Proceedings of the 8th North American International Conference on Industrial Engineering and Operations Management, Houston, Texas, USA, June 13-16, 2023

Applying Economic and Technical Indexes to Compare Net-metering and P2P Systems

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Abstract

As solar energy has been growing over the years, the energy markets have been gradually moving toward using a decentralized market. Renewable energy is slowly becoming unpopular because of the hidden fees being charged to people who have installed PV systems. The energy that is being generated does not match what is consumed. The significance to this study starts with people becoming more involved with solar energy if there are incentives worth having PV systems installed. Also, looking for ways to store the surplus of energy not being consumed. There are

three types of methods used to help get a better understanding of net-metering and peer-to-peer (P2P) solar systems. Using technical and economic indexes the comparison was done looking at the following indexes- peak power, energy balance, economic benefit, and transaction index. Based on a microgrid of 28 commercial buildings, readings of consumption were taken in intervals of one hour and a python model was made to find PV size and compare trading mechanisms. It was found that the combination of P2P and net-metering had the best overall performance, followed by net-metering itself, with the best season being fall for two and summer for net-metering by itself. However, P2P was found to be more economically suited than net itself. This shows that a P2P model implemented in a microgrid helps create more energy balance, although the combination would achieve the highest performance.

Keywords
Solar Energy, PV systems, Microgrids, Performance.

Biographies
Dr. Esteban A. Soto received his industrial engineer degree and master's degree in industrial management from the University of Concepcion (UDEC), Chile in 2014 and 2015, respectively. In 2022, he successfully completed his Ph.D. at Purdue University, focusing on renewable energy systems, specifically P2P energy trading models and large-scale integration of solar energy into the electrical grid. Currently, Dr. Soto works as a consultant at Sustainability Solution Group, specializing in decarbonization and energy transition projects. He assists organizations in devising and implementing strategies to mitigate greenhouse gas emissions and promote the adoption of renewable energy. Previously, he served as an instructor at Southeast Missouri State University and was the project coordinator for the Purdue Research Experience for Undergraduates (REU) Program, where he supported underrepresented students in gaining valuable research experience. Dr. Soto also has served as a mentor for Evergreen Climate Innovations and the NSF I-Corp program. Moreover, he is a Fulbright Scholar and has held leadership positions in both the Purdue Fulbright Association and the Purdue Chilean Association.

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Dr. Lisa Bosman, PhD in Industrial Engineering, was recently promoted to Associate Professor (to take effect August 2023) at Purdue University (West Lafayette, IN, USA). She is the founding director of iAGREE Labs (Inclusive, Applied, and Grounded Research in Entrepreneurially Minded Education) aimed to empower action through real-world solutions and evidence-based practices. While working at Purdue University (2018-present), Dr. Bosman (as a PI) was awarded 15 grants totaling $1,166,589. While working at a federally recognized tribal college and university, College of Menominee Nation (2011-2018) she was the PI for 15 awards totaling $897,551. Dr. Bosman has disseminated research through more than 75 peer-reviewed publications. In addition, she has published two teaching-oriented books: “Teaching the Entrepreneurial Mindset to Engineers (Springer, 2018)” and “Teaching the Entrepreneurial Mindset Across the University – An Integrative Approach (Springer, 2021)”. According to Google Scholar (05/23/2023), since 2018, her research has resulted in 946 citations, a 15 h-index, and 19 i10-index. Her core research centers on three themes related to developing the entrepreneurial mindset in future leaders and innovators: (1) Teaching and Curriculum Development, (2) Educator Professional Development, and (3) Real World Applied Learning (Academic Entrepreneurship Research – Solar Energy).