

VIRTUAL POWER PLANTS

Bellonaforum: Energilagring

**Globalt energilagringmarked – ny norsk
næringsutvikling**

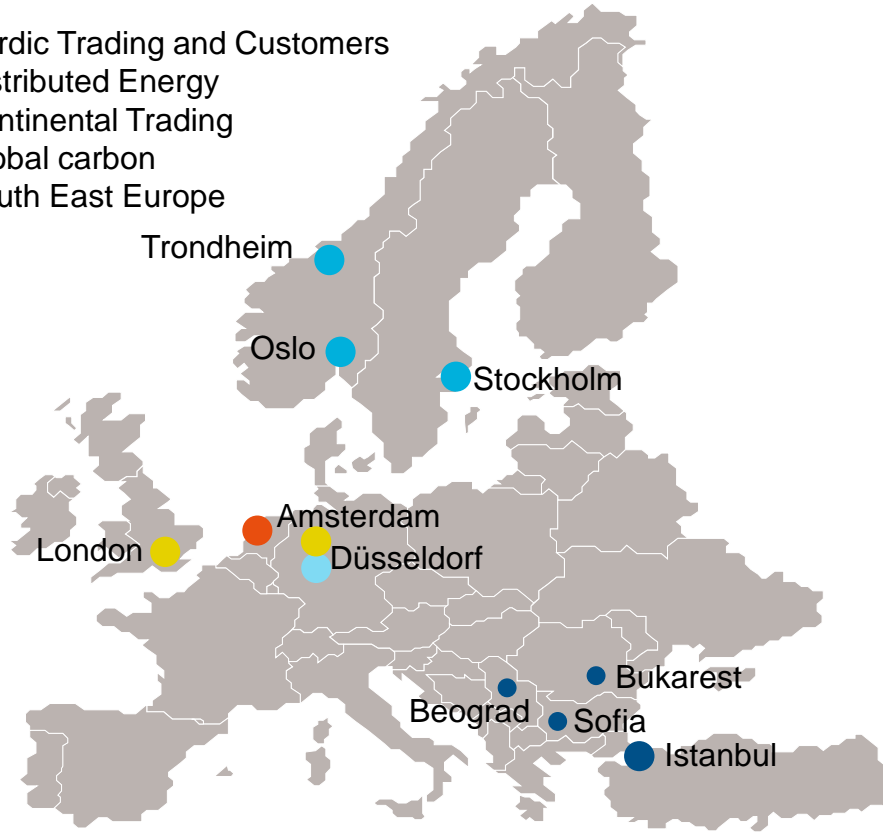
27 September 2016

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Trading & Origination (T&O) in Statkraft

- Nordic Trading and Customers
- Distributed Energy
- Continental Trading
- Global carbon
- South East Europe



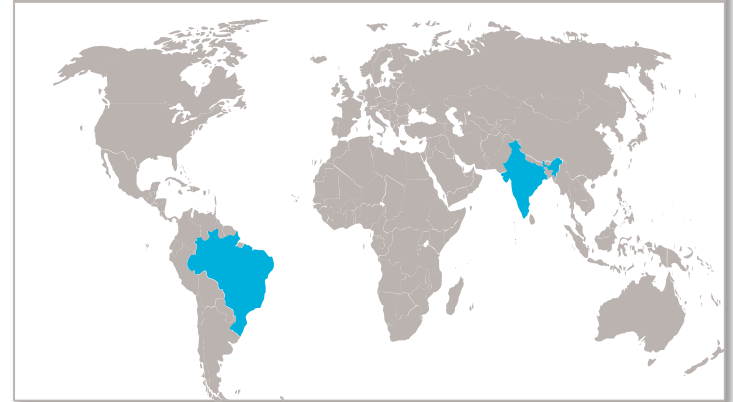
TRADING & ORIGINATION

Statkraft engages in wholesale trading in energy. This trade is based on standardized and customized contracts for power, gas, coal, oil, renewable energy certificates and CO₂ certificates. These operations are run from offices in Amsterdam, Beograd, Bucharest, Düsseldorf, Istanbul, London, Oslo, Sofia, Stockholm and Trondheim.

