PL995 relinquishment report

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1 Key licence history

Production license PL995 is located in the Møre Basin with the Ona High and Vigra High as the main structural expressions.

The license consists of blocks 6304/4, 5, 7, 8, 9, 10, 11, 12 and 6305/7, 10 (Fig. 1.1) and was awarded on the 1st of March 2019 with a work commitment to perform G&G studies and within one year take a decision to acquire 3D broad band seismic or drop.

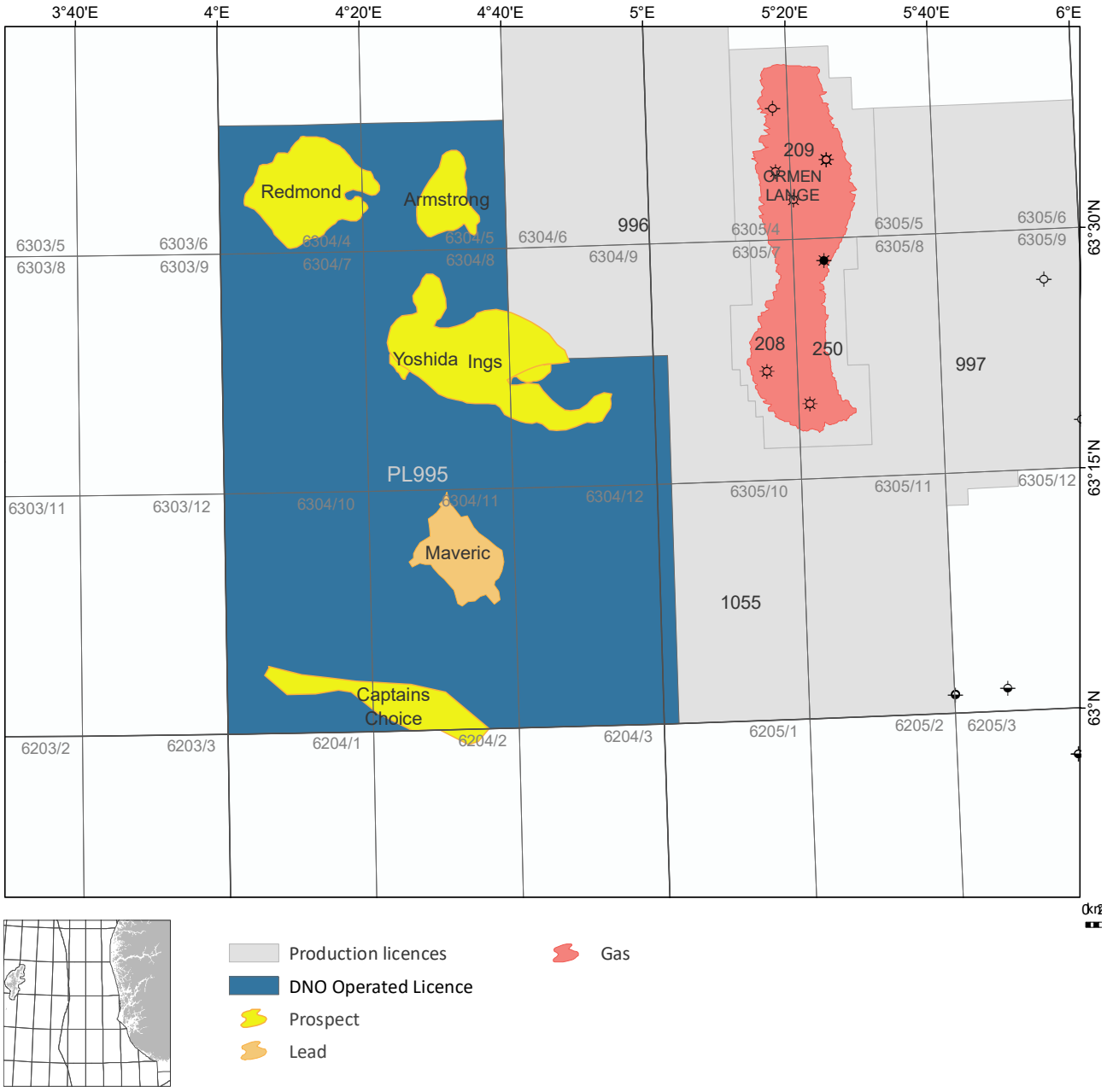

Fig. 1.1 Location map of PL995

The partnership in the license consists of DNO Norge AS (Operator) 60% and INEOS E&P Norge AS 40%.

The licence did not reach a decision for 3D or drop by 1st of March 2020 and applied for a six month extension of the 3D seismic decision. MPE approved the application by 24th of March 2020 with a new decision deadline at the 1st of September 2020.

The partnership agreed to relinquish the licence through a Licence2Share agreement 13th of May 2020.

A total of three MC, EC and two EC work meetings have been held. The overview of the meeting schedule is given in Table 1.1.

Table 1.1 PL995 licence meetings

PL995 licence meetings	
MC and EC meeting	19.03.2019
EC work meeting	07.05.2019
EC work meeting	16.10.2019
MC and EC meeting	13.11.2019
MC and EC meeting	11.02.2020
MC agreement on L2S	13.05.2020

2 Database

2.1 Seismic database

The joint venture parties agreed upon a common database consisting of released 2D and 3D seismic data. The map in Fig. 2.1 gives an overview of the data coverage and a list of the 3D and 2D data are found in Table 2.1 and Table 2.2 respectively.

