

PL561 Relinquishment Report

1. Key license history

PL561 was awarded on 19th February 2010 and consists of part of block 6608/7 and 6608/8. Wintershall Norge ASA (35%) was the operator with E.ON Ruhrgas Norge AS (25%), Det norske oljeselskap ASA (20%) and Concedo ASA (20%) as partners. In February 2012 E.ON Ruhrgas Norge AS changed its company name to E.ON E&P Norge AS. In March 2012 Wintershall Norge ASA changed its company name to Wintershall Norge AS.

The initial work obligations including reprocessing of seismic data and study of geology and geophysics are fulfilled. The period until a drill or drop decision had to be made was 2 year. A 1 year extension of the decision to drill and initial period was granted by the Ministry of Petroleum and Energy on the 6th February 2012. EC/MC meetings were held at least once a year, in addition there were work meetings.

The license area is located on the Dønna Terrace and at the western flank of the Nordland Ridge. PL561 is located northwest of the Dompap and Linerle discoveries. The application for the area focused on Jurassic prospects and leads. The main prospects applied for were Spettmeis, Svartmeis, Toppmeis and Tiur. After detailed area and prospect evaluation, the Svartmeis prospect became the main prospect. Unfortunately the potential volumes are too small and the probability of discovery is too low to defend a drill decision. Even a combined evaluation together with the Spettmeis prospect in PL652 could not justify a drill decision. The decision to relinquish the license was unanimous among operator and partners.

2. Database

The initial database described in the APA 2009 application was extended by the reprocessed ST9405MR10 (Figure 1). The total data to be processed consisted of an input area of approximately 1016 km² to produce a fully migrated output of 816 km². The area comprised 5 input survey volumes: SEG-D data from ST9405, ST9301 & ST0114, merged with GXT legacy 2009 data from ST9405 and ST0114 surveys.

The following issues were addressed:

- Eliminate multiples and other noise prior to imaging.
- Optimise the lateral positioning, continuity and focusing of target events and faults.
- Determine overburden velocities accurately such that the final product can be used for reliable depth prediction.
- Optimally match all input surveys in the pre-processing.
- Attenuate steeply-dipping long period multiples

The final products are:

- Kirchhoff PreSDM Post-Migration RMO+Radon Gathers (time)
- Kirchhoff PreSDM Stack Volumes in time: Raw offset stack, FM full offset stack, Enhanced full offset stack, Near angle, Mid angle, Far angle
- Kirchhoff PreSDM Stack Volumes in depth: Raw offset stack, FM full offset stack, Near angle, Mid angle, Far angle
- Beam PreSDM Stack Volumes in time: Raw full offset stack, Enhanced full offset stack
- Beam PreSDM Stack Volumes in depth: Raw full offset stack, Enhanced full offset stack
- Kirchhoff PreSDM RMO Stacking RMS velocity
- Beam PreSDM RMO Stacking RMS velocity

3. Review of geological framework

The reprocessed seismic has been used in geophysical and geological evaluation of the license area. This includes seismic mapping of all relevant horizons and faults, and amplitude analysis. Geological studies have covered petrophysical analysis, hydrocarbon charge studies, hydrocarbon phase prediction and resource and risk assessment for prospect evaluation.

The new seismic dataset of ST9405MR10 changed the understanding of presence and size of the prospects and leads (Figure 2). The prospects Svartmeis and Tiur were reduced in size. The Tiur amplitude anomaly was confirmed, but is hardly definable in area and strata. The Blåmeis and Lappmeis leads consist of poor reservoir quality Triassic and Lower Åre Fm. The leads Or and Sandsvale were confirmed almost unchanged. The Tårnseiler lead was evaluated as part of PL485 and considered non-economic.

4. Prospect update

The area of the Spettmeis and Toppmeis prospects was not awarded as part of PL561.

The Svartmeis prospect is a downthrown fault block relative to Spettmeis and Dompap (Figure 3 and 4). It has the largest volumes (mean: $4.4 \cdot 10^9$ SM³ gas and $2.84 \cdot 10^6$ Sm³ associated oil) and highest GPOS (43%) in PL561. The recoverable volumes are smaller than presented in the application (mean: $11.07 \cdot 10^9$ SM³ gas and $1.63 \cdot 10^6$ Sm³ associated oil) due to a southward shift of the BCU erosion line and therefore reduction of prospect area. Reservoir quality is the main risk due to the large depth of 4250 to 4800 m.

