# BKW's Experience with Demand Side Integration

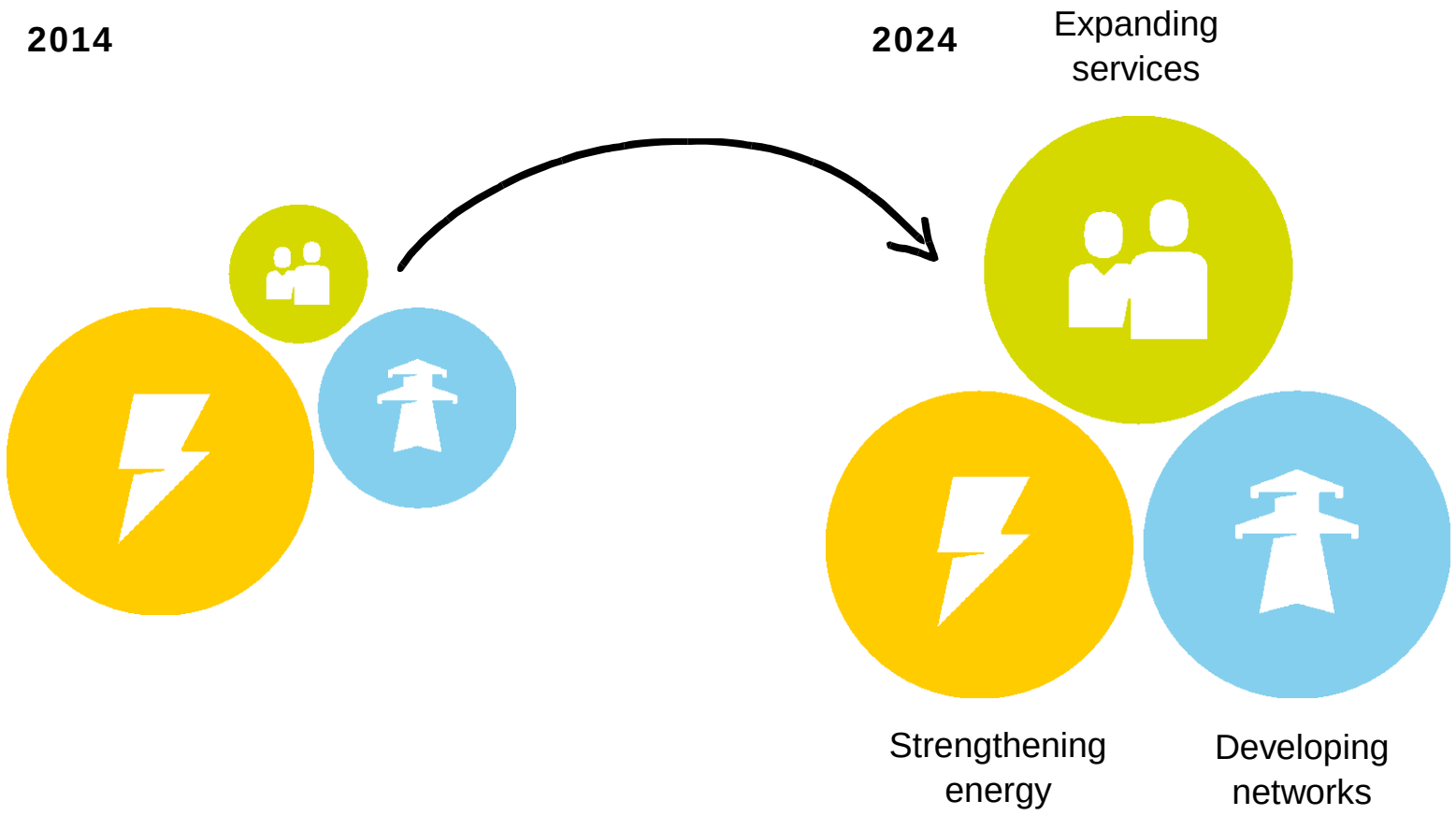
Christophe Bossel, Head of Networks, BKW, Switzerland



BKW

# Our strategy at a glance

We are evolving from a traditional electricity producer to Switzerland’s leading provider of complete energy solutions



# Strengthening energy

**Expanding** production of renewables, but only in areas where we can achieve cost-covering remuneration

**Maintaining the value** of existing production facilities to ensure they remain state of the art

**Trading strategy** geared towards production and price situation

Seeing **end customer sales** as an opportunity

# Generating energy sustainably and profitably

# We are developing our network

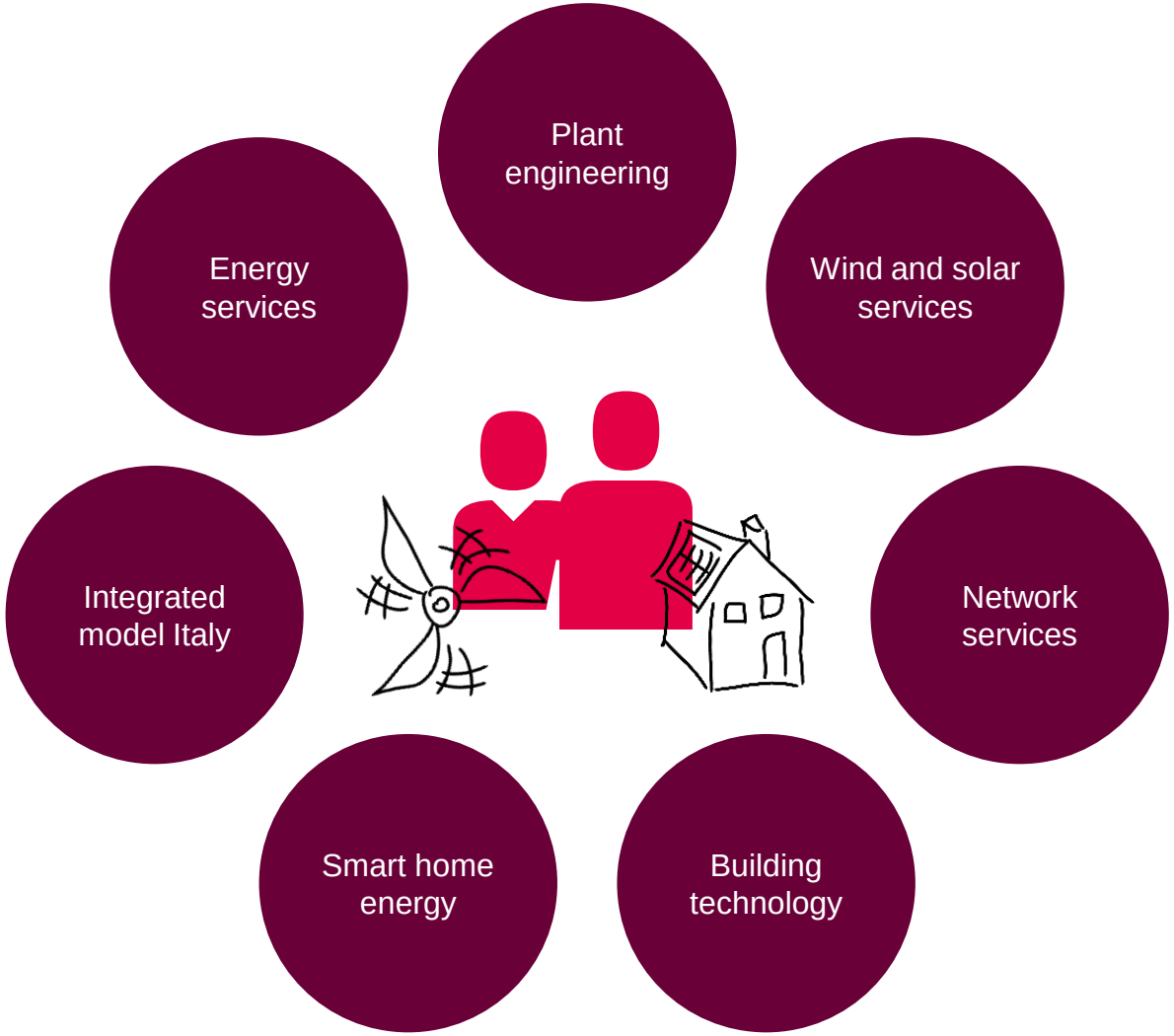
**We are investing in the expansion and maintenance of the distribution grid**

- Reliable, powerful, efficient
- Security of supply is key
- CHF 100 million per year

**We are investing in research and development**

- BKW Technology Centre in Nidau
- Innocampus Biel and partnerships with the Bern University of Applied Sciences and the Swiss Centre for Electronics and Microtechnology (CSEM)
- Swiss National Science Foundation projects with Swisstransformer
- Startup funding
- Swiss Energypark in collaboration with cantons of Bern and Jura

# We rely on integrated services




Developing comprehensive energy and infrastructure services.