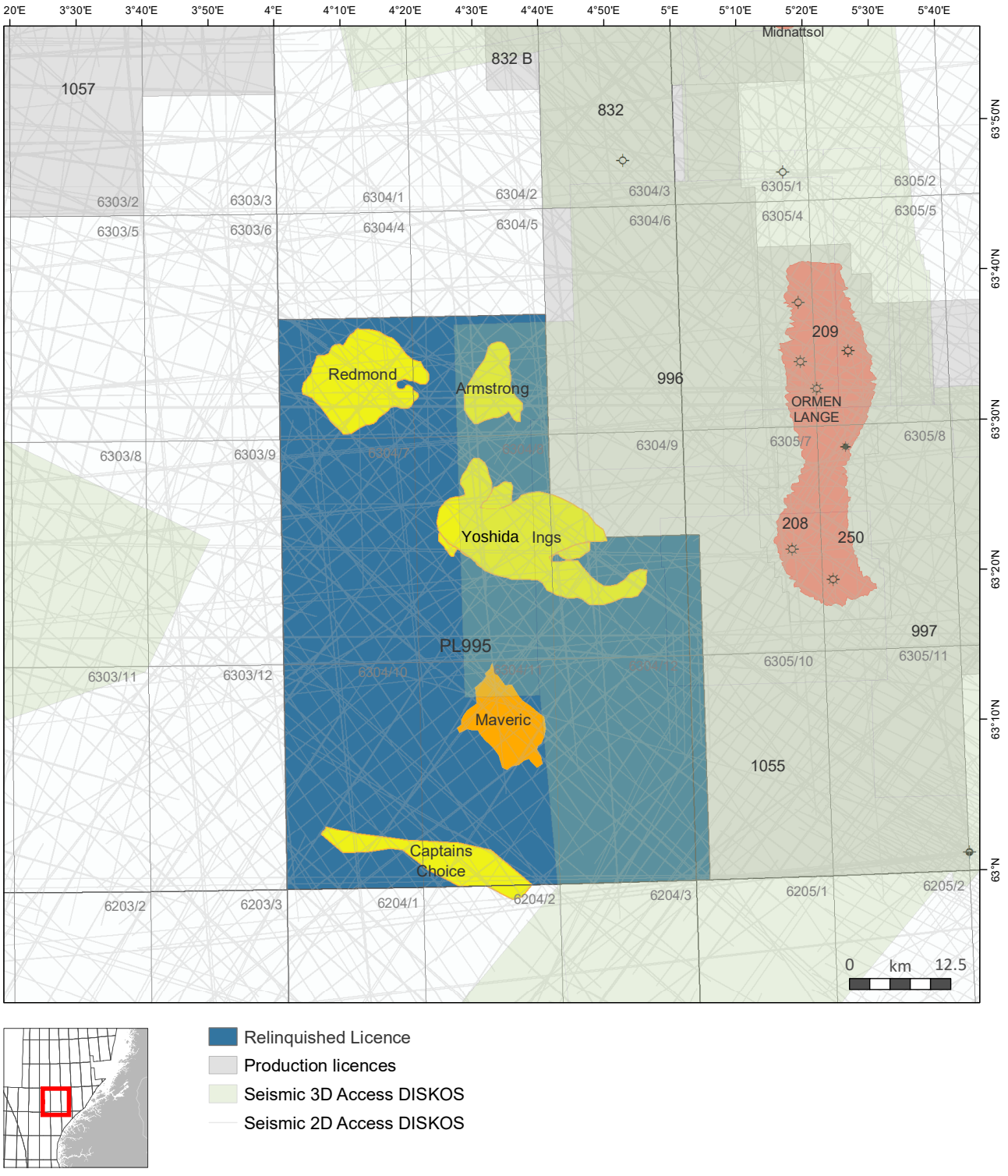

Fig. 2.1 PL995 common seismic database

Table 2.1 3D seismic database

Surveys	Vintage	Quality
PGS 3D Megasurvey	N/A	Variable
SH16001	2016	Good

Table 2.2 Common 2D seismic database

Surveys	Vintage	Quality	Comment
MNR06	2006	Good	good quality but poor line spacing
MNR05	2005	Good	good quality but poor line spacing
OLW02	2002	Mod	good line spacing over area applied for
MNW99	1999	Mod	used for regional mapping NW of area applied for
MS99	1999	Mod	used for regional mapping SW of area applied for
ST98	1998	Mod	used to fill data gap in NE of area applied for
JMF97	1997	Mod	used for regional maping N of area applied for
SG9711	1997	Mod	one line traverses area applied for
V2R96	1996	Mod	used for regional mapping NW of area applied for
MWT96	1996	Mod	used for regional mapping W of area applied for
WG96ONH	1996	Poor-Mod	used to fill data gap in SE of area applied for
MM95	1995	Mod	used for regional mapping S of area applied for
VMT95	1995	Mod	one line traverses area applied for
GOM-95	1995	Poor-Mod	used for regional mapping SW of area applied for
GMM-94	1994	Poor	poor line spacing in area applied for
NPD-MB-92	1992	Poor-Mod	four lines traverses area applied for
GGW-91	1991	Poor-Mod	used for regional mapping SE of area applied for

2.2 Well database

Fig. 2.2 is a map of the common well database. The wells are selected for their relevance in the mapping of the deep marine Cretaceous and the Paleogene plays in the Møre Basin. Table 2.3 is listing all wells in the common database.

