



Relinquishment Report

PL523

15.08.12

EC Representative: Marianne Skibeli

MC Representative: Chris Dart

PL 523 Summary

E.ON E & P Norge AS, as the Operator of the PL523 license, and the license partners are in agreement that no drillable economic prospects are identified in the license. The license will therefore be relinquished.

PL523 Torunn Prospect

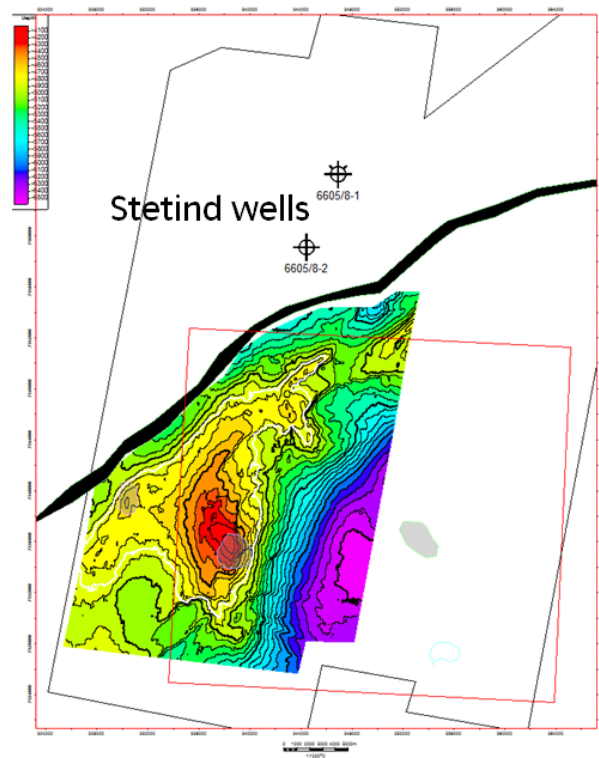
- Cretaceous prospect
- Submarine Fan system
- Lange sst. of Cenomanian age
- No other prospectivity identified

Critical factors: Reservoir quality and top seal

GCF 8 %

Total Resources [1e6 Sm³ OE]

P 90	P 50	P 10
3.85	21.9	92.6



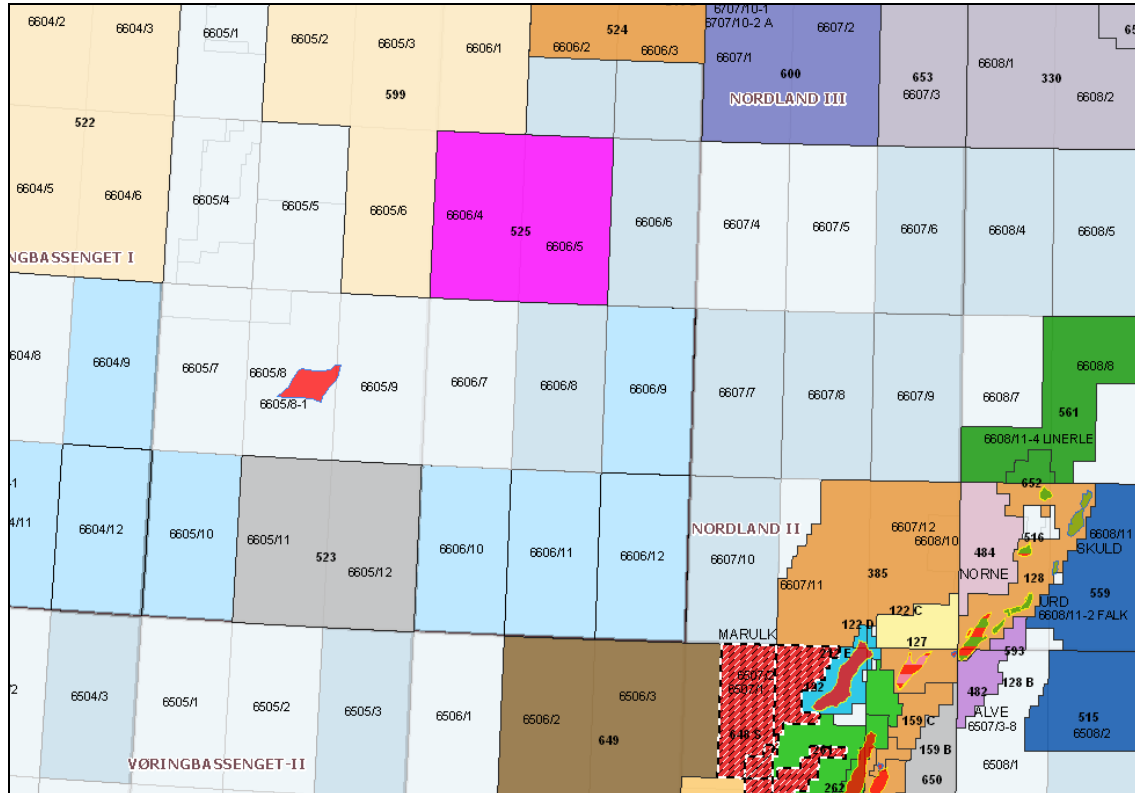
Conclusions:

- One high risk prospect, the Torunn prospect is identified and two leads. The GCF (Geological Chance Factor) for Torunn is 8%.
- Subsurface studies have failed to de-risk the prospects & leads interpreted and described in the 20th round application.
- The absence of a clear DHI or AVO signature at the reservoir level, and regional sedimentological work show a high risk for the possibility of the presence of good reservoir in the prospect. The new PSDM 3D seismic data show a well defined 4-way closure on several levels. However, several small faults over the structure and hydrothermal vents are seen, which makes the top seal also a high risk.
- We do not see more potential in the license.

Without a geophysical support for hydrocarbons it is very difficult to argue for a well, especially when the gas discovery at the nearby Stetind prospect (closest well) has a clear DHI response.

License overview and work- commitment.

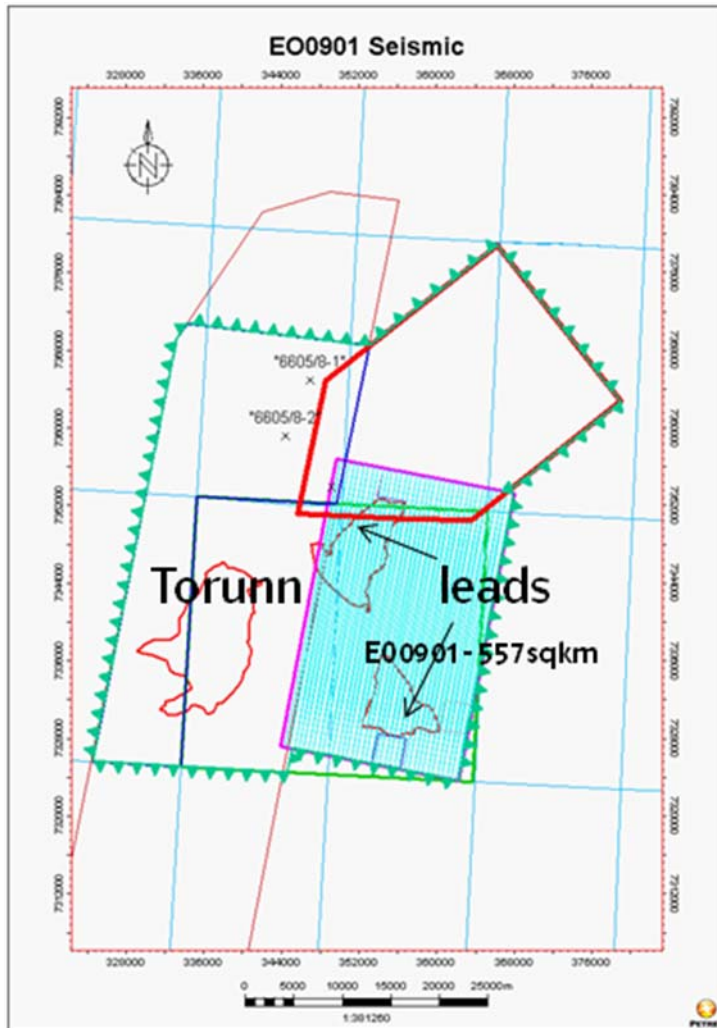
The PL 523 blocks are shown in the figure below.



