

Virtual power plants: Providing flexibility with renewable energy

AIT Industry Day 2015: Flexibility in electricity grid and market

Market integration renewable energies

Virtual power plants: Successfully implementing the energy transition

Who can balance short term fluctuations in the future?

Challenge balancing energy

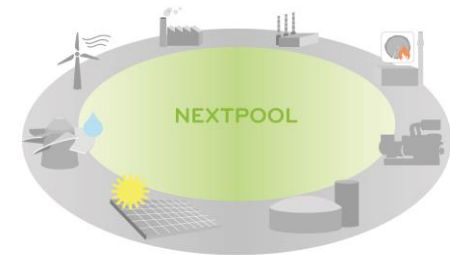
- Wind and PV are causing unpredictable fluctuations. Despite better projections, fluctuations are increasing
- So far: Focus on a few providers for balancing energy



Virtual power plants can balance fluctuations with renewable energies themselves!

Solution virtual power plants

- Connecting controllable renewable energy units and consumers to one virtual power plant: Even small, decentralized units can participate in the relevant markets
- Next Kraftwerke has connected more than 2500 renewable energy units in the Next Pool
- Biogas and small hydropower plants are particularly suited for providing balancing energy and demand-driven production



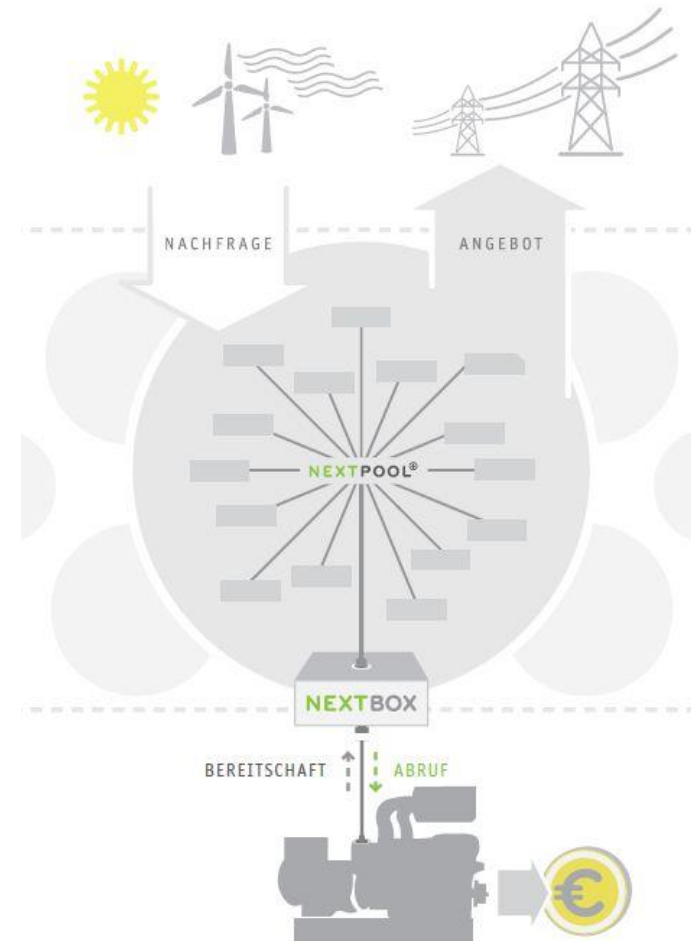
Virtual power plant “Next Pool”

Big pools utilize scaling advantages – Very complex optimization

Pool concept

- **Integration** of different plant types in one central control system is possible
- **Connecting** decentralized units with a remote control system (“Next Box”)
- **Next Box as interface** between unit and control system
- **Monitoring** of each individual unit is possible
- **Projections** of renewable energy feed-in for optimal balance group management
- **Marketing** of renewable energies on the energy market (Direct marketing)
- **Optimizing** operation profiles of e.g. hydropower plants (Flexibility)
- **Providing balancing energy** from connected units (Tertiary and secondary reserve)
- **Scaling effects:** One control system can manage a large number of units
- **Development:** The system becomes more flexible with every connected unit
- **Redundant:** Many small units are better than one big regarding the n-1 criteria

Next Pool



Overview – Ways of marketing

Trend to short term products: Renewable energy plants are balancing the grid!

