INTEGRATION OF DISTRIBUTED GENERATION AT THE REGIONAL ENERGY MARKET eTELLIGENCE

Die Integration verteilter Erzeuger am regionalen Energiemarktplatz eTelligence

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Smart Grids Week 2012
Bregenz, 24.05.2012

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AGENDA

- The Integrative Market of the eTelligence Project
- Distributed Generation in eTelligence
- Day-ahead Trading at the eTelligence Market
- Economic analysis of the Field Test
- Conclusion
eTelligence
One of Six EENERGY Projects

The research project »eTelligence« is a winner of the technology competition »E-Energy« of the German Federal Ministry of Economics and Technology (BMWi).

- In the model region Cuxhaven
- Working group of more than 20 partners under the guidance of utility provider EWE AG Oldenburg
Model Region
**eTelligence**

**Focal Points**

- Intelligent management (generators, grid, consumers)
- Connecting actors through a market place
- Connecting components through an ICT „nervous-system“ based on standards
Pay as bid market
Trading period: 10:00 – 11:00
Guaranteed liquidity via market maker interconnecting to EEX

Resolution: hour contracts
Individual price and forecast risk
Five days a week
Products: real / active power
# Distributed Generation

**Three Participating CHP Units**

<table>
<thead>
<tr>
<th>CHP Installation Location</th>
<th>Electrical Power</th>
<th>Thermal Power</th>
<th>Fuel</th>
<th>Peak Boiler</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communal Swimming Pool</td>
<td>460 kW</td>
<td>716 kW</td>
<td>Natural Gas</td>
<td>1,200 kW</td>
<td>-</td>
</tr>
<tr>
<td>Sewage Treatment Center</td>
<td>1,052 kW</td>
<td>1,116 kW</td>
<td>Sewage &amp; Natural Gas</td>
<td>1,750 kW</td>
<td>Gas &amp; Thermal</td>
</tr>
<tr>
<td>Micro CHP in an Office Building</td>
<td>5.5 kW</td>
<td>14.5 kW</td>
<td>Natural Gas</td>
<td>60 kW</td>
<td>Thermal</td>
</tr>
</tbody>
</table>
Distributed Generation

Flow of Smart Grid Data - Communication

Trading Center

- eTelligence market

Local Intelligence

- DSL-Modem
- IEC 61850 / IEC 61970 CIM/XML
- eTelligence Gateway (Marktagent)

Conventional Control Infrastructure

- Ethernet modul
- Ethernet
- PLC in the Boiler Room
- Ethernet
- PLC in the CHP Container
- Ethernet
- RS 232
- Boiler 1
- Boiler 2
- CHP 1
- CHP 2
Distributed Generation eTelligence Gateway

**Fully automated** processing

- Prediction of thermal load based on
  - External weather forecast
  - Local historical measured data
- Day-ahead scheduling based on
  - Market prices
  - Predicted thermal load
- Marketing of hour contracts
- Physical operation based on the sold schedule
Day-ahead Trading

Trading Design

- **Trading Period:** 10:00 – 11:00
- **Five days a Week → 24 h (Mon.-Thu.) / 72 h (Fri.)**
- **Products:** Real / Active Power
- **Resolution:** Hour Contracts
- **Pay as Bid Market**
- **Price and Forecast Risk**
- **Guaranteed Liquidity by a Market Maker**
Day-ahead Trading

Trading Sequence from the CHP perspective

- Selling of Schedule for Day d
- Selling of Schedule for Day d+1

For Day d
- 1. Prediction
- 2. Scheduling

For Day d+1
- 1. Prediction
- 2. Scheduling

Power / Load in kW

- Th. Load
- Prod. Power
- Sold/Scheduled Power
- Prediction of th. load

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Balancing Energy

Ausgleichsenergie

Einbruch der thermischen Last ➔ Abweichung vom Fahrplan
Economic analysis

Price analysis

MM Price is 5.1 % below EEX-Price and less volatile.
Economic analysis

Accumulated Cash Flow

→ Positive result even without a thermal storage!
Price Analysis

Deviation + 5.1 %  + 4.7 %

Mean 51.33 €  51.12 €  48.83 €

Price in €/MW

EEX Price  EEX Price Prediction  Market Maker Price

MM Price is 5.1 % below EEX-Price and less volatile
Conclusion

- **Despite increased risk** (esp. scheduling / prediction) the market integration potentially increases feasibility of small CHP units.

- **Despite the lack of a thermal storage**, the field test plant at the swimming pool realized an increased marginal income as compared to the risk free operation under a (fixed) feed-in tariff.

- But **low transaction costs** (margin of the market maker) is crucial.

- Need for scheduling **increases** the **complexity substantially**.

Step by Step Market Integration:

- Implementation of a **voluntary dynamic tariff** next to nowadays fixed feed-in tariff for small CHP.

- Comparable systemic value as market integration but
  - decreased transaction cost
  - decreased prediction risk on an individual basis.
Thank you for your Attention!

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