

# HOW CAN STATKRAFT BECOME "THE GREEN BATTERY" OF EUROPE?

- or contribute to .....?

**Arne Sandvold**

Statkraft Energi as

Power Generation Development



# THE STATKRAFT GROUP

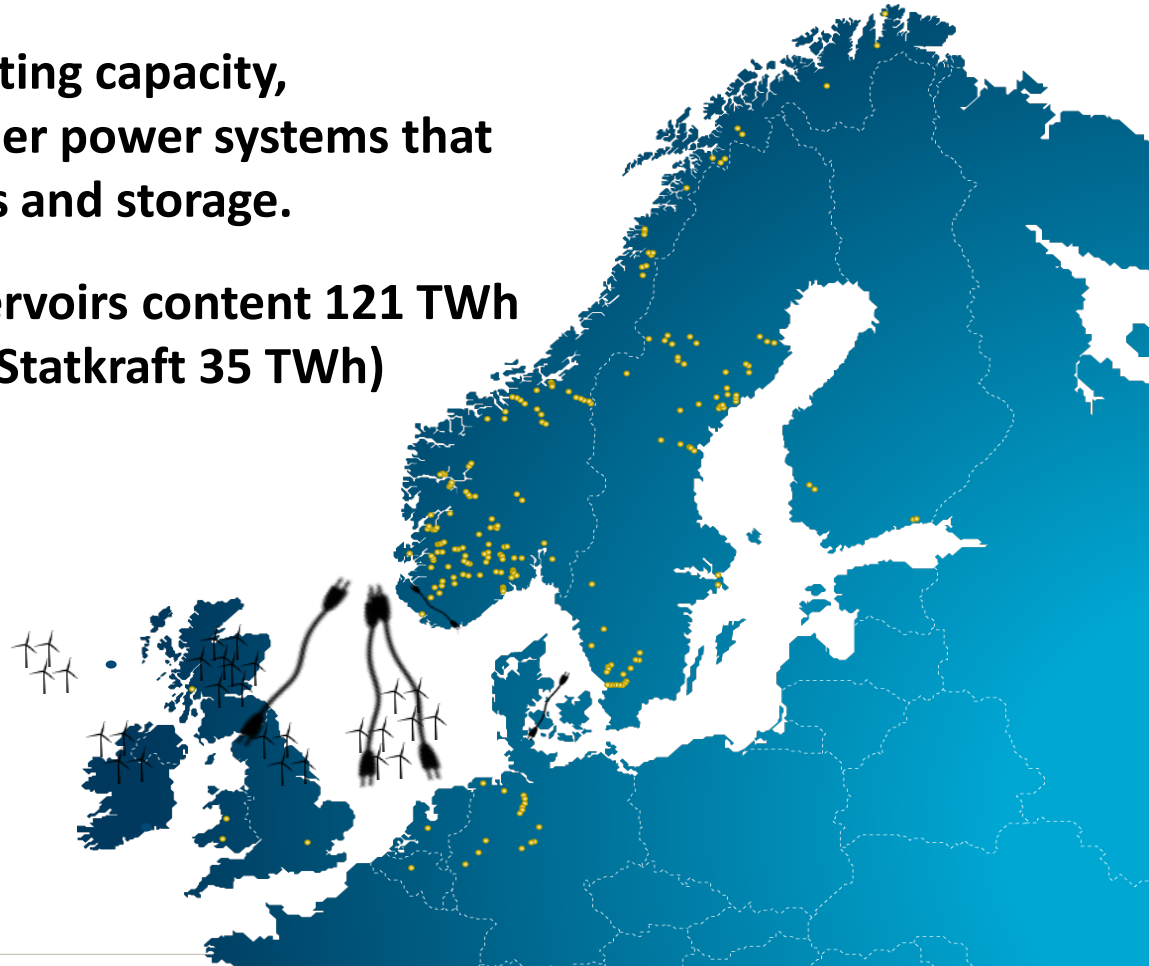
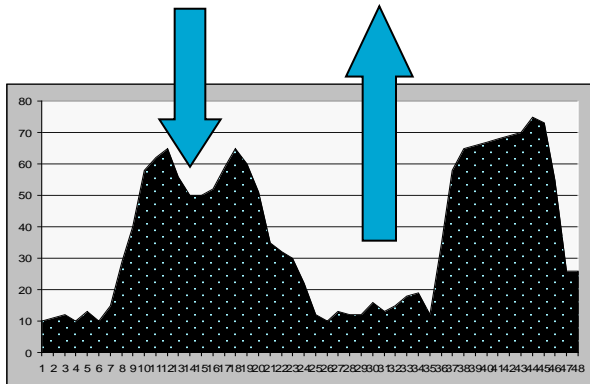
- ▶ **Environment-friendly power generation: 52.5 TWh\***
  - 33% of power generation in Norway
  - 12% of power generation Nordic region
  - 1% of power generation in Europe
- ▶ **Gross operating revenues 2011: NOK 22.4 billion**
- ▶ **Total assets 2011: NOK 144 billion**
- ▶ **3,400 employees in more than 20 countries**



