The role of Virtual Power Plants in an increasingly decentralized energy sector
ENERGIEWENDE MEANS DECENTRALIZATION

Decentralization means the world needs Virtual Power Plants

SMALL PARTS FORM THE NEXT BIG THING

2000: 1,000 renewable energy power plants

2016: >1.5 million renewable energy power plants

Almost 50% are owned by (groups of) individuals!

A VPP provides energy security most efficiently:

✓ It digitally aggregates the capacity of distributed units,
✓ controls them smartly
✓ and ensures that supply and demand are met at all times.

RENEWABLE ENERGY IN GERMANY 2014

WIND POWER
25,600 wind turbines
32 GW installed capacity
25.4% in 2004, 32.6% in 2014
139,800 jobs

SOLAR POWER
1.5 m solar systems
38 GW installed capacity
15% in 2004, 32.6% in 2014
50,000 jobs

BIOMASS POWER
15,000 power plants
9 GW installed capacity
13% in 2004, 12.4% in 2014
124,000 jobs

Renewable energy sources are important to the Germans
92%

76% in Brandenburg
64% in Saxony, 62% in Saxony-Anhalt
52% in Hesse

9% in Hamburg, 8% in Bavaria, 7% in Lower Saxony

65% in Berlin

Germans, who would like to produce their own green electricity

STATE RANKING
Fulfillment of electricity demand by renewable energy

<table>
<thead>
<tr>
<th>State</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brandenburg</td>
<td>44%</td>
</tr>
<tr>
<td>Saxony-Anhalt</td>
<td>17%</td>
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<tr>
<td>Saxony</td>
<td>17%</td>
</tr>
<tr>
<td>Bavaria</td>
<td>16%</td>
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<tr>
<td>Hesse</td>
<td>11%</td>
</tr>
<tr>
<td>Lower Saxony</td>
<td>9%</td>
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<tr>
<td>Münster</td>
<td>9%</td>
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<tr>
<td>Hamburg</td>
<td>8%</td>
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<tr>
<td>Berlin</td>
<td>7%</td>
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<tr>
<td>Hessen</td>
<td>6%</td>
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<tr>
<td>Saarland</td>
<td>6%</td>
</tr>
<tr>
<td>Thuringia</td>
<td>5%</td>
</tr>
<tr>
<td>Baden-Württemberg</td>
<td>3%</td>
</tr>
<tr>
<td>North-Rhine-Westphalia</td>
<td>2%</td>
</tr>
</tbody>
</table>

Source: BNetzA, AEE, BDEW, DKG, BIBM, Fraunhofer ISE

Date: April 2015
Being digital: Thinking in bits and watts

We are a digital aggregator of decentralized power producers & consumers through M2M communication

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

LINKED VIA THE REMOTE CONTROL UNIT NEXT BOX

CONTROLLED BY THE CENTRAL CONTROL SYSTEM
BEING FLEXIBLE: PREPARED FOR WHAT COMES NEXT

How to utilize the flexibility of renewables

**Control Reserve**
Stabilizing the grid and keeping the grid frequency at 50 Hertz.

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

**Power Trading**
(Short term) trading of power to use the units flexibility profitably.
### 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 100 employees with a broad academic background

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**DIGITAL, FLEXIBLE, SUSTAINABLE**