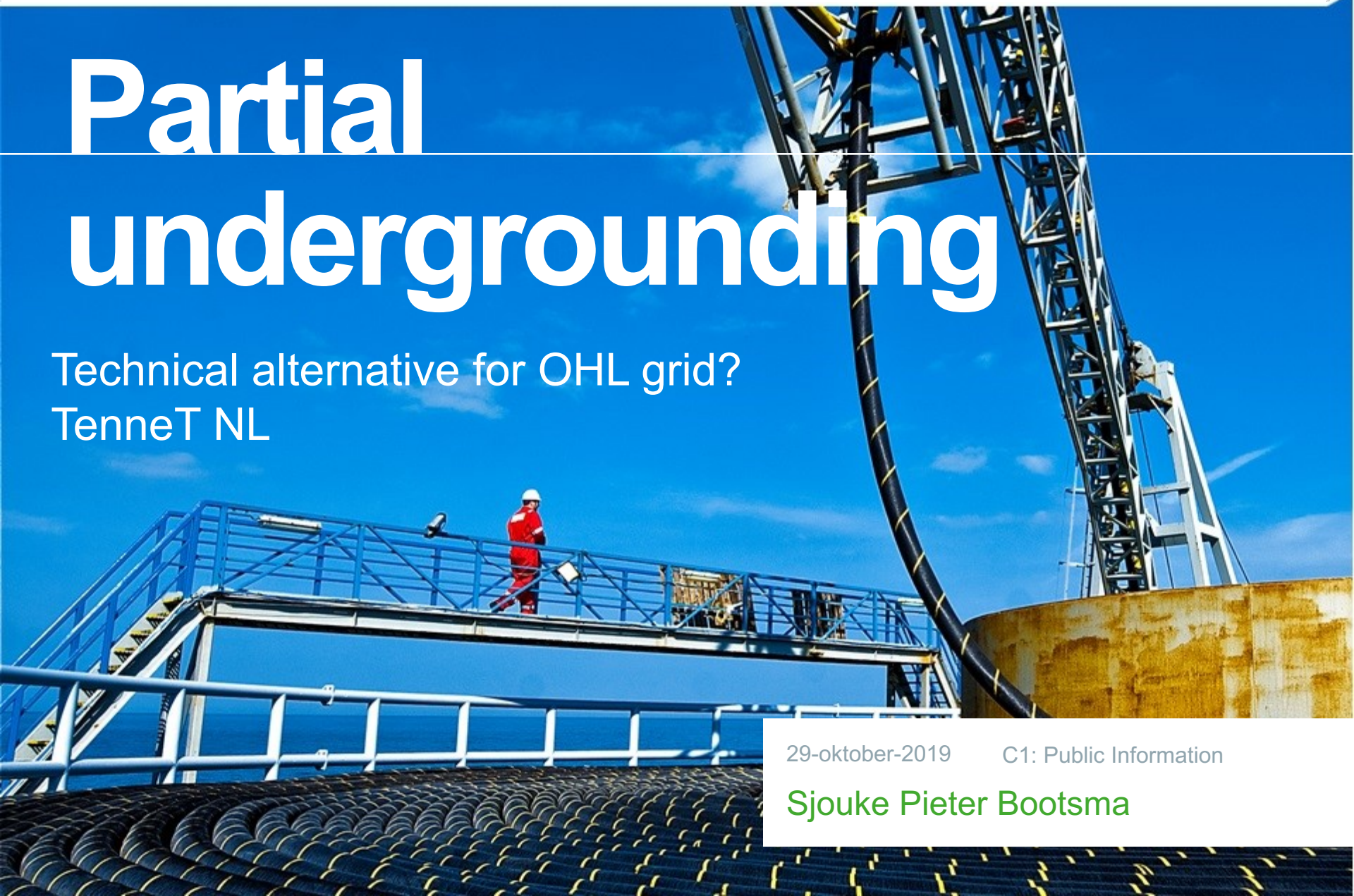
Partial undergrounding

Technical alternative for OHL grid?
TenneT NL



29-oktober-2019 C1: Public Information

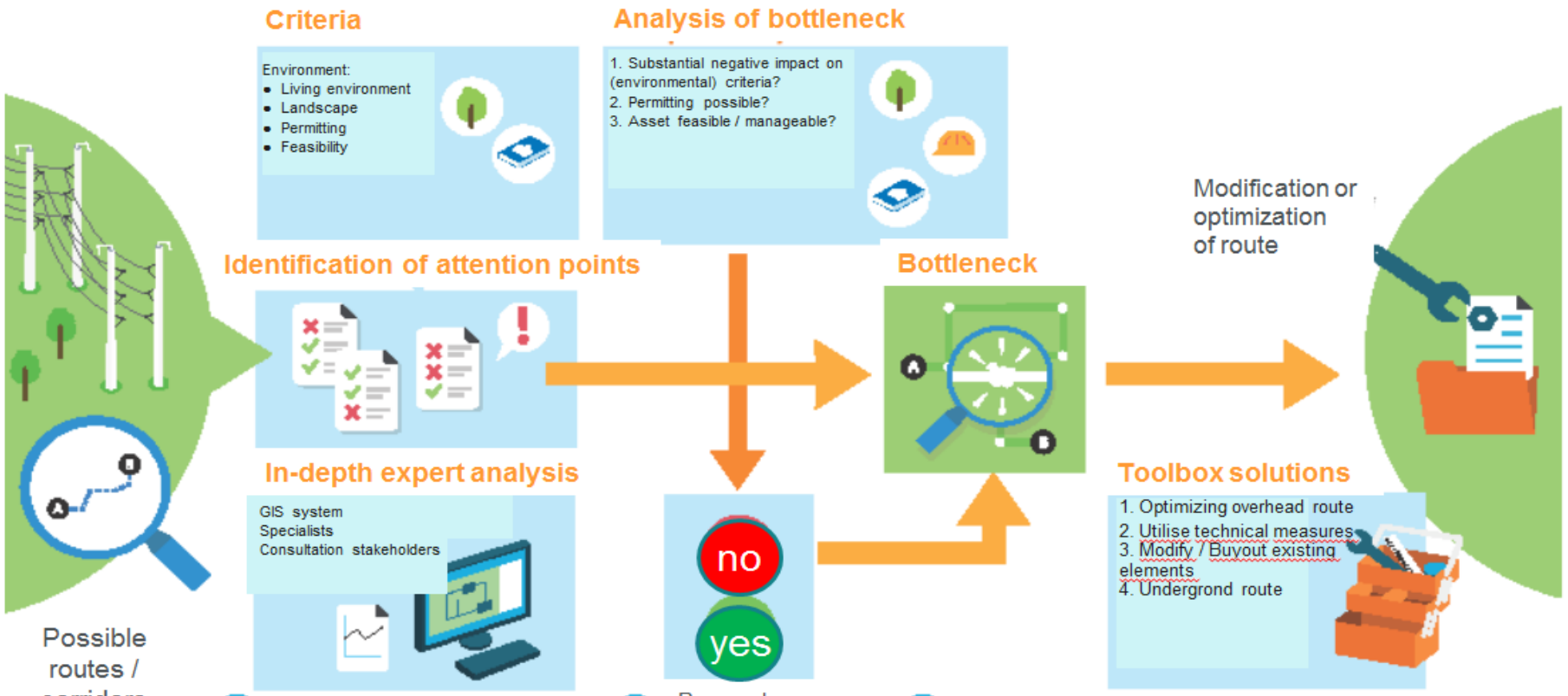
Sjouke Pieter Bootsma

Randstad (South and Northring) project

- Length of project (total): 80 km (Wateringen-Bleiswijk-Beverwijk)
- Length of cable sections: 20 km (10 km South and 10 km Northring), 5 UC sections, > 120 cable terminations
- Connect offshore wind parks: supply wind power to electricity consumers
- Ensure security of supply and increase transport capacity - transport a large amount of renewable energy from northern windfarms

If OHL are still default, when and where is UC a realistic alternative?

