

# **P4 - Policy 4: Coordinated Operational Planning**

## ***Chapters***

- A. Outage Scheduling**
- B. Capacity Assessment**
- C. Congestion Forecast**

## ***Introduction***

Policy 4 describes several stages of the operational planning phase. It starts approximately one year before actual operation with an outage scheduling process and continues through capacity assessment, day ahead congestion forecast until real-time n-1 security management.

Today's network operation is based on technical as well as market rules. The changes introduced by the electricity market developments have increased both the volumes and volatility from one hour to the other of cross-border trade in the meshed continental European high voltage network. As a consequence this has resulted to some extent into more operational complexity and increase of congestion risks. As a result, there is a need for increased information exchange and still closer coordination among TSOs during the operational planning phase.

Please refer to appendix 4 for basics and explanation of operational planning processes.

If a control block comprises several TSOs, one of these TSOs may be elected to act on behalf of the other for any of the mentioned processes.

This new version of the policy was inspired by the new insights regarding the regional approach concept. Furthermore the topic of n-1 security management has been transferred to Policy 3.

## ***History of changes***

- v 2.3. draft reviewed policy, to WG O&S, 8.02.2010, comments from internal consultation
- v.2.2 draft reviewed policy, to WG O&S, 26.08.2008, comments from WG O&S
- v.2.1 draft reviewed policy, to WG O&S, 1.09.2008
- v.2.0 final policy, approved by the UCTE Steering Committee on 03.05.2006

## ***Current status***

This version of the document has "draft reviewed policy" status and in due time will replace the current v.2.1 version. There is a strong link with Policy 3: "Operational Security".

Definitions, standards and guidelines are part of the rules.

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## A. Outage Scheduling

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### *Introduction*

The process of outage scheduling of the elements of the European interconnected electricity network plays an important role in the operational management of that network.

In order to keep the network in secure operating condition to guarantee a suitable level of reliability and market access, it is necessary to regularly carry out maintenance work which requires outages of elements. Furthermore, outages are also indispensable to carrying out reinforcement work in substations or to install new network elements.

The outages of TIE-LINES or network elements in the vicinity of TIE-LINES directly impact NTC values and possibly reduce the import and export potential between connected areas as well as the potential of mutual support, and consequently have to be prepared carefully in order to prevent lowering the network security in those areas. The outages of TIE-LINES may affect the security of areas that are in close “electrical” vicinity of the outage.

Together, TSOs determine the most suitable dates of outages for the maintenance or the reinforcement of the following network elements: TIE-LINES, substations and other internal system elements influencing the operation of neighbouring systems.

### *Definitions*

**D1. ENTSO-E Continental network planning deadlines.** Outage scheduling is an iterative process aimed at an operational and economic optimum for each TSO while respecting the SECURITY LIMITS and the N-1 CRITERION. This iterative process starts in the second half of the preceding year and finishes on the day preceding actual operation (day-ahead).

**D2. Region.** A group of control areas defined by TSOs whose composition depends on the operational tasks foreseen. Reference is made to Policy 3 regarding the issues of the responsibility area and observability area related to the regional approach.

**D3. Week.** For the process of outage scheduling the week is defined from Saturday till Friday.

### *Standards*

**S1. Operation security.** The TSOs have to jointly ensure that despite the planned outages of POWER SYSTEM elements, the interconnected network always meets the N-1 SECURITY PRINCIPLE in the concerned networks (►►P3-A).

**S2. Relevant elements.** The set of network elements (e.g. TIE-LINES, internal lines, bus-bars, phase shifters, transformers, major generating units), automatic and protection devices which influence two or more TSOs while being out of operation has to be agreed among involved TSOs on a regional basis.

**S2.1 Critical elements.** A subset of relevant elements which are considered to have a major influence on the operational management of the neighbouring systems has to be agreed among involved TSOs. The scheduling of the outages of these elements must be agreed among the TSOs involved on a regional basis. This set must include at least the elements considered in the EXTERNAL CONTINGENCY LIST (►►P3-A) determined by each of the TSOs involved in the region.

**S2.2 Non-critical elements.** A subset of relevant elements which are considered non-critical. The outages of those relevant are considered in the common scheduling process for information. At least the elements of the external observability list (►►P3-A2) should be part of the non critical elements.

