

Some thoughts on the NZEM: Benefits and Challenges

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Purpose of the talk

To lay out in a short time, towards the end of the day, a framework for discussion and subsequent pondering regarding our NZEM. Some points serve as reminders.

Preliminaries

It is widely accepted that active competition is the most effective means to achieve,

- efficiency and innovation in the supply of goods and services; and
- consumer protection, by providing choice among competitive offerings.

Some measures of market performance

- Competition
- Price (wholesale and retail)
- Reliability/Sufficiency of investment
- Diversity/Innovation
- Abundance of information

Competition

- In the wholesale market we had the Wolak report. There was ability and incentive to exercise market power but no abuse of market power reported.
- This triggered thoughts regarding market monitoring and has led to “robust and common knowledge methods to value water”?
- EMI DOASA is made available to industry.
- This (in part) has indicated the need for accurate hydro information.
- It has also triggered ideas regarding how to deal with risk and one particular question is what effective market instruments can mitigate the effects of risk.

Competition – Retail

- Has received a lot more attention in the last 5-7 years.
- EA has ran campaigns to encourage people to switch retailers.
- Is it working efficiently?
- Toby and Jim looking into this.

Price and sufficient investment

- Short of strict monitoring we can't ensure that prices are competitive.
- Monitoring in a hydro rich environment is difficult for many reasons one being that risk can not be distinguished from exercise of market power (Z and Ralph have developed examples to this effect).
- We could run an international comparison and a brief search yields that our average residential prices (Dunedin 16 cents per kwh, Auckland 20 cent per kwh etc) are close to those of Spain, Norway, UK and less than Denmark and Germany.
- Sufficient investment? Don't really know but no evidence to the contrary.

Innovation

- Breaking up generators meant that different people who took different positions on promising generation technology could do something about it.
- Some thought geothermal was a waste of time while others focussed on geothermal.
- In fact our HoD is the MRP sponsored Prof. chair of geothermal engineering and she tells me that NZ leads the way in many aspects of geothermal energy.
- Some thought wind was a waste of time while others pursued this vigorously.
- Having this diversity (through breakup) meant we diversified our approaches to generation and this encouraged innovation.

Information

- Prior to the market there was not much information available regarding generation and market operations.
- Hard to know what might have happened had we continued with a central system.
- Today we have vSPD with ALL details available. We can replicate every half hour of every day to great accuracy and attempt to understand detailed effects of reserve and branch group constraints.
- Codes like DOASA are available to market participants.
- Better hydro information is needed and Matthew presented on the EA's approach here.

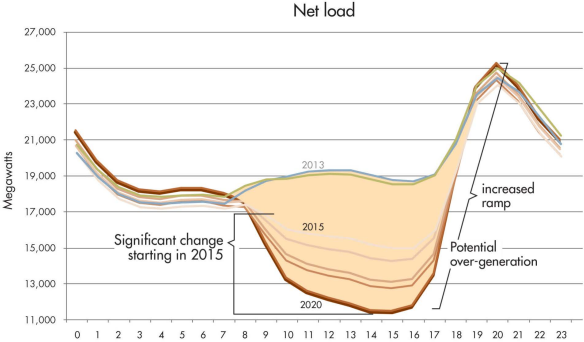
- It would be great if research groups like us were able to access 5 minute prices (we're kind of like modelling speculators).
- We're utilizing embodied information from other well functioning markets (pleasant surprise to spot Bev today)!

Contract information

- There are rules in the NZX (and other exchanges) on the disclosure of identities of major share holders of any company ($> 5\%$).
- This is deemed important for the efficiency and liquidity of these markets.
- Similar disclosures on futures contracts may help liquidity of contracts by removing barriers to information.

Challenges: Renewable generation is intermittent

Growing need for flexibility starting 2015



Ways to fix the stress

- From a planning perspective, model the problem to incorporate stochasticity.
- Transfer energy between off peak and peak periods.

Storage facilities in operation

- AES 64 MW Laurel Mountain Battery Resource in West Virginia has been operating commercially in PJM since 2011.
- AES 40 MW Tait facility operating in regulation PJM-Ohio since 2013. (source: Electricity Storage Association)
- Other facilities also in use in ERCOT and PJM.
- Clearly they seem to work in large scale. How about small scale batteries?

Solar defies economies of scale

- Most forms of power generation benefit from economies of scale.
- Larger thermal turbines are more heat efficient.
- Larger wind turbines are likely taller and have access to faster, more powerful wind.
- PV panels are as efficient in their standard rooftop size as they are in a large solar farm collection.
- Once economical they can be completely prevalent.

