



## Networks as the enabler of the new energy world

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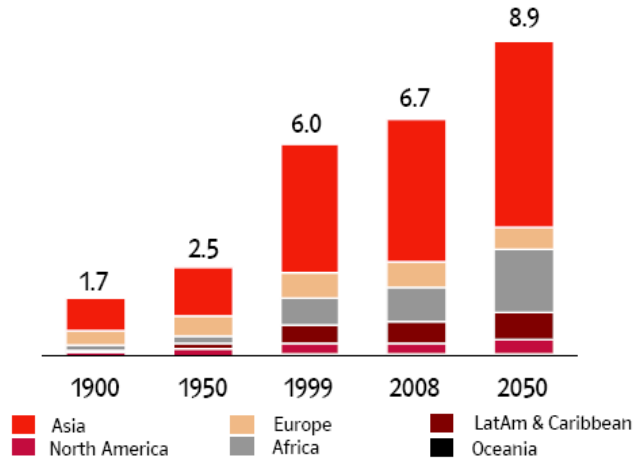
# Content

- Global trends
- EU Climate Policies
- Network Capabilities
- Integrated Concepts

# Population growth and associated resource requirements are the largest challenge of our time

## Global population to hit 9 bn by 2050

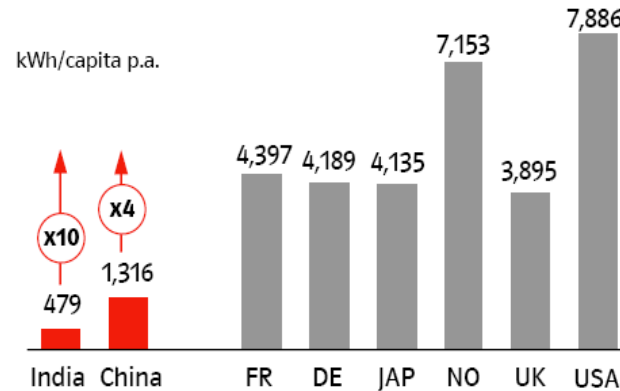
- Majority of increase is expected to come from Asia
- Pressure on energy resources and water supply set to intensify



Source: United States Census Bureau 2006

## OECD energy consumption 4x that of China

- Expectation that 80% of demand growth is met by fossil fuels
- China is building over 1 GW of coal fired plant per week in order to satisfy its rising energy demands

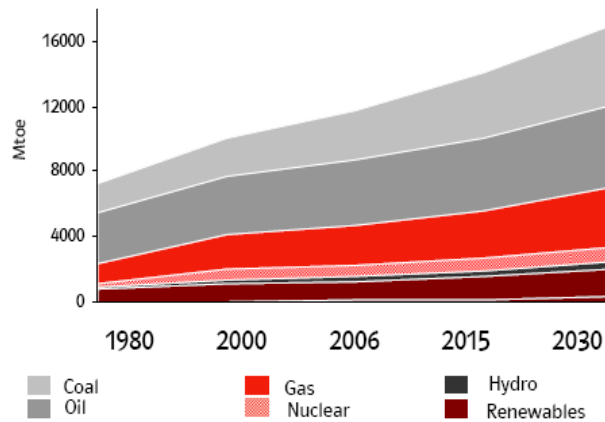


Source: United States Census Bureau 2006

# The increase in energy demand requires decarbonization of generation and enhanced end use ef

## Strong rise in global energy demand

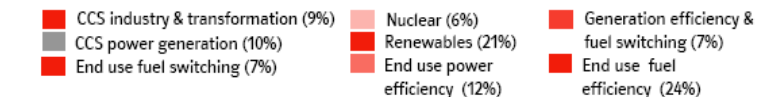
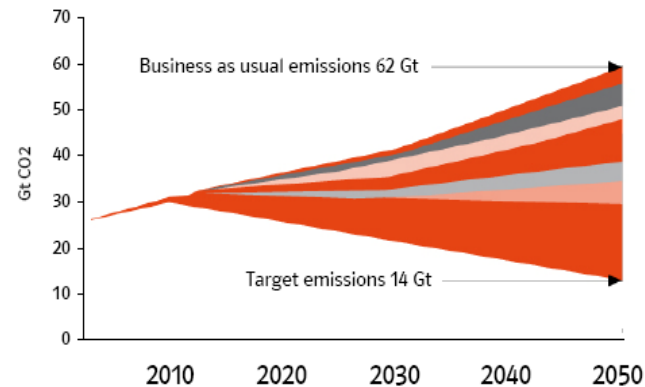
- Population growth and further industrialization of rural areas in Asia will drive energy needs
- Primary energy demand set to rise at average of 1.6% p.a. out to 2030