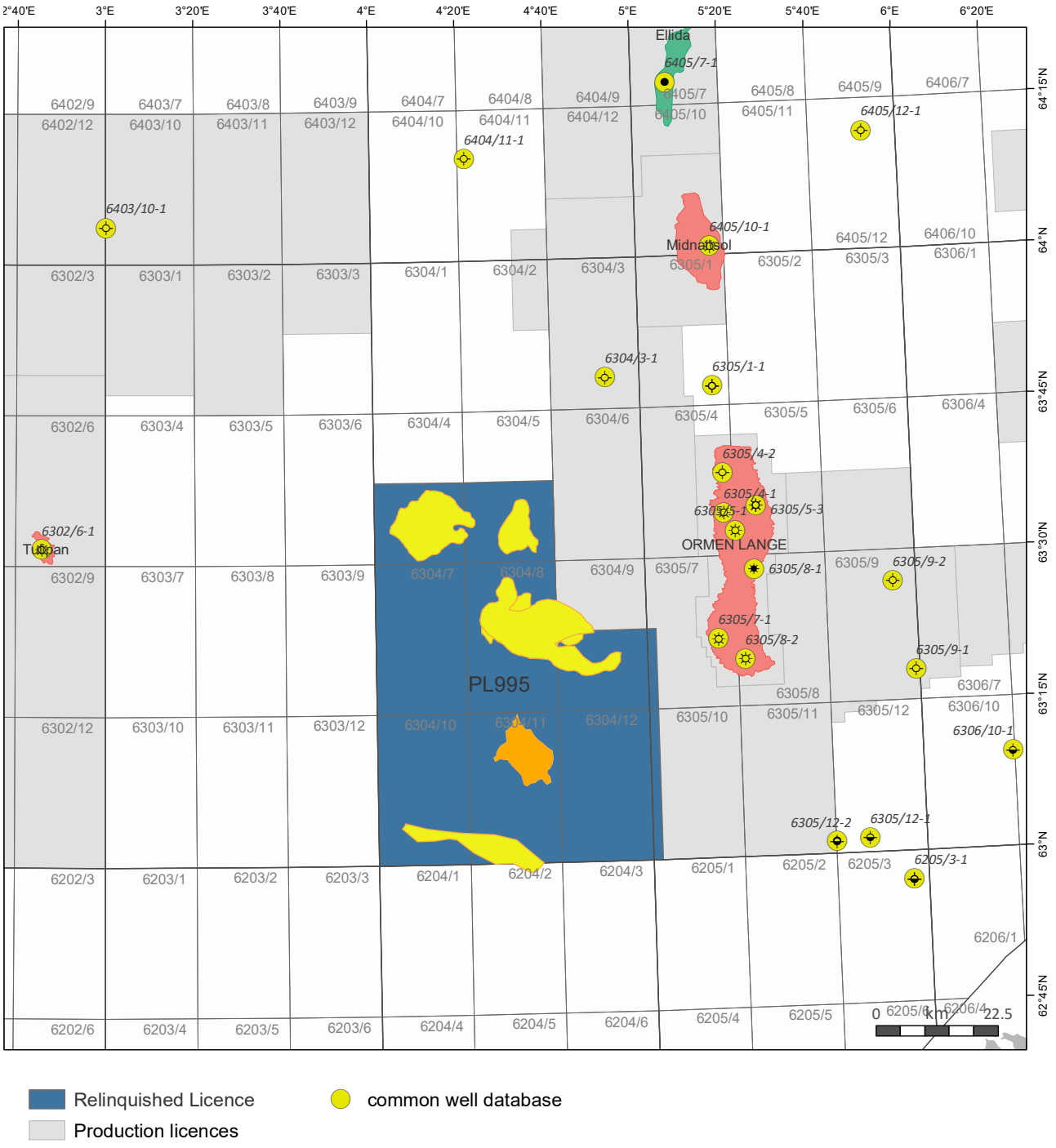

Fig. 2.2 map of common well database

Table 2.3 Common well database

Well	Result	Completion Date	Release status	TD formation	Field/disc.
6204/10-1	Dry	23.11.1995	Released	Basement	J-Prospect
6204/10-2R	Gas	21.11.1997	Released	Basement	L-Prospect
6204/11-1	Gas	14.11.1996	Released	Grey Beds	
6302/6-1	Gas	04.10.2005	Released	Springar	Tulipan
6304/3-1	Dry	07.08.2018	Released	Nise	Coeus
6305/1-1	Dry	19.11.1998	Released	Lysing	Ormen Lange Dome
6305/4-1	Gas	03.06.2002	Released	Springar	Ormen Lange
6305/4-2S	Dry	10.02.2011	Released	Nise	Ormen Lange
6305/5-1	Gas	07.10.1997	Released	Nise	Ormen Lange
6305/5-3S	Gas	27.10.2009	Released	Springar	Ormen Lange
6305/7-1	Gas	30.08.1998	Released	Springar	Ormen Lange
6305/8-1	Oil/Gas	08.09.2000	Released	Nise	Ormen Lange
6305/8-2	Gas	21.11.2014	Released	Springar	Ormen Lange
6305/9-1	Dry	31.07.2001	Released	Springar	Blåveis Prospect
6305/9-2	Dry	13.03.2011	Released	Springar	Dovregubben Prospect
6305/12-1	Shows	18.09.1991	Released	Red Beds	C Prospect
6305/12-2	Shows	17.12.1993	Released	Basement	E Prospect
6306/10-1	Oil/Gas Shows	17.12.1990	Released	Basement	Skalmen Prospect
6403/10-1	Dry	30.12.2002	Released	Kvitnos	Solsikke Prospect
6404/11-1	Dry	10.03.2002	Released	Nise	Havsule Prospect
6405/7-1	Oil	10.10.2003	Released	Lysing	Ellida
6405/10-1	Gas	07.09.2007	Released	Nise	Midnattsol
6405/12-1	Dry	16.01.2015	Released	Nise	Lindarormen Prospect

3 Results of geological and geophysical studies

Work programme
The imposed work commitments for the PL995 license was geological and geophysical studies enabling a 3D or drop decision for the area. The aim with the studies has been to help verifying reservoir presence and prospectivity.