2 106 contracts per trading day
524 480 contracts per year

Time frame from **1 hour** to **15 years**

2014: Trading activities in Brazil and India



Statkraft in Germany

- ▶ In Germany Statkraft operates
 - 9 run-of-river power plants and 1 pumped storage power plant
 - 4 gas and steam turbine power plants and another with 50 percent of the shares
 - 2 biomass heating power plants
- ▶ Significant Trading, Origination and Customer business

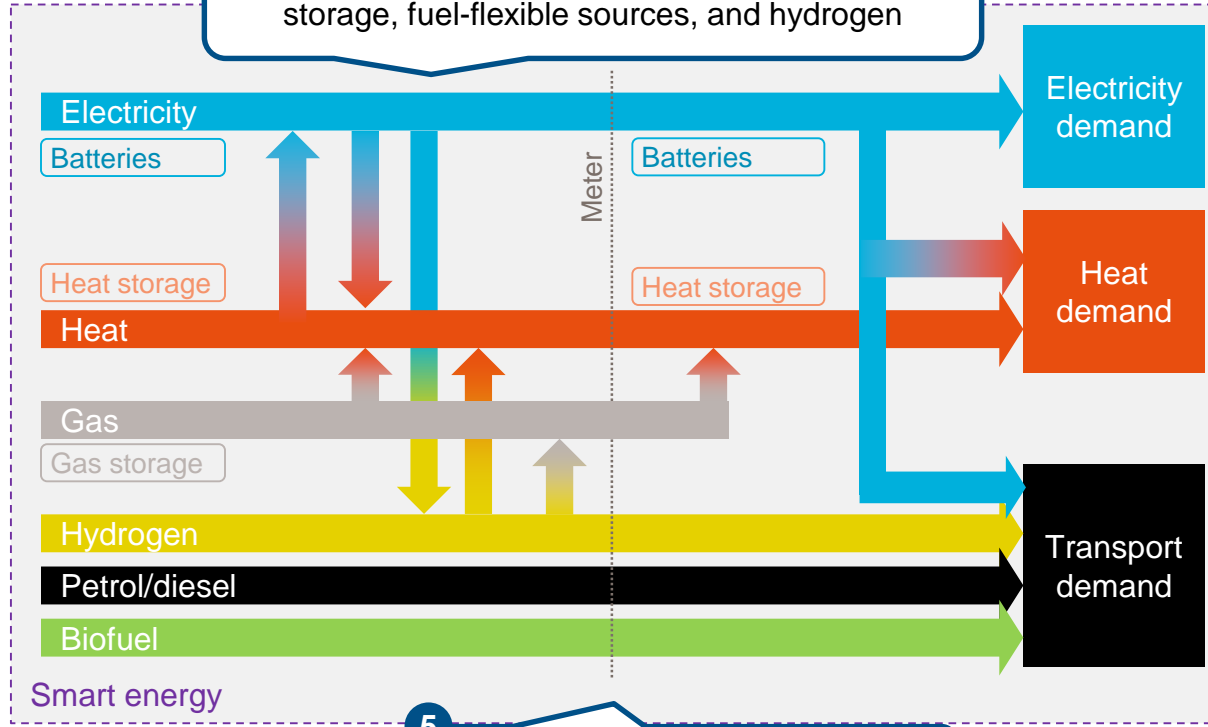


More intermittent renewable generation is a strong trend

1 More renewables generation overall



2 Convergence of energy sectors by electrification, storage, fuel-flexible sources, and hydrogen



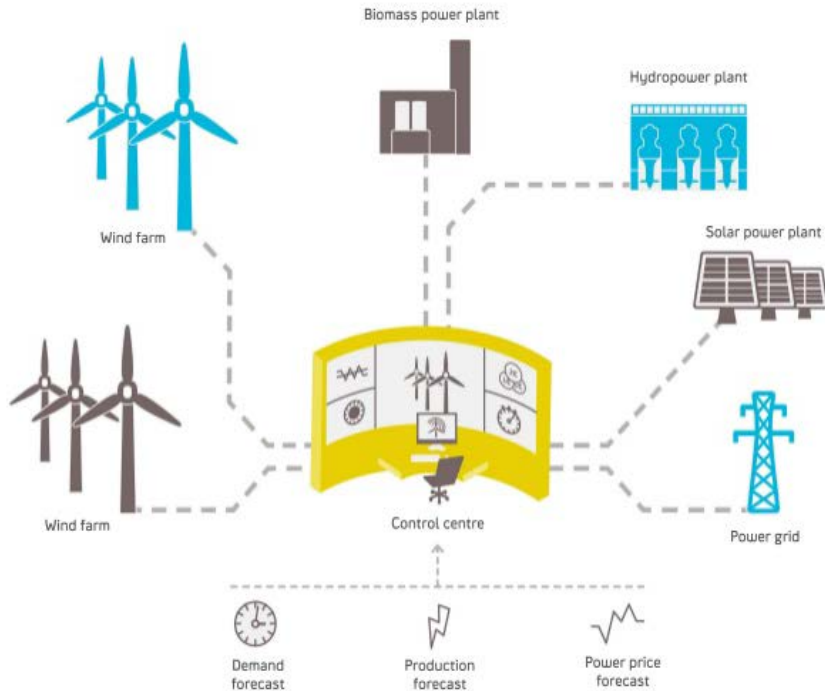
3 More flexible demand when electrified

4 More distributed generation and storage



5 Smart and efficiently operated

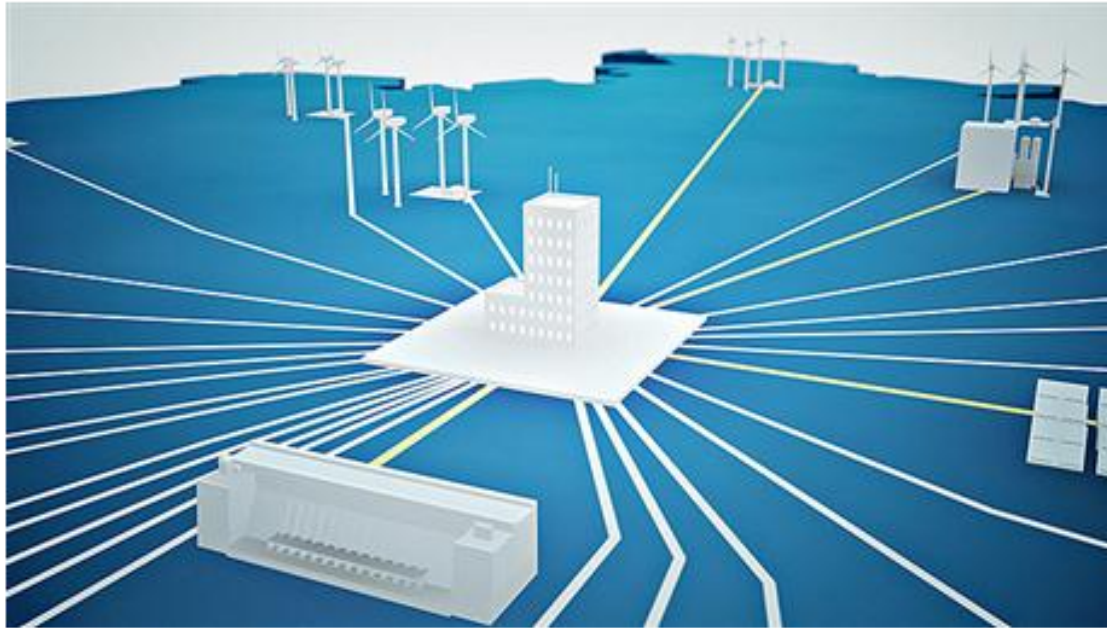
Virtual power plants can aggregate the increasing share of RES and provide flexibility



Def: «A flexible representation of a portfolio of DERs that can be used to make contracts in the wholesale market and to offer services to the system operator»*

- ▶ **Commercial VPPs** optimize energy sales from DERs, while **technical VPPs** (operated by the DSO) optimize grid operation
- ▶ VPPs can aggregate **generation** assets, **storage** assets, **demand** assets or combinations of the three
- ▶ Current challenges:
 - ▶ range of communication protocols
 - ▶ lack of standards
 - ▶ high costs of aggregating small assets

Deutschlands größtes Kraftwerk ist grün



Virtuelles Kraftwerk

10-9-2013

Düsseldorf, 10. September 2013 – Statkrafts virtuelles Kraftwerk steuert seit Anfang September 4.436 Megawatt (MW) an regenerativen Erzeugungskapazitäten und verfügt damit über mehr Leistung als das größte konventionelle Kraftwerk in Deutschland. Das Unternehmen hat gemeinsam mit den Betreibern über 2.000 Erneuerbare-Energien-Anlagen aus ganz Deutschland vernetzt und damit zentral regelbar gemacht.

