

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

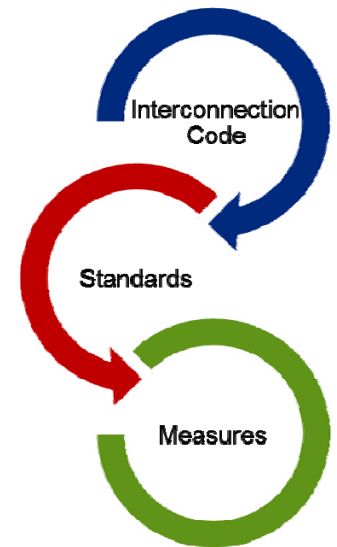


* Legend: **Stage 1** & Stage 2

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



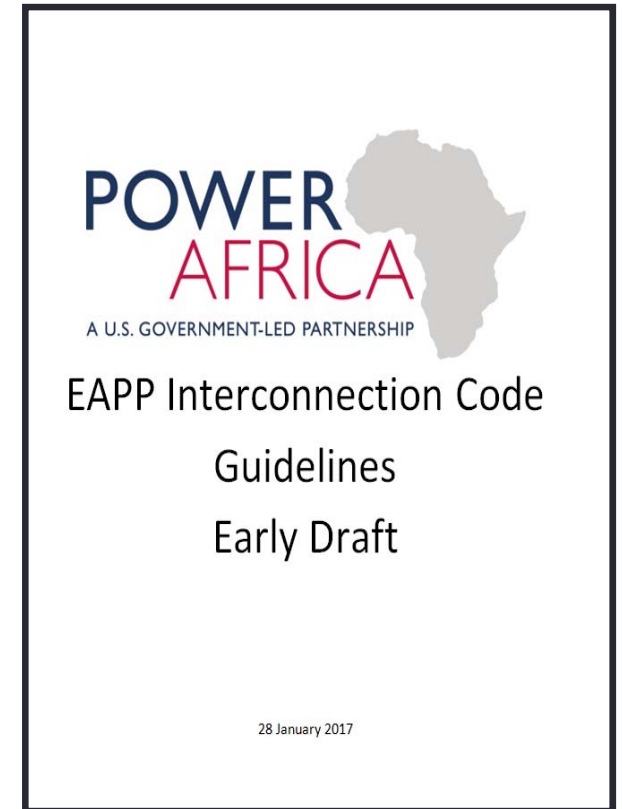
IC Standard Example

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

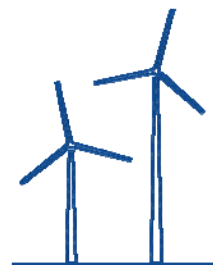
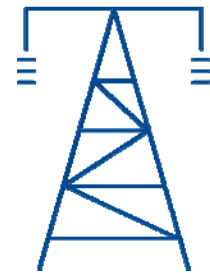
G. Operator Training



