Impacts of the EU/ETS in Northern Europe

Bjørn Kjetil Mauritzen, Head of Climate Office, Hydro

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Hydro Value Chain

Bauxite & Alumina

Energy

Primary Metal

Rolled

Attractively positioned, global reach

Norway
- 900 000 tpy hydro-powered aluminium production
- Technology centre, R&D for next-generation smelter
- Hydropower developments

Continental Europe
- Leading upstream, midstream and Rolled Products positions
- Recycling network

North America
- Alouette aluminium smelter in Canada, expansion potential
- Remelting

Extruded Products
- 50% ownership in global leader in extruded products*

Brazil
- World-class operations and strong resource base
- Bauxite and alumina growth projects
- Albras aluminium smelter

Middle East
- Qatalum 1 in production
- Qatalum expansion opportunity

Australia
- Primary aluminium production

* Pending regulatory approval

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Hydro's value chain in Norway

From hydropower to primary metal to products the world is demanding

Telemark

3,0 | 0,5

No reversion | 2044-2049

Sogn

3,2

2051-2057

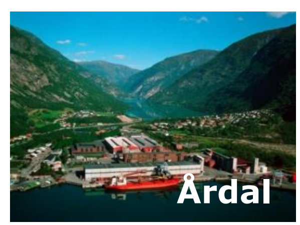
Røldal-Suldal

2,8

2023

+

Stakraft 6,4 TWh (2000-2020)



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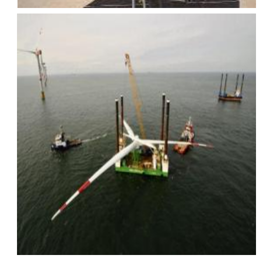

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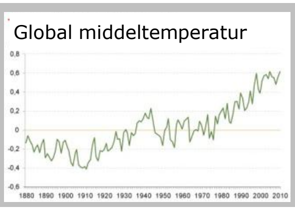
Nordics turn towards considerable surplus

4 key developments

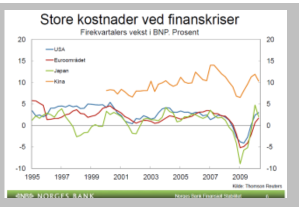
Climate change
Warmer, wetter, wilder– more hydropower, less consumption for heating



New renewables
Green certificates result in increased production from wind and hydro

Increased nuclear power production in Sweden and Finland

Energy-efficiency measures and weaker economic growth rate



Consequences

Considerable surplus in the Nordic power market

Drop in power prices

Less industrial activity and bigger drop in power prices
vs
more aluminium production and smaller fall in power prices

