



FLEXIBILITY FROM NATURAL GAS PIPELINES

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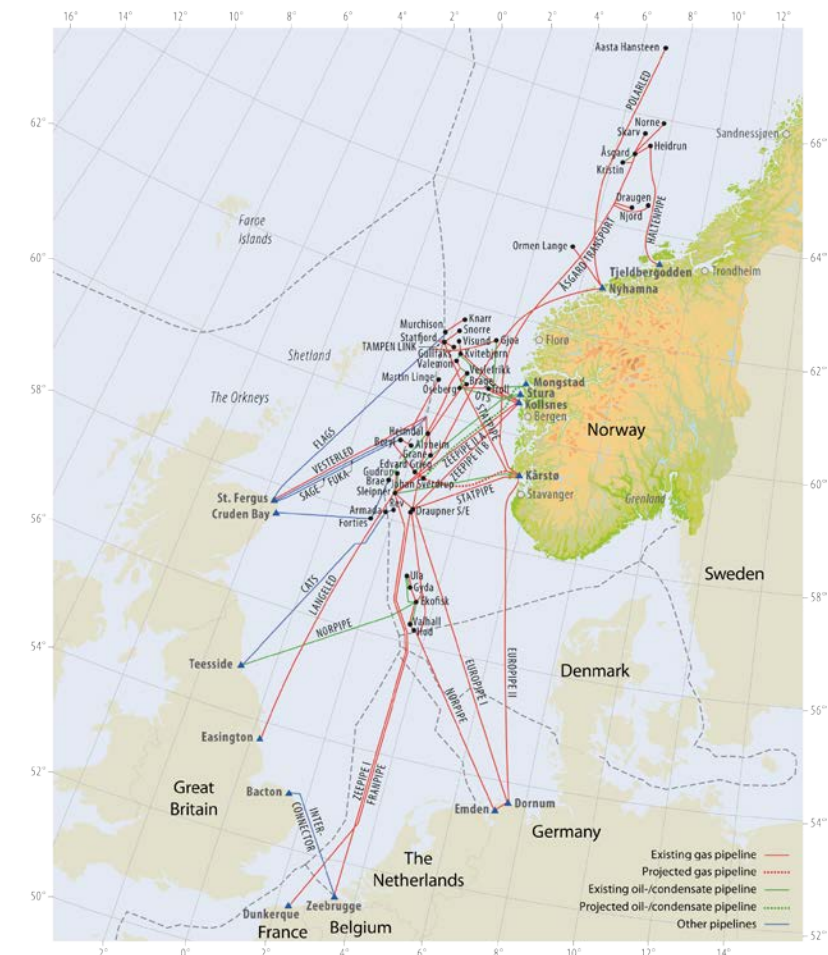
Agenda

- The natural gas value chain
 - Characteristics
 - Flexibility
- Flexibility services
- Opportunities and challenges

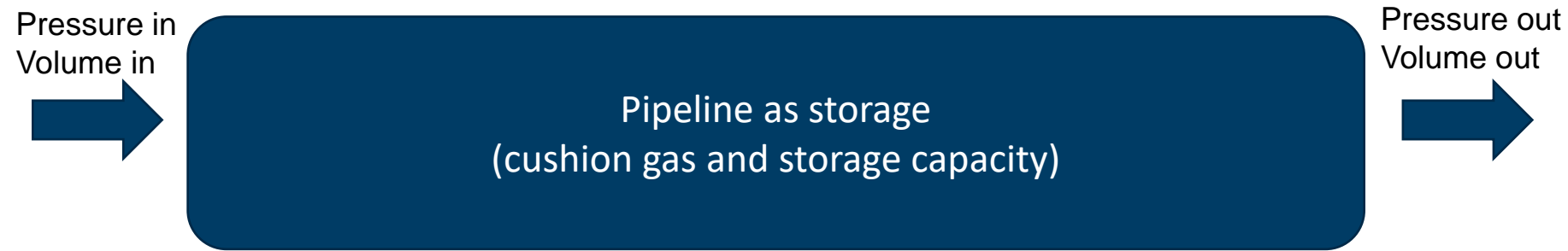
THE NATURAL GAS VALUE CHAIN

The Norwegian natural gas value-chain

- The world's largest underwater natural gas transportation system (8800 km of pipelines)
- Capacity of approximately 120 billion Sm³ dry gas per year
- High pressure
- Long pipelines
- Diversified fields and products
- System effects
- Quality requirements



