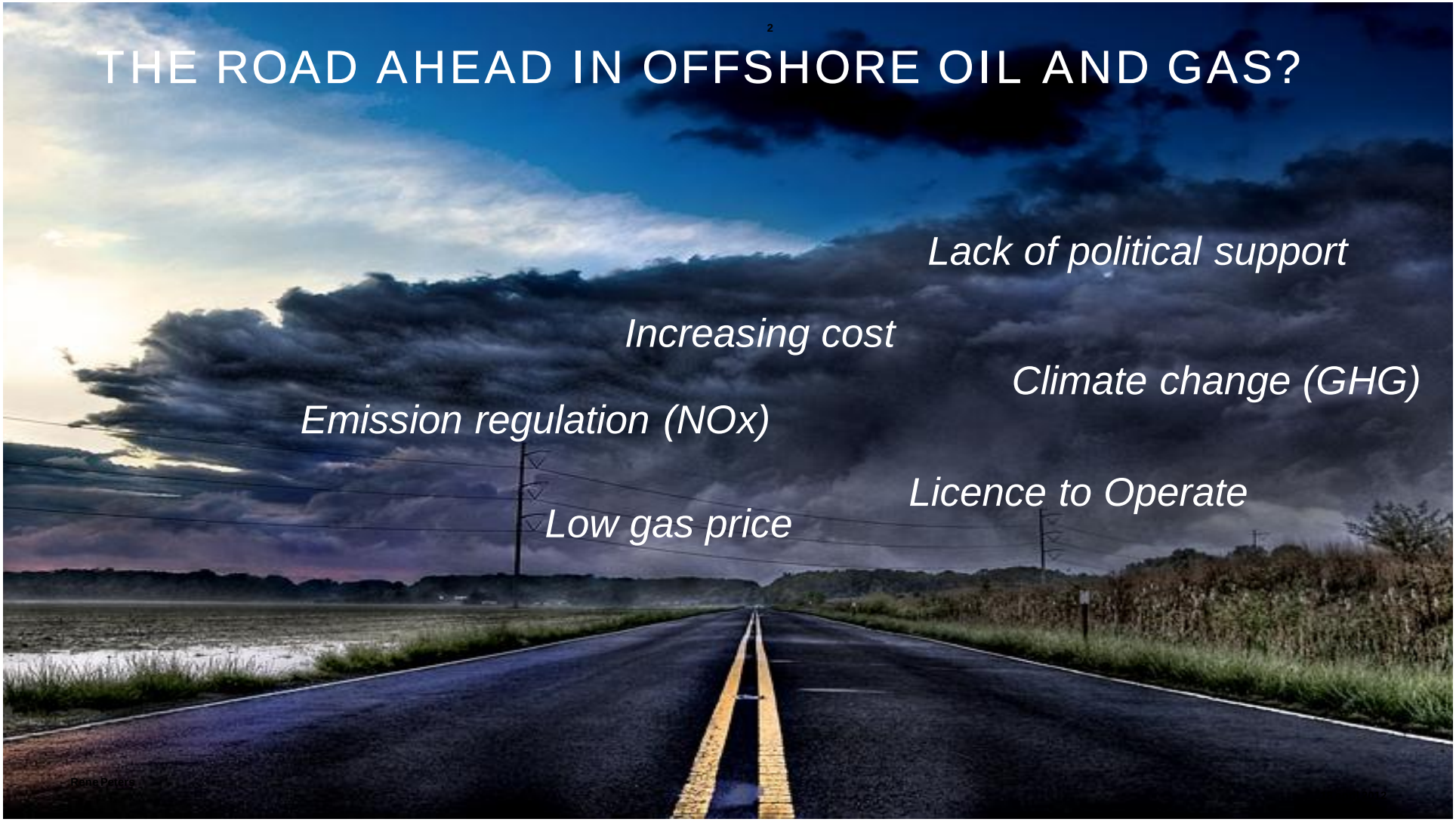
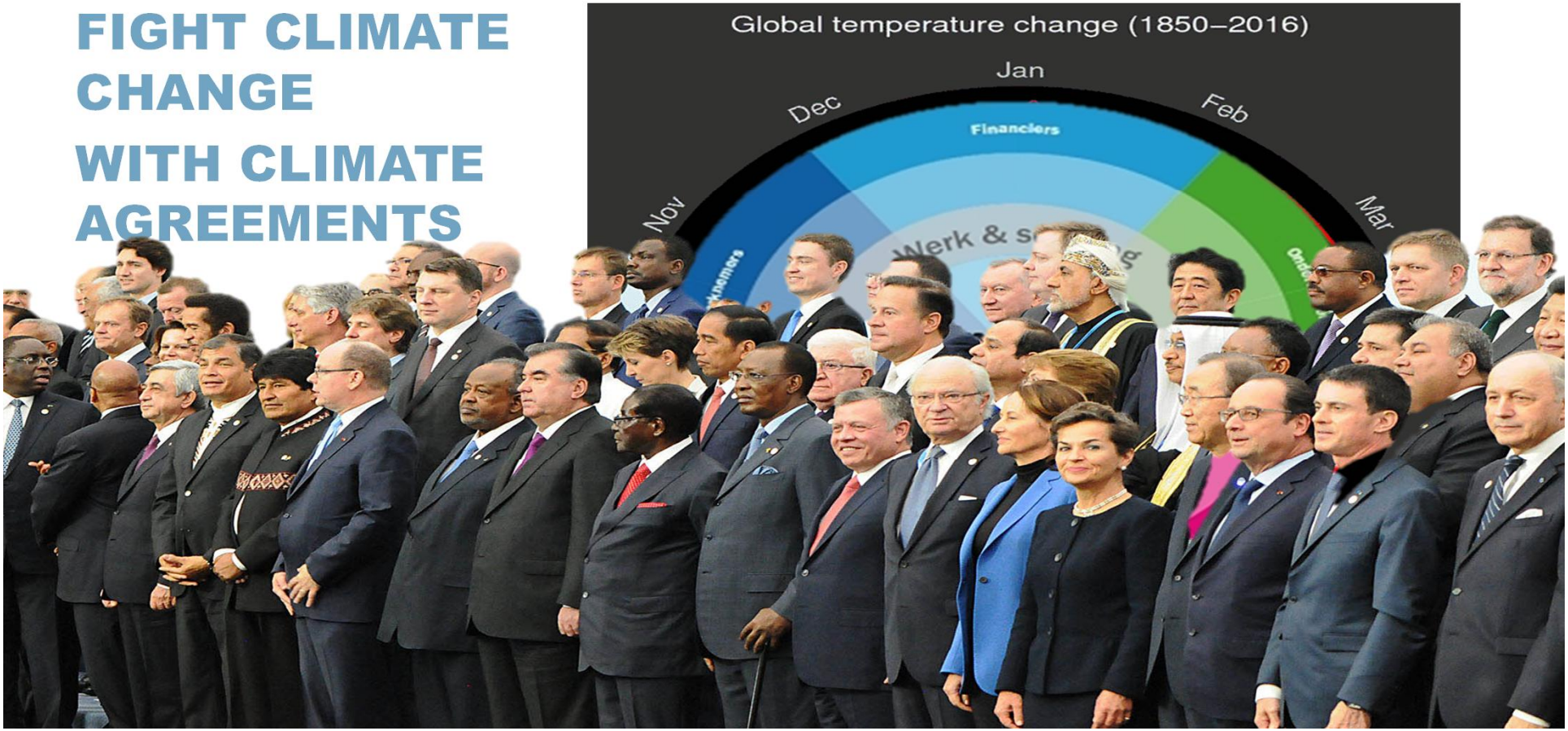

FINDING SYNERGY
IN OFFSHORE ENERGY
RENÉ PETERS – TNO ENERGY
TNO innovation for life

