

Communauté Economique Des Etats de l'Afrique de l'Ouest

WEST AFRICAN POWER POOL SYSTEME D'ECHANGES D'ENERGIE ELECTRIQUE OUEST AFRICAIN General Secretariat / Secrétariat Général

Operation Manual for WAPP Interconnected Power System



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Table of Contents

Overall Information

Load Frequency Control

Interchange Scheduling and Accounting Between Control Areas

Operational Security

Operational Planning

Emergencies Procedures

Communication Infrastructure

Information Exchange Between Systems

Operator Personal and Training

Glossary

Operation Manual — Table of Contents

0. OVERALL INFORMATION

- 0.1. Preamble
- 0.2. Introduction
- 0.3. Presentation of WAPP
- 0.4. Some important dates
- 0.5. Revision

1. POLICY 1: LOAD-FREQUENCY-CONTROL

- 1.1. Introduction
- **1.2.** Distribution of operating reserves
- **1.3. Primary control**
- 1.4. Secondary control
- 1.5. Tertiary reserve
- 1.6. Control and monitoring equipment
- 1.7. Quality of Control
- 2. POLICY 2: INTERCHANGE SCHEDULING AND ACCOUNTING BETWEEN CONTROL AREAS
 - 2.1. Introduction
 - 2.2. Determination of transmission capacity
 - 2.3. Scheduling of interchanges
 - 2.4. Real time monitoring
 - 2.5. Accounting for inadvertent deviations

3. POLICY 3: OPERATIONAL SECURITY

- 3.1. Introduction
- 3.2. N-1 criterion
- 3.3. Interchange scheduling
- 3.4. Power system operation
- 3.5. Relay coordination
- 3.6. Voltage control

4. POLICY 4: OPERATIONAL PLANNING

- 4.1. System reliability assessment
- 4.2. Recommendation for WAPP System modeling
- 4.3. Coordination of maintenance scheduling

5. POLICY 5: EMERGENCY PROCEDURES

- 5.1. Normal operation and operation under abnormal conditions
- 5.2. Limitation of large-scale failures
- 5.3. Reconstitution measures following network collapse
- 5.4. Control centre back-up

6. POLICY 6: COMMUNICATION INFRASTRUCTURES

- 6.1. Telecommunication facilities
- 6.2. Voice communication
- 6.3. Telecommunication operational procedures
- 6.4. Loss of telecommunication

7. POLICY 7: INFORMATION EXCHANGE BETWEEN SYSTEMS

- 7.1. Introduction
- 7.2. Confidentiality
- 7.3. Technical infrastructure

8. POLICY 8: OPERATOR PERSONNEL AND TRAINING

- 8.1. Responsibility and Authority
- 8.2. Certification
- 8.3. Training
- 8.4. Suggested Items for System Operator Training Courses
- 9. GLOSSARY ENGLISH-FRENCH /GLOSSARY FRENCH-ENGLISH

OVERALL INFORMATION

0. OVERALL INFORMATION	3
0.1. PREAMBLE	3
0.2. INTRODUCTION	3
0.3. PRESENTATION OF WAPP	3
0.3.1. WAPP objectives	4
0.3.2. Structure of WAPP	5
0.3.2.1. The General Assembly:	5
0.3.2.2. The WAPP Executive Board:	5
0.3.2.3. The Organisational Committees	5
0.3.2.4. The General Secretariat	5
0.4. SOME IMPORTANT DATES	7
0.5. REVISIONS	8

0. OVERALL INFORMATION

0.1. PREAMBLE

The objective of this document is to ensure that all the Interconnected power systems of the West African Power Pool (WAPP) operate the interconnected Western African network efficiently and effectively and that they participate equitably in the obligations and in the benefits resulting from the Interconnection. These Policies shall be reviewed by the Engineering and Operating Committee of WAPP, as the need arises.

All interconnected utilities in WAPP shall comply with the contents of this document. It can also be used as a basis to prepare more detailed documents (E.G. Operational procedures) governing the operation of each individual network.

This document is based on:

- The "UCTE Operation Manual". The "Union for the Co-ordination of Transmission of Electricity" (UCTE) is the association of transmission system operators in continental Europe.
- The "NERC Operating Guidelines". The North American Electric Reliability Council (NERC). in United States, Canada, and the northern portion of Baja California Norte, Mexico.
- The "SAPP Operating Guidelines". The Southern African Power Pool (SAPP) in Southern part of Africa.

It will enable all the interconnected Power Systems to monitor the operations of the West Africa Grid and to compare them against a benchmark.

0.2. INTRODUCTION

English and French shall be the official languages of communication between the interconnected power systems of WAPP.

The Policies are designed to ensure co-ordinated operation between interconnected power systems and to achieve high levels of system reliability and control at the points of interconnection. The Policies specify how the operational guidelines of WAPP shall be implemented. The Policies are based on established technical and operational experience accumulated over the years.

0.3. PRESENTATION OF WAPP

The West African Power Pool (WAPP) was established by Decision A/DEC.5/12/99 at the 22nd Summit of the Authority of ECOWAS Heads of State and Government in order to address the issue of power supply deficiency within the West African sub-region.

The Heads of State and Government of the ECOWAS Member States, at the 29th Summit held in Niamey, January 12, 2006, approved for signature by ECOWAS member States utilities, the Articles of Agreement relating to the establishment and functioning of the WAPP by Decision A/DEC.18/01/06.

Decision A/DEC.20/01/06 granted WAPP the status of a Specialised Institution of ECOWAS. The headquarters of WAPP is located in Cotonou, Republic of Benin

Membership in WAPP Organization is voluntary and is open to any entity, public or private, which either:

(a) own/operate generation facilities of 20 MW or larger, and/or distribute and retail supply electricity (the "Transmission Using Members"); and/or

(b) own/operate "major transmission facilities in the region", if such facilities are physically interconnected and have an impact on coordination of system operations in the West Africa region (the "Transmission Owning/Operating" Members).

Petroleum companies, producers and transporters of gas meant for electricity generation, as well as primary investors in the power sector can be Members

0.3.1. WAPP objectives

The following objectives have been assigned to WAPP:

- Formalize an official and extended collaboration in the region in order to develop power generation and transmission facilities, thus enhancing power supply and strengthening power security within the sub-region;
- Improve the reliability of power system and quality of power supply in the region as a whole;
- Minimize operating cost of networks;
- Increase investments needed for power grid expansion in the region, with emphasis on the implementation of cross-border projects;
- Create an attractive environment for investments in order to facilitate the funding of power generation and transmission facilities;
- Create a common operating standards and rules in the sector;
- Create a transparent and reliable mechanism for the swift settlement of power trade transactions;
- Increase the overall level of power supply in the region, through the implementation of priority generation and transmission projects that will serve as foundation for economic development and the extension of cheaper electricity supply to a greater number of consumers

0.3.2. Structure of WAPP

The governance structure of WAPP is:

- The General Assembly
- The Executive Board
- The Organizational Committees
- The WAPP General Secretariat, including the Information Coordination Centre and the Planning, Investment Programming and Environmental Safeguards Department.

0.3.2.1. The General Assembly:

The General Assembly is the highest decision making body for the WAPP.

0.3.2.2. The WAPP Executive Board:

The WAPP Executive Board would have decision making authority to develop and implement initiatives to achieve the mission of the WAPP Organization, taking into account the overall policy directives agreed upon by the General Assembly

0.3.2.3. The Organisational Committees

The Organisational Committees shall provide support and advice to the Executive Board on all matters concerning collective policy formulation functions for developing, maintaining and updating common "rules of practice" on technical, planning, operational and environmental aspects of WAPP. The Organisational Committees shall be composed of technical experts drawn from the WAPP membership. Member input on decision-making would take place primarily through active participation in the Organisational Committees.

0.3.2.4. The General Secretariat

The WAPP General Secretariat is the administrative organ to support the Executive Board in the accomplishment of the duties of the Executive Board and also responsible for the day-today management of WAPP. The WAPP General Secretariat would take responsibility for coordination of a team of independent professionals – permanent core staff of the WAPP Secretariat – that would implement day-to-day tasks required to accomplish the mission of WAPP. The staff of the WAPP Secretariat would perform the secretariat function for all meetings of the permanent WAPP Committees and any ad hoc tasks forces.

Its mandate is to:

- Facilitate the expansion of power generation and transmission facilities;
- Coordinate planning and operation of power systems;
- Ensure sustainable development through safe environmental practices ;
- Facilitate the implementation of institutional frameworks and the development of utilities;
- Promote effective communication between WAPP members, donors and the public.

The WAPP Information and Coordination Center (ICC) is an organ of the WAPP Secretariat and shall promote operational coordination between Transmission Owning/Operating Members through actual day-to-day information sharing/exchange between WAPP Operational Coordination Centers.

0.4. SOME IMPORTANT DATES

28 May 1975	Establishment of ECOWAS			
July 1993	Adoption of ECOWAS Revised Treaty ;			
December 1999	Establishment of the West African Power Pool (WAPP) by Decision A/DEC.5/12/99;			
January 2003	Adoption of Protocol on Energy by Decision A/DEC.17/01/03;			
January 2003	Creation of ECOWAS Energy Observatory by Decision A/DEC.2/01/03 of ECOWAS Heads of States and Government;			
January 2005	Adoption of ECOWAS Revised Master Plan for the generation and transmission of electrical energy by Decision A/DEC.7/01/05;			
January 2005	Adoption of a Regional Regulation framework by Decision A/DEC.6/01/05;			
January 2006	Approval of the Articles of Agreement de la Convention relating to the Establishment and functioning of the WAPP, by Decision A/DEC.18/01/06;			
January 2006	Granting of the status of Specialised Institution of ECOWAS by Decision A/DEC.20/01/06.			
September 2006	First Version of Operating Manual			

0.5. REVISIONS

Agreement adopting and defining modalities for the implementation of the Operation Manual for the interconnected power systems of WAPP sets out the way in which changes to the Operation Manual are to be made and reference is also made to WAPP and its member's obligations. In order to ensure that Users have access to a current version of the Operation Manual, Users who have received officially a copy of the Operation Manual receive a set of replacement pages containing the revisions made to the Operation. All pages re-issued have the revision number and date of the revision on the lower right hand corner of the page. The changes to the text since the previous page issue are indicated by a vertical line to the left hand side of the text. Where repagination or repositioning of the text on other pages has been found necessary but the text itself has remained unchanged the re-issued pages have only the revision number and date of the revision included.

The Operation Manual was introduced in October 2006 (version 1). The following 'index to revisions' provides a checklist to the pages and sections of the Operation Manual changed from Issue 1 of the Operation Manual. All inquiries in relation to revisions to the Operation Manual should be addressed to the Operation Manual development team at the address given at the back of the Operation Manual.

Revision 1		Effective Date:
POLICY	PAGE	CLAUSE

Revision 2		Effective Date:
POLICY	PAGE	CLAUSE

POLICY 1

LOAD-FREQUENCY-CONTROL

1. P1-L	OAD FREQUENCY CONTROL	3
1.1. I		3
1.2.	DISTRIBUTION OF OPERATING RESERVES	4
1.2.1	. Principle	
1.2.2	. Requirements	4
1.3. I	PRIMARY CONTROL	5
1.3.1	. Operational and design Standards	5
1.3.2	. Technical Standards	6
1.3.3	Procedures	6
1.4.	SECONDARY CONTROL	6
1.4.1	. Operational and design Standards	6
1.4.2	. Technical standard	7
1.4.3	Area Contribution	8
1.4.4	Procedures	9
1.5.	TERTIARY RESERVE	9
1.5.1	. Tertiary reserve characteristics	9
1.5.2	Procedures	9
1.6. (CONTROL AND MONITORING EQUIPMENT	10
1.6.1	. Basic principles	10
1.6.2	. Requirements	10
1.7. (QUALITY OF CONTROL	10
1.7.1	. Primary control	11
1.7	7.1.1. Deployment Time of Primary Control Reserve	11
1.7	7.1.2. Performance Measurement	11
1.7.2	Secondary controL	12
1.7	7.2.1. Quality of control during normal operation	12
1.7	7.2.2. Quality of control during large deviations	12
1.7.3	Procedures	13

WAPP Zone B





1. P1- LOAD FREQUENCY CONTROL

1.1. INTRODUCTION

Since electricity cannot be stored in any appreciable amount, power system has unique feature of a need for continuous and near instantaneous balancing of generation and demand, consistent with transmission system constraints. This requires adjusting generation output to match demand in real time. Whenever generation does not match the total demand, the frequency of the entire interconnected power system deviates from the frequency at which the systems were designed to operate: 50 Hz. Thus, this balance control covers two main functions:

- Frequency control, and
- Cross border exchange control.

The frequency and cross-border exchange are controlled by use of Primary Control installed on units and by use of Secondary Control (Load Frequency Controller or function of AGC) installed in the Load Despatch Centre of the Control Area.

Definitions

Control area: A control area is a coherent part (usually coincident with the territory of a company, a country or a geographical area, physically demarcated by the position of points for the delivery measurement of the interchanged power and energy to the remaining interconnected network), operated by a single network operator, with physical loads and controllable generation units connected within the control area. The WAPP interconnected power system is composed of 3 Control Areas:

- Côte d'Ivoire-Burkina-Faso,
- Ghana-Togo-Benin,
- Nigeria-Niger,
- Guinea Liberia Sierra Leone,
- Senegal Mali Gambia Guinee Bissau.

<u>Control area operator</u>: A control area operator is the operator of a control area.

For the control area:

- Côte d'Ivoire-Burkina-Faso, Côte d'Ivoire is the operator
- Ghana-Togo-Benin, Ghana is the operator
- Nigeria-Niger, Nigeria is the operator,
- Guinea Liberia Sierra Leone; Guinea is the operator,
- Senegal Mali Gambia Guinee Bissau; Senegal is the operator.

<u>Primary control</u>: The primary control is based on the principle of joint action to stabilise the system frequency at a stationary value after an imbalance between demand and generation and thus to ensure system reliability and interconnected operation. This includes an overall distribution of reserves and control actions between the synchronous control areas.

Primary control action (involving primary control reserve) begins within a few seconds after a frequency deviation, and takes full effect not more than 30 seconds later.

Secondary control: Secondary control reduces Area Control Error (ACE) automatically by means of secondary controller and contribute (particularly after the loss of generating unit) to the restoration of the frequency to its set point value ($f = f_{set}$) in order to free the power used by the primary control (primary control reserve).

Frequency and power interchanges must begin to return to their set point values as a result of secondary control (involving secondary reserve) after 30 seconds, with the process of correction being completed within 20 minutes.

Tertiary control: to the tertiary control enables the change of the working point of units participating in secondary control and distribute the secondary control power to various units in the best possible way in terms of economics considerations. The activation of tertiary control reserve shall be possible at any time.

1.2. DISTRIBUTION OF OPERATING RESERVES

1.2.1. Principle

The operating reserves shall be distributed as evenly as possible throughout the system on units in operation. The possible transmission system congestions have to be taken into account by the control area operator in the reserve calculation, in order to avoid a limitation in case of activation of operating reserves (Refer to P2 calculation of Net Transfer Capability).

The control area operator shall appraise its reserve continuously and particularly after the loss of generation or demand. It has to re-establish its required amount of reserve as soon as practicable, in order to protect itself against the next contingency and to avoid endangering the whole interconnected power system. For this purpose available generating units could be started, interchange contracts could be reduced or import of energy could be increased or reserves could be provided by any other providers of the interconnected power system.

1.2.2. Requirements

Each Control Area shall specify:

- its operating reserve policies, including the minimum reserve requirement (which shall not be less than the minimum requirement specified in section 1.3.1 and 1.4.3),
- the permissible mix of Spinning Reserve and non-spinning reserve, its procedure for applying operating reserve in practice,
- and the limitations, if any, upon the amount of interruptible load which may be included.

In order to monitor the responses of the generating units after the activation of the primary and the secondary reserve, each control area operator must be equipped with sufficient devices in order to record the needed data. The storage of these data must be sufficient to permit the analysis of normal operation and incidents in the interconnected power system.

Every year by December 1st, each Control Area shall provide the Information and Coordination Center (ICC) and the Engineering and Operation Committee with updated copies of its reserve policies.

1.3. PRIMARY CONTROL

1.3.1. Operational and design Standards

Nominal Set-Point Frequency: The nominal set-point frequency value in the interconnected WAPP Power System is 50 Hz.

Reference Incident: The maximum Power Deviation to be handled is the simultaneous loss of:

- the largest unit in Nigeria that is a 220 MW unit located at Egbin Power Station in Nigeria, and
- the largest unit in the Ghana-Côte d'Ivoire-Togo-Benin-Burkina Faso that is 170 MW unit located at Akosombo Hydro power station in Ghana.

The Self-Regulation of Load within the Interconnected WAPP Power System is assumed to be 1 %/Hz that means Load decrease of 1% in case of a frequency drop of 1 Hz.

Primary Control Target: The reference incident must be offset by Primary Control alone, without the need for load-shedding in response to a Frequency Deviation.

Deployment Times of Primary Control Reserve: The time for starting the action of Primary Control is a few seconds after the Incident.

Duration of Delivery: Primary Control Power must be delivered until the Power Deviation is completely offset by the Secondary Control Reserve of the Control Area in which the Power Deviation has occurred.

Contribution to Control: Each Control Area must contribute to the correction of a disturbance in accordance with its respective contribution coefficient for primary control.

Contribution Coefficients: The contribution coefficients must be determined and published annually for each Control Area. The contribution coefficients are binding for the corresponding Control Areas for one year in advance. They are based on the share of the energy generated within one year in relation to the entire Interconnected Power System. The contribution coefficients are monitored in real-time by control area operators and ICC operator.

Contributions to Primary Reserves: Each Control Area must contribute to the Primary Control Reserve as required. The respective shares are defined by multiplying the calculated reserve for the entire Interconnected WAPP Power System and the contribution coefficients of the various Control Areas.

