



# Value of Logging Information – Trends and learnings

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ebn

**Energising  
the transition**



# Professional Career

- 2008 – 2012            BSc Applied Earth Sciences – TU Delft
- 2013 – 2014            Msc Petroleum Engineering – Heriot-Watt University
  
- 2014 – 2017            Trainee Petrophysicist – EBN B.V.
- 2017 –                    Petrophysicist – EBN B.V.
  
- 2017 –                    Young Professional Representative at DPS

# Presentation outline

- Introduction EBN
- Data Acquisition
- Data Analysis by EBN – Pre- and Post-Drill data
- EBN's view on the results
  - Best practices logging suite from EBN's perspective
  - Example of a high V.O.I.

# Introduction EBN – Key facts

- Non-operating partner for oil & gas companies operating in the Netherlands
- Participating in nearly all E&P activities for 40%
- Investing in E&P of natural gas and oil on behalf of the Dutch State
- Shares held by Dutch State: EBN profits are transferred to the Dutch government
- 80+ employees, based in Utrecht



Total Gas production:  
48,2 bln Nm<sup>3</sup>  
EBN: 19,9 bln Nm<sup>3</sup>



1,6 mln bbl



€ 1,3 bln  
State revenues



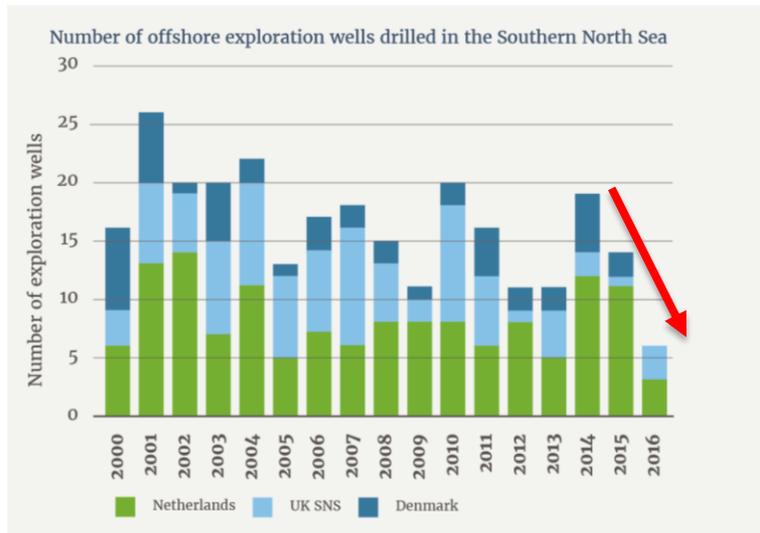
Remaining reserves:  
746 bln Nm<sup>3</sup>  
EBN: 301,3 bln Nm<sup>3</sup>



16 exploration and  
evaluation wells

# Data acquisition in danger?

- Essential part of a project, especially during the exploration phase
- Challenging times in the oil and gas means challenging times for new wells
- Cost should be as low as possible
  - Focus on main Exploration target- Less attention on Secondary targets
  - Reservoirs are logged only in case of Hydrocarbon indications
- Is this the right thing to do?

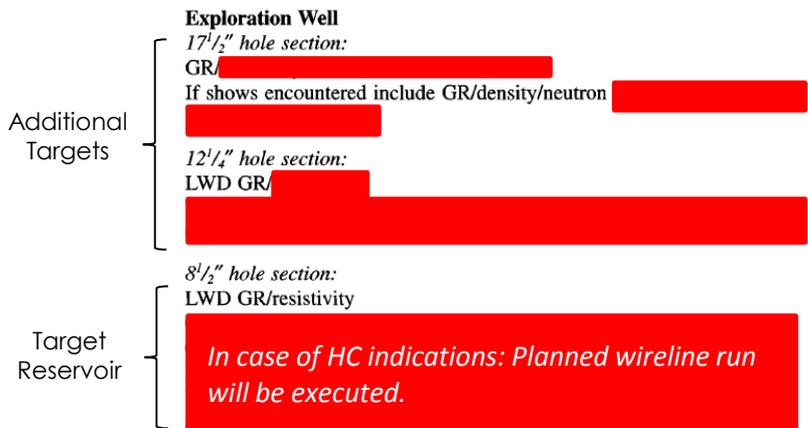


Focus On Energy Report 2017, EBN

# Data Acquisition – EBN’s observation

- What we observe at EBN:
  - Number of exploration wells has reduced
  - Data acquisition programs are reduced
  - Additional targets receive less attention
  - Even in target reservoir the logging program is made conditional

## What EBN observes nowadays..



- Of course there are exceptions:
  - In some cases Density, Neutron and Sonic are run together with GR and Resistivity as LWD
  - But still at no HC indications the remaining (wireline) program is often cancelled (RFT, Image log, NMR etc.)

