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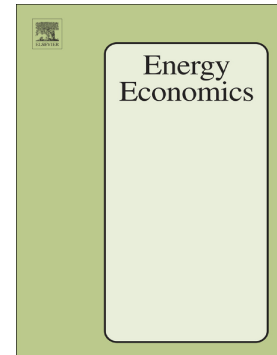
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On intermittent renewable generation & the stability of Australia's National Electricity Market

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Abstract

Energy-only markets have an inherently unstable equilibrium, even under ideal conditions, because participants are unable to optimise VoLL events. The addition of intermittent renewable generation is thought to make conditions harder. In this article, optimal VoLL events in an islanded NEM region is modelled by substituting high price caps for Boiteux capacity charges, then analysing the impact of adding progressively more Variable Renewable Energy (VRE) – up to 35% market share. Spot market conditions prove stable and tractable provided thermal plant exit and adjust perfectly. But VRE asset allocation is important; absent highly elastic demand or ultra-low cost storage, solar PV market share has economic limits because the technology rapidly cannibalises itself. Furthermore, as VRE rises in imperfectly interconnected regions, a tipping point appears to exist where hedge markets enter an unstable zone through shortages of 'asset-backed' firm intra-regional swaps and caps. Government-initiated CfDs for VRE need to be designed carefully to ensure any instability is not exacerbated by extracting contracts from an already shortening hedge market.

Keywords: Energy markets, missing money, variable renewable energy.

JEL Codes: D61, L94, L11 and Q40.

1. Introduction

Australia's National Electricity Market (NEM) formed part of a world-wide electricity industry microeconomic reform experiment which commenced in Chile from 1982 (Pollitt, 2004). England & Wales followed with their landmark 1990 reform while Australia commenced from 1994 (Green, 1998; Nelson & Orton, 2016). The initial wave of restructuring and deregulation had two or three template electricity markets designs involving various combinations of “energy-only” or “capacity & energy” market mechanisms, set in gross or net pools with day-ahead or real-time scheduling. These designs shared a market liberalisation objective but adopted different paths to achieve that outcome (Pollitt & Anaya, 2016). Results have been mixed.

By any measure the NEM had been a resounding success¹ and by 2005 was widely regarded as a template for power system reform (IEA, 2005). The NEM is an energy-only gross pool with a real-time (5-minute) uniform first-price auction clearing mechanism and forward derivative markets traded both on-exchange and Over-the-Counter at 300-400% of physical trade.²

¹ Performance improvements included average cost, price, plant availability, and reserve margins (see Simshauser, 2005). In more recent research, the wholesale market was one of the few areas of the electricity market that was performing well (see for example Nelson & Orton, 2015; Simshauser, 2014). From mid-2016 however, market performance deteriorated significantly.

² See Simshauser, Tian & Whish-Wilson (2015) and in particular Appendix III.

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