

Optimal use of the transmission network: a regional approach

A EURELECTRIC position paper

June 2016

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KEY MESSAGES

-)] In EURELECTRIC's view, achieving an integrated energy market depends on the ability to maximise the cross-border transmission capacity released to the markets in order to achieve an efficient dispatch of units across Europe.
-)] Building on a number of real cases as experienced by market parties today, the report illustrates that confusing incentives for TSOs do not allow for an optimal use of the European infrastructure and do not capture maximum social welfare. While system operation should aim at achieving the most efficient dispatch at regional and ultimately at European scale, we observe that cross-border capacity limitations are used as a non-costly way to deal preventively with potential congestions.
-)] In this report, EURELECTRIC develops a number of key principles that would lead to an improved calculation and allocation of available cross-border capacity and proposes several concrete improvements:
 - A market model that gives priority to the efficiency of the dispatch (e.g. no ex-ante limitations of cross-border capacity released), with efficient cross-border redispatching measures to accommodate the associated flows. Depending on the level of physical congestion that is experienced, the redispatching can be considered within the capacity calculation process (together with non-costly remedial actions) or performed after the market coupling.
 - An integrated congestion management based on regional capacity calculation and allocation methodology, allowing for frequent updates of available grid capacity.
 - An improved regulatory oversight - based on increased transparency - allowing both ACER/NRAs and market parties to see and understand how the transmission grid and TSO actions are impacting the dispatch outcome.
 - Adjustments to the regulatory framework to ensure that economic incentives for TSOs are better aligned towards maximising the cross-border transmission capacity released to the markets. In particular, the cost-allocation of cross-border redispatching needs to be addressed in the same framework as the distribution of congestion rents.

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1. Introduction

The Third Energy Package provides clear provisions for optimal capacity allocation. Additionally, the recently entered into force guidelines on Capacity Allocation and Congestion Management (CACM) give ambitious instructions on how Transmission System Operators (TSOs) should work together in order to maximize the capacities offered in the market to trade energy across bidding zones. However, a lack of tools and confusing incentives to guarantee an optimal use of the cross-border capacity impedes the goals set forth in the Third Energy Package and the CACM guidelines.

When allocating cross-border capacities to the market, TSOs are confronted with potential revenue from congestion rent when cross-border capacity is a scarce resource. On the other hand, when congestions occur, maximising capacity allocated to the market potentially entails redispatching costs. Such counterproductive incentives result in a sub-optimal allocation of cross-border transmission capacity to the market. Through this paper, EURELECTRIC would like to put forward some approaches – both ambitious and realistic – on how this situation can be tackled.

First, EURELECTRIC would like to illustrate the sub-optimality of the current practices through a number of real cases as experienced by market parties today. These cases all point to shortcomings or misalignments in the current framework. In a second step, EURELECTRIC develops a number of key principles that would lead to an improved calculation and allocation of cross-border capacity. The goal is to remediate the issues identified in the first part and lay the foundations for a number of concrete improvements. These improvements will then be elaborated in the third part, where market models, technical elements and the regulatory framework will be addressed. Finally, and as a conclusion to this paper, both intermediate and long-term goals are set to provide realistic and ambitious improvements to the calculation and allocation of cross-border capacity.

EURELECTRIC is convinced that reaching the target solution requires further measures and better aligned incentives for TSOs to optimize the capacities released to the market. This paper aims to address two key questions in this regard:

-) How can the market be sure that the calculation and allocation of cross-border capacity are optimal?
-) What tools and incentives are in place to ensure that TSOs do not play the “security of supply (SoS) card” systematically, resulting in excessive security margins at the costs of overall system efficiency?

2. Concrete examples of sub-optimal allocation of cross-border capacities

2.1. Belgian Winter Measures

A first example is the set of the so-called “winter measures” adopted in Belgium during the winter between 2014 and 2015. Following a tight adequacy situation (Belgium lost around one-third of its installed generation capacity compared to the previous winter), Central-West Europe (CWE) TSOs estimated that there was a risk for the security of supply and the reliability of the system. Especially in case of low wind and high load, Belgium would have had to cope with massive north to south flows, putting a large burden on the border between Belgium and the Netherlands.

