Market-based redispatch: a no-regrets option

smartEn Position Paper

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ABSTRACT

With an increase of variable RES and the further electrification of the energy system, physical congestions caused by grid constraints will be more common. Redispatching is an alleviating action to reduce these constraints that can be performed by changing the dispatching from generators, through curtailment, or otherwise restricting injection or demand. Redispatching can be performed mainly in two ways:

- Regulated approach (or rule-based approach) in which the System Operator (SO) centrally plans and mandates any redispatching actions.
- Market-based approach in which the SO asks on a voluntary basis the market to adjust production or demand at either side of the congestion.

While the market-based approach is backed by the Electricity Market Regulation and Directive, concerns of inc-dec gaming and market power by participants has driven some countries, in particular Germany, towards a regulated approach.
The objective of this position paper is to address the concerns and benefits of a market-based approach, how the existing legislation covers the risks, and proposes mitigating measures and tools for National Regulatory Agencies and SO to fully overcome them.

INTRODUCTION

Across Europe, network congestion has been increasing at both transmission and distribution levels, driven in particular by the uptake of variable renewable energy and decentralised resources, as well as delays in network expansion. The further uptake of electric vehicles, heat pumps and other electric appliances adds a new dimension to the challenge[1], especially at distribution level. These appliances add substantial new load, but at the same time have the potential to be significant flexibility resources.

Relying only on grid investments to cope with this challenge could take too long to realise and would be very expensive. On the other hand, making use of distributed flexibility resources not only for transmission but also for distribution network management can lead to *very* significant cost savings and much more efficient integration of renewable energy sources.[2] This is recognised by the Electricity Market Directive in Article 32 where it establishes, as a key element, that Distribution System Operators (DSOs) should procure flexibility services where these are cheaper than grid expansion.[3] It also indicates that incentive structures for DSOs should be adapted and DSOs "shall procure such services in accordance with transparent, non-discriminatory and market-based procedures."[4]

System operators and regulators could address congestion issues in several ways, each with their own challenges:

1. Market-based redispatch
2. Substantial grid reinforcement
3. Bidding zone reconfiguration, to smaller areas, moving towards a nodal market design rather than a zonal design
4. Dynamic grid usage charges that reflect in real time the needs of the grid
5. A rule-based approach on redispatch

smartEn believes that the best suited approach – achievable in the short term, while fully using the potential of the demand side and providing a cost-efficient solution to congestions – is to combine market-based redispatch with strategic grid reinforcement.

What is market-based redispatch and what are its benefits?

In case of congestion, redispatch consists of the system operator (SO) instructing market participants to change their positions, either by increasing or reducing production and consumption depending on the side of the congestion the market participant finds itself. In short, the SO can ask the market participant (generation,demand side and storage) to adjust their consumption or injection. Adjustments are made after the closure of day-ahead and intraday markets.

The approach taken by the SO can be either regulated, where participation is mandatory (e.g. in Germany) for generators above a certain size and the SO would force adjustments of production

[1] As estimated by the European Commission in its Energy System Integration Strategy, the share of electricity in final energy consumption will grow from 23% today to around 30% in 2030 and towards 50% by 2050.
[2] See e.g. Imperial College/ NERA for the UK Committee on Climate Change: https://www.theccc.org.uk/wp-content/uploads/2015/10/CCC_Externalities_report_Imperial_Final_21Oct20151.pdf
[3] Art. 32 in the Directive for the Internal Market in Electricity (Recast) 2019
[4] Art. 32 in the Directive for the Internal Market in Electricity (Recast) 2019

or demand paid out on a regulated price, or market-based, where actions are dispatched on the basis of freely offered prices from parties that choose to participate.

Market-based approach bases the redispatch decision on price signals linked to the need for redispatch action. It acts after the wholesale market (day-ahead and intraday markets), operating in a similar manner to the already existing balancing markets and other ancillary services. This mechanism engages generation,demand and storage to solve congestions in the cheapest way. It serves as a cost-effective alternative to expensive grid reinforcement while increasing the overall system efficiency.

