



PL 898 – Licence status report

Summary

The main reason for applying for the PL898 area in the APA2016 was to test out a new play in Paleocene sandstones eroded off the Nyk High and deposited to the South and within tie-in distance to the Aasta Hansten field. Main prospects, Erkesuden and Mariasuden had been identified as seismic anomalies (Thanetian in age). Additional prospectivity was in the "Kristisuden" lead (presumably of Danian age). The proposed work program was to acquire and to evaluate a new 3D CSEM data survey, in order to risk-modify the initial discovery probabilities (Pg of 22% for Erkesuden, and Pg 15% for Mariasuden).

The geophysical work program has been fulfilled and both prospects have consequently received a downgraded Pg. Total Pg after geophysical downgrade is 8% for Erkesuden and 3% for Mariasuden. The PL898 area has been evaluated and partners have agreed not to drill in the licence based on the low probabilities for success in combination with the relatively low volumes within Erkesuden and Mariasuden.

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1 Licence history

<u>Licence:</u>	PL898
<u>Awarded:</u>	10.02.2017
<u>License blocks:</u>	6707/10, 6707/11 & 6707/12
<u>License period:</u>	Expires 10.02.2024 Initial period: 7 years
<u>License group:</u>	Equinor Energy AS 70% (Operator) Wintershall Norge AS 30%
<u>License area:</u>	882.504 km ²
<u>Work program:</u>	Acquire 3D CSEM data – fulfilled. Decision to drill/drop, deadline February 10 th 2019.
<u>Meetings held:</u>	
04.03.2017	EC/MC meeting no. 1
05.29.2017	EC work meeting (CSEM survey design)
11.23.2017	EC/MC meeting no. 2
05.22.2018	EC work meeting
10.29.2018	EC/MC meeting no. 3
<u>Work performed:</u>	
2017:	Licence start-up
2017:	CSEM Survey design & seismic interpretation
2018:	Prospect mapping / evaluation
2018:	Decision made not to drill within the license
<u>Reason for surrender:</u>	
	None of the evaluated prospects within PL898 are regarded as drillable (Figure 1.1)

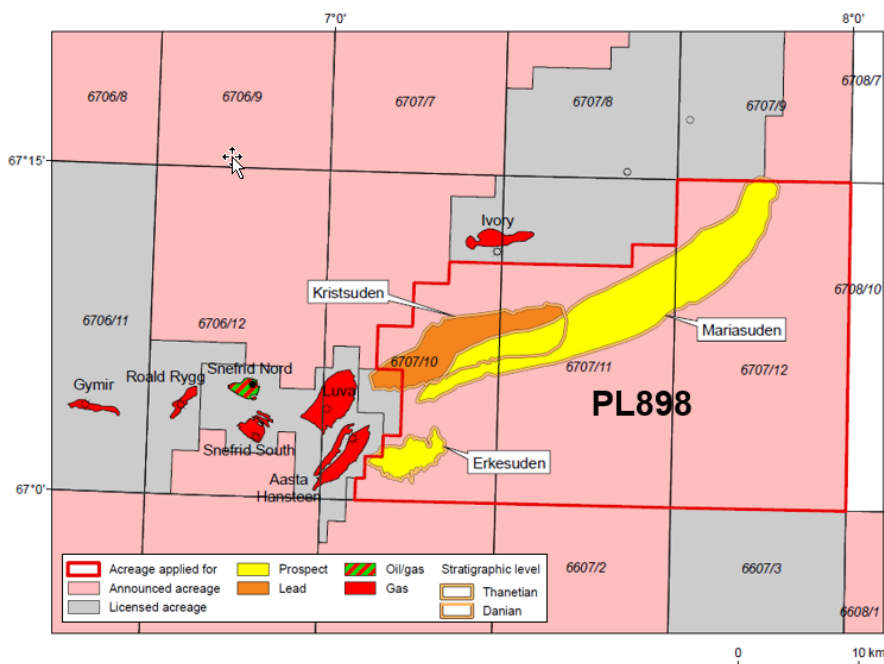


Figure 1.1: PL898 licence map showing the evaluated prospects Erkesuden and Mariasuden (yellow outlines), and the Kristidsuden lead (orange outline). Figure modified from application.