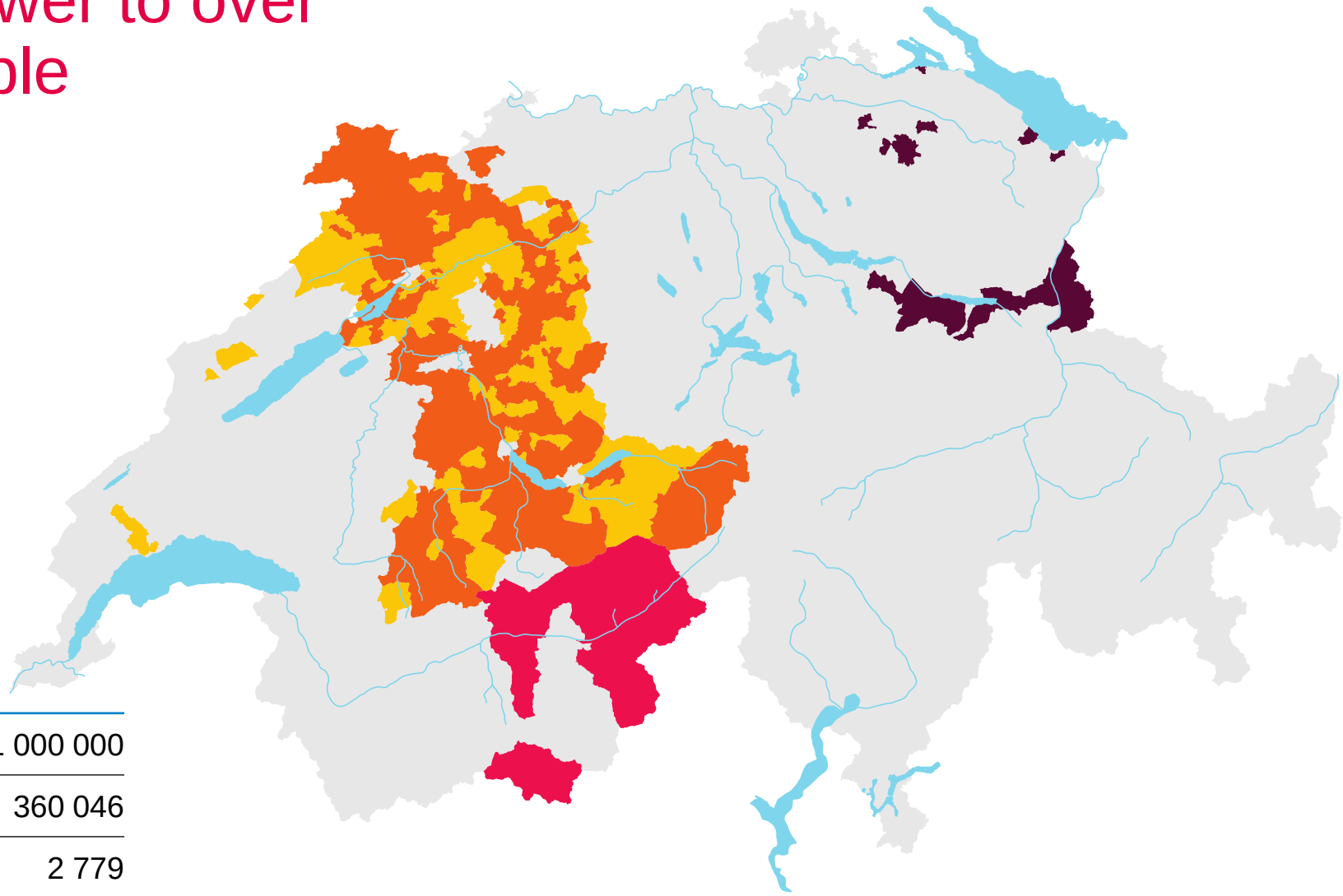
# Expanding services

We are expanding our services business through organic and inorganic growth.

Our group companies ISP (building technology) and Arnold (network services) together with their subsidiaries and the companies Solar-Log (solar services), ahochn (building technology) and Casa delle Nuove Energie (integrated model Italy) play a leading role in this.

# Supplying power to over a million people

- Abonax
- Deviwa
- Direct supply region
- Youtility



| | |
|---|---|
| Residents supplied | > 1 000 000 |
| Private customers | 360 046 |
| Business customers | 2 779 |
| Distribution partners | 144 |

# BKW’s international activities

**Production**

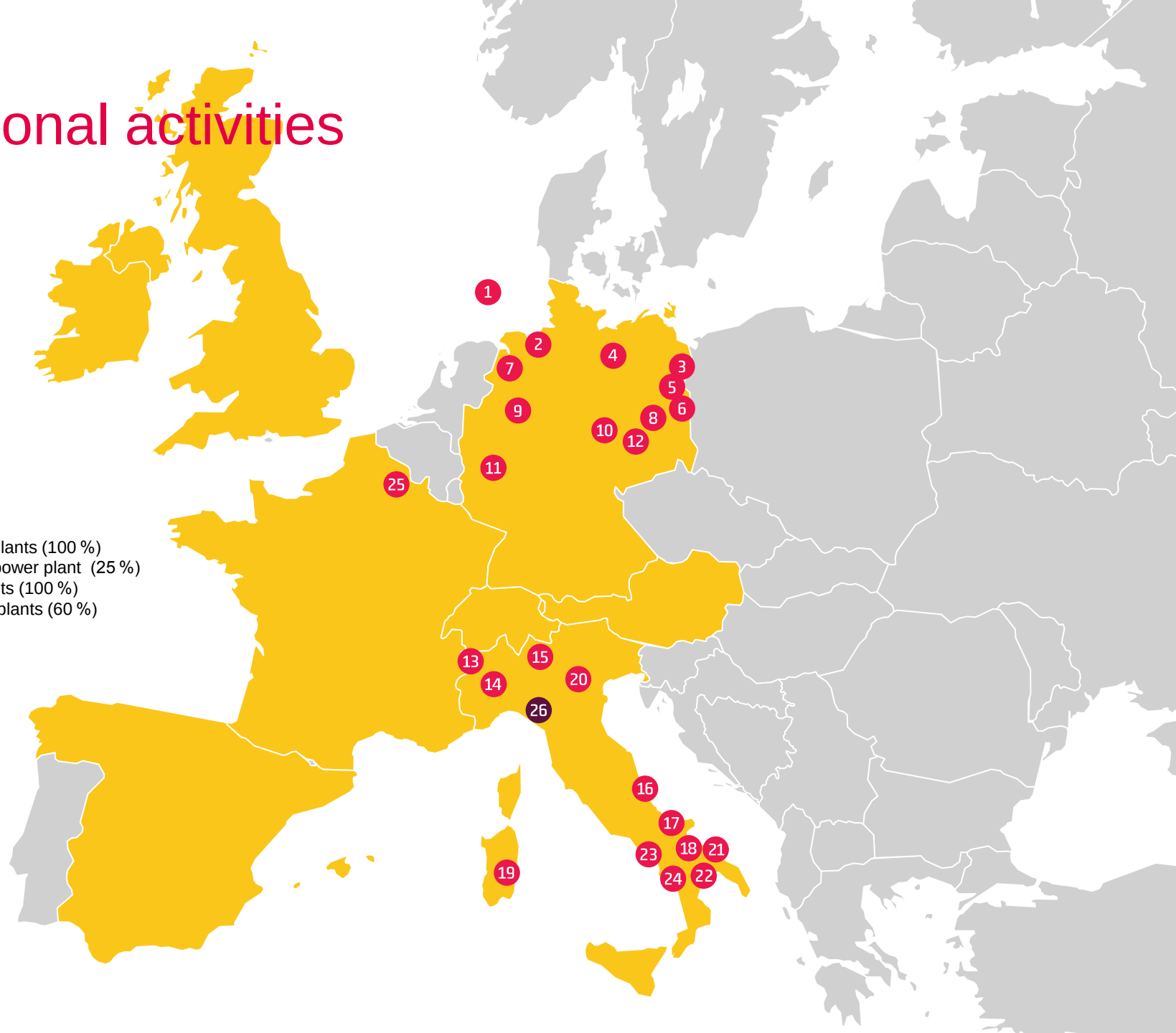
1 Borkum West II wind farm (4.5 %) (im Bau)
2 Wilhelmshaven coal-fired power plant (33 %) (under construction)
3 Lüdersdorf-Parstein wind farm (29 %)
4 Gross Welle wind farm (29 %)
5 Prötzel wind farm (29 %)
6 Wülkow wind farm (29 %)
7 Bippen wind farm (100 %)
8 Dubener Platte wind farm (100 %)
9 Sendenhorst wnd farm (29 %)
10 Holleben wind farm (100 %)
11 Landkern wind farm (100 %)
12 Bockelwitz wind farm (100 %)
13 BKW Hydro Valle d’Aosta hydroelectric power plants (100 %)
14 Livorno Ferraris gas-fired and combined-cycle power plant (25 %)
15 Idroelettrica Lombarda hydroelectric power plants (100 %)
16 Tamarete gas-fired and combined-cycle power plants (60 %)
17 Volturino wind farm (100 %)
18 San Chirico wind farm (100 %)
Monticelli wind farm (100 %)
Spina wind farm (100 %)
Franciosa wind farm (100 %)
19 BioPower Sardegna (10.5 %)
20 CHI.NA.CO hydroelectric powe plant (100 %)
21 Buglia wind farm (100 %)
22 Green Castellaneta wind farm (100 %)
23 Eolo wind farm (29 %)
24 Ripacandida wind farm (100 %)
25 Fresnoy Brancourt wind farm (100%)

**Sales**

26 Electra Italia S.p.A. (100 %)

**Trading**

Electricity wholesale



# Definitions

**Demand-side integration (DSI)**

Influencing electricity procurement, for example by adapting current consumption to the available generation or network capacity.
Hypernym for DSM and DSR.

**Demand-side management (DSM)**

The grid operator or other players directly influencing a consumer's power usage, without asking for permission in the singular case.

**Demand-side response (DSR)**

The grid operator or other stakeholders influencing consumer behavior mostly by monetary incentives (e.g. time-related tariff).