Direct marketing and operation optimization

- Base product: Marketing via energy traders
- Additional: Providing flexibility through demand-driven feed-in. Generating extra earnings through optimizing operational profiles and energy marketing
- Services: Market access and risk transfer (Feed-in projections)
- Realization via trade platforms such as EPEX Spot in Paris and EXAA in Vienna, both with own day-ahead and intraday-desk (up to 24/7) of the trader

Electricity marketing

Tertiary reserve in pool concepts

- Connecting power generating units with consuming units to a virtual power plant
- Marketing of pools to grid operators in daily tenders, competing with existing providers and conventional power plants
- Commitment to delivering high quality: Unit failure must be compensated within the pool

Providing balancing energy

Secondary reserve in pool concepts

- Operating the virtual power plant requires significantly more elaborate technology (IT security, technical characteristics of generating units)
- Marketing of pools to grid operators in weekly tenders, competing with existing providers and conventional power plants
- Requirements to delivered quality much higher than for tertiary reserve

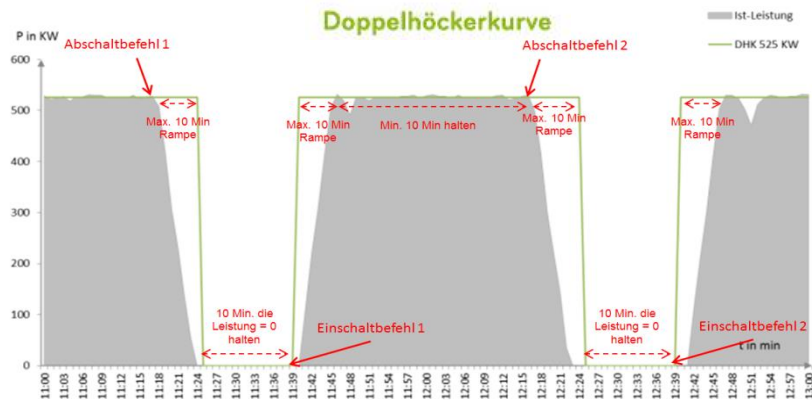
Accepting responsibility for the system: Example balancing energy

Technical link-up and pool integration make marketing possible

Participating in a virtual power plant

Step 1: Connection / Pool integration

- Installation of the Next Box to the unit by technical provider
- Connecting to Next Pool
- Prequalifying for technical suitability by grid operator



Step 2: Marketing balancing energy

- Offering the flexible power of the Next Pool in the daily/weekly tenders by the grid operator
 - Acceptance of bid at a certain power price and energy price
 - Technical realisation of the automated balancing signal on call by the grid operator
- 24/7 pool delivery through automated control system

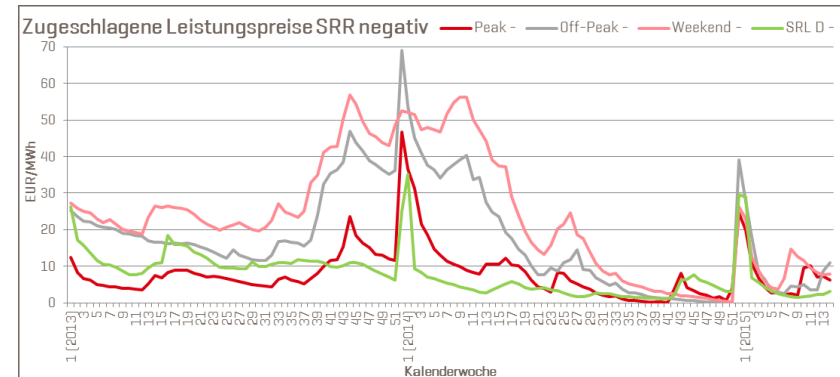
Balancing energy adds value

Revenues

- The grid providers pays for the provision of balancing energy according the results of the tender (power price)
- The grid provider pays an additional fee for the call-off order (energy price)

