AUN/SEED-Net JICA

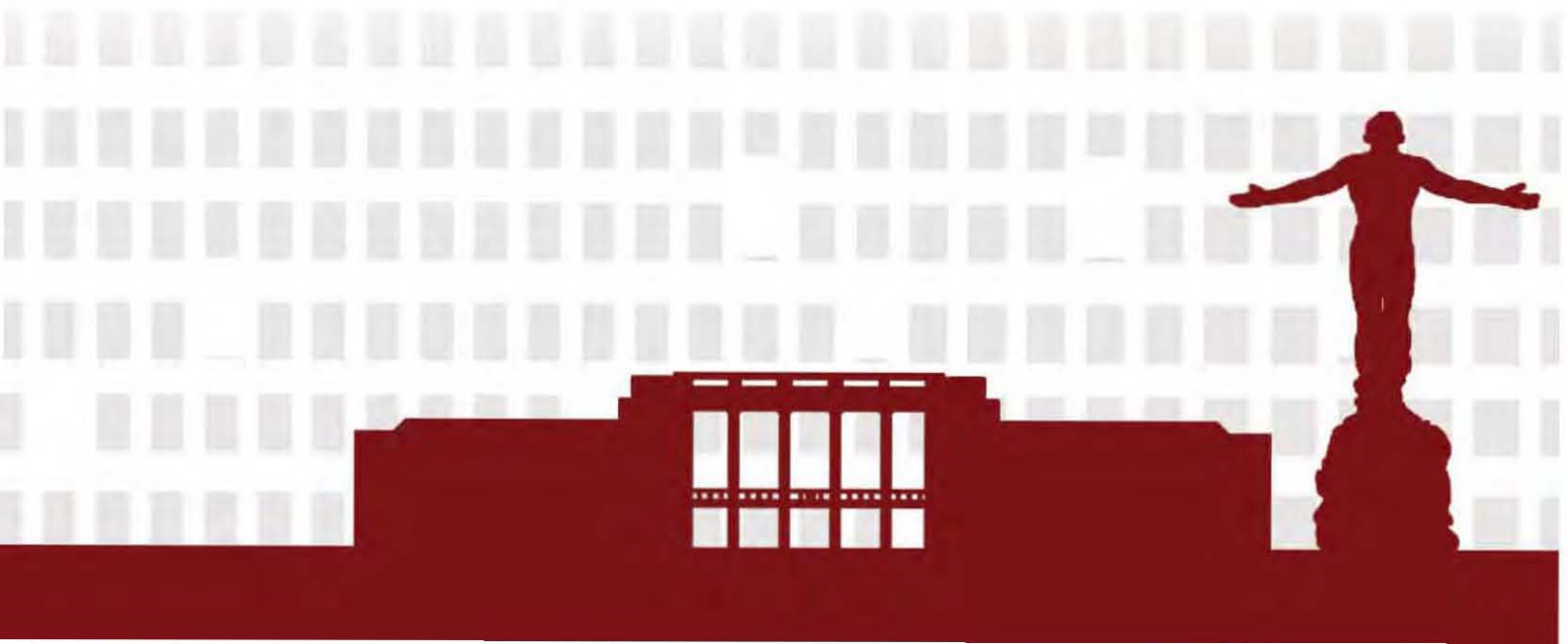
# 8th AUN/SEED-Net
## REGIONAL CONFERENCE ON ELECTRICAL AND ELECTRONICS ENGINEERING

Envision, Enable, and Empower
Smarter and Resilient Societies

*co-located with*

# 11th ERDT Conference
## on Semiconductor and Electronics, Information and Communications Technology and Energy

**16-17 November 2015**
**Metro Manila, Philippines**



**Proceedings of the 8th AUN/SEED-Net RCEEE 2015 and 11th ERDT Conference**
**on Semiconductor and Electronics, Information and Communications Technology, and Energy**

Editors:
Dr. Joel Joseph S. Marciano Jr.
Dr. Jhoanna Rhodette I. Pedrasa
Dr. Rhandley D. Cajote



ISBN: 978-616-406-075-3

Published by: ASEAN University Network / Southeast Asia Engineering Education Development Network (AUN/SEED-Net) JICA Project
Faculty of Engineering, Bldg. 2
Chulalongkorn University, Bangkok
Thailand 10330

Printed in the Philippines by: ERZALAN PRINTING PRESS
45 Cotabato Street, Luzviminda Village, Batasan Hills, Quezon City, Philippines

# 8th AUN/SEED-Net Regional Conference
## on Electrical and Electronics Engineering 2015

co-located with

# 11th ERDT Conference
## on Semiconductor and Electronics, Information and Communications Technology, and Energy

# Envision, Enable and Empower Smarter and Resilient Societies

Published by: ASEAN University Network / Southeast Asia Engineering Education Development Network (AUN/SEED-Net) in partnership with Engineering Research and Development for Technology (ERDT) and University of the Philippines Diliman.