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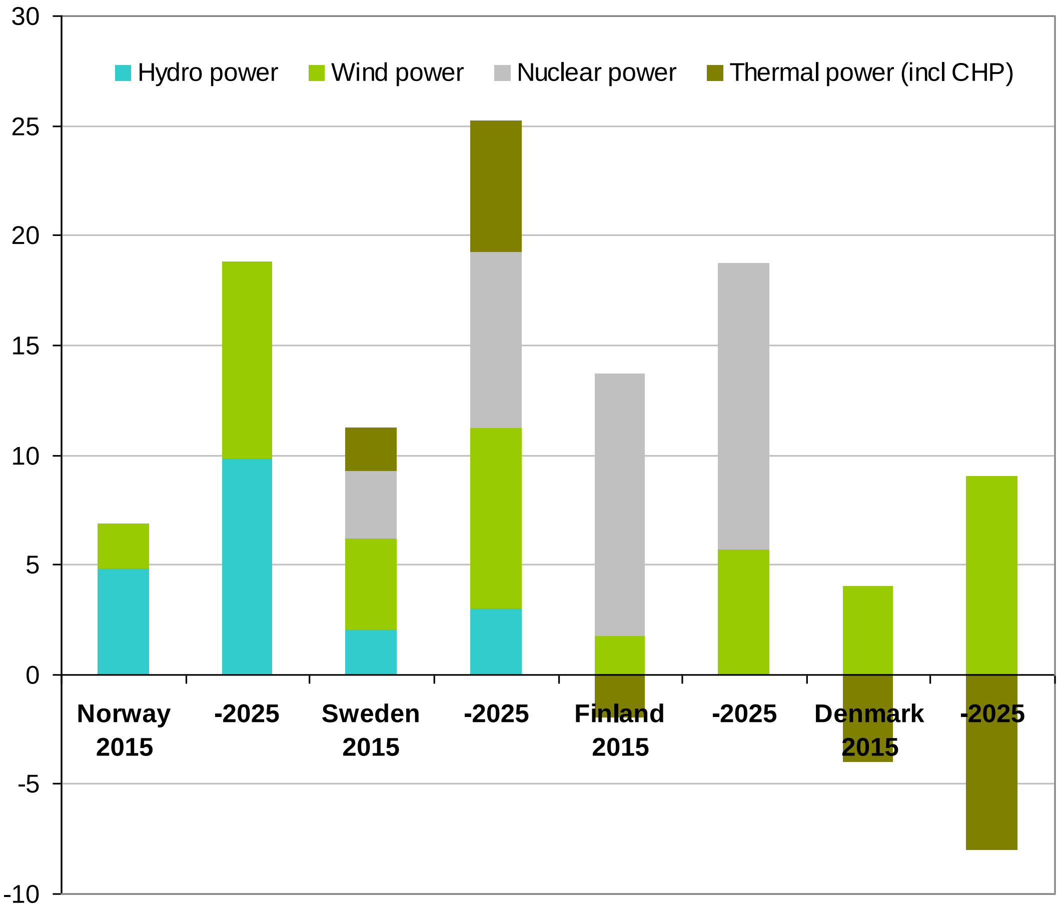
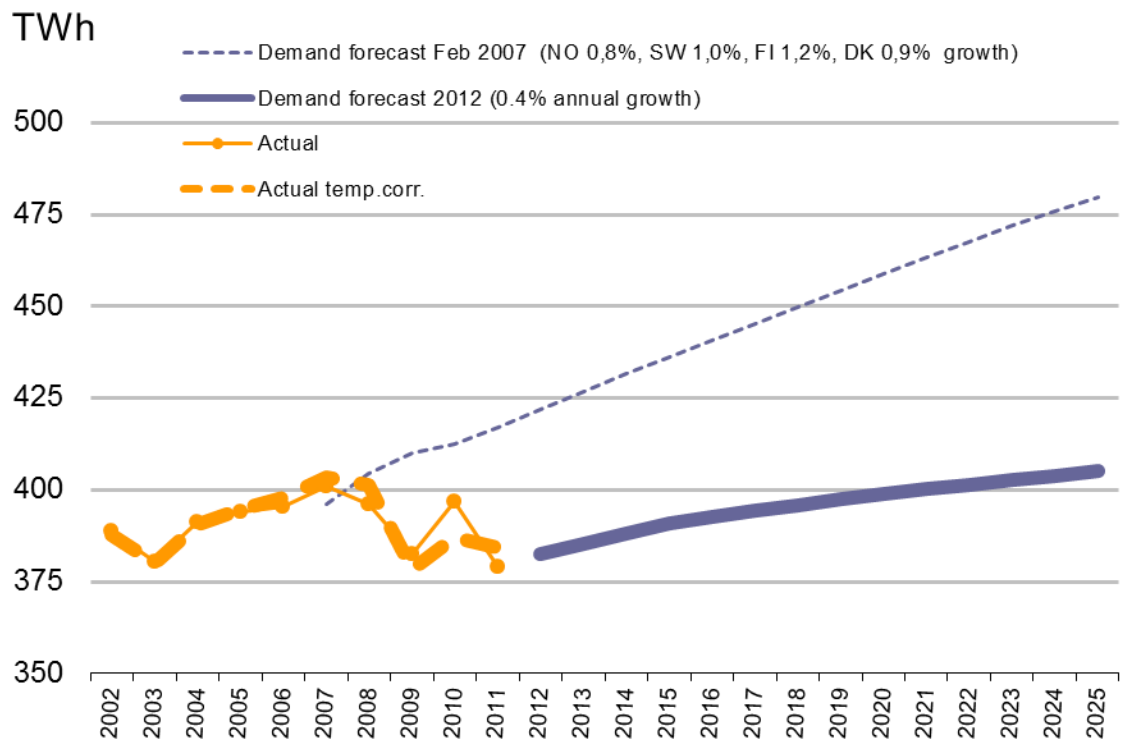
Significant increase in power capacity

- El-certificate market and RES-directive gives increased hydro- and wind- power production
- Increased nuclear power production in Sweden and Finland
- Analysis by Statnett, Svenska Kraftnät, Energimyndigheten and ECON/Thema confirms a surplus of 40 TWh