1.3.2. Technical Standards

Accuracy of Frequency Measurements: For primary control, the accuracy of frequency measurements used in the Primary Controllers must be better than or equal to 10 mHz.

Insensitivity of Controllers: The insensitivity range of Primary Controllers shall not exceed ± 10 mHz. Where dead bands exist in specific controllers, these must be reduced as much as possible.

1.3.3. Procedures

Contribution Coefficients: The Engineering and Operation Committee determines the contribution coefficients of each control area on an annual basis and sets these values into operation on the 1st of January of the next year.

Scheduling and monitoring: Each control area is responsible for continuous secure maintenance of their share in the primary control and must contribute to the correction of a disturbance in accordance with its respective contribution for primary control. Every day by 16:00 control area operator informs Information and Coordination Center (ICC) for the following day of the list of units with the control range from which they shall be supplying the primary control.

Performance Measurement: The network power frequency characteristic is calculated in response to a disturbance (loss of unit), based on measurements of the system frequency and other key values and on a statistical analysis.

1.4. SECONDARY CONTROL

1.4.1. Operational and design Standards

Area demarcation: each control area is physically demarcated by the geographical position of the delivery points for measurement of the power interchanges to the remaining interconnected network.

Area Control Error: In each control area, the Area Control Error (ACE) must be kept close to zero permanently:

$$ACE = P_{meas} - P_{prog} + K_{ri} \cdot (f_{meas} - f_0)$$

 P_{meas} is the sum of the measured Active Power transfers on the Tie-Lines between adjacent Control Areas.

 P_{prog} is the resulting Exchange Program with all the neighbouring Control Areas.

 K_{ri} is the K-factor of the Control Area under consideration.

 f_{meas} - f_0 is the difference between the measured system frequency and the set-point frequency (50 Hz).

Automatic control: In order to keep the ACE close to zero, the control must be automatic. Each Control Area operator must utilize subsystem such as Automatic Generation Control (AGC) to automatically direct the loading of regulation reserve. AGC is used to limit the magnitude of the Area Control Error (ACE).

Manual control: In case of deficiency of the AGC, the concerned control area operator shall use manual control to adjust generation to maintain scheduled interchanges.

Network power frequency characteristic λ_i : The power frequency characteristic of the network is defined as the ratio of the change of power to the corresponding change in frequency before secondary control. The power frequency characteristic (λ_i) is measured in megawatts per hertz (MW/Hz) and is usually associated with a (single) control area or the entire synchronous area. It is not to be confused with the K-factor.

The network power frequency characteristic includes all active primary control and selfregulation of load and changes due to modifications in the generation and demand patterns.

K-factor: In order to ensure that Secondary Control will only be called up in the control zone which is the source of the disturbance, all values for K_{ri} shall, in theory, be equal to λ_i .

Under no circumstances shall K_{ri} be modified during an Incident, since this action would go against the principle of Secondary Control.

Secondary control use: Secondary Control must only be used in order to correct an overall system deviation (ACE). Secondary Control must not be used, e.g. to minimize unintentional electricity exchanges or to correct other imbalances.

Power interchange set point values: The frequency and agreed power Interchanges (programmed value) of the Control Area concerned are entered in the secondary controller (AGC) as set point values.

The algebraic sum of the agreed hourly programme of Interchanges between a Control Area and adjacent areas constitutes the power interchange set point of the Control Area secondary controller (AGC).

Ramp rates: In order to prevent excessive frequency deviations when programme changes occur, it is necessary that this jump is converted to a ramp with Ramp Period 10 minutes, starting 5 minutes before the agreed programme change and ending 5 minutes later.

Offset correction time: One quality criterion for Secondary Control is the time taken for a control deviation to return to zero, i.e. the time taken to restore the frequency to its set point value and to restore Interchanges to their set point values. In practice, Primary Control action begins within a few seconds of a frequency deviation, and takes full effect not more than 30 seconds later. Frequency and power interchanges must begin to return to their set point values as a result of Secondary Control after 30 seconds, with the process of correction being completed after 20 minutes.

1.4.2. Technical standard

Tie-line metering and measurement: All Tie-Lines from a Control Area to Adjacent Control Areas must have measurements and meters in operation to record the actual active power flow in MW in real time and the energy in MWh in the time-frame for power exchanges that is used.

All tie-line's measurements MW and MWh shall be telemetered to both control centers located at both ends of the tie-line and to the control area operators and in parallel to the ICC using common agreed primary equipment.

Accuracy of frequency and power measurements: In Secondary Control, the accuracy of frequency measurement must be better than 10 mHz and the accuracy of the Active power measurement on each tie-line (from a Control Area to adjacent Control Areas) must be better than 1.5 % of its rated value. The measurements cycle time must be lower than 2 s.

Alternative measurements and back up equipment shall be available. During this period, accuracy and cycle times may be temporarily impaired.

Transmission of measurements: The measurements of the frequency and tie-line (between Adjacent Control Areas) power flows must be transmitted on a reliable manner to the AGC (at least two ways recommended, with an alarm in case of deficiency of a data transmission). The frequency shall be acquired within 1s cycles and the tie-lines (between Adjacent Control Areas) and generators outputs measurements within 2 second cycles at each Control Area responsible Control Centre and to ICC.

Data recording: Each Load Despatch Centre and Information and Coordination Center (ICC) has to be equipped with a recording of all values needed for monitoring the response of secondary controllers (AGC) and for analysis of the events in interconnected systems.

1.4.3. Area Contribution

Secondary reserve: Each control area must operate sufficient generating Capacity under automatic control to meet its obligation to continuously balance its generation and Interchange Schedules to its load for its Control Area.

Control Area Secondary reserve. The amount of secondary reserve is determined by the empirically-established reserve values recommended by UCTE¹ for areas of different size as follows:

$$R \ge (a \times L_{max} + b^2)^{1/2} - b$$

R = the required secondary control reserve (MW).

L_{max} = the maximum anticipated load of a control area for the period concerned (MW).

a = 20 and b = 150

¹ UCTE Union for the Co-ordination of Transmission of Electricity" The "Union for the Coordination of Transmission of Electricity" (UCTE) is the **association of transmission system operators** in continental Europe, providing a reliable market base by efficient and secure electric "power highways".

In addition each control area must be able to totally compensate the loss of its largest generation unit by activating first its secondary control reserve then one part of its tertiary control reserve if necessary within 20 minutes.

1.4.4. Procedures

Control Area Operator: Each control area must be operated by an individual load despatch centre that has the responsibility for the transmission system operation of the area, including the responsibility for availability, operation and provision of load-frequency control (primary and secondary control) to maintain the power interchange of the control area at the scheduled value and, consequently, to support the restoration of frequency deviations in the Interconnected WAPP power system.

Secondary control reserve: Each Control Area determines the secondary control reserve in MW (peak and off peak values, seasonal values). The Engineering and Operation Committee approves the values (to be reviewed annually).

Scheduling and monitoring: Each control area operator shall have enough power under automatic control to meet its obligation to continuously balance its generation and interchange schedules to the demand of its control area.

Every day by 16:00, control area operator shall inform the Information and Coordination Center (ICC) for the following day of the list of units under secondary control with the regulating reserve per unit.

1.5. TERTIARY RESERVE

1.5.1. Tertiary reserve characteristics

Tertiary control reserve (20 minutes reserve) is an additional amount of Operating Reserve sufficient to enable the change of working point of units participating in secondary control (automatically by means of secondary controller) and distribute the secondary control power to various units in the best possible way in terms of economic considerations. The activation of tertiary control reserve shall be possible at any time.

The tertiary control reserve shall be distributed to various units. Interruptible Load and directly controlled load may be included in the tertiary reserve if they can be interrupted within 20 minutes.

1.5.2. Procedures

The amount of tertiary reserve required at the day ahead scheduling stage D-1 for the day D and its actualisation during the day D will be decided by control area operator on the basis of historical trends in the reduction in availability of generating plant and increases in forecast demand up to real time operation. As a minimum the control area shall carry at least enough tertiary reserve to cover the most severe single contingency of its area.

Each area must immediately activate tertiary reserve in case of large imbalances between generation and demand and/or for the restoration of a sufficient secondary control band.

1.6. CONTROL AND MONITORING EQUIPMENT

1.6.1. Basic principles

The control system of each control area shall be designed and operated so that the control area operator can continuously and accurately meet its system and synchronous area control obligations and measure its performance. The control system design and operation shall follow accepted industry state-of-the-art techniques.

The system operator's displays shall present a clear and understandable picture of control area parameters. This includes necessary information from facilities within other control areas in addition to internal information.

1.6.2. Requirements

Each control area operator shall be provided with a recording of those variables necessary to facilitate monitoring of control performance, generation response, and post mortem analysis of area performance (ACE, system frequency and net tie-line exchange data).

Adequate and reliable backup power supplies shall be provided and periodically tested at the system control centre and other critical locations to ensure continuous operation of automatic generation control (AGC) and vital data recording equipment during loss of the normal power supply.

Each generating unit or group of generating units, which is to be operated under the secondary controller of a control area operator, must be integrated online into the corresponding secondary control circuit.

1.7. QUALITY OF CONTROL

Each Area Control Center shall evaluate the quality of control of its control area in order to:

- evaluate its primary and secondary responses and adjust if needed,
- ensure that the K factor of the secondary controller match the power frequency characteristics of the area

The Information and Coordination Center (ICC) shall evaluate the quality of control of the synchronised area and all control areas in order to estimate the operational reliability of the interconnected network and evaluate the primary and secondary responses of every Control Area.

1.7.1. Primary control

1.7.1.1. Deployment Time of Primary Control Reserve

The deployment time of the primary control reserves of the various control areas should be as similar as possible, in order to minimise dynamic interaction between control areas.

1.7.1.2. Performance Measurement

A distinction is drawn between the quality of control in the entire synchronous area (overall quality) and the quality of control in each control area (local quality). Each interconnected control area must act to provide effective primary control, in order to ensure that a high overall level of quality is maintained. The main purpose of an overall quality check is to evaluate the performance of the primary control of the entire synchronous area. This is achieved by analysing the system frequency of the network during disturbances. The main purpose of this frequency analysis is to estimate the operational reliability of the interconnected network. The network power frequency characteristic of the entire synchronous area is calculated by the following relationship:

 $\lambda = -\Delta P / \Delta f$ with

 ΔP being the variation in power causing a disturbance and,

 Δf being the quasi-steady-state frequency deviation in response to a disturbance

This is determined from a "smoothing line" drawn between 10 and 30 seconds after the disturbance.



It is assumed that the main part of the primary control reserve is activated after 20 seconds, while the contribution of secondary control to the correction of the disturbance will not yet be perceptible.

A local quality check will allow each party to ascertain whether their respective contribution to primary control is consistent with the requirements. An interconnected control area operator can check the quality of its primary control by evaluating the network power frequency characteristic in its control area each time a disturbance occurs, and comparing it with the network power frequency characteristic of the entire synchronous area. The network power frequency characteristic in a control area is calculated by the following relationship:

$\lambda = -\Delta P / \Delta f$ with

 ΔP being the variation in power generated in a control area in response to a disturbance, measured at interconnecting points of the tie-lines between adjacent Control Areas.

 Δf being the quasi-steady-state frequency deviation in response to a disturbance of ΔP .

1.7.2. Secondary control

1.7.2.1. Quality of control during normal operation

In order to allow the continuous monitoring of the quality of secondary control, the frequency deviation and power deviations are evaluated statistically each month by determining the standard deviation:

The following shall also be measured and monitored:

- Frequency deviations > 200 mHz
- Proportion of time during which the frequency deviation exceeds 200 mHz

1.7.2.2. Quality of control during large deviations

The quality of secondary control must be monitored by measuring and analysing control in individual control areas after losses of generating capacity or load exceeding 100 MW The exact size of the loss will be provided by the Control Area Operator concerned to the ICC.

Measurements of system frequency and power interchanges behaviour during an incident allow a statistical analysis of primary and secondary control performance.

The reaction or response of the synchronous area to a major disturbance (generator shutdown or loss of load) in a control area and the restoration of the system frequency to its initial value (quality of secondary control) is monitored. The system frequency shall be back to the set-point value within 20 minutes (1200 sec).

1.7.3. Procedures

In order to allow the quality of control to be monitored, it is advisable to record and continuously analyse outages in production or consumption exceeding 100 MW. The following information is required for this purpose:

- the location of the disturbance, date and time of the disturbance,
- the amount of production/consumption lost during the disturbance,

The Information and Coordination Center (ICC) will investigate, prepare report and communicate to all interconnected parties.

<u>Note</u>: Even if the system frequency measurement and power cross-border exchange measurements taken during a disturbance are inaccurate, this procedure will allow a statistical analysis of the network power frequency characteristics, primary control and secondary control.

POLICY 2 INTERCHANGE SCHEDULING AND ACCOUNTING BETWEEN CONTROL AREAS

2. P2- INT CONTE	ERCHANGE SCHEDULING AND ACCOUNTING BETWEEN ROL AREAS	3
2.1. INT	RODUCTION	3
2.2. DE	TERMINATION OF TRANSMISSION CAPACITY	3
2.2.1.	Introduction	3
2.2.2.	Criteria	3
2.2.3.	Procedures for scheduling	4
2.2.4.	Implementation of a new transaction	4
2.2.5.	Procedures for congestion management	4
2.3. SC	HEDULING OF INTERCHANGES	4
2.3.1.	Introduction	4
2.3.2.	Criteria	5
2.3.3.	Definition of Time Frame and Resolution	5
2.3.4.	Procedures for Day (D-1) preparation	5
2.3.4.	1. Preparation of exchange programs by control areas	5
2.3.4.	2. Transparency	5
2.3.5.	Procedures for Day (D-1 preparation)	5
2.4. RE	AL TIME MONITORING	6
2.4.1.	Introduction	6
2.4.2.	Criteria	6
2.4.3.	Procedures	6
2.4.4.	Requirements	6
2.5. AC	COUNTING FOR INADVERTENT DEVIATIONS	7
2.5.1.	Introduction	7
2.5.2.	Criteria	7
2.5.3.	Procedures	7
2.5.3.	1. Accounting office	7
2.5.3.	2. Settlement per day (D+1 for D)	7
2.5.3.	3. Final settlement of a recording period	8
2.5.3.	4. Recording period and compensation periods	8
2.5.3.	5. Substitute meter values	8
2.5.4.	The tariff period	9
2.5.5.	Requirements	9

2. P2- INTERCHANGE SCHEDULING AND ACCOUNTING BETWEEN CONTROL AREAS

2.1. INTRODUCTION

These rules address the following issues:

- Determination of the maximum capacity on tie-lines between Control Areas;
- Scheduling and implementing interchange between Control Areas;
- Real-time monitoring of cross-border power flows between Control Areas, and
- Accounting for inadvertent deviations.

2.2. DETERMINATION OF TRANSMISSION CAPACITY

2.2.1. Introduction

This section specifies how to assess the transmission capability between two control areas based on reliability criteria in order to ensure the operational security of the WAPP Grid.

2.2.2. Criteria

Exchange limit calculation

The maximum Cross-border Schedule between two systems shall not exceed the Net Transfer Capacity:

Net Transfer Capacity (NTC)

The net transfer capacity is the maximum total exchange program between two adjacent control areas compatible with security standards applicable in all control areas and taking into account the technical uncertainties on future network conditions.

The net transfer capacity is defined as:

NTC = TTC-TRM

Where Total Transfer Capacity (TTC) is the maximum Exchange Program between two (2) adjacent control areas that is compatible with operational security standards applied in each system and Transmission Reliability Margin (TRM) is a security margin that takes account of uncertainties on the computed TTC values arising from:

- Deviations of power flows resulting from the operation or functioning of primary control;
- Emergency exchanges between systems to cope with unexpected mismatch between generation and demand in real-time;
- Inaccuracies, e. g. in data collection and measurements.

2.2.3. Procedures for scheduling

Control areas shall determine their cross-border transfer capacities (NTC and TRM) per border and communicate the capacities to the Information and Coordination Centre (ICC). ICC shall assess and publish the TTC and NTC on the WAPP website.

		Year	Month	Week	Day D	Real time
NTC/TRM Control Area	from	15 th October year n-1 for the year n	20 business days before 1 st Business day of the month	3 business days before 1 st Business day of the week	Day- 1 by 10 00 GMT (D – 1)	Immediately the previous NTC/TRM is no longer valid
NTC/TRM determination		Peak and off peak values per month	Peak and off peak values/week	Peak and off peak values/days	Peak and off peak values	

2.2.4. Implementation of a new transaction

A new transaction is a transaction that has not yet been implemented or confirmed for implementation. Such transactions shall be presented to the ICC. ICC is not responsible for the implementation of the Transaction; however it may alert and advise the Control Areas if in its opinion there could be a risk to the security of the system.

2.2.5. Procedures for congestion management

Congestion is a situation in which the capacity of an interconnection between control areas is insufficient to accommodate all scheduled Interchanges. A congestion exists if the operational (n-1) criterion cannot be satisfied as a result of the load flow on the network under consideration.

If in the opinion of either party, the scheduled transfer may jeopardize the security of supply to its system; this party has the right to request the other to reduce its import or export to an amount that will be specified by the Control Area concerned. The party so requested shall comply promptly.

2.3. SCHEDULING OF INTERCHANGES

2.3.1. Introduction

The control program is adopted on a "day ahead" basis by the Control Area Operator and modified as necessary up to one hour before transfer takes place, unless an agreement to the contrary is accepted.

The task of scheduling exchange programs is performed during the operational planning phase. it aims to guarantee agreed cross-border exchange programs amongst all control areas.

Exchange Program: An exchange program represents the total scheduled energy interchange between two control areas.

Control Program: A control program constitutes the schedule of the total programmed exchange of a control area which is the sum of all exchange programs and the Compensation Program that is used for secondary control within 24h.

Compensation Program: Compensation of inadvertent deviation is performed by exporting to/ importing from the interconnected system during the compensation period by means of constant power within the same tariff periods as when they occurred.

