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CLASS

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CloudAssisted Services

Electricity Market and demand side management: Opportunity and challenge for Slovenian high-tech companies

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DSM market and technology drivers

The drivers:

- *Vertical decomposition & structuring of European electricity market* – introduction of energy trading - the stimulus for **new technologies and innovation**
- SET plan – targets and objectives of RES share in the electricity mix – the stimulus for **growth of the market size and investments**

2020: 20% (SI: 25%) → 2050: 50%? → 80%?

The challenge: balancing the grid in the conditions of growing RES target, using main new technologies:

- Energy storage
- Demand side management (DSM)

Harmonized EMS model in Europe – framework and driver for new technologies

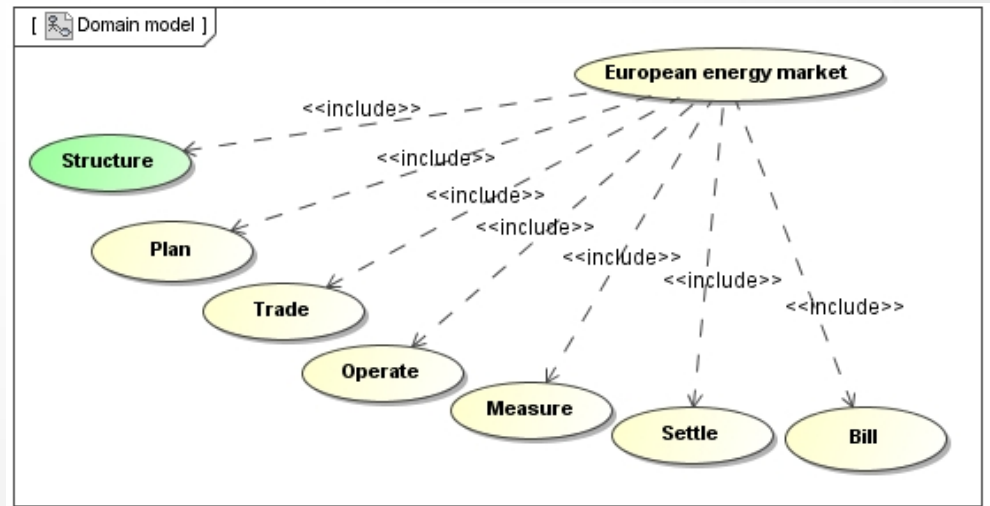
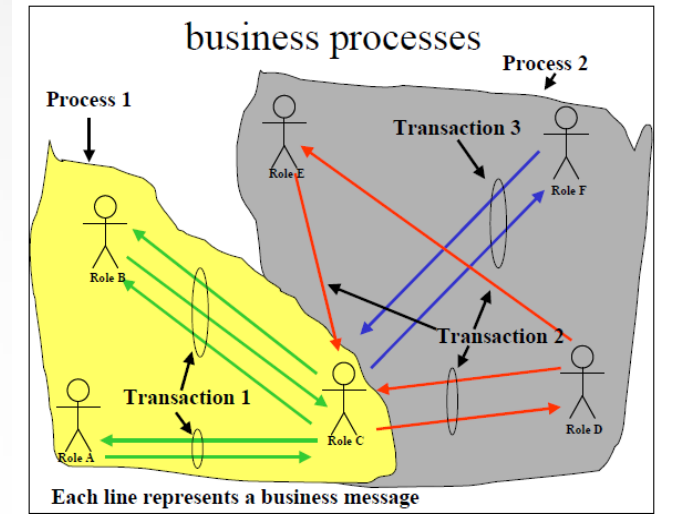
- Energy as a marketable product = the concept of bringing market to electricity generation and supply systems
 - generated a process of transformation around the world
- Current national role models
 - Austria, Denmark, Germany, Greece, Netherlands, Slovenia, etc
- Harmonized role model
 - Result of cooperation between
 - ETSO - European Transmission System Operators (presently named ENTSO-E),
 - eBlX - European forum for energy Business Information eXchange,
 - EFET - European Federation of Energy Traders
 - **Common denominator and guidance for all evolving national roles models**