# THE ROAD AHEAD IN OFFSHORE OIL AND GAS?



# FIGHT CLIMATE CHANGE WITH CLIMATE AGREEMENTS



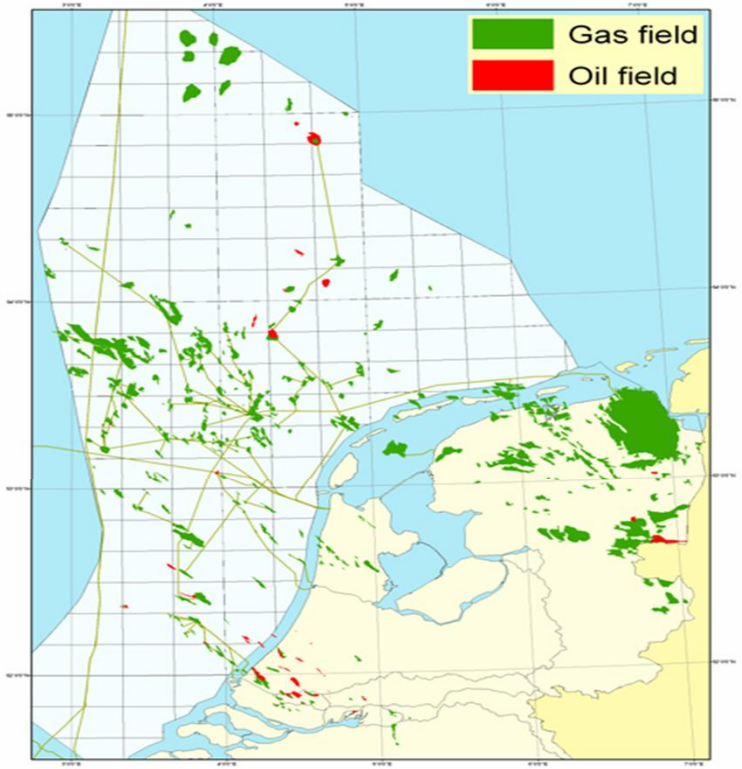
# CURRENT STATUS ON NATURAL GAS IN NL (2016)

**477 gas fields discovered** (on- & offshore)

- 253 in production
- 4 converted to gas storage
- **110** **depleted or seized production**
- 33 planned for production
- **77** **“stranded fields”**
- 148 platforms on the Northsea

Current reserves: 891 BCM (25 jr)
Of which ~665 BCM still in Groningen
Onshore: 109 bcm
Offshore: 117 bcm

Infrastructure (platforms and pipelines) are at maximum and will decline from now on!



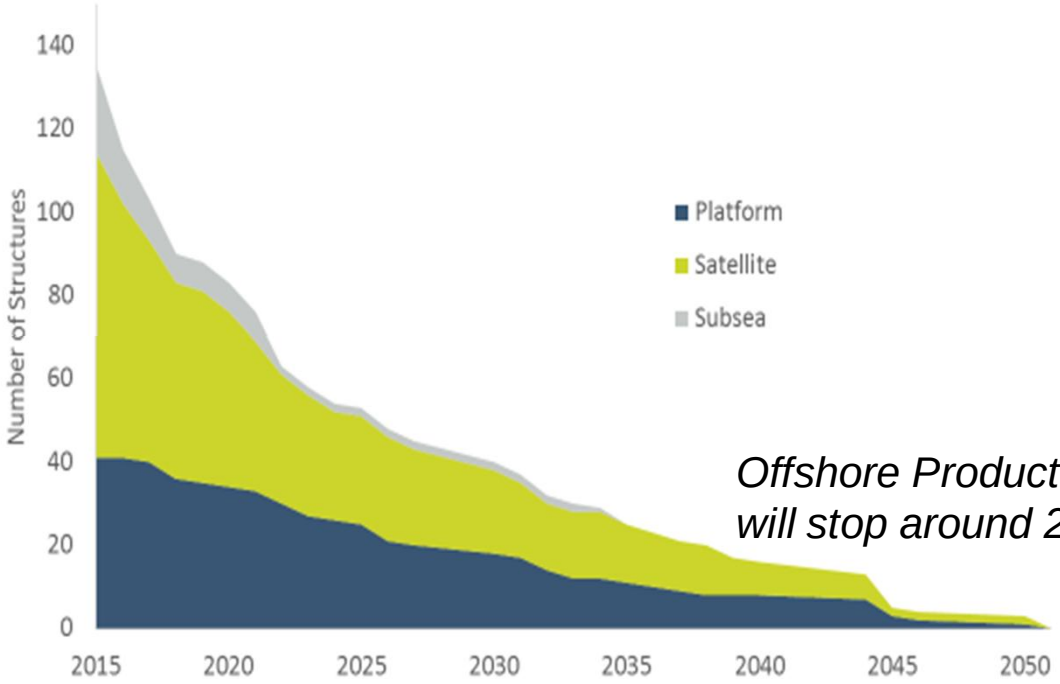

*Source: NLOG.nl report 2015*

# THE INDUSTRY IS PREPARING FOR DECOMMISSIONING

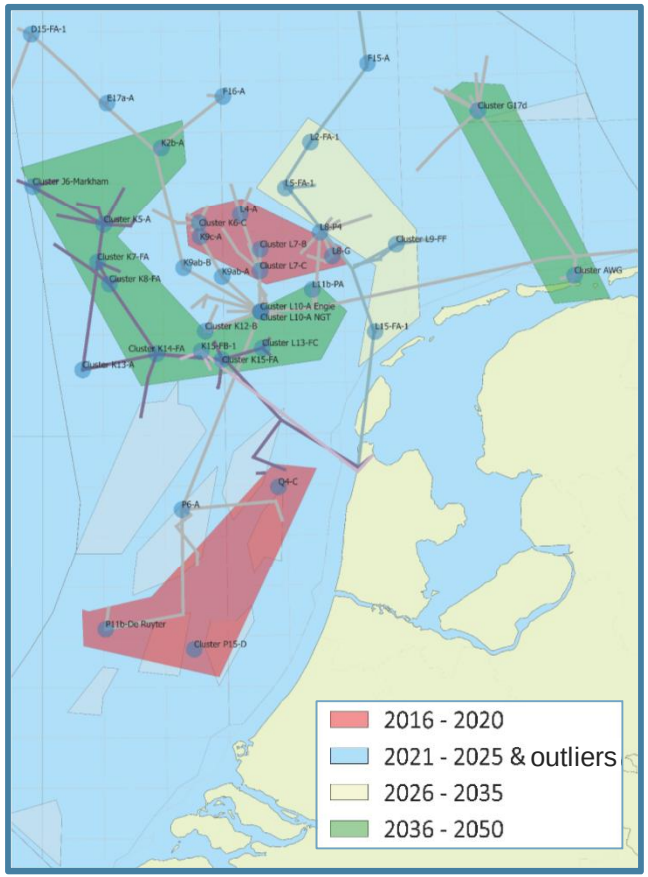
- High societal cost (EBN, tax regulation)
- Risk of Lock-out instead of Lock-in
- Impact on ecology from removal?
- End of life? (Economic or Technical)
- Any future use?
- Seeking for synergy?

