

Market Design Barriers to Renewable Energy in the National Electricity Market

Luke Marshall¹, Anna Bruce¹, Iain MacGill²

¹*School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Sydney NSW 2052, Australia*

²*Centre for Energy and Environmental Markets and School of Electrical Engineering and Telecommunications, University of New South Wales, Sydney NSW 2052, Australia*

E-mail: luke.marshall@student.unsw.edu.au

The National Electricity Market (NEM) is intended to be the primary mechanism for operational and investment decision-making in Australia's electricity sector. The NEM's electricity auction mechanism was designed to provide price signals for dispatch and investment of generators for Australia's electricity supply. It was designed at a time when renewable energy was not part of Australia's energy paradigm. It is however vitally important that the NEM can deliver an efficient and stable energy supply, no matter what technologies are present in the market at any given time. This research examines whether existing market mechanisms are suitable for the integration of renewable energy technologies.

Renewable energy presents a fundamentally different set of integration challenges to fossil-fueled generators. While the NEM's market mechanism was built to optimize the dispatch of dispatchable generators with high marginal operating costs, it did not consider the future presence of low-marginal cost, stochastically variable renewable generators. This means that a number of fundamental assumptions around the performance of generators in the NEM may not hold under high renewable penetration scenarios. This research applies emerging techniques in the fields of game theory and mechanism design to the problem of dispatch and revenue sufficiency for renewable generators in the NEM. It examines how low marginal cost generators (such as utility-scale photovoltaic plants) may be unable to reach revenue sufficiency in a range of scenarios, due to the fundamental implementation of rules in the NEM's electricity auction. Additionally, this research outlines a number of pathways for reform, by which the electricity market could be restructured to better reflect the long run marginal cost of renewable generation.