List of performed studies
- Petrophysics (Ikon Science)
- Rock Physics analysis and Inversion Feasibility study on PL995 (Ikon Science)
- Biostratigraphical analysis (INEOS)

Result of the rock physics and feasability study
The objectives of the Ikon petrophysics, rock physics and feasibility study was to determine the magnitude of the fluid effects in key reservoir zones (Egga, Springar, Nise, Peon) at the 5 studied wells (6405/10-1, 6305/5-1, 6305/7-1, 6302/6-1 and 35/2-1) and fit a porosity dependent rock physics model to the well logs to establish trends and elastic relationships at the wells. Further determine whether lithological effects can be distinguished from fluid effects and establish EEI angles that can be used as indicators of fluid or lithology and finally determine whether the fluid effect will be observable at seismic bandwidths.

A short summary of the of the results are listed below.

- There is a significant contrast between brine and gas sands observed in all the elastic logs
- The Constant Cement model shows a good fit to the data in the wells (except the peon unconsolidated sands)
- The AVO synthetics show amplitude differences between the fluid cases
- The top Egga reflection for the brine saturated case is observed as both a class 1 (peak) and a weak trough in the synthetics depending on the well
- The top Egga reflection for the gas saturated case is consistently a class 2 reflection
- EEI shows a strong fluid response over a wide range of Chi angles
- The fluid responses in the elastic logs and EEI logs upscaled to seismic frequencies are observable at seismic frequencies and should be visible in an inversion

4 Prospect update

DNO and INEOS was awarded the PL995 following the APA 2018 application where the Terra Nova Prospect was the main focus in the licence.

The APA 2018 prospects

All prospects and leads from the APA 2018 application are summarised in (Table 4.1).

The Terra Nova prospect (Springar Formation) was presented as the main prospect in the APA 2018 application. It was believed to represent a channelized sand body extending from the main Springar depositional area around the Ormen Lange area. The top seal was provided by the Tang Formation shales although the risk of Egga sandstones reaching the Terra Nova area was highlighted as a potential risk. Due to the close proximity of Terra Nova to the Ormen Lange field, the charge risk was seen as minor. The mean recoverable resource potential was of 9.6 GSm3 gas and a CoS of 14%.

Two additional prospects, Blue Peter and Captains Choice, were identified in the Egga Formation. They had a mean recoverable resource potential of 8.3 and 8.2 GSm3 gas respectively and both have a CoS of 11%.

All three prospects are stratigraphic traps and share the same key risks, which are trap seal and reservoir presence. The resource potential is shown in Table 4.1 below.

Table 4.1 Resource Potential from APA 2018

Discovery/ Prospect/ Lead name [1]	D/ P/ L [2]	Case (Oil/ Gas/ Oil&Gas) [3]	Unrisked recoverable resources [4]						Probability of discovery [5] (0.00 - 1.00)	Resources in acreage applied for [%] [6] (0.0 - 100.0)	Reservoir		Nearest relevant infrastructure [8]	
			Oil [10^6Sm^3] (>0.00)			Gas [10^9Sm^3] (>0.00)					Litho-/ Chrono-stratigraphic level [7]	Reservoir depth [m MSL] (>0)	Name	Km (>0)
			Low (P90)	Base (Mean)	High (P10)	Low (P90)	Base (Mean)	High (P10)						
Terra Nova	P	Gas	0.19	0.81	1.60	2.28	9.59	18.90	0.14	100.0	Springar Fm/ Late Cretaceous	3560	Ormen Lange	24
Blue Peter	P	Gas	0.26	0.70	1.38	3.13	8.30	16.10	0.11	100.0	Egga Fm/ Paleocene	3605	Ormen Lange	36
Captains Choice	P	Gas	0.16	0.69	1.27	1.98	8.19	15.10	0.11	95.0	Egga Fm/ Paleocene	3330	Ormen Lange	55
Peter Pan	L	Gas								100.0	Delfin Fm/Late Creteaceous			
Golden Ray	L	Gas								100.0	Delfin Fm/Late Cretaceous			
White Dog	L	Gas								100.0	Springar Fm/ Late Cretaceous			
Crossed Fish	L	Gas								100.0	Egga Fm/ Paleocene			
Mercur	L	Gas								100.0	Egga Fm/ Paleocene			
Outdoor Boy	L	Gas								100.0	Tang Fm/ Paleocene			
Aero King	L	Gas								100.0	Tang Fm/ Paleocene			
Aero King W	L	Gas								100.0	Tang Fm/ Paleocene			
AeroKing SW	L	Gas								100.0	Tang Fm/ Paleocene			

In addition, nine leads in the Upper Cretaceous to Paleocene stratigraphy were identified. All the prospects and leads, apart from the Terra Nova Prospect, was located in areas with only 2D seismic coverage. The risk associated with trap and reservoir presence was therefore significant.

New prospectivity.

During the licence period, the operator and the partner have done a thorough mapping of the area utilizing the licence common database and also utilizing company proprietary data which have not been a part of the shared common database.

Through the mapping project the prospectivity in the licence area has been redefined due to better understanding of the Late Cretaceous and Paleogene plays. In the area of the main prospect, Terra Nova, it was evident that the Springar Formation fairway was poorly developed and carried a high risk on both trap and reservoir presence. Unfortunately, the prospect could not be derisked during the license evaluation and especially the trap risk remained

significant. Due to this the license changed focus towards the remaining and new prospectivity of the area. The Egga Formation however, had a better expression on the seismic and could also be correlated with the Ormen Lange wells. The Terra Nova Prospect was redefined to the Egga Formation and re-named to Yoshida.

Further on three other new prospects emerged in the Springar Formation, the Redmond, Armstrong and Ings prospects.

Efforts through the licence work were also put on mapping the shallow Plio- to Pleistocene stratigraphy and the Maveric Lead was defined within the chaotic strata below the Storegga slope. Maveric consists most likely of a slump scar infilled with turbidite or contourite sediments. Although considerable efforts through G&G studies the licensees were never able to mature this to more than a lead.

Below is a short descriptions of the main prospects in the licence.

