

IEEE PES Conference Innovative Smart Grids Technologies

PLenary Session 1, 11 October 2010
On Smart Electric Power Systems

Sture Larsson

Technical Director, deputy CEO

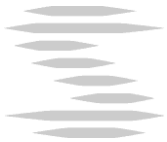
Svenska Kraftnät

The Swedish Transmission System Operator



Smart Grids

Development of the existing power system by integration of modern transmission and information technology



Smart Grids

Development of the existing power system by integration of modern transmission and information technology

Smart Grids – Smart Systems:

- > The Grids
- > What is connected to the Grids
 - Generation
 - Consumption



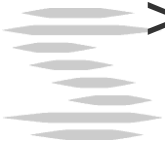
Smart Grids

Development of the existing power system by integration of modern transmission and information technology

> Why ? What are the driving forces ?

> Who shall pay ?

> What is the smartest way to do it ?



Smart Grids

Development of the existing power system by integration of modern transmission and information technology

> Why ? What are the driving forces ?

> Who shall pay ?

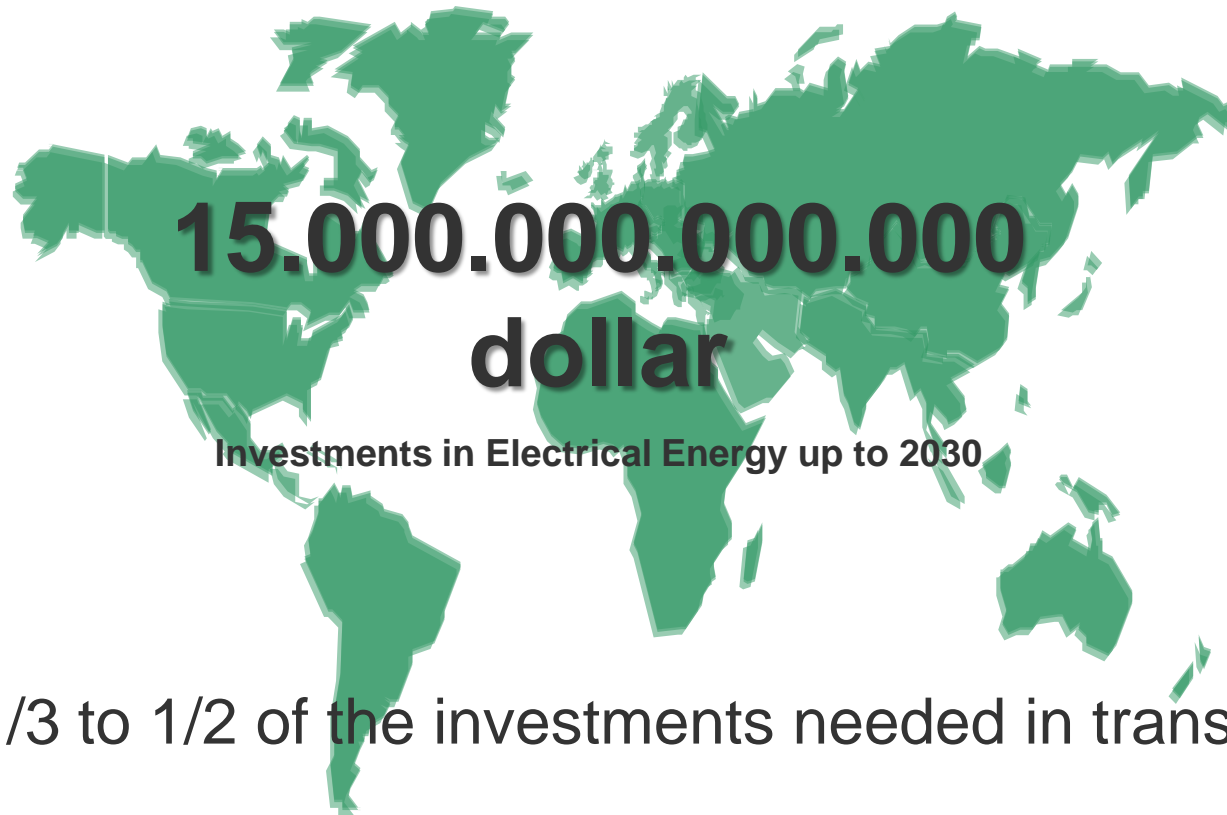
> What is the smartest way to do it ?

