Load flexibility in small and medium enterprises and criteria for successfully enabling them

Demand Flexibility – Dream or Reality

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Agenda

1. Project Hybrid-VPP4DSO
2. Demand response analysis for Styria
3. Qualitative assessment of business models for hybrid VPPs
4. Next steps

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Project Hybrid-VPP4DSO

Details of the project:

- Spring 2014 – Autumn 2016
- 9 project partners
- Further Information: http://www.hybridvpp4dso.eu/

Tasks of the project

- Identifikation of **DR potential** in Styria and Slovenia
- Identifikation of **critical grids**
- Identification of both market and grid business cases and **development of use cases** for hybrid VPPs
- **Simulation** of the hybrid-VPP operation in the distribution grid
- **Proof-of-Concept** in laboratory
- **Evaluation** of hybrid approach

Hybrid-VPP4DSO approach

Virtual Power Plants (VPPs)…

- Aggregation of small, decentralised units of both **production and consumption**
- Seperate consideration of commercial and technical VPP

HYBRID VPP4DSO **approach**…

Partcipation on
electricity and balancing **markets**

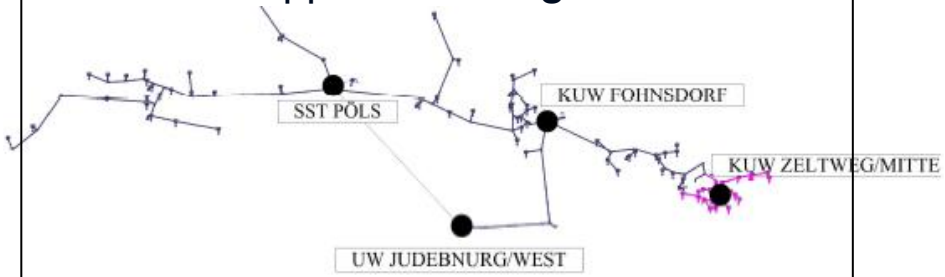
EPEX SPOT EUROPEAN POWER EXCHANGE

EXAA Energy Exchange Austria

APG AUSTRIAN POWER GRID

&

Support of local **grids**



Possible applications for VPPs

…between market, hybrid and grid.

Market-VPP	Hybrid-VPP (passive)	**Hybrid-VPP (active)**	Grid-VPP
The grid is robust enough to permit the operation of VPPs in the Electricity Market while not being jeopardised by it.	The degree of participation of the VPPs in the Electricity Markets is agreed with the DSO beforehand. This agreement guarantees that the grid limits are not violated.	The VPPs participate in the Electricity Markets as long as the grid limits are not violated. If a critical situation is identified during the VPPs operation, an algorithm takes care of it by limiting the participation of the VPP.	The VPPs do not participate in any Electricity Market, but only provide active local services to the DSO.

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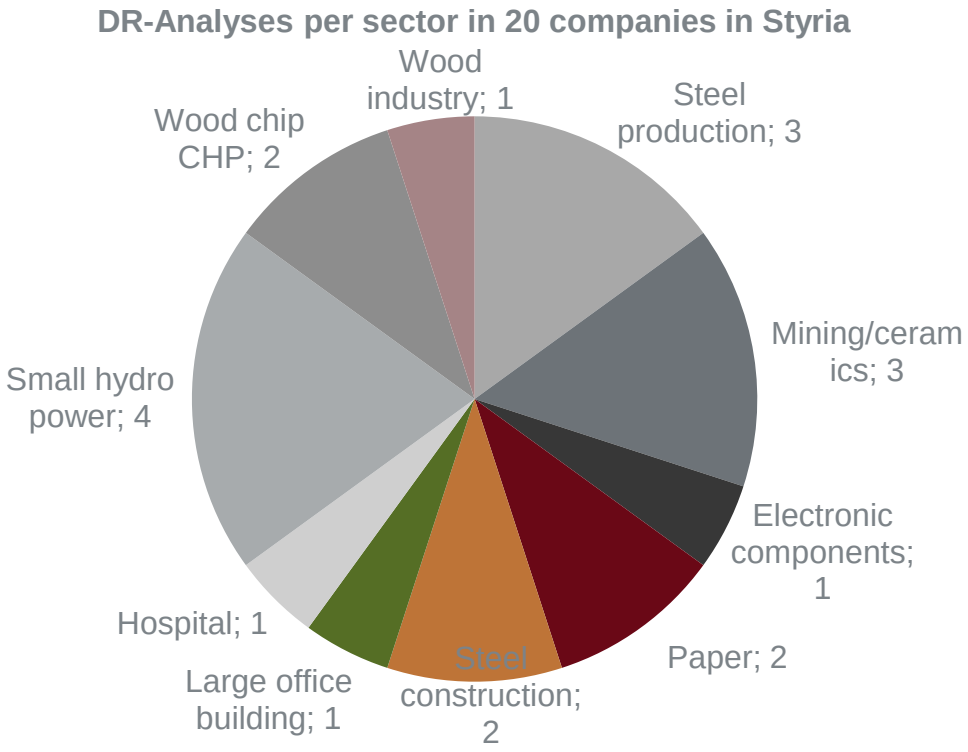
DR analysis in Styria

