



### Strategies towards an Efficient future North Sea Energy Infrastructure

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### **Motivation**

### System integration options Strategies

# The case of Dutch North Sea region (1/2): *ECN* Offshore wind is **growing** rapidly ...

Designated areas--> 4.5GW in 2023



 Vision beyond 2023: combined offshore wind and transnational grid development



Source: TenneT, 10 June 2016, Retrieved from: tennet.eu/nl/news/article/tennet-presents-hub-andspoke-concept-for-large-scale-wind-energy-on-the-north-sea.html

Source: Beleidsnota Noordzee 2016-2021, Noordzeeloket.nl

# The case of Dutch North Sea region (2/2): $\notin ECN$ ... while offshore gas production is in **decline**



TNO, Shell, Siemens, EBN. (2016). System Integration Offshore Energy: Innovation Project North Sea Energy. Retrieved 11 02, 2016, from https://www.tno.nl/media/8512/system\_integration\_offshore\_energy\_final-report\_tno\_r11234.pdf



Proportionally profiled production allowance Groningen accumulation (2011 - 2020)

Expected supply Groningen accumulation based on production plan (from 2021 onwards)

- Expected supply from as yet undiscovered accumulations
- Expected supply from aContingent Resources (PRMS)
- Expected supply from Reserves (PRMS)
- Be Historical production Groningen Field
- B Historical production 'small fields'

Source: Dutch Ministry of Economic Affairs. (2016). Delfstoffen en Aardwarmte in Nederland, revisie 1. Retrieved 12 21, 2016, from http://www.nlog.nl/jaarverslagen



#### Challenges for offshore wind and gas



- > Offshore system integration may resolve challenges and bring additional benefits
- Systematic overview in the many options is needed



#### Support for offshore system integration

#### > June 6, 2016, EU Energy Council:

"North Sea Declaration" - Regional coordination on offshore energy

June 15, 2016, Oil and gas producers (NOGEPA), NWEA, Natuur en Milieu, TenneT, TNO: "Gas meets Wind" - Declaration of Coordination and Cooperation in the North Sea Region

> June-Dec. 2016: Project SENSEI "Strategies towards an Efficient future North Sea Energy Infrastructure





## Motivation **System integration options** Strategies

### System Integration Options: SENSEI project



Development of large-scale offshore wind can be integrated with offshore gas infrastructure along the following main options:



### System Integration Options: Assessment framework (qualitative)

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#### System Integration Options: Base case





### System Integration Options: Offshore gas platform electrification

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#### System Integration Options: Power to Gas





#### System Integration Options: Offshore CCS







#### Summary of drivers and barriers

#### Main drivers:

- Higher market value for offshore wind from increased flexibility and reliability
- Lower development costs for offshore wind through savings on grid infrastructure
- Higher offshore gas production at lower operational costs
- Reduction of GHG emissions

#### Main barriers:

- Regulations (e.g. spatial planning, tight time schedules, support schemes)
- Uncertainty in market prices (electricity / gas / CO<sub>2</sub>) lead to uncertain business case
- Development needed on offshore conversion technology
- Public acceptance



## Motivation System integration options **Strategies**



### Development strategies (1/2)

Time horizon System integration options	Short-term <2023	Mid-term 2023 - 2030	Long-term 2030 - 2050
Electrification	Platform electrification near-shore	Platform electrification, far-offshore & stand-alone	Platform electrification, offshore grid
P2G / P2X	Power2Gas, onshore (demo)	Power2Gas, offshore	Power2X, offshore
ccs	CCS + electrification near-shore	CCS + electrification (depleted gas fields)	
GTW	GTW near shore (end-of-field)		GTW far offshore, through offshore grid
Energy storage			Energy storage offshore (H <sub>2</sub> , CAES)

- > Electrification is basis for further system integration options (develop in steps)
- > Favorable short-term options identified, although arranging regulatory issues takes time



### Development strategies (2/2)

#### > Actions for the short-term:

- Set-up **integral strategic vision and roadmap** for North Sea energy transition
- Identify **shortlist of business cases** that can lead to pilot projects
- Mobilize international coordination (and share experience, e.g. on platform electrification)
- Develop regional action plans and strategies (align investment development)
- Engage with **stakeholders** (e.g. manage spatial claims, secure value chains)
- > North Sea Energy project started, >20 stakeholders, embedded in long-term R&D program

#### **R&D** needs are broad:

- Technology development and demonstration -> set-up pilot projects
- System analysis of transition scenarios -> develop **roadmap** with strategic spatial planning
- Ecological impact analysis
- Socio-economic, societal and governance analysis -> policy recommendations



#### Conclusions and recommendations

- Comprehensive overview of system integration options in the North Sea is available
- North Sea system integration has significant economic and ecological potential and can accelerate energy transition
- > Need to quantify benefits and barriers in order to **identify business cases**
- Tight offshore wind planning and accelerated phase-out of offshore gas require swift action



#### Thanks for your attention





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