Energy Community Regulatory Board

15 April, 2014

Market Monitoring Guidelines

For the

8th Region

Developed in cooperation with and with the support of

STATEMENT OF PURPOSE

The purpose of the Market Monitoring Guidelines is to harmonize and coordinate the activities of the 8th Region[1] National Regulatory Authorities (NRAs) in carrying out responsibilities to monitor certain aspects of the liberalized electricity markets. This includes monitoring the transmission grid in order to ensure participants have access to the maximum amount of transmission transfer capacity on a non-discriminatory basis. This also includes monitoring the control of transmission transfer capacity by individual participants in order to identify potential market power.

[1] The 8th Region was established following a decision by the Ministerial Council of the Energy Community on 27 June 2008 with a view to implement a common procedure for electricity congestion management and transmission capacity allocation on a regional

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 transfer capability are consistent with EU regulations and directives. It should not be interpreted to signal a present doubt about the conduct of the Transmission System Operators.

In monitoring participant conduct as it relates to control of transfer capacity by individual participants pursuant to market activities, the Market Monitoring Guidelines seek to identify circumstances that are consistent with a hypothesis of market power. However, the Market Monitoring Guidelines are not intended to establish definitive conclusions regarding market power. Such conclusions are best addressed through referral to the competition authorities.

level. The 8th Region covers the Energy Community Contracting Parties and the seven neighbouring EU Member States Bulgaria, Greece, Hungary, Italy (limited to its interconnections with other markets of the 8th Region), Romania, Slovenia. For details refer to www.energy-community.org: areas of work – electricity - regional market – 8th Region.

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The Market Monitoring Guidelines have been developed by the Energy Community[2] Regulatory Board (ECRB)[3] with the kind support of USAID, IRG, Tetra Tech, and Potomac Economics.

[2] The **Energy Community** comprises Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Kosovo*, Moldova, Montenegro, Serbia and Ukraine. Armenia, Georgia, Turkey and Norway are Observer Countries. [**Throughout this document the symbol * refers to the following statement: This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence*.]

[3] The **Energy Community Regulatory Board** (ECRB) operates based on Article 58 of the Energy Community Treaty. As an institution of the Energy Community the ECRB advises the Energy Community Ministerial Council and Permanent High Level Group on details of statutory, technical and regulatory rules and should make recommendations in the case of cross-border disputes between regulators.

1. INTRODUCTION

(1) The key powers of National Regulatory Authorities (NRAs) granted by Directive 2003/54/EC (Article 23)[4] are related to ensuring effective competition and the efficient functioning of the market. This includes, monitoring the level of transparency and competition in the electricity market and the rules on the management and allocation of interconnection capacity. In accordance with these powers, the Market Monitoring Guidelines (hereinafter MMG) describe indicators, indicator thresholds, data, and data collection procedures for establishing recommended practices for regulatory monitoring in South East Europe electricity markets.

(2) The MMG shall be used by regulators in the 8th Congestion Management Region.[5]

(3) The MMG are developed to provide NRAs a tool helping to fulfil their obligations to monitor access to the networks including interconnectors and the implementation of congestion management rules. The MMG neither change nor withdraw monitoring powers from regulators as defined by Directive 2003/54/EC' but are intended to set up a harmonised approach for the monitoring tasks of regulators with a view to ensure comparability of monitoring results and introducing the possibility for regional monitoring.

(4) Chapter 5 of Congestion Management Guidelines part of Regulation (EC) 1228/2003[6] as Annex I, requires the TSOs to publish all relevant data related to network availability, network access and network use, including a report on where and why congestion exists, the methods applied for managing the congestion and the plans for its future management. Therefore the MMG could be also a useful tool for the TSOs related to reporting requirements of present and future management of interconnections capacities.

(5) The MMG describe the precise data requirements, procedures for data collection, monitoring procedures, indicators for sustained variance in the Indicators, and regulatory actions in case of sustained variance.

(6) The MMG do not develop legal bindingness.

[4] Directive 2003/54/EC of the European Parliament and the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC, OJ L 176 of 15.7.2003, p 37 et seqq. Likewise Third Energy Package Electricity Directive 72-2009, Article 37, OJ L 211 of 14.8.2009, p 55 et seqq.

[5] Interconnections that are subject to analysis under the MMG are identified based on the TSOs that operate the interconnection with respect to calculating ATC and other capacity values. For example, the interconnection between Serbia and Romania is identified as EMS-TEL. For interconnections involving transmission facilities located in the UNMIK-administer territory which are operated by the Serbian TSO (EMS), the interconnections are described using EMS and the adjacent control area: for example, EMS-KESH for the interconnection to Albania. This is similar to the way interconnections are recognized by ENTSO-E and we adopt this treatment.

[6] Regulation (EC) 1228/2003 of the European Parliament and the Council on the conditions for access to the network for cross-border exchanges in electricity, OJ L 157 of 15.7.2003, p 1 et seqq. Likewise and beyond Third Energy Package Electricity Regulation (EC) 714/2009, Annex I, chapter 5, OJ L 211 of 14.8.2009, p 15 et seqq.

2. GENERAL PRINCIPLES

(7) The MMG define the data required to implement market monitoring, specific monitoring indicators, thresholds to establish reasonable range for the indicator values, and actions for regulators when the indicator is outside the threshold ranges. The monitoring activity is exercised based on six predefined Monitoring Indicators plus indicator of cross-border transmission capacity auction data.[7]

– **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 – Generation Forecast Indicator**: Compares forecast generation in the Network Model to actual generation;

– **Indicator 6 – Transmission Reliability Margin (TRM) Indicator**: Compares actual TRM values to proxy TRM values calculated using control area balance data and net exchanges.

– **Indicator 7 – Market Share Indicator:** Calculates market shares using auction data on cross-border interconnections;

(8) Regulators shall direct TSOs to provide the necessary data and complete the Indicators on regular basis and intervene in cases of sustained variance from the predefined thresholds. Necessary data for executing monitoring by the regulators in line with the MMG shall be provided by Transmission System Operators. The individual data requirements referred to as part of the MMG are in line with Regulations and Directives of the EU and Energy Community acquis concerning regulatory oversight and transparency[8].

(9) All data shall be collected in accordance with the procedures described in Section 10.

(10) The Technical Annex attached hereto provides more detailed discussion of each indicator and should be referenced for more technical discussions.

[7] Further discussion in the following sections as well as the Technical Appendix explains each indicator.

[8] At the time of adoption of the Market Monitoring Guidelines, the relevant electricity *acquis* of the Energy Community comprised Regulation (EC) 1228/2003 and Directive 2003/54/EC. As of 1 January 2015, Regulation (EC) 714/2009,and Directive 2009/72/EC will replace the previous acts.

3. REGIONAL MARKET MONITORING

3.1 Introduction

(11) The practices discussed herein address Regional Market Monitoring issues. In general, Regional Market Monitoring should be implemented in situations where electricity markets extended beyond a single regulatory authority and coordination among regulators is necessary to extend a consistent monitoring regime over the entire regional market.

(12) More formally, Regional Market Monitoring is the collection, screening, and sharing of data so that regulators can detect regional market failures or abuse and respond in a coordinated manner.

(13) Within the 8th Region market, regional market monitoring should be implemented to help ensure efficient market mechanisms.

(14) As discussed in the following subsections, there should be three main elements to a Regional Market Monitoring arrangement:

- Coordination among regulators to establish a consistent set of harmonized market monitoring indicators;
- Exchange of data among regulators to enable calculation of indicators and sharing of indicator results;
- Coordination among regulators to share indicator results and to coordinate responses to instances of sustained variance in the indicator;

3.2 Consistent Market Monitoring Indicators

(15) Regulators within the regional market should establish a consistent set of practices for market monitoring so that all regulators address common market issues, use the same data, measure market variables consistently, and respond to market issues in a harmonized manner.

(16) Regulators may establish a coordinated process for amending existing practices and adding new practices.

3.3 Data Exchange

(17) Regulators should share data as identified herein. This cooperation should be facilitated by regulators identifying and agreeing on a central entity for collecting and processing data, reporting results, and notifying regulators in event an indicator has exceeded the threshold ranges.

(18) Data collected by individual regulators should be exchanged by way of a collective data base that allows access by all participating regulators. The results of the indicators should also be shared using the collective data base, which should be enabled to process data and produce such indicators.

3.4 Coordinated “Mitigation Measures”

(19) Coordination should be undertaken for regional monitoring in those instances of a sustained variance in a market monitoring indicator. Regulators should undertake coordinated Mitigation Measures” when such need arises.

(20) Mitigation Measures refer to actions taken by regulators when an indicator value falls outside of an indicator’s pre-established threshold range. Some mitigation actions can be undertaken by an individual regulator when the practices indicate. Other practices require specific coordinated actions among regulators.

(21) In general, the market monitoring indicators measure various market activities and market outcomes.

(22) When an indicator is failed (the indicator value exceeds a threshold range), the implication is that adverse market effects may arise. Regulators actions in response to indicator failures should involve efforts to address the cause or consequences of the indicator failure. These actions are specified for each indicator in the MMG.

(23) Examples of coordinated data collection and coordinated actions are provided in Annex 4.

3.5 Regional Monitoring and Reporting

(24) In accordance with Regulation (EC) No. 714/2009, “regulatory authorities shall cooperate with each other” to ensure compliance with Chapter IX of Directive 2009/72/EC which includes, among other things, Article 36 (c) which requires “eliminating restrictions on trade in electricity between Member States, including developing appropriate cross-border transmission capacities to meet demand and enhancing the integration of national markets which may facilitate electricity flows across the Community.”

(25) As an example of implementing regional cooperation for monitoring, the participating 8th Region NRAs initiated a Dry Run in 2013-14: the NRAs engaged in a monthly Regional Monitoring Rotation to act as the Regional Market Monitor to coordinate Market monitoring activities. A final implementation of the Regional Monitoring will be established by the ECRB Electricity Working Group as discussed in section 11.

(26) The Regional Monitor will have access to the Regional Market Monitoring Reports on the *South East Europe Automated Market Monitoring System* (SEEAMMS).

(27) The Regional Market Monitor responds to the automated Regional Monitoring Reports on the SEEAMMS site. Each report is described herein along with the duties of the Regional Market Monitor

(28) ***Participation Report***: The participation report records the latest data submitted by the data providers. Using this report, the Regional Market Monitor identifies NRAs that have not recently provided data. Ideally, all NRAs should be at most 2 months behind (in the case of January 2013, this is November, 2012). For NRAs more than 2 months behind in submitting data, please provide that NRA an email to indicating that the data collection is lagging. An automated email is produced in SEEAMMS that should be sent by the Regional Market Monitor to address the Participation Report.

(29) ***Provider Variance Report*** : This report indicates which data provider is experiencing a variance in one of the "provider-specific" monitoring indicators. A 'provider-specific" monitoring indicator is either Indicator 4, which is the load forecast indicator, or Indicator 5, which is the Generation Forecast indicator". They are called "provider-specific" because they relate to the internal operations of the data provider area and not directly to an interconnection. (As discussed under Interconnection Variance Report, the other monitoring indicators examine variables that are specific to an interconnection. It is important to note that even though the provider-specific indicators are not associated with a specific interconnection, the variables (load and generation) can adversely affect NTC on interconnections if they are not properly forecasted. This is because poor forecasts can cause the Network Model to show overloads that really do not exist in actual operations.)