- Technically

- Economically



Investments to meet the climatic challenges

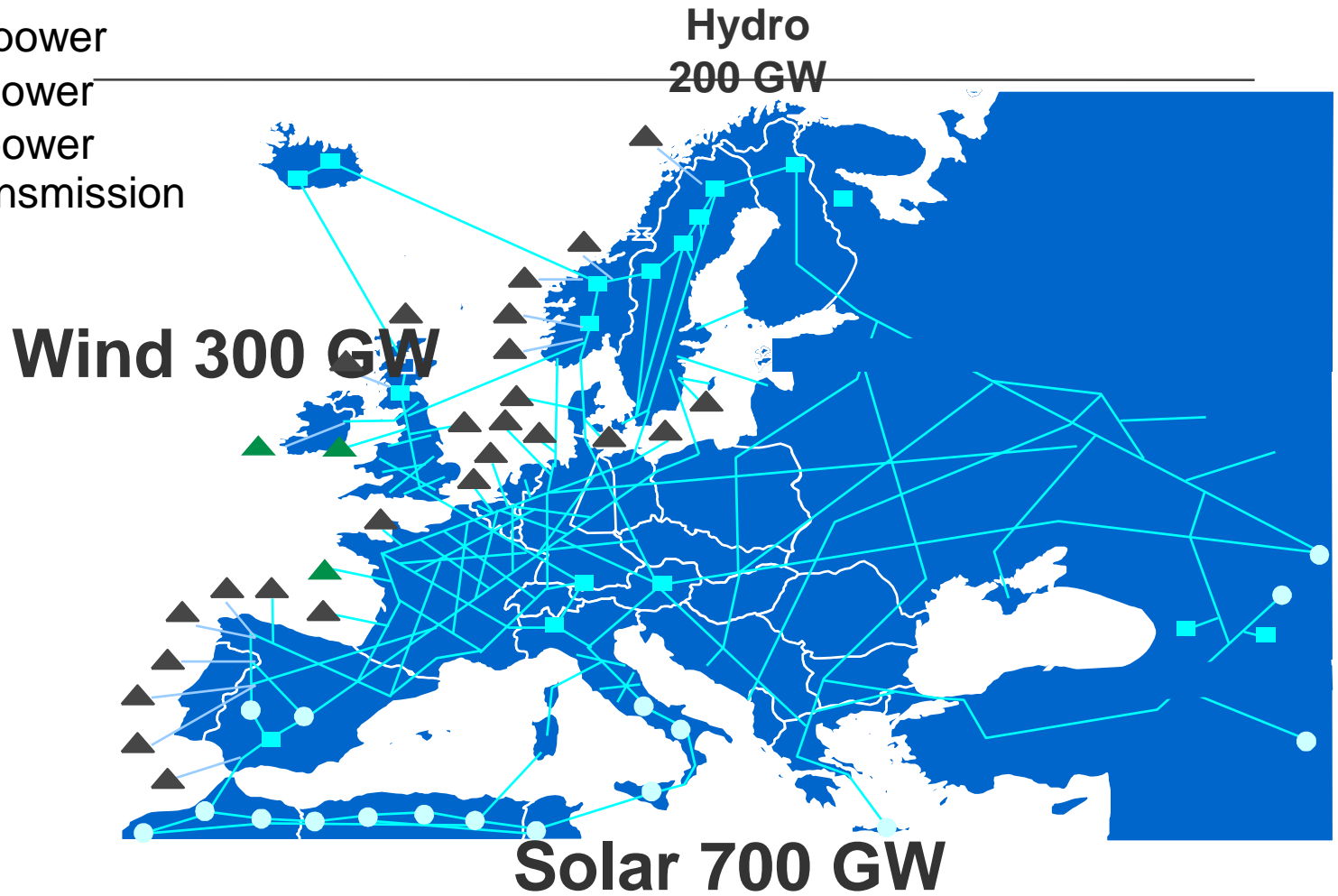


source: World Energy Outlook, 2006
(+ exchange rates corrections to 08)



A 20XX large-net European vision - based on smart thinking

- Hydro power
- Solar power
- ▲ Wind power
- DC transmission



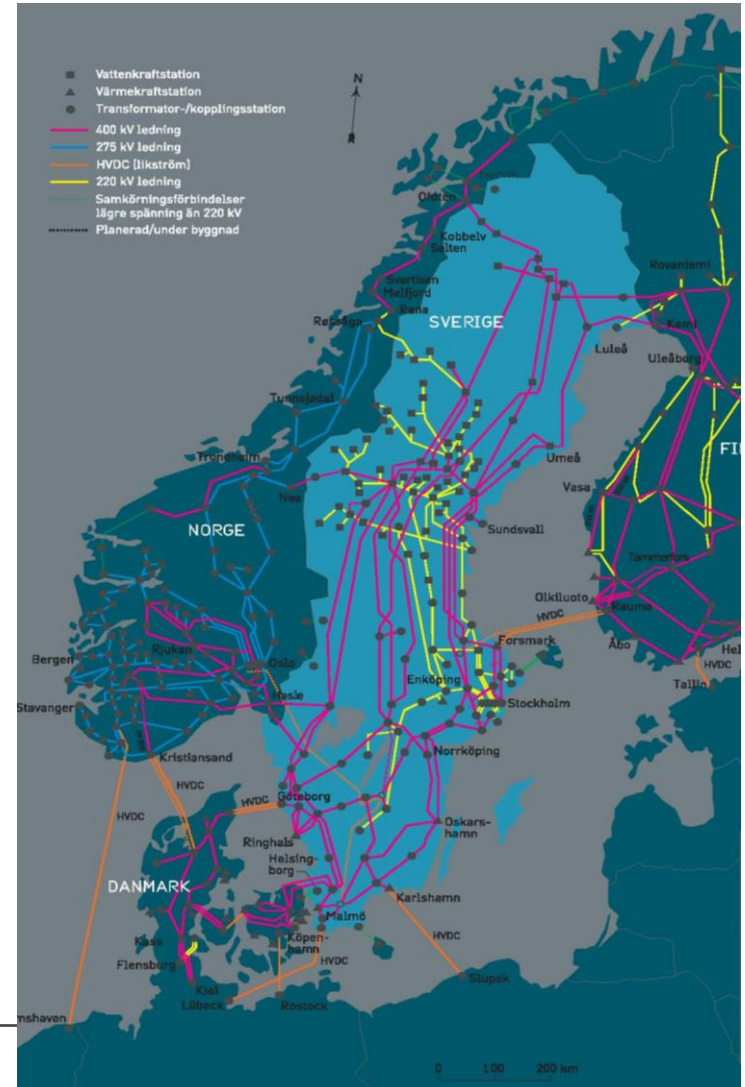
Svenska Kraftnät s Smart Grid vision

Objective of the Nordic TSOs

To develop the Nordic Power system to support the climate and energy policies laid out to reach the EU Commission sustainability targets

20/20/20 at year 2020

.... and beyond that !