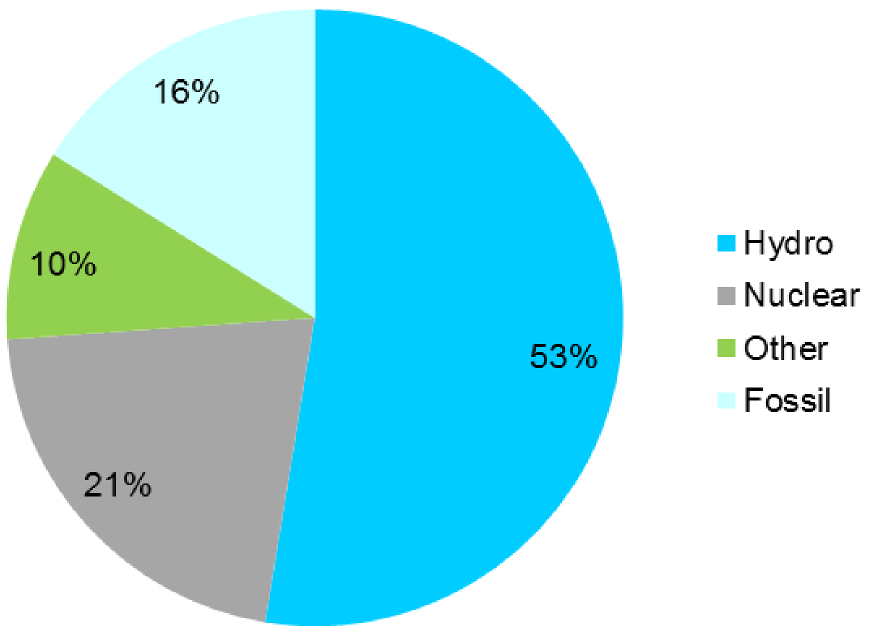
Lower demand growth

- Mature Nordic economies in combination with energy efficiency gives lower demand growth
- Reduced demand from industry induced by financial crisis
- Weaker elasticity to GDP-growth over time
- Climate change gives more production and lower demand