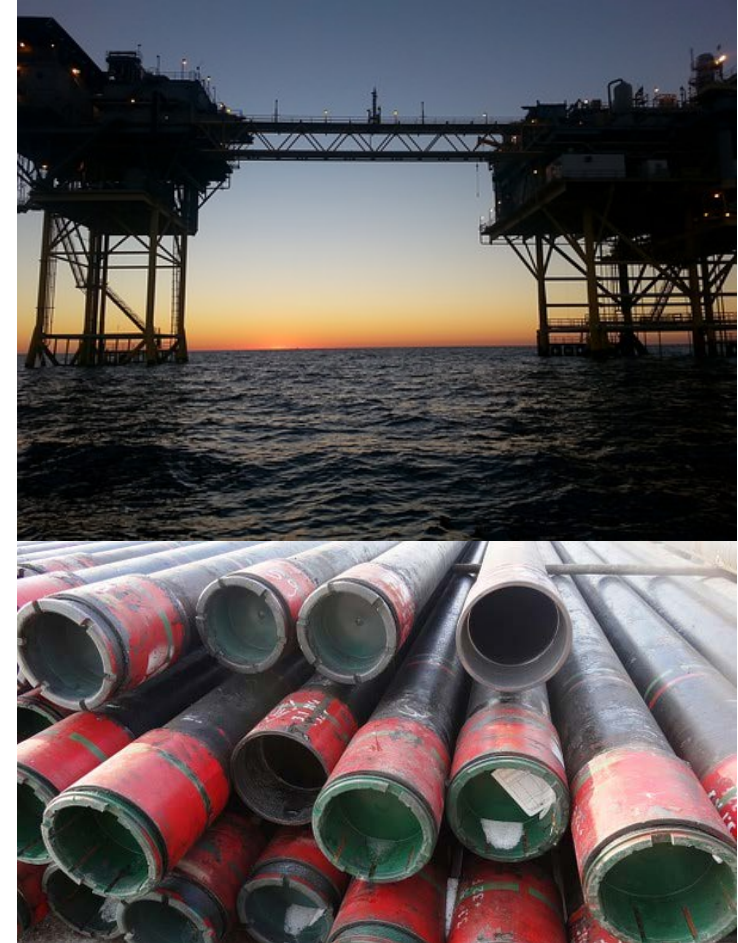
Pipelines as storage



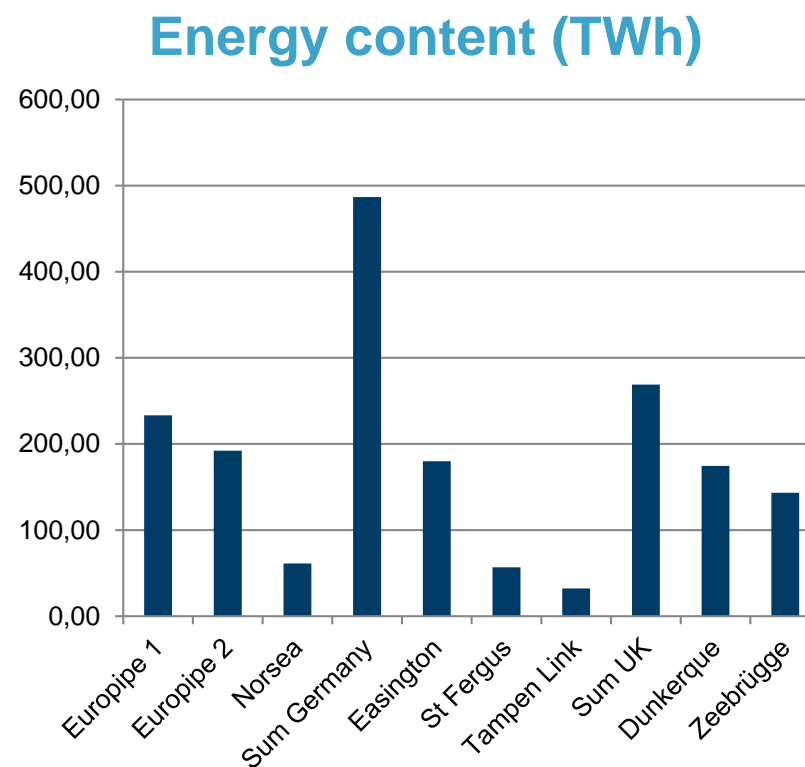
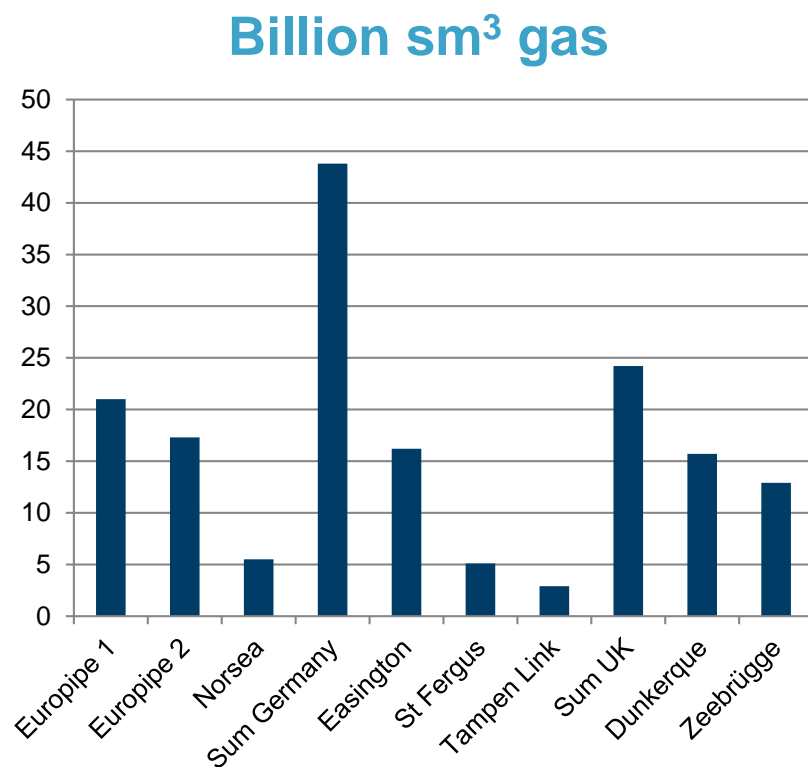
- Vary in- and outflow of the pipeline
- Influences both the inventory level, the storage capacity and the throughput of the pipeline
- Can be used as a storage facility to increase the flexibility in the transportation network
 - Handle foreseen and unforeseen network events
 - Exploit favorable market conditions
 - Offer new services (balancing services)

Flexibility in the natural gas value-chain

- Natural gas is flexible and easy to store
 - Reservoirs
 - Seasonal storage, weekly variations
 - Linepack / pipeline inventories
 - Daily to hourly storage
 - Conventional storages
 - LNG-storages