Wind Power Development Scenarios in Sweden

- ❑ National planning target set to facilitate:

30 TWh / 12 000 MW

- ❑ Summary of all identified projects:

> 36 000 MW / 90 TWh

- ❑ Presently installed capacity:

Hydro 16 000 MW

Nuclear 9 000 MW

Legend

Projektfas

● Fas 1

● Fas 2

● Fas 3

Installerad effekt

● 0 - 10 MW

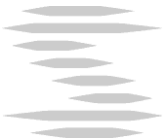
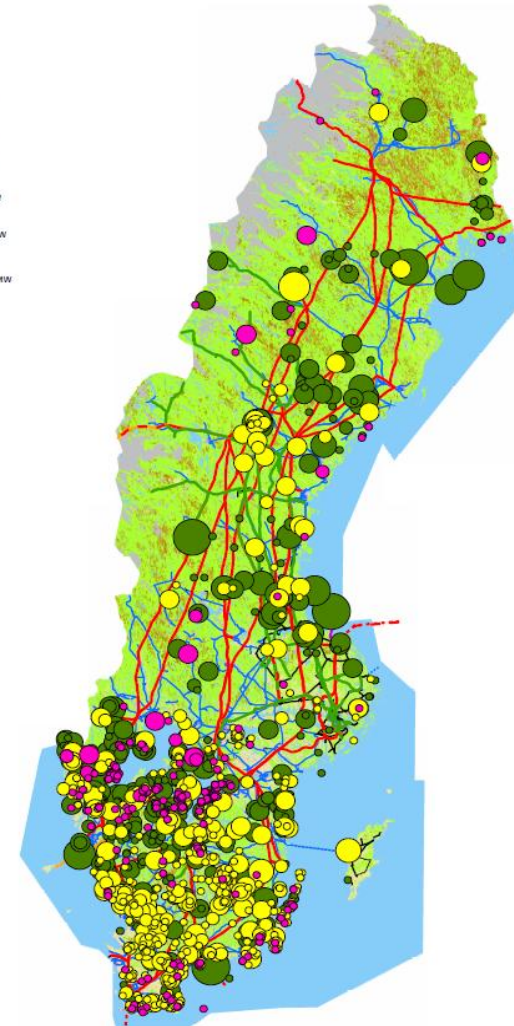
● 10 - 20 MW

● 20 - 100 MW

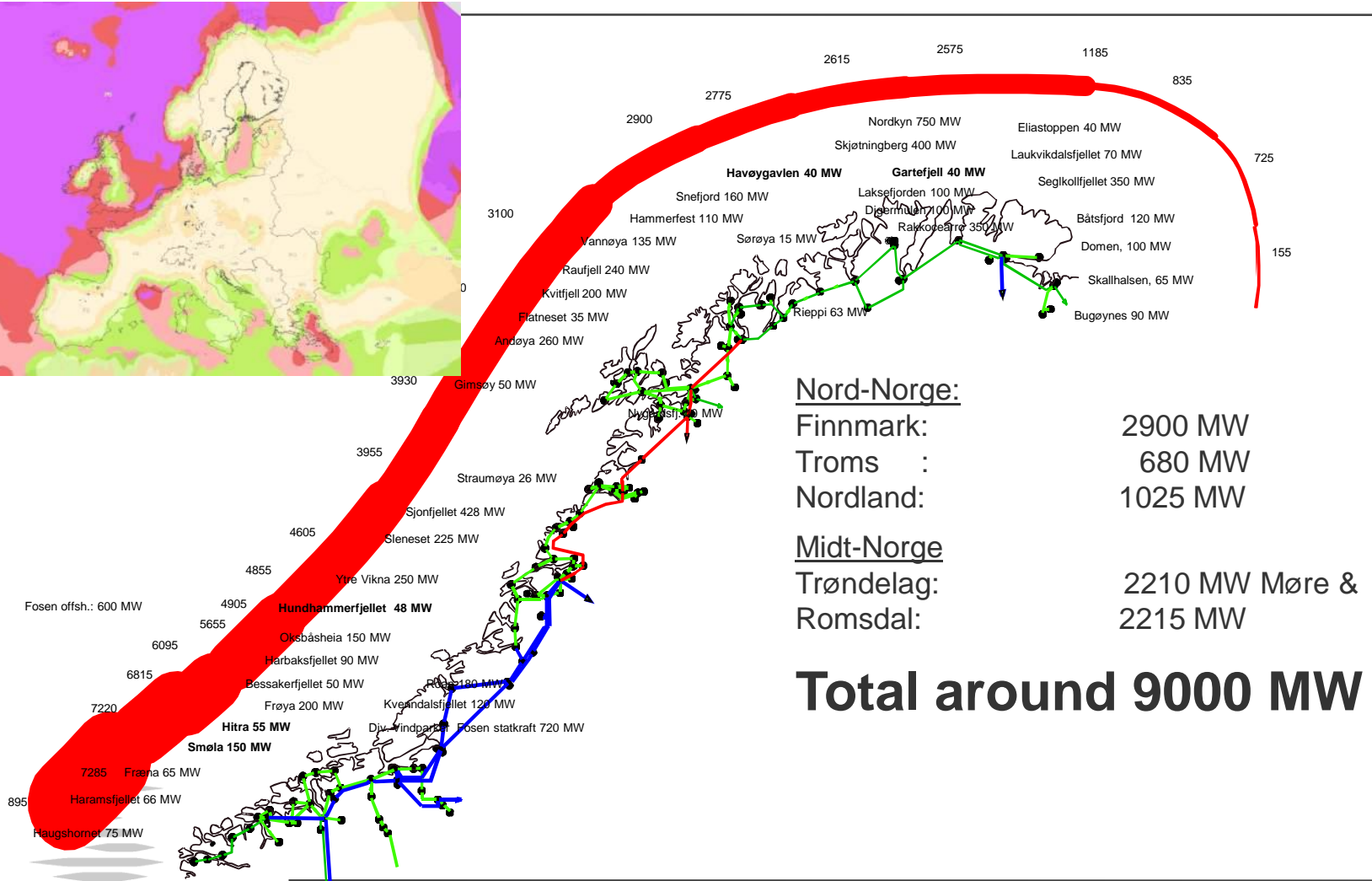
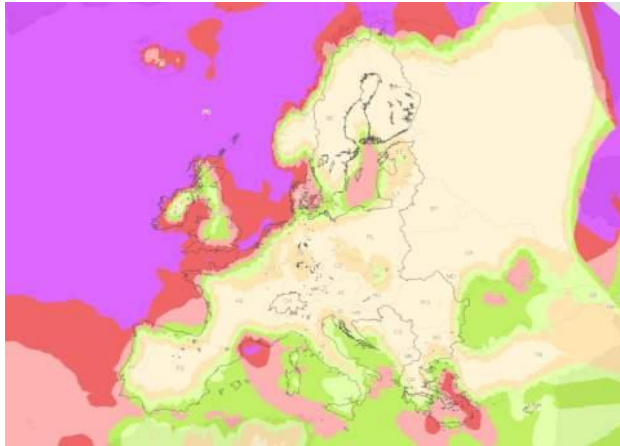
● 100 - 200 MW

