LNG AND SUPPLIES TO EUROPE

ROLE OF LNG IN FUTURE EUROPEAN GAS MARKET

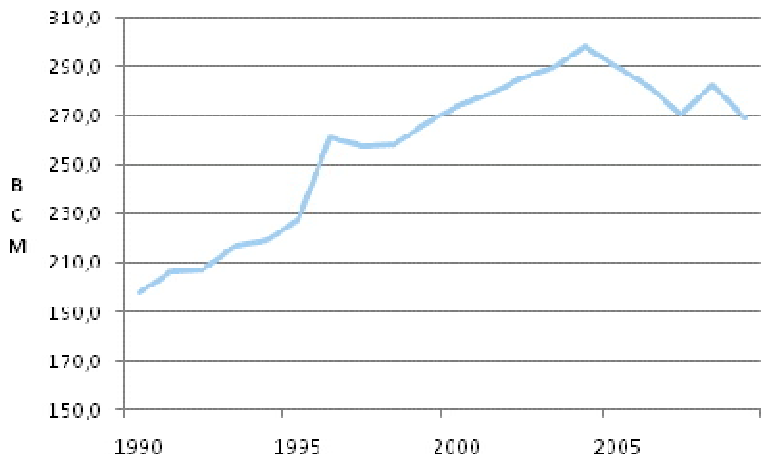
NOVEMBER 2010
LNG AND SUPPLIES TO EUROPE

AGENDA

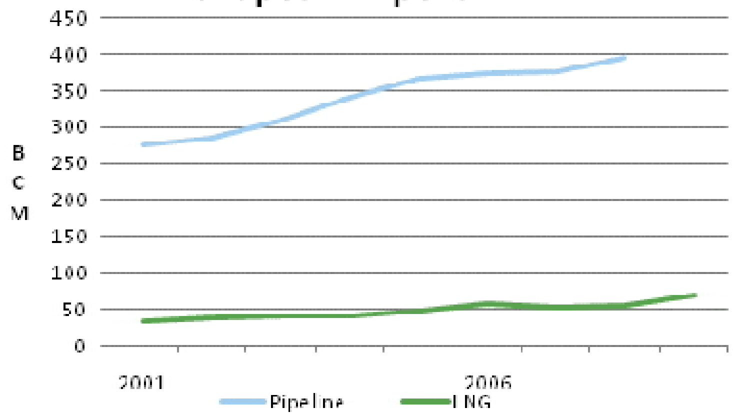
- Roles of LNG in Europe
- Emerging terminals and their purpose
- The transition to sustainability
- The pitfalls and the prize

