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Strategies towards an Efficient future North Sea Energy Infrastructure

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EERA DeepWind 2017

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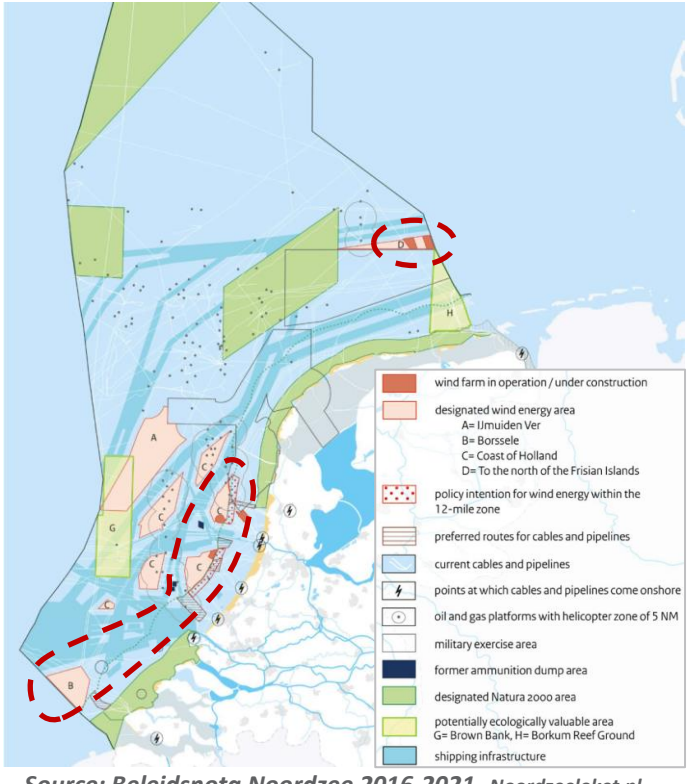
Motivation

