Client: AFESD – Arab Fund for Economic and Social Development

Subject: Developing the Interconnection Grid Code for the Pan Arab Electricity Market

Scheduling & Dispatching Code

Order: Arab Fund Grant Number 6/2018 dated 9/5/2019

Notes: -

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N. of pages: 34  N. of pages annexed: -

Issue date: 16/12/2019

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1 SCOPE OF APPLICATION

J. The scope of application provides elements for a proper understanding of the provisions.

This Chapter 1 of the Code concerns roles, rights, obligations and responsibility of all the Parties regarding Actual Energy Transfer on International Interconnections.

The process for the joint determination of the Total Transfer Capacity (TTC) and the Net Transfer Capacity (NTC) on yearly, monthly and daily bases is regulated. This joint assessment is carried out based on load flow studies considering the characteristics of the International Interconnection, the expected load demand and the planned maintenance on the interconnected Electricity Systems.

This process is coordinated by the Arab TSOs Committee.

Congestion management on the International Interconnections of the PAEM Electricity System takes place through joint allocation via explicit Auctions of the capacity in form of yearly, monthly and daily Long-Term Transmission Rights carried out by the Regional Market Facilitator on behalf of the relevant TSOs, but in its own name according to the Auction Rules.

The task of scheduling cross-border Actual Energy Transfer programs is performed during the operational planning phase and the control phase. It aims at guaranteeing agreed Actual Energy Transfer programs among all TSOs, in execution of contracts concluded outside the offering system (bilateral agreement). These are treated, in the energy market, according to the procedures set by the Regulator for dispatching activities.

Moreover, the process of joint curtailment, that concerns the reduction of the TTC/NTC caused by unavailability of Transmission System and/or some critical year periods to pursue secure system operation is regulated.

Finally, real time monitoring of the PAEM Electricity System, to evaluate the secure operation criteria, to coordinate the compliance of the Electricity System after events, and account for and settle unintentional deviations, are reported.

2 TRANSMISSION CAPACITY MANAGEMENT PROCESS

J. Common procedures for Transmission Capacity Management Process are required among the involved TSOs. This contributes to system access in a transparent and non-discriminatory manner for allocation of the cross-border capacity.

The Transmission Capacity Management Process is based on rules that define the concrete methodology for calculating capacity up to a year ahead and referred to as long-term capacity calculation. The objective defining long term capacity is twofold. Firstly, Registered Participants look to forecasted future day ahead pricing in the different Bidding Zones as an input to developing strategies for operation and investment decisions. The

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1 J. : Justification
goal of long-term capacity calculation is to provide Registered Participants with the information about expected capacity between Bidding Zones, as will have an impact on demand and supply of electricity and hence the day ahead pricing. Secondly, the calculation of long-term capacity will act as input to the issuing of long-term transmission rights on the borders of the Bidding Zones. Thus, the calculation of long-term capacity will also provide capacity for hedging purposes.

This process shall be coordinated by the Arab TSOs Committee.

2.1 Calculation of NTC on the Pan Arab Interconnection System Joint Procedure

2.1.1 General guidelines

| J. Establish common procedure for NTC calculation |

NTC and TTC assessments are performed through load flow calculations. The main prerequisites are:

- A suitable network model that allows determining the influences of neighboring areas.
  - Estimated generation and load patterns to simulate cross-border Actual Energy Transfer (Base Case).
- A procedure to harmonize and agree on the input data among the concerned TSOs.
- Guidelines to perform the simulations of cross-border Actual Energy Transfer in a most realistic and understandable way.

The responsibilities for the assessment of the TTC/NTC fall on TSOs. According to National Grid Codes or to national regulatory frameworks, TSOs are bound legally to operate the Grid, always respecting operational security, while monitoring the condition of its Grid and managing congestion.

Therefore, the subsidiarity principle is applied in steps during the TTC/NTC assessment process.

Each concerned TSO is thus responsible to provide the necessary input data for the load flow calculations for its Transmission System:

- Relevant network model and topology,
- Technical data of the Transmission System,
- Estimated generation and load patterns,
- Technical and operational limits.

The capacity assessments are based on common sets of data to form a commonly agreed Base Cases.

PAEM shall issue at least twice a year a PAEM Electricity System load flow forecast for winter and summer peak hours. Additional Snapshots of load flow situations may be provided if requested. In order to reach an adequate level of consistency and harmonization, the Arab TSOs Committee will provide interconnected network Base Cases. The TSOs will treat all data as confidential. The assessment procedure shall guarantee that each NTC value is reachable without compromising the security of the PAEM Electricity System.
The TTC/NTC are performed for each pair of electrically adjacent countries. In case of strong interdependencies among different groups of Member States (zones), calculation of TTC/NTC between these zones and the neighboring countries will be performed.

### 2.1.2 Base Case construction

#### J. The TTC/NTC calculations require a set of data common to all Member States.

This set of data comprising the Base Case includes a network model and input data describing load and generation patterns forecast, along with network topology for the study time frame (yearly, monthly and daily).

The TSOs shall provide the harmonization of the TSO’s individual inputs in order to set up the common data sets efficiently.

#### 2.1.2.1 Network Model

J. Common procedure to define the common model network to use in the calculation.

The network model should contain, to the degree possible, a full representation of the elements of the Grid of each Member State, including the Member States connected by HVDC Systems. The study area shall be as wide as possible to provide an accurate understanding of the distribution of physical flows on tie-lines resulting from international Actual Energy Transfers recognizing that some portion of power flowing from one area to another can circulate through third countries depending on the International Interconnection.

The effect of HVDC Systems between areas is represented through injection or sinks at the relevant nodes.

The calculation area for NTC assessment between two neighboring Member States will be determined case by case following the above principles and could involve just a subset of the full network model. Each partner can ask for an extension of the calculation area if necessary.

#### 2.1.2.2 Input data

J. Input data needed to perform the capacity assessment.

Load flow calculation shall be performed using an AC load flow model. TTC/NTC assessment for each time frame being considered requires the following

a) The thermal ratings of elements of the Transmission System as well as the electrical parameters. Thermal rating shall be addressed in Amps, not in MW. According to the time frame studied, the corresponding seasonal values of thermal ratings shall be used.

b) The maximum and minimum active and reactive power output for the Power-Generating Facilities units included in the network model.

c) The expected network topology at the time frame considered.
The generation pattern by the means of the injection at each node at the time frame considered.

The load pattern by the means of the net sink at each node at the time frame considered.

The common set of programs of cross border transaction and the net balances of each TSO Control Area at the time frame considered.

The common set of cross border transaction considered in the Base Case relates to the best forecast for Actual Energy Transfer at the time frame considered.

The expected maximum power generation available at the time frame considered.

Each TSO commits itself to provide the best estimated available input data for its own Control Area, reflecting as much as possible realistic scenarios, previously agreed within its country or with reference to the historical data.

The Base Case can be developed for:

a) Real observed operation situations.
b) Forecast conditions.

While the observed operation situations offer a true scenario of the behavior of the Electricity System, forecast can sometimes provide a better baseline because it would include the expertise of each TSO about the expected behavior of generation and load in its own country and knowledge about the scheduled maintenance works on the Integrated Power System and the Facilities. These two alternative views on Base Case construction could also be combined. The Base Case would be starting from a real observed situation (Snapshot of the Electricity System at selected scenarios) then modified by each TSO with updated information regarding its system considering foreseeable differences due to:

a) Load level, according to the Demand Forecasts over the time frame being analyzed.
b) Generation pattern based on forecasts of primary energy sources (hydro reserves, fuel availability...).
c) Network and generation planned or forced outages (long lasting).

