# Calibration of Dynamic Line Rating Model for Phasor Measurement Unit Based Wide Area Measurement System in Smart Grid Application

**Mohammad Kamrul Hasan, Musse Mohamud Ahmed, Sherfriz Sherry Musa, Denis Lee**

***Abstract*: The inefficiency of power transmission lines always becoming an issue in power system analysis. One of the most applicable methods Dynamic Thermal Current Rating (DTCR) to measure the thermal line ratings of existing transmission lines. This DTCR system operated through Phasor Measurement Units (PMUs) in Wide Area Measurement (WAM) system of the Sarawak Energy. To calculate the line rating based on measured or predicted weather conditions of the overhead transmission lines. However, the existing DTCR system of Sarawak Energy facing several accuracy issues. Therefore, this paper intended to perform an extended study on the sensitivity analysis of conductors in overhead transmission lines using the dynamic thermal rating model. The parameters (wind speed, the density of air, solar radiation) that influence the thermal line ratings considered in measuring, assessing the conductors' thermal effects and then these parameters were considered for the line rating models that dynamically will adjust the weather information of the conductor in overhead transmission lines on WAM systems. The performance of this study carried out using Matlab based simulation. The result shows that the proposed model that uses the dynamic factors brings the expected outcome in measuring the accurate ratings of the overhead transmission lines.***

***Index Terms - Smart Grid; PMU; DTCR; WAM; Heat Balance Model***

## I. INTRODUCTION

This PMU device in Wide-area measurement system is applied to measure, control and monitor the phasor measurement for both voltage and current at the remote end of the transmission lines. PMUs are the key to a real-time monitoring system that can guarantee a firm operation for transmission lines [1-2]. In addition, data gained from PMU can be applied for whole power system analysis. Due to the high-cost device, the placement of its device must be optimized and it cannot be placed across the network. Fig. 1 shows the overview of PMU measurement. The need for monitoring system in Dynamic Thermal Current Rating (DTCR) is vital for the data collection. The data type used for the system evaluation heavily influences the DTCR quality. Hence, different companies use different devices for DTCR [3]. Dynamic rating is an approach used to ensure the whole power system operation in a more effectual form. It also can be delineated as a required tool to increase the utilization level of smart grid solution.

In Dynamic Line rating system, magnitudes such as wind speed, wind direction, ambient temperature, and solar radiation are required for ampacity calculation. Moreover, the conductor temperature magnitude can be used to calculate the effective wind speed [4].

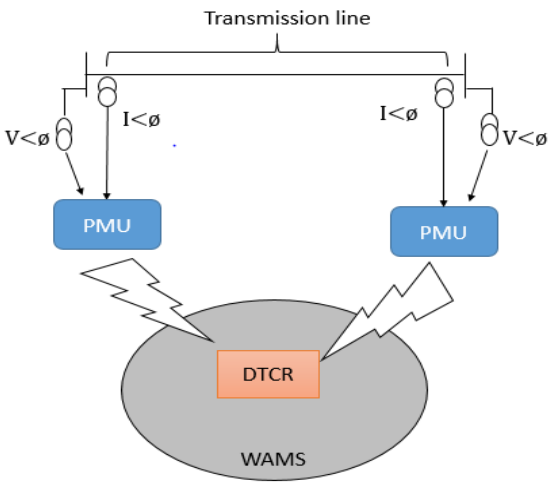


**Fig.1: PMU Measurement System**

There are nine main considerations used to evaluate the dynamic system monitoring in term of accuracy and complexity [5]. These categories are:

- Static rating or no rating (STR): Ratings based on national as well as the international standard for lines
- Seasonal rating (SER): Rating for seasonal conditions such as summer, winter, and autumn
- Weather Model (WM): Rating is based on the average weather for several years
- Weather Forecast (WF): Technique used for line system monitoring where data in real-time is gained
- Conductor Temperature Evaluation (CTE): Method used to measure the temperature of the conductor. For instances, temperature sensors

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**Mohammad Kamrul Hasan**, Department of Electrical and Electronic Engineering, Faculty of Engineering Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

**Musse Mohamud Ahmed**, Department of Electrical and Electronic Engineering, Faculty of Engineering Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

**Sherfriz Sherry Musa**, Department of Electrical and Electronic Engineering, Faculty of Engineering Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

**Denis Lee**, Sarawak Energy Berhad (SEB), 93050 Kuching, Sarawak, Malaysia