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## REGULATORS' ROLE IN HARMONIZING CROSS-BORDER TRANSMISSION CAPACITY CALCULATION METHODOLOGY IN SOUTH EAST EUROPE

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*Abstract* - This paper presents a case study from the Energy Community of South East Europe concerning the implementation of procedures for monitoring the market for cross-border transmission capacity. The market monitoring procedures were developed for the 8<sup>th</sup> Congestion Management Region by the Electricity Working Group of the Energy Community Regulatory Board. The procedures were coordinated among the national regulatory agencies to satisfy the monitoring requirements in accordance with the EU Electricity Directives. Following specific guidelines and using an internet-based application, the regulators collect and analyze key data on an ongoing basis concerning the TSO calculation of cross-border net transfer capacity (NTC) between control areas in the 8<sup>th</sup> region. A key result of the monitoring was to harmonize certain assumptions and forecasts among TSOs to help ensure accurate NTC values that support wholesale electricity trading.

*Key words* – Market monitoring – Transmission System Operator – Eighth region – Energy Community Regulatory Board – NTC – Control Area – ENTSO-E - ACER

### 1. INTRODUCTION

This paper describes a case study in South East Europe (SEE) involving regulatory oversight of cross-border transmission capacity calculation through monitoring of calculation procedures within Transmission System Operators (TSOs). Cross-border trade between countries in SEE requires access

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to cross-border transmission capacity. The quantity of cross-border transmission capacity that is available to market participants (i.e., traders and others seeking to buy and sell across borders) is calculated by TSOs as a central part of their congestion management responsibilities. Under European Union (EU) electricity directives, National Regulatory Authorities (NRAs) have broad scope to monitor and regulate the activities of TSOs, that extends to the direct oversight of the TSOs activities in calculating and allocating the cross-border transmission capability.

NRAs in South East Europe established a regional market monitoring system related to calculation of cross-border capacity, allocation and auctions under the auspices of the Energy Community of South East Europe with financial support from the United States Agency for International Development (USAID). The project began in 2006 when the 8<sup>th</sup> Athens Forum in 2006 invited USAID to move forward on its proposal for market monitoring to support liberalization of the electricity markets in the Energy Community Contracting Parties.

The market monitoring project was coordinated by the Energy Community Regulatory Board Electricity Working Group (ECRB EWG). The result of this is the publication of Market Monitoring Guidelines which were approved by ECRB in April 2014 that ratified South East Europe Automated Market Monitoring System (SEEAMMS) project's dry run. SEEAMMS expanded the capacity of regulators to oversee and monitor key activities of TSOs and thereby contribute to increased transparency of the electricity markets according to the Regulation (EC) 714/2009, and Directive 2009/72/EC. SEEAMMS allows participant Transmission System Operators (TSOs) to upload data to a web-based interface where the data is stored, processed, and reported to regulators.

SEEAMMS uses the data required to implement market monitoring, specific monitoring indicators and thresholds to establish reasonable range for the indicator values. The monitoring activity is exercised based on seven predefined Monitoring Indicators plus indicator of cross-border transmission capacity auction data:

- Indicator 1 - The Base Case Exchange (BCE) Indicator: compares Base Case Exchange assumptions in the Network Model to Cross-Border schedules.
- Indicator 2 - The Already Allocated Capacity (AAC) Indicator: Compares AAC to peak commercial schedules.
- Indicator 3 - Critical Facilities Indicator: Compares estimated flows on critical facilities in the Network Model to actual flows on the facilities.
- Indicator 4 - Load Forecast Indicator: Compares forecast load in the Network Model to actual load.
- Indicator 5 ó Generation Forecast Indicator: Compares forecast generation in the Network Model to actual generation;
- Indicator 6 ó Transmission Reliability Margin (TRM) Indicator: Compares actual TRM values to proxy TRM values calculated using control area balance data and net exchanges.
- Indicator 7 ó Market Share Indicator: Calculates market shares using auction data on cross-border interconnections.

## 2. LEGAL BACKGROUND

The development of the market monitoring procedures was closely guided by the EU electricity directives concerning regulatory oversight of cross-border trading and internal market competition. Regulation (EC) No. 713/2009 provides the most direct guidance on monitoring electricity markets. Article 11 of the Regulation is titled "Monitoring and reporting on the electricity and natural gas sectors". It states, in relevant part:

*[The Agency for the Cooperation of Energy Regulators ("ACER")], in close cooperation with the Commission, the Member States and the relevant national authorities including the national regulatory authorities..., shall monitor the internal markets in electricity and natural gas, in particular the retail prices of electricity and natural gas, access to the network including access of electricity produced from renewable energy sources, and compliance with the consumer rights ....*

As the quoted portion of the Regulation states, market monitoring envisions access to the grid as a distinct area of monitoring. This particular area of monitoring is what has been most extensively developed in the SEE market monitoring project. And it is well recognized in EU Policy (as well as in the general opinion regarding market liberalization) that non-discriminatory access to the grid is a critical factor in successfully liberalization.