**S3. Exchange of information.** TSOs collect and share information about planned outages of the relevant elements within regional groups. The scheduled outages of critical elements are reviewed at the Weekly Operational Teleconference (►B- S7: WOPT).

**S4. Coordination of planned outages.** The outage schedule takes all relevant elements into account and must be agreed upon by involved TSOs concerning the critical elements. Changes are communicated as soon as possible to the involved TSOs. TSOs plan the outages in three planning horizons:

**S4.1. Long-term planning.** In the second half of the preceding year, TSOs start outages scheduling in regional groups for the forthcoming year. At the end of the preceding year, TSOs agree on a joint schedule of outages of all network elements impacting two or more TSOs for the next year.

**S4.2. Medium-term planning.** The outage scheduling agreed for the whole year must be revised on a monthly basis, considering the possible changes known at that time, and providing a reviewed version for the rest of the year agreed among involved TSOs.

**S4.3. Short-term planning.** In case of any changes, the agreed schedule has to be reviewed in the course of the year and any amendments will be notified to and agreed with each TSO in the group concerned as soon as possible, but at the latest on Friday before the week concerned.

**S5. Confirmation of planned outages.** Each TSO reviews and confirms the outages of relevant elements to involved neighbouring TSOs in the course of the week (but latest on Thursday because of the D-2CF process) before the week concerned during the WOPT (►B- S7).

## **Guidelines**

**G1. Organisation of work.** TSOs meet in groups or have teleconference calls to coordinate the outage scheduling on a regional basis. The groups and their composition can be changed by the TSOs involved. If necessary TSOs perform joint studies on the impact of planned outages.

**G2. Common data-base.** TSOs in the same group continuously update a common data-base on a common IT-platform with information on the relevant elements considered, the critical elements agreed and the joint schedule of outages for the rest of the year.

## B. Capacity Assessment

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### *Introduction*

The process of capacity assessment deals with the determination by TSOs of cross-border capacity available to the market. Especially in the parts of the continental European network where congestions are experienced on a regular basis, this capacity assessment process is crucial. However, due to the changing pattern of trade, congestions are likely to appear suddenly in any part, thus capacity assessment should cover every interconnection and hence the maximum set of plausible situations to come. Due to the complexity of transit flows and interactions between areas, the TSOs' capacity assessment process must be coordinated. The accuracy of the capacity assessment depends on the availability of reliable information about each TSOs' network system, including expected load and generation patterns.

This chapter deals with two methods of the capacity assessment. The first one is based on NTC and the second one on Flow-Based. Both methods can be used as indicative or binding assessment.

Capacity assessment should be designed as a continuous risk assessment process, including all necessary updating loops.

### *Definitions*

- D1. Best forecast.** Forecast for the capacity assessment process, using the best information available within the region.
- D2. Base-Case Exchange (BCE).** The exchanges forecasted for a specific time horizon (e.g. one year, one month or one week) before the time stamp of a base-case that could be modified upon agreement of all TSOs involved. The BCE are neither typical values, nor the most probable, they only reflect a possible base-case situation.
- D3. ENTSO-E RG CE reference case.** Each half year, TSOs create a joint ENTSO-E RG CE reference case, which is used as a starting point for the calculation of half-yearly NTC values. The reference case includes exchanges.
- D4. Total Transfer Capacity (TTC).** The maximum exchange program between two areas satisfying the N-1 SECURITY PRINCIPLE (►P3-A).
- D5. Net transfer Capacity (NTC).** The maximum exchange program, which can be realised taking into account the N-1 SECURITY PRINCIPLE (►P3-A) and uncertainties.
- D6. Available Transfer Capacity (ATC).** The capacity which is allocated on the market.
- D7. Transmission Reliability Margin (TRM).** Security margin covering the uncertainties of TTC calculations. These uncertainties consist of unintended deviation of power flows, emergency exchanges between TSOs to cope with unexpected unbalanced situations in real-time and inaccuracies in data collection and measurements.
- D8. Composite NTC value.** The composite NTC value calculated for the borders between three or more TSOs. The composite NTC value is not necessarily the sum of bilateral NTC values.