# DECOMMISSIONING OF OFFSHORE INFRASTRUCTURE

- In a business as usual scenario (EBN 2016)

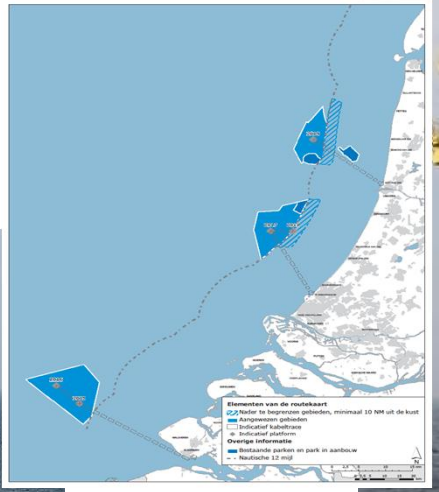



*Offshore Production will stop around 2050*



# DEVELOPMENT OF A NEW OFFSHORE ENERGY INFRASTRUCTURE

- At high societal cost (offshore grid)
- Spatial limitations
- Grid connections onshore
- Power balancing
- 3.5 GW until 2023
- Near shore
- No plan after 2023

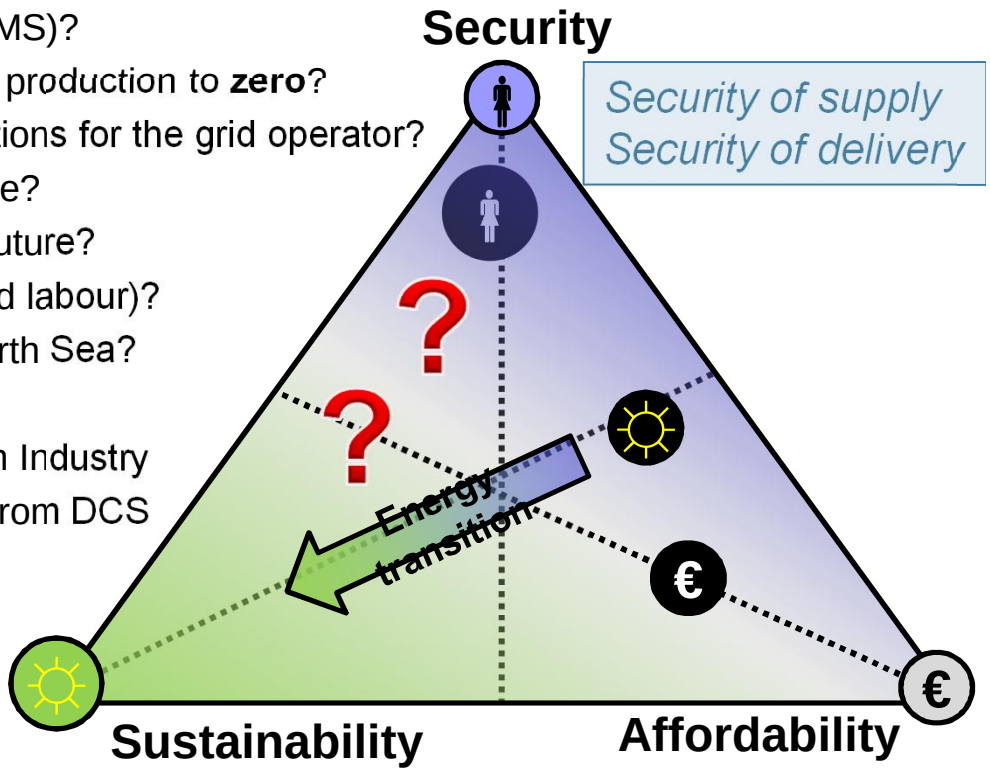




*Wind farm transformer station*

# OUR COMMON CHALLENGE IN OFFSHORE ENERGY

- Perform **better** than is imposed by legislation (BEMS)?
- Reduce GHG emissions from offshore oil and gas production to **zero**?
- Provide power **balancing** and energy **storage** options for the grid operator?
- **Enable** the development of an electric grid offshore?
- Create **space** for new offshore wind parks fo the future?
- Maintain our **economic value** to the society (€ and labour)?
- Stimulate **biodiversity** and the **ecology** of the North Sea?
- Maintain our **license to operate** in the North Sea
- Create new **business opportunities** for the Dutch Industry
- **Accelerate** the energy transition to clean energy from DCS



# VISION: FROM SEGREGATION TO INTEGRATION


How can we accelerate the energy transition cost effectively and with societal acceptance?

gasmeetswind
NORTH SEA ENERGY

SYSTEM INTEGRATION OFFSHORE ENERGY

COOPERATION IN THE NORTH SEA REGION

*SEARCHING FOR SYNERGIES*

# ALIGN DRIVERS FOR KEY STAKEHOLDERS

**Offshore Wind**



**Society**

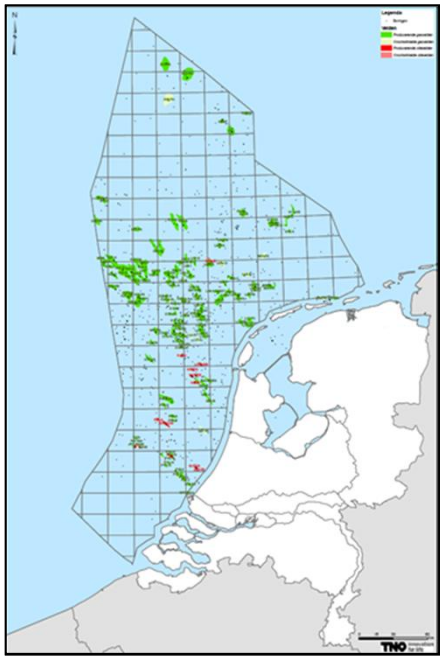

**Offshore O&G**

*Cost reduction*
*Emission reduction*
*License to Operate*
*Efficiënt spatial use*

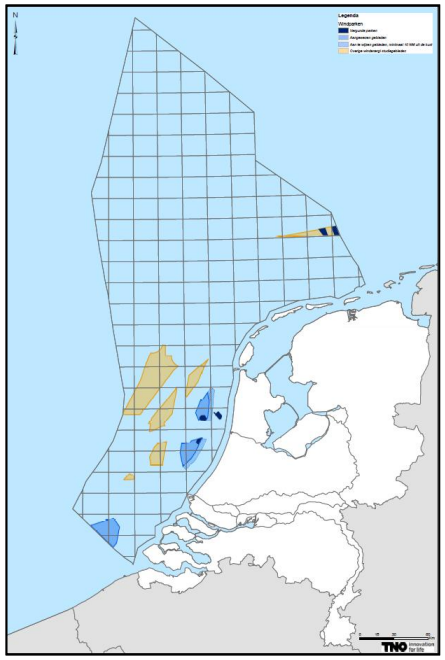
**SYSTEM INTEGRATION OFFSHORE ENERGY**

*Accelerated transition*
*Human Capital offshore*
*Stability offshore grid*
*Minimise societal costs*

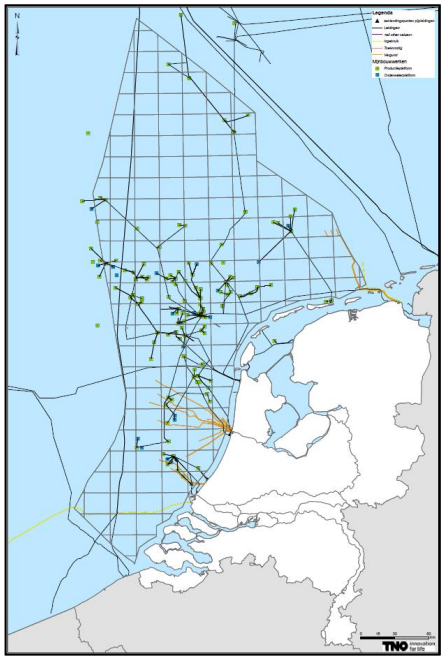
# INTENSIVE USE NORTH SEA LEAVES LITTLE SPACE



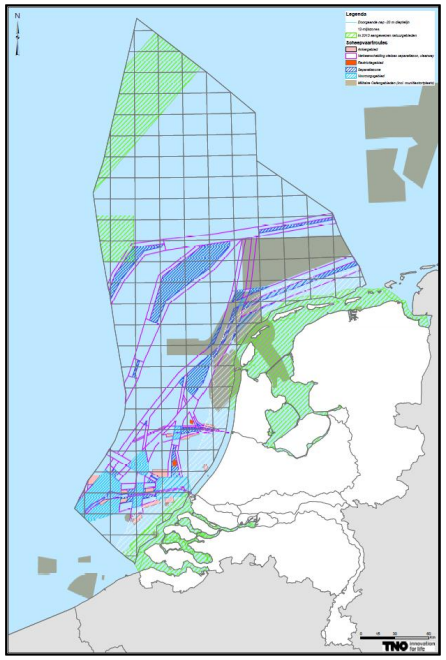
**Offshore Oil & Gas**



**Offshore Wind**



**Offshore Infrastructure**



**Excluded zones**

# HIGH PUBLIC INTEREST, I.E. POLITICAL PRESSURE

AD NEDERLAND BUITENLAND SPORT SHOW REGIO MEER AD

PLANET ENERGIE

**Oliebedrijven en TNO: gebruik booreilanden voor windparken op zee**

Aanbevelen Delen 98 Tweet G+1 0

David Bremmer
10-3-16 - 07:00

BEWAAR ARTIKEL

GERELATEERD NIEUWS


'Afgedankt booreiland weer afzinken op de zeebodem'


