EASTERN AFRICA POWER POOL

AFRICAN ELECTRICITY SUPPLY INDUSTRY STANDARDS-
PERCIEVED NEED OF THE POWER POOLS

PRESENTATION TO AFSEC CAPACITY BUILDING WORKSHOP

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Technical assistant to the ES
The Power Pool

- Established in 2005
- 9 countries & 12 utilities

Potential Members: Djibouti, Uganda, Eritrea, Somalia, and South Sudan
Power pools....

- Are concerned with coordination of planning, development and operation of interconnected power supply systems in a defined region. Technical codes to establish the duties and responsibilities of system/network operators as well as pool coordination entities and network users.

- Are also concerned with development and operation of regional electricity markets. Commercial codes to establish the duties and responsibilities of market operators as well as market participants.

Hence there is a requirement to develop and adopt technical codes of practice by constituents of the pool to ensure safe, efficient and reliable operation of the interconnected system.

Ensuring coordinated planning/operation and facilitation of the development of electricity market are among the objectives of EAPP.
ONGOING PROJECTS

I. Technical assistance and Capacity Building to EAPP

II. Regional Master Plan and Grid code study

III. Technical assistance for operationalization of the EAPP CC and IRB

IV. Powering Progress project (PTS, ETAS)
### Objectives:

<table>
<thead>
<tr>
<th>To identify power generation and interconnection projects, at Master Plan level, to interconnect the power systems of EAPP countries in short-to-long term.</th>
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</thead>
</table>

| To develop common Grid Code in order to facilitate the integrated development and operations of the power systems of EAPP countries. |

**Financed by:** AfDB/NEPAD-IPPF  
**Grant amount:** US$....+GBP....= 1.7 M$
Study results - Prospects

- Increased reliability: probability of 2% deficit less than 5% (RMP)
- Reduced operational & capital costs
- RGP-RIP gives highest benefit: 1.2 Billion USD. annually.
- NGP-RIP most realistic Scenario. Region saves 969 million USD annually.
- Scenarios feasible even if cost doubles.

Need to develop and enforce relevant technical as well as commercial codes of practice across the pool to capture the benefit of coordinated operation of the interconnected system.
EAPP interconnections

First level of regional coordination

National generation plans and regional interconnection plan
EAPP-EAC Interconnection Code

The objectives of the Interconnection Code are:

• To implement common standards for satisfactory operational security, reliability and quality of supply in the Interconnected Transmission System of Eastern Africa

• To encourage integrated planning of generation capacity and transmission expansion

• To define responsibilities for the operation and management of the Interconnected Transmission System

• To ensure non-discriminatory access to the Interconnected Transmission System for all Users

• To ensure that System Operators are adequately trained and authorised
Interconnection Code Structure

- Preface
- General Conditions
- Glossary and Definitions
- Planning Code
- Connections Code
- Operations Codes
- Interchange Scheduling and Balancing Codes
- Data Exchange Code
- Metering Code
- System Operator Training Code
General Conditions

To ensure, so far as possible, that the various sections of the Codes work together and work in practice:

- Implementation and Enforcement
- Unforeseen Circumstances
- Safety and Environment
- Establishment of a Code Review Panel
- Force Majeure
- Non-compliance and Derogations
- Dispute Resolution
- Independent Expert Opinion
- Bilateral Agreements
Planning Code

- To be used within EAPP in the planning of the medium and long term development of the EAPP Interconnected Transmission System
- To be taken into account by Member Utilities on a coordinated basis
- To specify the planning data required to be exchanged by EAPP and TSOs to enable the EAPP Interconnected Transmission System to be planned in accordance with the planning standards

Specifies the minimum technical and design criteria, principles and procedures
Connections Code

Specifies the minimum technical, design and operational criteria which must be complied with by TSOs and Users when connecting Users to the Interconnected Transmission System.

- Power Quality
- Design Standards
- HVDC
- Protection Criteria
- Generators
- Wind Turbines
- Communications and SCADA
Operations Codes

Day-to-day procedures required to facilitate efficient, safe and coordinated operation of the Interconnected Transmission System

- Operational Planning
- Operational Security
- Emergency Operations
- Incident Reporting
- Demand Control
- System Tests
Interchange Scheduling and Balancing Codes

Sets out the procedures for the scheduling, coordination and balancing of power transfers across the Interconnected Transmission System

- Interchange Scheduling
- Balancing and Frequency Control
- Ancillary Services
Data Exchange Code

A unified listing of all data to be exchanged by EAPP and TSOs for the purpose of modelling steady state and dynamic conditions for the EAPP Interconnected Transmission System

- Power System models for different timescales
- Basic Data requirements
- Study Data requirements
- Procedures and Responsibilities for System Models
Metering Code

Sets out the way in which power and energy flows will be measured at the points of interchange between Control Areas.

