Resources and future potential in the Netherlands

TNO

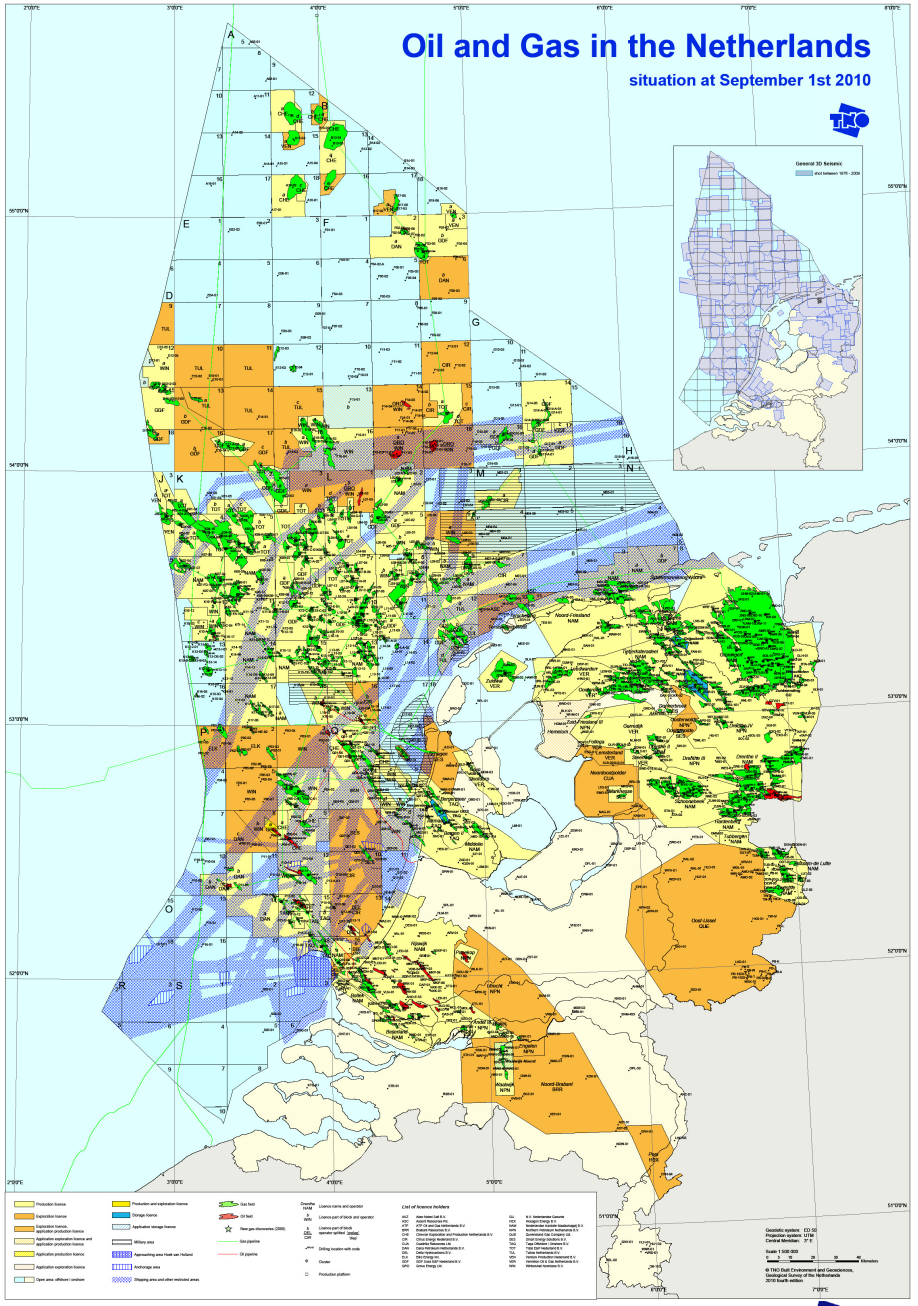
ebn
best access to dutch gas

Ministery of Economic Affairs,
Agriculture and Innovation

Prospex 2010

Present day E&P map

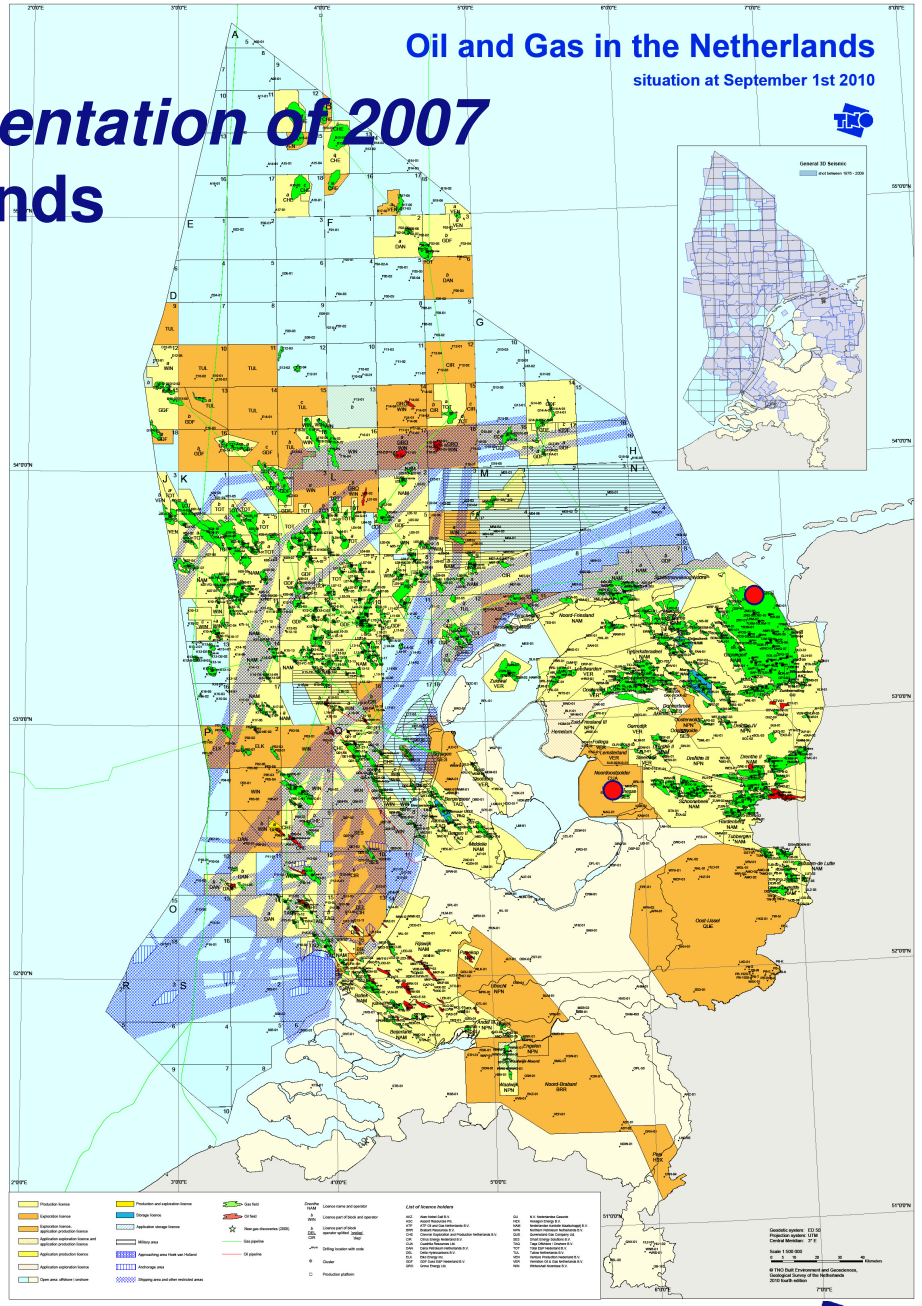
- Outline of the presentation
  - Quick status report on activities and reserves
  - Futures
  - Mining climate initiatives.
  - (Sub-surface) Spatial planning and synergies



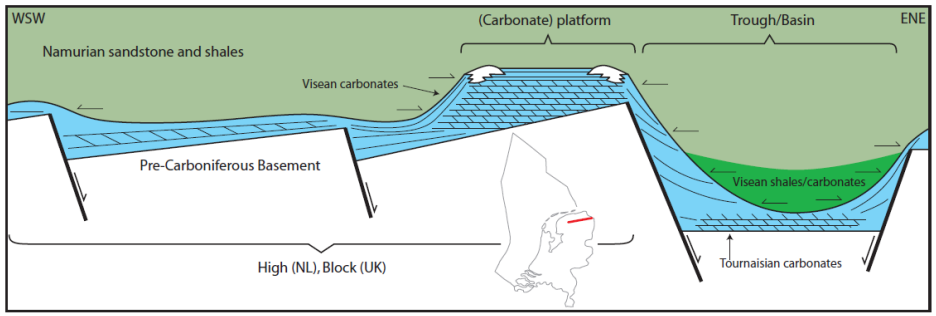
Conclusions Prospex presentation of 2007
Challenges in the Netherlands