## Standards

- S1. Operation security.** During the capacity assessment process the TSOs have to jointly ensure that the interconnected network always meets the N-1 SECURITY PRINCIPLE (►P3-A).
- S2. Capacity assessment.** TSOs perform capacity assessments for different time frames and in advance of corresponding capacity allocation procedures. Those binding values are assessed on the basis of the TSOs' best forecast. Capacity assessment takes special situations into account (e.g. public holidays).
- S3. Harmonisation of capacity values.** Neighbouring TSOs have to harmonize the calculated capacity values on their common borders and region. In case there is no agreement on a common value, the lower value has to be used, as this ensures secure operation in both systems.
- S4. Procedure for the capacity assessment.** Each TSO uses a coordinated and harmonised methodology with the neighbouring TSOs or in the region. The methodology must guarantee system security in the affected grids. It has to deliver available capacities satisfactory and reliable for the market.

The solutions are based on the following general methodologies:

- S4.1. NTC values.** TSOs use the procedure for the calculation of NTC values which is described in appendix 4 section B.
- S4.2. Flow-Based Capacity Assessment (FBCA).** The procedure for flow-based capacity assessment is described in appendix 4 section C.
- S5. Base Case Preparation.** The time schedule and the data of the base cases needed for the NTC calculation are determined and controlled by the ENTSO-E RG CE plenary or its appropriate subgroup.
- S6. Indicative NTC values.** Each TSO calculates half yearly NTC values based on the ENTSO-E RG CE reference base-case. Those indicative NTC values are non-binding, not simultaneous and not cumulative (they cannot be summed up). Maximum import and export values per country have to be clarified separately.
- S7. Weekly Operational Teleconference (WOPT).** TSOs within regional groups organise a weekly teleconference call to share operational information regarding:
  - S7.1.** planned outages of relevant network elements (►A- S2)
  - S7.2.** special events or circumstances
  - S7.3.** week-ahead "trend" of the markets and possible influence on the assumptions to consider
  - S7.4.** influence on the published available capacity values
  - S7.5.** common investigation to be initiated, e.g impact of (public) holidays, availability of generation reserves.
- S8. Calculation of ATC values.** In case there is a joint capacity allocation procedure, TSOs calculate and harmonise the ATC values.

- S9. Confidentiality of data.** The use and communication of the data exchanged and of the associated results are restricted to needs linked with the improvement of the security of supply. They have to be treated in compliance with Policy 7.

## **Guidelines**

- G1. Capacity Assessment coordination.** In case of harmonised procedures, TSOs could establish a common service.
- G2. Exchange of information.** For the purpose of performing common studies TSOs exchange the appropriate information, e.g. scenarios for load and generation patterns.
- G3. Composite NTC value**
- G3.1. Calculation of composite NTC values.** In case of strong interdependencies between more than two control areas, TSOs can decide to calculate composite NTC values.
- G3.2. Splitting of the composite NTC values.** A composite NTC value can be split by the TSOs involved into bilateral NTC values.
- G4. Model used for FBCA.** For the flow-based methods common network models should be delivered by the responsible TSOs in a coordinated way in the region with the following parameters:
- G4.1.** a very detailed model of the region with the equivalent of the lower voltage network when it is necessary,
- G4.2.** updated important changes of the network topology,
- G4.3.** updated load patterns,
- G4.4.** updated generation pattern, considering especially wind generation,
- G4.5.** updated power exchange realized by HVDC links as TSO internal generation/load nodes,
- G4.6.** updated possible position of the phase shifters and transformers,
- G4.7.** for the non-participating TSOs, the DACF or snapshot files for the representative historical timestamps are used.
- G5. Model used for FBCA.** Model used for FBCA could be based on different existing network models. It depends on the crossborder capacity allocation cycle (yearly, monthly, daily).
- G5.1. For the daily procedure.** The network model should be based on the DACF models. For each day, TSOs in the region should decide which DACF scenario has to be used. The common network model in this case is called D-2CF. The region should coordinate the exchange of D-2CF and specific time stamps.
- G5.2. For other cycles.** TSOs define the common scenarios based on their experience checking the worst working conditions in the forecasted period. On these decisions the common network model is created.
- G5.3.** Each TSO provides its individual D-2CF load flow data set on the EH ftp-server before 7 p.m. (C.E.T.), where it is accessible to all other participating TSOs