Dode en gewonden door storm op Noors boorplatform


Derde windpark Noordzee draait officieel

fd. Home Mijn nieuws Laatste nieuws Krant Beurs Meer

OPINIE

Tekst Krant 4 434

**Oude infrastructuur Noordzee biedt nieuwe kansen**

Rene Peters
woensdag 16 maart 2016, 20:30

NOS Nieuws Sport Uitzendingen

TELEFIRST AEX 305 km 21°

**'Gebruik overbodige Noordzeeplatforms voor opslag windenergie'**

ZA 30 APRIL, 18:34 BINNENLAND

Olie- en gasbedrijven moeten hun afgedankte Noordzeeplatforms niet opruimen, maar ze gebruiken om windenergie mee op te slaan. Onderzoeksinstituut TNO ziet daarin een duurzame oplossing voor de platforms die de komende jaren overbodig worden doordat de olie- en gasvelden leeg raken

GESCHREVEN DOOR
Heleen Ekker
Redacteur

# OPPORTUNITIES INTEGRATION OFFSHORE ENERGY

**Short term 2015 - 2023**

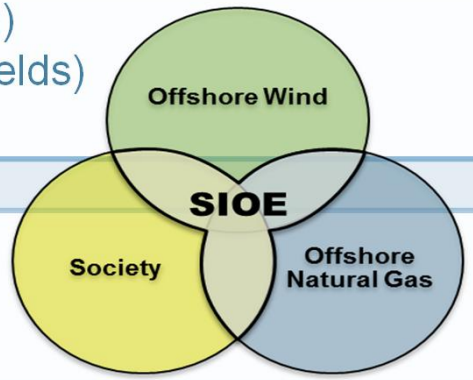
- Electrification of oil and gas production
- Elimination of NOx, SOx and $CO_2$ emissions
- Development of an offshore electricity grid

**Medium term 2023 - 2030**

- Offshore Power to Gas for peak shaving (H2 production)
- Gas 2 Wire (with CCS) for power balancing (stranded fields)
- Integration of infrastructure for offshore wind

**Logn term 2030 - 2050**

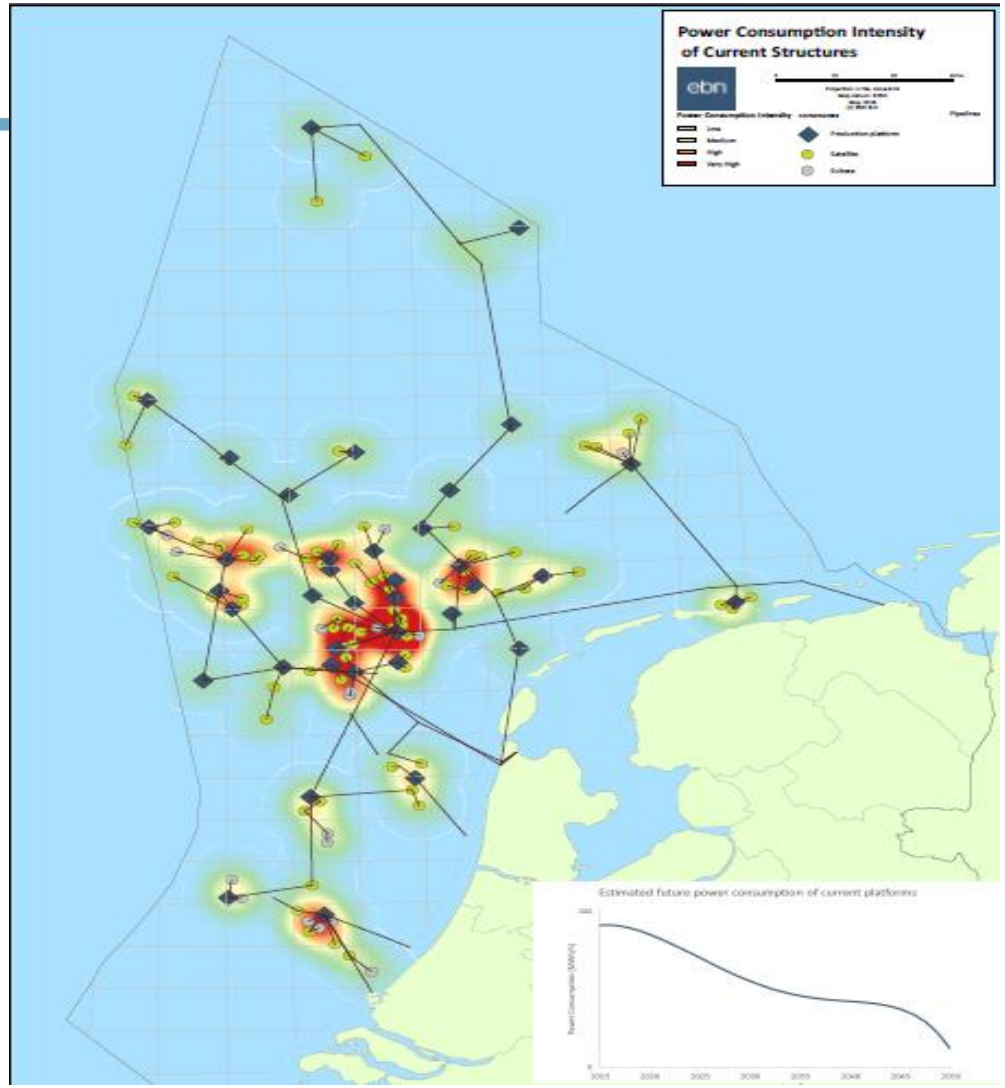
- Reuse of infrastructure for offshore wind (substations)
- Energy conversion and storage
- Use of the gas grid for energy transport (H2 or SNG).




*System Integration in Offshore Energy*

# POWER CONSUMPTION OFFSHORE PLATFORMS

- Hotspots of power use in central Northsea
- Close to Ijmuiden-Ver future wind park
- Potential for electrification offshore wind
- Potential for energy balancing/conversion (P2G)
- Potential for grid use for energy transport