for Government and Industry

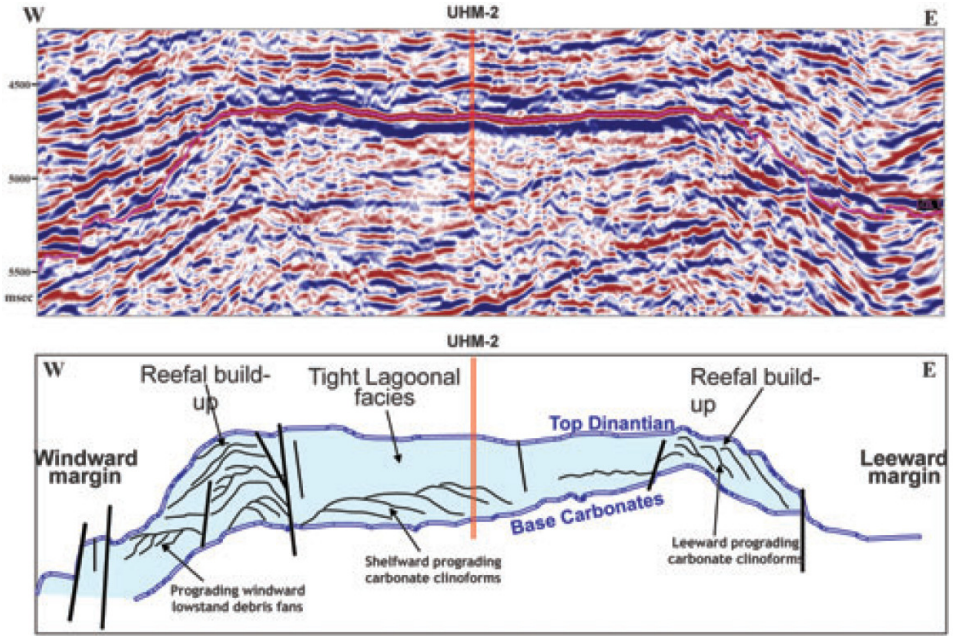
- Take advantage of the Window of Business opportunity
- Extend life time offshore infrastructure:
  - Get Non-Producing fields including stranded fields on stream
  - Develop appraised & un-appraised blocks
- Explore:
  - Prospects in proven play: infill relative low risk, low reward
  - Expand proven play areas: e.g. Rotliegend feather edge, Carboniferous play higher risk higher reward
  - Evaluate non-proven play: e.g. high risk, high reward Dinantian play or Upper Jurassic Strat. trap



Dinantian play



Kombrink 2008



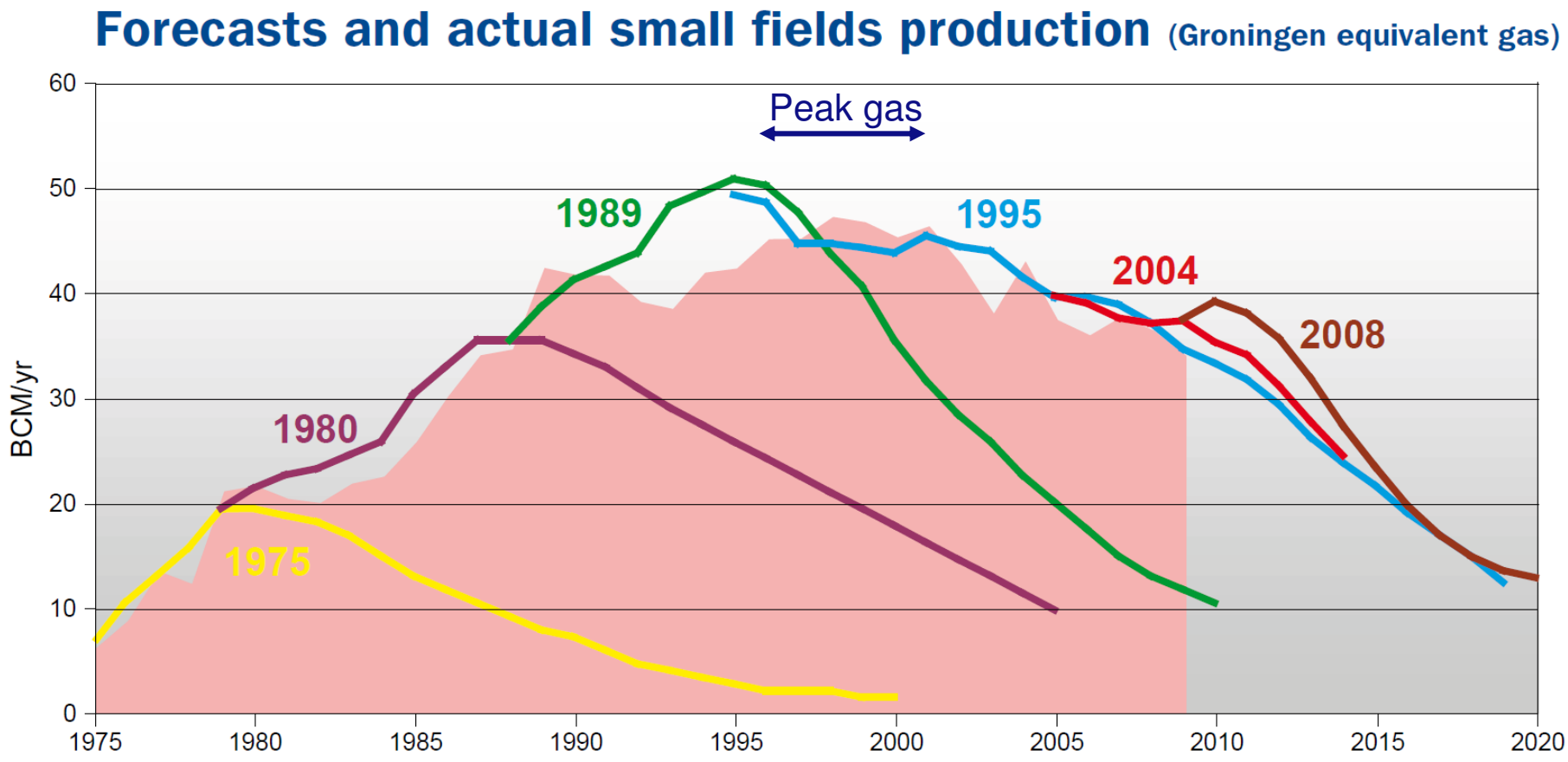
Herber & de Jager 2010

Fig. 4. Seismic and geological cross-section through the Uithuizermeeden-2 well, which reached TD at 5423m AHRT in Devonian mudstone. Dinantian carbonates were water-bearing.

Exploration and production activity 2008-2010

	2008	2009	2010 (to date)
Exploration wells	9	9	7
Appraisal wells	4	6	2
Production wells	14	37	15
Seismic acquisition 2D (km)	838	1849	?
Seismic acquisition 3D (km^2)	1893	-	?
Fields on stream	8	21	?
Granted exploration licenses	15	10	8
Returned exploration licenses	1	11	4
Granted production licenses (incl. extensions)	2	5	4

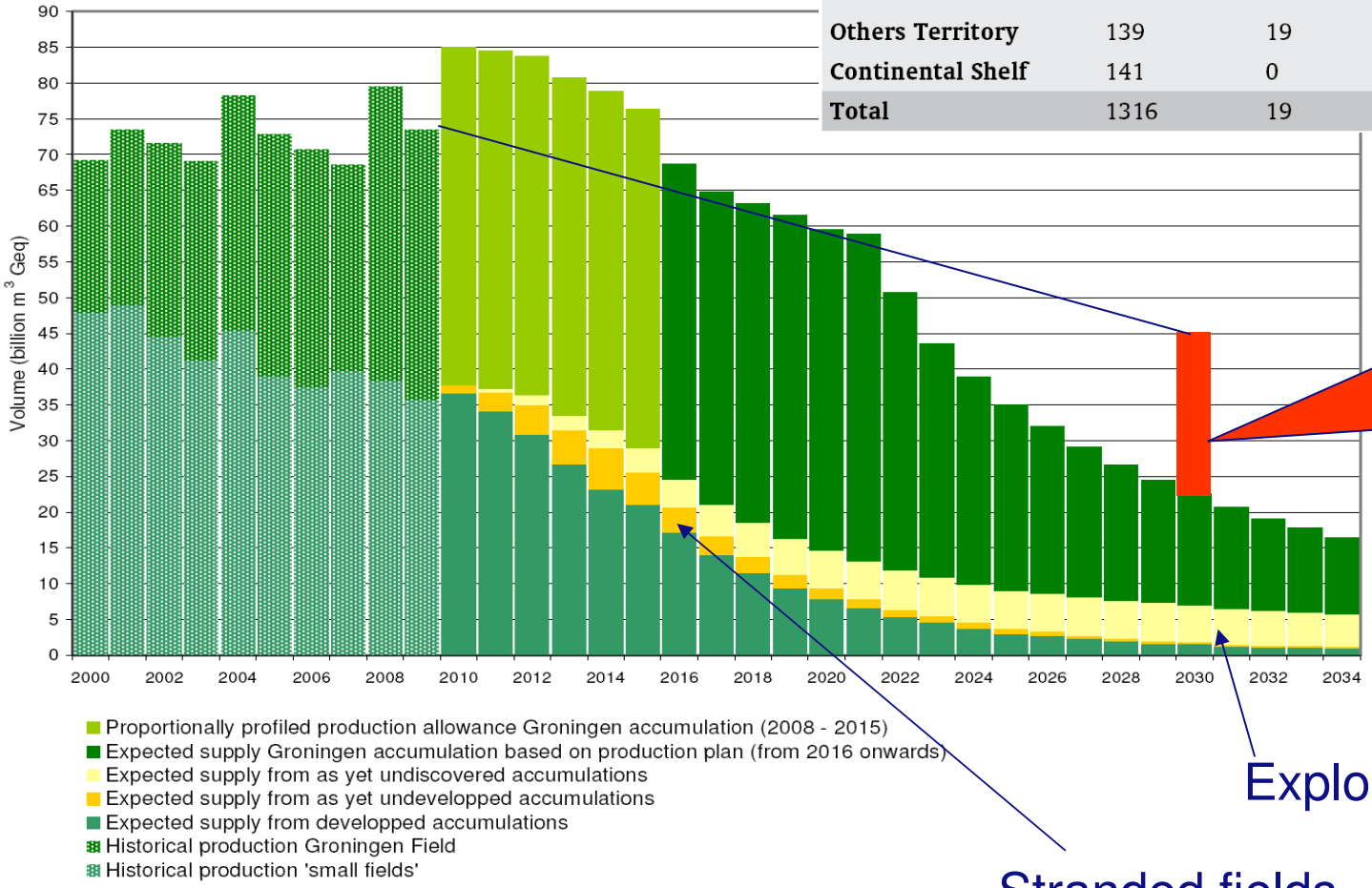
Future predictions: riding the wave



Reserves in the Netherlands

Gas resources in the Netherlands as at 1 January 2010 in billions of Sm³

Accumulations	Developed		Undeveloped	Total
		UGS*		
Groningen	1036	-	0	1036
Others Territory	139	19	12	170
Continental Shelf	141	0	44	184
Total	1316	19	55	1390