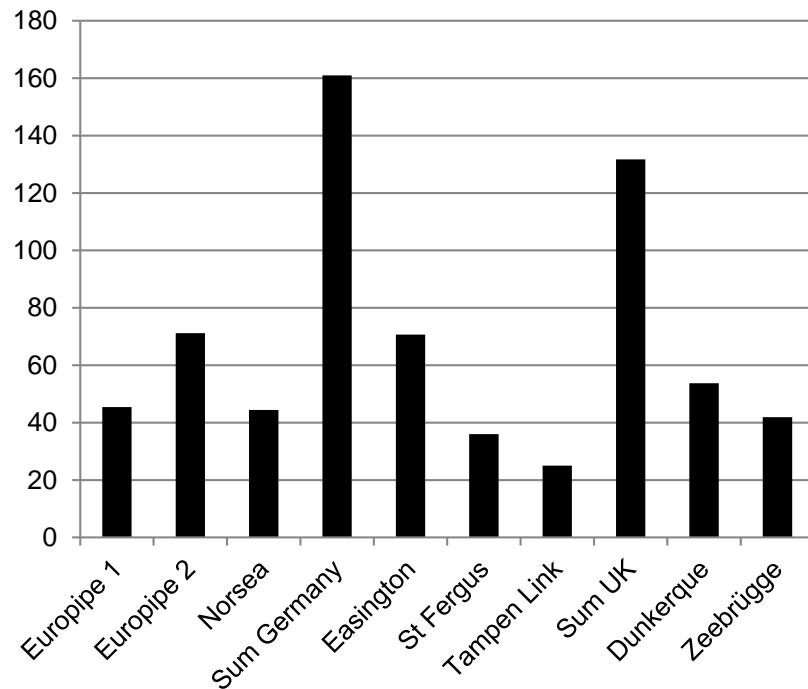


Yearly natural gas deliveries from Norway to Europe

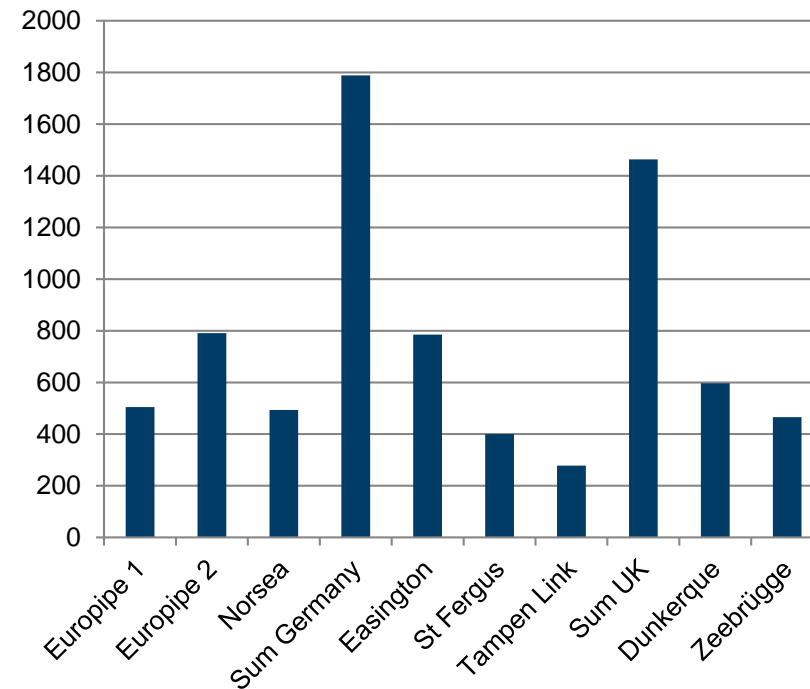