Source: IEA

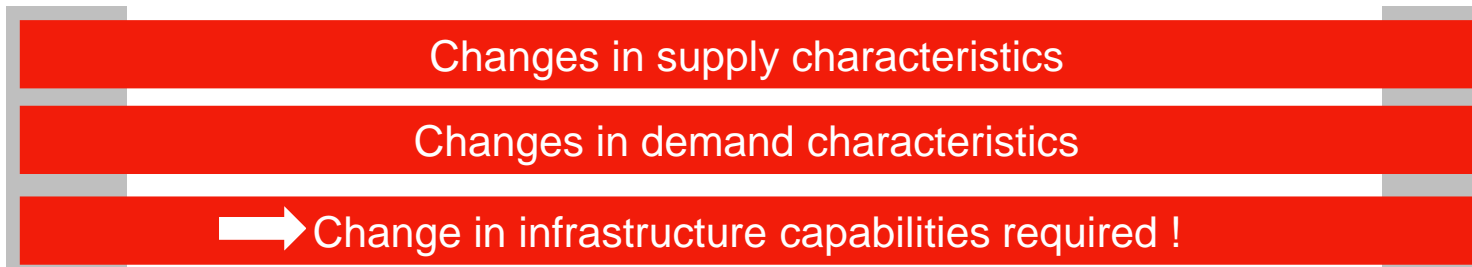
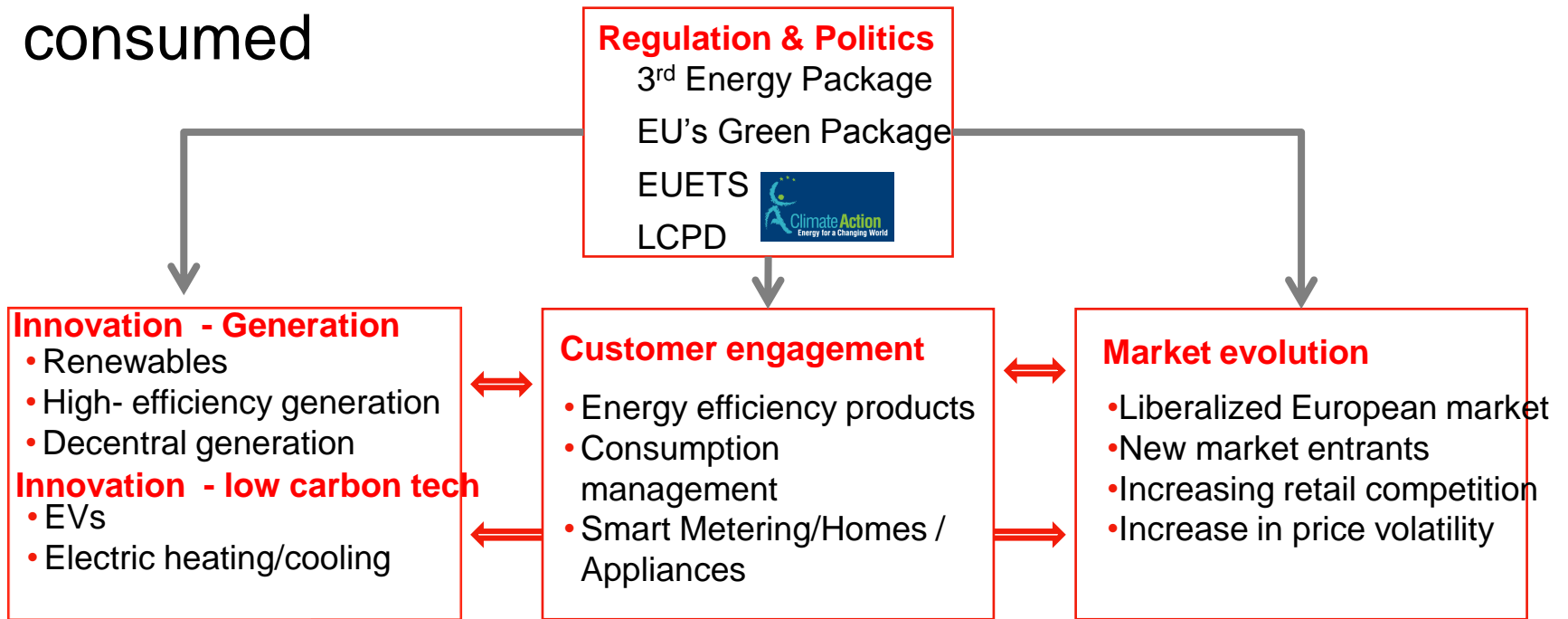
## Technologies to tackle climate change

