Electricity Distribution

nationalgrid

Company Directive

POLICY DOCUMENT: DSO3/0

Electrical Modelling and Analysis

Summary

This directive sets requirements for modelling and analysis of NGED's electricity networks and the wider electrical systems they form part of. Modelling and analysis for the assessment of Low Voltage networks are outside of the scope of this directive.

Author: **Stephen Quinn**

Implementation Date: **July 2024**

Approved by

Benjamin Godfrey
Director of Distribution System Operator

Date: **23rd July 2024**

Target Staff Group	**DSO directorate, IT&D CNI department, Network Design department, Control Centre, planning and design staff in Field Operations**
Impact of Change	**Amber: introduces formal governance of electrical modelling and analysis but does not make major changes to existing custom and practice.**
Planned Assurance checks	**Review implementation with the Head of Modelling and Analysis and the Primary System Modelling and Analysis Manager.**

IMPLEMENTATION PLAN

Introduction

This directive sets requirements for modelling and analysis of NGED's electricity networks and the wider electrical systems they form part of. Modelling and analysis for the assessment of Low Voltage networks are outside of the scope of this directive.

Main Changes

This is a new directive.

Impact of Changes

Target Staff Group	**DSO directorate, IT&D CNI department, Network Design department, Control Centre, planning and design staff in Field Operations**
Impact of Change	**Amber: introduces formal governance of electrical modelling and analysis but does not make major changes to existing custom and practice.**

Implementation Actions

Managers of the target staff group shall brief their staff. They may request assistance with briefing from the author.

Implementation Timetable

This directive shall be implemented from the date of issue.

REVISION HISTORY

DOCUMENT REVISION & REVIEW TABLE			
Issue	**Date**	**Comments**	**Author**
0	08/07/2024	Initial issue of POL:DSO3	Stephen Quinn

CONTENTS

1.0 INTRODUCTION

Electrical analysis is required to assess capabilities, safety and behaviours in the planning, design and operation of the distribution system.

Analysis requires suitable models of NGED's electricity distribution network and the wider electrical system it forms part of, including:

1. Adjacent transmission, distribution and customer networks, and

2. Demand, generation and electricity storage connected to all of these networks.

1.1 About the Distribution System Operator

National Grid Distribution System Operator (**the DSO**) is a directorate of National Grid Electricity Distribution. It was created to fulfil the roles of the Distribution System Operator identified by Ofgem in the ***DSO Incentive Governance Document***[1].

The DSO comprises the following departments:

- **Modelling and Analysis**, responsible for:
    - The provision of network models based upon DNO and third-party data, derived datasets, and network analysis tools; and
    - Management of the transmission impact of distribution connections, including Statement of Works.
- **System Planning**, responsible for forecasting customer load and strategic planning of the primary and secondary distribution system.
- **Commercial and Operability**, responsible for the commercial and operational aspects of using Flexibility Services to alleviate distribution system constraints. This department incorporates the **Energy Management Centre**, whose remit and responsibilities are set by this directive.
- **DSO Strategy and Stakeholder Engagement**, responsible for communicating the purpose and direction of DSO to internal and external stakeholders.

More information about the DSO can be found at:

- https://sharepoint.westernpower.co.uk/sites/wpd/dso/public/SitePages/Distribution-System-Operator---DSO.aspx (internal only)
- https://www.nationalgrid.co.uk/dso (external)

[1]Implemented via special condition 4.8 of the Electricity Distribution Licence, published at https://www.ofgem.gov.uk/publications/decision-proposed-modifications-riio-2-electricity-distribution-licences in Associated Documents.

1.2 Interpretation

Where the term “should” is used in this directive it means the provision is a recommendation, which is normally followed. The term “may” is used to express permission. Where the term “shall” or “must” is used in this document it means the provision is mandatory, which must be followed.

Technical terms used in this directive are defined in the DSO Glossary, which is available internally at

https://sharepoint.westernpower.co.uk/sites/wpd/dso/public/Lists/DSO%20Glossary.

