

# ***ECONOMIC CURTAILMENT OF RENEWABLE ENERGY SOURCES***

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## **Overview**

Curtailement of renewables is only allowed today when it is necessary to guarantee the safety of the system. Yet, in a power system featuring a large share of intermittent renewable energy sources (RES) and inflexible thermal generators, efficiency gains on generation costs could be achieved by curtailing the production of RES. Of course, as RES feature very low variable production costs, over-curtailement can also be costly. This trade-off is driven by the flexibility of the generation mix and the variability of RES output.

When the decision to curtail production is left to generators, there is furthermore a competition issue, as producers might have incentives to depart from the optimal level of curtailment (maximising the total system welfare). These incentives will be modified if the remuneration of RES generators is based on market prices or on a premium, and if curtailment is compensated or not.

## **Method**

A two-period stylised model is employed in order to take into account both the variability of RES output and the flexibility of the generation mix.

Demand is constant over both periods. RES is available in the first-period, but availability is uncertain in the second period. Only part of the thermal resources that were not generating in the first period are then able to start-up/ramp-up to generate in the second period.

Thermal generators bid competitively, and RES producers offer their production at a zero-marginal cost. However RES producers can choose to curtail production in the first time-period.

We consider different remuneration schemes for RES (market-based and/or premium) and different compensation schemes in case of curtailment.

The optimal level of curtailment is then determined, as well as the level maximising the profits of RES producers, and the level of maximising the profits of all generators (both thermal and RES). Results are mapped for different values of system flexibility, installed RES capacity and RES variability.

## **Results**

Curtailement RES generation is rationale in case of high variability of RES output and limited flexibility of the generation mix. The impact of curtailment (price-impact and volume-impact) is different for each stakeholder (consumers, thermal generators, RES generators) and varies with the installed RES capacity and the system flexibility. RES can benefit from curtailment even without a compensation scheme.

However, generators have incentives to depart from the optimal level of curtailment. They can withdraw capacity by curtailing too much of the production, or they can curtail too little of the production. This will be especially the case if RES and thermal generators are integrated within a single company.

## **Conclusions**

These results have strong policy implications. They show that while smart curtailment schemes could reduce cycling costs and help mitigate the costs of RES variability, it will raise competition issues. A possible solution would then be to have a third-agent, such as the system operator, monitoring these curtailment decisions. It implies that the system operator should then have access to quality forecasts of RES production.

## **References**

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