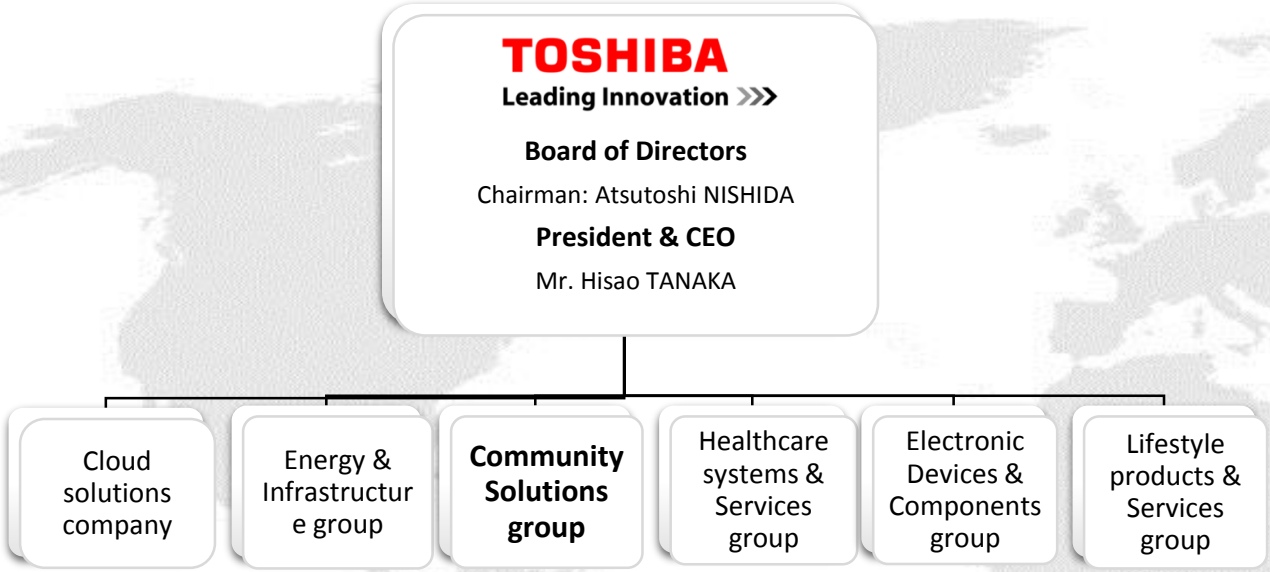
CYBERGRID

How to operate virtual power plant.

How it Works.

TOSHIBA
Leading Innovation

cyberGRID introduction



CYBERGRID

Company name:	cyberGRID
Headquarters :	Vienna, Austria
Ownership:	76% Toshiba Corporation
Division:	Community solutions division