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

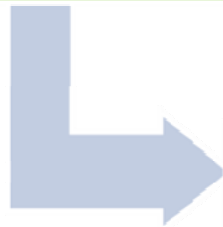


Implementation Process



- **Self-Assessment, - Utilities**

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



- **Validate Utility Gaps, - EAPP & Power Africa**

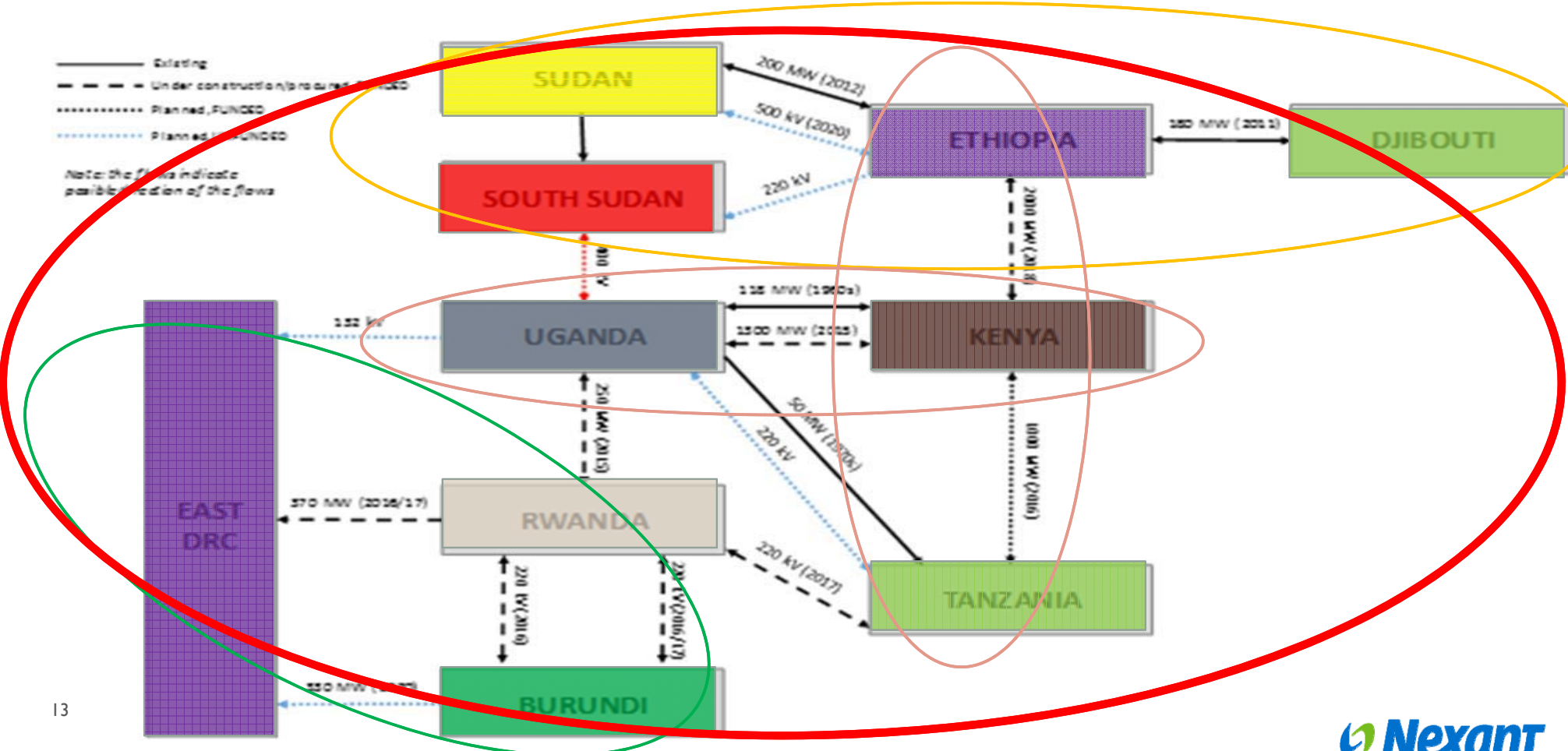
- Review Utility Self-Assessment Findings
- Validate Gaps
- Mitigation Plans to Close Gaps Developed



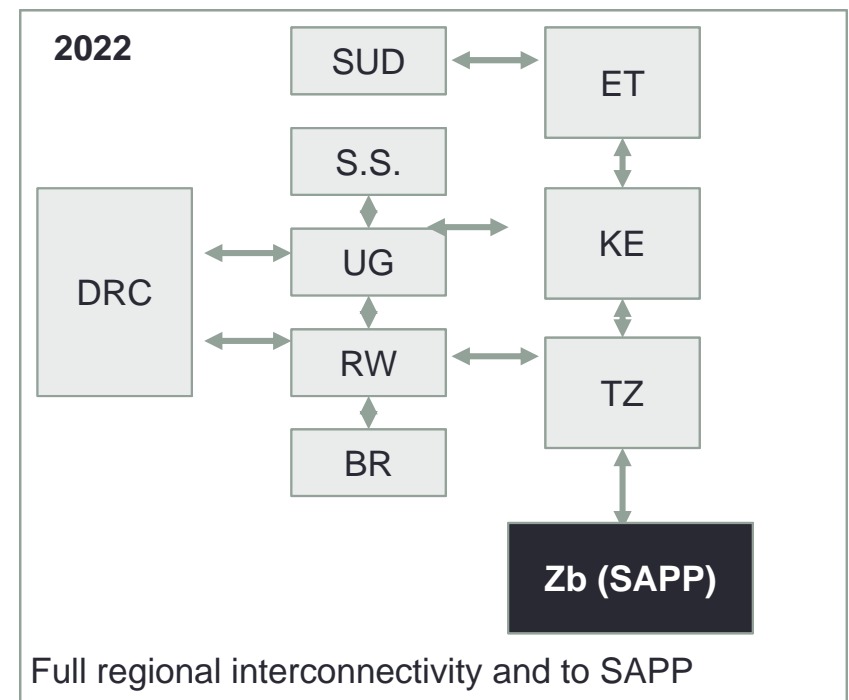
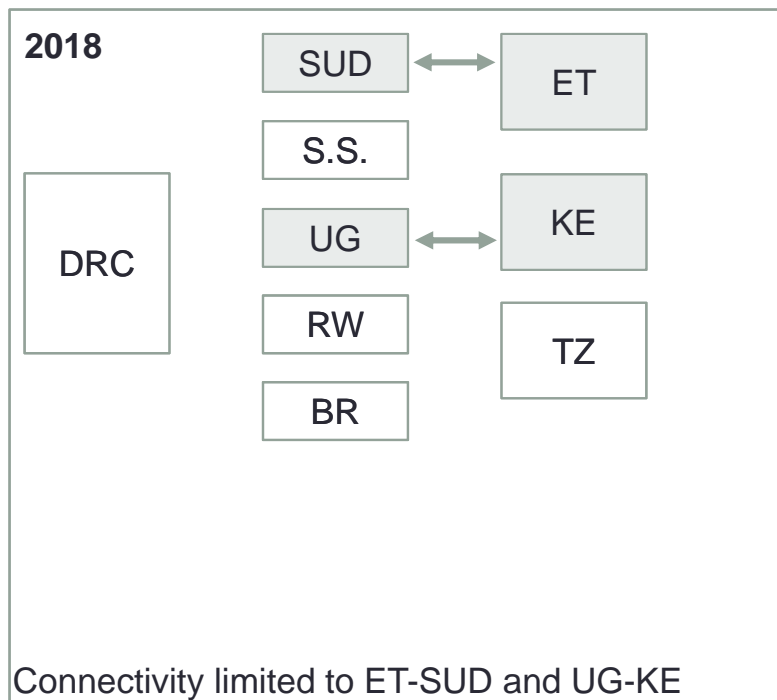
- **Implement Mitigation Plans - Utilities**

