3D SPATIAL PLANNING OF THE DUTCH SUBSURFACE:
WHY IS IT SO VITAL?

VALUE OF SUBSURFACE DATA AND INFORMATION FROM A GOVERNMENT PERSPECTIVE

Tirza van Daalen
Director Geological Survey of the Netherlands
Geological Survey of the Netherlands

- geoscientific data, information and knowledge for
  - management of **earth resources**
  - **reduction of risks and costs** associated with geohazards and adverse ground conditions

- internationally: to enable governments to secure
  - **investments** in exploration
  - **revenues** from the production of earth resources.
Network of keyregistries of the Netherlands
One-time collection, multiple use
geology of the Netherlands

- small European country
- high population density
- high land use intensity
- high degree of urbanisation

- 60% coastal and fluvial lowlands
- 99% Quaternary

earth resources
- energy, groundwater
- construction materials
- salt, silica sand
activities in the Dutch subsurface

› in the deep subsurface
  … we make money

› in the shallow subsurface
  … we avoid costs
Groningen gas fields - the Dutch earthquake zone

By Anna Holligan
BBC News, The Netherlands

As earthquakes become more intense and more frequent in the north of the Netherlands, there is mounting pressure on the government to reduce the amount of gas being extracted there.

It is a curse for thousands of inhabitants having to cope with the effects of living amid the Groningen gas fields - the largest in Europe.

There exists a consensus among all parties - including the gas companies - that the process of extracting the gas is causing earthquakes, but the country is thriving on the proceeds.

In 2012 the Dutch government made about 14bn euros (£12bn; $18bn) from the Groningen gas fields. Without these revenues, the Netherlands' deficit would be similar to that of crisis-struck Cyprus (6.3%).

"It comes rumbling towards you, louder and louder and louder," says Daniella Blanken, who runs the Groningen Ground Movement.

"Everything starts to shake. It ends with a bang.

Klaas Koster and Jannette Schoorl show a crack in the wall of their home in Middelstum
Delft DSM: terminate groundwater extraction
Pompen of verzuipen

Onderzoek naar toekomst grondwaterwinning door DSM Gist in Delft

Garages en tunnels die gevaar lopen
Evolving regulatory context

- **Mining Act**
  - Geological Survey administers E&P subsurface and production data

- **DINO database**

- **Key Register Subsurface**
  - Geological Survey administers deep & shallow subsurface data, integrating with Dutch e-government system

- **DINO 2.0 database**
<table>
<thead>
<tr>
<th><strong>what?</strong></th>
<th>all data obtained under a exploration or production license must be handed to the TNO, who will make them publicly available (incl. proprietary 3D models)</th>
</tr>
</thead>
</table>
| **why?** | attract E&P industry  
(smaller fields = smaller players) |
| **maintenance value** | 10s millions (cumulative) |
| **asset value** | 10s billions |
| **helps securing** | 100s billions (state revenues) |
Big things are happening

› 28th of March 2018 The Ministry of Economics and Climate announce the historical decision to stop the Groningen Gas Production by 2030
  › 2020 production below 12 billion cubic meter

› 30th of May 2018 Small Gas Fields Policy
  › No E&P licenses for gas production onshore
  › No E&P for licenses for shalegas
  › Max exploration offshore

› Climate goals and alternative energy
  › 2030 towards 1200 geothermal doublets
  › CO2 storage
  › Storage of heat
Value of Data to reduce the ‘Geological Uncertainty’

CDA study by Schlumberger 2011:

- Common Data Access Limited (CDA) is a not-for-profit subsidiary of Oil & Gas UK,

http://www.oilandgasuk.co.uk/datamanagementvaluestudy
User requirements for the Subsurface Domain

- Reduce construction failure costs public sector.
- Integrated Spatial Planning – 3D Coupled modelling – combine surface topography and subsurface models
- Risk Based Asset Management (PAS 55) - estimate reduction on life expectancy of network
- Coupling between Building Information Model BIM and Geological Models = GeoBIM
Asset Management Public Sector
Civil Engineering

- Ability to impact cost
- Cost of changes
- Traditional decision process
- Preferred decision process

Effort/Effect vs. Time: Design, Construction, Operation
37% of project overruns cite ground problems as a major contributor

70% of public projects were delivered late and 73% were over the tender price

Nationaal Economic Development Office UK & US
National Audit Office UK & US
Societal Cost & Benefit BRO
2 – 5 % reduction of Construction Failure costs in the public sector
11 September 2017

Automated free re-use of data

KEY REGISTER

What:
- Vital subsurface information
- Improved reliability (authentic data)
- Imposed standards
- Implemented by law

Why:
- Enables smart re-use of data
- Will increase efficiency (e-Government)
- Saves money
11 September 2017
Automated free re-use of data

... 2012 ONWARDS: BUILDING THE NEW KEY REGISTER

Data Input

Data Provider System

1010 1110 1001 0010
Upload
Service (26)

Data Provider

Upload
Portal (<26)

Data Management

Data Manager

Intake Register

Data Register: 26

Output Register

Application Manager

Authorisation Register Trans

Authorisation Data Manager

Organisation Rights Register

External Services
(Spatial, certification)

Data Output

Data Provider System

1010 1110 1001 0010
Download
Service (26)

Data User

DINOloket
Portal (<26)

Geomodelling
layer models

- limits to representation possibilities
- especially for the Holocene (complexity, data density)

voxel models
voxel modelling

\{ x, y, z, p_1, p_2, \ldots, p_n \}

GeoTOP
(100 x 100 x 0.5 m)

NL-3D
(250 x 250 x 1 m)
GeoTOP programme

- Zeeland 2007 - 2008
- Goeree 2008
- Zuid-Holland 2008 - 2009
- Noord-Holland 2009 - 2011
- Rivierengebied 2010 - 2011
- Westelijke Wadden 2012 - 2013
- Oostelijke Wadden 2013 – 2014
GeoTOP results (1)
DRIVER FOR URBAN-SCALE MODELING: 3D SPATIAL PLANNING

‘layer approach’ acknowledges the subsurface in spatial planning

planning conflicts in the subsurface led to a ‘structure vision’

Early 2000’s

3D spatial planning requires 3D subsurface data

2011-2015
Concluding remarks

- Subsurface management is vital for the Netherlands:
  - Subsurface mngt underpins 100 billions of revenue for the Dutch state
  - Subsurface mngt helps prevent billions of unforeseen costs associated with activities in the shallow subsurface

- Success factors for natural resource management
  - recycling data, information, concepts
  - cumulating rather than recurring investments
  - Data is valuable component in the subsurface (shallow as well as deep, onshore & offshore)