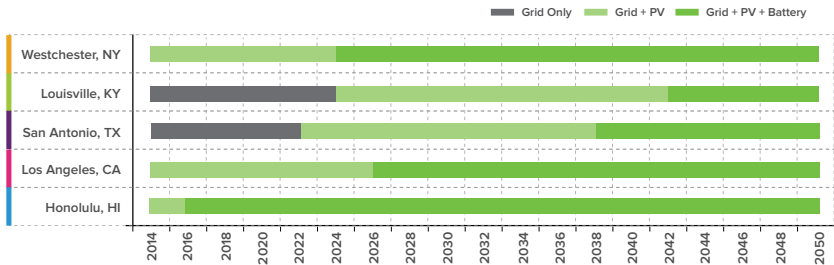
Decentralized batteries?

- It is clear that large batteries integrated in a large system can be very useful.
- Is there a need for “distributed batteries”? Would each household need one?
- Currently in New Zealand, one has to pay 16 to 25 cents per kWh for retail electricity.
- The same household can sell back power to the grid (generated from PV say). The maximum price they can sell back however is 7 cents per kWh.
- Certainly households equipped with their own renewable distributed generators would benefit from having their own battery.

Will solar + battery be common?

A recent study by the Rocky Mountain Institute on “The economics of load defection” points out that the outlook is favourable to solar plus battery plus grid as the most economical option for residential and commercial consumers of electricity.

FIGURE ES1:
ECONOMICALLY OPTIMAL SYSTEM CONFIGURATION
RESIDENTIAL



- They point out that large kWh defection could undermine revenue for grid investment under current rate structure and business models.
- Large variable rates encourage more PV use.
- Large peak rates encourage more battery use.
- It becomes tricky to set appropriate tariff structures that would guarantee the continuance of the lines business as it operates today.

FIGURE ES5:
NORTHEAST POTENTIAL CUSTOMER DEFECTION
RESIDENTIAL

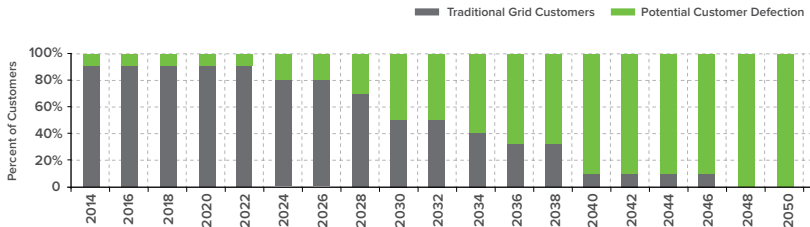
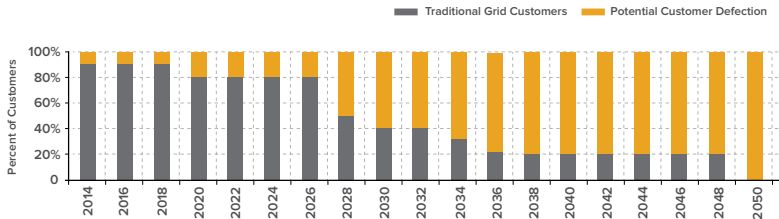


FIGURE ES6:
NORTHEAST POTENTIAL CUSTOMER DEFECTION
COMMERCIAL



- The probability of a scenario where many opt for PV plus battery plus an electric vehicle is significant.
- EVs can be used for transportation as well as storage.
- We may even have solar cars that would have storage capabilities become prevalent.
- Such vehicles certainly help curb emissions.
- This changes the nature of the lines business.

- Instead of being the core of distributing power from large power generators to consumers, the network may need to stay only for back up purposes.
- This change is due to the breakdown of economies of scale when it comes to PVs.
- It will be exasperated if batteries are similarly non-scalable economically.
- This changes the lines business from a risk free, sure (albeit perhaps low) profit business to something much more high risk.
- The lines companies may want to diversify into other businesses (as they have done already in NZ).
- This can become a downward spiral and end lines companies as we know them.

- As a result of the downward spiral, we would end up with stranded assets.
- RMI's analysis points out that this would be economically inefficient.
- They also point out that with careful planning, lines companies can remain financially viable entities.
- This would eliminate the large inefficiencies cause by dispensing with the grid.
- There may also be other uses “riding on the back” of the grid. This could be similar to phone lines being used for early internet connections.

- Clearly there is a large amount of uncertainty facing us.
- We have technological uncertainty of all electrical equipment and costs.
- But more significantly, the entire world economy is changing shape.

Any comments or questions are most welcomed?