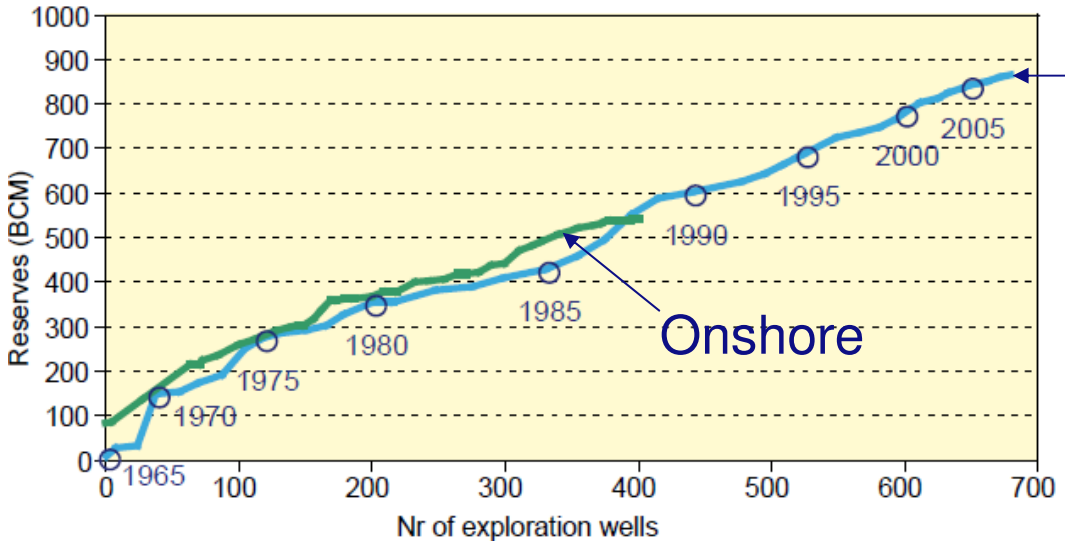


30-30 ambition
Min. E,A&I and
EBN

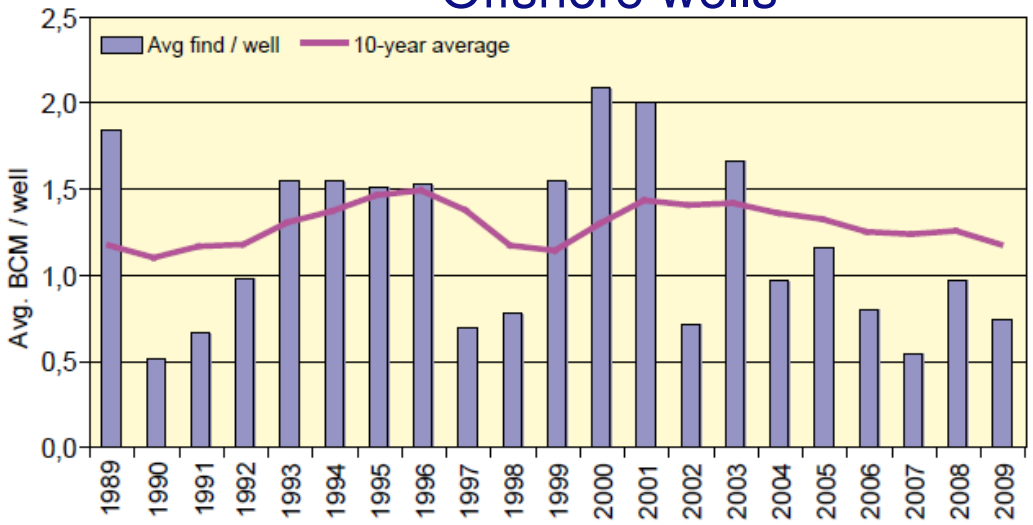
Exploration potential

Stranded fields

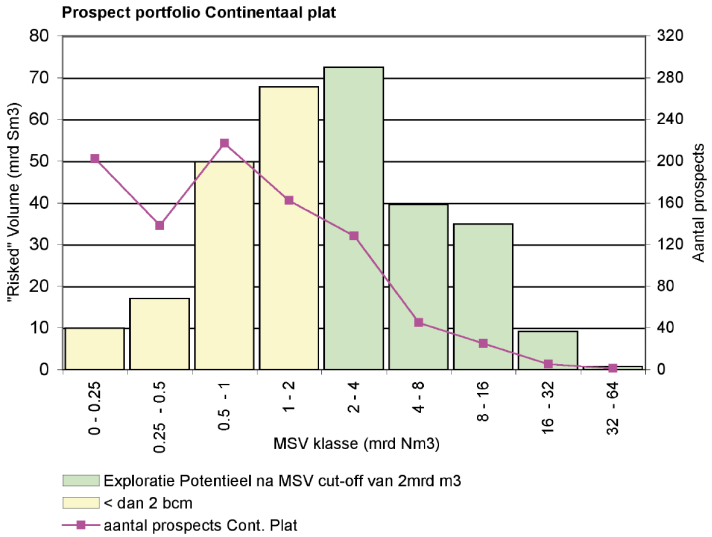
The Netherlands - Not in creaming mode yet