The seismic velocities from the reprocessing allowed improving the velocity model. Seismic velocities were calibrated to well information in the most robust model.

Dimming of seismic amplitude at BCU level north of Svartmeis and Spettmeis indicates potential absence of Spekk Fm. This information and new depth maps were used for a new basin modelling study. The outcome shows that the Svartmeis prospect is most likely charged with gas/condensate.

An inhouse seal analysis study for the Svartmeis Prospect showed that capillary leakage and hydraulic fracturing of the top seal are no risk. Leakage along fault is very unlikely. Potential across fault leakage was identified, but a high SGR gives positive indications for fault seal.

However a combined development economic evaluation of Spettmeis (PL652) and Svartmeis prospects was made in order to make both prospects economic. Unfortunately the outcome of the evaluation does not justify a drill decision.

The Tiur prospect was remapped using ST9405MR10. This improves the understanding of the prospect. Unfortunately the new data show that the GPOS is lower (2%) than originally estimated (8%). The main risks are charge (20%) and Trap (36%). The area of the Tiur prospect is also reduced. Therefore the recoverable volumes (mean: $5.37 \cdot 10^6 \text{ SM}^3$ oil and $0.59 \cdot 10^9 \text{ Sm}^3$ associated gas) are smaller than estimated in the application (mean: $26.1 \cdot 10^6 \text{ SM}^3$ oil and $3.63 \cdot 10^9 \text{ Sm}^3$ associated gas). Due to the high risk Tiur is no longer classified as a prospect.

5. Technical evaluations

A combined production, facility and economic evaluation was completed for the Svartmeis prospect (PL561) and Spettmeis prospect (PL652). The main scenario considers an exploration well and sidetrack at the Spettmeis prospect and, if successful, an exploration well and sidetrack at the Svartmeis prospect. Dependent on the Svartmeis exploration outcome, 3 to 6 production wells are needed. Subsea tie back scenarios were designed via Spettmeis to the Norne platform. The field layout includes a subsea template, a cooling unit and a HIPPS. Production start was assumed to be in 2021 with keeping plateau until 2024 (Figure 5).

6. Conclusions

The extensive work program carried out gave a good picture of the GPOS and HC volumes expected in PL561 and the Svartmeis prospect. The combined development economic evaluation of the PL561 and PL652 was positive, but not sufficient to make a drill decision at this stage.

The decision to relinquish PL561 was taken unanimous.