System integration options

Strategies

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

- Designated areas**--> 4.5GW in 2023**

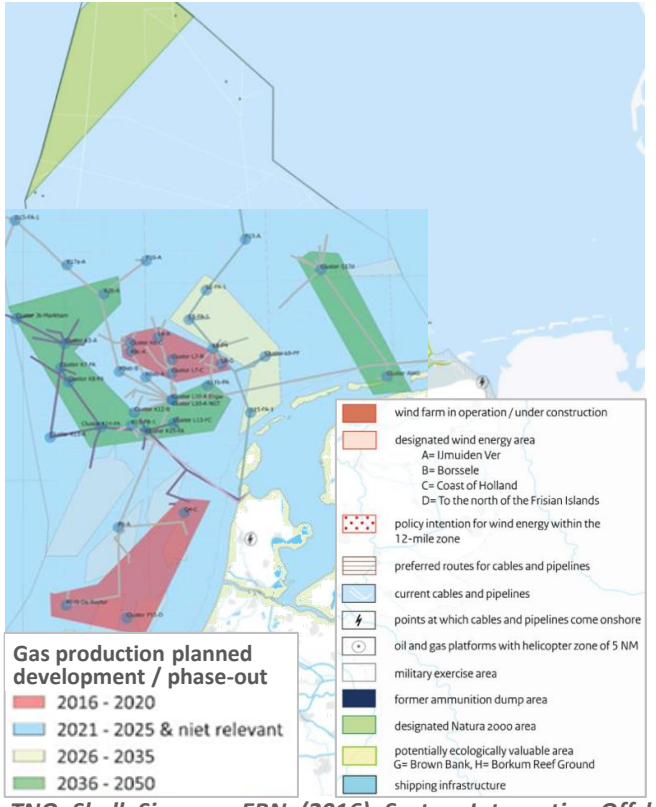


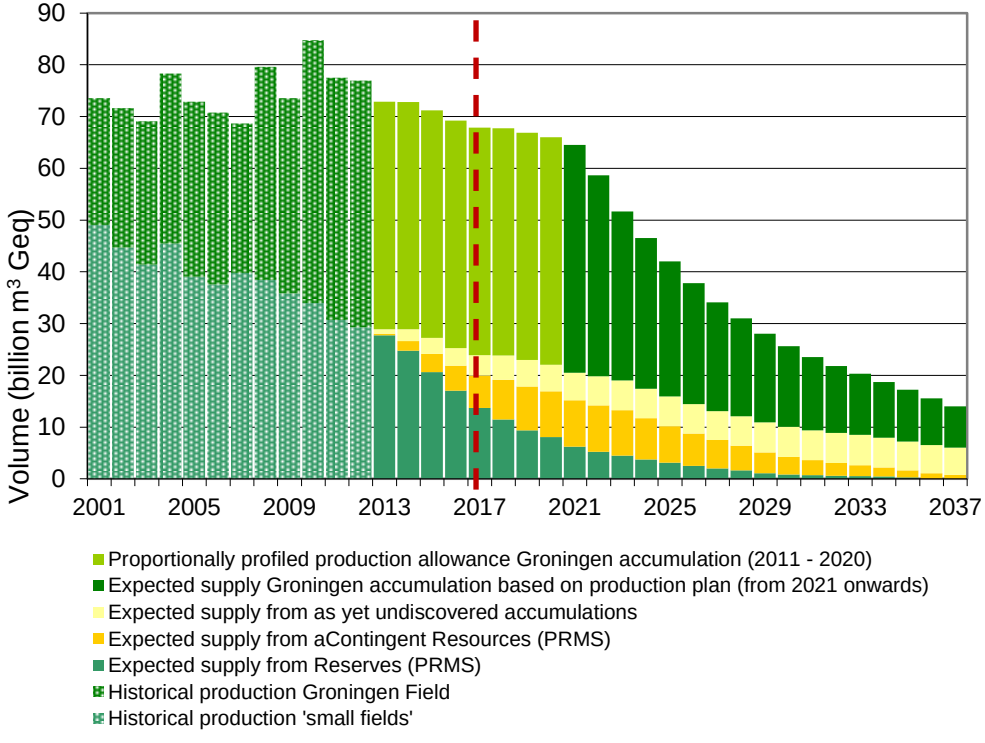
Source: Beleidsnota Noordzee 2016-2021, Noordzeeloket.nl

- 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-and-spoke-concept-for-large-scale-wind-energy-on-the-north-sea.html

The case of Dutch North Sea region (2/2): … while offshore gas production is in **decline**

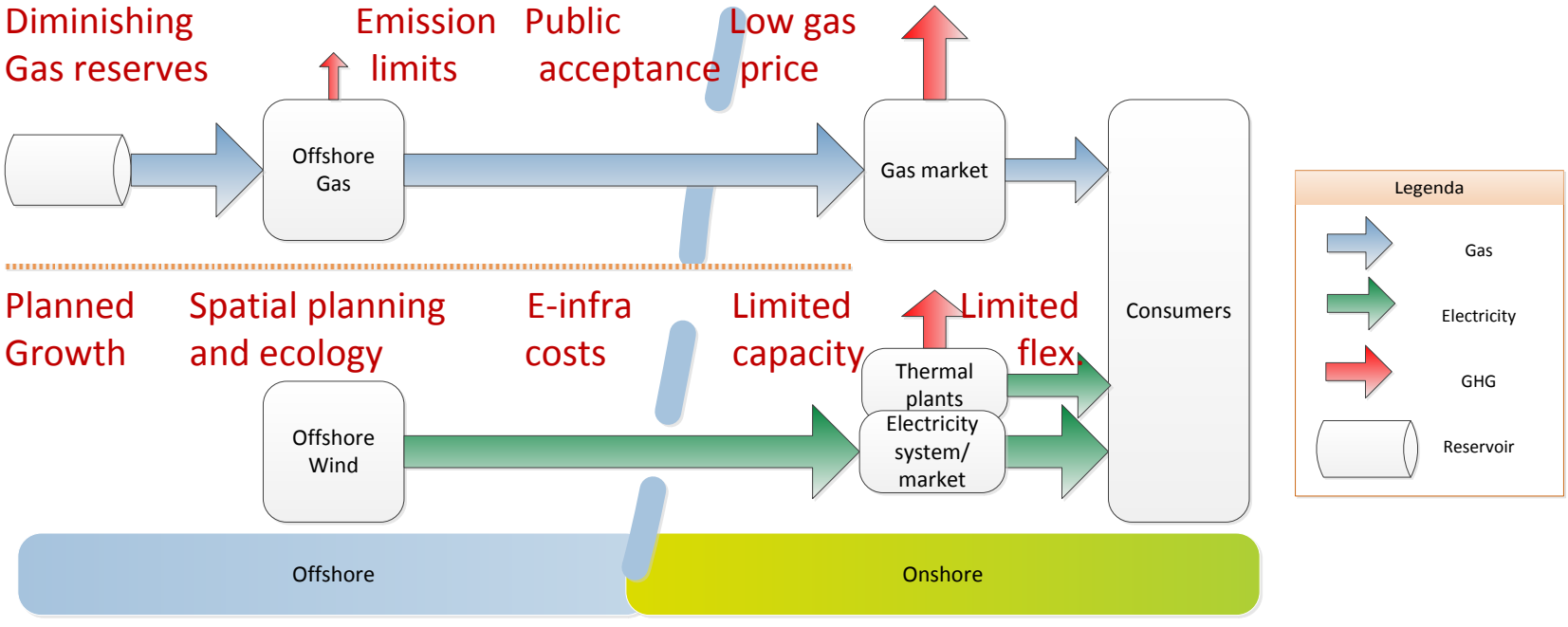




TNO, Shell, Siemens, EBN. (2016). System Integration Offshore Energy: Innovation Project North Sea Energy. Retrieved 11 02, 2016, from https://www.tno.nl/media/8512/system_integration_offshore_energy_final-report_tno_r11234.pdf