Redmond
The Redmond Prospect has had the main focus in the operators licence work, based on the risked resource potential.

Trap: Redmond is a low relief four-way dip closure on the top Springar Formation and is directly overlying the deep-seated Jurassic Vigra High (Fig. 4.1, Fig. 4.2). The entire closure is of 122 km^2 in size with the crest at 3540 m and the lowest closing contour at 3610 m spilling towards the East. The expression of a closure is only present at the depth converted structure maps. The lack of a TWT closure at the prospect location can be explained by steeply tilted seabed and rapid lateral thickness variations in the overburden.

In the volumetric calculations the spill point is set to 3610 m although there are uncertainties in the depth conversion results. The P90 to P10 hydrocarbon water contacts are derived from a normal distribution with the crest as the minimum (3540 m) and the spillpoint as maximum (3610 m).

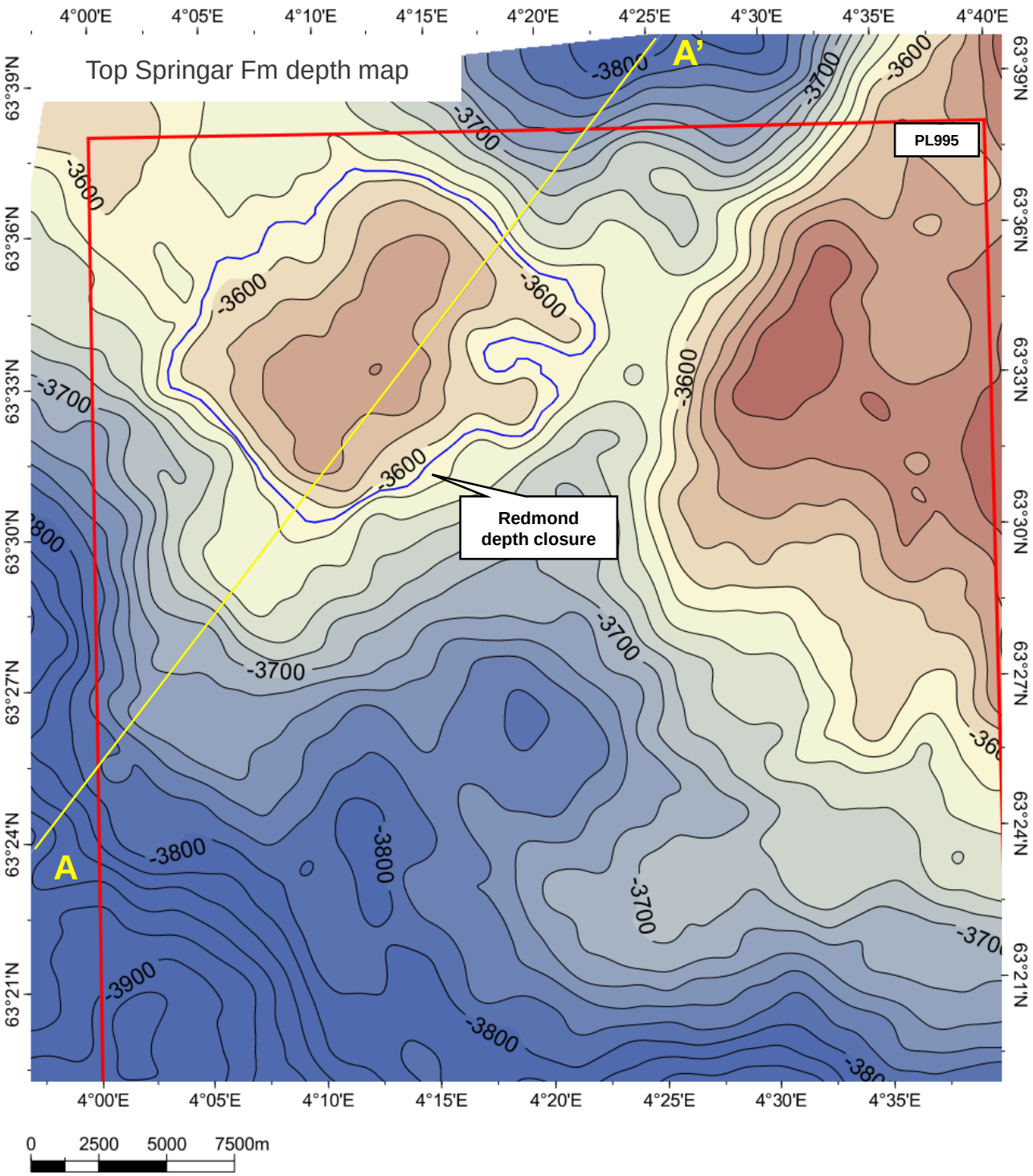

Fig. 4.1 Top Springar Formation depth map

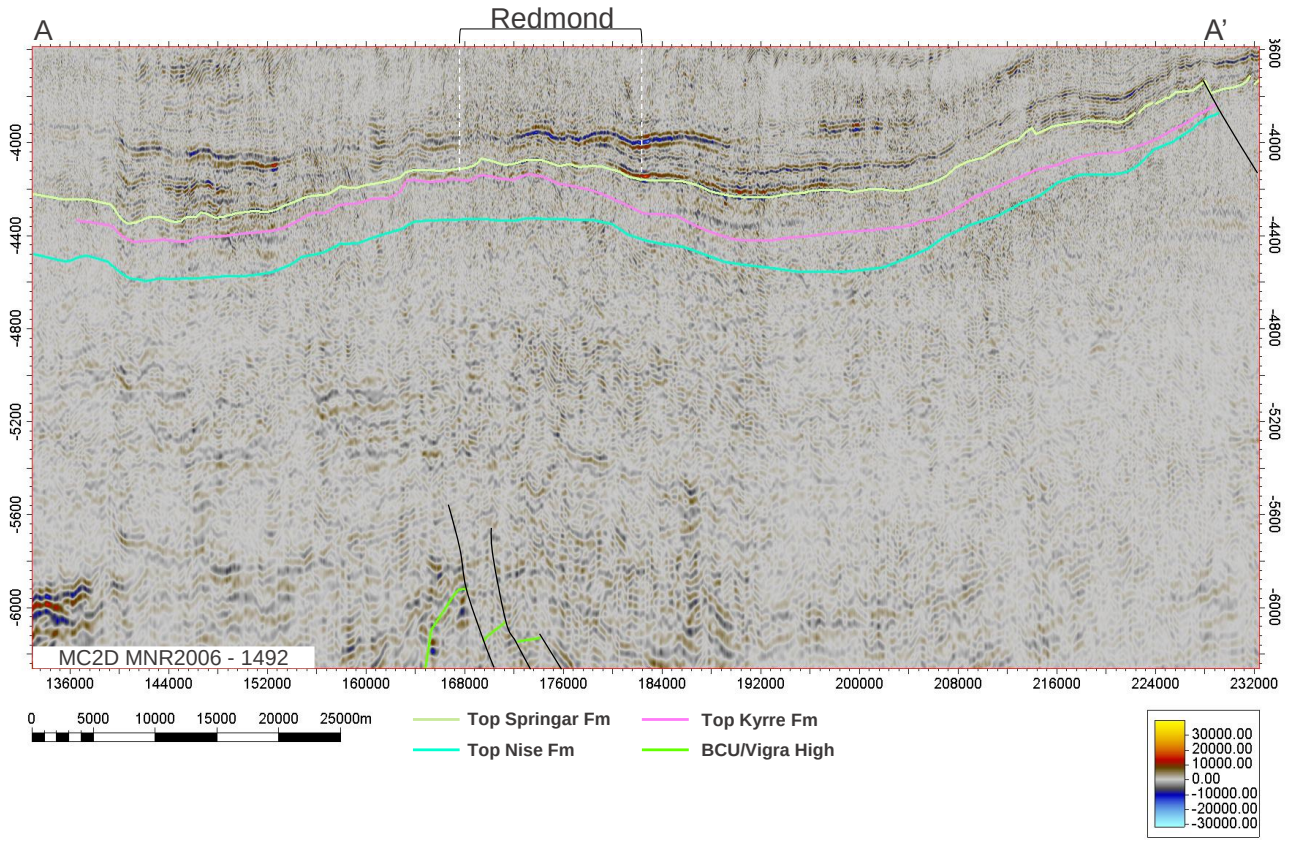

Fig. 4.2 The Redmond structure - 2D seismic section

Reservoir: From published studies and subtle seismic facies variations in the Egga/Springar depositional systems it is seems that the early part of the depositional fairway has reached out to the Vigra High area.

The expectation is a low net to gross reservoir interval in the Upper Springar Formation traversing the Vigra High. For simplicity for the scoping volumetric calculations an optimistic view of a constant reservoir thickness across the prospect is assumed.

Derived from isopach mapping the maximum and minimum thicknesses are 190 m to 60 m respectively and the net to gross ratio used is from 0.3 to 0.1. The porosity distribution is derived from key wells in the Ormen Lange area ranging from 0.22 to 0.18. Normal distributions are used for selecting the P10 to P90 reservoir parameters.

Migration: From discoveries and regional knowledge a gas phase similar to the Ormen Lange gas is assumed. A gas condensate ratio (GCR) of 12000 Sm^3 /Sm^3 with a condensate yield of 14.8 bbl/mmscf was used. The condensate density of 52 API and a gas density of 0.61 rel. air. The Ormen Lange field has close to normal formation pressure, however, the Redmond Prospect is located further into the basin and there is reasons to assume a pressure more similar to the Tulipan Discovery (6302/6-1) which is overpressured by 180 bar. A temperature of 95^0 C is used.