No definite rules need be established to perform these tasks, but it is assumed they would be carried out according to the Good Utility Practice of each TSO. The specific procedure that each TSO uses to modify the starting Base Case must utilize modifications that are consistent with real generation limits/possibilities and Actual Energy Transfer on the interconnection tie-line. Each TSO must explain the nature and extent of any modification performed on starting Base Case and shall communicate the rationale when sending to other partners.

2.1.3 Guidelines for load flow calculation

2.1.3.1 Cross border exchange simulation

J. A common methodology to establish the TTC/NTC limits critical for maintaining system security.

In order to determine the cross-border transaction limit between two neighboring Member States, cross border Actual Energy Transfers are gradually increased while maintaining the load in the whole system unchanged until security limits are reached.
Starting from common Base Case Actual Energy Transfer, the additional Actual Energy Transfer is performed through an increase generation on the exporting side and an equivalent decrease of generation on the importing side. This generation shift is to be made stepwise until a network constraint is violated.

The generation increase/decrease shall be performed according to some predefined criteria. The general criteria as well as any exceptions are to be defined by the TSOs involved in the calculation of a given TTC/NTC. Some possible ways to distribute generation increase/decrease in a given Electricity System of a Member State over the different generating sets in this area are the following:

a) Proportional increase/decrease: for example, the factor which distributes the generation increase/decrease in a given Electricity System of a Member State over different Power-Generating Facilities in this area could be the ratio of Base Case schedule of each Power-Generating Facility to the total of internal generation scheduled and involved in the shift.

b) Increase/decrease according the previously observed behavior of the Power-Generating Facilities. For example, the factor which distributes the generation increase/decrease in a given country could consider the usual response pattern of generation to different system loads.

c) Increase/decrease according to a well-known merit order: whenever economic dispatch is applied the increase/decrease of generation shall be applied according the merit order.

The shift is to be performed considering the technical operation constraints of each Power-Generating Module and its technical limits (maximum/minimum power, optimal use of a power plant, water or fuel available).

The choice among different shift possibilities or even a combination of shifting strategies is left to the responsibility of each TSO but shall be explained and communicated to the other TSOs involved in computing a given TTC/NTC.

The Party who is making the calculation is responsible at a minimum for the contingency analysis in its Transmission System and cross border tie lines including some well-known contingencies in the neighboring Electricity System which influence the security of its own Electricity System.

2.1.3.2 Limitation due to security constraints

| J. Identification of specific constraints that limit the TTC/NTC of an Electricity System. |

The Actual Energy Transfer increase/decrease goes on until security rules are violated in the Grid and the interconnection tie-lines of the TSO performing the calculation, or inside another Electricity System of a Member State with respect to thermal ratings of elements of the Transmission System. Security problems can result in thermal, voltage, stability limitations that are to be defined by the country which performs the calculation and shall be coherent with the rules published in its National Grid Code.

If the constraint occurs within the country that runs the calculation, it first shall be determined if the congestion could be relieved by corrective measures without reducing
the security level of the Electricity System. If the constraint remains, then the limit becomes directly effective.

If the constraint occurs in another Electricity System of a Member State, its impact shall be confirmed by the relevant TSO of the Grid where the congestion takes place, before the limit is considered as effective. Thus, the TSO running calculation shall:
   a) Notify involved TSO.
   b) Discuss the physical reality of this constraint.
   c) Consider the constraint in the security analysis only if the involved TSO concurs.

Therefore, to have an NTC value limited by a security constraint within another TSO’s Grid implies an explicit agreement with the other TSO on the reality of this constraint. Once all constraints are recognized by both the neighboring TSOs, they shall be considered binding. The last value of additional Actual Energy Transfer which does not involve any security problem forms the value \( \Delta E \). It represents the extra amount of power over the Base Case that can be exchanged continuously from one Electricity System of a Member State to another while ensuring the safe operation of both interconnected Electricity System. This value, added to the initial transaction value (BCE: Base Case Exchange) gives the Total Transfer Capacity (TTC) between these countries:

\[
TTC = BCE + \Delta E = NTC + TRM
\]

Where:
   a) TRM is the Transmission Reliability Margin defined in the Article 2.1.4.
   b) NTC is the Net Transfer Capacity.

If the physical generation shift between the two concerned Electricity Systems according to their actual available generation is reached and no security rules are violated, no realistic limitation on the TTC/NTC for the Base Case is found. In this case, the NTC between these two Electricity Systems would equal the shift of all available generation.

2.1.4 Transmission Reliability Margin

A common procedure for evaluating TRM is critical for security of the interconnected transmission system.

Some margin in the TTC, related to the deviations occurring both in real-time operations and in the capacity assessment process, must be maintained.

This capacity refers particularly to the unintended deviations due to the power-frequency (secondary) control and primary frequency control, needs for common reserve, and emergency Actual Energy Transfer to cope with unbalance situations. These sources of uncertainty are used to calculate the TRM factor for a given direction of transfer. Each TSO calculates its own TRM values according to requirements for ensuring the operational security of its Grid.

Finally, each pair of neighboring Member States should agree on a unique value of TRM for a given direction of transfer. In case of disagreement, each TSO will maintain its final value of TRM in operations according to the need of its own Electricity System for which it is the solely responsible.
TRM is determined by unintended load-frequency regulation deviations and needs for common reserve and emergency Actual Energy Transfer.

Load-frequency control margin can be estimated through statistical analysis of past data using the estimated variance of deviation of historical series for one or more years. These time series shall be previously filtered to avoid the bias which may be introduced by large deviations, occurring as the result of sudden load imbalances (like the one induced by generator trips), that must be considered in the emergency Actual Energy Transfer.

As far as common reserve and emergency Actual Energy Transfer are concerned, their amount is to be evaluated and agreed by the involved countries.

2.1.5 Uncertainties in TTC calculation

J. The process of TTC calculation could be affected by physical model inaccuracies and unintended deviation of physical flows. Additional margin may need to be considered.

Uncertainties regarding the Base Case Actual Energy Transfer, which means uncertainties on a scenario about the expected behavior of market participant, may translate into more substantial uncertainties about TTC/NTC. The assessments of TTC and NTC are based on calculations that consider specific assumptions regarding Base Case Actual Energy Transfer. Uncertainties in Base Case scenarios may be considered when allocating NTC in different time frames. Separately from the assessment of the NTC/TTC and the calculation of the transmission reliability margin TRM, TSOs may decide whether additional margin shall be considered, in case of strong uncertainties in generation scenarios.

In a yearly planning procedure, the uncertainties on the scenarios may be quite substantial allowing only a partial allocation of NTC in advance. When getting closer to the operating horizon, these uncertainties may diminish such that that further portions of TTC/NTC may be allocated to market participants. Moreover, subsequent calculation of TTC and NTC at different time frames (yearly, monthly, day ahead) will be necessary to allocate for each condition the maximum value of TTC.

2.1.6 Treatment of different results among TSOs

J. Agreement between TSOs that use different security criteria is necessary for coordinated operations

The N-1 security deterministic criterion to perform the contingency effects assessment is recommended.

In the case that National Grid Code and/or additional guidelines issued by national authorities or regulators oblige TSOs to different security criteria, the concerned TSOs will need to apply them. Reconciling conflicts which arise will be based on the principle of subsidiarity.

Before applying the TTC assessment procedure, each TSO has to declare which are the security rules (security criteria and security thresholds) adopted, the worst outage case it has to take into account in order to safeguard its own system security, and the technical constraints limiting the power shift to assess the NTC value for a given direction of power flow.
Each TSO is responsible for deciding on its own network topology and the way it intends to perform the generation shift from its side, which must be declared and communicated.