EUROPEAN LNG IMPORT IS INCREASING

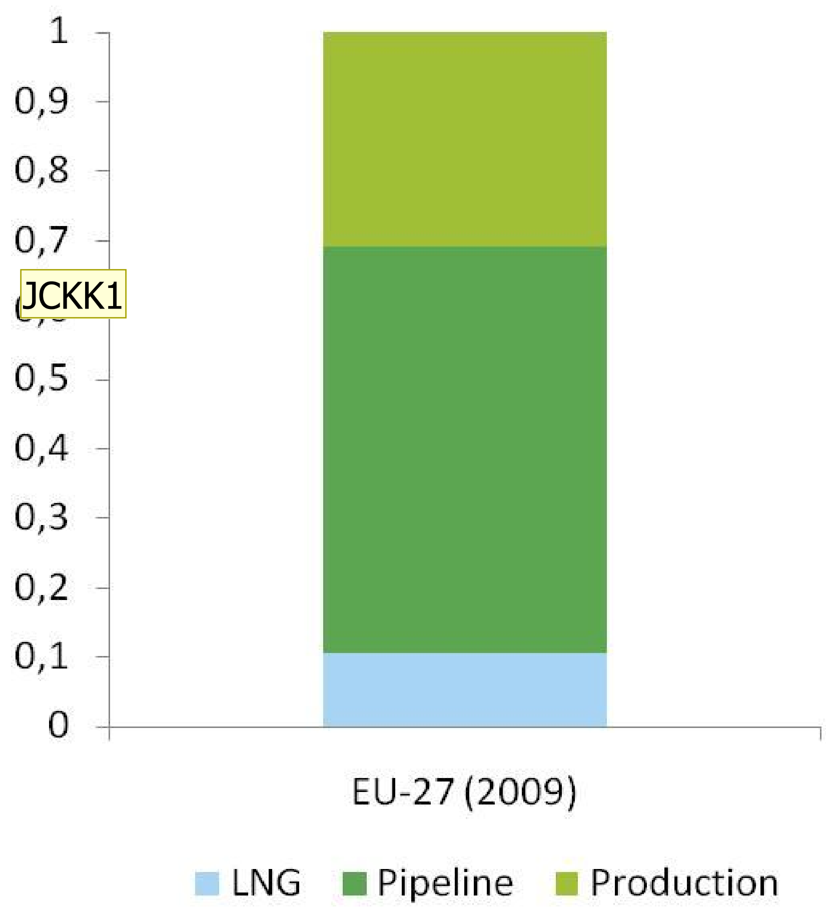
EU-27 Gas Production



European Import



LNG in European Gas Supplies



RAMBØLL

Slide 3

JCKK1 Aksen skal være i % samt der må godt være labels på søjlerne!
Jack Michael Kristensen; 07/11/2010

LNG TO EUROPE WILL IN THE FUTURE POSSES A DUAL ROLE

Traditional Role

Base load to market as

Market was primarily for heating and process purposes

Flexibility could be delivered from long term pipeline contracts and Storage Facilities

Emerging role

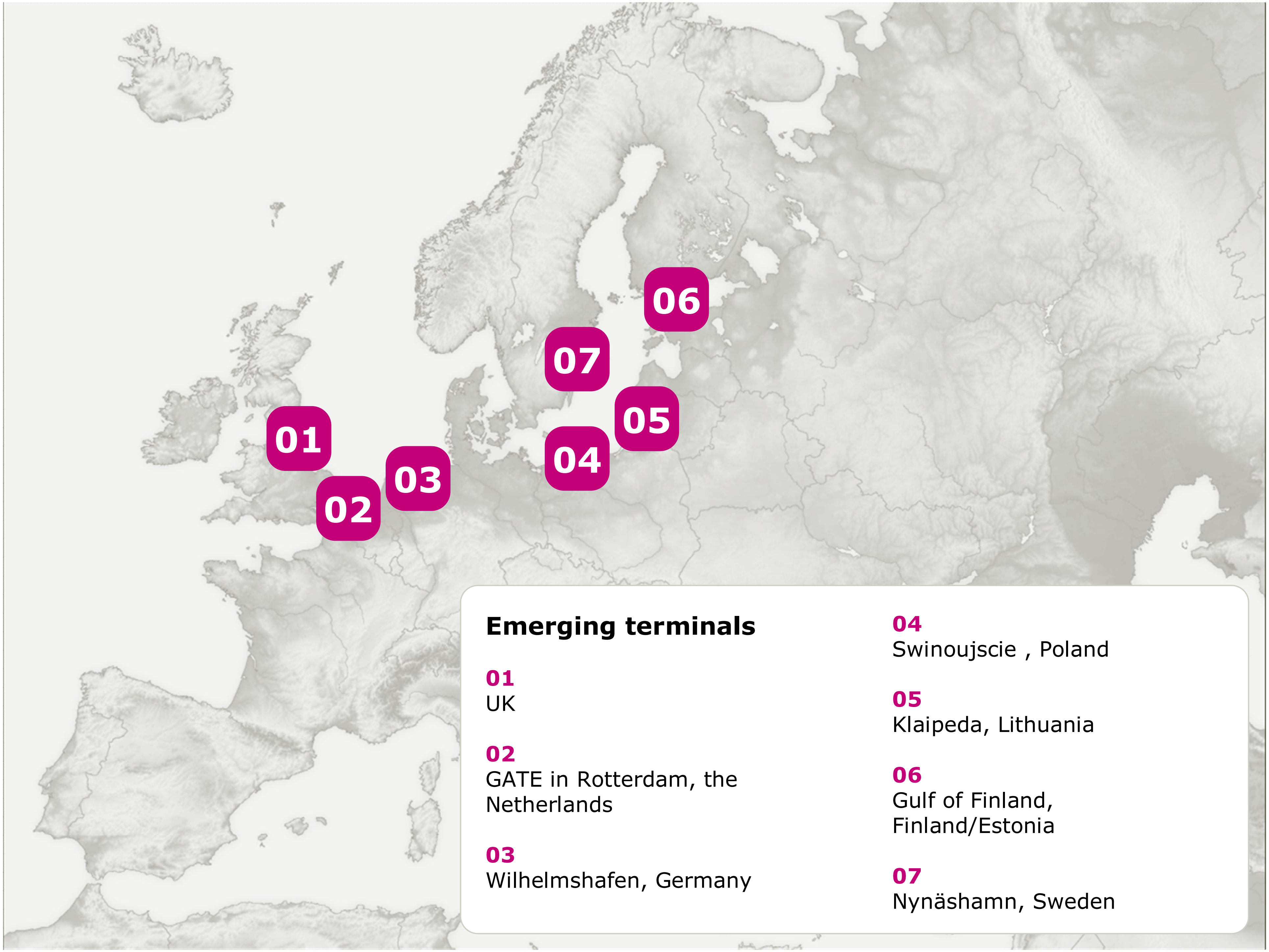
Flexibility is needed as

Power production is covering more volumes in the demand picture

Diversity is becoming important in terms of Security of Supply, Flexibility Measures and Risk Management