2 Database overviews

2.1 Seismic data

Common seismic database in PL898 included public 2D seismic lines (various vintages of the NPD-VØRB surveys), multiclient 2D seismic surveys (MNR) and seismic 3D surveys that are all listed in table 2.1.

Seismic Survey	NPDID	2D/3D	Year	Quality	Status
ST9603 component survey for ST11M09	3830	3D	1996	Fair	Public
BPN9601 component survey for ST11M09	3755	3D	1996	Fair	Public
ST11M09	NA	3D	2011	Good	Public
PC10NO01	7240	3D	2010	Good	Public
NPD-VØRB-85	2765	2D	1985	Fair	Public
NPD-VØRB-86	2866	2D	1986	Fair	Public
NPD-VØRB-87	3007	2D	1987	Fair	Public
NPD-VØRB-88	3145	2D	1988	Fair	Public
NPD-VØRB-89	3263	2D	1989	Fair	Public
NPD-VØRB-90	3338	2D	1990	Fair	Public
MNR04	4252	2D	2004	Fair	Public
MNR06	4364	2D	2006	Fair	Public
MNR09	7001	2D	2009	Fair	Public

Table 2.1: List of seismic data in common seismic database for PL898

Figure 2.1 shows the 3D CSEM survey (MCPL898) acquired as part of the work program in licence PL898, the 3D seismic database and the closest wells.