Harmonized EMS model in Europe – framework and driver for new technologies (2)

- Model contains **roles** and **domains** with connections and inter-actions
- The model defines the **messages** between two roles (and not the whole business process)

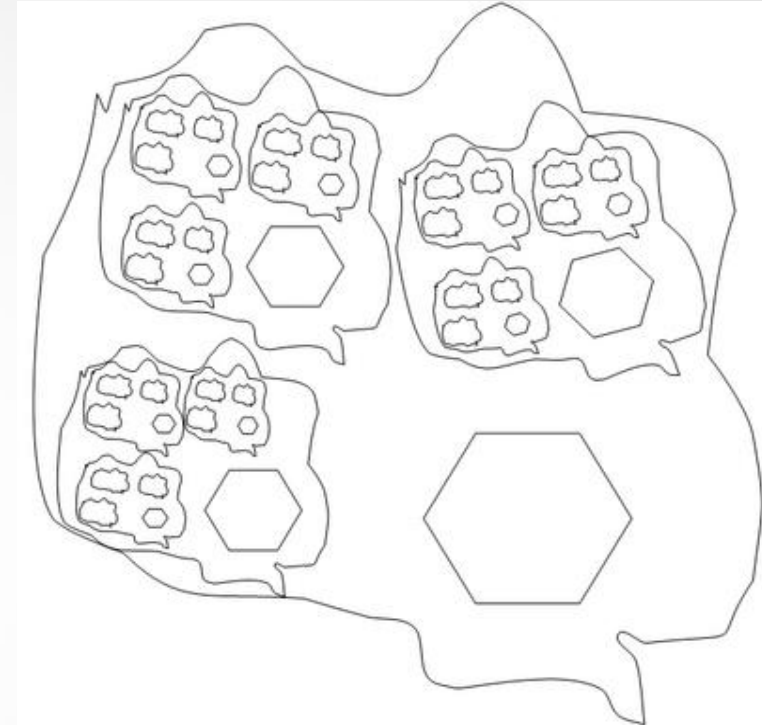
Two basic views of the model:

EEM phases in ebIX model
(**process view!**)