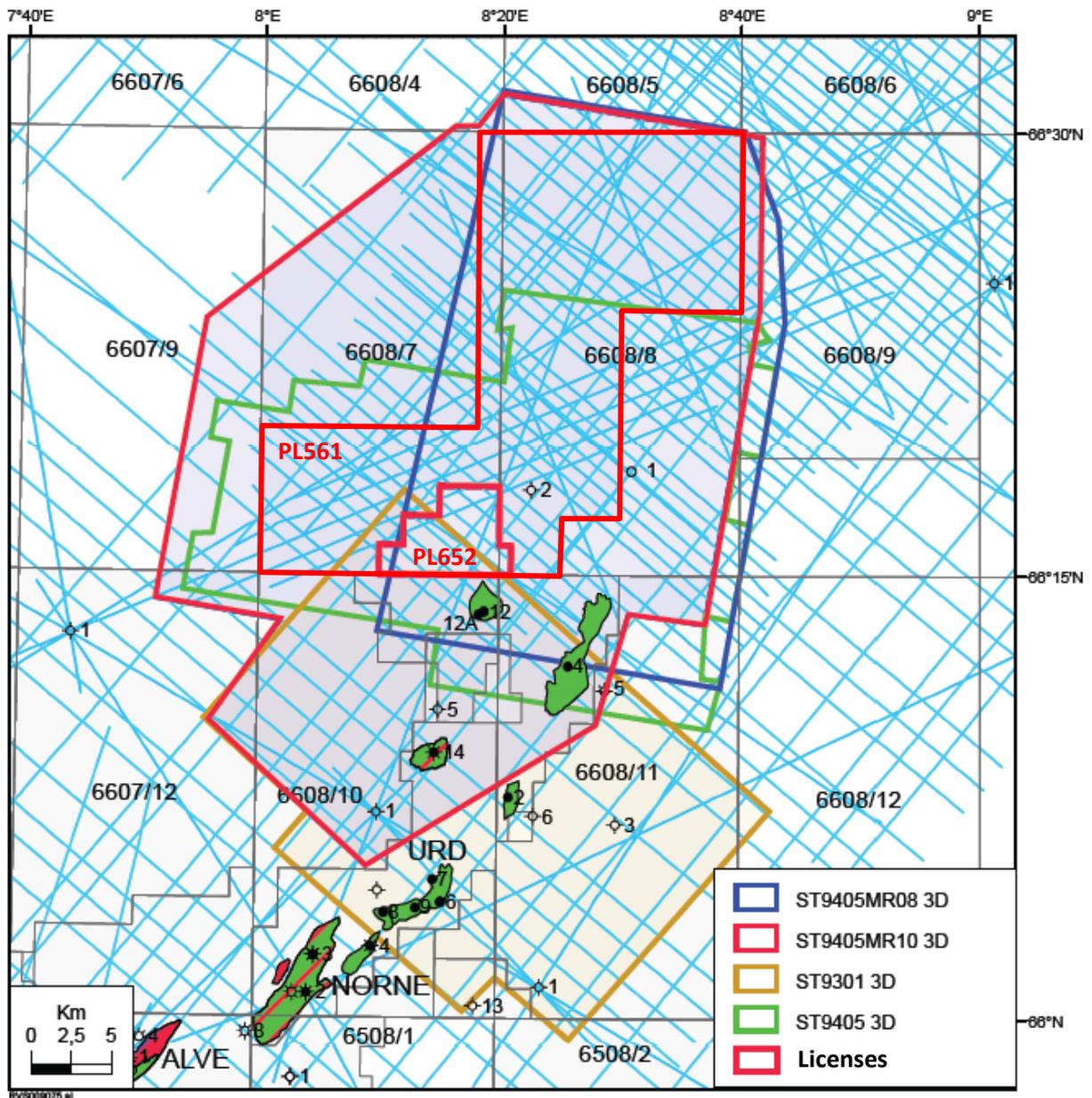


Figure 1: Seismic database.