On the basis of some studies, TSO concluded that the global flow from north to south had to be reduced by adjusting downward the Net Transfer Capacities (NTCs) on a coordinated basis on several CWE borders. For instance, at the monthly auction of January 2015, roughly half of the commercial cross-border transmission capacity usually made available to the market was offered on the border between Germany and the Netherlands and the border between Belgium and the Netherlands.

As seen from this example, TSOs tackled potential internal congestion problems anticipatively by withdrawing commercial cross-border transmission capacity from the market. This was done without considering the welfare these commercial exchanges would have generated with respect to extra redispatching costs for handling the anticipated flows with other means. A better coordination between TSOs taking into account all remedial actions - including redispatching - should have been considered. Instead, the prompt reduction of NTCs illustrates that TSOs currently tend to deal with potential congestion by the cost-free option of reserving a large share of interconnection capacity for non-commercial flows.

2.2. Curtailment on the interconnector between Germany and Denmark (DK1-DE)

A second example is the current use of the interconnector between Germany and Denmark (DK1-DE). This interconnector tends to be systematically curtailed on request of TenneT, the TSO on the German side of the interconnector. The curtailment leads to a frequent disconnection of the Nordic market area from the continental region, as DK1-DE constitutes 40% of the Nordic-Continental Europe interconnection. The level of curtailment on the interconnector has been significant for a number of years and is increasing. The average capacity that is available to the market is currently around 15%. This curtailment is expected to continue for the coming years until the German North-South DC lines are achieved.

In November 2014 the Danish TSO Energinet.dk and the German TSO TenneT published a joint study that assesses the overall welfare effect of increasing cross-border capacities on the DK1-DE interconnector by using cross-border redispatch resources in the intraday market¹. The study concentrates on the welfare effects and concludes that there is a positive overall European welfare effect from increasing cross-border capacities on the DK1-DE interconnector with the use of cross-border redispatch. However, in addition to this conclusion, the study furthermore concludes that there is also a negative welfare effect from a German-Danish perspective to pursue such a solution. Energinet.dk and TenneT did not pursue an increase of cross-border capacities through redispatch measures, given the negative welfare loss from a German and Danish perspective.

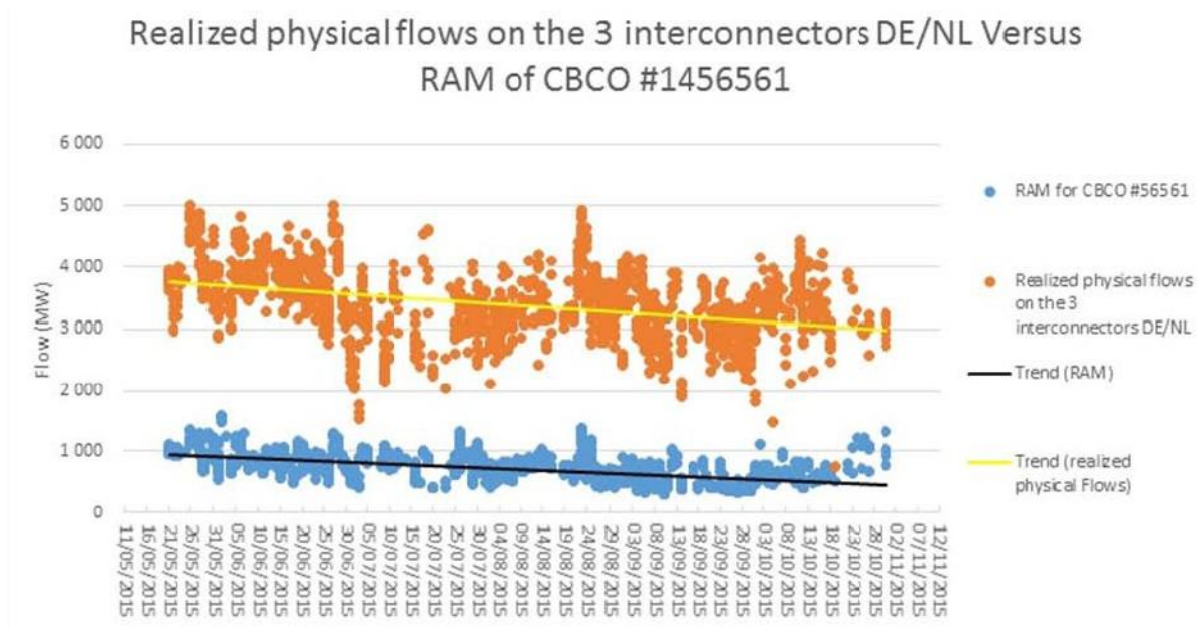
The example of the DK1-DE interconnector clearly shows that TSOs have misaligned incentives to optimize the cross-border capacity that is made available to the market. Measures to improve the situation are known and available, and would result in an improvement of the overall welfare. However, the involved TSOs do not take into account the impact on regional welfare as they are only confronted with any change in welfare in their direct scope. Using cross-border limitations as a non-costly way to deal preventively with potential internal congestions entails an ongoing loss of regional welfare.