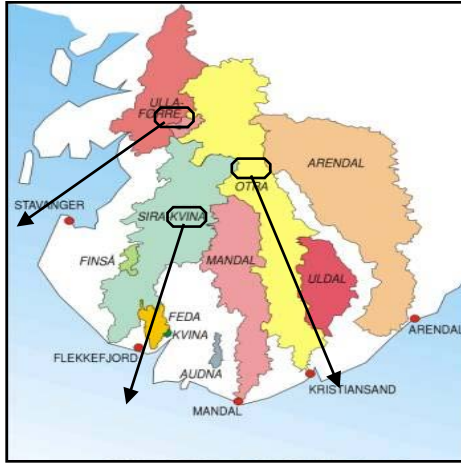
# Supporting the power system in Europe

Due to the energy regulating capacity, Norway may support other power systems that require backup solutions and storage.

- Nordic hydro reservoirs content 121 TWh
- Norway 85 TWh (Statkraft 35 TWh)



# NORWEGIAN POSSIBILITIES



Appr. 50% of total hydro reservoirs in Europe – 85 TWh

▶ **Three alternative options:**

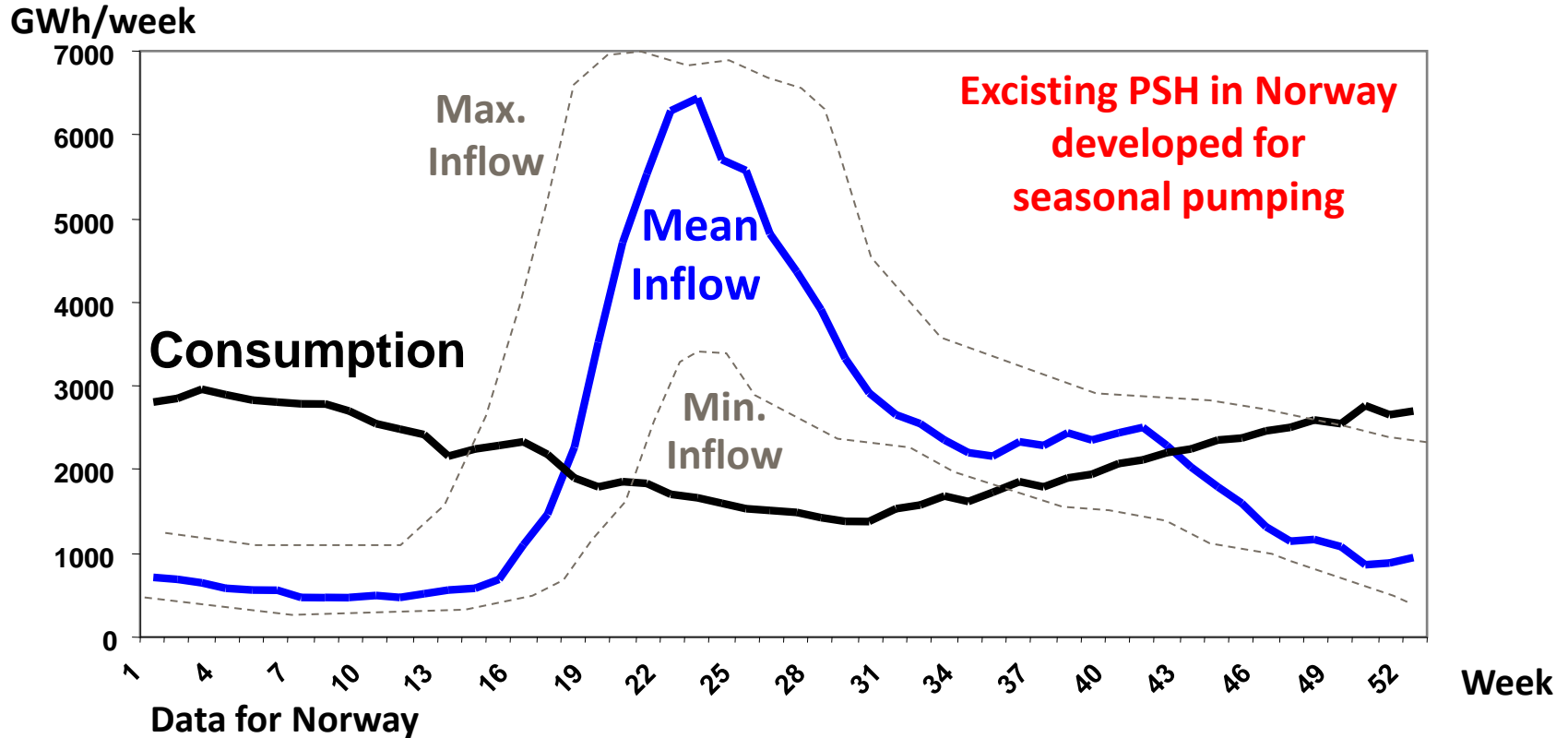
1. Change the operation pattern in existing plants
2. Increase installed capacity
3. Build pumped hydro storage in connection with existing reservoirs