→ Competition on price

→ Competition on flexibility



Emerging terminals

01
UK

02
GATE in Rotterdam, the Netherlands

03
Wilhelmshafen, Germany

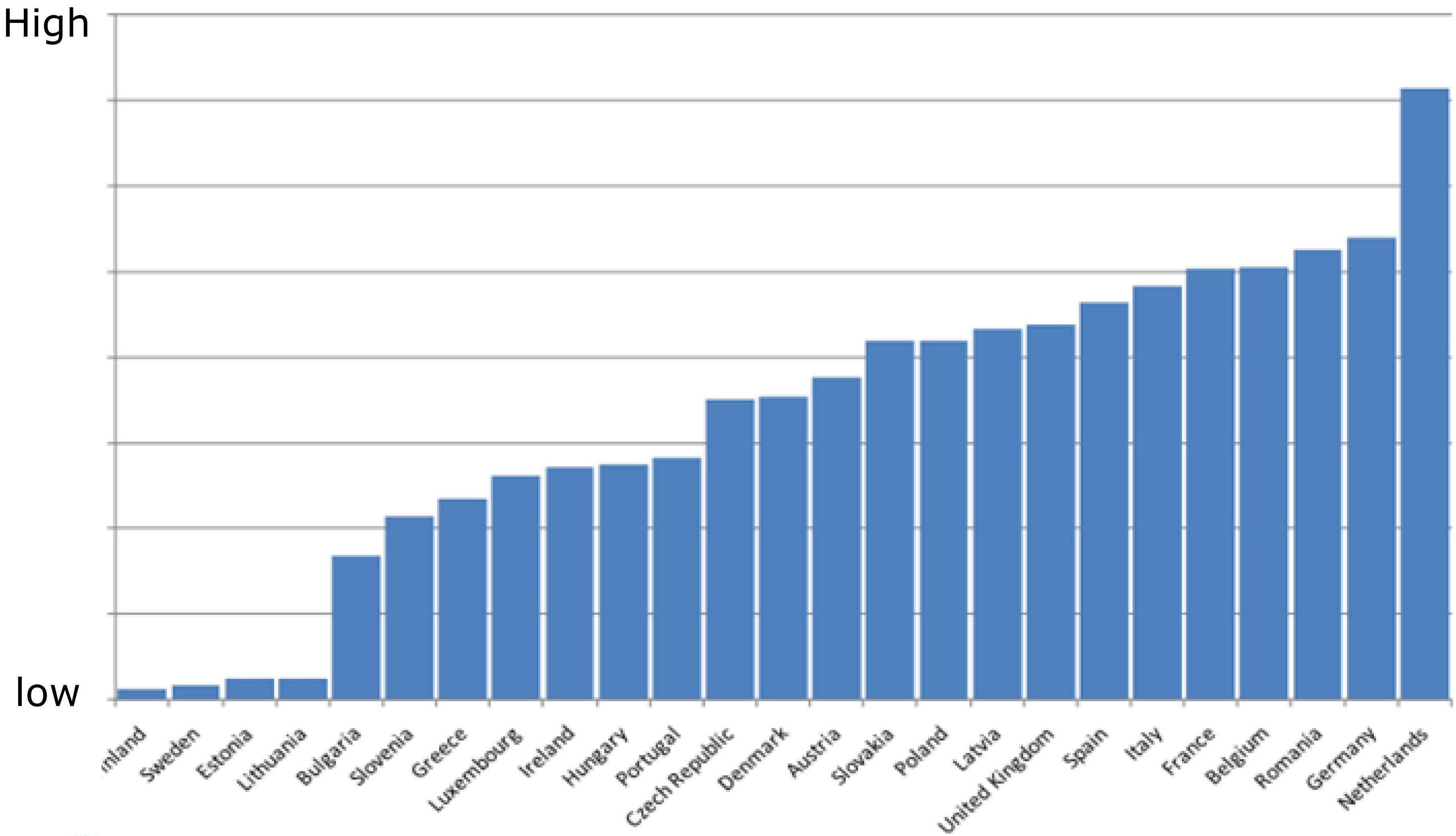
04
Swinoujscie , Poland

05
Klaipeda, Lithuania

06
Gulf of Finland, Finland/Estonia

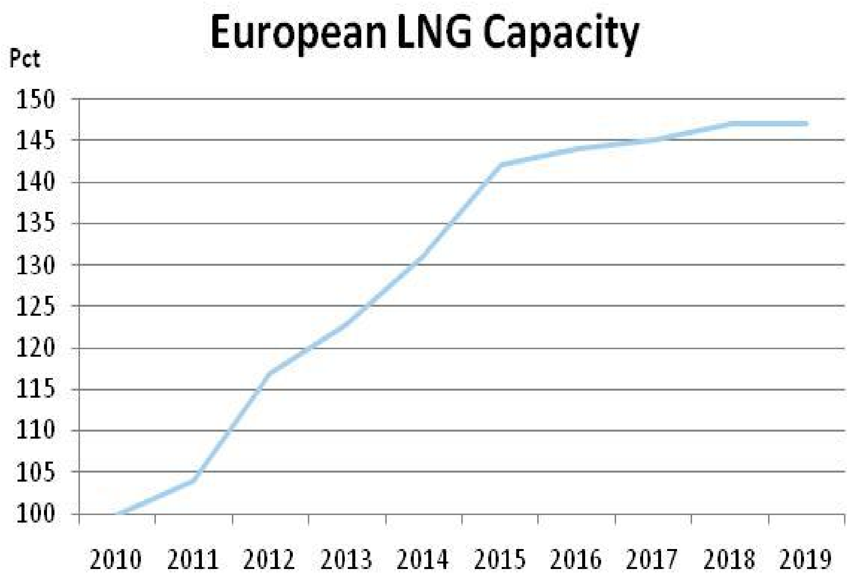
07
Nynäshamn, Sweden

