

Dutch-German views on Offshore Wind & Hydrogen

18.10.2019

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Running out of Space?



504 Megawatt in neun Monaten

Ausbau der Windenergie sinkt um 80 Prozent

Die Krise der deutschen Windindustrie verschärft sich. Bis Ende September lag der Ausbau an Informationen weit unter dem Durchschnitt. Eine Besserung der Lage ist kaum in Sicht.



Von *Stefan Schultz* ▼



NRC  HANDELSBLAD

Te weinig ruimte voor alle opgewekte stroom

10-10-2019 | WOORDEN: 1234 | NRC HANDELSBLAD | PAGINA: 01 | MARK MIDDEL,

Te veel zonne- en windenergie Het elektriciteitsnet in Groningen kan alle initiatieven voor
zame stroomopwekking nog niet aan. Reportage Groningen vangt zon en wind op voor
... maar het energienet kan het niet aan.

... begrijp je pas waarom Groningen de
... kan windmolenparken en drie grote
... kruist, glinsteren grote en
... scholen.

SPIEGEL ONLINE
Menu | Politik Meinung Wirtschaft



Limits to Green Growth

Klimaatakkoord 2030

49% less CO₂ in 2030

70% RES electricity



Klimaschutzpaket 2030

40% less CO₂ in 2030

65% RES electricity



Complete Decarbonization in 2050

Time (left)