Regulation (EC) No. 714/2009 on network access and congestion management contains important provisions that guided the market monitoring project. First, the regulation clearly calls for maximizing the amount of cross-border capacity available to market participants:

*The maximum capacity of the interconnections and/or the transmission networks affecting cross-border flows shall be made available to market participants, complying with safety standards of secure network operation (Regulation (EC) No. 714/2009, Article 16(3)).*

Therefore, Regulation No. 713/2009 specifically sets access to the grid as key area of market monitoring. Regulation (EC) No. 714/2009 specifically requires that the maximum capacity be made available and that TSO compliance with this maximum availability is a duty and objective of the regulatory authorities.

As a result, the SEE market monitoring process was guided by specific EU requirements to both monitor access to the grid as envisioned in Regulation (EC) No. 713/2009 and to ensure maximum capability for cross-border trading.

In addition to monitoring the calculation of cross-border capacity, the various EU regulations and directives create authority for regulators to monitor market participants' use of the cross border capacity.

Regulation (EC) No. 1227/2011 provides explicitly for market monitoring for market manipulation in wholesale electricity markets. In article 7 of Regulation (EC) No. 1227/2011, market monitoring is addressed:

*1. [ACER] shall monitor trading activity in wholesale energy products to detect and prevent trading based on inside information and market manipulation. It shall collect the data for assessing and monitoring wholesale energy markets as provided for in Article 8.*

*2. National regulatory authorities shall cooperate at regional level and with the Agency in carrying out the monitoring of wholesale energy markets referred to [above].*

Accordingly, of monitoring individual participant and their market power is something that is contemplated within the EU policy and validate the monitoring of cross-border capacity usage.

### **3. MARKET MONITORING PROCESS**

The market monitoring project was based on harmonized data collection and data analysis among regulators in the Eighth congestion management region. This area encompasses the energy community and several neighboring EU countries. The market monitoring approach given in the Guidelines is to collect data on a certain variable of interest, say the load forecast used by the TSO cross-border capacity assessment, and then measure whether the variable of interest is within expected boundaries when actually observed. Hence, using the load forecast example, the regulators will assess whether a load forecast used by the TSOs in the capacity assessment is relatively close to the load observed in real time.

The indicator (and the other indicators in the project) use a forecast error measure:

$$(\text{Forecast Value} - \text{Actual Value}) / \text{Actual Value}.$$

This formula results in a percentage value and measures the percentage by which the forecast value departs from the actual. Of course, all forecasts have errors so the presence of an error does not necessarily mean the forecast is in doubt. The error must be outside a threshold range that is intended to identify Indicator values that require regulatory attention because they are in variance from what is expected in a well-functioning process.

The Market Monitoring Guidelines use thresholds based on historical experience. Using historical experience to establish thresholds is based on the assumption that during some part of the historical period participants being monitored lacked the incentive or opportunity to act in a manner adverse to the market. The threshold range determines whether the value of a Market Monitoring Indicator is in variance and, as a result, requires regulatory follow-up. In variance simply means the forecast error is relatively large. Because all of the 8th Region Indicators are a form of forecast error, the range really tells us whether the forecast misses by a large margin or within reasonably acceptable margins. If it is off by a large margin range it requires some follow-up or mitigation by the regulator.

The threshold range is calculated using all forecast errors for a given Indicator and for all participants in the most recent six-month period. These values are placed together in a pool for purposes of the analysis. From this pool, the 15th and 85th percentiles are calculated. A percentile is the value of a variable below which a certain percentage of observations fall the 15th percentile is the Indicator value below which 15 percent of the observations in the pool are found (85 percent are higher). Likewise, the 85th percentile is the Indicator value below which 85 percent of the observations in the pool are found (15 percent are higher).

Therefore, the basic approach to monitoring the cross-border capacity market is to identify key variables that are forecasts in the network mode and to determine whether the forecast error of these variables falls within a reasonable range based on all participants' forecasts.

In monitoring access to the grid, the Market Monitoring Guidelines focus on methods and data used by the Transmission System Operators in establishing the Net Transfer capacity (NTC) on cross-border interconnections. Monitoring access to the grid is intended to verify the methods and data are being used in estimating available cross-border transfer capability are consistent with EU regulations and directives. It should not be interpreted as a direct measure of a potential error of the TSO, but only an indicator that deserves follow-up analysis.

