

# PL607 licence relinquishment report

Upon expiry of the initial period, 13.05.2015

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## 1. Key licence history

Licence PL607 was awarded on 13<sup>th</sup> May 2011 as part of the 21<sup>st</sup> licencing round to GDF Suez E&P Norge AS (60% and operator) and Concedo ASA (40%).

The licence commitment was to drill one firm well with total depth 3000m. The drilling commitment had to be fulfilled within 3 years of the licence award (13.05.2014).

During 2013 OMV farmed into the licence, acquiring 20% share from Concedo ASA, and early 2014 Total Norge farmed into the licence, acquiring 20% from GDF SUEZ.

The firm well commitment was satisfied in 2014 by drilling of the 'Byrkje' well 7218/8-1 to 3000m. The well was dry.

Following drilling, Total acquired 20% equity from Concedo ASA, and effective 30th June 2014 the PL607 partnership was as follows:

- GDF SUEZ (op) 40%
- Total 40%
- OMV 20%

16<sup>th</sup> January 2015 OMV announced their withdrawal from the licence (effective 1st June 2015).

By 22<sup>nd</sup> April it was confirmed on L2S that there were no majority in the partnership to extend the licence beyond the initial period.

7<sup>th</sup> May a notification letter was sent to the Authorities regarding the expiring of PL607 initial period.

Overview of licence meetings:

Date	Meeting		
	EC #	MC #	Work meeting
20.06.2011	1	1	
18.08.2011			1
18.11.2011	2	2	
29.03.2012			2
26.06.2012			3
15.11.2012	3	3	
06.06.2013	4	4	
19.09.2013	5		
21.11.2013	6	5	
03.06.2014	7	6	
12.08.2014	8	7	
23.10.2014	9	8	
20.11.2014	10	9	
05.02.2015			4
20.02.2015			5

The licence was relinquished due to the perceived risk and value of the remaining prospectivity following the result of the *Byrkje* well. The estimated size and risk of the prospects was insufficient to meet the financial requirements of the licence partners, largely due to the immaturity of infrastructure in the Barents Sea.

## 2. Database

A common database was established by the licence partners. The content is summarised below.