2.3.2. Criteria

Exchange program. The exchange program must have the same value on both sides of the border.

Sum of the control programs: The sum of the control programs of all control areas for each time unit must at any time be equal to zero.

2.3.3. Definition of Time Frame and Resolution

The power exchange shall be a multiple of 1 MW.

2.3.4. Procedures for Day (D-1) preparation

2.3.4.1. Preparation of exchange programs by control areas

Every day (D-1) the control Area operators have to agree with the neighbouring control area operators on the exchange programs per border for every time unit for the day D by 14:00 GMT on Day (D-1). The agreed exchange programs will be transmitted to the ICC.

2.3.4.2. Transparency

The exchange programs between control areas shall be published by the ICC after completion of the verification of exchange programs and not later than 16:00 Hrs CMT on Day (D-1). The information is given to all interconnected Control Areas.

2.3.5. Procedures for Day (D-1 preparation)

In case of intra-day changes of exchange programs, the control area operators have to agree with the neighbouring control area operators on the bilateral exchanges per border for every time unit and not later than 1 hour before setting the new program into force.

2.4. REAL TIME MONITORING

2.4.1. Introduction

The task of real time monitoring is performed during the system operation phase. In order to prevent disturbances related to load frequency control, in the system it is essential to check the WAPP-wide consistency of the input variables for real time operation used by the various parties involved.

This comprises:

- Exchange programs among all control areas,
- Cross-border power flows in real-time,
- Power deviation and frequency deviation used as an input value for load frequency control.

2.4.2. Criteria

Control programs. The sum of control programs of all control areas must be equal to zero at any time.

Power exchange: The sum of the measurements of the power exchanges of all control areas must be equal to zero at any time

Power deviation The sum of power deviations of all control areas must be equal to zero at any time.

2.4.3. Procedures

Measurement problems

The operator of the relevant control area has to inform the neighbouring control area(s) operators and the ICC of any measurement problems with regard to the cross border exchanges with other neighbouring control areas.

Detection of abnormal operation

In case the sum of the control programs or the sum of active flows of neighbouring control areas is not equal to zero, the Information and Coordination Centre (ICC) shall immediately inform the corresponding operators of the control areas.

2.4.4. Requirements

Accuracy of power measurements: The accuracy of active power measurement on the line under consideration is determined by the accuracy of the measurement chain. The sampling rate of measurements must not exceed 2 seconds.

Transmission of measurements: The measurements of the tie-line power flows across the border of a control area must be transmitted in a reliable manner to the Control Area Operator and to the Information and Coordination Centre (ICC) (with an alarm in case of deficiency in data transmission). The transmission delay must be shorter than 2 seconds.

2.5. ACCOUNTING FOR INADVERTENT DEVIATIONS

2.5.1. Introduction

The task of accounting for inadvertent deviations is performed on the day following the system operation. It comprises the settlement of the account of inadvertent deviations of each control area with reference to a recording period. The compensation of inadvertent 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.

Accounting is an important issue to check the WAPP-wide consistency of the input variable "compensation program" used by the various parties involved in order to prevent system disturbance related to load frequency control.

2.5.2. Criteria

Inadvertent deviation: Calculation per tariff period of inadvertent deviations of a control area for accounting purposes in MWh shall be as follows:

Inadvertent Deviation = (Sum of the metered tie-line flows) - (Control Program)

The sum of all inadvertent deviations of WAPP synchronous area must be equal to zero.

Compensation of inadvertent deviation: The sum of all compensation programs for each time unit of the WAPP synchronous area must be equal to zero.

2.5.3. Procedures

2.5.3.1. Accounting office

Accounting offices shall be available on business days from 08:00Hrs to 16:00Hrs GMT.

2.5.3.2. Settlement per day (D+1 for D)

Accounting point: One side of a tie-line is defined as "accounting point" and will be used as basis for accounting for both adjacent control areas.

The parties at a common border have to agree on a common accounting point. Usually it is located within the substation close to the border between two parties.

Adjacent control area operators have to validate the metering data by 14:00Hrs.

Settlement: Information and Coordination Centre (ICC) shall calculate the single control area account of inadvertent deviations for every tariff period per day (D-1, 00:00Hrs GMT - 24:00Hrs GMT) and submit the result to the concerned control area operator. The data has to be certified by the control area operator.

The control area validation and the control area settlement have to be completed as soon as possible, but not later than16:00Hrs the following business day.

2.5.3.3. Final settlement of a recording period

Information and Coordination Centre (ICC) shall calculate the individual control area final account of inadvertent deviations for every tariff period for the recording period as well as the resulting compensation programs, and submit the result to the control area operator. This shall be completed by 16:00Hrs, at the latest, two business days before the next compensation period.

Settlement closure: The inadvertent deviations for every tariff period for the recording period must be certified by the control area operators. The final validation has to be completed by 16:00Hrs, at the latest, one business day before the compensation period.

Transparency: Inadvertent deviations per tariff period for the recording period and compensation programs for the compensation period must be communicated to all control areas by 16:00Hrs, at the latest, one business day before the compensation period.

2.5.3.4. Recording period and compensation periods

Recording period

The standard recording period is defined to comprise 7 days (one week), from Monday 0:00Hrs to Sunday 24:00Hrs.

Compensation period

The standard compensation period is defined to comprise 7 days (one week), from Thursday 0:00Hrs to Wednesday 24:00Hrs. In case of holidays or for other reasons, exceptions to this rule may apply (Information and Coordination Centre (ICC) shall define a new compensation period). In any case a compensation period shall last at least 4 days and a compensation period has to start always with a delay of three business days after the end of the corresponding recording period.

2.5.3.5. Substitute meter values.

In case of failure of the main meter at the accounting point between Control Areas the following procedure is recommended:

- If available, use the check meter values from the accounting point,
- If available, use the main meter values from the other end of the tie-line,
- If available, use the check meter values from the other end of the tie-line,
- Otherwise, the partners involved agree on the methodology to determine substitute values.

2.5.4. The tariff period

The tariff period is the time interval fixed by the Engineering and Operation Committee during which inadvertent deviations are given the same value for offsetting by compensation in kind. The tariff periods shall distinguish between the dry season and rainy season.

Monday to –	DSTP1	18:00-21:00	Sat Sunday and	DSTP1	18:00-21:00
Friday		GMT	holidays		
	DSTP2	04:00-07:00		DSTP2	
	DSTP3	00:00-04:00		DSTP3	00:00-18:00
		07:00-18:00			07:00-18:00
		21:00-24:00			21:00-24:00

Dry season (1.October.-30. April) GMT time

Rainy season1May.-30 September)

Monday to –	RSTP1	18:00-21:00	Sat Sunday and	RSTP1	18:00-21:00
Friday -			holidays		
	RSTP2	04:00-07:00		RSTP2	
	RSTP3	00:00-04:00		RSTP3	00:00-18:00
		07:00-18:00			07:00-18:00
		21:00-24:00			21:00-24:00

DSTP: Dry Season Tariff Period RSTP: Rainy Season Tariff Period

2.5.5. Requirements

Metering at delivery point: The meters shall incorporate a facility to compensate the readings for line losses according to the delivery point determined at the border between control areas(or other acceptable means to evaluate the losses).. These correction factors shall be determined by meter technicians.

Tie-line metering: All Tie-Lines from a Control Area to Adjacent Control Areas must have meters in operation to record the actual active energy in MWh (and reactive energy in MVArh) both for import and export. As much as possible, Meters shall be of same make and type at both ends of the line.

All tie-line's MWh/MVarh measurements shall be telemetered to both Control Centers at both ends of the tie-line under consideration and also to the Information and Coordination Centre (ICC).

Instrument transformers: Voltage and current transformers installed at each accounting point shall have an accuracy class rating of 0.2. Current transformers shall have 2 cores for measurement purposes.

Energy metering: On the basis of the current and voltage values measured by the transformers, the energy meters determine the active energy flow in both directions related to a given time frame. The main and check energy meters at the accounting points shall have an accuracy class rating of 0.2S.

Redundancy Accounting points shall be equipped with main and check meters at each tie-line. Main and check meters shall be connected each to a separate core of the current transformer.

Voltage transformer cables: To ensure the accuracy of the metering system, voltage transformer cables shall be selected in such a way that a voltage drop is reduced to 0.1% or less of the nominal voltage.
POLICY 2 INTERCHANGE SCHEDULING AND ACCOUNTING BETWEEN CONTROL AREAS

2. P2- INT CONTE	ERCHANGE SCHEDULING AND ACCOUNTING BETWEEN ROL AREAS	3
2.1. INT	RODUCTION	3
2.2. DE	TERMINATION OF TRANSMISSION CAPACITY	3
2.2.1.	Introduction	3
2.2.2.	Criteria	3
2.2.3.	Procedures for scheduling	4
2.2.4.	Implementation of a new transaction	4
2.2.5.	Procedures for congestion management	4
2.3. SC	HEDULING OF INTERCHANGES	4
2.3.1.	Introduction	4
2.3.2.	Criteria	5
2.3.3.	Definition of Time Frame and Resolution	5
2.3.4.	Procedures for Day (D-1) preparation	5
2.3.4.	1. Preparation of exchange programs by control areas	5
2.3.4.	2. Transparency	5
2.3.5.	Procedures for Day (D-1 preparation)	5
2.4. RE	AL TIME MONITORING	6
2.4.1.	Introduction	6
2.4.2.	Criteria	6
2.4.3.	Procedures	6
2.4.4.	Requirements	6
2.5. AC	COUNTING FOR INADVERTENT DEVIATIONS	7
2.5.1.	Introduction	7
2.5.2.	Criteria	7
2.5.3.	Procedures	7
2.5.3.	1. Accounting office	7
2.5.3.	2. Settlement per day (D+1 for D)	7
2.5.3.	3. Final settlement of a recording period	8
2.5.3.	4. Recording period and compensation periods	8
2.5.3.	5. Substitute meter values	8
2.5.4.	The tariff period	9
2.5.5.	Requirements	9

2. P2- INTERCHANGE SCHEDULING AND ACCOUNTING BETWEEN CONTROL AREAS

2.1. INTRODUCTION

These rules address the following issues:

- Determination of the maximum capacity on tie-lines between Control Areas;
- Scheduling and implementing interchange between Control Areas;
- Real-time monitoring of cross-border power flows between Control Areas, and
- Accounting for inadvertent deviations.

2.2. DETERMINATION OF TRANSMISSION CAPACITY

2.2.1. Introduction

This section specifies how to assess the transmission capability between two control areas based on reliability criteria in order to ensure the operational security of the WAPP Grid.

2.2.2. Criteria

Exchange limit calculation

The maximum Cross-border Schedule between two systems shall not exceed the Net Transfer Capacity:

Net Transfer Capacity (NTC)

The net transfer capacity is the maximum total exchange program between two adjacent control areas compatible with security standards applicable in all control areas and taking into account the technical uncertainties on future network conditions.

The net transfer capacity is defined as:

NTC = TTC-TRM

Where Total Transfer Capacity (TTC) is the maximum Exchange Program between two (2) adjacent control areas that is compatible with operational security standards applied in each system and Transmission Reliability Margin (TRM) is a security margin that takes account of uncertainties on the computed TTC values arising from:

- Deviations of power flows resulting from the operation or functioning of primary control;
- Emergency exchanges between systems to cope with unexpected mismatch between generation and demand in real-time;
- Inaccuracies, e. g. in data collection and measurements.

2.2.3. Procedures for scheduling

Control areas shall determine their cross-border transfer capacities (NTC and TRM) per border and communicate the capacities to the Information and Coordination Centre (ICC). ICC shall assess and publish the TTC and NTC on the WAPP website.

		Year	Month	Week	Day D	Real time
NTC/TRM Control Area	from	15 th October year n-1 for the year n	20 business days before 1 st Business day of the month	3 business days before 1 st Business day of the week	Day- 1 by 10 00 GMT (D – 1)	Immediately the previous NTC/TRM is no longer valid
NTC/TRM determination		Peak and off peak values per month	Peak and off peak values/week	Peak and off peak values/days	Peak and off peak values	

2.2.4. Implementation of a new transaction

A new transaction is a transaction that has not yet been implemented or confirmed for implementation. Such transactions shall be presented to the ICC. ICC is not responsible for the implementation of the Transaction; however it may alert and advise the Control Areas if in its opinion there could be a risk to the security of the system.

2.2.5. Procedures for congestion management

Congestion is a situation in which the capacity of an interconnection between control areas is insufficient to accommodate all scheduled Interchanges. A congestion exists if the operational (n-1) criterion cannot be satisfied as a result of the load flow on the network under consideration.

If in the opinion of either party, the scheduled transfer may jeopardize the security of supply to its system; this party has the right to request the other to reduce its import or export to an amount that will be specified by the Control Area concerned. The party so requested shall comply promptly.

2.3. SCHEDULING OF INTERCHANGES

2.3.1. Introduction

The control program is adopted on a "day ahead" basis by the Control Area Operator and modified as necessary up to one hour before transfer takes place, unless an agreement to the contrary is accepted.

The task of scheduling exchange programs is performed during the operational planning phase. it aims to guarantee agreed cross-border exchange programs amongst all control areas.

Exchange Program: An exchange program represents the total scheduled energy interchange between two control areas.

Control Program: A control program constitutes the schedule of the total programmed exchange of a control area which is the sum of all exchange programs and the Compensation Program that is used for secondary control within 24h.

Compensation Program: Compensation of inadvertent deviation is performed by exporting to/ importing from the interconnected system during the compensation period by means of constant power within the same tariff periods as when they occurred.

2.3.2. Criteria

Exchange program. The exchange program must have the same value on both sides of the border.

Sum of the control programs: The sum of the control programs of all control areas for each time unit must at any time be equal to zero.

2.3.3. Definition of Time Frame and Resolution

The power exchange shall be a multiple of 1 MW.

2.3.4. Procedures for Day (D-1) preparation

2.3.4.1. Preparation of exchange programs by control areas

Every day (D-1) the control Area operators have to agree with the neighbouring control area operators on the exchange programs per border for every time unit for the day D by 14:00 GMT on Day (D-1). The agreed exchange programs will be transmitted to the ICC.

2.3.4.2. Transparency

The exchange programs between control areas shall be published by the ICC after completion of the verification of exchange programs and not later than 16:00 Hrs CMT on Day (D-1). The information is given to all interconnected Control Areas.

2.3.5. Procedures for Day (D-1 preparation)

In case of intra-day changes of exchange programs, the control area operators have to agree with the neighbouring control area operators on the bilateral exchanges per border for every time unit and not later than 1 hour before setting the new program into force.

2.4. REAL TIME MONITORING

2.4.1. Introduction

The task of real time monitoring is performed during the system operation phase. In order to prevent disturbances related to load frequency control, in the system it is essential to check the WAPP-wide consistency of the input variables for real time operation used by the various parties involved.

This comprises:

- Exchange programs among all control areas,
- Cross-border power flows in real-time,
- Power deviation and frequency deviation used as an input value for load frequency control.

2.4.2. Criteria

Control programs. The sum of control programs of all control areas must be equal to zero at any time.

Power exchange: The sum of the measurements of the power exchanges of all control areas must be equal to zero at any time

Power deviation The sum of power deviations of all control areas must be equal to zero at any time.

2.4.3. Procedures

Measurement problems

The operator of the relevant control area has to inform the neighbouring control area(s) operators and the ICC of any measurement problems with regard to the cross border exchanges with other neighbouring control areas.

Detection of abnormal operation

In case the sum of the control programs or the sum of active flows of neighbouring control areas is not equal to zero, the Information and Coordination Centre (ICC) shall immediately inform the corresponding operators of the control areas.

2.4.4. Requirements

Accuracy of power measurements: The accuracy of active power measurement on the line under consideration is determined by the accuracy of the measurement chain. The sampling rate of measurements must not exceed 2 seconds.

Transmission of measurements: The measurements of the tie-line power flows across the border of a control area must be transmitted in a reliable manner to the Control Area Operator and to the Information and Coordination Centre (ICC) (with an alarm in case of deficiency in data transmission). The transmission delay must be shorter than 2 seconds.

2.5. ACCOUNTING FOR INADVERTENT DEVIATIONS

2.5.1. Introduction

The task of accounting for inadvertent deviations is performed on the day following the system operation. It comprises the settlement of the account of inadvertent deviations of each control area with reference to a recording period. The compensation of inadvertent 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.

Accounting is an important issue to check the WAPP-wide consistency of the input variable "compensation program" used by the various parties involved in order to prevent system disturbance related to load frequency control.

2.5.2. Criteria

Inadvertent deviation: Calculation per tariff period of inadvertent deviations of a control area for accounting purposes in MWh shall be as follows:

Inadvertent Deviation = (Sum of the metered tie-line flows) - (Control Program)

The sum of all inadvertent deviations of WAPP synchronous area must be equal to zero.

Compensation of inadvertent deviation: The sum of all compensation programs for each time unit of the WAPP synchronous area must be equal to zero.

2.5.3. Procedures

2.5.3.1. Accounting office

Accounting offices shall be available on business days from 08:00Hrs to 16:00Hrs GMT.

2.5.3.2. Settlement per day (D+1 for D)

Accounting point: One side of a tie-line is defined as "accounting point" and will be used as basis for accounting for both adjacent control areas.

The parties at a common border have to agree on a common accounting point. Usually it is located within the substation close to the border between two parties.

Adjacent control area operators have to validate the metering data by 14:00Hrs.

Settlement: Information and Coordination Centre (ICC) shall calculate the single control area account of inadvertent deviations for every tariff period per day (D-1, 00:00Hrs GMT - 24:00Hrs GMT) and submit the result to the concerned control area operator. The data has to be certified by the control area operator.

The control area validation and the control area settlement have to be completed as soon as possible, but not later than16:00Hrs the following business day.