*Definition: Formulated by the authors, based on VDE 2012 "[…] Demand Side Integration".*

# Hint

**Questions on Smart Grid Terminology?**

BKW provides the most comprehensive **smart grid glossary** on the web:

- Available in English, French, German
- Based on widely accepted sources, where available (laws, norms, …)
- Explicit naming of the sources and further terminological commentary

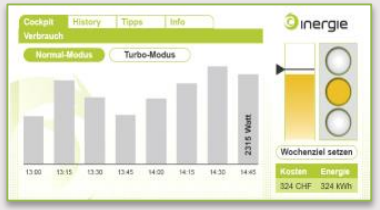
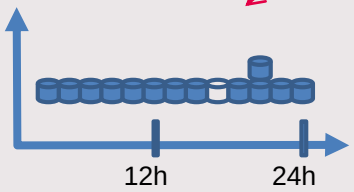
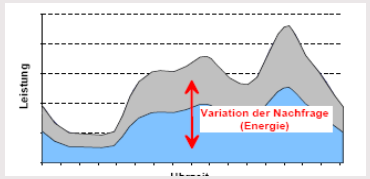
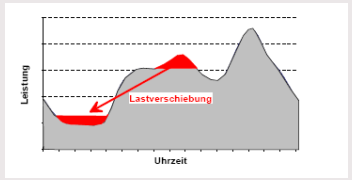
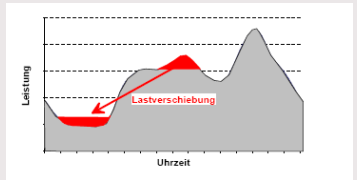
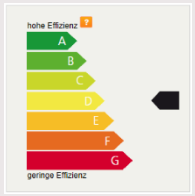
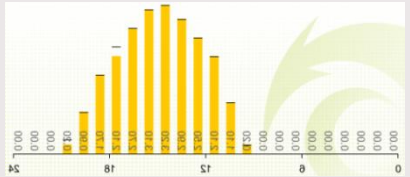
Take a look at the following PDF (page 8):
http://www.bkw.ch/smart-grid-taxonomy

# BKW's field test "iSMART Ittigen" (1/2)

- Ittigen: Suburban town next to Bern
- Field test: From 2009 to 2013
- Focus on private households
- Development of 5 pilot products
- 265 customers with smart meter

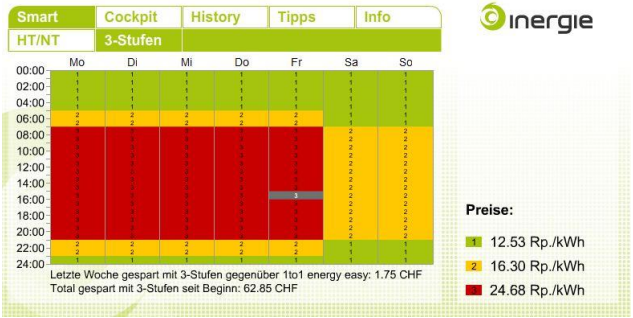
Demand Side Response

Demand Side Management

| VISU | SMART | FLEX | Appliance Efficiency | PowerVISU |
|---|---|---|---|---|
|  |   |   |   |  |
|   |   |   |   |  |
| Consumption Reduction | Load and/or Peakshifting | Provision of Operating reserve | Energy Efficiency | PV Monitoring |

# BKW's field test "iSMART Ittigen" (2/2)

- The SMART pilot product focussed on Demand Side Response DSR
  - Different pilot tariffs were simulated (2-, 3- and 6-tier-pricing)




- Positive results
  - Pilot users identified loads that could be shifted, e.g. dishwasher
  - Up to 5% load was shifted to low tariff times

- Negative results
  - Most loads cannot be shifted (e.g. washing machine or stove usage)
  - Rebound effect: pilot customers consumed more energy, e.g. for streaming or downloading files during low tariffs
  - Customers want automatically-run loads during low tariffs, e.g. electrical boiler

**Develop products with low user interaction (DSM) and clear financial benefit.**

# Four DSM services

BKW power flex

Ampard

BKW SmartRSA

BKW my sun

Tages-Anzeiger



# Schweiz produziert zurzeit keinen Atomstrom

In der Nacht auf den Montag wurde das Kernkraftwerk Gösgen vom Netz genommen. Damit sind vorübergehend alle Schweizer AKW ausser Betrieb.

Reparatur einer Dampfleckage: Das AKW Gösgen produziert zurzeit keinen Strom. (Bild vom 29. Juni 2011)

17.08.2015

Das AKW in Gösgen ist wegen einer Ursachenabklärung und der Reparatur einer Dampfleckage im nicht nuklearen Turbinenkreislauf vom Netz genommen worden. Dies teileten

**Stichworte**

Umwelt

Atomenergie

**Artikel zum Thema**

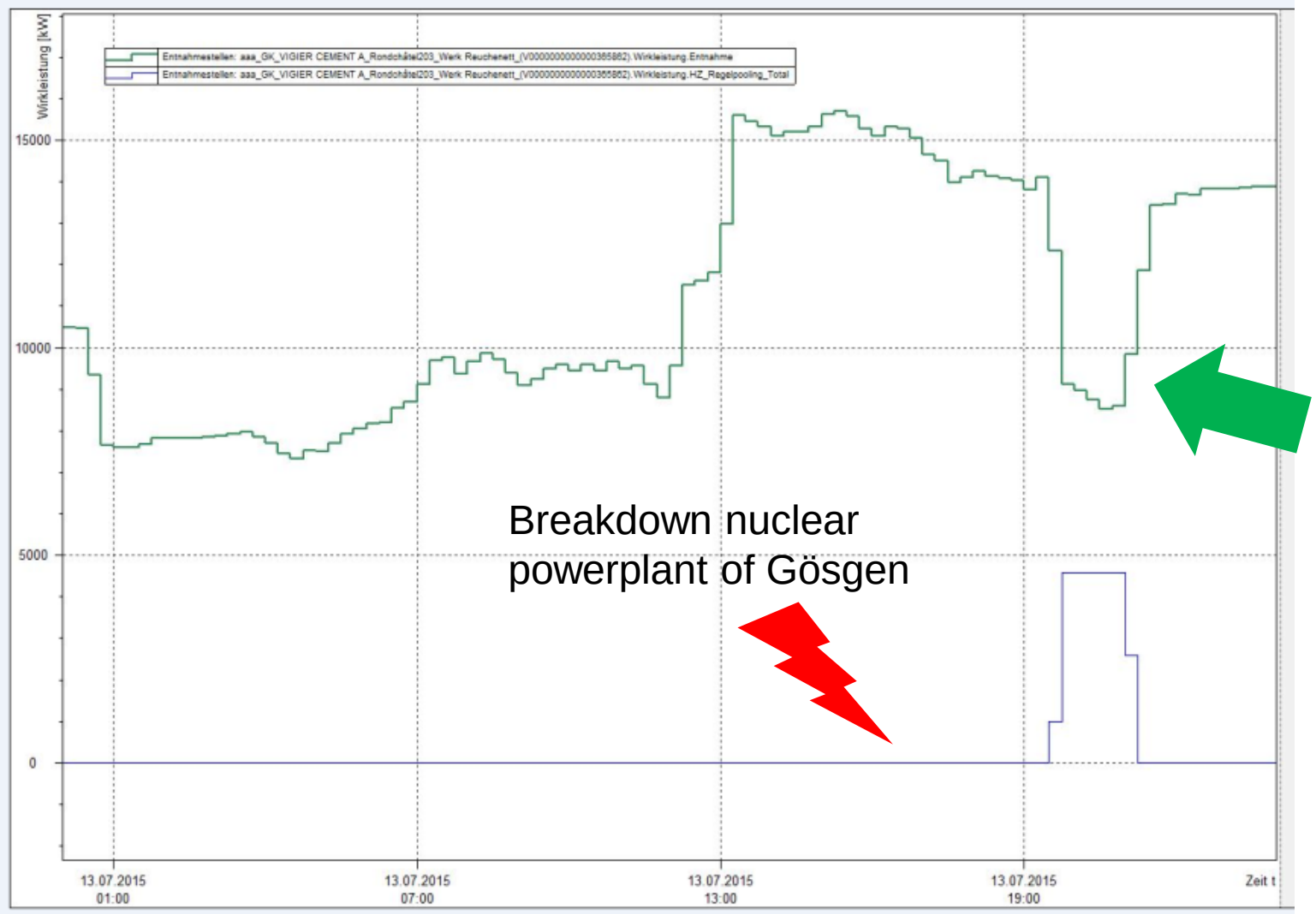
## Gösgen und Beznau müssen nachbessern

Die Sicherheitsmargen sollen weiter erhöht werden: Das ENSI verlangt, die AKW gegen schwere Erdbeben und Überflutungen zu sichern. Mehr...

