

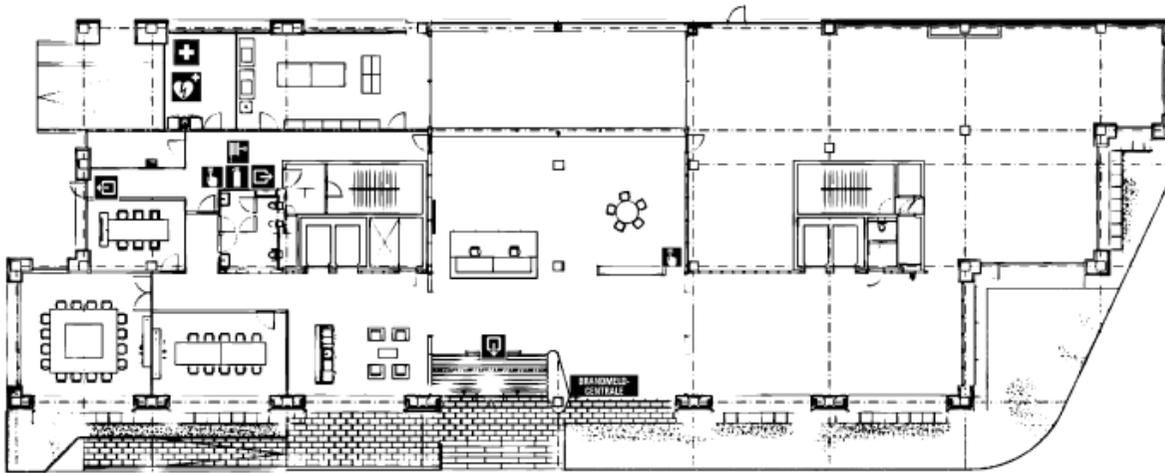


A Sea of Opportunity
Exploration in the Netherlands

EBN



Safety instructions



Safety Instructions

Emergency number: +31302339090

Smoking only outside.

In case of evacuation:

- Leave building with host via emergency exit.
- Do not use elevators.
- Muster outside - Daalseplein

Programme of today

- 10:30 – 12:00 Presentations by EBN
12:00 – 13:00 ***Marine transport to Oudaen, with an experienced guide***
13:00 – 16:00 NL Scout meeting – as usual, this time sponsored by EBN

Presentation overview:

- E&P on the North Sea
- Promotional activities NL
- Exploration projects
- Exploration Day



E&P on the North Sea

North Sea stakeholder meetings

EBN B.V.

Exploration pre-NL scout meeting, Friday June 7, 2019

ebn

North Sea stakeholder meetings

Final report and recommendations to government: July 2019

Chair: Jaques Wallage

Stakeholders:

Fisheries

NGO's

- Greenpeace
- Stichting de Noordzee
- Vogelbescherming
- WNF
- Natuur en Milieu

NOGEPA

EBN

Port of Rotterdam

Tennet

NWEA

Stakeholders:

Ministries

- EZK
- IENW
- LNV
- BZK

KNAW

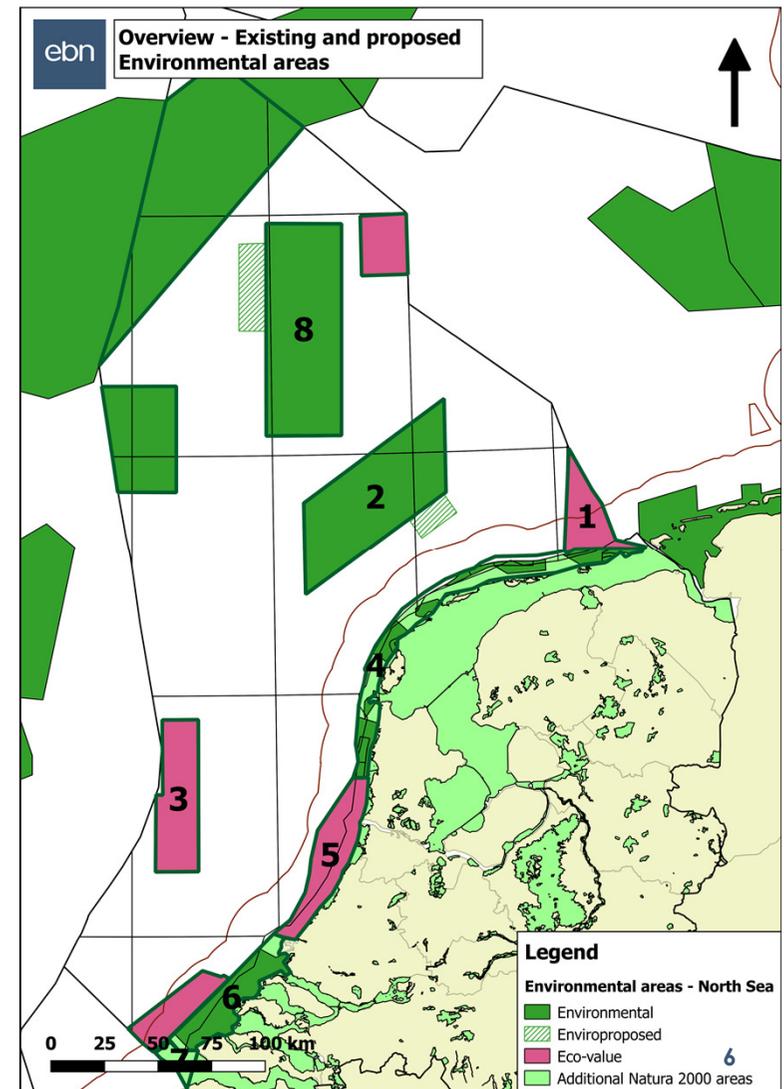
NIOZ

RUG

Existing and proposed environmental areas

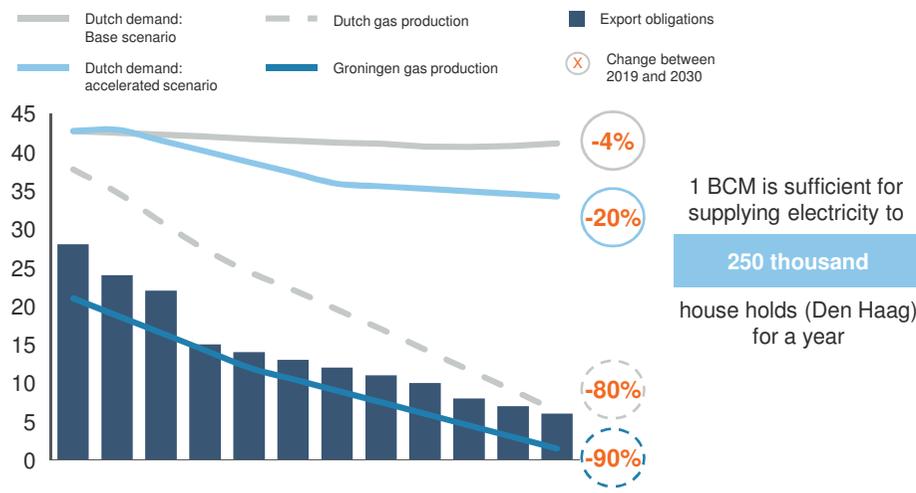
1. Borkumse Stenen
2. Friese Front
3. Bruine Bank
4. Noordzee Kustzone (Noord van Wadden)
5. Hollandse Kust (Hoek van Holland – Bergen)
6. Voor-delta (Zuid van Rotterdam)
7. Vlakte van Raan (Kust bij Zeeland)
8. Centrale oestergronden*

* Based on brochure Stichting de Noordzee

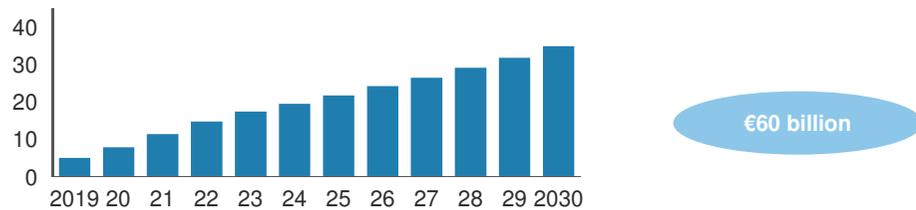


Dutch natural gas demand remains stable to 2030, while production rapidly declines

