Regional Flexibility Markets

Using market based flexibility for integration of power from renewables in distribution grids

Results of the VDE/ETG “Regioflex“ Task Force

Paris, 14, January 2015
1. Development path of electrical energy supply
   • What are the aspects characterizing the change process?
   • What are the resulting challenges?

2. Flexibility markets as a key factor of future energy supply
   • What are the conditions?
   • Who are the actors involved?
   • Regional flexibility markets (”RegioFlex” markets) as an option?

3. Summary and outlook
   • What are the conclusions to be drawn?
   • Where is further action needed?
Development of renewable energies in Germany

<table>
<thead>
<tr>
<th>Typ of system</th>
<th>inst. power 31.12.2013 in GW</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV</td>
<td>35,9</td>
</tr>
<tr>
<td>Wind</td>
<td>34,7</td>
</tr>
<tr>
<td>Water</td>
<td>5,6</td>
</tr>
<tr>
<td>Biomass</td>
<td>8,1</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>84,3</strong></td>
</tr>
</tbody>
</table>

Quelle: BMWi – Bundesministerium für Wirtschaft und Energie (www.erneuerbare-energien.de)
Increase in renewable energy (RE) in the voltage levels

* The increase in power from renewable energy (RE) in 2010 was about 9.3 GW, mostly connected in the low voltage levels.
For the distribution network level, this means that

- 95% of the increase in decentralized power from renewable energy is connected to the distribution network (high, medium and low voltage level)

- "One way Roads" of the distribution network as designed until now are only suitable for bi-directional loading to a limited extent

- Due to decentralized production and of the resulting dynamic load the technical requirements concerning grid control and stability level will increase

- High investments in the distribution network are needed to adapt to the changing tasks and new challenges

- The distribution network is an elementary component of the entire changing process
Agenda

1. Development path of electrical energy supply
   - What are the aspects characterizing the change process?
   - What are the resulting challenges?

2. Flexibility markets as a key factor of future energy supply
   - What are the conditions?
   - Who are the actors involved?
   - Regional flexibility markets (”RegioFlex” markets) as an option?

3. Summary and outlook
   - What are the conclusions to be drawn?
   - Where is further action needed?
The traffic light system as a network indicator

- **Green light**
  - No bottlenecks in case of cross-border trading
  - No local bottlenecks or critical network conditions
  - Market and secure network operation comply

- **Yellow light**
  - No bottlenecks in the case of cross-border trading
  - Regional bottlenecks and/or regional voltage stability endangered
  - **Use of regional flexibility options by distribution system operators (market-based)**

- **Red light**
  - Bottlenecks at the cross-border interconnections and/or
  - Regional bottlenecks without sufficient flexibility options
  - Transition to central network control (EnWG §13 II und EnWG §14a)
The traffic light system in the grid aggregation area

- The network area of the distribution system operator (DSO) is characterized by different network topologies
  - Radial network and/or ring network (open/closed)
  - Degree of meshing (rural or urban network structure)

- Necessary for using “RegioFlex”
  - The DSO defines technical units (“grid aggregation areas”) for his network thus setting a clear allocation of the connection for the network user (“locality information”)
  - The number and size of grid aggregation areas depend on the technical requirements and the secure integration of decentralized power generation
  - The DSO continuously monitors the status of the respective network segment
  - The DSO gives continuous and prompt status notification in the necessary granularity

- Notification of the technical conditions per grid aggregation area by using the “traffic light system” is cessity of recording
Proposal for the design of the “RegioFlex“ concept (1/3)

- Use of market-based mechanisms to avoid critical regional network situations as an alternative to the network expansion
  - Physical conditions of the network operation are the basis
  - Regional markets for system services /flexibility designed along the lines of the design on the transmission grid level
- Concept study for a market based organizational approach
  - Testing plausibility by the application of the use case systematics
- Use case-description
  - Application of IEC 65559-2
- Analysis of requirements of DSOs and design of standardized flexibility products for the yellow traffic light phase
  - Prequalification procedure (including “locality information” -> securing grid supporting functions of the flexibility options)
  - Standardization and comparability of products in order to secure liquidity
The use case structure of the “RegioFlex” Concept
### Actors in the “RegioFlex“ -Concept

#### Prosumer
- Description of (available) flexibility options
- Covering the entire value chain
- All groups (household, tertiary sector, industry)

#### AGG/BRP*)
- Bundling of the flexibility options by the contract-prosumers
- In close cooperation with BRP or in a common function

#### DSO
- Germany: approx. 900 DSOs
- Main task: to secure the regional system stability
- Modernization and expansion of the network

#### DAM**) 
- DAM is a new function
- Supply of master data
- Improvement of the existing market structures

#### SMGW-A***)
- Metering operator: Responsible for the measuring point
- Reliable and secure data communication
- Interface: prosumer

#### RegioFlex – trading platform
- Trading platform
- Need for discussion: Number, Expansion, delimitation and operators
- In the long term: one market place

*) BRP: Balancing Responsible Party; **) DAM: Data Access Point Manager; ***) SMGW-A: Smart Meter Gateway Administrator
Proposal for the design of the “RegioFlex“ concept (2/3)

- Call for delivery of flexibility products and compensation by the DSO
  - Allocation of the full costs on the grid tariffs (“flexibility versus network expansion”)

- Use of “RegioFlex” in two directions
  - To transfer the status of the grid aggregation with market based flexibility
    - from a yellow traffic light back to the condition of a green traffic light or
    - to avoid the condition of a red traffic light