Structuring of the Electricity Market System

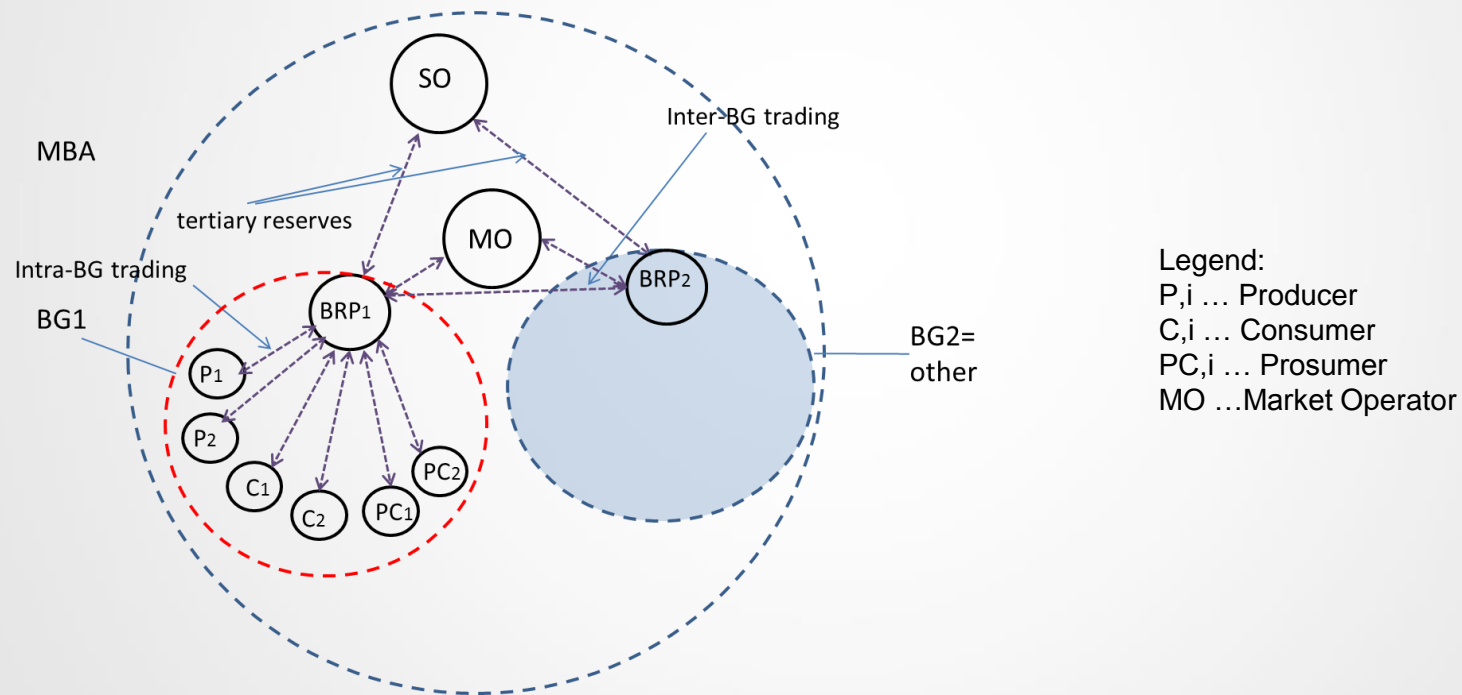
- Vertical and horizontal decomposition
 - Vertical decomposition: nested subsystems, with essentially the same functions as „parental subsystem“
 - Horizontal decomposition:
 - several nested subsystems on the same level
 - Additional subsystem:: joint and supportive processes, for operation of the electricity system
- 4 levels primary subsystems of EMS
 - 1st level: Balance group
 - 2nd level: Market balance area
 - 3rd level: Market area (Local market area)
 - (4th level: European)



Schematic representation of vertical and horizontal decomposition of electrical grid system into nested subsystems
Each subsystem is nested in the „parental“ subsystem on the next level

1. Introducing automatic energy trading to the prosumer level in BG

MBA subsystem and roles (potentially) involved in processes for trading energy



DSM enabling technologies (2)

Introduction in two technology steps:

1st step: Trading based on WIN-WIN business model between BRP and prosumer (party connected to the grid)

Business case: VPS for tertiary reserves of SO trading of flexibilities of energy consumption (and production)

Pilot demonstration project 2011, 4 industrial prosumers, 30 MW installed power



1st win-win algorithm

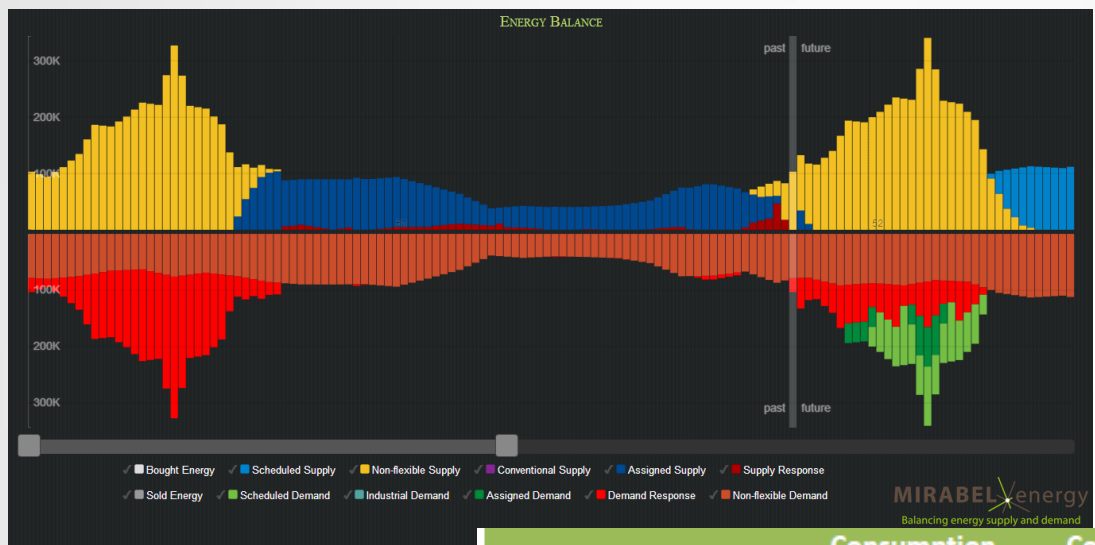
One of 20 the best European solutions for DSM, (Madrid, 2010)