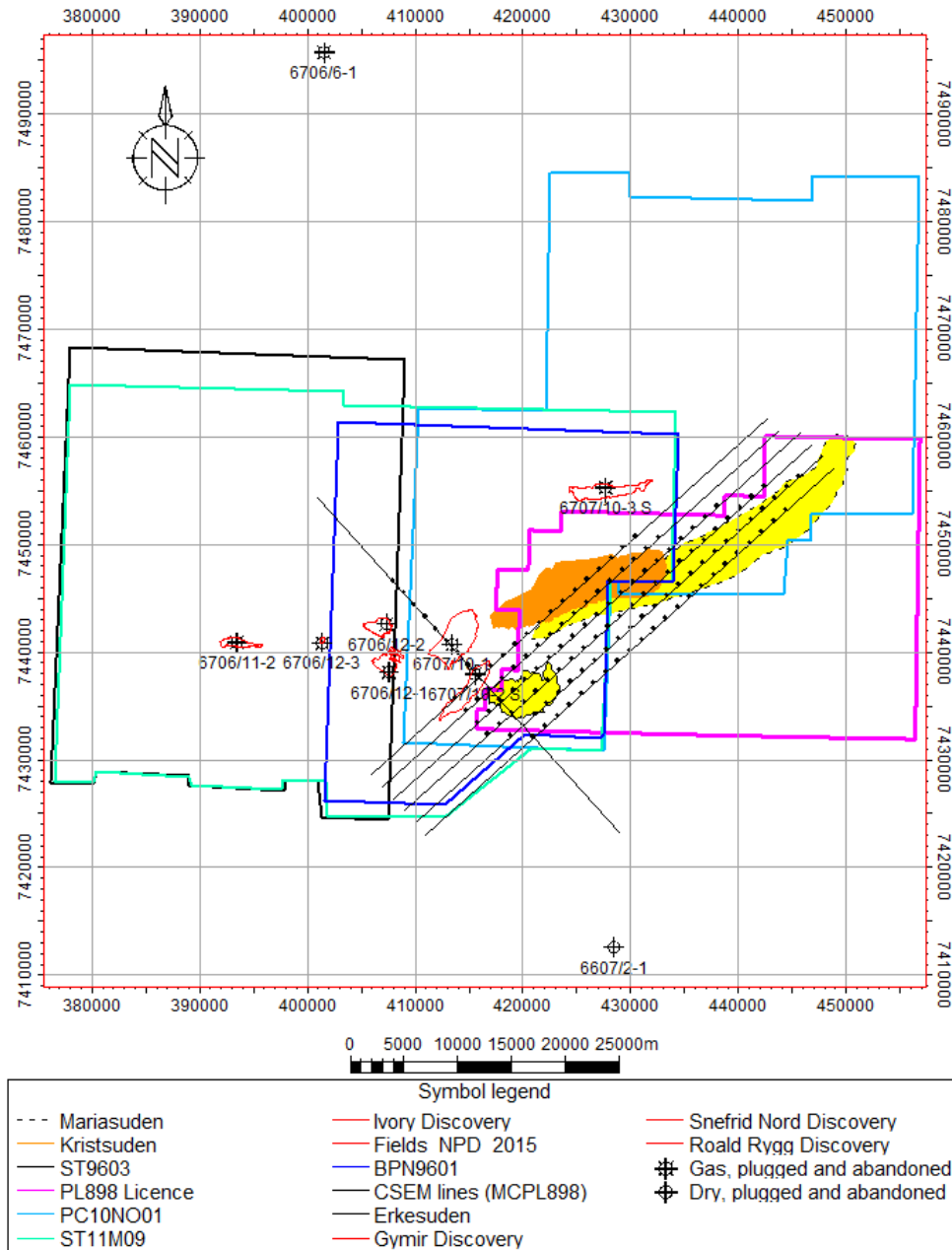


Figure 2.1: 3D seismic surveys, some of the wells, and the 3D CSEM acquired specifically for PL898

2.2 Well data

A list of all wells in the common well database for PL898 is listed in table 2.2

Wells	Year	Drilling operator	Prospect	NPDID	License	Status	Age at TD	Formation (TD)
6604/2-1	2011	BG Norge AS	Gullris	6568	PL522	Dry	L. Cretaceous	Springar
6605/1-1	2009	StatoilHydro ASA	Obelix	5979	PL328	Dry	L. Cretaceous	Nise
6607/2-1	2007	ENI Norge AS	Cygnus	5471	PL329	Dry	L. Cretaceous	Springar
6706/11-2	2015	Statoil Petroleum AS	Gymir	7709	PL602	Gas	L. Cretaceous	Nise
6705/10-1	2009	StatoilHydro ASA	Asterix	6044	PL327B	Gas	E. Cretaceous	Springar
6706/6-1	2003	Esso E&P Norway AS	Hvitveis	4705	PL264	Gas	Paleocene	No formal name
6706/12-1	2008	StatoilHydro ASA	Snefrid Sør	5867	PL218	Gas	L. Cretaceous	Kvitnos
6706/12-2	2015	Statoil Petroleum AS	Snefrid Nord	7651	PL218	Gas/Oil	L. Cretaceous	Nise
6706/12-3	2015	Statoil	Roald Rygg	7666	PL602	Gas	L. Cretaceous	Kvitnos
6707/10-1	1997	BP Norway Lim. U.A.	Luva	3075	PL218	Gas	L. Cretaceous	Kvitnos
6707/10-2S	2008	StatoilHydro ASA	Haklang	5918	PL218	Gas	L. Cretaceous	Nise
6707/10-2A	2008	StatoilHydro ASA	Haklang	5931	PL218	Gas	L. Cretaceous	Kvitnos
6707/10-3S	2014	Centrica	Ivory	7550	PL528B	Gas	E. Cretaceous	Lange

Table 2.2: List of wells included in the well database for PL898

3 Results of geological and geophysical studies

EMGS acquired a new multi-client CSEM survey called MCPL898 in the summer of 2017. The pre-processed data was delivered in October 2017. The main goal with the CSEM was to de-risk the probability of a hydrocarbon fluid phase and to differentiate between residual and live gas. Figure 3.1 shows the survey design for the paleocene prospectivity in the licence. Erkesuden has full coverage and the south western part of Mariasuden is covered (including full coverage of the minimum column in magenta outline). The tie line to Haklang and Luva discoveries were for calibration of Rh at Paleocene level. Feasibility studies had indicated that with less than 1km burial depths the CSEM data should, with confidence, indicate high gas saturated Paleocene reservoirs (high resistivity bodies).