2.5.3.3. Final settlement of a recording period

Information and Coordination Centre (ICC) shall calculate the individual control area final account of inadvertent deviations for every tariff period for the recording period as well as the resulting compensation programs, and submit the result to the control area operator. This shall be completed by 16:00Hrs, at the latest, two business days before the next compensation period.

Settlement closure: The inadvertent deviations for every tariff period for the recording period must be certified by the control area operators. The final validation has to be completed by 16:00Hrs, at the latest, one business day before the compensation period.

Transparency: Inadvertent deviations per tariff period for the recording period and compensation programs for the compensation period must be communicated to all control areas by 16:00Hrs, at the latest, one business day before the compensation period.

2.5.3.4. Recording period and compensation periods

Recording period

The standard recording period is defined to comprise 7 days (one week), from Monday 0:00Hrs to Sunday 24:00Hrs.

Compensation period

The standard compensation period is defined to comprise 7 days (one week), from Thursday 0:00Hrs to Wednesday 24:00Hrs. In case of holidays or for other reasons, exceptions to this rule may apply (Information and Coordination Centre (ICC) shall define a new compensation period). In any case a compensation period shall last at least 4 days and a compensation period has to start always with a delay of three business days after the end of the corresponding recording period.

2.5.3.5. Substitute meter values.

In case of failure of the main meter at the accounting point between Control Areas the following procedure is recommended:

- If available, use the check meter values from the accounting point,
- If available, use the main meter values from the other end of the tie-line,
- If available, use the check meter values from the other end of the tie-line,
- Otherwise, the partners involved agree on the methodology to determine substitute values.

2.5.4. The tariff period

The tariff period is the time interval fixed by the Engineering and Operation Committee during which inadvertent deviations are given the same value for offsetting by compensation in kind. The tariff periods shall distinguish between the dry season and rainy season.

Monday to –	DSTP1	18:00-21:00	Sat Sunday and	DSTP1	18:00-21:00
Friday		GMT	holidays		
	DSTP2	04:00-07:00		DSTP2	
	DSTP3	00:00-04:00		DSTP3	00:00-18:00
		07:00-18:00			07:00-18:00
		21:00-24:00			21:00-24:00

Dry season (1.October.-30. April) GMT time

Rainy season1May.-30 September)

Monday to –	RSTP1	18:00-21:00	Sat Sunday and	RSTP1	18:00-21:00
Friday -			holidays		
	RSTP2	04:00-07:00		RSTP2	
	RSTP3	00:00-04:00		RSTP3	00:00-18:00
		07:00-18:00			07:00-18:00
		21:00-24:00			21:00-24:00

DSTP: Dry Season Tariff Period RSTP: Rainy Season Tariff Period

2.5.5. Requirements

Metering at delivery point: The meters shall incorporate a facility to compensate the readings for line losses according to the delivery point determined at the border between control areas(or other acceptable means to evaluate the losses).. These correction factors shall be determined by meter technicians.

Tie-line metering: All Tie-Lines from a Control Area to Adjacent Control Areas must have meters in operation to record the actual active energy in MWh (and reactive energy in MVArh) both for import and export. As much as possible, Meters shall be of same make and type at both ends of the line.

All tie-line's MWh/MVarh measurements shall be telemetered to both Control Centers at both ends of the tie-line under consideration and also to the Information and Coordination Centre (ICC).

Instrument transformers: Voltage and current transformers installed at each accounting point shall have an accuracy class rating of 0.2. Current transformers shall have 2 cores for measurement purposes.

Energy metering: On the basis of the current and voltage values measured by the transformers, the energy meters determine the active energy flow in both directions related to a given time frame. The main and check energy meters at the accounting points shall have an accuracy class rating of 0.2S.

Redundancy Accounting points shall be equipped with main and check meters at each tie-line. Main and check meters shall be connected each to a separate core of the current transformer.

Voltage transformer cables: To ensure the accuracy of the metering system, voltage transformer cables shall be selected in such a way that a voltage drop is reduced to 0.1% or less of the nominal voltage.

POLICY 3 OPERATIONAL SECURITY

3.	P3-	OPE	ERATIONAL SECURITY	3
ć	3.1.	INT	RODUCTION	3
	3 2	N-1	CRITERION	z
•	3.2. 3.2	1	Introduction	с 2
	3.2	. i. つ	Definition of "N-1" Criterion	л Л
	2.2	. <u>∠</u> . 2	Deminition of N-1 Chilehon	4 5
	ວ.∠. ວາ	.S. 1	Standarda	5
	0.Z. 0.0	.4. 5	Data Evoluarias	0 6
	J.Z.	.э.	Data Exchanges	D
	3.3.	INT	ERCHANGE SCHEDULING	6
4	3.4.	PO	WER SYSTEM OPERATION	6
	3.4.	.1.	Basic principles	6
	3.4.	.2.	Requirements	7
4	3.5.	RE	LAY COORDINATION	7
	3.5.	.1.	Basic principle	7
	3.5.	.2.	Requirements	8
	3.6.	VO	LTAGE CONTROL	8
	3.6.	.1.	Basic principle	8
	3.6.	.2.	Requirements for the control area	8
	3.6.	.3.	Requirements at the borders	9

3. P3- OPERATIONAL SECURITY

3.1. INTRODUCTION

The Control Area Operator is responsible for preparing and executing procedures for reliable operation in real time and for future conditions, under normal, contingency and emergency operations. Co-ordination between systems enhances the conditions for mutual assistance (to cope with risks) created by interconnected network operations and prevents or reduces the consequences of disturbances, as well as facilitating restoration strategies after a system collapse.

It is necessary to ensure that a high reliability of the electricity system is maintained within the entire WAPP synchronous area at all times.

To achieve this, close cooperation has to be developed particularly in the following areas:

- operational planning and in real time operation,
- general supervision of the power system,
- maintenance coordination,
- system protection co-ordination,
- power system stability,
- voltage and reactive power control,
- Exchange of information between the Control Area Operators.

This policy P3 specifies the requirements and standards for operational security as it relates to the following issues:

- N-1 criterion
- Interchange scheduling
- Power system operation
- Relay coordination
- Voltage control

3.2. N-1 CRITERION

3.2.1. Introduction

The N-1 security criterion refers to the requirements placed upon the operation of the power system of the synchronous area with a view to maintaining the security of the entire interconnected network at any time during the operational planning phase and in real-time. Secure operation of the interconnected network will make it possible to attain good quality service such that in the majority of cases, the outage of a generating unit or transmission element will have no negative impact on the supply to customers. Adherence to the "N-1 criterion" is of major importance to prevent disturbances.

This criterion shall be applied by all Control areas in combination with appropriate choice of generation, transmission facilities and sufficient reserves. With effective operational planning, insecure situations can be identified in advance, and necessary preventive action taken.

The following contingencies can occur:

- loss of any interconnecting element without any impact on network users;
- loss of any interconnecting element with immediate consequences on network users;
- loss of any interconnecting element with consequences on power exchanges;
- loss of interconnected operation.

3.2.2. Definition of "N-1" Criterion

Any probable single event leading to a loss of any power system element shall not endanger the security of interconnected operation, i.e., trigger cascaded trips or the loss of a significant amount of load. The remaining network elements, which are still in operation shall be able to withstand the additional load or change of generation, voltage deviation or transient instability regime caused by the initial failure.

It is acceptable in some cases for Control areas to allow for loss of load on condition that its magnitude is compatible with secure operation and is predictable and locally limited.

Single event

The loss of any power system element (generating unit, transmission circuit, transformer, reactive compensation device etc.) must not jeopardise the security of operation of interconnected networks as a result of limits being reached or exceeded for current, voltage, stability, etc., and accordingly shall not cause cascaded trippings with interruptions in supply. These events must be avoided in the system supervised by the Control Area Operator and also in adjacent systems. Particular attention is required for tie-lines or in the vicinity of borders.

Hence the following shall be observed:

- The loss of a single element in the power system must not cause a frequency deviation outside acceptable limits as specified in Policy 1 section 1.3.1
- The loss of a single element in the power system must not cause a voltage drop which may lead to voltage instability;
- The loss of a single element in the power system must not cause instability in the interconnected system;
- The loss of a single element in the power system must not cause cascading outages of other elements as a result of exceeding operational security limits.

Note 1: However, the loss of any element could affect areas connected by a radial line (and the output of their local power plants) and as such these areas are excluded from this rule.

<u>Note 2</u>: The N-1 criterion may be assured in a system with the support of an adjacent system, subject to the prior agreement between the two systems.

3.2.3. Requirements

Monitoring of the N-1 criterion

Control Area Operators shall monitor at any time the N-1 criterion within their own system through observation of the interconnected system (their own system and some defined parts of adjacent systems) and carry out security computations for contingency analysis.

After a contingency, each Control Area Operator shall return its power system to N-1 compliant condition as soon as possible and in case of a possible delay, it will immediately inform the ICC and all other Control Area Operators affected.

Most probable contingencies

Control Area Operators shall define the set of most probable contingencies in operational planning and in real-time conditions and implement measures to comply with the N-1 criterion. Each Control Area Operator is directly responsible for enforcing the N-1 criterion by taking account of the loss of one or multiple network elements (N-k criterion) when such contingencies can occur with sufficiently high probability to threaten the security of operation: e.g. N-2 lines for some double-circuit lines when appropriate. The specific case of loss of a bus-bar is considered by taking into account an acceptable level of loss of load which is predictable and locally limited (due to the extremely low probability of fault).

The contingency screening process covers the loss of single or multiple elements of generation or transmission equipment at any time. This screening also takes account of temporary weather conditions or weakness of a single network equipment.

3.2.4. Standards

Application of the N-1 security criterion.

It is the responsibility of each Control Area Operator to apply the N-1 Criterion to its network and inform adjacent Control Area Operators about potential problems in the application of this criterion. The Control Area Operators concerned shall jointly verify the compliance with the N-1 criterion taking into consideration cross-border power transfers. The tripping of tielines at other borders shall also be considered when appropriate.

Tripping of interconnected lines.

In order to maintain the support derived from interconnections as long as possible, deliberate tripping of tie-lines shall be avoided as long as interconnected operation remains possible, unless otherwise defined and agreed upon between neighbouring Control Area Operators.

Overload indicators.

All tie-lines, major transmission lines and power transformers shall be equipped with devices which enable overloads to be detected and information transmitted to Control Centres, in order to alert Control Area Operators of an impending risk of violating the N-1 criterion.

3.2.5. Data Exchanges.

Control Area Operators shall exchange all information and data related to network topology, active and reactive flows, sums of exchange programs and to some extent the pattern of generation, as required for calculations of network security (only when the data is relevant for interconnected operation). These data will be used to perform real-time and forecast calculations for network security and also for congestion forecast for weeks and day ahead.

Online and offline calculations for network security.

This involves the representation of the actual network in each Control Area and in the adjacent systems. To this end, measurements and status of switching devices shall be transmitted to Control Centres in order to allow effective observation of these circuits. Adjacent control areas will be limited to the first loop linking the system nodes closed to the border. Equivalent representation is deemed sufficient for remote control areas. This method allows members to apply their algorithms for the real-time assessment of security of the cross-border network which takes into account the actual situation in real time.

Each Power system and Control area shall provide transmission network models and data of their systems. These data sets shall represent the existing networks and the detail in which the various system components are modelled shall be adequate for all reliability assessments. This means that system modelling data shall include sufficient details to ensure that system required analyses can be performed.

3.3. INTERCHANGE SCHEDULING

The net amount of interchange scheduled between Control Areas shall not exceed the mutually agreed transfer limits of the interconnections.

The entire network, including tie-lines, shall be operated in such a way that sufficient transmission capacity is available for the delivery of reserve power for primary control for the areas which may be affected by the most severe single contingency (refer to TRM).

3.4. POWER SYSTEM OPERATION

3.4.1. Basic principles

An effective system coordination and supervision is desirable for a reliable operation of the interconnected power system. The basic reliability principle is that all Control Area Operators shall operate so that instability, uncontrolled separation, or cascading outages will not occur as a result of the most severe single contingency (N-1 Criterion).

Therefore under all operating conditions, any probable single event leading to loss of system elements (generating unit, compensation facility, transformer or any transmission circuit) shall not endanger the security of the interconnected power system.

3.4.2. Requirements

It is the duty of each Control Area Operator to monitor the status of the power system. This means the Control Area Operator in each control centre shall receive with sufficient time sampling the following information:

- system frequency;
- transmission line status ;
- active and reactive power flow ;
- generating unit status;
- active and reactive power from generating unit;
- voltage levels in the nodes;
- status of spinning and static reactive power resources;
- spinning and static reactive power values;
- Appropriate information about the operation of the protection system.

Each Control Area Operator shall determine with other neighbouring Control Area Operators the suitable set of real time data to be exchanged on-line.

In addition, each Control Area Operator shall:

- evaluate the power system security status (i.e. evaluating the effect of the loss of any significant transmission or generation facility, "N-k criterion");
- carry out short term demand forecast (day ahead)
- evaluate the reserves ;
- carry out post mortem analysis with the aid of recorded data.

3.5. RELAY COORDINATION

3.5.1. Basic principle

Each Power System shall implement a protection system, operation and preventive maintenance procedures, which will enhance the system reliability with the least adverse effect on the interconnection.

Power system protection procedures shall be made available to all appropriate system personnel and shall provide for instructions and training where applicable.

The procedures shall cover the following:

- Planning and application of protection systems
- Review of protection systems and settings
- Operations under normal, abnormal and emergency conditions
- Regular scheduled testing and preventive maintenance
- Analysis of the actual protection system operation.

3.5.2. Requirements

Since protection systems in one power system can affect operations in neighbouring systems, all protection systems in the interconnected system shall be co-ordinated. Each power system shall supervise the status of its protection system and notify all relevant neighbouring parties of every change in status.

Each protection device shall be recalibrated at least once in a year. A review of the protection settings may also be carried out when required. Any improper operation of a protection device shall be investigated immediately and rectified as soon as possible.

Notification of changes

Neighbouring systems shall be notified in advance of changes in generating sources, transmission, load or operating conditions, which may require changes in their protection systems.

3.6. VOLTAGE CONTROL

3.6.1. Basic principle

Reactive power flows on tie-lines shall be maintained at a minimum level in order to limit voltage drops and to allocate the total transfer capacity mainly to active power. In order to ensure a safe operation of the synchronous area, the voltage levels at boundaries need to be optimised. The voltage difference between the two ends of the tie-line shall be maintained at a minimum as much as possible. In the event that the reactive power cannot be produced or absorbed in a control area, specific bilateral agreements shall be made to transfer reactive power through tie-lines.

3.6.2. Requirements for the control area

Each Control Area Operator shall operate its reactive resources to maintain system voltages within established limits under N-1 conditions.

Reactive generation scheduling, transmission line and reactive resource switching etc., and load shedding, if necessary, shall be implemented to maintain appropriate voltage levels. Reactive power resources shall be dispersed and located so that they can be applied effectively and quickly when contingencies occur.

Each Control Area Operator shall take corrective actions, including load reduction and load shedding if necessary to prevent voltage collapse when reactive resources are insufficient.

Each Control Area Operator shall have at its disposal, information on all available generation and transmission reactive power resources (including the status of voltage regulators, tap changers as well as power system stabilisers).

The voltages on the 330kV, 225kV, 161kV and 132kV parts of the Transmission System close to the border shall normally remain within $\pm 5\%$ of nominal value. The minimum voltage is -10% and the maximum voltage is +10% but voltages between +5% and +10% will not last longer than 15 minutes unless abnormal conditions prevail.

Nominal	Normal	Min Voltage	Max Voltage
voitage	Operation	-10%	+10%
330 kV	±5% (315–360)	300	360
225 kV	±5% (214-236)	200	245
161 kV	±5% (153-169)	145	175
132 KV	±5% (126-138)	120	145

3.6.3. Requirements at the borders

Reactive power flows on tie-lines shall be maintained at a minimum level and if possible not beyond the natural demand of the tie-line in order to limit voltage drops and to allocate the total transfer capacity mainly to active power. In operational phase and in real time operation, Control Area Operators shall communicate in order to harmonise the voltage level.

POLICY 4 OPERATIONAL PLANNING

4. P4 COORDINATED OPERATIONAL PLANNING	3
4.1. SYSTEM RELIABILITY ASSESSMENT	 3 3
4.1.2. Power System adequacy	4
4.1.2.1. Principle	4
4.1.2.3. WAPP Generation Adequacy	5
4.2. RECOMMENDATION FOR WAPP SYSTEM MODELLING	5
4.3. COORDINATION OF MAINTENANCE SCHEDULING	. . 6 6
4.3.2. Requirements	6

4. P4 COORDINATED OPERATIONAL PLANNING

4.1. SYSTEM RELIABILITY ASSESSMENT

4.1.1. System reliability report

The assessment of power system reliability involves evaluating the ability of the power system to supply power and energy demand at all delivery points at any time within acceptable standards. Power system reliability (generation and transmission facilities) can be defined by two basic and functional attributes: adequacy and security.

<u>Adequacy</u>

Adequacy is a measure of the capacity of a power system to supply the aggregate electric power and energy demand of customers at component ratings and voltage limits, taking into account planned and unforeseen outages of system components.

Adequacy issues involve:

- Monitoring the existing and forecast system status, especially the adequacy between demand forecast, generation investment and transmission projects, while maintaining sufficient reserve margins;
- Identifying new system constraints, and new generation needs or transmission capacities.

<u>Security</u>

Security is a measure of the ability of a power system to withstand sudden disturbances such as electric short circuits or unforeseen loss of system components.

Every year, each interconnected power system shall establish a System Reliability Report. Retrospective reports related to years Y-1 and Y-2 will be published in year Y. Forecast reports published in year Y shall cover three levels of forecasts:

- Short term forecast: years Y+1,Y+2 and Y+3
- Medium term forecast: year Y+5
- Long term forecast: year Y+10

The System Reliability Report has to ensure that the least cost development of the transmission system is able to cope with future demands and maintains the quality of supply which is in compliance with WAPP reliability standards. This report details the demand forecast, the assessment of generation adequacy, the assessment of transmission system adequacy and the need for interconnection with other power systems. New transmission network elements and network enhancements shall be listed in this report.