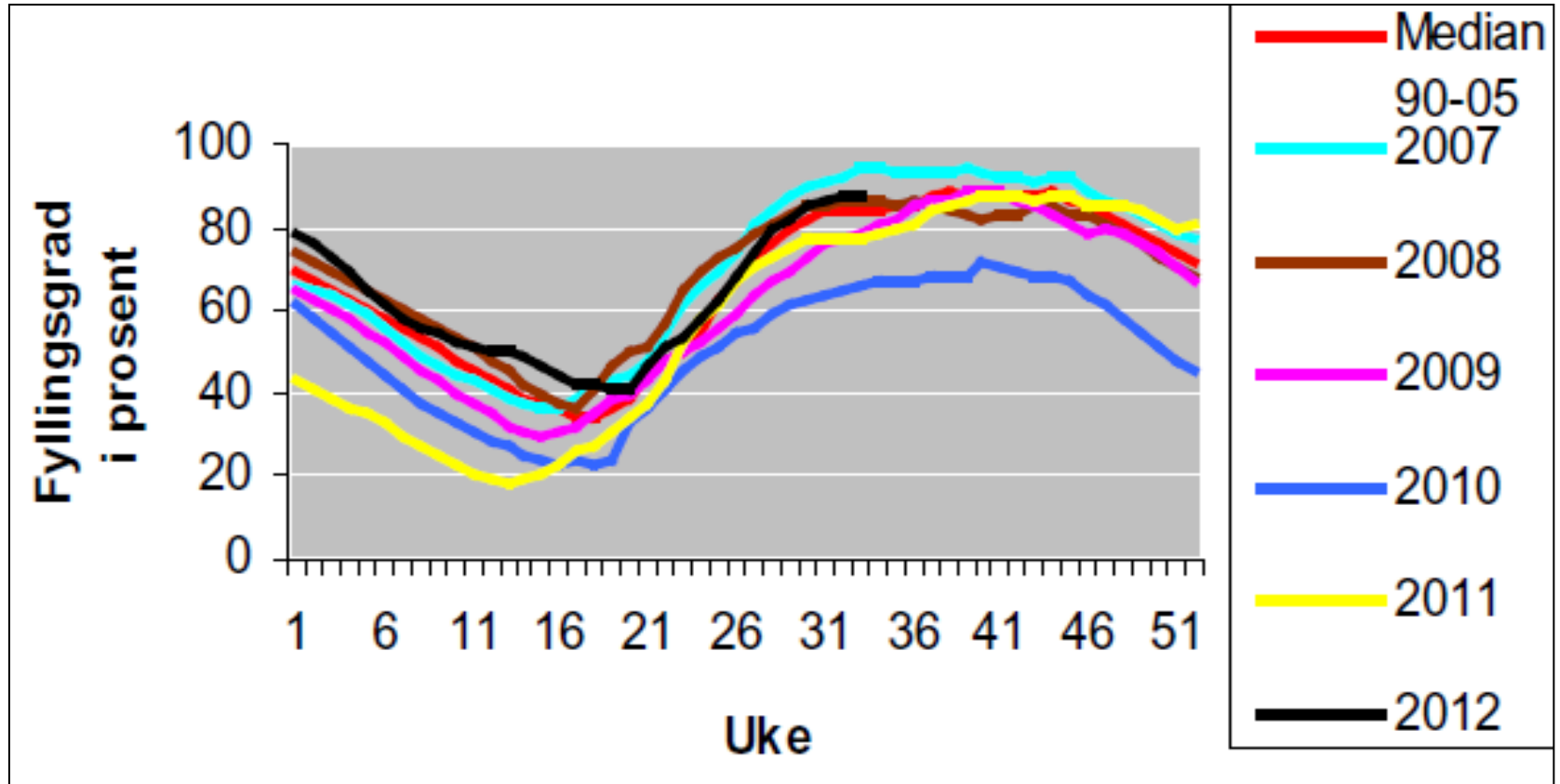
**Both increased capacity and pumped storage is possible where the distance to the Continent is the shortest**

