hybrid-VPP4DSO
RECOMMENDATIONS

HYBRID VPP4DSO

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IMPRINT

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THE PROJECT

The research project hybrid-VPP4DSO concerns (active) hybrid virtual power plants (hybrid-VPPs), capable of participating in electricity markets and actively supporting (distribution-) grid operators, if required.

The main project contents were:

- Identification of critical network sections and the demand response (DR) potential in the distribution network
- Development and assessment of business models for hybrid-VPPs
- Experimental development of hybrid-VPP algorithms
- Simulation of hybrid-VPP in the distribution network
- Technical proof-of concept in a laboratory environment

Objectives of the project:

1. Electricity generation from renewable sources and corresponding consumption should be better coordinated, for example by attuning the turning on or off electric loads to the demand and supply.

2. The electricity system as a whole should be further optimized and stabilized.

3. New business and service models for hybrid virtual grids should be developed that also provide electricity customers with economic advantages.

Based on the project results, grid operators can optimize their planning of future measures and investment, while energy suppliers can offer additional services to their clients. Information concerning hybrid-VPP4DSO is demonstrably beneficial to politicians in the expansion planning of renewable energies.

The recommendations of the project are presented in this brochure.

GENERAL FRAMEWORK CONDITIONS

If sufficient flexibility is available, a hybrid-VPP can contribute to the **reduction of voltage problems** along critical network sections. This enables the power connection of new customers and of renewable feeders or a shift of a necessary grid expansion to a later point in time. It is advisable to have flexibilities placed at the end of grid sections, as over- and under voltages occur there especially.

Due to the great increase of renewable feeders in the electricity grid, the increase of e-mobility and the intensified usage of heat humps **hybrid-VPPs will both grow in importance** as costs for the grid expansion can be reduced. The higher volatility accompanying the electricity generation and the higher load peaks, which are expected, result in a higher demand of flexibility.

Currently there are many ongoing changes within the electricity balancing market. On one hand, a market separation between Austria and Germany was decided on. This has the potential of raising prices. On the other hand, the “Guideline on Electricity Balancing” (GL EB) was passed. The guideline requires cooperation for imbalance netting and a common, cross-border procurement of balancing energy with the objective of increasing the liquidity of the market. The tendency of this is to lower prices. The intermediate- and long-term price development on the Austrian balancing market is hard to predict.

Under the current framework conditions, the commercialization of flexibility with a hybrid-VPP to day-ahead and intraday market cannot be advised due to the high costs of a hybrid-VPP.

High availability, data protection and data safety are essential factors when it comes to the design of the ICT-architecture of a hybrid-VPP. The security standards impact costs significantly. Consequently, the required amount of plugged flexibilities to attain a positive business case is increased.

As such, potential adaptions of framework conditions to support the successful implementation of hybrid-VPPs as well as incentives for the respective target groups are summarized from the project team`s point of view. They have been divided for “regulatory framework” and the respective target groups, which are “distribution system operators”, “energy suppliers and aggregators” and “industrial and commercial customers and generation plants”.

REGULATORY FRAMEWORK

Creation of equivalent conditions for grid-supporting flexibility in comparison to grid expansion: in order to achieve this, the reduction of insecurities of the chargeable costs for the VPP is required. This encompasses the allowability of "smart" investments for switching infrastructure and operation costs for the VPP-operation need to be comparable with the annual upstream grid costs.

New output-parameters for grid benchmarking: if a smart grid contributes to increasing the productivity of the grid, a reduction of the peak load would currently weaken the output-parameter for the incentives regulation and consequently create a negative effect on benchmarking. Therefore, solutions in terms of new output-parameters instead of peak load are required.

Incentives for the usage of synergies. There can be good synergies, if a distribution system operator is allowed to operate the VPP: if a distribution system operator is allowed to operate the VPP, synergy effects could be used and the reduction of costs could be achieved (e.g. using the communications infrastructure, control technique for the grid including operating personnel, …). It should be checked and distribution system operators are permitted to operate and offer switching infrastructure for hybrid-VPPs as a service for market participants. In particular, the division of costs and financial recognition for the market- and grid-conducive utilization has to be clarified.

Incentives for the standardization/ harmonization of communications- and switching infrastructure: the possibility for customers to change provider is enabled and simplified and the cost for changing can be reduced. It is important to consider that innovation is still possible.

Creation of respective premises for the role of the system distribution operator as neutral market facilitator: the role of the system distribution operator should be developed further towards a neutral market facilitator. It could also include the anti-discriminatory provision of VPP-infrastructure for the market participants, as it was already realized in Slovenia. The option for customers, to change the flexibility marketer in the short period, would be supported a lot. This is being planned in the so-called "winter-package"[1] .

1 EC, 2017. Directive of the European Parliament and of the council on common rules for the internal market in electricity, COM(2016) 864 final/2, 2016/0380 (COD); online: https://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v7_864.pdf; download June 1st 2017

INCENTIVES FOR DISTRIBUTION SYSTEM OPERATORS

When future grid expansions are planned, it should be examined whether a virtual power plant can support the grid operation in order to influence the customer behaviours. This could also include the involvement of some flexibilities offered by market players. Thereby, an increase of efficiency could be attained under certain circumstances.

A hybrid-VPP could support distribution system operators especially during "short-period peak times". These can occur due to volatile feeders as e.g. PV- and wind energy plants and potential short-period overloads.