Developer and deployer of VPP/DR solutions for Utilities

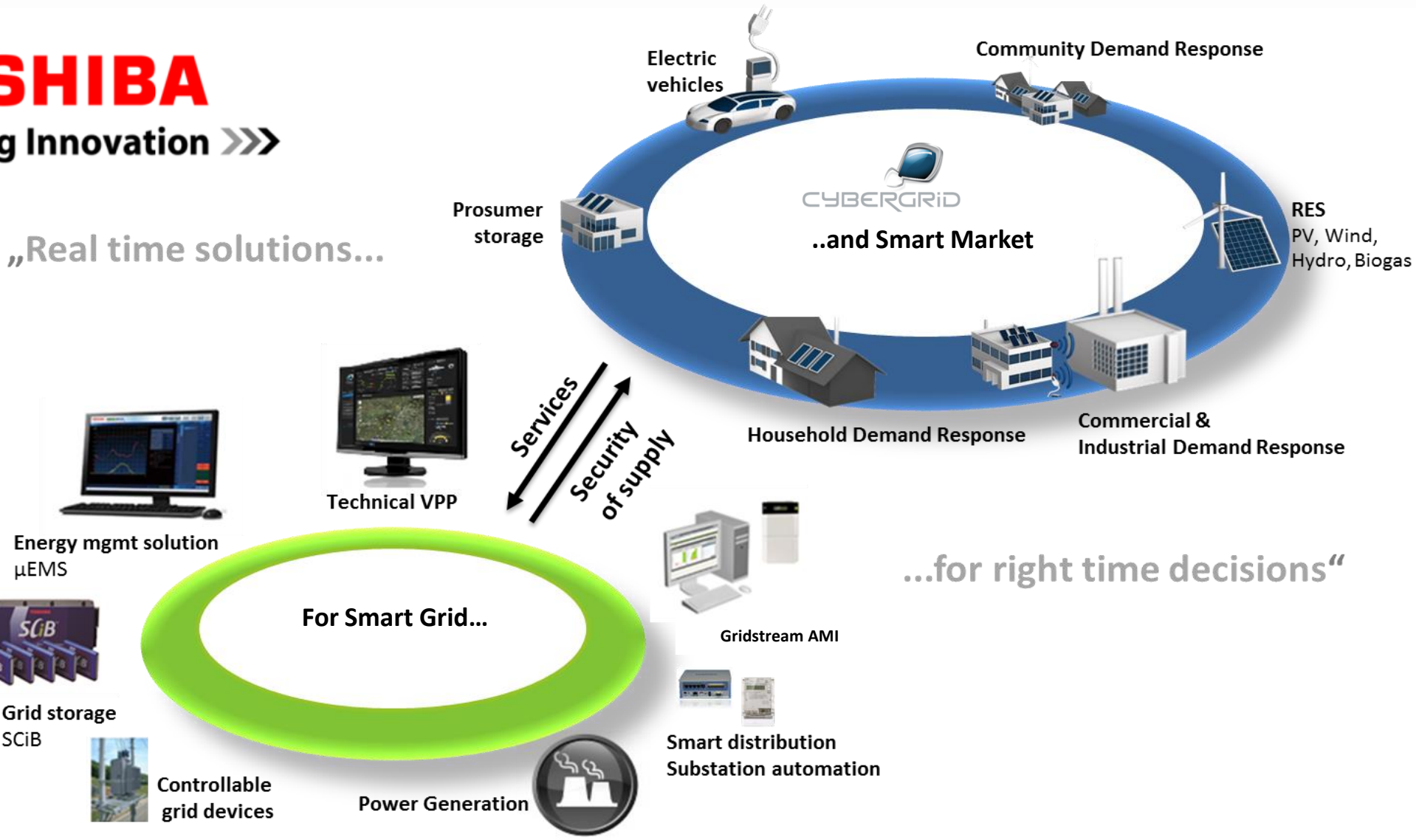
State of the art technology for “pooling” demand response, distributed generation and storage capacity

CYBERGRID

Total energy management solutions

TOSHIBA
Leading Innovation

„Real time solutions...



