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Need for Educational Reform
A View from Europe/Norway

Terje Gjengedal, Senior Vice President/ Professor

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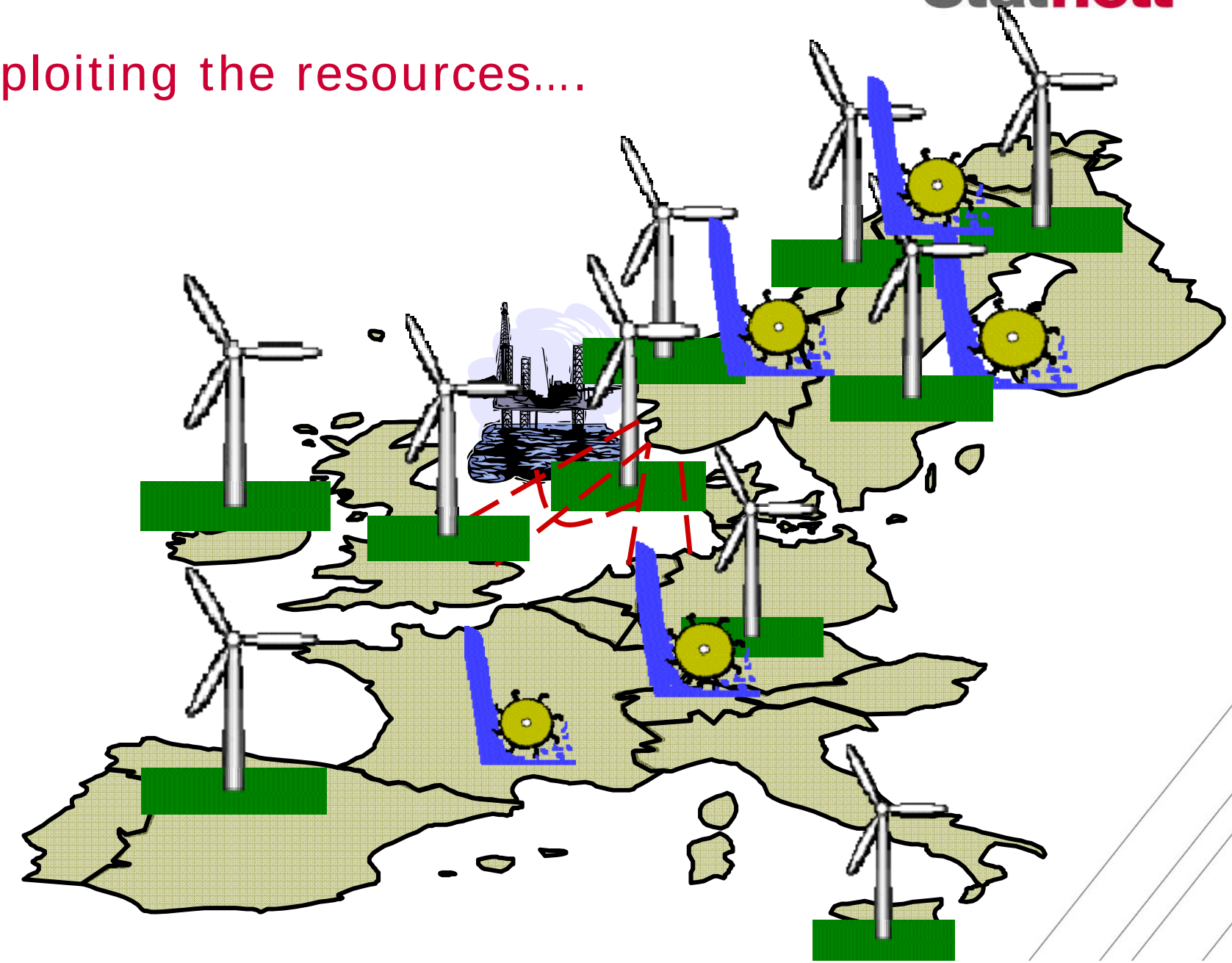
Exploiting the resources….

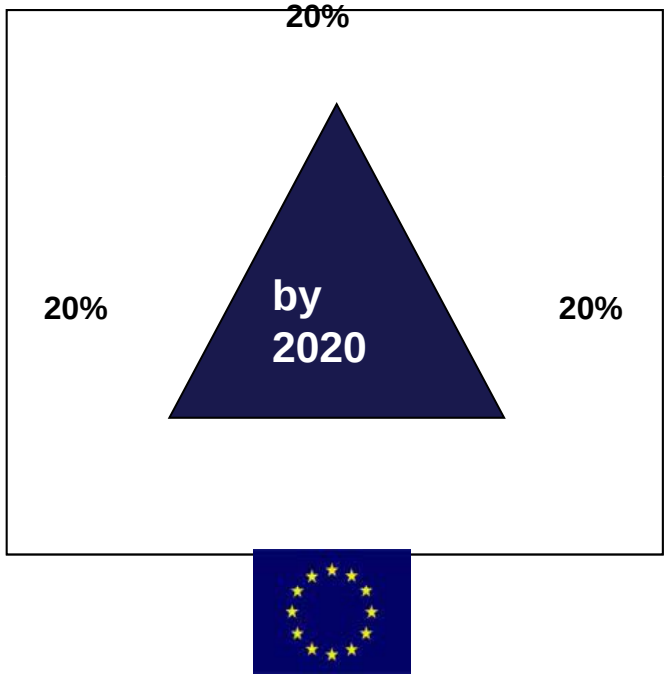


The EU Energy Policy..

20 20 20 - 2020

20% reduction in emission of greenhouse gases

20% improvement in energy efficiency



20% renewable energy

..IMPLIES HUGE INVESTMENTS IN RENEWABLE ELECTRICTY..