SECURITY OF SUPPLY TEMPERATURE AND APPROPRIATE MEASURE DIFFERS



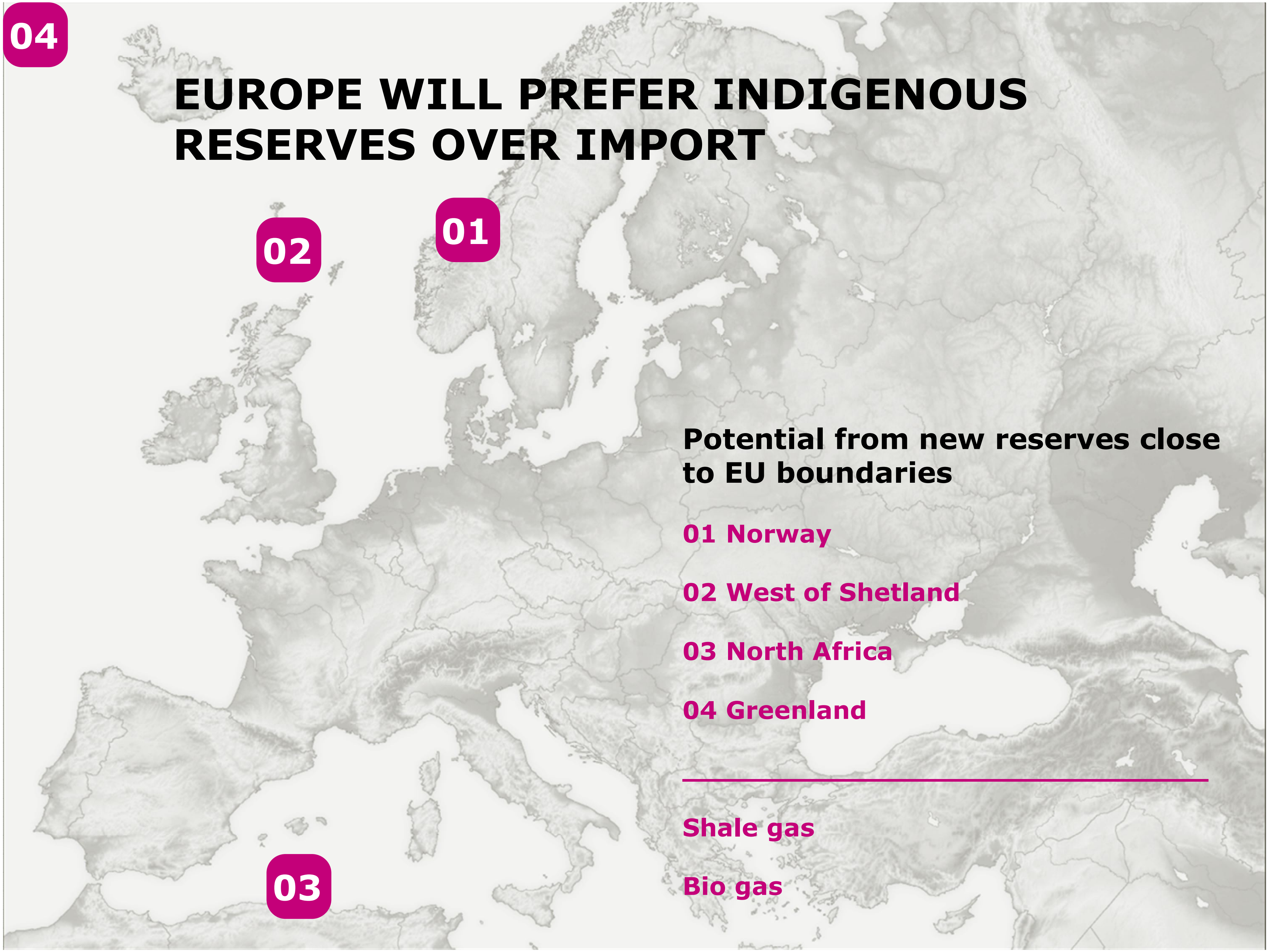
LNG POTENTIAL IN EUROPE

- Expected to increase
- Low share today
- Increased need for diversity:
  - Security of Supply
  - Portfolio optimization
  - Price
  - Duration of contracts
- Flexibility of LNG is attractive



Does Europe have alternatives to LNG?