2.1.7 Already Allocated Capacity and Available Transmission Capacity

During the allocation process (see Chapter 3), that could cover time frames from year ahead to day ahead, a set of new concepts are introduced. These are the Already Allocated Capacity (AAC) and Available Transmission Capacity (ATC).

The AAC is the total amount of allocated transmission rights while the ATC is the part of NTC that remain available. AAC and ATC are thus a result of each stage of the Allocation Process.

The following relation exist:

\[ \text{ATC} = \text{NTC} - \text{AAC} \]

The following figure gives an overview over the transfer capacity concept.

![Figure 4-1. Transfer capacity definitions](image)

3 ALLOCATIONS PROCESS

The Allocations Process contains the terms and conditions for the allocation of Transmission Rights on International Interconnections of Member States.

Long-term cross-zonal capacity shall be allocated to market participants by the Regional Market Facilitator in the form of physical transmission rights pursuant to the “Use It or Sell It” principle or in the form of FTRs (Financial Transmission Rights). All TSOs issuing long-term transmission rights shall offer long-term cross-zonal capacity through the Regional Market Facilitator to Registered Participants for at least annual and monthly time frames. Regulatory authorities of Member States may decide to maintain physical Long-Term Transmission Rights on its Bidding Zone borders.
3.1 Objective

These Allocation Rules contain the terms and conditions for the allocation of Transmission Rights on the International Interconnections of Member States. The Registered Participant will have access to these rules by the signature of the Participation Agreement. In particular, the Allocation Rules set out the rights and obligations of Registered Participants as well as the requirements for participation in Auctions. They describe the process of Auction, including the determination of Marginal Price as a result of Auction, the conditions for transfer and return of Long-Term Transmission Rights, remuneration of holders of such returned Long-Term Transmission Rights, and the processes for curtailment of Long-Term Transmission Rights along with invoicing and payment.

The Regional Market Facilitator will publish and keep up-to-date on its website a list of borders where Long-Term Transmission Rights are allocated, together with information on the type of Long-Term Transmission Rights.

3.2 Regional Market Facilitator

J. The Regional Market Facilitator shall undertake the allocation functions in accordance with the Allocation Rules and the applicable national legislation. The Regional Market Facilitator shall be the Party signing the Participation Agreement with the Registered Participant.

The Regional Market Facilitator shall undertake the allocation functions in accordance with these Allocation Rules.

For the purposes of these Allocation Rules, the Regional Market Facilitator shall be the Party signing the Participation Agreement with the Registered Participant.

The form of the Participation Agreement and the requirements for its completion shall be published by the Regional Market Facilitator and may be amended from time to time by the Regional Market Facilitator without changing any terms and conditions specified in these Allocation Rules unless otherwise stated in these Allocation Rules.

The Regional Market Facilitator shall publish on its website detailed technical operating provisions of Allocation Rules.

3.3 Requirement for participation in Auctions and Transfer

J. Technical and financial requirements needed to participate in the Auction.

Market participants may acquire a Long-Term Transmission Rights only from participation in Auctions or via transfer.

The participation both in Auctions and in transfers requires that the market participant:
  a) execute a valid and effective Participation Agreement;
b) have access to the Auction Tool.

c) comply with the requirements for provision of collaterals as specified in Article 3.3.1.

In any case, market participants must fulfil the obligations as specified in the relevant Articles of these Allocation Rules.

3.3.1 Collaterals

Registered Participants shall provide collaterals in order to secure payments to the Regional Market Facilitator resulting from Auctions of Long-Term Transmission Rights. Only the following forms of collaterals shall be accepted:

a) a Bank Guarantee;

b) a cash deposit in a dedicated Business Account.

Collaterals may be provided in one of the forms mentioned or a combination of these forms, provided that the Regional Market Facilitator is entitled as beneficiary to the full collateral.

Credit Limit shall always be greater or equal to zero.

The collaterals shall be provided in Dollars/Euros.

A Registered Participant may request an increase or decrease of the collaterals in form of a Bank Guarantee and/or cash deposit or change of the form of the collaterals at any time. A decrease of the collaterals of a Registered Participant shall only be allowed if the Credit Limit after applying the requested decrease of the collaterals would be greater than or equal to zero.

3.3.2 Credit Limit

J. It is needed to calculate and continuously update the Credit Limit of each Registered Participant for each subsequent Auction.

The Regional Market Facilitator shall calculate and continuously update the Credit Limit of each Registered Participant for each subsequent Auction. The Credit Limit shall be equal to the amount of the collaterals in place minus any outstanding payment obligations. The Regional Market Facilitator shall make this information available to each Registered Participant individually through the Auction Tool. Maximum payment obligations for a Registered Participant, resulting from its Bid/Bids registered at the closure of the Bidding Period, shall be considered as outstanding payment obligations.

3.4 Allocation Rules

3.4.1 General provisions
The Regional Market Facilitator shall allocate Long-Term Transmission Rights to Registered Participants by way of Explicit Allocation. Prior to the Auction the Regional Market Facilitator shall publish Auction Specifications on its website.

The Auctions shall be organized via the Auction Tool. Each Registered Participant fulfilling the requirements for participating in the Auction may place Bids in the Auction Tool until the relevant deadline for placing Bids in the specific Auction expires according to the respective Auction Specification.

After the relevant deadline for placing Bids in the specific Auction has expired, the Regional Market Facilitator shall evaluate the Bids including against the respective Credit Limits of the Registered Participants. The results of the Auction will be notified to Registered Participants via the Auction Tool.

The Regional Market Facilitator shall provide information on forthcoming Auctions by publishing on its website a provisional Auction calendar with the dates of Auctions reasonably in advance before the Auctions take place.

### 3.4.2 Capacity Allocation timeframe and form of product

| J. Definition of typologies and timeframe of available financial and physical products |

The standard forward capacity allocation timeframes, subject to product availability, are defined as follows:

a) yearly timeframe, starting on the first day and ending on the last day of a calendar year;
b) monthly timeframe, starting on the first day and ending on the last day of a calendar month.
c) daily timeframe, starting on the day preceding the delivery day (Monday – Sunday).

For the standard timeframes and subject to TTC availability, the Regional Market Facilitator shall organize by default at least one Auction per year for the yearly timeframe, one Auction per month for the monthly timeframe and one Auction per day for the daily timeframe.

### 3.4.3 Auction Specification

| J. Define the characteristic of the Auction |

The Regional Market Facilitator shall publish the provisional Auction Specification that shall state in particular:

a) the code identifying the Auction in the Auction Tool;
b) type of Long-Term Transmission Rights;
c) Capacity Allocation timeframe (yearly, monthly, daily);
d) form of product (base, peak, off-peak);
e) identification of cross border(s) bidding;
f) deadline for return of the Long-Term Transmission Rights allocated in previous Auctions for the respective cross border(s) bidding.
g) the Product Period;
h) Reduction Period(s) associated with the Product Period when applicable;
i) the Bidding Period;
j) the deadline for the publication of the provisional Auction results;
k) the contestation period;
l) the provisional offered capacity which shall not include cross zonal TTC released via return of Long-Term Transmission Rights.
m) any other relevant information or terms applicable to the product or the Auction.

After publication of the provisional Auction Specification, the Regional Market Facilitator shall publish the final Auction Specification.

The final offered capacity shall consist of:
   a) the provisional offered capacity;
   b) the available cross zonal TTC already allocated to Registered Participants for which a valid request for return of Long-Term Transmission Rights has been submitted for this Auction.

The Regional Market Facilitator shall also publish the format of the Bids to be used.