One of the 1st VPP demonstration projects based on DSM

Adaptation of 5 MW for at least 1 h

2nd step: Trading with flex-offers

- Flexibilities in energy and time, on the side of energy consumption and of energy production



Flex-offers

Best poster-paper award
**World Smart Grids
Forum, Berlin 2013**



Best Poster Award

For a very significant contribution in the field of Smart Grid entitled:

MIRABEL - Efficiently managing more renewable energy using explicit demand and supply flexibilities

Andreas Doms (SAP AG, Germany); Zoran Marinšek (INEA d.o.o., Slovenia); Torben Bach Pedersen (Aalborg Universitet, Denmark)

Richard Schramm
SIC, Chair of ITC

Johannes Stein
Voll, Germany ITC

	Consumption price reduction	Consumption price reduction including imbalances
TSO trial	13%	-
Peak reduction	18%	48%
Integration of 10 % of wind	30%	67%
Integration of 10 % of solar	24%	30%
Using real world external market data (no RES)	13%	48%

2. Augmenting demand response

- development and implementation of advanced demand response algorithms, which maximize demand response, based on cost-benefit considerations, utilizing the (concept of) energy reservoirs in processes :
- Reservoirs in production and ambiental processes
- New techniques and technologies for storing produced energy

Cost-benefit DR boost

Summary DSM enabling technologies

- Automatic demand response based on price of supplied/purchased energy
- The aggregated flexible size of demand offer, responding on-line automatically to changing price
- Boosted demand response due to demand response management technology

35 years of history, with more than **50 DRM** systems at industrial prosumers with **250 MWe** installed power, achieved **35 Mwe** reduction of peak power

DSM in EMS – technology cross-section domain

- Participating technologies

Control Technologies (CT),
Process Control Techn. (PCT)

Cloud Computing (CC)

process scheduling

- Cross –section with other technology domains

Smart Grids - processes
in demand side
management (DSM)

Cogeneration (CHP)

Systems for efficient use
of energy

Electrical Energy
storage

Smart Grids - processes
for transmission of
energy (DMS)

Thermal Energy
storage

Smart communities and
regions

Deployment of new technologies on the market

- Challenges

- Transition of the electricity market → changing roles of traditional players
- Segmentation of the users (parties connect to the grid)
- New players on the market – further segmentation of the roles
- Scaling of technologies and products to different user groups