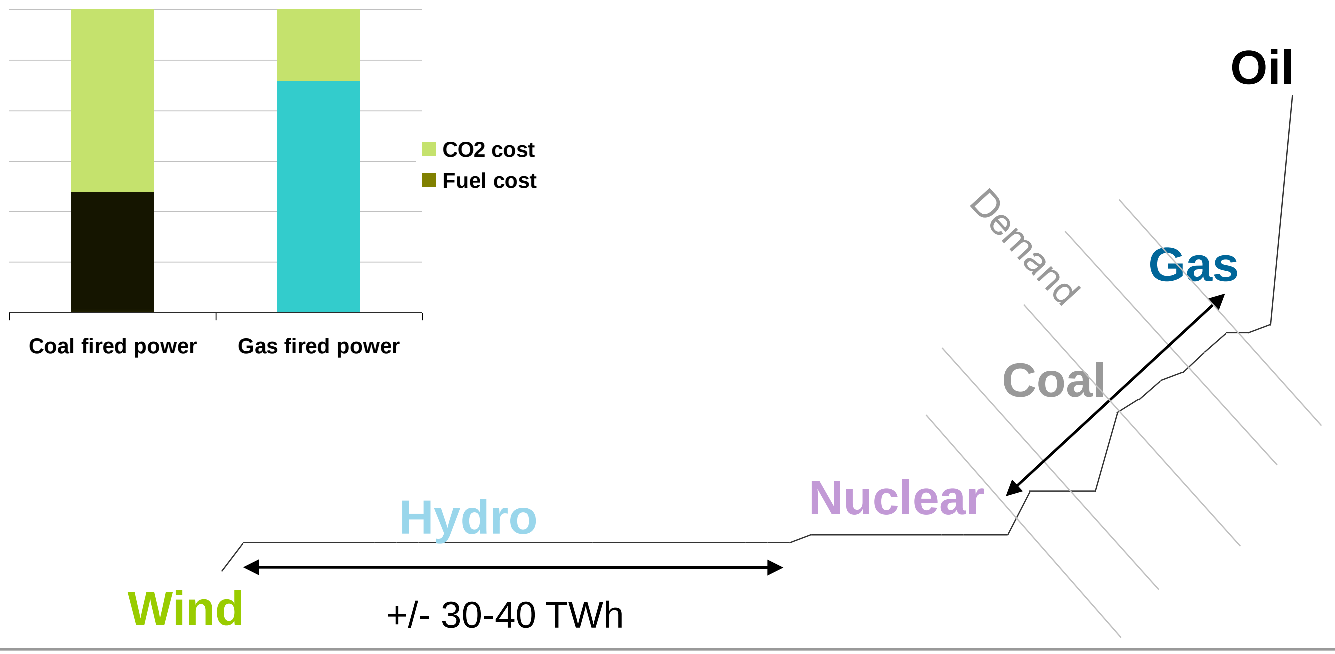
Nordic power production

Dominated by hydro and nuclear power

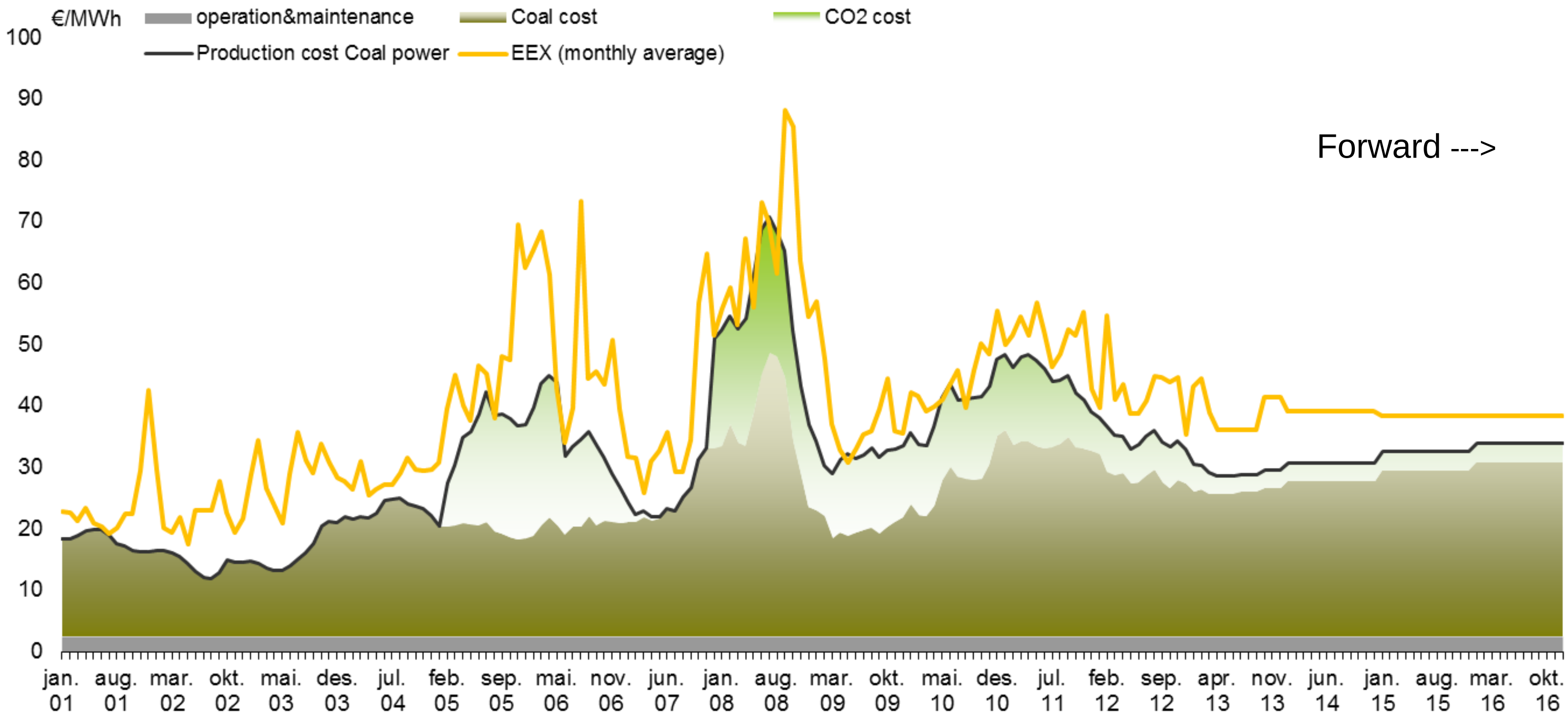


Indirect cost

- Indirect cost can be 5-6 times larger than cost of direct emissions
- Varies over time and markets
- Effect is based on fuel used by **marginal power production** rather than fuel mix
- Impact of power production based on coal is twice as high power production based on gas