Space /
Land

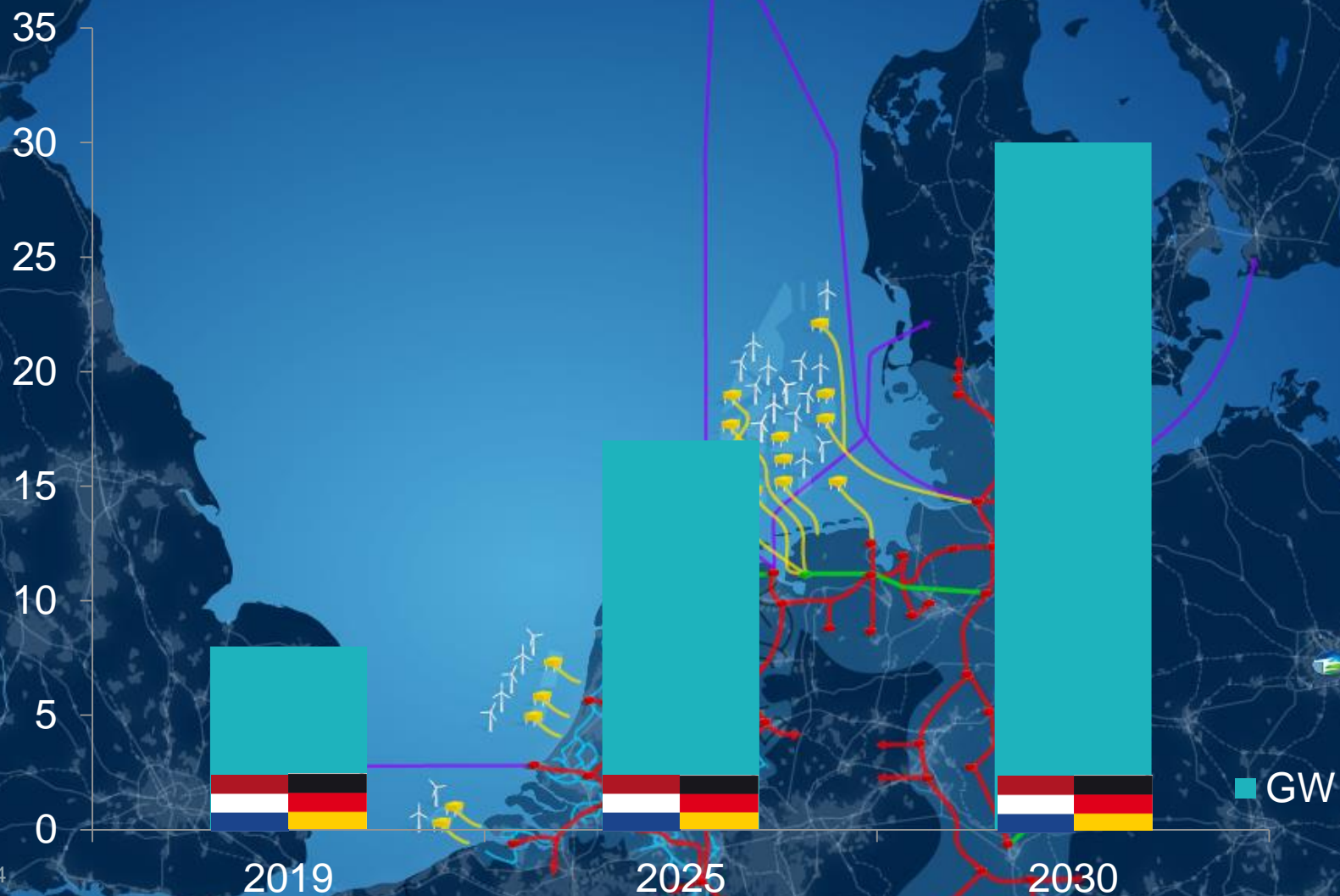
Public
Acceptance

Funds /
Economic
Cost





Bigger role for Offshore Wind



North Sea 2050 Vision



180 GW?



The modular Hub-and-Spoke concept is a technically feasible solution that can adapt to specific design requirements. The consortium is well placed to develop, build and operate Hub-and-Spoke projects.

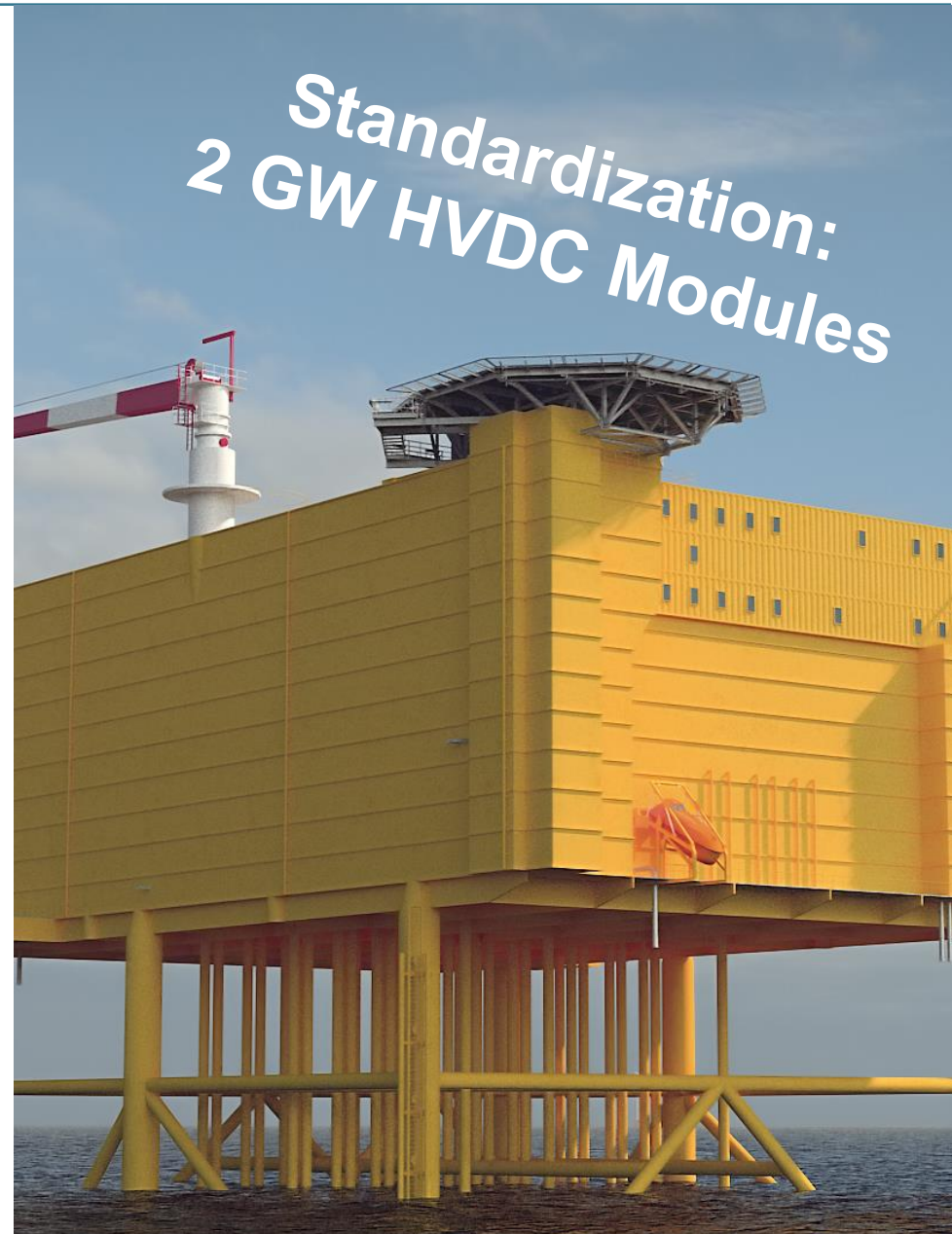
- | | | |
|------------------------------|-------------------------|----------|
| Electricity connection point | Gas to power conversion | End User |
| H2 connection point | Electricity connection | |
| P2X conversion | H2 connection | |