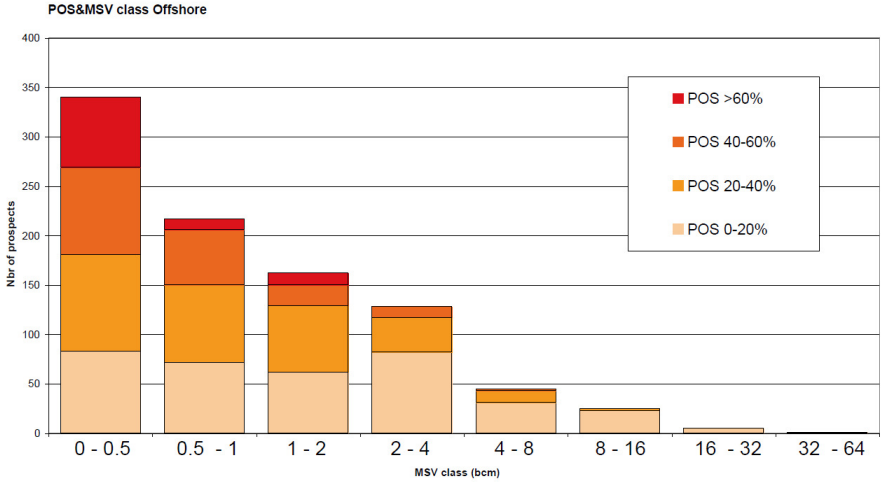


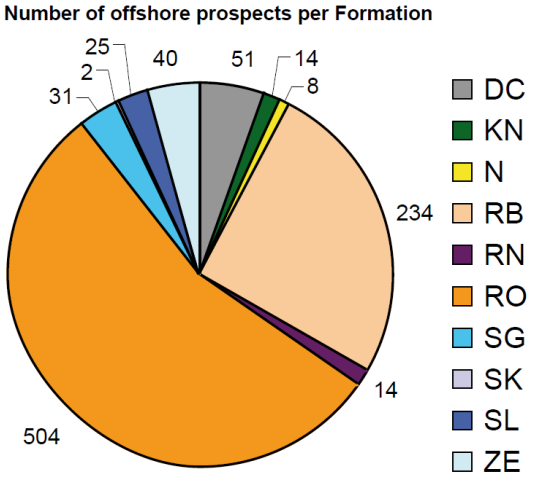
Offshore wells

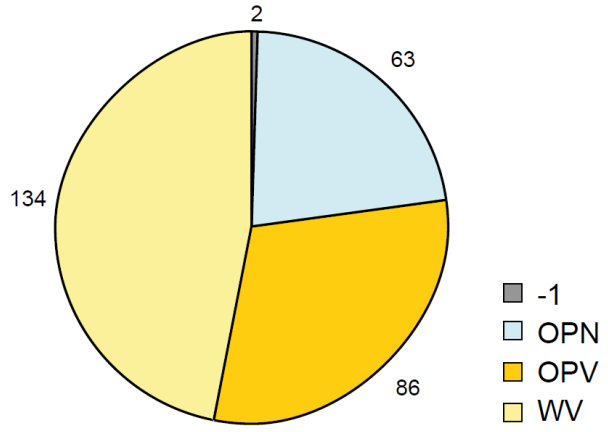


Offshore Prospect portfolio

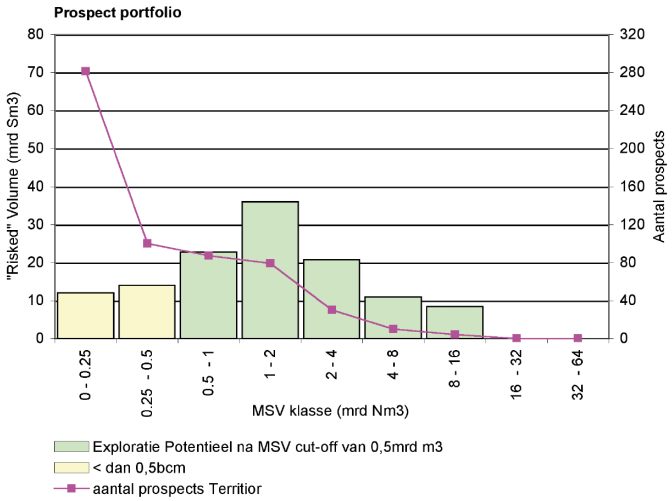


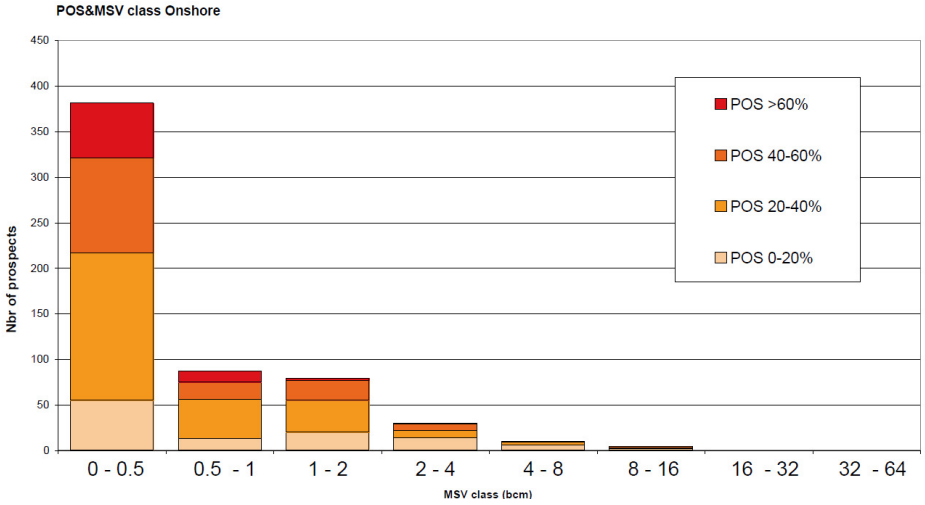




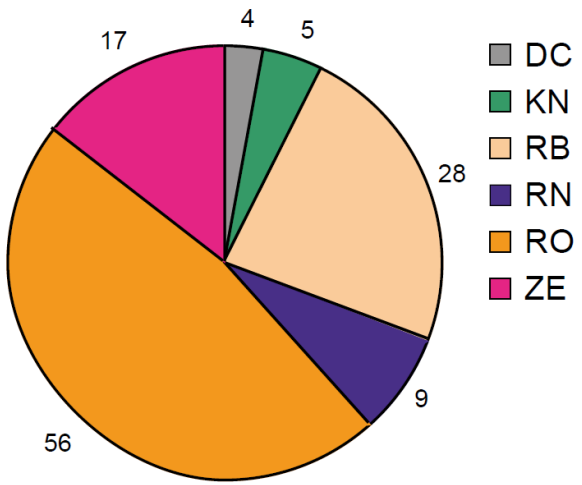


Onshore Prospect portfolio

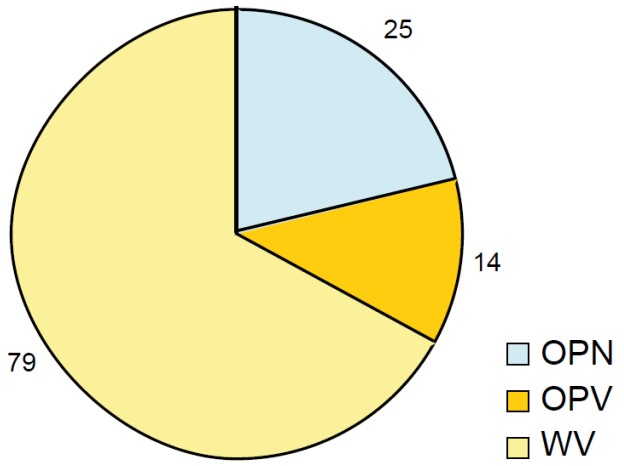




EXP of onshore prospects per formation

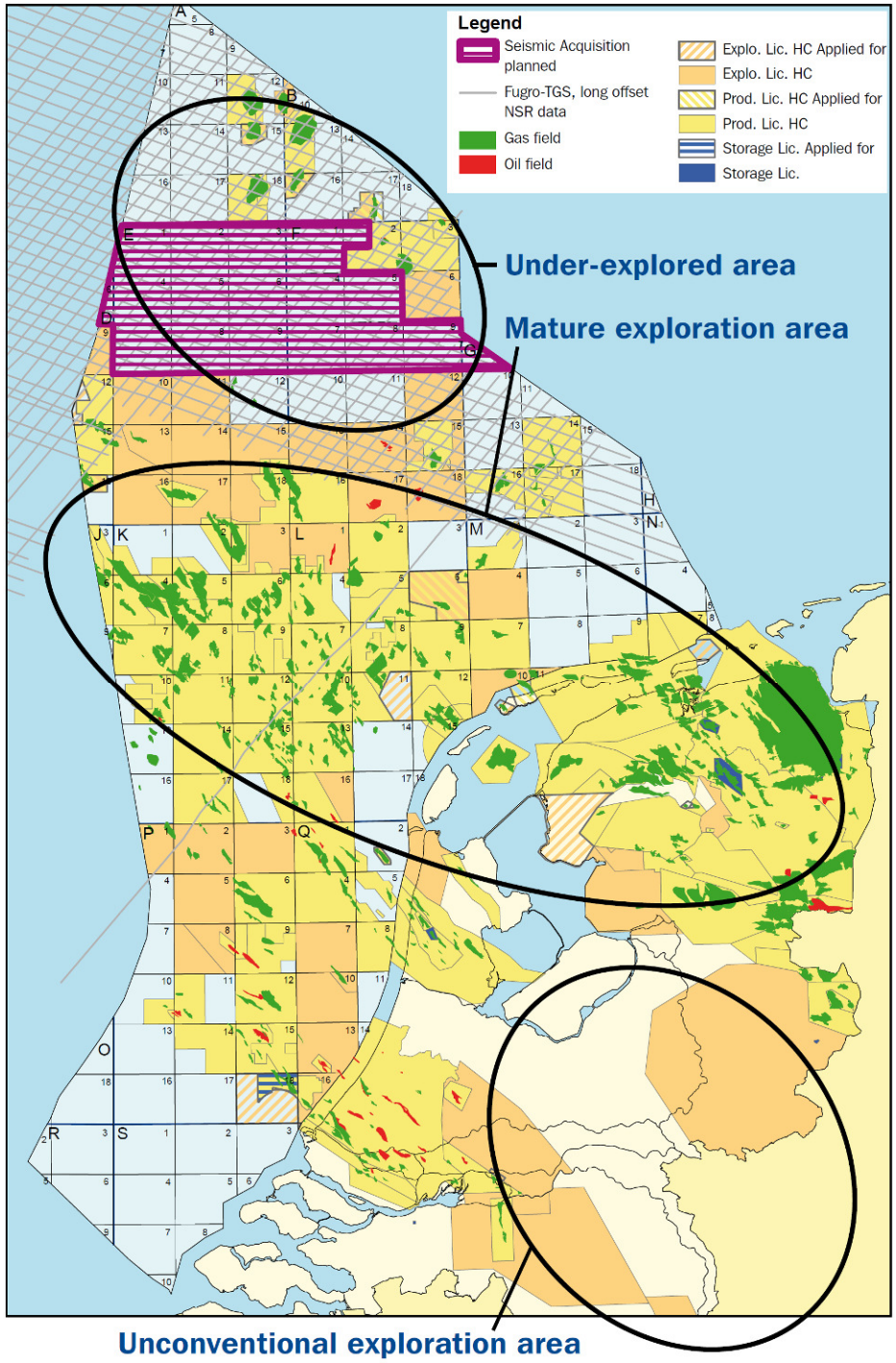


EXP of onshore prospects per license type



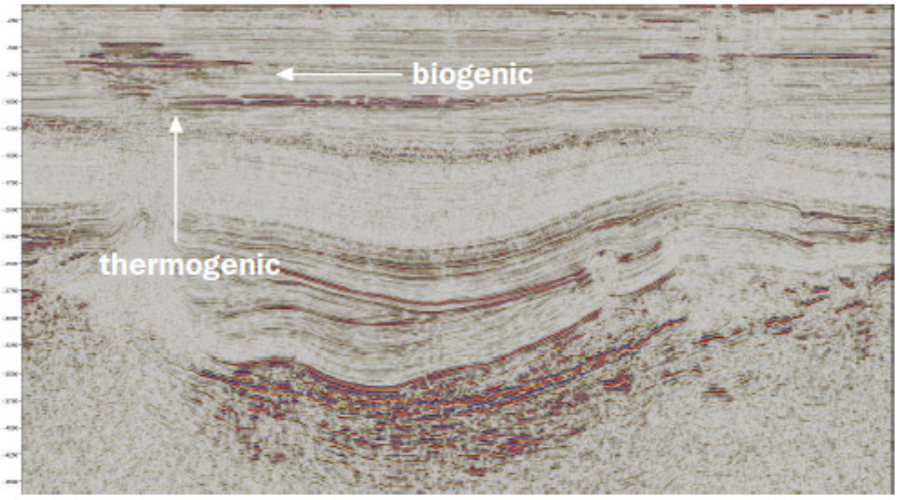
Prospective areas

- Under-explored area
  - New plays
  - Conventional plays
- Mature exploration area
  - New plays
  - Expanding play area
  - Prospect sweep
  - Marginal and stranded assets
- Unconventional play

