

BATTERIES IN THE GRID

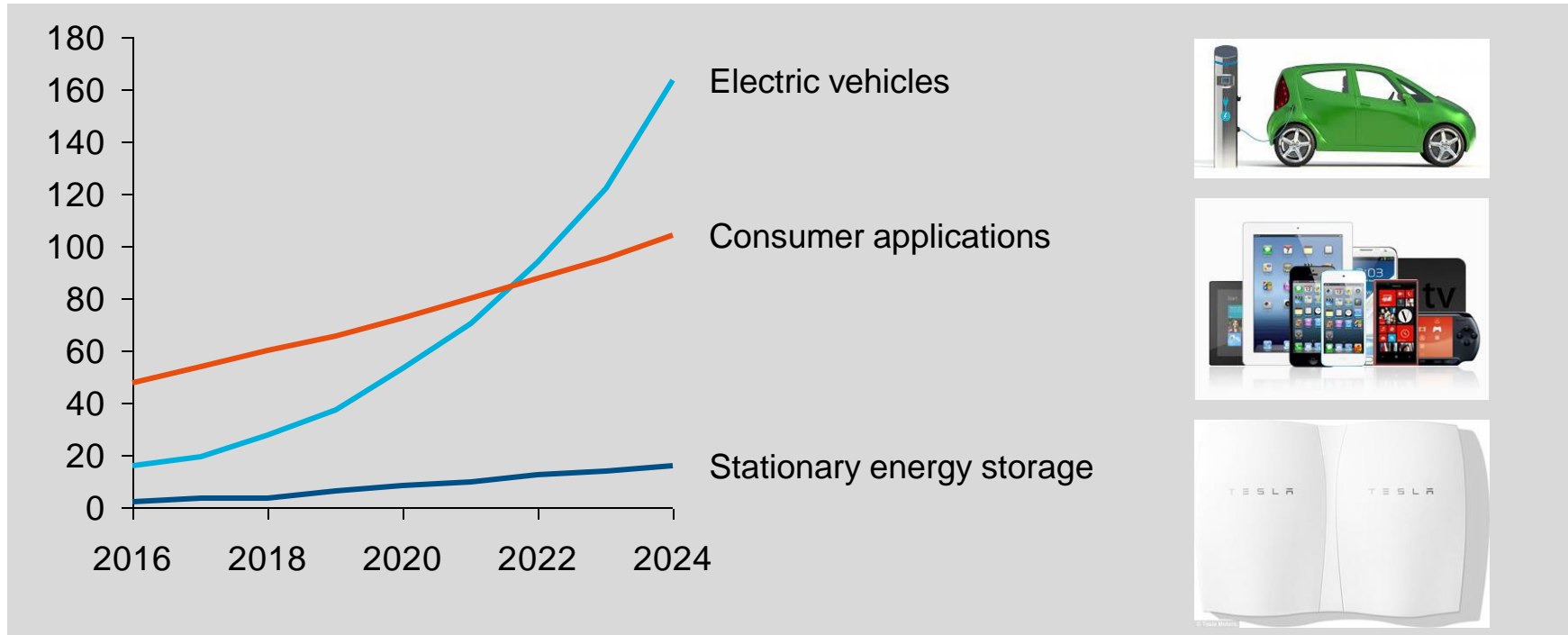
KSU-SEMINAR, BODØ

2016-09-08 Jan Schelling



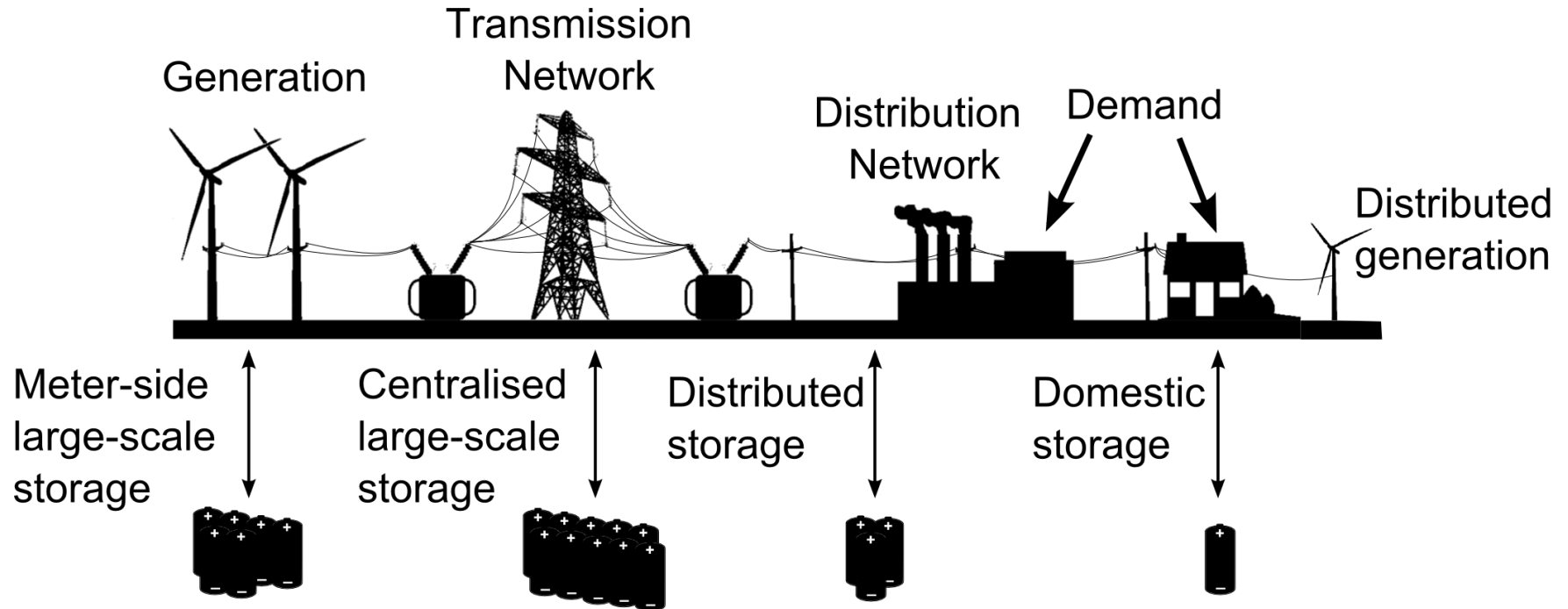
Battery industry set to grow exponentially – yet grid storage to remain relatively small

Global annual battery demand by market segment (GWh)