- Necessary concomitants of market deployment

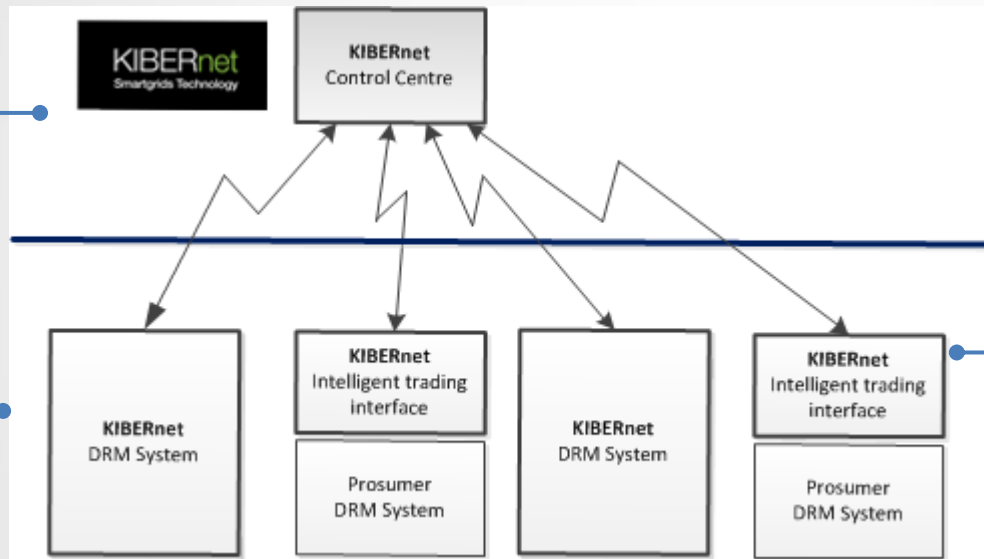
- New business models for traditional players
- New active role of prosumers (and consumers) → new social models for residential prosumers

Deployment on the market – a scenario

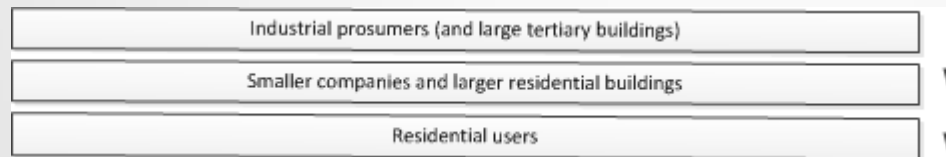
Control Center at BRP or MGR or ?

DRM system at prosumer equipped with energy trading interface for trading with Control centre

Intelligent trading interface for coupling prosumer's DRM with Control centre



- **Compact embedded systems** on standard HW of renowned producers
- **Open systems** (designed to custom requirements, interfacing other parts of EMS)
- **As part** of complete internal EMS



A family of intelligent interfaces, incl. Smart meters
Integrated solution with other services as part of »energy package services«

Deployment on the market – main business cases

Business case 1: VPS for tertiary reserves of SO

= DSM against classical peaker stations, case will grow with RES share

- high voltage to medium voltage: larger industrial prosumers and large tertiary buildings
- No of prosumers VPS: 20 -100 - (200)

Business case 2:

•VPS based on DSM for optimization of operation of microgrid.

- Scaling-down to medium and low voltage: inclusion of smaller companies and larger buildings
- No of prosumers: 100 – 1.000 – (5.000)

Business case 3:

VPS based on DSM for optimization of operation of Balance Group

- Scaling down to all groups of prosumers
- No of prosumers: 10.000 – 100.000 – (500.000)

Potential for demand response

(10%) - 15% - 20% - (25%) of peak demand, depending on cost-effect parameters

Opportunity and challenges for Slo high tech companies

- Several have achieved technology breakthroughs on parts of this domain
- Several of them sufficiently early to claim a part of the niche market
- Automatic flexibility trading by prosumers can be the „joint RIS3 platform“

- Successful model of strategic networking was generated by CC ACT, CC CLASS and CC SURE → brought together partners from different technology problem domains

→ Besides main business cases that could change the electricity market, a number of cloud-enabled services could/will be generated

- The synergy of their **business visions and goals** to deploy own technology solutions on international market through innovative technology networking model **created first Slovenian Technology bridge (called Technology Hub) with Japan**, that led in early 2013 to establishment of European Economic Interest Grouping JETNET.



Thank You

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