Transfer to clients

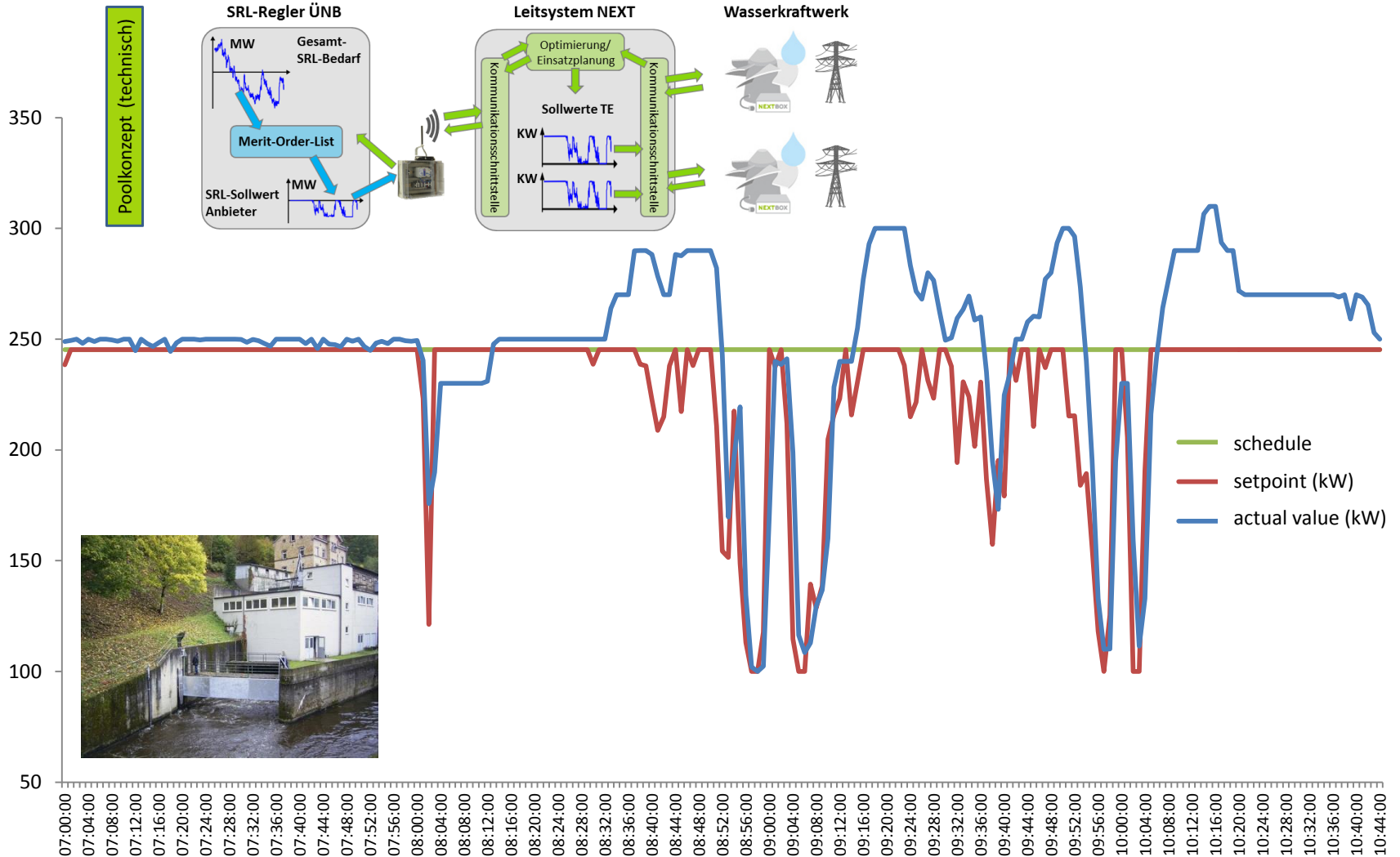
- Next Kraftwerke shares power price revenues with its clients (i.e. unit operators)
- Clients also profits from energy price revenues