3.4.4 Reduction Periods of offered capacity

J. If applicable, announcement of forecast Reduction Period (curtailment)

The Regional Market Facilitator may announce one or more Reduction Periods in the Auction Specification. In this case, the Auction Specification shall include for each Reduction Period information on the duration of the Reduction Period and the amount of offered capacities.

Reduction Periods do not apply to already allocated Long-Term Transmission Rights and shall not be considered for any purpose including compensation as a curtailment according to Section 3.7.

3.4.5 Bids submission

J. Describe the requirement of Bids submission.

The Registered Participant shall submit a Bid or set of Bids to the Regional Market Facilitator in accordance with following requirements:
   a) it shall be submitted electronically using the Auction Tool and during the Bidding Period as specified in the Auction Specification;
   b) it shall identify the Auction via an identification code as specified in Article 4.2.1;
   c) it shall identify the Registered Participant submitting the Bid;
   d) it shall identify the Bidding Zones border and the direction for which the Bid is submitted;
   e) it shall state the Bid Price, in Dollars/Euros per MW for one hour of the Product Period and equal to or greater than zero;
f) it shall state the Bid Quantity in full MW which shall be expressed without decimals; the minimum amount of a single Bid is one (1) MW.

g) the Registered Participant may modify its previously registered Bid at any time during the Bidding Period including cancellation. In case the Bid has been modified only the last valid modification of the Bid shall be considered for the Auction results determination.

h) if a Bid Quantity, or a quantity calculated as a sum of the Bid Quantity for several Bids submitted for the same Auction, by a Registered Participant exceeds the offered capacity announced in the final Auction Specification, this Bid, or these Bids shall be completely rejected. Where a modification of previously submitted Bids results in exceeding the offered capacity, the modification shall be rejected, and the previously registered Bids will stand.

The above-mentioned process shall apply to all forms of an Auction product and all forward capacity allocation timeframes.

3.4.6 Bid registration

J. Verify the acceptance of Bids submission

Provided that a Bid or a set of Bids fulfils the requirements set forth in 3.4.5, the Regional Market Facilitator shall confirm to the Registered Participant that such Bid(s) have been correctly registered by an acknowledgment of receipt via the Auction Tool. If the Regional Market Facilitator does not issue an acknowledgment of receipt for a Bid, such Bid shall be deemed not to have been registered.

The Regional Market Facilitator shall notify a Registered Participant whose Bid is rejected as invalid and the reason for this rejection, without undue delay after the Bid is rejected.

The Regional Market Facilitator shall maintain a record of all valid Bids received.

Each valid Bid registered at closure of the Bidding Period shall constitute an unconditional and irrevocable offer by the Registered Participant to buy Long-Term Transmission Rights up to the Bid Quantity and at prices up to the Bid Price and under the terms and conditions of these Allocation Rules and the relevant Auction Specification.

3.4.7 Credit Limit verification

J. At closure of the Bidding Period a check whether the maximum payment obligations connected with registered Bids exceed the Credit Limit shall be made.

At closure of the Bidding Period, the Regional Market Facilitator shall check whether the maximum payment obligations connected with registered Bids exceed the Credit Limit. If the maximum payment obligations connected with these Bids exceed the Credit Limit, these Bids, starting with the Bid with the lowest Bid Price, shall be excluded, until the maximum payment obligations are less than or equal to the Credit Limit.

The Regional Market Facilitator shall indicate insufficient collaterals as the reason for the Bid exclusion in the Auction results notification to the Registered Participant.
3.4.8 Auction Results Determination

J. Auction

results using an optimization function and determination of Marginal Price.

After the expiration of the Bidding Period for an Auction and the Credit Limit verification pursuant to Article 3.4.7, the Regional Market Facilitator shall determine the Auction results and allocate the Long-Term Transmission Rights in accordance with this Article 3.4.8.

The Auction results determination shall include the following:

a) determination of the total quantity of the allocated Long-Term Transmission Rights per bidding cross border and direction;

b) identification of winning Bids to be fully or partially satisfied;

c) determination of the Marginal Price per bidding cross border and direction. If the total quantity of cross border TTC for which valid Bids have been submitted is lower than or equal to the relevant offered capacity for the relevant Auction, then the Marginal Price shall be zero.

The Regional Market Facilitator shall determine the Auction results using an optimization function. The Regional Market Facilitator shall publish explanatory information about the algorithm of optimization function and determination of Marginal Price.

Where a Reduction Period is indicated in the Auction Specification for an Auction, the Regional Market Facilitator shall determine the Auction Results modified as follows: For each Reduction Period the quantity of Long-Term Transmission Rights to be allocated to individual Registered Participants shall be calculated on a pro-rata basis taking into account the quantity of Long-Term Transmission Rights corresponding to the respective winning Bids of each Registered Participant and the respective reduced offered capacities.

3.4.9 Notification of Auction results

J. Publishing of Auction result requirements.

The Regional Market Facilitator shall publish on its website the Auction results.

The publication of the Auction results for each bidding cross border included in the Auction shall comprise at least the following data:

a) total requested Long-Term Transmission Rights in MW;

b) total allocated Long-Term Transmission Rights in MW;

c) Marginal Price in Dollars/Euros per MW per hour;

d) number of Registered Participants participating in the Auction;

e) list of names and number of Registered Participants who placed at least one winning Bid in the Auction;

f) list of registered Bids without identification of the Registered Participants (Bid curve);

g) congestion income per Bidding Zone.
The Regional Market Facilitator shall make available via the Auction Tool to each Registered Participant who submitted a Bid to a specific Auction for each Bidding Zone border included in the Auction at least the following data:

a) allocated Long-Term Transmission Rights for each hour of the Product Period in MW;
b) Marginal Price in Dollars/Euros per MW per hour;
c) amount due for allocated Long-Term Transmission Rights in Dollars/Euros.

3.4.10 Contestation of Auction Results

Registered Participants shall check the Auction results and, where reasonably appropriate, may contest Auction results within the contestation period set out in the relevant Auction Specification.

The Regional Market Facilitator shall only consider a contestation where the Registered Participant is able to demonstrate an error by the Regional Market Facilitator in the Auction results.

The contestation shall be communicated to the Regional Market Facilitator and shall contain the following:

a) Date of contestation;
b) identification of contested Auction;
c) identification of the Registered Participant;
d) detailed description of the facts and the reason for contestation; and
e) evidence of erroneous Auction results;

The Regional Market Facilitator shall notify its decision on the contestation to the Registered Participant in time as reported in the relevant Auction Specification.

3.5 Usage of Transmission Rights

3.5.1 Return of Long-Term Transmission Rights

J. Requirements for returning Long Term Transmission Rights.

Long Term Transmission Right holder(s) may return some or all their Long-Term Transmission Rights to the Regional Market Facilitator for reallocation at any subsequent long-term Auction once the final Auction results are published.

Returned Long-Term Transmission Rights shall be a constant band of whole MW(s) over the specific timeframe of the subsequent Auction. The Auction at which the Long-Term Transmission Rights were allocated and the subsequent Auction to which the Long-Term Transmission Rights are to be returned shall be for the same form of products.

The minimum volume for a returned Long-Term Transmission Right shall be one (1) MW over the specific timeframe of the subsequent Auction.
The Regional Market Facilitator shall make the volumes of returned Long-Term Transmission Rights available at the subsequent long-term Auction, increasing the offered capacity announced in the provisional Auction Specification accordingly and equally for each hour of the Product Period. The same applies when the offered capacity announced in the provisional Auction Specification for the subsequent long-term Auction contains a Reduction Period.