Natural gas demand and production in the Netherlands, BCM



The Netherlands will have to increase imports in the future, BCM



Production declines to 2030 with

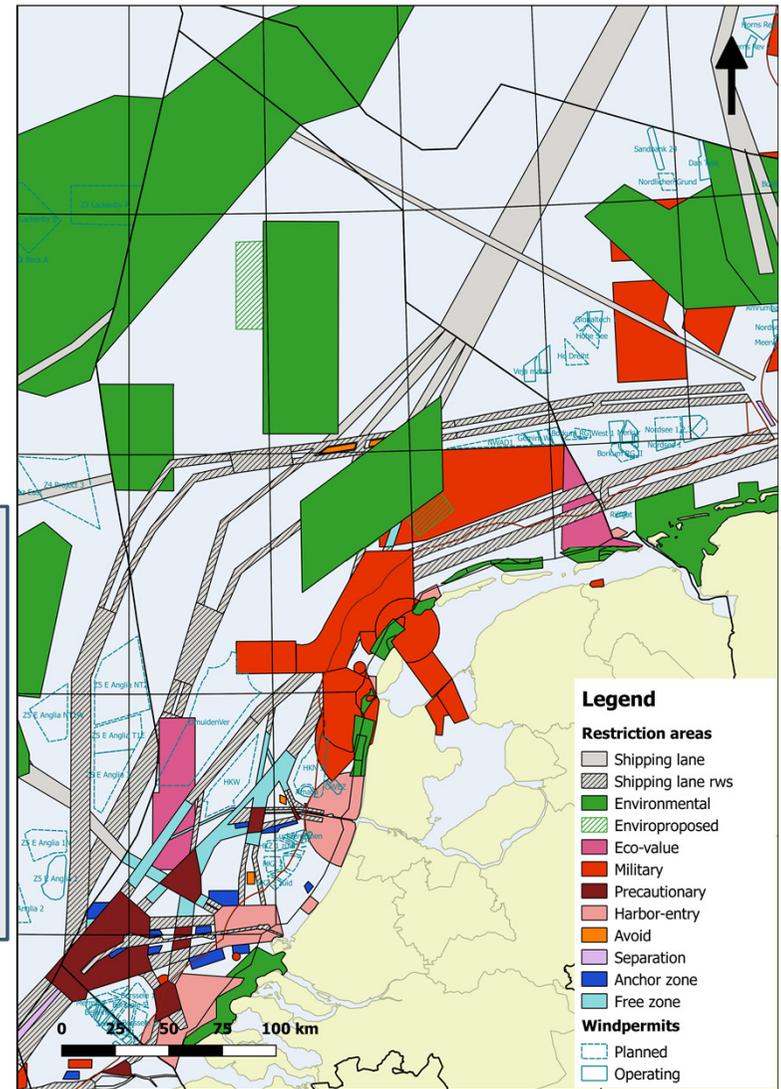
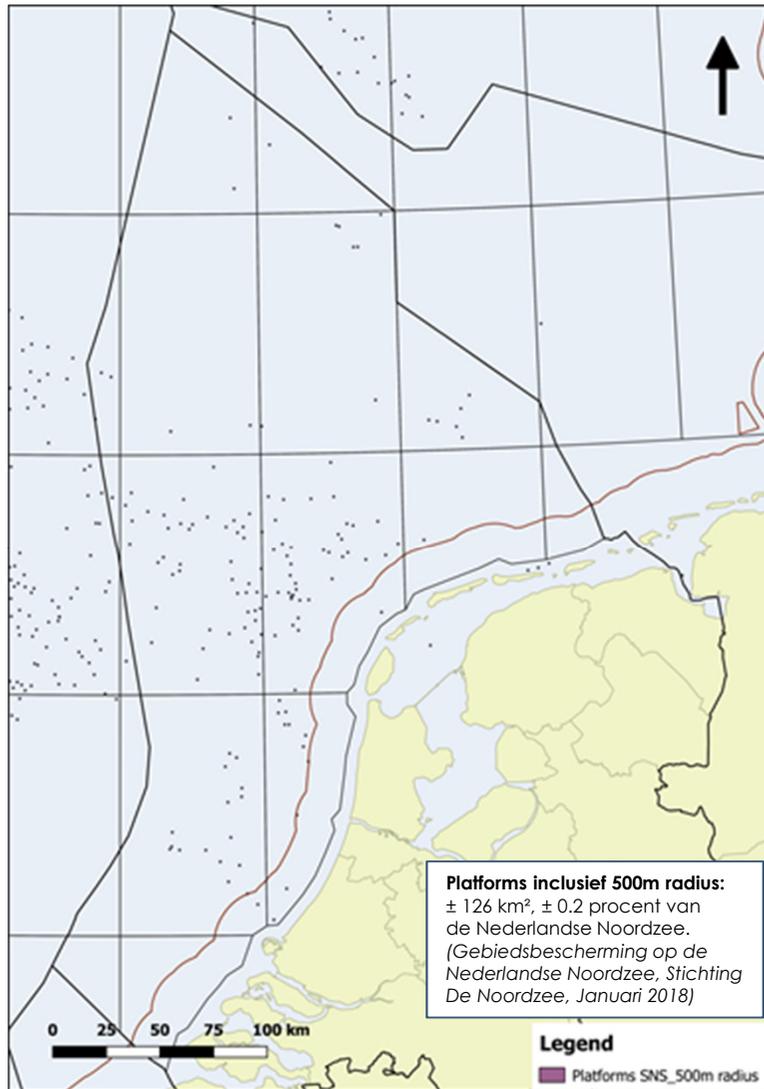
80%

- A large gap exists between supply and demand of natural gas in NL
 - Due to declining production and relatively stable demand the Netherlands will become more dependent on imported gas
 - Conform the Dutch energy policy, E&P on the Dutch SNS is preferred above production from Groningen or imported gas
- 

Source: Energy Insights' Gas Intelligence Model, Bloomberg, Plan Bureau voor de Leefomgeving

Use of the North Sea

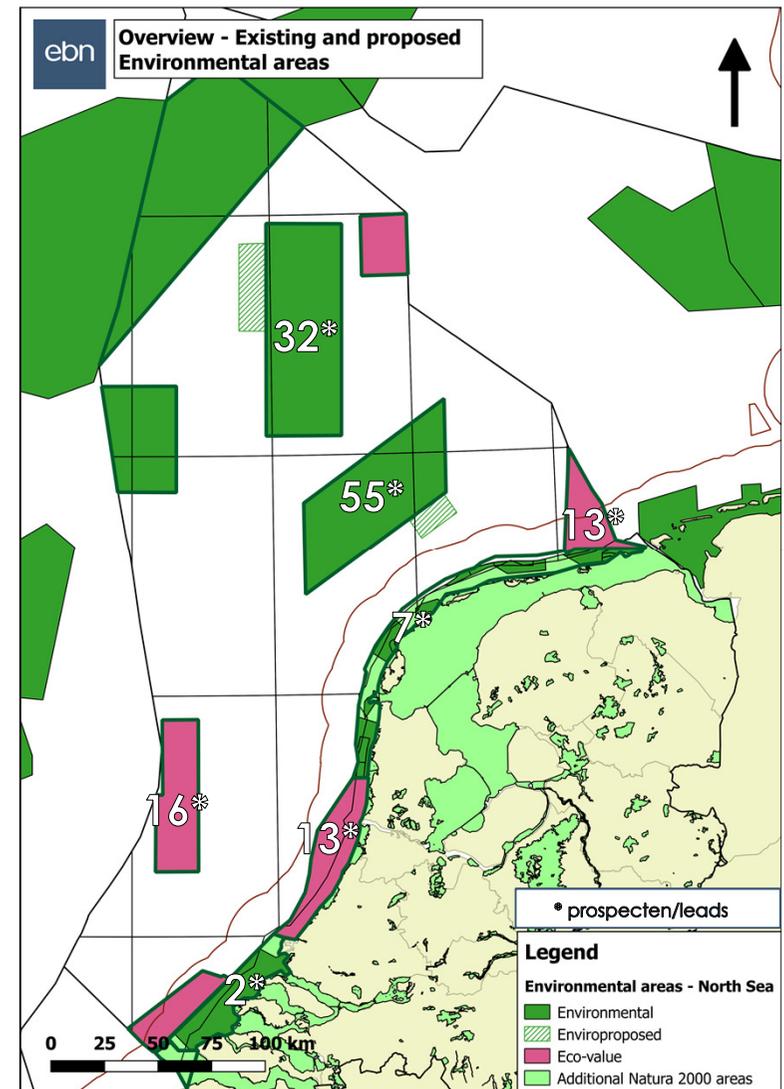
O&G requires little space for production-facilities, however needs specific locations



Total reserves & resources per environmental area

1. Borkumse Stenen
2. Friese Front
3. Bruine Bank
4. Noordzee Kustzone (Noord van Wadden)
5. Hollandse Kust (Hoek van Holland – Bergen)
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A Sea of Opportunity

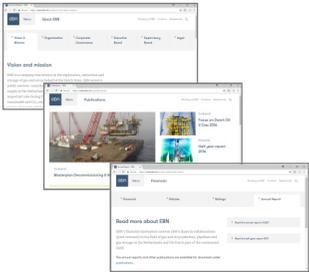
EBN



A Dutch exploration initiative

Because exploration (and production) needs a boost, EBN started a promotional campaign for offshore the Netherlands.