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

Project partners:

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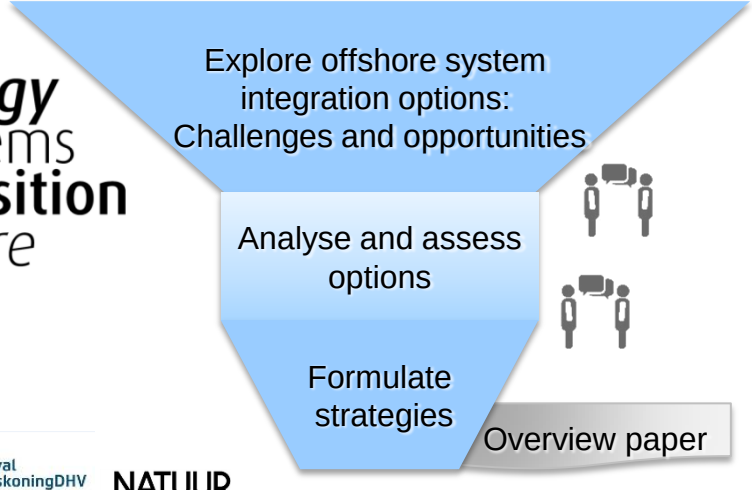
ESTRAC

Energy Systems Transition Centre



Supported by wind and gas sector and NGOs

TenneT · TKI Wind op Zee · ENGIE · ebn · NAM · NWEA · Royal HaskoningDHV · SIEMENS · Natuur & Milieu · NOGEPA · TKIgas

