Integration of Smart Energy Solutions into Smart Grids - Key Success Factors for a Sustainable City Development

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Head of BU Distribution

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Some innovations have taken a little bit longer…

- 1887: 1st wind power
- 1883: AEG founded, Berlin
- 1884: BEWAG founded, 1st public energy supplier in GER
- 1881: 1st e-car
- 1838: 1st fuel cell
- 1847: Siemens founded, Berlin
- 1953: introduction of colour television
- 1954: 1st World Cup for GER
- 1969: 1st man on the moon
- 1973: Oil crisis
- 1998: Google
- 2004: Schumachers 7th victory
- 2001/07/11: Janika/Per Dagmar …
- 2004: Facebook invented
- 2006: Cloud computing
- 2007: 1st IPhone
- 2008: 100.000 Downloads Apps
- 2011: Fukushima in Germany: ‘Energiewende’
- 2001: 10.000.000.000 Downloads Apps
- 2012: Curiosity arrived
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- 1991: world wide web
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Efficiency increase in our daily life …

Cars

- Driven km with 1 liter fuel
  - 1960: 12.5
  - 1980: 9.8
  - 2010: 13.3

Street Lighting

- lm / W
  - 1960: 40
  - 2010: 120

Home

- Heated area in m² per 1.000 kWh p.a.
  - 1960: 3.3
  - 2010: 66.6

Computer Technology

- Computations per kWh
  - 1960: 100.000
  - 2010: 10 quadrillion
... but the future is electric!
Change of the energy landscape in Germany – Going Green

Total power generation installed capacities in Germany in GW

Power generation in Germany in TWh

Quelle: DENA, BDEW (based on BMU-Leitszenario 2009)
The new energy landscape – Opportunities and challenges

From …

large power station
hydroelectric power station
110 kV
household
industry

Generation follows load

… To

wind
water
biomass
fuel cell

Industry
KW

110 kV
20 kV
0.4 kV

load follows generation

household
industry

solar
CHP
Integration of fluctuating energy vs security of supply

Grid load, wind energy prognosis vs. wind energy production in Eastern-Germany – Development shown in the transmission grid of 50Hertz (01.-31.10.2010):

Source: 50Hertz Transmission
‘Energiewende‘ – Different challenges and responsibilities

Rural grid operators
(e.g. Brandenburg)

- Metropolitan grid operators
  (e.g. Berlin)

Intelligent integration and transport

Intelligent management and usage

Source: LSGV, 2011
Sustainable City Development – Berlin at a glance

1. Smart Grids
2. Visualisation & Transparency
3. Smart Storage
4. Smart Solution: Virtual Power Plant
5. E-Mobility projects
Smart Grid – automatisation enables integration of renewables based on increased reliability

- **Security of electricity supply** is of increasing importance
- **Grid maintenance + grid intelligence** is the key of further development
- Increasing production from **volatile renewables**

- **Automatisation** of grid stations (transformer stations) is one major driver

- **Increased reliability** based on cable replacements is crucial

**Stromnetz Berlin invests 1.400 Mil. € in the forthcoming years to optimise both: reliability and integration of renewables**
Transparency – a first step towards behavioral changes and increasing Energy Efficiency

Renewable energy in the Berlin grid
Choose your energy source

Vattenfall runs the largest smart meter project in Germany (Berlin, Märkisches Viertel)
## Energy storage – Balance of volatile generation

<table>
<thead>
<tr>
<th>Method</th>
<th>Degree of maturity</th>
<th>Degree of efficiency</th>
<th>Capacity GER</th>
<th>Outlook</th>
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<tbody>
<tr>
<td>Pump storage</td>
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<td>Compressed air storage</td>
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Vattenfall operates a 2 MW battery in Berlin
Vattenfall’s Virtual Power Plant – Connecting wind, power & heat

How does the Virtual Power Plant work?

Central control room

Buildings with heat pumps

Buildings with CHP plants

Renewable energy

Public power grid

Current flow with excess wind in the grid

Current flow with a shortage of wind in the grid

Wireless connection with heat pumps & CHP plants

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Vattenfall Berlin – We make Electric-Mobility happen!

Private & Corporate
- Vattenfall & Volvo JV
- Charging Infrastructure
- Managed Charging (Wind-to-vehicle, vehicle-to-grid)
- Vattenfall MINI-E-Study

Public
- Showcase Berlin
- Fast Charging
- Pilot Inductive Charging for Public transport
- Charge Point & Tender Berlin
Home offer in NL, GER & SWE (e.g. for Volvo cooperation)

Incentive for Limited Edition Volvo V60 PHEV (first 1000 only)
Vattenfall home charging pack 1
1. Green electricity contract for 3 years.
   (Wind power Lillegrund in Sweden, wind in the Netherlands and Germany. In Germany only one year contracts)
2. Wall box and installation.
   Electric system check and upgrade included in the price.
3. Solar panel is optional
Discount, 15,000 km free electric driving applicable both for B2B* and B2C.

*Incentive package and discount is applicable for B2B customers who have chosen or are directly connected to the vehicle. Incentive package and discount is not applicable for companies.
Public Charging Networks implemented in three urban markets

- **Charge networks implemented**
  - Commercial Operations in NL
  - Large test networks in Berlin & Hamburg

> 250 charging points Amsterdam  > 80 Charging Points Berlin  > 60 Charging Points in Hamburg

**Service Offering:**
- Personal RFID access card
- Access to Nuon/Vattenfall charging infrastructure
- Access to third party public infrastructure
Show room E-Mobility

- Coordination by Berlin Agency for Electromobility (e-mo)
- 32 main projects with 150 partners
- Project volume: rd. 100 mio. €
- 4000 vehicles
- 100 charging stations today – 800 charging stations until 2015

- IPIN - Integrationsplattform Intelligente Netze (D1)
- SMART – Capital Region – Netzkonzept für die Hauptstadtregion, Lastverhalten eines CO₂-minimierten Fuhrparks (D2)
- Micro Smart Grid EUREF (D3)
Distributing electricity for everyday life – Today and tomorrow

### Milestones of the upcoming 20 years

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