# Data Analysis – Intro/Method

- Well proposals of 18 exploration wells have been investigated
- Wells are drilled between 2012-2017 (before and after the 'oil crisis')
- Wells have different target reservoirs:
  - Carboniferous, Permian, Triassic, Jurassic and Cretaceous
- For simplicity purposes only the following tools has been taken into the analysis:
  - GR, Resistivity, Density, Neutron, Sonic, NMR, Image Log, Pressure Points, Fluid Samples, Checkshots (VSP), Cement Bond (CBL), Cores, Sidewall Cores
- End of Well Reports and own database has been checked to find out the realization

# Data Analysis - Results per well

Spud date	Main target	GR	Resistivity	Density	Neutron	DT & DS	Pressure points	Fluid sample	NMR	Image log	Core	Sidewall cores	Checkshot	CBL	Percentage reliased
2017	Permian	1	1	1	1	1	1	1	1	1	1	0	1	0	91%
2016	Trias	1	1	1	1	1	1	1	1	0	1	1	1	1	50%
2016	Trias/Permian	1	1	1	1	1	1	0	0	0	0	1	1	1	67%
2016	Permian	1	1	1	1	1	1	1	0	0	0	0	0	0	86%
2015	Other	1	1	1	1	1	1	1	1	1	0	1	1	1	20%
2015	Permian	1	1	1	1	1	1	0	0	0	0	0	1	1	100%
2015	Other	1	1	1	1	1	1	1	1	0	1	1	1	1	55%
2015	Permian	1	1	1	1	1	1	0	0	0	0	0	1	1	63%
2015	Trias	1	1	1	1	1	1	1	0	0	1	0	0	0	100%
2014	Permian	1	1	1	1	1	1	0	0	1	0	0	1	1	100%
2014	Other	1	1	1	1	1	1	1	1	1	0	0	1	1	100%
2014	Other	1	1	1	1	1	1	1	1	1	1	1	1	1	82%
2014	Trias	1	1	1	1	1	1	1	0	0	1	0	1	1	100%
2013	Other	1	1	1	1	1	1	1	0	1	1	1	1	1	91%
2013	Trias	1	1	1	1	1	1	0	0	1	0	0	1	1	100%
2012	Other	1	1	1	1	1	1	1	1	1	1	0	1	1	100%
2012	Permian	1	1	1	1	1	1	1	0	0	1	0	1	1	100%
2012	Permian	1	1	1	1	1	1	0	0	1	0	0	1	1	100%

1 = Tool available in original data acquisition plan

0 = Tool not available in data acquisition plan

Green color = Tool has been run

Red color = Tool has not been run

# Data Analysis - Results per Tool

Tool	Times proposed	Times Realised	Percentage Realised
GR	18	18	100%
Resistivity	18	18	100%
Density	18	17	94%
Neutron	18	16	89%
DT & DS	18	16	89%
Pressure points	18	16	89%
Fluid sample	12	7	58%
NMR	7	4	57%
Image log	9	7	78%
Core	9	6	67%
Sidewall cores	6	2	33%
Checkshot	10	6	60%
CBL	8	6	75%

# Conclusions study

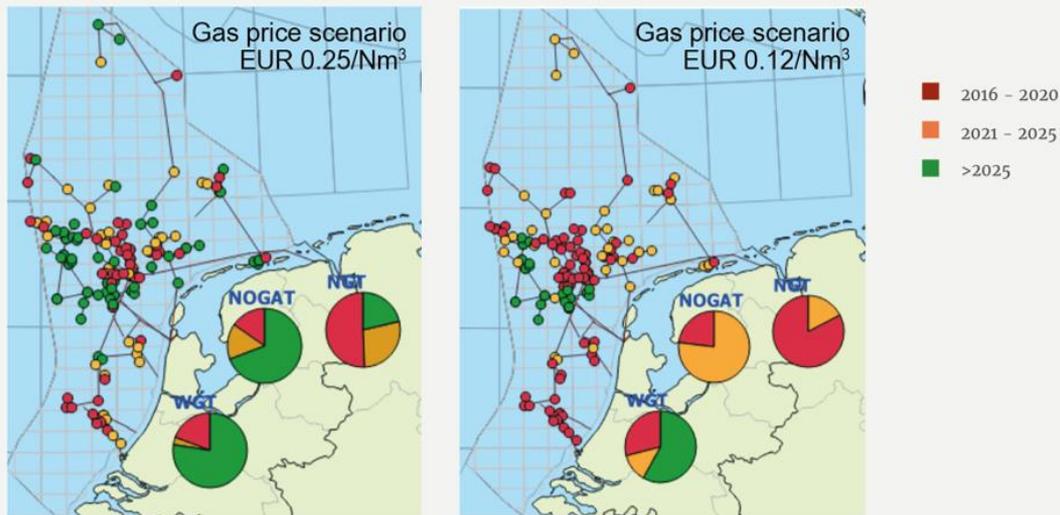
- Trend in thinning data acquisition programs is visible
  - Less Fluid samples, Image logs and Cores after 2014
  - More tools cancelled after 2014
- Cancelling mainly due to absence of shows, but also due to well issues and time pressure
- Pressure points are always in the well proposal and most of the times acquired