● 200 - 1000 MW

● 1000 - 4000 MW



Identified projects in northern Norway



Nord-Norge:

Finnmark: 2900 MW
 Troms : 680 MW
 Nordland: 1025 MW

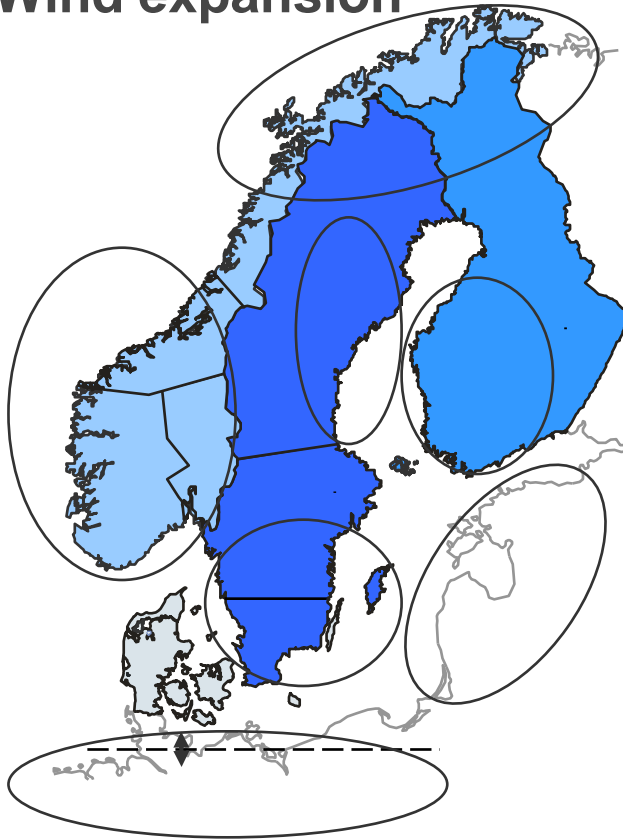
Midt-Norge

Trøndelag: 2210 MW
 Romsdal: 2215 MW

Total around 9000 MW

Wind development in a broader perspective

Wind expansion



Extensive wind development scenarios

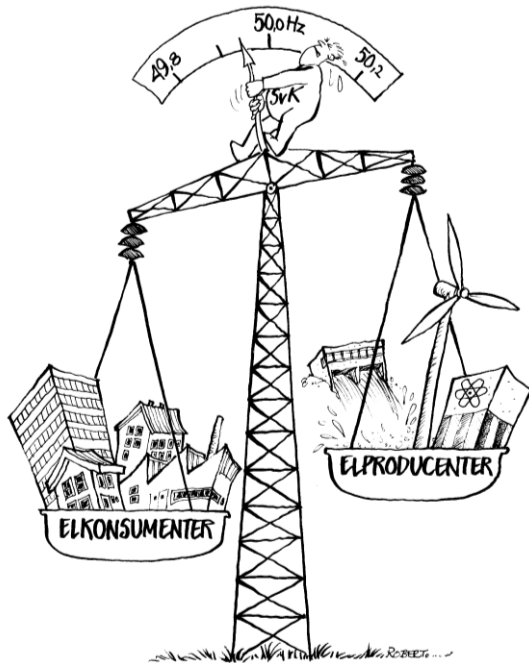
- ❑ Wind capacity may reach levels that are highly significant in relation to presently installed generation capacity
- ❑ Implies a major transformation of the Nordic Power System and its physical characteristics



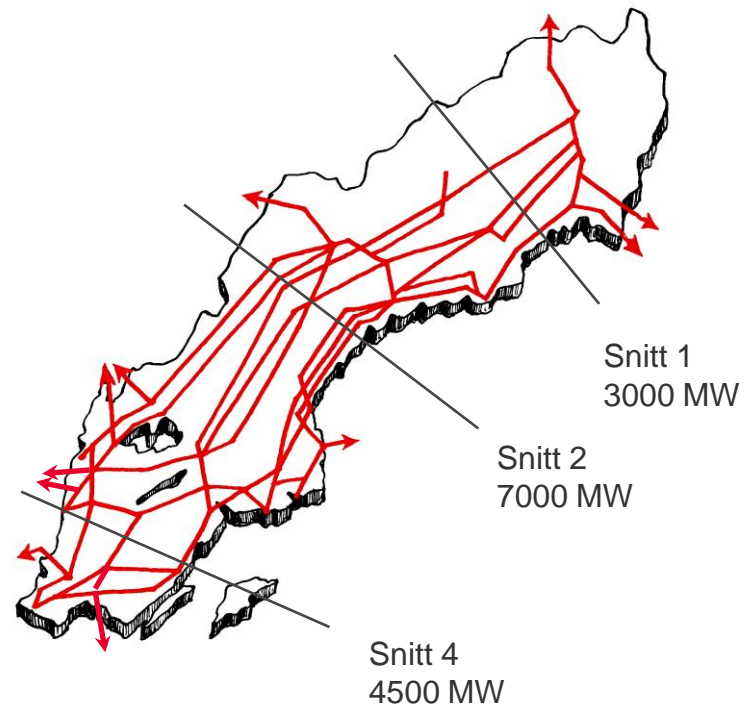
Impact on central System Operator duties

