Future Electricity Market Summit – Low marginal cost, security and financing

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Variable generation changing nature of residual demand





Changing the economic case for new generation





Low marginal cost



Overview

- A title of "zero marginal cost markets" is misleading.
- The NEM is not, nor will it be anytime soon, a zero marginal cost market.
- 100% hydro power systems are not zero marginal cost markets; resources have an opportunity value.
- The NEM has long had very low marginal running cost (coal) plant with high fixed costs
 - There is nothing special about these characteristics (airlines, coal, metals, ships and power generation, software, telecoms)
- At all points in time, the NEM has an upward sloping aggregate supply function
- Adding VRE changes the structure, but not the nature, of the aggregate supply function
 - Certificate side-markets have (unhelpfully) amplified self-commitment bidding. But this should correct itself over time.



Merit order effect - the over-dramatization of...

- There is nothing spectacular about merit order effects
- As Felder (2011) noted, a new nuclear plant, or a new transmission interconnection, produces a merit order effect.
- Merit order effects are not necessarily welfare enhancing
- They are also dynamic in nature. In the short run:
 - Price Impression Effects ("VRE On")
 - Flexibility Effects ("VRE On, Inflexible Coal Plant On")
 - Stochastic Production Effects ("VRE Off")
- In the long run:
 - Utilisation Effects (Inflexible Coal Plant slide up ATC Curve)
 - Rebound Effects ("Coal Plant Exit, prior effects unwind")



Dynamic effects of VRE entry – Wind

Unit Price (\$/MWh)





Wind at 15%, Simshauser (2018)

Dynamic effects of VRE entry – Solar

Unit Price (\$/MWh)



Queensland, Australia

Solar at 15%, Simshauser (2018)

Price Impression vs Stochastic Production Effect





Rebound Effect



To summarise...



On energy-only markets and high VRE

- Simshauser (2018) modelled to ~40% VRE tractable equilibrium over this range provided the thermal plant stock adjusts perfectly
 - Of course, a very tight nexus is required between the Reliability and the Market Price Cap (ie \$14k MPC)
 - Can be orchestrated via \$14k MPC, or LoLP*MPC payments (original E&W Pool design) with lower MPC, or Boiteux Capacity Payments.
- Marshman, Brear, Jeppesen & Ring (2019) model to ~60% VRE with FCAS markets and find a tractable equilibrium through to 50% if the plant stock adjusts perfectly
 - They find some missing money emerging at > 50% VRE market share, and so some out-of-market payment may be required for peaking plant at that point



Outputs of symposium

- Changing technology mixes will change market outcomes, but they do not change the fundamental economic principles behind market design.
- Market-clearing prices in such a market are not necessarily mostly zero even in an energy-only market, especially with grid scale storage, an active demand side of the market and scarcity pricing.
- However, increasing intermittent generator penetration increases the importance for adequately pricing scarcity and all network constraints and services. Such pricing is required to deliver investment incentives for the right technologies to locate at the right locations to eciently maintain a stable and reliable electrical network.



Output of symposium

- Unfinished business:
 - Network constraints
 - Zonal v nodal pricing
 - Dynamic costs and scheduling
 - Ahead market considerations: As VRE penetration increases, the potential gains from co-optimizing across multiple periods from a market operator could increase, because actions by market participants that impact dynamic system costs can be priced to reflect that action



Output of symposium

- Long-horizon forward prices
 - Capacity market alternative
 - Expansion of RRO concept: If the NEM approach to long run resource adequacy is deemed to need changing, a way to preserve appropriate performance and investment incentives while improving hedge liquidity out to longer horizons is to mandate procurement levels and reporting of long run contract positions by retailers – aligning debt and equity horizons with contract position length



On Security of Supply



Overview

- Almost all of the capital substitution has occurred through VRE switch out of thermal synchronous generation
- Services once provided for free as a by product of energy provision, no longer provided
 - Frequency
 - Inertia
 - Voltage
 - System strength
- Interventions by the market operator are common



Security of supply - increasingly challenging.





NEM FCAS Costs 2010-2019 – rising sharply



Queensland, Australia

Forecast Uncertainty...





SA, 8 Feb 2017

Outputs of the symposium

- Some services can be prescribed by TNSP/DNSP given common good nature
- Others can be priced
- Transitional arrangements might be required
 - e.g. primary frequency control
- Commonality of approach to transmission and distribution important at least from a principles perspective
- Where possible, use of co-optimised markets
 - Local or regional



Financing



Overview

- Historically, an enormous volume of capital has flowed into new generation and network investments in the NEM
- This has occurred during periods of energy & climate change policy discontinuity and significant shocks in debt and equity capital markets (2003-04, GFC, 2011-13)
- Good opportunity is invariably matched by a flow of capital
- The market may not always deliver the theoretically optimal mix, or the lowest cost of capital given various market frictions, but:
 - This is to be expected, we don't live in a perfect world;
 - It doesn't mean allocated capital was inefficient;
 - Investing in electricity assets isn't meant to be easy or without risk. It was never easy (even as vertically integrated monopolies) – this is a complex industry;
 - The good news is that capital has never been cheaper.



Spot and forward markets: investment occurs when required





Source: Simshauser (2019)

Any change to the market requires surgical precision. Uncertainty matters: investment can freeze-up





'Enormous flow of capital' 2006-2018 = \$143.5 billion (excludes Merchant M&A)





The VRE Refinancing Task – Changes to market design could create refi issues



Outputs of the symposium

- Important to recognise increasing proportion of costs being 'fixed'
- Market design not necessarily the issue risk allocation and technology price deflation more likely to be issues
- Some alignment of investor financing requirements and policy could be useful e.g. RRO contract tenor
- There are missing markets vis-à-vis System Security. With no price signal, we should be less confident of meeting rising security challenges:
 - NEM requires markets for Operating Reserves (e.g. see Hogan 2013), Fast Frequency Response, Inertia etc.
 - These need not be organised spot markets, but some form of market and price signal is required