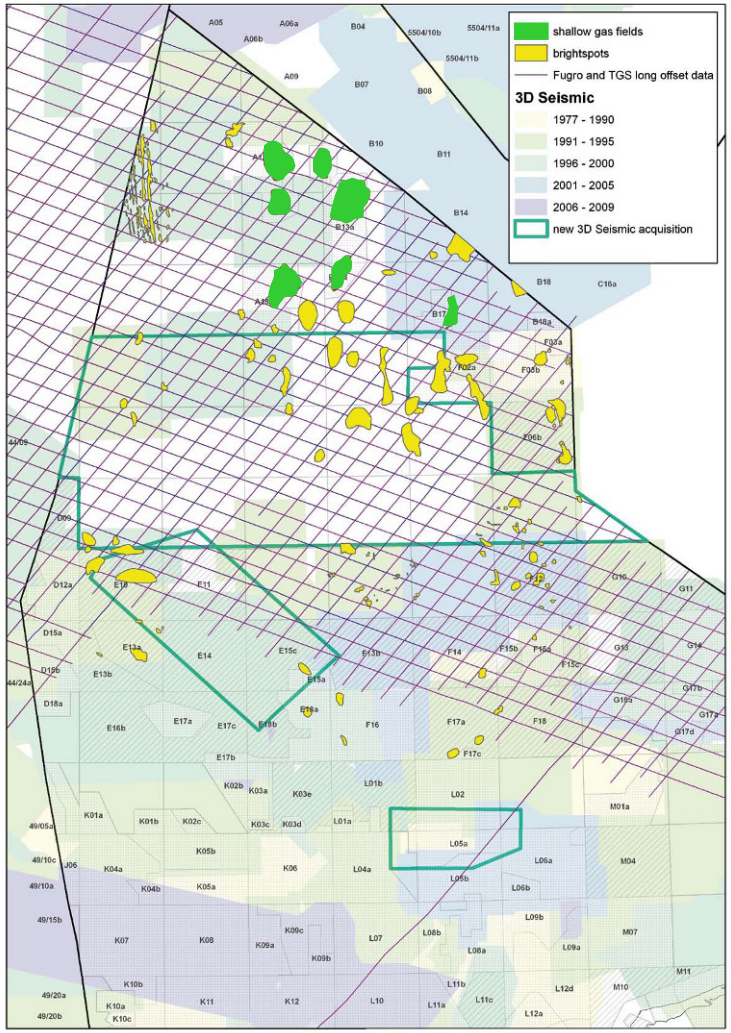


Prospex 2010

Shallow gas field and prospectivity

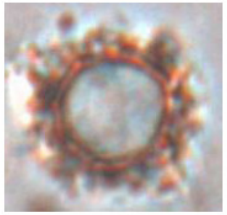


Long offset NSR data, courtesy of Fugro and TGS

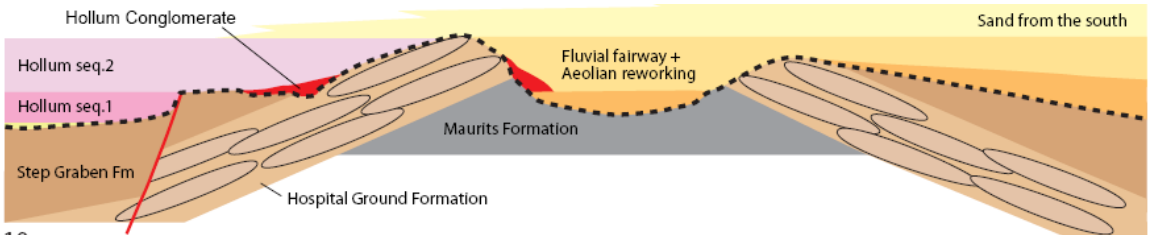


Expanding mature plays

- Opportunities in a mature play
  - Even better imaging through new recording methods and state of the art processing
  - Better innovative dating and integrated correlation techniques
  - Better geological models



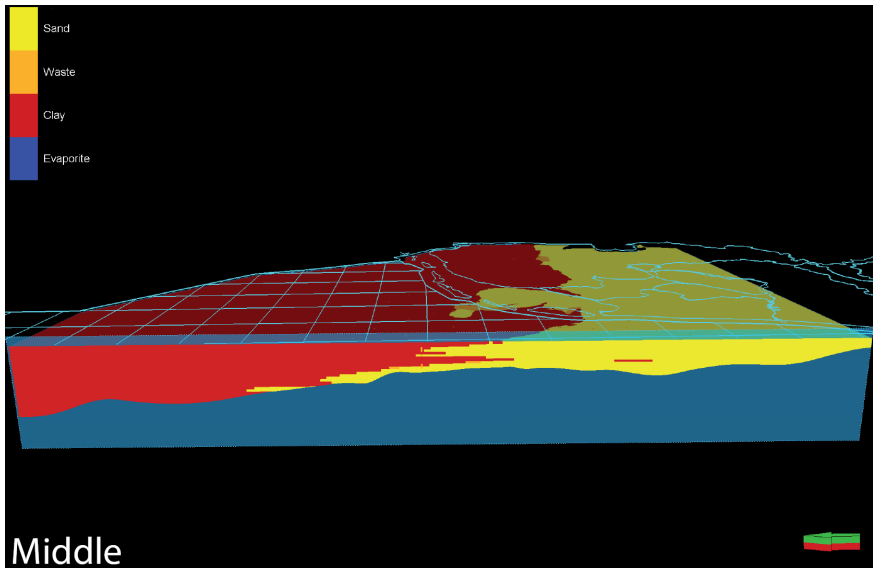
Prospex 2010

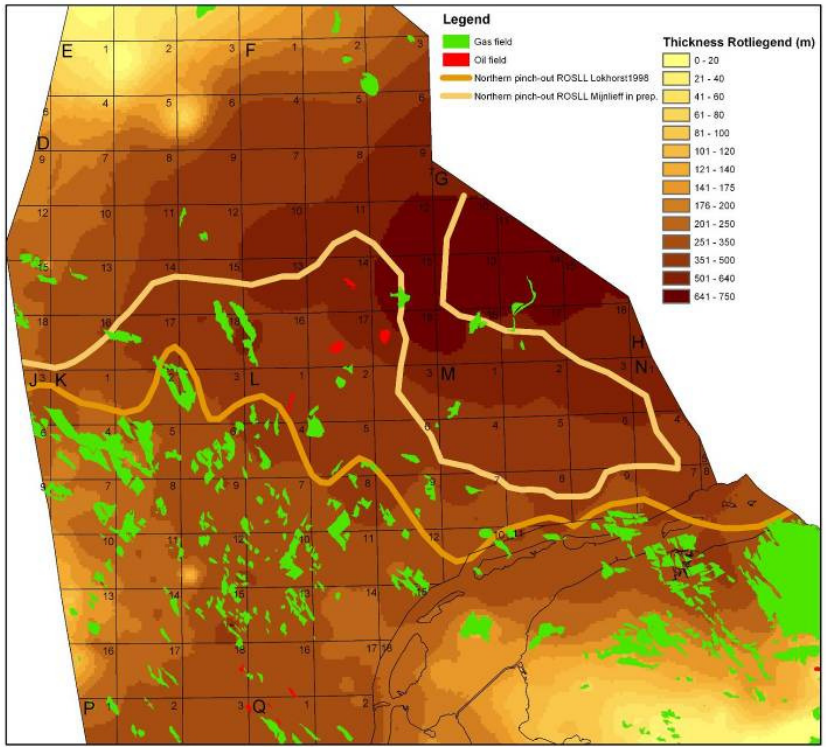


Mijnlieff & Pezatti 2009

Play expansion

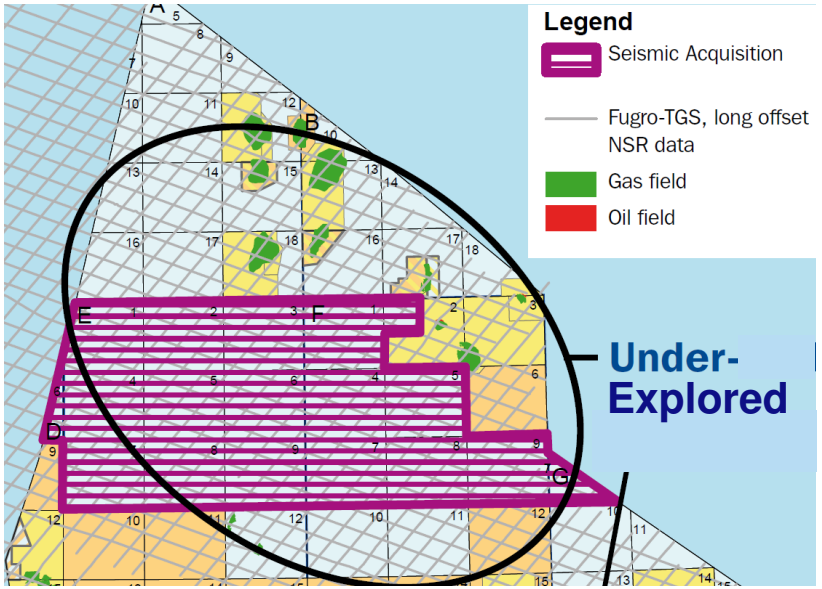
- The Rotliegend play
- Other: strat-trap sub-plays in the Carboniferous and the Jurassic



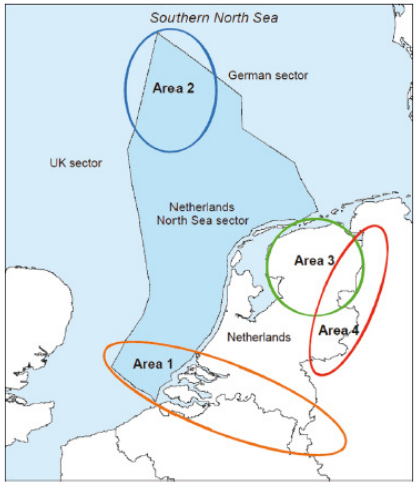


Under-explored area

- New data
- FFF & models



Source rocks inventory



PetroPlay 200?