25.06.2015

http://www.tagesanzeiger.ch/schweiz/standard/schweiz-produziert-zurzeit-keinen-atomstrom/story/30249819

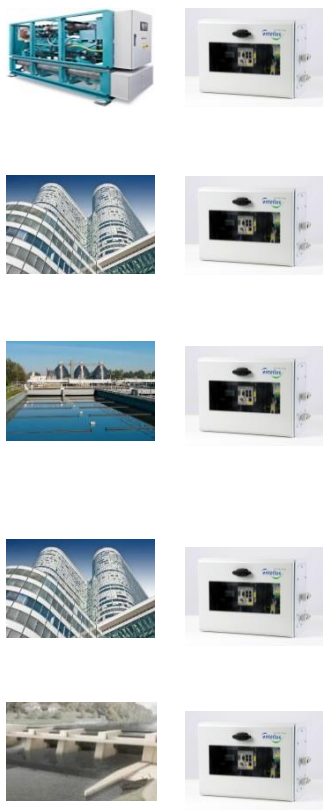
# BKW and Cement mills of Vigier Ciment SA help Swissgrid to keep the grid stable

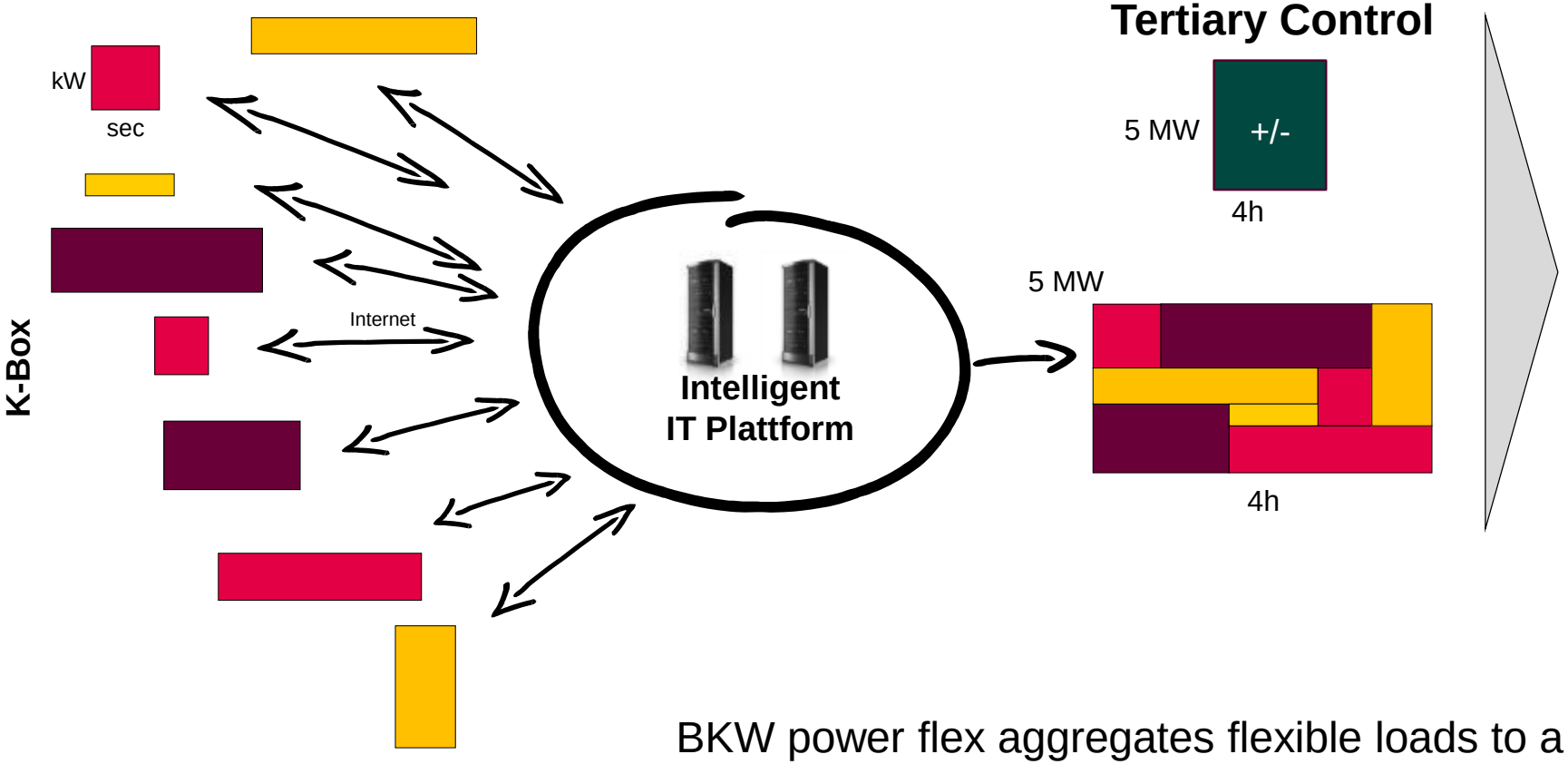



Vigier Ciment stops its mills to reduce the energy demand in the grid for the requested period of 90 minutes

# BKW power flex – How it works

**Decentral Flexibility (Industry Loads)** → **Aggregator/ Virtual Power Plant** → **Commercialisation**

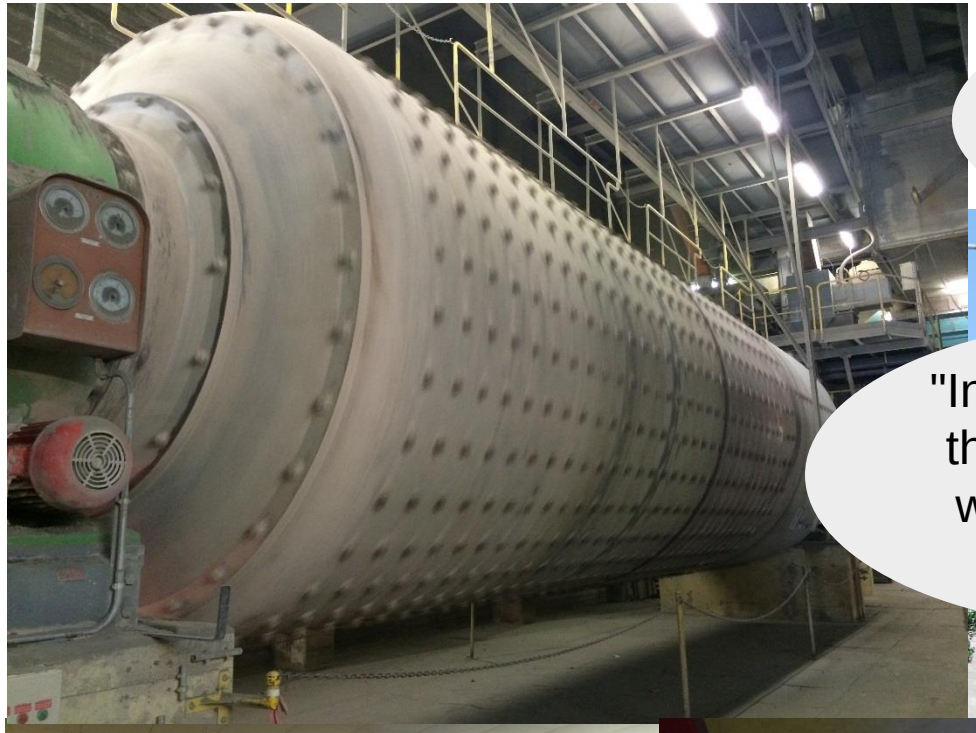





BKW power flex aggregates flexible loads to a virtual power plant.
This control reserve pool is sold to the TSO/ swissgrid.

www.bkw.ch/powerflex

A cooperation between BKW and ENERNOC



"We have the possibility to stop our mills on demand."


"In collaboration with the energy supplier we help stabilizing the grid."



"We will consider this possibility in the calculations of our future plants."