Companies of DR analysis in Styria



DR analysis

- 57% of the companies agreed to take part in the interviews
- In Slovenia much less response

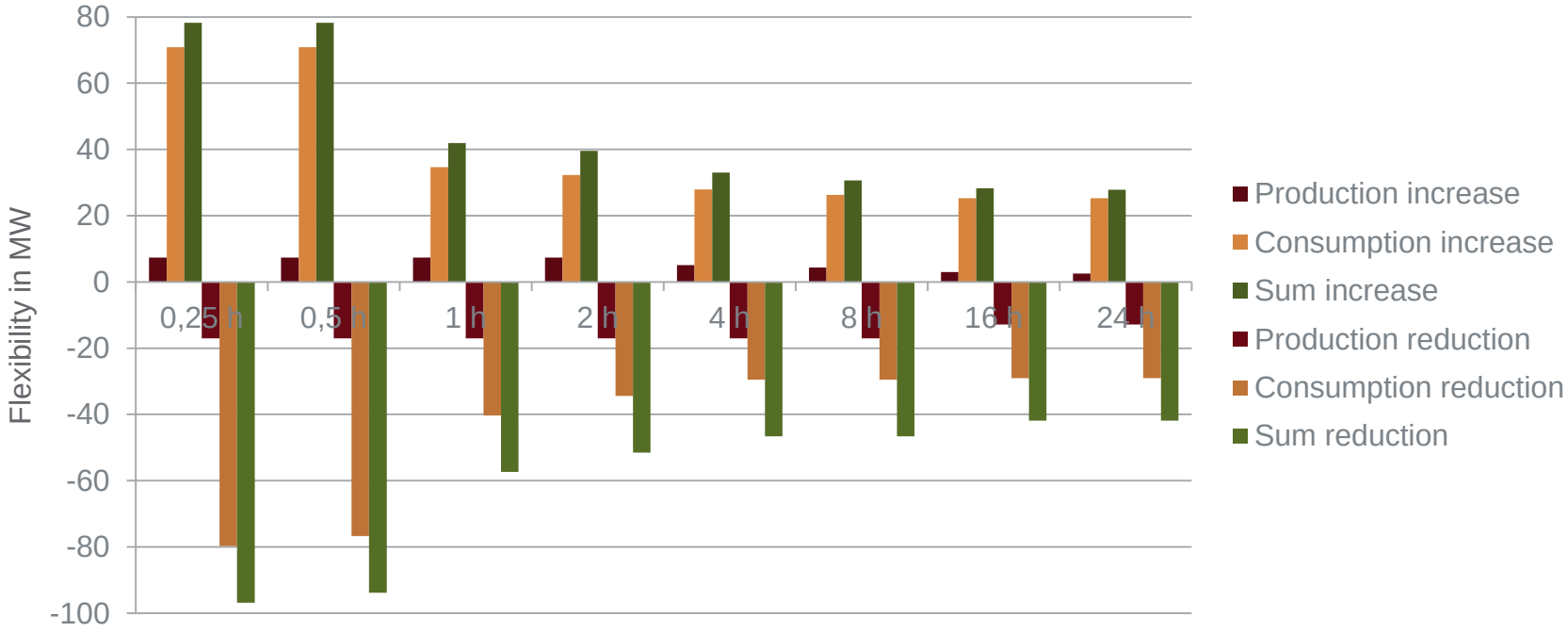
- Higher DR potential in companies/ for processes, when
  - Storable semi-finished goods and **storage** space available
  - **Load factor** of less than 100%
  - High **automation**
  - Low involvement of **personnel** in the processes