- Business-as-usual would lead to emissions of 62 Gt by 2050
- 14 Gt target consistent with 2°C warming target (450ppm)



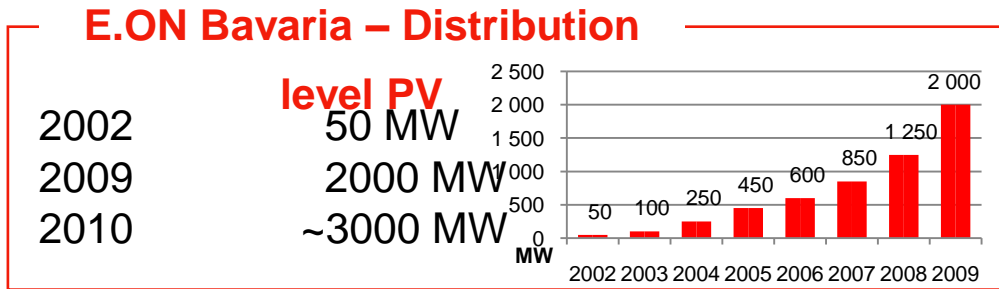
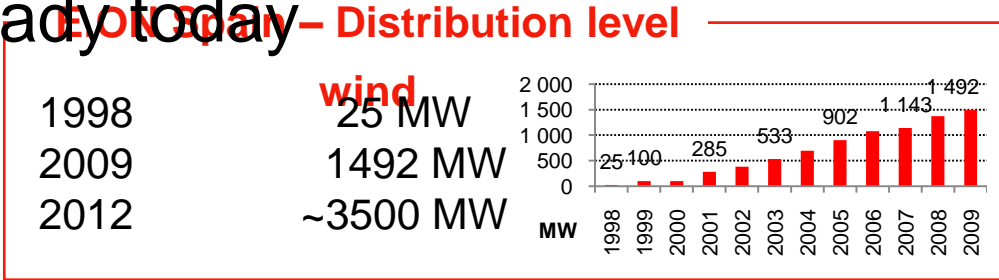
Source: IEA 2008

European efforts to address climate change are impacting largely the way energy is produced and consumed



Several examples from E.ON distribution businesses show that enhanced grid capabilities are required already today