The two blocks in grey 6605/11 and 12 are located in the Vøring Basin in the Norwegian Sea.

Work Commitment Initial Period PL 523

- **Within 3 years from award (by May 15th 2012).**
Acquire (new acquisition) of minimum 450 km² 3D seismic data.
(Re-) process 3D seismic data covering the license area.
Decide to drill or drop the license.
- Within 5 years from award (by May 15th 2014)
- BoV “Beslutning om videreføring”
- Within 5 years from award (by May 15th 2015)
- Submit PDO (Plan for development and operations) or drop license



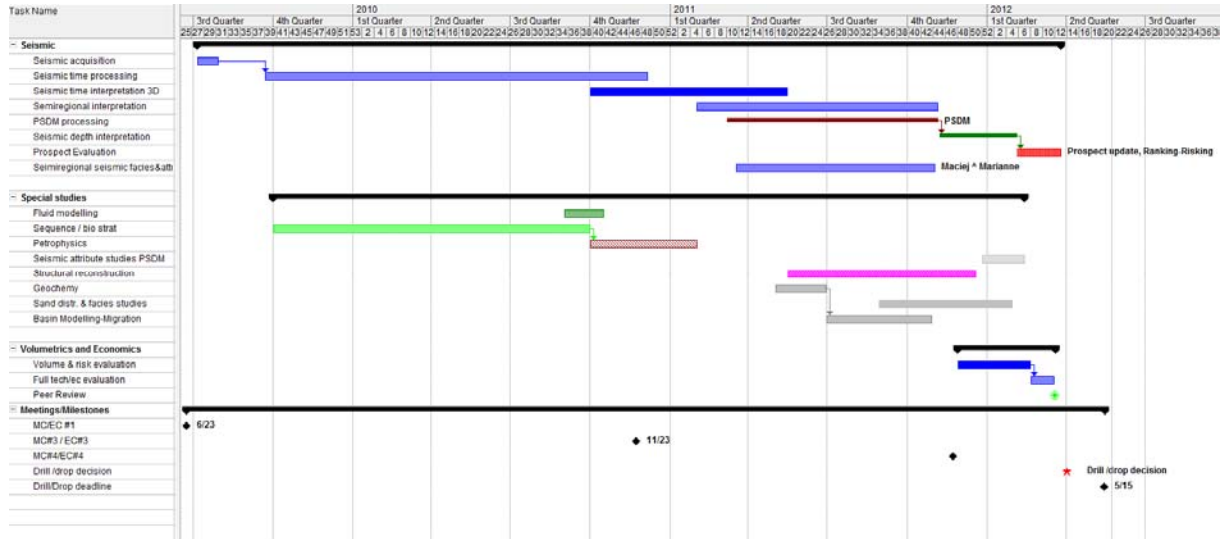
The figure shows the performed seismic acquisition of the 3D survey EO0901 (blue area), the PSTM of the merged dataset (green outline), and PSDM over the prospects (blue outline)

The licence was awarded in 2009 in the 20th licensing round. The general information is listed in the information below.

During this 3 years period we have performed seismic acquisition of a 3D survey, PSTM of the merged dataset (see figure), and PSDM over the prospects. In addition several geological and geophysical studies have been performed. (See the project plan and list of studies.)

Special studies:

- Fluid modelling
- Sequence stratigraphy
- Petrophysics
- Seismic attribute evaluation PSDM
- Structural Reconstruction (Midland Valley)
- Sand distr.- facies maps of the Cretaceous Cenomanian – Coniacian sequences & Campanian seq.



Project plan.

▣ General Information

Production licence	523
NPDID production licence	5463304
Fact map	link
Status	ACTIVE
Main area	Norwegian sea
Licensing activity	20
Date granted	15.05.2009
Date valid to	15.05.2015
Original area [km2]	839.790
Current area [km2]	839.790

▣ Phases

Date phase valid from	Date phase valid to	Phase
15.05.2009	15.05.2015	INITIAL

▣ Licensees - current

Date valid from	Company longname	Interest [%]
11.02.2012	E.ON E&P Norge AS	40.00000
-	Det norske oljeselskap ASA	20.00000
-	Norwegian Energy Company ASA	20.00000
-	Dana Petroleum Norway AS	20.00000

▣ Operatorship - current

Date valid from	Company longname
11.02.2012	E.ON E&P Norge AS

▣ Area - current

Date valid from	Block name	Polygon number	Polygon area [km2]	Vertical limitations
15.05.2009	6605/11	1	419.895	
-	6605/12	2	419.895	

Acquisition and PSDM reprocessing

The reprocessed area consists of approximately 2200 km² of full fold 3D marine seismic data of which 600 km² was newly acquired within EO0901 survey and merged with pre-existing 3D seismic.

SURVEY	Full-fold area (km ²)
EO0901	600
NH0202	600
FLES98	1000

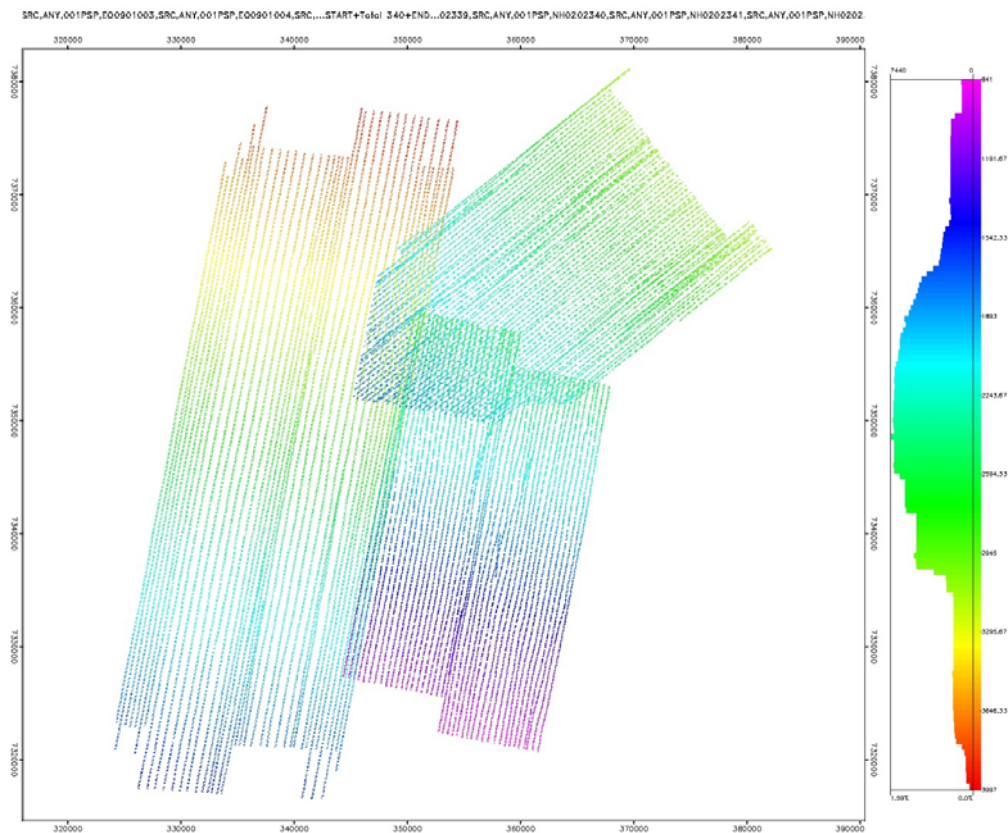


Figure. Location map showing SP locations for EO0901, NH0202 and FLES98 surveys used in the reprocessing project.