This report has to be provided to ICC.

4.1.2. Power System adequacy

4.1.2.1. Principle

The adequacy of WAPP interconnected power system has to be assessed taking into account both the generation and transmission aspects.

Assessment of the generation adequacy involves evaluating the ability of the generating units to match system demand growth by a comparison between the demand and the total generating capacity which is considered as "guaranteed" (further developed in subsection 4.1.2.2Generaton Adequacy").

Assessment of the transmission system adequacy involves evaluating whether the transmission system is sufficiently sized to accommodate the potential imports and exports resulting from the various power system balances, thereby improving the reliability of the WAPP interconnected power system (further developed in subsection 4.1.2.3 WAPP Transmission system adequacy").

4.1.2.2. WAPP Generation Adequacy

<u>General Organization</u>: Every year, each interconnected Power System has to establish a Power Balance Forecast that has to be included in its System Reliability Report. The power balance forecast should examine the next ten (10) years for the typical rainy (May to September) and dry (October to April) seasons. To help to clearly illustrate the changes over the years, the past year is described with historical values and the current year with updated forecast values.

<u>WAPP synchronous reference points</u>: The demand corresponds to a common synchronous reference for the entire WAPP network; the selected reference points); are the first Thursday of April and the first Thursday of August at 21:00. GMT (between 20 and 21) (to be completed next meeting); the demand forecast is based on assumed normal climatic conditions.

Generation Balance: Each Interconnected Power System shall determine its "Remaining Capacity", Remaining capacity is the difference between the "Reliable available capacity" and the demand. It represents the reserves available for power plant operators at the reference time. For adequacy forecast, these reserves can be used to cover load above forecast demand or plant unplanned outages greater than expected. The remaining capacity can be positive (capacity surplus or export potential) or negative (lack of capacity or need for imports).

Each Interconnected Power System has to assess its generation adequacy with the method determined by the Engineering and Operating Committee (EOC) of the WAPP.

The ICC has to assess generation adequacy for the WAPP interconnected power system. The peak demand of the WAPP interconnected power system is estimated by the sum of the synchronous demands of the WAPP interconnected Power Systems.

<u>Confidentiality</u>: The ICC and every interconnected Power System are obliged to ensure that the information relating to all transactions is confidential. Therefore, they can only use aggregate data to establish the power balance forecasts.

4.1.2.3. WAPP transmission system adequacy

Principle: Transmission adequacy assessment consists in comparing the Remaining Capacity with the Net Transfer Capacity at the borders (the power that can be safely transmitted across the borders) of each WAPP interconnected Power System.

Level of analysis: At the WAPP level, the transmission system adequacy analysis focuses on the interconnections and on the internal lines, which have a direct effect on the international exchanges.

Duties of the ICC: The ICC has to establish various scenarios for interchanges and power injections according to the regional market. In addition, sensitivity analysis should be performed taking into account hydrological situations, fuel price fluctuations... etc.

The ICC has to assess the WAPP transmission system adequacy for the whole WAPP area in order to evaluate the need for an expansion program.

Transmission capacity for the interconnections: Under normal conditions, no restrictions of the transmission capacity should occur on the network. Any ancillary equipment associated with a transmission line (current transformers, disconnectors, power circuit breakers, reactors, current and voltage measurement devices) particularly for the interconnection lines, should be designed to match the maximum transmission capacity. Interconnected power systems shall agree between them on a common transmission capacity limit for each border.

4.2. RECOMMENDATION FOR WAPP SYSTEM MODELLING

Principle: System analysis, including steady-state and dynamic simulations of the WAPP interconnected power system, is required to assess the reliability of the interconnected power systems, to meet demand forecast, and determine the need for system enhancements or reinforcements. To achieve this, ICC should establish a set of common objectives for the development and submission of necessary data for WAPP system modelling.

Objective: Network simulation of the WAPP interconnected power system should determine whether at the forecast demand levels, line and equipment loadings are within thermal ratings, voltages are within limits, and the power system is stable.

WAPP System data: WAPP system modelling data should include sufficient detail to ensure that system contingency, steady-state, and dynamic analyses can be simulated.

Duty of the ICC: ICC in conjunction with all the interconnected Power Systems should identify the scope and specify the data required for reliability analyses and the procedures for data reporting. These requirements and procedures should be periodically reviewed, documented and published for all WAPP interconnected Power Systems (at least every five (5) years).

Duty of the WAPP interconnected Power Systems: Every WAPP interconnected Power System should provide accurate and appropriate equipment characteristics and power system data for modelling and simulation purposes.

Importance of the generation equipment: Synchronous generating units are the primary means of voltage and frequency control in the WAPP interconnected power system. The correct operation of generating units control can be the crucial factor in determining whether the power systems can sustain a severe disturbance without a cascading failure in the interconnected power system. Generating units dynamic data are used to evaluate the stability of the power systems, analyse current system disturbances, identify potential stability problems and analytically validate or provide solutions for the identified problems.

Data format: Engineering and Operation Committee shall define the data format to be used

4.3. COORDINATION OF MAINTENANCE SCHEDULING

4.3.1. Principle

WAPP interconnected Power Systems shall mutually agree on the most suitable schedule for maintenance work on tie-lines, generating units and facilities having a substantial impact on the interconnected power system.

Scheduled outages will enable WAPP interconnected Power Systems to carry out maintenance work on their facilities at regular intervals with a view to ensuring reliability. Unavailability of one (1) tie-line may have immediate consequences on Net Transfer Capacity.

4.3.2. Requirements

The provision of a uniform set of data of the transmission systems and forecasts for the scheduled power exchange allows each WAPP interconnected Power System to perform individual studies (medium and short term) for the simulation of e.g.

- the effects of power plant outage on power flows, both on national and interconnected networks;
- load flow transfers associated with the outage of lines or other elements of a power system, taking into consideration the influence of other networks.

WAPP interconnected Power Systems shall exchange information for the maintenance planning coordination, for medium and short term:

- Medium term planning for year Y: WAPP neighbouring interconnected Power Systems shall meet at least twice a year to agree on a joint schedule of outages on the international lines for which they are responsible, or the transmission elements that may affect the reliability of the interconnected operation. The first meeting shall be in the middle of the year Y-1 and the second at the end of the year Y-1. This schedule will take into account overhaul programs for major generating facilities in the vicinity of borders, and all other maintenance related matters.
- Short term planning: If necessary, this schedule has to be reviewed in the current year and any amendment communicated in writing to all WAPP interconnected Power Systems concerned.

When maintenance schedules are defined and agreed upon between WAPP interconnected Power Systems, each WAPP interconnected Power System shall confirm weekly (and daily when relevant in case of changes) the outages of important power plants (where necessary) and transmission lines to affected neighbouring WAPP interconnected Power Systems.

Planned outage of generating units (plant) : Scheduled generating unit outages that may affect the reliability of interconnected power systems shall be planned and coordinated among the WAPP interconnected Power Systems of affected Control Areas:

- The outage of a power unit must not jeopardise the security of operation of the interconnected network. Particular attention is required for power plants of large size and those in the vicinity of borders between different WAPP interconnected Power Systems,
- The WAPP interconnected Power Systems shall agree with power plant operators on the maintenance schedule of generation units. The WAPP interconnected Power Systems shall co-ordinate this maintenance activity with the planned outages in the transmission network, and agree with the power station operator on binding dates in this respect. Changes are only possible by mutual consent.

Each WAPP interconnected Power System has to collect relevant information on scheduled outages of power plants and transmit it to neighbouring WAPP interconnected Power Systems.

Routine maintenance of telemetering, control equipment and associated communication channels shall also be coordinated between the WAPP interconnected Power Systems.

POLICY 5 EMERGENCY PROCEDURES

5. P5 EM		3
5.1. OP	PERATIONS UNDER NORMAL AND ABNORMAL CONDITIONS	3
5.1.1.	Operation under normal conditions	3
5.1.2.	Operation under abnormal conditions	3
5.2. LIN	/ITATION OF LARGE-SCALE FAILURES	3
5.2.1.	Notifying neighbouring system and ICC	3
5.2.2.	Balancing generation	4
5.2.3.	Load shedding plan	4
5.2.4.	Coordination	4
5.3. RE	STORATION MEASURES AFTER A NETWORK COLLAPSE	5
5.3.1.	Principle	5
5.3.2.	Requirements	5
5.4. BA	CK-UP CONTROL CENTRE	5

P5 EMERGENCY PROCEDURES

5.1. OPERATIONS UNDER NORMAL AND ABNORMAL CONDITIONS

5.1.1. Operation under normal conditions

Normal Operation condition is a steady state whereby all limit values are strictly observed or adhered to, all customers have secure supply and the N-1 Criterion is met in the whole power system,

Under normal conditions all limit values are adhered to e.g.

- Adherence to the maximum and minimum permissible voltages, maximum currents on the network equipment, and agreed system short-circuit levels on the individual network nodes.
- Operation of the network with a voltage profile which is as balanced as possible and generally high, and consequently results in reduction of transmission losses and improvement in system stability.

5.1.2. Operation under abnormal conditions

All conditions deviating from normal operation shall be deemed to be abnormal conditions. The system operator of the affected system shall be obliged and therefore authorized to take all necessary measures to prevent any disturbance from spreading, and/or to ensure efficient restoration of supply. These measures shall take priority over the individual interests of the system users.

Operation under abnormal conditions has the following characteristics:

- All customers may be supplied;
- Limit values are no longer observed;
- The (n-1) criterion is no longer met.

5.2. LIMITATION OF LARGE-SCALE FAILURES

5.2.1. Notifying neighbouring system and ICC

A system which is experiencing or anticipating operation under abnormal conditions shall communicate its current and expected status to other neighbouring system operators and notify the ICC. Other Power Systems capable of providing assistance shall declare their capabilities.

As soon as a system anticipates that it could face operation under abnormal conditions, power station, distribution and transmission operators shall be informed so that they can respond quickly and appropriately to the situation.

In case of an emergency, the main task for all systems is to maintain the synchronous operation of the WAPP Interconnected Power System. The system operator in whose system the emergency occurs shall immediately take all possible measures to restore normal operating conditions.

5.2.2. Balancing generation

A system having a shortage of generation shall promptly balance its generation and interchange schedules to its demand without regard to financial implications. The emergency reserve provided in a frequency deviation is intended to be used only as a temporary source of emergency energy and is to be promptly restored so that the interconnected system can again withstand the next contingency. A system unable to balance its generation and interchange schedules to its load shall shed sufficient load to restore the frequency and interchanges to the scheduled values.

5.2.3. Load shedding plan

The amount of load to be shed at each stage shall be defined by the Engineering and Operation Committee. However, a tentative load shedding plan is as presented below:

- 49.8 Hz: Alert to the personnel, activation of generation capacities at short notice (including that which is not available under primary and/r secondary control, shall be activated and generating units with fast-start capability connected to the network).
- 49.5 Hz: First stage Instantaneous load shedding(10% of the system load)
- 49.2 Hz: Second stage Instantaneous load shedding (20% of the system load)
- 49.0Hz: Disconnection of tie-line(s).

All Units shall remain connected to the system between 48.5 Hz and 51 Hz.

Max power flow relays will be located at the borders and set points shall be determined by network studies.

- From PHCN to CEB
- From CEB to VRA
- From VRA to CIE
- From CIE to SONABEL
- From PHCN to NIGELEC
- From CEB- to PHCN
- From VRA to CEB
- From CIE to VRA
- From SONABEL to CIE

5.2.4. Coordination

Measures relating to frequency control and voltage control have to be coordinated by the ICC.

5.3. RESTORATION MEASURES AFTER A NETWORK COLLAPSE

5.3.1. Principle

Restoration to normal operation after a system-wide collapse shall be realised as fast as possible based on developed and verified plans, which shall be agreed among the Parties of the WAPP.

5.3.2. Requirements

Each Party shall develop and periodically update a plan to restore its power system to normal conditions in an orderly manner in the event of a partial or total shutdown of the system. This plan shall be co-ordinated with other Parties to ensure effective restoration of the WAPP system. Such plans shall include first of all the restoration of supply to power plant auxiliaries from generating sources with black-start capability. Different non-synchronous parts of the WAPP interconnected power system shall be synchronised after restoration of frequency and voltage levels in each part in accordance with allowed difference on frequency and voltage magnitudes and voltage angles. The restoration of the WAPP interconnected power system shall be coordinated by the ICC or its delegated authority.

System restoration procedures shall be verified by simulation and/ or actual testing of power station where practicable. Telecommunication facilities used to implement the plan shall be periodically tested. Operating personnel shall be trained in the implementation of the plan. Such training should include simulated exercises, if practicable.

Telecommunication systems and remote control systems must remain in operational condition, in order to allow the complete restoration of the network.

5.4. BACK-UP CONTROL CENTRE

Each Control Area shall have a plan to continue operation of its System in the event that its main control centre becomes inoperable. This shall include having a back-up control centre.

POLICY 6

COMMUNICATION INFRASTRUCTURE

6. P6-CO	MMUNICATION INFRASTRUCTURE	3
6.1. TE	ELECOMMUNICATION FACILITIES	3
6.1.1.	Criteria	3
6.1.2.	Requirements	3
6.1.3.	Standards	4
60 V/		Α
0.2. V		4
6.2.1.	Language standard	4
6.2.2.	Voice recorder	4
6.3. C	OMMUNICATION OPERATIONAL PROCEDURES	4
6.3.1.	Criteria	4
6.3.2.	Requirements	5
64 10		5
6/1		5 ۲
0.4.1.		
0.4.Z.	Requirements	5

6. P6-COMMUNICATION INFRASTRUCTURE

6.1. TELECOMMUNICATION FACILITIES

6.1.1. Criteria

Each Power System and Control Area shall be equipped with adequate and reliable telecommunication facilities internally and with other Power Systems and Control Areas to ensure the exchange of information necessary to maintain the reliability of the Interconnected power system. Redundant facilities using alternate routes and medium shall be provided.

6.1.2. Requirements

Telecommunication System

Reliable and secure telecommunication networks shall be provided within and between Power Systems and Control Areas.

Dedicated telecommunication channels shall be provided between a Control Centre and the Control Centre of each adjacent System. All dedicated telecommunication channels should not require intermediate switching to establish communication.

Alternate and physically independent telecommunication channels should be provided for emergency use to back up the circuits used for critical data and voice communications.

Telecommunication availability

Its calculation is based on the MTBF/ (MTBF+MTTR) of each component between two gateways including also the backup links, and it is recommended that the availability be higher than 99.8%.

Restoration services on critical telecommunications channels should be available twenty-four (24) hours per day, every day of the year. Each Control Centre operator should be able to take control of any telecommunication channel for its own use when necessary.

Reliability of Telecommunications Facilities.

Vital telecommunications facilities shall be managed, tested and actively monitored (audio alarms, annunciations, etc). Special attention shall be given to emergency telecommunications facilities and equipment not used for routine communications.

Telecommunication performance

Under normal conditions, the transmission delay, for a given data volume of mutually agreed real-time data exchange, between gateways should not exceed 2 seconds. The system has to have sufficient bandwidth for a given data volume to meet the required performance. A speed of at least 2 Mbps is recommended for all the interconnected lines. A lower speed than 2 Mbps should only be used as an interim

Global Positioning System (GPS)

All SCADA systems shall be synchronised to the GPS for accurate time keeping.

6.1.3. Standards

Telecommunication Network

- The Wide Area Network (WAN) shall be based on TCP/IP protocol.
- Communication between Control Centres shall be harmonised and based on ICCP protocol.
- Tele-control real-time information shall be based on IEC standards;
- Non real-time services such as file transfer for exchange of transmission schedules, network model, planning data or statistics shall be based on the protocol FTP;
- E-mail for special applications shall be based on SMTP.

6.2. VOICE COMMUNICATION

6.2.1. Language standard

Unless otherwise agreed upon, English and French shall be the official language for all communications between and among System Operators and System Personnel responsible for the real-time generation control and operation of the interconnected Electric System. Operations internal to the Operating Authority may use an alternate language.

6.2.2. Voice recorder

A recording system shall ensure permanent recording of all phone conversations from ICC and Control Centres , and shall be located in the Control Centre and in the ICC.

Archival

The recording system shall be able to play back directly up to one month telephone conversation. Archival storage shall be done on CDs or DVDs or any appropriate medium. Archives shall be stored for at least one year.

Access to recorded communication

In case one party or ICC requires copies, records shall be made available.

6.3. COMMUNICATION OPERATIONAL PROCEDURES

6.3.1. Criteria

Procedures for Control Centre to Control Centre communications, shall be established by Power System and Control Area operators to ensure that communication between operating personnel are consistent, efficient, and effective during normal and emergency conditions.

6.3.2. Requirements

Each Control Area shall co-ordinate telecommunications between the Power Systems in the Control Area. This shall include investigating and recommending solutions to telecommunication problems within the Control Area and with other Control Areas.

Telemetering, control, and communications

Scheduled outages of telemetering and control equipment and associated communication channels shall be coordinated between the affected areas.

6.4. LOSS OF TELECOMMUNICATION

6.4.1. Criteria

Operating instructions and procedures shall be established by each Control Area to enable operations to continue during the loss of telecommunication facilities.

