Presentation Goals

• **Common Gaps Observed; 2016-17**
  - Operational Readiness for EAPP Regional, Cross-Border Transmission Grid Operations

• **Mitigation Plan Implementation**
  - Capital Equipment
    • Plans & Procedures
    • Studies
Background - EAPP Interconnection Code Compliance

2012: EAPP Interconnection Codes (IC) Developed
- Technical rules necessary to ensure the East African region transmission grid is planned and operated in a reliable, secure and efficient manner.

2016: Council of Ministers Approve Implementation
- “EAPP IC Compliance Program, Stage 1 Operations”.

2016-17: Utilities Identified Gaps, Developed Mitigation Plans
- Self-assess current state of readiness for cross-border, interconnected operations utilizing IC Standard requirements.
Interconnection Code Objectives

• **Common standards** for operational security, reliability, and quality of supply in the Interconnected Transmission System of Eastern Africa

• Encourage integrated planning of generation capacity and transmission expansion

• Define responsibilities for the operation and management of the network

• Ensure that Operators are trained and authorized to take necessary actions to maintain reliable grid operation
Interconnection Code Compliance Criteria

- Transmission Systems
  * Transmission voltages of 60kV and higher

- Generators
  * 30MW plants connected to transmission systems at voltages of 60kV or higher

- Distribution Systems
  * Connected to transmission systems of voltages 60kV or higher
EAPP Interconnection Code Sections

Code Sections

- **General Conditions (GC)**
  - Glossary and Definitions
- **Connections Code**
- **Operations Code**
- **Interchange Scheduling and Balancing Code**
- **System Operator Training Code**
  - Planning Code
  - Data Exchange Code
  - Metering Code

*Legend: *Stage 1 & Stage 2*
Standards and Measures

For each Code requirement, standards and measures are developed:

- **Standards**: describes the Code requirements

- **Measures**: describes what is required and the recommended evidence to demonstrate compliance
## IC Standard Example

<table>
<thead>
<tr>
<th>Code</th>
<th>Standard #</th>
<th>Standard</th>
<th>Measure</th>
<th>Phase</th>
</tr>
</thead>
</table>
| 05 OC| OC-123     | Each TSO establishes plans for Automatic Load Shedding for underfrequency and undervoltage conditions. | i) Each TSO has plans for Automatic Load Shedding for underfrequency and undervoltage conditions.  
   - ii) Controls and instrumentation are installed and tested to enable automatic load shedding plans when needed.  
   - iii) Details of the Automatic Load Shedding plans and any constraints to their implementation are documented and communicated to EAPP CC. | 1     |
EAPP Interconnection Code Guidelines

Supplement to the Interconnection Codes to clarify the standard’s requirements and measures:

- Off-Nominal Frequency Planning
- Governor Response Settings
- Automatic Generation Control Requirements
- Emergency Plans for Capacity or Energy Shortages
- Emergency Manual Load Shedding Plan
- Operational Planning Procedures
- Synchronization Capability
- Power System Stabilizer Capability
- Out-of-Step Protection Capability
- System Restoration and Black Start
Stage 1 - Standards Needed for Initial Cross-Border Operations

A. Monitor and Control Frequency
   A1. Off Nominal Frequency Plan
   A2. Primary Response and Governors
   A3. Secondary, Tertiary Response and AGC

B. Monitor and Control Voltage

C. System Protection Requirements & Coordination
Stage 1 - Standards Needed for Initial Cross-Border Operations

D. Operational Planning, Coordination & Communication
   D1. Interchange Schedules
   D2. Transfer Capabilities
   D3. Outage Planning

E. Emergency Plans

F. Lines of Communications; Neighboring TSO’s

G. Operator Training
Responsible Entities

An entity that has responsibility for complying with part or all of a given standard

- Transmission System Operator
- Generator User
- Distribution User
- EAPP
  - EAPP Steering Committee
  - EAPP Permanent Secretariat Coordination Centre
  - Independent Regulatory Board
  - Code Review Panel
  - Subcommittee on Operations
  - Subcommittee on Planning
  - Subcommittee on the Environment
Implementation Process

- **Self-Assessment, - Utilities**
  - TSO, Generation, Distribution
  - Identify Gaps in EAPP IC Standard compliance
  - Develops Plans to Close Gaps

- **Validate Utility Gaps, - EAPP & Power Africa**
  - Review Utility Self-Assessment Findings
  - Validate Gaps
  - Mitigation Plans to Close Gaps Developed

- **Implement Mitigation Plans - Utilities**
  - Develop detailed Project Plans
  - Coordinate w/ EAPP Committees
  - Complete Project Plans
Existing & Planned Interconnectors
Gradual Transition from Islands to Regional Interconnectors

2018

DRC

SUD

S.S.

UG

RW

BR

ET

KE

TZ

Connectivity limited to ET-SUD and UG-KE

2022

DRC

SUD

S.S.

UG

RW

BR

ET

KE

TZ

Zb (SAPP)

Full regional interconnectivity and to SAPP
Common Fundamental Issue Observed
- Which Codes to Follow?

Country “A”
National Grid Codes

Country “B”
National Grid Codes

EAPP Interconnection Codes
Mitigation Plans

Plans that address any gaps identified during the Gap Analysis:

- The Plan must include what needs to be done, by whom, and by when
- For equipment needed, the estimated capital cost shall be included
Mitigation Plan Implementation – by Type

* Aggregate of Member’s Validated Gaps
## Similar Mitigations Needed by Members

### - Capital Equipment

<table>
<thead>
<tr>
<th>Operating Category</th>
<th>Function</th>
<th>* Level of Effort</th>
<th>** Cost Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Off-Nominal Frequency Plan (aka UFLS)</td>
<td>TSO / DUser</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>2. Secondary Response; Automatic Generation Control</td>
<td>TSO / GUser</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>3. Voltage Monitoring &amp; Control</td>
<td>TSO / GUser</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>4. System Protection</td>
<td>TSO/ GUser / DUser</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>5. Primary Response; Generator Governors</td>
<td>GUser</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>6. Communication Links; Fiber Optics</td>
<td>TSO</td>
<td>High</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Level of Effort:** Qualitative estimate of the labor and skill required to complete.

**Cost Impact:** Rough estimate of the cost to mitigate gaps.
- **Medium** = $500,000 - $4,999,000
- **High** = > $5,000,000
THANK YOU

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