- G5.4.** Daily data sets will be supplied for at least the reference times 3:30, 7:30, 10:30, 12:30, 17:30 and 19:30 (C.E.T.).
- G6. Common network models of the TSOs in the region.** These common network models for the FBCA and other applications should be updated according to the best knowledge. Possibly the existing DACF models can be applied for that purpose.
- G7. Exchange of common network models among regions.** Different regions could harmonise and exchange common network models.
- G8. Handling of transformer and phase shifters taps.** During the capacity assessment procedures the transformer and phase shifters taps are not changed.
- G9. Transmission Reliability Margin (TRM).**
- G9.1.** Each TSO, within its own discretion, has to determine the TRM which is taken into account in the capacity assessment process.
- G9.2.** There are two different reliability margins. The TRM is used in case of NTC value calculation. The Flow-Based Reliability Margin (FBRM) applies to flow-based capacity assessment.
- G9.3.** For different time periods both the TRM and the FBRM may have different values. TRM and FBRM can be defined independently and individually for several time periods.

### ***Bibliography***

- [Indicative values for Net Transfer Capacities (NTC) in Europe, winter and summer, working day, peak hours, ENTSO-publication twice a year]
- [Definitions of Transfer Capacities in liberalised Electricity Markets, ENTSO, April 2001]
- [Procedures for Cross-Border Transmission Capacity Assessments, ENTSO, October 2001]

## C. Congestion Forecast

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### *Introduction*

In order to carry out load flow forecasts during the operational planning phase and to identify possible congestions, it is necessary to exchange relevant data among TSOs. The influence of the neighbouring networks on the considered network has to be taken into account, especially for contingency analysis, even if the identified congestions are not located on TIE-LINES. Hence, one of the main tasks for TSOs is to organise this data exchange, to agree upon the preparation of the data sets and to ensure the confidential treatment of the data exchanged (►P6).

The process of congestion forecasting can be split into different phases, among which:

- **Day-Ahead Congestion Forecast (DACF)** procedure, based on the most reliable network models exchanged by TSOs in the previous day
- **Intraday Congestion Forecast (IDCF)** procedure, based on the most reliable information (e.g. network models) exchanged by TSOs in the current day.

### **Regional approach (►P3-A)**

The operation of the grid becomes more and more complex with a fast increase in cross-border flows. For this reason, it is envisaged for TSOs to improve their existing cooperation to guarantee security of supply also at regional level and, consequently, offer best conditions for market integration.

The cooperation should aim at providing the involved Parties' security improvements of the power system operation, in order to ensure the security in the region, develop security calculations based on common and shared procedures and anticipate detection of congestions which might occur in real time.

### **Standards**

**S1. Infrastructure.** For exchanging the DACF load flow data sets and the results of the network security analysis, TSOs use the Electronic Highway (EH) infrastructure described in Policy 6.

### **S2. Data provision.**

**S2.1 Network model** Each TSO provides to the EH-ftp server a forecasted load flow data set of its grid, with the whole, detailed network model related to the transmission grid, i.e. a real model (no equivalents) of at least all elements at  $\geq 220\text{kV}$  level like busbar couplers, nodes, lines, transformers, nodes' load and injections. Equivalent or real lines and transformers can be used to represent networks of lower voltages, in case they influence the 750kV, 380 kV or 220 kV level significantly.

**S2.2 Data format.** TSOs will use the current CIM-format to be finalized and published on the ENTSO-E website for the exchange of the DACF load flow data sets.



**S2.3 Data processing.** Each TSO has to provide its complete DACF load flow data set with exchange program on the EH ftp-server before 6 p.m. (C.E.T.), where it is accessible to all other participating TSOs.

**S2.4 Backup procedure.** In case of EH-ftp server malfunction, TSO exchange the data sets by sending an e-mail to an agreed list of addressees.

**S2.5 Coordination.** The ENTSO-E RG CE relevant body is responsible for the coordination of the DACF process, i.e. improvements, quality monitoring and problem solving.

**S2.6 Access to control block programs.** Besides the participants' networks, the CONTROL BLOCK programs, provided by the ENTSO-E CO-ORDINATION CENTERS, should be accessible to all TSOs.