PL607 Common database								
Wells	Year	Status	Company	Content	Content stratigraphy	TD [TVD RKB]	TD stratigraphy	Comments
7119/12-1	1980	>20 years	Statoil	OIL shows		3087	Stø	Tie point for Jurassic, res quality
7120/12-1	1980	>20 years	Norsk Hydro	shows		3516	Kobbe	Kveite fm sandstone
7119/12-2	1981	>20 years	Statoil	shows		1902	Fruholmen	Tie point for Jurassic, res quality
7120/12-2	1981	>20 years	Norsk Hydro	GAS/COND	Stø/Snadd	4667	Pre-Devonian	Synrift Lower Cret Knurr sand res props
7117/9-1	1982	>20 years	Norsk Hydro	DRY		3196	Kolmule	Eocene sandstone turbidites
7117/9-2	1983	>20 years	Norsk Hydro	DRY		1994	Kolmule	Kveite fm depo environ
7119/12-3	1983	>20 years	Statoil	GAS/COND	Stø	3308	Nordmela	Tie point for Jurassic, res quality
7119/7-1	1983	>20 years	Norsk Hydro	DRY		3134	Permian	Tie point for Jurassic, res quality
7120/12-3	1983	>20 years	Norsk Hydro	GAS	Stø	2522	Fruholmen	Kveite fm depo environ
7120/10-1	1984	>20 years	Esso	DRY		2000 [MD]	Fruholmen	Kveite fm sandstone
7120/7-3	1984	>20 years	Statoil	shows		3061	Nordmela	Eocene bright seismic anomaly - ooze
7120/6-1	1985	>20 years	Norsk Hydro	OIL/GAS	Stø	2820	Tubåen	Snøhvit, Jurassic res props, fluid props
7121/5-1	1985	>20 years	Statoil	OIL/GAS	Stø	3197	Snadd	Kveite fm sandstone
7121/5-2	1986	>20 years	Statoil	OIL/GAS	Stø	2540	Fruholmen	Kveite fm sandstone
7219/9-1	1988	>20 years	Norsk Hydro	shows		4286	Snadd	Tie point for Jurassic, res quality
7120/1-2	1989	>20 years	Shell	OIL	Knurr/Hekkingen	2613	Fruholmen	Synrift Lower Cret Knurr sand res props
7120/10-2	1990	>20 years	Esso	DRY		2497	Hekkingen	Synrift Lower Cret Knurr sand res props
7120/2-2	1991	>20 years	Norsk Hydro	OIL/GAS		2794	Stø	Synrift Lower Cret Knurr sand res props
7122/2-1	1992	>20 years	Norsk Hydro	DRY		2120	Stø	Synrift Lower Cret Knurr sand res props
7219/8-1S	1992	>20 years	Saga	DRY		4044	Stø	Closest tie point for Jurassic, res quality
7316/5-1	1992	>20 years	Norsk Hydro	GAS	Torsk	4014	Kveite (Torsk)	Eocene sandstone turbidites
7019/1-1	2000	traded	Agip	GAS	Stø	2998	Tubåen	Synrift Lower Cret Knurr sand res props
7216/11-1S	2000	>2 years	Norsk Hydro	DRY		3733	Torsk	Eocene sandstone turbidites
7122/7-3 (Goliat)	2006	traded	ENI	OIL/GAS	Tubåen/Snadd/Kobbe	2725	Tempelfjorden	Kveite fm depo environ
7120/2-3S (Skalle)	2011	traded	Lundin	GAS	Kolmule/Stø/Knurr	2620	Snadd	Kolmule sandstone gas discovery
7220/8-1 (Skrugard)	2011	traded	Statoil	OIL/GAS	Stø/Nordmela	2221	Snadd	Tie point for Jurassic, res quality, fluid prop
7218/11-1 (Darwin)	2013	traded	Repsol	DRY		2542 [MD]	Early Cret	Tie point for Cretaceous, drilling props (Ooze)
7219/8-2 (Iskrystall)	2013	traded	Statoil	GAS	Middle Jurassic	3425 [MD]	Late Triassic	Tie point for Jurassic, res quality, fluid prop
7220/7-1 (Havis)	2012	>2 years	Statoil	OIL/GAS	Stø/Nordmela	2229	Late Triassic	Tie point for Jurassic, res quality, fluid prop
7220/5-1 (Skrugaad appraisal)	2012	>2 years	Statoil	OIL/GAS	Stø/Nordmela	1740	Late Triassic	Tie point for Jurassic, res quality, fluid prop

Seismic	Year of acq	Owner	Year of proc	Proc company	Processing	Proc products
WG1001_3D	2010	Western	2010	Western	PSTM	full, near, mid, far
WG1001-GDF-MRT12_3D	2010	Western	2012	ION GXT	PSTM, PSDM, BEAM	PSTM: full, near, mid, far PSDM: full, near, mid, far BEAM: full