The benefits of a market-based redispatch are various:

- Increased competition due to a wider spectrum of technologies participating

A market mechanism facilitates the inclusion of flexibility. DSF does not have the same cost structures as traditional generation. Rather, it has opportunity costs that vary with time, location and the individual providing it. These aspects cannot be determined through a cost-based approach which is more appropriate for generation assets. Adopting a regulated approach to redispatch means that only generators will provide it, while a market-based approach fosters the participation of all technologies.

- Increased transparency

In many European countries, the network components of consumer bills have been rising significantly, but information on the actual causes of this is often unknown: system management actions appear to general market actors as a "black box". If congestion management actions are based on bilateral agreements or obligations, this naturally centralises knowledge and power with system operators. Regulatory oversight is often challenging, especially because transparent information on market alternatives is not usually available in such cases.

Instead, a market-based approach can bring transparency to system management challenges and congestion problems, It reveals the variety of flexibility services available in the market, allowing the most cost-effective solutions to be identified. Allowing a wide variety of resources, including Demand Side Flexibility (DSF), to compete to provide congestion management services will increase liquidity and reduce the likelihood of any market party being able to exercise market power. The potential of this approach is already well understood from the procurement of ancillary services for transmission system management, which has produced cost-effective outcomes, even though the flexibility potentials are still far from being fully developed.[5]

- Reduced grid reinforcement investment costs

Market-based procurement of congestion management has proven to be cheaper for the SO, in the majority of cases with structural congestions, and in turn for the end consumer. It will play a significant role in reducing the needs for additional grid investment to support the electrification of the economy. The European Commission estimates that, if DSOs were able to solve local congestion through flexibility markets, the EU could save up to €5 billion per year in avoided investments by 2030[6].

[5] The smartEn Map EU Balancing Markets 2018
[6] https://ec.europa.eu/commission/commissioners/2019-2024/simson/announcements/speech-commissioner-simson-smart-energy-europe-smarten-online-symposium_en

Cost-based/regulated congestion management is geared towards generation assets, leaving out Demand Response (DR) because it does not fit into the operational, costs-oriented structure. Market-based redispatch would open the participation to the cheapest and most efficient technologies at any given moment. For example, through this approach, grid investments in Germany to support the connection of new loads, storage and RES generation would be reduced by an estimated 55% by 2035 according to E-Bridge[7]. This would amount to total savings in this period of €20 billion.

- Cost-effective integration of variable RES and environmental benefits

A true market for congestion management, with a technology-neutral (and inclusive) approach, will not only have financial benefits and ensure social welfare, but will also play a role in better integrating RES in the grid. According to a study by E-Bridge[8], the increase of flexibility through a market-based approach would reduce the need for RES curtailment in Germany by up to 65%, with the significant environmental benefit of avoiding the emission of 1.5 million tonnes of CO_2 per year.

Concerns and risks surrounding market-based redispatch

The concerns around market-based redispatch are related to the potential for abuse of the market. Strategic bidding is made possible by the structural design of European electricity markets based on subsequent markets: after the initial wholesale markets (day-ahead and intraday markets), the redispatch market would alleviate congestions closer to real-time.

The literature on market-based redispatch has raised two main concerns that could reduce its societal benefits:

- Locational market power resulting in limited liquidity, that could result in higher prices than through a regulated approach.
- The potential for strategic bidding by taking advantage of the way that the redispatch market acts after the wholesale market. Market players could bid strategically in the wholesale market to create congestion, with the aim of being paid for solving this very congestion in the redispatch market. This is also known as inc-dec gaming.

Inc-dec gaming is discussed in several papers which are mostly focussed on the transmission level, where redispatch actions are more prevalent. However, these concerns are also being used as arguments against local congestion management.[9]
These papers focus on traditional generation and very large consumers, suggesting that they would be willing to bid into zonal wholesale markets, without the intention of delivering, so as to benefit from the correction in the redispatch market. The papers assume that DR providers would be moved by the same set of incentives.
However, some specificities apply to the demand side, that minimise the impact it can have on incentives for inc-dec gaming[10]:

- Impact on prices: participation of demand can reduce the potential benefits of a generator engaging in inc-dec gaming by tightening the gap between the redispatch price and the day-ahead price.