Long-Term Transmission Right holder(s) wishing to return their Long-Term Transmission Rights shall send a notification via the Auction Tool to the Regional Market Facilitator no later than the deadline specified in the Auction Specification for the subsequent Auction to which the Long-Term Transmission Right is to be returned. A valid notification of the return shall contain, at least, the following information:

a) code of the Long-Term Transmission Right holder;
b) identity of the subsequent Auction to which the Long-Term Transmission Right is returned;
c) the volume of the Long-Term Transmission Rights for return.

In order to be able to return Long-Term Transmission Rights the Registered Participant shall:

a) have a valid and effective Participation Agreement with the Regional Market Facilitator;
b) hold the relevant Long-Term Transmission Rights at the time of the notification of the return;
c) send the notification before the deadline specified in the Auction Specification;
d) fulfill its financial obligations concerning relevant Long-Term Transmission Rights pursuant to these Allocation Rules.

If the return is accepted, the Regional Market Facilitator shall decrease the total volume of the Long-Term Transmission Rights held by the respective Long-Term Transmission Right holder by the amount returned.

Registered Participants who returned Long-Term Transmission Right are entitled to receive a remuneration equal to the value of the returned Long-Term Transmission Rights set during the relevant subsequent Auction(s) calculated for each hour as follows:

a) the Marginal Price of the Auction at which the returned Long-Term Transmission Right was reallocated in Dollars/Euros per MW per hour multiplied by
b) the quantity of MW which was reallocated.

3.5.2 Transfer of Long-Term Transmission Rights

J. Requirements for transfer Long-Term Transmission Rights.

Long-term Transmission Right holder(s) may transfer some or all their Long-Term Transmission Rights to another Registered Participant once the Auction results in respect of those rights are defined.

The minimum volume of Long-Term Transmission Rights that may be transferred shall be one (1) MW over one (1) hour.
The transferor shall send a notification of the transfer to the Regional Market Facilitator via the Auction Tool with the following information:

a) the codes of the transferor and transferee;
b) the time period of the transfer including the start and end dates and hours;
c) the volume (MW) of the transferred Long-Term Transmission Right in whole MW(s) defined per hour.

The notification of the transfer shall be delivered to the Regional Market Facilitator no later the time indicated in the relevant Auction Specification.

In order to be able to transfer the Long-Term Transmission Rights the following requirements shall be fulfilled:

a) The transferor and transferee have a valid and effective Participation Agreement with the Regional Market Facilitator.
b) The transferor holds the concerned Long-Term Transmission Rights at the time of the notification of the transfer.
c) The transferor has fulfilled its financial obligations concerning relevant Long-Term Transmission Rights pursuant to this Allocation Rules regardless whether the transferor transfers all or only part of its Long-Term Transmission Rights and even in the case of multiple transfers among several Registered Participants.
d) The transferor has delivered the notification of the transfer before the defined deadline reported in the relevant Auction Specification.

The Regional Market Facilitator shall issue an acknowledgement of receipt of the notification to the transferor and shall inform the transferee about the notification of the transfer.

The notification of transfer shall be confirmed by the transferee no later than the time indicated in the relevant Auction Specification.

The Transferor shall not be entitled to withdraw the transfer notification once the transferee has accepted it.

3.5.3 Use and remuneration of Long-Term Transmission Rights

J. Definition of remuneration of Long-Term Transmission Right.

Long-term Transmission Rights shall be subject to the Use it or Sell It principle. Where TSOs issue and apply Long-Term Transmission Rights on Bidding Zone borders, they shall enable Long-Term Transmission Rights holders and/or their counterparties to nominate their Actual Energy Transfers schedules.

The holder of allocated Long-Term Transmission Rights, and their counterparties where applicable, shall nominate all or part of their Long-Term Transmission Rights for its physical use in accordance with Nomination Rules.

The Regional Market Facilitator shall publish a list with the relevant Nomination Rules for the Bidding Zone borders on its website. Nomination rules shall contain at least the following information:
a) the entitlement of a physical transmission rights holder to nominate Actual Energy Transfer schedules;
b) minimum technical requirements to nominate;
c) description of the nomination process;
d) nomination timings;
e) format of nomination and communication.

The Nomination shall be done in compliance with the Rights Document (see Article 3.5.4). In case the Registered Participant does not nominate its Long-Term Transmission Rights, the Regional Market Facilitator shall make the underlying cross zonal TTC of the non-nominated Long-Term Transmission Rights available for the relevant daily allocation. The physical Transmission Right holders who do not nominate their Long-Term Transmission Rights for physical use of their rights shall be entitled to receive remuneration as described below.

The remuneration shall be calculated as the difference between the volumes stated in the Rights Document and the final volumes nominated and accepted by the relevant TSO, multiplied by the Marginal Price of the daily Auction at which that Long-Term Transmission Right was reallocated, for the concerned hourly period.

3.5.4 Rights Document

The Rights Document shall contain the information about the volume in MW that eligible persons are entitled to nominate at specific Bidding Zone borders and directions and for hourly periods in case of Long-Term Transmission Rights identified by Capacity Agreement Identification (CAI).

Eligible entities may be the following:
   a) the Long-Term Transmission Rights holder; or
   b) entities notified by the Transmission Rights holder during the Nomination process to the respective TSOs in line with the relevant Nomination Rules;

The Regional Market Facilitator shall send the Rights Document daily, via the Auction Tool to the eligible entity, according the time indicated in the relevant Nomination Rules.

3.5.5 Use of Daily Transmission Rights

J. Physical allocation of daily transmission right.

Daily Transmission Rights allocated in an Auction, shall be subject to the Use it or Lose It principle with no financial compensation.

The holder of allocated Transmission Rights may nominate the Transmission Rights for its physical use.
Persons eligible to nominate Transmission Rights shall fulfill the requirement described in Nomination Rules.

Eligible entities may be the following:
   a) the Transmission Rights holder; or
b) the entity notified by the Transmission Rights’ holder during the Nomination process to the respective TSOs in line with the relevant Nomination Rules;

The Nomination shall be done in compliance with the Rights Document. The Regional Market Facilitator shall publish a list with the relevant Nomination Rules for the Bidding Zone borders on its website.

The nomination deadlines for respective Bidding Zone borders are set forth in the relevant Nomination Rules. The Regional Market Facilitator shall publish information on its website on the nomination deadlines per Bidding Zone border.

The Regional Market Facilitator shall send the Rights Document daily according to the time indicated in the relevant Nomination Rules. The Rights Documents shall be considered provisional until the end of the Contestation Period.

### 3.6 Fallback Procedures

**J. Requirement for fallback procedure of standard process.**

The Regional Market Facilitator shall organize a fallback procedure in all cases of failure of a standard process within its own responsibility.

### 3.7 Curtailment

**J. Transmission Rights** irrespective of the Product Period may be curtailed in the event of Force Majeure, or to ensure operation remains within Operational Security Limits.

Curtailment may be applied on allocated Long-Term Transmission Rights including, where the case may be, on nominated Long-Term Transmission Rights.

Each Registered Participant affected by curtailment shall lose its right to transfer, return or nominate for physical use the concerned Long-Term Transmission Rights or to receive remuneration based on the Use-It-or-Sell-It principle.

In case of curtailment, the affected Registered Participant is entitled to receive reimbursement or compensation according to Article 3.7.2.

#### 3.7.1 Process and notification of curtailment

The curtailment shall be carried out by the Regional Market Facilitator based on a request by one or more TSO(s) at the Bidding Zone border where Long-Term Transmission Rights have been allocated.