Change in supply characteristics



Change in demand characteristics

**E.ON Westf. Weser – Smart Home**

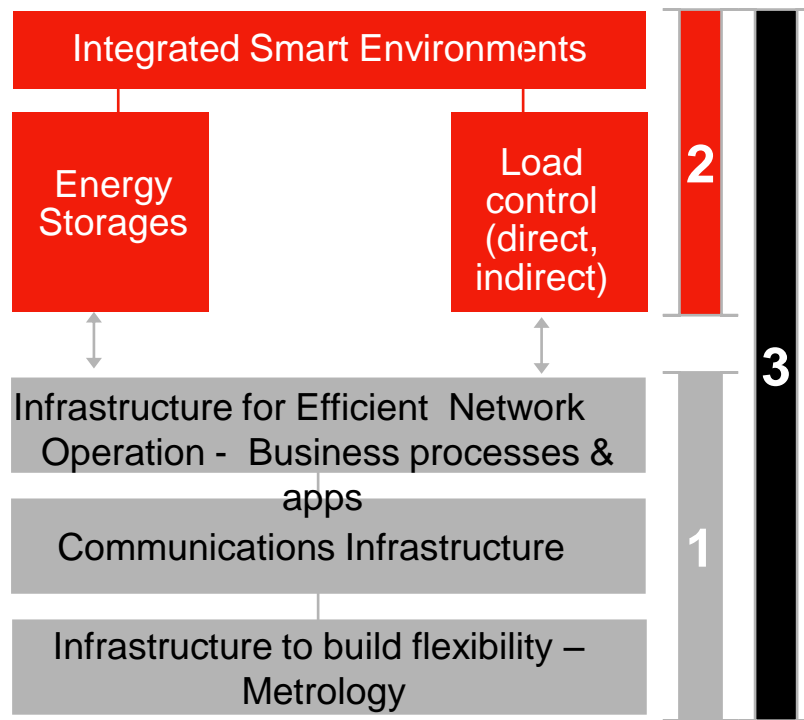
- Automated reduction of room temperature
- Automated adjustment of house lighting
- Tailored to customers life style and routine

**Energy landscape to change even more dynamically in the years to come:**

- Increasing stringency of environmental targets
- Advancement of innovative technologies
- Enhanced customer education on energy

# The network infrastructure of tomorrow must exhibit a high level of flexibility to adapt to changing requirements

## Requirements for flexible grid operation



## What E.ON is doing in RD&D

1. Developing technical excellence in operation of new assets and systems
2. Defining and demonstrating how the distribution business can use "active" tools to enhance flexibility
3. Exploring how to most effectively integrate high-efficiency distribution with active tools

