
APPENDIX ON ADEQUACY PATCH

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1. INTRODUCTION

The simulations performed in this study consider an economic dispatch model which aims to minimize the total systems costs or equivalently maximize the total welfare of the system. In relation to the possible occurrence of Energy Non-Served (ENS), the 'ENS' penalty term = $VoLL * ENS$, is part of the total system cost. ENS is thus priced at the Value of Lost Load 'VoLL' set in the model (which in the simulations is actually equal to the Day Ahead Price Cap). In hours in which ENS might occur within the modelled perimeter, the economic dispatch model tries to find solution with the lowest global ENS. However, the situation leading to the minimum global ENS, might in turn lead to a 'non-fair' distribution of ENS among countries in structural shortage, ie countries needing imports to ensure its adequacy. A mitigation measure has been implemented in the electricity market to prevent these situations from occurring. The principles of this mitigation measure are presented in this appendix.

2. IMPLEMENTATION IN EUPHEMIA

Within the EUPHEMIA algorithm (PCR Market Coupling Algorithm [ADQ-1]), a mitigation measure has been implemented to prevent price-taking orders (orders submitted at the price bounds set in the market coupling framework) to be curtailed because of 'flow factor competition'.

The solution implemented in EUPHEMIA within flow-based market coupling (FBMC) follows the curtailment sharing principles that already existed under ATC/NTC. The objective is to equalize the ratio of curtailment (\sim Energy Non Served (ENS)) between bidding zones as much as possible.

3. FLOW FACTOR COMPETITION

If two possible market transactions generate the same welfare, the one having the lowest impact on the scarce transmission capacity will be selected first. It also means that, in order to optimize the use of the grid and to maximize the market welfare, some sell (/buy) bids with lower (/higher) prices than other sell (/buy) bids might not be selected within the flow-based allocation. This is a well-known and intrinsic property of flowbased referred to as 'flow factor competition'.

4. FLOW FACTOR COMPETITION AND PRICE TAKING ORDERS

Under normal FBMC circumstances, 'flow factor competition' is accepted as it leads to maximal overall welfare. However for the special case where the situation is exceptionally stressed e.g. due to scarcity in one particular zone, 'flow factor competition' could lead to a situation where order curtailment takes place non-intuitively. This could mean e.g. that some buyers which are ready to pay any price to import energy would be rejected while lower buy bids in other bidding areas are selected instead, due to 'flow factor competition'. These 'pay-any-price' orders are also referred to as 'Price Taking Orders', which are valued at the market price cap in the market coupling. This would lead to the situation where one bidding area is curtailed while the clearing prices in the other bidding areas are lower or equal to the market price cap. This is the situation that the adequacy patch seeks to mitigate by 'by-passing' flow factor competition in such cases and ensuring maximal imports for zones experiencing curtailment.

5. CURTAILMENT SHARING

The situation becomes more complex when two or more markets are simultaneously in curtailment /e facing a scarcity situation. For these situations, the mechanism put in place aims to 'fairly' distribute the curtailments across the involved markets by equalizing the curtailed price-taking orders to total price-taking orders ratio between the curtailed zones. The curtailment sharing is implemented by adding a large penalty term into the primal problem plus solving a sub-optimization problem for the minimization and sharing of curtailment, where all network constraints are enforced, but only the acceptance of the price taking volume is considered in the objective function. The curtailment ratios weighted by the volumes of price taking orders are therefore minimized (see EUPHEMIA public description for details [ADQ-1]). The results of this study are taking into account those curtailment minimization and sharing rules by applying those after the optimization found by ANTARES.

REFERENCES

[ADQ-1] <http://www.nemo-committee.eu/assets/files/euphemia-public-description.pdf>