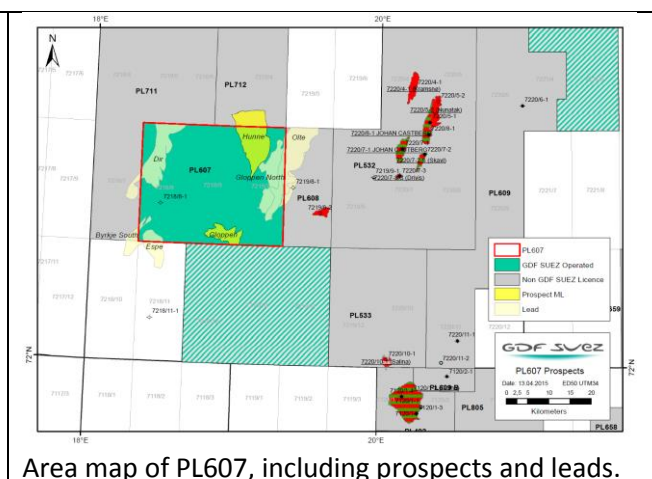
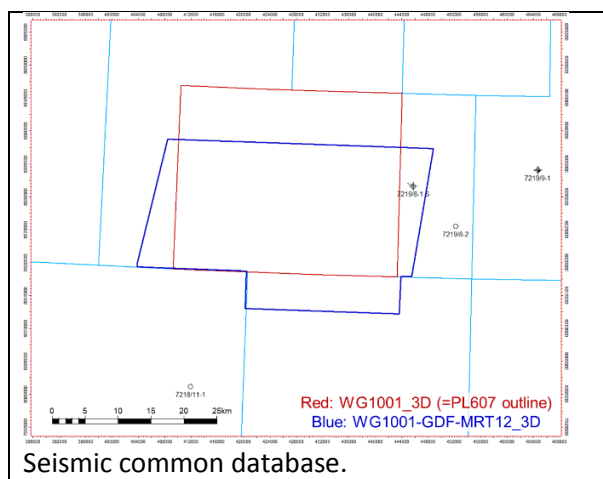
EM data	Year of acq	Owner	Year of proc	Proc company	Processing
Petromarker line PM08-2010	2010	Petromarker	2012	Petromarker	Inversion

Studies
Barents Sea: Cretaceous and Tertiary Reservoir Quality Database - Ichron 2010

Wells 7219/8-2 (Iskrystall) and 7218/11-1 S (Darwin) were added (traded) to the CDB during the licence period as the closest relevant offset wells for Jurassic and Cretaceous targets respectively.

Reprocessing of the 2010 WG1001\_3D took place in 2012 to generate a PSDM volume, which was influential in maturing *Gloppen* from a lead to a prospect.



### 3. Review of geological framework

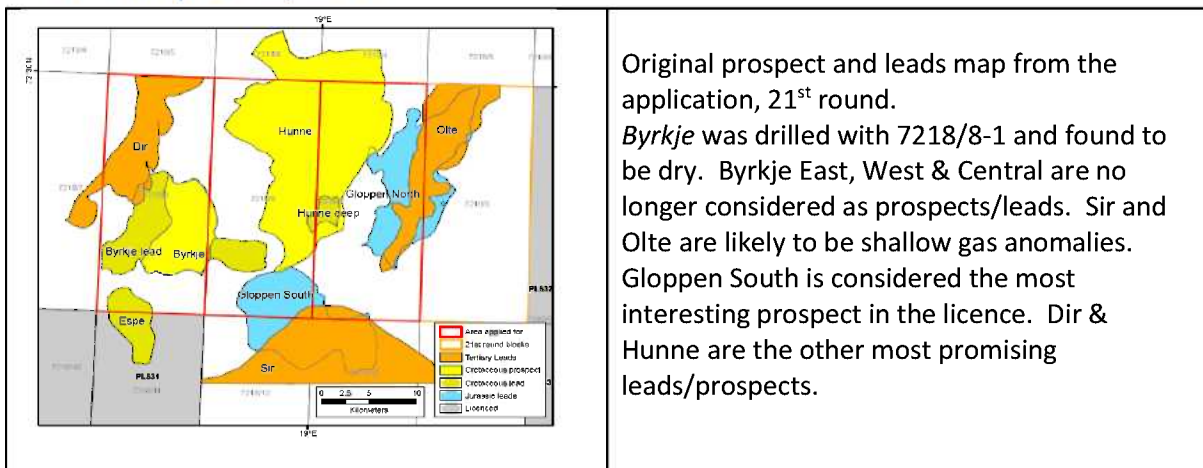
The general, established stratigraphy of the licence area has not been significantly revised as a result of studies performed. Neither did the 7218/8-1 well significantly influence the pre-drill stratigraphy. However, it did provide data that updated the depositional model for the Upper Cretaceous.