Daily capacity

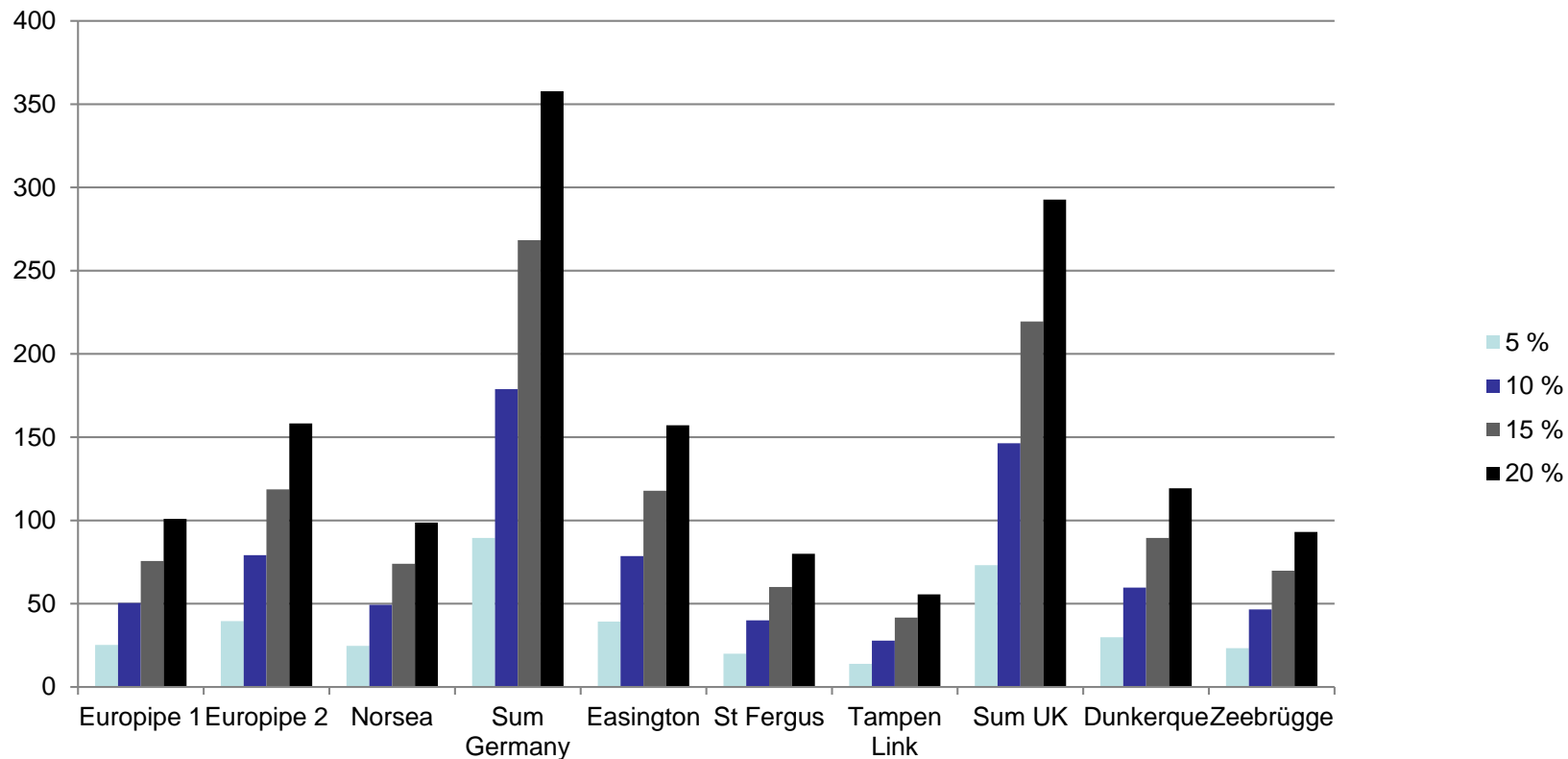
Pipeline capacity (Msm³)



Pipeline capacity (GWh)



Potential linepack flexibility (GWh)



