Tutorial 5

Short Circuit Currents on Distribution Systems

Background

In order to achieve the ambitious UK government carbon reduction targets the distribution system is observing a vast increase in the amount and number of distributed generators (DG) connected to it. A key consideration when connecting DG is the effect on the system short circuit current (SCC), whereby the additional contribution from generation can overstress equipment on the distribution system.

The £17m (€20m) Low Carbon Networks Fund (LCNF) project, FlexDGrid, has focussed on calculating, measuring and mitigating the effect of SCC contributions from DG in Birmingham, UK.

Aim of the tutorial

The tutorial will focus on the learning to date of new and updated tools and technologies; centring on the improvements to power system analysis modelling capability and understanding advancements in real-time monitoring and experiences of using technologies for mitigation of SCCs.

This tutorial provides participants a complete overview in the advancements in SCC modelling, monitoring and mitigation. The tutorial will explore the improvements that can be made on the distribution system by applying these advancements as well as the potential commercial benefits of employing these new engineering techniques.

Content

1. Introduction
   - Introduction of speakers
   - Overview of SCC and the impact on the distribution system
   - Introduction of FlexDGrid: aims and objectives

2. Modelling Short Circuit Currents
   - Traditional modelling methods
   - Advantages of more granular modelling
   - The expected change in SCC at different voltage levels due to Low Carbon Technologies uptake
3. Real-time monitoring of Short Circuit Currents
   - Benefits of monitoring data
   - Monitoring technology description
   - Results and accuracy of monitoring technology
   - Using monitoring data to better understand system characteristics
   - Active Network Management using monitoring data

4. Mitigation of Short Circuit Currents
   - Overview of FCL technologies
   - Solutions for connecting FCLs to the distribution system
   - Considerations when connecting FCLs
   - Performance of FCLs
   - Modelling FCLs for SCC calculations

5. Discussion

Expected benefits

Participants will gain a detailed understanding of:
   - Description of Short Circuit Currents and the impact on the Distribution System
   - How advanced modelling methods can be used to improve understanding of Short Circuit Currents
   - How monitoring data can be used to improve system models and advance customer connection options
   - Technologies and methods that can be used to mitigate Short Circuit Currents

Who should attend?

This tutorial is intended for all stakeholders (network distributors, equipment manufacturers, distribution generation developers, consumers and regulators) who want to increase their knowledge of the effects of DG integration with respect to SCC and how these can be addressed through the latest developments in modelling, monitoring and mitigation.

Support material

Copies of presented slides will be handed out.

About the presenters

Jonathan Berry (jberry@westernpower.co.uk)

Jonathan Berry is an Innovation and Low Carbon Networks Engineer at Western Power Distribution, a UK Distribution Network Operator. He has been working in the UK distribution network industry for over 10 years. For the last five years Jonathan's attention has been on developing and delivering projects
focusing on the design and installation of new technologies to support the integration of future Distributed Generation (DG) connections on the distribution network. Prior to this, his work centred on the design and delivery of DG connections between five and 100MW to the distribution system. Jonathan was the Project Manager and overall Technical Lead for FlexDGrid; ensuring the technical and commercial solutions developed were suitable for adoption across the UK.

Ali Kazerooni (Ali.Kazerooni@pbworld.com)

Ali Kazerooni is a Chartered Principal Engineer at an international engineering consultancy firm, WSP. He has been working on various power systems study projects in transmission and distribution networks for over 14 years. Ali has been heavily involved in supporting UK DNOs with various innovation projects during the last four years. He was the technical lead for power system studies in FlexDGrid and he led a team to enhance network modelling process for fault level calculation studies. He also worked on a methodology to develop a fit-for-purpose model for Fault Current Limiter (FCL) technologies trialled in FlexDGrid. Ali has been author and co-author of technical papers in various international journals and conferences.

Neil Murdoch (neil.murdoch@pbworld.com)

Neil Murdoch is a Principal Engineer and Distribution Team Leader at an international engineering consultancy firm, WSP. Before joining WSP, he worked for five years at Scottish and Southern Energy Networks as a System Planning Engineer. He has worked as a consultant and advisor on a number of projects on electricity distribution networks across the globe, including networks in the Middle East and Africa. More recently, he has led the engineering team designing and installing FCLs as part of the Low Carbon Networks Fund project, FlexDGrid. The connection of the FCLs has increased the fault level capacity on the 11kV network in Birmingham, UK. Neil was also the co-author of the paper at CIRED 2015 titled “Standardised Connections and the Economic Benefits of Fault Current Limiters on Distribution Networks”.

Paul Edwards (edwardsp@pbworld.com)

Paul Edwards is a Senior Distribution Engineer at an international consultancy firm, WSP. He has worked with various UK Distribution Network Operators, studying new generation connections, managing the delivery of connections and designing protection schemes for both capital and new connection projects. Recently, he led the engineering team on the design and installation of Fault Level Monitors as part of the
Low Carbon Network Fund Project, FlexDGrid. The knowledge gained from
the connection of the fault level monitors has been used to develop the
understanding of fault levels on the 11kV network in Birmingham. Paul was the co- author of a paper at the 2016 CIRED Workshop
and author of the paper "Characterisation of 11kV Fault Level Contributions
Based on Substation Load Profile" at this year’s CIRED Conference.