Pre-drill depositional model for the reservoir intervals was sandy turbidites sourced from East Greenland, which was at the time (ca. 100Ma) in close proximity to PL607 position. Post well studies, specifically from the image log and from heavy mineral analysis, suggest a modification of this theory.

Image log analysis of the upper reservoir interval reveals a depositional architecture indicating a NW dipping paleo slope and deposition in an open marine setting. Heavy mineral analysis, on the other hand, indicates material with probable provenance from the north/northwest. This would imply re-working of Greenland-derived material back to the northwest, having first been deposited, possibly onto the Veslemøy High, by slightly older distal turbidites. That the Byrkje structure (on the Veslemøy High) existed at time of deposition is the conclusion of an existing structural study. Although at first these three lines of evidence appear contradictory, there is an uncomplicated way to explain how the interval can have been derived that satisfies all available data.

During work on the *Gloppen* prospect, structural studies investigated the complex geometrical evolution of the Veslemøy High area. Separate structural studies by GDF SUEZ and Total did not conclude in the same way, although both highlighted the uncertainty of the western and southern part of *Gloppen*, which is compromised by poorer quality seismic and repeated Cretaceous faulting. This work did not revise the geological framework, but sought to establish the expected sequence or juxtaposition of lithologies. The equivocal interpretations will not be fully established without drilling the sequence.

## 4. Prospect update



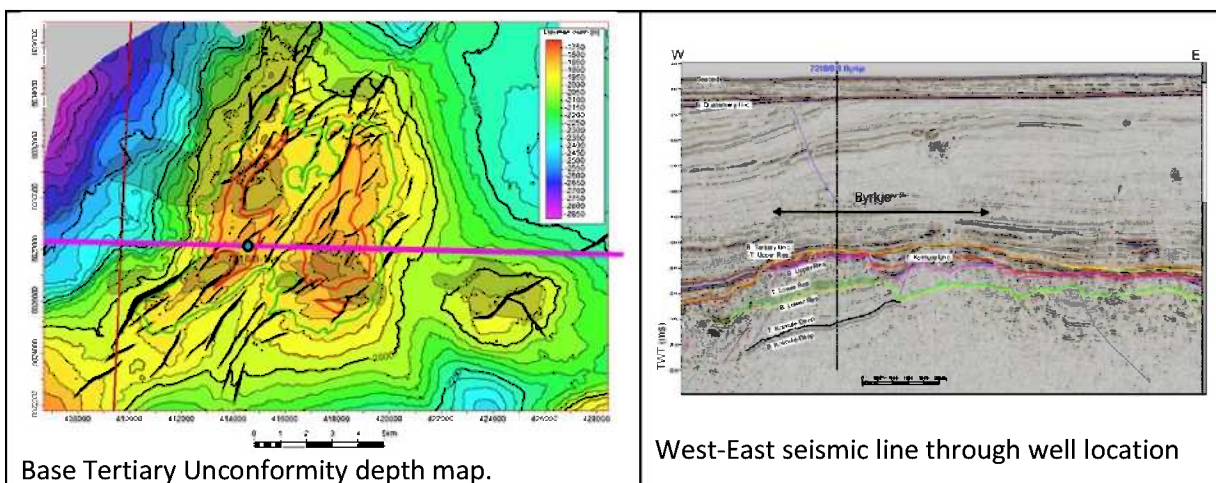
### Byrkje

The *Byrkje* prospect was drilled with well 7218/8-1. The primary target was to prove petroleum in Upper Cretaceous reservoir rocks (the *Kviting* Formation) and Lower Cretaceous (upper part of the *Kolmule* Formation). The secondary target was to prove petroleum in reservoir rocks in the lower part of the *Kolmule* Formation.

The well encountered thin siltstone layers in the *Kveite\** Formation with elevated gas readings in a gross interval of about 35 metres. Mobile gas was detected in a siltstone layer. Reservoir rocks were not encountered in the *Kolmule* Formation. The well is classified as dry, with traces of gas.