...for right time decisions“

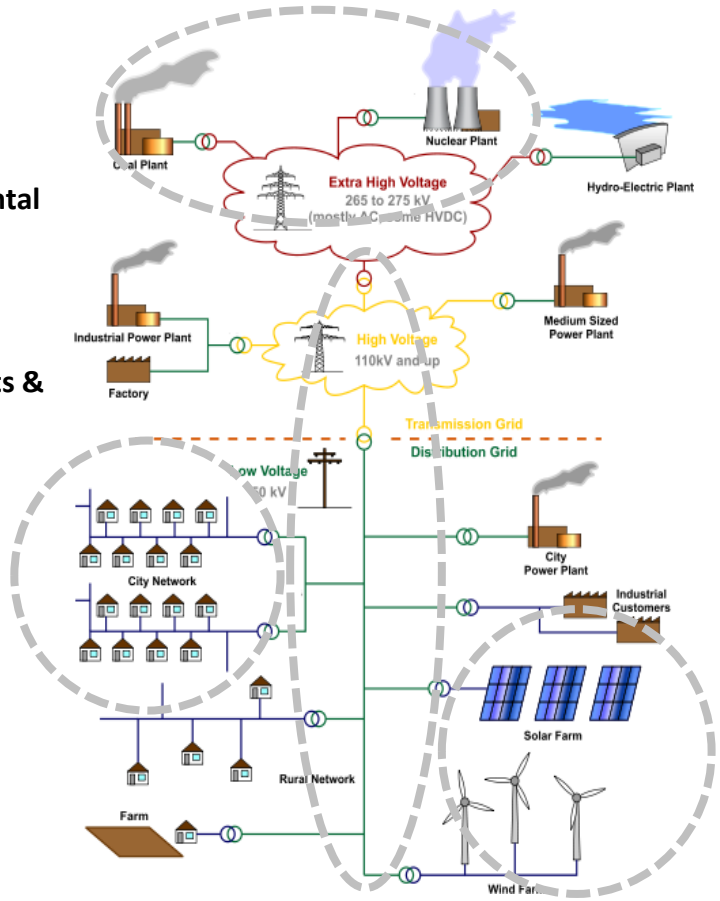
CYBERGRID

Transforming energy sector

Environmental Issues

New markets & needs

Growing demand



Aging infrastructure

Public resistance against new projects

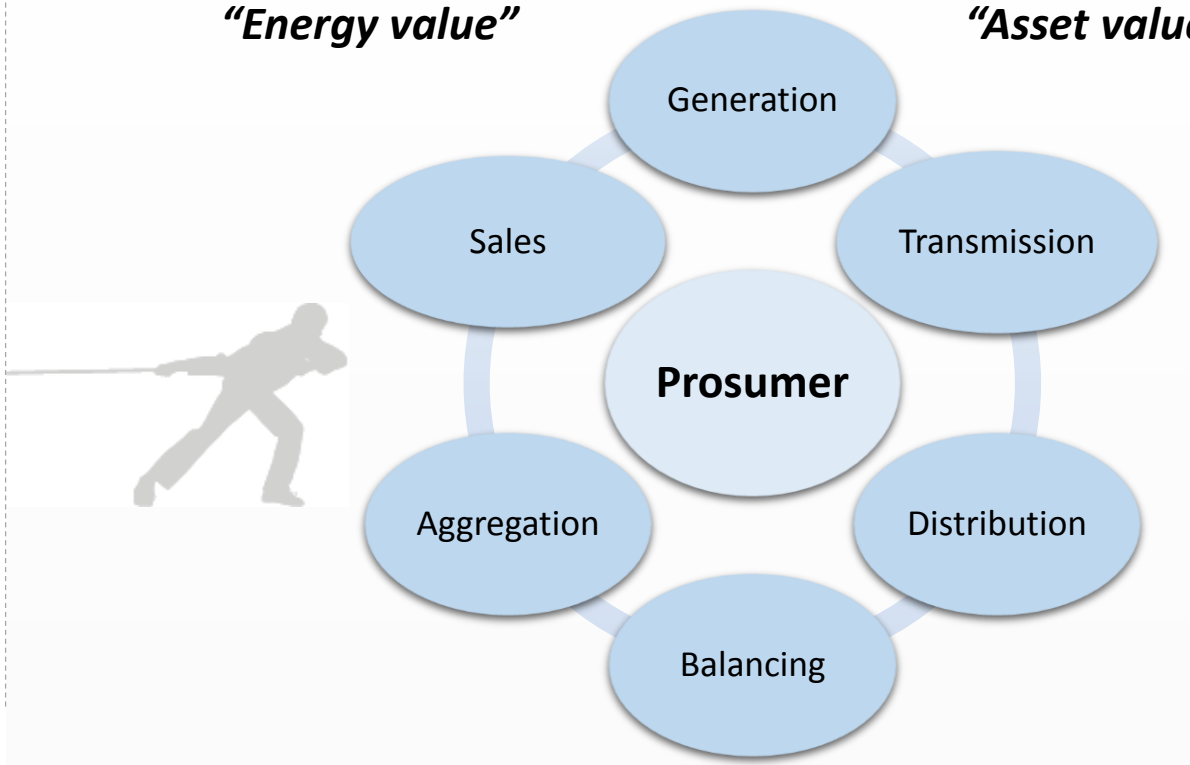
New technologies

Increasing share of renewables

Fundamental forces

"Energy value"

"Asset value"



New market roles

How it works?