BKW power flex

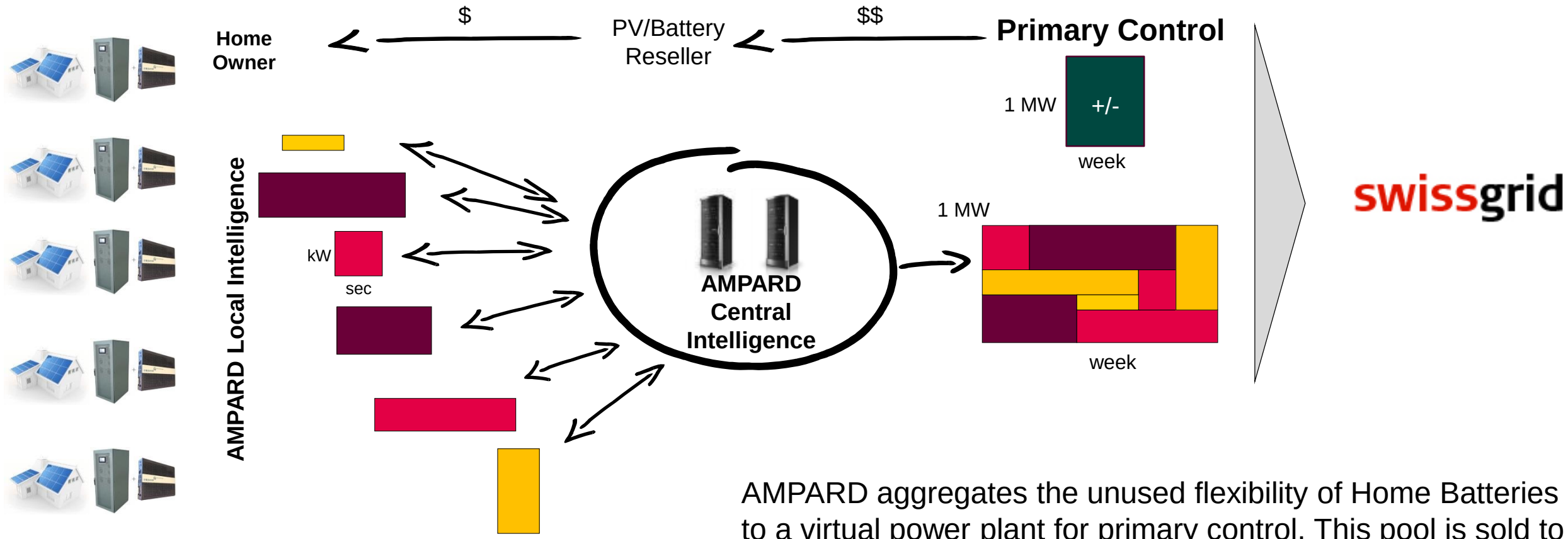
Ampard

BKW SmartRSA

BKW my sun

# AMPARD – How it works

**Decentral Flexibility (Batteries)** → **Aggregator/ Virtual Power Plant** → **Commercialisation**

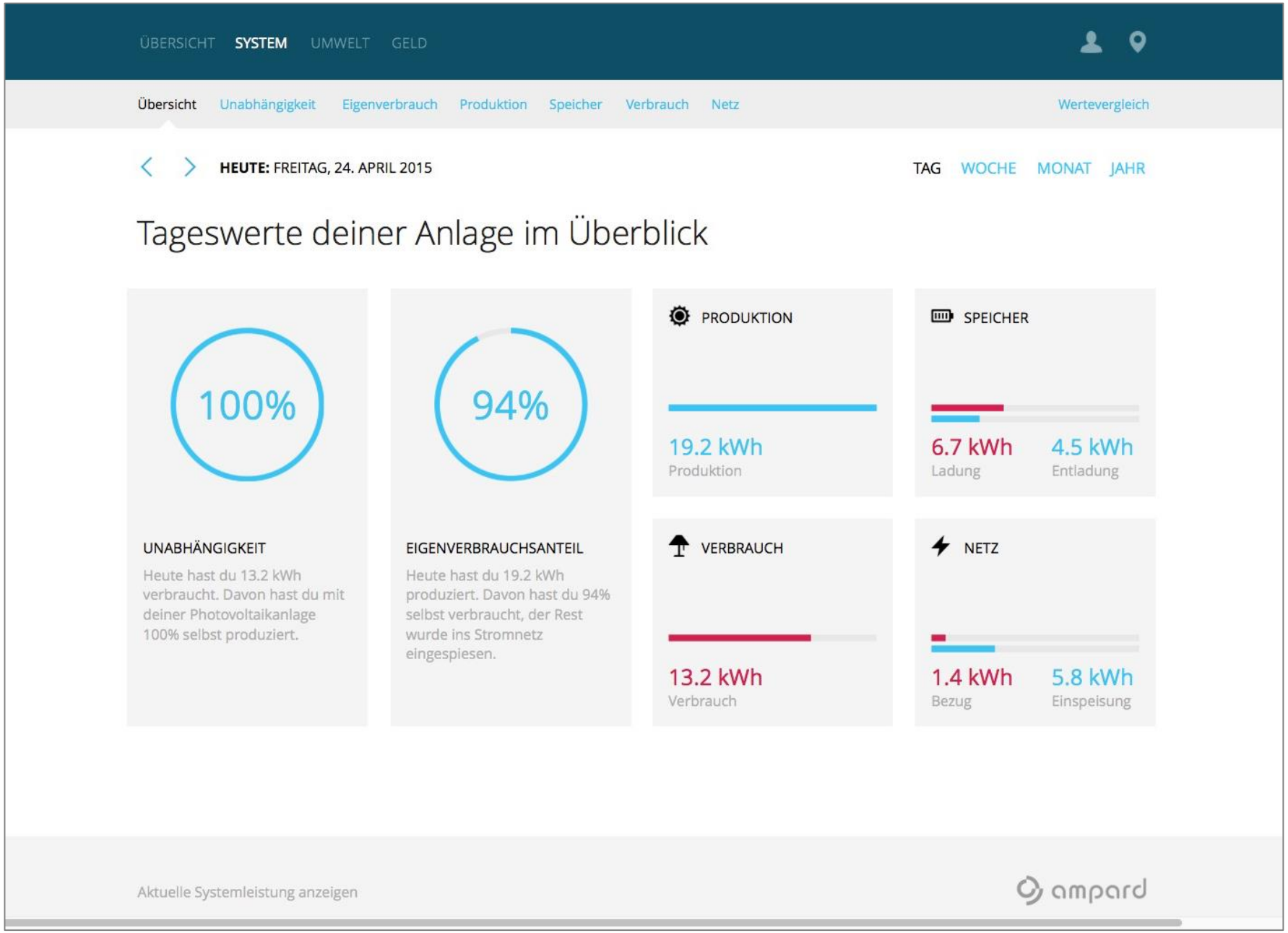



AMPARD aggregates the unused flexibility of Home Batteries to a virtual power plant for primary control. This pool is sold to the TSO/ swissgrid.

A cooperation between BKW and ampard

www.ampard.com
http://www.bkw.ch/privatkunden/solarstromspeicher

# User Interface



BKW power flex

Ampard

BKW SmartRSA

BKW my sun

# DSM with Ripple Control (RSA) until "Yesterday"

**Switzerland**

- Prevalent technique in Switzerland – remote control of water heater and electric heating
- Introduced in the 60s in order to make good use of available base load energy at night
- Signal: Frequency modulation via substation

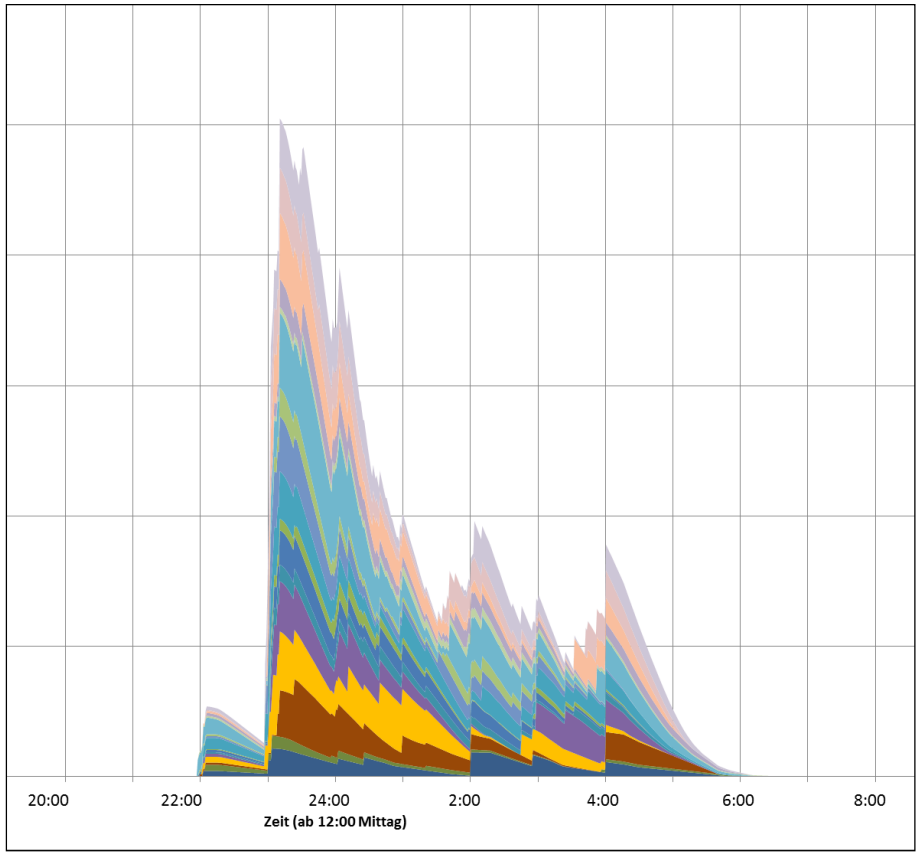
**BKW**

- Receivers / controlled loads: 120'000 (total number of clients: 300'000)
- Controlled Power: max. 700 MW (full peak consumption in whole grid ~1 GW)
- Controlled Energy: 700 MWh (total daily consumption 20 GWh per day)

