STATUS VEDR. NORGES MULIGHETER TIL Å BLI EUROPAS GRØNNE BATTERI

Lars Audun Fodstad, Seniorrådgiver, Statkraft Energi AS
Teknologisk Møteplass 12.mai 2011

Statkraft
PURE ENERGY

Statkraft
PURE ENERGY

No. 1 WITHIN RENEWABLES IN EUROPE

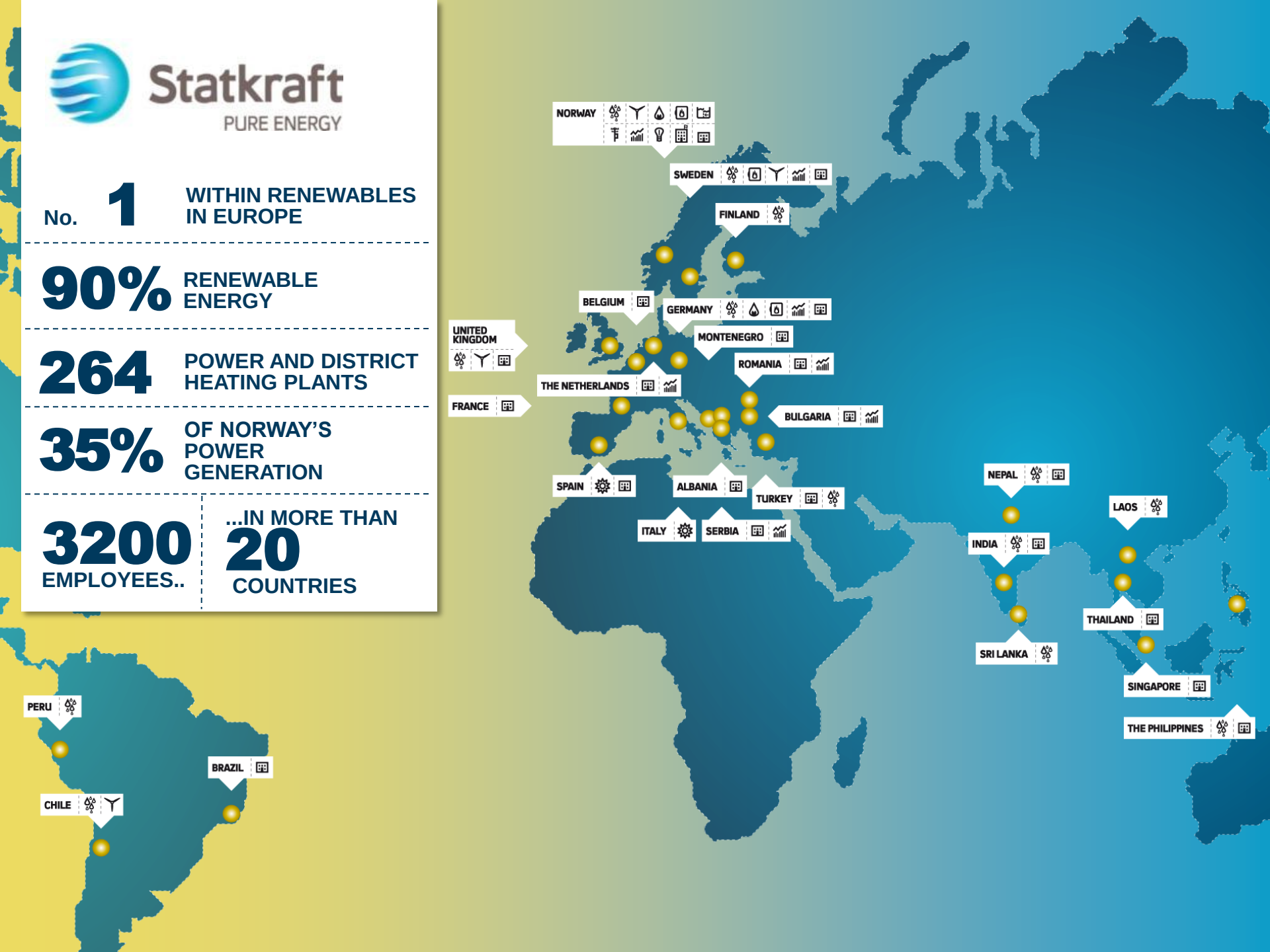
90% RENEWABLE ENERGY

264 POWER AND DISTRICT HEATING PLANTS

35% OF NORWAY'S POWER GENERATION

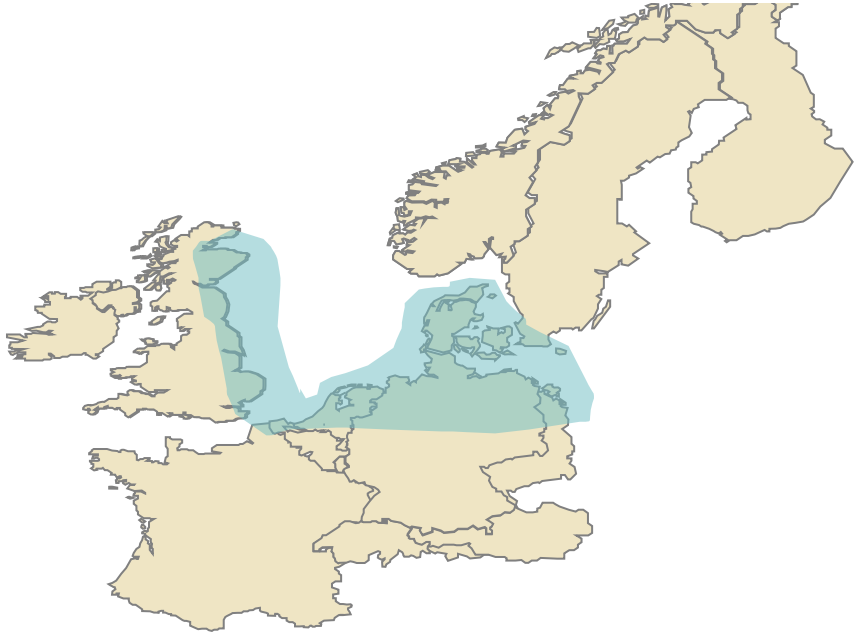
3200 EMPLOYEES..

...IN MORE THAN **20** COUNTRIES



THE NORTH SEA AREA
WIND POWER DEVELOPMENT – 2020 SCENARIO

- Offshore:
  40 000 MW
- Total onshore/offshore:
  100 000 MW
- Creating a Wind Belt onshore/offshore from UK via France, Belgium, The Netherlands, Germany, Denmark and Southern Sweden



Statkraft

CHALLENGES

The Development of VarRES (Wind and Solar) around the North Sea creates a huge need for:

--> **Infrastructure Development**

- Connecting VarRES to
  - Load centres
  - Flexibility options
  - Storage facilities
- Enabling market development

--> **Flexibility to handle the variability**

--> VarRES developing from a minor to a main part of the production portfolio with dispatch priority, means a total new situation – a paradigm shift

--> Creates a huge need for flexibility in the other parts of the electricity system

Statkraft

FLEXIBILITY NEEDED

- --> Traditional
  - -- Reserve capacity
    - Primary
    - Secondary
    - Tertiary
  - -- Daily load variations

  May be enhanced due to more rapid production changes

- --> New important challenges
  - -- Long-term backup capacity
  - -- Huge ramp-up capacity