- Develop detailed Project Plans
- Coordinate w/ EAPP Committees
- Complete Project Plans

Existing & Planned Interconnectors

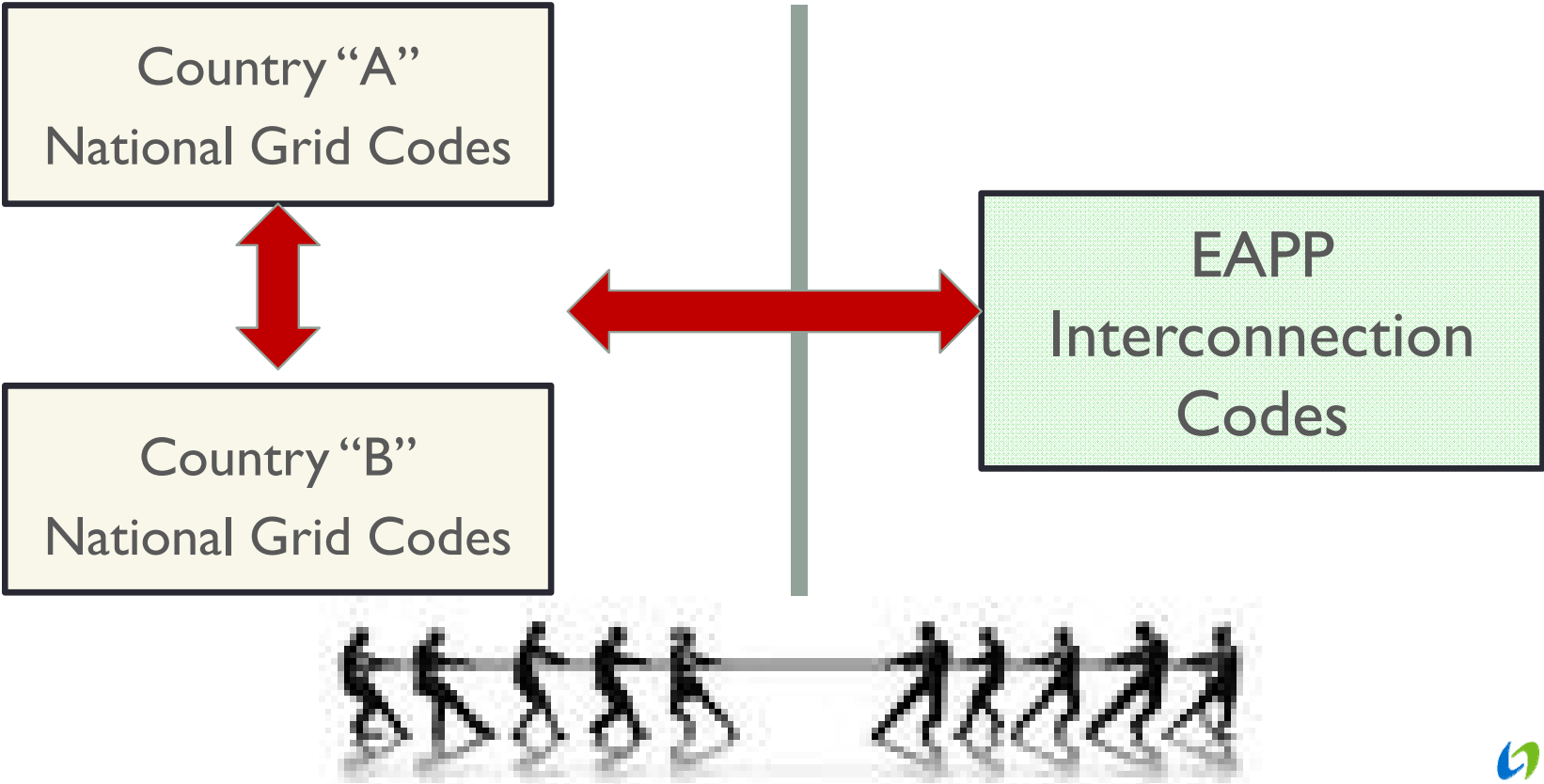


Gradual Transition from Islands to Regional Interconnectors



Common Fundamental Issue Observed

- Which Codes to Follow?



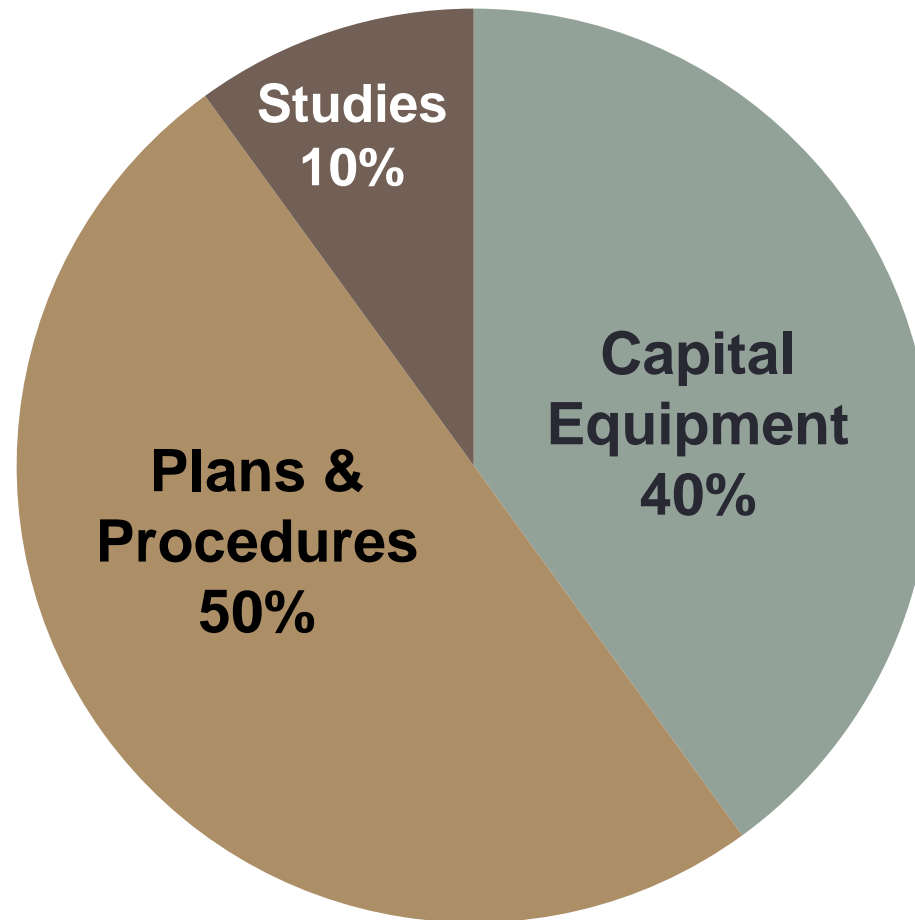
Mitigation Plans

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



17

** Aggregate of Member's Validated Gaps*

Similar Mitigations Needed by Members - Capital Equipment

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

* **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

Bob Stuart, Nexant
Power System Operations Subject Expert