- Technical, design and operational criteria
- Accuracy and calibration
- Approval, certification and testing
- Meter reading and data management
System Operator Training Code

To ensure that System Operators throughout EAPP and EAC are provided with continuous and coordinated operational training in order to promote the reliability and security of the EAPP Interconnected Transmission System.

- Responsibilities
- Basic Training
- Continuing Training
- Authorisation
POWER TRANSMISSION STANDARDS (PTS)
Development of Power Transmission Standards (PTS)

To facilitate adoption of the Interconnection Codes, EAPP engaged the service of a consultant to:

- develop a set of standards that describe what constitutes compliance with each provision of the Interconnection Code
- develop a tool to help EAPP members to identify the gaps between their desired state and their current state
- develop a tool to identify the steps needed to close the gaps, then prioritize and assign these steps
- Pilot the tools with EAPP member utilities

The standards and the tools are developed in excel spreadsheet format.
Basic File Structure for (Excel Workbooks)

- **Step 2**: One Standards Workbook for each code section
- **Step 3**: One Gap Analysis Workbook for each Responsible Party
- **Step 4**: One Action Tracker Workbook for each Responsible Party plus one action plan summary

Query for assigned standards

Query for gaps

Develop action plans to close gaps
Transmission Standards

• Are established for each of the Interconnection Codes
  – Each Interconnection Code paragraph may have multiple standards
  – Standards workbooks identify who is responsible to comply with the standard (TSO, EAPPCC, etc.)

• Contain a
  – General description of what is required to comply (from the Interconnection Code content)
  – Specific recommended evidence or measure (developed by Nexant)
A draft version of all the Transmission Standards has been distributed:

- Planning Code (PC)
- Connections Code (CC)
- Operations Code (OC)
- Interchange Scheduling and Balancing Codes (ISBC)
- Data Exchange Code (DEC)
- Metering Code (MC)
- System Operator Training Code (SOTC)
The frequency of the EAPP Interconnected Transmission System is controlled to between 49.5 Hz and 50.5 Hz (±1%) under normal operation, unless exceptional circumstances prevail. Following a system disturbance such as a load variation, the frequency band is extended to 49.0–51.0 Hz (±2%). If a major generator is tripped, a major transmission element fails or large loads are suddenly disconnected, the maximum frequency band becomes 48.75–51.25 Hz (±2.5%). If several of the contingencies mentioned previously occur simultaneously, the operating condition is labelled as extreme and the frequency can be below 47.5 Hz or above 51.5 Hz (-5%/+3%) for up to 20 seconds, and then extreme measures should be taken to restore the system. These figures are summarized in Table CC-1.

<table>
<thead>
<tr>
<th>Code Text</th>
<th>Standard</th>
<th>Measure</th>
</tr>
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</table>
| Under normal operation, the frequency of the EAPP Interconnected Transmission System shall be nominally 50 Hz and shall be controlled between 49.5 Hz and 50.5 Hz (±1%) unless exceptional circumstances prevail. Following a system disturbance such as a load variation, the frequency band is extended to 49.0–51.0 Hz (±2%). If a major generator is tripped, a major transmission element fails or large loads are suddenly disconnected, the maximum frequency band becomes 48.75–51.25 Hz (±2.5%). If several of the contingencies mentioned previously occur simultaneously, the operating condition is labelled as extreme and the frequency can be below 47.5 Hz or above 51.5 Hz (-5%/+3%) for up to 20 seconds, and then extreme measures should be taken to restore the system. These figures are summarized in Table CC-1. | The frequency of the EAPP Interconnected Transmission System is controlled to between 49.5 Hz and 50.5 Hz (±1%) under normal operation, unless exceptional circumstances prevail. If several of the contingencies mentioned previously occur simultaneously, extreme operating conditions, system frequency is returned to between 47.5 Hz and 51.5 Hz (-5%/+3%) within 20 seconds, & then extreme measures are taken to restore the system. | - Procedures for frequency monitoring and control are documented & implemented  
- Tools used to monitor and control frequency are described & implemented  
- System frequency is recorded and stored for analysis  
- When system frequency falls below 49.5 Hz or exceeds 50.5 Hz, the exceptional circumstances causing the deviations are logged & reported  
- Procedures for returning system frequency to between 47.5 Hz & 51.5 Hz following simultaneous occurrence of several contingencies are documented & implemented. The procedures describe the extreme measures to be taken to restore the system  
- When system frequency falls below 47.5 Hz or exceeds 51.5 Hz for more than 20 second, following simultaneous occurrence of several contingencies the cause of the deviation is investigated & corrective actions taken, as necessary |
## Development of Power Transmission Standards (PTS) - ctd