(30) The entities listed in the Provider Variance Report have experienced variances in their data in one of these three indicators (Indicator 4, Indicator 5, or Indicator 7). The role of the Regional Market Monitor is to report to the relevant NRA these variances, ask the NRA follow up with their TSO in accordance with the Mitigation Action by Regulators as indicated in the 8th Region Market Monitoring Guidelines, and finally, to ask the NRAs to report back on their experience with the TSOs in these instances.

(31) ***Interconnection Variance Report*** : The Interconnection Variance Report is similar to Provider Variance Report to the extent the Report is used to identify variances and describe the relevant Mitigation Action by Regulators. The Interconnection Variance Report deals with Indicators 1, 2, 3, and 6. These are the Indicators that address a specific interface. For example, Indicator 1 is the Base Case Exchange (BCE) Indicator. Values for this indicator are reported on specific interconnections. For each entry in the Interconnection Variance Report, the Regional Market Monitor sends an email to the data provider similar to the one for the Provider Variance Report.

(32) For both the Provider variance Report and the Interconnection Variance Report, an automated email is produced in SEEAMMS that should be sent by the Regional Market Monitor to address variances.

4. INDICATOR 1: THE BASE CASE EXCHANGE (BCE) INDICATOR

4.1 Introduction

(33) *Description*: Indicator 1 monitors Base Case Exchange (BCE) assumptions. BCE assumptions are forecasts of commercial schedules in the Network Model. The Network Model establishes cross-border Net Transfer Capacity (NTC).

(34) *Purpose:* The purpose of the indicator is to monitor the accuracy of the BCE assumptions in order to help ensure an accurate Network Model and, consequently, accurate NTC values.

(35) *Benefit*: Accurate NTC values will help ensure that market participants are provided the maximum amount of cross-border interconnection capacity consistent with network security constraints.

(36) *Approach:* This Indicator calculates a percentage forecast error between BCE values (the forecast) and the actual cross-border commercial schedules.

4.2 Data Requirements

(37) The data requirements for the BCE Indicator are:

– **BCE values**: The exchange programs between control areas in the monthly Network Model.

– **Net Commercial Schedules**: For every hour of the particular month under analysis, the TSOs on both sides of each the interconnection (and if applicable in both directions) "nominate" schedules. This value should represent all imports and exports scheduled on the interconnection between any two parties, including updates to such schedules initiated during the day of operation.

(38) For each hour, each net schedule is calculated by subtracting the total export schedules from total import schedules according to[9]:

Net Commercial Schedules = Imports – Exports [1.1]

(39) A negative value indicates that the TSO is a net exporter for that hour; a positive value indicates it is a net importer.

4.3 Procedure

(40) The procedure for implementing Indicator 1 requires the execution of the following steps:

– Identify data requirements and request data;

– Use data to calculate indicator;

[9] Some TSOs may keep the scheduling data in different formats and use different conventions. The TSO should make clear what data is being provided so it can be interpreted properly.

– Identify threshold and compare indicator to threshold;

– Identify action to be taken when threshold signals a variance form the indicator.

4.4 Calculating the BCE Indicator

(41) BCE Indicator calculation should be performed according to the following percentage error formula:

BCE Indicator = [BCE - Net Peak Commercial Schedules]/Net Peak Commercial Schedules [1.2]

Where **Net Peak Commercial Schedules** is the monthly maximum of Net Commercial Schedules, defined above.

4.5 Calculation of BCE Indicator Threshold

(42) The BCE Indicator Threshold is defined as the value above or below which the calculated indicator is considered to be outside a reasonable range and therefore is at variance from the indicator and may require regulatory action.

(43) When BCE values are inaccurate, NTC values could be distorted. For a BCE value that is "too low", the BCE value is significantly below the net peak commercial schedule, giving a negative value to the indicator. For a BCE value that is "too high", the BCE value is significantly above the net peak commercial schedule, giving a positive value to the indicator.

(44) Using the percentage Indicator Threshold, there is a variance in the indicator in a given month when:

BCE INDICATOR < Indicator Threshold lower bound

or

BCE INDICATOR > Indicator Threshold upper bound,

[1.3]

where BCE INDICATOR is the percentage forecast error[10] defined above in equation [1.2].

[10] In general, the percentage forecast error, which is applied through these Guidelines is calculated as [Forecast-Actual]/Actual

4.6 Indicator Threshold Values

(45) The Indicator Threshold for the BCE Indicator should be a "reference value". A reference value is a statistic that is based on historical experience with the indicator value.

(46) A significant deviation from historical experience indicates conditions warranting regulator attention.

(47) The Indicator Threshold value for the BCE Indicator should be a range based on the middle 70th percentile of recent historical BCE Indicator observations. This means the error deviations (as given in paragraph (41)) should be collected to an historical data base. More precisely, the BCE Indicator values calculated from the most recent six months and from all 8^{th} Region participants should be collected to a data set. From this historical data set, a range should be established symmetric around zero around using the 85^{th} and 15^{th} percentile. These end point percentiles provide the length of the threshold range, the distance between the 85^{th} percentile and the 15^{th} percentile. The threshold range is set by this distance and set symmetric around zero. Indicator values outside this threshold should be considered to be an indicator variance. See ANNEX 5 -- EXAMPLE OF THRESHOLD RANGE CALCULATION.

(48) Each month the data set used to establish the Indicator Threshold should be updated with the previous month's indicator values and a new Indicator Threshold should be established.

4.7 Sustained Variances

(49) The monthly indicator is a starting point for identifying the need for regulator action. The ultimate objective should be identifying "sustained" instances of net commercial schedules departing from BCE values. Two indications should be considered" (1) the difference in BCE and net commercial schedules is significant and (2) that this difference is a sustained phenomenon:

– The BCE Indicator should be outside the Indicator Threshold range in the current month, and

– The BCE Indicator should have been outside the Indicator Threshold range in one of the past two months.

4.8 Mitigation Action by Regulators

(50) When the two conditions of paragraph (49) are met, regulator action is warranted.

(51) Initially, this action should be a request to the TSO to explain the sustained variance and provide a plan to reduce forecast error.

(52) If the TSO does not provide such a plan, and the TSO does not provide clarity concerning the forecast errors, the regulator should recommend the following alternative forecast methods:

– The simple average of the most recent three months of actual peak net commercial schedules;

   1. This alternative BCE value should be used if it performs better in the BCE Indicator than the TSO BCE value itself.

2. To determine if the three-month moving average performs better than the TSO BCE value, the TSO should be asked to calculate a percentage error statistic using the moving average in the same manner as the BCE Indicator. If the rolling average is more accurate given the indicator thresholds, the TSO should adopt the three-month moving average method for BCE estimates on a temporary basis.
3. The temporary period should be linked to improvements in the TSO's BCE forecasting which should continue to be monitored during the temporary period against the three-month moving average. More precisely, the TSO should continue to calculate BCE values even though the three-month moving average value is to be used. During this temporary period, the TSO's calculated BCE value should be compared to the three-month moving average value to determine if the BCE forecasts have improved.
4. An equal or smaller number of indicator variances for the forecast BCE compared to the three-month moving average over a six-month period should be considered sufficient evidence that the BCE forecasts have improved.

5. INDICATOR 2: ALREADY ALLOCATED CAPACITY INDICATOR

5.1 Introduction

(53) *Description*: Indicator 2 monitors the part of Already Allocated Capacity (AAC) that is actually scheduled for cross-border transactions.

(54) *Purpose*: The purpose of the indicator is to detect whether participants are withholding capacity from the market by buying the capacity and not using it. This is sometimes called "hoarding". Part of the capacity that is reserved but that is not scheduled on a sustained basis either cause transmission capacity to be withheld from other participants or require other participants to wait to for release of this capacity (which occurs only near in time to the operating horizon).

(55) *Benefit:* Monitoring capacity usage will deter participants from withholding capacity from the market and will tend to open the market to wider competition.

(56) *Approach*: The approach in this indicator involves identifying the hour with the greatest volume of commercial schedules (monthly peak schedules). This hour should be matched and compared to the corresponding reservations (i.e., the AAC) for that day.

(57) The evaluation is conducted in both directions on each interconnection. Therefore, the TSO should be asked to provide commercial schedules and AAC in both directions on each interconnection.

5.2 Data Requirements

(58) The data requirements for Indicator 2 are:

– **Commercial schedules**: For every hour of a given month, on each interconnection, the TSO "nominates" schedules against the AAC. In other words, market participants with reservations (AAC) will schedule their transactions through the TSO. In a given hour, there may be exports and imports. A negative value indicates exporting; a positive value indicates importing. Some TSOs may keep the scheduling data in different formats and use different conventions. It is important for the TSO to specify what data is being provided so it can be interpreted properly. For an explanation on finding the peak commercial schedule, see the Technical Annex

– **AAC values**: As the focus for this indicator is AAC on the day when commercial schedules are at their monthly peak value, the TSO should provide daily AAC values. These values may be the same for each day of the month. Daily AAC values include, the AAC from annual, monthly, weekly, or day-ahead processes and/or auctions (but exclude intra-day- AAC). On each interconnection, there will be two AAC values, one in each direction. For example, on the interconnection between Romania and Serbia, there is an AAC for Serbia to Romania and one for Romania to Serbia. Therefore, for each interconnection, the TSO should provide two AAC values. In addition, if each party to the interconnection offers an AAC value in each direction, i.e., the scheduling of capacity is shared (50:50) between the neighbouring control areas, the party should report only its 50 percent share.

– **ATC values:** The indicator requires daily ATC values including the ATC resulting from annual, monthly, weekly, or day-ahead processes and/or auctions. Also like the AAC values discussed above, there may be two ATC values on each interconnection, one in each direction, e.g., on the interconnection between Romania and Serbia, there is an ATC for Serbia to Romania and one for Romania to Serbia. Therefore, if the ATC is shared, the party should report only its 50 percent share in each direction.

5.3 Procedure

(59) The procedure for implementing Indicator 2 requires the execution of the following steps:

– Identify data requirements and request data;

– Use data to calculate indicator;

– Identify threshold and compare indicator to threshold;

– Identify action to be taken when threshold signals a variance from the indicator.

5.4 Calculating the AAC Indicator

(60) The AAC the indicator is based on the percentage forecast error formula:

AAC Indicator = [AAC- Peak Commercial Schedules]/ Peak Commercial Schedules [2.1]

Where Peak Commercial Schedules are the monthly maximum of the Commercial Schedules.

5.5 Calculation of AAC Indicator Threshold

(61) The Indicator Threshold is the value above or below which the calculated indicator is considered to be outside a reasonable range and therefore signals a variance in the indicator and may require regulatory action.

(62) The the indicator is in variance when two conditions are met: First:

AAC INDICATOR > Indicator Threshold, [2.2]

where AAC INDICATOR is the percentage error defined above in equation [2.1]. Second:

ATC < ATC Indicator

5.6 Indicator Threshold Values

(63) The Indicator Threshold value for the AAC Indicator should be a range based on the 85th percentile of all historical ACC Indicator observations. This means the error deviations (as given in paragraph (41)) should be collected to an historical data base. More precisely, the AAC Indicator values calculated from the most recent six months and from all 8th Region participants should be collected to a data set. From this historical data set, a range should be established symmetric around zero around using the 85th and 15th percentile. These end point percentiles provide the length of the threshold range, the distance between the 85th percentile and the 15th percentile. The threshold range is set by this distance and set symmetric around zero. Indicator values outside this threshold should be considered to be an indicator variance. See ANNEX 5 -- EXAMPLE OF THRESHOLD RANGE CALCULATION.

(64) Each month the data set used to establish the Indicator Threshold should be updated with the previous month’s indicator values and a new Indicator Threshold should be established.