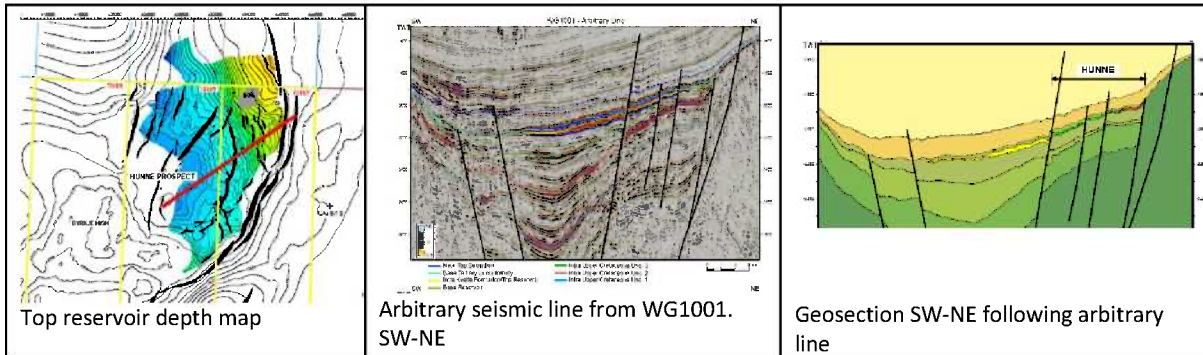
The well was drilled to 3000m MD and terminated in Early Cretaceous *Kolmule* Formation. Water depth is 385 metres. The well was permanently plugged and abandoned.

\**Kviting* Formation had been prognosed, with the expectation of the sandy facies encountered in the *Hammerfest* Basin (type well 7120/12-1). Post drill interpretation of the shale-rich facies encountered indicates more likely '*Kveite* Fm.' (type well 7119/12-1) with green-grey shales and claystones with thin interbeds of limestone and siltstone. *Kolmule* Fm. drilled at *Byrkje* location is younger than has been drilled elsewhere in *Barents* Sea. As such, it is insufficiently described by the *type* lithology from well 7119/12-1.