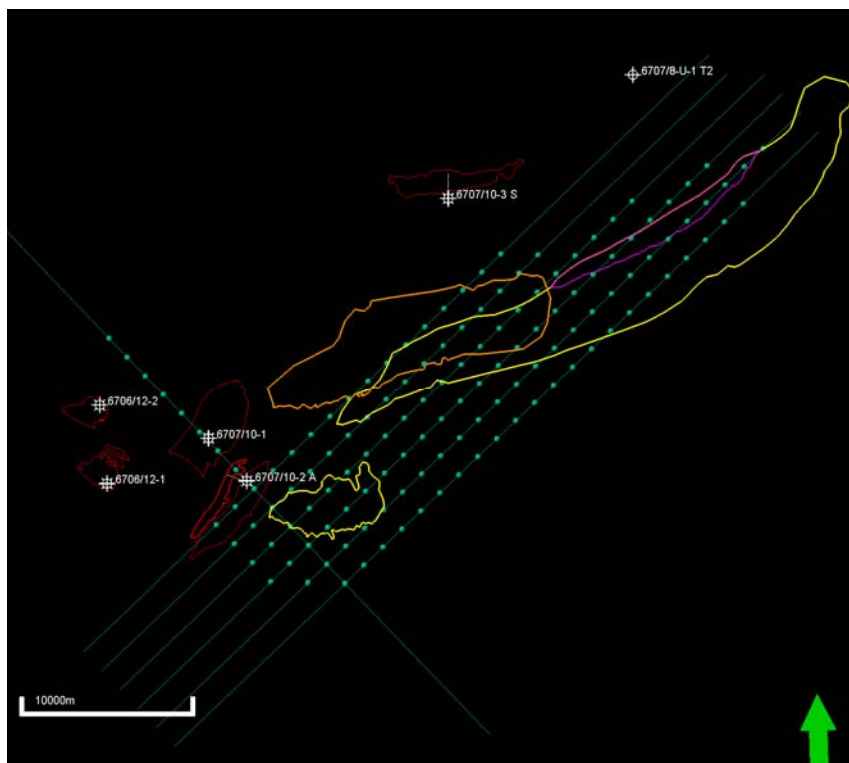


Fig 3.1 Showing the 3D CSEM survey (MCPL898) design in relation to Erkesuden, Mariasuden and Kristisuden. A 2D tie line to the Luva & Haklang discoveries was selected for calibration of Rh with known gas columns.

The inverted synthetic data showed a resistivity anomaly with minimum gas column and with low resistivity, 20 Ω m (Figure 3.2a).

The geological risk for Erkesuden and Mariasuden is 0.22 and 0.15. After the seismic quantitative evaluation the Pg was downgraded to 0.15 and 0.07 respectively.

Both prospects got a DHI strength of 0.459, which resulted in a final Pg of 0.08 for Erkesuden and 0.03 for Mariasuden.

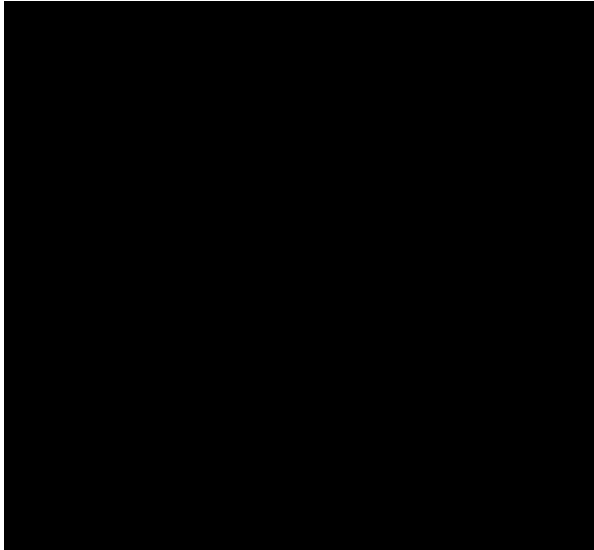


Figure 3.2a: Inverted synthetic data with anomalies.