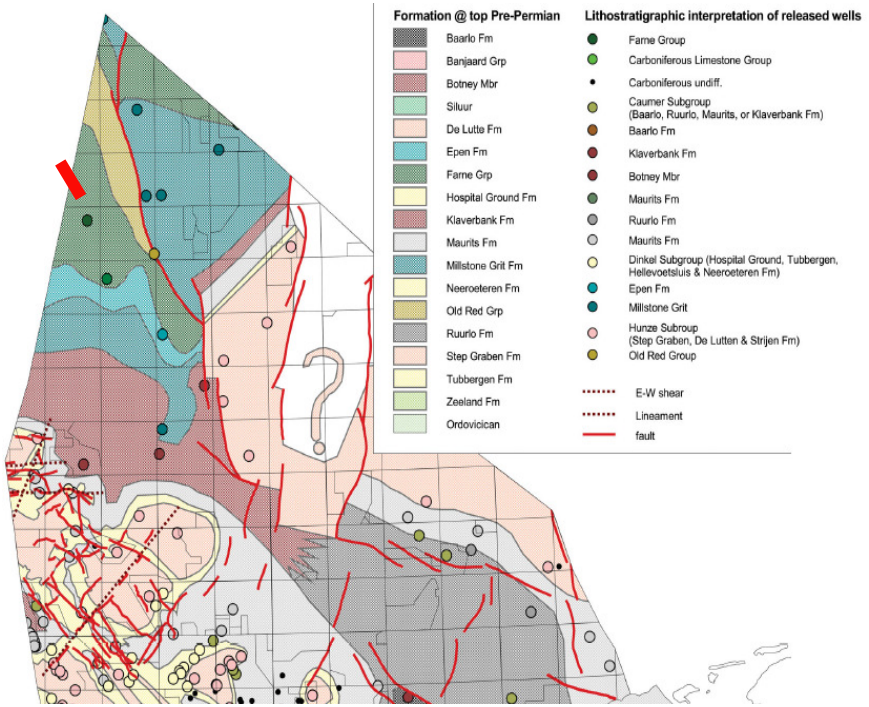
The four study areas defined at the start of the project.

Summary table of the evaluation of the potential source rocks (SR).

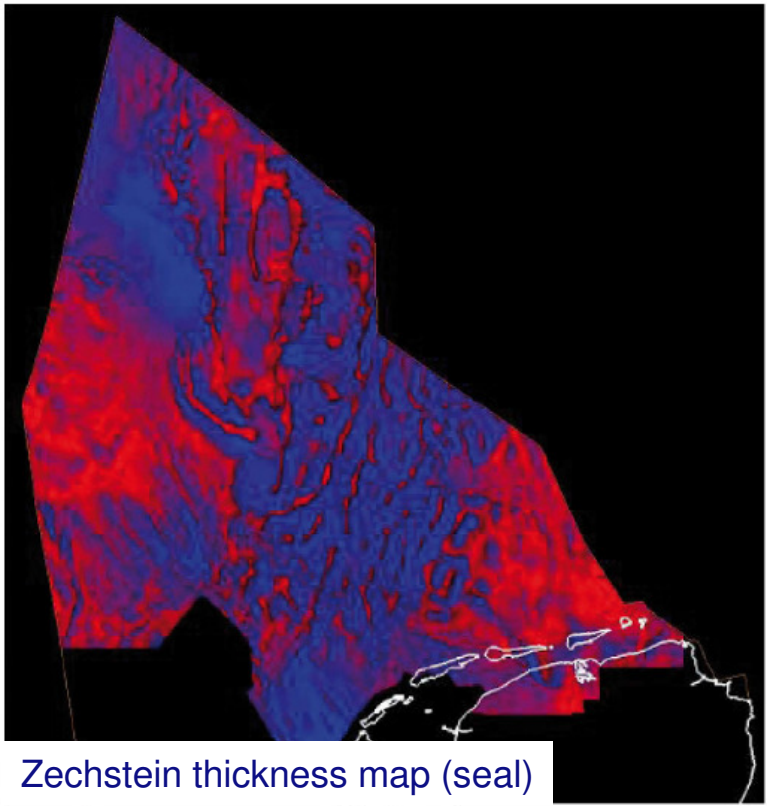
Age of units	Area	Type	TOC median [%]	TOC max [%]	Maturity [%Rr]	Initial SR potential	Present-day SR potential
Devonian	Area 1	III + (II)	0.5	2.9	1.5 - 3.0	fair	low
	Area 2	III + (II)	0.2	5.8	0.7 - 1.5	fair	fair to low
	Area 3 & 4	(II)	0.7	1.1	4.0 - 5.0	low to fair ?	low
Dinantian	Area 1	III + (II)	0.6	16.9	0.8 - 2.0	fair	fair to low
	Area 2	III + II	1.2	68.2	0.5 - 2.0	fair to good	fair
	Area 3 & 4	(II)	2.7	8.7	4.0 - 5.0	low to fair ?	low
Top Dinantian - Base Namurian	Area 1	II + III	2.5	12.1	1.0 - 1.2 (NW)	good to fair	fair
					3.0 - 2 (SE)	excellent	low
	Area 2	III + (II)	3.2	6.0	0.5 - 2.0	good	good
	Area 3 & 4	II	3.5	6.2	4.0 - 5.0	excellent	low
Namurian	Area 1	III + II	1.1	4.5 (21.5)	0.5 - 1.5 (NW)	fair	fair
					2.3 - 5.0 (SE)	fair	low
	Area 2	III + (II)	2.2	72.1	0.5 - 2.6	fair	fair
	Area 3 & 4	III + II	1.3	77.1	1.5 - 4.5	good	low

Westphalian in the Step Graben and Central Graben

Reservoirs & seal



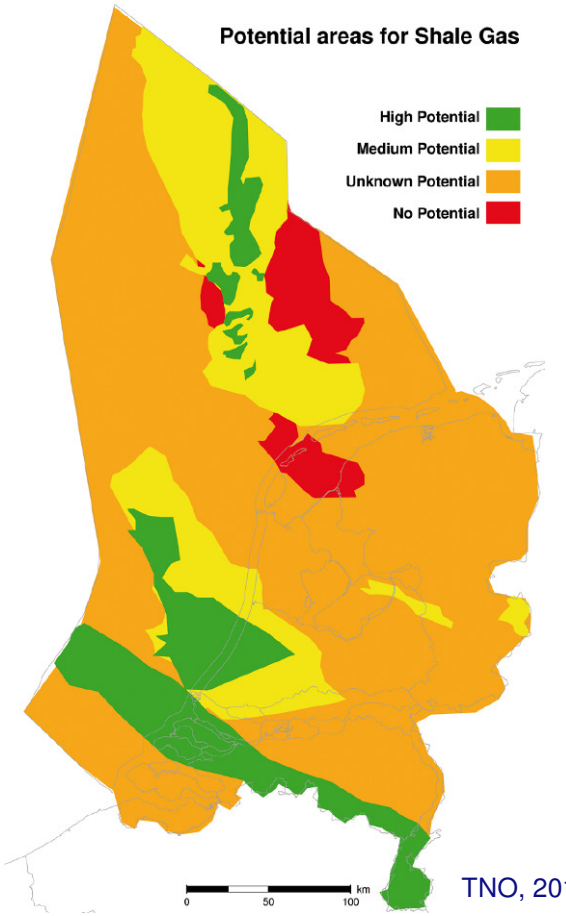
Top Pre-Permian distribution map (potential reservoirs)



Zechstein thickness map (seal)

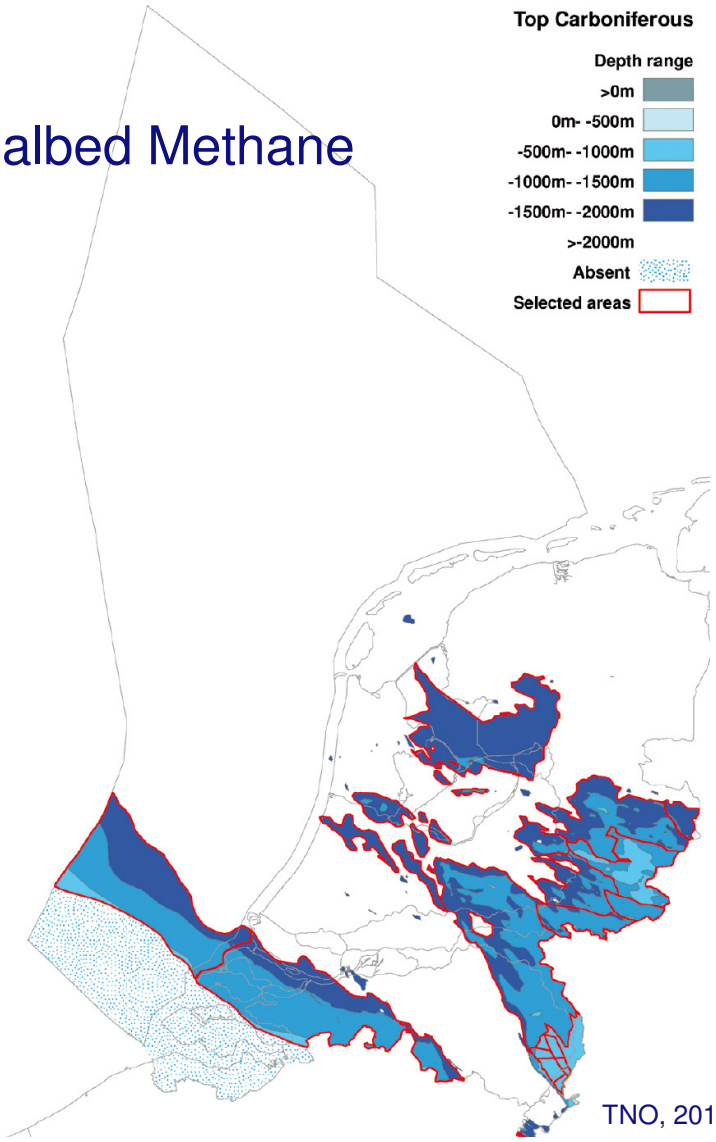
Unconventionals, lot of debate and uncertainties
Inventory studies