Balance regulation

Load-frequency control

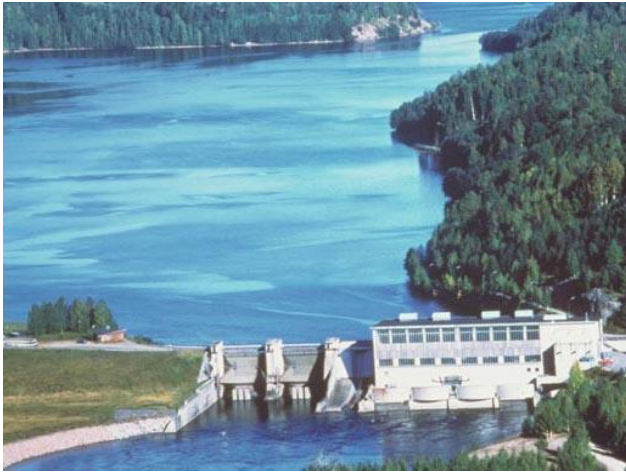


Transmission

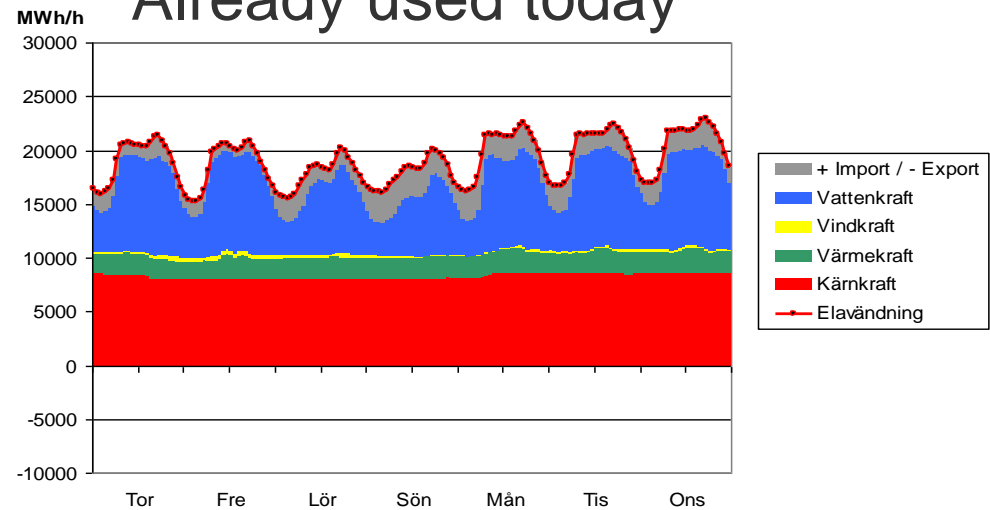


Balance regulation in hydro

Efficient, emission-free



Already used today



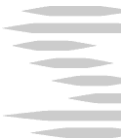
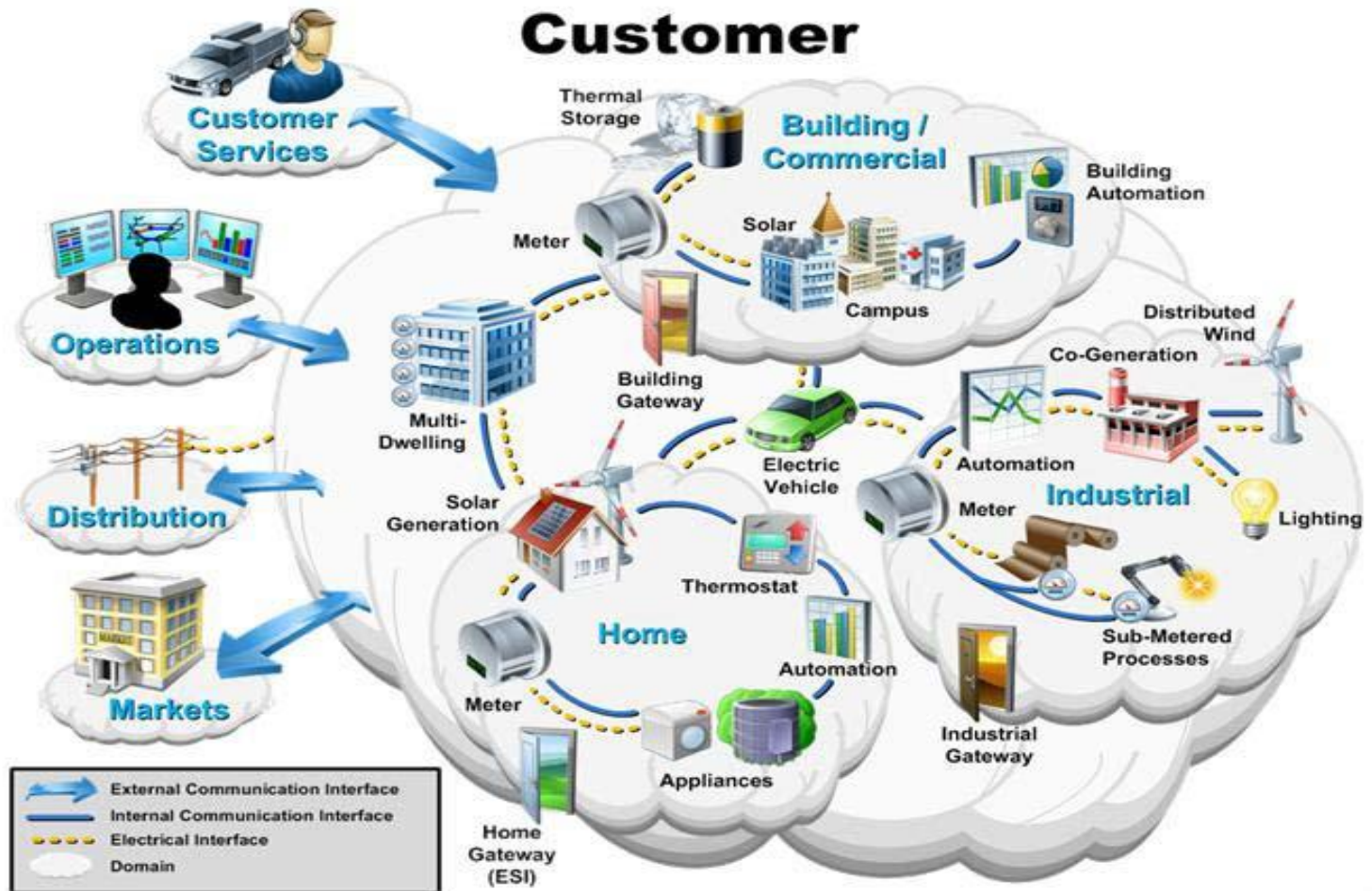
The regulation capacity of hydro power is extensive but not infinite