EUROPE WILL PREFER INDIGENOUS RESERVES OVER IMPORT



Potential from new reserves close to EU boundaries

01 Norway

02 West of Shetland

03 North Africa

04 Greenland

Shale gas

Bio gas

THE UNCONVENTIONAL REVOLUTION STILL UNCERTAIN IN EUROPE

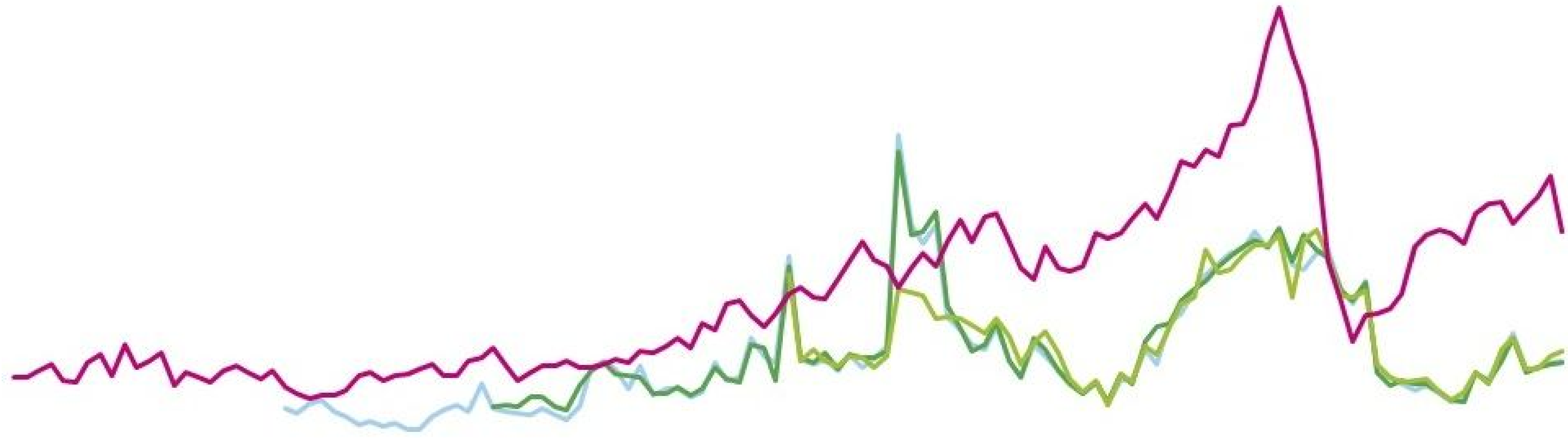
- Potential reserves in Europe
- Remain unproven

Why?