[7] https://www.e-bridge.de/wp-content/uploads/2019/02/20190212_Studie-E-Bridge_Vorteil_netzdienlicher-Flexibilit%C3%A4t_final.pdf
[8] Same as reference 7
[9] Hirth et al (2019), Hirth & Schlecht (2020)
[10] NODES, DNV-GL "Market-based redispatch in in the distribution grid" (2020)

- Demand is volatile, sensitive to price variations, and depends on external factors, like human behaviour, that might make short-term forecasting of congestion difficult. As gaming relies on forecasting of congestion, inclusion of demand side participants reduces the potential benefits.
- Different incentives for generators and demand: generators extract their benefits from the difference between production costs and the market price. The demand side extracts its benefit from marginal cost of using an additional unit of energy.
- The demand sides' main activities are not the production of energy. Their main focus can be an industrial process or provision of commercial services. Hence their main interest will be in continuing with that activity. Penalties and risks associated to gaming can be too costly to consider them.

In general terms, strategic bidding can be caused by:

- **Structural congestion:** A combination of structural congestion and inappropriate bidding zones can cause strategic bidding (see southern Norway price zone case below). In these cases, strategic bidding could be the logical conclusion given the existing information on potential success. This can be exacerbated if the risk of penalties is below the potential benefits from this action. But where structural congestion happens, market actors have already the information on the potential of success for their bidding strategy. Structural congestion issues need to be assessed either from the grid-reinforcement side and from the bidding zone design perspective. Bidding zones should be reflective of structural congestion and designed to alleviate them and to reflect these issues through prices rather than taking the less efficient solution of regulated redispatch.
- **Forecasting congestion:** Being able to forecast structural congestions, due to available information on transmission capacity, or due to reduced number of market participants can incentivise inc-dec gaming strategies making them the benefit-maximising strategy.

Several of the mitigating measures included in the following sections address these causes of strategic bidding.

How to overcome the risks and successfully implement local flexibility markets

While these concerns regarding inc-dec gaming and locational market power are to be taken seriously, there is a risk that they could be used as a blanket argument against a market-based approach.

Market abuse concerns are not unique and particular to congestion management nor to the electricity system. All market mechanisms can be prone to strategic bidding and gaming behaviour. The same risk was present in the design of balancing services and can also affect other models. In that context, policymakers didn't decide that, due to the potential for such behaviour, markets were impractical and so all power systems should continue to be run through central planning.

Concerns over market power and abuse have been addressed before, in particular in electricity markets, and solved through unbundling and the implementation of competition law. Concerns about the potential for market abuse should not be allowed to halt the kinds of development and innovation necessary for the EU to achieve its climate targets in a timely and cost-effective manner. Instead, the concerns should be addressed.

On the contrary, the potential for distortive and discriminatory practices in the electricity system is typically much higher when system operators act outside of a market framework. Well-designed flexibility markets, with the appropriate control and market monitoring measures should be able to avoid the incentives for gaming.

Some countries are already using markets to address zonal congestion, with significant success. They have proven that as soon as the market is given the chance to develop, liquidity and competition can be expected to improve. It helps unlock innovative solutions, including demand response and other digitally-driven options that can often be accessed and developed within short time periods.

Mitigating measures

To mitigate risks of inc-dec gaming and enhance fully market-based redispatch mechanisms, a comprehensive set of regulations and control mechanisms can be established or further enforced and amplified if already existing.

Together with these mitigating measures it is necessary to fully implement the Electricity Market Design legislation. European legislation through the Electricity Market Directive and Regulation mandates the procurement of grid services through a market-based approach. In particular Article 13 of the Electricity Market Regulation for redispatching activities and Article 32 of the Electricity Market Directive for procurement of services by DSOs. At the date of writing a significant lagging can be observed in the implementation and transposition into national law of these legislative packages.

Mitigating measures follow two principles. First, that an increase in competition will reduce the expected benefits of gaming. And second, that an increased risk of detection and fines will lower the interest in inc-dec gaming.