6.4.2. Requirements

Each Control Area shall have operating instructions and procedures to enable continued operations during the loss of telecommunication facilities.
POLICY 7

INFORMATION EXCHANGE BETWEEN SYSTEMS

7. P7 INFOR	MATION EXCHANGE BETWEEN SYSTEMS	3
7.1. INTRO	ODUCTION	3
7.2. Confi	dentiality	3
7.2.1. C	Confidential information	3
7.2.2. T	reatment of confidentiality	3
7.3. Techi	nical Specifications	4
7.3.1. K		4
7.3.1.1. 7.3.1.2.	Fax	4 4
7.3.1.3.	E-mail on internet	4
7.3.2. S	Standards	4
7.3.2.1.	Voice transmission standards	4
7.3.2.2.	Fax transmission standard	4
7.3.2.3.	Video-conferencing transmission standard.	4

7. P7 INFORMATION EXCHANGE BETWEEN SYSTEMS

7.1. INTRODUCTION

In the WAPP network, data from the transmission grid are required for various operational tasks and system studies. These data primarily belong to the WAPP interconnected Power Systems and need to be organised such that they are usable for the mentioned purposes. This Policy addresses the general rules for data handling and the rules that the WAPP interconnected Power Systems involved should follow for the provision and usage of these data by system operators and other WAPP interconnected Power Systems.

7.2. CONFIDENTIALITY

7.2.1. Confidential information

Confidential information includes:

- All information clearly marked as "confidential".
- All information relating to the users of the electricity transmission grid systems, which is commercial in nature and, if disclosed, is likely to influence market conditions.

Each system operator, who provides information to another party or receives information that is commercially sensitive, has the right to request that such information be protected under an agreement of confidentiality. Such, agreements shall not conflict with this Policy.

7.2.2. Treatment of confidentiality

Use of individual information

Each party may make free use of its individual information for any purpose without constraints; as long as no data from other WAPP interconnected Power Systems are included.

Use of confidential information

Only system operators may use the confidential information strictly for their operational needs unless otherwise agreed or by request from authorized agencies under national or international law. Such confidential information is only disclosed to its managers, employees, advisers and representatives as long as these persons are bound by an obligation of confidentiality with the same content as laid down in this Policy.

Confidential information handling

The system operator organizes its data handling in such a way as to minimize the risks of misuse or unauthorized access or disclosure of confidential information.

Data excluded

Confidentiality does not apply to data:

• That is in the public domain other than by reason of breach of this clause;

- That is already lawfully in the possession of the recipient prior to its receipt from the disclosing party;
- That the recipient is required to disclose under any law, court order or order of authorities.

7.3. TECHNICAL SPECIFICATIONS

7.3.1. Requirements

7.3.1.1. Voice communications

A dedicated telecommunication line for voice with ICC and adjacent control centers is required for normal and emergency situations. These lines shall be independent from the existing PABXs and shall have provision to operate under extreme conditions of the system (Provision of UPS, redundant equipment etc).

7.3.1.2. Fax

Fax equipment should also be available 24 hours a day in the control room (at least A4 size paper shall be supported)

FAX should be properly stamped with senders name. (Date and time stamp)

7.3.1.3. E-mail on internet.

Internet e-mail shall be available for operators 24 hours a day. All incoming and outgoing mails shall be scanned for virus detection. Each system shall ensure that a filtering mechanism is in place in order to block unnecessary e-mails to the system operation (Spam blocking and filtering).

7.3.2. Standards

7.3.2.1. Voice transmission standards

The voice quality should conform at least to the CCITT standards G729.

7.3.2.2. Fax transmission standard.

For fax transmission, the European Standard G3 (Group 3) is adopted.

7.3.2.3. Video-conferencing transmission standard.

For Video conferencing ITU-T standards H.320 and H.323 are applicable.

POLICY 8

OPERATOR PERSONNEL AND TRAINING

8. P8-OPERATOR PERSONNEL and TRAINING	3
8.1. RESPONSIBILITY AND AUTHORITY	3
8.2. CERTIFICATION	3
8.2.1. Selection of system operators	3
8.2.2. WAPP-certified system operator	3
8.2.3. Certification committee	3
8.3. Training	4
8.3.1. Background	4
8.3.2. Recommendations	4
8.4. Suggested topics for System Operator Training	5
8.4.1. Normal operation	5
8.4.1.1. Basics of power flows	5
8.4.1.2. Economic operation	6
8.4.1.3. System protection	6
8.4.2. Abnormal operation	6
8.4.2.1. Dynamic performance of system	6
8.4.2.2. Dynamic performance of equipment	6
8.4.2.3. Power system restoration	7
8.4.3. Interconnected system operation	7
8.4.3.1. WAPP operating criteria and guidelines	7
8.4.3.2. Effects on system performance	7
8.4.3.3. WAPP policies	7
8.4.4. Modern power system control aids	7
8.4.4.1. Equipment	7
8.4.4.2. Theory and use of software applications for normal and emergency conditions:	8
8.4.5. Communications	8
8.4.6. System protection	8
8.4.7. Supervisory skills	8

P8-OPERATOR PERSONNEL AND TRAINING

This policy defines the responsibilities, authorities and the certification standards, and the training requirements of system operators.

8.1. **RESPONSIBILITY AND AUTHORITY**

Each System Operator shall be delegated sufficient status and authority to take any action necessary to ensure that the System or Control Area for which he is responsible, is operated in a stable and reliable manner.

Each Control Centre shall provide its System operators with a clear definition of their authority and responsibilities.

Each Control Centre shall advise the other Control Centres of the authority and responsibilities of its own system operators.

8.2. CERTIFICATION

8.2.1. Selection of system operators

Each Control Centre Area shall select its system operators using criteria likely to promote reliable and safe operations.

Personnel selected as system operators should be capable of directing other operating personnel in their own system, and, at the same time, working efficiently with their counterparts in other control centres.

A System operator should have:

- high level of intellectual ability and above-average reasoning capability especially when under pressure,
- reasonable mechanical, electrical and mathematical aptitudes, communication, supervision and decision-making skills.

To maintain an adequate level of capability and expertise in system operations, each system should have and implement screening techniques and selection procedures for its System operators.

8.2.2. WAPP-certified system operator

In a Control Centre responsible for a Control Area, at least one WAPP-Certified System Operator shall be on duty at all times (operator that have the responsibility for the real-time operation of the interconnected system, and responsible for complying with WAPP Policies).

8.2.3. Certification committee

A Grading Committee shall be established within the WAPP to evaluate/interview candidates. The evaluation process shall consist of:

- Evaluation of the candidates against afairly detailed job description;
- Analysis of the candidate's past records and experience;

- In-depth interview with each candidate;
- Evaluation of intelligence, logical frame of mind, technical aptitudes, mathematical and communications skills together with psychological fitness;
- Educational and academic background;
- English and French proficiency;
- Physical evaluation (hearing, vision and speech).

8.3. TRAINING

8.3.1. Background

The increasing sophistication of Control Centres with regards to control equipment, instrumentation and data presentation techniques and the interconnection of adjacent Systems, requires careful selection and training of Control Centre personnel. Proper and prompt action during an emergency, as well as minute-to-minute operation of a complex system, depends upon effective and efficient human performance. Each System Operator should therefore be well qualified, mentally suited, and thoroughly conversant with the principles and procedures of interconnected system operations.

To operate a power system effectively, a System Operator must have a thorough understanding of the basic principles of electricity. The power system consists of a variety of components, equipment and apparatus, hence thorough understanding of their characteristics and how these devices are integrated to form a system, is absolutely essential. The System Operators should also have good communication skills, the ability to make prompt decisions and be capable of supervising others.

In anticipation of abnormal situations on the Interconnected System, System Operators should receive special training to increase their awareness and make them capable of quickly conveying essential information to other Control Centres. Each Operating Authority shall provide its System Operators with a coordinated training programme that is designed to promote reliable operations.

The objectives of the training shall consider:

- the knowledge and competencies required to apply policies,
- procedures, and requirements for normal, emergency, and restoration conditions,

and shall be based on WAPP operating Policies and procedures, and applicable regulatory requirements.

8.3.2. Recommendations

Each interconnected power system shall adhere and implement the WAPP developed training programme for WAPP certified system operators.

Training should include both classroom and on-the-job training.

Each interconnected power system should periodically simulate emergency situations in order to maintain a high level of readiness among Control Centre personnel.

Inter-Utility exchanges of System operators should be encouraged.

Each interconnected power system should consider training on power system simulator.

8.4. SUGGESTED TOPICS FOR SYSTEM OPERATOR TRAINING

The following outline includes suggested topics for inclusion in a training programme. This outline is intended to be a comprehensive list to be utilized by interconnected systems in designing training programme. Actual course content for any given trainee will depend upon the trainee's background, job responsibilities, organizational requirements, and its training objectives, among others.

This section lists the items that should be included in a training course for system operators.

8.4.1. Normal operation

8.4.1.1. Basics of power flows

- Alternating Current (AC) Generation Transmission Transformation Loads and effect on system Phase angle Reactors Capacitors Parallel flows
- Direct Current (DC) Transmission Interconnections

<u>Voltage Control</u> Load characteristics Standards Schedules Cause for voltage deviations Generation excitation Transformer taps Reactive sources (Generators, Synchronous condensers, Capacitors, Reactors, Static VAr compensators) Line and cable switching

Concepts of Active Power Control Operating Reserve Dispatching techniques Generators AGC's and Governors Area Control Error (ACE) Interchange control Inadvertent interchange Special operating programme(s) Short term Load Forecast Dispatching techniques Heat rates Fuel costs Start-up and shutdown costs Unit commitment

Economic despatch Transmission losses Reactive flows Incremental and decremental costs Introduction to energy trading techniques

<u>Operating Guidelines and Constraints</u> Reliability Criteria for Interconnected Systems Operation Contingency assessment (Generator outages, Transmission lines outages, Transformer outages, Busbar Outages, Outages of reactive energy sources, Combination of above) Equipment capabilities and limits (Thermal, Voltage / Reactive, Stability)

<u>Operating considerations:</u> Safety of personnel and equipment Synchronising Line switching and clearance Ferro resonance Metering Maintenance scheduling criteria (Generation, Transmission,)

8.4.1.3. System protection

Basic protection relaying schemes Protection discrimination and sensitivity Interpretation of relay operations

8.4.2. Abnormal operation

8.4.2.1. Dynamic performance of system

Transient stability Oscillations Causes of disturbances Special Protection System (SPS)

8.4.2.2. Dynamic performance of equipment

Governor response Exciter response Automatic controls (Under-frequency relays, AGC, Voltage, Generator and load tripping, System separation) Line fault Generator trip Frequency deviation and Interchange deviation Voltage level Isolated system operation High-and-low –frequency operation High-and-low-voltage operation

8.4.2.3. Power system restoration

Generator start-up capabilities and pick-up rates Synchronizing within a System and at the Points of Interconnection Black starting

8.4.3. Interconnected system operation

8.4.3.1. WAPP operating criteria and guidelines

Philosophy of Operation Benefits Obligations Responsibilities Authority

8.4.3.2. Effects on system performance

Frequency Interchanges Reserves Mutual assistance

8.4.3.3. WAPP policies

- Policy 1: Load-Frequency-Control
- Policy 2: Interchange Scheduling and accounting between control areas
- Policy 3: Operational Security
- Policy 4: Operational planning
- Policy 5: Emergency procedures
- Policy 6: Communication infrastructures
- Policy 7: Information exchange between systems
- Policy 8: Operator personnel and training

8.4.4. Modern power system control aids

8.4.4.1. Equipment

Man-machine interface Supervisory control Data acquisition Fail over and restart (master-slave switchover) Uninterruptible Power Supplies (UPS) State estimation Economic dispatch AGC Unit commitment Load flow Contingency analysis Interchange accounting Alternative Control Methods during Equipment and Software Unavailability Typical Software Applications

8.4.5. Communications

Power line carrier schemes (PLC) Private microwave systems Radio Optical fiber Other telecommunication networks (GSM, state-owned ...)

8.4.6. System protection

Basic protection relaying schemes Protection discrimination and sensitivity Interpretation of relay operation

8.4.7. Supervisory skills

Language (English and French) Verbal communication Decision - making Stress management

9.	GLOSSARY / GLOSSAIRE		
English		French	
Abnormal conditions	All conditions deviating from NORMAL OPERATION shall be deemed to be abnormal conditions. Operation under ABNORMAL CONDITIONS has the following characteristics: • All customers may be supplied; • Limit values are no longer observed; • The (N-1) CRITERION is no longer met.	Conditions perturbées	Toutes les conditions s'écartant de L'EXPLOITATION NORMALE devront être considérées comme étant perturbées L'Exploitation en CONDITIONS PERTURBEES présente les caractéristiques suivantes: • Tous les clients peuvent être alimentés; • Les valeurs limites ne sont plus observées; • Le CRITERE (N-1) n'est plus satisfait.
Accounting of Inadvertent Deviations	 ACCOUNTING is the organizational process implemented in order to: collect the values of the exchanged energy for each time interval; determine the INADVERTENT DEVIATIONS of energy; set-up the corresponding COMPENSATION PROGRAMS. 	Décompte des Ecarts Fortuits	 Le DECOMPTE est le processus organisationnel mis en place pour: collecter les valeurs de l'énergie échangée pour chaque intervalle de temps; déterminer les ECARTS FORTUITS d'énergie, mettre en place les PROGRAMMES DE COMPENSATION
Accounting office	A place within a CONTROL AREA where energy exchanges with other CONTROL AREAS are collated and processed.	Bureau des décomptes	Un emplacement au sein de la ZONE DE REGLAGE où les échanges d'énergie avec les autres ZONES DE REGLAGE sont collectées et traitées
Accounting point	One side of an INTERCONNECTION is defined as "ACCOUNTING POINT" and will be used as basis for accounting for both ADJACENT CONTROL AREAS. The parties at a common border have to agree on a common ACCOUNTING POINT. Usually it is located within the substation close to the BORDER between two zones.	Point de décompte	Une extrémité d'une INTERCONNEXION est définie comme le "POINT DE DECOMPTES" et servira de base pour les décomptes entre deux ZONES DE REGLAGE ADJACENTES. Les parties situées sur une frontière commune devront s'accorder sur un POINT DE DECOMPTES commun. Généralement, il est situé dans le poste le plus proche de la FRONTIERE entre les 2 zones.
Active power	ACTIVE POWER is a real component of the APPARENT POWER, usually expressed in kilowatts (kW) or megawatts (MW).	Puissance active	La PUISSANCE ACTIVE est la composante réelle de la PUISSANCE APPARENTE, généralement exprimée en kilowatts (kW) ou en mégawatts (MW).
Adequacy	The ability of the electric system to supply the aggregate electrical power DEMAND and energy requirements of the customers at all times, taking into account SCHEDULED AND UNSCHEDULED OUTAGES of system elements.	Adéquation	La capacité du système électrique à faire face à la DEMANDE cumulée des clients, en énergie de façon permanente, tout en tenant compte des INDISPONIBILITES PROGRAMMEES ET NON PROGRAMMEES des éléments du système.

English		French	
Adjacent	An ADJACENT CONTROL AREA (or ADJACENT	Zone de réglage	Une ZONE DE REGLAGE ADJACENTE (ou SYSTEME
control area	SYSTEM) is any CONTROL AREA (or system)	adjacente	ADJACENT) est une ZONE DE REGLAGE (ou système)
(adjacent	either directly interconnected with or electrically	(système	directement interconnectée avec une autre ZONE DE
system)	close to (so as to be significantly affected by the	adjacent)	REGLAGE (ou un système), ou électriquement proche (de
	existence of) another CONTROL AREA (or system).		façon à être influencé de façon significative par son
			existence).
AGC	AUTOMATIC GENERATION CONTROL (AGC)	Réglage	Le REGLAGE AUTOMATIQUE DE LA PRODUCTION
	is an equipment that automatically adjusts the	Automatique de	est un équipement qui ajuste automatiquement la
	generation to maintain its generation dispatch,	la production	production afin de maintenir le plan de production, le
	interchange schedule plus its share of frequency	(AGC)	programme échange et la puissance nécessaire au réglage
	regulation		de la fréquence.
Apparent	APPARENT POWER is the product of voltage (in	Puissance	LA PUISSANCE APPARENTE est le produit de la tension
power	volts) and current (in amperes). It consists of a real	apparente	(en volts) et du courant (en ampères). Elle est composée
	component (ACTIVE POWER) and an imaginary		d'une composante réelle (PUISSANCE ACTIVE) et d'une
	component (REACTIVE POWER), usually		composante imaginaire (PUISSANCE REACTIVE),
	expressed in kilovolt-amperes (kVA) or megavolt-		exprimée généralement en kilovolt-ampères (kVA) ou
	amperes (MVA).		mégavolt-ampères (MVA).
Area Control	The AREA CONTROL ERROR is the instantaneous	Ecart de réglage	L'ECART DE REGLAGE est la différence instantanée
Error (ACE)	difference between the actual and the reference value		entre la valeur actuelle et la valeur de référence des
	for the power interchange of a CONTROL AREA,		échanges en puissance d'une ZONE DE REGLAGE
	taking into account the effect of the frequency bias		(ECART FORTUIT), en prenant en compte l'ECART DE
	for that control area according to the NETWORK		FREQUENCE en fonction de l'ENERGIE REGLANTE de
	POWER FREQUENCY CHARACTERISTIC of		cette ZONE DE REGLAGE.
	that control area.		
Articles of	WAPP Articles of Agreement adopted on 6 th July	Convention	La Convention de l'EEEOA signée le 6 juillet 2006 a pour
Agreement	2006 with objectives to institute a management		objectifs d'instituer les structures de gestion de l'EEEOA,
	structure for the West African Power Pool (WAPP),		de les organiser et de définir leurs modalités de
	its organization and functions, in order to establish a		fonctionnement afin d'établir un bon mécanisme de
	good framework of cooperation between its		cooperation entre ses Membres pour assurer un
	Members to ensure improved efficiency of power		approvisionnement efficace en energie des Etats Membres
	supply in ECOWAS Member States and increased		de la CEDEAO et augmenter l'accès à l'énergie de leurs
	access to energy for its citizens.		citoyens.

