Key technological drivers for the future of gas

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The emphasis on green and clean will fundamentally reshape the energy system

1.3 bn people still lack access to electricity
Energy access needs to be improved, at the same time as the marginal cost of fossil fuel production is rising

Affordable & Available

Secure & Reliable

Green & Clean

Energy security concerns persist
Consumers expect energy supply to be resilient to political events and, in future, to more extreme weather

Sustainability emphasis is growing
Desire to reduce carbon emissions and local pollution. In particular, the increasing emphasis on ‘green and clean’ energy is expected to drive substantial change from now until 2025 – and the transition is already well underway
Towards a low carbon, resilient and sustainable future

“Gas provides the fastest and most economic pathway to a world with both lower carbon intensity and cleaner air.”

(Source: COP21 report)
Energy System Framework – connecting sources with end users

multiple energy carriers and multiple functions

Energy Carriers from source to end-use

Sources/Exploration | Production | Transport | Storage | Distribution | Conversion | End-use

Electric | Gas | Heat | Liquid | Solid

Sources from source to end-use
Technology innovation builds new value chains for different industries

**Gasification**
- Starting material
- Gasifier
- Syngas

**Power-2-gas**
- Power sources
- Power plant
- Hydrogen
- Methane

**Biogas**
- Biogas production
- Biogas

Connections:
- Mobility
- Gas grid
- Industry
Energy transport – large distances – inter regional

Energy Carriers from source to end-use

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<td>![Sources Icon]</td>
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- Electric
- Gas
- Heat
- Liquid
- Solid
Transporting gas is more cost efficient than transmitting electricity

<table>
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<tr>
<th>Electricity transmission NL-UK</th>
<th>Gas transport NL-UK</th>
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<tbody>
<tr>
<td><strong>BritNed Interconnector:</strong></td>
<td><strong>Bacton-Balgzand Gas Pipeline:</strong></td>
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<tr>
<td>- 260 km</td>
<td>- 230 km</td>
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<tr>
<td>- € 600 mln</td>
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<tr>
<td>- 1 GW capacity</td>
<td>- 20 GW capacity</td>
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<tr>
<td>- € 230 per kW/100 km</td>
<td>- € 11 per kW/100 km</td>
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Source: Gasunie (2014)
Storing large volumes of energy for longer periods
Underground Gas versus Pumped Hydro

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Energy Carriers from source to end-use

- **Sources**
- **Production**
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In Europe - Existing Underground Gas Storage (UGS) is factor 12 bigger than potential Pumped Hydro

~ 900 TWh currently stored in EU underground gas storages

Factor 12

~ 70 TWH maximum potential for pumped hydro plants in Europe (mainly in Norway and Turkey)
...and gas to facilitate & store all these renewable energy sources!
Innovation project: Real-time gas networks

- A £7m innovation project
- Creating a smart gas network
- Ensuring future gas networks can be flexible, secure, cost effective and safe
- Key enabler for the accommodation of different gas compositions into the network
- In partnership with SGN
- Funded by GB energy regulator

“We are excited by this partnership with DNVGL and the opportunity it affords to radically change how we manage and design our networks, whilst removing barriers for new sources of gas and stimulating downstream gas renewables. A key challenge is to not only manage the volume and flow in our network, but to manage and model the energy content. Once again we are showing the energy market that gas has a significant role to play in the future energy mix.”

Gus McIntosh: Innovation & New Technology Manager: SGN
Enablers of a Smart Gas Network

Technology
- Smart meters
- Gas quality monitoring
- Asset tags & embedded sensors
- Advanced survey techniques

Analytics
- Growth In Data
- Descriptive analytics
- Predictive analytics
- Asset Optimisation

Real-time management & control
- Automated control
- Real-time modelling
- Real-time control

Supporting all sources of Renewable Energy
Energy transition with optimal use of infrastructures: Towards a low carbon, resilient and sustainable future energy supply

TODAY

Collaboration

“Smartening” grid connections & new conversion technologies

(re-) Use of existing assets

Sustainable energy supply
Thank you!

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SAFER, SMARTER, GREENER