- Stringent legislation
- Environmental concerns
- Rigs are currently not available in Europe (in a larger scale?!?)
- Higher cost of land in Europe than in US

HOW LNG CAN PRETEND TO BE PIPELINES

- Security of Supply = Security of Demand
- Establishment of a pipeline is more than a legal contract
- If gas flows, it flows in the pipeline
- LNG: No bilateral linkage between buyer and seller
- Terminal ownership and support from LNG producers can create this



A MORE FLEXIBLE PRODUCT IS NEEDED TO COPE WITH THE CHALLENGES

- Short term markets and transparency
- Common reference price for LNG to develop market

GAS DEMAND IN A GREEN EUROPE

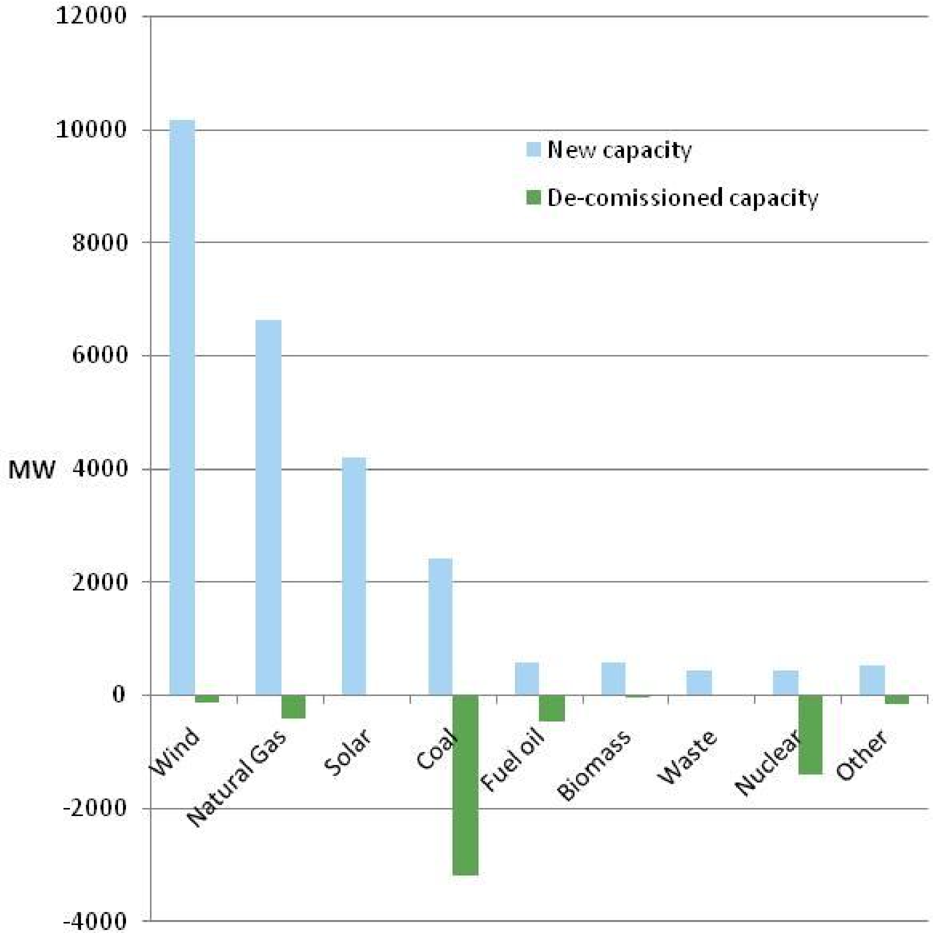
- Gas as transition fuel to zero-carbon
  - Bio gas
  - Renewable
- Carbon Capture Storage (CCS)

EUROPEAN ENERGY LANDSCAPE
WIND LEADING NEW POWER CAPACITY 2009

- Wind and gas develop as complements
- Gas gives the necessary flexibility required by wind

