Relinquishment Report
PL416

14.05.2012

MC Chairman Svend Erik Pettersson
EC Chairman Trond H. Wierød

BoV or Drop decision – PL 416

PL 416 Recommendation

The pre-drill evaluation of PL416 showed that the licence had a multi-storey prospect in the Jurassic. The Geological Chance Factors (GCFs) varied between 7-23% (individual reservoirs). The key risk factors were varying but charge and migration was seen to be the key risk element. The pre drill volumes and risk of the Jurassic prospects were estimated as follows:

P50 Recoverables	Volumes in Mboe	GCF
Sognefjord	61	23
Fensfjord	27	10
Krossfjord	26	11
Brent	16	8
Johansen	20	7
SUM	150	

The 31/8-1 well encountered the expected reservoirs bu they were water wet with no shows, E.ON Ruhrgas Norge as the Operator recommended to relinquish the PL416 License. Our Partners in the License agree with the Operators recommendation.

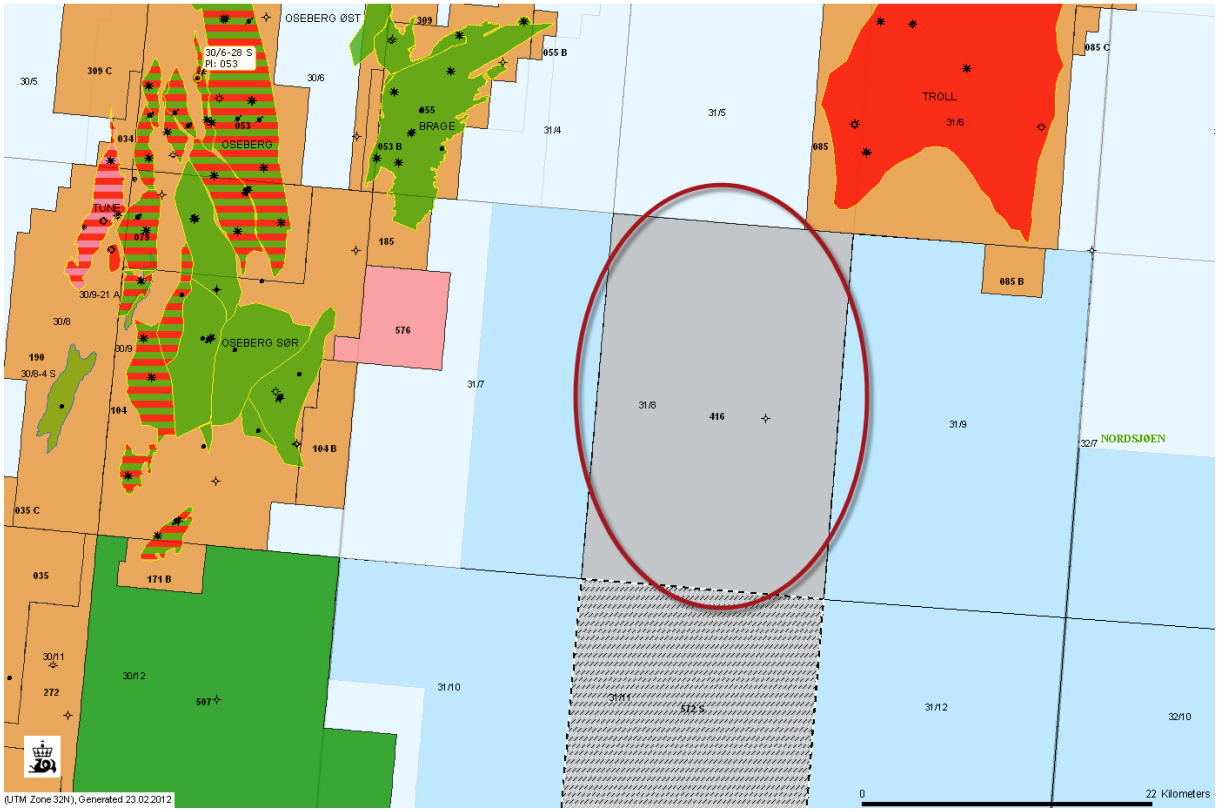
Licence overview and work-commitment

PL 416 comprising some 512Km² in block 31/8 was awarded in the APA2006 on 16.02.2007 and is valid until 16.02.2013. The licence was awarded to Rocksource ASA (35%), Det Norske Oljeselskap ASA (15%) and E.ON Ruhrgas Norge AS as the operator (50%). The licence commitment comprised acquiring EM within the first year from award and collecting 3D seismic covering minimum 250Km² within the first 2-years period. The license commitment was met and the resulting seismic has the name EO0801. A drill decision was taken in February 2010. Detailed seismic interpretation, petrophysics, AVO studies, charge

and migration studies, EM, sequence stratigraphy study are just some of the work done in the license.