- Steel mills
- Foundries
- Paper Plants
- Shopping Malls
- Glass and Ceramics Manufacturers
- Chemical Industries
- Hospitality

I&C customers can adapt behavior...

...by optimizing their energy use...

- Demand response
- Distributed generation
- Storage

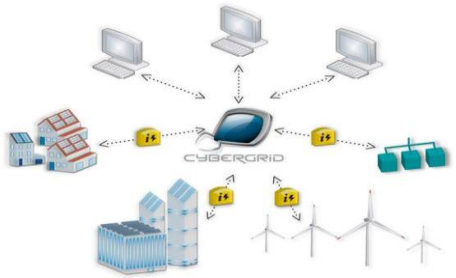
...while IT enables operation with real time data...

Demand Response

...for each industries receive compensation...

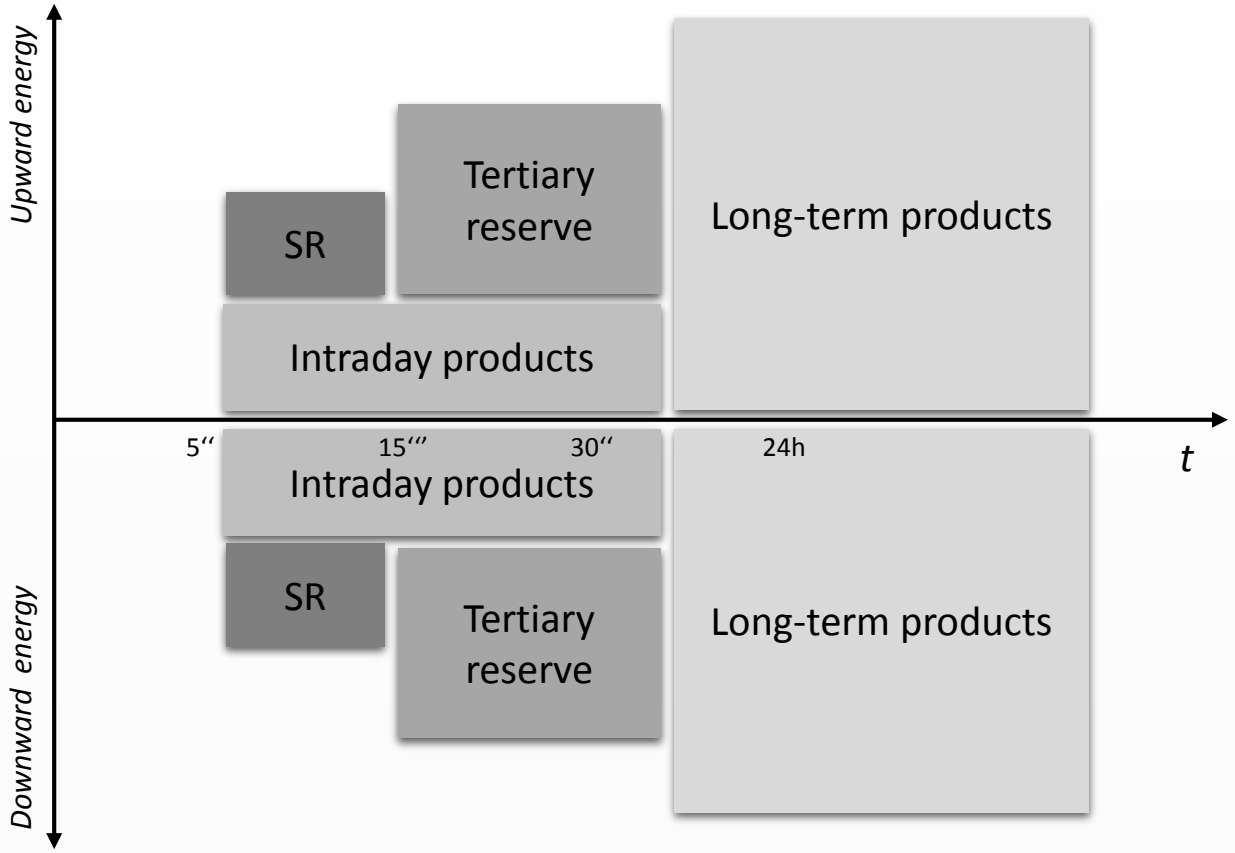
...participate in markets or balance the grid...