1. **Independent market monitoring**: If there is concern about the potential for inc-dec gaming, NRAs can introduce mechanisms, through an observatory body, to spot cases of inc-dec gaming and impose sanctions. Market-based procurement of flexibility can also be measured against the traditional option of network expansion. Any financial impacts on system operation from a potential abuse of market power would thus be limited, compared with the status quo. NRAs have similar roles in different areas of the electricity sector, and there is no reason congestion management should not be treated in the same way.
2. **Enforcing and expanding existing legislation**: EU regulation bans inc-dec gaming under competition law. Regulations already exist to guarantee the consistency of wholesale markets. Since strategic bidding involves both the wholesale market and the congestion market and it has adverse effects on final customers and social welfare, following and enforcing transparency provisions from REMIT (Reg 2011/1227)[11] (Regulation of Wholesale Energy Market Integrity and Transparency) and the Transparency Regulation (Reg 2013/543) is mandatory.Through enforcement of the competition law, REMIT and other regulation NRAs have the right tools to prevent inc-dec gaming strategies. Some countries have introduced specific regulatory frameworks for congestion management that consider the possibility of strategic bidding. One such case is Norway, where the TSO is entitled to ignore the price offered if there is indication of strategic bidding or if the price is not socio-economically beneficial.z

[11] REMIT Quarterly issue No. 24 / Q1 2021

3. **Randomised activation:** Another alternative to reduce incentives for gaming would be an element of randomised activation. This small amount of added uncertainty would make strategic bidding far riskier, undermining the attractiveness of such activity.
4. **Baseline & compliance methodology:** Where consumers/aggregators are providing DR in the wholesale and redispatch markets, proper baseline and compliance methodologies would prevent them from bidding volumes that they would not be able to deliver. A generator's baseline is usually zero quantity, i.e., the generator will not produce if it has no offer. While a consumer's baseline is based on their normal consumption patterns. A failed inc-dec gaming effort could have costly effects on their normal activity, forcing them to purchase the difference at higher prices. Significant changes in their baseline could also be easily detectable by monitoring agencies.
5. **Reference level prices:** A reference level scenario can be established for different periods. Reference level prices can be then compared to bids or market prices in competitive periods. Significant deviations (i.e., anomalously high prices in the redispatch market and/or anomalously low ones in the wholesale market) from the reference levels would warrant an ex-post investigation, and the risk of a fine in case of strategic bidding.
6. **Technology-neutral products in all markets**: A technology neutral product design is backed by the Electricity Market Design, and should be fully implemented to ensure the participation of flexible loads in all products. Inc-dec gaming is a practice observed almost exclusively in generators (e.g., the UK case mentioned above). With the inclusion of flexible loads and DR in all markets, and in particular congestion management, generators seeking to create artificial situations in order to benefit from them would tend to be undercut by cheaper bids provided by DR. DR does not have the opportunity to create congestions in the wholesale market which are the cornerstone of strategic bidding behaviour.

Mitigating measures in practice

- **Transmission Constraint Licence Condition (TCLC) in the UK**[12]: Ofgem established the TCLC as a response to concerns of gaming and market power in the balancing system by generators charging unduly high prices to the system operator. These generators were exploiting a constraint in the transmission grid. The TCLC is geared towards generators during periods with congestion issues due to the incapacity of the grid to absorb or export all the injections. When the system operator needs to redispatch the generation in order to avoid the congestion, and the generator obtains a financial benefit from it, the TCLC limits the generator from obtaining an excessive benefit from its action. To assess if a generator is either paying the SO an excessively low amount or is seeking to receive an excessively high payment from the SO in order to adjust their injection, Ofgem will assess the bid against comparable generator bids and such as the generator's Stable Export Limit (SEL). With this control mechanism ofgem has limited the potential market abuse by generators. According to their own assessment, the TCLC has delivered £156m in cost savings while allowing the continuation of a market-based approach to congestion management.

- **Bid rejection in Norway**: The Nord Pool market, one of the most competitive and liquid electricity markets in the world, has also taken on significant measures to avoid gaming in different markets. In particular in the south of Norway, where generators could use

[12] https://www.ofgem.gov.uk/publications-and-updates/final-decision-guidance-transmission-constraint-licence-condition

Nordpool's constraints on available transmission capacity to create artificial congestion. After observing an average 19.5% increase above the marginal cost in certain times of the day the Norwegian TSO, Statnett, introduced a bid selection process, where if bids exceed the marginal cost by a significant amount, they can be dismissed and possibly incur in fines if repeated.