(65) There is no lower bound Indicator Threshold for the AAC Indicator.

(66) ATC Indicator is to provide an indicator that that significant incremental scheduling was not available to the market, which makes potential withholding of AAC more likely to succeed. While in theory this value should be zero, very small levels of ATC are also indicative of a lack of ATC. This value should be set at 25 MW.

5.7 Sustained Variances

(67) The monthly indicator is a starting point for identifying the need for market monitoring action. The objective is to find "sustained" instances of peak commercial schedules departing from AAC values. To do this, the indicator values over a three-month period should indicate the following:

– In the current month, the AAC Indicator should be above the Indicator Threshold range and the ATC should be less than the ATC Indicator, and

– The AAC Indicator should have been above the Indicator Threshold range and the ATC should have been less than the ATC Indicator, in one of the preceding two months.

(68) These requirements ensure that both the difference in AAC and peak commercial schedules is significant and that this difference is a sustained phenomenon while at the same time ATC was not available.

5.8 Mitigation Action by Regulators

(69) When the three conditions described in paragraph (67) are met, regulator action is warranted.

(70) The first approach should be a request for the TSO to explain the source of the withholding – i.e., whether the same participant is the source of the unscheduled reservations in the three months analyzed and whether that participant possesses the largest allocation of capacity in the three months on that interconnection. Any such participant may be contacted by the TSO to provide an explanation for the underscheduling.

(71) Regulators should take the explanations provided by the TSO and the participant and determine whether other factors are present that are consistent with a hypothesis of market power. These other circumstances to consider are:

– The participant makes short-term, market-based sales in the control area location supplied by the unused capacity;

– The participant makes exports on another interconnections out of the control area supplied by the unused capacity;

– Other suppliers have indicated interests in selling in the relevant location as indicated by unsuccessful offers to buy transmission capacity.

(72) Referral of the situation to the Competition Authorities should be considered when regulators suspect hoarding based on the indicator results.

6. INDICATOR 3: CRITICAL FACILITIES INDICATOR

6.1 Introduction

(73) *Description:* Indicator 3 monitors simulated power flows on key transmission elements in the Network Model.

(74) *Purpose:* The purpose of the indicator is to detect whether transmission constraints in the Network Model that limit NTC values are constraints that actually occur in real-time operations. The monitoring is intended to ensure accurate Network Model and, consequently, accurate NTC values.

(75) *Benefit*: Accurate NTC values will help ensure that market participants are provided the maximum amount of cross-border interconnection capacity consistent with network security constraints.

(76) *Approach:* This Indicator identifies "critical facilities" in the network model that limit NTC values. The base case flow on these critical facilities in the Network Model is compared to the peak flow in actual operations on these facilities. The critical facilities could be a transmission facility that is part of the interconnection or it could be a transmission facility internal to the transmission network.

6.2 Data Requirements

(77) The data requirements for this indicator are:

– **The identity of the security constraint(s) on each interconnection**[11]: For the estimate of NTC on each interconnection, the TSO will have simulated the maximum safe exchange over the interconnection (this maximum exchange is "ΔE"). This maximum exchange is limited by a security constraint, which in most cases is expected to be a specific transmission line ("critical facility"). On each interconnection, this simulation occurs in both directions. Hence, there may be two critical facilities on one interconnection, one for each direction.

– **The power flows on the security-constrained element in the Base Case of the Network Model**: For each security-constrained element, the Network Model will record the simulated power flow on transmission elements under *base case* conditions. The data of interest is in the simulated flow on the critical facilities under *base case conditions*, not the flows under the simulated in the "change" case where, ΔE was estimated. The change case was only to identify the critical facility, the flows on that facility in the base case is the data element.

– **The actually hourly power flow on the security-constrained element**: Actual power flows on the critical facility identified above.

[11] See Technical Annex.

6.3 Procedure

(78) The envisaged procedure for implementing the indicator foresees the following steps:

– Identify data requirements and request data;

– Use data to calculate indicator;

– Identify threshold and compare indicator to threshold;

– Identify action to be taken when threshold is in variance.

(79) Each of the four steps is discussed in the remainder of this subsection.

6.4 Calculating the Critical Facilities Indicator

(80) The Critical Facilities indicator should be calculated using the percentage forecast error formula:

Critical Facilities Indicator = [Simulated Peak Flow - Actual Peak Flow]/Actual Peak Flow [3.1]

6.5 Calculating the Critical Facilities Indicator Threshold

(81) The Indicator Threshold is the value above or below which the calculated indicator is considered to be outside a reasonable range and therefore signals a variance in the indicator and may require regulatory action.

(82) When flows that are simulated in the Network Model do not correspond to the flows that actually occur, the network model may be inaccurate and NTC values can be distorted. In the case of Critical Facilities, the problem arises if the simulated flow in the base case is "too high," (significantly exceeds what is observed in actual experience). When this base case is used to simulate the largest transfer to the adjacent control areas (ΔE), this largest transfer may be underestimated and, thus, may lead to underestimating NTC.

(83) The simulated flow value is not expected to be exactly equal to actual flow experience. Many network and commercial variables change between the time the Network Model is estimated and the time when peak flows occur. Therefore, some margin of difference should be allowed when setting the Indicator Threshold.

(84) Using the reference range, the indicator is in variance less often:

Critical Facilities Indicator > Indicator Threshold, [3.2]

where Critical Facilities Indicator is the percentage error defined above in [3.1].

6.6 Indicator Threshold Values

(85) The Indicator Threshold for the Critical Facilities Indicator should be a "reference value".

(86) A reference value is a statistic (described below) that is based on historical experience with the indicator. A significant deviation from historical experience indicates conditions warranting regulatory attention.

(87) The Indicator Threshold value for the Critical Facilities Indicator should be a range based on the middle 70th percentile of all historical Critical Facilities Indicator observations. This means the error deviations (as given in paragraph (84)) should be collected to an historical data base. More precisely, the Critical Facilities Indicator values calculated from the most recent six months and from all 8th Region participants should be collected to a data set. From this historical data set, a range should be established symmetric around zero around using the 85th and 15th percentile. These end point percentiles provide the length of the threshold range, the distance between the 85th percentile and the 15th percentile. The threshold range is set by this distance and set symmetric around zero. Indicator values outside this threshold should be considered to be an indicator variance. See ANNEX 5 -- EXAMPLE OF THRESHOLD RANGE CALCULATION.

(88) Each month the data set used to establish the Indicator Threshold should be updated with the previous month's indicator values and a new Indicator Threshold should be established.

(89) There is no lower bound Indicator Threshold for the Critical Facilities Indicator.

6.7 Sustained Variances

(90) The objective is to find "sustained" instances of actual flows on the critical facilities departing from base case flows. To do this, the pattern of the indicator values over a three-month period should reveal two indications:

– The Critical Facilities Indicator should be outside the Indicator Threshold range in the current month, and

– The Critical Facilities Indicator should have been outside the Indicator Threshold range in one of the past two months.

(91) These requirements ensure that both the difference in actual and base case flows is significant and that it is a sustained phenomenon.

6.8 Mitigation Action by Regulators

(92) When the two conditions described in paragraph (90) are met, regulator action is warranted.

(93) A first approach should be a request for the TSO to explain the sustained variance.

(94) If the TSO does not provide a plan and the TSO does not provide clarity concerning the forecast errors, the regulator should recommend the following alternative forecast method:

– If these indicator results indicate that one TSO has superior forecasting outcomes (i.e., less often is at variance with the indicator), the regulator should consider a technical discussion between its TSO and a TSO having superior outcome to determine whether there is a superior method of forecasting that should be adopted.

7. INDICATOR 4 - MONITORING LOAD FORECASTS IN THE NETWORK MODEL

7.1 Introduction

(95) *Description:* Indicator 4 monitors load forecasts used in the Network Model.

(96) *Purpose:* The purpose of the indicator is to monitor the accuracy of the load assumptions in order to help ensure accuracy in the Network Model and, consequently, accuracy in NTC values.

(97) *Benefit:* Accurate NTC values will help ensure that market participants are provided the maximum amount of cross-border interconnection capacity consistent with network security constraints.

(98) *Approach*: This Indicator calculates a percentage forecast error between forecast load and the actual load.[12]

7.2 Data Requirements

(99) The data requirements for this indicator are:

– **Load Forecast**: TSOs publish monthly NTC values for month-ahead transmission service. This is based on a monthly Network Model that uses forecast load for the month. From the Network Model, the TSO should provide the forecast load.

– **The actual hourly load** – The TSO should provide the control area load for each hour of the month.[13]

(100) The envisaged procedure for implementing the indicator foresees the following steps:

– Identify data requirements and request data;

– Use data to calculate indicator;

– Identify threshold and compare indicator to threshold;

– Identify action to be taken when a variance in the indicator exceeds the threshold.

7.3 Calculation of Load Forecast Indicator

(101) In order to monitor the relationship between the forecast and actual load values, a Percentage Error formula should be applied:

[12] The Technical Annex provides the theoretical basis for this screen.
[13] While only the peak load is required for this screen, Indicator 6 described in section 9 requires hourly values.

Load Forecast Indicator = [Load Forecast -Actual Peak Load]/Actual Peak Load.

Where Load Forecast is forecast load value used in the monthly network model as defined above and Actual Peak Load is the maximum load realized dirign the month

7.4 Calculation of Load Forecast Indicator Threshold

(102) The Load Forecast Indicator Threshold is defined as the value above or below which the calculated indicator is considered to be outside a reasonable range and therefore signals a variance in the indicator and may require regulatory action.

(103) When load forecast values are inaccurate, NTC values could be distorted. For a load forecast value that is "too low", the load forecast value is significantly below the actual load, giving a negative value to the indicator. For a load forecast value that is "too high", the load forecast value is significantly above the actual load, giving a positive value to the indicator.

(104) The indicator is in variance less often:

LOAD FORECAST INDICATOR < Indicator Threshold lower bound

or

LOAD FORECAST INDICATOR > Indicator Threshold upper bound,

[1.3]

where LOAD FORECAST INDICATOR is the percentage forecast error defined above.

7.5 Indicator Threshold Values

(105) The Indicator Threshold for the Load Forecast Indicator should be a "reference value". A reference value is a statistic that is based on historical experience with the indicator.

(106) A significant deviation from historical experience indicates conditions warranting regulator attention.

(107) The Indicator Threshold value for the Load Forecast Indicator should be a range based on the middle 70th percentile of all historical Load Forecast Indicator observations. This means the error deviations (as given in paragraph (101)) should be collected to an historical data base. More precisely, the Load Forecast Indicator values calculated from the most recent six months and from all 8^{th} Region participants should be collected to a data set. From this historical data set, a range should be established symmetric around zero around using the 85^{th} and 15^{th} percentile. These end point percentiles provide the length of the threshold range, the distance between the 85^{th} percentile and the 15^{th} percentile. The threshold range is set by this distance and set symmetric around zero. Indicator values outside this threshold should be considered to be an indicator variance. See ANNEX 5 -- EXAMPLE OF THRESHOLD RANGE CALCULATION.

(108) Each month the data set used to establish the Indicator Threshold should be updated with the previous month's indicator values and a new Indicator Threshold should be established.

7.6 Sustained Variances

(109) The monthly indicator is a starting point for identifying the need for regulator action. The ultimate objective should be identifying "sustained" instances of actual peak load departing from load forecast values. Two indications should be considered, ensuring that both the difference in load forecast and actual load is significant and that it is a sustained phenomenon:

– The Load Forecast Indicator should be outside the Indicator Threshold range in the current month, and

– The Load Forecast Indicator should have been outside the Indicator Threshold range in one of the past two months.