### Number of Standards by Entity

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<tr>
<th>Code</th>
<th>SC</th>
<th>EAPPCC</th>
<th>SCP</th>
<th>SCO</th>
<th>SCE</th>
<th>TSO</th>
<th>Gen</th>
<th>DUser</th>
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The Gap Analysis Tool

• A simple to use tool that EAPP members can use to determine the gap between their current state and the desired state
• For example:
  - **Standard:** The frequency of the EAPP Interconnected Transmission System is controlled to between 49.5 Hz and 50.5 Hz (±1%) under normal operation, unless exceptional circumstances prevail
  - **Measures:**
    • Procedures for frequency monitoring and control are documented and implemented;
    • Tools used to monitor and control frequency are described and implemented;
    • System frequency is recorded and stored for analysis;
    • When system frequency falls below 49.5 Hz or exceeds 50.5 Hz, the exceptional circumstances causing the deviations are logged and reported
Gap Analysis Tool....

• (example contd.): Gap Analysis
  – Current State:
    • Procedures for frequency monitoring and control already exist and are adequately documented
    • Tools for monitoring and controlling frequency have to be installed and are functioning but there is no mechanism to record
    • When the system frequency falls below 49.5 Hz or exceeds 50.5 Hz the reasons for frequency deviations are logged but there are no provisions for producing reports
  – Gaps:
    • System frequency is not recorded and stored for up to three years for analysis in the Control Center
    • There is no procedure to report events and send them to the EAPP when the system frequency falls below 49.5 Hz or exceeds 50.5 Hz
Action Step Tool Description

• A tool that allows EAPP members to:
  – Identify the steps to be taken to close each gap
  – Identify the entity that is responsible for taking the step to close the gap
  – Prioritize the steps to match the timing of interconnections

• Example for Gaps Identified:
  – System frequency is not recorded and stored for up to three years for analysis in the Control Center
  – There is no procedure to report events and send them to the EAPP when the system frequency falls below 49.5 Hz or exceeds 50.5 Hz
## Action Step Tool - Priority Definitions

<table>
<thead>
<tr>
<th>Priority Description</th>
<th>Priority</th>
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<tbody>
<tr>
<td>Implement prior to commencing interconnected system operation</td>
<td>1</td>
</tr>
<tr>
<td>Required for reliable system operation under normal and n-1 conditions</td>
<td>2</td>
</tr>
<tr>
<td>Required to deal with more severe and less frequent emergencies</td>
<td>3</td>
</tr>
<tr>
<td>Required to optimize economic operation and facilitate markets</td>
<td>4</td>
</tr>
</tbody>
</table>
Action Step Tool – Example Priorities

Examples for Setting Priority of Action Steps Identified:

– System frequency is not recorded and stored for up to three years for analysis in the Control Center. (Priority 2)
– There is no procedure to report to the EAPP events when the system frequency falls below 49.5 Hz or exceeds 50.5 Hz. (Priority 2)

the step followed in the development of the standards, measures and the tools to assist in the compliance process.
Pilot the Use of the Gap and Action Step Tools

- With pilot utilities (Kenya & Ethiopia)
  - Gap Analysis associated with the planned interconnection was conducted
  - an Action Step Analysis associated with the interconnection
  - Support their development of a Road Map and Implementation Plan for implementing an interconnection which fully meets the requirements of the Interconnection Code
Next Steps

- Workshop on the draft PTS to receive feedback. Participants include TSC members from utilities, regulators, national standard bodies, COMESA representatives...
- In conjunction with utilities involved with the pilot, present the tools and the pilot results to the EAPP and member utilities
- Training on PTS Gap analysis and action plan tracker tools for all utilities
- Utilities will:
  - Conduct Gap Analysis
  - Develop Road-Map & Implementation Plan
- The consultant shall support their efforts during Pilot Phase
  - Review draft materials and comment
  - Support development of Road-Map and Implementation Plan
THANK YOU

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