**S3. Data collection.** Each TSO collects DACF files from the EH-ftp server and constructs a network model (i.e. the DACF merging process) that represents the most probable state of the forecast time. That model can include all ENTSO-E networks, but a TSO can also disregard the data sets of TSOs whose influence on its network is deemed negligible. This process can be done in a centralised way (organised by any TSO that volunteered). Alternatively this process can be done in a centralised way by a TSO, a regional group or a TSO initiative.

#### **S4 Quality of DACF**

**S4.1 Quality of data set and merging process:** TSOs follow the rules included into the document "Quality of datasets and calculations".

**S4.2 Monitoring the quality of the process.** On a regular basis, but at least twice a year, ENTSO-E RG CE relevant body checks the frequency and quality of the DACF process and presents the results to the plenary with the proposals of improvements.

**S5. Confidentiality of data.** The use and communication of the data exchanged and of the associated results are restricted to needs linked with the improvement of the security of supply. They have to be treated in compliance with Policy 7.

**S6. Participation of TSOs.** All TSOs of the SYNCHRONOUS AREA participate in the DACF method.

**S7. Datasets for DACF.** Daily data sets will be supplied for at least the reference times 3:30, 07:30, 10:30, 12:30, 17:30 and 19:30 (C.E.T.).

**S8. Vulcanus data.** For the purpose of managing the DACF process, all CONTROL BLOCKS of the SYNCHRONOUS AREA provide the Vulcanus system with the Day Ahead exchange programs before 6 p.m. (C.E.T.).

**S9. Security check.** All TSO of the ENTSO-E RG CE shall carry out DACF N-1 security calculations according to Policy 3 A1-S3.a

**S10. Congestion Management** In case of a detected congestion the DACF security analysis results should be sent in a prescribed format to the EH-ftp server or to any other appropriate media for access to every TSO. The involved TSOs then decide whether and what kind of countermeasures should be taken to solve the detected congestion (►P3).

**S11. Additional data.** For examining DACF data quality or for purposes of examinations of events in the interconnected network TSOs should provide on request of other TSOs snapshots (SN) of the real operation. In case of disturbances or other unusual operation of interconnected system each TSO can require SN. All TSOs who are requested to do so should prepare and send SN to other TSOs through the EH-ftp server as soon as possible and at latest two working days after the request was made.

## Guidelines

- G1. Dataset for IDCF.** In order to allow TSOs to perform different security analysis during different timeframes and for a future IDCF procedure purpose, TSOs should exchange 24 daily data sets corresponding to the reference times from 00:30 to 23:30 (C.E.T.). The IDCF should be provided at latest 1 hour before each reference time.
- G2. DACF procedure.** TSOs shall harmonize the merging procedure in terms of at least replacement of missing data and solving unbalance.
- G3. Intraday information on significant information.** TSOs should exchange as soon as possible significant intraday modifications such as topological reconfiguration, generation pattern, HVDC, phase shifter transformer (PST) tap position, modification of the standard automatic devices operation, etc.
- G4. Vulcanus system.** Besides the DACF information, each TSO checks the cross-border exchange programs for the next day on the Vulcanus system to estimate whether extraordinary transit flows or congestion might be expected.
- G5. IDCF procedure.** TSOs exchange network models every hour. The same basic infrastructure and formats as for the DACF shall be used for this procedure as well. The IDCF requires a high level of automation and should be introduced after a full consolidation of the DACF process for 24 hours. The following exceptions to the DACF description must be mentioned:
- G5.1. Data provision.** The models of the TSOs network are adjusted with updated expected load profiles, production schedules and expected topology (including outages, phase shifter transformer tap positions). The models could be based on a current snapshot of the TSOs network.
- G5.2. Coordinated remedial actions.** In case congestion is detected, the TSOs involved decide whether and what kind of measures shall be taken to solve the detected congestion, if possible based on the measures defined during the DACF process.
- G5.3. Vulcanus system.** Besides the IDCF information, each TSO checks the cross-border exchange programs for the next hours on the Vulcanus system to estimate whether extraordinary transit flows or congestion might be expected. All CONTROL BLOCKS of the SYNCHRONOUS AREA should provide the Vulcanus system with the intraday control program and schedules.

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- [Definition of X-nodes and nominal thermal limits and file naming conventions]
- [Technical guidelines for the Net Transfer Capacity determination, March 2004]
- [Quality of datasets and calculations, UCTE subgroup Network Models and Forecast Tools, January 2007]