Maximum use of the capacity is demanded to meet European needs

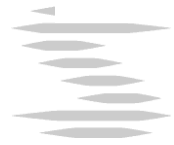
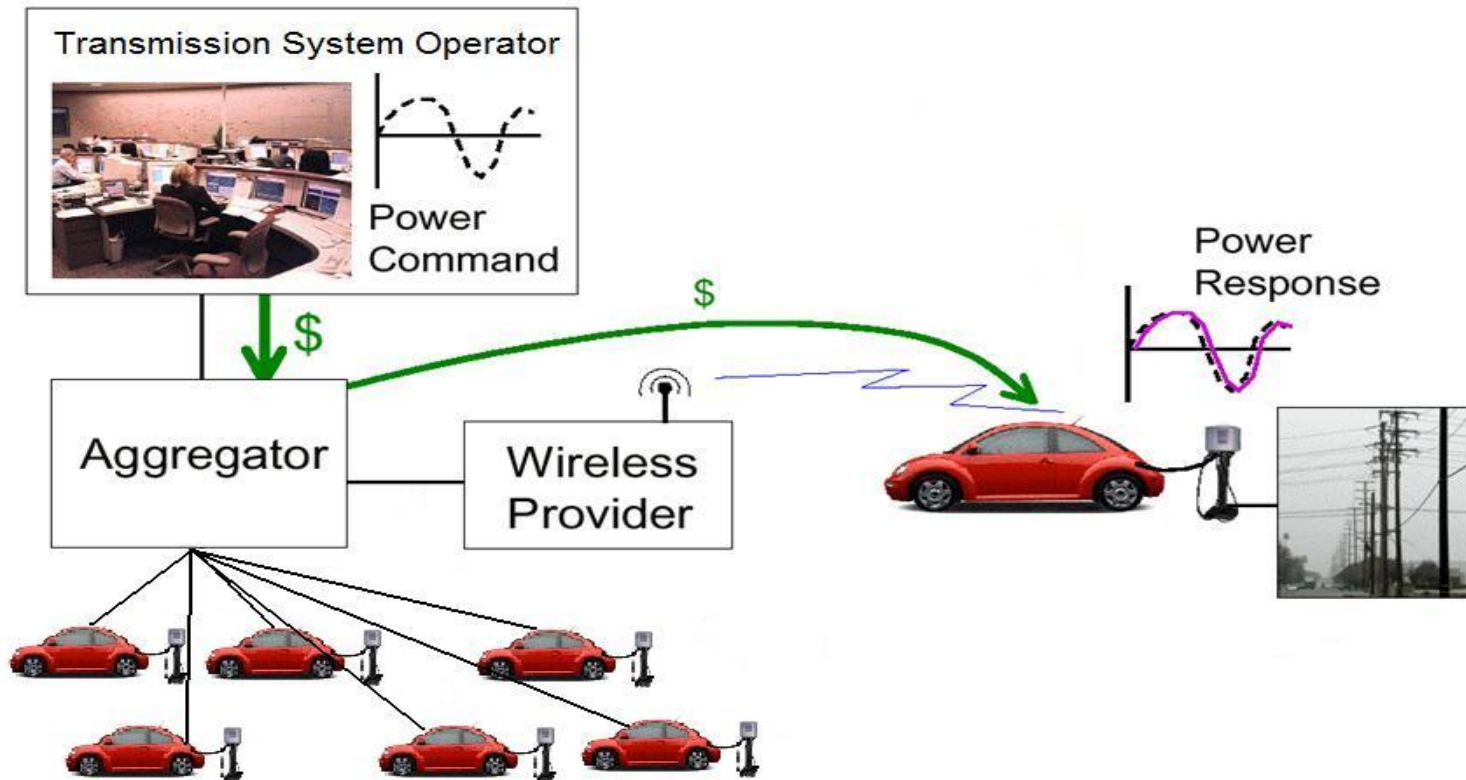
In conflict with local environmental concerns



Demand flexibility - Smart Grids



Vehicle-to-Grid (V2G) Vision

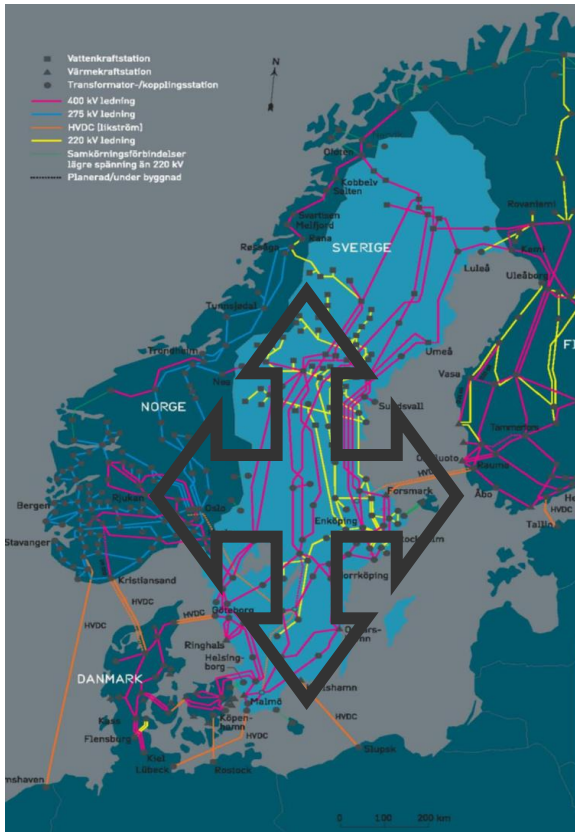


Development of Market and Regulatory Instruments

- > To incentivize development of efficient use of electricity
- > To transform dynamic market prices into effective demand flexibility
- > To share the economic profit along the value chain from system operation to the electricity end user

