

Power System Testing

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Overview



- Motivation
- Classical Approach
- Objectives, Approach and Outcome
- Methodology
- Background

Motivation



- Challenges in the transition from a passive distribution grid to an integrated, smart system
 - Growing complexity in grid operation
 - Interdependencies of market roles and power/ ICT convergence
 - Multiple actors and objectives in grid operation

- How can risks minimized and safe system operation verified?

Classical approach and questions raised: component and field testing

■ Component testing for grid code compliance

- Behavior of a single device under standardized grid conditions
 - » How to test interaction and interoperability?
 - » How to consider high penetration scenarios?

■ Field testing

- Testing under normal operation with given use patterns
 - » Testing of a variety of use patterns possible only for a variety of different test locations
 - ➔ very costly and time demanding
 - » Testing of failures or extreme situations is difficult, if not impossible

Objectives, approach and outcome

Objectives

- Categorize testing tasks in future power systems
- Map testing tasks to existing testing capabilities and facilities
- Define the needs for development

Approach

- Select a set of relevant use cases
- Specify the testing needs
- Describe the testing activities/ procedures
- Derive the necessary testing capabilities
- Map the capabilities to state-of-the-art testing facilities
- Describe possible gaps

Out-come

- Common view on future testing needs in power systems
- Guideline for laboratory developments

Objectives, approach and outcome

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 - Describe possible gaps
- Provision of flexibility to the grid
 - Massive OLTC MV-LV Transformer deployment
 - Dynamic grid support
 - High penetration of power electronics
 - **Emergency, Blackout and Restoration testing procedure**

Out-come

- Common view on future testing needs in power systems
- Guideline for laboratory developments

Approach and Methodology



- Workshops to define future system testing tasks
 - Power System Testing Workshops

- Description of exemplary test use cases
 - Description of necessary testing capabilities
 - **Emergency, Blackout and Restoration testing procedure**

- Mapping of the capabilities to state-of-the-art testing facilities
 - Testing facilities within DERlab and ISGAN/ SIRFN

Following the approach:

- Select a set of relevant use cases ←
- Specify the testing needs
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USE CASE:

- *Emergency, Blackout and Restoration testing procedure*

Background

- **The Network Code on Emergency and Restoration (NC ER) is a key factor for ensuring security and continuity of electricity supply across Europe, as it deals with the procedures and remedial actions to be applied in the Emergency, Blackout and Restoration states. This involves preparation of system defence, system restoration and re-synchronisation plans in advance, dealing with information exchange, procedures for operating when a system enters into one of these states and ad-hoc analysis of the incidents.**

According to NC ER:

“The aim of the Restoration Plan is to restore the system to Normal State as fast as possible. Each TSO will design a Restoration in consultation with relevant DSOs, Significant Grid Users, neighbouring TSOs and Synchronous Area TSOs. This plan shall include procedures for re-energisation, for frequency management, for re-synchronisation and for communication.”

“Article 49 - Compliance testing and periodic review of Restoration Plan

1. Each TSO shall test measures of its Restoration Plan based on computer simulation, using data from DSOs identified pursuant to Article 21(8) and Restoration Service Providers, at least every five years. The TSO shall define these simulation tests in a dedicated testing procedure covering at least:

- a) energising restoration path from Restoration Service Providers with Black Start or Island Operation capabilities;
- b) the supply of Power Generating Modules main auxiliaries;
- c) Demand reconnection process; and
- d) process for Resynchronisation of Networks in Island Operation.”

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- Emergency, Blackout and Restoration testing procedure
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■ Describe the testing activities/ procedures

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- Describe the testing activities/ procedures

- **Derive the necessary testing capabilities**

- Map the capabilities to state-of-the-art testing facilities

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Thank You!



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