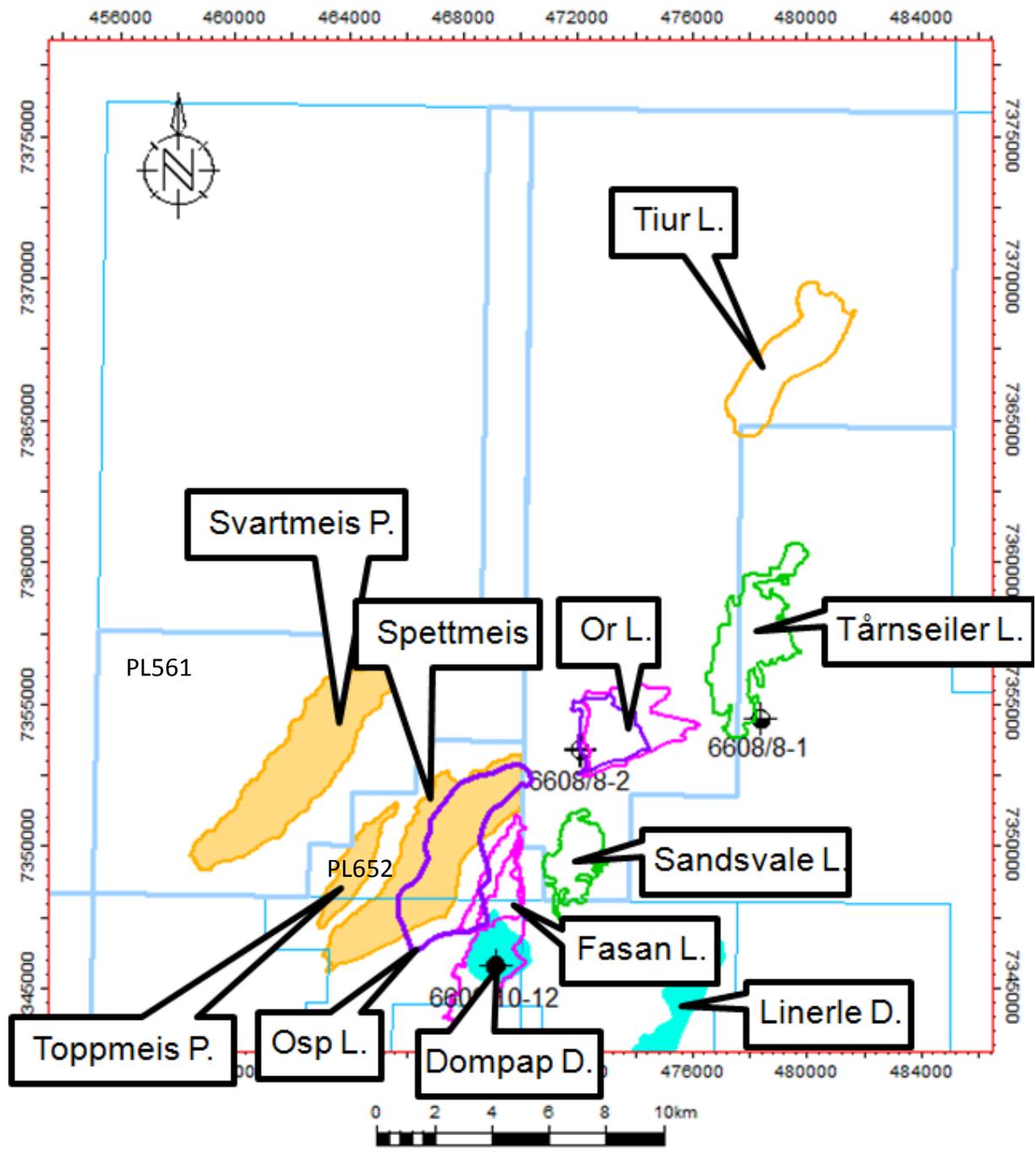


Figure 2: PL561 and PL652 location map showing the prospects and leads west-northwest of the Dompap and Linerle discoveries.

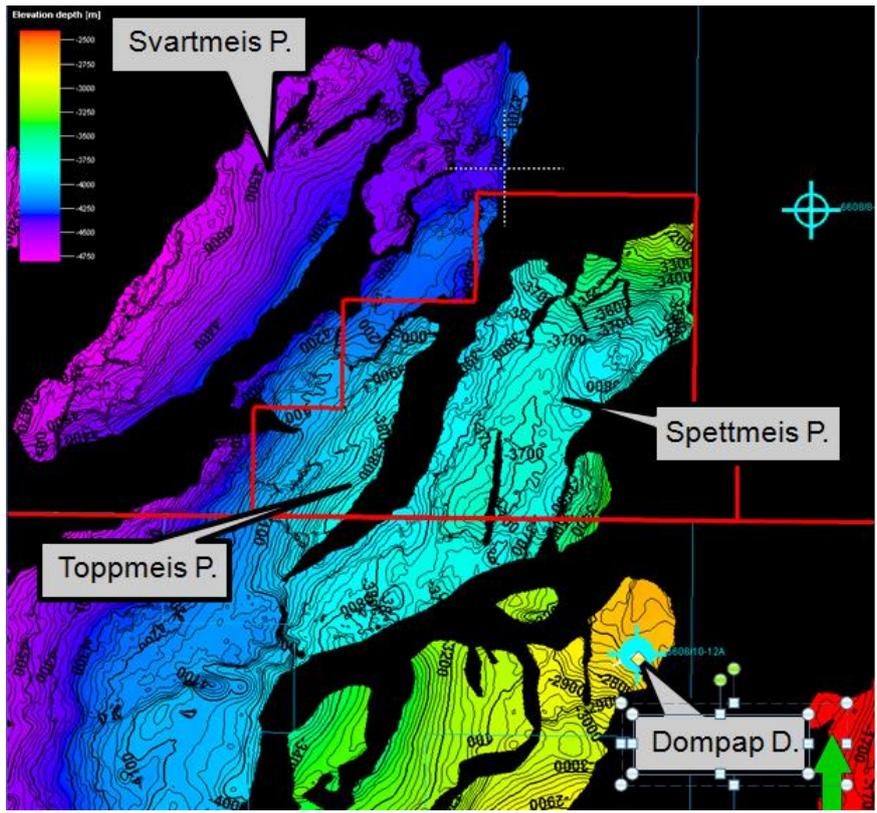


Figure 3: Top Åre Fm depth map showing location of Jurassic prospects and Dompap discovery. CI = 20 m.