# DSM with Ripple Control Today and Henceforth

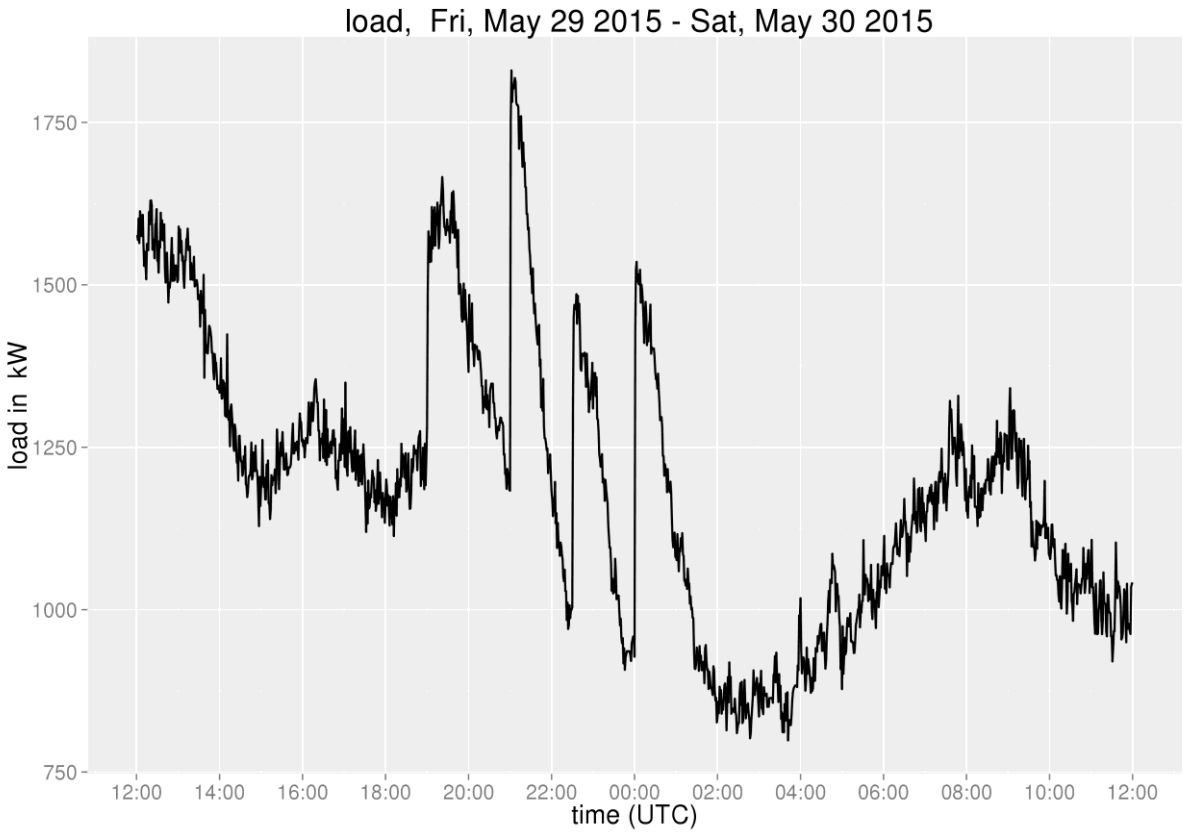
**BKW "SmartRSA"**

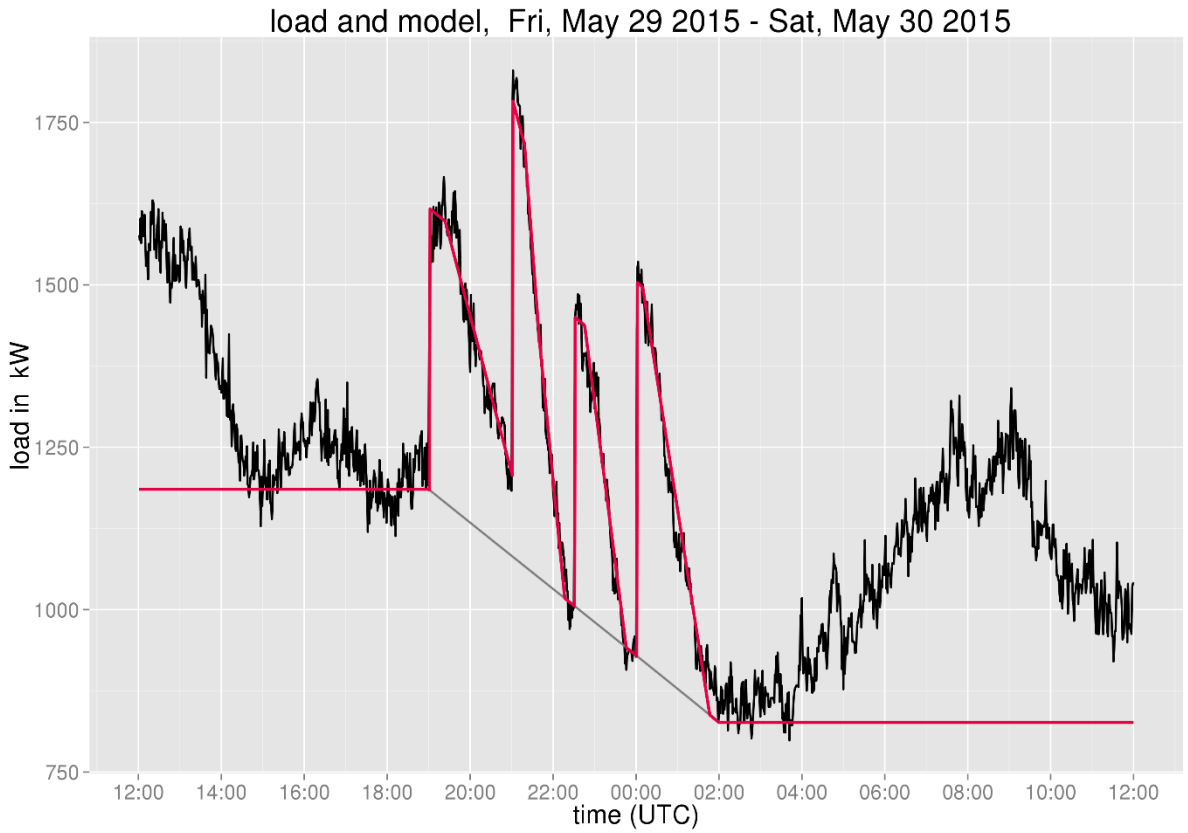
- Idea: Make better DSM with existing infrastructure by means of a new optimization system
- First Accomplishments:
  - Well-controlled compliance with selectable peak power limits at transformers (HV/MV) and feeders
  - Procurement of Energy: Adaption of load curve to price curve
  - Realization of very cost-effective self consumption optimization for small producers
- Solution features …
  - Model based optimization (load curve model, …)
  - Service Oriented Architecture (SOA)



# Models for water heater load curves

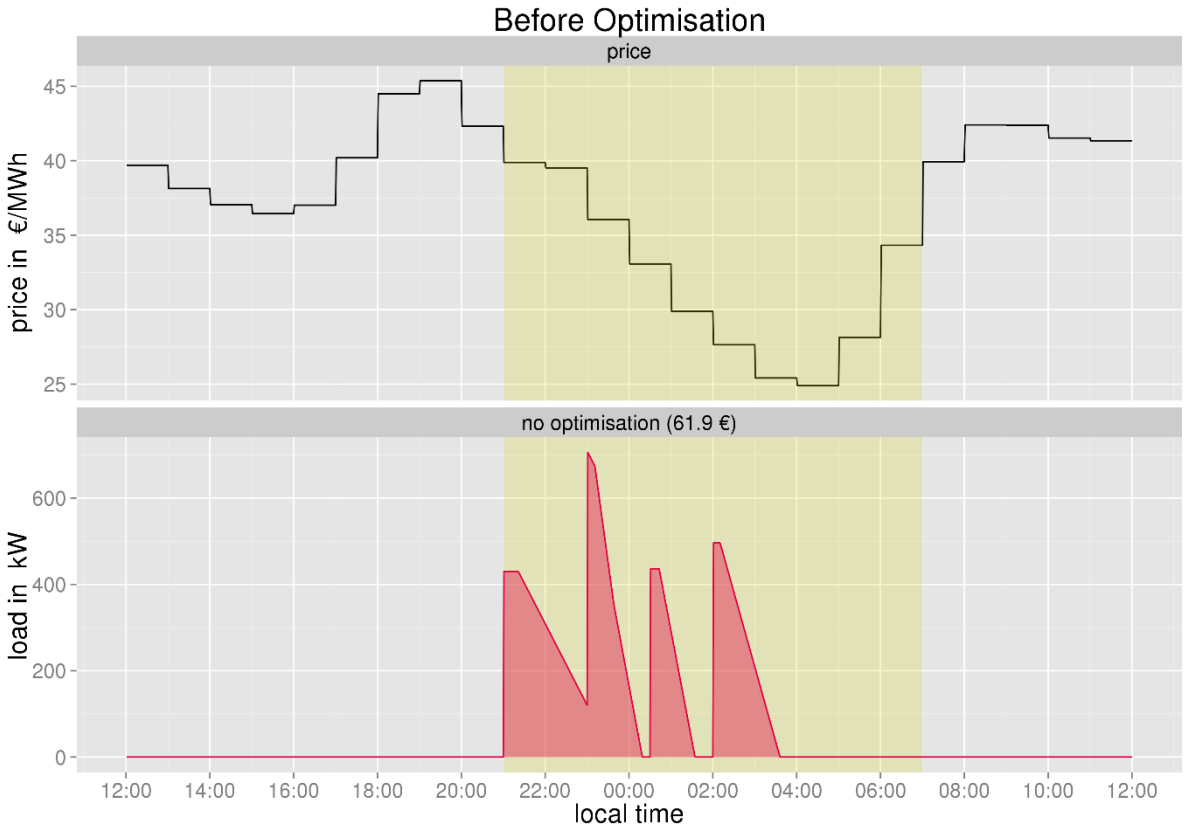
Load data in minute resolution are analyzed in order to build models for the load curve at substations of many water heaters.