Cooperation...

Lessons Learned & Synergies

- Engineering, Planning & Construction
- Better Project Management
- Standardization
- Combined Purchasing Power
- Lower Maintenance & Overhead Expenses
- Offshore (spatial) Masterplan
- Sustainable Liability & Risk Rules

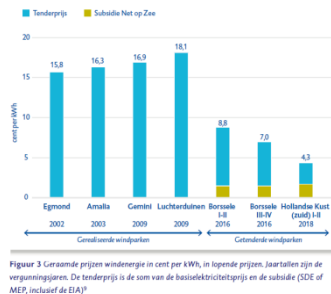




... pays off

Algemene Rekenkamer confirmed 40% cost reduction on offshore connections

Source: Algemene rekenkamer, Focus op kosten windenergie op zee, 2018



2013 Reference year
Average windfarm: 15ct/Kwh
□ wind farm cost: 12,5 ct/Kwh
□ **grid connection cost: 2,5 ct/Kwh**



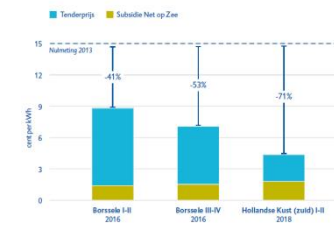
1,5 ct/Kwh



DNVGL: Offshore TSO model is cost-efficient

Source: DNV GL report 'Cost of offshore transmission', published 27 June 2019

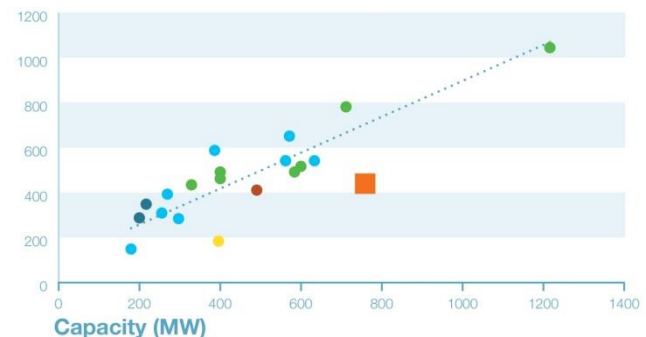
Ambitie van 40% prijsdaling wordt ruimschoots gehaald



Figuur 4 Tenderprijs en gesamde subsidiebedragen Net op Zee (ECN). In deze vergelijking werken we met bedragen die niet gecorrigeerd zijn voor inflatie. Als we wel een correctie voor inflatie toepassen dan wordt de vermindering 2 à 3 procentpunten groter

