Upstream Gas Network modeling at EBN
November 2014
• Who or what is EBN?
• What is our challenge?
• What is our solution?
The company
EBN: about

- EBN invests in exploration and production of natural gas and oil on behalf of the Dutch State.
- All profits of EBN are transferred to the Dutch government.
- Number of employees (01-01-2014): 73.
- Based in the city of Utrecht.
- Oil production 2013: 1.7 million barrels.
- Gas production 2013: 32 billion m³.
- State revenues 2013: €7.2 billion.
EBN: about

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EBN: What we do

- EBN is the mandatory partner for oil and gas companies in the Netherlands
- We invest in exploration, production and storage of oil & gas
- We develop and share knowledge
- We advise the government on the mining climate, financial capabilities of operators and new opportunities for making use of the subsurface
- We are involved in the marketing and selling of Dutch natural gas through GasTerra
EBN: participation

Exploration (no participation, unless)
- EBN does *not* participate, unless the license holder requests to participate
- License holder and EBN close an agreement of cooperation

Production (participation, unless)
- EBN *does* participate, unless the Dutch State expects financial disadvantages
- License holder and EBN close an agreement of cooperation
Decreasing production

Scenario-based risked production forecast small fields gas production

- Produced & in production
- Prospective resources
Decreasing production

Scenario-based risked production forecast small fields gas production

Produced & in production

Contingent, shale, tight

Prospective resources

Business as usual

BC/oy

Valuable network
Flows in the network

Service provider
- Transport
- Compression
- Drying
- Cleaning
Flows in the network
- Services on incoming gas
- Payment for service
- Own production
- Costs of services by others
- Revenues of own production
Building blocks

Company database
- Production figures
- Network description

SQL server
- Installations
- Sidetaps
- Pipelines

GIS database

Infrasim

Excel
- Financial agreements
  - Processing payments
  - Opexes
  - Opex sharing

exeGesIS
Microsoft dot.net

Arc Editor

Arc GIS

24 November 2014
Model input

- Start & end date
- Production data specifics
  - (which resource classes etc)
- Gas price scenario
- Inflation rate
- … but also
... data layers

Map

Model
...processing agreements
Resulting network logics
**Demo London**

Mode: economic viability  
Network coverage: full  
IPRES query: Randomized  
(--)

### Platform lifespans and flow totals over model period

<table>
<thead>
<tr>
<th>Platform cluster name</th>
<th>Start year</th>
<th>Decommissioning year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster AWG</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>Cluster K13-A</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>Cluster K14-FA</td>
<td>2014</td>
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<tr>
<td>Cluster K15-FA</td>
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<td></td>
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<tr>
<td>Cluster K5-A</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>Cluster L13-FC</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>Cluster P15-D</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>Den Helder Gasbehandeling LoCal</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>Den Helder Gasbehandeling WGT</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>G17a-S1</td>
<td>2015</td>
<td></td>
</tr>
<tr>
<td>K15-FB-1</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>K15-FC-1</td>
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<tr>
<td>K15-FK-1</td>
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<tr>
<td>K18-G4</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>K5-CU</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>L13-FD-1</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>L4-G</td>
<td>2017</td>
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<tr>
<td>Maasvlakte onshore (gas)</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>P15-E</td>
<td>2014</td>
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<tr>
<td>P6-B</td>
<td>2030</td>
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<tr>
<td>Q13a-A</td>
<td>2014</td>
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<tr>
<td>Q1-D</td>
<td>2014</td>
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</tr>
<tr>
<td>Q4-C</td>
<td>2014</td>
<td></td>
</tr>
<tr>
<td>Q8 Terminal Velsen Noord (gas)</td>
<td>2014</td>
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</tr>
<tr>
<td>Uithuizen Gasbehandeling NGT</td>
<td>2014</td>
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<tr>
<td>A18-A(CL)</td>
<td>2014</td>
<td>2014</td>
</tr>
<tr>
<td>AME-1</td>
<td>2014</td>
<td>2014</td>
</tr>
</tbody>
</table>
Conclusions

- The combination ArcGIS - Dot.net works well
- The choice to get the layer data from the map (and not directly from the database) is a good one
- Results can be presented in ArcGIS clearly
- We have to move the financial data to the datawarehouse
- Exegesis did a nice job 😊
END
Model initiation
Model parameters: start & end date

Model builder - Demo London (full, economic viability mode)

Model start year: 2014
Model end year: 2050
### Model parameters: gas price

**Model year**  | **Product unit** | **Price per product unit**
--- | --- | ---
2014 | Nm³ | 0.25
2015 | Nm³ | 0.26
2016 | Nm³ | 0.26
2017 | Nm³ | 0.27
2018 | Nm³ | 0.27
2019 | Nm³ | 0.28
2020 | Nm³ | 0.28
2049 | Nm³ | 0.50
2050 | Nm³ | 0.51
Model builder - Demo London (full, economic viability mode)

Platform clusters
- A12-CPP
- A18-A(CL)
- AME-1
- AME-2
- B13-A
- Cluster AWG
  - Start year: 2014
  - Capex: 0.00 €
  - Minimum flow: 109500000 Nm³

Platforms
- AWG-1C
  - Platform types
  - Production profiles
- AWG-1P
  - Platform types
  - Production profiles
- AWG-1R
  - Platform types
  - Production profiles
- AWG-1W
  - Platform types
  - Production profiles

Pipelines
- *J6-A-Markham :: WGT EXT Sidetap K5-A
- *K14 to WGT
- *K18-Kotter-P :: Q1-Helder-AP
- *LoCal Sidetap onshore Callantsoog :: Den Helder Gasbehandeling
- *NGT EXT Sidetap K9ab-B :: L10-AR
- *NGT Sidetap N00 (open) :: Uithuizen Gasbehandeling NGT
- *NOGAT EXT Sidetap F2-Hanze :: F3-FB-1P
- *P11b-Van Ghent :: P11b-De Ruyter
- *P15-D :: Maasvlakte onshore (gas)
Network remarks

The resulting network is directed and acyclic.
It is composed of: edges: 173; vertices: 179; branches (weakly connected components): 7.

The following infrastructure elements caused errors and cannot be added to the network:
Platform cluster ‘Chiswick’ is not within tolerance distance of any pipeline start or end point.
Platform cluster ‘Grove’ is not within tolerance distance of any pipeline start or end point.
Platform cluster ‘Cluster K10-B’ is not within tolerance distance of any pipeline start or end point.
Platform cluster ‘P9-Seafox-1’ is not within tolerance distance of any pipeline start or end point.
Sidetap 'F2-A-Hanze TMLS' is not within tolerance distance of any pipeline start or end point.
Sidetap 'P11b-De Ruyter TMLS' is not within tolerance distance of any pipeline start or end point.

Warnings:
Platform cluster ‘Cluster L10-B’ has 2 out edges.