9.	GLOSSARY / GLOSSAIRE		
English		French	
Availability	AVAILABILITY is a measure of time during which a generating unit, transmission line, ANCILLARY SERVICE or another facility is capable of providing service, whether or not it actually is in service. Typically, this measure is expressed as a percentage available for the period under consideration.	Disponibilité	LA DISPONIBILITE est la période au cours de laquelle un groupe, une ligne de transport, un SERVICE AUXILIAIRE ou un autre ouvrage est disponible pour produire un service, qu'il soit réellement en fonction ou non. Cette mesure est normalement exprimée en pourcentage de disponibilité pour la période considérée.
Black-start capability	BLACK-START CAPABILITY is the ability of a generating unit to go from a shutdown condition to an operating condition and start delivering power without assistance from the power system.	Aptitude au démarrage en autonome	L'APTITUDE AU DEMARRAGE EN AUTONOME est l'aptitude d'un groupe de production de passer de l'arrêt à la production d'énergie sans l'assistance du réseau.
Border	A BORDER is a conventional line separating a part of the SYNCHRONOUS ZONE from the rest of the system for the purpose of calculation of INADVERTENT DEVIATIONS. It corresponds to the geographical boundaries of countries and does not split any CONTROL AREA.	Frontière	La FRONTIERE est la ligne conventionnelle isolant une ZONE SYNCHRONE de l'ensemble du système pour le calcul des écarts fortuits. Cette ligne correspond à la limite géographique entre les pays et ne doit pas traverser une ZONE DE REGLAGE.
Capacity	CAPACITY is the rated continuous load-carrying ability of generation, transmission, or other electrical equipment, expressed in megawatts (MW) for ACTIVE POWER, expressed in megavars (MVAr) for the reactive power or megavolt-amperes (MVA) for APPARENT POWER.	Capacité	La CAPACITÉ est la valeur disponible en continu d'un moyen de production, d'un équipement de transport, ou tout autre équipement électrique, exprimée en mégawatts (MW) pour la PUISSANCE ACTIVE, exprimée en megavars (MVAr) pour la PUISSANCE REACTIVE en mégavolt-ampères (MVA) pour la PUISSANCE APPARENTE.
Compensation facility, (compensator)	Equipment that is installed to keep the system voltage within the normal range (capacitors, reactors)	Ouvrage de compensation, (compensateur)	Equipement qui est installé pour maintenir la tension aux valeurs normales (condensateurs, réactances)
Compensation period	Compensation period is the time interval during which the CONTROL AREA clears the balance of INADVERTENT DEVIATIONS according to the COMPENSATION PROGRAM.	Période de compensation	La Période de Compensation est l'intervalle de temps au cours duquel la ZONE DE REGLAGE compense les ECARTS FORTUITS selon le PROGRAMME DE COMPENSATION.
Confidentialit y	Confidentiality is as defined in Article 10 of the General Provisions of WAPP zone A Operation Manual.	Confidentialité	La Confidentialité est définie dans l'Article 10 des Conditions Générales du Manuel d'Exploitation de l'EEEOA zone A.

9. **GLOSSARY / GLOSSAIRE** English French **TRANSMISSION CONGESTION is the situation** Une CONGESTION est une situation dans laquelle le Congestion Congestion (Transmission whereby the network cannot adequately transfer the réseau ne peut pas transférer en sûreté la production vers **Congestion**) power generated in a part of the network to another le lieu de consommation. part where the power is required. Contingency **CONTINGENCY** is the unexpected failure or outage Aléa Un ALÉA est la défaillance inattendue ou la perte d'un of a system component, such as a generator, composant du système, tel qu'un groupe de production, une ligne de transport, un disjoncteur, un interrupteur, ou transmission line, circuit breaker, switch, or other tout autre composant électrique. Un ALÉA peut aussi electrical element. A CONTINGENCY also may comprendre de multiples composants, liés par des include multiple components, which are related by situations leading to simultaneous component situations menant à des pertes simultanées de composants. outages. Une ZONE DE RÉGLAGE est une entité cohérente A CONTROL AREA is a coherent part (usually Zone de Réglage Control area coincident with the territory of a company, a country (coïncidant généralement avec le territoire d'une or a geographical area, physically demarcated by the compagnie, d'un pays, ou d'une zone géographique, position of delivery points for measurement of the physiquement délimitée par la position des points de interchanged power and energy to the remaining mesure de la puissance et de l'énergie échangées avec le interconnected network), operated by a single reste du réseau interconnecté), exploité par un seul NETWORK OPERATOR, with physical loads and **OPERATEUR DE RESEAU, avec des charges et des** controllable generation units connected within the unités de production capables de suivi de charge au sein de la zone de réglage. control area. **Opérateur de** L'OPERATEUR D'UNE ZONE DE REGLAGE est A CONTROL AREA OPERATOR is the operator of **Control area** a CONTROL AREA Zone de Réglage l'opérateur du centre de conduite d'une ZONE DE operator **REGLAGE.** Programme de Le PROGRAMME DE REGLAGE qui est utilisé pour le Control A CONTROL PROGRAM constitutes the schedule of the total programmed exchange of a CONTROL Réglage réglage secondaire, est le programme total import ou program AREA which is the sum of all EXCHANGE export d'une zone de réglage, qui est la somme de tous les **PROGRAMMES D'ECHANGE et du PROGRAMME DE PROGRAMS** and the compensation program that is used for secondary control. COMPENSATION. D: the day when the EXCHANGE SCHEDULES are D, D-1, D +1 J, J-1, J +1 J: le jour où les PROGRAMMES D'ECHANGES sont réalisés. set into force. D-1 : the day ahead (before) "d" J-1 : le jour précédent (avant) "J" J+1: le jour après le "J" D+1: the day after "d"

9.	GLOSSARY / GLOSSAIRE			
English		French	rench	
Demand	DEMAND is the electric power that is delivered to or by a system or part of a system, generally expressed in kilowatts (KW) or megawatts (MW), at a given instant or averaged over any designated interval of time. DEMAND should not be confused with LOAD (a LOAD is usually a device).	Demande	La DEMANDE est la puissance fournie à ou par un système ou partie d'un système, généralement exprimée en kilowatts (kW) ou mégawatts (MW), à un instant donné ou calculée sur une période donnée. On ne doit pas confondre la CONSOMMATION avec la CHARGE (une CHARGE est associée à un équipement).	
Disturbance	DISTURBANCE is an unplanned event that produces an abnormal system condition.	Perturbation	Une PERTURBATION est un événement non planifié qui provoque un fonctionnement anormal du système.	
Engineering and Operation committee	Functions of the ENGINEERING AND OPERATION COMMITTEE are defined in Article 6.4 of the Articles of Agreement of The West African Power Pool (Organization and Functions)	Comité d'ingénierie et d'Exploitation	Les fonctions du COMITE D'INGENIERIE ET D'EXPLOITATION sont définies dans l'article 6.4 de la Convention Portant sur l'Organisation et le Fonctionnement de l'EEEOA.	
Exchange program	An EXCHANGE PROGRAM represents the total scheduled energy interchange between two CONTROL AREAS	Programme d'Echange	Un PROGRAMME D'ECHANGE représente le total des échanges programmés entre deux ZONES DE REGLAGE.	
Exchange schedule	An EXCHANGE SCHEDULE defines an agreed transaction with regard to its size (megawatts), start and end time, and type (e.g. Firmness)	Echange	Un ECHANGE définit une transaction contractuelle conformément à sa puissance (mégawatts), heures de début et de fin et catégorie (par ex. garantie).	
Frequency	See: SYSTEM FREQUENCY	Fréquence	Voir FREQUENCE DU SYSTEME	
Frequency Control	This is the adjustment of generation output to match DEMAND in real time	Réglage de la fréquence	C'est l'ajustement de l'offre à la DEMANDE, en temps réel.	
Frequency control error	The FREQUENCY CONTROL ERROR K*Δf of a CONTROL AREA is the product of the FREQUENCY DEVIATION Δf and the K-FACTOR of the CONTROL AREA Kri	Ecart de Réglage de la Fréquence	L'ECART DE REGLAGE de la Fréquence K*Δf d'une ZONE DE REGLAGE est le produit de l'ECART DE FREQUENCE Δf et du COEFFICIENT K de la ZONE DE REGLAGE Kri.	
Frequency deviation	Frequency Deviation means a departure of the actual SYSTEM FREQUENCY from the set value Frequency.	Ecart de Fréquence	L'ECART DE FREQUENCE signifie tout déviation de la FREQUENCE DU SYSTEME par rapport à la valeur de consigne de la fréquence.	
Generating set (generation unit)	A generating set consists of a generator (and its driving apparatus) and a turbine.	Groupe de production (unité de production)	Un Groupe de Production comprend un alternateur (et ses organes de régulation) et une turbine.	
GMT	Greenwich Mean Time	GMT	Heure au Méridien de Greenwich.	

English		French	
ICC	The ICC is the INFORMATION AND CO- ORDINATION CENTRE of the West African Power	CIC	Le CIC est le CENTRE D'INFORMATION ET DE COORDINATION du système d'Echanges d'Energie
	POOI (WAPP).		Electrique Ouest Africain (EEEOA).
Interconnecte d system	An INTERCONNECTED SYSTEM is a system consisting of two or more individual electric systems that normally operate in synchronism and are physically connected via INTERCONNECTIONS.(see also:	Système Interconnecté	Un SYSTEME INTERCONNECTE est un système composé d'au moins deux systèmes électriques individuels qui sont normalement exploitées au synchronisme et qui sont physiquement connectés par l'intermédiaire d'au moins une INTERCONNEXION.(voir aussi: ZONE
Interconnectio n	An interconnection is a transmission link (e.g. Tie- line or transformer) which connects two or more POWER SYSTEMS (or CONTROL AREAS)	Interconnexion	SYNCHRONE).Une Interconnexion est un ouvrage de transport (une ligne d'interconnexion ou un transformateur par exemple) reliant deux SYSTEMES ELECTRIQUES (ou ZONES DE REGLAGE) ou plus
Island (power system)	An ISLAND represents a portion of a power system or of several power systems that is electrically separated from the main INTERCONNECTED SYSTEM (separation resulting e.g. From the disconnection / failure of transmission system elements).	Réseau séparé	Un Réseau séparé représente une partie d'un système électrique ou de plusieurs systèmes électriques séparés électriquement du système INTERCONNECTÉ principal (une séparation résultant par exemple d'une mise hors tension / d'une défaillance d'éléments du système de transport).
K-factor	The K-FACTOR is a value, usually given in megawatts per Hertz (MW/Hz), which is normally determined for a singleCONTROL AREA; it defines the FREQUENCY BIAS of that CONTROL AREA for SECONDARY CONTROL.	Facteur-K	Le FACTEUR-K est une valeur, généralement donnée en mégawatts par Hertz (MW/Hz), qui est normalement déterminée pour une seule ZONE DE REGLAGE; il donne l'ECART DE FREQUENCE de cette ZONE DE REGLAGE pour le REGLAGE SECONDAIRE.
Load	LOAD means an end-use device or customer that receives power from the electric system. LOAD should not be confused with DEMAND, which is the measure of power that a load receives or requires. LOAD is often wrongly used as a synonym for DEMAND.	Charge	La Charge est l'équipement ou le client qui reçoit l'énergie du système électrique. On ne devrait pas confondre CHARGE et CONSOMMATION (DEMANDE) qui est la mesure de la puissance qu'une Charge reçoit ou requiert. La CHARGE est souvent à tort confondue avec la CONSOMMATION (DEMANDE).

9.	GLOSSARY / GLOSSAIRE			
English		French	French	
Load frequencycont roller	 Load Frequency Controller is a centralised automatic function to regulate the generation in a CONTROL AREA in order: To maintain its interchange power flow at the CONTROL PROGRAM with all other control areas; To restore the frequency in case of a frequency deviation originating from the CONTROL AREA to its set value in order to free the capacity engaged by the PRIMARY CONTROL. 	Réglage Fréquence- Puissance	 Le réglage fréquence-puissance est une fonction automatique centralisée servant à modifier la production dans une ZONE DE REGLAGE afin de: maintenir les transits d'énergie égaux au PROGRAMME DE REGLAGE avec les autres ZONES DE REGLAGE restaurer la fréquence en cas d'un écart de fréquence dont l'origine est dans cette zone de réglage, à sa valeur de consigne afin de libérer la puissance engagée par le REGLAGE PRIMAIRE. 	
Load shedding	Load-shedding is the disconnection of some load from the SYNCHRONOUS POWER SYSTEM, performed preferably automatically or manually, to control the SYSTEM FREQUENCY in emergency situations.	Délestage	Le DELESTAGE est la mise hors service d'une partie de la charge du SYSTEME ELECTRIQUE SYNCHRONE, réalisée automatiquement de préférence ou manuellement, pour contrôler la FREQUENCE DU SYSTEME en situations d'urgence.	
MVAr	REACTIVE POWER is an imaginary component of the APPARENT POWER. It is usually expressed in kilo-vars (kVAr) or mega-vars (MVAr). The REACTIVE POWER is the imaginary part of the complex product of voltage and current.	MVAr	La PUISSANCE REACTIVE est la composante imaginaire de la PUISSANCE APPARENTE . Elle est généralement exprimée en kilo-vars (kVAr) ou en mégavars (MVAr). La PUISSANCE REACTIVE est la partie imaginaire du produit complexe de la tension et du courant.	

9.	GLOSSARY /	GLOSSAIRE	
English		French	
N-1 Criterion (N-1 criteria)	The N-1 is a rule whereby the loss of any probable single event leading to a loss of any power system element shall not endanger the SECURITY of interconnected operation, i.e., trigger cascaded trips or the loss of a significant amount of load. The remaining network elements, which are still in operation shall be able to withstand the additional load or change of generation, voltage deviation or transient instability regime caused by the initial failure.	Critère N-1	Le Critère du N-1 est une règle par laquelle tout événement probable et isolé menant à une perte d'élément du système électrique ne devrait pas mettre en danger la SÉCURITÉ de l'exploitation c'est-à-dire provoquer des déclenchements en cascade ou des pertes significatives de charges. Les éléments restants de réseau, qui sont toujours en service devront être capables de faire face à l'appel de charge supplémentaire ou au changement du plan de production, aux écarts de tension ou au régime transitoire d'instabilité causé par le défaut initial.Le Critère du N-1 est une règle par laquelle Tout événement probable et isolé menant à une perte d'élément du système électrique ne devrait pas mettre en danger la SECURITE de l'exploitation. Les éléments de réseau restants, qui sont toujours en service devront être capables de faire face à l'appel supplémentaire ou au changement du plan de production, aux écarts de tension ou au régime transitoire d'instabilité causé par le défaut
Net transfer capacity (NTC)	The NET TRANSFER CAPACITY is defined as: NTC = TTC-TRM The NET TRANSFER CAPACITY is the maximum EXCHANGE PROGRAM between two ADJACENT CONTROL AREAS compatible with security standards applicable in all CONTROL AREAS of the SYNCHRONOUS AREA.	Capacité Nette de Transfert	La CAPACITE NETTE DE TRANSFERT est définie par: NTC = TTC-TRM La CAPACITE NETTE DE TRANSFERT est le PROGRAMME maximum d'ECHANGE entre deux ZONES DE REGLAGE ADJACENTES compatibles avec les exigences de sécurité applicables dans toutes les ZONES DE REGLAGE de la ZONE SYNCHRONE.

9.	GLOSSARY / GLOSSAIRE		
English		French	
Network	The NETWORK POWER FREQUENCY	Energie	L'ENERGIE REGLANTE DU RESEAU est le quotient de
power	CHARACTERISTIC OF THE NETWORK is	Réglante λ_i	la variation de la puissance par la variation de la
frequency	defined as the ratio of the change of power to the		fréquence correspondante en l'absence de réglage
characteristic	corresponding change in frequency before		secondaire. L'ENERGIE REGLANTE est exprimée en
λ_i	SECONDARY CONTROL. The POWER		mégawatts par hertz (MW/Hz) et est généralement
	FREQUENCY CHARACTERISTIC (λi) is		associée à une ZONE DE REGLAGE (unique) ou à
	measured in megawatts per hertz (MW/Hz) and is		l'ensemble de la ZONE DE SYNCHRONISME. Cela ne
	usually associated with a (single) CONTROL AREA		doit pas être confondu avec le facteur K. L'ENERGIE
	or the entire synchronous area. It is not to be		REGLANTE inclut tous les REGLAGES PRIMAIRES et
	confused with the K-FACTOR. The network power		l'AUTOREGLAGE de la charge ainsi que les changements
	frequency characteristic includes all active		dus aux modifications du plan de production et de la
	PRIMARY CONTROL and SELF-REGULATION		demande.
	of load and changes due to modifications in the		
	generation and demand patterns.		
Normal	NORMAL OPERATION has the following	Exploitation	Une EXPLOITATION NORMALE présente les
operation	characteristics:	Normale	caractéristiques suivantes:
	 All customers have secure supply; 		 Tous les clients disposent d'un approvisionnement
	All limit values are observed (e.g. No		sûr;
	overloads);		• Toutes les valeurs de limites sont observées(c'est-à-
	• The (n-1) criterion is met in the whole power		dire pas de surcharges);
	system		• Le critère du (N-1) est respecté au sein de tout le
			système électrique.
Operating	OPERATING POLICIES constitute the guidelines	Directives	Les DIRECTIVES D'EXPLOITATION constituent les
policies	developed for INTERCONNECTED SYSTEMS	d'exploitation	règles développées pour l'exploitation des SYSTEMES
	operation; they form the main part of the Operation		INTERCONNECTES; elles constituent la partie principale
	Manual. Each POLICY consists of criteria,		du Manuel d'exploitation. Chaque DIRECTIVE est
	standards, requirements, guides, and instructions,		composée de critères, de normes, de prescriptions, de
	and applies to all CONTROL AREAS/POWER		guides, et d'instructions, s'appliquant à toutes les ZONES
	SYSTEMS.		DE REGLAGE et aux différents systèmes électriques.
Operational	OPERATIONAL PLANNING Phase is the period	Gestion	La GESTION PREVISIONNELLE couvre la période de 3
planning	from 3 years to the real time operation.	Prévisionnelle	ans jusqu'à l'exploitation TEMPS REEL.