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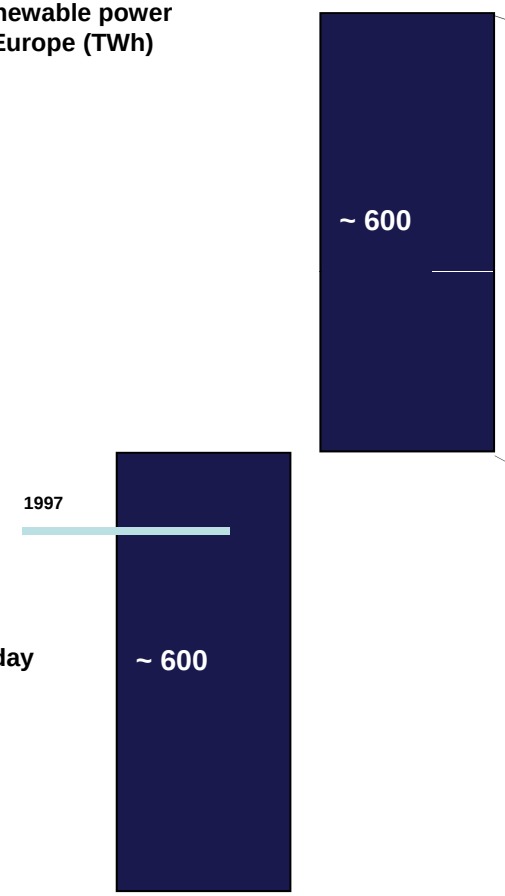
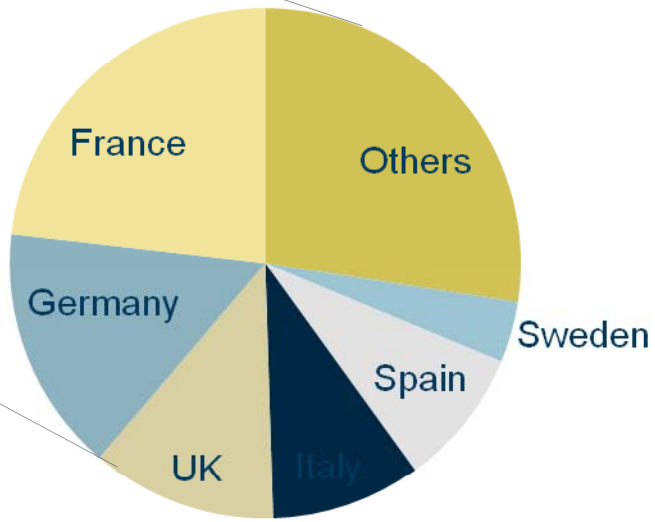
Renewable power in Europe (TWh)



Growth needed to 2020

..where the main bill is split by a few nations

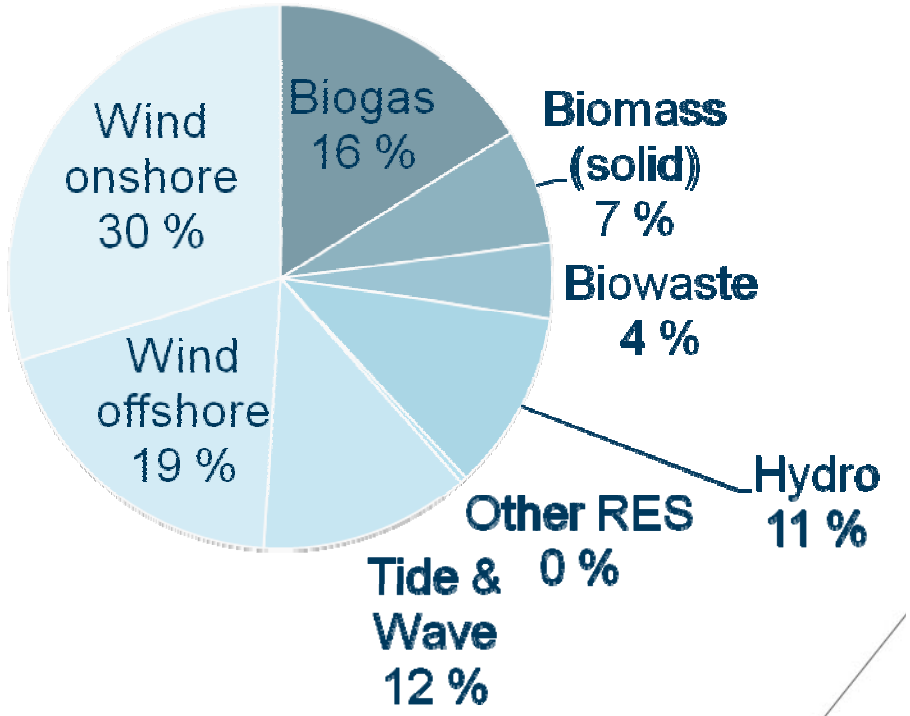


Estimated burden sharing
new renewable power (TWh)

Source: OPTRES, EU Kommisjonen, Statkraft, ECON

.. ACROSS A RANGE OF TECHNOLOGIES

600 TWh in new renewable power production towards 2020



Kilde: OPTRES, Statkraft, Econ

How to transfer the power?