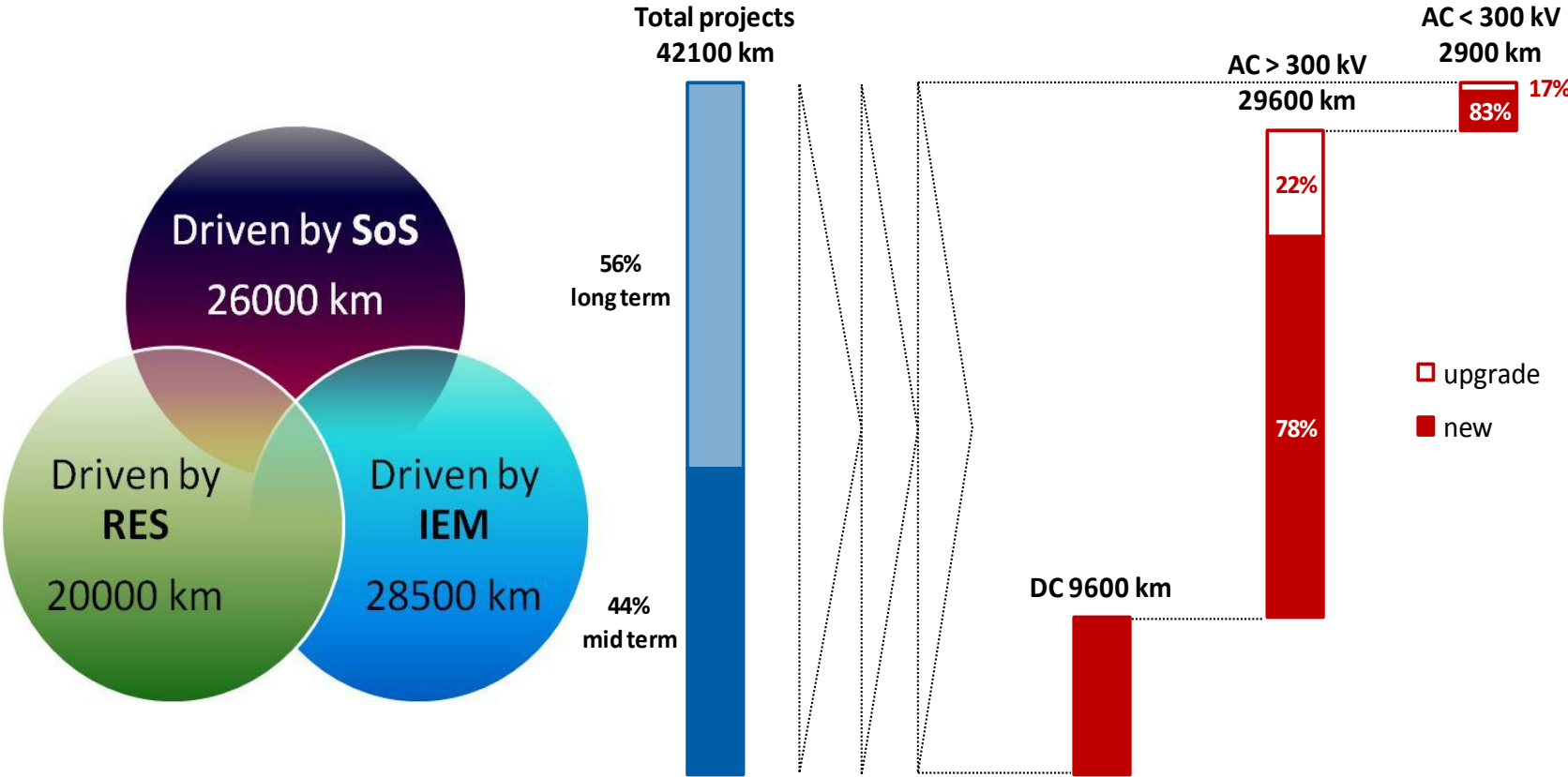


Enhanced transmission capacity needs



- > Transport of large volumes of renewable generation
 - > Transport of back-up generation
 - > Facilitate use of efficient and sustainable sources of balancing capacity
 - > Equalize wind generation over large areas
-