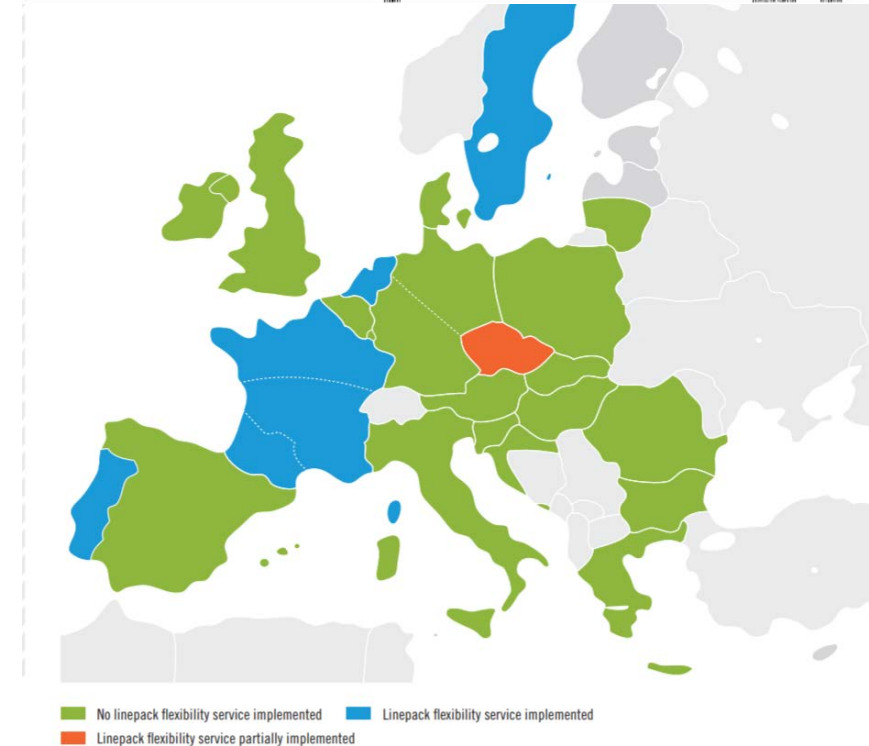
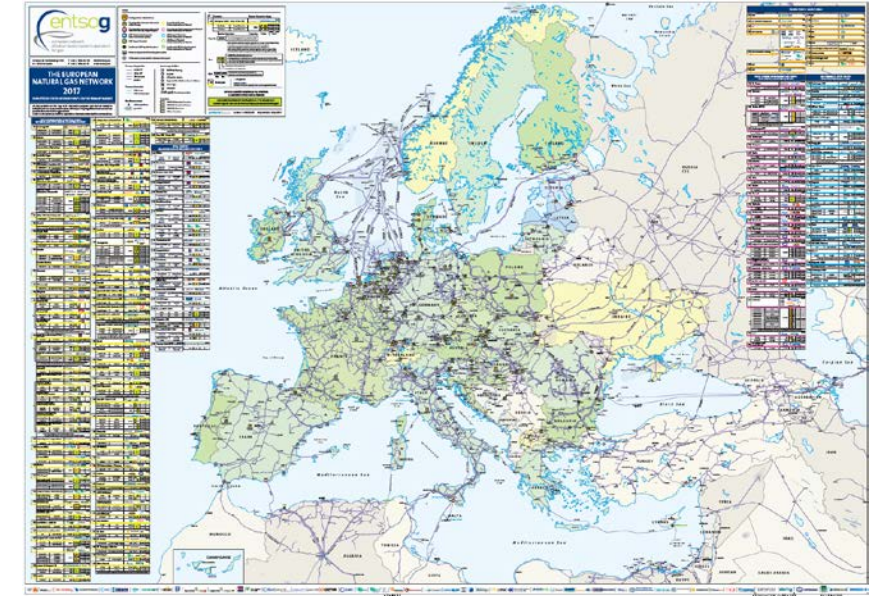
FLEXIBILITY SERVICES

ENTSOG – Linepack flexibility

- “The network code on gas balancing shall not prevent TSOs from allocating linepack to network users if approved by the relevant NRA. Where linepack is sold, TSOs shall allocate the linepack to network users as a commercial product on a transparent and non-discriminatory basis and it shall be offered at a cost reflective price. The price may also be determined through competitive mechanisms. The decision by the relevant NRA to allocate linepack shall be based on objective criteria, including the physical characteristics of the networks, whether the provision is consistent with Section 4 of these Framework Guidelines and whether offering a linepack product would facilitate a more efficient use of the system.”