CAPEX (MEUR)

Normalised for 50 km offshore cable - 15 km onshore cable



Requirements more Offshore Wind



- Decisions 8 years ahead (routekaart 2030)
- Modular 2 GW expansion steps
- Pro-active electrification in coastal zones
- Onshore grid expansion incl. DC to load centers and interconnectors
- Power-to-Gas

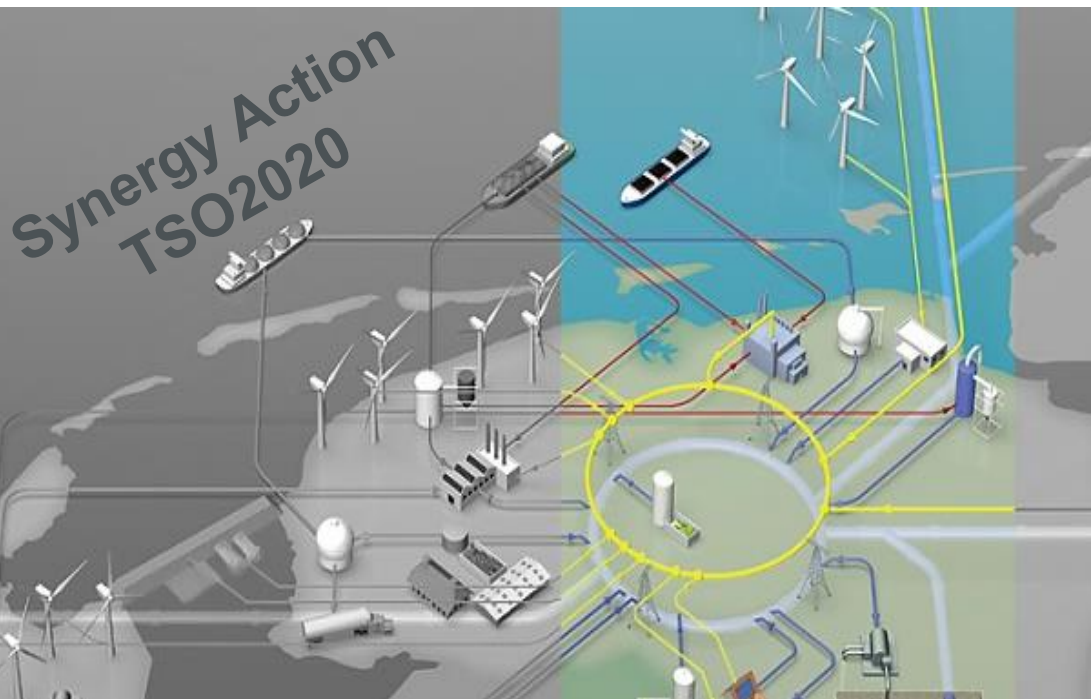
Electrification O&G platforms

...should be part of the solution



Power-2-Gas / Hydrogen

- Complete electrification is no option
- A complementary gas system provides flexibility & stability to the electricity system
- Electricity based gases allow for “greening” non-electrifiable sectors & industrial processes