DR analysis per sector

Sector	Potential	Specifics	Shifting times [h]
Steel production	High	Reduction with electric arc furnace for raw materials but the **higher the requirement for the good the less the chance for load shifts**; nearly no chance for load shifts in thermal treatment processes	0.25 - 24
Mining/ ceramics	High	Mainly depending on **level of automation**, **storage capacity** and actual degree of their **capacity utilization**	0.5 - 8
Paper	Small/ medium	Mainly depending on **storage capacity** before/after shredders, grinding machines, mills etc.	0.5 - 24
Large office building	Small	From **ventilation**, **air conditioning**, etc.	0.25 - 1
Hospital	Small	Emergency generators cannot be used in general (**disaster protection**); but small potential from ventilation, air conditioning, steam humidifiers, etc.	0.25 - 2
Small hydro power	Medium	Depending on **capacity level**: April to June 100%; consideration of **feed-in regulation**	up to 24
Wood chip CHP	Medium	Reduction possible if **bypass for heat production** is foreseen; consideration of **feed-in regulation**	up to 12

Flexibility potential of these companies in Styria

- Typical **shifting** times between
  - **5 min to 30 min** for process loads
  - 5 min to 1 h for non-process loads (increase) and 5 min to 30 min for reduction
- Size of **technical units** between
  - **150 kW to 8 MW** for process loads
  - 140 kW to 5 MW for non-process loads as boilers, etc.



Company view: Concerns and Chances

Concerns

- **Economic disadvantage** for the company
- **Increase of technical problems** with production line
- **Reduction of comfort parameters** for employees
- **Reduction** of the **quality of the products**
- Technical capability of the **existing system**
- Disadvantage with **feed-in regulation** for renewable energies
- Conformity with **disaster protection plan**
- **Data security**

Chances

+ **Economic profit** for the company
+ Less outsourcing due to the chance of **economic production during weekend**
+ Increasing the **green image**
+ Chance for **economic attractive operation mode** of renewable electricity production **after end of the feed-in tariff**
+ Consideration of the actions within the new **energy efficiency law**

Company view: Implementation of DR

What would be a **knock-out criteria** for a participation in a DR-project?

- In most cases an **economic disadvantage** for the company
- **risk of a lower quality** of the produced goods
- **higher maintenance costs**
- **data security**

Which **additional effort** would be necessary in the company to implement a DR-system?

- Mostly **already existing production planning** system can be adapted
- consideration of technical capability of the existing systems, sometimes technical adaptations will be necessary
  - separate cabling of consumers
  - integration in process control
  - main parallel mode of generator, etc.

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Business Cases for active Hybrid-VPPs

Market - Business Cases

1. Spot/Intraday
2. **Tertiary reserve (mFRR)**
3. **Depending on pool: secondary reserve (aFRR)**
4. Minimising imbalance costs of balance responsible party
5. Potential future markets

Grid - Business Cases

Perspective of Customer

1. Minimising grid connection costs

Perspective of distribution grid operator

2. **Minimizing investment costs in grids**
3. **Upkeep of supply in cases of system incedents**
4. Minimizing grid tariffs charged by DSO / TSO