Historical marginal cost of coal power and Spot power at EEX



CO2 cost based on EUA-price, Coal cost based on CIF ARA coal price, Production cost Coal power based on efficiency 40%
Prices based on closing April 29th 2013

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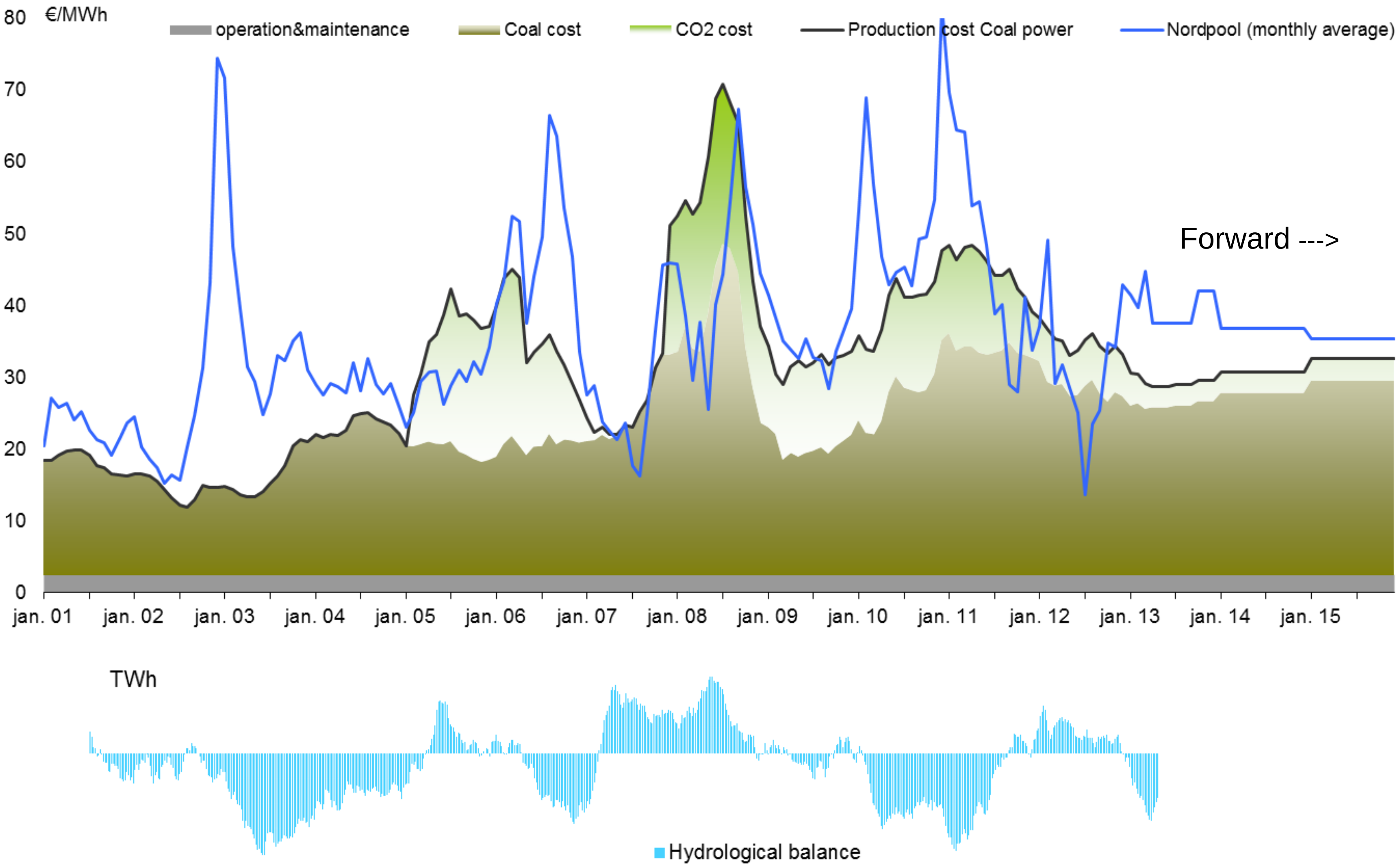
Coal power, price setter for Nordic power price



CO2 cost based on EUA-price, Coal cost based on CIF ARA coal price, Production cost Coal power based on efficiency 40%
Prices based on closing June 26th 2012