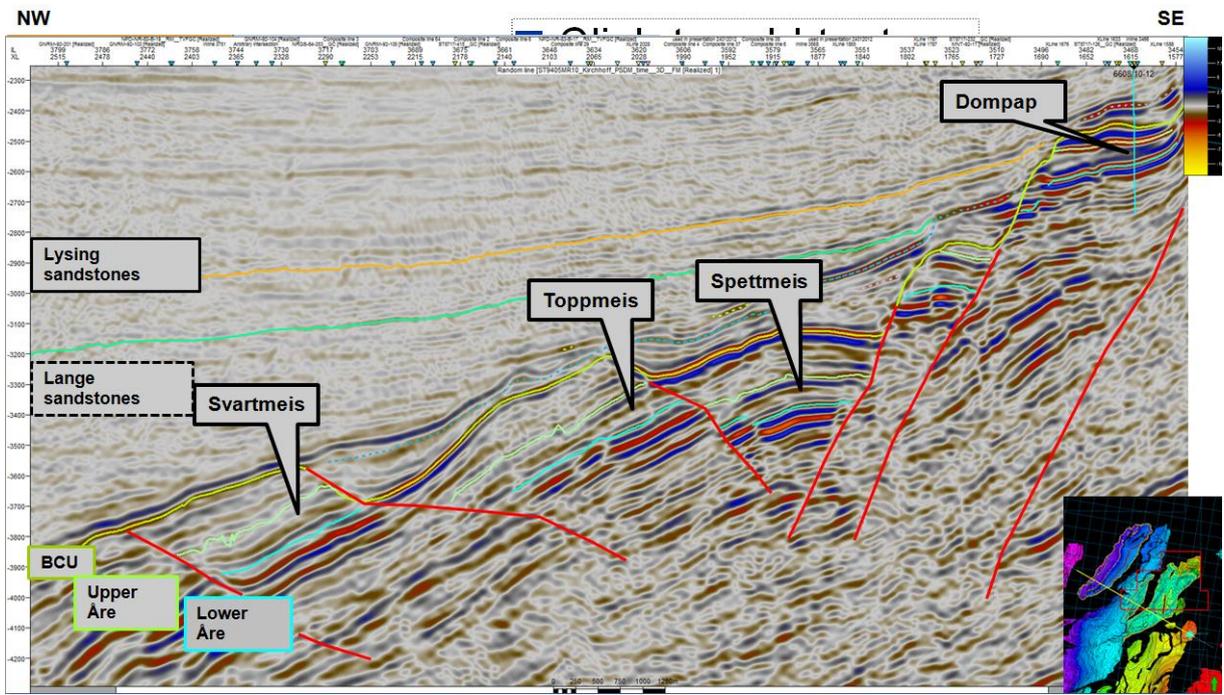


Figure 4: Seismic cross section of the reprocessed ST9405MR10 showing the reinterpreted prospects Spettmeis, Toppmeis and Svartmeis, as well as the Dompap discovery and potential Lysing and Lange sandstones.