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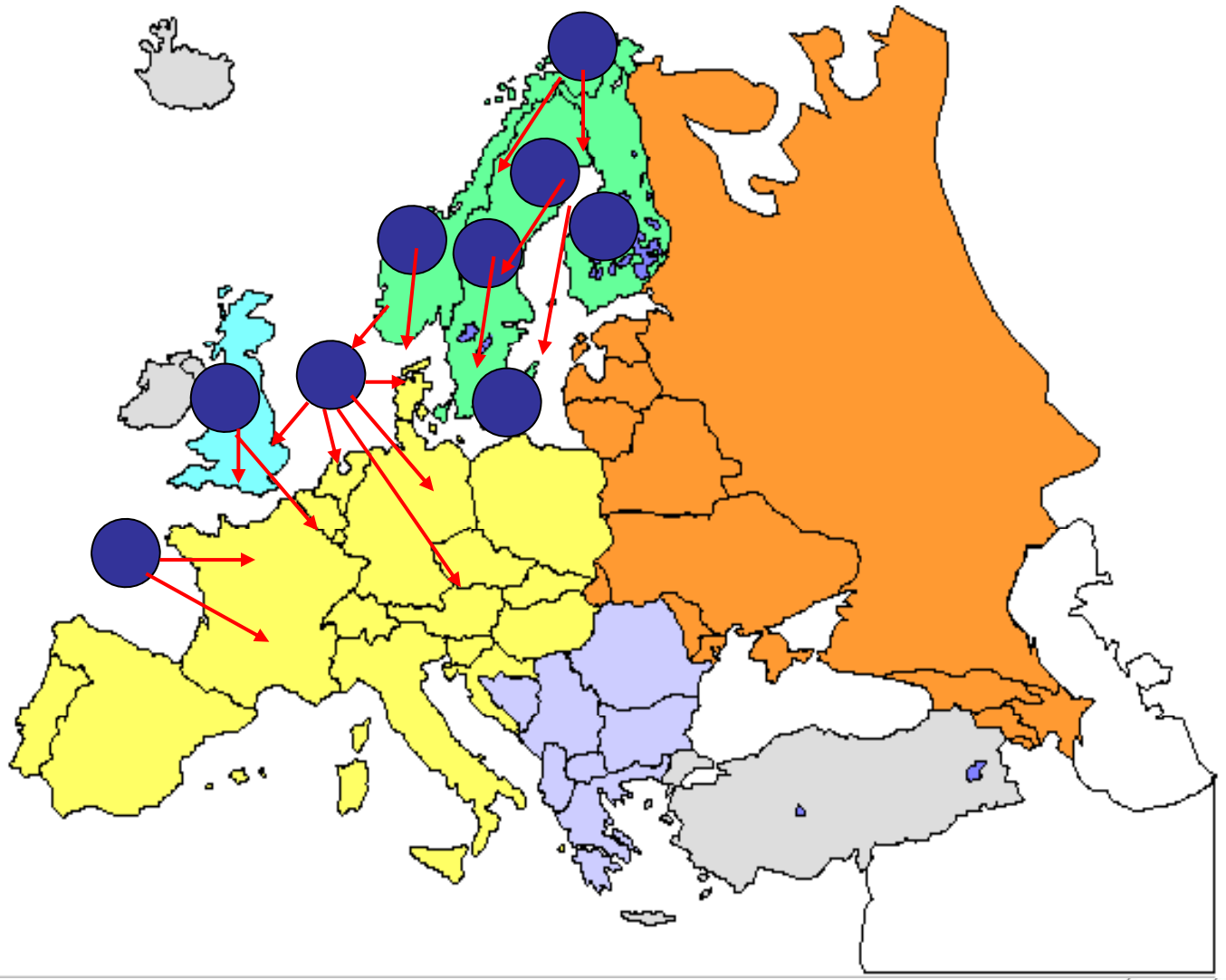

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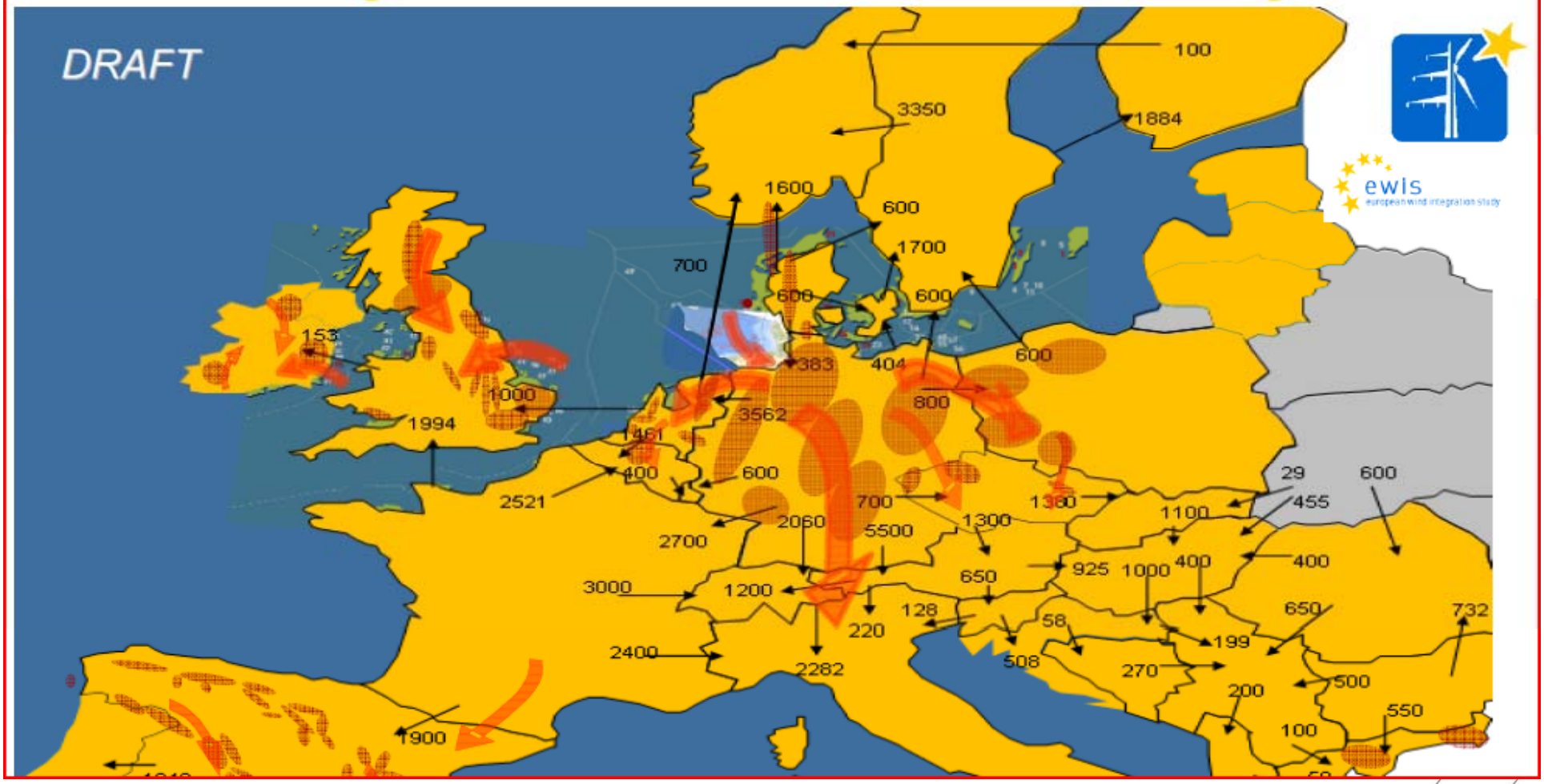
Necessary Grid Re-Enforcements by 2015