9.	GLOSSARY /	GLOSSAIRE	
English		French	
Operational procedures	OPERATIONAL PROCEDURES are a set of instructions and, practices that may be automatically or manually implemented by the system operator to maintain the integrity of the INTERCONNECTED SYSTEM.	Procédures D'exploitation	Les PROCEDURES D'EXPLOITATION sont un ensemble de consignes et de pratiques pouvant être automatiquement ou manuellement mises en place par l'opérateur du système afin de maintenir l'intégrité du SYSTEMES INTERCONNECTE.
Power system	The POWER SYSTEM comprises of all generation, load and network installations interconnected throughout the network.	Système Électrique	Le SYSTEME ELECTRIQUE comprend toutes les installations de production et de consommation du réseau interconnecté par le réseau.
Primary control Primary control range	PRIMARY CONTROL maintains the balance between GENERATION and DEMAND in the network using turbine speed governors. PRIMARY CONTROL is an automatic decentralized function of the turbine governor to adjust the generator output of a unit as a consequence of a FREQUENCY DEVIATION in the SYNCHRONOUS AREA. The Primary Control Range is the range of adjustment of primary control power, within which primary controllers can provide automatic control, in both directions, in response to a frequency	Réglage Primaire Bande de Réglage Primaire	Le REGLAGE PRIMAIRE maintient l'équilibre entre la PRODUCTION et la CONSOMMATION dans le réseau, en utilisant les régulateurs de vitesse des turbines. Le REGLAGE PRIMAIRE est une fonction automatique décentralisée du régulateur de la turbine pour ajuster la production d'un groupe suite à un ECART DE FREQUENCE dans la ZONE SYNCHRONE. La BANDE du REGLAGE PRIMAIRE est la bande de variation de la PUISSANCE DU REGLAGE PRIMAIRE au sein duquel les régulations primaires peuvent fournir un réglage automatique, dans les deux directions, en
	deviation. The concept of the primary control range applies to each generator, each CONTROL AREA, and the entire SYNCHRONOUS AREA.		réponse à un écart de fréquence. Ce concept de bande de réglage primaire s'applique à chaque alternateur, à chaque ZONE DE REGLAGE et à la ZONE SYNCHRONE.
Primary control reserve	The PRIMARY CONTROL RESERVE is the (positive or negative) part of the PRIMARY CONTROL RANGE measured from the working point prior to the disturbance up to the maximum PRIMARY CONTROL POWER (taking account of the limiter).	Réserve Primaire	La RESERVE DE REGLAGE PRIMAIRE est la partie (positive ou négative) de la BANDE DE REGLAGE PRIMAIRE, mesurée à partir du point de fonctionnement avant la perturbation, jusqu'à la puissance maximale du REGLAGE PRIMAIRE (tenant compte du limiteur).

9.	GLOSSARY / GLOSSAIRE		
English		French	
Primary controller	The PRIMARY CONTROLLER is a decentralised and locally installed control equipment for a GENERATION SET to control the valves or wicket gates of the turbine based on the speed of the generator (for synchronous generators directly coupled to the electric SYSTEM FREQUENCY) (see PRIMARY CONTROL).	Le Régulateur Primaire	Le REGULATEUR PRIMAIRE est un équipement décentralisé de réglage installé localement sur une unité de production afin de contrôler les soupapes ou vannes de la turbine en fonction de la vitesse de l'alternateur (pour les alternateurs synchrones directement connectés à la FREQUENCE DU SYSTEME ELECTRIQUE) (voir REGLAGE PRIMAIRE).
Reactive power	See MVAr	Puissance Réactive	Voir MVAr
Real time operation	Control activities of a power system in real time as opposed to those operations that are simulated (planning, scheduling, studies, analyses etc.).	Exploitation en Temps Réel	Ensemble des activités de conduite en temps réel du système électrique, par opposition aux activités effectuées en temps différé (planification, programmation, études, analyses etc.).
Recording period	RECORDING PERIOD is the time interval for which inadvertent deviations for specific CONTROL AREA should be summed up separately for each TARIFF PERIOD.	Période d'enregistre- ment	La PERIODE D'ENREGISTREMENT est l'intervalle de temps pour lequel les ECARTS FORTUITS d'une ZONE DE REGLAGE sont cumulés séparément pour chaque PÉRIODE TARIFAIRE.
Reference incident	 The maximum Power Deviation to be handled is the simultaneous loss of: the largest unit in Nigeria that is a 220 MW unit located at Egbin Power Station, and the largest unit in the Ghana-Côte d'Ivoire-Togo-Benin-Burkina Faso that is 170 MW unit located at Akosombo Hydro power station in Ghana. 	Incident De Référence	 l'Ecart de Puissance maximale à supporter est la perte simultanée : du plus grand groupe au Nigeria, qui est un groupe de 220 MW situé dans la Centrale Electrique d'Egbin, et du plus grand groupe au Ghana - Côte d'Ivoire – Togo – Bénin - Burkina Faso, qui est un groupe de 170 MW situé dans la Centrale Hydroélectrique d'Akosombo au Ghana.
Reference point (WAPP synchronous reference points)	The two WAPP REFERENCE POINTS are the selected typical peak period for dry season and rainy season (first Thursday of April and the first Thursday of August at 21:00. GMT)	Point de Référence (Points de référence synchrones de l'EEEOA)	Les deux POINTS DE REFERENCE de l'EEEOA sont les points choisis et représentatifs des valeurs de pointe en périodes sèche et pluvieuse (premier jeudi d'avril et premier jeudi d'août à 21h00).

9.	GLOSSARY / GLOSSAIRE		
English		French	
Reliability	RELIABILITY describes the degree of performance of the elements of the bulk electric system that results in electricity delivery to customers under normal conditions and in the quantity desired.	Fiabilité	La FIABILITE décrit le degré de performance des éléments du système électrique qui contribuent à la fourniture de l'électricité aux clients, sous des conditions normales et selon les quantités désirées.
SCADA	Supervisory Control and Data Acquisition is a system of remote control and telemetry used to monitor and control the power system.	SCADA	SCADA un système de téléconduite et de télémétrie utilisé pour superviser et exploiter le système électrique.
Scheduled outage (Planned Outage)	An outage of a Power Unit or of part of the Transmission System, or of part of a User System, co-ordinated by the Control Operator during the OPERATIONAL PLANNING phase.	Indisponibilité programmée	Une Indisponibilité programmée est une indisponibilité d'un Groupe, d'un élément du réseau de transport ou d'une partie des équipements d'un consommateur coordonnée par l'opérateur du Dispatching pendant la phase de GESTION PREVISIONNELLE.
Secondary control	SECONDARY CONTROL reduces Area Control Error (ACE) automatically by means of secondary controller and contribute (particularly after the loss of generating unit) to the restoration of the frequency to its set point value (f=f set) in order to free the power used by the primary control (primary control reserve).	Réglage Secondaire	Le REGLAGE SECONDAIRE est un dispositif qui réduit automatiquement l'Ecart de Réglage de Zone (ACE) et qui contribue (notamment après la perte d'une unité de production) à la restauration de la fréquence à sa valeur de consigne (f= fcons) afin de reconstituer la réserve primaire.).
Secondary control range	The SECONDARY CONTROL RANGE is the range of adjustment of the secondary control power, within which the SECONDARY CONTROLLER can operate automatically, in both directions at the time concerned, from the working point.	Bande de Réglage Secondaire	La BANDE DE REGLAGE SECONDAIRE est la bande de variation de la réserve secondaire, au sein de laquelle le REGULATEUR SECONDAIRE peut fonctionner automatiquement, dans les deux directions, à partir du point de fonctionnement.
Secondary control reserve	The positive or negative secondary control reserve is the part of the secondary control range between the working point and the maximum or minimum value.	Réserve du Réglage Secondaire	La RESERVE DE REGLAGE SECONDAIRE positive ou négative est la partie de la bande du REGLAGE SECONDAIRE entre le point de fonctionnement et la valeur maximale ou minimale.
Secondary controller	A SECONDARY CONTROLLER is the single centralized equipment per CONTROL AREA for operation of SECONDARY CONTROL.	Régulateur Secondaire	UN REGULATEUR SECONDAIRE est l'équipement centralisé par ZONE DE REGLAGE pour l'exploitation du REGLAGE SECONDAIRE.

9.	GLOSSARY / GLOSSAIRE		
English		French	
Security (system security)	SECURITY is the ability of the power system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements.	Sécurité	La sécurité est l'aptitude du réseau électrique à supporter les perturbations soudaines telles que les court-circuits électriques ou la perte inattendue des composants du système.
Self- Regulation of Load	The Self-Regulation of Load within the Interconnected WAPP Power System is assumed to be 1 %/Hz that means Load decrease of 1% in case of a frequency drop of 1 Hz.	L'autoréglage de la charge	L'autoréglage de la charge au sein du Système Interconnecté de l'EEEOA, est présumée être de 1 %/Hz, ce qui signifie que la charge décroît de 1% en cas de baisse de fréquence de 1 Hz.
Spinning reserve	SPINNING RESERVE is the additional capacity from power generators that are on-line, loaded to less than their maximum output, and available to serve customer demand immediately after a contingency have occurred.	Réserve Tournante	La réserve tournante est la puissance additionnelle égale à la différence entre la puissance totale disponible de l'ensemble des groupes de production déjà synchronisés au réseau et la puissance produite par ces groupes et qui est disponible pour alimenter la demande immédiatement après un aléa.
Stability	Stability is the ability of an electric system to maintain a state of equilibrium during normal and Abnormal system conditions or disturbances.	Stabilité	La STABILITE est l'aptitude d'un système électrique à maintenir un état d'équilibre pendant les situations normales et anormales d'exploitation ou de perturbations.
Synchronous area	A SYNCHRONOUS AREA is an area covered by interconnected systems whose CONTROL AREAS are synchronously interconnected. Within a SYNCHRONOUS AREA the system frequency is same. A certain number of SYNCHRONOUS AREAS may exist in parallel on a temporal or permanent basis.	Zone Synchrone	Une ZONE SYNCHRONE est une zone couverte par les SYSTEMES INTERCONNECTES dont les ZONES DE REGLAGE sont interconnectées de manière synchrone. Une ZONE SYNCHRONE est caractérisée par une fréquence unique. Un certain nombre de ZONES SYNCHRONES peuvent co-exister de façon temporaire ou permanente.
Synchronous reference point	See Reference Point	Point Synchrone de Référence.	Voir Point de Référence
System collapse	System collapse is the loss of power generation and supply to a large part (partial collapse) or to the entire synchronous area (total collapse)	Effondrement du Système	L' effondrement du Système est la perte des moyens de production et de la fourniture d'énergie à une grand partie du système (effondrement partiel) ou à la zone synchrone toute entière (incident généralisé ou effondrement total)
System frequency	System frequency is the frequency of the power system that can be measured in all network areas of the SYNCHRONOUS AREA.	Fréquence du Système	La Fréquence du Système est la fréquence du système électrique qui peut être mesurée en tout point du réseau de la ZONE SYNCHRONE.

9.	GLOSSARY /	GLOSSAIRE	
English		French	
System losses (Electric system losses)	Electric system losses are total energy losses in the power system. The losses consist of transmission, transformation, and distribution losses between supply sources and delivery points.	Pertes du Système Electrique Pertes réseau	LES PERTES DU SYSTEME ELECTRIQUE sont les pertes totales en énergie électrique au sein du système électrique. Les pertes comprennent les pertes transport, les pertes des transformateurs, et les pertes distribution entre les points de production et les points de livraison.
System Operator (Power System Operator)	A SYSTEM OPERATOR is a utility that is responsible for operating a POWER SYSTEM and its interconnections	Exploitant de Système Électrique	Un EXPLOITANT DE SYSTEME ELECTRIQUE est une société qui a en charge l'exploitation SYSTEME ELECTRIQUE et de ses interconnexions.
system operator	A system operator is the individual in charge of the operation of the Power System in a Control Center.	opérateur de Système Électrique	Un opérateur de Système Électrique est l'individu responsable de l'exploitation du Système électrique dans un Centre de Conduite.
Tariff period	TARIFF PERIOD is the time interval (e.g. Season, holiday, working day, etc.) During which INADVERTENT DEVIATIONS are attributed the same value for offsetting by Compensation in kind. The accumulation of inadvertent deviations Within the recording period is performed separately for each TARIFF PERIOD.	Période Tarifaire	La période tarifaire est l'intervalle de temps (c'est-à-dire la saison, les vacances, les jours ouvrables, etc.) au cours desquels on attribue aux ECARTS FORTUITS la même valeur pour la = compensation en nature. L'accumulation d'ECARTS FORTUITS au sein de la période d'enregistrement est faite séparément pour chaque PERIODE TARIFAIRE.
Term	Definition	TERM	DEFINITION
Tertiary control	TERTIARY CONTROL enables the change of the set points of units participating in secondary control and distribute the secondary control power to various units in the best possible way in terms of economics considerations. The activation of tertiary control shall be possible at any time	Réglage Tertiaire	La réserve tertiaire permet ede modifier les points de consigne des groupes participant au réglage secondaire et permet de répartir économiquement la puissance nécessaire en réglage secondaire à diverses unités. L'activation du réglage tertiaire devrait être possible à tout moment.

9.	GLOSSARY / GLOSSAIRE		
English		French	
Tertiary reserve	Tertiary control reserve (20 minutes reserve) is an additional amount of Operating Reserve sufficient to enable the change of working point of units participating in secondary control (automatically by means of secondary controller) and distribute the secondary control power to various units in the best possible way in terms of economic considerations. The activation of tertiary control reserve shall be possible at any time.	Réserve Tertiaire	La réserve tertiaire (réserve 20 minutes) est un niveau supplémentaire de Réserve d'Exploitation suffisant pour modifier les points de fonctionnement des groupes (automatiquement au moyen du contrôleur secondaire) participant au réglage secondaire et pour répartir économiquement la puissance nécessaire en réglage secondaire à diverses unités. L'activation de la réserve tertiaire devrait être possible à tout moment.
Tie-line	A tie-line is a circuit (e.g. A transmission line) connecting two or more POWER SYSTEMS (or CONTROL AREAS)	Ligne d'intercon- nexion	Une ligne d'interconnexion est un circuit (par exemple une ligne de transport) reliant deux SYSTEMES ELECTRIQUES (ZONES DE REGLAGE) ou plus.
Total transfer	TOTAL TRANSFER CAPACITY is the maximum	Capacité Totale	LA CAPACITE TOTALE DE TRANSFERT est. le
capacity	EXCHANGE PROGRAM between two ADJACENT	De Transfert	PROGRAMME MAXIMAL D'ECHANGES entre deux
(TTC)	CONTROL AREAS that is compatible with	(TTC)	ZONES DE REGLAGE ADJACENTES, compatibles avec
	operational security standards applied in each		les exigences de sécurité d'exploitation appliquées dans
	system.		chaque système.
Transfer	Transfer capability is the measure of the ability of	Capacité De	La capacité de transfert est la mesure de la capacité des
capability	interconnected electric systems to reliably transfer	Transfert	systèmes électriques interconnectés de transférer l'énergie
	power from one area to another over all transmission		de façon fiable, d'une zone à une autre sur toutes les lignes
	lines between those areas. The units of transfer		de transport entre ces zones. Les postes de capacité de
	capability are in terms of electric power, generally		transfert sont, en termes d'énergie électrique,
	Expressed in megawatts (IVIW). Transfer capability		generalement exprimes en megawatts (MW). C'est-a-dire
	is also directional in nature. I hat is, the transfer		que la capacité de transiert d'une zone A vers une zone B
	capability from area A to area B is not generally aqual to the transfer capability from area B to area		ii est pas generalement egale à la capacité de transfert d'une zone B vers une zone A
	A.		u une zone D vers une zone A.

9.	GLOSSARY /	GLOSSAIRE	
English		French	
Transmission reliability margin (TRM)	 The TRANSMISSION RELIABILITY MARGIN is a security margin that copes with uncertainties on the computed TTC values arising from: INADVERTENT DEVIATIONS of physical flows during operation due to the functioning of SECONDARY CONTROL; Emergency exchanges between network operateurs to cope with unexpected unbalanced situations in real-time; Inaccuracies, e. G. In data collection and measurements. 	Marge De Sécurité Du Réseau	 LA MARGE DE SURETE DU TRANSPORT est une marge sécuritaire qui permet de faire face aux incertitudes sur les valeurs calculées des CAPACITES TOTALES DE TRANSFERT d'écoulant des : ECARTS FORTUITS de flux physiques pendant l'exploitation dus au fonctionnement du REGLAGE SECONDAIRE ; Echanges d'urgence entre les exploitants de réseau pour faire face aux situations de déséquilibres inattendues en temps réel ; Imprécisions, par exemple dans la collecte des données et les mesures.
UCTE	Union for the co-ordination of transmission of electricity" the "union for the co-ordination of transmission of electricity" (UCTE) is the association of transmission system operators in Continental Europe, providing a reliable market base by efficient and secure electric "power highways".	UCTE	"L'Union pour la Coordination du Transport de l' Electricité" (UCTE) est une association d'exploitants de système de transport en Europe continentale, fournissant une base de marché fiable à travers des « autoroutes de l'énergie électrique » efficaces et fiables.
WAPP member	WAPP member is as defined in article 9 of the ARTICLES OF AGREEMENT and is any public or private entity that is signatory to this document.	Membre de l'EOAAA	Un Membre de l'EOAAA est défini dans l'article 9 de la CONVENTION et est toute entité publique ou privée qui est signataire de ce document
Y, Y-1 etc	Y:The reference year Y-1: the year ahead (before) "Y" Y+1: the year after "Y"	A, A-1 etc	A: l'année de référence A-1: l'année précédent (avant) "A" A+1: l'année après "A"