“ElementOne” 100 MW



Elektrolyseur



Speicher



regenerativer
Windstrom



Wasserstoff



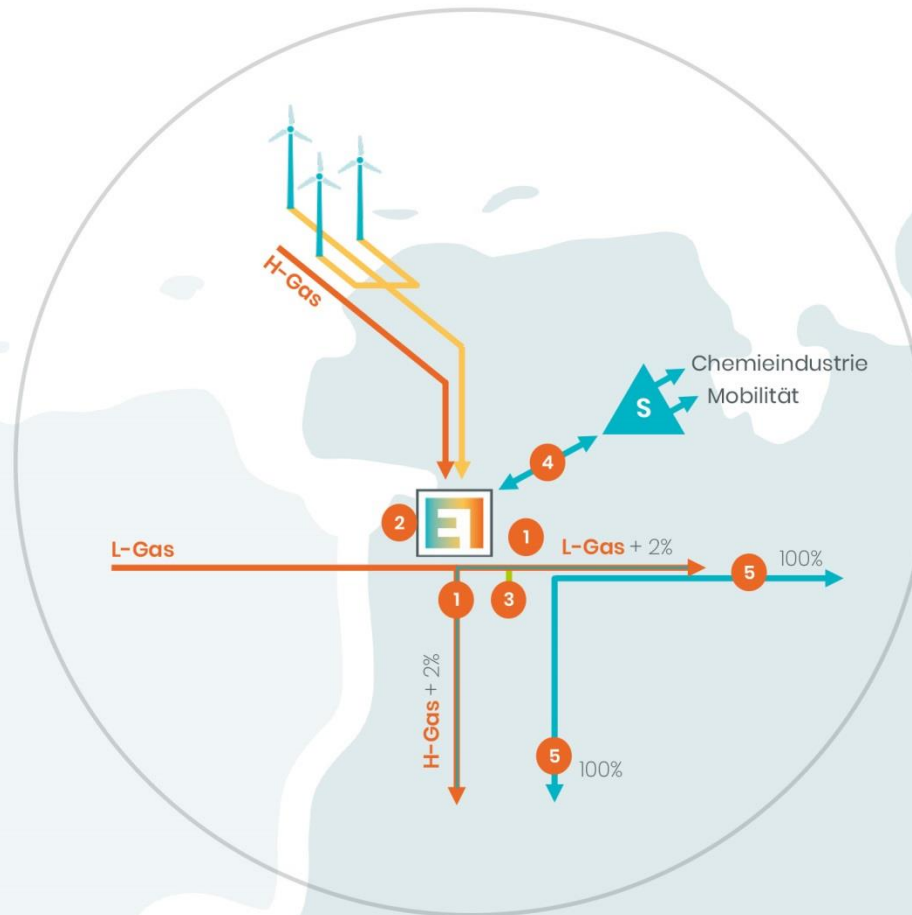
(normale) Erdgasleitung



Erdgasleitung mit einem
Wasserstoffanteil von 2%



synthetisches Methan



ELEMENTEINS
ENERGIEWENDE MIT
SEKTORKOPPLUNG

1

Einspeisung
2% Wasserstoff in
bestehende L- und
H-Gasleitungen

2

Optionale Bereitstellung von
Wasserstoff am Elektrolyseur
(u. a. Wasserstoff-Tankstellen,
Methanisierung in Biogas-