Shale gas



TNO, 2010

Coalbed Methane



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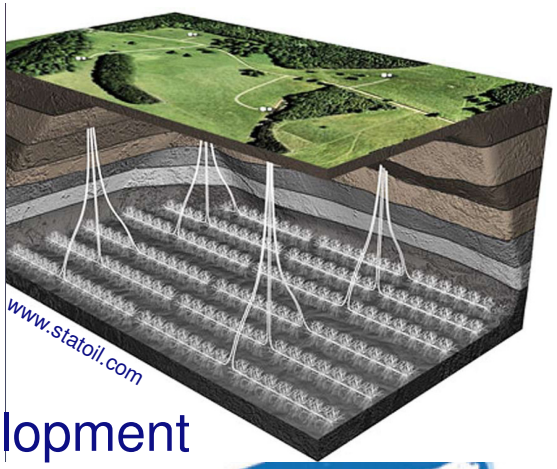
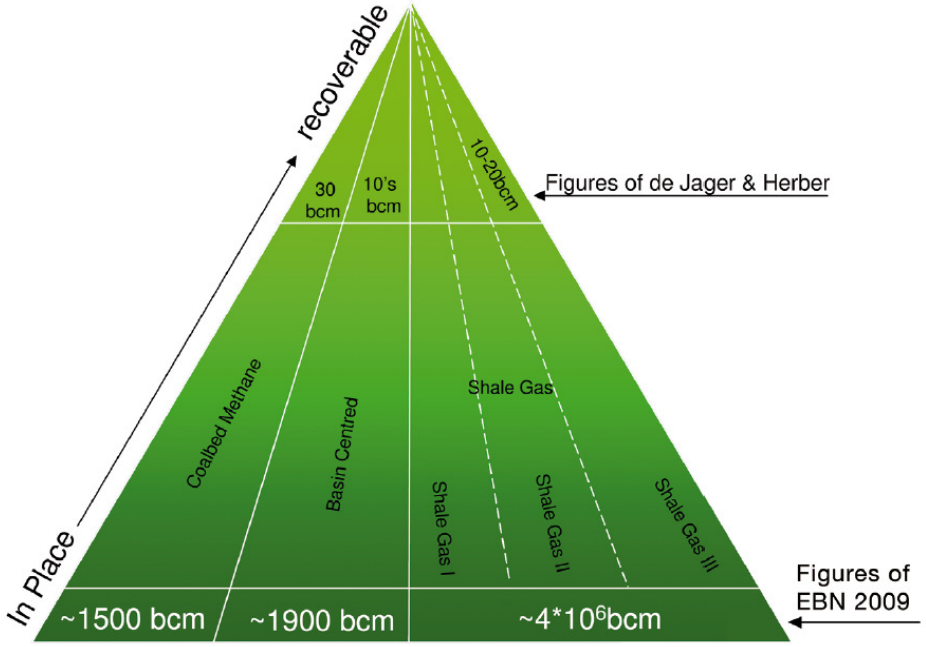
Unconventionals: Volume, GIIP vs reserves



Development options and restrictions

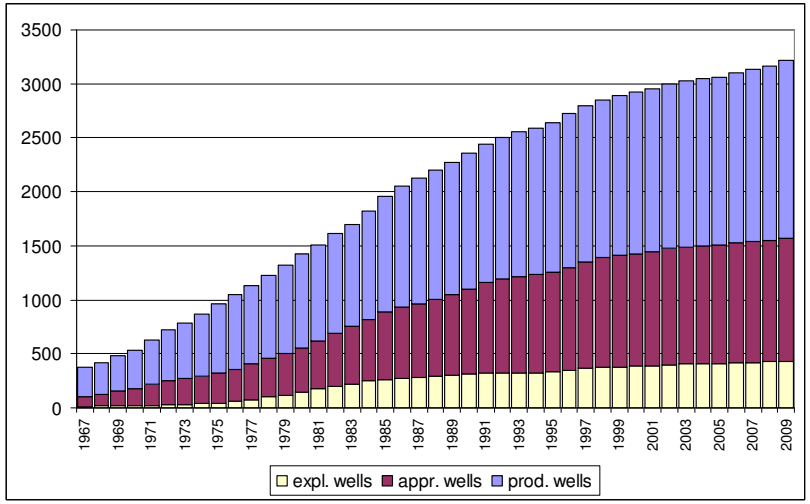
Herber & de Jager 2010

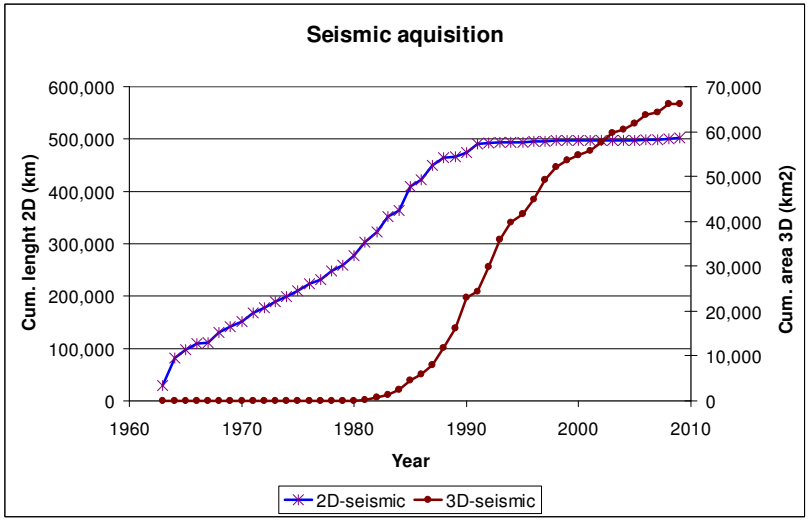
Volume guesstimates

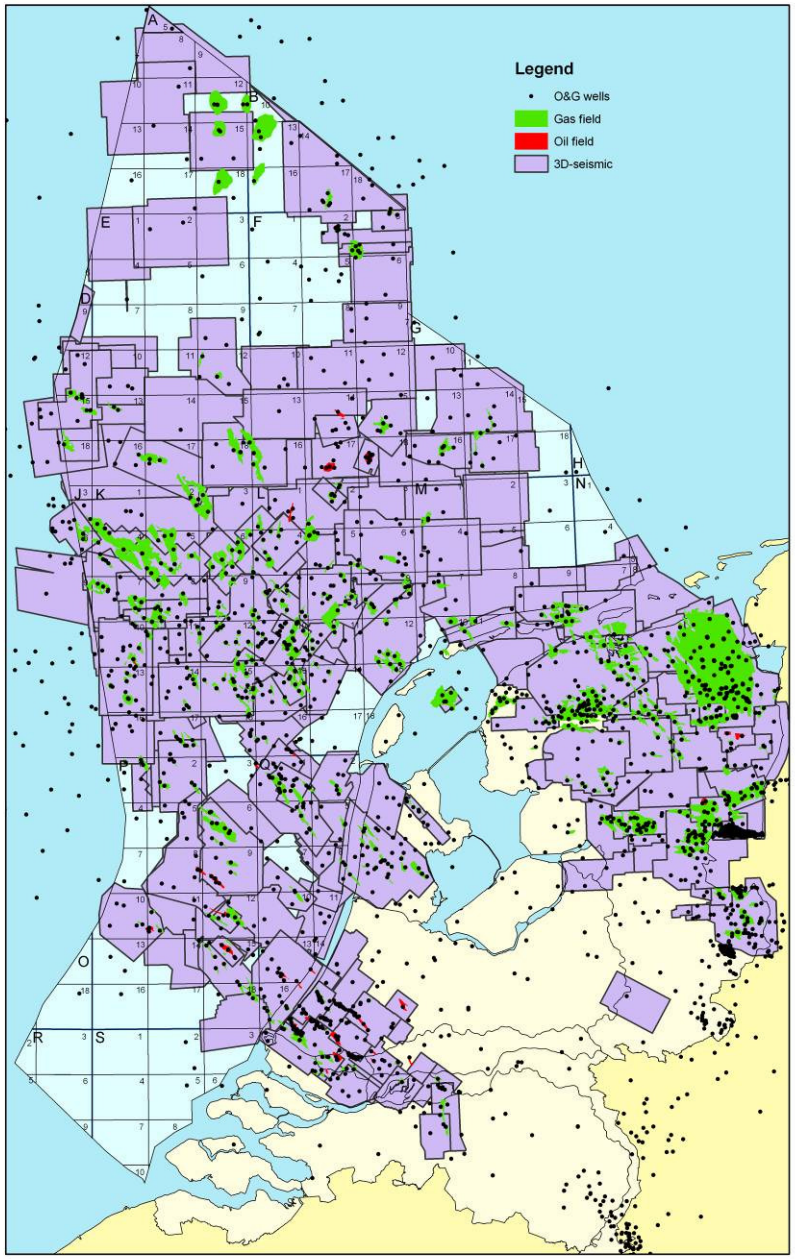


From In Place to recoverable volumes.