Focused on around exploration in attractive blocks across the Dutch North Sea

<h3>EBN website</h3> 	<h3>Brochure</h3> 	<h3>Sample teasers</h3>  <p>Leads and prospects</p>
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Support from EZK

*Dutch Offshore Gas
A Sea of Opportunity*

Published statements from the Ministry of Economic Affairs and Climate



Government of the Netherlands

Our Dutch gas ...

...benefits the climate:

- *“Carbon footprint of imported gas is higher”*
- *“Methane emission within Dutch gas chain is lower than for other countries”*

...benefits the economy:

- *“Increases economic activity and job security”*
- *“Yields monetary benefits to the Dutch state”*



Government of the Netherlands

Our Dutch gas ...

...drives the energy transition:

- *“This growth and development of knowledge and infrastructure related to gas exploration is of vital importance”*
- *“It drives further developments in geothermal energy and subsurface carbon storage”*

...safeguards the energy supply:

- *“We should be able to obtain natural gas without large dependencies on foreign suppliers”*

EBN's invitation

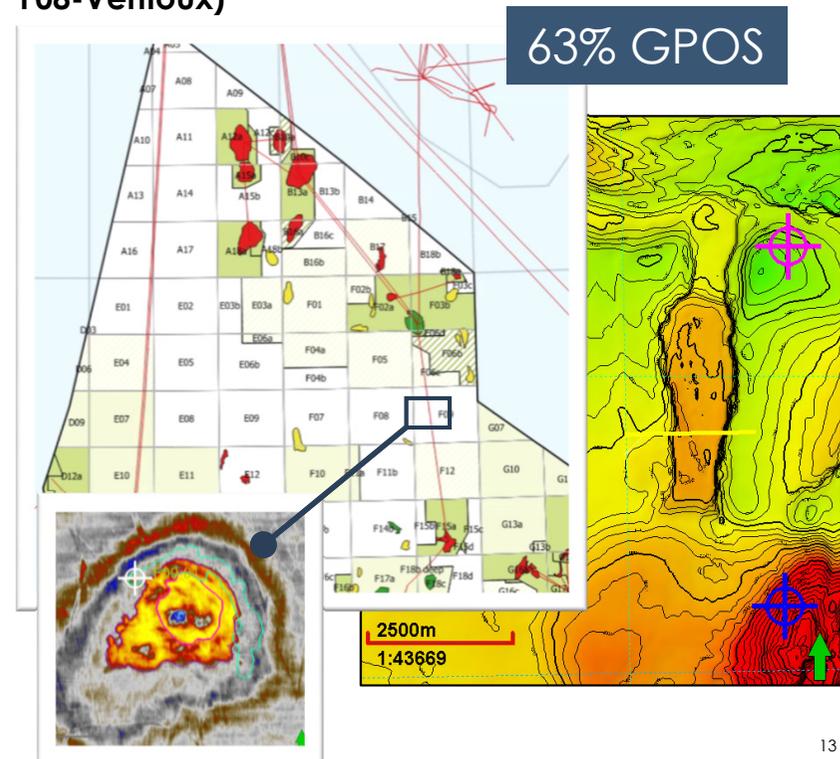
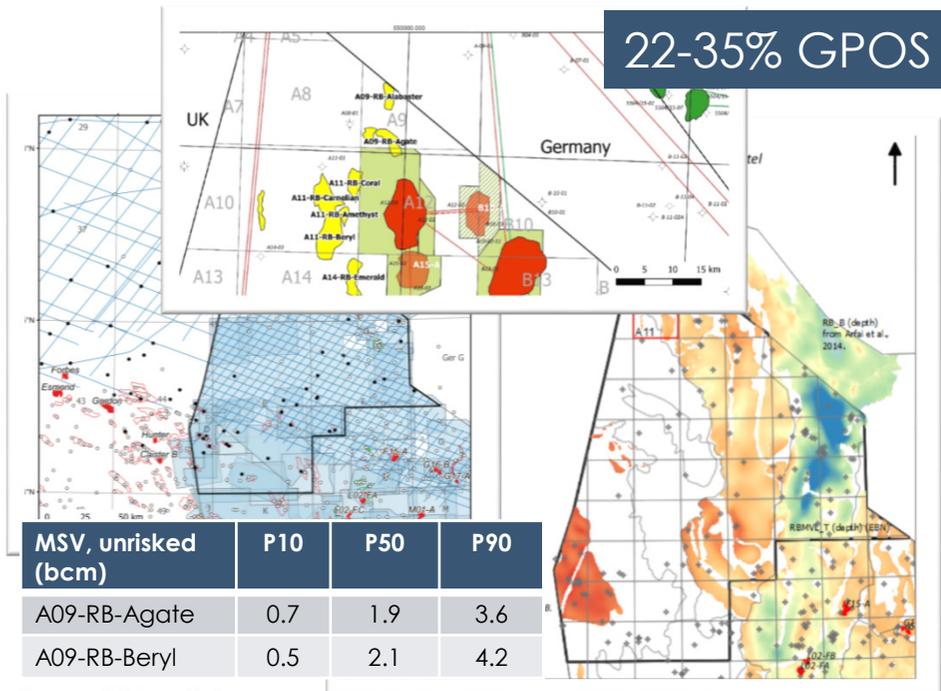
Available on request

*Dutch Offshore Gas
A Sea of Opportunity*

EBN has prepared sample teasers for high POS, clustering exploration opportunities in unlicensed, underexplored areas in proximity to infrastructure

Triassic plays (e.g. A09-RB-Agate & A11-RB-Beryl)

Shallow plays (F09-P06) & Jurassic F09-Stelvio and F08-Ventoux)



Source: EBN analysis

www.ebn.nl





Exploration project
status
(Q2 2019)

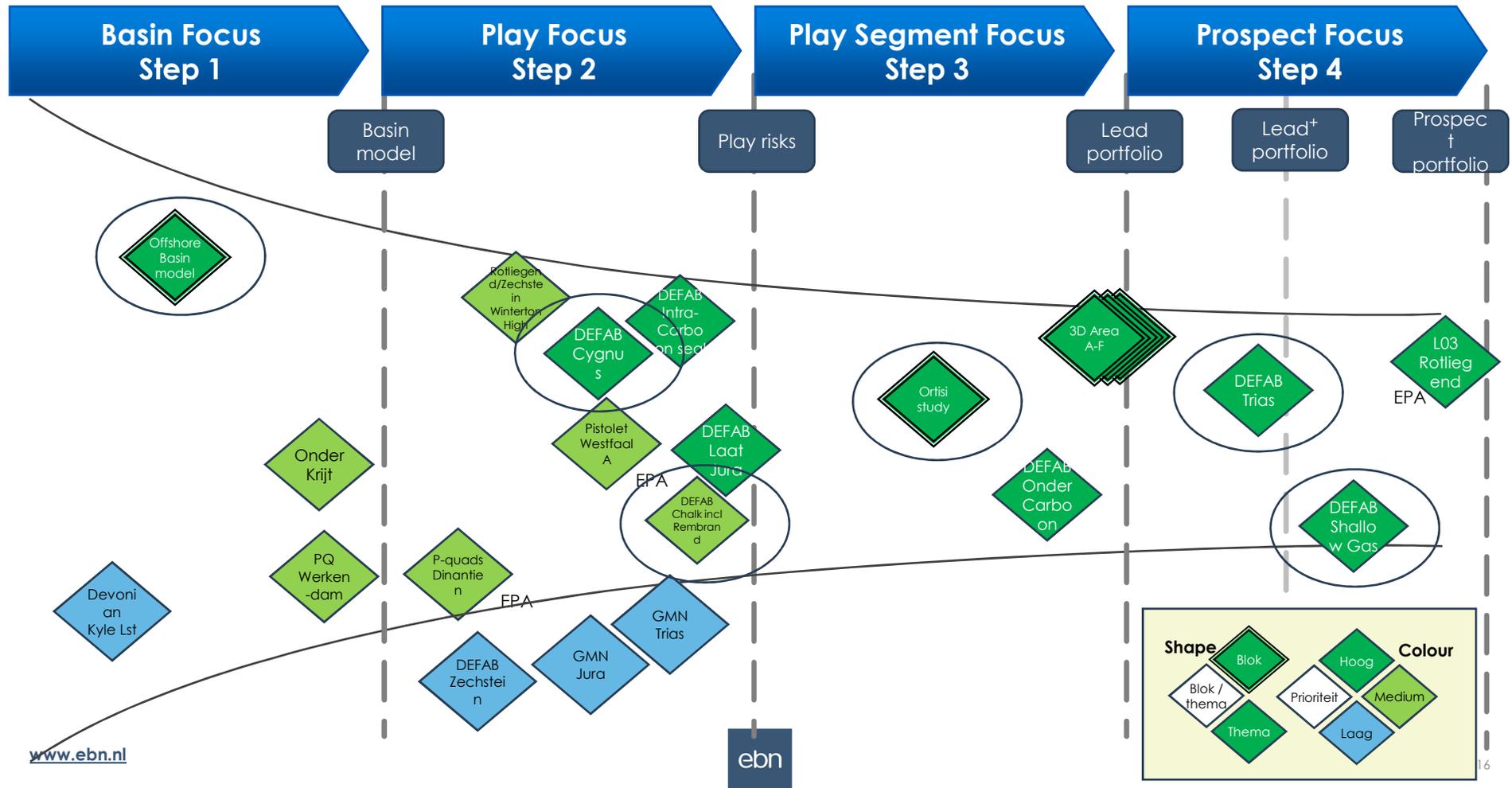


The road to success

To raise interest and attract foreign investors and operators, it is aspired by the Exploration dept. to provide by end of year a:

- Regional overview of all **play types** present in the Dutch subsurface including products such as Common Segment **Risk maps**, Yet-to-Find **volumes**, creaming curves etc.
- Overview of lead and prospect portfolio in open blocks including
 - Top 3 leads/prospects per play (Shallow Gas, Chalk, Jurassic, Triassic, Cygnus, Lower Carboniferous, Dinantian)
- **This includes a high level overview of the distribution, quality and maturity of source rock intervals and their HC generation capacity through time and space**

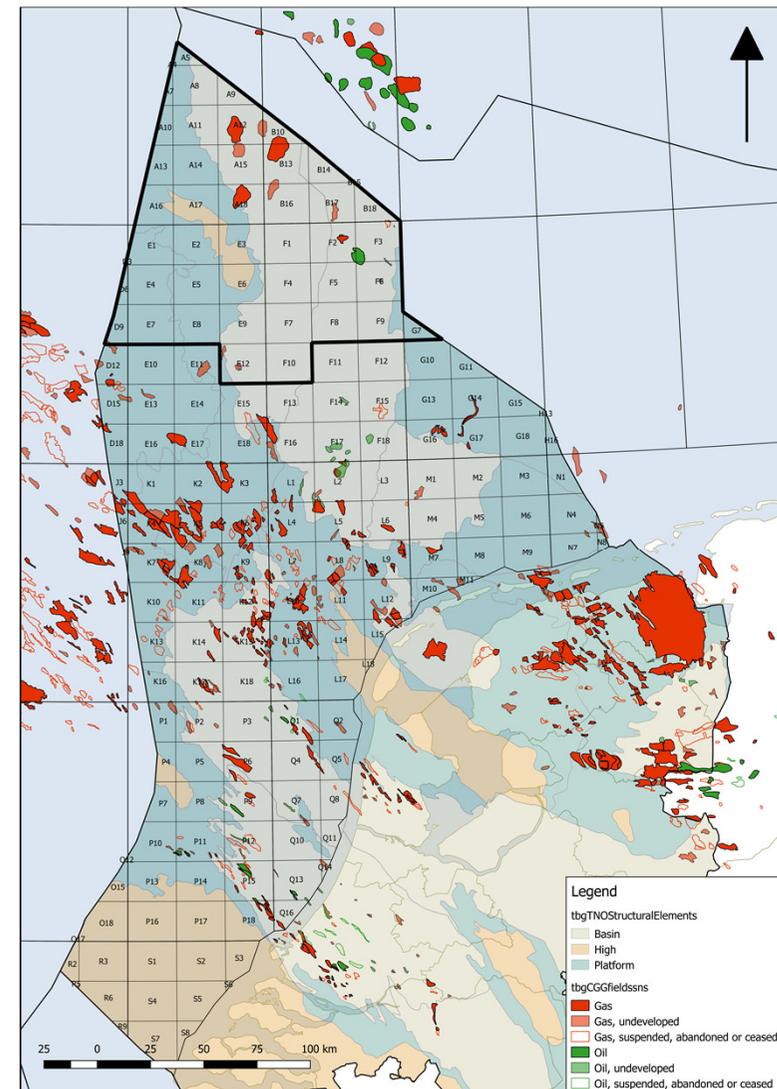




Petroleum system analysis

Basin modeling project carried out by IGI (Q2/Q3 2019) to provide high level overview of the:

- distribution, quality and maturity of source rock intervals and
- their HC generation capacity through time and space
- Entire Dutch Offshore 57000 km²
- More focused basin modeling of the Lower Carboniferous (e.g. Scremerston coals) in the northern Dutch offshore may be required
- Input to regional play fairway analysis



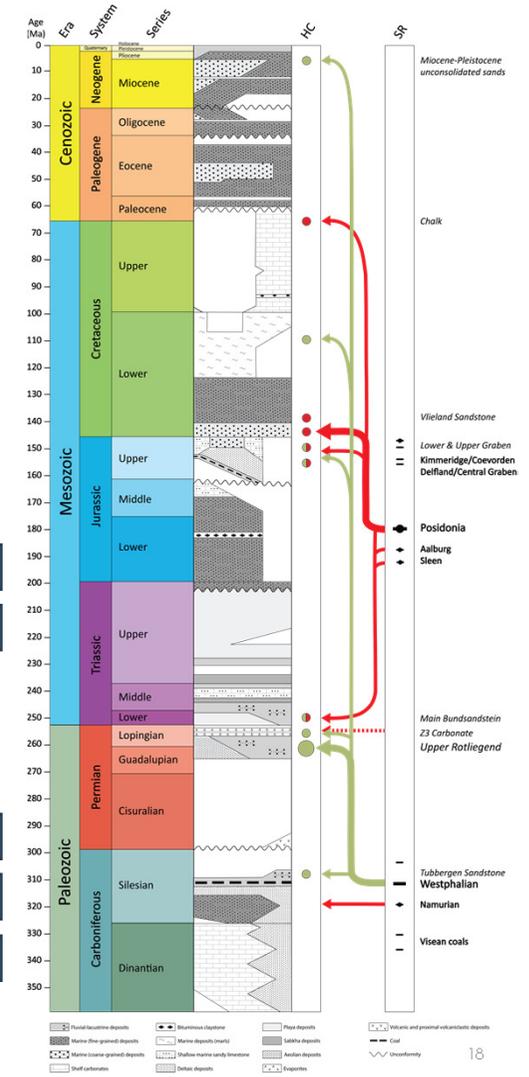
Stratigraphic layers for model

Layers/primary horizons

- Mio-/Pliocene [Upper North Sea]
- Paleo-/Oligocene [Lower/Middle North Sea]
- Upper Cretaceous [Chalk]
- Lower Cretaceous [Rijnland]
- Upper Jurassic [Schieland]
- Lower/Middle Jurassic [Altena]
- Upper Triassic [U. Germanic Triassic]
- Lower Triassic [L. Germanic Triassic]
- Upper Permian [Zechstein]
- Upper Permian [Upper Rotliegend]
- Carboniferous [Limburg & deeper]

Source rocks

- Kimmeridge Clay
- Posidonia
- Westphalian Coal
- Lower Carboniferous (Scremerston) coals
- Namurian Shale and Yoredale Fm.



Northern Offshore Lower Slochteren (“Cygnus”)



Trap

Trap:

Broad, anticlinal low-relief, faulted



Seal

structure comprising a series of terraced, tilted fault blocks

Seal:

Shales of the Silverpit Fm.



Reservoir

Reservoir:

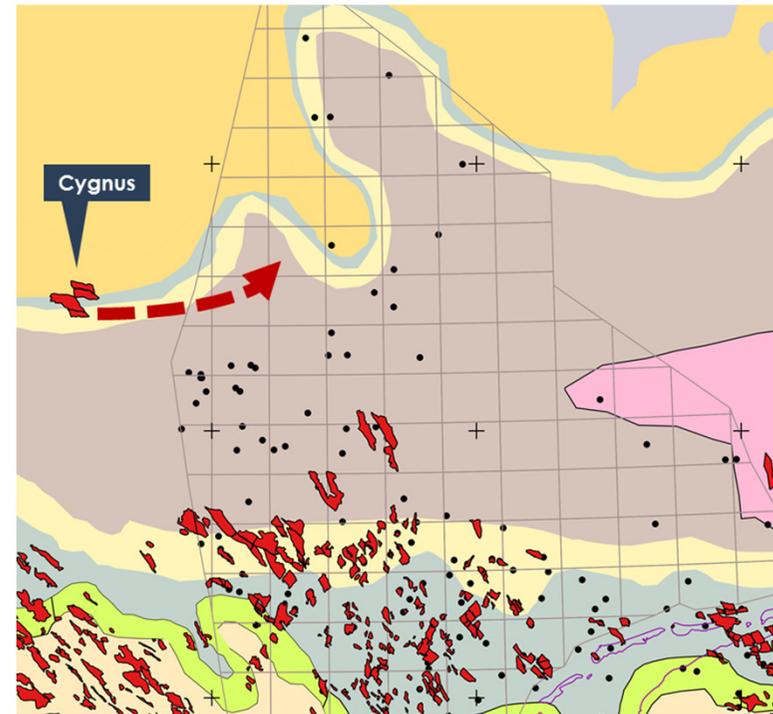
- 1) Permian Rotliegend Leman Sandstone formation
- 2) Upper Carboniferous Westphalian C Ketch formation