The Regional Market Facilitator shall notify the affected holders of Long-Term Transmission Rights as soon as possible of a curtailment of Long-Term Transmission Rights including the triggering event via email and on the webpage of the Regional Market Facilitator. The notification shall identify the affected Long-Term Transmission Rights, the affected volume in MW per hour for each concerned period, the triggering events for
curtailment, and the amount of Long-Term Transmission Rights that remain after the curtailment.

The curtailment shall be applied to Long-Term Transmission Rights of the concerned periods on a pro rata basis, which means in proportion to the held Long-Term Transmission Rights, regardless of the time of allocation.

3.7.2 Compensation for curtailments

J. Calculation of curtailment compensation

In cases of curtailment the compensation for each affected hour and Registered Participant shall be calculated as:

a) the Marginal Price of the initial Auction multiplied by
b) the volume in MW per hour corresponding to the difference between the Long-Term Transmission Rights held by the Registered Participant before and after the curtailment.

3.8 Invoicing and Payment

A Registered Participant shall pay the amounts due as calculated in accordance with Article 3.8.1 for all Long-Term Transmission Rights allocated to him. This obligation shall be fulfilled irrespective of any return or transfer or curtailment of all or some of these Long-Term Transmission Rights in accordance with these Allocation Rules.

3.8.1 Calculation of due amounts

J. Obligation and calculation regarding payment of the amount of Transmission Rights

Registered Participants shall pay for each of the Long-Term Transmission Rights allocated to them an amount equal to:

a) the Marginal Price (per MW per hour); multiplied by
b) the sum of Long-Term Transmission Rights in MW allocated in individual hours of the Product Period incorporating any Reduction Period where relevant.

Upon the collection of the payment, the Regional Market Facilitator shall update the Credit Limit accordingly.

3.8.2 Invoicing and payment conditions

J. Definition of time to send invoice and update of Credit Limit.

Payments shall be settled before the start of the Product Period according the deadline specified in Auction Calendar, published on Regional Market Facilitator website.

The Regional Market Facilitator shall issue invoices for payments for all Long-Term Transmission Rights on a monthly basis in accordance with Auction Calendar, published on Regional Market Facilitator website.
The invoices shall be issued for the following payments:
   a) the amount of the monthly installment(s) if the Long-Term Transmission Right has a duration of more than a month;
   b) the amount due if the Long-Term Transmission Right has a duration equal to a month or less;
   c) any relevant taxes and levies.

The Regional Market Facilitator shall send the invoice to the Registered Participant or it should make it available to the Registered Participant via the Auction Tool.

In the cases of curtailment of Long-Term Transmission Rights, the invoices shall consider any payments to be credited to the Registered Participant regarding return of Long-Term Transmission Rights remuneration.

Upon the collection of the payment, the Regional Market Facilitator shall update the Credit Limit accordingly.

4 DAILY SCHEDULING

4.1 Introduction

J. The scheduling processes described in this document not only support but even enhance the commercial cross border Actual Energy Transfer as desired by Member States. Within this scope this Chapter describes in a general approach how to run this process within PAEM.

This document describes the scheduling process only for normal operational conditions.

The Regional Market Facilitator and TSOs are responsible for the process coordination.

The type of control hierarchy and organization of the structure regarding the information exchange for the scheduling process are to the responsibility of the Arab TSOs Committee and Pan Arab ARC.

A description of this process begins with a simplified representation of a Synchronous Area is showed in Figure 6-1.
The Synchronous Area consists of multiple interconnected Control Areas/Control Blocks, each of them with centralized Secondary Control. Each Control Area/Control Blocks may be divided into sub-Control Areas that operate their own underlying Secondary Control, assuming this does not jeopardize interconnected operation. The hierarchy of Secondary Control consists of the Synchronous Area, with Control Blocks and (optionally) included Control Areas as showed in Figure 6-1.

If a Control Block has internal Control Areas, the Control Block organizes the internal Secondary Control according to one of the following schemes (basically, the type of internal organization shall not influence the behavior or quality of Secondary Control between the Control Blocks):

a) **Centralized**: Secondary Control for the Control Block is performed centrally by a single controller (as one Control Area); the operator of the Control Block has the same responsibilities as the operator of a Control Area.

b) **Pluralistic**: Secondary Control is performed in a decentralized way with more than one Control Area; a single TSO, called the Block Coordinator, regulates the whole block towards its neighbors with its own controller and regulating capacity, while all the other TSOs of the block regulate their own Control Areas in a decentralized way individually;

c) **Hierarchical**: Secondary Control is performed in a decentralized way with more than one Control Area; a single TSO, the Block Coordinator, operates the superposed block controller which directly influences the subordinate controllers of all Control Areas of the Control Block; the Block Coordinator may or may not have regulating capacity on its own.

In order to fulfil these functions, Secondary Control operates by the network characteristic method. Secondary Control is applied to selected generator sets in the Power-Generating Facilities comprising this control loop. Secondary Control operates for periods of several minutes and is therefore dissociated from primary control. This behavior over time is associated with the PI (proportional-integral) characteristic of the secondary controller.
Each Control Area/Control Block shall be operated by an individual TSO that has the responsibility for the Transmission System operation of this area (usually coincident with the territory of a company or a country), including the responsibility for availability, operation and provision of primary control, secondary control and tertiary control within the Control Area/Control Block to maintain the Actual Energy Transfer of its Control Area/Control Block at the Scheduled Energy Transfer value and, consequently, to support the restoration of frequency deviation in the interconnected network.

The type of control hierarchy and organization shall not influence the behavior or quality of secondary control in a negative way or introduce control instability (e.g. cascaded controllers with integral parts can result in impaired or unstable secondary control). A Control Block may divide up into sub-Control Areas that operate their own underlying generation control.

Each TSO operates enough control reserves under automatic control by the Secondary Control to meet its obligation to continuously balance its generation and interchange schedules to its load for the Control Area/Control Block.

4.2 Exchange scheduling data

| J. Rules to define daily cross border Actual Energy Transfer. |

The Aggregated External TSO Schedules between two related Scheduling Areas shall be bilaterally agreed upon using the Agreement Process before the delivery. After that, the Verification Process shall be performed.

The sum of the Netted Area AC Positions of all LFC Areas for each time unit of a Synchronous Area shall be at any time equal to zero. The Coordination Center Zone Operators ensure this by performing the Verification Process.

An HVDC System crossing the border of a Pan-Arab Synchronous Area between two related Scheduling Areas or a HVDC System within a Pan-Arab Synchronous Area between two related Scheduling Areas is considered in the Pan-Arab scheduling process like an AC interconnection, even if it is treated in the Scheduling Area as a Power-Generation Facility or a Load Facility. Aggregated Netted External Schedules concerning HVDC Systems shall be reported separately from Aggregated Netted External Schedules concerning AC links.

The following general rules for scheduling between TSOs and LFC Area Operator, LFC Block Operator or Coordination Center Zone Operator apply:

a) Standards for identification.

b) Resolution for time interval, content and precision of the exchanged SAX (Scheduling Area Exchange document).

c) Verification Process.

d) Troubleshooting in case of problems with data exchange.

e) Agreed timing for processes.

4.2.1 Framework for Pan Arab Coding Scheme

For the electronic exchange of documents referring to the scheduling process among Member States, a common identification of the involved Pan Arab entities (Scheduling
Areas, LFC Areas, LFC Blocks and Coordination Center Zones) on all levels (Energy Identification Code) shall be defined. This implies that each Entity within the Pan Arab organization shall be identified as a Party (EIC-X-code). Depending on the role being played, different role type codes shall be applied to TSO, LFC Area Operator, LFC Block Operator and Coordination Center Zone Operator. Areas shall be identified by EIC-Y-code. The registration or change of an Energy Identification Code shall be coordinated together with the Market Facilitator. For this, every Party is responsible for informing all other involved Parties. The valid list of codes shall be published at the Market Facilitator website.