...to pool capacity and...



CYBERGRID

Demand response products

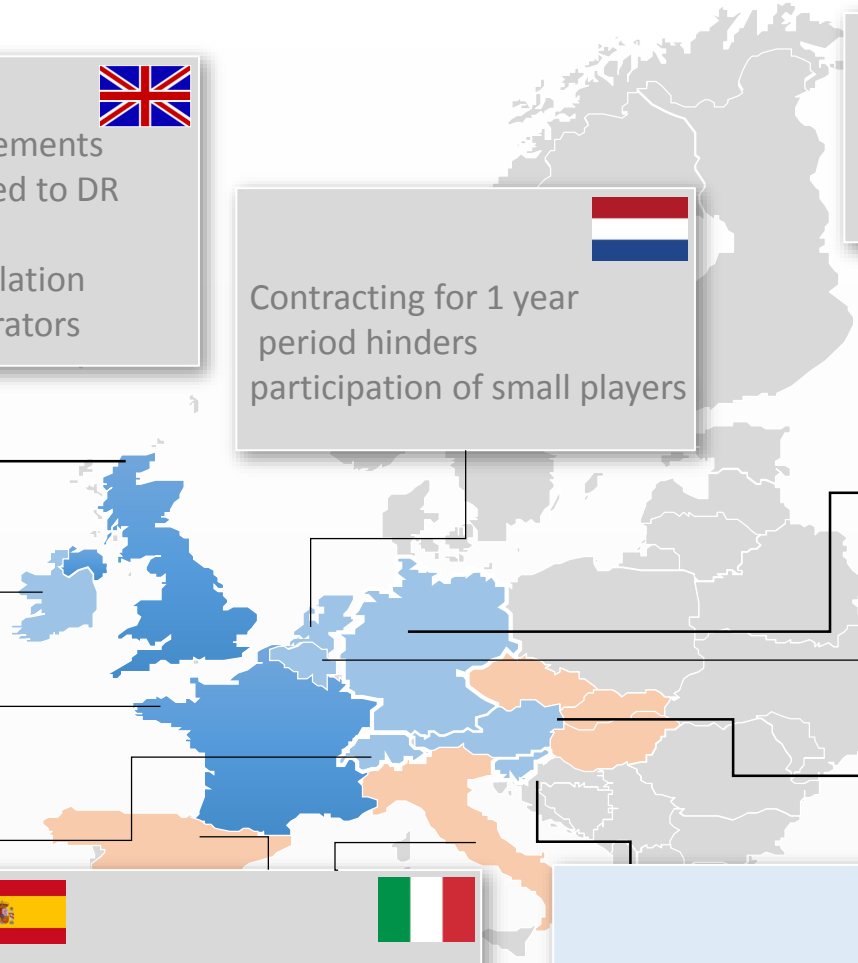


- Limited number of loads capable of constant automatic swithing
- Tertiary reserve most suitable for DR, however question of sufficient payments (GE)
- Increasing energy efficiency by avoiding peak consumption
- System prediction and optimization capabilities enable up-to a week reliable products

Both, upward and downward products are enabled → Value for DRES integration

Demand Response accross Europe

Repeated pattern of regulatory barriers –regulation fitted to generator, based on historical needs