The ECRB document recommends two measures concerning the capacity assessment used by transmission system operators (TSOs) to calculate the transmission capacity that is available for cross-border trade in South East Europe.

Namely, the capacity assessment uses certain assumptions about future conditions that are critical in establishing the limits on reliable transfers between control areas. Monitoring data available to regulators indicate TSOs should harmonize practices in at least two areas in order to make the estimates of cross-border capacity more accurate.

Based on monitoring results, National Regulatory Authorities (NRAs) issued a number of inquiries to TSOs regarding variances in the market monitoring indicators that made it apparent that there exist certain inconsistencies in the TSO responses concerning the understanding and harmonization of the Base Case Exchange (BCE) and the Transmission Reliability Margin (TRM) indicators. Based on discussions between regulators and TSOs of Energy Community Contracting Parties and, also reflecting, the experience of the regulators of Austria, Greece, Italy, Croatia and Romania regarding the interpretation of the BCE and the TRM indicators the ECRB recommendations of this paper have been. The following summarizes main findings of the indicator interpretation and establishes a basis for the recommendations.

**BCE Indicator:** Currently in SEE region, the main metric for cross-border trading capacity is the Net Transfer Capacity (NTC), which is established by TSOs using the network model. The BCE indicator monitors BCE assumptions in the Network Model. BCE assumptions are forecasts of commercial schedules in the Network Model. The purpose of the BCE indicator is to monitor the accuracy of the BCE assumptions in order to help ensure an accurate network model and, consequently, accurate NTC values. It is important that the BCE value represent the best estimate of expected cross-border exchanges. If not, the NTC value will be inaccurate and may underestimate or overestimate the cross-border transmission capacity, and thereby distort the opportunities for market activity.

The BCE indicator calculates a percentage forecast error between BCE values (the forecast) and the actual cross-border commercial schedules (realized ones). There is a lack of consistency throughout the region for the interpretation of the BCE value. TSOs disagree whether the BCE assumption represents a forecast of cross-border schedules or not. The following conclusion is based on review of EC Capacity Allocation and Congestion Management (CACM) Regulation No. 1222/2015, Common Grid Model Alignment methodology (CGMA) related ENTSO-E documents and processes, as well as discussion with regulators and their TSOs (including EU member states). The BCE value, especially those for time horizons >D-2, should reflect the best forecast of net commercial exchanges between two TSOs. For 2016, there continues to be failures of the BCE screen in South East Europe.

**TRM Indicator:** According to the Regulation (EC) No. 1222/2015 CACM and related ENTSO-E documents, Reliability Margin is an amount cross-border capacity set aside for TSOs to respond to:

- Unintended deviations of physical electricity flows within a market time unit caused by the adjustment of electricity flows within and between control areas, to maintain a constant frequency;
- Uncertainties which could affect capacity calculation and which could occur between the capacity calculation time-frame and real time, for the market time unit being considered.

Because it uses up cross-border capacity, the higher the TRM value, the lower the NTC value, which reduces opportunities for cross-border trade. The purpose of the indicator is to monitor the accuracy of TRM calculation.

This TRM Indicator calculates a metric that is intended to track the ENTSO-E TRM formula, which is also included in the ECRB Market Monitoring Guidelines:

According to CACM guidelines and ENTSO-E documents, TRM assessment should be based on influence of unintended deviations of flows due to load-frequency control, and calculation uncertainties.

The TRM indicator is often found to be in variance in the region. In many instances the TRM values is not calculated in accordance with the recommended ENTSO-E approach. In some instances the TRM is agreed upon between TSOs as a fixed value that does not depend on the key operating statics.

#### **4. RESULTS OF THE ANALYSIS AND RECOMMENDATIONS**

As we discussed above, based on monitoring results over time, and based on discussions with regulators from the EU countries Austria, Greece, Italy, Croatia and Romania and it became apparent that there exist certain inconsistencies in the TSO responses concerning the understanding and harmonization of two indicators: the BCE assumptions and the TRM values. The following summarizes main findings of the indicator interpretation and establishes a basis for the recommendations.

The BCE indicator calculates a percentage forecast error between BCE values (the forecast) and the actual cross-border commercial schedules (realized ones). There is a lack of consistency throughout the region for the interpretation of the BCE value. The Market Monitoring Guidelines were written and the market monitoring indicators were designed based on the interpretation that the BCE was the best forecast of cross-border schedules. Accordingly, the BCE Indicator in the market monitoring application compared the BCE forecasts to the actual net commercial exchanges. This was consistent with the ENTSO-E guidelines which we required "best forecast" of cross-border exchanges.