7.7 Mitigation Action by Regulators

(110) When the two conditions described in paragraph (109) are met, regulator action is warranted.

(111) A first approach should be a request for the TSO to explain the sustained variance and submit a plan to improve forecasts.

(112) If the TSO does not provide a plan and the TSO does not provide clarity concerning the forecast errors, the regulator should recommend the following alternative forecast method:

– If these indicator results show that another 8th Region TSO has superior forecasting outcomes (i.e., less often at variance with the indicator), the regulator should consider a technical discussion between its TSO and the other TSO having superior outcome to determine whether there is a superior method of forecasting.

8. INDICATOR 5 - MONITORING GENERATION FORECASTS IN THE NETWORK MODEL

8.1 Introduction

(113) *Description:* Indicator 5 monitors generation forecasts used in the Network Model.

(114) *Purpose:* The purpose of the indicator is to monitor the accuracy of the generation assumptions in order to help ensure an accurate Network Model and, consequently, accurate NTC values.

(115) *Benefit:* Accurate NTC values will help ensure that market participants are provided the maximum amount of cross-border interconnection capacity consistent with network security constraints.

(116) *Approach:* This Indicator calculates a percentage forecast error between forecast aggregate generation and the actual aggregate generation for the major control area generators.[14]

8.2 Data Requirements

(117) The data requirements for this indicator are:

- **Generation Output assumed in the monthly Network Model**: From the monthly Network Model, the TSO should provide the peak generation output in MW assumed for the ten largest control area generators that have a capacity of at least 50 MW. These entries should be "Production units", which aggregate individual generating units at multi-unit plant sites.
- **Actual monthly peak output.:** TSO should provide actual peak monthly output of the generators identified in previous data element, which are the ten largest control area generators that have a capacity of at least 50 MW.

8.3 Procedure

(118) The envisaged procedure for implementing the indicator foresees the following steps:

- Identify data requirements and request data;
- Use data to calculate indicator;
- Identify threshold and compare indicator to threshold;
- Identify action to be taken when a variance in the indicator exceeds the threshold.

[14] The Technical Annex provides the theoretical basis for this screen.

8.4 Calculation of Generation Forecast Indicator

(119) In order to monitor the relationship between the forecast and actual generation values, a percentage forecast error formula should be applied: For each of the ten largest generators,

Generation Forecast Indicator = [Forecast Generation Output – Actual Generation Output] / Actual Generation Output.

(120) Because each control area should submit data on up to 10 individual indicators, there are up to 10 indicator values per month per control area.

8.5 Calculation of Generator Forecast Indicator Threshold

(121) The Generation Forecast Indicator Threshold is defined as the value above or below which the calculated indicator is considered to be outside a reasonable range and therefore signals a variance in the indicator and may require regulatory action.

(122) When generation forecast values are inaccurate, NTC values could be distorted. For a generation forecast value that is "too low", the generation forecast value is significantly below actual generation, giving a negative value to the indicator. For a generation forecast value that is "too high", the generation forecast value is significantly above the actual generation, giving a positive value to the indicator.

(123) The Generation Forecast Indicator is in variance in a given month when:

GENERATION FORECAST INDICATOR < Indicator Threshold lower bound

or

GENERATION FORECAST INDICATOR > Indicator Threshold upper bound,

where GENERATION FORECAST INDICATOR is the percentage forecast error defined above.

8.6 Indicator Threshold Values

(124) The Indicator Threshold for the Generation Forecast Indicator should be a "reference value". A reference value is a statistic that is based on historical experience with the indicator.

(125) A significant deviation from historical experience indicates conditions warranting regulator attention.

(126) The Indicator Threshold value for the Generation Forecast Indicator should be a range based on the middle 70th percentile of all historical Generation Forecast Indicator observations. This means the error deviations (as given in paragraph (117)) should be collected to an historical data base. More precisely, the Generation Forecast Indicator values calculated from the most recent six months and from all 8th Region participants should be collected to a data set. From this historical data set, a range should be established symmetric around zero around using the 85th and 15th percentile. These end point percentiles provide the length of the threshold range, the distance between the 85th percentile and the 15th percentile. The threshold range is set by this distance and set symmetric around zero. Indicator values outside this threshold should be considered to be an indicator variance. See ANNEX 5 -- EXAMPLE OF THRESHOLD RANGE CALCULATION.

(127) Each month the data set used to establish the Indicator Threshold should be updated with the previous month's indicator values and a new Indicator Threshold should be established.

8.7 Sustained Variances

(128) The monthly indicator is a starting point for identifying the need for regulator action. The ultimate objective should be identifying "sustained" instances of actual generation departing from generation forecast values. Two indications should be considered, ensuring that both the difference in generation forecast and actual generation is significant and that it is a sustained phenomenon:

– The Generation Forecast Indicator should be outside the Indicator Threshold range in the current month, and

– The Generation Forecast Indicator should have been outside the Indicator Threshold range in one of the past two months.

8.8 Mitigation Action by Regulators

(129) When the two conditions described in paragraph (128) are met, regulator action is warranted.

(130) A first approach should be a request for the TSO to explain the sustained variance and submit a plan to improve forecasts.

(131) If the TSO does not provide a plan and the TSO does not provide clarity concerning the forecast errors, the regulator should recommend the following alternative forecast method:

– If these indicator results show that another 8th Region TSO has superior forecasting outcomes (i.e., less often at variance with the indicator), the regulator should consider a technical discussion between its TSO and the other TSO having superior outcome to determine whether there is a superior method of forecasting.

9. INDICATOR 6 - MONITORING TRANSMISSION RELIABILITY MARGIN

9.1 Introduction

(132) *Description*: Indicator 6 monitors the Transmission Reliability Margin (TRM) used in calculating NTC values.

(133) *Purpose:* The purpose of the indicator is to monitor the accuracy of TRM. NTC is calculated as Total Transfer Capability (TTC) *less* TRM. Accurate TRM values help ensure accurate NTC values.

(134) *Benefit:* Accurate NTC values will help ensure that market participants are provided the maximum amount of cross-border interconnection capacity consistent with network security constraints.

(135) *Approach:* This Indicator calculates a percentage forecast error between TSO posted TRM values and an estimate of TRM based on ENTSO-E procedures.[15]

9.2 Data Requirements

(136) The data requirements for this indicator are:

– **Transmission Reliability Margin** – TSO should provide TRM values used in monthly NTC calculations for month-ahead transmission service on each interconnection.

– **Aggregated Generator Output in MW.** TSO should provide the actual total hourly output of all control area generating units on an aggregated basis (individual units do not have to be identified).

– **Net Commercial Schedules –** see section 4.2.

– **The actual hourly load** – see section 7.2.

– **Capacity value of any emergency exchange** –TSO should provide cross-border capacity set aside for emergency exchanges. These values should be known in advance based on existing agreements. The value should be reported on each interconnection.

9.3 Procedure

(137) The envisaged procedure for implementing the indicator foresees the following steps:

– Identify data requirements and request data;

– Use data to calculate indicator;

– Identify threshold and compare indicator to threshold;

– Identify action to be taken when a variance in the indicator exceeds the threshold.

[15] The Technical Annex provides the theoretical basis for this screen.

9.4 Calculation of TRM Indicator

(138) The New TRM Indicator is based on the TRM calculation guidelines of ENTSO-E.[16] According to ENTSO-E, TRM should be either $U_E + U_r$ or $Max(U_E + U_r)$, which mean that TRM is (at most) the sum of: $U_E + U_r$, where

- U_E is the cross-border capacity set aside on an interconnection for emergency exchanges.
- U_r is $k * \sigma$
  Where:

  σ is the standard deviation of Area Control Error (ACE). ACE is the hourly difference between control area load and total supply (generation plus net imports).

  The standard deviation of ACE (σ) should be on hourly ACE deviations in a moving six-month time series;

  k = 3, (3 standard deviations)

(139) For each interconnection, the TRM proxy index value should be calculated as:

- $I_{TRM} = U_E + w*U_r$
- Where U_E and U_r are the values described above;
- *w* is the portion of the import TTC on the interconnection relative to all control area import TTC.[17] We use this weight to reflect the fact that unintended deviations (ACE) will be accommodated over all interconnections. Therefore, the amount of cross-border capacity needed on an individual interconnection will be in proportion to the TTC on this interconnection relative to all TTC into the control area. While ENTSO-E does not reflect this explicitly, it is the logical implication of the formula.

(140) The TRM value is a forecast of the actual use of the interconnection for emergencies and imbalances. Hence, the TRM Indicator uses the Percentage Error formula:

$$\textbf{TRM Indicator} = [\text{TRM} - I_{TRM}] / I_{TRM}$$

[16] "Procedures for Cross-Border Transmission Capacity Assessments," ETSO (2001), P 9-10.

[17] As an example, if a control area has two interconnections one with a TTC of 100 MW and the other with TTC of 200 MW, then 1/3 of the Ur is assigned TRM for the first interconnection and 2/3 to the TRM on the other interconnection. This approach is based on the inherent characteristics of the value U_r. U_r is what must remain on the interconnections in order to allow the system to use the interconnections to recover from a temporary imbalance. The value should be distributed across all interconnections in proportion to their relative impedances, which is highly correlated with import TTC.

9.5 Calculation of TRM Indicator Threshold

(141) The Indicator Threshold is the value above or below which the calculated indicator is considered to be outside a reasonable range and therefore signals a variance in the indicator and may require regulatory action.

(142) The indicator is in variance less often:

TRM INDICATOR > Indicator Threshold,

where TRM INDICATOR is the percentage error defined above.

9.6 TRM Indicator Threshold Values

(143) The Indicator Threshold value for the TRM Indicator should be a range based on the 85th percentile of all historical TRM Indicator observations. This means the forecast error deviations (as given in paragraph (140)) should be collected to an historical data base. More precisely, the TRM values calculated from the most recent six months and from all 8^{th} Region participants should be collected to a data set. From this historical data set, the Indicator Threshold should be established using the 85^{th} percentile. Indicator values above this threshold should be considered a signal of indicator variance.

(144) The Indicator Threshold value for the TRM Indicator should be based on the 85th percentile of all historical TRM Indicator observations (i.e., based on historical percentage error deviations as given in paragraph (140)). More precisely, the TRM Indicator values calculated from recent months and from all 8^{th} Region participants should be collected to a data set. From this historical data set, a range should be established symmetric around zero around using the 85^{th} and 15^{th} percentile. These end point percentiles provide the length of the threshold range, the distance between the 85^{th} percentile and the 15^{th} percentile. The threshold range is set by this distance and set symmetric around zero. Indicator values outside this threshold should be considered to be an indicator variance. See ANNEX 5 -- EXAMPLE OF THRESHOLD RANGE CALCULATION..

(145) Each month the data set is updated with the previous month’s indicator values and a new Indicator Threshold is established.

(146) There is no lower bound Indicator Threshold for the TRM Indicator.

9.7 Sustained Variances

(147) The monthly indicator is a starting point for identifying the need for market monitoring action. The objective is to find “sustained” instances of I_{TRM} departing from TRM values. To do this, the indicator pattern over a three-month period should indicate the following:

– The TRM Indicator should be above the Threshold range in the current month, and

– The TRM Indicator should have been above the Indicator Threshold range in two of the preceding three months.

(148) These requirements ensure that both the difference in TRM and I_{TRM} is significant and that this difference is a sustained phenomenon.