⊟ Generell informasjon

Utvinningstillatelse	416
NPDID for utvinningstillatelser	4237675
Faktakart	lenke
Status	ACTIVE
Område	North sea
Tildelt i:	TFO2006
Dato for tildeling	16.02.2007
Gyldig til dato	16.02.2013
Opprinnelig areal [km2]	512.269
Nåværende areal [km2]	512.269



Location, structural setting and reservoirs

The PL 416 license covers the area comprised by block 31/8 in the Northern Stord Basin. The block is located east of the Western Bjørgvin Arch and approximately 70Km west of the Øygarden Fault Complex. The closest infrastructure is the Troll Field some 16Km to the north -northeast and the Brage Field some 30 Km to the northwest. Whereas the Oseberg Field can be found on the northern elongation of the Utsira High and Troll on the Horda Platform the Breiflabb prospect is located on the northern rim of the Stord Basin and hence part of a different province than the two mentioned above. The prospect is a 3-way dip closure. Levels regarded as reservoirs within the license are more or less sediments of the entire Jurassic period. However, the Sognefjord had to be successful in order for the secondary targets to be attractive.

Prospects description, volumes and risking

The individual reservoir levels within the **Breiflabb** multi-storey prospect have more or less the same geometry, small 3-way dip closures dependant on juxtaposition seal for the P90 cases and 3-way dip closures dependent on fault seal for the more optimistic cases. The Top of the Sognefjord Fm. is eroded by the BCU unconformity.

An internal Charge / Migration study implies that migration from Viking graben or the mature basins in the North is not very likely. The conclusion is that potential HC has to be derived from a local kitchen area. A positive EM anomaly with a good structural fit to the prospect resulted in a de-risk of the Charge from 0,3 to 0,5.

The top reservoir is not very deep, and is as such adequate for AVO / Fluid Substitution studies. However, the top of the Sognefjord Fm. is positioned in the sidelobe of the hard Heather shale response, thus making the study "non conclusive". In the Fluid Substitution study we saw a different response for gas on the far offset compared to the water or oil wet cases. It was therefore concluded that it was unlikely that Breiflabb was gas filled as no such effect was observed on the seismic.