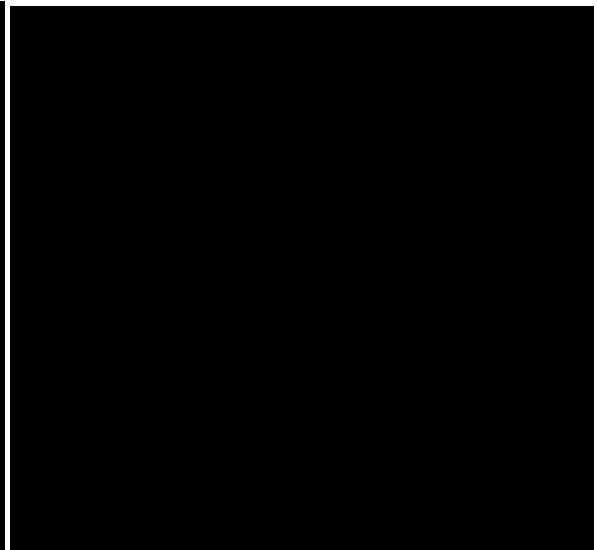


Figure 3.2b: Inverted real CSEM data (Rv)

4 Prospect update report

Erkesuden and Mariasuden (figure 4.1 & 4.2) have been extensively presented in the APA2016, and a QC reinterpretation on modern seismic data over the area has not led to any significant change in the understanding of the prospects other than Erkesuden may have slightly thinner reservoir than believed at the time of the application. This will ultimately result in even smaller volumes in PL898, however the seismic and geophysical assessments are kept as they were in the application. Now, with the addition of the combined seismic and CSEM DHI assessment modification.

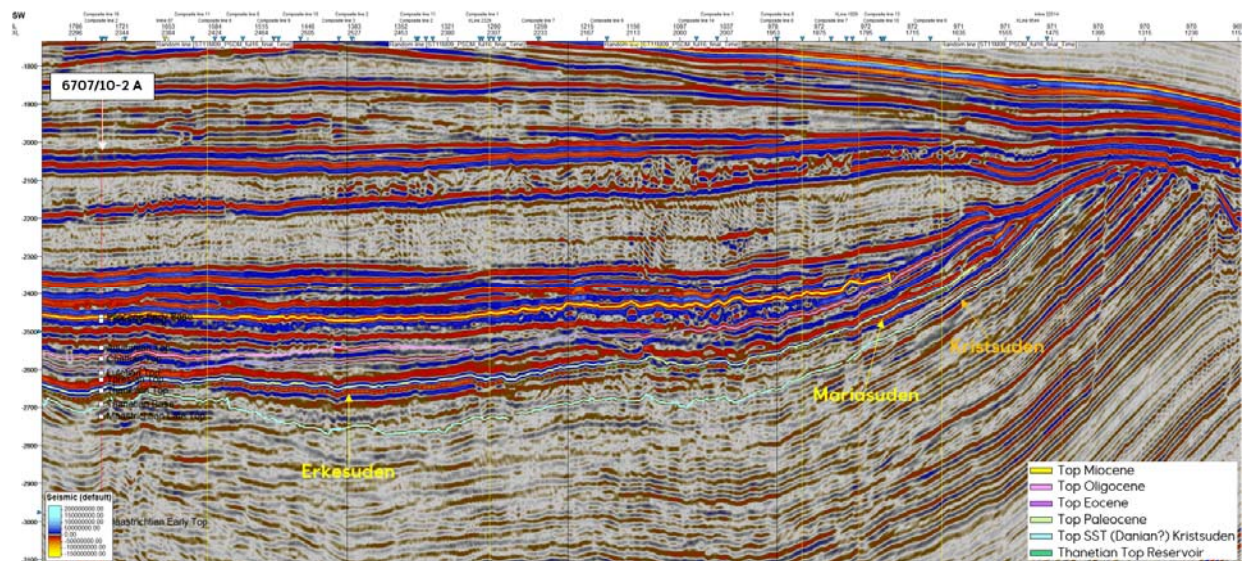


Figure 4.1: Random seismic tie line from the 6607/10-2A well over Erkesuden., Mariasuden and the Kristsuden (Lead).