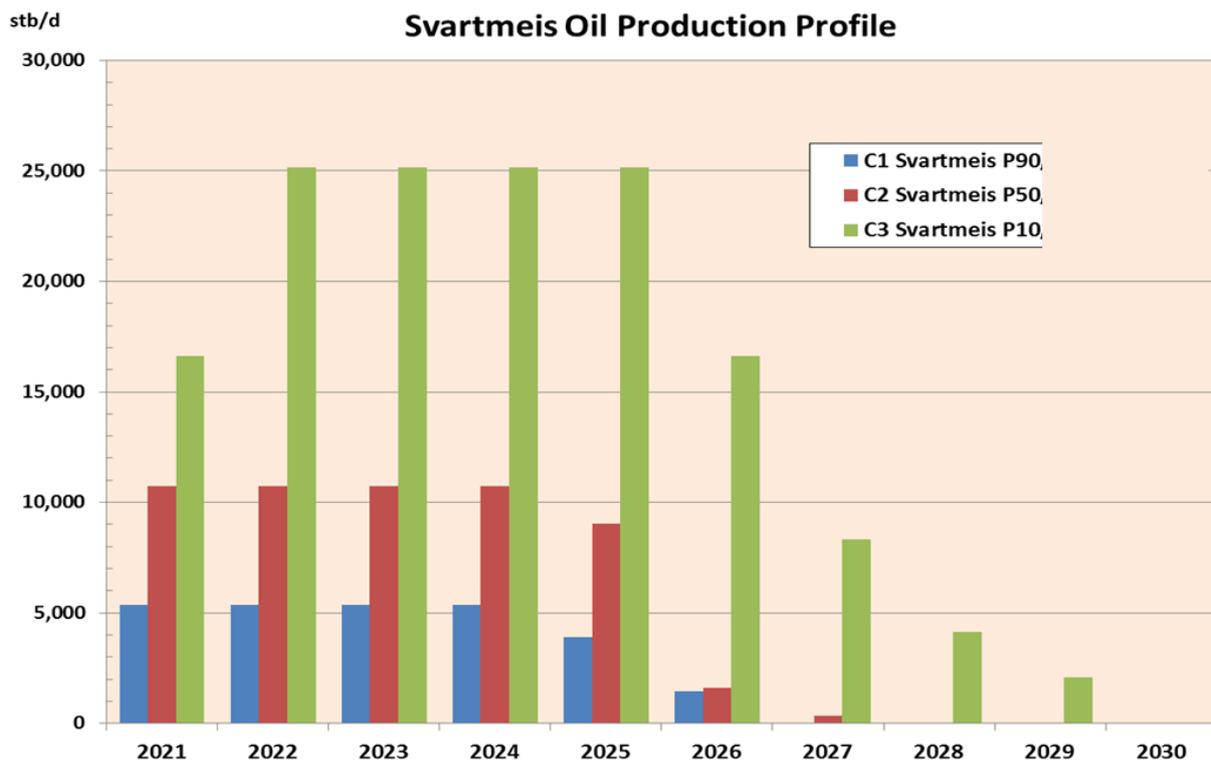
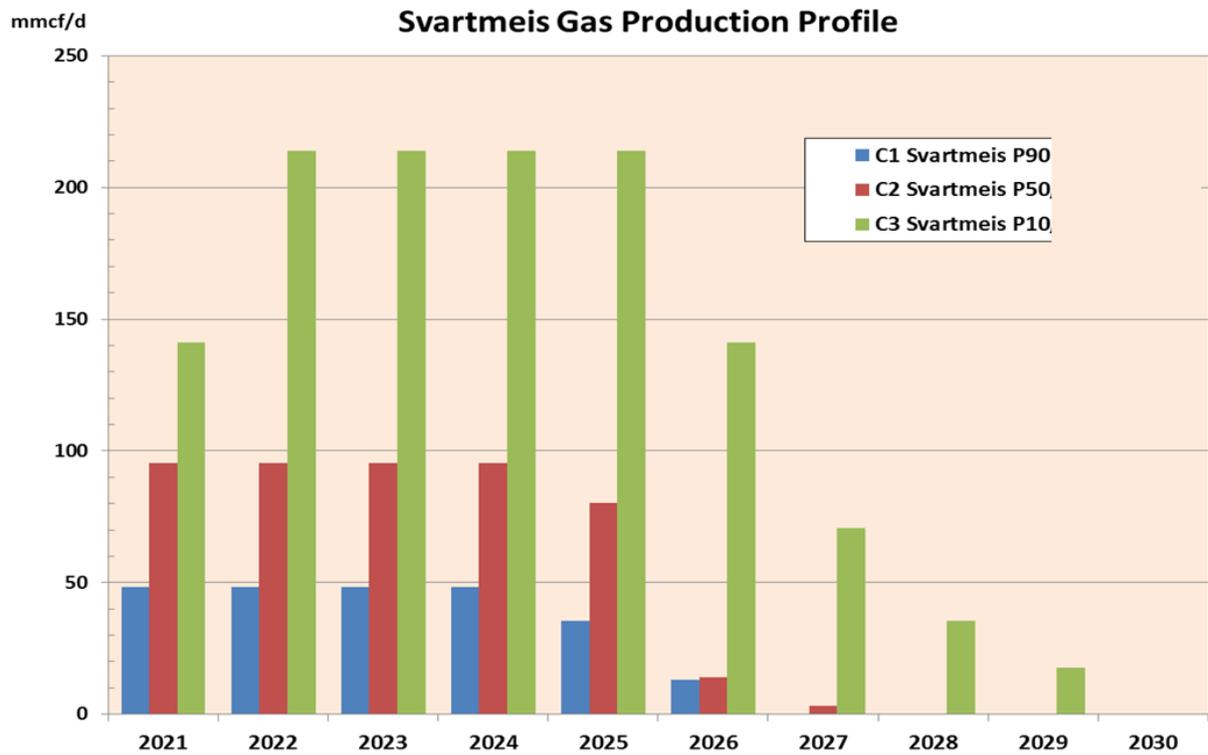