9.8 Mitigation Action by Regulators

(149) When the two conditions described in paragraph (147) are met, regulator action is warranted.

(150) A first approach should be a request for the TSO to explain the sustained variance and provide a plan to reduce forecast error.

(151) If no such plan is put forth and clarity is not attained from the TSO, the regulator should consider directing the TSO to adopt specific methods for establishing TRM. Adopting the ENTSO-E approach that underpins the calculation of the TRM Index in this monitoring Indicator would be recommendable.

10. INDICATOR 7 – MARKET SHARE INDICATOR

10.1 Introduction

(152) *Description*: Market Share Indicator monitors the share of capacity controlled by market participants.

(153) *Purpose:* The purpose of the indicator is to measure market shares of import capacity and generation ownership.

(154) *Benefit:* Market Shares provide indicator of market power.

(155) *Approach*: Calculates summary statistics that inform regulators about market outcomes and competitive structure.

10.2 Data Requirements

(156) The data requirements for Market Share Indicator are:

<u>Yearly Auction Data</u>

– **Offered Capacity in Yearly Auction**: This is the amount of cross-border transfer capability offered in the yearly auction. TSOs should provide this for each interconnection and in both directions.

– **Allocated Capacity to each Participant**: For each interconnection and in both directions, TSO should provide the identity of each participant that was allocated cross-border capacity in the yearly auction and the amount allocated.

– **Marginal Price in €/MWh**: For each interconnection and in both directions, the TSO should provide the marginal clearing price in the yearly auction.

- **Capacity Resold and repurchased by each participant**: For each interconnection and in both directions, the TSO should provide the identity of the buyer and seller of resold yearly cross-border capacity.

Monthly Auction Data

- **Offered Capacity in Monthly Auction**: This is the amount of cross-border transfer capability offered in the monthly auction. TSOs should provide this for each interconnection and in both directions.
- **Allocated Capacity to each Participant**: For each interconnection and in both directions, TSO should provide the identity of each participant that was allocated cross-border capacity in the monthly auction and the amount allocated.
- **Marginal Price**: For each interconnection and in both directions, the TSO should provide the marginal clearing price in the monthly auction.
- **Capacity Resold and repurchased by each participant**: For each interconnection and in both directions, the TSO should provide the identity of the buyer and seller of resold monthly cross-border capacity.

Weekly Auction

- **Offered Capacity in Weekly Auction**: This is the amount of cross-border transfer capability offered in the weekly auction. TSOs should provide this for each interconnection and in both directions.
- **Allocated Capacity to each Participant**: For each interconnection and in both directions, TSO should provide the identity of each participant that was allocated cross-border capacity in the weekly auction and the amount allocated.
- **Marginal Price**: For each interconnection and in both directions, the TSO should provide the marginal clearing price in the weekly auction.
- **Capacity Resold and repurchased by each participant**: For each interconnection and in both directions, the TSO should provide the identity of the buyer and seller of resold weekly cross-border capacity.

Daily Auction

- **Offered Capacity in Daily Auction**: This is the amount of cross-border transfer capability offered in the daily auction. TSOs should provide this for each interconnection and in both directions.
- **Allocated Capacity to each Participant**: For each interconnection and in both directions, TSO should provide the identity of each participant that was allocated cross-border capacity in the daily auction and the amount allocated.
- **Marginal Price**: For each interconnection and in both directions, the TSO should provide the marginal clearing price in the daily auction.

- **Capacity not nominated by each participant and released to TSO**: For each interconnection and in both directions, the TSO should provide the identity of the buyer and seller of released daily cross-border capacity.
- **Actual Physical Flow** : TSO should provide hourly physical (metered) flow on each interconnection.

Related Congestion Management Data

- **Curtailment**: For every hour in each direction, TSO should provide curtailment MW representing total reduction in output from generation as a result of real-time curtailments.
- **Cost of Curtailments**: For each curtailment, TSO should provide total fees paid to market players in connection with real-time curtailment MW.

10.3 Calculation of Interconnection Capacity Shares

(157) Two capacity share calculations should be calculated. The first is a standard capacity share value which is simply the portion of interconnection capacity into the control area controlled by a market participant relative to other market participants. The second is the Herfindahl-Hirschmann Index (HHI), which measures concentration of capacity shares. The HHI increases as the largest supplier increase its share of the total capacity.

Standard Capacity Share Calculations

(158) Standard capacity share for participant *i* is

- $\mathbf{K_i/\Sigma K_j}$
- where

$\mathbf{K_i}$ = i i is yearly, monthly, and less than monthly import capacity purchased into control area by participant *i* less import capacity resold.

$\mathbf{\Sigma K_j}$ is the net capacity owned or imported by all others into the control area.

Herfindahl-Hirschmann Index

(159) Let $\mathbf{K_i/\Sigma K_j}$ be as defined above (the share of net capacity owned or imported into the control area by participant *i*). The HHI is the sum of all participants market shares squared:

$$\mathbf{HHI = \Sigma_i(K_i/\Sigma K_j)^2}$$

10.4 Calculation of Interconnection Capacity Shares Thresholds

(160) A market participant's control area capacity share is used to make inferences about the participant's *market power*. Market power is the ability to control supply and increase price. This can occur when a seller controls a large portion of available supply, either alone (unilateral market power) or in a cartel (conspiratorial market power).

(161) The HHI is a measure of concentration. Generally, under both U.S. and E.U. policy, a market with an HHI of 1000 (for example ten firms with 10-percent market share each) is considered to be "unconcentrated."[18] A market with an HHI in the range of 1000 to 2000 (1800 for U.S. policy) is considered to be "moderately" concentrated. A market with HHI over 2000 (1800 for U.S.) is considered to be highly concentrated.

(162) The following thresholds should be used in assessing the indicative market power of a participant:

A participant is assumed to lack market when both of the following are met:

– Market Share < 20 percent, and

– HHI < 2500.[19]

10.5 Further Analysis by Regulators

(163) Variances of the thresholds identified in this section are indicative of market power. Further analysis should be undertaken by regulators to develop definitive findings of market power. These additional analysis should include:

– Refining market shares to reflect

(1) the combined capacity of all interconnections into a control area;

(2) generation capacity located inside the control area that is not committed to regulated native load;

[18] Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings,' DG COMP, 28, January 2004; U.S. Department of Justice Merger and Federal Trade Commission Guidelines.

[19] Except in the cases close to pure monopoly (one firm with 100 percent market share) and close to perfect competition (many firms with close to zero-percent market share each), there is no formulaic way to translate market share and concentration statistics to definitive market power conclusions. The U.S. Federal Energy Regulatory Commission uses a 20-percent market share threshold and a 2500 HHI threshold when assessing the market power of supplier. In particular, when a supplier's market share is less than 20 percent and the HHI in that market is less than 2500, then the supplier is presumed to have no market power. These thresholds are used for market share statistics that include both control of capacity on interconnections and control of generation capacity, not just control of capacity on the interconnection.

11. PROVISIONS FOR IMPLEMENTATION

11.1 SEEAMMS

(164) As discussed herein, SEEAMMS is the *South East Europe Automated Market Monitoring System*. SEEAMMS is a key aspect of implementation of these MMG.

(165) Data collection, storage, and reporting should be conducted via (SEEAMMS) that has been and will continue to be developed for regulators in accordance with these MMG.

(166) The SEEAMMS should fulfil the following minimum requirements:

– It is maintained by a central body[20].

– It allows direct entry of market monitoring data by TSOs which is then combined into a regional market monitoring database.

– Using the market monitoring database, SEEAMMS automatically calculates the indicators and thresholds as specified in the MMG.

– These indicators are produced and reported to regulators in accordance with the reporting procedures specified in the MMG.

– The SEEAMMS should check for data entry errors and notify regulators in the event of an indicator variance.

(167) Access to the SEEAMMS is granted within the following limits

– To TSOs for entering, editing, and viewing the monitoring data for and limited to their system.

– To regulators for viewing the data entered by the TSOs of their jurisdiction and results of Indicators and variances for their .jurisdiction.

– For the regional monitor related to all data.

11.2 Electricity Working Group

(168) The ECRB Electricity Working Group shall implement the MMG by

– Establishing the procedures by which the 8th Region NRAs shall cooperate on a regional basis, for example, in the 2013-14 Dry Run, a monthly rotation among NRAs was used to facilitate cooperation (see subsection 0).

– Other potential coordinating entities may include, but not necessarily be limited to, the Energy Community Secretariat, NRAs under other rotating processes, or a third-party consultant.

[20] E.g. Energy Community Secretariat (ECS).

(169) The ECRB Electricity working group shall modify the SEEAMMS to adapt to new methods and data requirements, such as the Coordinated Auction Office.

(170) The ECRB Electricity Working Group shall propose and approve changes to these MMG and submit these changes to the ECRB , as appropriate .

ANNEX 1 - DEFINITIONS

(1) Definitions used in Directives 2003/54/EC and 2009/72/EC as well as Regulations (EC) 1228/2003 and 714/2009 are applied in an un-modified way. Terms used beyond these definitions of are applied as listed hereinafter.

(2) ***Already Allocated Capacity*** (AAC) – The total amount of allocated transmission rights for a given time period.

(3) ***Base Case*** – A set of common data used in the *Capacity Assessment* which includes a network model and input data describing load and generation patterns forecast and network topology at the studied time frame.

(4) ***Base Case Exchange*** (BCE) – The forecast of cross-border transactions in the *Base Case*. A BCE is an assumption about "exchange programs" between TSOs. It reflects anticipated cross-border schedules of the transmission network that is used to estimate NTC in the Network Model. The Network Model is a computer simulation of the transmission network. BCE assumptions are used as a starting point in calculating *Net Transfer Capacity* (NTC).

(5) ***Base Case Network Model*** - The simulated Network Model used to estimate NTC assuming network conditions that accurately reflect transmission elements, load, generation, and exchanges between TSOs (i.e., BCEs)[21]. The Network Model uses the network base case and determines the "base case flows" on each transmission element. This estimate of base case flows is used in determining how much transmission capacity is available to the market (i.e., NTC). This estimate is critical because NTC depends on how much additional flow can be accommodated over the network.

(6) ***Capacity Assessment*** – A harmonized framework developed by European Transmission System Operators[22] to ensure that Network Models used to calculate cross-border transmission capacity values rely on comparable principles and practices.

(7) ***Commercial Schedules*** – The sum of cross-border transactions reported to the TSO by market participants with valid transmission reservations to support such a transactions. Commercial schedules (imports) is the total cross-border transactions destined to the TSO control area reported up to the real-time dispatch; Commercial schedules (exports) is the total cross-border transactions destined to the neighbouring TSO control area reported up to the real-time dispatch.

(8) ***Critical Facility*** – The transmission facility in the network model that is the binding constraint in the when estimating the maximum transfer (ΔE) between two control areas in the Capacity Assessment.

(9) ***Data Provider*** – The entity responsible for providing data under these Guidelines.

21 (ex-) ETSO, Procedures for Cross-Border Transmission Capacity Assessments, October 2001, page 6.

22 (ex-) ETSO, Procedures for Cross Border Transmission Capacity Assessments, October 2001.

(10) ***Delta E*** (ΔE) – A construct used in the *Capacity Assessment* that represents the extra amount of power over the *Base Case* that can be exchanged continuously from one country to another while ensuring the safe operation of both interconnected electricity systems. ΔE represents the extra amount of power over the base case that can be exchanged safely in all hours from one TSO to another TSO or to multiple TSOs if combined NTC calculation is performed (under the "N-1 criteria," i.e., the worst-case single outage is in effect)[23].