¹ "Investigation of welfare effects of increasing cross-border capacities on the DK1-DE interconnector", 2014 RWTH, Aachen University

2.3. Remaining Available Margin on interconnectors between Germany and the Netherlands

As a third example, EURELECTRIC would like to raise its concerns regarding the Remaining Available Margin (RAM) on the interconnectors between Germany and the Netherlands. The RAMs on these interconnectors were constraining the Flow-Based Market Coupling (FBMC) in the CWE region for approximately 30% of the hours during summer 2015, and have significantly decreased over the same period. The implementation of the FBMC in CWE has been strongly supported by EURELECTRIC as an approach to operate the European power systems with higher cost efficiency. Since the go-live on 21 May 2015, price convergence has indeed been more frequent, with an increased possibility of cross-border exchanges and improved competition for the European power sector. Furthermore, the transparency platform developed in the framework of the flow-based projects can open new possibilities for stakeholders to understand how cross-border transmission capacities are calculated and appreciate the efficiency of power system operation.

Unfortunately, the CWE FBMC transparency platform remains incomplete and poorly documented by the TSOs at this stage. Despite this, ex-post publications on critical branches made it possible to identify already that the RAM on some interconnectors between Germany and the Netherlands (e.g. CBCO #1456561) has significantly decreased during the summer of 2015. This decrease may be justified by evolving operational conditions but further investigation has confirmed that the realized physical flows between the two countries have also decreased in the same proportion (see Figure below representing physical flows on the 3 interconnectors between Germany and the Netherlands and the RAM of CBCO #1456561 when this CBCO was constraining market coupling). This observation suggests that the involved TSOs may have deliberately offered less cross-border capacity to the market than what the infrastructure could handle. This would induce a significant loss in the European social welfare, given that this interconnection is responsible for around a third of the times when coupling is constraint. More transparency is needed to confirm this observation: for example, publishing systematically ex-post the realized flows on critical elements that constrain the market coupling, such as branches, virtual outages, exports and imports.



Source: Joint Allocation Office data

The aforementioned observation questions the practices of the TSOs that have initiated this reduction of the RAM and the resulting reduced ability of market parties to access cross-border capacity. At a minimum, it shows that TSOs need to provide further transparency so that market parties can understand fluctuations in the cross-border capacity that is available for the market. This is an important element for market parties to manage and optimize their portfolio.

2.4. Problem statement

The examples are showing that the current calculation and allocation of cross-border capacity are driven by a limited view of the welfare that cross-border exchanges could bring. While disappointing, this outcome is not unexpected given the tools and incentives that are in place – as illustrated in the examples above – and guide the TSOs when making the allocation of cross-border transmission capacity between non-commercial and commercial flows.