North Sea a common area for development

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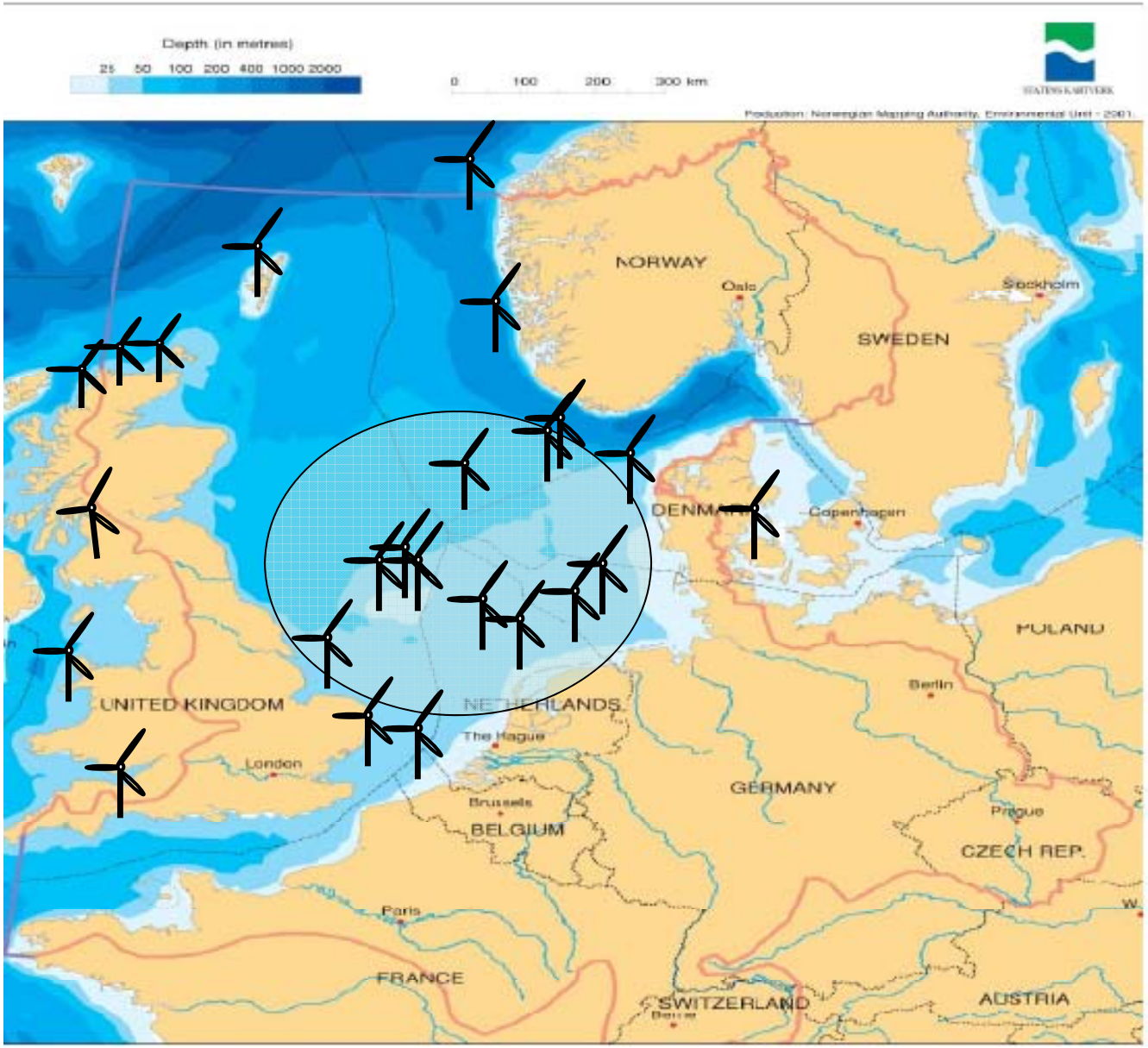
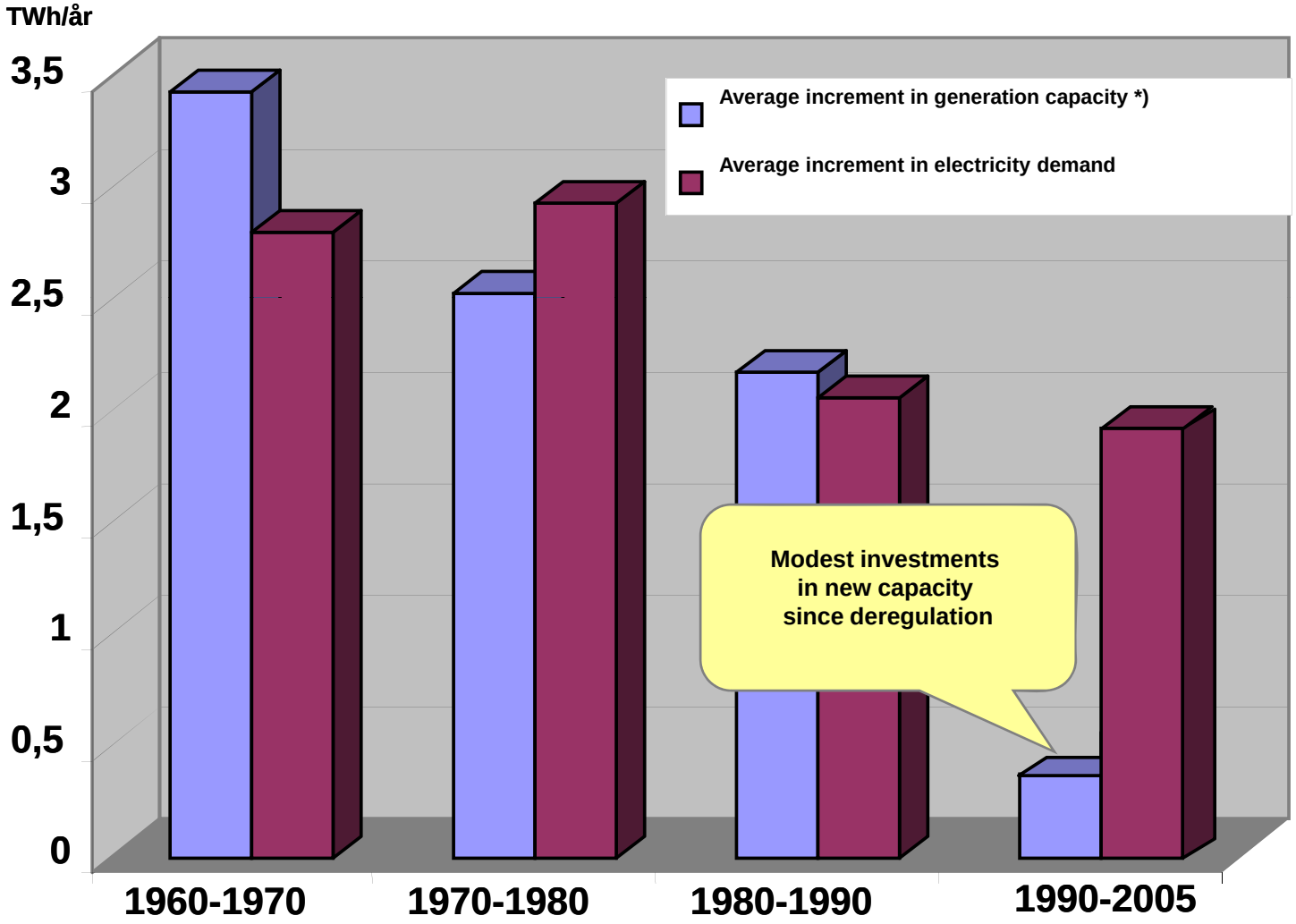