Tender requirements mostly adjusted to DR

Minimum size 4 MW hinders participation

Tender requirements mostly adjusted to DR

Baseline calculation fitted to generators

Contracting for 1 year period hinders participation of small players

Complex tendering rules

Low energy prices hinder DR→ Opening capacity markets in 2018

Complex bidding on SR

Tender requirements mostly adjusted to DR

Needed ability to replace resources within activation

Opening capacity markets in 2016

Markets for DR opens in Summer 2014

Low prices hinders large scale DR

Unfriendly regulatory framework- Strong TSO load reduction programs

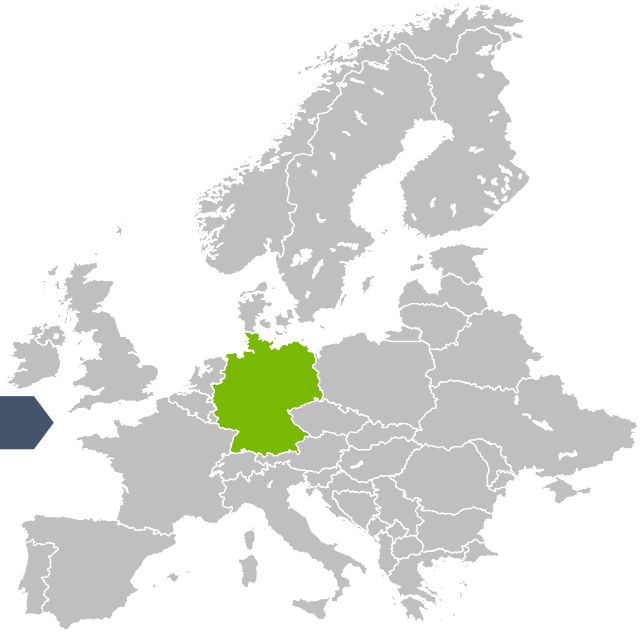
Market for DR opened in 2013, existing barriers are 24/7 availability, long-term contracting

Vattenfall, Germany

Getting knowledge about:

- DR issuses
- Aggregation
- behaviour of small and mid-sized loads
- Communication
- data for system architecture

>80 connected loads >54 automatically switchable loads



VATTENFALL

Vattenfall, Germany

Results:

- No negative impacts on customer devices occurred.
- Importance of negative DR for high DRES integration
- Local storage capacities realized by DR are a huge benefit for power systems especially where wind power became the dominating power

German markets:

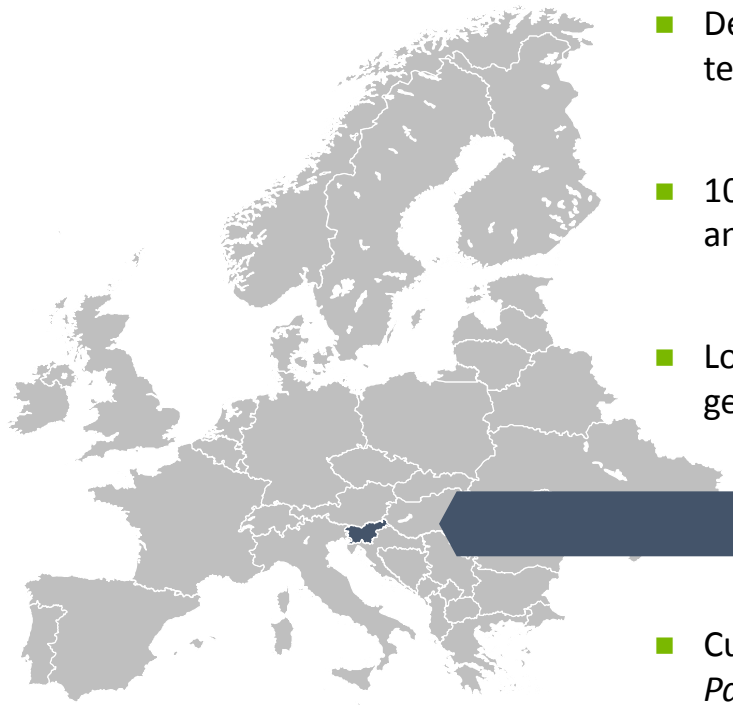
„Minuten reserve“ market:

- Daily tenders
- 15 min product, 4 h duration
- **Low prices → Investment insecurity hinders DR**

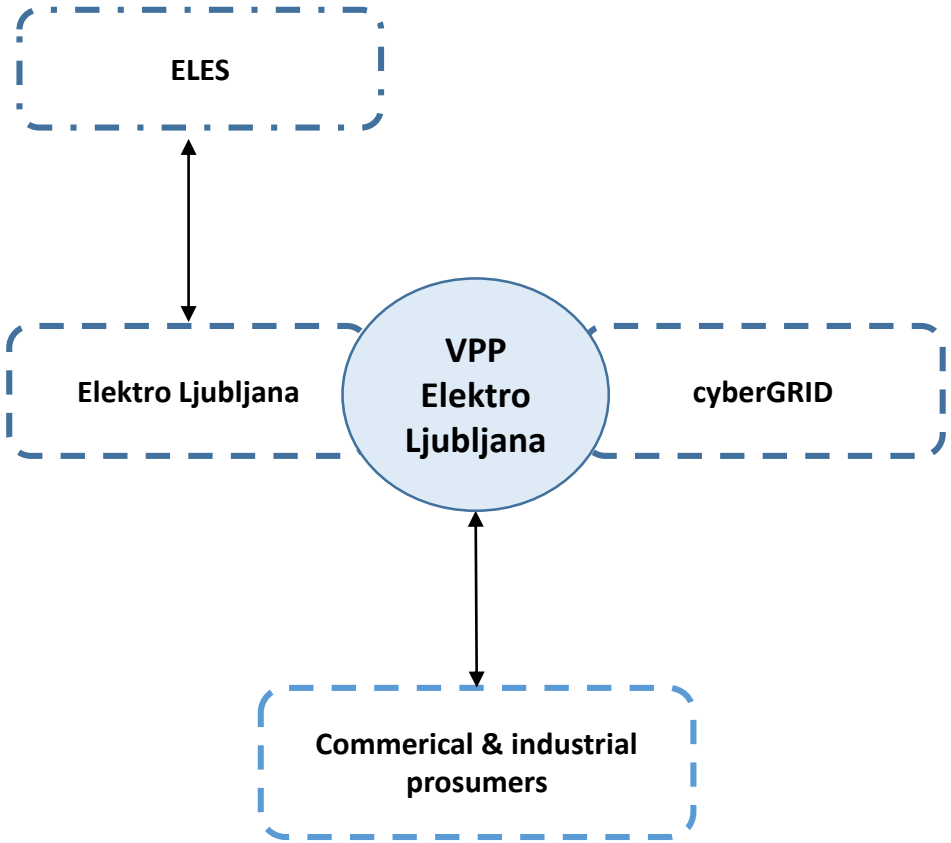
→ Intraday market
Day-ahead market

Elektro Ljubljana, Slovenia

Elektro Ljubljana Group has established southeast Europe's first virtual power plant.



- Delivering 12 MW of VPP capacity for tertiary reserve purposes
- 100 % availability of peaking positive and negative capacity
- Load curtailment + distributed generation
- Customers: *Steel mills, Foundries, Paper Plants, Shopping Malls, Glass and Ceramics Manufacturers, Chemical Industries*