(11) **Herfindahl-Hirschmann Index (HHI)** – A measure of market concentration that sums the square of each market participant's market share: HHI = $\mathbf{\Sigma_{all\ j}\ (K_j)^2}$ where K_j is the market share of participant j and $\mathbf{\Sigma_{all\ j}}$ means the sum over all participants.

(12) ***Limiting Facility*** – Transmission facility identified in the Network Model that results in a security constraint that limits the level of Δ*E.*

(13) ***Market Power*** -- The ability to control prices, either alone (unilateral market power) or in a collusive arrangement, like a cartel (conspiratorial market power).

(14) ***Mitigation Measure*** – Actions taken by regulators when a indicator value falls outside of the pre-established threshold range. Some mitigation actions can be undertaken by an individual regulator when the practices indicate. Other practices specify coordinated actions among regulators.

(15) ***Net Transfer Capacity*** (NTC) – the cross-border electricity transmission capacity available to the market. NTC on an interconnection shall be defined as: NTC = TTC– TRM.

(16) ***Network Model*** – See Base Case Network Model.

(17) ***Regional Coordinating Entity*** – Entity that operates the regional monitoring activities of the market monitoring under these Guidelines.

(18) Retail Load Obligation – Obligation of the owner of generation to serve retail customers under a regulatory requirement.

(19) ***SEEAMMS*** – Acronym for South East Europe Automated Market Monitoring System (See Section 1).

(20) ***Indicator Threshold*** – The value range above or below which the calculated indicator is considered to be outside a reasonable range and therefore signals a variance in the indicator and may require regulatory action.

(21) ***Total Transfer Capacity*** (TTC) – TTC is defined as: TTC = ΔE + BCE.

(22) ***Transmission Reliability Margin*** (TRM) – The amount of cross-border capacity that is set aside to ensure network security from unintended imbalances and emergencies.

[23] (ex-) ETSO, *Op Cit.,* page 8.

ANNEX 2 - TEMPLATES

Templates for data collection are available on the South East Europe Automated Market Monitoring System: www.seeamms.com

Technical Description of BCE Indicator

BCE assumptions are used as a starting point in calculating how much cross-border transmission capacity is available to the market, known as Net Transfer Capacity (NTC). Because BCE can impact the level of NTC this indicator is intended to monitor the accuracy of the BCE assumptions so that NTC values are accurate.

What is a BCE Value?

A BCE is an assumption about “exchange programs” between TSOs. It reflects anticipated cross-border schedules of the transmission network that is used to estimate NTC in the Network Model. The Network Model is a computer simulation of the transmission network

The BCE values may not be a direct input into the Network Model. The Network Model will use load and resource balances as inputs. These balances reflect the BCE values, but do not reveal them directly. The BCE values add to or subtract from the resources available to meet load and are reflected in the resources, but are not a direct model input.

Because the BCE values are not a direct input into the Network Model, the TSOs “pre-process” the BCE values. In other words, BCE values are used to establish the resource balances prior to the resource balances being input to the Network Model. The indicator requires the BCE values that are used to derive the resource balance for the Network Model.

Calculating the BCE Indicator

The basic calculation of the BCE indicator is simple. It is a “percentage error formula”, a common approach to measuring forecast errors. This formula considers both positive and negative errors:

BCE INDICATOR = [*BCE - Net Peak Commercial Schedules*]/*Net Peak Commercial Schedules* [A.1.1]

Example A 1.1:

Let BCE= 250, Net Peak Commercial Schedules = 230 MW;

Then BCE INDICATOR = [250-230]/230 = 8.7%

How Does BCE Affect ATC Calculations?

The simulated Network Model used to estimate NTC must assume network conditions that accurately reflect transmission elements, load, generation, and exchanges between TSOs (i.e., BCEs). These assumptions are called the “Base Case” Network Model[24].

The Network Model uses the network base case and determines the “base case flows” on each transmission element. This estimate of base case flows is used in determining how much transmission capacity is available to the market (i.e., NTC). This estimate is critical because NTC depends on how much additional flow can be accommodated over the network.

[24] Procedures for Cross-Border Transmission Capacity Assessments,” ETSO, October 2001, page 6.

How is NTC Calculated?

NTC on an interconnection is defined as:

NTC = TTC– TRM; [A1.2]

where TTC is Total Transfer Capacity and TRM is Transmission Reliability Margin. BCE only indirectly affects TRM. Our focus is the effect on TTC.

The TTC is defined as:

TTC = ΔE + BCE, [**A1.3**]

where ΔE represents the extra amount of power over the base case that can be exchanged safely in all hours from one TSO to another TSO or to multiple TSOs if combined NTC calculation is performed (under the "N-1 criteria," i.e., the worst-case single outage is in effect)[25]. .

How do BCE Values Affect TTC?

BCE values affect TTC in two ways. Consider the TTC equation A1.3. BCE is an additive component of TTC. Consequently, changes to BCE can have a direct effect on TTC. If the BCE value on an interconnection is not accurate (i.e., it does not reflect anticipated exchanges), then TTC (and, consequently, NTC) may be too big or too small.

It is important to note that the BCE component of the TTC equation does not mean that part of the TTC is reserved for BCE transactions. Transactions identified in the BCE must secure NTC through the processes used by all market participants. BCE values are reflected in the Network Model in order to help ensure an accurate estimation of operating conditions.

What is the Second Way BCE Values Affect TTC?

BCE values also affect TTC through its impact on ΔE.

From above, recall equation A1.3. Hence, if BCE values affect ΔE, then they will affect TTC. Recall that ΔE is the estimate of the extra power that can safely be transferred over an interconnection above the base case in the Network Model (under the N-1 criteria, i.e., under the assumption that the worst single outage is in effect). If BCE values reflected in the base case are not accurate, then the estimate of base case flows on the cross-border facilities may be too high (or too low), which causes ΔE to be too low (or too high) and, consequently TTC is too low (or too high).

What time frame should be considered in the indicator?

The monthly time frame should be the focus when examining NTC values because the monthly NTC market is the most commonly used market in the region. The exception is the FYR of Macedonia-Greece interconnection and the Greece-Italy interconnection, which are more frequently transacted. Moreover, more frequent allocations are sometimes based on the monthly Network Model

[25] See, (ex-) ETSO, *Op Cit.* page 8.

How to Find the Peak Net Commercial Schedule

The data for each month will consist of approximately 720 data points, one for each hour of a 30-day month. This data may include hours when there are net exports and hours when there are net imports.

On many interconnections, the exchanges are in the same direction every hour of the month. In these cases, the peak net commercial schedules are those occurring during the hour of the month when the import or the exports are the greatest (if export data is presented as negative values, then the greatest net export is the greatest negative value in absolute terms).

On some interconnections, some hours will have net imports and other next exports. In such cases, the hour with highest net export (in absolute value) must be compared to the highest net import hour and the larger of these two values are chosen as the peak net commercial schedules.

Technical Description of AAC Indicator

The AAC Indicator is focused on the utilization of cross-border capacity. The indicator in this subsection measures the extent to which participants actually schedule the capacity that they reserve. Paths that are reserved but that are under scheduled on a sustained basis either cause transmission capacity to be withheld from other participants or require other participants to wait to the “last-minute” for release of this capacity.

What are Schedules and Reservations?

A transmission reservation sets aside capacity (in the planning horizon) for use under a future “schedule” (in the operating horizon). As an analogy, one can view the reservation as an airline ticket and the schedule as the airport “check-in”. The reservation saves a seat, but passengers must schedule (*via* check-in) in order to board the airplane. Likewise, the transmission reservation saves a place on the network, but the schedule is necessary before a participant can physically occupy the network.

Comparison to BCE Indicator

The AAC Indicator is somewhat related to the BCE Indicator. The BCE compares forecast cross-border exchange values (so-called Base Case Exchanges or BCE values) to actual exchange programs (net commercial schedules). This is a comparison of forecast and actual *net* exchanges between TSOs. The AAC Indicator compares forecast and actual *gross* exchanges. Reservations are what participants indicate will be their exchanges in a given direction in a given month. The actual commercial schedules in a given month (*non-netted*) are the actual transactions scheduled and which take place in a given direction.

In the BCE Indicator, there is single analysis on each interconnection, because BCE values indicate the net exchange. The AAC Indicator has an analysis in both directions on the interconnection. For example, both Romania to Serbia and Serbia to Romania are evaluated.

The Evaluation

Reservations on each interconnection are represented by Already Allocated Capacity (“AAC”). Schedules are represented by “commercial schedules”. Both of these concepts are contract-path concepts. A contract-path value indicates what is exchanged between two parties, usually between TSO control areas. Typically, this full contract amount will not flow physically over the interconnection between the parties.

The interconnections of interest are those where reservations (AAC) are greater than commercial schedules on a sustained basis. In such situations, the participant that has rights to the AAC is not fully using it. This means other participants may not be able to reserve capacity on the interconnection or they may have to wait until the reservation is released under “use-it-or-lose-it rules”. In either case, the other participants suffer a competitive disadvantage.

The Importance of ATC Levels

A participant that reserves but does not schedule fully cross-border capacity may be “hoarding.” However, “hoarding” only occurs if no additional reservations are possible. In other words, in addition to under-scheduled reservations, hoarding requires that all ATC be at or close to zero. When ATC=0 or is close to zero, then hoarding can be effective because other participants cannot reserve the capacity (or can reserve only small amounts). If under-scheduling occurs but ample ATC exists, then any attempt to hoard is futile because participants are still able to reserve the ATC.

Monitoring Relationship: In accordance with the discussion above, Indicator 2 monitors Commercial Schedules, AAC, and ATC values.

How to Compare AAC values to Commercial Schedules

AAC represents the total reservations on an interconnection. Commercial schedules represent total actual schedules on an interconnection. Reservations tend to be more stable over a given time period relative to commercial schedules. For example, reservations on an interconnection over a given month may change only for a few days during the month. This is because a monthly reservation is usually intended to reserve space for the peak value of the commercial schedule over the monthly time period. Commercial schedules, on the other hand, may exhibit significant day-to-day and even hour-to-hour variation.

Because AAC is in one direction (e.g., Croatia to Serbia), the indicator compares actual commercial schedules in a given direction without netting schedules in the opposite direction.

What Time Frame Should Be Considered in the Indicator?

Reservations are typically initiated on a monthly basis. These reservations may be made in a month-ahead auction or during an annual allocation process. Although less common, some reservations are made a week ahead and some are made even the day before or the day-of. Therefore, while there is usually not significant variation in AAC, it is possible that it changes on a daily or even hourly basis.

Because reservations are typically made on a monthly basis, the monthly time frame should be used for monitoring AAC and commercial schedules. For systems where AAC varies significantly within the monthly timeframe, evaluation within a shorter timeframe may be appropriate. Such a determination can be made as experience accumulates.

Calculating the AAC Indicator

The basic calculation of the AAC indicator is simple. There are two values each month for each interconnection, one in each direction.[26] Starting with the monthly peak commercial schedules on an interconnection and the AAC the indicator is based on the commonly-used percentage error formula:

AAC INDICATOR = [AAC- Peak Commercial Schedules]/ Peak Commercial Schedules – [A 1.4]

Example A 1.2:

Let AAC = 250 MW;

Let Peak Commercial Schedules = 130 MW;

AAC INDICATOR = [250 – 130]/130; = 120/130 = 92%.

With the AAC being 250 MW in this example and peak commercial schedules being 130 MW, the Indicator indicates that the AAC was 92% higher than the actual peak commercial schedules.