The following key terms are repeated here for convenience:

Term	Definition	Notes
Analysis	Electrical calculations performed upon a **Model**	
Commissioned	Including all permanently installed plant and mains, in their **Intact** configuration.	Also known as Connected. Temporary connections and prevailing running arrangements are not included.
Committed	**Commissioned**, with the addition of: 1. Accepted connection and diversion offers, including any associated reinforcement 2. Reinforcement that has been granted approval to initiate by DSO System Planning 3. asset replacement and network rationalisation that have been granted approval to initiate by Asset Management	Also known as Accepted. The approval to initiate gate is subject to change as the Grid Way programme is implemented in the coming months
Control Phase	The period 0-24 hours inclusive ahead of real time operation. The Control Phase follows on from the Programming Phase and covers the period down to real time.	For the avoidance of doubt, this includes the period of real-time operation.

Term	Definition	Notes
Intact	With open points in their normal position and without any outages that are material to the condition being considered or studied.	
Master Model	A centrally maintained **Model** representing a defined position.	
Model	A representation of the topology, impedance, capabilities and inherent behaviours of an electrical system.	
Offline	For use outside of the **Control Phase**	This encompasses both: • **System Planning** and **Network Design** applications, and • Operational applications in the periods before and after the **Control Phase**: o **Operational Planning Phase** o **Programming Phase** o **Post-Control Phase**
Online	For use in the **Control Phase**	**Online** systems are typically used by Control Engineers or form part of Load Management Schemes such as Active Network Management.

Term	Definition	Notes
Primary Distribution	The parts of the distribution system including and upstream of the switchgear on the lower voltage side of each Primary Substation.	In NGED this covers all elements of the 132 kV, 66 kV and 33 kV networks. The 11 kV or 6.6 kV switchgear of each Primary Substation is the interface between Primary Distribution and Secondary Distribution, and is considered to form part of both systems. As such, it is the joint responsibility of Primary and Secondary system planners.

2.0 SCOPE

This directive and its subordinate Standard Techniques set requirements for modelling and analysis of NGED's electricity networks and the wider electrical systems they form part of.

2.1 Low Voltage Networks

Modelling and analysis for the assessment of Low Voltage networks are outside of the scope of this directive, and remain under the authority of the Head of Engineering Policy.

Note: The use of Connect/LV software for the planning and design of Low Voltage networks is documented in ST: SD5H.

3.0 APPROVAL OF SUBORDINATE STANDARD TECHNIQUES

The Head of Modelling and Analysis may approve Standard Techniques subordinate to this Policy Directive (i.e. those in the DSO3 series) on behalf of the Responsible Executive Manager of the DSO suite.

4.0 GENERAL REQUIREMENTS

Master Models and tools and techniques related to **Models** and **Analysis** shall comply with the requirements of this directive and its subordinate Standard Techniques. Where specific requirements are not set,

4.1 Variations

Where any difficulty is encountered with the application of this directive, the authors shall be notified, who will consider whether to recommend a variation to the Responsible Executive Manager of the DSO suite.

5.0 REQUIREMENTS FOR OFFLINE MODELS AND ANALYSIS

5.1 Roles

The Head of Modelling & Analysis has authority over **Offline Master Models** and tools and techniques related to **Offline Models** and **Offline Analysis**.

The Primary Modelling & Analysis Manager is responsible for **Offline Master Models** of the **Primary Distribution System** and tools and techniques related to **Offline Models** and **Offline Analysis** of the **Primary Distribution System**.

Where relevant requirements for **Offline Models** and **Offline Analysis** are not set by this directive or its subordinate Standard Techniques, network modelling techniques, analysis tools and analysis techniques shall be subject to the approval of:

- The Head of Modelling and Analysis; or
- For the assessment of the **Primary Distribution System**, the Primary System Modelling and Analysis Manager.

5.2 Offline Master Models

5.2.1 Primary Distribution System

The Primary System Modelling and Analysis team shall maintain **Offline Master Model**s of NGED's 33kV, 66kV and 132kV networks reflecting the following positions:

1. **Commissioned**
2. **Committed**

Updates to each of these **Offline Master Model**s shall be made within three months of the necessary data becoming available.