However, it should be clear that this current framework is not without costs, despite the fact that TSOs currently seem to consider it costless to curtail cross-border capacity. In addition to the continuous welfare losses due to market inefficiency that is caused by reduced cross-border capacity, there are also long term negative effects given that the restriction of cross-border capacity provides wrong investment signals to both generators and TSOs. For generators, the market distortion caused by the inability to trade and move electricity from generation to load gives wrong investment signals as where to invest in generation assets. The decision to invest in generation assets may be driven by artificial – and wrong – bottlenecks, foregoing better opportunities at another location. On the side of TSOs, the option of moving internal congestion to the border can represent a ‘no cost’ option for a given TSO. The result is that this TSO no longer has a cost-driven incentive to invest in the necessary grid reinforcements to alleviate the internal congestion, as other, less-costly options are available. Both these inappropriate investment signals are detrimental to the correct functioning of the internal market.

To remediate the failings in the way cross-border capacity is currently allocated, as illustrated and identified through these examples, a number of key principles will be developed next. These general principles will then be used as foundations of concrete proposals.

3. Key principles when optimizing (cross-border) capacity

3.1. Efficient dispatch

The allocation of cross-border capacity should aim at achieving ultimately the most efficient dispatch at the regional and European scale. This corresponds to maximizing the social welfare and competitiveness of the European power sector.

From a system wide perspective, the most efficient dispatch at a regional and European scale would be achieved if no grid restriction is taken into account. However, given that there are physical limitations to power transmission, the best approximation of this would be to:

-)] Allocate in any timeframe as much cross-border capacities as the physical transmission infrastructure allows (of course taking into account security measures such as N-1), regardless of the internal trades of each country.

-) As a result of basing the allocation on unloaded physical capacities of the transmission grid, market prices may be such that the corresponding dispatch leads to congestions, for example resulting from loop flows. This is mostly visible in the day-ahead stage. Such congestions would have to be managed with a coordinated redispatch (internal and cross border) until an optimal set point is achieved.

Such an approach would imply significant effort of redispatching and a necessary condition to achieve this is to make TSOs able to manage congestions efficiently.

The capacity calculation should target as accurately as possible the physical capabilities of the system and may consider partial loading of congested lines based on internal trades as long as (cross border) redispatch actions are integrated in the capacity calculation process.

3.2. Efficient cross-border redispatch

As emphasized above, a necessary tool to achieve an efficient dispatch is the ability to perform cross-border redispatching. This raises important questions that the CACM did not fully address.

The first is how to organize cross-border redispatching efficiently. Article 16 of the CACM guidelines foresees that 10 months after its entry into force, methodologies for the generation and load data provision (GLDPM) have to be proposed. While transparency obligations on technicalities and availability are already covered by other regulations such as the Regulation on Energy Market Integrity and Transparency² (REMIT), the key questions to be answered will be related to the provision of schedule of generation units as well as “relevant information on dispatching”.

A second issue that arises for cross-border redispatching is how it can be organized in an efficient manner. This requires information but also correct and efficient pricing methodologies. This key question is also not solved in the CACM as Article 35.5 only gives high-level directions on how the pricing of redispatching could be done. This is to be performed either via a reference to the price of electricity in the relevant time frame, or via a cost-based approach. The first option is not satisfactory as generation, demand side or storage units that are in the money are expected to run, while the ones that are not running typically do so because they are out of the money, i.e. do not recover their variable costs at the price of electricity in that timeframe. The second option raises questions regarding the information that needs to be given by the producers to the TSOs as the costing of a unit may be more complex in practice and depend on a number of parameters.

Third, the potential interactions between redispatching on the one hand and intraday and balancing markets on the other hand must also be carefully considered.