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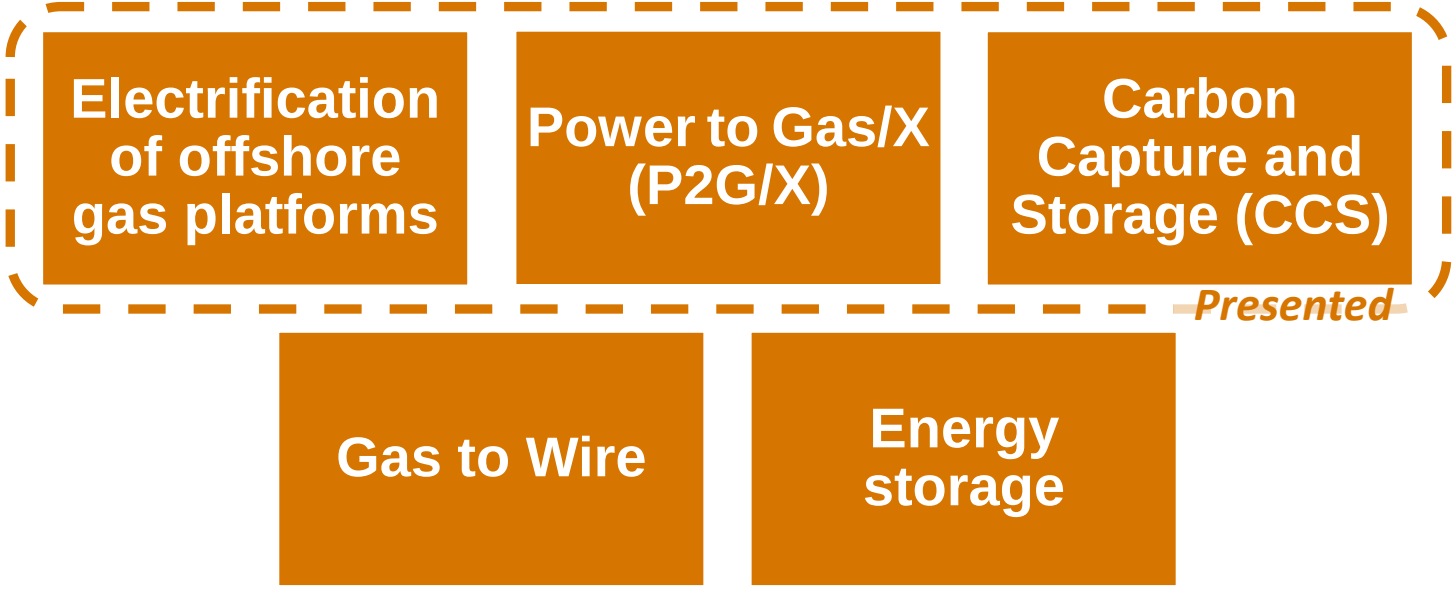
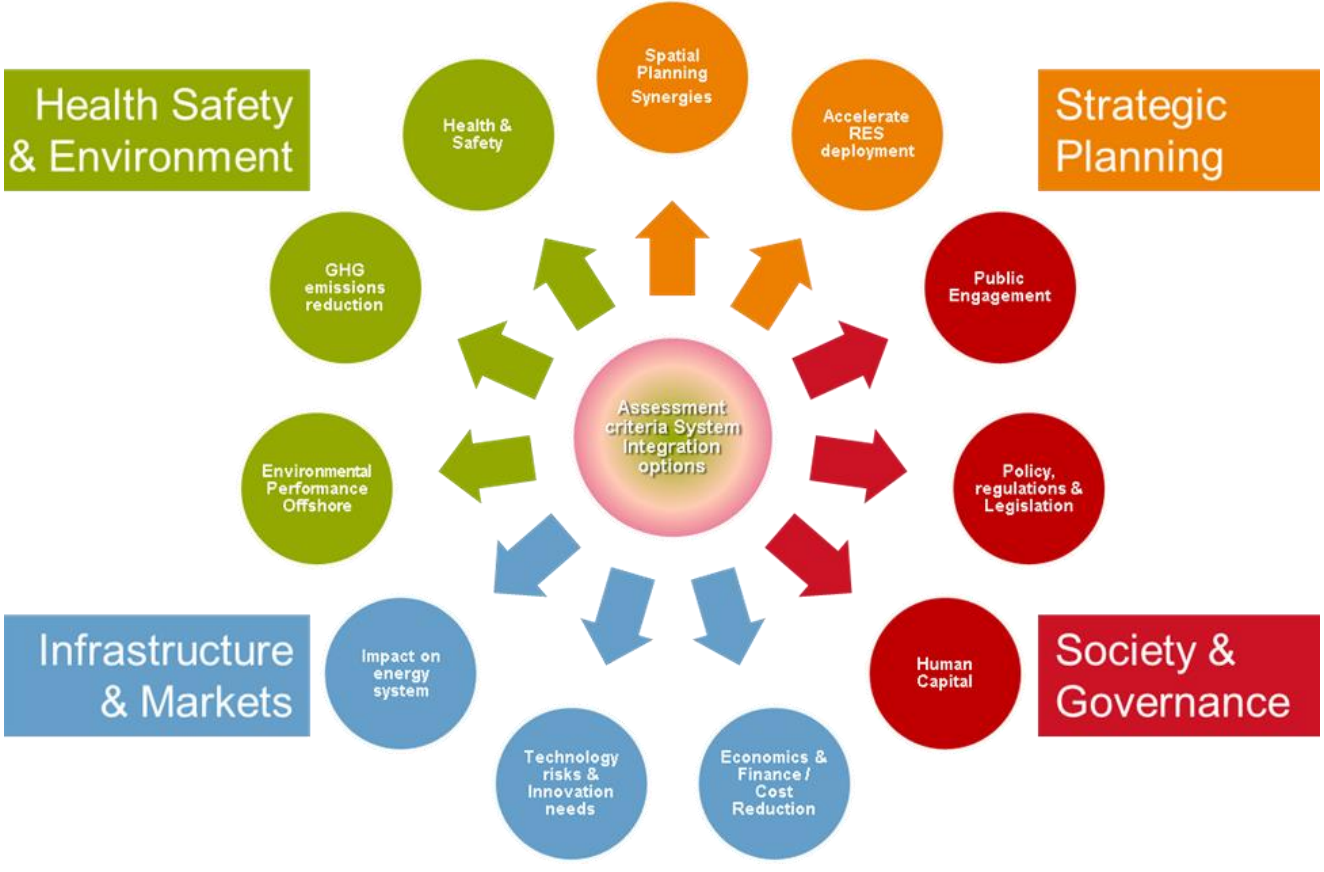
System Integration Options: SENSEI project