Technical Description of Critical Facilities Indicator

The Critical Facilities Indicator focuses on simulated power flows on key transmission elements in the *Network Model*. The Network Model is a simulation of transmission network conditions that is used to estimate Net Transfer Capacity (NTC) values for cross-border transmission[27]. If the simulated power flows do not reasonably correspond to flows experienced in actual network operation, then the Network Model may produce inaccurate estimates of NTC and result in unnecessarily restrictive access to the interconnection.

How is the Network Model Related to NTC values?

In assessing NTC, the Network Model simulates expected network conditions using “base case” assumptions and forecasts, which include generation output, load, and the physical arrangement of the network projected for the time period studied. Inaccurate NTC values can occur because a critical purpose of the Network Model is to identify incremental capacity that is available above the base case conditions. The Network Model measures this incremental capacity by simulating the maximum exchange between two neighbouring TSOs. As explained above, this simulated exchange is referred to as “ΔE.”

The Focus on ΔE

(ex-)SETSO[28] states:

NTC = ΔE + BCE – TRM, [A1.5]

where BCE is Base Case Exchanges and TRM is Transmission Reliability Margin. The BCE Indicator addressed BCE. The focus in this Indicator is ΔE.

[26] The value in each direction is the sum of the AAC reported by both parties to the interconnection because the scheduling is shared (50:50), between the adjacent control areas. While each TSO will report just what it schedules itself, the AAC screen reflects the sum of the AAC.
[27] See generally (ex-) ETSO, “Procedures for Cross-Border Transmission Capacity Assessments” (October 2001).
[28] Op. cit., p. 10.

ΔE is based on a simulated exchange. This is simulated by TSOs exchanging generation between control areas. Cross-border exchanges are gradually increased by increasing generation output in the first TSO and decreasing it in the neighbouring TSO. This will cause simulated power flow from the first TSO to its neighbour. Most of this will flow over the direct interconnection, but some may “loop” around through other systems creating a phenomenon known as “loop flow”.

The equation above shows ΔE has a direct impact on NTC. Therefore, if the Network Model provides an inaccurate ΔE value, then NTC will be inaccurate.

As indicated by (ex-) ETSO[29], ΔE is the largest exchange possible between TSOs subject to (N-1) security constraints. Therefore, for a given ΔE, there should be an associated security constraint. In other words, ΔE would be larger, but a security constraint had been reached in the modeling process.

This security constraint is important because it is the critical link in limiting ΔE (and thus limiting NTC).

What is a Security Constraint?

A security constraint is a limit on the ability of a transmission facility to transfer safely additional power. This can be a “thermal” limit whereby a MW limit on a transmission line conductor is at its rated capacity. But the limits can also be related to voltage or network “stability”. [30]

In some cases, a security constraint may not be the reason ΔE is limited. For example, a simulated exchange may utilize fully all available generation in neighbouring TSOs before exceeding the limit on any transmission facility. This makes the available generation the limiting factor in reaching ΔE, not a security constraint. [31]

Monitoring Approach

For each interconnection, the ΔE estimated by the TSOs will be associated with a security constraint. In most cases, this likely involves flow limits on specified transmission facilities. The base case Network Model estimates flows on these specific facilities and, thus, are an estimate (or forecast) of the actual flows. If this forecast is reasonably accurate (relative to actual flows), then one can conclude there is a reasonable basis for the estimated ΔE values.

Compared to BCE Indicator

As indicated above, this Indicator 3, Critical Facilities Indicator, has similarities to the BCE Indicator. BCE means Base Case Exchanges, which are the forecasted exchanges between TSOs in the time period studied in the Network Model. Just like ΔE, BCE values also directly affect NTC, as equation A 1.5 shows.

The BCE Indicator compared the forecasted BCE value used in the base case Network Model to the actual exchanges (net commercial schedules). Now, the Critical Facilities Indicator monitors the accuracy of ΔE. However, ΔE is an output of the Network Model, not an input (BCE values are inputs). Therefore, this indicator seeks to monitor the critical determinants of ΔE, which are the simulated flows on the facility which is the subject of the binding security constraint in the Network Model.

[29] Op. cit., pp. 7-8.
[30] Op. cit., p. 8.
[31] Op. cit., p. 9.

Comparing Base Case Flows to Actual Flow

It is important to explain why the simulated power flows on security-constrained facilities in the Network Model should be compared to the power flows on those facilities under actual operations. The base case conditions in the Network Model are meant to reflect anticipated conditions in the time period studied, including generation dispatch, load, and exchanges between TSOs. Therefore, the resulting simulation should produce flows on the security-constrained facilities that have a reasonable basis in reality.

It is important to note that this indicator seeks to monitor the simulated flows in the base case, not the flows in the alternative case that tests the level of ΔE. In other words, there are two key Network Model results. One is the base case, which is the best estimate of conditions during the study periods. The other is the alternative or "change" case, which is the case of the simulated exchange, (ΔE). It is the base case that is supposed to be the best forecast of future conditions and, hence, is the most appropriate comparison to actual experience.

A Caveat

It is well-known, of course, that expected operations and actual operation will almost never correspond because of changing conditions between the time the forecast is made and the time when the network actually operates. However, if a divergence between forecast and actual is large and sustained, then grid access may be unnecessarily restricted.

What Time Frame Should Be Considered in the Indicator?

The monthly time frame is appropriate for most of the interconnections in the SEE region when examining NTC values because the monthly transmission capacity market is the most commonly-used market in the region. While some TSOs offer more frequent transactions, these are not as widely used. Moreover, the weekly and daily allocations are sometimes based on the monthly Network Model anyway. Therefore, accuracy NTC values in the monthly Network Model would imply accuracy in the shorter time frames.

Simulated Flows less than Actual Flows

The Critical Facilities Indicator is focused on simulated flows that are greater than actual flows. It may also be the case that the base case simulated flows are too low, in which case NTC would be over estimated. In such a case, reservations on the interconnection could cause over-scheduling to occur, which would require more frequent use of real-time congestion management procedures. In such cases, curtailments of cross-border schedules could be required to ensure security.

The concern is greater in instances when the simulated flows are overstated, leading to smaller NTC values. In such cases, cross-border access is restricted unnecessarily and competition is injured. In the opposite case, where the simulated flows are too low, the market effect may be to increase real-time curtailments of cross-border schedules. This effect may increase market risk due to the threat of more frequent curtailments. However, this market effect is less injurious to competition than the understating of NTC, which is more related to security concerns. Hence, the monitoring indicator should be focused on cases when the simulated flows on security-constrained facilities are significantly greater than the actual experience.

Note that changes in the system configuration do not require changes to this indicator. The indicator uses the monthly Network Model results and identifies the limiting elements for NTC calculations. If additional facilities are placed in or out of service, the Network Model may identify different limiting facilities, but the indicator procedures are still applicable.

Technical Description of Load Forecast Indicator

The Load Forecast Indicator focuses on a indicator to monitor load forecasts in the Network Model which is used to estimate Net Transfer Capacity ("NTC") values for cross-border transmission[32]. These simulated flows are used to estimate the limits on cross-border interconnections (i.e., NTC). If the simulated power flows do not reasonably correspond to flows experienced in actual network operation, then the Network Model may produce inaccurate estimates of NTC and result in unnecessarily restrictive access to cross-border interconnections.

How is the Network Model Related to NTC Values?

In assessing NTC, the Network Model simulates expected network conditions using "base case" assumptions and forecasts, which include generation output, load, and the physical arrangement (topology) of the network projected for the time period studied. Inaccurate NTC values can occur because a critical purpose of the Network Model is to simulate an exchange between two neighboring TSOs in order to identify incremental capacity that is available above the base case conditions.

Importance of Load Forecasts

Because the simulations are based on forecast load conditions (among other forecasts), it is important that the load forecasts are accurate. Hence, this monitoring indicator is intended to monitor the accuracy of the load forecasts.

Monitoring Approach

The monitoring approach is straightforward: compare the load forecast used in the Network Model to the load actually experienced. The objective is to determine whether there is a sustained divergence between the forecast and actual values.

Comparison to Previous Indicators

This "Load Forecast Indicator" has similarities to the indicators in previous subsections. It is most similar to the BCE Indicator. The BCE Indicator monitors the accuracy of forecast net exchanges between control areas in the Network Model, much like the Load Forecast Indicator monitors the accuracy of forecast load. It is also similar to the AAC Indicator, which monitors what participants reserve on the interconnections (which is forecast usage) compared to what they actually use.

A Caveat

It is well-known, of course, that expected load and actual load will almost never exactly correspond because of changing conditions between the time the forecast is made and the time when the network actually operates. However, if a divergence between forecast and actual is large and sustained, then grid access may be unnecessarily restricted.

[32] See generally (ex-)ETSO, "Procedures for Cross-Border Transmission Capacity Assessments" (October 2001).

Technical Description of Generation Forecast Indicator

The Generation Forecast Indicator focuses on a indicator to monitor generation forecasts in the Network Model which is used to estimate Net Transfer Capacity ("NTC") values for cross-border transmission[33]. These simulated flows are used to estimate the limits on cross-border interconnections (i.e., NTC). If the simulated power flows do not reasonably correspond to flows experienced in actual network operation, then the Network Model may produce inaccurate estimates of NTC and result in unnecessarily restrictive access to cross-border interconnections.

How is the Network Model Related to NTC Values?

In assessing NTC, the Network Model simulates expected network conditions using "base case" assumptions and forecasts, which include generation output, load, and the physical arrangement (topology) of the network projected for the time period studied. Inaccurate NTC values can occur because a critical purpose of the Network Model is to simulate an exchange between two neighboring TSOs in order to identify incremental capacity that is available above the base case conditions.

Importance of Generation Forecasts

Because the simulations are based on forecast generation conditions (among other forecasts), it is important that the generation forecasts are accurate. Hence, this monitoring indicator is intended to monitor the accuracy of the generation forecasts.

Monitoring Approach

The indicator compares the generation forecast used in the Network Model to the actual generation output. The objective is to determine whether there is a sustained divergence between the forecast and actual values.

A Caveat

It is well-known, of course, that expected generation and actual generation will almost never exactly correspond because of changing conditions between the time the forecast is made and the time when the network actually operates. However, if a divergence between forecast and actual is large and sustained, then grid access may be unnecessarily restricted.

Technical Description of the TRM Indicator

The TRM Indicator is based on the TRM calculation guidelines of ENTSO-E[34]. According to ENTSO-E, TRM should be (at most) the sum of:

$$U_E + U_r$$

[33] See generally (ex-)ETSO, Op cit.
[34] "Procedures for Cross-Border Transmission Capacity Assessments," ETSO (2001), P 9-10.

Where, U_E is the cross-border capacity set aside for emergency exchanges. These values should be known in advance and reported to on each interconnection; the value U_E is specific to an interconnection.

U_r is k* σ

Where σ is the standard deviations of regulation deviation (ACE). This is based on historical imbalance values; k =3, (3 standard deviations typically will encompass more than 95 percent of all observations in a randomly-disturbed process).

U_r is what must remain on the interconnections in order to allow the system to use the interconnections to recover from a temporary imbalance. The value would be distributed across all interconnections in proportion to their relative impedances (highly correlated with import TTC);

The Indicator Index

For each interconnection, an index value is calculated as:

$I_{TRM} = U_E + w{*}U_r$

Where U_E and U_r are the values described above and *w* is the portion of the import TTC on the interconnection relative to all control area import TTC. Hence if a control area has two interconnections one with a TTC of 100 MW and the other with TTC of 200 MW, 1/3 of the Ur is assigned TRM for the first interconnection and 2/3 to the TRM on the other interconnection.

