CONGESTION MANAGEMENT ON THE DISTRIBUTION GRID BY CURTAILMENT OF GENERATION

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The shift from centralized towards decentralized electricity generation challenges the distribution grid. Local congestions will occur more often necessitating the further development of congestion management rules. FEBEG favors a market based congestion management system as enduring solution.

1. CURTAILMENT OF GENERATION

Distribution System Operators (DSO's) claim the right to curtail generation, ex-ante or in real-time, to manage the congestion in the distribution grid: in certain circumstances such an intervention is considered as unavoidable to guarantee the stability and security of the grid.
Curtailment of a generation facility, e.g. wind turbine, biomass unit, cogeneration, …, means that the concerned facility is **obliged to reduce its output to a lower level or to zero at the request of the DSO.**

2. IMPACT OF CURTAILMENT OF GENERATION

Generator

Needless to say that a curtailment action has an immediate impact on the generator: during the period of curtailment the generator will have no or lower revenues (no electricity to sell, no green certificates, …) while he still has fixed costs to cover. **Instead of generating revenues, the generator will thus be making a loss during the period of curtailment**.
Any investment decision for a generation facility is based on a positive business case and a sufficient return on investment. As the fixed costs for some technologies, e.g. wind turbines, are rather high, the expected number of operating hours is a determining factor. Potential curtailment by the DSO will, in that respect, **increase uncertainty about the revenues and thus add risks to the projects which will result in higher financing costs**.

BRP

Curtailment of a generation facility will also have an impact on the underlying Balancing Responsible Party (BRP) having the balancing responsibility for the curtailed facility.
The expected output of the generation facility is part of the sourcing portfolio of the BRP to cover the demand of his customers. When the forecasted output is not there due to the curtailment, the BRP will have to look for replacement energy that he will have to source on the day-ahead, intraday or balancing market. As the curtailment action disturbs the optimal dispatch (merit order) **the non-generated energy will have to be replaced by other – usually more expensive – generation**.
A curtailment action in real-time will, on top of that, **create an imbalance for the BRP who risks – depending on the market circumstances – to be confronted with an imbalance cost.**
To limit these risks, the BRP/retailer will have no other choice than to translate this loss of quality of generated energy into a reduced contract price to be paid to the generator.

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3. BALANCE OF THE SYSTEM IS KEY

Congestion management should not have an impact on the functioning of the wholesale markets. This is a key principle for a robust market design that is also supported by European legislation and as such applied by the Transmission System Operator (TSO) in Belgium. As a consequence, neutralization of the perimeter of the BRP is necessary for the following reasons:

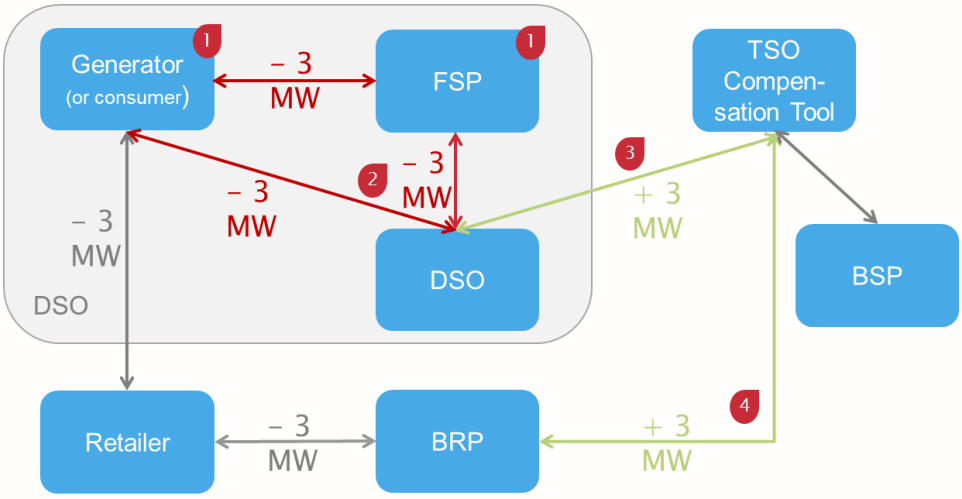
- every unilateral action of a third party in the perimeter of the BRP creates an imbalance for the BRP;
- a BRP should not have any financial impact due to an imbalance caused by an intervention of a third party;
- third parties are responsible for their own actions: a BRP cannot be held responsible for actions of third parties which he did not want and which he cannot control.

FEBEG proposes a model for congestion management on the distribution grid that is cost-efficient and that guarantees system balance – on a BRP portfolio level – at all times. Not ensuring the system balance will generate additional costs and risks that the BRP/retailer eventually will have to translate in a reduced contract price paid by the BRP to the generator.

4. MODEL FOR CONGESTION MANAGEMENT

Neutralization of the BRP via 'redispatch'

FEBEG proposes to neutralize the perimeter of the BRP via a mechanism of '**redispatch', i.e. a mechanism that ensures that the BRP remains balanced by neutralizing the impact of the congestion management measure on the BRP with energy that is injected elsewhere in the system**.