Status - linepack

- There are significant differences in the levels of linepack offered throughout Europe
- ENTSG have identified two high level means of offering this product to network users:
 1. Implicit linepack service
 2. Explicit linepack service



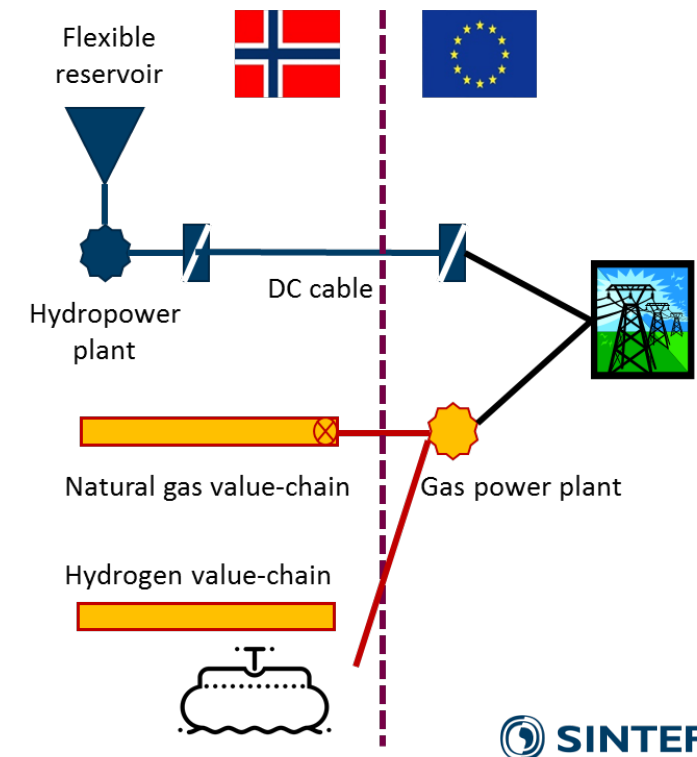
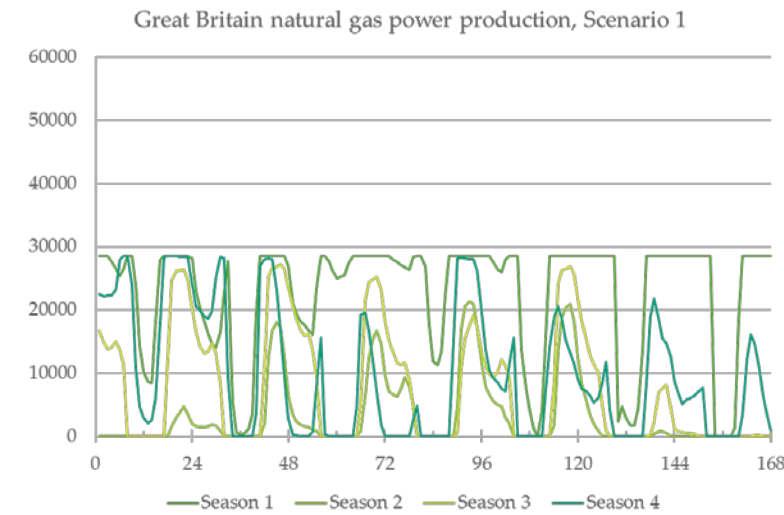
Norwegian system – linepack services

- Opflex
 - Opflex is an operational back-up service for shippers at Exit Points in Area D
 - Opflex is only available Within Day
 - Daily Opflex may be provided if a shipper experience loss of Gas due to reduced Field Availability or Transportation Curtailment
 - Opflex can only cover deliveries which were nominated prior to the unforeseen problem occurred
- Lineflex
 - Lineflex is a service available to shippers in applicable Transportation Systems for periods with planned maintenance activities in the Transportation System or at Fields
 - The Lineflex service will allow a shipper to deliver Gas into the Transportation System for redelivery during the event

OPPORTUNITIES AND CHALLENGES

Norway as a flexibility provider

- Need to understand the role of natural gas in the European energy markets and the need for flexibility in different time horizons, resolution and amount
 - What is the role of natural gas? Base load with CCS or for peak loads?
 - Which services can be offered?
- Supply and use of natural gas with minimal carbon footprint
- Interaction with the power markets and with the hydrogen value-chain
 - Requires a portfolio perspective for both investment analysis, service design and operational planning
- Capabilities of the pipeline system
- Capabilities of ramping (with CCS)
- Development of regulations and services (business models)





Teknologi for et bedre samfunn