Using ENKO for infeed management – method and prediction capabilities

Dr. Clemens Gerbaulet 15.03.2018
Renewable curtailment in Schleswig-Holstein 2018
Distribution of intensity

Infeed management in Schleswig-Holstein in 2017¹

~3,300 GWh
Curtailment of renewable energy sources

~350 Mn €
Costs for grid customers

¹ Values for 2017. BNetzA: Quartalsbericht zu Netz- und Systemsicherheitsmaßnahmen
Today I will talk about ENKO

ENKO is part of the SINTEG-project NEW 4.0

NEW 4.0 goal: 100% renewable energy supply for the Region Hamburg and Schleswig-Holstein until 2035

- Increase local renewables usage: sector coupling, smart-grid approaches
- ENKO (by ARGE Netz and SH Netz) uses voluntary demand flexibility
  → More green electricity, less grid congestion and less infeed management
- The ENKO-platform is live since January:
  → Q3 & Q4 2018: Live-simulation of ENKO with pilot-customers
  → During simulation: Feedback, process optimization, technical feasibility
  → Since January 2019: Real operation
Using Flexibility for congestion management in ENKO

Grid operation module

Proactive identification of grid congestion

Planning measures
- Identification of sensitive flexibility assets
- Cost-optimal "Merit-Order" algorithm

Flexibility selection is final

Flexible platform

Offered flexibility potential

Bid award information
Energy sourcing and update of load schedule*
Provisioning of load

Normal process for remaining congestion

"Yellow traffic light"

Grid operator

"Red traffic light"
Current curtailment regulation § 13 Abs 2 EnWG remains unaffected

Flexibility supplier

* In the framework of the research project balance compensation by the grid operator is not done.
Predictions using sophisticated artificial neural networks
Prognoses published on netzampel.energy (after ENKO gate closure)

Actual renewable curtailment

Prediction of renewable curtailment

13. November 2018 , 14:00

www.netzampel.energy
Cost & sensitivity-based algorithm → cost-efficient selection

**Cost-efficient „sensitivity merit order“**: Selection is based on costs to relieve congestion for all grid congestions simultaneously.

### Example calculation for price-sensitivity merit order with a single congestion (1.5MW) and only 0% and 100% regulation steps also for renewables

<table>
<thead>
<tr>
<th>Asset</th>
<th>Power (MW)</th>
<th>Sensitivity</th>
<th>Price (€/MWh)</th>
<th>Price-sensitivity (€/MWh)</th>
<th>Congestion-reduction (MW * Sens)</th>
<th>Cost 1h</th>
<th>Awarded?</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEG 01</td>
<td>3</td>
<td>0.3</td>
<td>90</td>
<td>300</td>
<td>0.9 MW</td>
<td>270 €</td>
<td>Yes</td>
</tr>
<tr>
<td>EEG 02</td>
<td>2</td>
<td>0.25</td>
<td>90</td>
<td>360</td>
<td>0.5 MW</td>
<td>180 €</td>
<td>Yes</td>
</tr>
<tr>
<td>Flex 01</td>
<td>1</td>
<td>0.23</td>
<td>95</td>
<td>413</td>
<td>0.23 MW</td>
<td>95 €</td>
<td>Yes</td>
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<tr>
<td>Flex 02</td>
<td>1</td>
<td>0.23</td>
<td>97</td>
<td>422</td>
<td>0.23 MW</td>
<td>97 €</td>
<td>No</td>
</tr>
<tr>
<td>EEG 03</td>
<td>2</td>
<td>0.21</td>
<td>89</td>
<td>424</td>
<td>0.42 MW</td>
<td>178 € - Savings 83 €</td>
<td>No</td>
</tr>
</tbody>
</table>

**Example for a simple Sensitivity Merit-Order**

- **Voluntary flexibility**
- **Regulated flexibility (e.g. EEG)**

**Congestion-management**

**Volume [MW]**

**Sensitivity-price [p/s]**
Lessons learned from live operation and live-simulation

**The ENKO concept generally works and amends existing processes**
- Voluntary participation of flexibility providers generally works
- Processes are transparent
- Extension to Einsman, does not influence safe grid operation
- Validation of load-provisioning based on meter data

**Status**
- Live operation based on SINTEG VO since January 2019
- Both API and Web-interfaces are important – standards necessary
- New capabilities developed that can be built upon in the future if needed:
  - Prediction structure works well for ENKO process
  - New algorithms such as sensitivity based merit order optimization algorithm
Thanks!

Dr. Clemens Gerbaulet
clemens.gerbaulet@hansewerk.com