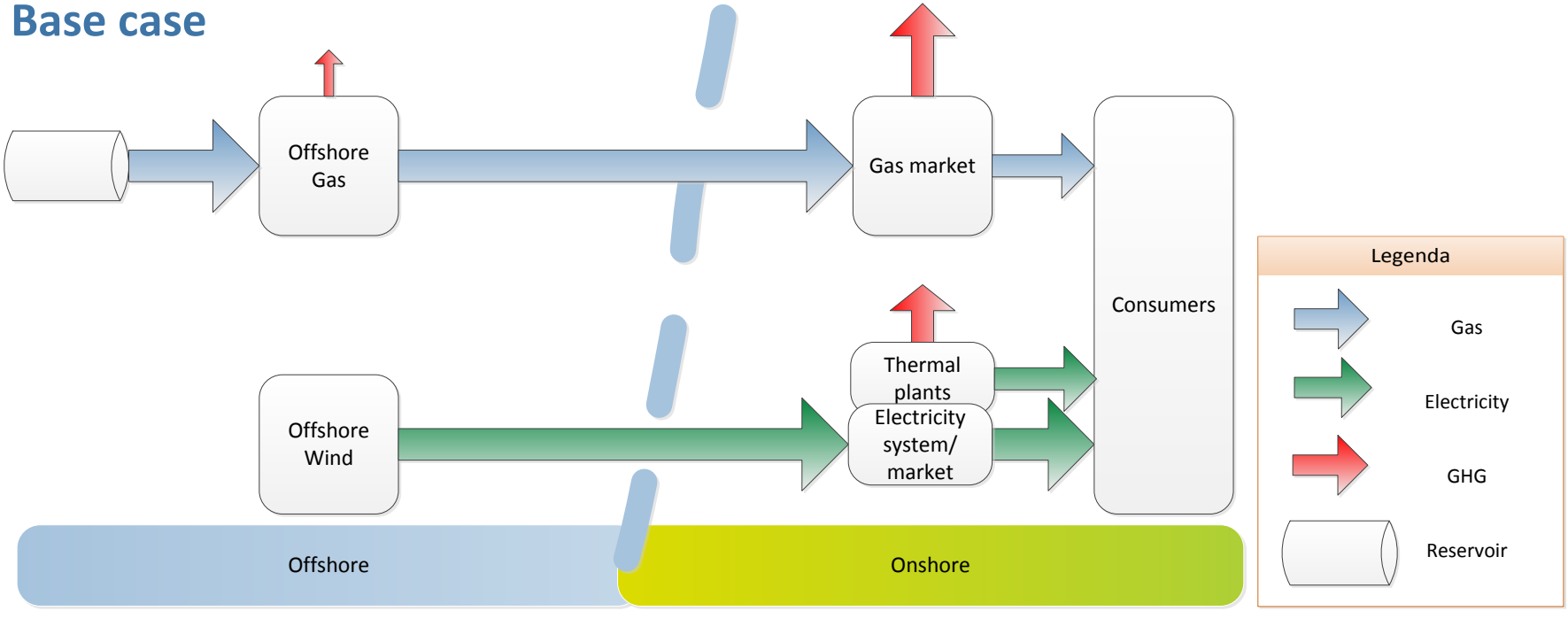
Development of large-scale offshore wind can be integrated with offshore gas infrastructure along the following main options:



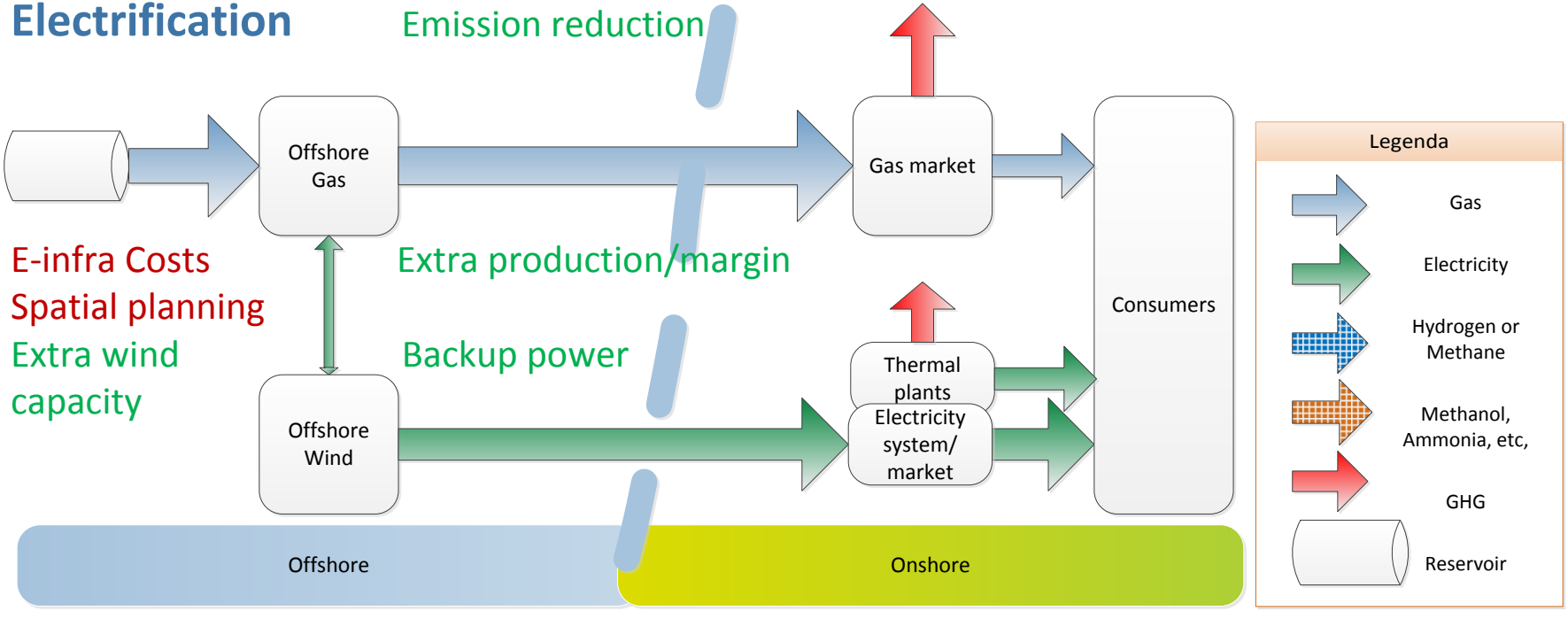
System Integration Options: Assessment framework (qualitative)



