ideas**