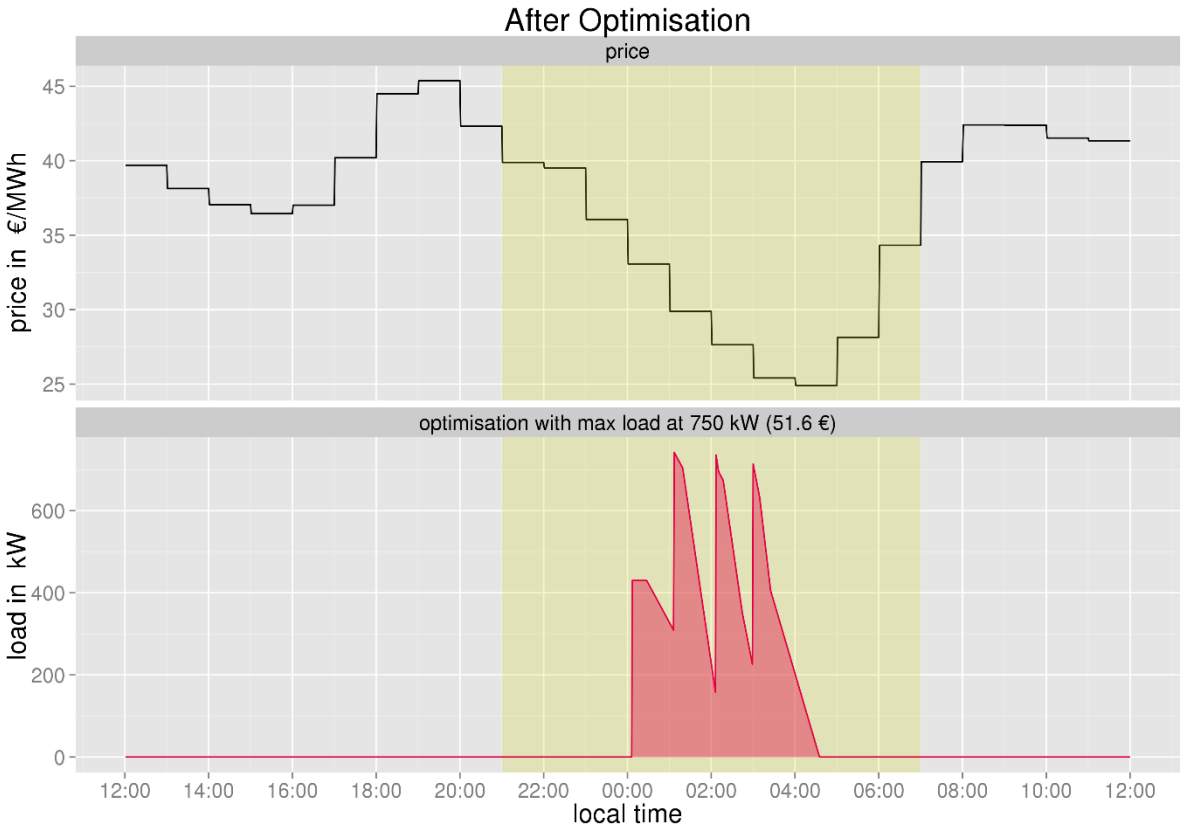


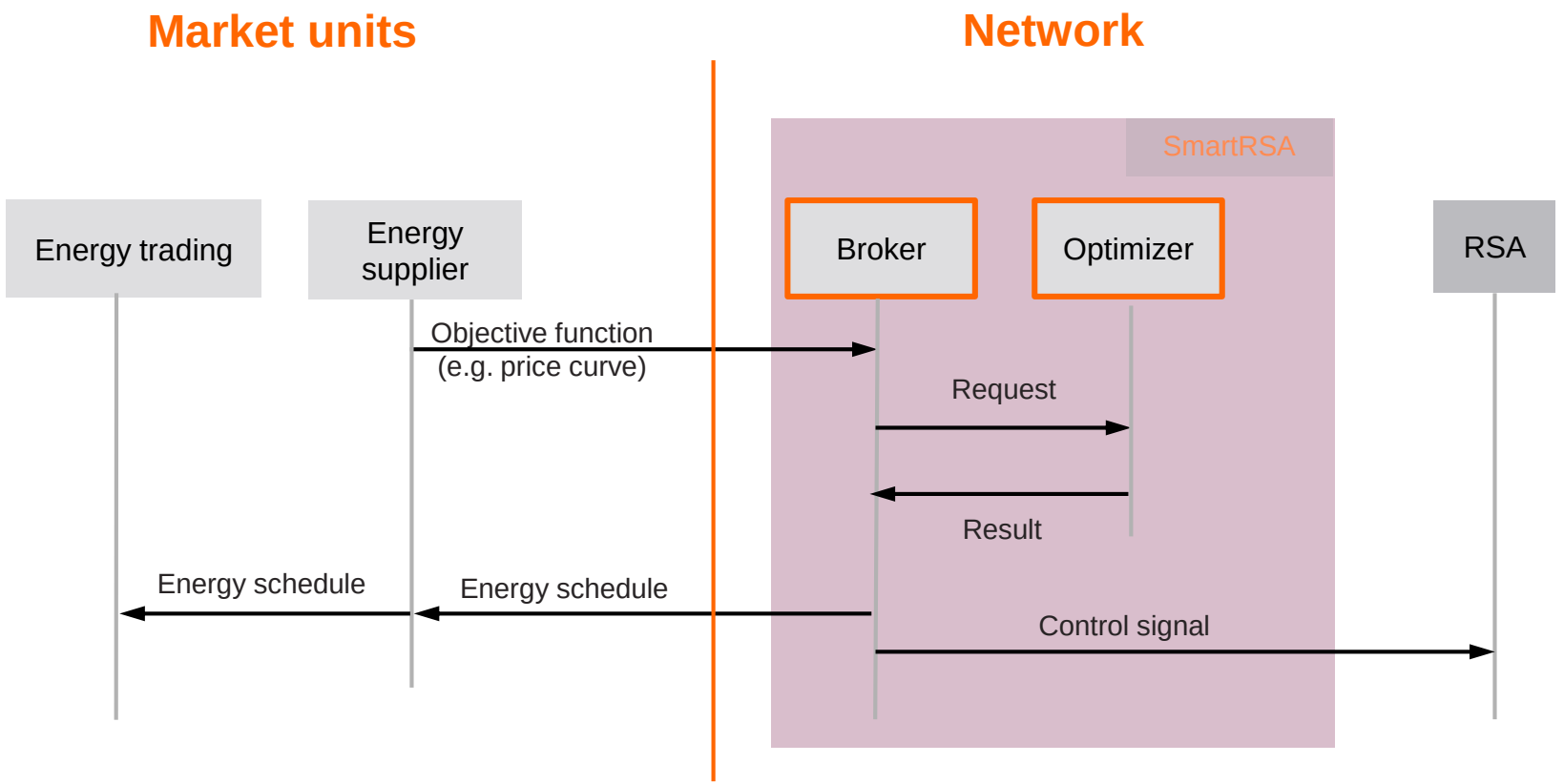
# Optimal load distribution

An optimisation algorithm finds the load distribution with the lowest price.
The load from the water heater does not surpass a given limit.
Low tarif times are always respected to prevent additional costs for customers.



# Collaboration between network and market units




**BKW SmartRSA enables savings in procurement by the <u>complete vertical integration</u> of the utility – instead of a limited optimization of isolated units (grids, trading, …).**