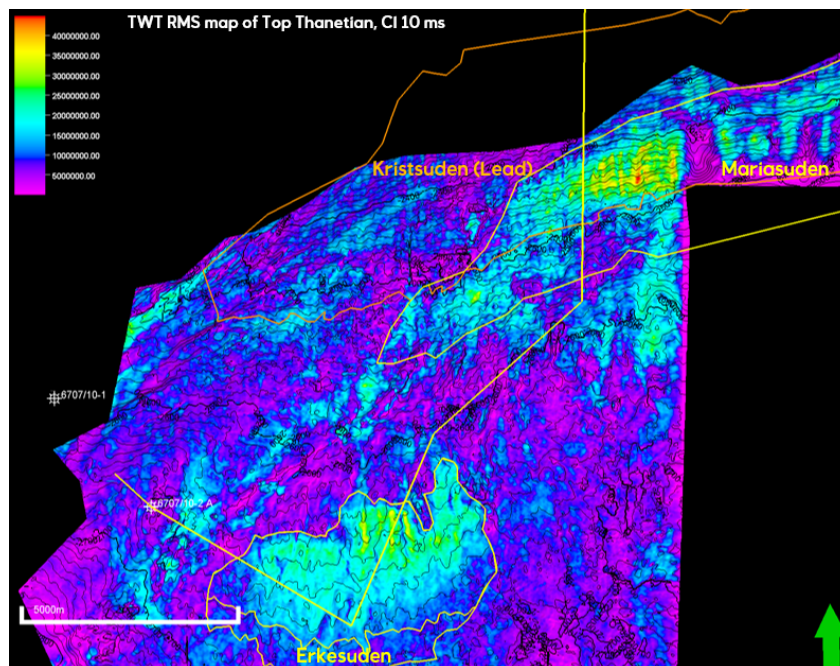


Figure 4.2: RMS time map of Top Thanetian (top reservoir) showing the amplitude anomalies over Erkesuden and Mariasuden prospects. Yellow line shows the position of the random line shown in figure 4.1

Two different models that could explain the observed geophysical data signature behavior on Erkesuden were presented in the application (chapter 2.3.1, p.32). Model A: "A gas-filled sandstone reservoir with good properties overlain by a non-standard (highly anisotropic) shale". Model B ("anti-model"): "A gas filled silt (non-reservoir) overlain by normal shales. Model A was expected to show a high resistivity contrast with the overburden, whereas model B was not expected to give significant contrast on CSEM data. The CSEM feasibility study prior to application concluded that Erkesuden was ideal target for CSEM where sensitivities would be high for a net pay above ~10m and HC saturation above 60%.



Volumes and prospect data for Erkesuden and Mariasuden are found in tables 4.1 and 4.2 below.