EO0901 Acquisition Details

Acquisition	
Vintage	EO0901 - 2009
Contractor	PGS
Source Vessel	Viking Vanquish
Source	
Type	Sleeve airgun
Number of sources	2 (flip/flop)
Source separation	50 m
Operation Pressure	2000 PSI
Volume	5260 cu.in.
Depth	10 m
Shot Interval	18.75 m
Streamer	
Number of cables	10
Number of groups	480
Length	6000 m
Depth	8 m
Group Interval	12.5 m
Separation	100 m
Recording	
Sample Rate (ms)	2
Record Length (ms)	7000
Tape Format	SEG-D
Filters	High-cut 187 Hz at 260 dB/Oct.
Geometry	
Acquisition Bin Size	12.5 m by 25 m
Nominal Fold	80

The PSTM processing was completed in January 2011 by PGS` s processing department in Oslo. The data below the Base Tertiary level was of poor quality in the Rås basin therefore it was decided to continue with PSDM processing which was awarded to CGGV in Oslo. The PSDM processing of the seismic data of approximately 2200sqm was executed from March 2011 to November 2011.

The main challenge was to improve signal-to-noise ratio in the Cretaceous in the southern part of the area (mainly covered by FLES98) by using advanced depth imaging tools and appropriate velocity model building methods. The Final Migration was run using Amplitude Preserving Controlled Beam Migration

The new PSDM migration stacks show better reflectivity in the Cretaceous where the main prospects lie. The images appear clearer and should be more correctly positioned than those of the PSTM processing.

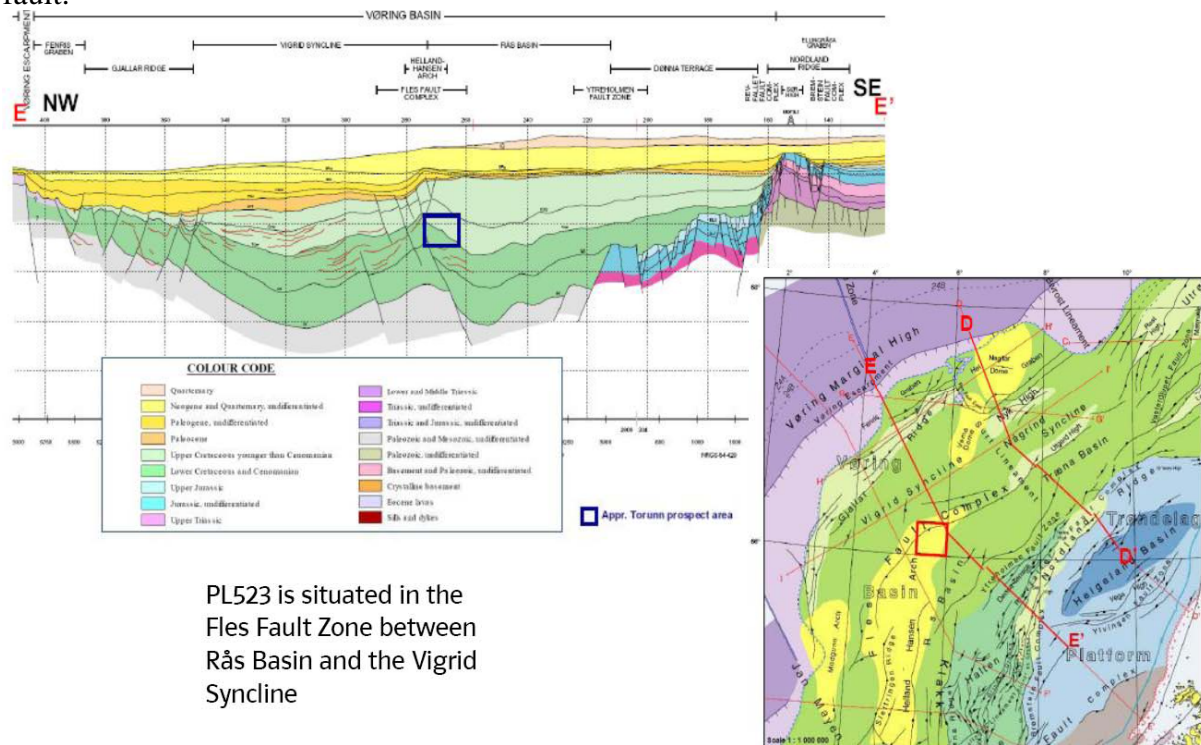
Both faults and deep reflectivities are also enhanced, thus enabling a better understanding of the geology and tectonic history of the area.

Regional setting

The two blocks 6605/11 and 12 are located in the Vøring Basin in the Norwegian Sea.

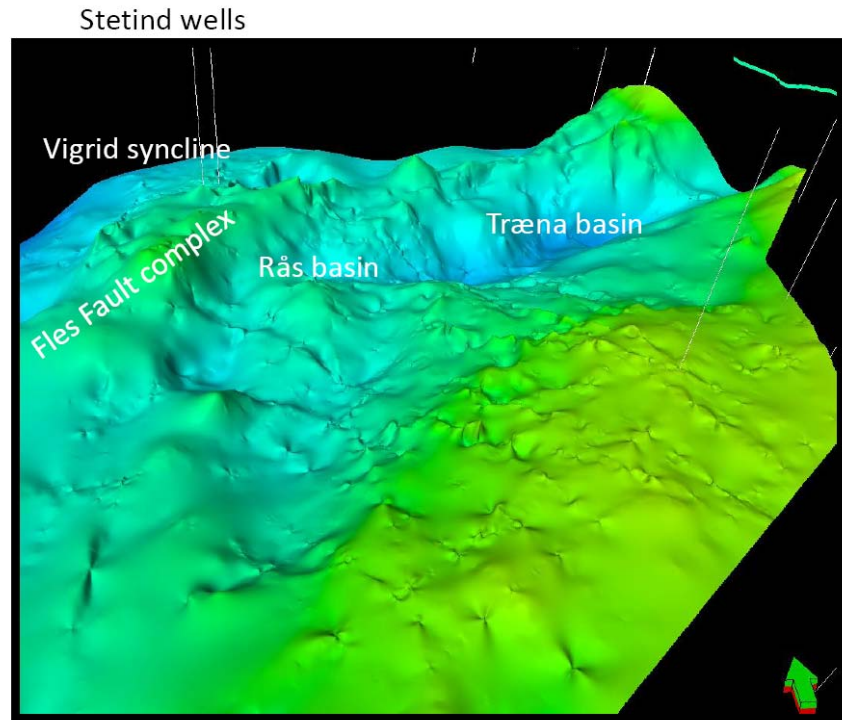
PL523 is situated in the Fles fault zone between Rås Basin and the Vigrid Syncline.