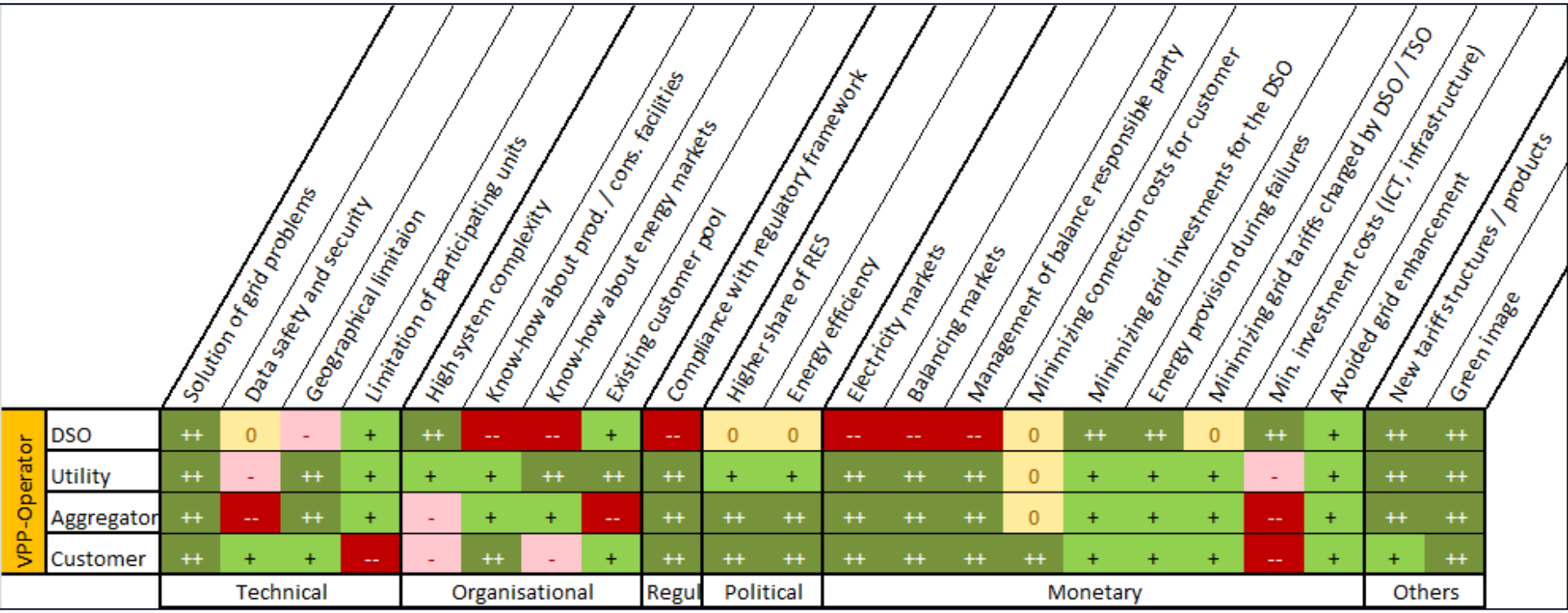
=> Combination of business cases to use cases.

Business models for active Hybrid-VPPs

Business models from perspective of potential VPP-operators

1. Distribution grid operators
2. Energy utilities
3. Aggregators
4. Big consumers with own production capacity

Qualitative assessment of the business models



VPP-Operator	Solution of grid problems	Data safety and security	Geographical limitaion	Limitation of participating units	High system complexity	Know-how about prod. / cons. facilities	Know-how about energy markets	Existing customer pool	Compliance with regulatory framework	Higher share of RES	Energy efficiency	Electricity markets	Balancing markets	Management of balance responsible party	Minimizing connection costs for customer	Minimizing grid investments for the DSO	Energy provision during failures	Minimizing grid tariffs charged by DSO / TSO	Min. investment costs (ICT, infrastructure)	Avoided grid enhancement	New tariff structures / products	Green image
DSO	++	0	-	+	++	--	--	+	--	0	0	--	--	--	0	++	++	0	++	+	++	++
Utility	++	-	++	+	+	+	++	++	++	+	+	++	++	++	0	+	+	+	-	+	++	++
Aggregator	++	--	++	+	-	+	+	--	++	++	++	++	++	++	0	+	+	+	--	+	++	++
Customer	++	+	+	--	-	++	-	+	++	++	++	++	++	++	++	+	+	+	--	+	+	++
	Technical				Organisational				Regul	Political		Monetary									Others	

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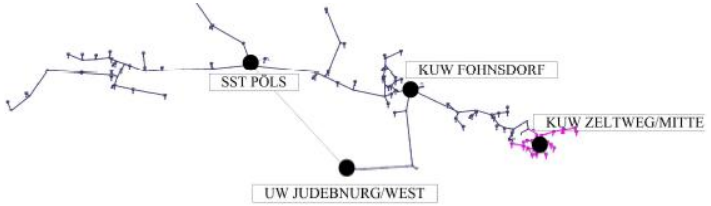
Outlook

Next steps

- Solutions proposals for unbundling issue
- Simulation model for test grids in Slovenia and Styria
- Definition and simulation of use cases
- Combination of grid and market model



- Evaluation of the use cases for different scenarios

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e!Missi0n Project **Hybrid-VPP4DSO**

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Evaluation of the use cases for different scenarios