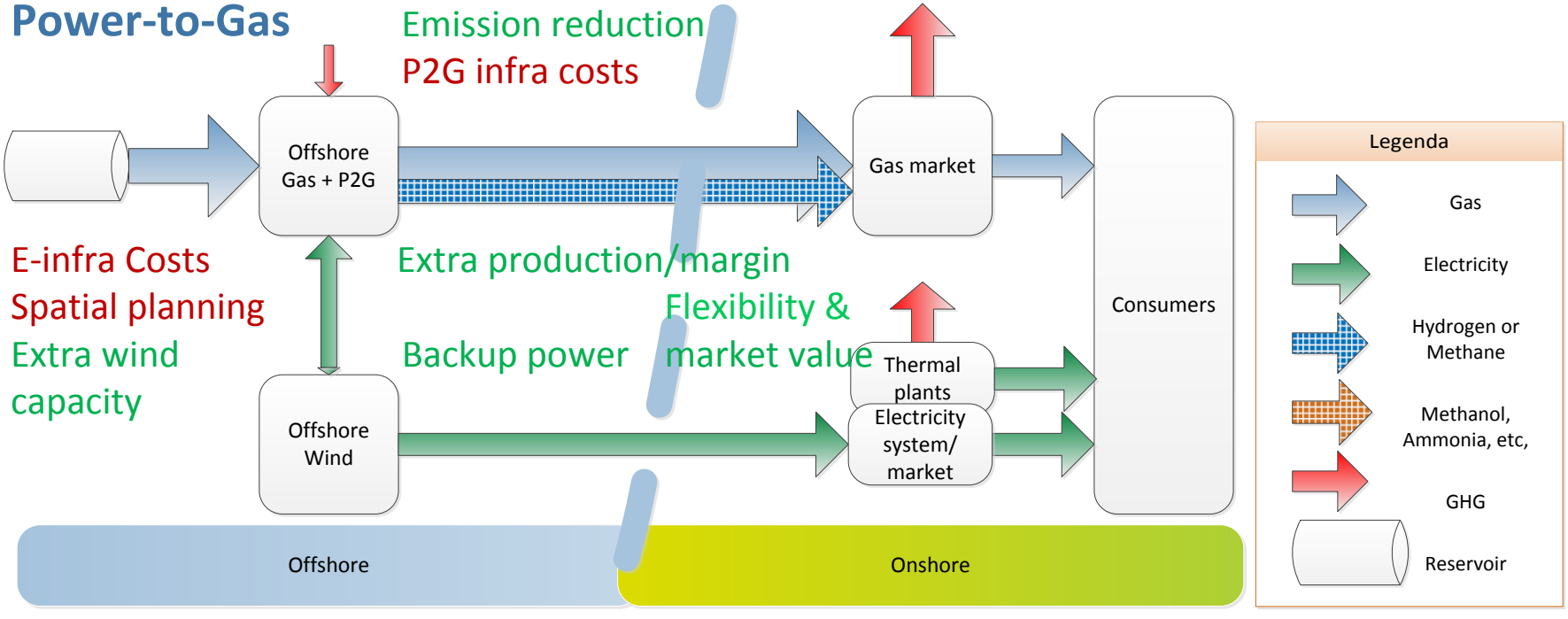
System Integration Options: Base case



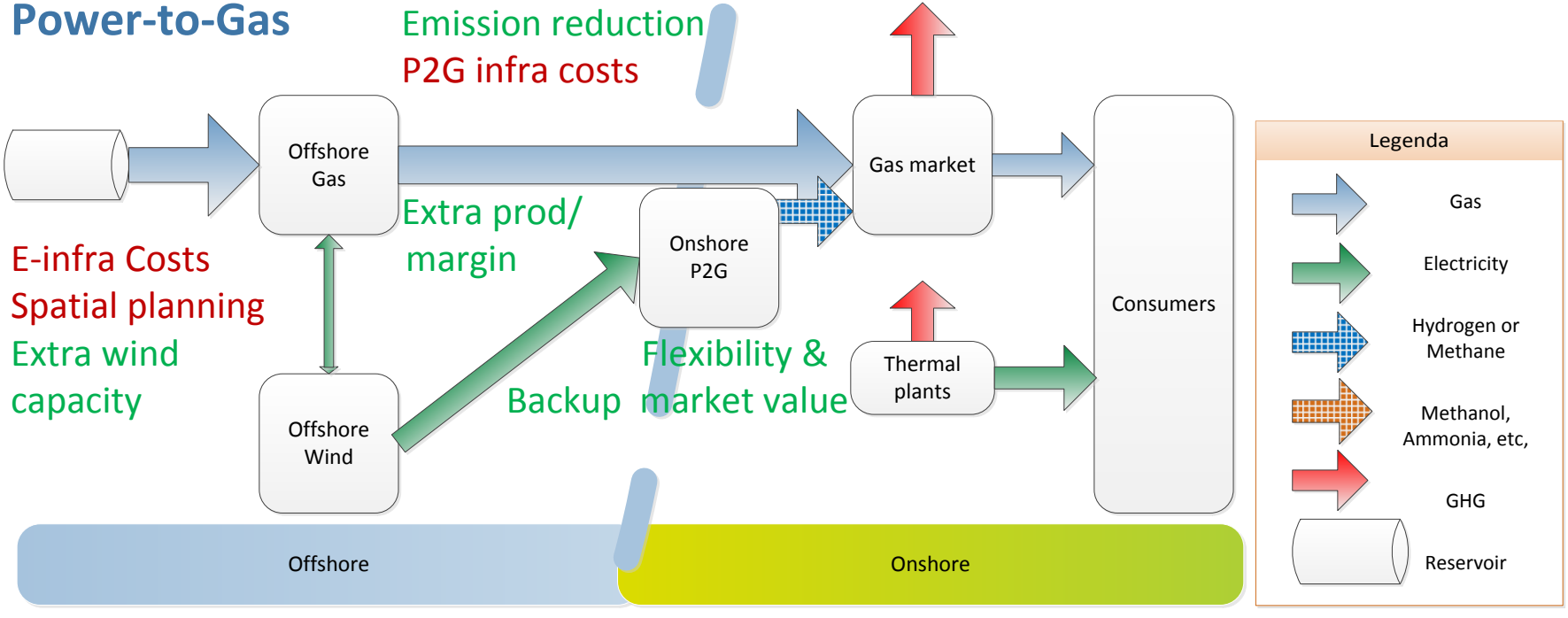