The key well for the block is the 2 Stetin gas discovery wells (6605/8-1 and 2) on the NW side of the main Fles fault.



PL523 is situated in the Fles Fault Zone between Rås Basin and the Vigrid Syncline

- PL523 is situated in the Fles Fault Zone between Rås Basin and the Vigrid Syncline
- The key wells for the blocks is the 2 Stetind wells on the NW side of the main Fles Fault.
- **Challenge** -
Confident mapping of the Cretaceous key surfaces & potential reservoir horizons and BCU.
A lot of volcanic intrusions masking the seismic interpretation.



There are a lot of sills and dikes intruded in the sedimentary layers in this area. These mask the seismic image, and makes the confidence of the seismic interpretation difficult.

Prospect Summary

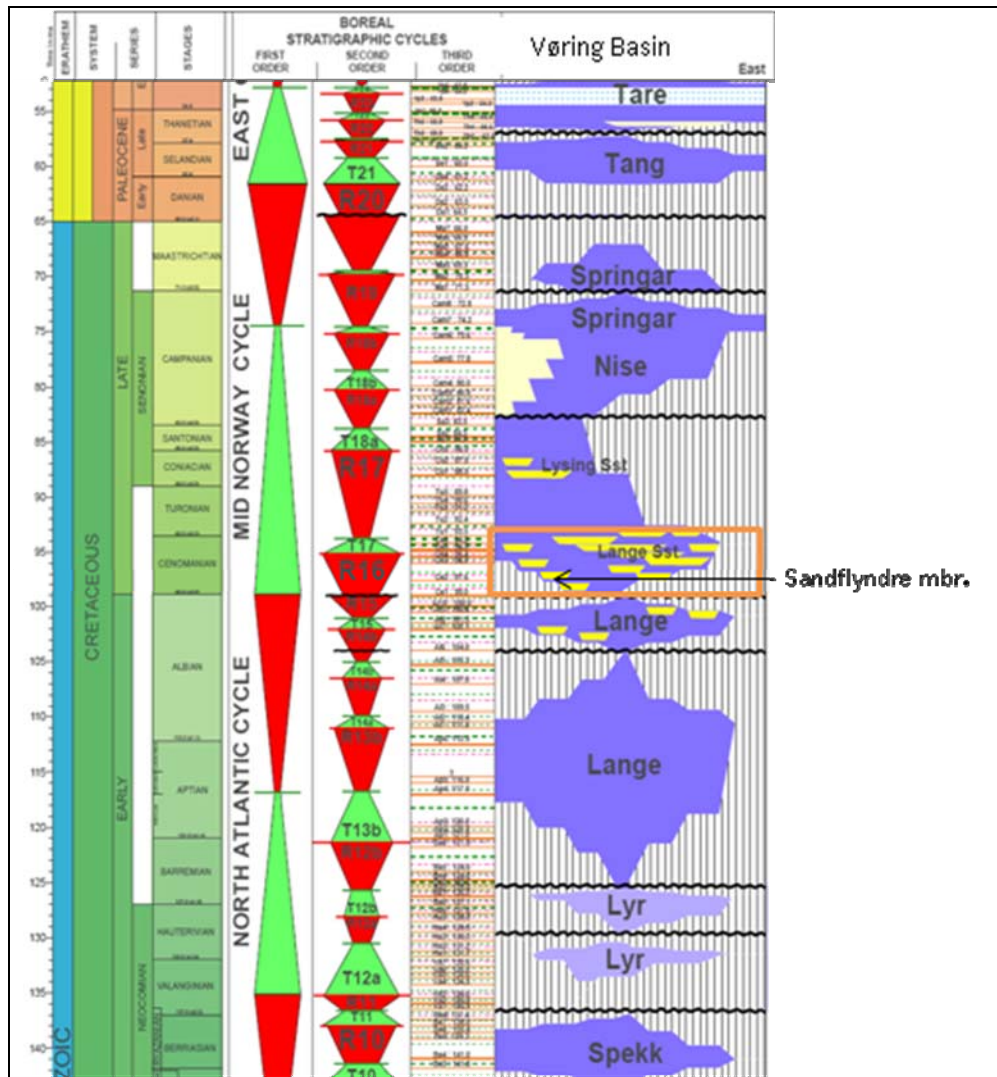
The only prospectivity remaining in these blocks are the Cretaceous (Cenomanian) 4-way closure (Torunn Prospect.) The reservoir is interpreted to be turbidites belonging to the Lange Fm.

The Torunn structure is complex and has undergone several tectonic phases. The last Miocene compressional phase generated a larger inversion structure along this Fles Fault Zone, which is the most important phase generating the Torunn structure.

Two other closures at the same stratigraphic level are mapped; however they are smaller and deeper and are therefore not seen as interesting.

Top seal of the structure is the Cenomanian – Turonian shales. Several vents from the intrusives are seen several places over the Torunn structure. Therefore the seal is considered to be of high risk.

Source rock is considered to be TOC rich shales of the Upper Jurassic Spekk Fm. and/or Lower and Mid. Cretaceous (Lange Fm.). In the deep Rås Basin the source rock is most likely to be in the gas window. The Torunn prospect is therefore only evaluated as a gas prospect.