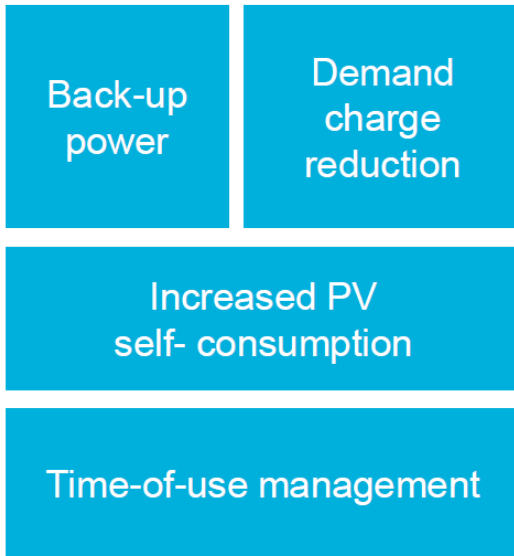
Source: BNEF 2016

Typical connection points for grid storage

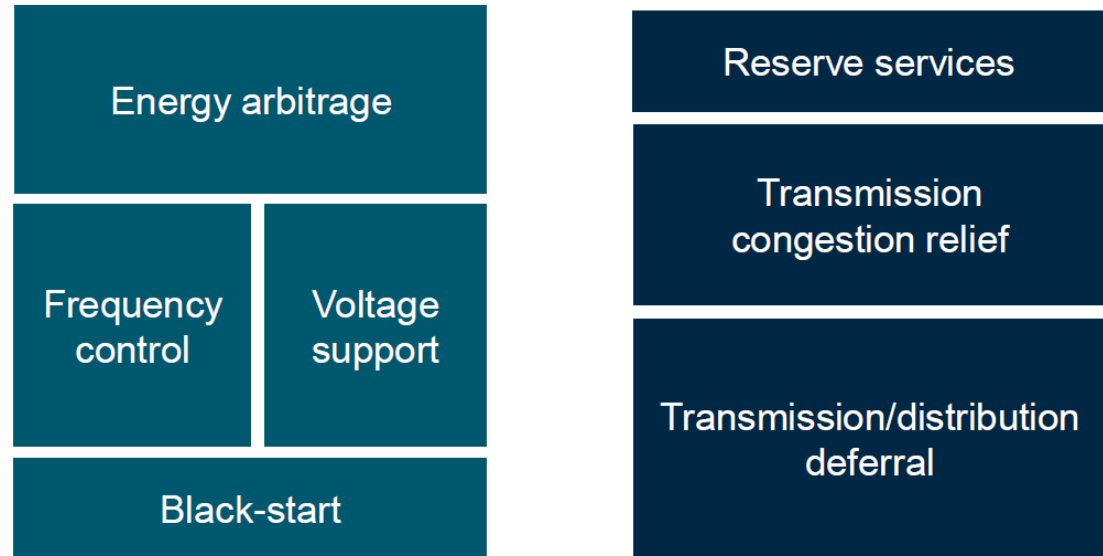


Potential revenue streams from batteries

Behind-the-meter

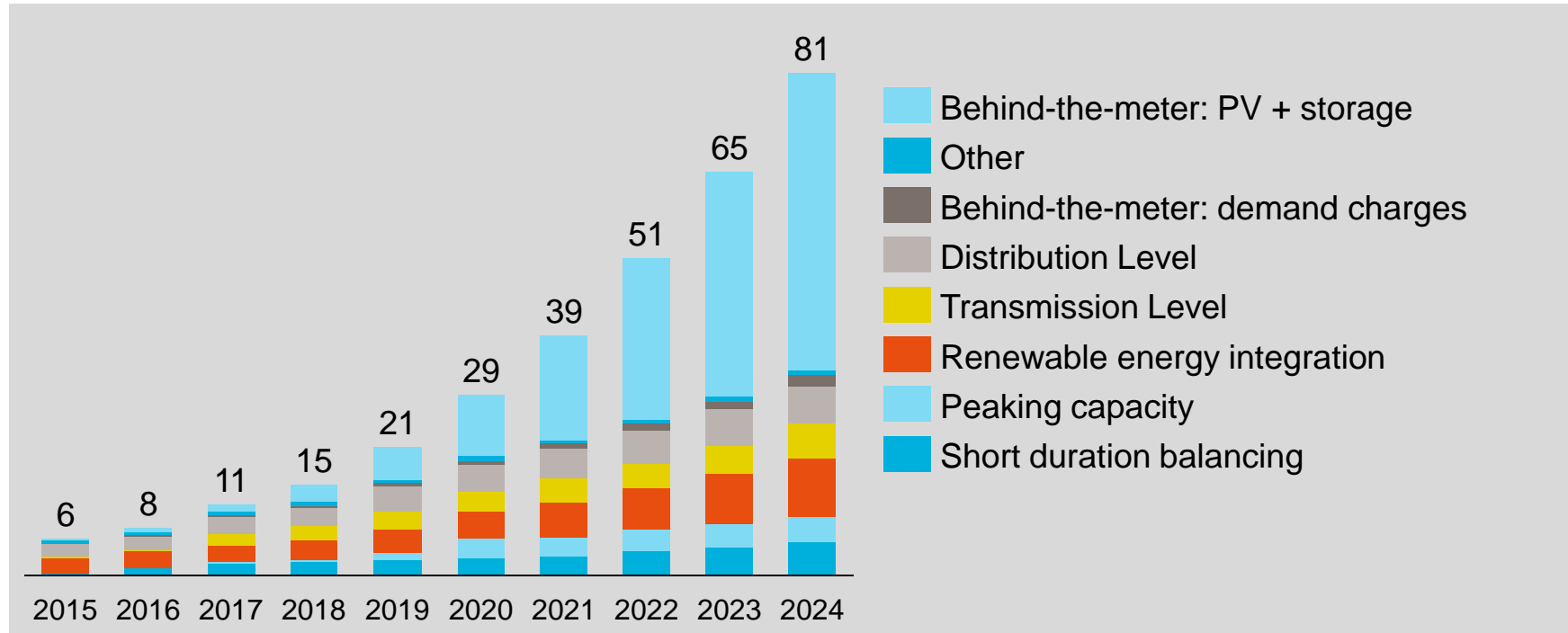


Front-of-the-meter



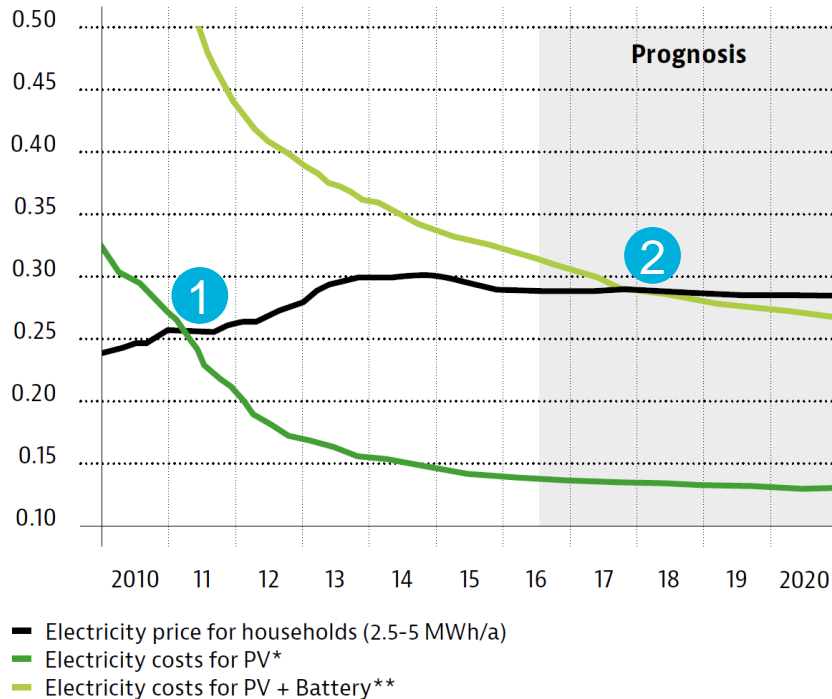
Main application in the future: Behind-the-meter in combination with solar PV

Global cumulative market size by application (GWh)



Battery price parity in sight in selected markets

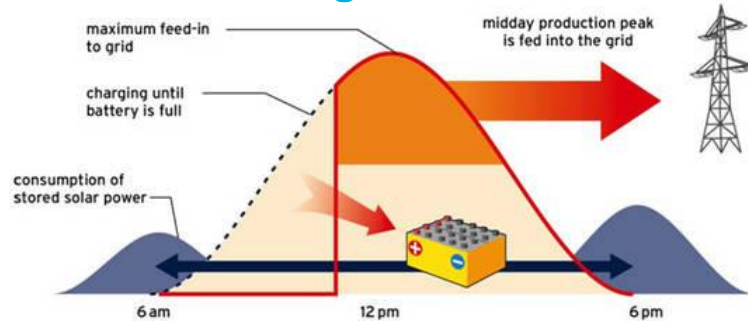
Solar & battery costs vs. electricity price (EUR/kWh)