System Integration Options: Offshore gas platform electrification



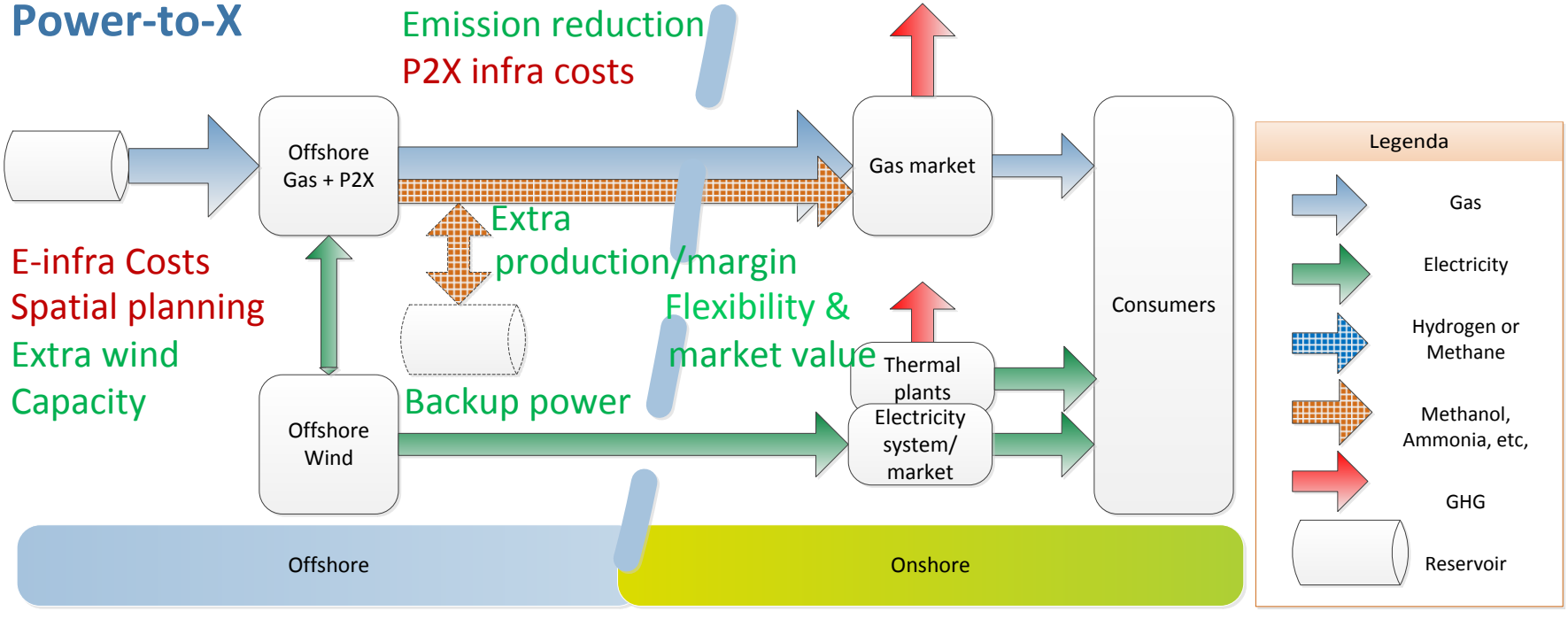
System Integration Options: Power to Gas