The mean in place total volume potential for Redmond is 16.3 Mm^3oe and a mean recovery factor of 0.65 gives 10.6 Mm^3oe (gas).

The main risk factor for the Redmond Prospect is the reservoir presence and quality. The prospect location is on the far reach of the Springar/Egga fan systems, and the geophysical evidence of the presence of the reservoir is vague. From the isopach maps it is evident that the relevant interval is thinning towards the Vigra High and might only be present as a low net to gross rim surrounding the structure. The selected reservoir risk 0.35.

The structural closure is not present at the TWT maps, but due to the seabed slope and rapid lateral variation of the overburden it is a clear expression on the depth maps. The lack of a depth closure can however not be ruled out. A trap risk of 0.6 is selected.

From regional mapping it is abundant of geophysical evidences of vertical hydrocarbon migration throughout the basin. The prospect is directly overlying a focus area around the deep-seated Vigra High. A gas case have been selected to account for the discoveries in the Møre Basin although an oil case can not be ruled out. In this assessment we do not see the hydrocarbon charge to fail and the selected risk factor is 1.0.

The Redmond Prospect has an overall chance of success of 21%.

Redmond is located 60 km west of the Ormen Lange Field and do not fulfil the minimum field size economic criteria.

Following this assessment, the licence decided to change focus to the Yoshida Prospect located closer to the Ormen Lange Field.

Yoshida

The Yoshida prospect is defined within the 3D seismic coverage area of the common database. Overview figures of Yoshida is presented in Fig. 4.3 and Fig. 4.4. The Yoshida Prospect is mapped as an Egga Mb stratigraphic trap, with the key risk element being the lateral seal. The Egga deep marine sandstone system continues westward from the Ormen Lange area where its tied to wells. The system has an subtle expression as an extra seismic trough within the relevant interval and is interpreted to be confined to the east - west trending channelized system. Lateral pinch-outs are seen to the north and south and also towards the east in the direction of sand input. This configuration sets up a trap with dip closure towards the west and pinch-out seal towards north, south and east.

