Description of Exercise

This benchmark case considers the time frame from 2005 to 2008 for recovery optimization. The actual 2004 simulation model containing all information and properties is given. In addition, production and injection data from 1997 to end of 2004, and 4D-seismic data for the same period (2003-2001 and 2004-2001) have been provided. These data will be the basis for the history match to be performed by participants. Each participant will produce a report describing the results and the methods used to achieve their results. Then, the participants will discuss the results in the ATW workshop. At this stage, proposals for improvements will be made. More information regarding the Norne benchmark and the exercise is available at our website:
http://www.ipt.ntnu.no/~norne/

The participants should work in following workflow:

1. Download the Eclipse Norne model and import it into their reservoir simulator. The production history for 1997-2004, reports and all required data are given in our website http://www.ipt.ntnu.no/~norne/database/.
2. Participants history match the model until the end of 2004 and predict the production (oil, water and gas rates) performance until end of 2008. No minimum economic rates apply.
3. Using the history matched results from above, come up with an optimal production strategy for the remaining recoverable resources for the future period. Participants may suggest techniques to enhance recovery, since significant amount of the recoverable reserves are already produced by the end of October 2008.
4. The format for the production strategy contains
   DATE      BHP or Q       WELL ID & Perforation
            (bar)     (Sm³/day)
5. The following constraints apply to the strategy:
   1. For each injector well max. FBHP = 450 Bar
   2. For each producer well min. FBHP = 150 Bar
   3. For each injector well the max. water rate = 12000 Sm³/day
   4. For each producer well the max. liquid rate = 6000 Sm³/day
   5. Maximum water-cut = 95%
   6. Two wells at max. can be sidetracked to increase recovery
6. The following economic parameters can be used:
   - Oil price 75 US$ per bbl
   - Discount rate 10% reference time is January 2005
   - Cost of water handling/injection 6 US$ per bbl
   - Cost of gas injection 1.2 US$ per Mscf (M = 1000)
   - Cost of a new sidetracked well 65 Million US$
   Participants may also assume their own parameters when it comes to other EOR methods eg. Surfactants, Polymers, Low salinity injection etc.
7. Discuss and compare results of their achieved recovery factor.

Q&A

1. Coursen Model and Simulators
Can we use different simulators apart from Eclipse? My simulator doesn’t take the coarsening keywords you used, can I reconstruct the model so as to use my simulator but still maintain the important features of the e segment model?

**Answers:** Yes, you can use a different simulator; you can also remake the model so as to suit your simulator but only maintain important characteristics and features of the model.

2. **EOR**

What techniques are we allowed for EOR in the optimization process? Are we supposed to try gas injection or with use water with or without surfactants? More information will be needed on constraints and costs if these processes are to be tried.

**Answers:** Open, the participants may suggest their best EOR Technique, assume reasonable costs in terms of dollars or discounted oil volume. Bullet 3 in the provided workflow describes.

2. **Optimization period**

It is not quite clear during which period optimization is supposed to take place. Should we optimize from January 2005 to the end of 2009 or should it be from January 2009 to the end of 2009?

**Answers:** HM 1997 -2004, optimize from Jan.2005 to Dec 2008

3. **History match data**

Although we are supposed to do history matching until the end of 2004, production data are provided until the end of 2006. How are they supposed to be used?

Do we have bottom-hole pressures for all wells in Segment E? If measured values are not available it might be a good idea to provided interpolated values from the VFP tables to minimize differences.

**Answers:** We only provided production and injection history to 2004 and BHPs to 2004, check the data base. There is no 2006 data provided.

4. **Other Data**

Do we have access to porosity-permeability correlations for different zones based on core data? Are there any facies models available?

**Answers:** poro – perm correlations can be found in the Simulation model, no facies model available.

4. **Deadline**

What is the deadline for submitting results?
**Answers:** No deadline to submit results, but participants will present the results in the workshop, and submit a summary of results (up to 3 pages) during the time of the workshop. The results will be collected and a general publication with all contributing participants as authors will be prepared including the summary of the discussion from the workshop.