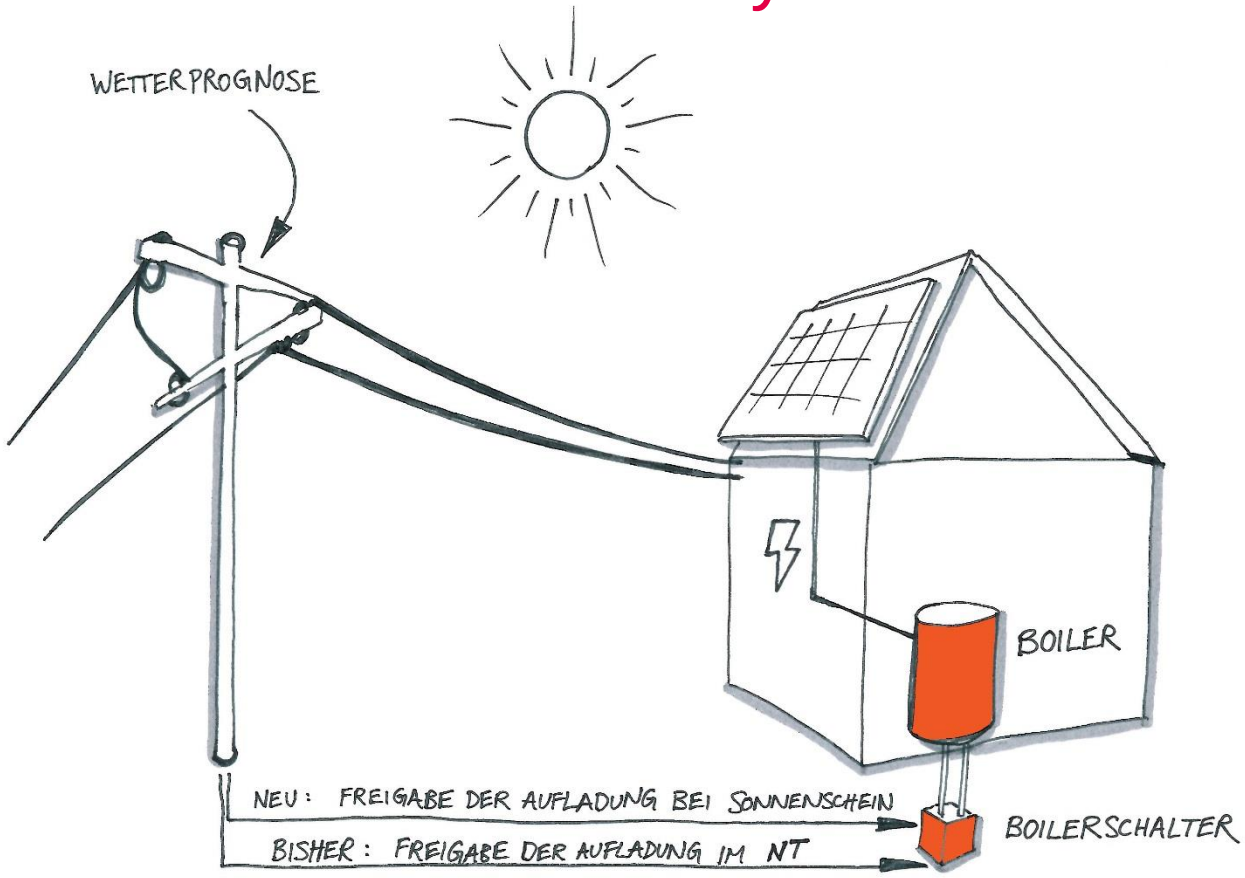
BKW power flex

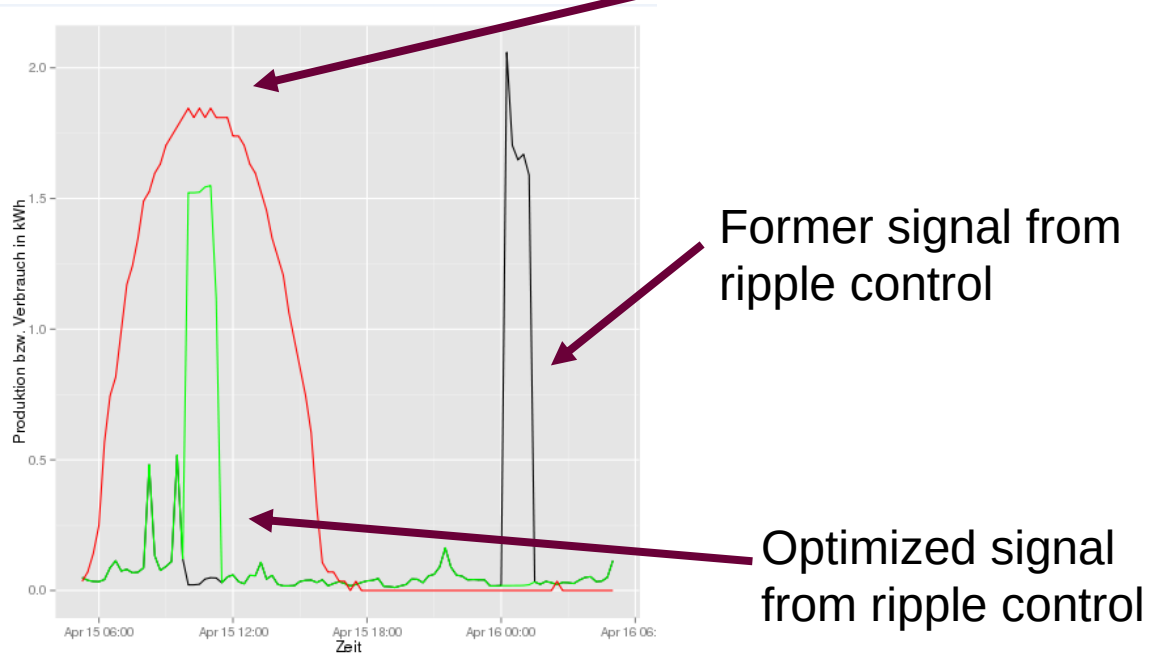
Ampard

BKW SmartRSA

BKW my sun

# SmartRSA my sun




**BKW my sun allows the customer to use self-produced solar energy to feed the electric water heater. This increases his self-sufficiency and reduces his energy bill.**

# Summary on BKW SmartRSA

**BKW has realized**

- substantial savings in energy procurement
- Reduction of peaks at substations
- Daily Reaction on Market
- As service to the customer: Local Optimization of Self-Consumption (*my sun*)

**Current Proposal**

- Detailed analysis of the potential for utilities (procurement, peaks)
- Feasible proposal for optimization with existing infrastructure
- Realization on the customer's system

**Future Development**

- Full System integration with customers infrastructure
- Intraday trading and control power
- Use of smart meters and other sensors and actors

**Patent**

- European patent application Nr. 14 405 069.7: "Verfahren zur Analyse eines aggregierten Verbrauchssignals und zur Laststeuerung in einem elektrischen Versorgungssystem"

# BKW creates customer value through DSM

As a vertically integrated utility, BKW endorses the energy transition.

BKW offers field-proven DSM solutions to utilities, business customers and private customers.

BKW puts DSM into practice, thus stabilizing a grid which has to cope with more and more stochastic infeed from PV, wind and other distributed resources.

BKW reduces costs for energy procurement by means of a new utilization of the established ripple control system (RSA).

BKW enables owners of flexible loads to realize revenues.

# Questions?

BKW

# Thank you for your attention !

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BKW

# Info

International Public Conference

**DEMAND RESPONSE**

Challenges and Opportunities in the Context of Energy Transitions

Thu 10 Sept 2015 / EPFL Lausanne

irgc international risk governance council

EPFL ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

ENERGY CENTER

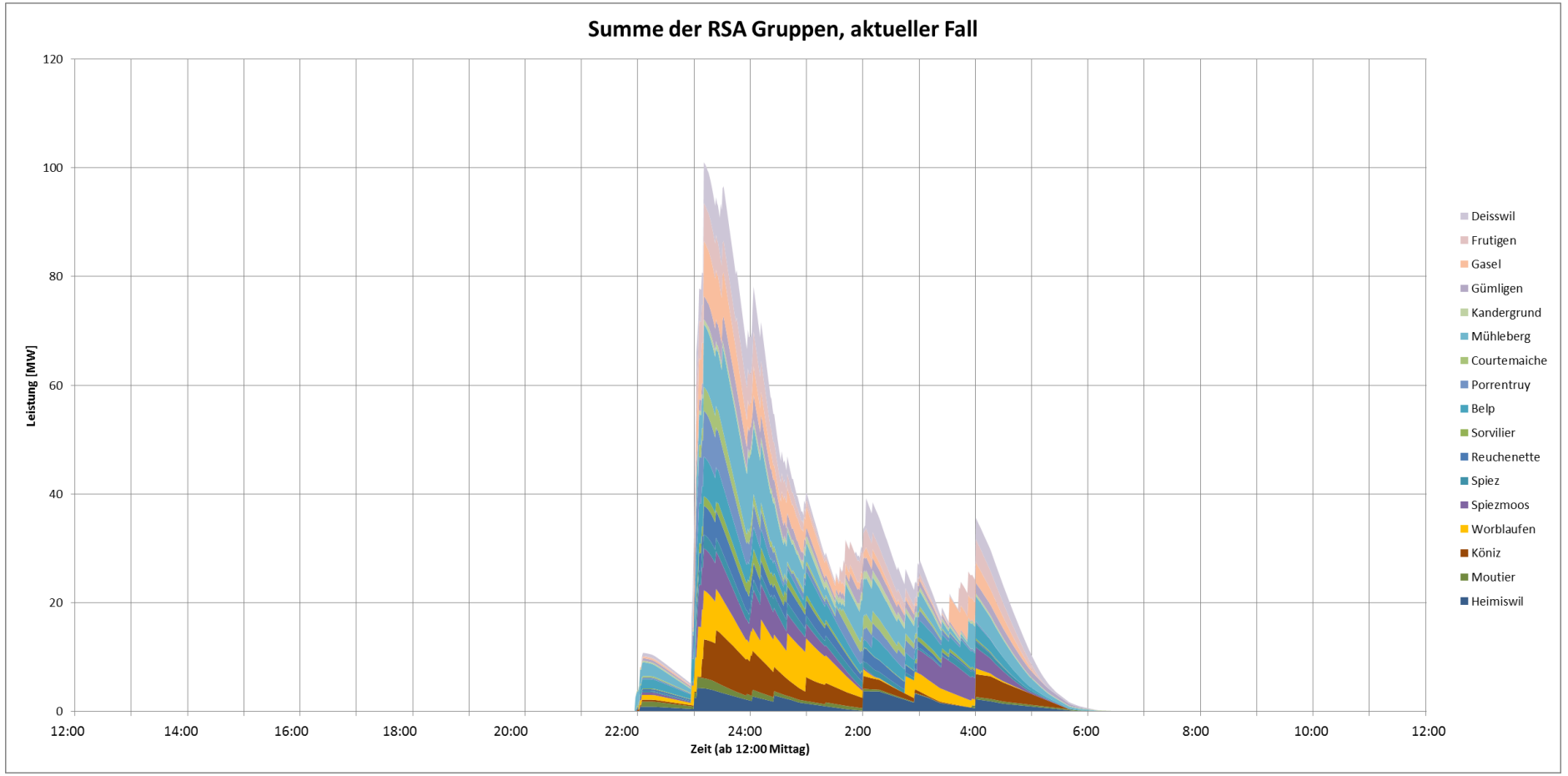
CENTER ON RISK ANALYSIS AND GOVERNANCE

public conference on **Demand Response: Opportunities and Challenges in the context of Energy Transitions.** An overview of the conference is available here: http://www.irgc.org/event/demand-response/

The conference is co-organised by the EPFL Energy Center (http://energycenter.epfl.ch) and the International Risk Governance Council (www.irgc.org) . It will be held at EPFL, Lausanne, Switzerland, on 10 September 2015. It is part of IRGC activities on the risk governance of energy transitions, which are described here.

It will be followed on 11 September by an invitational expert workshop on the same topic, at which a small group of experts will discuss about realizable potential, business models, consumer behaviour and regulatory aspects.

# 17 Unterstationen: Lastprofil vor der Optimierung…



# …nach der Optimierung