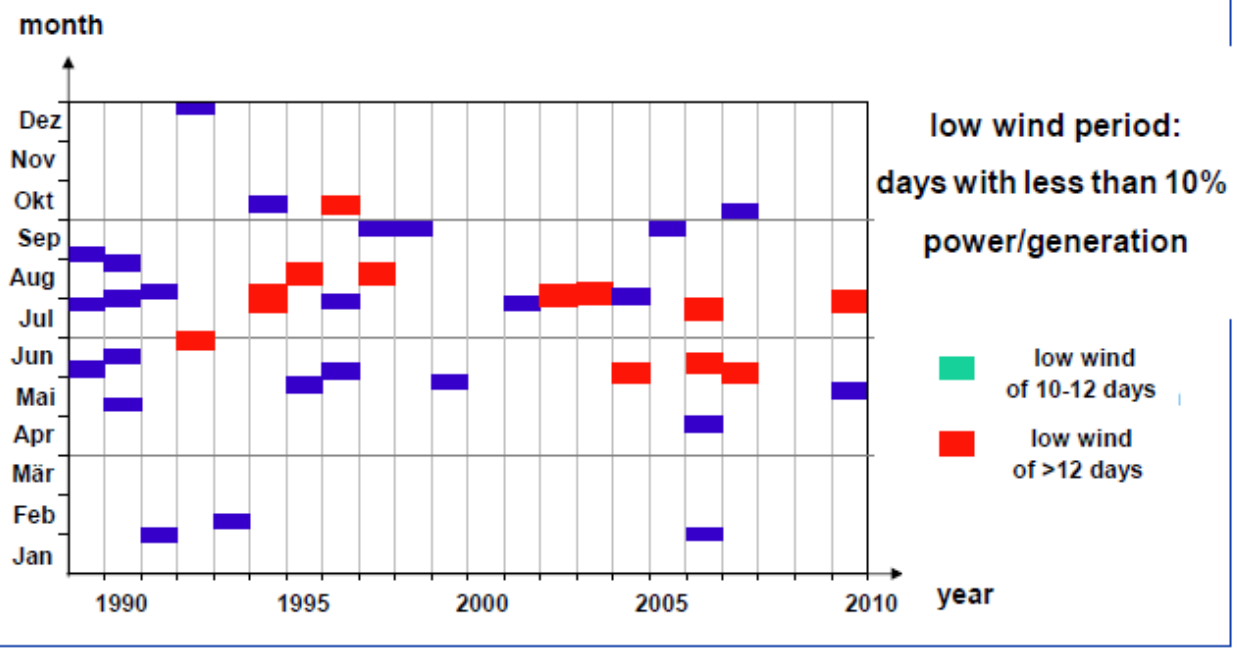
Statkraft

NEED FOR LONG-TERM BACKUP CAPACITY

VGB PowerTech

Wind Statistic → less than 10%

Period between 1989 until 2010



Source: Franz Bauer , VGB

Statkraft

NEED FOR RAMP-UP CAPACITY

--> Estimated need for ramp-up capacity in Germany in 2030:

35 GW in two to six hours

Source: Franz Bauer, VGB / Fraunhofer IWES

Statkraft

FLEXIBILITY OPTIONS

- Production
  - Nuclear
  - Fossil fired, gas and coal
  - Reservoir based hydro
- Storage
  - Pumped Storage
  - CAES
  - Batteries/EV
- DSM/Smart Grids
- Connecting and further develop the Norwegian hydro resource to deliver a significant part of the needed flexibility?

Statkraft

EUROPEAN HYDRO FLEXIBILITY

- Reservoir based Hydro Power in the production mix:
  - In general used for Storage and Peak Power production
  - In Norway developed for Seasonal Storage and Base Load production
  - Hydro Storage Capacity and Rated Power (1998)

UCTE	57 TWh	49 GW
Norway	84,1 TWh	27,3 GW
NORDEL, ex.NO	38,6 TWh	19,1 GW

  - Developed as the UCTE hydro, Norwegian hydro should have had 72,3 GW installed
  - This means there is a huge possibility to expand the installation in Norwegian hydro to store surplus VarRES production and serve peak power needs

Statkraft

NORWEGIAN HYDRO STRUCTURE

- Built in caverns inside the mountains
- Upper reservoir is connected to the power station by tunnel
- Outlet is also by tunnel
- Outlet is either
  - direct into downstream reservoir or
  - direct into the sea
- This structure makes Norwegian hydro special well suited for expanding the capacity and also for development of pumped storage

Statkraft

NORWEGIAN HYDRO FLEXIBILITY OPTIONS

--> Hydro
  -- Installed capacity 28 GW
    - Can contribute a lot to balancing, regulation, peak and back-up production except for some hours at winter peak load
    - Example: The existing 1 GW connection to Denmark
  -- Expansion possibilities in Southern Norway 7 - 8 GW
    - Converting from base load to peak load production by installing additional generators in the existing power stations

--> Pumped storage
  -- Installed capacity 1 GW
    - Mainly built for seasonal pumping
  -- Expansion possibilities in Southern Norway 15 - 20 GW
    - Storage capacity for continuous pumping 120 hours
    - Using only existing reservoirs both upstream and downstream

Statkraft

EU INFRASTRUCTURE DEVELOPMENT I

The Commission's Communication of 17.11.2010

4.1.1. Making Europe's electricity grid fit for 2020

Focus upon four priority corridors:

1. Offshore grid in the Northern Seas and connection to Northern as well as Central Europe
2. Interconnections in South Western Europe
3. Connections in Central Eastern and South Eastern Europe
4. Completion of the Baltic Energy Market Interconnection Plan