Last but not least, the cost allocation of redispatching also needs to be tackled. This is a complex question that would need to be addressed at least on a regional level, reflecting the region within which a coordinated capacity calculation and redispatching is performed. In order to tackle congestion correctly – i.e. without pushing it to the borders – redispatch in one or several other bidding zones would need to be possible. However, this would entail costs for the TSO performing the redispatching that are not linked to congestion within its own control zone. As this is a regional optimisation, cost-allocation of cross-border redispatching need to be addressed in the same framework as distribution of congestion rents (i.e. distributed among the involved TSOs).

² Regulation 1227/2011

3.3. Regular recomputation of available capacities across all timeframes

In EURELECTRIC's view, cross-border exchange capacities released to the markets should be as close as possible to the physical limitations of the system. As operation conditions are more accurately forecasted when approaching real time, it is relevant that cross-border exchange capacities are revised over time and progressively increased (if possible) across the different wholesale market closures (Long Term, Day-Ahead, Intra-Day, Balancing). EURELECTRIC supports thus that all efforts are made to compute capacity most accurately at least 4 times: ahead of long-term products commercialization, before day-ahead market closure, intraday (for example at 8 hours before operation for each Imbalance Settlement Period (ISP), or at 6pm day-ahead for the entire day), and intraday 2 hours before operation for each ISP. Making this recomputation a reality calls for technical achievements that are certainly difficult to accomplish. Nevertheless, EURELECTRIC believes that such progress would deliver significant benefits and should be prioritized accordingly.

As we have seen in the previous examples, TSOs occasionally fail to deliver as much capacity as possible to allow efficient cross-border power exchanges. To cope with this actual issue, EURELECTRIC formulates hereafter recommendations for technical and regulatory actions that can be implemented shortly and deliver quick wins to the benefits of European customers.

4. Approaches to improve cross-border capacity available for the market

Building on the key principles, EURELECTRIC proposes in this chapter some concrete approaches to improve the cross-border allocation of transmission capacity. The proposals fall into three categories, covering the market model, the technical aspects of the allocation methodology and the regulatory framework. Combined, the proposals would greatly improve the allocation of cross-border capacity and allow for a more optimized use of the capacity by market parties.

4.1. Improvements to the market model

EURELECTRIC sees three ways in which the market model may allow for an improved calculation and allocation of the cross-border capacity to the market. The objective is to allow an optimal dispatch across units in Europe, taking into account the physical transmission grid in place:

-)] A first model is the nodal market model. Such a market model is centred on the physical transmission grid where each unit forms its own price 'zone'. Nodal pricing provides a more detailed and accurate picture of transmission and generation. It enables the market to reveal areas of more expensive electricity, encouraging both efficient transmission solutions and dispatch of generation units. However, it also has serious drawbacks. While a nodal model may reveal areas of occasional more expensive electricity, these zones are very sensitive to changes in the transmission grid, generation fleet, and local demand. Extremely small bidding zones induce thus significant investment uncertainty. A nodal model may also preclude the development of a competitive market. For those reasons, EURELECTRIC does not consider a move towards a nodal model in Europe either realistic or desirable.
-)] A second model would be to have a unique bidding zone across Europe, and rely massively on redispatching when necessary. This approach may lead to inefficiencies in handling large structural congestions.

-) A third model would be to combine a reasonable number of zones with limited transmission capacity between them and develop tools that make it possible to operate the European infrastructure most efficiently. This is probably close to the model currently used in Europe, but methods to calculate and allocate capacity would have to evolve. As for today, cross-border capacity is operated in Europe on a 'nodal' basis, setting ex-ante limits on the amount that can be exchanged between the zones, and afterwards dispatching units within these limits. As these limits are not only based on the physical characteristics of the interconnections, but also on the flows contingent on expected trades within the bidding zone, this approach tends to generate significant constraints on the dispatch, creating welfare loss.