Figure 5: Gas and oil production profile for the Svartmeis prospect.

Block	Block 66087	Prospect name	Siaatmeis	Discovery/Prospect/Lead	Prospect	Prospect ID (or New)	NPD will insert value	NPD approved (Y/N)
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)				
Oil, Gas or O&G case:	Gas	Reported by company	Wimerstal Norge A	Reference document		Assessment year		2013
This is case no.:		Structural element	Donna Terrace	Type of trap	Struct. 3-way	Water depth [m (MSL)] (>0)	360	Seismic database (2D/3D)
Resources IN PLACE and RECOVERABLE		Associated phase						
Volumes, this case		Main phase	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean
In place resources	Oil [10 ⁶ Sm ³] (>0.00)	Low (P90)						High (P10)
Recoverable resources	Gas [10 ⁶ Sm ³] (>0.00)	0.88	0.58	3.59	22.10	0.23	0.06	2.84
	Oil [10 ⁶ Sm ³] (>0.00)	0.37	0.15	4.40	10.20			6.66
	Gas [10 ⁶ Sm ³] (>0.00)							
Reservoir Chrono (from)	Rhaetian	Reservoir litho (from)	Ave Fm	Source Rock, chrono primary	Oxfordian to Tithon	Source Rock, litho primary	Spekk Fm	Callovian
Reservoir Chrono (to)	Sinemurian	Reservoir litho (to)	Ave Fm	Source Rock, chrono secondary	Rhaetian to Helian	Source Rock, litho secondary	Ave Fm	Melke Fm
Probability [fraction]								
Technical (oil + gas + oil & gas case) (0.00-1.00)	0.43	Oil case (0.00-1.00)	0.00	Gas case (0.00-1.00)	0.43	Oil & Gas case (0.00-1.00)	0.00	
Reservoir (P1) (0.00-1.00)	0.60	Trap (P2) (0.00-1.00)	0.80	Charge (P3) (0.00-1.00)	0.90	Retention (P4) (0.00-1.00)	1.00	
Parameters:		Comments						
Depth to top of prospect [m (MSL)] (> 0)	4248	Base	High (P10)					
Area of closure [km ²] (> 0.0)	17.0							
Reservoir thickness [m] (> 0)	56							
H/C column in prospect [m] (> 0)	141							
Gross rock vol. [10 ⁶ m ³] (> 0.000)	0.126							
Net / Gross [fraction] (0.00-1.00)	0.23							
Porosity [fraction] (0.00-1.00)	0.09							
Permeability [mD] (> 0.0)	10.0							
Water Saturation [fraction] (0.00-1.00)	0.20							
Eg [Rm3/Sm3] (< 1.0000)	0.0043							
GOR, free gas [Sm ³ /Sm ³] (> 0)	2226							
GOR, oil [Sm ³ /Sm ³] (> 0)	1549							
Recov. factor, oil main phase [fraction] (0.00-1.00)								
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0.30							
Recov. factor, gas main phase [fraction] (0.00-1.00)	0.30							
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0.46							
Temperature, top res [°C] (>0)	160							
Pressure, top res [bar] (>0)	750							
Cut-off criteria for N/G calculation		1	2	3				

Table 1: Prospect Data.