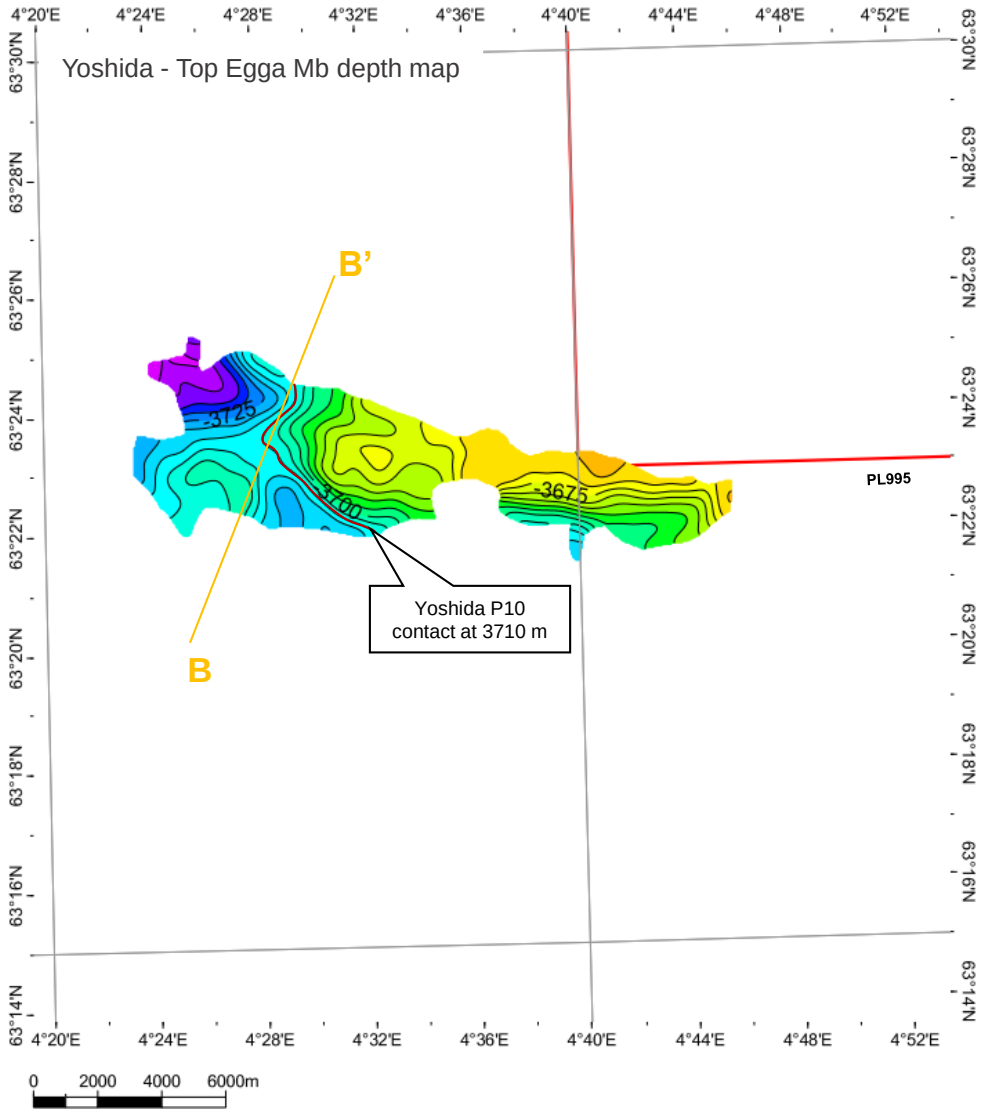

Fig. 4.3 Yoshida overview figure

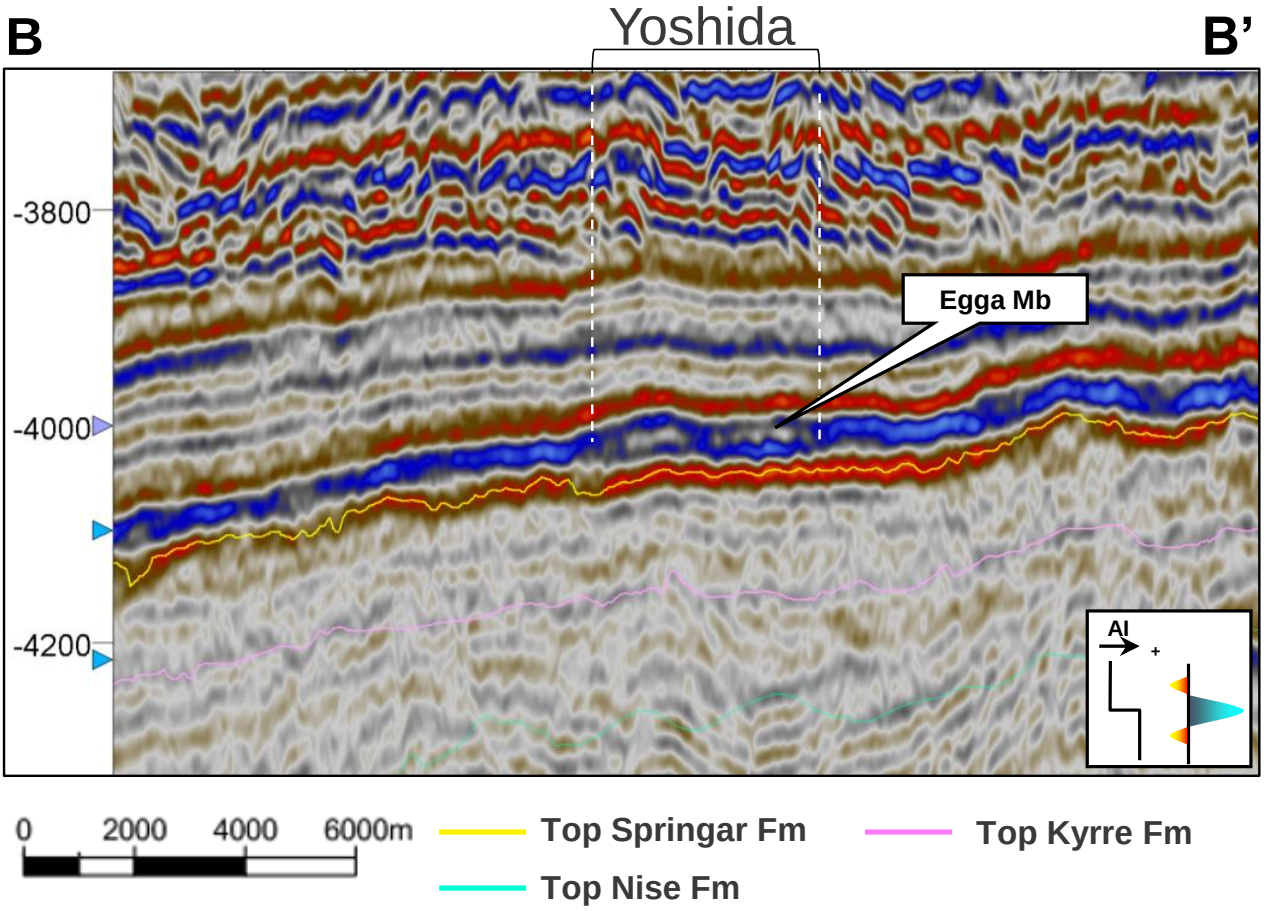

Fig. 4.4 Yoshida seismic cross section

Trap: The crest of the trap is mapped at 3665 m. A P90 - P50 - P10 contact distribution of 3680 - 3694 - 3710 m is selected.

Reservoir: The expected reservoir parameters are derived from the Ormen Lange wells and adjusted for the burial depth. A P90 - P50 - P10 porosity distribution of 0.224 - 0.25 - 0.276 is selected. The net to gross distribution is 0.5 - 0.6 - 0.7.

Fluid parameters: An Ormen Lange fluid type is selected, however, with a 180 bar overpressure that is seen in well 6302/6-1 further west in the basin. The parameters used are: Gas Condensate Ratio - 12000 Sm^3/Sm^3, condensate yield - 14.84 bbl/mmscf, Gas Expansion Factor - 242 Sm^3/RSm^3, condensate density - 52 API and Gas density - 0.61 rel. air.

From the assessment the mean volumes of Yoshida is 9.2 Mm^3oe (gas).

The Yoshida reservoir quality and presence is regarded as moderate risk. There is an expression on the seismic indicating a continuation of the Egga system from the Ormen Lange area. A reservoir risk of 0.64 is selected.

The trap is the main risk due to the stratigraphic pinch-out configuration. A risk of 0.28 is selected.

The charge into the prospect is regarded as low risk and a factor of 0.9 is selected.

From the assessment there is an overall COS of 16% for the Yoshida prospect.

Captains Choice

The Captains Choice Prospect was interpreted as an Egga sandstone injected into the upper Tang Formation. Through the licence evaluation it was likely that the seismic expression of the prospect corresponds to an expected ooze response.

As a concequence, reservoir presence risk was seen as very high and Captains Choice has not been considered as the prospect to go forward.

Ings