ELEKTRO LJUBLJANA

CYBERGRID

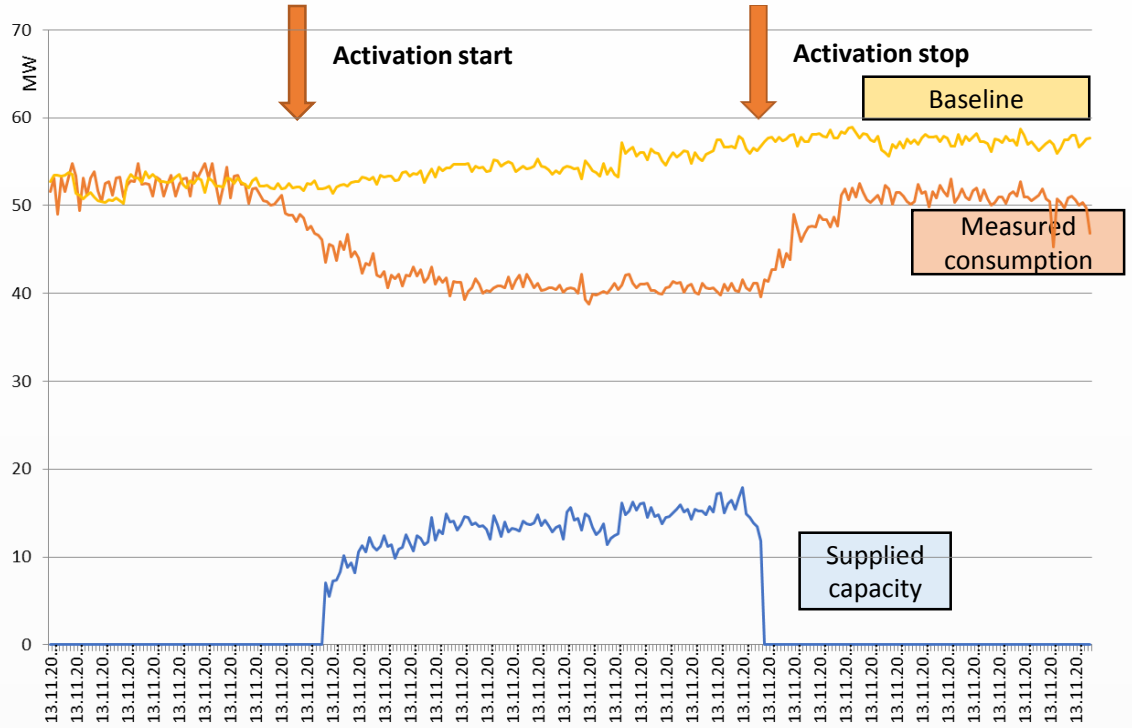
Example of Elektro Ljubljana tertiary reserve product

Contract
- Yearly bilateral contract with the TSO
- Yearly testing of newly introduced capacity
- Aggregator part of balancing group
- Energy fee & Capacity fee

Product
- 15 min response time
- Max. number of activations: 2 per day
- Unavailability time after activation max. 10 hours
- Maximum time of activation max. 2 hours
- 24/7 availability

Experiences
- Real life activations started in November, 2013
- On average 3 activations per month
- Elektro Ljubljana VPP is successuflly providing capacity
- Expansion of capacity planned for new tender

Real life activation (November, 2013)



Enabling Demand Reponse

1. Reasonable tender requirements

- Complex contracting hinders DR
- Pool allows aggregation
- Minum bid size (1 MW)
- Duration of the product (2 h)
- Activation time (15 min)
- Availability requirements

- Allowing assymetric bidding
- Positive and negative products
- Ability to replace resources within activation
- Shorter contracting periods enable smaller players
- Baseline measurement methodology

2. Prices and products enabling investment security

3. Mechanism for aggregation accross balance groups

Customers, Partners, Projects

Customers

Partners

Projects

EDRC
- European demand response center; project coordinator

eBADGE
- Pan European inteligent balancing mechanism; technical coordinator

cyberPRICE
- Dynamic pricing mechanism: TOU/CPP/RTP; Project coordinator

evolvDSO
- Efficient DRES integration in distribution networks

hybrid-VPP4DSO
- Intelligent load management for distribution network

CYBERGRID

Thank you!

CYBERGRID