# E.ON is exploring three broad areas in RD&D to understand the optimum structure of future networks

## 1 Technical excellence in operation of new assets and systems

Integration of SCADA and AMR systems – **E.ON Sweden**

Prototype adjustable transformer in distribution substation – **E.ON Germany**

Smart Metering – **E.ON Sweden, E.ON Germany, E.ON Spain**

Dynamic Line rating – **E.ON UK**

## 2 "Active" tools

Battery testing on Pellworm Island – **E.ON Germany**

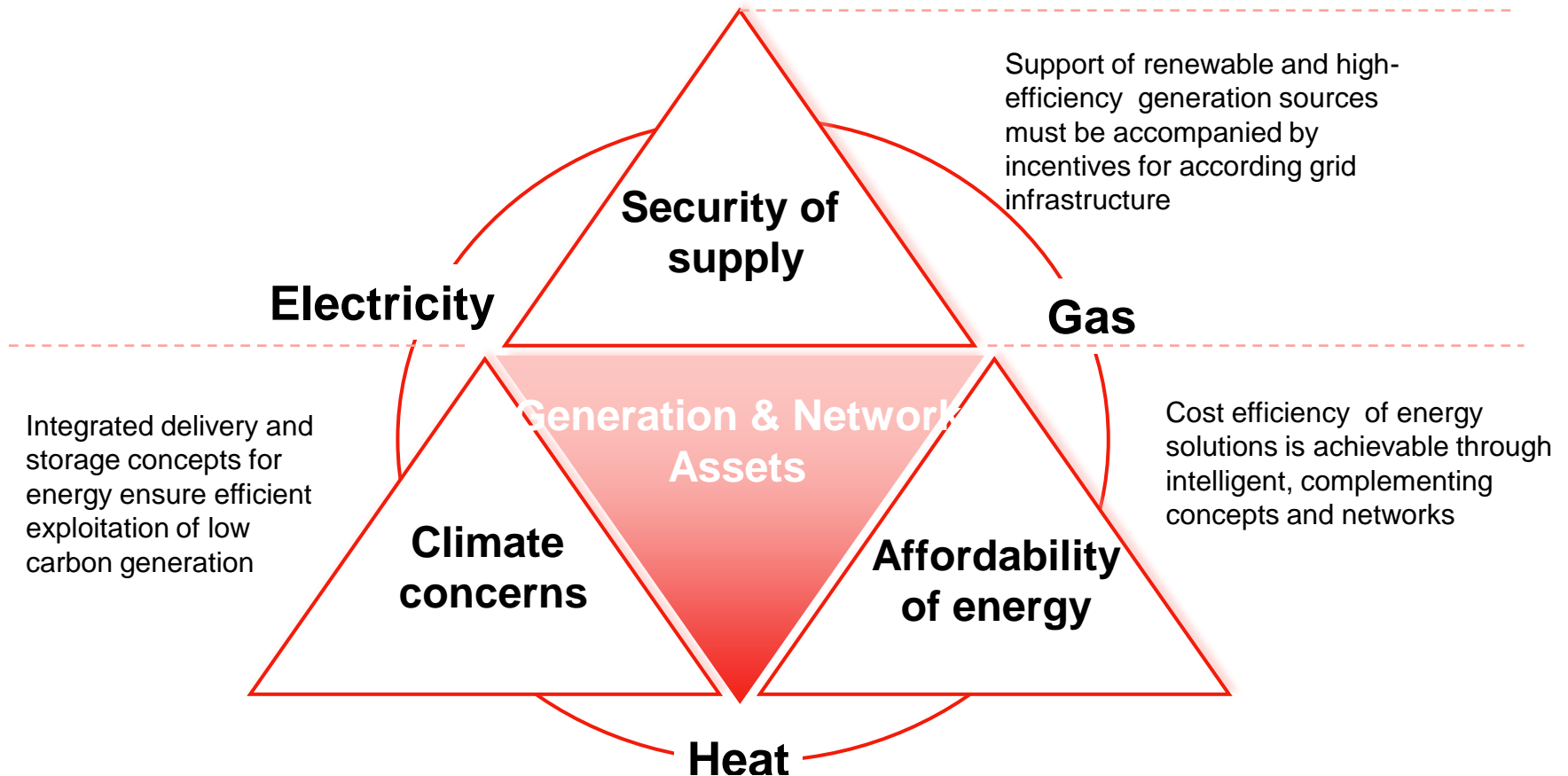
Twindrive project in cooperation with VW – **E.ON Germany**