Source

Source rock & Charge:

- Carboniferous Westphalian A/B
- Namurian

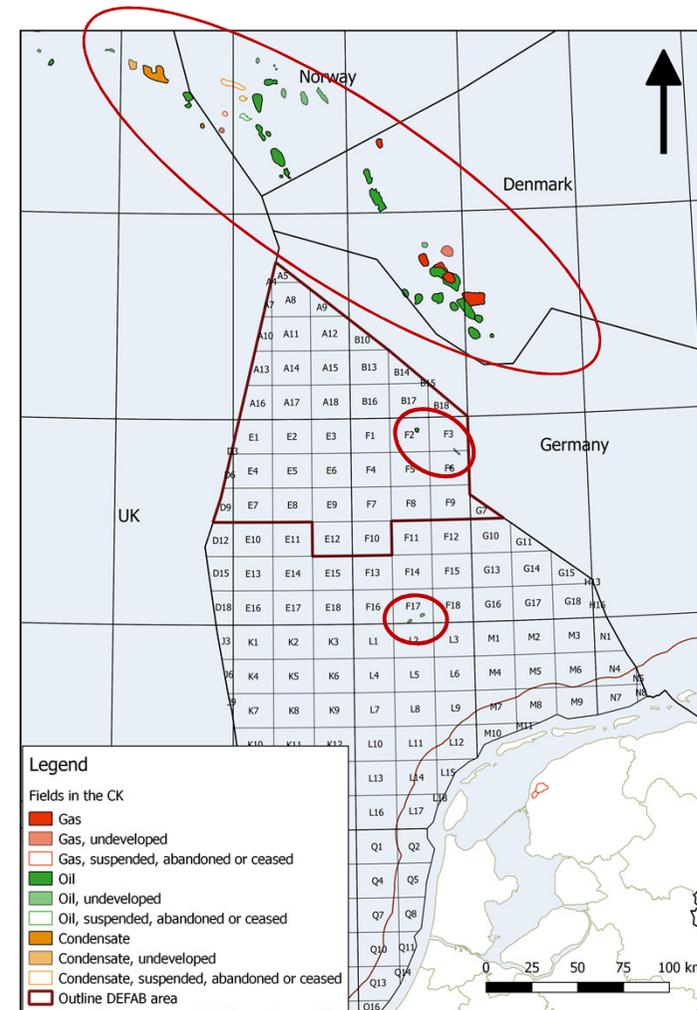


Good understanding of geological conditions of Cygnus Field (“perfect storm”) has been built up as part of MSNH study carried out at Heriot-Watt (commissioned by OGA). Their study now extended by HW further to the East into the Dutch offshore with the aim to support further play fairway analysis.

Northern Offshore Chalk prospectivity

Goals

- Collect and integrate all data into EBN knowledge base
- Play fairway analysis to understand better the critical play risks (for both oil & gas)
- Can we extend learnings from elsewhere (e.g. F17-Rembrandt) to the North?
- Is there opportunity for maturing a lead & prospect portfolio?



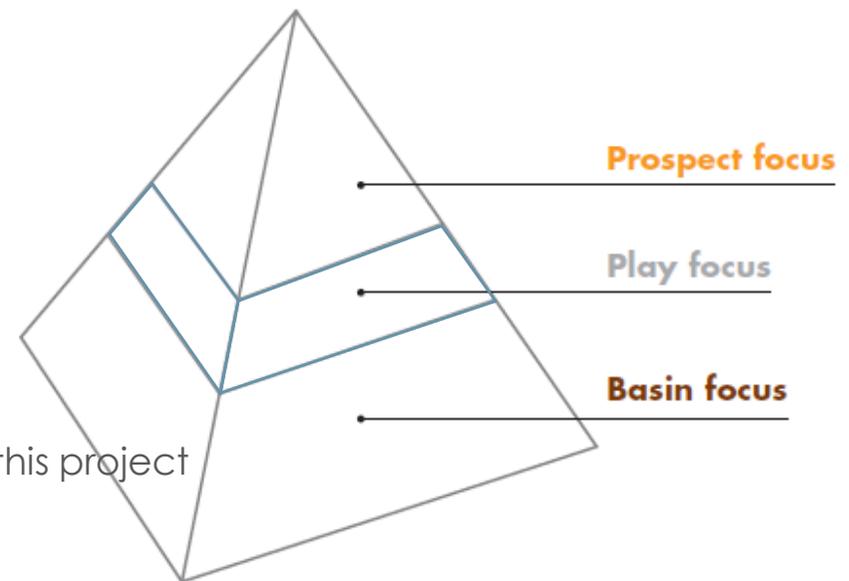
Project status → Play focus

- Play quantification
- Common Risk Segment mapping (CRS)
- Play chance and uncertainty
- Post-drill well analysis

Future deliverables

→ Prospect/lead portfolio

* IGI basin modeling study will also provide input for this project

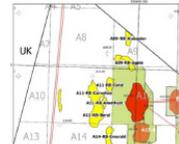


Northern Offshore Triassic Leads Portfolio

- Large number of Triassic leads mapped and evaluated
- Subsurface presentation available (Kennisbank)
- For leads in A9 and A11 blocks now prospectus available

Asset Overview: A09-RB-Agate and A11-RB-Beryl, Triassic

The Triassic in the northern Dutch offshore remains significantly under-explored, although elsewhere in the Southern North Sea Basin leads have been identified in the blocks which are located in proximity of the A09 and A11 blocks.



A09-RB-Agate, Triassic

The undiscovered Agate lead is the largest of 3 leads mapped in the open A09 offshore block. These leads could be drilled with slanted wells from a single drilling platform.

POSg: 22%

Block activity

- The A-quadrant is therefore relatively underexplored, with circa 12 Exploration wells drilled, typically one well/500km². Data for these wells is public.
- The nearest well (A08-1) well was drilled in 1996 into an Upper Jurassic 4-way dip closure on top of a Zechstein salt diapir.
- The closest infrastructure is the A12a platform which drains gas from the Tertiary A12-FA field (Shallow gas). The A12a jacket leg platform is unmanned and has processing capability. Distance from A12a to A9 is approximately 16km.
- The A09 block is fully covered with 3D seismic acquired in 1993, publicly available, and PSTM reprocessed in 2012.



Volumetric assessment

- Primary targets: Mixed fluvial/eolian sandstones of the Volpriehausen Fm.
- Secondary targets: Detfurth, Hardeggen and Solling Fm.
- Estimated recovery factors of 60-70%
- In the success case these structures are charged with natural wet gas with ca. 5% non-HC gasses (CO₂, N₂).

Risked recoverable bcm	P90	P50	P10
A09-RB-Agate	0.1	0.3	0.8
Total in block	0.5	1.5	4.4

Work program Requirements

- Apply for exploration license.
- Reprocess 3D vintage data.
- Drill exploration well to de-risk lead portfolio, to be converted into a production well (in success case).
- In success case, A09 could support stand-alone development. The prospects can be drilled with deviated wells from a single, central platform location. An alternative option would be a tie-back to A12 facilities in case A09 volumes < P50 volumes.
- The A12 facilities are capable of handling the higher reservoir pressures expected from the Triassic.

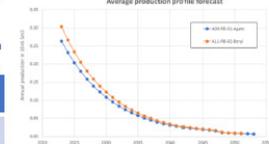
Risking of Triassic play elements

Structure	80%	Seismic South - identify A11 to A09
Charge & migration	90%	Wells Lower facies Basin - Seismic
Seal presence & efficiency	50%	Seismic other Gas fill Well hydro
Reservoir presence	90%	Adeq as ind Seismic prove well d

Economic overview

- The aggregated expected volume of the leads in the block (**1.5 bcm in A09**) is significant, with a strong inter-lead risk dependency.
- A successful first well would open up the portfolio, and the combination of at least two discoveries per block would warrant a multi-well, stand-alone platform development concept.
- The Minimum Economic Field Size in this area has been estimated ca 1 bcm (recoverable) based on following assumptions:

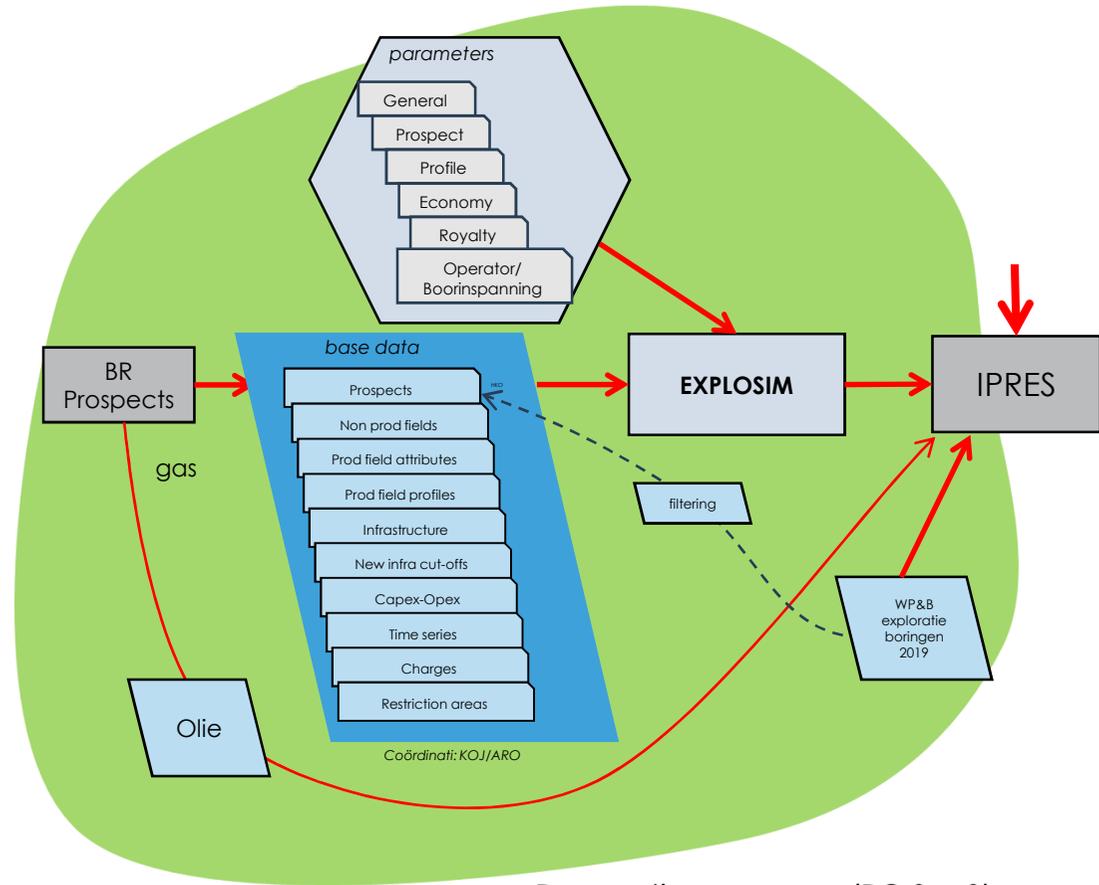
Drilling start	2021	Avg. decline	15%
Est. Qi	0.25 m/m \$m ³ /yr	Gas price	€0.19 /m ³
RVIR cut-off	10%	Marginal allow.	25%-40%



EARR (EBN Annual Reserves Reporting)

ExploSim ("Exploration Simulator") is in-house developed software in which the Exploration process is simulated with the aim to

- Quantify risked volumes in RC 8 & RC 9 for EARR
- Generate forward looking risked CAPEX/OPEX & production profiles
- Identify attractiveness of opportunities and cross-dependencies
- Identify sensitivity of economic attractiveness to external parameters (gas price, tax, infrastructure & COP, etc)





ORTISI - Project update

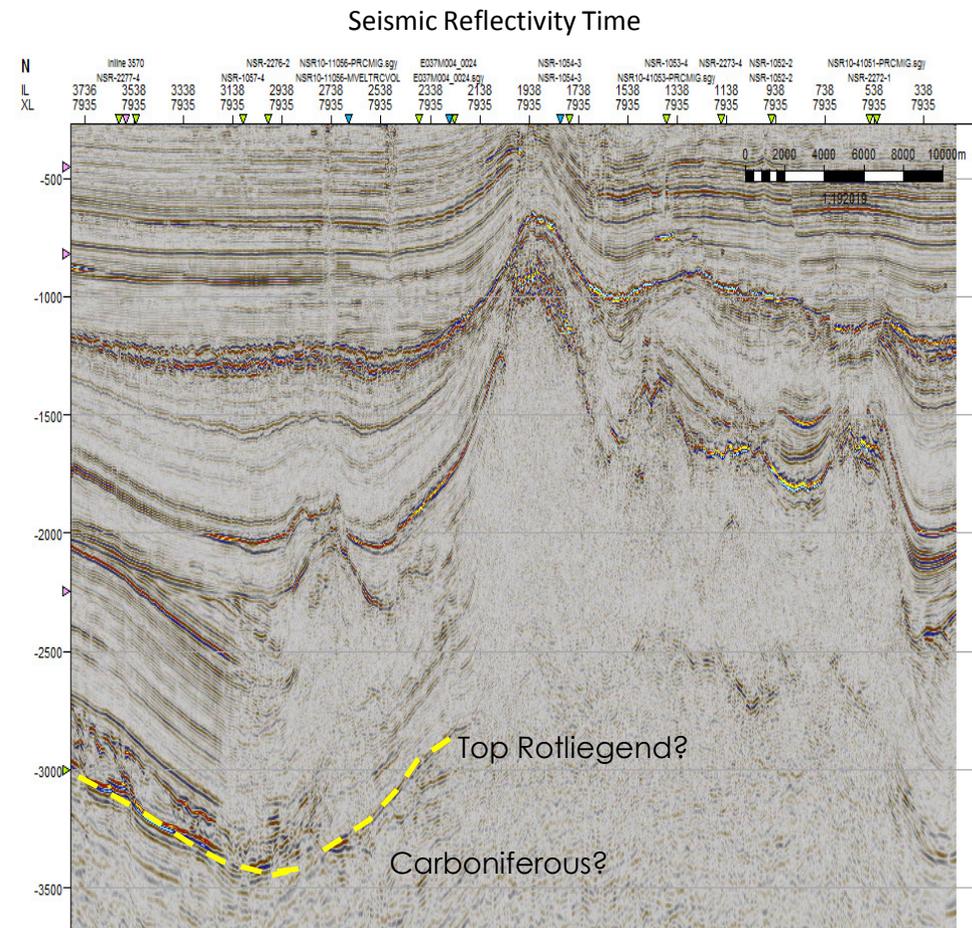
*(Opportunity Realisation Through Improved
Seismic Imaging)*

Audrey Roustiau & Martin Ecclestone
07th of June 2019

ebn

Where can we add value?

- Large areas within known working petroleum systems and probable gas accumulations are present but where imaging quality hampers further exploration work,
- These areas require a next step-change in seismic data and imaging quality to identify and mature remaining potential,
- This step-change in seismic quality may occur in seismic reprocessing \$\$ and acquisition \$\$\$.



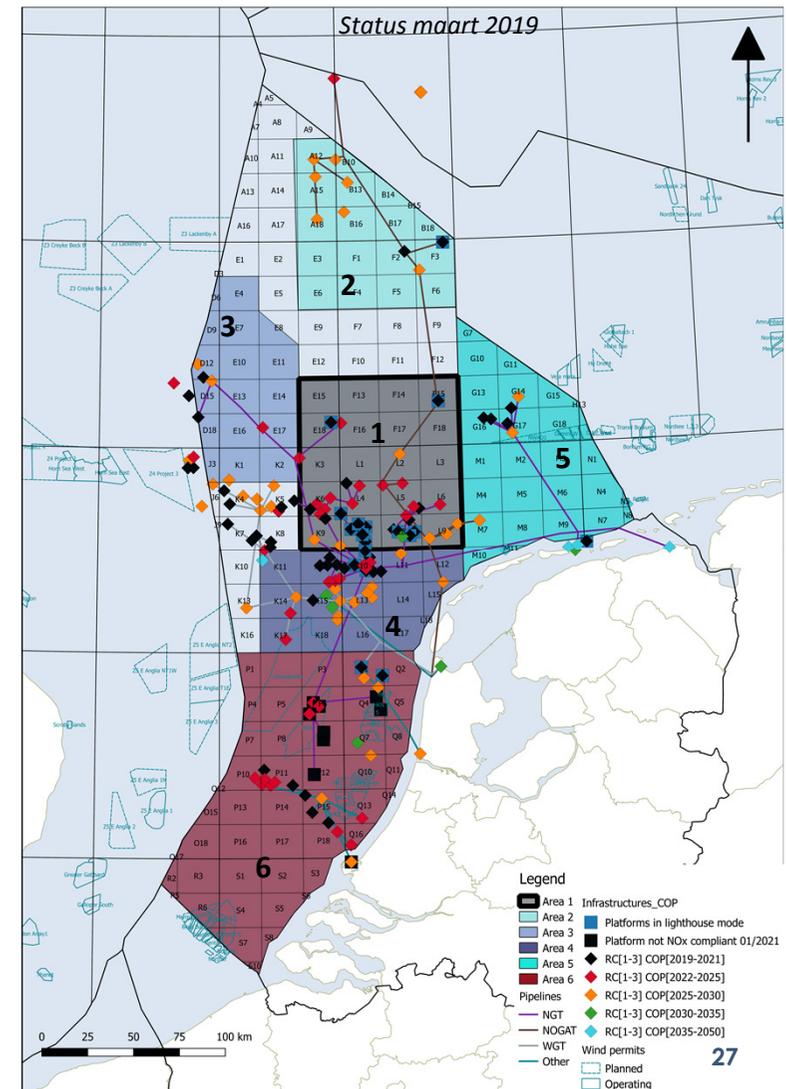
Challenging imaging & depth conversion

ORTISI overall strategy



Areas of interest

- 6 areas identified based on the level of exploration activities, the COP of the infrastructures and the remaining prospectivity,
- Focus on area 1:** Large Expected recoverable volume
- Seismic and prospect review ongoing,
 - Play Based Exploration Analysis - ongoing
 - Seisnetics test (EPI)