When the regulators detected that the BCE often departed from the net commercial exchanges, the TSO reported back inconsistent interpretations of the BCE assumptions used on the model. In order to illuminate the issue, the NRAs and TSOs of EU members in SEE were asked their own interpretation for the BCE values. It was found that BCE values should indeed be related closely with forecast of net exchanges. As a result, the following recommendation was made by the ECRB:

*Given national regulators' responsibilities to monitor the activities for TSOs and related Regional Security Coordinators (RSCs), relating to cross-border NTC values, regulators should require BCE values based on a forecast of net commercial schedules, following the latest developments of ENTSO-*

*E Common Grid Model Alignment Methodology (CGMA), and defining common CGMA algorithm based on forecasts and analyses of electricity market behavior and recent historical data.*

TRM Indicator calculates a metric that is intended to track the ENTSO-E TRM formula, which is also included in the ECRB Market Monitoring Guidelines. There were consistent variances in this indicators and regulator sought responses from TSOs. In many instances the TRM values is not calculated in accordance with the recommended ENTSO-E approach. In some instances the TRM is agreed upon between TSOs as a fixed value that does not depend on the key operating statics. It was found the even EU member states used fixed TRM values.

As a result of the monitoring data and follow up with TSOS and EU members, the following ECRB recommendation was made:

*Contracting Party regulators should start working with their TSOs to develop and adopt the common TRM assessment algorithm based on the present recommendation. In many instances, this would improve access to the interconnectors. The recommendation would have the TSOs calculate a TRM that varies on a monthly basis and which is in accordance with the ENSTO-E technical guidance.*

## **5. CONCLUSION**

In line with the European Union legislation, the main responsibility of a NRA is to monitor electricity markets, especially to monitor the TSO activities related to the calculation and allocation of maximum allowed cross-border capacity in order to provide for unhindered market transactions via interconnectors. The European TSOs market codes (UCTE, ENTSO-E) have so far included the method of calculation of inputs (such as BCE and TRM) that are necessary for the calculation of available cross-border capacity (NTC, ATC). But these methods have not been done in a sufficiently accurate or clear manner. Such relaxed definitions gave certain öflexibilityö to TSOs in the interpretation and method of calculation of NTC values of neighbouring TSOs for the same interconnector, which should not be the case since both TSOs use the same Network Model. In these cases, the lower value is used as the final one. This situation has been justified on the basis that TSOs have a responsibility for reliable and safe operations of the power system and, for this reason, TSO was given silent approval of relaxed interpretation of the NTC calculation method.

Because electricity market liberalization has become ever more explicit and because the provisions of EU legislation require the transparency and control over all market participants, it is expected that new ENTSO-E Market Rules will define NTC calculation methods more closely and clearly in order to avoid different interpretation of different TSOs and NRAs in the future. SEE region and the Energy Community Regulatory Board have made a pioneering initiative by being the first in Europe to launch a project on monitoring cross-border capacity calculation. The project was not launched due to doubt about TSOs expertise or due to observed errors. Instead, it was initiated to organise constant verification and improve the methodologies for the inputs and calculation of NTC. This project was realised with the assistance of consultants from the USA and based on the multi-decade experience in electricity market monitoring there. The project was approved and supported by the Agency for Cooperation of Energy Regulators (ACER), both in terms of methodology and in legal grounds.

As a result of the market monitoring work, the Energy Community Regulatory Board (ECRB), upon recommendation of the ECRB Electricity Working Group, accepted the Recommendations for

Harmonisation of Interpretation and Calculation of BCE and TRM indicators. This recommendation was in response to the existence of different interpretations and calculations of input assumptions for the calculation of available cross-border transmission capacity by different TSOs and NRAs in the SEE region. The recommendation calls for the harmonisation of relevant methodologies and implementation of a unique interpretation and calculation on the basis of technical ENTSO-E rules. An important reason for the adoption of the Recommendations was the fact that it is possible to compare indicators via SEEAMMS software only if TSOs interpret and calculate separate indicators in the same manner. Since it was proved otherwise, further unhindered monitoring of calculation of cross-border transmission capacity via application of Market Monitoring Guidelines and SEEAMMS software was being hindered.

The Recommendation for Harmonisation of BCE and TRM Indicators was adopted on the 36<sup>th</sup> session of the Energy Community Regulatory Board in April 2017 which was a proof of high level of cooperation between the Contracting Parties NRAs, especially in the field of electricity market monitoring. The Recommendations Document is not binding, but it is a document by which all the NRAs from the Energy Community Contracting Parties send their message to all TSOs in the SEE region, both to those from Contracting Parties and to those in EU member states, that it is necessary to harmonise all calculations for technical and market reasons, but also in order to have further unhindered monitoring of cross-border capacity calculation via the sophisticated software SEEAMMS and the possibility to compare input indicators.

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