4.2.2 Electronic Data Exchange

Electronic Data Exchange for is used for scheduling between Scheduling Areas, LFC Areas, LFC Blocks and Coordination Center Zones. The communication facilities shall fulfill the specified availability and performance to facilitate of this process. It is the responsibility of all TSOs to operate their IT processes, including the communication, with acceptable performance. The electronic Data Exchange format for Verification Process shall be agreed upon by the involved TSOs.

4.2.3 Time Interval

The following resolutions for the time intervals shall be allowed: \( t_i = 1\text{min}, \frac{1}{4}\text{h}, \frac{1}{2}\text{h} \) or 1h. The scheduling process shall be available every day from 00:00 to 24:00 (GMT+2).

4.2.4 Troubleshooting

The Parties involved in the scheduling process having trouble with the transmission of data to their related counterparties should either accept the counter Scheduled Energy Transfer values (SAS and/or SAX) or agree upon the values on the phone with their counterparties.

4.2.5 Verification Process

Coordination Center Zone Operators of PAEM are responsible for performing the Verification Process.

After completing each Agreement, the TSO shall assemble and transmit a SAX to the entity performing the Verification Process. This transmission shall also take place in the case of any modifications.

The TSO is responsible for the transmission of SAXs to the entity executing the Verification Process.

The entity performing the Verification Process shall verify the SAXs. As part of Verification Process a status report will be sent to respective TSOs.

After day “D” the responsible Coordination Center Zone Operators must transmit the final Scheduled Energy Transfer values to the Pan Arab Settlement Responsible Party.

The Verification Process compares corresponding values of Aggregate Netted External TSO Schedules dedicated to the same border without applying corrective measures.
A positive verification result shall have the same values for a given direction and for all time intervals in a given time frame.

In case of a negative verification result the related TSOs have the obligation to resolve.

The aggregation of all Aggregate Netted External TSO Schedules shall sum up to zero within the same Synchronous Area.

5 ON LINE INTERCONNECTION SYSTEM MONITORING

### J. The task of online observation is performed during the system operation phase to control the state of the PAEM Electricity System.

The task of online observation is performed during the system operation phase. In order to prevent systematic faults in the context of Load Frequency Control, it is essential to check the PAEM-wide consistency of the input variables for online operation used by the single Parties involved. This comprises the control deviation used as an input value for Load Frequency Control as well as the real-time observation of cross border Actual Energy Transfer and Actual Energy Transfer program among all Control Areas/Control Blocks of PAEM.

In this regard, Coordination Center Zone Operators, LFC Block Operators and LFC Area Operators all have responsibility.

#### 5.1 Control Programs Setpoint

The Control Program setpoint constitutes the power interchange setpoint for the Control Areas’ Secondary Control. In order to prevent excessive fluctuations on interconnections when program changes occur, it is necessary that this jump is converted to a ramp lasting 10 minutes in total, starting 5 minutes before the agreed change of the Control Program setpoint and ending 5 minutes later, regardless of the time-step (one hour, 30 minutes or 15 minutes).

In order to prevent unintentional frequency deviations and major control actions under undisturbed conditions, TSOs are required to maintain careful compliance with times for program changes, particularly where changes in the Control Programs setpoint of several hundred MW are involved. Care must be taken to ensure that generating capacity is brought on line or disconnected on a staggered basis.

A substantial change in Control Programs setpoint shall not have a negative impact upon system operation of the type which might be associated with a disturbance.

#### 5.2 Tie-Line metering, monitoring and control

The LFC Block Operators shall acquire the metering data of the tie-lines to adjacent LFC Block to record the energy in the time-frame used for power exchanges.

The Coordination Center Zone shall be provided with data of total hourly Scheduled Exchanges for each LFC Block and real-time active power tele-measurements of each tie-line crossing the border of the Coordination Center Zone area.

General controls on interconnection system between Control Area, Control Block and Coordination Center Zone Operator are described below.
5.2.1 Control Programs and Power Deviations

a) The sum of Control Program setpoints of each Control Area, Control Block of a Synchronous Area shall be equal to zero at any time.

b) The sum of power deviations of all Control Area of a Control Block shall be equal to the Power Deviation of the Control Block concerned (taking account of the range of measurement accuracy).

c) The sum of Power Deviations of all Control Block in the area of a Coordination Center Zone shall be equal to the Power Deviation calculated with respect to the external border of the Coordination Center Zone concerned (taking account of the range of measurement accuracy).

d) The sum of Power Deviations of all Control Blocks of a Synchronous Area shall be equal to zero at any time.

5.2.2 Physical Actual Energy Transfers

a) The sum of the physical Actual Energy Transfers of all Control Areas of a Control Block shall be equal to the physical Actual Energy Transfer of the Control Block concerned.

b) The sum of physical Actual Energy Transfer of all Control Block in the area of a Coordination Center Zone shall be equal to the physical Actual Energy Transfer with respect to the external border of the Coordination Center Zone concerned.

c) The sum of the measurements of the physical Actual Energy Transfer of all Control Blocks of a synchronous area is equal to zero at any time (taking account of the range of measurement accuracy).

5.2.3 Perturbation of measurement equipment

a) The operator of the relevant Control Area shall inform the neighboring LFC Area Operators and the corresponding operator of the Control Block of any perturbation in the measurement equipment regarding the physical Actual Energy Transfer crossing the border with the neighboring Control Area.

b) The operator of the relevant Control Block shall inform the neighboring LFC Block Operator and the corresponding Coordination Center Zone about any perturbation in the measurement equipment regarding the physical Actual Energy Transfer crossing the border with the neighboring Control Block.

5.2.4 Measures in case of discrepancies

a) Observation of Unintentional Deviations are used to identify and correct as soon as possible abnormal operating and accounting situations (e.g. abnormal values of tie-line tele-measurements, misunderstanding in setting the Actual Energy Transfer program of a Control Area).

b) The LFC Block Operator shall contact the responsible Control Area Operator as soon as possible in order to take corrective measures and resume normal operation.
5.2.5 Transmitted and calculated Power Deviation differs

a) If the transmitted Power Deviation of a Control Area differs from the Power Deviation calculated by the Control Block, the operator of the relevant Control Block shall immediately contact the operators of the corresponding Control Areas to resolve the issue.

b) If the transmitted Power Deviation of a Control Block differs from the Power Deviation calculated by the Coordination Center Zone, the operator of the relevant Coordination Center Zone shall immediately contact the operator of the relevant Control Block to resolve the issue.

5.2.6 Power Deviations sum

a) In case that the sum of the Power Deviations of the Control Areas in a Control Block is not equal to the Power Deviation of the Control Block, the operator of the relevant Control Block shall contact the corresponding operators of the Control Areas in order to solve the problem.

b) In case that the sum of the Power Deviations of the Control Blocks in the area of a Coordination Center Zone is not equal to the Power Deviation calculated with respect to the external border of the Coordination Center Zone concerned, the Coordination Center Zone shall contact the corresponding operators of the Control Blocks in order to solve the problem.

5.2.7 Control Programs sum

a) In case that the sum of the Control Program setpoints of the Control Areas in a Control Block is not equal to Control Program of the Control Block, the operator of the relevant Control Block shall inform the corresponding operators of the Control Areas.

b) In case that the sum of the Control Programs of all Control Blocks in the synchronous area is not equal to zero, the responsible Coordination Center Zone shall inform the corresponding operators of the Control Blocks.