- 1**
 - ▶ Solar PV costs drop below electricity prices
 - ▶ PV systems with 100% self-consumption become profitable
- 2**
 - ▶ Solar PV plus battery costs drop below electricity prices
 - ▶ PV systems with storage become profitable

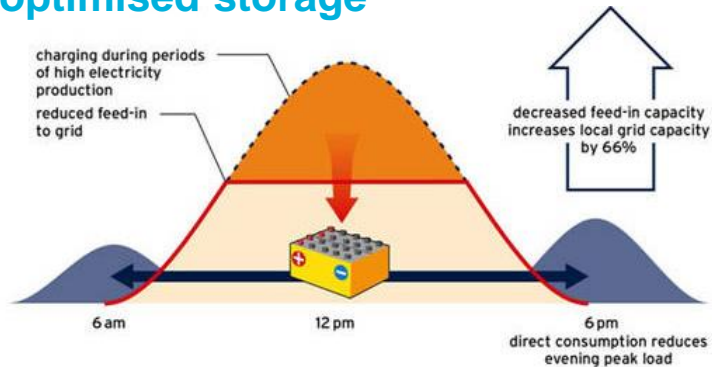
Solar/battery system operation can be optimised for the grid

Conventional storage



- ▶ Battery charges as soon as solar production exceeds demand
- ▶ Battery may be fully charged by the time peak solar occurs
- ▶ **Mid-day solar peak is fed to the grid**

Grid-optimised storage



- ▶ Battery charges preferably during solar peak
- ▶ Mid-day solar peak is capped
- ▶ **Local grid capacity is increased**

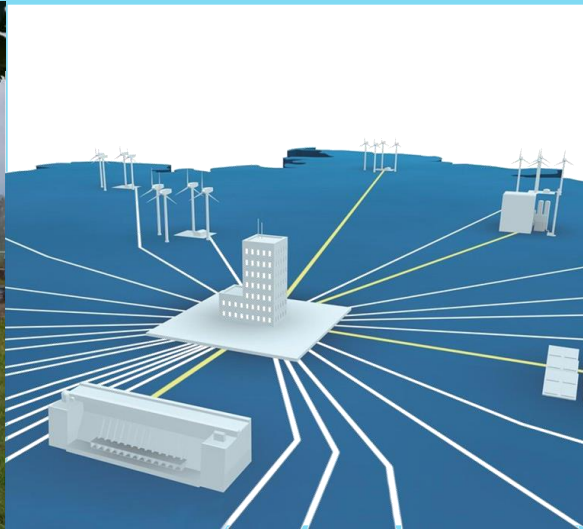
Statkraft is studying various battery applications as an addition to our business

Frequency Support



- ▶ Dörverden, Germany
- ▶ 3 MW/3 MWh Li-ion
- ▶ Comm. operation since Feb 2016

Virtual Power Plant



- ▶ Largest "power plant" in Germany
- ▶ 7700 MW wind, 700 MW solar
- ▶ 60 MW secondary reserve

Solar & Batteries



- ▶ Statkraft BLP Solar Solutions, India
- ▶ Formation: Nov 2015
- ▶ Distributed solar systems

Conclusions

Batteries are great!

Can fulfil many short-duration functions (daily cycle or less)

But:

Need to compete with demand response, power to heat, existing storage capacity, interconnectors

Most cost-effective:

PV storage behind the meter, frequency support

Profitability depends on:

Market and Regulation:
retail price, wholesale price variations, value of grid services



THANK YOU

jan.schelling@statkraft.com



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