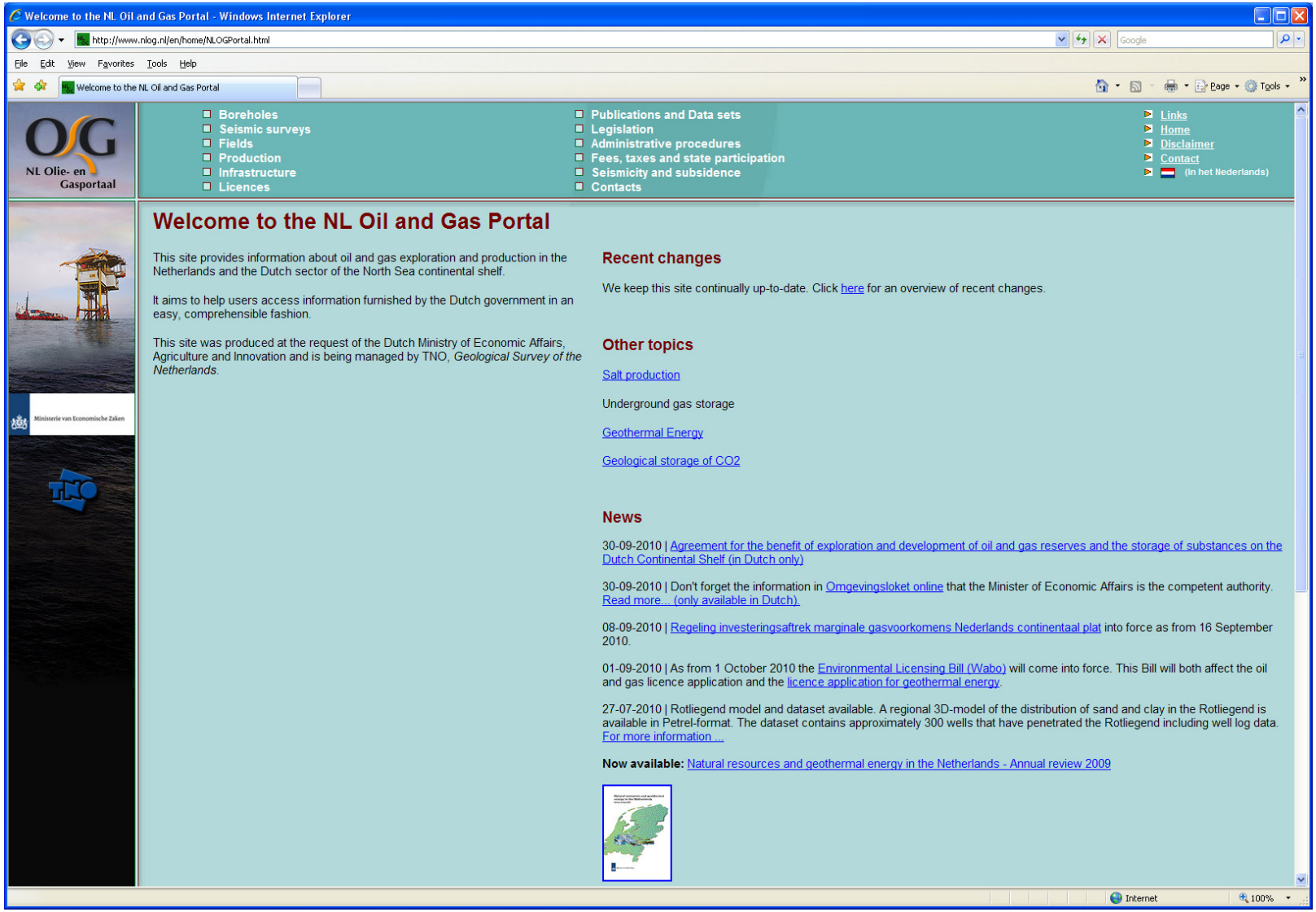
Data in the Netherlands







Availability of data & information through: NLOG.nl



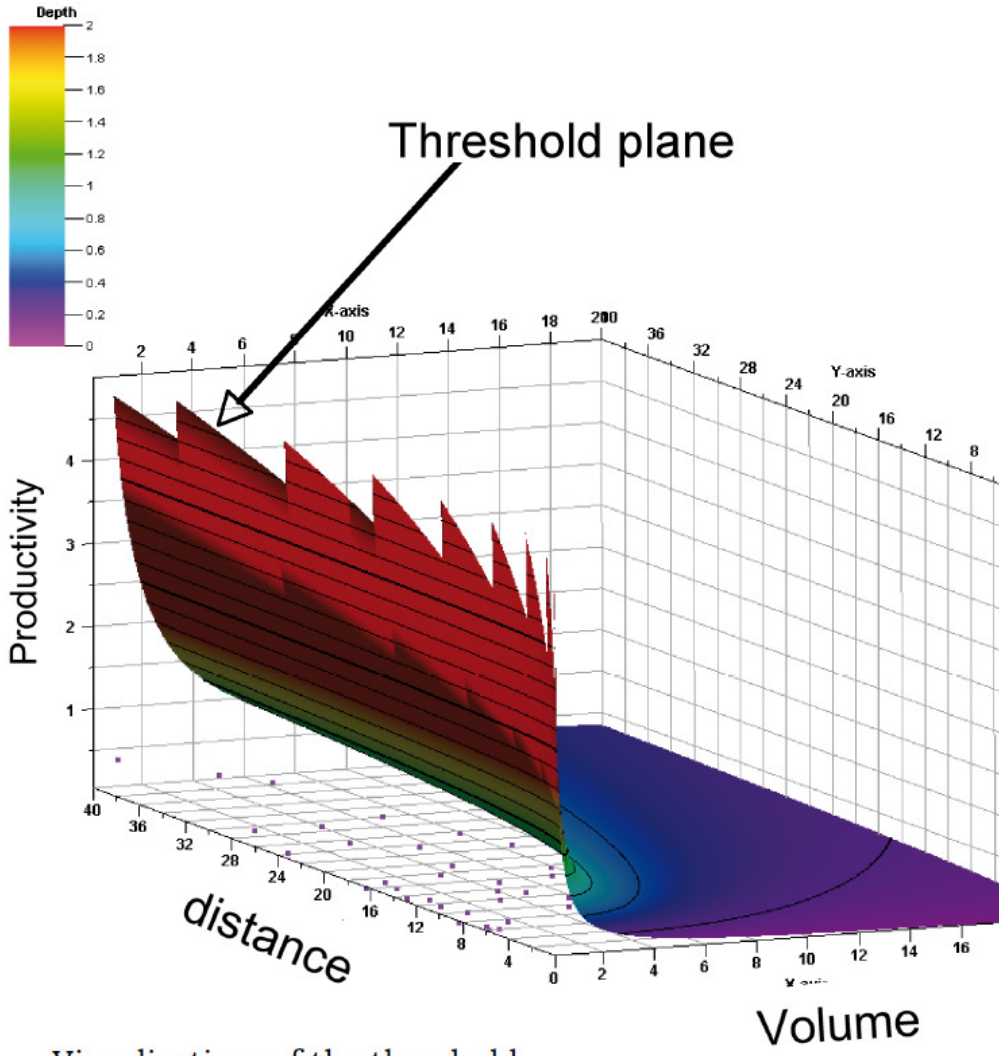
Mining Climate initiatives

- Small fields policy (long standing successful strategy)
  - Guaranteed off-take (GasTerra)
  - Guaranteed transport (Gas-Transport-Services)
- 40% Participation of EBN in exploration and production
- “Fallow declaration” of inactive parts of production licences
- Marginal fields initiative

Marginal fields initiative

Parameter definitions:

1) Volume: Technically recoverable volume according to envisaged development plan (relates to GIIP connected to wells).
2) Initial productivity of a vertical unstimulated well against envisaged pipeline pressure.
3) Distance: Closest point to which can be hooked on with respect to ullage, capacity, gas composition.



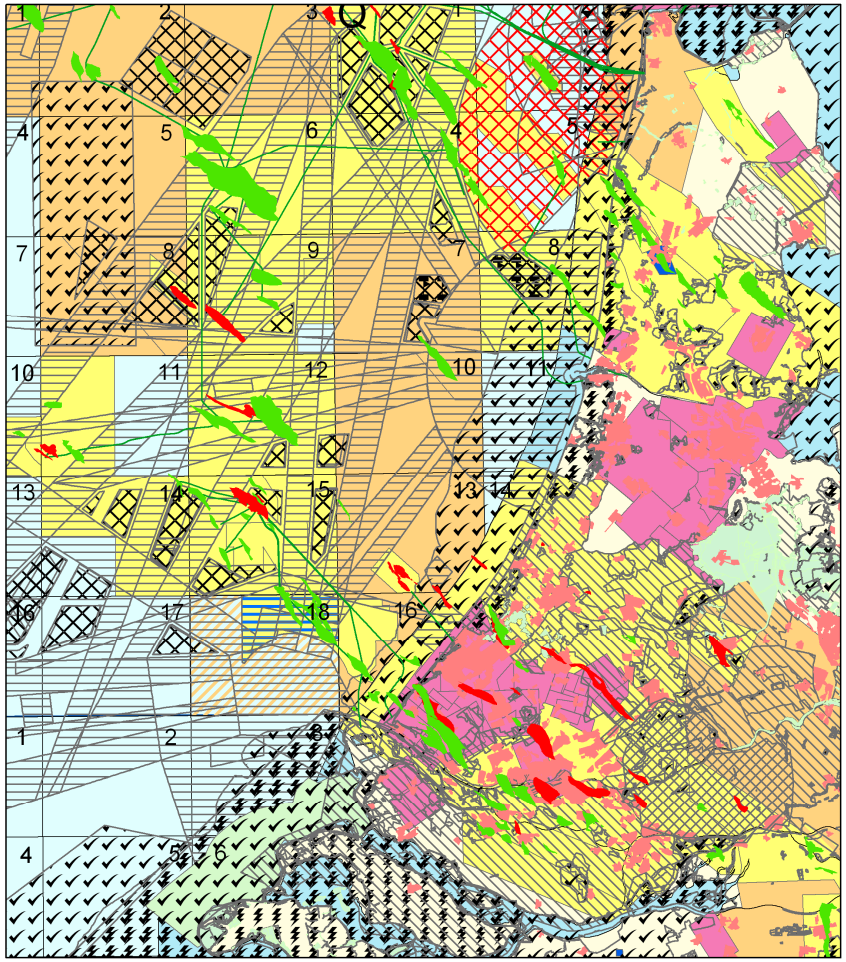
Visualisation of the threshold plane defined by the formulas

Definition of threshold plane:

Q threshhold = 1.2 . Volume -0.66 . Distance 0,15

Increasingly more complex playing field

- Interference of sub-surface activities
  - Exploration and production of gas and oil
  - Geothermy
  - Storage of:
    - natural gas, N_2, CO_2, H_2, compresssed air
    - waste
- Surface activities:
  - Nature reserve
  - Shipping lanes
  - Windparks
  - Urban areas
- Consequences of activities
  - Induced seismic
  - Subsidence
- Public perception



Synergy between users

- Shared knowledge and experience
  - Geology
  - Techniques
  - Development
- Gas to wire ⇔ windparks
  - Alternative evacuation strategy
- Exploration geothermy ⇔ exploration oil & gas
  - Improved pre-drill economics through “risk reduction”
  - Relief of abandonment costs

Conclusion

- Still scope in the Netherlands
  - 1) conventional gas
  - 2) unconventional gas
- Data position in the Netherlands is unique
- “Mining Climate” progressively improves to meet standards for a new phase in exploration and production.
- Exploration & Production of gas needs new strategy in a complex 3-to-4D spatial planning
- …