Source: Austrian Power Grid AG

Pooling decentralized units for balancing energy

Example: Secondary reserve profile of a small hydropower plant in the Next Pool



Electricity market driven load profile of renewable energy plants

Plant operation at high prices

Flexibilisation of renewable energy plants

Unit flexibility

- Renewable energy plants, like hydropower plants, are often controllable flexibly, taking into account numerous restrictions

Market access

- Fluctuation prices must be visible for unit operators: Marketer reveals price signals or controls actively
- Relevant markets: day-ahead and intraday

Operational optimization

- Value results from optional nature: Schedule depends on market signals and can be adjusted short term
- Option value increases with volatility in energy markets and with better quality in balancing energy products

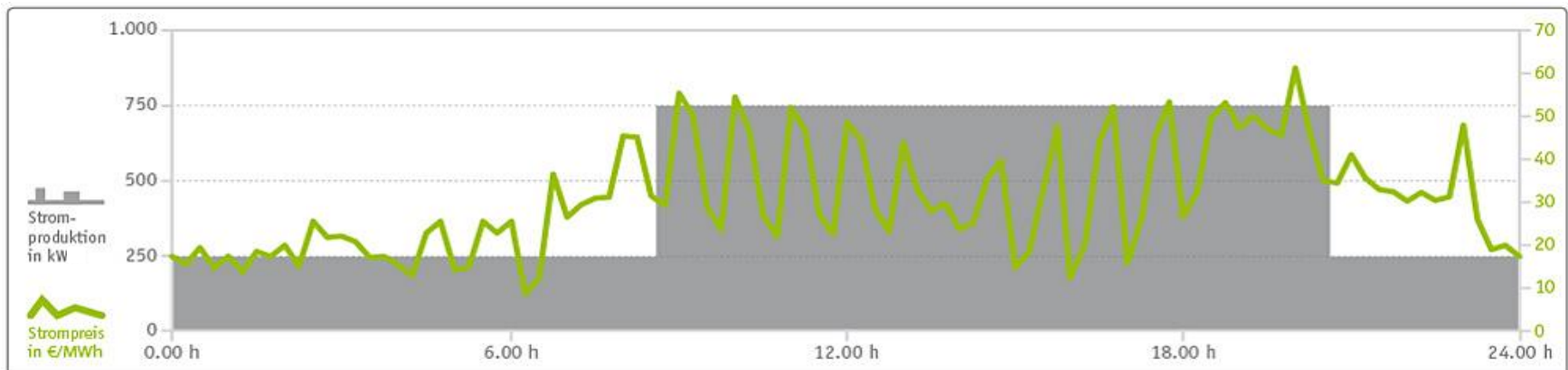
Relevance to daily operations

Ways of marketing

- Secondary reserve: Reliable operating points for schedule at frequent, mostly short term, adjustments
- Tertiary reserve: Reliable 4-h-profile at infrequent adjustments for at least 15 minutes
- Day-ahead/Intraday optimisation: Frequent adjustments possible; setting the load profile until 75 min before delivery

Operational planning

- Power plant dispatch opts for the most valuable option, different markets are competing in this!
- Next Box supports $\frac{1}{4}$ h-interval remote control, depending on unit flexibility



Market integration of renewable energies

Status quo of balancing short term fluctuations

Virtual power plants can balance fluctuations with renewable energy plants themselves!

What are virtual power plants providing already today?

- Market access for smaller, decentralized generating and consuming units
- Energy Marketing: access to energy markets; responsible for renewable energy projections
- From a technological perspective, balancing energy can be provided today already through decentralized renewable energies, e.g. small hydropower plants, and increases grid stability; wind could provide the same in theory as well
- Demand-driven operational planning according to price signals is possible; utilizing the optional nature of renewable plants

Why are virtual power plants important to the energy market?

- Without the integration of renewables, the energy market as we know it will not exist in a few years from now
- Increasing competition for providing balancing energy is reducing total economic cost
- Biogas- and small hydropower plants are particularly suited for providing ancillary services
- Balancing energy is the first step towards the market integration of renewable energy plants and a system- or demand-orientated operation
- Virtual power plants are a contribution of market mechanisms against increasing regulations in energy markets

Contact details

Get in touch...

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