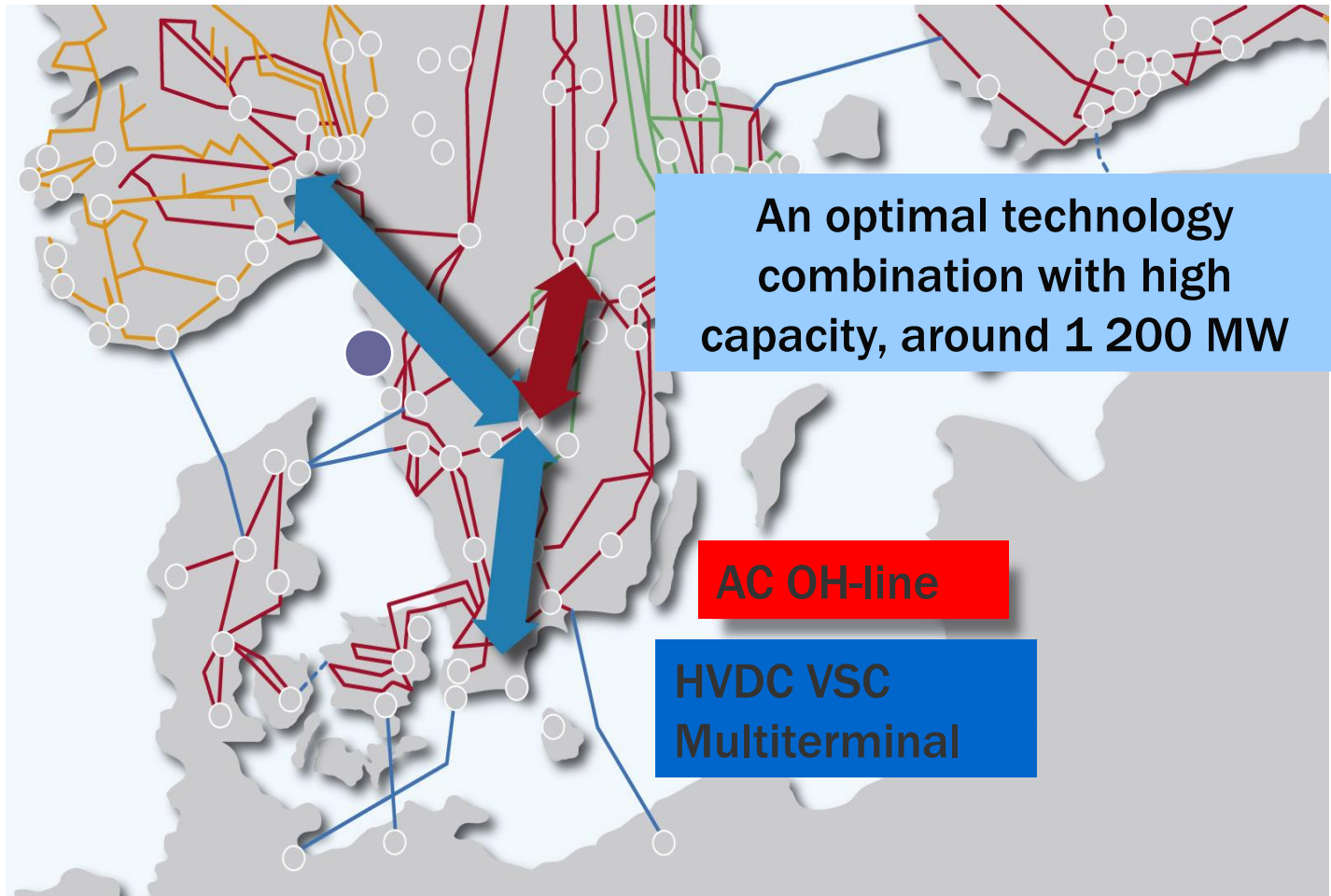
European 10 year network development plan by ENTSO-E



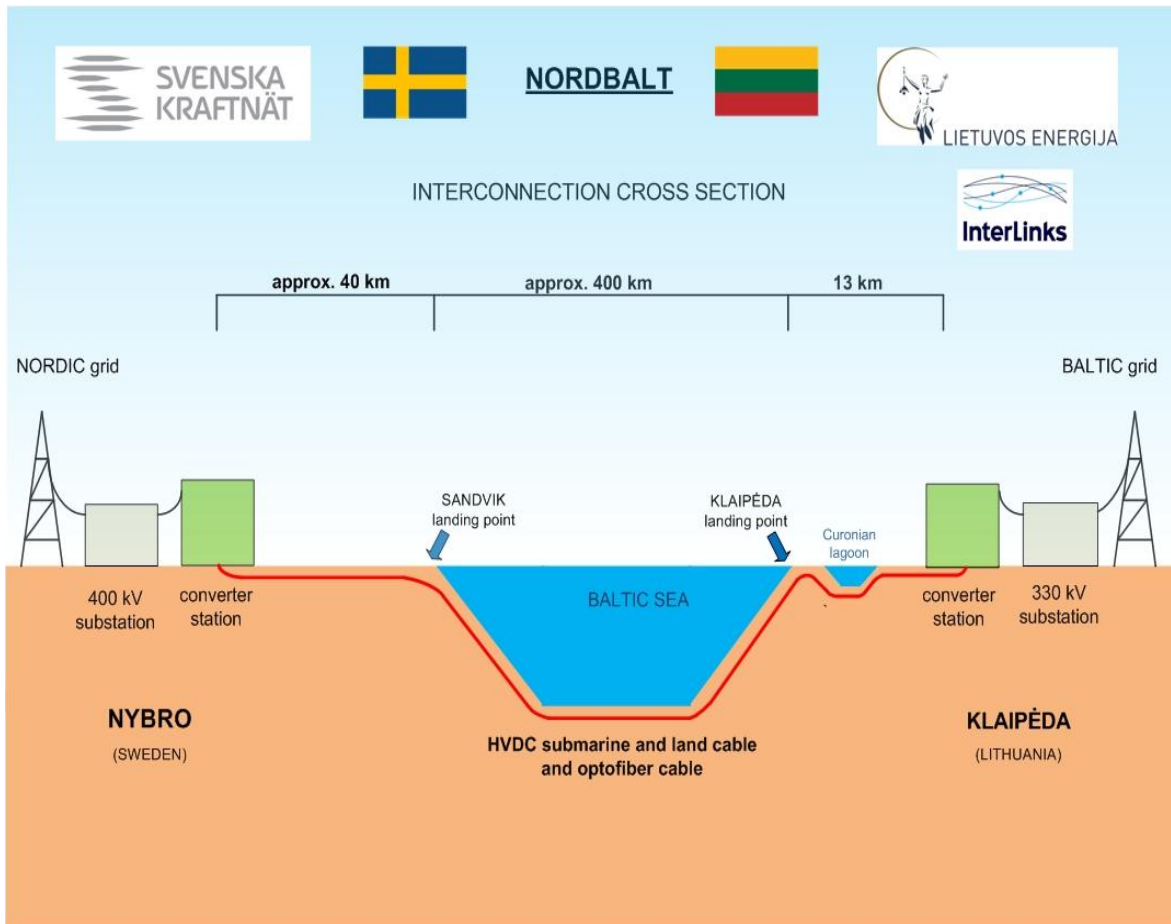
~14% of existing transmission line km



South West Link, - a 'Smart Grids' application



The NordBalt Interconnector



- **Capacity** 700 MW
- **Voltage** 300 kV
- **Length** ~450 km
- **Technology** VSC



TSO Requirements on Smart Grids

Development of the existing power system by integration of modern transmission and information technology

- > High capacity grid reinforcements
- > More advanced system protection and control
- > Demand flexibility as a balancing resource



Thanks for your attention !

