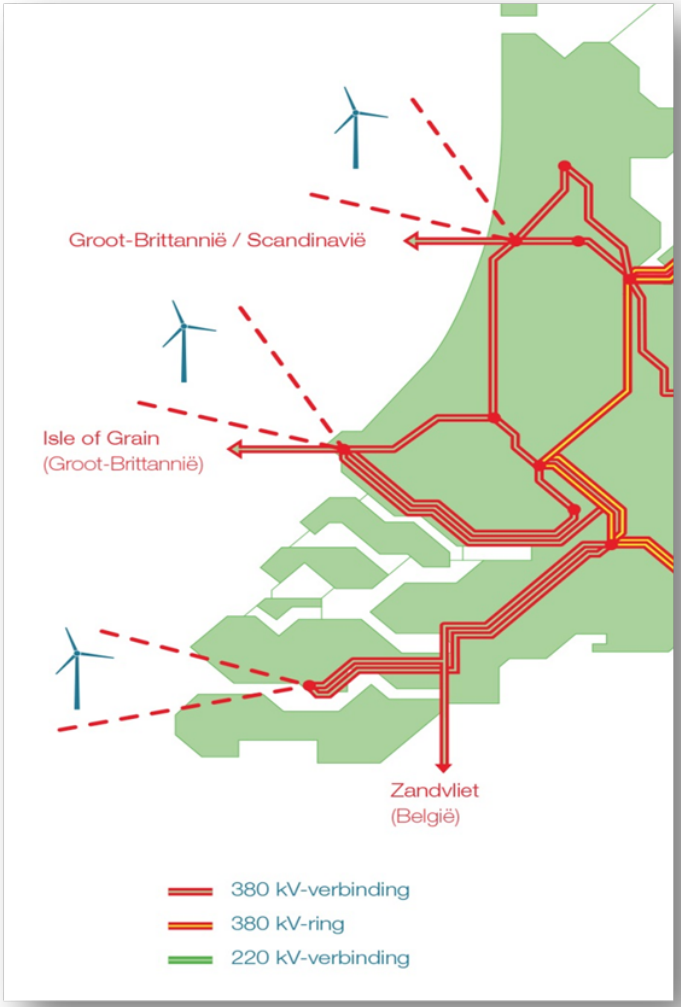
380 kV cabling - Randstad North Ring

5-juli-2017

Sjouke Pieter Bootsma
Senior manager Large Projects NL

Randstad 380 kV: closing the ring



- Connection between:
  - Maasvlakte (Rotterdam-area) and
  - Beverwijk (Amsterdam area)
- Total investment 220 M€ + 650 M€
- South-ring operational since 2014, incl. 10 km AC 380 kV underground cable
- North-ring: IBN 2018 – Q4
- External stakeholders:
  - 16 local authorities,
  - two provincial authorities
  - 4 waterboards
  - Port of Rotterdam & Port of Amsterdam
  - 1 international airport (Schiphol)
  - Etc.

Project to be realized in one of Europe's most densely populated regions

Project Randstad North-ring

New 380-kV overhead line: 60 km (system length) / 302 Wintrack pylons

3 new 380-kV / 150-kV substations

Remove existing 150 kV-line / 32 km (system length) new 150 kV cable

New 380-kV cable – in North-ring: +/- 10 km (system length) / 4 sections

Planning Process

Cf. ‘Rijkscoordiatieregeling RCR’ = National Coordination Scheme

Step 1
What do we need?

Step 2
In what area?