Starting point: Maximise value from assets

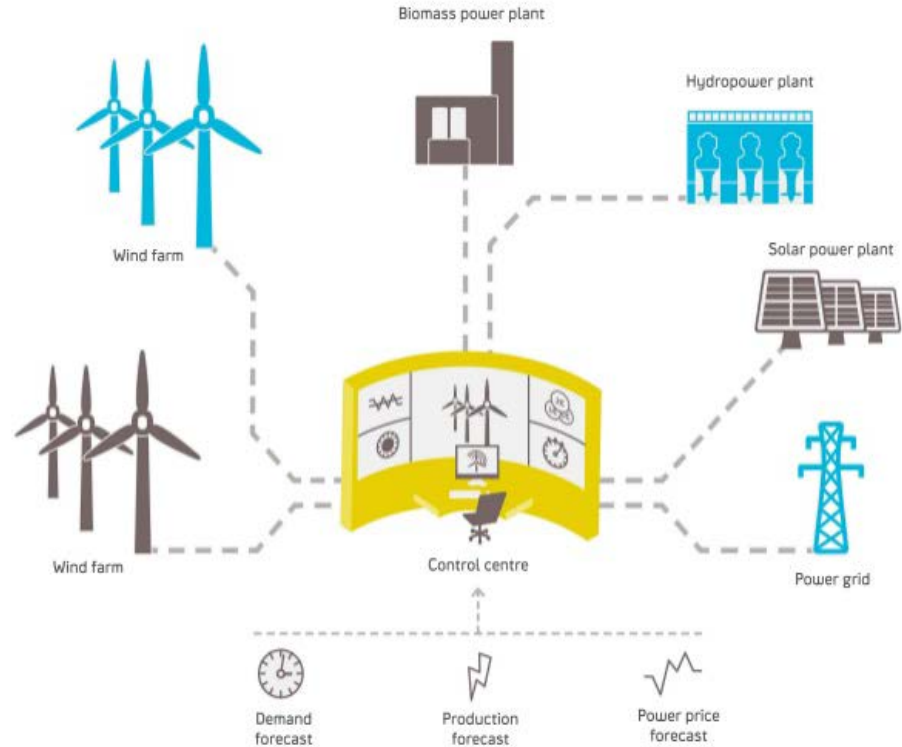
German hydropower plants acquired through the EON swap (2009) valued against the German EEG

Achieve significantly higher price through moving plants out of EEG and into direct sales

Create substantial additional profits through rolling out the same concept on third party volumes

Statkraft's German VPP

- ▶ Capacity: 9500 MW
(> 5 % of installed capacity in Germany)
- ▶ Number of assets: ~1000
- ▶ Wind, Solar, Hydro, Storage
- ▶ In operation since 2013



Other markets

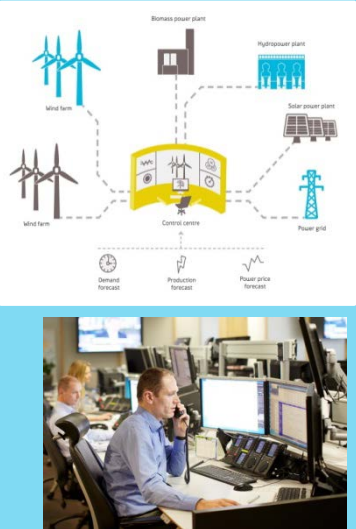
Third party assets



Statkraft's assets





Market Operations




Customer business

Direkt vermarktet,
sauber versorgt.
Statkraft
BezugsStrom







Wholesale & reserve markets



THANK YOU



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