Management of Voltages in LV Networks

Progress Report

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1 Executive Summary

This report details the progress of the project titled 'Management of Voltages in LV Networks' funded by the ENA/API and undertaken by the University of Wollongong (UOW) in conjunction with a consortium of Australian Distribution Network Service Providers (DNSPs). The original project scope called for modelling of a finite number of 'typical' low voltage (LV) distribution networks. However, shortly after project commencement, it became clear that the application of such models would be limited as the wide variation in LV network topologies across DNSPs precluded effective identification of 'typical' networks. Consequently, a change of scope was requested of the industry partners (i.e., the consortium of DNSPs) such that the project develop a highly flexible modelling tool that could be applied to a wide range of LV network topologies. This change of scope, being directly beneficial to the industry partners, was endorsed by the DNSPs directly involved in the project and was also approved by the ENA asset management committee.

An effective project team has been established incorporating both UOW and DNSP staff. The project team meets regularly to discuss the progress and roadblocks, if any. Also, knowledge sharing systems have been established, especially for team members to share relevant project related information. Significant progress has been made on the design and implementation of the network modelling tool that has become the main project outcome.

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2   Introduction

This report details the progress of the project (till date) titled 'Management of Voltages in LV Networks' funded by the ENA/API and undertaken by the University of Wollongong in conjunction with a consortium of Australian Distribution Network Service Providers (DNSPs).

2.1   Change of Project Scope

The original project scope called for modelling of a finite number of 'typical' low voltage (LV) distribution networks. Shortly after project commencement, it became clear that the application of such models would be limited as the wide variation in LV network topologies across DNSPs precluded effective identification of 'typical' networks. Consequently, a change of scope was requested of the industry partners such that the project develop a highly flexible modelling tool that could be applied to a wide range of LV network topologies. This change of scope, being directly beneficial to the industry partners, was endorsed by the DNSPs directly involved in the project and was also approved by the ENA asset management committee.

3   Project Progress

Overall, the project has been progressing well. OpenDSS has been selected as a software platform for modelling and tool development purposes. A Microsoft Excel graphical user interface (GUI) has been developed to communicate with the OpenDSS program in order to allow user input and provide graphical output of the simulation results.

As of the end of the July 2019, the modelling tool has the following capabilities:

- o It can construct networks consisting of three-phase and single-phase lines including the neutral conductor (3-phase 4-wire and 1-phase 2-wire lines).
- o It allows users to select from a number of different overhead conductor and underground cable types.
- o It allows users to enter the customised data for conductors and tower geometry
- o It allows users to include multiple loads, solar PV systems and energy storage systems at any bus in the network.
- o It allows users to modify the neutral grounding impedance at the distribution substation and load connections.
- o It can draw (i.e., provide a graphical representation) the schematic diagram of a network that the user is building.
- o It allows users to run either snapshot or time-series simulations with time varying loads and generation and varying stiff voltage at the distribution transformer.
- o It can export simulation results and the network plot with minimal user input.
- o It gives the option for voltage management using:
  - PV inverter control (volt/var or volt/watt)
  - On-load tap changer at the distribution substation
  - LV regulators (three-phase and single-phase)

The documentation (manual) for the modelling tool is currently being updated to include the latest capabilities of the tool with more detailed explanation of each network component.

4   Next Steps

Following the project plan, the next steps for this project involve:
- o   Inclusion of energy storage (battery) control
- o   Inclusion of DSTATCOM
- o   Inverter testing in the laboratory
- o   Verification of the proposed tool using a realistic network
- o   Developing an option to make more user-friendly simulation output
- o   Second beta release of the proposed tool (to be made available to the industrial partners) on 9th August 2019

5   Conclusions

This document reports the progress of the project titled 'Management of Voltages in LV Networks' undertaken by University of Wollongong in conjunction with a consortium of Australian DNSPs (industry partners). The report highlights the latest project updates and lists the next steps for the project. The project is progressing well and within schedule.

6   Appendix

6.1   Project Plan

Table shows the agreed project plan for the remainder of the project.

Table 7.2: Project Plan

Timeframe	Activities/Tasks	Responsibilities
July – Sept 2019	- Inverter testing in the laboratory - Addition of more voltage management strategies to the modelling tool including energy storage	UOW
Aug 2019	- Second beta release of the modelling tool to industry partners - Face to face meeting	All
Sept – Dec 2019	- Completion of modelling tool development - Validation of modelling tool by UOW team and industry partners - Cost benefit analysis	All
Dec 2019 - Jan 2020	Report writing	UOW

6.2   Endorsement by Participating Members

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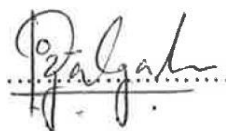
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