Block 670712	Prospect name	Erkesuden	Discovery/Prospect Lead	prospect	Prospect ID (or New)	NPD will insert value	NPD approved (Y/N)	No
Play name	New Play (Y/N)	Yes	Outside play (Y/N)	No				
Oil, Gas or O&G case:	Reported by company	Equinor ASA	Reference document	AP2016 Awards in predefined areas Block 670712, 10 and 11				
This is case no.:	Structural element	Yereng Basin	Type of trap	Stratigraphic				
1 of 1	Main phase	Base, Mode	Base, Mean	High (P10)	Associated phase	Low (P90)	Base, Mode	Base, Mean
Resources IN PLACE and RECOVERABLE	Oil [10 ⁶ Sm ³] (>0.00)	4.59		11.60	0.07	0.09	0.13	0.21
Volumes, this case	Gas [10 ⁶ Sm ³] (>0.00)	3.91		11.60	0.07	0.09	0.13	0.21
In place resources	Oil [10 ⁶ Sm ³] (>0.00)	2.33		6.93	0.04	0.06	0.08	0.13
Recoverable resources	Gas [10 ⁶ Sm ³] (>0.00)	3.05		6.93	0.04	0.06	0.08	0.13
Reservoir Chrono (from)	Reservoir litho (from)	Tang	Source Rock, chrono primary	Late Cretaceous	Source Rock, litho primary	Springar	Seal Chrono	Eckene
Reservoir Chrono (to)	Reservoir litho (to)	Tang	Source Rock, chrono secondary	Jurassic-Cenozoic	Source Rock, litho secondary	Spekk-Tare	Seal Litho	Bygge
Probability fraction	Oil case (0.00-1.00)	0.00	Gas case (0.00-1.00)	1.00	Oil & Gas case (0.00-1.00)	0.00		
Technical (oil + gas + oil & gas case) (0.00-1.00)	Trap (P2) (0.00-1.00)	0.70	Change (P2) (0.00-1.00)	0.90	Retention (P2) (0.00-1.00)	1.00		
Reservoir (P1) (0.00-1.00)	Base	2155	Comments: Reservoir (P2) is included in trap risk (P2) Source rock (secondary) is mainly Large Formation to Nise Formation, as well as Tang Formation. Technical probability includes downgrade from Seismic and CSEM probability assessment.					
Parameters:	Depth to top of prospect (m MSL) (> 0)	8.1						
Area of closure (km ²) (> 0.0)		12.3						
Reservoir thickness (m) (> 0)		25						
HC column in prospect (m) (> 0)		47						
Gross rock vol. [10 ⁶ m ³] (> 0.000)		0.128						
Net / Gross fraction (0.00-1.00)		0.65						
Porosity fraction (0.00-1.00)		0.24						
Permeability (mD) (> 0.0)		250.0						
Water Saturation fraction (0.00-1.00)		0.25						
Bq [Rm3Sm3] (< 1.000)		0.0038						
11Bo [Rm3Sm3] (< 1.000)		0.0043						
GOR, free gas [Sm ³ /Sm ³] (> 0)		56325						
GOR, oil [Sm ³ /Sm ³] (> 0)		69888						
Recon. factor, oil main phase fraction (0.00-1.00)								
Recon. factor, gas ass. phase fraction (0.00-1.00)		0.55						
Recon. factor, gas main phase fraction (0.00-1.00)		0.55						
Recon. factor, liquid ass. phase fraction (0.00-1.00)		0.65						
Temperature, top res [C] (>0)		40						
Pressure, top res [bar] (>0)		220						
Cut off criteria for NiG calculation	1 Value=0.4	2 Porosity>0.1	3					
	For NPD use:							
	Intrapp. or geolog-int.							
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Table 4.1: Prospect data – Erkesuden, gas case