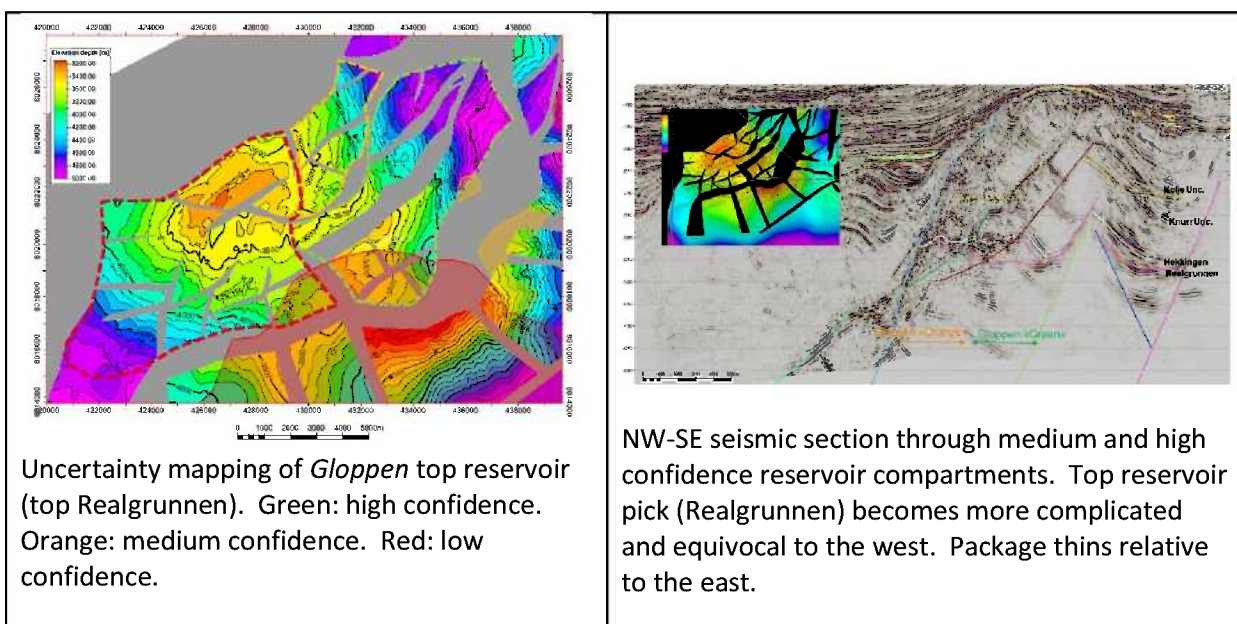
## Hunne

The *Hunne* prospect is a combination stratigraphic and fault trap in Upper Cretaceous (or Lower Paleocene) sandstone. The *Hunne* play is proven by the Pingvin (7319/12-1) discovery. The most likely phase is gas. *Hunne* prospect is compromised by the up-dip culmination being in the licence to the north (PL712) where the PL607 licence partners do not have 3-D seismic. The pinch out is thus mapped on 2D seismic. Seismic modelling has been carried out for *Hunne*, but the quality is poor outside the PSDM re-processed area (the northern, up-dip segment) and there are no close offset wells with shear sonic data with which to calibrate the seismic. No fluid contact was observed on the reprocessed seismic, which means that either the HC column is limited or that the reservoir quality is rather poor.



## Gloppen

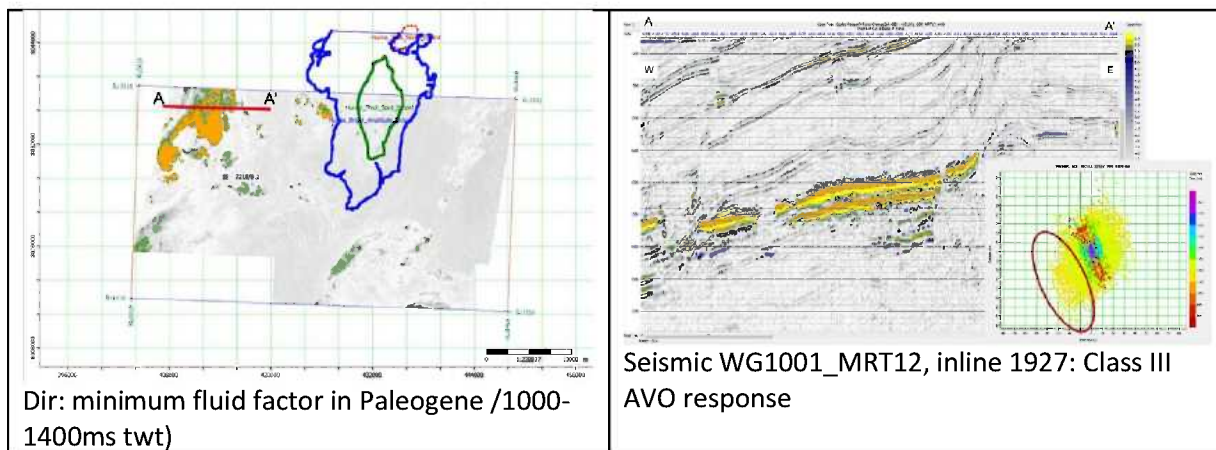
The *Gloppen* prospect was a lead at licence application, but became the principal prospect within the licence following the Byrkje dry well, and the subject of the majority of subsurface studies. *Gloppen* is a Jurassic tilted fault block structure with a complicated fault extension configuration in the western segment. The reservoir is Realgrunnen Subgroup which is confidently interpreted in the easternmost fault blocks, but subject to significant uncertainty in the west where successive Cretaceous faults appear to potentially erode the top of the structure. Reservoir presence in the west is therefore uncertain. Reservoir quality at the present burial depth is compromised due to previous deeper burial and subsequent uplift. The magnitude of uplift and timing of hydrocarbon charge will control reservoir quality. Offset well studies have been used as analogues to constrain uncertainty, but the range remains wide.



