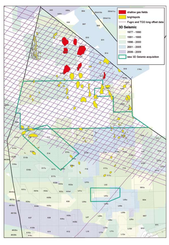
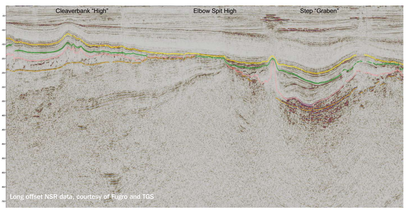
Ministry of Economic Affairs, Agriculture and Innovation

Shallow Gas Prospectivity
in the Netherlands

Introduction



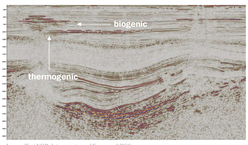
3D data and Fugro long cable regional lines.



Shallow gas is defined as gas that occurs to a depth of 1000m. The source can be biogenic and/or thermal. In the northern part of the Dutch offshore many bright spots can be seen on seismic. The traps are generally low relief anticlines related to saltdomes, with stacked reservoir sands containing separate gas columns.

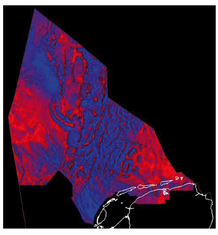
A12-FA: the first shallow gas production platform.

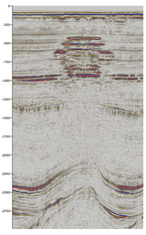
Concept Shallow Gas resources



Long offset NSR data, courtesy of Fugro and TGS

Sourcing can be thermogenic, biogenic or a mixture of the two. Broad., low dip structures exist above salt domes in which the gas is trapped. The shales act as partial seal, only limited gas colums can exist. Venting to shallower units creates a stacked, christmas trea like pattern of bright spots.

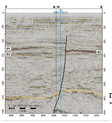




3D visualisation of the Tertiary structure of the Northern Offshore of the Netherlands. Numerous anticlinal closures can be mapped with a height of more than 20 m. Many of these closures are supported by bright spots. To the right Zechstein halite thickness is depicted. Red colours indicate large thickness.

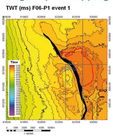
From Bright Spot to Volume

Seismic interpretation



mapping

Bright spot mapping



Where does Bright spot fit in the model?

Joint Industry Project Shallow Gas (2011)

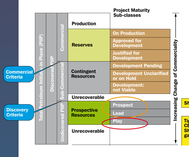
Problem:

Bright spot properties and economic gas occurrence have an unclear relationship with depositional setting (i.e. reservoir type), hampering effective exploration, production , and hazard assessment.

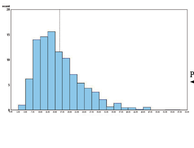
TNO proposes to develop:

1. a 3D, basin scale reservoir model of the shallow gas occurrences (Eridanos D, tunnel-valleys) where key external controls can be linked directly to depositional elements (fans, valley fills, clinoforms, topsets, etc) calibrated by extensive existing and new well data.
2. a migration and charging model for the shallow gas reservoirs based on present-day fluid dynamic data and basin modeling to predict (economically profitable or hazardous) unconventional gas occurrences.

Sub-classify by project Maturity



Volume calculation



Properties

Project components

Themes	Components	Result
Reservoir Model Seq-strat approach	Quantitative seismic analysis	Where did stratigraphic/depositional favorite plays form
	Reservoir architecture & bright spot distribution	What gas types (bio/thermogenic)
	Bio/chrono stratigraphy, Chemical proxies	When are reservoirs and seals formed (climatic/gacioeustatic controls)
Migration Charge model	Petroleum systems (basin modelling)	When and How charged
		What are the pressure conditions

Integration

PREDICTION

The first shallow gas fields were discovered offshore the Netherlands in the early 70's, but it took more than 35 years before the first field came on production.
Production started in 2008 with the second field development following in 2009.

For information on Exploration and Production issues and E&P data s… …nl & www.ebn.nl