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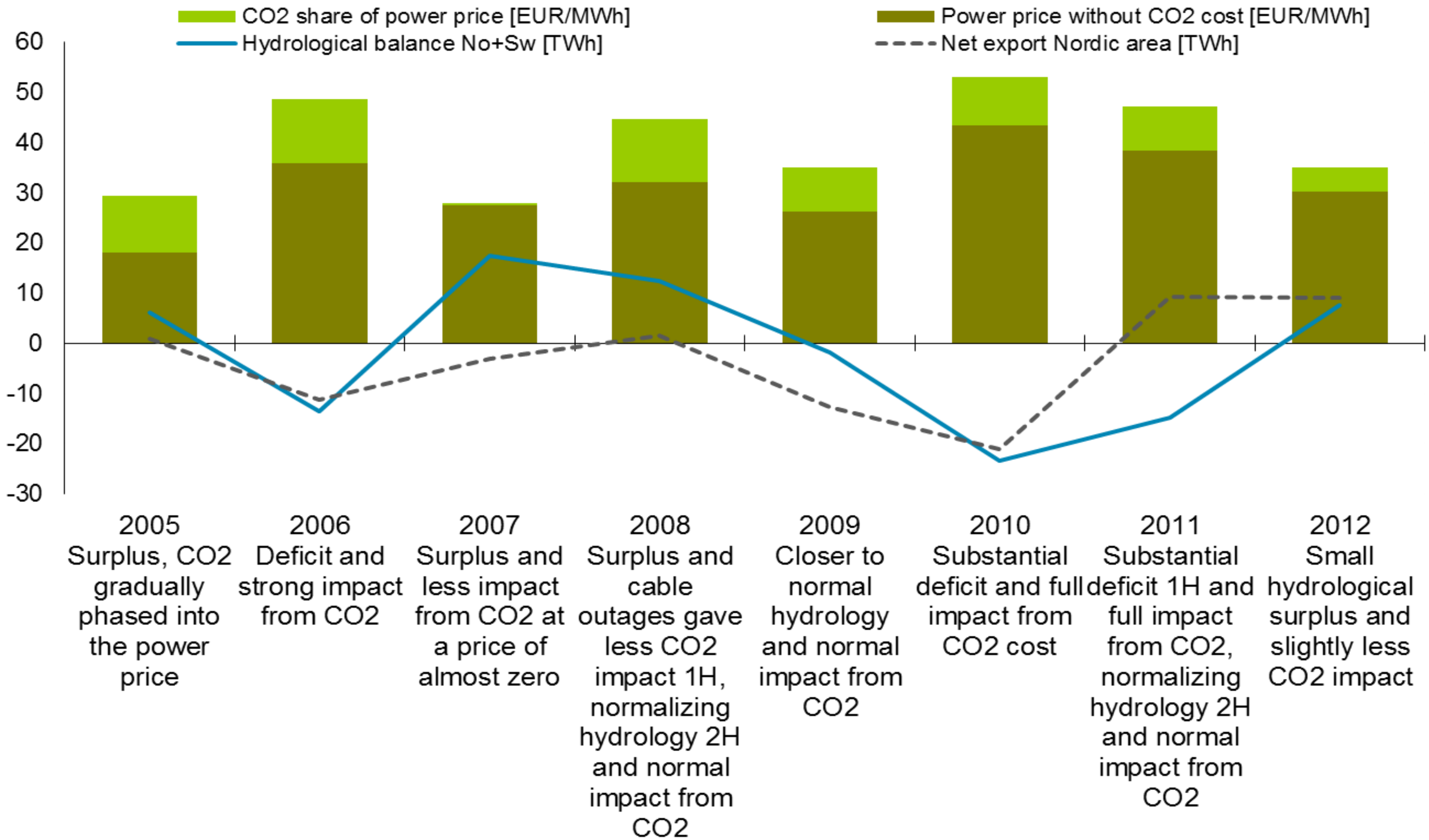
CO_2 share of Nordic electricity prices, calculated by transfer factor