EU target 20% renewable by 2020

200 TWH from the North Sea?

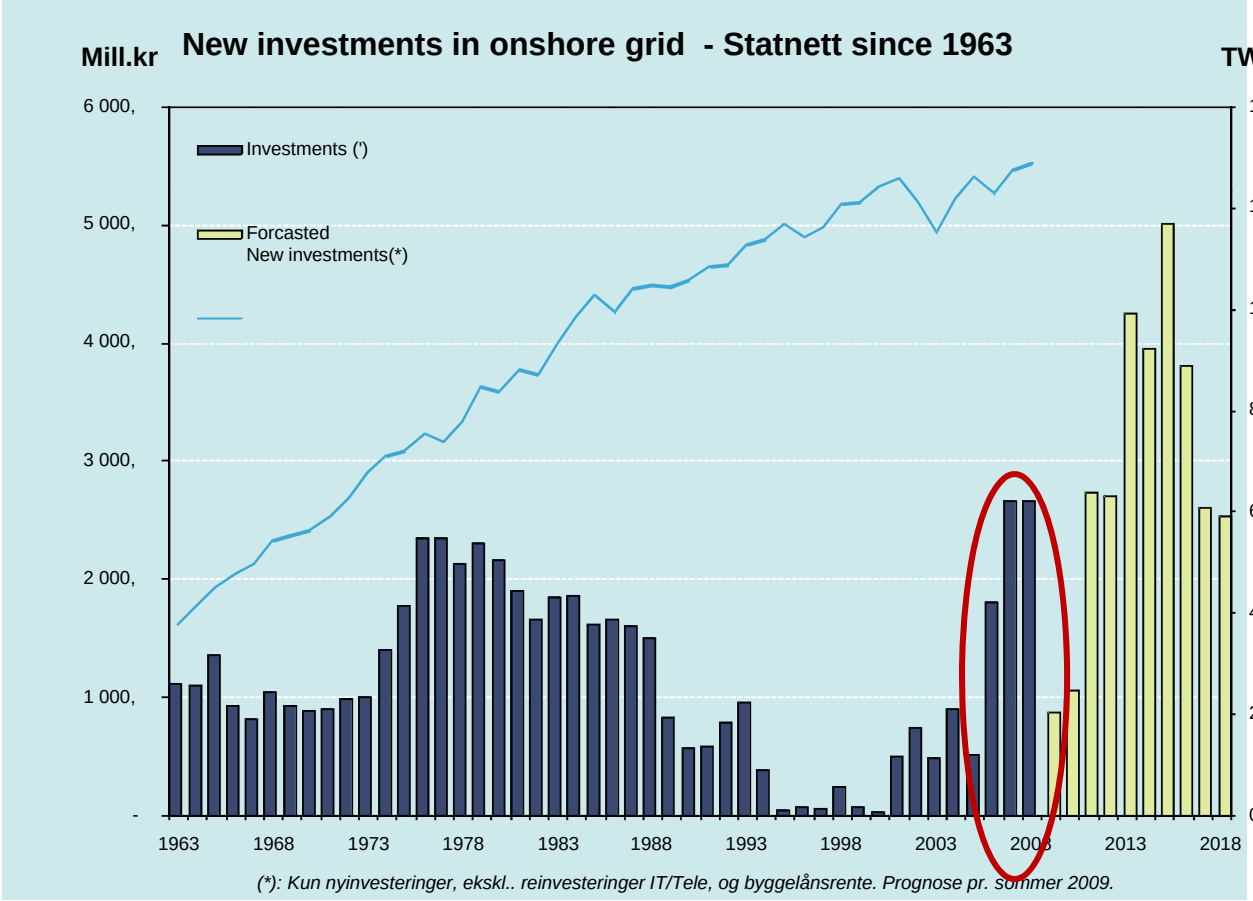
Average Annual Growth in Electricity Demand & Generation Capacity *).