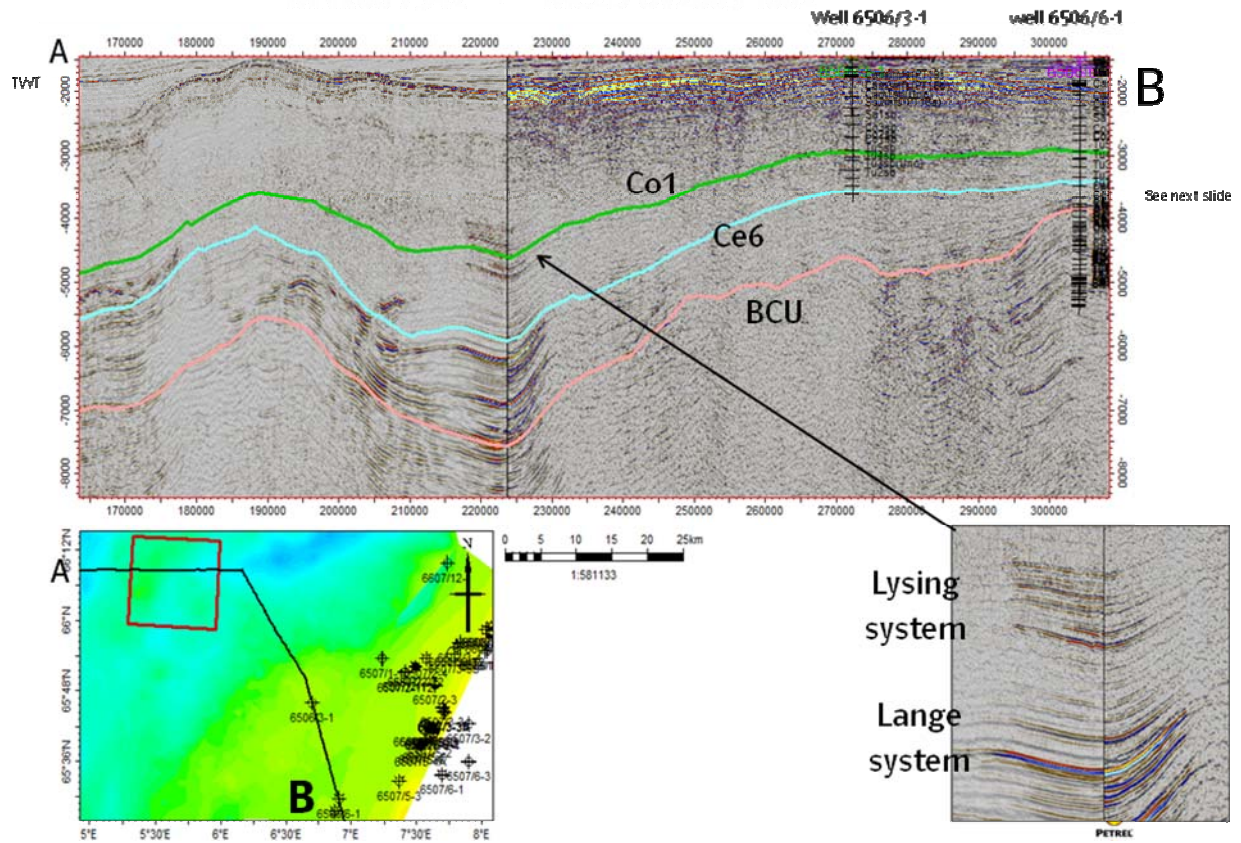


On regional 2D seismic lines the Ce6mfs marks the top of a series of reflectors that constitute a specific motif encountered throughout the Rås Basin. See seismic line below.

This seismic facies weakens very much in the license area. The figure below also shows the characteristic signature of the younger Lysing fm. The sandy sequences seem to shale out toward the Fles fault complex and inversion structure.

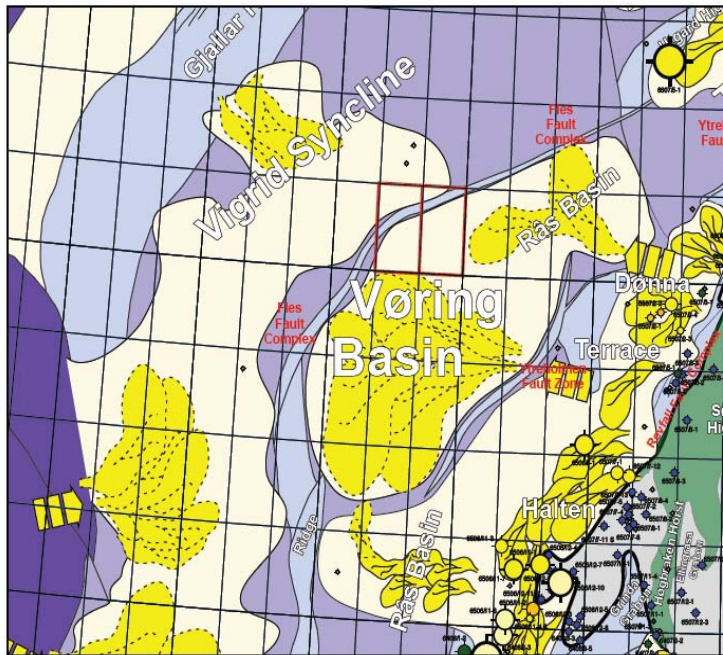
Both systems have decreasing amplitude patterns from east to west.

To do a confident regional mapping of the key Cretaceous surfaces to understand the potential reservoir distribution is a challenge, and the confidence level of the BCU interpretation is not very high. The understanding of the depth to the known upper Jurassic source rock is therefore also an uncertainty.



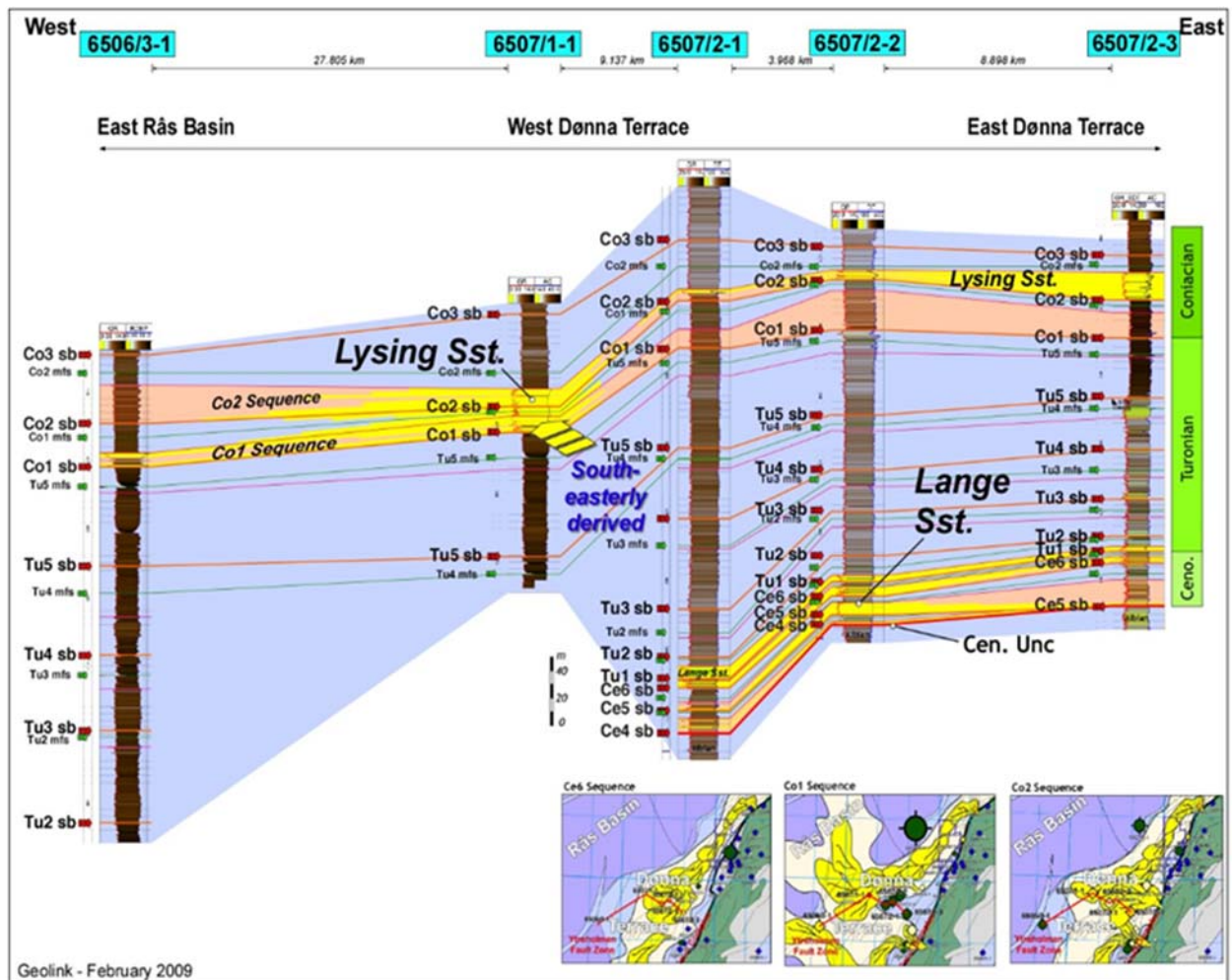
See next slide

The Cenomanian Facies map is shown below.