6 ACCOUNTING AND SETTLEMENT OF UNINTENTIONAL DEVIATIONS

J. The task of accounting of Unintentional Deviations is performed “after the fact”, to validate meter measurement data, before the settlement of each Control Area.

The task of accounting of Unintentional Deviations is performed “after the fact”, at the next working day following the system operation. It comprises the validation of meter measurement data, followed by the derivation and matching of accounting data, before the settlement of the account of Unintentional Deviations of each Control Area/Control Blocks/Coordination Center Zone with reference to a recording period is carried out.

The compensation of Unintentional Deviations is performed by using a program of compensation "in kind" within the compensation period, as an import/export of the corresponding amount of energy per tariff period, that was accumulated in the recording period.
The tariff period shall be defined by Arab TSOs Committee according to Pan Arab ARC considering season, workday/holiday, peak/low hour and shall be published on PAEM website.

The sum of Compensation Programs of all Control Blocks, and respectively of all Control Areas, within PAEM shall be zero.

All times mentioned in this document are related to GMT+2.

6.1 Workflow for the accounting and settlement process

The accounting data goes from the bottom to the top (TSO >Control Area>Control Block>Coordination Center Zone).

The Unintentional Deviation as well as the related Compensation Programs are calculated and sent from top to bottom (Coordination Center Zone > Control Block > Control Area).

Coordination Center Zone, Control Block and Control Area are responsible for allocating Unintentional Deviations which result in Compensation Programs for Control Block and Control Area. Each level shall ensure that there is no difference (or rounding difference) induced by the allocation.

A small amount of energy which cannot be compensated, due to rounding, remains on the account of Unintentional Deviations.

6.2 Recording Period, Compensation Period

All TSOs agree on a standard recording period “w” and a standard compensation period. The standard recording period shall be defined to comprise 7 days (one week), (from Monday, 0:00 to Sunday 24:00) whereas the standard compensation period shall be defined to comprise 7 days (one week), from Thursday, 00:00 to Wednesday 24:00 of the week following the recording period.

The accounting process is based on the recording period “w”. The compensation of Unintentional Deviations is performed “in kind” within the compensation period – as an import/export of the corresponding amount of energy per tariff period, that was accumulated in the recording period. Figure 6-1 gives an overview to this procedure.

6.3 Accounting and Settlement General Rules

J. Relevant rules to perform accounting and settlement of Unintentional Deviations.

6.3.1 Accounting and Settlement Period

The daily accounting and settlement are done for the day “D” on the next working day.
The weekly accounting and settlement are done for the recording period.

6.3.2 Time Frame

The time frame for accounting of **Unintentional Deviations** shall correspond with the time frame of the **Actual Energy Transfer** program (1h, ½ h, ¼ h). The time frame shall be the same on a common border between two areas.

6.3.3 Rounding rules

Generally, the data exchanged is in MWh. If all **Control Areas** in a **Control Block** agree, a mathematical rounding in kWh can be performed. The program for compensation of **Unintentional Deviation** of a **Control Block** shall be in full MW only. By default, the program for the compensation of **Unintentional Deviations** for a **Control Area** should be in MW but if all **Control Areas** in a **Control Block** agree, the program for the compensation of **Unintentional Deviations** may be in kW. The remaining amount of energy in kWh stays on the account of **Unintentional Deviations**.

6.3.4 Electronic Data Exchange

Electronic data exchange for accounting and settlement is required using e-mail via **PACN**. If the e-mail via **PACN** is disturbed, an electronic back-up shall be agreed such as e-mail via internet. If electronic communication is generally disturbed, fax or phone shall be used as back-up.

6.3.5 Consideration of DC-links

**HVDC Systems** are not considered in the **PAEM** Accounting and Settlement Process because they are not considered in the Load Frequency Control.

6.3.6 Modification of the accounting process and related data

All involved **TSOs** shall provide the complete and correct information about all issues affecting the accounting process such as new or changes of tie lines (including DC-links), changes of resolution and time frames. In case of changes, the requesting **TSO** shall inform the affected **TSO, Control Area, Control Block** and **Coordination Center Zone** at least 30 days in advance.

6.4 Bilateral agreement for the accounting/settlement process

| J. Agreement among **TSOs** to define exchange data about measurement and accounting data. |

In order to perform the accounting and settlement process in a correct manner, the partners of a common border shall establish a bilateral accounting agreement to define the list of TIE-LINES, meter measurement and accounting data. **TSOs** shall agree on the list of TIE-LINES to be included in the **PAEM** accounting process. This list also has information about meter measurement and accounting data. It shall provide:

a) Names of both involved **TSOs**
b) Name of tie-lines

c) Name and related TSO of substations tie line is connecting

d) List of meter measurement data to be used to derive the accounting value

e) List of meter measurement data to be exchanged

f) Identifier (ID) for each meter measurement data to be exchanged

g) Identifier (ID) of accounting point

h) If line losses to be considered, agreement on formula to calculate accounting data

The TSOs shall agree on the exchange format for metering, accounting and settlement. This agreed list shall be transmitted to the related Coordination Center Zones for PAEM publication. The data from the accounting point shall be used by all PAEM bodies involved as a unique representation of the physical Actual Energy Transfer concerning the tie-line.

6.5 Data Publication

After ending up with the PAEM accounting and settlement process the agreed accounting data shall be published on the PAEM website.

7 SYNCHRONOUS TIME CORRECTION

J. Frequency and balancing controls are not perfect. This means that a discrepancy may result between synchronous time and universal coordinated time (UTC).

Frequency and balancing control are not perfect. There will always be occasional errors in tie-line meters, whether due to transducer inaccuracy, problems with SCADA hardware or software, or communications errors. Due to these errors, along with normal load and generation variation, net Area Control Error (ACE) in an International Interconnection cannot be maintained at zero. This means that frequency cannot always be maintained at exactly its nominal value (50Hz or 60 Hz), and that average frequency over time usually is not exactly 50 Hz or 60 Hz. Each Interconnection shall have a Time Control process to maintain the long-term average frequency at its nominal value.

If the mean system frequency in the Synchronous Area deviates from the nominal frequency (50 Hz or 60 Hz), this results in a discrepancy between Synchronous Time and universal coordinated time (UTC). This time offset serves as a performance indicator for primary, secondary and tertiary control (power equilibrium) and shall not exceed 30 seconds.

The relevant Coordination Center Zone is responsible for the calculation of Synchronous Time and the organization of its correction. Correction involves the setting of the set-point frequency for Secondary Control in each Control Area/Control Block at 49.95 Hz or 50.05 Hz, depending upon the direction of correction, during the night-time hours.

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2 For example, if frequency has been running 2 mHz high (50.002Hz), a clock using Interconnection frequency as a reference will gain 1.44 seconds in 10 hours intervals (50.002 Hz-50.000 Hz)/50 Hz * 10 hrs * 3600 s/hr = 1.44 s).

3 Regulating the frequency setpoint to 50 ±0.05 Hz, every hour a variation of 6,768 sec will be. So, starting from a time error of 30 sec, in about 5 hours the time error should be next to zero.
Time error between local mean time and electric clock time on the 60Hz System shall be monitored by the Saudi-Arabian TSOs in accordance with its National Grid Code.

When the electric time error has reached a value where correction is required, the relevant Coordination Center Zone shall issue instructions to the Control Area/Control Block to correct the electric time.

The format of instruction shall be approved by the Arab TSOs Committee.

If a Control Area/Control Block is disconnected from the Synchronous Area, it should correct its electric clock time to that of the Synchronous Area before reconnecting.