Step 3
Development different routes

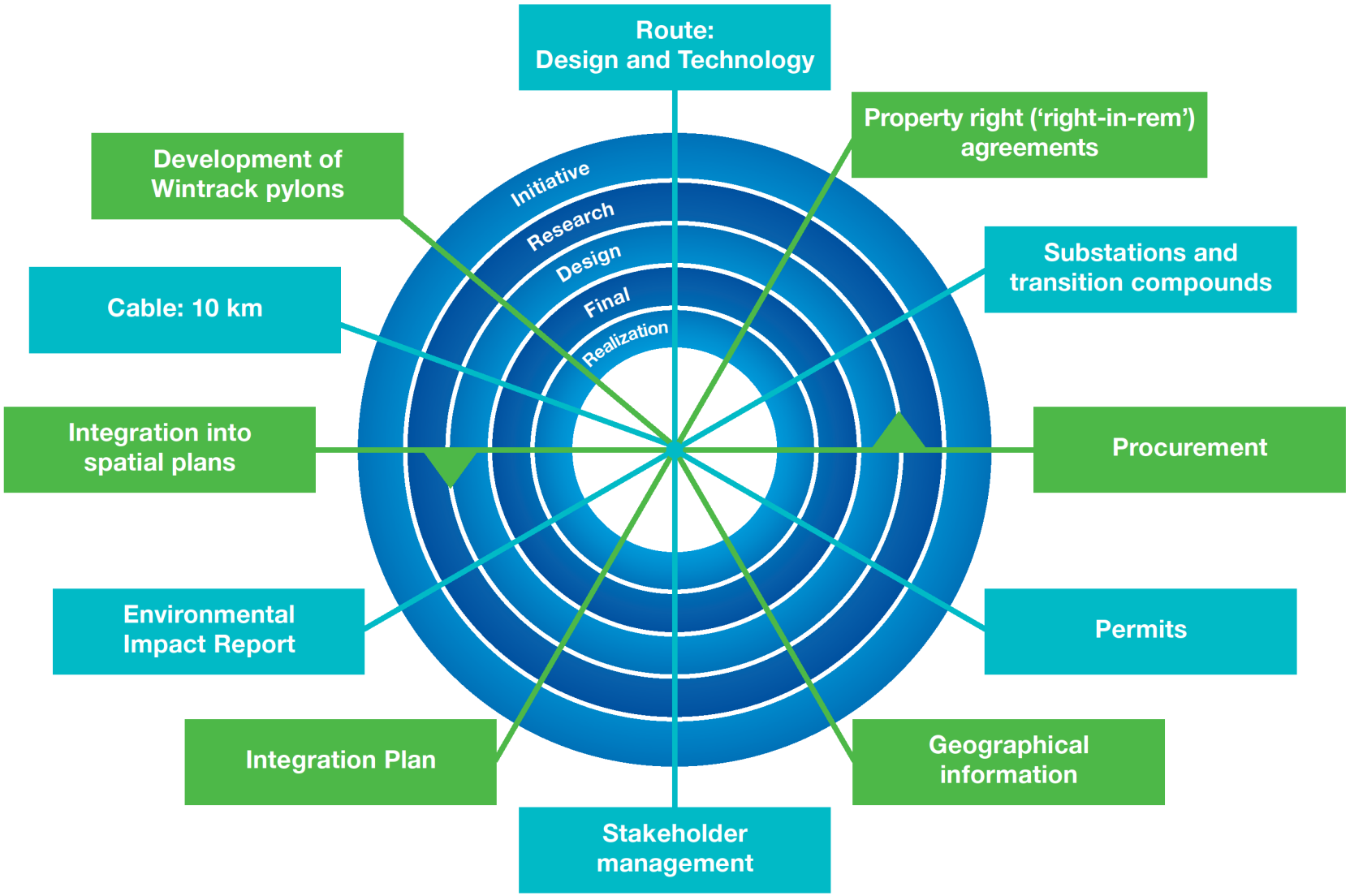
Step 4
Environmental Impact Report

Step 5
Selection route

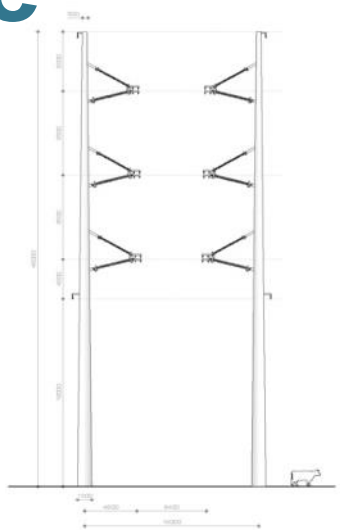
Step 6
Detail planning

Minister of Economic Affairs and Minister of Infrastructure & Environment decide ultimately on the route, incl. where to use cabling sections, based on information provided by TenneT. Appeals against the route will be handled directly by the highest court (Raad van State)

Complexity of project



Overhead lines versus underground cable

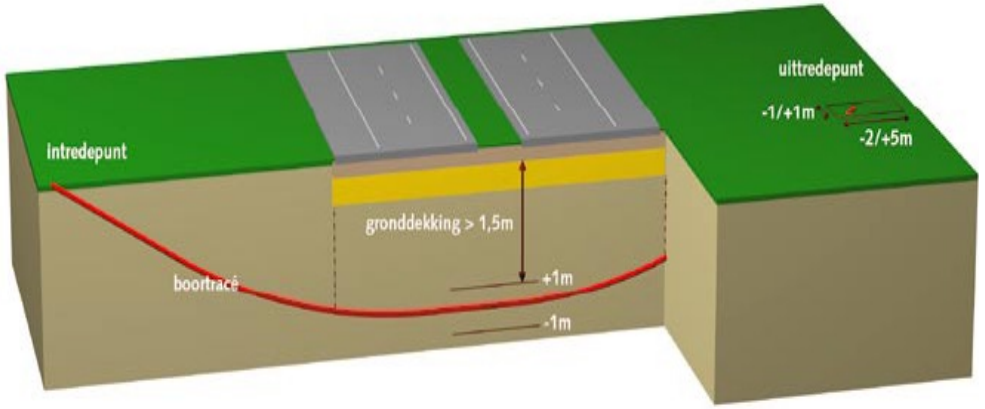


Overhead line

- Wintrack pylon; compact and a magnetic field of 100 instead of 300 metres (“Donaumast”)
- A new standard.