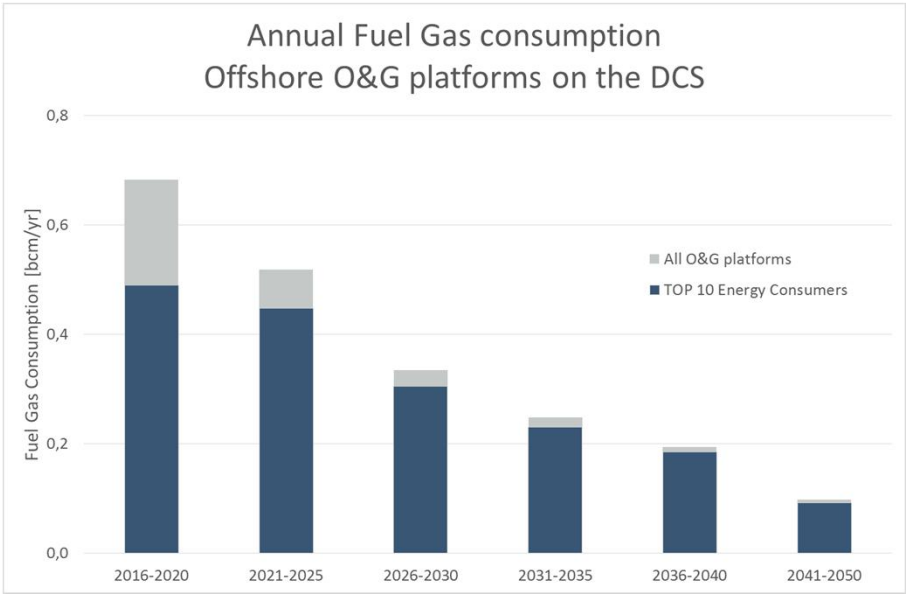


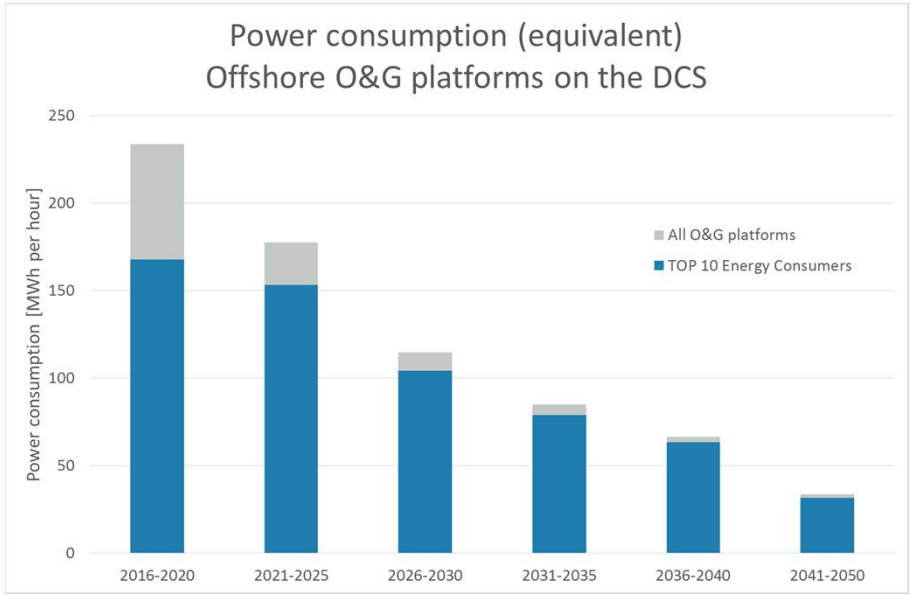

*Source:*

ebn SIEMENS TNO

# CURRENT USE OF FUEL GAS TO POWER PLATFORMS

- Offshore power use dominated by top 10 platforms

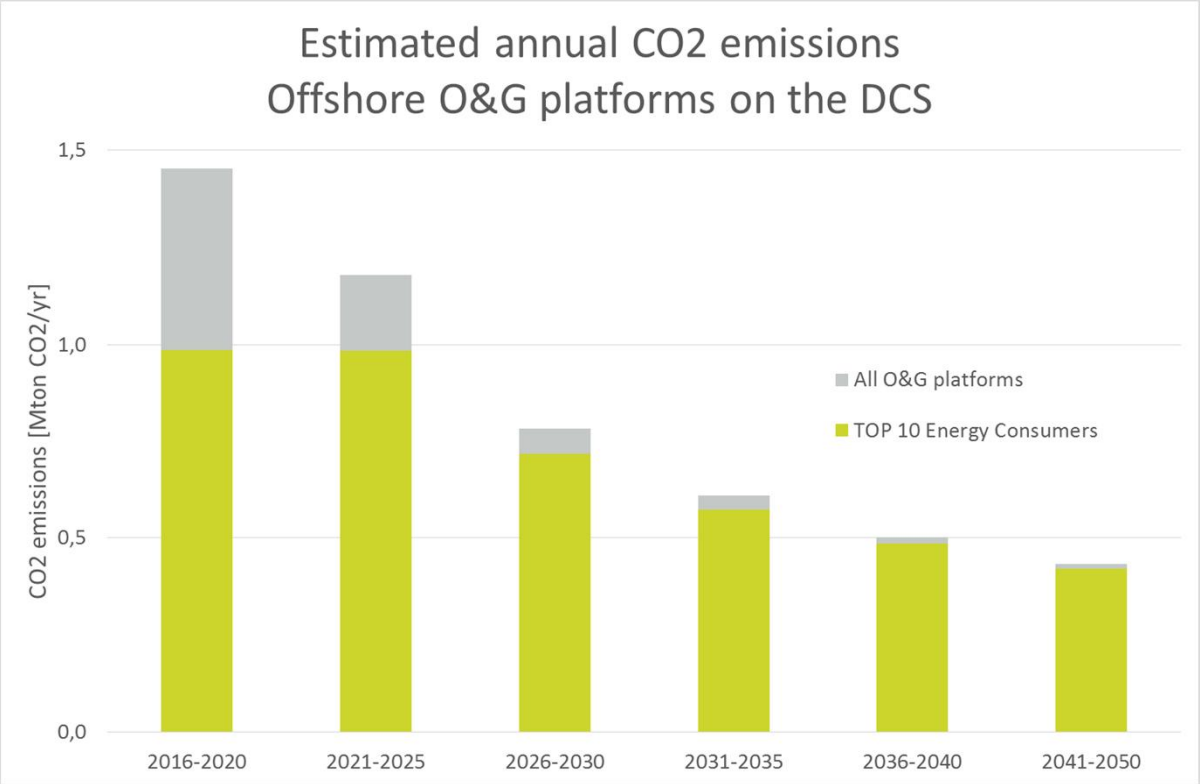



*Source EBN (2016)*

# HUGE POTENTIAL FOR CO2 EMISSION REDUCTION

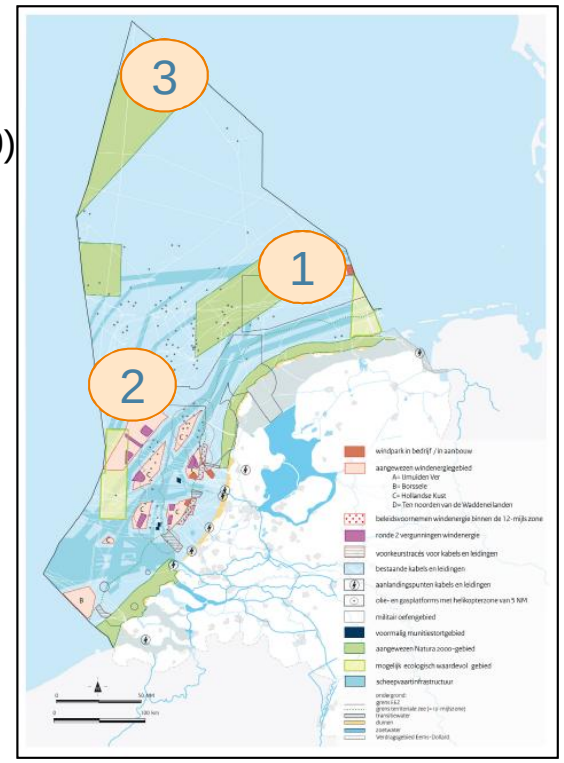
- Top 10 platfoms can realise 1 Mton/yr CO2 emission reduction
- Equal to 3% of the NL target for 2023
- Equal to ambitions ROAD CCS project
- And produce 0.5 BCM/yr more gas to shore (3%)