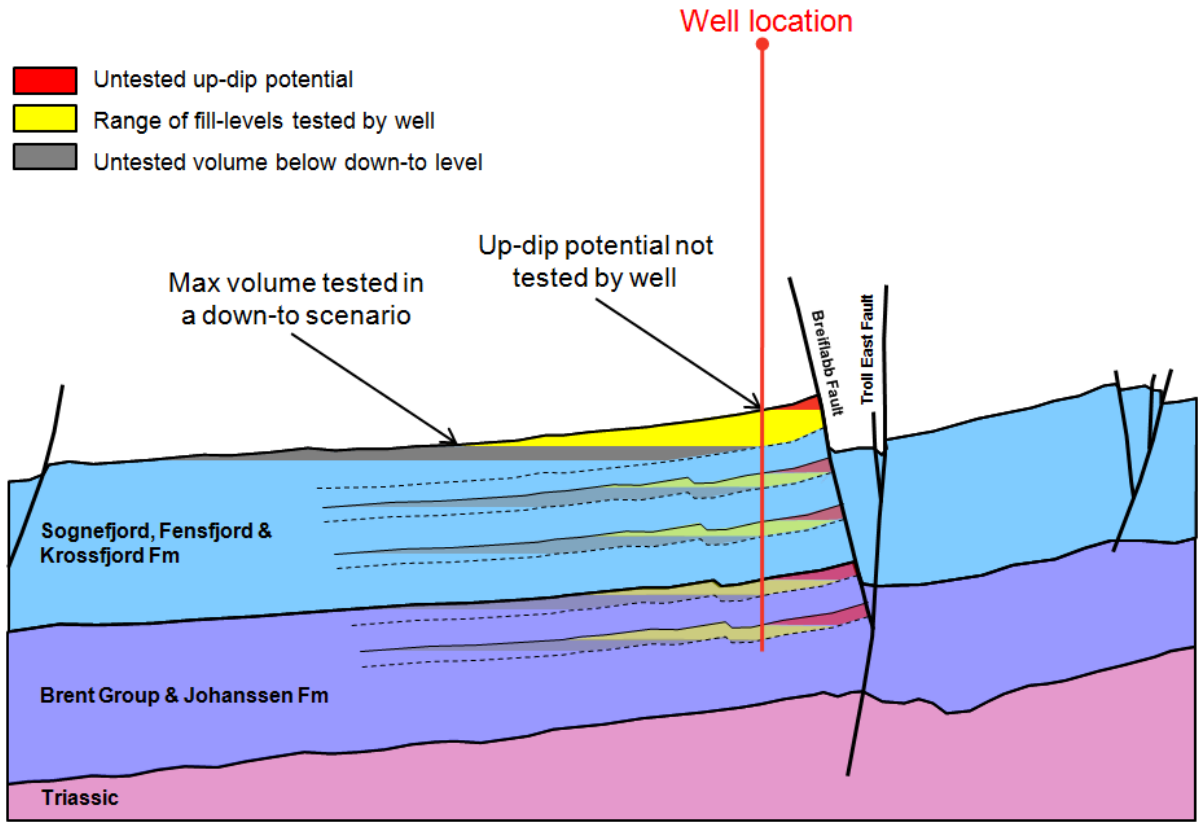
The new seismic is of very good quality and the Geometry risking factor was de-risked to 1,0. ERN as the operator undertook a study mapping the Upper Jurassic Delta, and were supported by the results from GeoLink that the Sognefjord Fm. in the Breflabb prospect should have good reservoir properties, hence a Reservoir risk set to 0,9.

With regards to the seal risk, the Top Seal is provided by the Upper Jurassic Heather Shale. Small 3-way-dip closure against N-S prospect bounding fault only requires juxtaposition seal. Seal risk for the majority of the structure is significantly higher as fault seal is required to fill beyond the 3-way closure. Fault seal study suggests sealing capacity of 20 – 50m, depending on N/G of Sognefjord Fm. The Operator regarded the lateral Seal risk to be moderate, hence a seal risk of 0,5.

The volume calculations are based on Area Depth maps and thickness. The areal extent of the Sognefjord trap is 62Km² for the P50 estimate. The shallowest point of the traps is at prognosed to be 2090m for the Top Sognefjord Fm. but is probably closer to 1970m based on the actual well top for Top Sognefjord.

The main risk is seen to be charge / migration. The overall GCF is calculated to be 23% for the Sognefjord Fm. prospect. The volumes can be observed in the tables above.

Jurassic Cross Section:



Post Mortem on the Positive EM anomaly

It was the uplift of the charge risk that led to the Drill decision for this well. It was therefore decided in the License to investigate this "False Positive" anomaly. Here is the summary:

The approach / work scope agreed after the start up meeting on 19th December, 2011 was as follows:

- QC of the pre-drill processing work carried out in 2007 and 2008
- Forward modeling to test for bathymetry and survey geometry effects
- QC of the data to check for pipeline / infrastructure effects
- New forward modeling to verify the pre-drill modeling on target sensitivity
- Reprocessing of the real data for comparison to the forward models and pre-drill work
- New guided and unconstrained inversion of both lines – results to be exported in segy format
- Testing of anti-models that could explain the anomaly (if required)

The conclusions from the technical work (completed on 31st January, 2012) and final report were as follows:

QC of pre-drill analyses

- Pre-drill unconstrained inversions did not show any response across the target
- Pre-drill guided inversions did show an anomaly coincident with the Breiflabb structure on both survey lines, **however**, examination of multiple inversion steps showed that the lateral positioning of the anomaly to be highly inconsistent. Unfortunately, this fact was not recognized at the time.
- The preprocessed U/D separated raw data (NMVO / PDVO plots) showed some response (<10 %) across the target area at offsets of 8.5 – 10 km.