## Dir

The *Dir* lead is a diagenetic trap under the opal-A to opal-CT transformation zone within the ooze layer of Eocene age. It corresponds to a bright, soft event (class III/IV AVO behaviour) crosscutting the northwest-dipping stratigraphy. The reduction of AI at the diagenetic boundary indicates the presence of hydrocarbons, most likely gas.

The amplitude response is aurally large (>200km<sup>2</sup>, with 64km<sup>2</sup> within the licence block) and at least two seismic cycles thick (c.80m tvd). The second soft marker can be interpreted either as the bottom of the transformation zone (OACT zone) or as a gas-filled silty layer. The possibility of having turbidite deposits sourced from the north (Eocene uplift of Stappen High with erosion of Realgrunnen) is considered unlikely. The clinorforms (visible mainly above the ooze layer) appear to be sourced from the northeast and do not present breaks steep enough to deliver sand to the toe-sets.



## Sir

*Sir* lead is located almost entirely outside the PL607 license. It is at the same stratigraphic level as *Dir*, but on the other side of the Veslemøy High, compromising potential reservoir source from the north. It has not been studied as part of the PL607 work.

## Olte

*Olte* lead is interpreted as shallow gas in the Paleocene section. The bright amplitudes are following the western fault of the 7219/8-1 S block. No sand was found in the *Byrkje* well or 7219/8-1S in this interval. Therefore, the *Olte* lead is not been pursued.

## Espe

A small seismic anomaly at the same level as *Hunne*. This lead has not been investigated. Size and position make this an unrealistic target before significant infrastructure maturity. The *Hunne* play concept needs to be demonstrated as effective before attention is turned to *Espe*. Two thirds of the lead lies outside of PL607.



## 5. Technical evaluations

Conceptual development scenarios were evaluated for *Byrkje* and *Gloppen* prospects.

For *Byrkje*, a solution exporting via Snøhvit was incorporated, despite the lack of capacity. It assumed a second LNG train and that PL607 contribute towards this as an area solution with other operators.

During evaluation of *Gloppen*, a stand-alone development case was evaluated with FPSO and a dedicated LNG train on Melkøya. The evaluated case was 70% gas, 30% oil. The substantial cost drove up the minimum economic field size (*mefs*) significantly.

Gloppen development solution, March 2015:

- No injection or artificial lift
- Wells: 3800m tvdss with 2000m horizontal reach
- FPSO with storage and offloading of condensate. Local power generation
- 20 Msm<sup>3</sup>/d gas capacity
- Export of rich gas through 225km gas pipeline to Melkøya LNG
- New *Train II* on Melkøya LNG with 20 Msm<sup>3</sup> capacity

## 6. Conclusions

Remaining potential in PL607 exists in three stratigraphic intervals:

- Jurassic Realgrunnen (*Gloppen*)
- Cretaceous Kveite (*Hunne/Espe*)
- Eocene intra-Torsk (*Dir*).

These prospects and leads are estimated to be high risk, with insufficient size to warrant the commitment to drill.

The licence partners considered Gloppen to be the primary objective in the licence (following the result of the Byrkje well) and this was the focus of the majority of the subsurface work.

All partners consider a gas case as most likely. Some partners only consider a gas case, deeming the oil case to be impossible given the relative position of the structure and the deeply buried kitchen lying firmly in the gas window. Due to the immaturity of infrastructure, the minimum economic field size for a gas development is beyond the expected resources from Gloppen.

The Cretaceous and Eocene prospects and leads are even more risky and likely to be smaller volumes. Such targets would be more attractive as tie-in opportunities to a regional development. Until there is development in the area these prospects do not meet financial thresholds of the licence partners.

Consequently, the partners in PL607 have decided not to apply for extension of the initial exploration period.