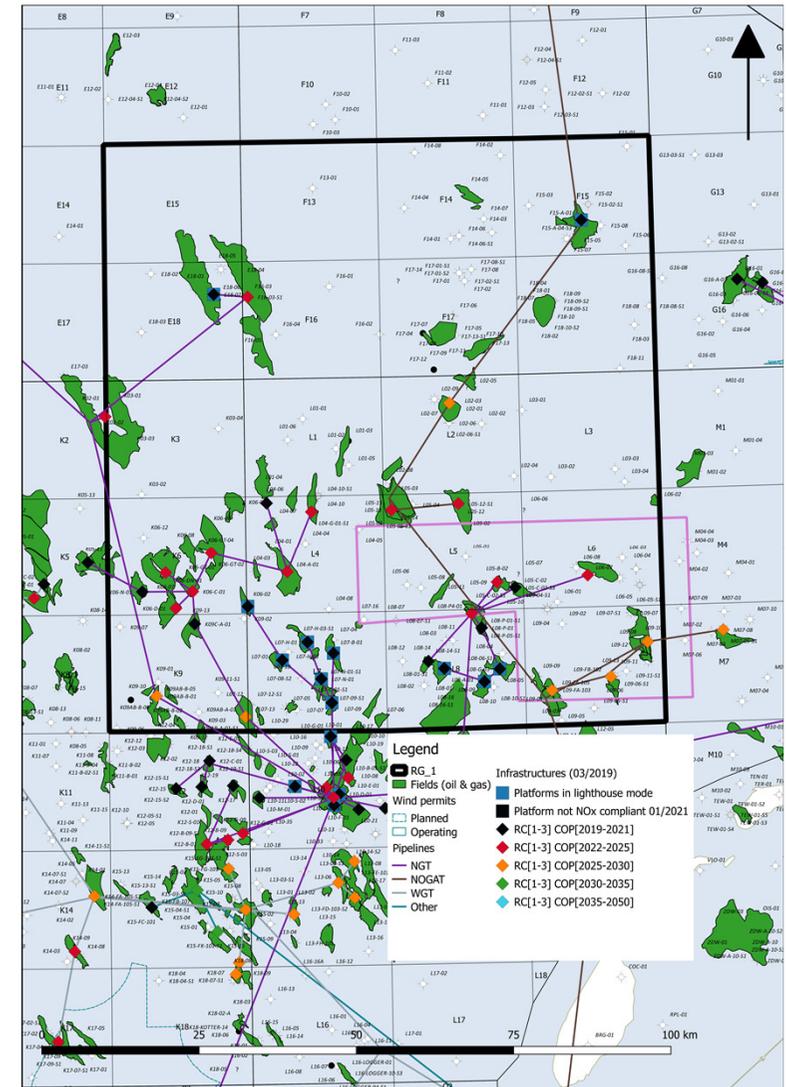
Seisnetics test – Area 1



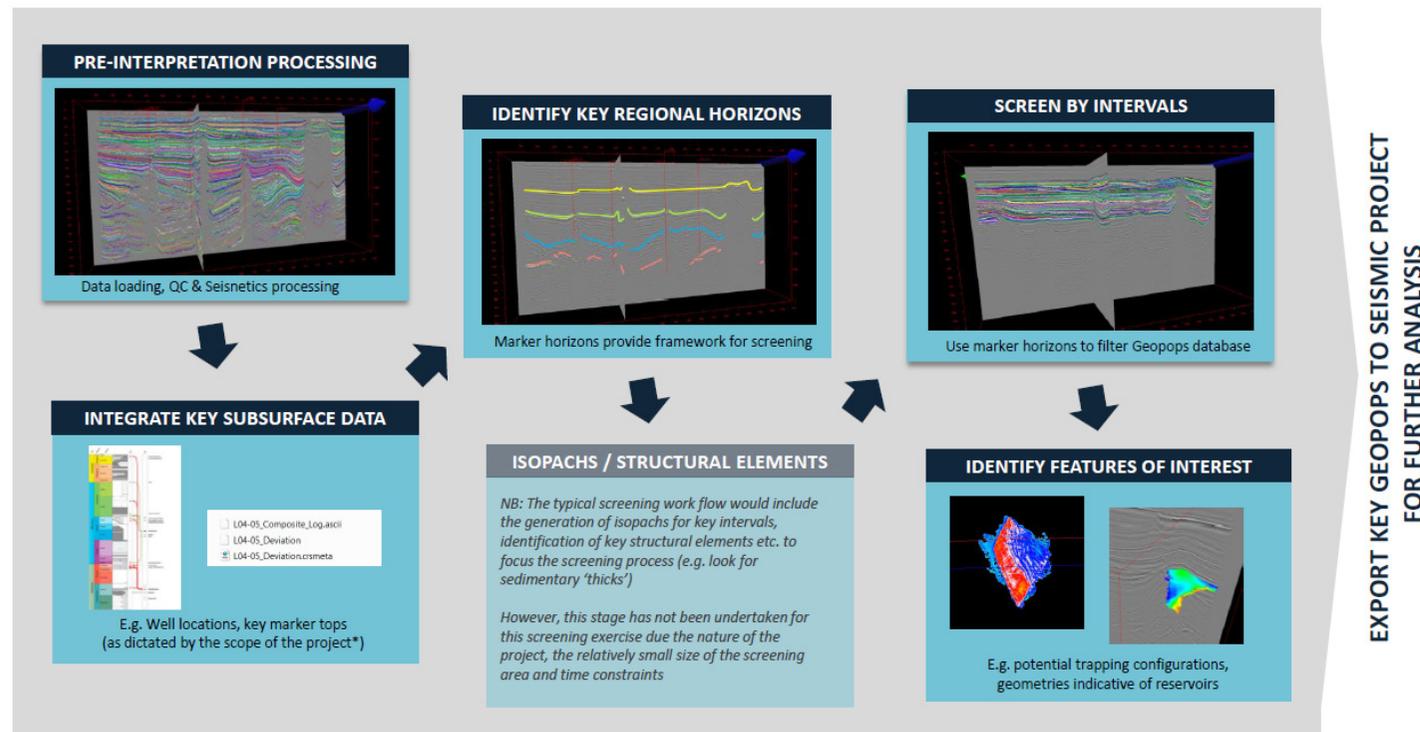
Artificial Intelligence for Oil and Gas Prospecting
 Seismic Facies Mapping for Traps, Seals and Reservoirs
 Structural definition

- L02/L09 Fullstack PSDM volume from 2010 selected:
 - Area with producing gas fields and several prospects and leads,
 - Good quality seismic

- Test start: 01/05; Test close-out: 22/05,



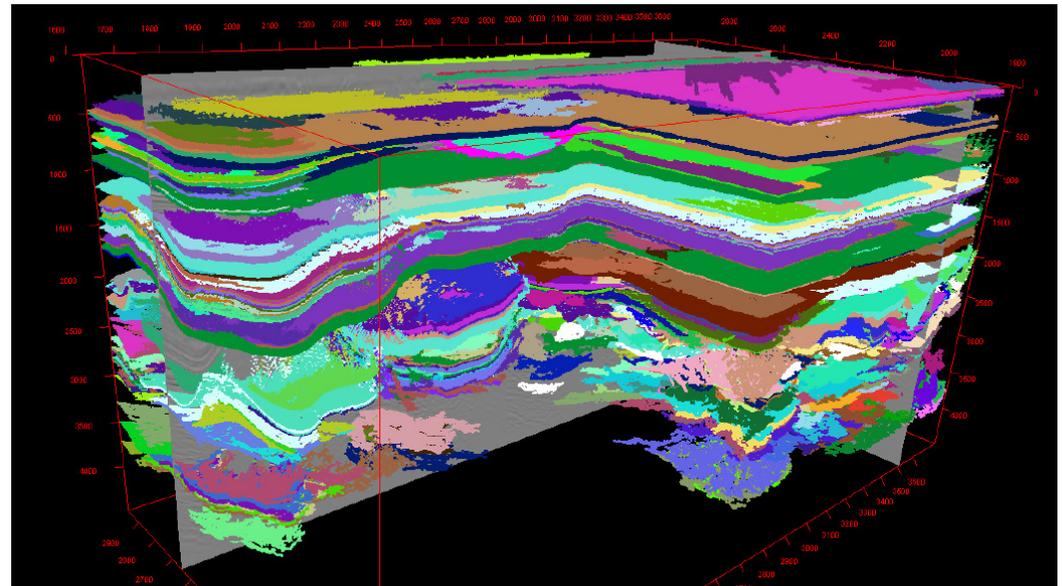
Seisnetics screening workflow (3D waveform classification)



*only basic well data (e.g. X/Y, key tops) has been integrated into this screening analysis. Phase 2 could include the integration of more data (petrophysical logs, field locations etc.)