Block 6707/10 11 12		Prospect name		Mariasuden		Discovery/Prospect Lead		prospect		Prospect ID (or New)		NPD will insert value		NPD approved (Y/N)		No	
Oil, Gas or O&G case:		New Play (Y/N)		Yes		Outside play (Y/N)		No		AP2016 Awards in predefined areas Block 6707/12_10 and 11		NPD will insert value		2018		NPD will insert value	
This is case no.:		Reported by company		Equinor ASA		Reference document		Stratigraphic		Water depth (m MSL) (>0)		1250		Assessment year		2018	
Resources IN PLACE and RECOVERABLE		Structural element		Veng Basin		Type of trap		High (P*10)		Associated phase		Base, Middle		Base, Middle		Seismic database (D/D/D)	
Volumes, this case		Main phase		Base, Middle		Base, Mean		High (P*10)		Low (P*90)		Base, Middle		Base, Middle		High (P*10)	
In place resources		Oil [10 ⁶ Sm ³] (>0.00)		10.10		16.90		25.30		0.10		0.09		0.13		0.25	
Recoverable resources		Gas [10 ⁶ Sm ³] (>0.00)		4.00		10.10		15.30		0.05		0.09		0.17		0.16	
Reservoir Chrono (from)		Reservoir litho (from)		Tang		Source Rock, chrono primary		Late Cretaceous		Source Rock, litho primary		Springer		Seal Chrono		Eckene	
Reservoir Chrono (to)		Reservoir litho (to)		Tang		Source Rock, chrono secondary		Jurassic-Cenozoic		Source Rock, litho secondary		Spekk-Tare		Seal Litho		Bygge	
Probability fraction		Oil case (0.00-1.00)		0.00		Gas case (0.00-1.00)		1.00		Oil & Gas case (0.00-1.00)		0.00					
Technical (oil + gas + oil & gas case) (0.00-1.00)		Trap (P2) (0.00-1.00)		0.25		Change (P3) (0.00-1.00)		0.75		Retention (P4) (0.00-1.00)		1.00					
Reservoir (P1) (0.00-1.00)		Low (P90)		1655		High (P*10)		2.4									
Parameters:		Depth to top of prospect (m MSL) (> 0)		11.8		Area of closure (km ²) (> 0)		17.1									
		Reservoir thickness (m) (> 0)		35		HC column in prospect (m) (> 0)		42									
		Gross rock vol. [10 ⁶ m ³] (> 0.000)		103		Net / Gross fraction (0.00-1.00)		124									
		Porosity fraction (0.00-1.00)		0.55		Permeability (mD) (> 0)		0.554									
		Water Saturation fraction (0.00-1.00)		0.24		Bg [Rm(Sm ³)] (< 1.000)		0.70									
		GOR, free gas [Sm ³ /Sm ³] (> 0)		250.0		GOR, oil [Sm ³ /Sm ³] (> 0)		0.28									
		Recon. factor, oil main phase fraction (0.00-1.00)		0.25		Recon. factor, gas main phase fraction (0.00-1.00)		250.0									
		Recon. factor, gas ass. phase fraction (0.00-1.00)		0.30		Recon. factor, liquid ass. phase fraction (0.00-1.00)		0.30									
		Temperature, top res [°C] (>0)		28		Pressure, top res [bar] (>0)		0.55									
		Cut off criteria for NiG calculation		188		1 Value=0.4		2 Porosity>0.1		3							
		For NPD use:		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value	
		Intrapp. or geolog-int.		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value	
		Date		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value	
		Kart nr		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value		NPD will insert value	

Table 4.2: Prospect data – Mariasuden, gas case

5 Technical evaluation

The key numbers from the Technical Economical evaluation from APA 2016 is shown below. The field development solution consists of one single slot satellite with one producer tied back to Aasta Hansten platform. The Pg has been halved since this valuation, from 0.15 to 0.08. [REDACTED]

Key valuation metrics		
100% License	Expected values	Given discovery*
NPV after tax (8% disc., MUSD`16)	3,3	53
Capital efficiency index (CEI)	0,13	0,56
IRR (after tax, %)	12,00 %	25 %
Break Even Brent Blend Price (USD\bbl)	86	68
Capex/boe (undisc, USD/boe produced)	n/a	7,5
Commercial threshold volume (100%, mmbbl)	n/a	16
Probability of commercial discovery (%)	n/a	n/a
Finding cost (USD/Boe)**	6,93	n/a

*Info regarding development case assumption given discovery to be included here. Exploration cost to be included (see example)

** Weighted Well cost divided by risked Mean volume

**Weighted well cost = Dry cost + (Discovery cost - Dry cost)*Pg

6 Conclusion

The work program for the initial period of PL898 has been fulfilled by the partnership. Based on the technical evaluation in the production licence the partnership has not identified any drillable prospects within the licence acreage. Licence PL898 will therefore expire.