- **The German-Danish situation**: A frequent example is the physical congestion in the border between Germany and Denmark, where there is potential for gaming on the Danish side due to Energinet's use of the manual frequency reserve (mFRR) as a redispatch mechanism. The Balance Responsible Party (BRPs) of generation units could create artificial congestion in the wholesale market, and offer to solve this congestion through bids in the mFRR market. Energinet was concerned about this, so monitors the BRPs' total purchases/sales and final imbalances in relation to the used mFRR. However, where anomalies have been found they have been attributed to the difficulty to predict the needs of mFRR and not necessarily to strategic behaviours. In this case, Energinet has acknowledged the risk of gaming, has introduced monitoring measures, and through them concluded that no gaming practices are actually happening.

- **The Netherlands**: TenneT has introduced a series of measures to avoid gaming in congestion management. First a Cost-Benefit Analysis (CBA) is performed in order to assess the grids needs. If grid reinforcements are not viable or would require additional time, market-based congestion management is introduced. To avoid gaming, a series of requirements are introduced in the market design:

    - A minimum of three competing market participants
    - DR participation, together with generation and storage
    - Intervention in case of suspicious bids
    - Penalties and bidding-zone splitting might be applied

  The threat of bidding-zone splitting and the competitive nature of the market encourage the self-policing of the participant's behaviour. If one market participant observes suspicious bids, they have incentives to report them to the SO and regulator.

These practical examples highlight that, even though the risk of gaming is present and should be considered, they are not insurmountable, and with appropriate rules and mitigating measures, the negative effects can be reined in, allowing the benefits of a market-based approach.

Interim alternatives to fully market-based redispatch

Although system operators, market players and NRAs should be moving towards fully market-based redispatch, there are some transitional alternatives that could be used to address congestion management efficiently in the nearer term:

1. **Hybrid model**: The hybrid model presents a combination of regulated and market-based approach, as a first step towards the move of a full market. The main concerns about inc-dec gaming arise from the incentives on large generators, which do not apply to DSF providers. The hybrid model would have a regulated approach for generation and would add a market-based solution for DSF providers. This approach has also been suggested

by the enera[13] project in Germany. It combines a cost-based compensation for generation and storage over 100 kW with a market-based approach for DR and small-scale generation. Bids submitted by market actors have to compete against the regulated prices of generation. In this case, the market-based bids will only be selected if they are competitive and below the regulated prices.

2. **Capacity-based markets and long-term contracts:** The higher the participation in the local flexibility market, the less incentive there will be for strategic bidding, as participants face a higher risk of being underbid by flexibility providers with a lower marginal cost.

   If the market is not yet developed or there is systemic low participation, the system operator can offer long-term contracts through tenders to attract demand-side providers of flexibility. Such capacity-based products would be voluntary and remunerate either installed capacity or actual availability. Long-term capacity-based procurement is also desirable for system operators, as it can give them confidence that sufficient resources will be available far enough into the future, so that they can avoid launching grid reinforcement projects. This would ensure stability for both parties and guarantee a fair price.

CONCLUSION: Getting started

With the increasing role of decentralised generation and the significant steps being taken towards electrification of the economy, system operators will have to adapt to a new way of system management. In the new energy system and with the participation of active consumers it will be increasingly difficult to justify mandatory mechanisms that do not empower prosumers and take advantage of the flexibility they can provide.

While the risks of gaming and locational power exist in every market, the potential for wrongdoing or perverse incentives should not be a burden to innovation. The market-based approach provides significant benefits to overall system efficiency, avoided costs from grid reinforcement, environmental effects, and integration of new technologies. Regulation should be enforced and geared towards maximising these benefits and not risking losing them for fear of inc-dec gaming and market power, when the more efficient solution would be to implement mitigating measures to avoid them. This paper proposes alternative approaches and mitigating measures already being applied in different EU markets, to kick-start market-based redispatch, considering the interests of all market parties and facilitating the move towards a safe, clean and affordable transition for the European electricity system.

[13] https://projekt-enera.de/wp-content/uploads/enera-Improving-redispatch-thanks-to-flexibility-platform-experience.pdf

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