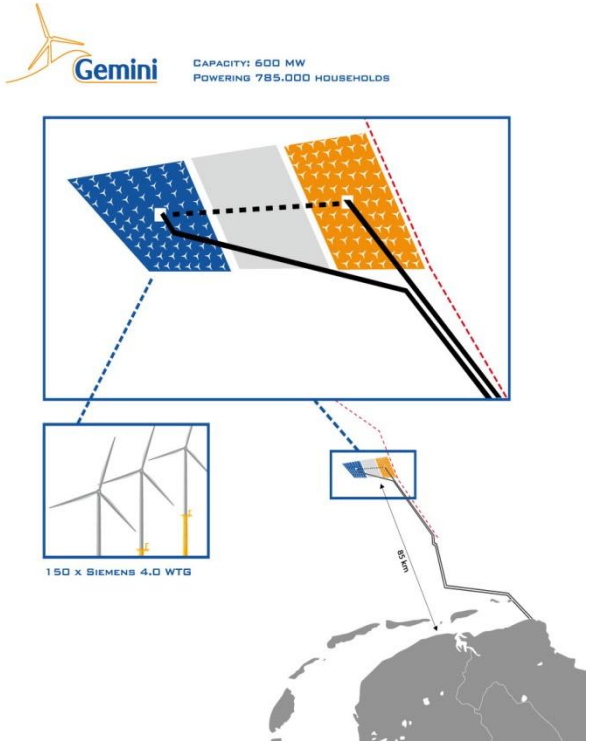


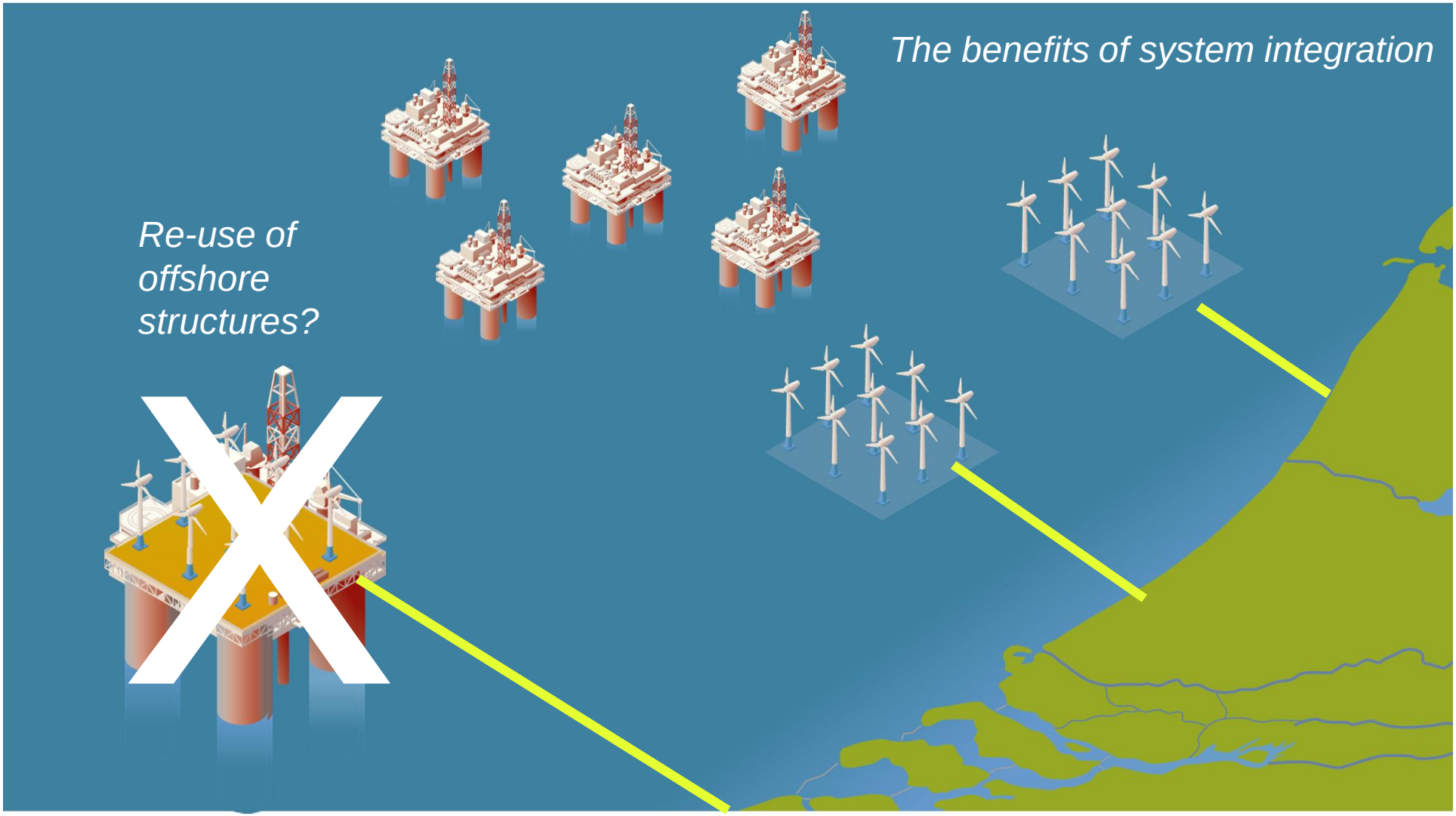
# BEST OPPORTUNITIES FOR ELECTRIFICATION AND INTEGRATION

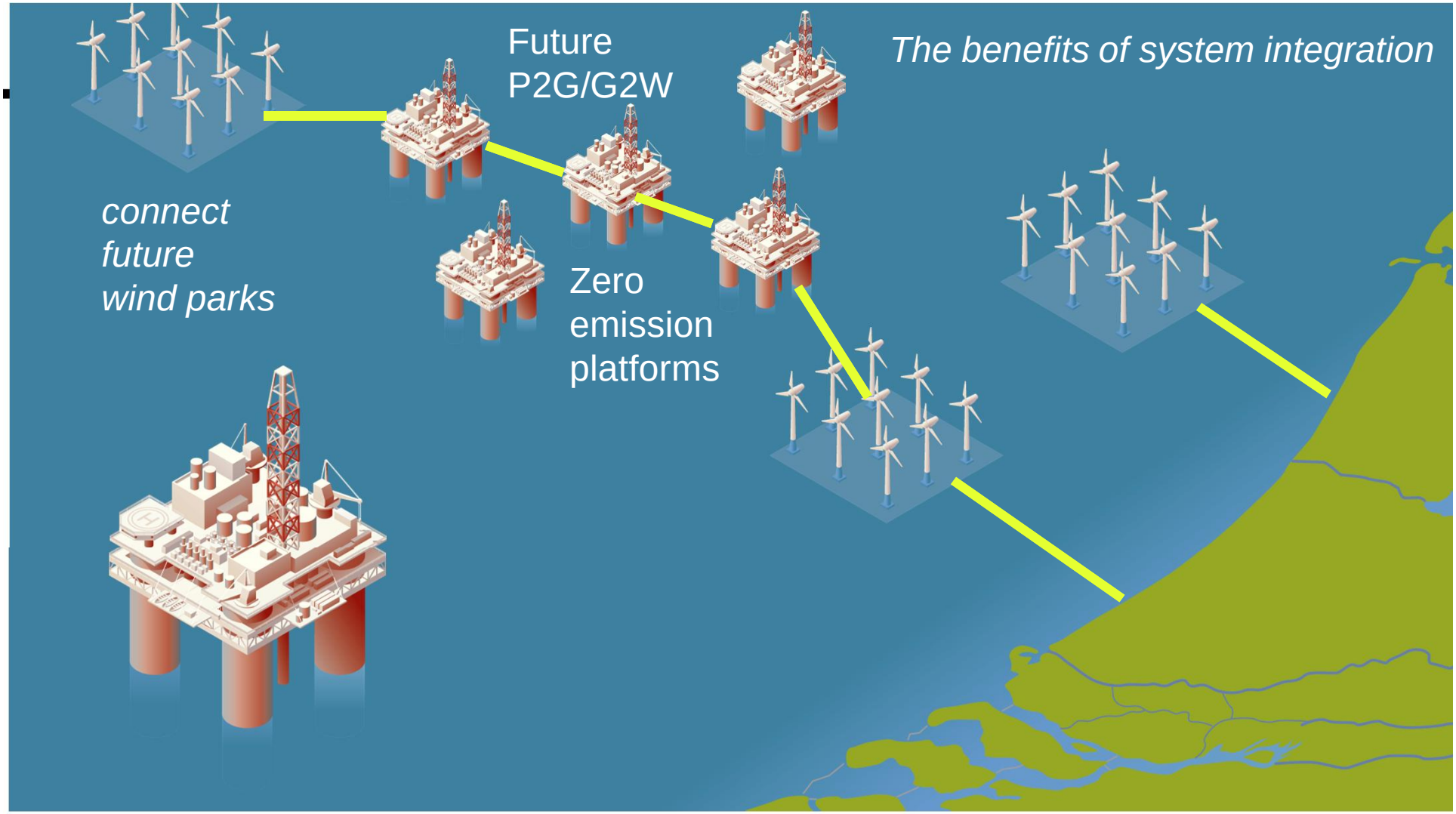
Electrification of Platforms

- 1: ST - Gemini windpark (< 2020)
- 2: MT - IJmuiden Ver (< 2025)
- 3: LT – Doggers bank (< 2030)