Norway 1960 - 2005



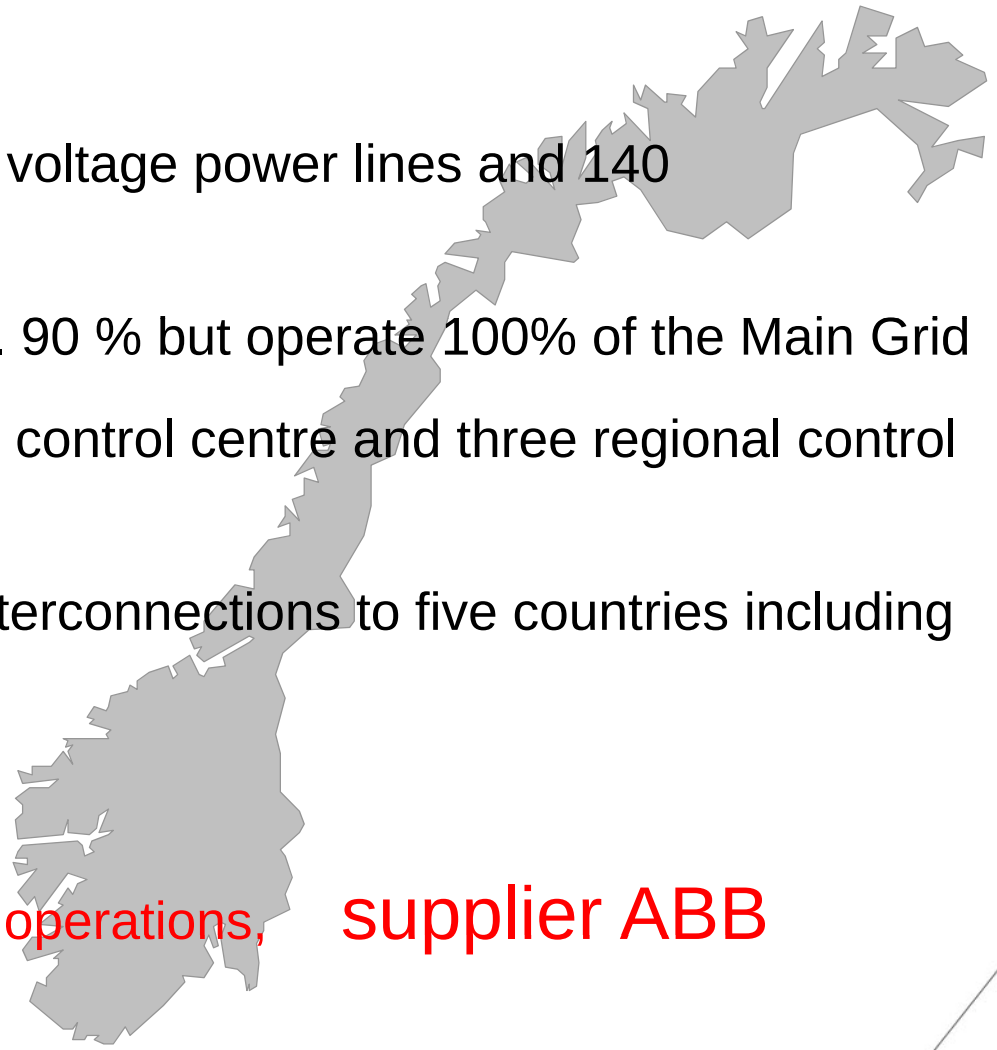
*) Increase in mean annual generation capacity

Implementing the next generation transmission has started –



After years with low investment in new capacity, a new era is underway

Statnett in brief



- Established 1992
- Owns 10 000 km high voltage power lines and 140 transformer stations.
- Statnett owns approx. 90 % but operate 100% of the Main Grid
- Operates one national control centre and three regional control centers
- Owns and operates interconnections to five countries including 4 HVDC subsea cables