Another way would be to consider a 'zonal' basis, assuming that the grid is fully available, by relaxing limits on the amounts that can be exchanged between the zones. On this basis, units can be dispatched in the most economically optimal way. If the resulting outcome of the dispatch would exceed the security limits of the grid, coordinated redispatching can be performed to bring the outcome back within the security limits.

Several options are possible in this regard, depending on the expected level of transmission constraints:

-) In case of frequent transmission constraints, the redispatching measures could be introduced directly in the market coupling. If congestion impedes the optimal exchange of flows between zones, redispatching of some specific units that would not run given the market prices (based on the information provided in D-2 in the framework of the GLDPM) could be considered as a costly remedial action within the capacity calculation process.
-) In case of occasional transmission constraints, the market coupling could run with only the physical transmission constraints, limiting the amounts that can be exchanged between zones and regardless of flows resulting from trades within the bidding zones. If, afterwards, the market outcome results in flows that breach the operational security limits of the transmission grids, coordinated redispatching actions can be taken.
-) In case of rare transmission constraints, a fully zonal model can be used where no transmission constraints are taken into account. Similar to the previous case, if the market outcome would result in flows that exceed operational security, coordinated redispatching actions can be taken.

EURELECTRIC considers that the above market models provide a better method of allocating cross-border transmission capacity, compared to the current practice.

4.2. Technical improvements

A second axis of improvements is technical-based. In order to maximize capacities, EURELECTRIC is convinced that integration of methodologies and/or tasks should be put in place. The collaboration and sharing between TSOs should not be limited to data. While CACM provides a list of methodologies to be commonly proposed by the TSOs and validated by the NRAs, EURELECTRIC has doubts on the way this is going to be handled. EURELECTRIC is convinced that this is only a high level guideline and that the sharing of methodologies/tasks should be further extended towards a real integration of tasks and methods. For instance, CACM foresees the development of a “Common Grid Model”. However, the current understanding of this project by EURELECTRIC members is that this is only about sharing data. This is insufficient, as working with different methodologies and only afterwards sharing the results or data leads to inefficient and slow processes. Instead, having one, optimal methodology in place across the different control areas would lead to smaller reliability margins that have to be taken.

Some of the common methodologies to be developed, as foreseen by the CACM, are the following:

1. For the coordinated approach on congestion management as prescribed by the CACM, TSOs should develop a common approach, such as:
 -) Coordinated use of phase shifting transformers (PST), in particular in the base case of the flow based market coupling.
 -) Efficient use of redispatching within a bidding zone (included in the calculation of the base case).
 -) EURELECTRIC is concerned given the fact that prescriptions of the CACM remain high level. Therefore, we urge TSOs to propose ambitious measures.
2. TSOs should develop a coordinated approach for setting flow based parameters:
 -) Generation Shift Key (GSK) methodologies: currently GSK methodologies are not harmonized. Harmonisation is necessary to guarantee an optimal use of the network. A set of shared principles and best practices should be the minimum requirement.
 -) Reliability margins: as the CACM only provides vague principles on the establishment of the reliability management, TSOs should provide the necessary transparency to ensure that these margins are as small as possible and do not result in excessive reduction of cross-border capacity.
 -) Ex-post publication of realized data allowing both National Regulatory Authorities (NRAs) and market parties to understand the drivers of price convergence and assess whether an optimal amount of cross-border capacity has been released.
3. TSOs should build an operational framework that allows for frequent updates of the grid situation and market players adapting to that. In that perspective, we see a close relationship with the Capacity Calculation Regions (CCRs) stemming from the CACM guidelines and the Regional Security Centres as defined in the System Operation guidelines. Their geographical definition should be the same.

4.3. Improvements to the regulatory framework

The actual level of regulatory oversight does not allow NRAs or ACER to check if maximal cross-border transmission capacity is indeed released to the markets, despite formulated as an objective in the CACM guidelines. To remedy this, the following improvements could be implemented.