ISBN: 978-616-406-075-3

# RISK ANALYSIS ON DISTRIBUTED ENERGY RESOURCES PARTICIPATION IN A DAY-AHEAD ELECTRICITY MARKET OPERATING UNDER A VIRTUAL POWER PLANT SYSTEM

**Rogelio F. Bersano Jr.[1, 2 *] and Michael Angelo Pedrasa[1]**

[1]Electrical and Electronics Engineering Institute, University of the Philippines Diliman, PHILIPPINES.
[2]Mindanao State University – Iligan Institute of Technology, PHILIPPINES.
[*]E-mail: rogeliojr.bersano@g.msuiit.edu.ph

## ABSTRACT

Distributed Energy Resources (DER) are small, modular, decentralized, grid-connected or off-grid energy systems located in or near the place where energy is used [1]. They are integrated systems that can include effective means of power generation, energy storage, and delivery. DER system application is a very good alternative in improving the power quality and reliability of electricity supply while providing low-cost energy. DER on the other hand is not yet competitive and actively participating in the electricity market due mainly to the high risk of catering to a large market with its much clustered size and a very high uncertainty of availability [2]. They are however passively installed with the intent to serve as a background in the mainstream of electricity distribution network. A possible scenario of a passive approach of DER implementation is shown in figure 1.

The basic approach to making DER a forefront player in the electricity market is the aggregation of a number of DER systems into one single profile in a similar manner as that of a transmission-connected generator [3]. This idea known as "virtual power plant" can decrease the risks from operating DER system independently. The VPP profile will be based on the aggregated capacity of its DER portfolio and their individual bid for their sale of energy. The VPP system operator will then bid this aggregated capacity to the day-ahead electricity market. Due to the volatility of the hourly spot price, each DER bids face a risk of not being catered. This study evaluates the profitability and risk of bidding in a day-ahead electricity market of each DER operating under a VPP system. A Monte-Carlo Simulation is conducted to determine the spot price, and the expected profit of DERs. Value at Risk (VaR) and Conditional Value at Risk (CVaR) are used to quantify the risk of the DER bids. The proposed procedure provides DER operators an efficient tool to be able to quantify the risk and handle the uncertainties in participating in a day-ahead electricity market.

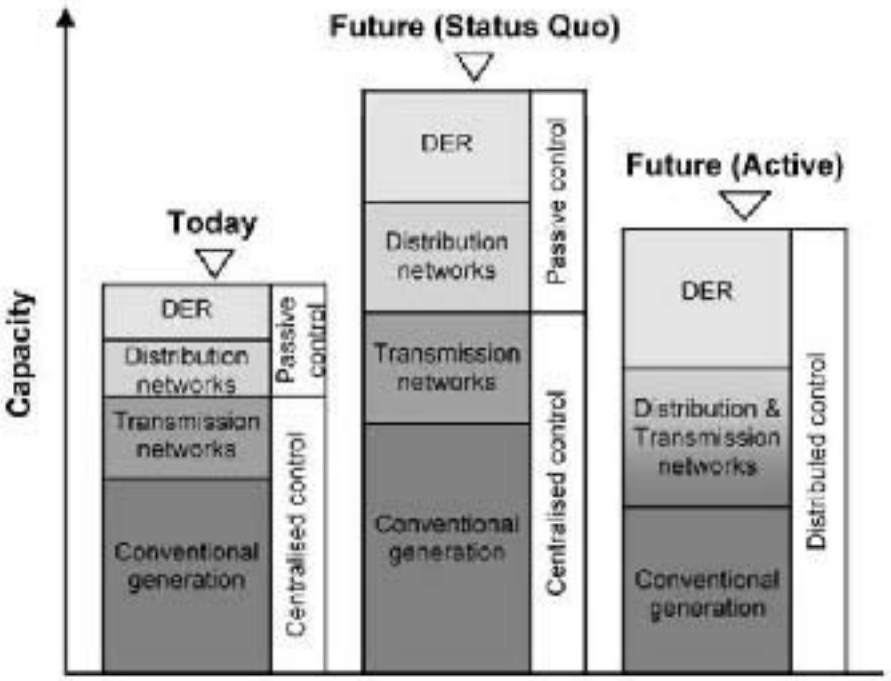



**Figure 1.** Projection of DER capacities [2]

**Keywords:** Distributed Energy Resources, Virtual Power Plant

**Acknowledgment**
The authors would like to thank the University of the Philippines – Diliman for the support in this study.

**References**
[1] M. F. Akorede, H. Hizam, and E. Pouresmaeil, "Distributed energy resources and benefits to the environment," *Renew. Sustain. Energy Rev.*, vol. 14, no. 2, pp. 724–734, Feb. 2010.

[2] D. Pudjianto, C. Ramsay, and G. Strbac, "Virtual power plant and system integration of distributed energy resources," *IET Renew. Power Gener.*, vol. 1, no. 1, p. 10, 2007.

[3] M. Peikherfeh, H. Seifi, and M. K. Sheikh-El-Eslami, "Optimal decision making for Virtual Power Plant operation," in *2010 Conference Proceedings IPEC*, 2010, pp. 625–629.