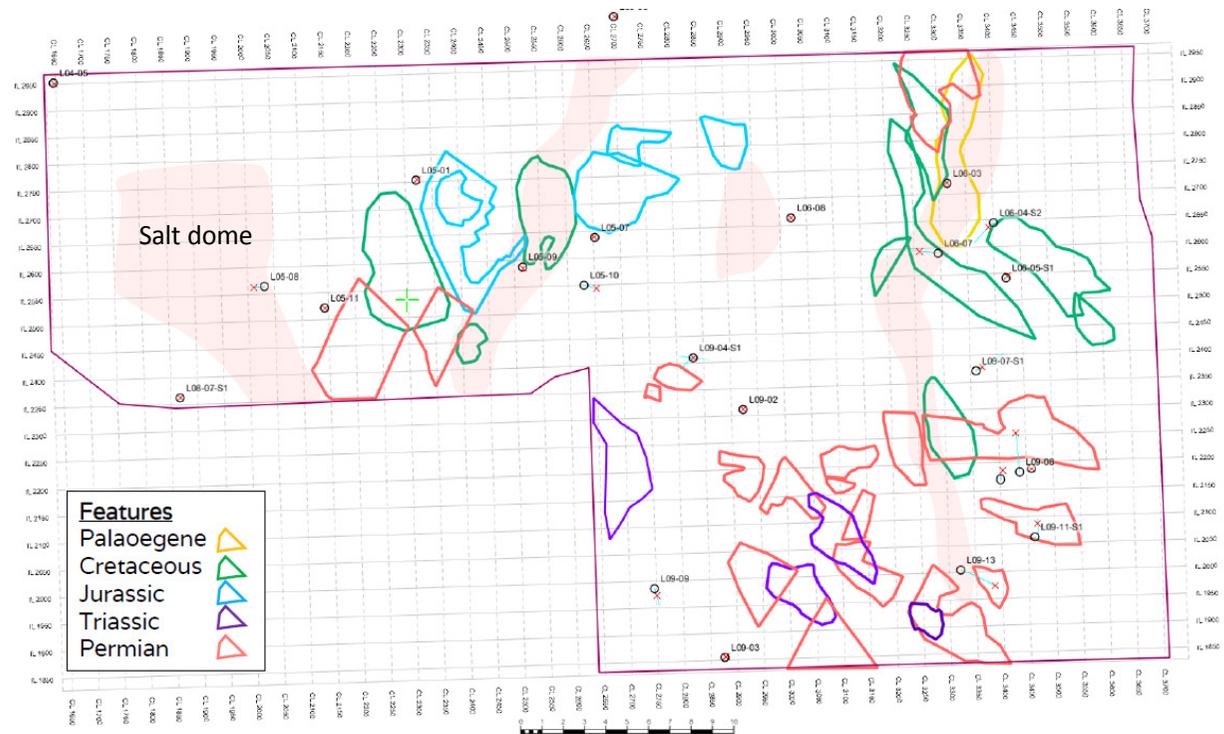
Pre-interpretation processing

- ~1100 km² of data processed in 51 minutes
- ~7000 geopopulations with TWT, amplitude and fitness attributes – queryable database,
- Parameters autogenerated by the algorithm (i.e non biased).



Screening highlights (Early Stage)

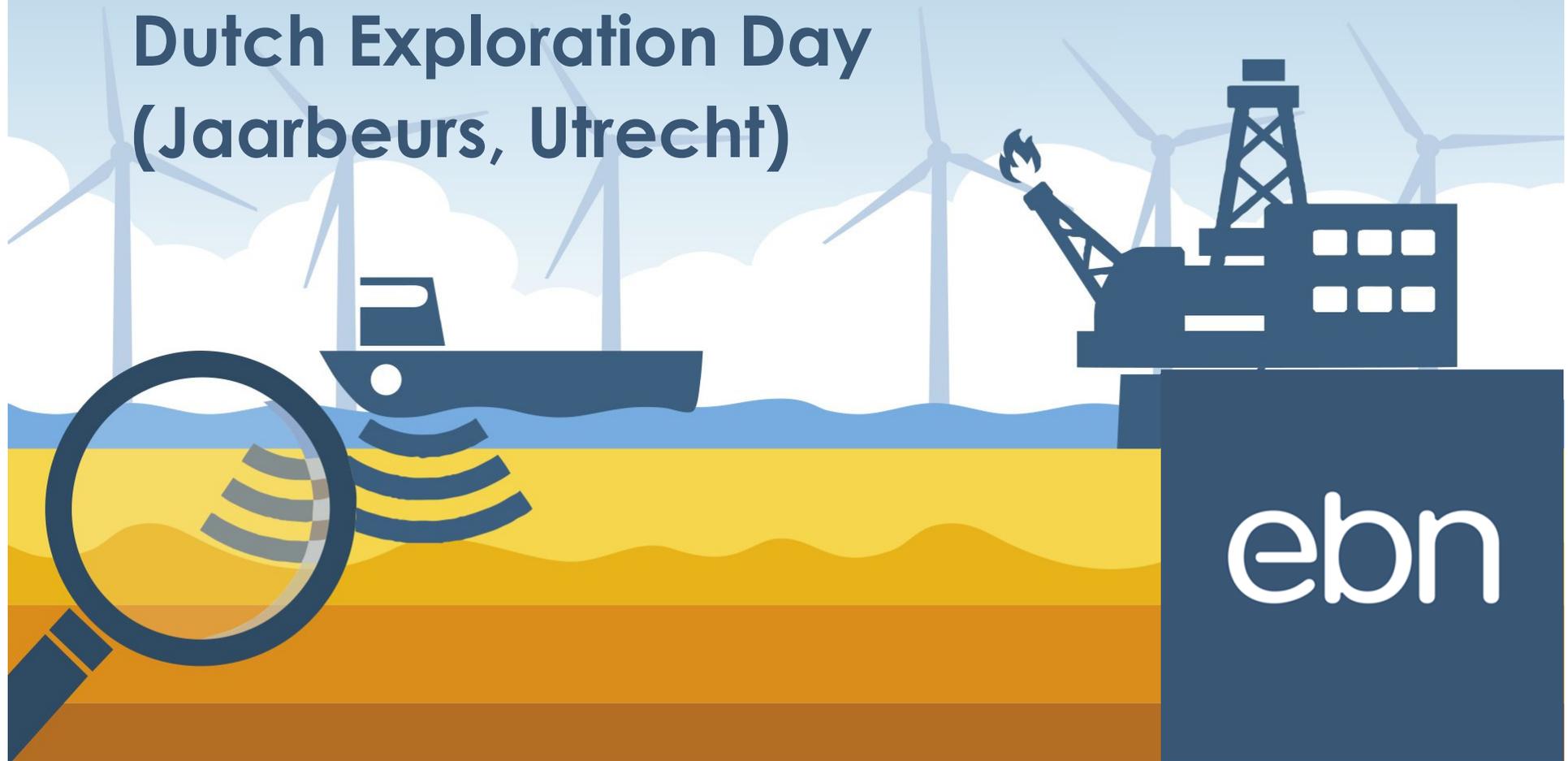
- Identified > 20 structural closures and > 5 combined stratigraphic/ structural closures



Further work Q2/Q3...

- Finalize the seismic and prospect analysis,
- Integrate the results of the Seisnetics test,
- Incorporate the results of the PBE analyse,
- Define strategy with E&P Assets and start engaging operators

Wednesday 20 November
Dutch Exploration Day
(Jaarbeurs, Utrecht)



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Goals

- ❖ Meet & Greet, networking
- ❖ Share Exploration success
- ❖ Learn from (subsurface) knowledge & experience

Topics (?)

- ❖ Exploration & Development projects & activities
- ❖ Digitilisation
- ❖ Seismic processing & imaging
- ❖ R & D / Innovation

Please feel free to suggest topics, and or to volunteer for presentations

Contact: Kees van Ojik, kees.ojik-van@ebn.nl or exploration@ebn.nl