- “RegioFlex“ as a regional market place
  - Prosumers as well as aggregators are able to offer flexibility options from their portfolio
  - DSOs are able to publish and contract the need in flexibility

- Data sets at “RegioFlex“
  - Place, time, duration and scope as well as the type of the flexibility option
Proposal for the design of the “RegioFlex“ concept (3/3)

- “RegioFlex“ concept in detail
  - Electronical measuring data recording for each network aggregation area
  - To define: Organization, number, size and operators of the “RegioFlex“ – platform
  - Open time window between the individual items of information of the actors
  - Definition of the tradable products
  - Consideration of technical aspects
Use case diagram: Master data exchange

Message: #SD with #MS
and request assignment list

Request: #SD with #MS of #AS

Response: #SD with #MS

Response: assignment list: #SD with #AG

Assignment lists:
#SD with #AG

Assignment:
#MS and #NA

Response:
#SD, #AS
& #AG at #MS
Use case diagram: Flexibility contracting

- **Monitoring:** Checking offers #flexdata
- **Response:** Relevant offers #MD
- **Evaluation and selection of offers #flexdata**
- **Contracting:** #flexdata
- **Acceptance of bids:** Information about transaction (#flexdata)
- **Planning:** Implementation sale (#flexdata)
- **No acceptance of bids:** Information about open orders (Cancellation)
- **Information about possible release order:** #AS
- **Update forecast grid situation (#PD, RE, load, topology)**
- **Publishing of contracts**
- **Cancellation of open orders**

**Participants:**
- PROSU
- SMGW-A
- AGG/BRP
- DSO
- DAM
- REGIOFLEX
### The screen mask of the “RegioFlex“ concept

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Offer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>64285 001</td>
<td>DE000134 64285 M4AR7QH2I9A2SE3G4KW9</td>
<td>21.11.14 15:00:00</td>
<td>120:00</td>
<td>...</td>
<td>-45,0</td>
<td>25,0</td>
<td>10,00</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>23</td>
<td>51063 005</td>
<td>DE000723 51063 4AR77QH2I9B2SE3G4KW</td>
<td>15.08.14 12:00:00</td>
<td>60:00</td>
<td>...</td>
<td>12,0</td>
<td>15,00</td>
<td>5,00</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>35</td>
<td>85428 011</td>
<td>DE000534 85428 Q6AT7PH7I3A2TE3K4GF9</td>
<td>13.03.14 20:00:00</td>
<td>45:00</td>
<td>...</td>
<td>19,0</td>
<td>19,80</td>
<td>15,70</td>
</tr>
<tr>
<td>Demand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>75689 025</td>
<td>DE000335 75689 6GAT7PH7I3A2Z3K400G</td>
<td>28.09.14 15:00:00</td>
<td>60:00</td>
<td>...</td>
<td>-35,0</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
Agenda

1. Development path of electrical energy supply
   - What are the aspects characterizing the change process?
   - What are the resulting challenges?

2. Flexibility markets as a key factor of future energy supply
   - What are the conditions?
   - Who are the actors involved?
   - Regional flexibility markets ("RegioFlex" markets) as an option?

3. Summary and outlook
   - What are the conclusions to be drawn?
   - Where is further action needed?
Summary and outlook

- Increasing decentralized generation requires new possibilities for actions for the distribution system operator
  - Distribution system operators can use flexibilities from the prosumer via “RegioFlex” for the operation of the grid

- Using flexibilities requires an adequate ICT-infrastructure
  - For using flexibilities the knowledge of the network condition is essential

- “RegioFlex” is a valuable complement to the present energy market design
  - “RegioFlex” enables a technologically neutral competition of possible flexibilities

- Flexibilities for the network operation are linked to the local network area
  - Critical network situations in the distribution network are regional (emergence and mitigation)

- Using flexibilities by the distribution system operator requires the adaptation of regulation and market rules as well as a corresponding standardization
  - At the moment the use of flexibilities is not intended by law/ regulatory framework
Thank you for your attention

VDE – Netzwerk Zukunft
Use Case: Using flexibility (1/3)

- Monitoring
- Detecting critical grid situation
- Evaluation, calculation, selection: #AS
  - Message: Activate #Flexdata
  - Evaluation, calculation, selection: #AS
  - Message: #NA #TL (yellow)
  - Publishing
- Monitor fullfillement and individual flexibility capacities #Flexdata
- Deactivate/Activate #AS
- Loop
- Break
Use Case: Using flexibility (2/3)

- Detecting new critical grid situation
- UC Ultima Ratio
- UC Ultima Ratio
- Detecting normal grid situation
- Message: #NA #TL (green)
- Publishing

Activate #AS

Message: End #Flexdata

break
Use Case: Using flexibility (3/3)
Use Case: Day ahead planning

Forecast of the grid situation (#PD, RE, load, topology) for day-ahead

Calculation of critical grid situation per #NA

Flexibility request: #flexrequest

Processing: #MD
Use Case: Flexibility offering

- **PROSU**
- **SMGW-A**
- **AGG/BRP**
- **DSO**
- **DAM**
- **REGIOFLEX**

**Monitoring**

**Response: Current data of REGIOFLEX #MD**

**Calculation:**
- #flexdata, #PI

**Offer:**
- #AS, #flexData, #PI

**Processing**
- #MD