Seismic data give evidence of a widespread **specific seismic facies** throughout the Rås Basin. It is characterised by **decreasing amplitude** from East to West and from South to North. These data together with published regional studies suggest that **basin floor fans** developed in the Rås Basin during Cenomanian times.

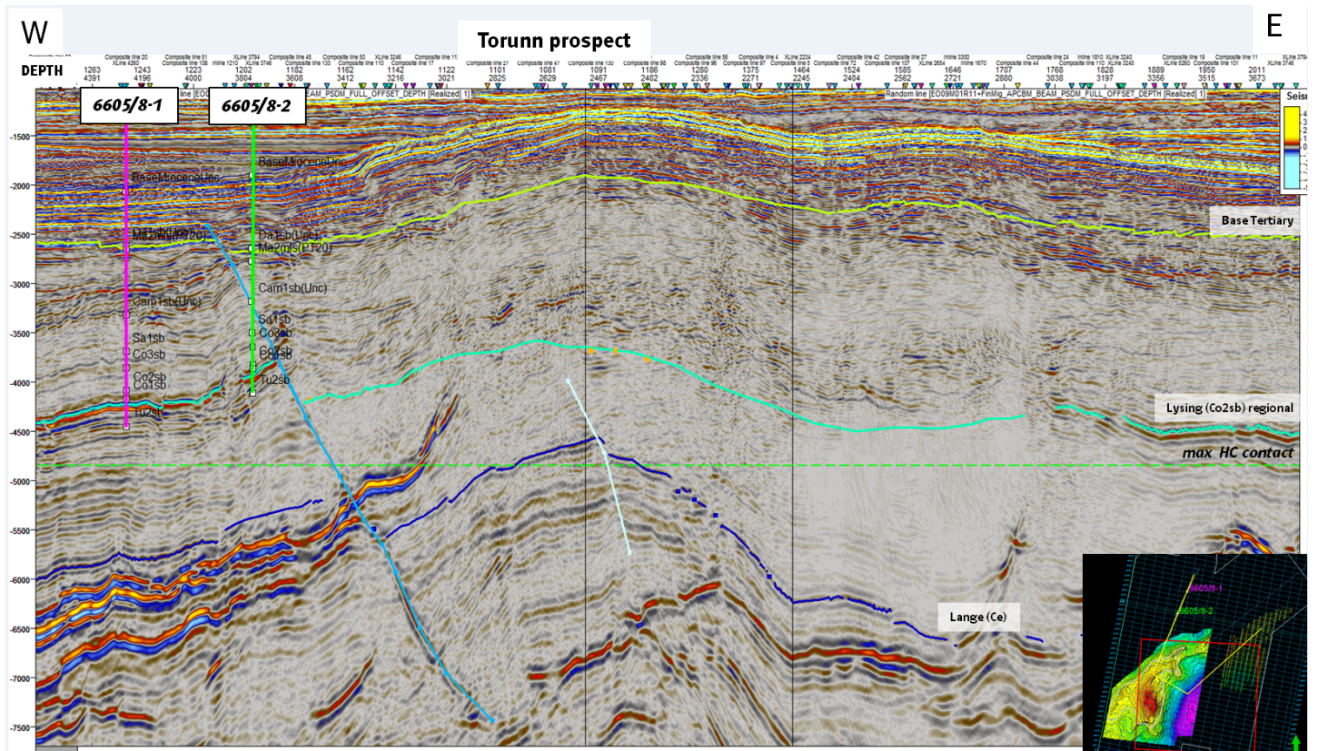
The absence of correlation between Lange deposits in the Rås Basin and in the Vigrid Syncline suggests that these two depocenters were disconnected. The Fles Fault Complex acted as a boundary.



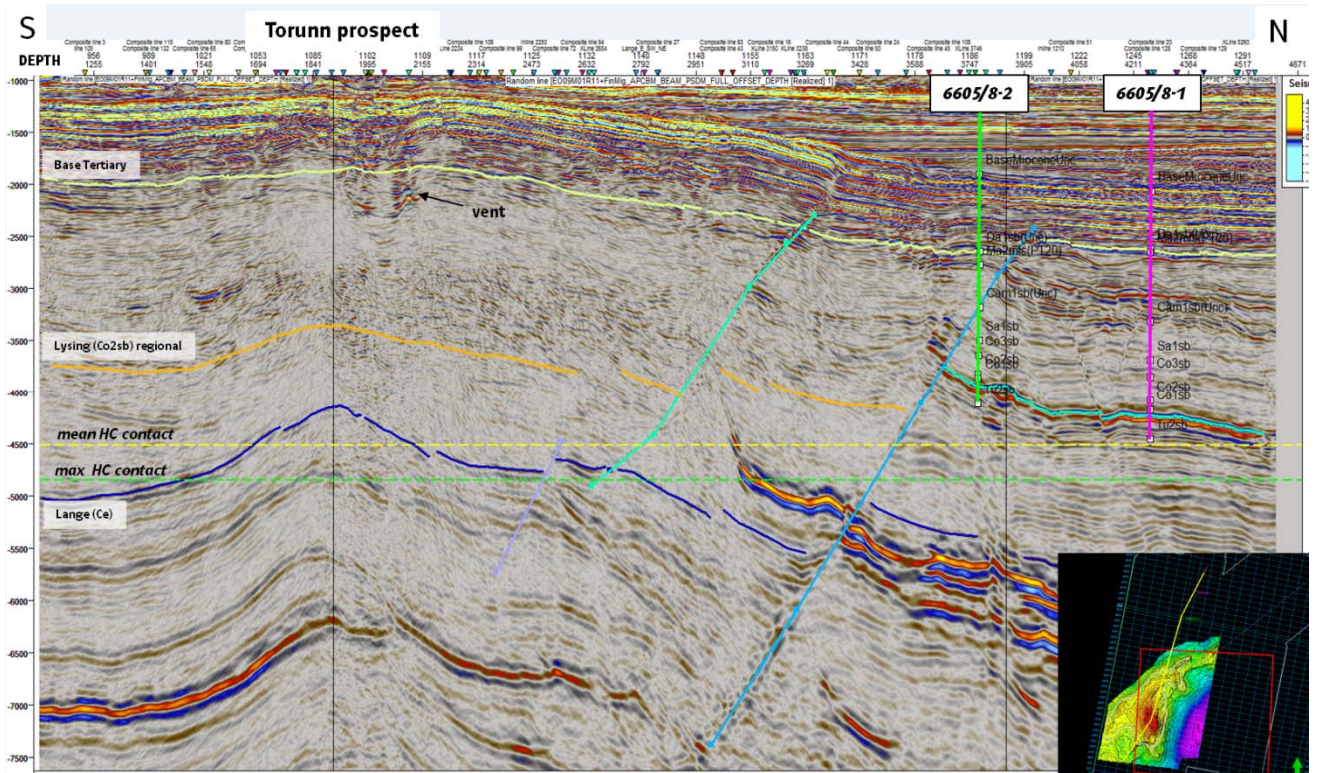
Cross-section showing a west- east correlation of the Cenomanian-Conician sequences.

As already mentioned a lot of volcanic intrusions are masking the seismic interpretation. Gas leakage and vents are interpreted over the structure on the 3D which has undergone several tectonic reactivations, meaning that there is also a top seal problem.

No DHI or AVO response can be observed on the seismic (See figure blow). If hydrocarbon is present, modelling shows these should be visible on the seismic. The nearby Stetind gas discovery has a pronounced 'soft kick' and an AVO class III anomaly observed.