Spud date	Pressure points	Fluid sample	NMR	Image log	Core	Sidewall cores
2017	1	1	1	1	1	0
2016	1	1	1	0	1	1
2016	1	0	0	0	0	1
2016	1	1	0	0	0	0
2015	1	1	1	1	0	1
2015	1	0	0	0	0	0
2015	1	1	1	0	1	1
2015	1	0	0	0	0	0
2015	1	1	0	0	1	0
2014	1	0	0	1	0	0
2014	1	1	1	1	0	0
2014	1	1	1	1	1	1
2014	1	1	0	0	1	0
2013	1	1	0	1	1	1
2013	1	0	0	1	0	0
2012	1	1	1	1	1	0
2012	1	1	0	0	1	0
2012	1	0	0	1	0	0

# EBN's view on the results

- Overall trend is worrying in a mature region like Netherlands
  - Exploring a new reservoir of petroleum system needs sufficient data
  - Infrastructure in danger if not connected to new fields
  - If infrastructure disappears, prospects will never be drilled

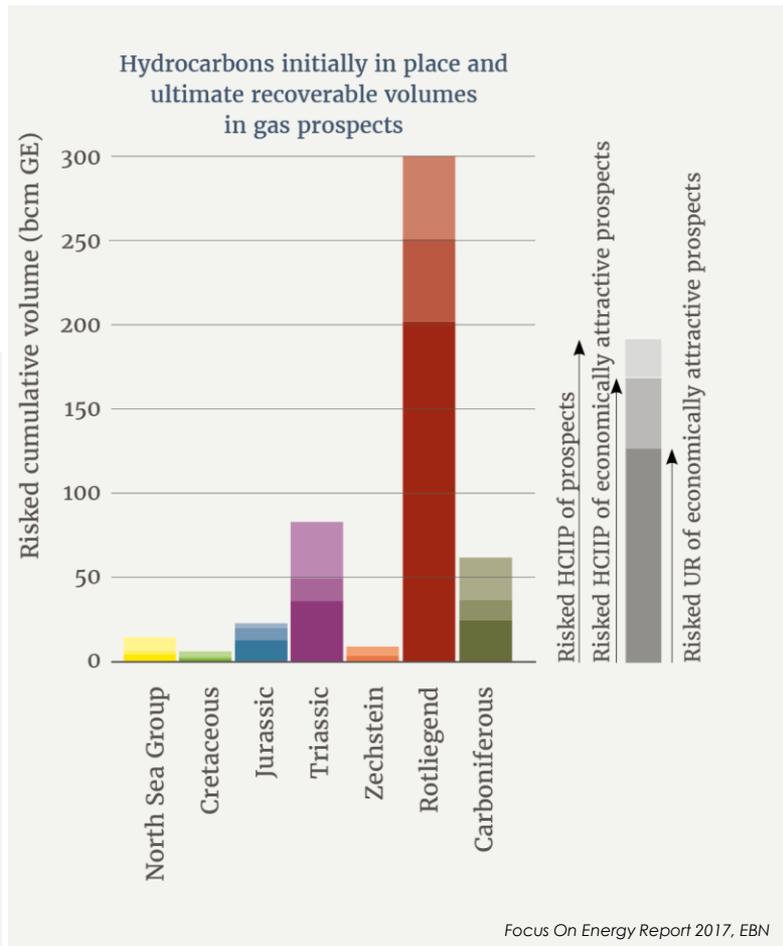
COP of infrastructure, best and worst case scenario



COP Based on reserves & cont/prosp resources

COP Based on reserves

From: Focus on Dutch Oil and Gas 2016, EBN



Focus On Energy Report 2017, EBN

# EBN's view on the results

- Message to operators:
  - Dry wells can be valuable too, so don't save costs on data!
  - This can lead to finding new opportunities or cancelling a planned well!
  - Running an extra tool is a fraction of the well costs
  - Data can be exchanged/traded with other operators
  - Acquire data as much as possible, especially on exploration targets
  - Convince management by showing the value of extra data
- Message to Service Companies
  - Try to understand operators' restrictions and act upon them
  - Running a tool for free and prove extra value – Win-Win

## Cost distribution example of an exploration well (Real case)

- Data acquisition\* excluding rig rate: 0,75 mln
- Data acquisition including rig rate for 4 days: 1,75 mln
- Dry well: 15,5 mln
- Well after testing and completion: 20 mln
- Fraction of logging costs after a dry well:
  - $0,75/15,5 = 0,05$
- Fraction of logging costs after a completed well:
  - $0,75/20 = 0,04$

\*GR, Res, Neu, Den, Son, RFT, Fluid Samples, NMR, Image logs, Core, VSP

# EBN's recommendation on Exploration logging programs

## Preferred logging program for a 'Normal' Exploration Well

Logging Type		Tool type
LWD/MWD	Wireline	Gamma Ray
		Resistivity
		Density
		Neutron
		Sonic
		Pressure Points
		Fluid Samples
		NMR
		Core
		VSP
CBL		

## 'Must Have' Logging tools for complex reservoirs

Tight (<0,01 mD) /Green Sand Reservoirs	Shaly Reservoirs	Chalk Reservoirs
SGR	SGR	NMR
NMR	NMR	Core
Core	Core	Image Logs
		Geomechanical Tool
		PLT

# Example of a tool with high V.O.I.

# Example of a missed pay