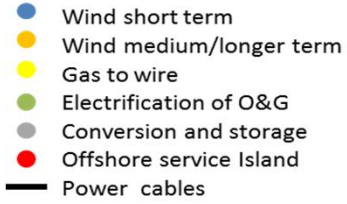



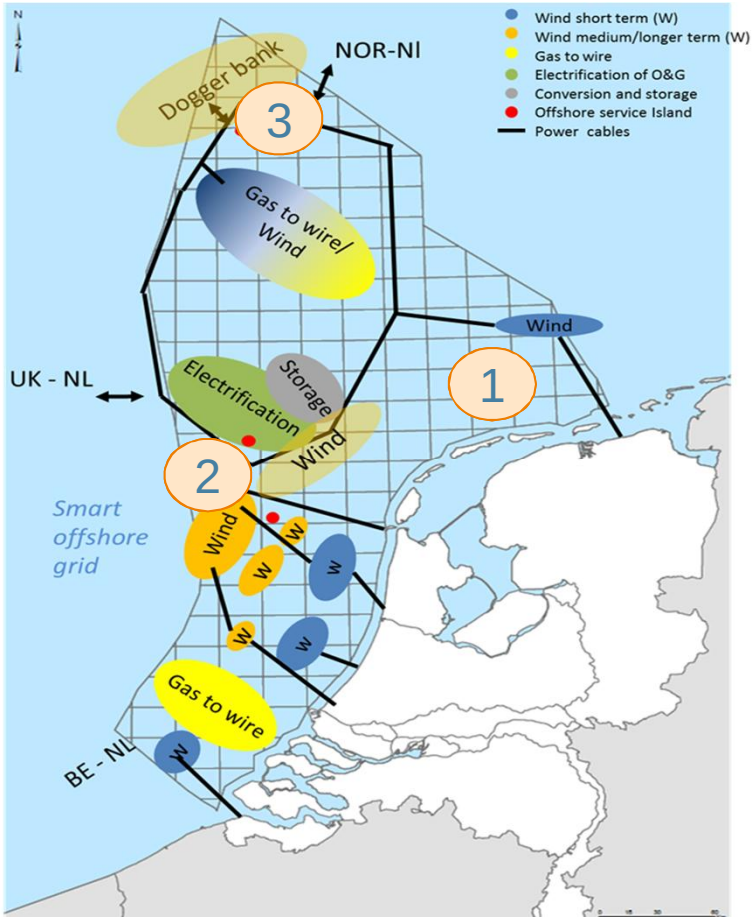

The benefits of system integration
Re-use of offshore structures?


Future
P2G/G2W
The benefits of system integration
connect
future
wind parks
Zero
emission
platforms

# NORTHSEA ENERGY VISION

- Electrification of the platform will enable the development of an offshore grid
- After electrification the Northsea can be a clean energy source combining offshore wind and offshore gas.
- The next step is use the gas and electricity grid for energy balancing and storage
- On the long term infrastructure can be reused or integrated



# CONVERT EXCESS POWER INTO HYDROGEN
# POWER TO GAS - DEMO PROJECTS GERMANY

**WindGas Falkenhagen** — *in operation*

- 2 $MW_{el}$ / 360 $m^3/h$ $H_2$ **Alkaline electrolysis**
- $H_2$ injection in gas transportation pipeline

**WindGas Hamburg** — *in operation*

- 1.5 $MW_{el}$ / 290 $m^3/h$ $H_2$ **PEM electrolysis**
- $H_2$ injection in gas distribution pipeline

## Power to Gas

H2

- to store energy
- to source H2 network
- as a product for chemical industry

Next step:

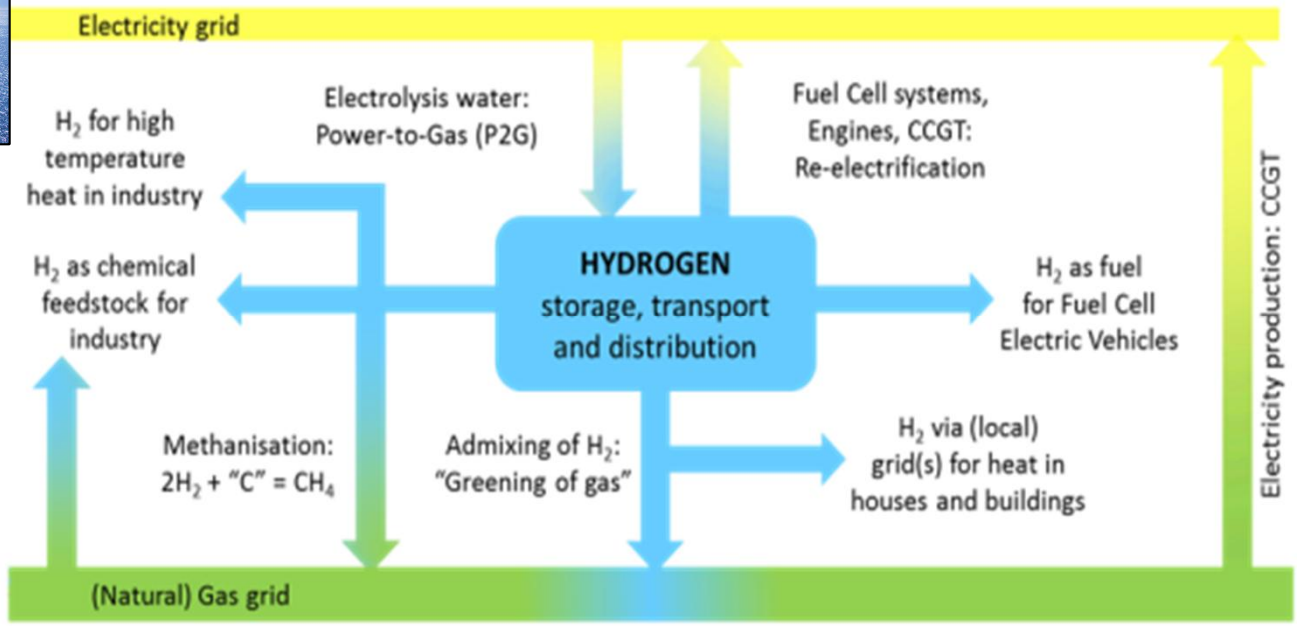
- Power to methane
- Power to methanol
- Power to DME
- Power to Ammonia