Process

1 *Congestion bid*

A congestion bid is an offer to the DSO with the modalities to be curtailed. **This congestion bid can be obligatory or voluntary:**

- a generator is obliged to make a congestion bid when technical flexibility is imposed in the connection contract between the generator and the DSO, i.e. a **flexible connection contract**;
- all other grid users can voluntary make congestion bids – directly or via a FSP – based as on a **commercial agreement** with the DSO: these grid users can be generators with a connection agreement with guaranteed fixed capacity or consumers that can increase their consumption locally in order to avoid that a generation facility needs to be curtailed.

As he will not have to make certain costs, the congestion bid indicates the amount that the generator or consumer will pay to the DSO for each quarter of an hour of curtailment. For a generator this will be the variable running costs (fuel cost, CO_2-costs, maintenance, …- green certificate); for a consumer this will be the electricity price in the supply contract minus operational costs.
The modalities of these congestion bids should be determined in the flexible connection contract or in the commercial agreement with the DSO. Ideally these bids can be updated on a short-term basis, but in a first phase they could be an attachment to the flexible connection contract and the commercial agreement with a possibility to update them on a yearly basis.

2 *Activation of the congestion bid*

The DSO selects a congestion bid. If multiple congestion bids are available to solve a particular congestion, the DSO selects the most favorable congestion bid, i.e. the bid that generates the most revenues for the DSO. This **merit order of congestion bids** will also respect an environmental logic: as renewable energy sources have lower variable running costs and therefore less 'avoided costs', they will be at the end of the merit order and selected as last.
The DSO activates the congestion bid by sending a set point to the concerned generator or FSP, e.g. limit generation to 7 MW.
The congestion bid will be invoiced and settled according to the modalities in the flexible connection contract or in the commercial agreement with the DSO.

3 *Activation of the compensation bid*

The **DSO estimates the curtailed volume based on a 'reference profile'**, e.g. reference profile of 10 MW minus set point of 7 MW equals to an activated flexibility volume of 3 MW.
At the same time the DSO sends a set point, **the DSO sends the estimated curtailed volume, e.g. 3 MW, for 'redispatch' to the TSO Compensation Tool.**

Reference profile

Principle
Generators should be able to **freely choose** between 'nominations' and 'historical data' as reference profile for the DSO's to determine the curtailed volumes.

Nominations
Nominations are the most accurate estimations by the BRP of the expected generation: therefore nominations ensure **coherence between markets** respecting the flexibility value chain. When nominations are already used to valorize flexibility in the balancing market, e.g. cogeneration unit supplying R2, they allow to make a trade-off for the use of flexibility in different markets.

Historical data
A distinction should be made between dispatchable (e.g. biomass, cogeneration, gas motor, …) and limited dispatchable (e.g. wind turbines) generation units. For dispatchable units a reference profile based on the historical data of the specific unit can be used. With respect to the limited dispatchable units, it makes more sense to use a reference profile based on historical data in a geographical area, e.g. country, region, province, …

4 *TSO Compensation Tool*

As only the TSO can correct the perimeter of the BRP, the Compensation Tool should be managed by the TSO which implies cooperation between the DSO's and the TSO.
The TSO Compensation Tool consists of a merit order with compensation bids: all market parties should be able to submit compensation bids to the TSO Compensation Tool. A compensation bid indicates the price that will have to be paid to increase generation or lower consumption.
When the TSO Compensation Tools receives the estimated curtailed volume for a generation facility, **it will correct the perimeter of the underlying BRP and activate a compensation bid for the required volume, e.g. +3 MW**.

Settlement

As the curtailed energy is injected in the system elsewhere and the perimeter of the BRP is corrected**, the global system will be in balance and the BRP will not be impacted by the curtailment of a generation facility in its portfolio: the BRP/retailer will pay the generator for the energy like if no curtailment has taken place**. As the BRP also doesn't risk to be confronted with an imbalance, he will not price this risk into his contract with the generator.
Off course **some discrepancies will occur**, i.e. differences between the estimated curtailed volume and the actually realized curtailed volume, e.g. – 3,5 MW in reality instead of the estimated – 3 MW. Several solutions are possible to settle these discrepancies: or the DSO informs the retailer about discrepancies to be settled between the retailer and the generator, or the TSO informs the BRP about discrepancies via the imbalance billing, …

10 ADVANTAGES

1. The proposed model for congestion management is market based and cost-efficient.
2. It ensures a level playing field between all grid users.
3. As the perimeter of the BRP is corrected, the congestion management measures have no influence on the functioning of the wholesale market.
4. The flexibility market is incentivized as the FSP can participate by submitting either congestion bids or compensation bids.
5. The DSO can select the most favorable bid (merit order) to solve a local congestion respecting an environmental logic.
6. The curtailed energy is replaced by the cheapest available energy (merit order) in the whole country.
7. The cost for the DSO is limited to the difference between the congestion bid and the compensation bid.
8. The remaining cost for the DSO ensures a proper incentive to continue to invest in the grid.
9. The business cases of generators are not impacted at all as the model is neutral for the generator.
10. The proposal builds upon existing tools or tools under development, e.g. bid ladder.