



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**INVESTIGATION ON SMART GRID OF GENERATION,
TRANSMISSION AND DISTRIBUTION WITH
INTERFACE OF SCADA FOR POWER LAB LABSOFT**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology Industrial Power with Honours.

by

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology Industrial Power with Honours. The member of the supervisory is as follow:

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ABSTRAK

Implimentasi terhadap Grid pintar menawarkan jalan penyelesaian untuk membuatkan utility handal dalam mengatasi masalah permintaan pengeluaran tenaga yang tinggi dan memberikan pelbagai kebaikan kepada masyarakat, sekuriti dan kualiti penjana kuasa system. Walaupun bagaimanapun, gambaran mengenai Grid Pintar kurang jelas. Thesis ini akan menyiasat pengetahuan am tentang grid pintar dalam konteks generasi, penghantaran and pengedaran dengan menggunakan SCADA for Power Lab oleh Lucas Nulle. Sistem latihan Lucas Nulle memberi peluang untuk mendemostrasikan dan menaplikasikan gambaran Grid Pintar dengan lebih jelas dalam konteks grafik dan praktikal. Eksperimen ini dilakukan dengan persediaan yang diperlukan untuk mengabungkan sumber tenaga dan pengguna untuk menyiasat hubungan asas tentang grid pintar. Untuk menjalani eksperimen ini, lukisan grid mudah telah dibina menggunakan perisian SCADA For Power Lab interaksi dengan LN Trainer. Hasil eksperimen menunjukkan bahawa perisian SCADA For Power Lab bekerja dengan baik dalam mengawal dan memantau Grid Pintar dalam generasi, penghantaran and pengedaran system jana kuasa.

ABSTRACT

Smart grid implementation offers a solution to make the utility better handle demand and deliver various potential benefits to society security and quality of the power system. However, the majority of these activities emphasized only the distribution grid and the big picture of the transmission grid in content of smart grid are unclear. This paper will yield a general practical knowledge on smart grid of generation, transmission and distribution using the Lucas Nulle training system to contribute knowledge. Lucas-Nulle (LN) training system gives opportunities to demonstrate and convey the technological content of smart grid in a graphic and practice-oriented. To achieve this study, a simple grid design consist busbar circuit have been built using SCADA for Power Lab interfacing LN Trainer. Both the parameter such as current, voltage, power and reactive power are monitored remotely via SCADA simulation that allows the coordination between power demand and generation with different transmission lines and star/delta configuration linked with LN Trainer to give better understanding. The experimental results show that the SCADA for Power Lab works properly in the monitoring and controlling the Smart Grid of generation, transmission and distribution.

DEDICATION

To my beloved parents, mama and abah

All my friends,

Naufal, Nadhirah, Zalifa, Farra, Adibah, Amirah, Afiqah

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LIST OF ABBREVIATIONS

DRM	-	Demand Response Management
DSM	-	Diagnostic and Statistical Manual
EMS	-	Energy Management System
GHF	-	Greenhouse Gases
HMI	-	Human Machine Interface
ICT	-	Information and Communication Technology
ISR	-	Internal Storage Retrieve
MTU	-	Master Terminal Unit
PQRAS	-	Power quality, Reliability, Availability and Security
RTU	-	Remote Terminal Unit
SCADA	-	Supervisory Control and Data Acquisition
TTD	-	Time Tagged Data

LIST OF PUBLICATIONS

CHAPTER 1

INTRODUCTION

1.1 Introduction

Azzuhri, S.R Mahadi, 2004) justified that, since the middle 20th century, electricity is the basic need in our daily lives. Life have been great and ease as electricity empower our most appliances for example, office equipment, device that were used to make life easier, safer and more interesting The electrical networks are compose by system of generation, transmission and generation of electricity, these network allow the loads to meet the generation points from the initial design of local dc network and finally to modern together in interconnected network with many voltage levels and multiple complex electrical components (J.Denardin, J.Escrig, D,Altbir 2008).

However, (X.Fang, S.Misra, G.Xue 2012) concerned that the populations are increasing and too many demand of power supply especially from urban area. This has resulted conventional power grid faced several problems with efficient distribution. The Smart Grid create a largely distributed automated energy delivery network by used two-way communication of electricity and information; viewed as the next generation power grid.

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A further definition of Smart grid is given by (V.Kumar , P.Rai, 2014) who describes a modern electric power grid infrastructure as Smart Grid is advance in sensing and metering technologies, smoothly coordinated automated control, and also has a modern communication network and advance energy management techniques into electricity power grid. For the demand of a new era, new technologies will better prepare the power supply in future. Furthermore, the increasing contribution from renewable energy are more compatible with conventional power station network if there is more flexible network management. For this paper, SCADA software for Power Lab will be using to give the exact idea to investigate the range of coordination between power demand and generation.

1.2 Problem Statement

The conventional grid system is not able to withstand the efficient distribution. Be that as it may, Smart grid can. They can enable the utility better handle demand by

empowering digital technology to quantify the power consumption at power grid's end points when more power should be allocated to a certain household away from peak load periods.

The purpose of this study will investigate the fundamental relationship found in smart grid that will require combination of energy source and consumer. For that to happen, LN trainer will be use in this project alongside SCADA software simulation.

Lucas-Nulle (LN) training system gives opportunities to demonstrate and convey the technological content of smart grid in a graphic and practice-oriented. This method is particularly useful in studying it can be adjusted to fit all the wide-ranging training requirement relevant to this research. It also a comprehensive, well-rounded program that allow a deeper insight in spanning power generation and distribution procedures all the way to energy usage and utilization.

The software works of this paper is done under SCADA software for Power Lab. SCADA is a software program used for the monitoring and control of power engineering system. SCADA system are being used in industries to control easily and practically. It practically enables to display all measured value and operate states between inside system in real time on actual instruments and the software.

1.3 Objective

The purpose of this study will investigate the fundamental relationship found in smart grid that will require combination of energy source and consumer. For that to happen, scope for this experiment are circuit is fed by external three-phase 415V incoming supply, difference load configuration parameter which is star and delta

configuration, difference in operate line model which is 150km and 300km. The LN trainer will be use in this project alongside SCADA for Power Lab software simulation.

The objective of this project:

- I. To investigate on Smart Grid of generation, transmission and distribution using LN Trainer with the interface of SCADA software.
- II. To study about how the SCADA monitoring system, display all measured value and operates states between real-time on existing LN trainer and the software itself.
- III. To investigate on three-phase transmission lines.

1.4 Scope of Project

This project is restricted to:

- I. Circuit is fed by external three-phase 415V incoming supply.
- II. Difference load configuration parameter use which is star and delta configuration.
- III. Difference in operate line model which is 150km and 300km