$$2\,H_2O_{(l)} \xrightarrow[Electrolysis]{} 2H_{2(g)} + O_{2(g)}$$

*Source: Uniper (2016)*

# OFFSHORE P2G AND G2W FOR POWER BALANCING

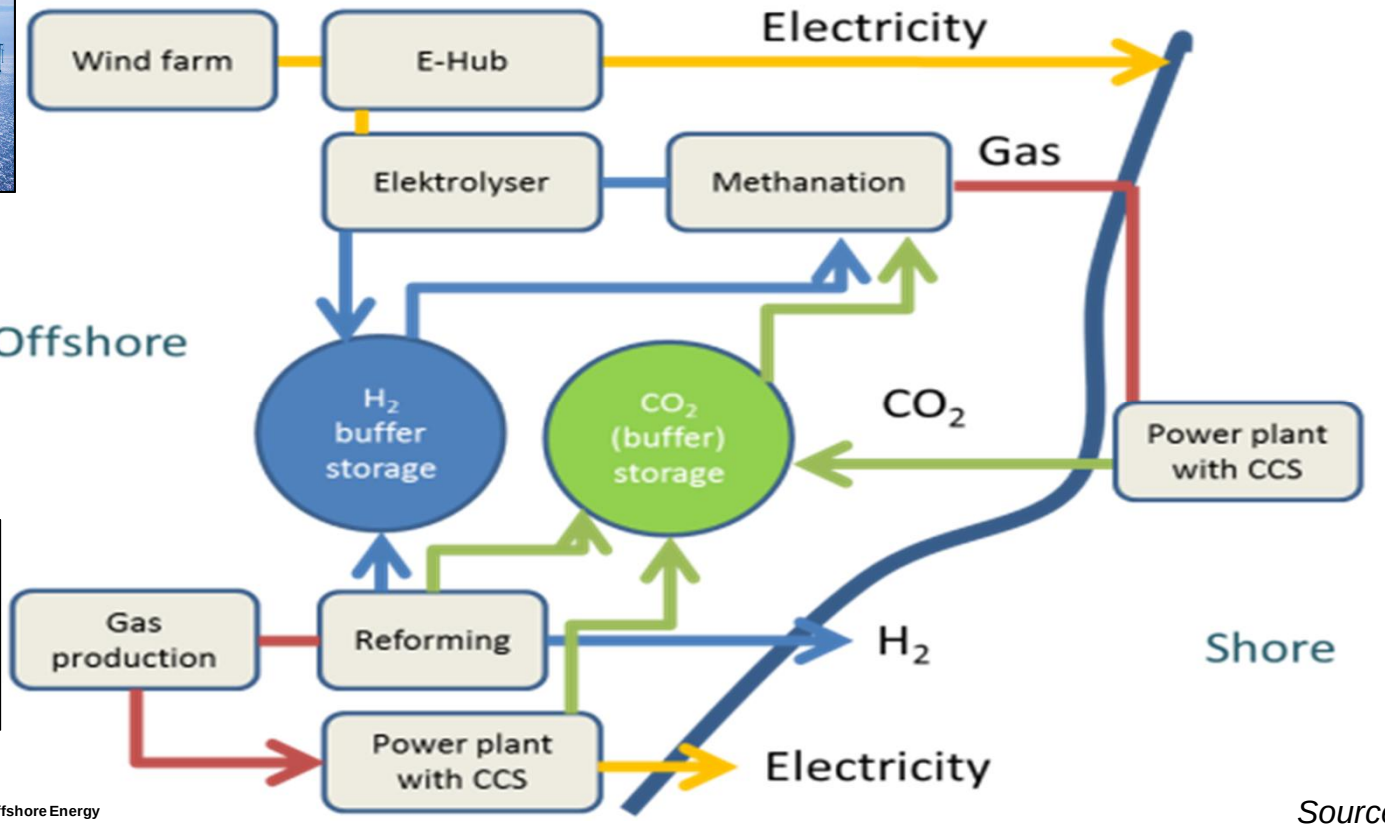
*Balancing the offshore grid*




*Use the gas network for energy transport to shore*

*Produce H2 for direct use in transport or industry*

# FUTURE OFFSHORE CLEAN ENERGY SYSTEM






*Source: EDI/RUG 2015*

# LONG TERM OPTIONS FOR INTEGRATION OFFSHORE WIND AND GAS

Energy Island concept (TenneT)

# FUTURE ENERGY CONCEPTS

*Aqua farming*

Creative ideas?
Contribute to the North Sea Energy Challenge:
See: www.northsea-energy-challenge.com

*Tourist attractions*

*Next step:*

# PROGRAM NORTHSEA ENERGY INNOVATION

- Collaboration to grasp opportunies for synergy between offshore oil and gas and offshore wind
- Multistakeholder involvement
- Public Private Partnership – Topsector Energy, Industry, Academia, NGO
- Coordinated by TKI Gas and TKI Wind
- Collaboration of knowledge partners
- Develop a vision on a future North Sea Clean Energy System
- Realise innovations to make it happen
- Start 2017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NORTH SEA ENERGY

COOPERATION IN THE NORTH SEA REGION

*SEARCHING FOR SYNERGIES*

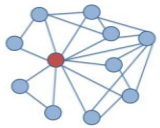
# INNOVATION PROGRAM FOCUS AREAS

**Strategic Spatial Planning**
Spatial synergies
Scenario development
Restricted areas

**Society and Governance**
Human Capital
Public Participation
Regulations

SIOE

**Physical Network**
Connections
Nodes
Services
Maintenance



**Health, Safety & Environment**
Health and Safety
Emissions and Environment

# PARTIES CURRENTLY INVOLVED IN INITIATIVES RELATED TO NORTH SEA ENERGY

# GUIDANCE FROM OFFSHORE ENERGY COORDINATION GROUP

**Jo Peters**
- Secr. General
- Branch oil and gas

**Hans Timmers**
- director
- Branch wind sector

**Tjerk Wagenaar**
- director
- NGO

**Paul de Krom**
- CEO
- Research and Technology Insitute

**Mel Kroon**
- CEO
- Offshore grid operator

**Niek Jan van Kesteren**
- VNO - NCW

NWEA NOGEPA TNO innovation for life TenneT Taking power further NATUUR & MILIEU

**MANIFESTO**

**Declaration of Coordination and Cooperation in the North Sea region**

If there is one area where the energy transition is visibly taking shape, it is the North Sea region. In the next decades fossil exploration and production will diminish, while renewable energy production is growing. In the short and medium term, fossil fuels and renewables will coexist for some time. With this in mind the offshore North Sea oil and gas operators on the Dutch continental shelf, the offshore wind sector and NGO's, have joined forces and declare that they will collaborate in order to contribute to a safe, sustainable, reliable and affordable energy system in balance with improving eco-systems. We believe that such joint effort will generate benefits for the society as a whole (People), the environment (Planet), as well as the operators involved (Profit).

Considering the North Sea region as an extensive source of energy, our joint efforts will be targeted at innovation to speed up the energy transition. In developing an integral long term vision (till 2050) and a call to action (till 2030) we include all North Sea stakeholders, such as companies, governments and the public in the surrounding countries, as well as parties with a stake in nature, agriculture, fishery, navigation, restoring the eco-system etc.

We agree that we will explore the possibilities of Coordination & Cooperation in the North Sea region, such as:

- Aligning related initiatives that have the potential to create synergy, e.g. the joint use of logistics and mobility and mutual understanding of data;
- Joint innovation and research: support of the development of the North Sea as a sustainable source of energy and, for that, cooperation with the Topsector Energy Innovation Programmes. Joint analysis of the potential of electrification of offshore platforms and of required safety areas around platforms. Innovation aimed at system-integration, power2gas, energy-storage, E-grid and improving ecosystems;
- Joint Communication: aimed at societal and political support that helps to harvest synergies;
- Community building: creating a broad council to share interests, expertise, products, data and logistics in support of the energy transition.

NOGEPA, NWEA, TENNET, TNO and Stichting Natuur & Milieu will form a steering committee to further investigate the possibilities. In order to realize a sustainable and integral result, the committee operates in close contact with the SRI (Social Responsible Innovation) -Lab of the Dutch Topsector Energy in which the many stakeholders in the North Sea region will participate.

Signed June 15th 2016, Rotterdam

Hans Timmers, NWEA
Jo Peters, NOGEPA
Niek Jan van Kesteren
Paul de Krom, TNO
Mel Kroon, TENNET
Tjerk Wagenaar, Stichting Natuur en Milieu

gasmeetswind
NORTH SEA ENERGY SYMPOSIUM


WIN(NING) + WIN(D) = WIN(ST)
TNO innovation for life
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# MEDIA EXPOSURE


*FD article March 2016*

*Opening NOS journaal 30 april 2016*