Underground cable

- By using open excavation and drillings (HDD = Horizontal Directional Drillings)
- Magnetic field 40 to 60 meters
- Used at complex spatial bottlenecks.



Why underground cabling

Aspects

- More complexity in the grid-system by using underground cables for a 380 kV connection, this means introducing more risks;
- Limited international experience and unfamiliarity with these risks;
- Rising political demand for “underground solution” ;
- TenneT needs to innovate and will do further research.

Starting points for TenneT:

- Responsible for a solid and reliable network;
- Acceptable risks;
- Obligations within the EU-network of TSOs.

TenneT started a research program together with Technical Universities on the behaviour & risks of 380 kV cabling in a mashed grid.
This program started right after the decision to use 380 kV cabling

380 kV cable research program (1/2)

Key research question:

"Is it possible to determine the maximum amount of 380 kV cable in an existing 380 kV overhead line grid."

Research approach:

- Academic research on grid phenome's like: transients, switching voltages, harmonics …
- Practical operational topics like: spare parts methodology, repair strategy, cable installation …

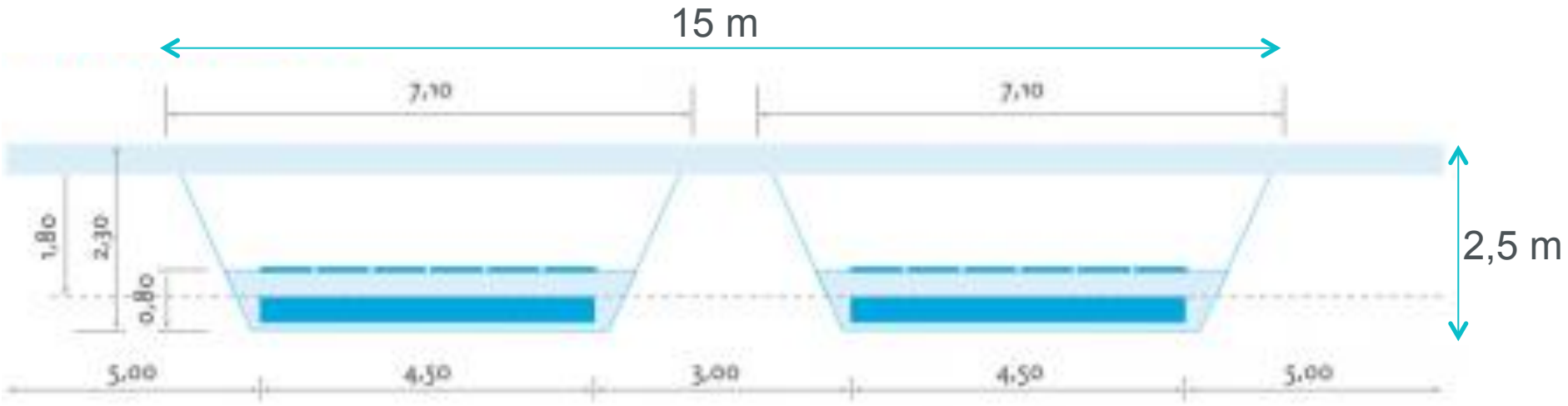
Research partners:

TU Delft TU/e APG AUSTRIAN POWER GRID WIENER NETZE

380 kV cable research program (2/2)