Statkraft

EU INFRASTRUCTURE DEVELOPMENT II

The Commission's Communication of 17.11.2010

Further details of the first priority corridor:

Offshore grid in the Northern Seas and connection to Northern as well as Central Europe –

to integrate and connect energy production capacities in the Northern Seas with consumption centres in Northern and Central Europe **and hydro storage facilities in the Alpine region and in the Nordic countries**

Statkraft

FROM THE GERMAN GOVERNMENT'S ENERGY CONCEPT

--> With a growing proportion of fluctuating energy sources such as wind energy and photovoltaics, we require a significant more flexible system of electricity supply in order to compensate for variations in wind and sunshine at any time.

--> In the long term, it is important and necessary to expand storage capacity

--> In the medium term, we want to tap all the available potential in Germany for pumped storage hydroelectricity, bearing in mind the technological and economic parameters

--> In the long term, this potential alone will not be sufficient. Therefore the use of foreign pumped storage plants to boost Germany's supply is of great significance. Formidable potential for this exists in Norway, but the Alps can also be tapped further

--> The German government will begin talks with Norway and the Apine countries, with the involvement of energy companies, in order to achieve long-term energy supply cooperation with European partners, with a special view to the creation and use of energy storage capacity

Statkraft

UK – FROM THE OFFSHORE VALUATION
The Boston Consulting Group 2010

--> In each scenario we have assumed that any additional backup capacity can and will be provided through interconnection, the cost of which is factored into our overall valuation. This backup capacity could also be provided by UK-based generation or storage – or may need to be if Europe cannot provide sufficient balancing services (p 16)

--> increasing the level of variable renewable electricity on the grid is likely to present the greatest challenges. Our analysis suggests that the UK grid could accommodate approximately 50% variable renewables by 2050 – provided that 34GW of backup capacity, storage or interconnection can be made available (p 17)

--> In support of the above point, government would benefit from taking a stronger leadership role in international discussions of the design of a North Sea supergrid, with the aim of securing an outcome that allows the UK to maximise the value of its offshore resource. This can be done through forums such as the North Sea grid initiative, ENTSO-E (which has recently published a draft 10-year grid development plan) and the European Commission (which is in the process of developing a North Sea Grid Blueprint). (p 23-24)

Statkraft

BARRIERS - INCENTIVES

- Business models
  - Cost/benefit sharing between different parts – present solution doesn't give incentives for new production capacity
- Environmental acceptance
  - Understanding of the emission reduction and the global benefit
  - Local environmental consequences must be accepted
- Public acceptance
  - Relevant economic compensation to ground owners and local communities

Statkraft

REALISING NORWEGIAN POSSIBILITIES

- Statnett's Grid Development Plan
  - Opens for Skagerak IV 700 MW, NorNed II 700MW, Sydvest-link 1100 MW, Germany 2x700 MW (probably 4x700 MW) and UK 2x700MW
  - Will benefit from using existing Norwegian Hydro together with Continental and UK Var RES
  - Will probably not give necessary incentives for further development of Norwegian Hydro

- Norwegian Hydro Capacity/Pump Storage directly connected to Continental and UK Grid
  - May give necessary incentives for further development of Norwegian Hydro resources by sharing cost and benefit between transmission and production
  - Opens for delivering significant quantity of needed ramp up capacity and long term back-up capacity

Statkraft

SUMMING UP

--> Norway has alone close to 50 % of the hydro reservoir capacity in Europe

--> To take advantage of this huge flexibility resource it is necessary to connect it to nodes in the wind belt

--> Physical, technological and environmental is it possible to realise a flexible capacity of 20 GW from Norway before 2030

--> EU, Germany and UK are aware of these possibilities

--> Necessary business models have to be developed

--> Public acceptance is needed

--> It is not necessary to build new reservoirs

-- It may be necessary to revise some regulatory frames to make it possible

Statkraft

THANK YOU!

Lars Audun Fodstad

Direct +47 24 06 74 30

Mobile +47 913 01 785

laf@statkraft.com

Statkraft Energy AS

Lilleakerveien 6 P.O.Box 200 Lilleaker

NO-0216 Oslo, Norway

www.statkraft.com

Statkraft

PURE ENERGY

Our internet site:

www.statkraft.com
www.statkraft.no
Pump storage plant video:
www.statkraft.com/energy-sources/hydropower/pumped-storage-hydropower/