## 3 Integrated smart environments

Sustainable Malmö 2020 – **E.ON Sweden**

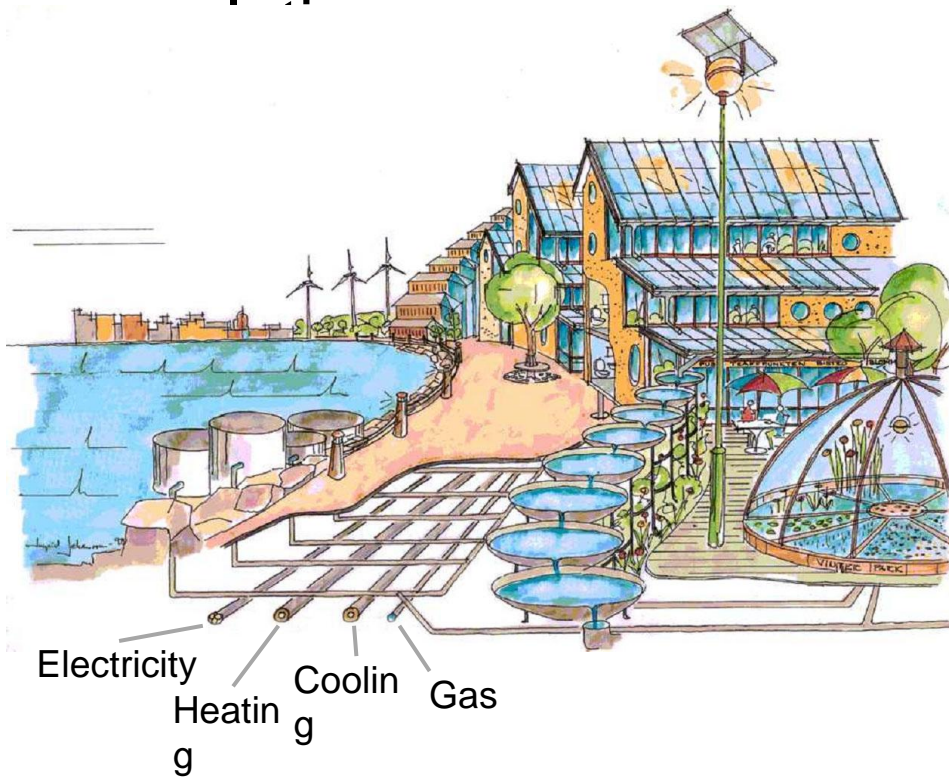
Smart MK 2020 – **E.ON UK**

# The naturally enabling role of networks for sustainable energy concepts cannot be confined to electricity only



**Addressing the energy trilemma requires integrated approach of energy sources and networks!**

# The sustainable city of Malmö demonstrates the efficiency potential from integrating power, heat and



- Integration of decentralized generation such as solar PV and urban wind
- Production of biogas from agricultural, industrial and household waste
- Generation of electricity and heat through high-efficiency CHP plant
- District heating for distribution of heat, incl. customer self-produced heat
- Ground source heating and cooling system through Malmö's aquifer

**Residents of Sustainable Malmö, Western Harbor live 100% on local, green energy!**

**And even smarter integrated living is just a stone's throw away**

# Thank You for Your attention!

## Questions?

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Nordic

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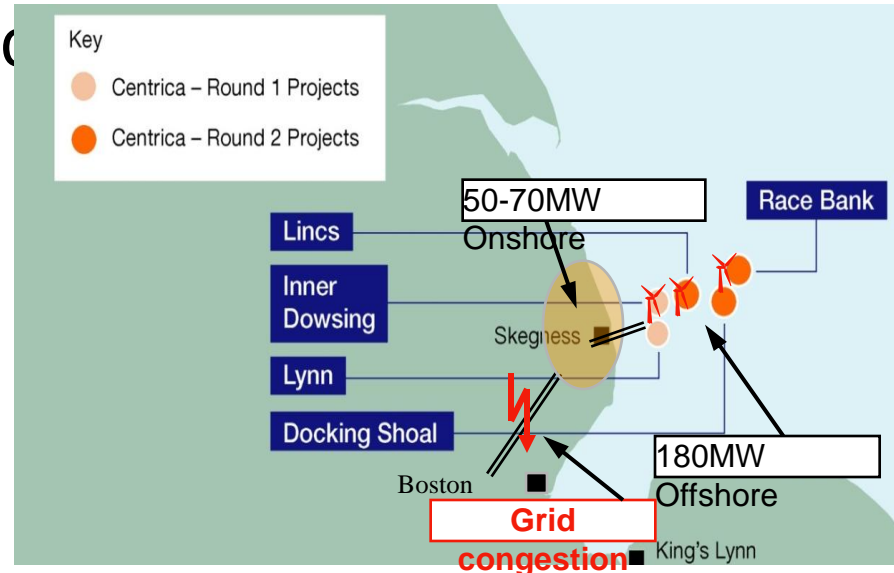
Nordic

Backup

# E.ON UK has implemented dynamic line ratings to extend existing network capacity

## Issue:

- Significant amounts of existing and planned wind farm generation
- The demand at Skegness is insufficient to absorb all generation
- Further generation would cause conventional line rating to be exceeded



## Smart solution

- Weather monitoring equipment in Boston and Skegness transfers data to SCADA
- Wind speed and ambient air temp. data enables calculation real-time line rating
- Novel software solution allows
  - Active export control
  - Real time load measurement
  - Dynamic circuit ratings

## Smart result

- Dynamic optimization of thermal network capacity increases generation connection capacity:
  - Existing 226 MW
  - Additional ~ 90MW
- **Costs of £500k vs. network enforcement of £3 to £5m**