PSDM arbitrary seismic section in depth tying to Stetind wells to the East. Seismic package to the west of the section is characteristic to Lysing reflectivity and is tied regionally to Coniacian 2 sequence boundary. The top Lange (top prospect) is the blue horizon.



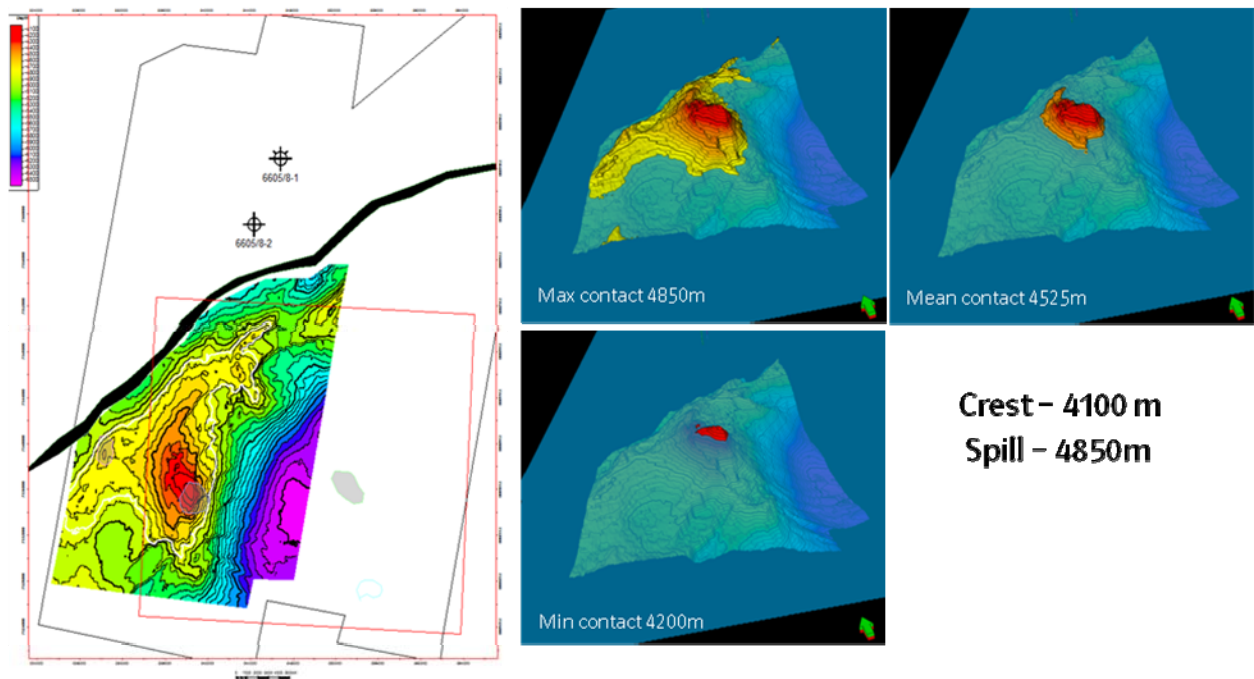
PSDM S-N seismic section in depth through the crest of the Torunn prospect. HC used for volumetric are shown in yellow and green lines. The top Lange (top prospect) is the blue horizon.

Risk

Critical factors: Reservoir quality and top seal. No DHI or AVO

	Prospect risk
Charge	70%
Reservoir	40 %
Seal	30%
Geometry	95 %
	GCF = 8 %

Reserves



Torunn Prospect Volume calculations in GEOX

Input for the volume calculations

Parameter [Units]	Dist. type	Mean	Std. dev.	F90	F50	F10
HC water contact [m]	Unif	4525.0	187.6	4265.0	4525.0	4785.0
Spill point depth [m]	Const	4850.0	0.0	4850.0	4850.0	4850.0
Reservoir thickness [m]	Ln2MnMx	123.0	61.5	58.2	109.5	206.3
Parameter [Units]	Dist. type	Mean	Std. dev.	F90	F50	F10
Net/gross ratio [decimal]	Norm	0.35	0.0933	0.228	0.35	0.472
Porosity [decimal]	Norm	0.225	0.0466	0.164	0.225	0.286
Gas saturation [decimal]	Norm	0.65	0.0747	0.552	0.65	0.748
Parameter [Units]	Dist. type	Mean	Std. dev.	F90	F50	F10
Wet gas shrinkage factor [decimal]	Const	1	0.0	1	1	1
Gas expansion factor (1/Bg) [Sm ³ /m ³]	Ln2LoHi	284.1	26.8	250.0	282.8	320.0
Condensate yield [Sm ³ /1e6 Sm ³]	Unif	300.0	57.7	220.0	300.0	380.0
Recovery factor Non Assoc. Gas [dec...]	Ln2LoHi	0.541	0.116	0.4	0.529	0.7
Recovery factor Condensate [decimal]	NrmLoHi	0.4	0.0764	0.3	0.4	0.5

Fluid inputs GeoX

Parameter [Units]	Dist. type	Mean	Std. dev.	F90	F50	F10
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In-place and recoverable summary