Academic research

- *6 PhD trajectories → more than a decade of knowledge built-up*



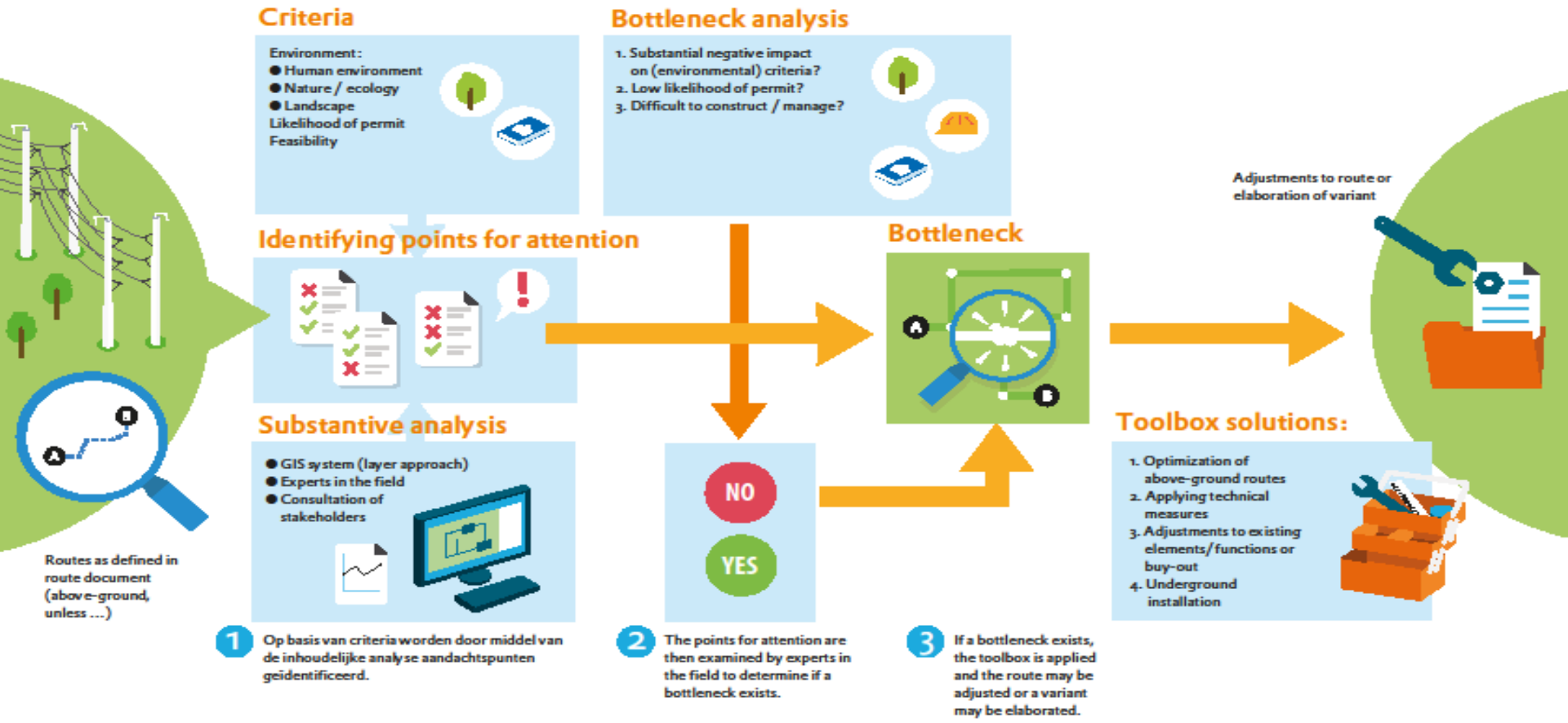
Provisional conclusions for the Dutch 380 kV grid:

1. *The amount of 380 kV cable needs a case-by-case-study*
2. *Minimum length cable section: 1 km*
3. *Maximum # of cable sections (between 2 substations): 3*

Cabling to resolve spatial constraints ('spatial de-bottlenecking')

Infographic

Research approach for bottleneck analysis



Example: Drilling

(Underneath North Sea Canal)

https://www.youtube.com/watch?v=mPY7VWDoQ5Y

Example: open excavation

(near runway Schiphol Airport)

Example: 380 kV jointbay

Disclaimer

Aansprakelijkheid en auteursrecht TenneT

Deze powerpoint wordt u aangeboden door TenneT TSO B.V. (“TenneT”). De inhoud ervan - alle teksten, beelden en geluiden - is beschermd op grond van de auteurswet. Van de inhoud van deze powerpoint mag niets worden gekopieerd, tenzij daartoe expliciet door TenneT mogelijkheden worden geboden en aan de inhoud mag niets worden veranderd. TenneT zet zich in voor een juiste en actuele informatieverstrekking, maar geeft ter zake geen garanties voor juistheid, nauwkeurigheid en volledigheid.
TenneT aanvaardt geen aansprakelijkheid voor (vermeende) schade, voortvloeiend uit deze powerpoint, noch voor de gevolgen van activiteiten die worden ondernomen op basis van gegevens en informatie op deze powerpoint.

www.tennet.eu

TenneT is een toonaangevende Europese netbeheerder (Transmission System Operator, TSO) met haar belangrijkste activiteiten in Nederland en Duitsland. Met circa 22.000 kilometer aan hoogspanningsverbindingen zorgen we voor een betrouwbare en zekere elektriciteitsvoorziening aan 41 miljoen eindgebruikers in de markten die we bedienen.

Taking power further