3

Methanisierung mit
biogenem CO₂ aus
Biogasanlagen

4

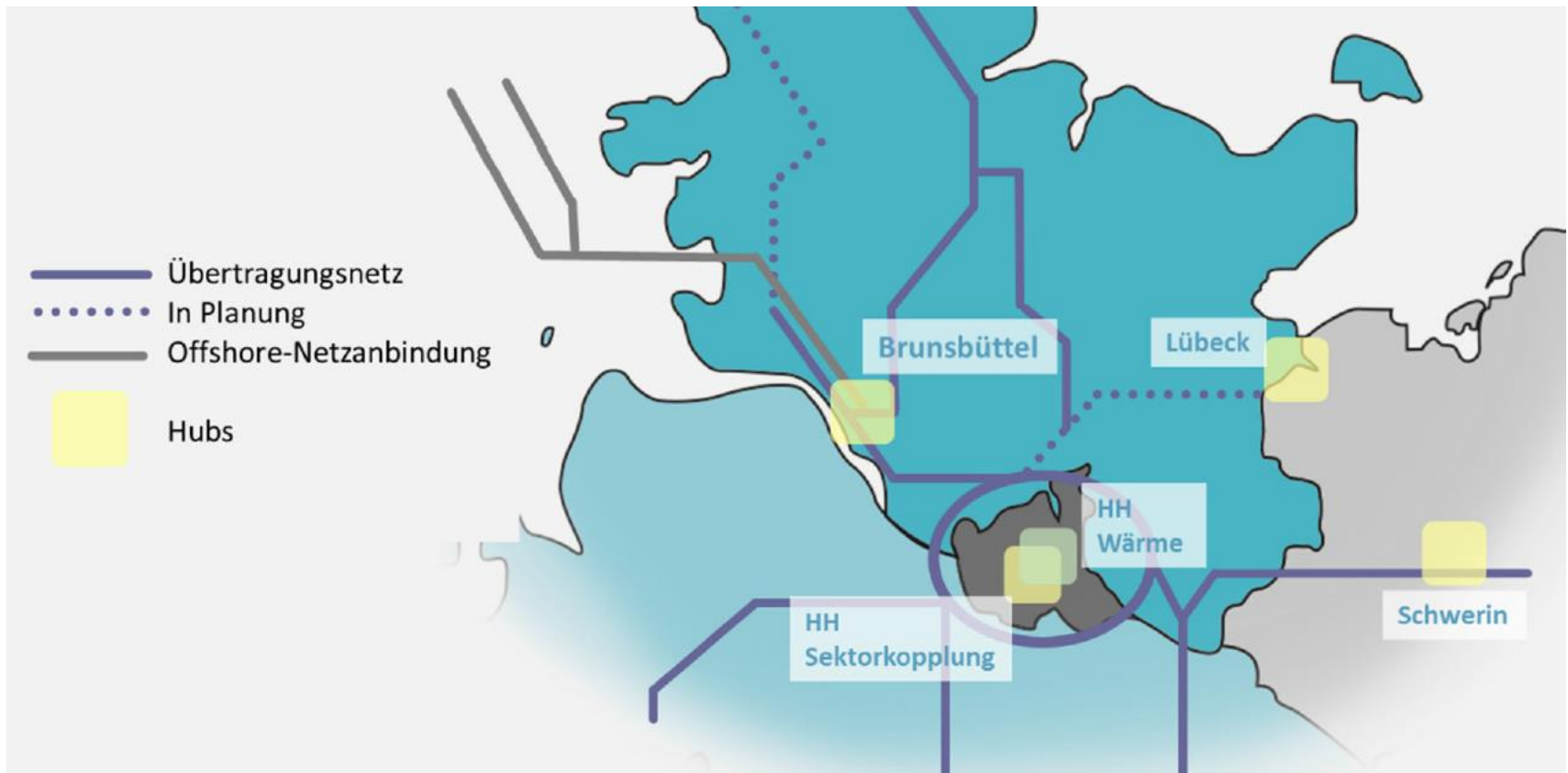
Einspeisung eines
Kavernenspeichers

5

Leitungssystem
mit 100% Wasserstoff

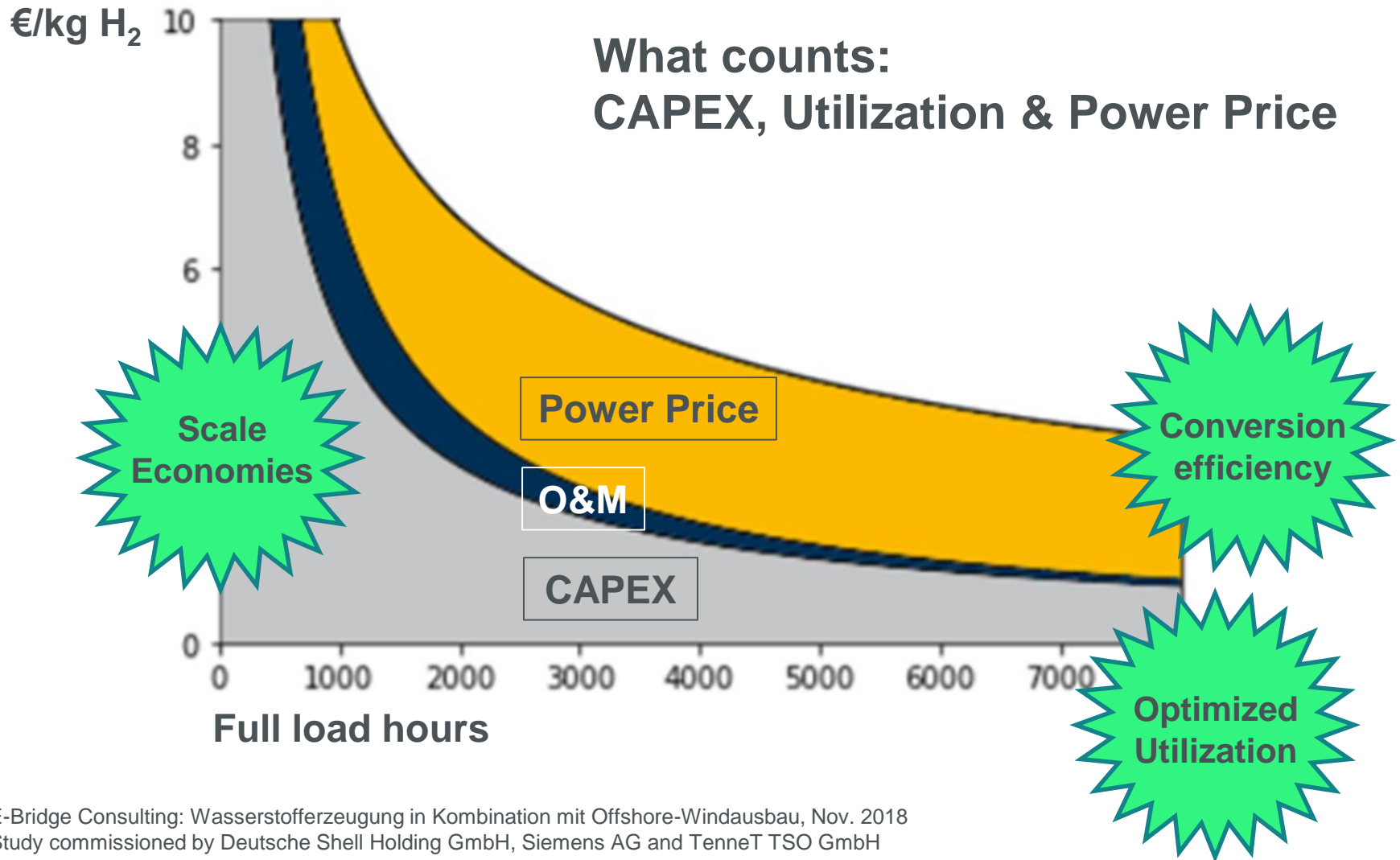
„Norddeutsches Reallabor“

Norddeutsches Reallabor – Hubs in & around Hamburg focus on **cross-sector usage of hydrogen & urban quarter transformation**





Hydrogen – A way forward (I)



Hydrogen – A way forward (II)



Wasserstoffherzeugung in Kombination mit Offshore-Windausbau

Im Auftrag von Deutsche Shell Holding GmbH, Siemens AG, TenneT TSO GmbH

Management Summary

27.11.2018

Parameter	Tender Model
Tender subject	MW offshore wind with minimum H production
Premium	EURO/kg Hydrogen
Duration	20 years
Selling market	No determination
Connection	onshore
Power transport	To be realized by TSO

In a nutshell

1

Ambitious climate goals & limits to green growth suggest even more offshore wind

2

Electrifying the North Sea requires a new level of x-border cooperation. Good news: X-border cooperation pays off!

3

Integrated system development is the key: Onshore/Offshore & Power/Gas

4

How to bring Hydrogen to the market in time & as cost efficient as possible?

5

Cooperation - The Netherlands & Germany to take the lead?





Infrastructure Outlook 2050

A joint study by Gasunie and TenneT on integrated energy infrastructure in the Netherlands and Germany



Home



Summary



Content



Introduction



Methodology



Scenario framework



Transport infrastructure



Infrastructure model



Conclusions



Appendices



www.tennet.eu

TenneT is a leading European electricity transmission system operator (TSO) with its main activities in the Netherlands and Germany. With approximately 22,000 kilometres of high-voltage connections we ensure a secure supply of electricity to 41 million end-users.

Taking power further