- 8 AC/DC converters in operations, supplier ABB

Statnett looking forward

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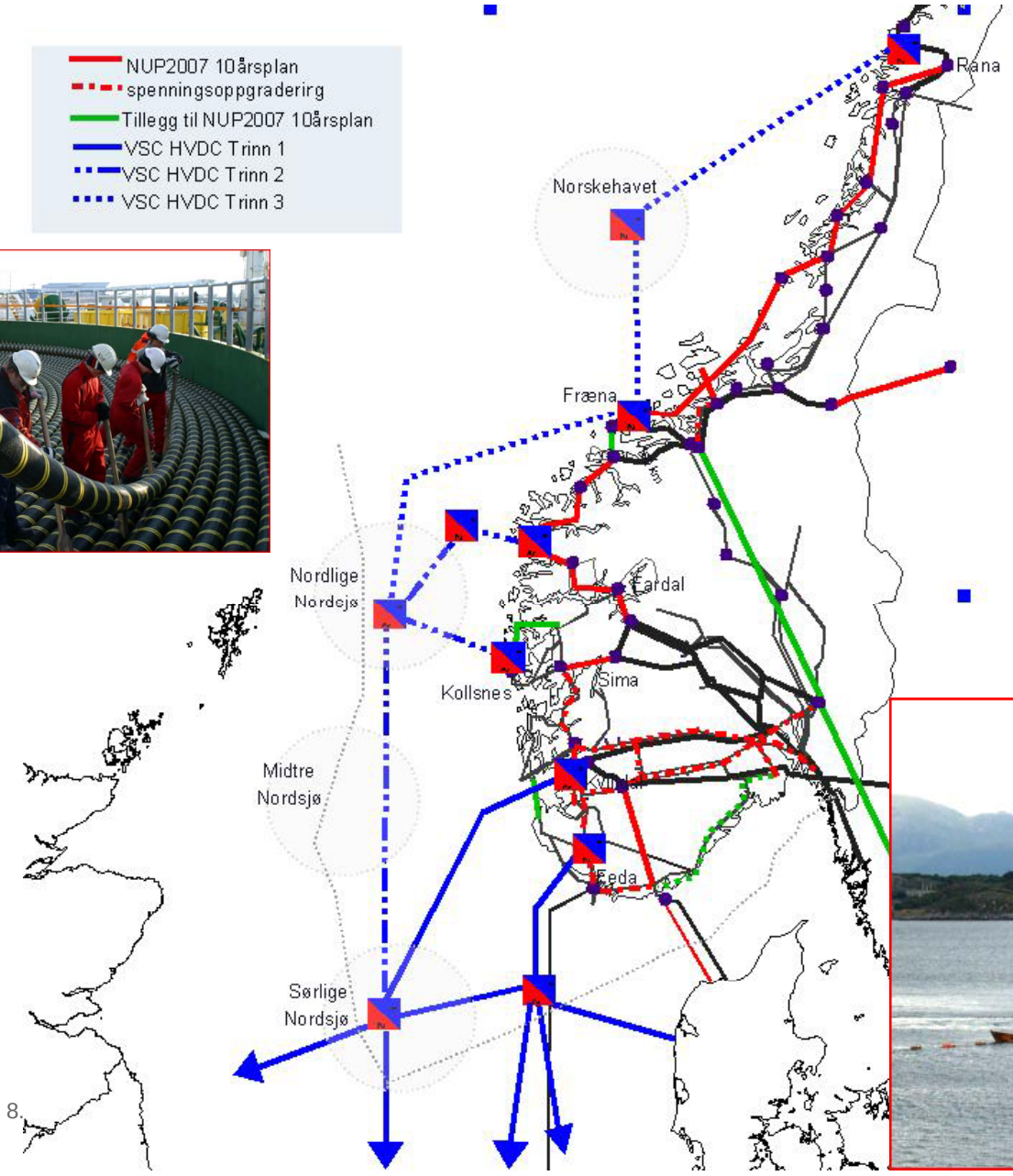


Vision

Possible offshore grid 2020 -2040

Possible North Sea modular development

Fantacy or reality??