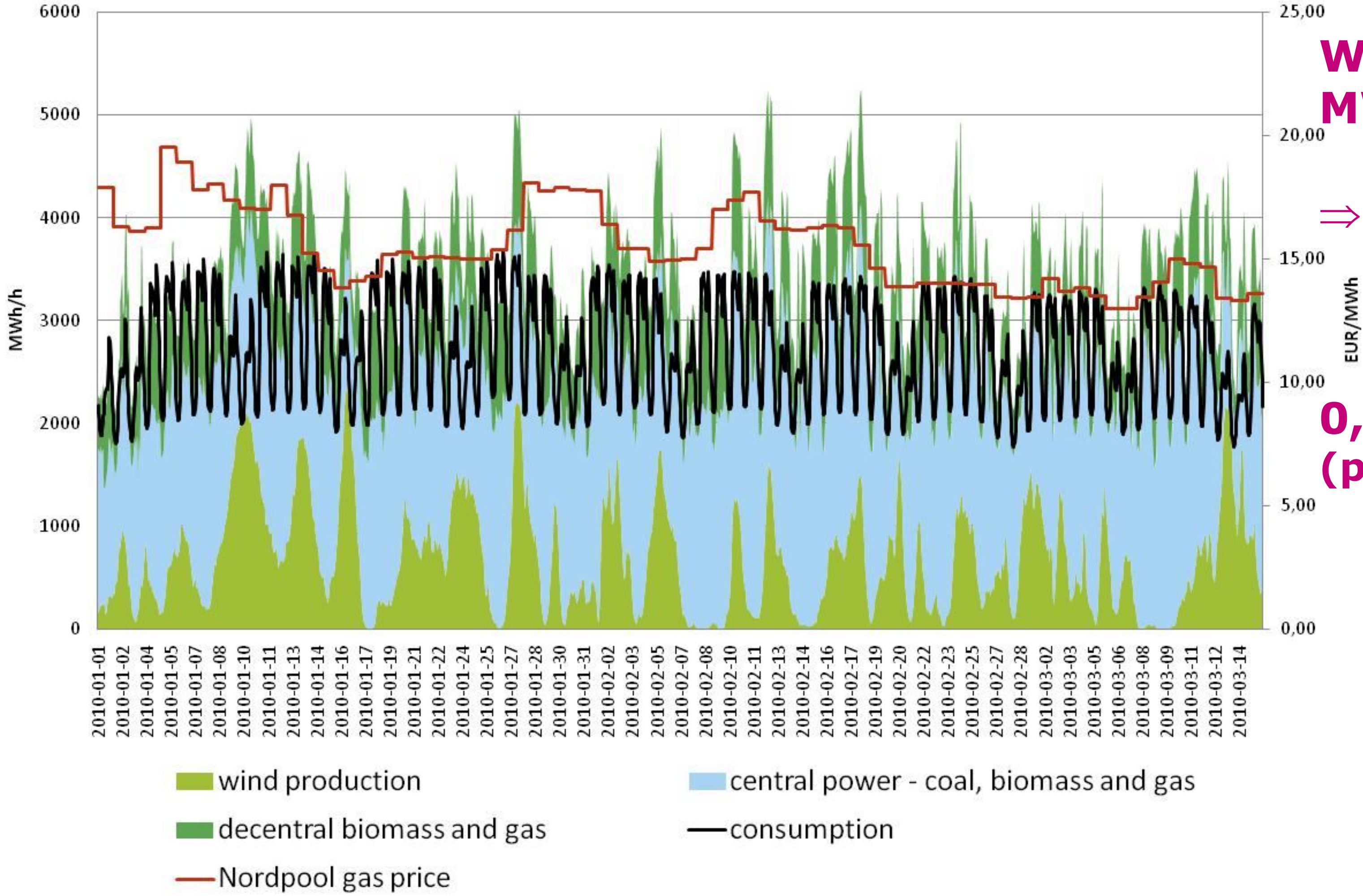
Increased wind production →

- Increased demand for flexibility in gas deliverables
  - Flexibility in contracts
  - Flexibility from gas storage
  - Flexibility from LNG
- Security of supply



Source: EWEA

POWER PRODUCTION – WIND AND GAS



Wind > 1000 MWh/h

⇒ price drops

0,36 EUR (p=0.002)

Source: Energinet.dk

NEW APPLICATIONS FOR LNG

Emission Control Areas

SO_x: 0.1% sulphur content in fuel from Jan 2015

NO_x: Reduction of 80% in ships built after 2016

E.g. Norway, Baltic Sea and North Sea

REDUCTION OF EMISSIONS

Fuel type	SO_x (g/kWh)	NO_x (g/kWh)	PM (g/kWh)	CO_2 (g/kWh)
Residual Oil 3.5% Sulphur	13	9-12	1,5	580-630
Marine diesel oil 0.5% Sulphur	2	8-11	0,25-0,5	580-630
Gasoil 0.1% Sulphur	0,4	8-11	0,15-0,25	580-630
LNG	0	2	~0	430-480

