Demand Response Experiences from Germany

Erfahrungsaustausch Integration der erneuerbaren Energien in die Verteilnetze
Deutsch-französisches Büro für erneuerbare Energien (DFBEE)
Paris 27. März, 2014
Executive Summary: Entelios supports with the intelligent management of distributed energy resources - Loads, Storage & Generation.

- **Demand Response (DR)** is a process to manage customer consumption (demand) of electricity in real-time in response to dynamic supply conditions. Demand Response combines distributed energy resources (electrical loads, storage and generation units) in a Virtual Power System.

- Intelligent management of the demand side will become increasingly important for energy companies of the future. By integrating their individual consumption flexibility in a DR program, energy consumers can receive attractive financial benefits while enhancing the stability of the energy system. DR benefits energy companies through the commercial use of the aggregated flexibility; achieving higher customer proximity and cost-effective flexible capacity for generation portfolios and grid operations.

- **Entelios is an energy management solution provider** (of technology & services) for distributed energy resources in industrial, commercial and institutional sectors. Entelios’ customers are European energy companies (energy retailers, TSOs, DSOs, ESCOs) that are looking for innovative value-adding energy services for to their B2B customers, or to enhance grid and supply stability, through DR.

- **Entelios is an enabling partner for energy companies** to set up their own DR programs with their commercial, industrial and institutional customers. Based on its leading solution suite and operational capabilities, Entelios offers automated industrial Demand Response “as-a-Service” (DRaaS®). The Entelios solution suite supports major open smart grid interoperability standards (i.e. data formats, protocols, access points) via the Ebox® as a universal interface to all types of flexibility assets. The solution offers fully-automated pooling up to secondary reserve requirements, short- and medium term forecasting, and even complex optimization, monitoring & control.

- Entelios has built up operational expertise in DR since 2010 as one of the first DR aggregators and white-label DR solution providers in Europe. Entelios is founding member of the Smart Energy Demand Coalition (SEDC) and member of the European Commissions’ Smart Grid Task Force.

- **Entelios AG was acquired by EnerNOC, Inc.** (Nasdaq:ENOC) in Feb 2014. EnerNOC is a leading provider of Energy Intelligence Software (EIS) and related solutions. EnerNOC unlocks the full value of energy management for utility and commercial, institutional, and industrial (C&I) customers by delivering a comprehensive suite of demand-side management services that reduce real-time demand for electricity, increase energy efficiency, improve energy supply transparency in competitive markets, and mitigate emissions.
Entelios is a solution provider to utilities and grid operators for managing distributed energy resources in an industrial & commercial setting.

- **Entelios is an aggregator and energy management solution provider** for distributed energy resources.

- **Automated Industrial Demand Response “as-a-Service” (DRaaS):**
  - Entelios Software Suite (Central Entelios „NOC“) and universal industrial interface „E-Box“ to connect participants
  - Professional & Operational Services

- **Founded in 2010,** Operations in Germany, Austria and Ireland, European focus

- **Feb 2014 acquisition by EnerNOC,** Operations in USA, Canada, Australia, New Zealand, Japan (>12,000 C&I customers)

- **Achievements** (extract):
  - Collaborating with all four TSOs of Germany, active in MRL & SRL trading
  - Co-developed standards, e.g. „baselining“, load forecasting
  - First utility partnership end of 2010, currently several partnerships (e.g. Dong) also outside Germany (e.g. Verbund/ Austria)
  - **Entelios DR Pool** with >600 MWuM by end of 2013, incl. very large industrial customers
  - One of the three founding members of the SEDC ([www.sedc-coalition.eu](http://www.sedc-coalition.eu))
  - Entelios is part of the ADVANCED consortium, a DSO focused FP7 project, including ERDF, Enel, RWE, Iberdrola

http://www.advancedfp7.eu/Home/Partners

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The Entelios solution integrates all types of flexibility assets – loads, storage and distributed generation.

Markets, today & tomorrow:

- Balancing Power (MRL / SRL)
- Energy Trading (i.e.: Intraday, Day-Ahead)
- EEG "Direktvermarktung"
- AbLaV / Redispatch
- Capacity Markets
- Balancing Group Optimisation
- Portfolio Management
- Managing DSO Constraints
Prioritization and coordination amongst the stakeholders needed. DSO could „own“ the solution and has „oversight“ privileges.