As discussed above, and as explained in ENTSO-E (Op cit.), I_{TRM} should be the maximum TRM value on an interconnection. Hence, the forecast/actual approach taken in the other Dry Run indicator can be used in this indicator. In particular, the posted TRM value can be viewed as the forecast value and the I_{TRM} can be viewed as the actual value. Hence, the forecast error formula can be used:

$(TRM – I_{TRM})/I_{TRM}$

where I_{TRM} is defined above and the term TRM is the actual posted TRM values.

The Indicator Threshold

Like the other dry-run indicators, the indicator Threshold is based on historical indicator values using the 85^{th} percentile. Hence, an historical series of percentage forecast errors is developed and the 85th percentile of this data is the threshold. Percentage forecast errors above the 85^{th} percentile are flagged as a monthly variance.

Regulator action is recommended when the monthly variance occurs and there was a monthly variance in one of the previous two months. Regulator should initiate an initial conference with the TSO to determine the source of the indicator variance.

Technical Description of the Market Share Indicator

Market Share Indicator monitors the share of capacity controlled by market participants. The purpose of the indicator is to measure market shares of import capacity. Market Shares provide indicator of market power. The approach is to calculate summary statistics that inform regulators about market outcomes and competitive structure.

Two capacity share calculations should be calculated. The first is a standard capacity share value which is simply the portion of interconnection capacity into the control area controlled by a market participant relative to other market participants. The second is the Herfindahl-Hirschmann Index (HHI), which measures concentration of capacity shares. The HHI increases as the largest supplier increase its share of the total capacity.

Standard Capacity Share Calculations

Standard capacity share for participant *i* is

- $\mathbf{K_i/\Sigma K_j}$
- where

$\mathbf{K_i} = \mathbf{T_i}$ is net capacity owned or imported into the control area by participant *i*.

$\mathbf{T_i}$ is yearly, monthly, and less than monthly import capacity purchased into control area by participant *i* less import capacity resold.

$\mathbf{\Sigma K_j}$ is the net capacity owned or imported by all others into the control area.

Herfindahl-Hirschmann Index

Let $\mathbf{K_i/\Sigma K_j}$ be as defined above (the share of net capacity owned or imported into the control area by participant *i*). The HHI is the sum of all participants market shares squared:

$$\mathbf{HHI = \Sigma_i(K_i/\Sigma K_j)^2}$$

Calculation of Market Shares

A market participant's control area capacity share is used to make inferences about the participant's *market power*. Market power is the ability to control supply and increase price. This can occur when a seller controls a large portion of available supply, either alone (unilateral market power) or in a cartel (conspiratorial market power).

The HHI is a measure of concentration. Generally, under both U.S. and E.U. policy, a market with an HHI of 1000 (for example ten firms with 10-percent market share each) is considered to be "unconcentrated."[35] A market with an HHI in the range of 1000 to 2000 (1800 for U.S. policy) is considered to be "moderately" concentrated. A market with HHI over 2000 (1800 for U.S.) is considered to be highly concentrated.

The following thresholds should be used in assessing the indicative market power of a participant:

A participant is assumed to lack market when both of the following are met:

- Market Share < 20 percent, and
- HHI < 2500.[36]

[35] Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings,' DG COMP, 28, January 2004; U.S. Department of Justice Merger and Federal Trade Commission Guidelines.

[36] Except in the cases close to pure monopoly (one firm with 100 percent market share) and close to perfect competition (many firms with close to zero-percent market share each), there is no formulaic way to translate market share and concentration statistics to definitive market power conclusions. The U.S. Federal Energy Regulatory Commission uses a 20-percent market share threshold and a 2500 HHI threshold when assessing the market power of supplier. In particular, when a supplier's market share is less than 20 percent and the HHI in that market is less than 2500, then the supplier is presumed to have no market power. These thresholds are used for market share statistics that include both control of capacity on interconnections and control of generation capacity, not just control of capacity on the interconnection.

Further Analysis by Regulators

Variances of the thresholds identified in this section are indicative of market power. Further analysis should be undertaken by regulators to develop definitive findings of market power. These additional analyses should include:

– Refining market shares to reflect

(1) the combined capacity of all interconnections into a control area;

(2) generation capacity located inside the control area that is not committed to regulated native load;

ANNEX 4 – EXAMPLES OF REGIONAL COORDINATION

As discussed in Section 3, regional market monitoring involves the need to coordinate data collection and regulatory actions. In this Annex, we provide examples in the MMG that require coordinate data collection and coordinated action.

Coordinated Data Collection

Indicator 2 compares Already Allocated Capacity to peak commercial schedules. Each TSO is asked to provide the AAC values on its own side of the interconnections. The peak commercial schedules represent the total schedules on the interconnection. Hence, the relevant comparison requires the AAC on both sides of the interconnection to be added together. This requires regulators to have data from both TSOs not just its own TSO.

Coordinated Mitigation

A number of indicators in the MMG involve forecasts of inputs to the Network Model (Indicators 1, 3, 4, 5). In each instance, the regulator action in the event of indicator failure is to coordinate with a neighbouring regulator. In Indicator 1, the action is as follows:

– Temporarily using the BCE values provided by a neighbouring TSO that has superior forecasts (based on less frequent failures of this indicator). A regulator in this position should consult with the neighbouring control area regulator to initiate this approach. The temporary period should be linked to improvements in monitored TSO's forecasting which should continue to be monitored during the temporary period.

– The TSO should continue to calculate BCE values even though the neighbouring TSO's BCE value is being used in the Network Model. During this temporary period, the TSO's calculated BCE value should be compared to the neighbouring BCE value to determine if the forecasts have improved.

– An equal or smaller number occurrences of indicator variance compared to the neighbouring TSOs over a six month period should be considered sufficient evidence that the BCE forecasts have improved. If these indicator results indicate that one TSO has superior forecasting outcomes (i.e., the indicator is in variance less often), the regulator should consider a technical discussion between its TSO and a TSO having superior outcome to determine whether there is a superior method of forecasting.

In indicators 3, 4, and 5, an approach like the following is established: If these indicator results indicate that one TSO has superior forecasting outcomes, the regulator should consider a technical discussion between its TSO and a TSO having superior outcome to determine whether there is a superior method of forecasting that should be adopted.

ANNEX 5 -- EXAMPLE OF THRESHOLD RANGE CALCULATION

The Market Monitoring Indicators in the 8th Region Market Monitoring Guidelines are designed to detect instances when adverse market effects may occur. The Indicators measure a variety of market-related variables and the Indicators produce numerical values (usually percentages) that are compared to a “threshold” range. This threshold range is intended to identify Indicator values that require regulatory attention because they are in “variance” from what is expected in a well-functioning market. The critical question is establishing what this expected threshold range should be.

Drawing on experience in the U.S., 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. For example, in the U.S. power exchange markets (like the New York ISO), generator marginal cost “benchmarks” are sometimes established by using the generator’s observed offers during off-peak load periods, when there is a strong incentive to offer at marginal cost.[37]

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 it is relatively large. Because the 8th Region Indicators are mostly 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 it requires some follow-up or “mitigation” by the regulator.

The 8th Region Market Monitoring Guidelines employ an historical data approach to set a range for each Indicator. For each indicator the approach is similar. All historical Indicator values for a given Indicator and for all participants in the most recent six-month period are placed together in a “pool” for purposes of the analysis. From this pool, the 15th and 85th percentiles are calculated as a starting point. A percentile is the value of a variable below which a certain percentage of observations fall. For example, in the case of the pool of Indicator values, the 15th percentile is an Indicator value for which 15 percent of the observations in the pool are lower than this value. Likewise, the 85th percentile is an Indicator value for which 85 percent of the observations in the pool are lower than this value (15 percent are higher).

The 15th and 85th percentile only establish the “length” of the threshold range. We use this length to create a threshold range symmetric around zero. In a system where calculations are affected only by random errors, the threshold range should be symmetric. Therefore if the actual observations are non-symmetric, systematic errors may be occurring. We do not want threshold ranges that include systematic errors so we use the observations only to establish the length. In this way we rely on historical experience but attempt to eliminate the systematic errors.

[37] These benchmarks are used to measure the generator’s offers at other times when the incentive to exercise market power may be high.

Illustration of the Method: The Table below illustrates how a threshold range is calculated for Indicators 1through 6. The Table uses fictitious numbers for the BCE Indicator to illustrate the calculation; none are actual values from SEEAMMS. The Table shows thirty-two observed BCE Indicator values (remember, the BCE Indicator is a forecast error so the BCE Indicator values are percentages (*but they are not percentiles*). The first step in illustrating the calculation is to show the BCE Indicator values sorted by smallest to largest. In that sorted stack the 15th percentile identifies the lowest 15 percent of the observations. This occurs at -13%. The 85th percentile identifies the lowest 85 percent of observations (which is equivalent to identifying the highest 15 percent). This value in our example is 24%. Using -13% and 24%, we have a length of 37%: 24% - (-13%) = 37%. Hence using this length and setting it symmetric around zero, the threshold range is (-18.5% and 18.5%).

Illustration of Threshold Range Calculation
(Ficticious BCE Indicator values Jan-April 2013)

		BCE Indicator (Forecast Error)	BCE Indicator Values Sorted in Ascending Order
Jan-13	EMS	23%	-17%
	HEPS	25%	-17%
	OST	19%	-15%
	ISO-BH	8%	-15%
	Kostt	-17%	-14%
	CGES	32%	-13%
	MEPSO	-14%	-12%
	TEL	-10%	-10%
Feb-13	EMS	[illegible]	-10%
	HEPS	17%	[illegible]
	OST	[illegible]	-9%
	ISO-BH	7%	-5%
	KOSTT	-9%	-2%
	CGES	-17%	-2%
	MEPSO	-1%	-1%
	TEL	21%	5%
Mar-13	EMS	16%	7%
	HEPS	-13%	8%
	OST	5%	10%
	ISO-BH	-5%	16%
	KOSTT	-10%	17%
	CGES	25%	19%
	MEPSO	22%	21%
	TEL	29%	22%
Apr-13	EMS	-15%	22%
	HEPS	-2%	23%
	OST	22%	23%
	ISO-BH	-12%	25%
	KOSTT	29%	25%
	CGES	10%	29%
	MEPSO	23%	29%
	TEL	-2%	32%

All BCE Values Sorted

Calculating the Threshold

15th Percentile is: -13%

which means 15% of observations have a value less than -13% (green shade)

85th Percentile is: 24%

which means 15% of observations have a value greater than 24% (red shade)

Threshold length determined by -13%, 24%; Length is 37 percentage points

BCE Indicator < -37/2% = -18.5%
or
BCE Indicator > 18/2% = 18.5%
imply a "variance" in the BCE Indicator

For the threshold range in this example, individual BCE Indicator values for a market monitoring participant below -18.5% or above 18.5% would be in “variance,” meaning regulatory follow-up may be warranted.[38] Because the thresholds are based on historical data, the thresholds may change form month-to-month because the observations in the pool change.[39]

[38] Mitigation is warranted if a participant exceeded the threshold in the current month an in one of the two most recent months.

[39] It is worthwhile to note that random variations in a variable will be distributed in a way that 80 percent of the observed values will fall between the 15th and 85th percentiles. Therefore, the use of thresholds based on these two percentile levels will identify the 10 percent of "outlier" values on both the low end and the high end when the variations are random.