Distribution system operator as market-facilitator: the role of the distribution system operator as a market-facilitator e.g. by provision of communications infrastructure to their customers as well as measurement-, aggregation- and switching-services for aggregators/flexibility marketers offers the following benefits:

- Distribution system operators can offer both aggregators/marketers and grid customers **innovative services and use synergy effects at the same time**. Thanks to the application of the new generation of meters (smart meters), including communications- and data management infrastructures, corresponding cost advantages can be used. The setup of parallel infrastructures (VPP operator in parallel to grid operator) for communications and remote switching should be avoided, to ensure that the requirement for high data availability is met. In terms of the smart-meter-roll-out, system operators should consider the possibility of refitting the customer interfaces of the installed smart meters. Additionally, the meters can also deliver the required data (power measurement!) in intervals smaller than 15 min (e.g. 60 s, 2 s), with the consent of the customer and based on suitability of the existing communication channels (bandwidth, latency). A meter alternative should enable switching contacts.

- In the intermediate term, the distribution system operator should be able **to offer a central data-hub for all qualified market participants**. This would also support the customers in changing to other aggregators, in the short-term, as foreseen in the current draft of the "winter package".

- The distribution system operator benefits from the **access to further information about the grid operation** and the exact condition of the flexibilities **unified with the option to control or if needed adapt switching proceedings**.

INCENTIVES FOR ENERGY PROVIDERS AND AGGREGATORS

Increased customer loyalty through new services for customers by means of hybrid-VPP: through operation of the hybrid-VPP by the energy provider operators of small and medium-sized plants (e.g. hydro plants), they are enabled to participate in the balancing market and can offer customers an additional services. Like that, customer loyalty can be strengthened.

Better estimation of amount of imbalance for imbalance settlement of balance group: the hybrid-VPP offers the energy provider a better overview of the customer plants and enables an improved day-ahead prediction through the increased dada availability. Consequently, the required amount of imbalance can be reduced and the additional information can be used, in real time, to estimate the short-period requirement of balancing energy.

Participation of the hybrid-VPP in the balancing market is economically interesting: the participation of the hybrid-VPP in the market of tertiary balance energy is for both the operator of the hybrid-VPP and for the provider of flexibilities, under current market framework conditions, economically interesting. The usage of price differences on the spot market by a hybrid-VPP is currently not economically attractive.

Minimum size of a hybrid-VPP: for economic reasons a hybrid-VPP should provide flexibilities with a minimum 15 MW and with availabilities higher than 65%. The profitability improves with increasing flexibility (power and availability) per connection point.

Useful contract duration for a hybrid-VPP: from the viewpoint of the aggregator the contract duration should be longer than one year, with two years being even better. Longer durations are rather unpopular among customers; for shorter durations, the sufficient predictability is lacking for the system distribution operator. The short-term changing option for customers to other aggregators as quoted in the “winter package” would hinder the business case for a hybrid-VPP.

INCENCTIVES FOR INDUSTRIAL AND COMMERCIAL CUSTOMERS AND GENERATION PLANTS

Prevention of connection costs for new customers or for extensions: if the feeding in or the consumption is switchable by use of a hybrid-VPP, this can contribute to a simplification or acceleration of grid access and respectively lower grid connection costs can be achieved.

Additional benefit from visualization of user behaviour: the VPP enables the capture of user behaviour (based on minutes) and provides additional value for interested companies (e.g. by visualising the available potential to reduce load peaks, the performance based grid usage fee can be optimized, etc.).

Economic benefit for customers by reduction of power failure: the economic benefit for the customers by reduced power failures, due to environmental impacts or predicted maintenance, can be considerable through utilisation of a VPP.

The usage of flexibility is especially relevant for the following generators: connection (positive balancing energy) of CHPs, storage hydro power plants, emergency generators, gas turbines etc. or reduction of feeders (negative balancing energy), when on short notice additionally a minimum of 300 kW per location and switching duration of a minimum of 4 h are possible. The setting to an external index value should work within 10 min.

Power plants with ongoing green electricity tariff-funding are not permitted to participate in the Austrian balancing market according to current legal framework (status: 04/2017).

Wind power is only partly eligible, as the supply of balancing power cannot be ensured. Therefore, it is only allowed to participate in the balancing market when pooled together with another technology as a failure reserve.

The usage of flexibility is especially relevant for the following loads: shutdown or start of production processes, if the process is pre-qualifiable (only, if a constant electrical power can be ensured with the measure/ power switching; power/load variable to 3% accuracy). Well suited are therefore e.g. electrolytic processes, electric heat, variable heat pumps and cooling machines, charging stations for e-mobility etc., if at least 300 kW per location can be switched over a period of at least 4 h. The setting of the index value should be possible for the tertiary balancing market within 10 min.

From today's point of view, the most relevant switching times are:

- Positive balancing energy (connection of producers, cut-off of loads): in summer on weekdays from 4 to 8 a.m. and from 4 to 8 p.m.; in winter mainly from 4 to 8 p.m.
- Negative balancing energy (cut-off of producers, connection of loads): during the entire weekend 24 h and on weekdays from 0 to 4 a.m., in the future possibly also from 4 to 8 a.m.

Lead time for the demand of flexibility: the shorter, the better; ideally ≤10 min; flexibilities with lead times of 24 h and more are hardly applicable unprofitable commercialisation.

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