5.2.2 Secondary Distribution System

The Secondary System Modelling and Analysis team shall maintain **Offline Master Model**s of NGED's 6.6kV and 11kV networks reflecting the **Commissioned** position.

Each of these **Offline Master Model**s shall be updated from the latest available data at least once every three months.

5.2.3 Source Data and Accuracy

The **Offline Master Model**s shall be kept up-to-date at the positions described in 5.2.1 and 5.2.2 insofar as is reasonably practicable.

The Asset Management directorate shall provide data necessary to model newly commissioned plant and mains within one month of commissioning.

The Field Operations directorate shall provide data necessary to model newly accepted connection offers within one month of acceptance.

Insofar as is reasonably practicable, data shall be sourced via the primary information systems defined in POL: AM4.

Where data required for the **Offline Master Model**s cannot be sourced, conservative assumptions may be made. All assumptions shall be clearly documented for users of the models.

5.2.4 External Elements

The **Offline Master Model**s shall include direct modelling or equivalents of the following external elements insofar as is necessary for the analysis and assessment of the modelled networks:

1. Other NGED networks
2. Transmission networks
3. Other Authorised Distributor networks
4. Customer networks
5. Demand
6. Generation
7. Electricity Storage

5.2.5 Approved Applications

The **Offline Master Model**s shall be suitable for the following **Offline** applications:

1. Load-flow assessment of steady state flows and voltages
2. Voltage step-change assessment
3. Switchgear short-circuit duty assessment
4. Network reduction to create equivalents for use in **Offline Models** of adjacent networks

The **Offline Master Model**s may also be used for the following **Offline** applications with the addition of application-specific data by users:

1. Determination of protection settings
2. Power quality assessment
3. Earthing assessment
4. Transient and dynamic analysis

These models shall not be used for any other applications, including **Online** applications, without the approval of the Head of Modelling and Analysis or their designate.

6.0 REQUIREMENTS FOR ONLINE MODELS AND ANALYSIS

Online *systems are typically used by Control Engineers or form part of Load Management Schemes such as Active Network Management.* ***Online Analysis*** *of NGED's distribution* ***System*** *is a new and rapidly developing subject. This directive sets initial policy, but is not comprehensive and is likely to change in due course.*

6.1 Roles

The Critical National Infrastructure Manager has authority over **Online Master Models** and tools related to **Online Models** and **Online Analysis**. They are supported by the Head of Modelling and Analysis regarding electrical engineering matters.

Where relevant requirements for **Online Models** and **Online Analysis** are not set by this directive or its subordinate Standard Techniques, network modelling techniques, analysis tools and analysis techniques shall be subject to the approval of the Critical National Infrastructure Manager, who shall consult the Head of Modelling and Analysis regarding electrical engineering matters.

6.2 Online Models

Insofar as is reasonably practicable, **Online Models** shall reflect the **Commissioned** system as modified by all prevailing:

- Temporary connections
- Outages
- Running arrangements
- Loading

Insofar as is reasonably practicable, **Online Models** shall be updated as frequently as is necessary to prevent incorrect decisions or actions being taken on the basis of the outputs of any **Online Analysis** that uses those **Online Models**.

It would typically be necessary to update ***Online Models*** *within a few minutes of real time to meet this requirement. In some cases, it could be appropriate to delay commissioning of plant and mains or not make temporary connections until the affected* ***Online Model*** *can be updated to reflect them.*

6.3 Online Analysis

Insofar as is reasonably practicable, **Online Analysis** tools shall be sufficiently robust and produce outputs sufficiently quickly to prevent any incorrect decisions or actions being taken on the basis of their outputs or in the absence of their outputs.

APPENDIX A: SUPERSEDED DOCUMENTATION

This is a new document and no document is superseded by its issue.

APPENDIX B: RECORD OF COMMENT DURING CONSULTATION

POL: DSO3/0 – comments

APPENDIX C: KEYWORDS

Model, modelling, analysis, assessment, DSO, Distribution System Operator, PSSE, IPSA, PowerFactory, PSS Sincal