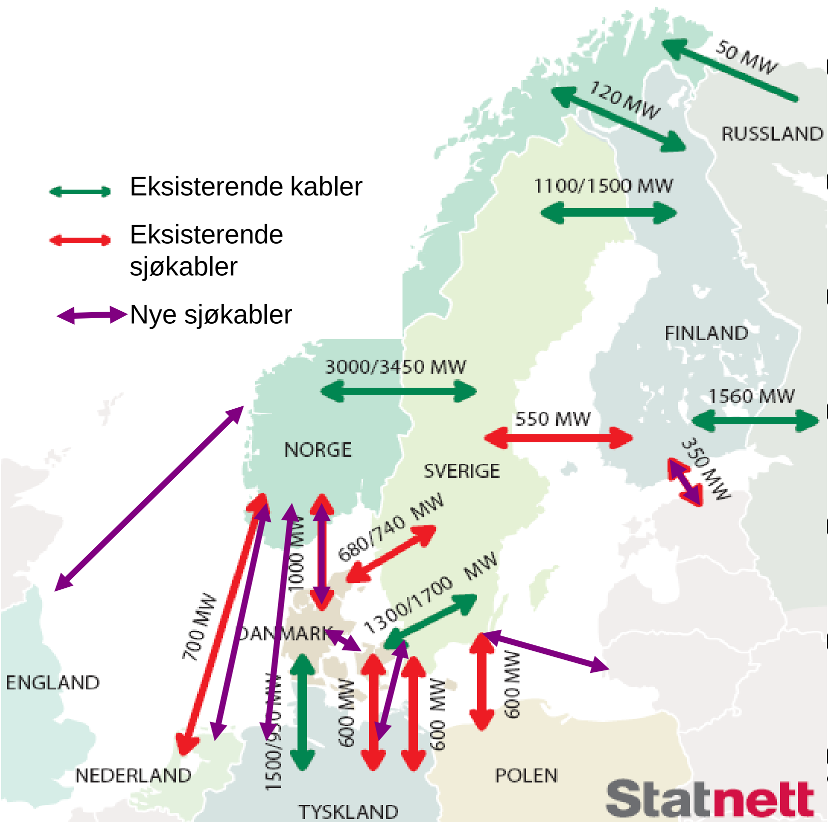


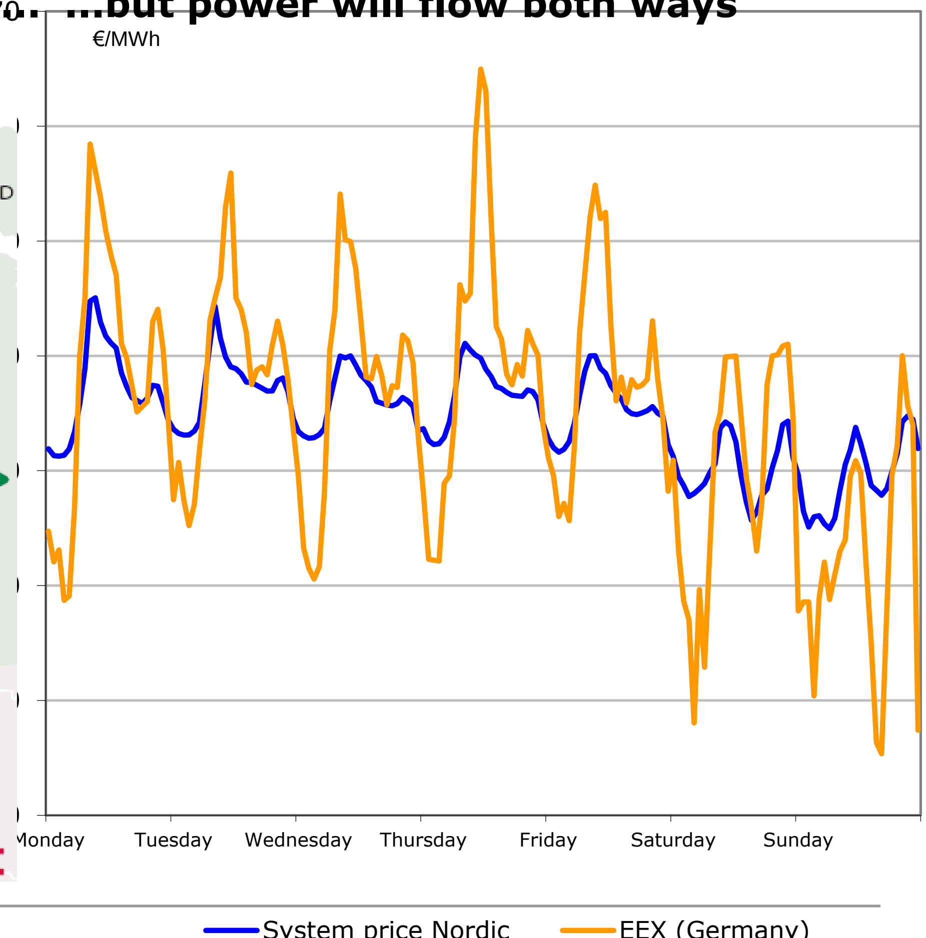
Actual power price, Nord Pool, and CO2 share calculated by transfer factor at 0,67