First, improved monitoring should be implemented to allow both NRAs and any third party to check that the European transmission infrastructure is used fully and efficiently. Transparency platforms are key elements in this regard, and much of the required monitoring can be achieved using tools that are already in place. For example, the implementation of flow-based market coupling in the day-ahead and intraday time frames makes it possible for TSOs to communicate ex-post realizations on existing or virtual branches that have triggered active constraints in the market-coupling algorithm. Based on such publications, any NRA, market party or independent observer could check if TSOs allow using transmission network at their full potential. Note that TSOs can legitimately consider margins to cope with forecast errors, but if those margins are never fully used, they could also be considered as oversized. However, most importantly, such monitoring would at least make an informed assessment of such elements possible.

Secondly, NRAs could derive economic incentives from elements of the ex-post monitoring. An example would be the proportion of cross-border tradable capacities made available to the market compared to the available capacity declared ex-ante by TSOs (and constraining the regional dispatch). In particular, part of the revenue of congestion rents, which is supposed to be used to increase cross-border exchanges, could be considered as an external income for TSOs. When they perform well - i.e. when their declared capacities do not constrain the market coupling or when measured realizations (before redispatch actions) are close to the maximal capacity of the assets - TSOs could get a new reward as part of an incentive-based regulation. This would drive TSOs to cooperate more effectively in order to optimize cross-border flows.

Last, if information and incentive-based approaches are insufficient to achieve an optimal allocation of cross-border capacity and the related increase in social welfare at the European level, more structural adjustments to the regulatory framework should be considered. One possibility is the full integration of system operations that are related to the computation and allocation of cross-border capacity over the bidding zones where inefficiencies remain. This integration would streamline the methodologies that are used, facilitate the exchange of data and improve overall efficiency of operational processes such as the joint redispatching actions.

5. Conclusion

EURELECTRIC is convinced that current cross-border capacity calculation and allocation do not allow for an optimal use of the European infrastructure and do not capture maximum welfare. While TSOs should indeed ensure the integrity of the grid, the current approach is both sub-optimal and one-sided. As the examples tend to show, cross-border interconnections are currently used as a non-costly way of dealing with situations that could result in physical congestions on transmission grids. While this is indeed a cheap remedy from the TSO point of view, it significantly reduces the ability of the market to achieve an efficient dispatch of units across Europe. In EURELECTRIC's view, achieving an efficient, integrated energy market depends on the ability to maximize the cross-border transmission capacity released to the markets.

In order to do so, a number of possible approaches have been suggested in this paper. Given the welfare that is currently lost, it is imperative that both short-term measures are implemented while moving towards the long-term goal of a fully optimal dispatch across Europe.

In the short-term, the following measures should be employed:

-) A market model that gives priority to the efficiency of the dispatch, with corrective, efficient redispatching measures to accommodate the associated flows. Depending on the level of physical congestion that is experienced, the redispatching can be considered within the capacity calculation process or performed after the market coupling.
-) An operational framework that allows for frequent recalculations taking the latest best available information into account.
-) The development of common methodologies for both congestion management and setting the parameters of market coupling. This should foster the use of the best available methodology and at the same time increase efficiency by aligning processes.
-) An improved monitoring, allowing both NRAs and market parties to see and understand how the transmission grid and TSO actions are impacting the dispatch outcome.
-) Adjustments to the regulatory framework to ensure that economic incentives for TSOs are better aligned towards providing a maximum amount of cross-border transmission capacity to the market. An integral element of such a framework is a cost allocation for cross-border redispatching, ensuring that such actions are not economically detrimental to the TSO that has to perform them.

In the long term, it is important to move towards building consistent and sustainable economic signals to investments. This may involve different solutions depending on the context. Full integration of system operations related to the computation of capacities and with coordinated redispatching would facilitate the achievement of the approach proposed in the paper.

EURELECTRIC pursues in all its activities the application of the following sustainable development values:

Economic Development

▶ Growth, added-value, efficiency

Environmental Leadership

▶ Commitment, innovation, pro-activeness

Social Responsibility

▶ Transparency, ethics, accountability



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