The Ings Prospect was defined as a stratigraphic trap in the Springar interval and requires and updip sand to sand juxtaposition fault seal. The prospect is located in a distal part of the system and has high reservoir risk. There is also high risk on top seal with the Egga sand directly above.

Due to the high risk on top seal and trap integrity Ings was not considered as a prospect to go forward with.

INEOS did as a partner in the licence a separate evaluation of the Yoshida and Ings prospects based on proprietary reprocessed version of the available 3D seismic in the prospect area and presented the assessment in an EC meeting. INEOS were unable to define a trap on the Ings Prospect and concluded also negatively on the Yoshida Prospect with regards to amplitude response and the prospect size. INEOS had significant lower volumes than the Operator.

Summary

By utilizing the available data and studies the licence partners have assessed the resource potential in PL995. The total potential is summarised in Table 4.2 and Table 4.1 . Based on the technical and economical assessments the partnership concluded that none of the mapped prospects had the potential to reach a minimum economic threshold value for being tie-in candidates to the Ormen Lange Field.

The license partnership decided unanimously to relinquish the area.

Table 4.2 Licence prospectivity resource potential

Prospect name	D/P/L	Case	Unrisked recoverable resources						Probability of discovery	Resources in Licence acreage (%)	Reservoir		Nearest relevant infrastructure	
			Oil (10^6Sm^3)			Gas (10^9Sm^3)					Stratigraphical level	Reservoir depth	Name	km
			P90	Mean	P10	P90	Mean	P10						
Redmond	P	Gas	0.33	0.82	1.43	4.01	9.81	17.10	0.21	100	Springar	3540	Ormen Lange	60
Armstrong	P	Gas	0.05	0.21	0.42	0.54	2.45	4.92	0.19	100	Springar	3540	Ormen Lange	40
Yoshida	P	Gas	0.25	0.71	1.26	2.92	8.49	15.00	0.16	100	Egga	3660	Ormen Lange	35
Ings	P	Gas	1.77	5.86	12.9	21.4	69.6	153.6	0.12	75	Springar	3585	Ormen Lange	35
Captains Choice	P	Gas	0.16	0.69	1.27	1.98	8.19	15.1	0.11	95	Tang	3330	Ormen Lange	55
Maveric	L	Gas								100	Pliocene	1270	Ormen Lange	50