Interconnectors are no one-way street…

Power flows both ways in accordance with supply and demand

Considerable focus on interconnectors… …but power will flow both ways





Towards a low-carbon economy

Transition period until the rest of the world follows Europe is critical

- Hydro supports a global quota regime
- No level playing field before 2030
- Main challange is power sourcing until 2030
- CO_2-compensation essential to avoid carbon leakage in transtion period
- In a low-carbon economy, power-intensive industry will have a competetive advantage in low-emission regions such as in the Nordics

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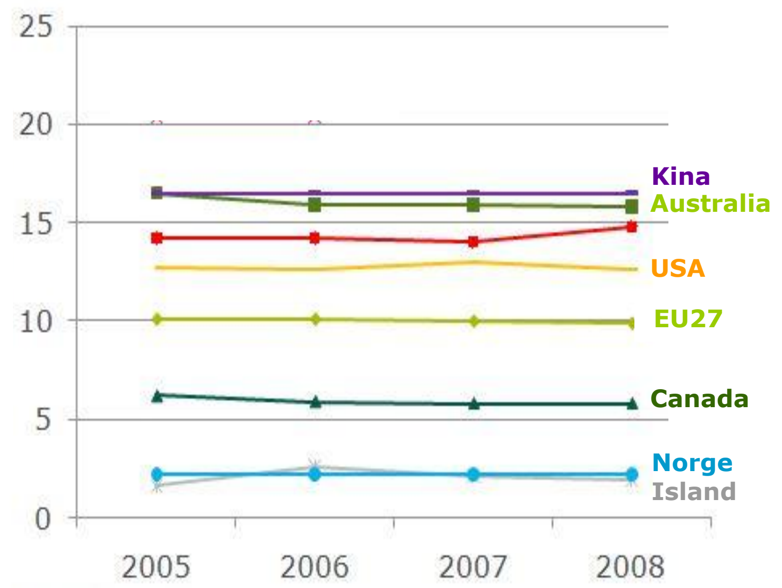
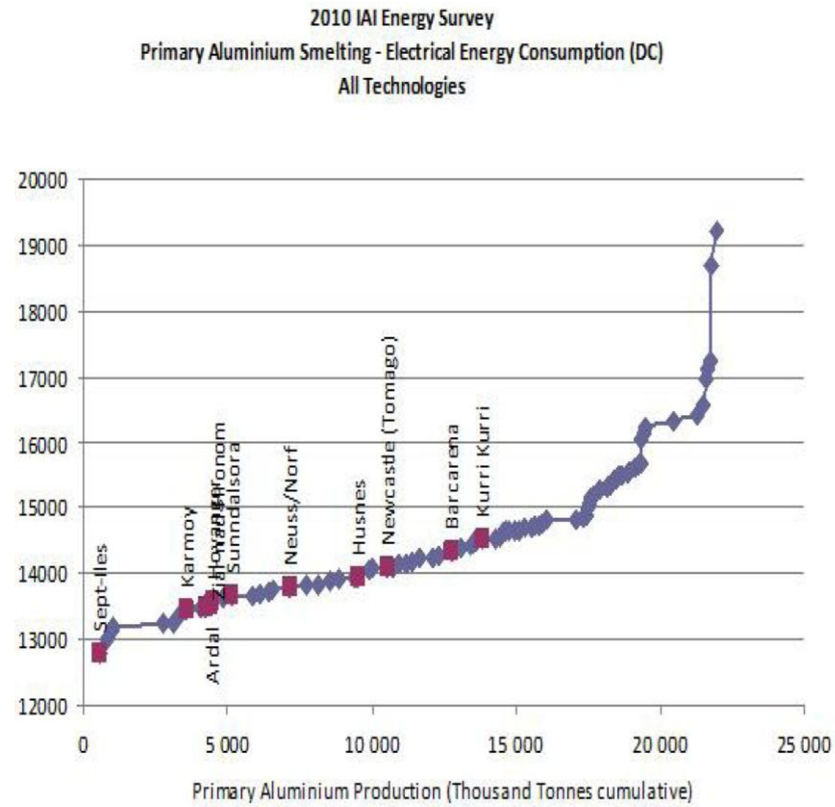
Energy and climate in a global perspective

Carbon footprint should become key location factor in the future

In tonnes CO_2-equivalents per tonne aluminium





Source: Institut für angewendte Ökologie (Öko-institut e.V.), 12.5.2011

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