Post-drill analyses

- Comparison of the real data to a forward model using a constant background resistivity showed significant bathymetry effects in the real data, however, these were clearly not consistent with (or related to) the anomaly across the Breiflabb prospect.
- Analysis of the resistivity data from 31/8-1 showed that the subsurface background resistivity profile was similar to the pre-drill prediction, with moderate anisotropy present in the formations below the BCU.
- Forward modeling carried out using resistivity values from the well (and data from nearby wells for the Lower Jurassic and Triassic section) showed no significant response when there is no HC filled target present (i.e. no response from the structure / geology alone).
- When a 2000 Ohmm2 transverse resistivity target was included in the forward modeling (equivalent to a 40m thick reservoir with 50 Ohm-m resistivity), a weak response was detected – primarily at offsets of 5 – 7 km. **NB.** Much shorter offsets compared to the 8.5 – 10 km observed in the real data.
- Inversion of the forward modeled data suggested that a 2000 Ohmm2 target could have been detectable in unconstrained inversion results.
- Unconstrained inversion of the real data showed no indication of any anomaly at the target level.
- Guided inversion of the real data showed the presence of a weak anomaly in the target layer (which has the highest background resistivity in the apriory input model), the lateral position of which changes with inversion step as the algorithm seeks the best mathematical solution. Not a reliable DHI!

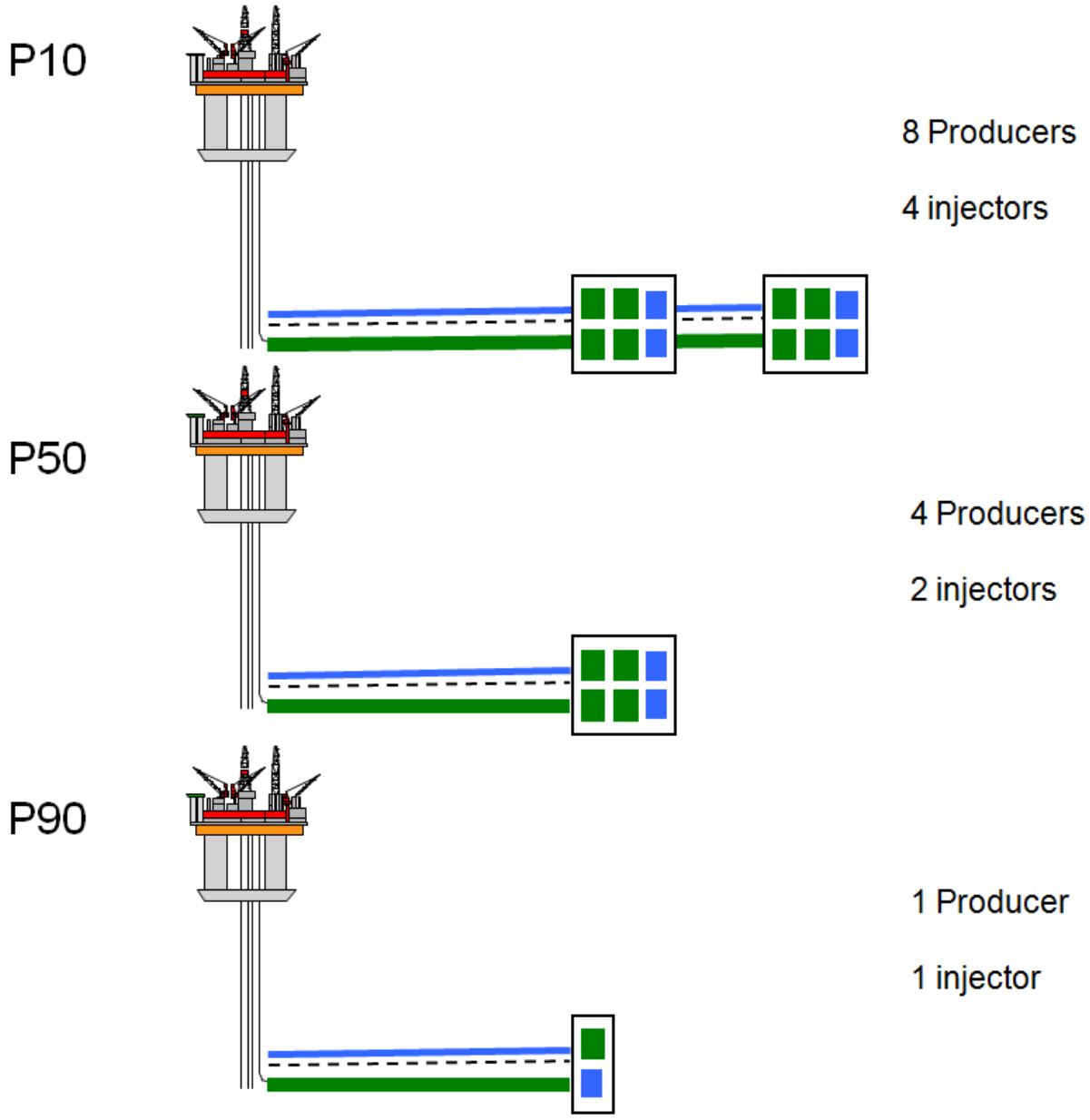
Conclusions:

- The lateral positioning of the anomaly in the pre-drill guided inversion results can be seen to be highly unstable and primarily dependent on inversion step.
- The Breiflabb structure and surrounding background resistivity distribution does not give rise to any significant resistivity anomaly – even when higher resistivity and anisotropy values are used for the deeper layers below the TD of the 31/8-1 well.
- Forward modeling including a 2000 Ohmm2 target, shows that if Breiflabb had been hydrocarbon filled – it should have been detectable on offsets of 5 – 7 km. **i.e.** at much shorter offsets than the slight increase in NMVO observed at 8.5 – 10 km.

- No response is seen in new unconstrained inversion of the real data. Guided inversion results give an anomaly, but the lateral position is highly unstable.
- On this basis, the Breiflabb dataset **DOES NOT** contain any significant resistivity anomaly – and that the pre-drill GCF uplift was significantly overestimated.

Technical/economical evaluation of the prospectivity in the PL416 License

If the Breflabb well had been a discovery, the following Tie back to Troll B/C solution was proposed for the P10/50/90 cases.



The development was assumed to be a simple template (water-depth 300m).
Single well or templates with 2 or 6 slots depending on size of discovery. Tie back to Troll B/C facilities, 35 km. Water Injection from either Troll B/C or Oseberg. Utilization of

existing subsea infrastructure may provide cost reduction possibilities. 297 MNOK exploration well (367 inc DST). 470 MNOK production / injector well

There uncertainties related to available space and capacities on the Troll B/C which may mean additional topsides modification cost were not taken into account in the evaluation.

Economic Assumptions:

- Exploration well 2011
- Appraisal well 2012 (P50 & P10 Case)

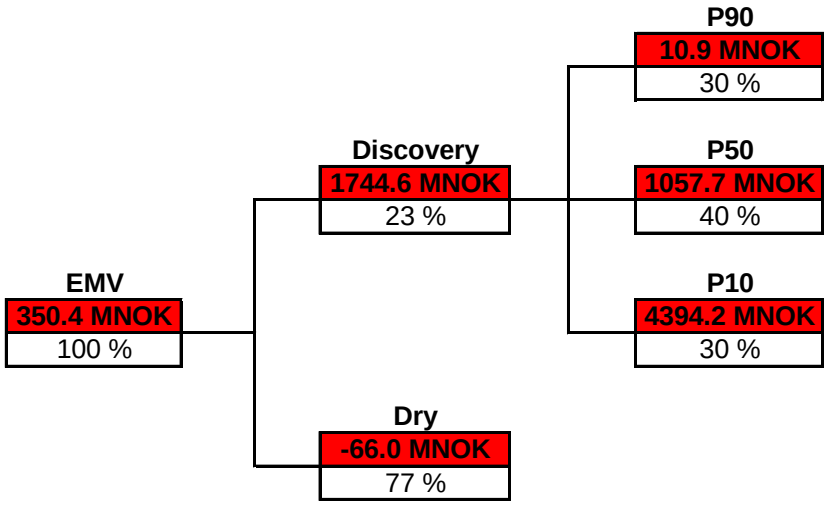
- Dry hole cost 250 MNOK (2400m TD)
- Discovery well cost 297 MNOK
- Producer / injector cost 470 MNOK

- Discounted to 01.01.2010
- Discount rate: 10.0%
- 100% Equity

- Base oil price: $75/barrel
- Base gas price: $200/mSm^3
- 2.5% annual inflation

Economic Results:

- All cases have positive NPV (P90 case marginal)
- Weighted mean discovery NPV = 1745 MNOK
- EMV @ 23% GCF = 350 MNOK



Conclusion and recommendation

The dry 31/8-1 well shows that the prospect failed due to Charge / migration. The possible volumes left up flank will be uneconomical.

With this result, the PL416as partners have agreed to the Operators recommendation to relinquish the license.