Kriegers Flak

VSC HVDC technology for offshore development

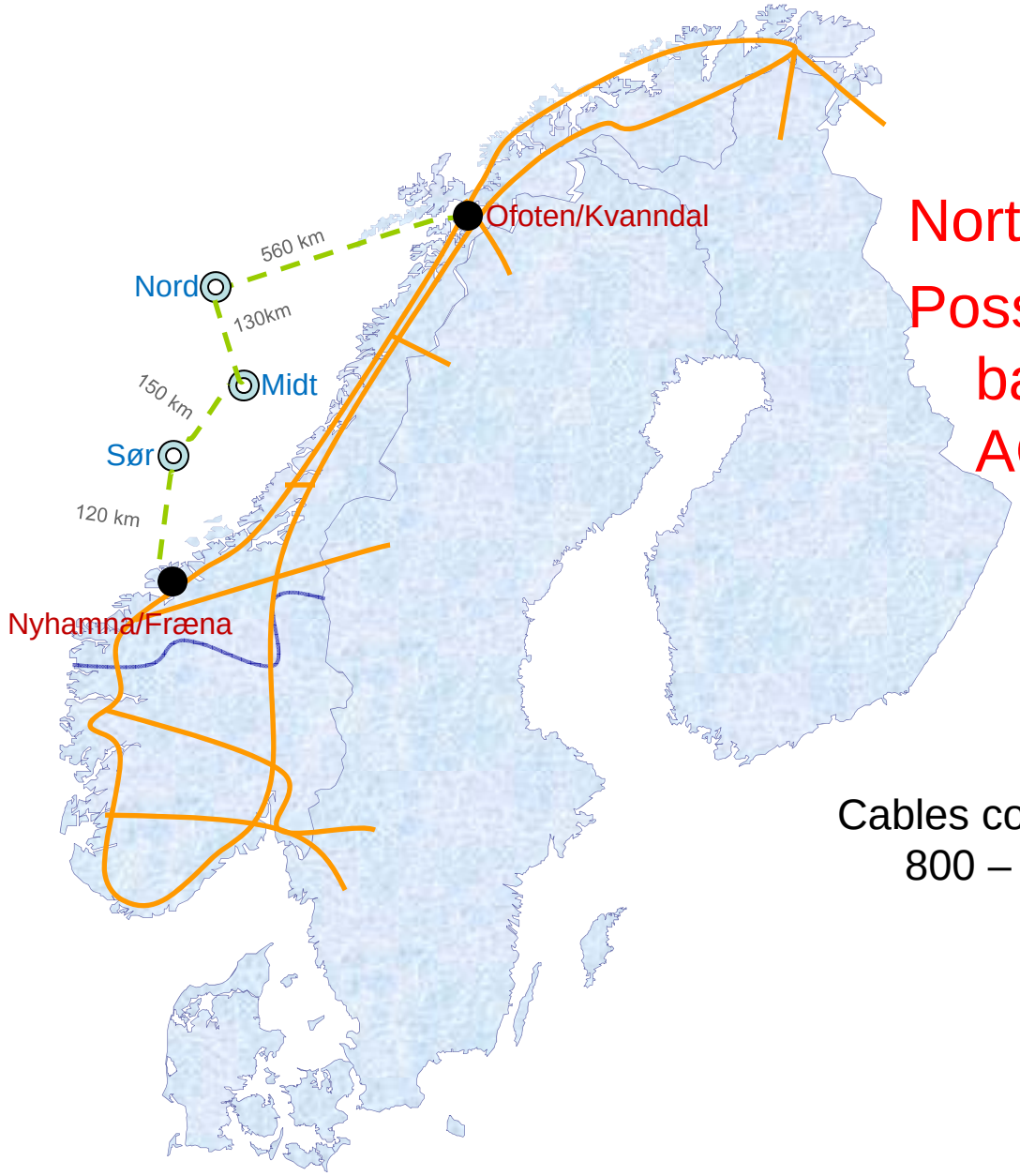
In operation

In progress

DC platforms

Coordinated offshore devlopment

From national to European thinking



Northern areas:

Possible offshore development based on floating offshore AC/DC installations

Cables connected to floaters from 800 – 1400 meter sea depth

Some new Interconnectors

DC submarine to England

NorNed 2 – 2.nd DC submarine to Nederland

Nord.Link – DC submarine to Germany

Skagerrak 4 – the 4th DC to Denmark

Energy 21
The future energy system
Reporting to the Minister of Oil&Energy

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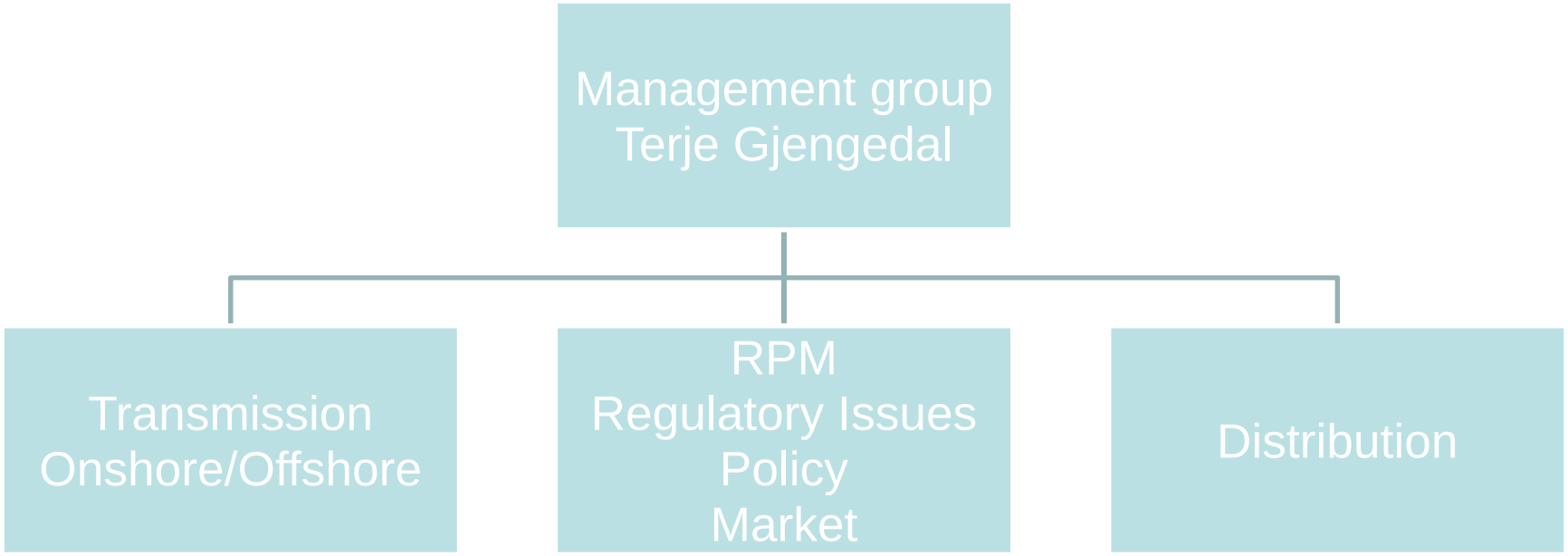

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Some Challenges:

There will be an evolution in the grid :

how do we plan and how do we operate?

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After this- what will be a major challenge to us?

Three simple words:

Competence

Competence

Competence

Competence profile

- Broadly educated engineers with basic understanding of fundamentals
- Specialists and ’deep diggers’

- We need competence to make the right decisions
  - The right long term planning and development
  - The right designs
  - Decide on the right equipment
  - At the right cost
  - Impact on operations

Competence needed:

Power systems operation, control, design

Power electronics, HVDC. Facts

Transmission system design

Consenting

Environmental impacts

DV cable technology

Substation design

O&M

Economy, electricity markets

Renewable technologies

System integration

Contracts and other legal aspects

+++++++

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At Statnett:

- Focus on Continuing education
- Self learning
- Web based/ On line courses - need to develop

- Forming a Learning Environment
- Improve the relations with Universities and Colleges
- Establish a U&C program


Thank you
for listening!