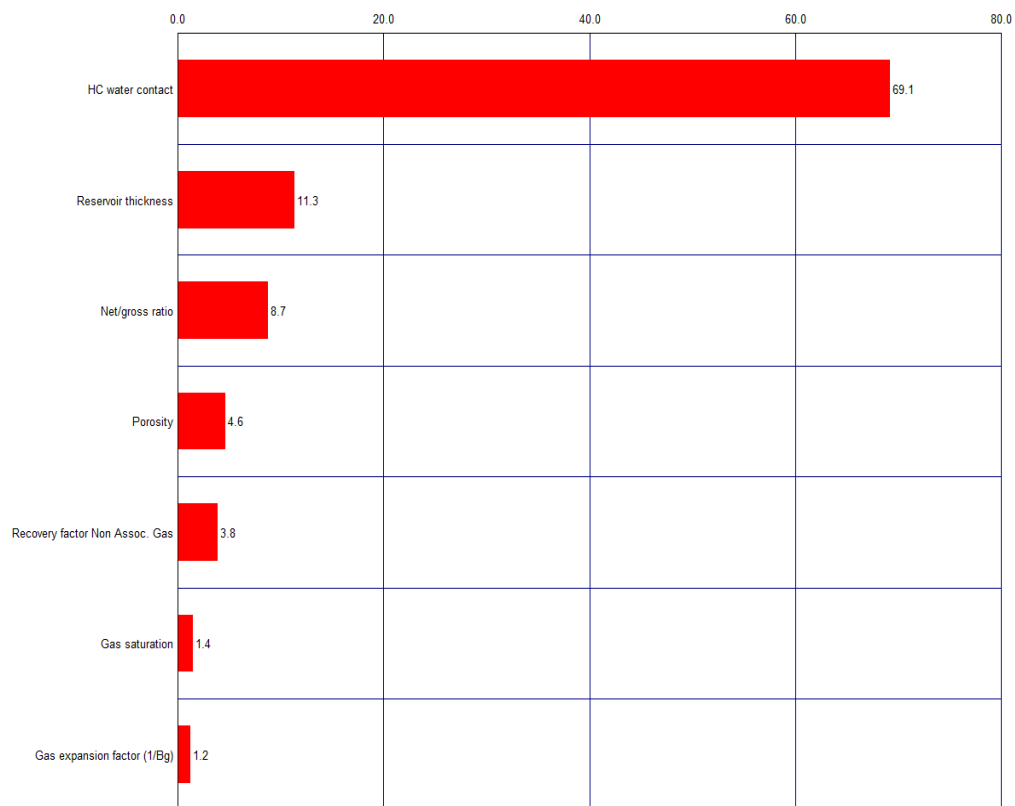
P90 assumed
non-economical

Resource Type [Units]	Dist. type	Mode	Mean	Std. dev.	F90	F50	F10
Inplace							
Accumulation size Oil [1e6 Sm3]	MC(0)	0	0	0	0.0	0.0	0.0
Accumulation size Assoc. Gas [1e9 ...]	MC(0)	0	0	0	0.0	0.0	0.0
Accumulation size Non Assoc. Gas [...]	MC(10000)	5.36	57.4	65.1	6.02	34.3	141.2
Accumulation size Condensate [1e6...]	MC(10000)	1.59	17.4	20.6	1.75	9.99	42.6
Accumulation size Total Resources [...]	MC(10000)	6.49	74.8	85.2	7.78	44.4	184.9
Recoverable							
Accumulation size Oil [1e6 Sm3]	MC(0)	0	0	0	0.0	0.0	0.0
Accumulation size Non Assoc. Gas [...]	MC(10000)	2.42	30.9	36.1	3.15	17.8	75.9
Accumulation size Assoc. Gas [1e9 ...]	MC(0)	0	0	0	0.0	0.0	0.0
Accumulation size Condensate [1e6...]	MC(10000)	0.547	6.91	8.34	0.681	3.91	17.1
Accumulation size Total Resources [...]	MC(10000)	4.08	37.8	44.2	3.85	21.9	92.6

**Profiles
generated in
Geox Fullcycle for
P50 and P10**

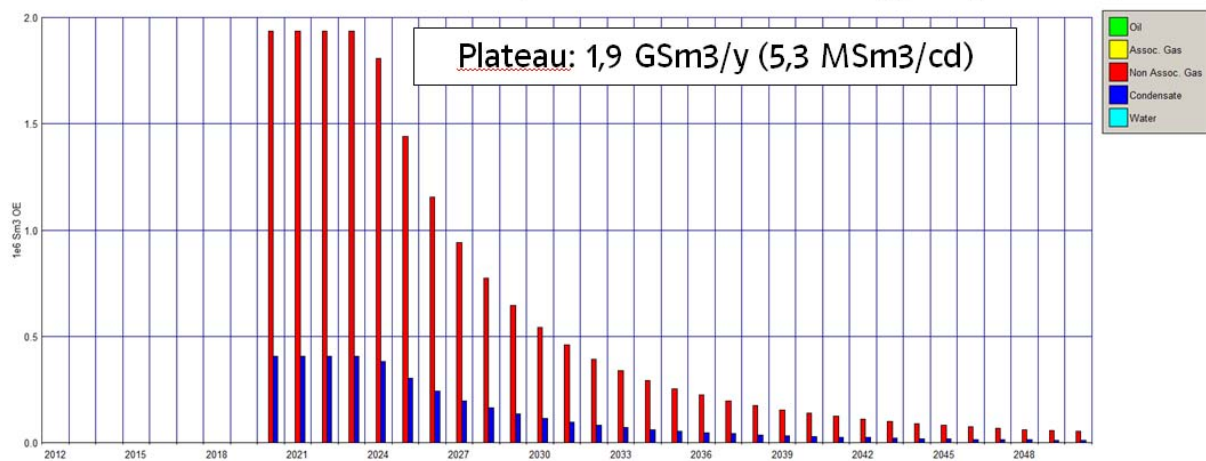
Recoverable reserves for the P50 case is $21.9 \times 10^9 \text{ SM}^3$ o.e., predominantly gas

The parameter which has the biggest effect of the volumes is the depth of the HC contact.
See “Variance diagram” from GEOX below.



Variance diagram

P50 Production Profile (Geox success trail group ~ P50)



Start-up: 2020

Number of wells: 6

Technical reserves:

18,5 GSm3 rich gas

3,9 MSm3 condensate

PL 523 Torunn development scenarios

PL523 Torunn P50/P10

- Concept for both P50 and P10 is a standalone FPSO.
- 80 km gas export pipeline, tie-in to the future NSGI pipeline (Aasa Hansteen – Nyhamnna)
- P50: 2 templates with a total of 6 producers
- P10: 5 templates with a total of 20 producers

Licence Name Case	PL523 Torunn Gas		
GeoX	Cost item	P50	P10
5	Exploration wells	604	604
8	Appraisal wells	604	604
17	Production/Injection wells	3 474	11 580
22	Facilities fixed cost	14 396	32 863
26	Opex level MNOK/year:	823	1 085
18	Decommissioning	790	1 700
	Decommissioning as fraction of CAPEX	0,039015	0,034802

Conclusions

All work commitments in the licence have been fulfilled and through extensive sub-surface studies EON E&P Norge AS and partners have concluded that prospectivity is limited and the probability of finding hydrocarbons in the licence is very low. Therefore the licence group unanimously support relinquishment of PL 523.

Tabel 1 Prospect data – Torunn prospect evaluation 15.08.12
(Resources Base case = P50)

Block	Prospect.	Disc/Prosp/Lead	Prosp ID (or New!)	NPD approved?		
6605/11&1	Torunn	Prospect	Fylles ut av OD	Fylles ut av OD		
Play (name / new)		Struct. element	Company reported by / Ref. Doc. / Year			
Fylles ut av OD		Fles Fault Zone	E.ON E&P Norge AS/ PL 523tilbakelevering 2012			
Oil/Gas	Resources INPLACE					
	Main phase			Ass. Phase		
	Low	Base	High	Low	Base	High
Oil 10 ⁶ Sm ³				1.75	9.99	42.6
Gas 10 ⁹	6.02	34.3	141.2			
	Resources RECOVERABLE					
	Main phase			Ass. Phase		
	Low	Base	High	Low	Base	High
Oil 10 ⁶ Sm ³				0.68	3.91	17.1
Gas 10 ⁹	3.15	17.8	75.9			
Prob. discovery:						
-Technical (oil+gas case)		-Commercial prob. (oil+gas		-Prob for oil/gas case		
	0.137					
Which fractiles are used as Low & High?				Low: P90	High: P10	
Type of trap	Waterdepth	Reservoir Chrono (from - to)		Reservoir Litho (from - to)		
Structural	720	Cretaceous		Lange Formation		
SourceRock, Chrono	SourceRock, Litho	Seal, Chrono		Seal, Litho		
Kimmeridgian-Early	Spekk Formation	Cenomanian		Lange Formation		
Seismic database	PSDM EO 0901					
Probability						
- Reservoir (P1)	- Charge (P3)		- Trap (P2)		- Retention (P4)	
0.4	0.7		0.95		0.3	
Parametres:	Low		Base		High	
Depth to top of prospect (m)			4100m			
Area of closure (km ²)					146.7	
Gross rock vol. (10 ⁹ Sm ³)	7741.7		13234.6		19325.3	
HC column in prospect (m)	165m		425m		685m	
Reservoir thickness (m)	58m		123m		206	
Net / Gross	0.23		0.35		0.47	
Porosity (fraction)	0.164		0.225		0.286	
Water Saturation	0.45		0.35		0.25	
1/ Bg.	250		284		320	
1/Bo.						
Recovery factor, main phase	0.40		0.54		0.70	
Recovery factor, ass. phase	0.30		0.40		0.50	
GOR, free gas (Sm ³ /Sm ³)						
GOR, oil (Sm ³ /Sm ³)						
Temperature, top res (deg C) :	92		Pressure, top res (bar) :		370	