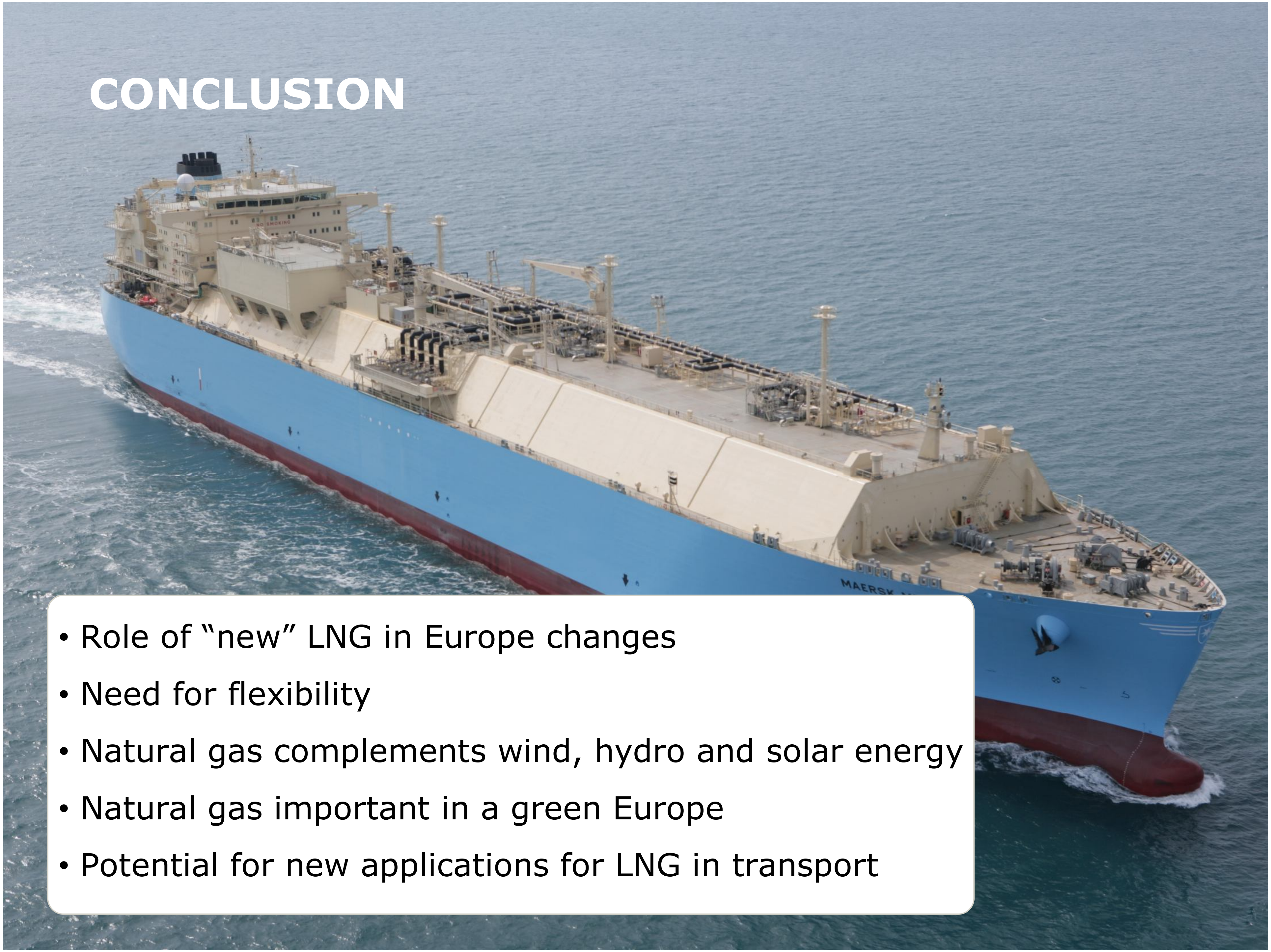
Change from residual oil to LNG:

Fuel type	SO_x (g/kWh)	NO_x (g/kWh)	PM (g/kWh)	CO_2 (g/kWh)
Reduction	99%	81%	98%	~15-25%

Source: MAGALOG 2008

However: Greenhouse gases may increase, mainly methane

CONCLUSION



- Role of “new” LNG in Europe changes
- Need for flexibility
- Natural gas complements wind, hydro and solar energy
- Natural gas important in a green Europe
- Potential for new applications for LNG in transport

KEEP IN TOUCH...

Ramboll Oil & Gas

www.ramboll-oilgas.com

Dr Frederik Roose Øvlisen
fio@ramboll.com