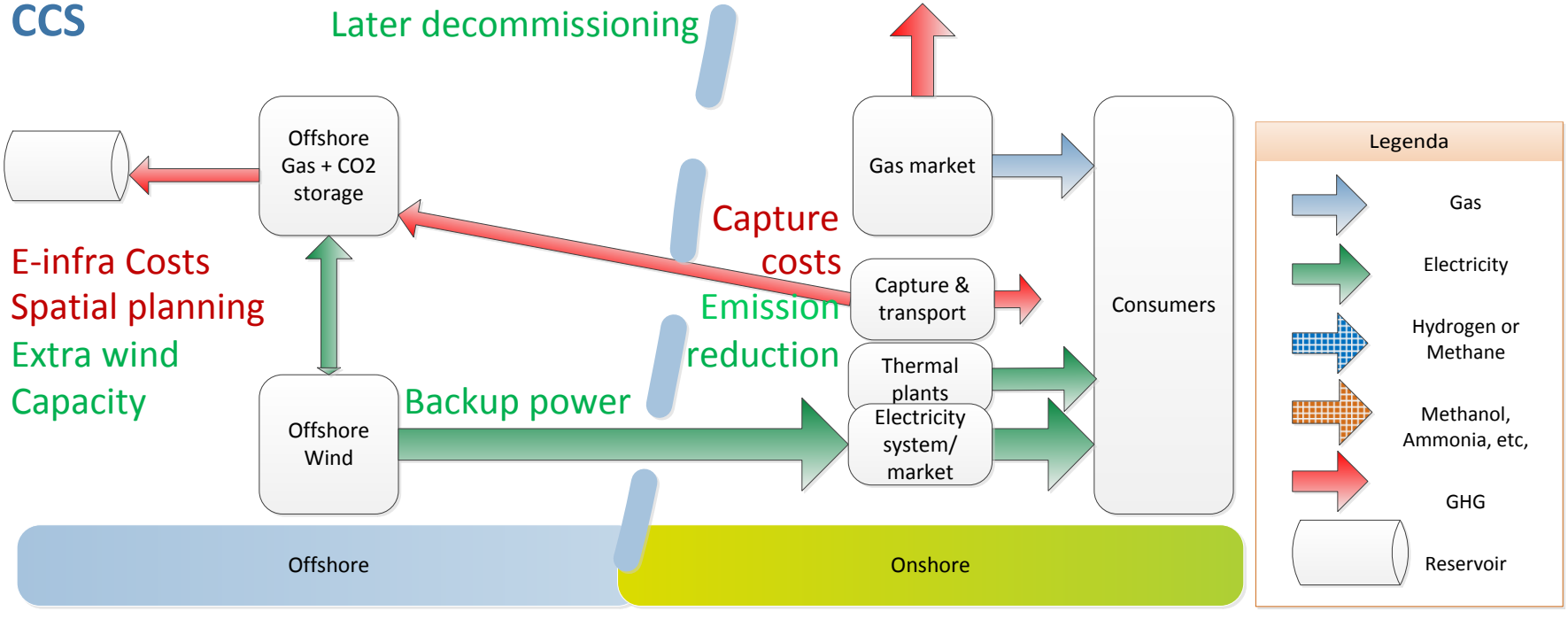
System Integration Options: Power to Gas (onshore)



System Integration Options: Power to X



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_2) lead to uncertain business case
  - Development needed on offshore conversion technology
  - Public acceptance

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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_2, 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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