- Without new greenfield assets or reservoirs, but by extended use of existing

# The hydrology vs energy consumption



# Scandinavian reservoirs – typical seasonal variation



# TECHNICAL POTENTIAL INCREASED CAPACITY SOUTHERN NORWAY

Future PSH possibilities in Norway depends on :

- limitations in the change of water level in upper and lower reservoirs
- and duration for pumping / generation

Change in waterlevel	PSP Capacity (MW) duration pumping mode			Increased capacity existing plants (MW)
	24 hours	7 days	60 days	
				7500
0,5 m/hour	85000	30000	N / A	
0,1 m/hour	30000	16000	2600	
0,01 m/hour	3200	3200	1500	

➤ **The technical potential is not the main challenge !**

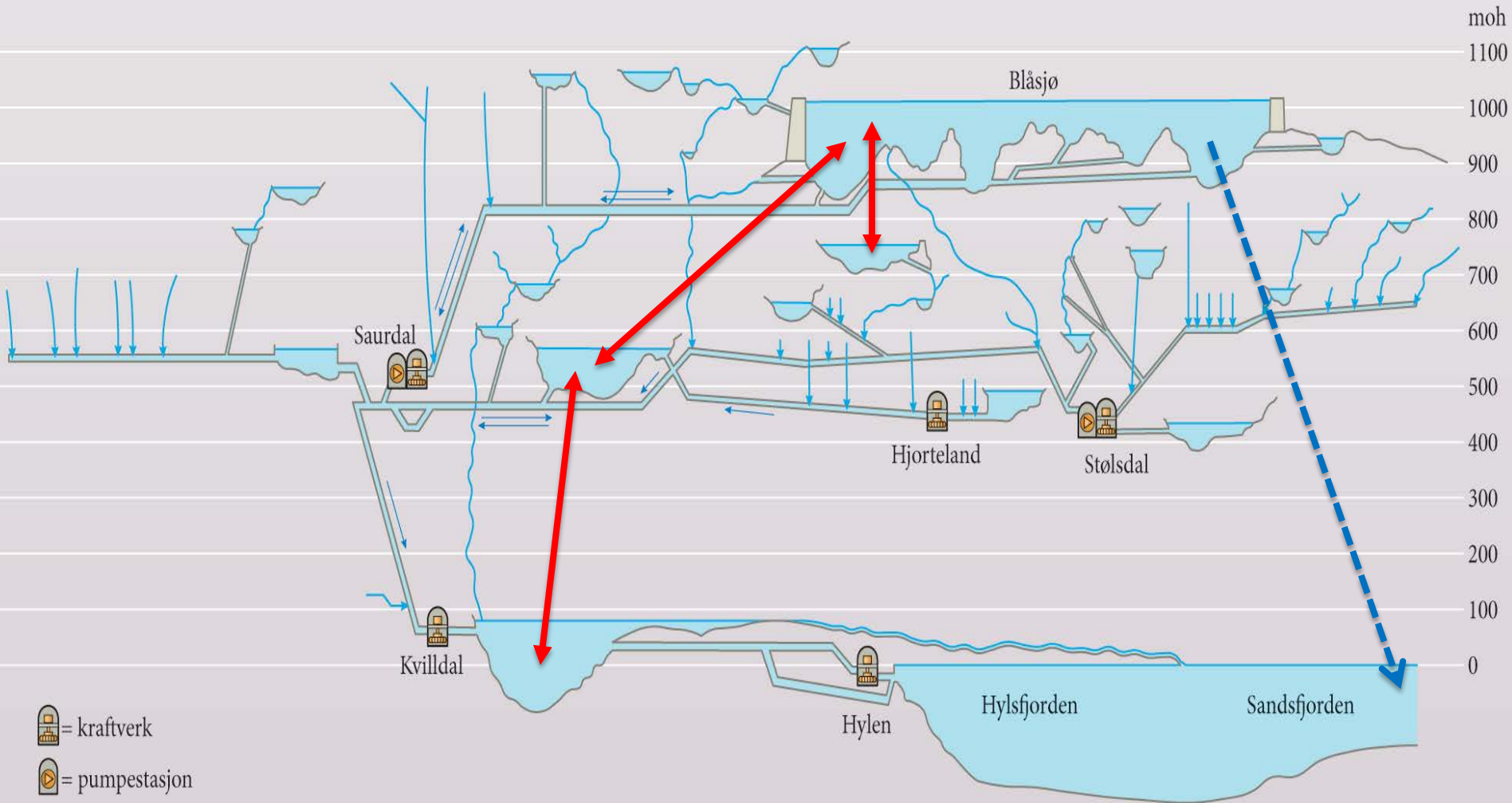


# LAKE BLÅSJØ 7.8TWH RESERVOIR

Potential upper reservoir,  
several possibilities