Notes:
N.N.: role that will manage the capacity mechanism, may be assumed by different stakeholders depending on national regulation, e.g. EPEX Spot or TSO.
SCADA: Industrial / Building Automation
Load Potential in the German industry alone add up to approx. 9 GW

Survey & expert based DR analysis

Source: FFE, München (www.ffe.de)
Industry Analysis: Complexity vs. Flexibility = Revenue Potential

DR Potentials – Loads, Generation and Batteries

Quelle: Entelios Analyse

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**TSO managed products – MRL, SRL, AbLaV / situation in Germany**

<table>
<thead>
<tr>
<th>Description</th>
<th>Primary Control</th>
<th>Secondary Control</th>
<th>Tertiary Control (Minute Reserve)</th>
<th>AbLaV (SOL)</th>
<th>AbLaV (SNL)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Response Time</strong></td>
<td>30 seconds</td>
<td>5 minutes</td>
<td>15 minutes</td>
<td>1 second</td>
<td>15 minutes</td>
</tr>
<tr>
<td><strong>Response Type</strong></td>
<td>Direct control by TSO</td>
<td>Direct control by TSO</td>
<td>Semi-automated</td>
<td>Automated UFR</td>
<td>Direct control by TSO</td>
</tr>
<tr>
<td><strong>Activation</strong></td>
<td>Normal frequency deviation</td>
<td>System imbalance; frequency deviation</td>
<td>Replacement of Secondary Control</td>
<td>Extreme frequency deviation</td>
<td>Supply shortfall</td>
</tr>
<tr>
<td><strong>Procurement</strong></td>
<td>Weekly</td>
<td>Weekly</td>
<td>Daily</td>
<td>Monthly</td>
<td>Monthly</td>
</tr>
<tr>
<td><strong>Minimum Offer</strong></td>
<td>1 MW</td>
<td>5 MW</td>
<td>5 MW</td>
<td>50 MW</td>
<td>50 MW</td>
</tr>
<tr>
<td><strong>No. of Products</strong></td>
<td>1 (symmetric)</td>
<td>4 (pos/neg; peak/off-peak)</td>
<td>12 (pos/neg; 4-hour blocks)</td>
<td>1 (neg)</td>
<td>1 (neg)</td>
</tr>
<tr>
<td><strong>Payment Type(s)</strong></td>
<td>Capacity only</td>
<td>Capacity and energy</td>
<td>Capacity and energy</td>
<td>Capacity and energy</td>
<td>Capacity and energy</td>
</tr>
</tbody>
</table>

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Example: aluminium manufacturer providing SRL

March 2013, large aluminum producer

![Graph showing aluminium production and control reserve delivery]
Potential value for DSOs from establishing Demand Response with industrial and commercial customers.

### Value for grid operators from establishing Demand Response

<table>
<thead>
<tr>
<th><strong>Direct use of aggregated flexibility („MWuM“)</strong></th>
<th><strong>Indirect revenue generation potential</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• System management</td>
<td>• Active management of transport maximum capacity</td>
</tr>
<tr>
<td>• Utilize as emergency capacity</td>
<td>• Use DR as entry use-case e.g. to further enhanced energy services</td>
</tr>
<tr>
<td>• Potentially: Optimize own balancing group / avoid unscheduled balancing energy</td>
<td></td>
</tr>
<tr>
<td>• Through partners - commercialise as balancing power (Tertiary and Secondary Reserve Power), or EEX (Intraday), or future capacity / flexibility markets</td>
<td></td>
</tr>
<tr>
<td>• Through partners - optimize own generation portfolio through aggregated flexibility</td>
<td></td>
</tr>
</tbody>
</table>

| **Indirect cost saving potential**               | |
|-------------------------------------------------|• Substitute and/ or delay investments into electricity networks |
|                                                  |• Improve prediction quality through DR („looking behind the meter“) |
Demand Response part of the European regulatory agenda:

Energy Efficiency Directive in support of the Third Energy Package:
Art 15.8 Member States shall promote access to and participation of Demand Response in balancing, reserves and other system services markets, inter alia by requiring national regulatory authorities [...] in close cooperation with demand service providers and consumers, to define technical modalities for participation.

ACER Framework Guidelines: These terms and conditions, 12/25Ref: FG-2012-E-009 Framework Guidelines on Electricity Balancing including the underlying requirements, shall, in particular, be set in order to facilitate the participation of demand response, renewable and intermittent energy sources in the balancing markets.

ENTSO-E Network Codes: Creating the framework for realization
A positive historic opportunity to create regulatory unity and open markets structures which empower consumer participation and Demand Response.
From theory to reality – some key messages for DSOs and Regulators.

- Flexibility is key for building the future European energy system
- Intelligent aggregation / pooling of flexibility (consumption & distributed generation) provides a reliable source of capacity
- Demand-side flexibility of industrial & commercial prosumers is available and an attractive business already today
- EU Energy Efficiency Directive pushes member states to start using Demand Response in each country, foreseeing that even DSOs use it
- **To make use of the value of DR: DSOs and Regulators need to take a decision about DSOs role in a new market design; What do DSOs want to become: Infrastructure-of-last-resort or Market Facilitator?**
- DSO need to push for required stakeholder coordination (DSO, TSO, Retailer, Balance Responsible Party, etc.) in a new market design
- In parallel: DSO should start learning today with industrial & commercial prosumers through Demand Response pilots (beyond smart meter technology)

* Reference to European Commission’s Smart Grid task Force Expert Group 3
Thank you!

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