De-bottlenecking approach of spatial constraints



Environmental bottlenecks Randstad

Southring

- UC near the city of Delft (Zuidpolder) → OHL in open landscape (unique in highly populated area) would have negative impact on openness landscape and nature

Northring

- UC below North Sea Canal → OHL would have negative impact on shipping (technical)
- UC near Schiphol → OHL would have negative impact on Schiphol airport because of height restrictions (technical)
- UC Floriande → OHL would have negative impact at residential and recreation area Floriande and nature
- UC Rijpwetering → Several houses would be (nearly) under OHL

Conclusion

In the Randstad-project open landscape and nature (Southring) and impact for local residents (Northring) were leading and also technical reasons (North Sea Canal and Schiphol) are important

Construction phase Randstad Northring

Cable trench approximately 14 metre wide, big impact on farmers' ground

Cable research program

Reliability of UC and influence on the power system

- Large number of delicate joints and terminations will decrease reliability
- Significant longer repair time compared to overhead lines

Modelling cable electrical behaviour

- Risk of high overvoltages in case of resonance
- Amplification of background harmonics reason for filter(s)(stations) (see next slide)

Technical Performance of long length of cables

- Large amount reactive power, results in large number of coils
- Several technical concerns (zero missing phenomenon, energizing, auto reclosure, current distribution)
- Countermeasures will influence reliability of the hybrid line

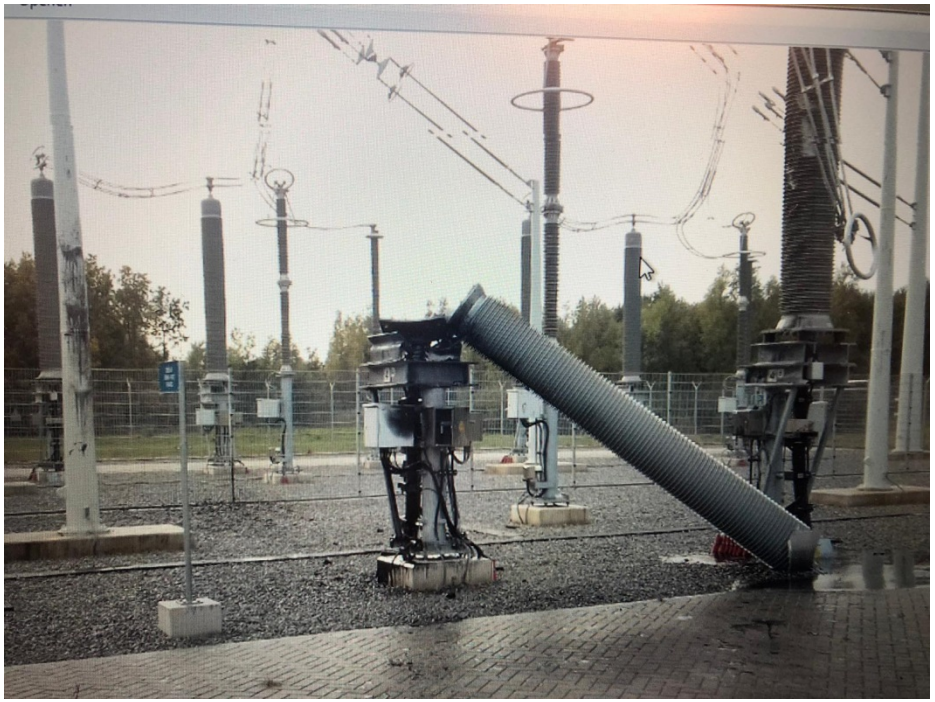
Monitoring and real time measurement

- Reflections of transient voltages due to lightning strokes and switching operation
- Further research necessary to transients in case of multiple partial undergrounding

Filterstation (for amplification of background harmonics)

Recent failures of cables / -terminations

Maasvlakte substation (some 5 years ago): exploded cable termination, incl. oil spillage



Randstad Northring (Octobre 2019, after 3 weeks in service!): explosion and fire cable termination

Randstad Northring (2017): cables damaged during drilling under North Sea Canal, still not in service, repair expected in 2020

UC not an exchangeable alternative

General

- 380 kV grid Northwest Europe important backbone
- Robust meshed grid: TenneT is responsible for a solid and reliable network within a EU-grid
- UC means more complexity and more risks (see slide before)
- But: rising political and environmental demand for UC
- And: UC has to be affordable due to social costs

Before construction

- Feasibility: investigate possibility of UC related to the location in the total grid
- Reliability: research consequences UC for reliability of the grid and determine wether risks UC are acceptable

After construction

- Repair more complex and takes more time than OHL
- Total grid becomes more vulnerable during repair