# ULLA-FØRRE POWER PLANT SCHEME





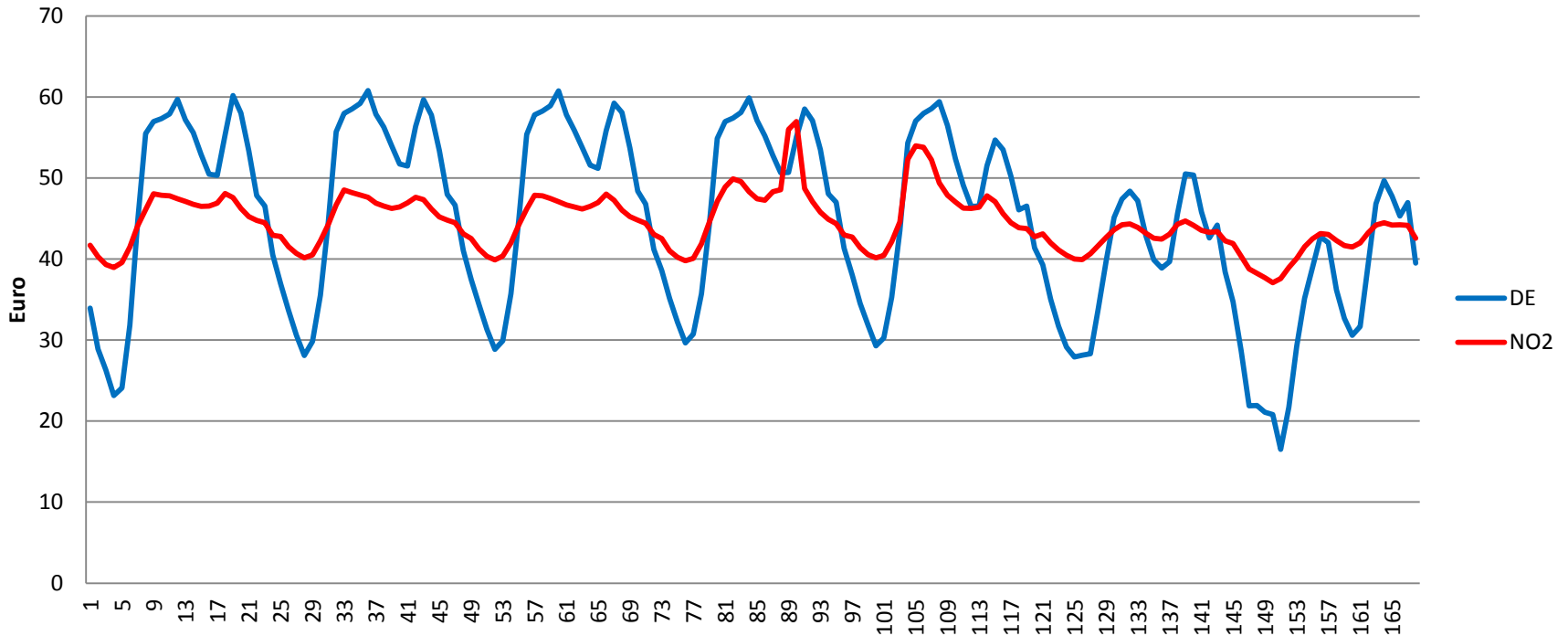
**Typical lower reservoir**

# PSP - Environmental possibilities / challenges

- ⇒ No new "greenfield assets" is needed
  - ⇒ only extending existing plants / reservoirs
  - ⇒ no new big releases of water into running rivers
- ⇒ Statkraft R&D-projects ongoing in existing reservoirs :
  - ⇒ More often limnitations, but not outside existing water levels
  - ⇒ More often lower levels, not only late winter / spring
  - ⇒ Erosion and unstability
  - ⇒ Biodiversity, Local climate, Temperatures, Broken Ice etc.
- ⇒ Larger release of fresh water into the fjords
- ⇒ New rock caverns & tunnels – need of larger spill areas "outdoors"
- ⇒ Area usage due to new interconnectors & domestic infrastructure

# Interconnectors driven by price differences

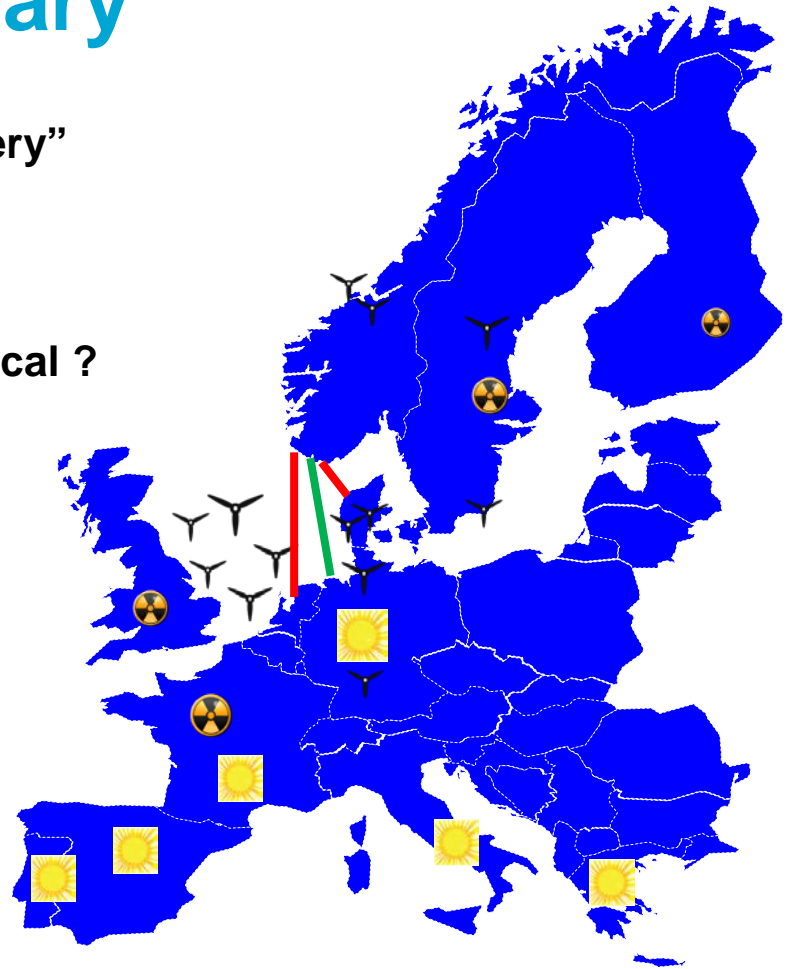
Average week profile 2009 - 2011



# Summary

- Large possibilities for utilizing Norwegian reservoirs and new PSH as a "European Battery"
- Existing flexibility will be utilized first
  - Requires large investments in infrastructure
- Political will for PSP, both crossborder + local ?
  - Public acceptance - governing of expectations
  - Environmental solutions, taxes
- Plans for new interconnectors are modest
  - We support Statnetts plans for GER (2018) UK (2020)
  - But more is needed
- Business Case Development?
  - Future Market Design?
  - Who is the Customer / Market Place
  - Business Model (incl. interconnectors)
  - Real Case simulations and profitability evaluations
- The need for flexibility and storage will be covered by a range of technologies

and we can contribute







**THANK YOU**



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