The Role of Flexibility and Virtual Power Plants in Modern Power Markets

Nicolas Sommer

Joint Meeting Hertie Energy and Environment Network (HEEN) and Strommarkttreffen
01. July 2016
Outline
NEXT Kraftwerke, Trading, and Flexibility

› NEXT Kraftwerke
  – Who we are and what we do

› Trading electricity on short-term markets
  – Which markets are we talking about?
  – Our activities

› Flexibility
  – Reactive and Proactive
WHAT IS A DIGITAL UTILITY?

- A VPP operates and markets power plants, without owning them!
- It’s a platform where independent producers & consumers are connected to grid operators & markets through M2M communication
**Being flexible: Prepared for what comes next**

Earning opportunities in our business model

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**Reactive Flexibility**

Stabilizing the grid and keeping the grid frequency at 50 Hertz.

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**Services**

Optimal trade with remote-controlled units within the Market Premium Model.

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**Proactive Flexibility**

(Short term) trading of power to use the units flexibility profitably.

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- Flexible production of bioenergy, hydro, etc.
- Demand Side Management
## COMPANY DEVELOPMENT

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<tbody>
<tr>
<td>Assets</td>
<td>10</td>
<td>85</td>
<td>300</td>
<td>1220</td>
<td>2563</td>
<td>2844</td>
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<tr>
<td>Employees</td>
<td>5</td>
<td>16</td>
<td>31</td>
<td>57</td>
<td>77</td>
<td>107</td>
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<tr>
<td>Revenue in Million. €</td>
<td>0</td>
<td>0</td>
<td>36</td>
<td>101</td>
<td>184</td>
<td>274</td>
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</table>
The Next Kraftwerke portfolio comprises of renewable energy producers and large-scale power consumers in all control areas in Germany, Belgium & Austria.

- Flexible Renewables (Bioenergy, hydro, etc.)
- DSM / Emergency Generators
- Solar power
- Wind power

* The Next Kraftwerke portfolio comprises of renewable energy producers and large-scale power consumers in all control areas in Germany, Belgium & Austria.
BEING DIGITAL: THINKING IN BITS AND WATTS

3,000 UNITS IN SIX COUNTRIES, 2,000 MEGAWATTS

LINKED VIA THE REMOTE CONTROL UNIT NEXT BOX

PROCESSED & ORCHESTRATED BY THE CENTRAL CONTROL SYSTEM
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German Wholesale Electricity Market
Timeline and Setup

**DAY-AHEAD MARKET**
- Energy with physical delivery on the next day
- Hourly auction at 12pm
- Quarter-hourly auction at 3pm
- Sell your renewable forecast

**INTRADAY MARKET**
- Continuous trading with products close to real-time
- Sell / Buy forecast residuals

**BALANCING MARKET**
- Daily / Weekly Tender of reserve power products by the Transmission System Operator (TSO)
The Trading Workflow: A Closer Look
Markets and Deadlines

<table>
<thead>
<tr>
<th>Purpose</th>
<th>HOURLY OPTIMIZATION</th>
<th>QUARTERLY OPTIMIZATION</th>
<th>QUARTERLY AND HOURLY CONTINUOUS RE-BALANCING</th>
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<tbody>
<tr>
<td>Trading process</td>
<td>Coupled Day-ahead</td>
<td>Start of Intraday</td>
<td>Start of continuous quarterly Intraday trading</td>
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<tr>
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<td>hourly auction</td>
<td>nominations</td>
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<tr>
<td></td>
<td>12 pm</td>
<td>2:30 pm</td>
<td>3 pm</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>4 pm</td>
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</tbody>
</table>

- Day-Ahead auction for **hourly** products
- Actual forecast → schedules → TSO grid planning
- Intraday auction for **quarter-hourly** products (→ PV)
- Continuous intraday for hourly and quarter-hourly products
- Periodic update of forecasts
Control Reserve
Stabilizing the grid and keeping the grid frequency at 50 Hertz

Derivative market
Long and mid term (years/months)

Day-Ahead Market
Short term (Day+1)

Intraday Market
Very short term (hours)

Balancing market
Real time (minutes)

Primary reserve capacity (PRC)

Secondary reserve capacity (SRC)

Tertiary reserve capacity (TRC)

Reserve provided by the balancing group manager

MR= The grid’s ability to balance fluctuations by inertia.
PV forecast

The Need for Management of your Portfolio in the Very-Short Term

Forecast errors need balancing → Expensive!
> Live-data is essential for high-quality forecasts
Balancing services – Flexibility by VPPs

How does it work?

235 units

334 units

376 units

MW

0

5

10

15

Minuten

SRL-Soll

SRL-1st
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Demand Side Management
Proactive Flexibility – Adjustment of Production (Day-Ahead)

Peak Load Operation

- High prices (Day-Ahead) $\rightarrow$ Ramp up production (and vice versa)
- Very flexible plants: Production adjustment on the basis of intraday-prices
Proactive Flexibility

Weekly schedule of biogas plant: Sa, 31.1.2015 until Fr, 6.2.2015
Electricity markets deal very well with increasing RES
ABOUT

THE GOAL  Making 100% renewable energy possible
THE PATH  Digital, flexible, sustainable
THE STATUS  One of the largest Digital Utilities in Europe
THE TEAM  About 110 employees with a broad academic background

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NEXT KRAFTWERKE