Current state of flexibility services EDB responses




Contents

- Summary
- What flexibility is being used?
  - Commercial arrangements
  - Trials
- Opportunities and barriers
- Report on ‘Addressing The Locational Valuation Challenge For Distributed Energy Resources’
- Some thoughts from Vector

Summary

- Most EDBs use HW ripple control
  - for grid management (not commercially)
  - incentivise uptake through discounted tariffs
- Other flexibility is used but:
  - commercial arrangements are still in infancy
  - most flexibility resources are EDB owned
- Larger EDBs are trialling flexibility services
  - mainly to investigate technical feasibility
- There are several barriers for the adoption of flexibility services
- EDBs are concerned about grid constraints but aim to manage these with existing technology

Flexibility used

- Backup generation (diesel – Network Waitaki) (small hydro – Network Tasman)
- Street lighting (PowerNet, Marlborough Lines, WEL Networks)
- Irrigation load (MainPower, Orion)
- Export credits (Orion)
- Batteries (residential and EV) (Vector, Wellington Electricity)
- Batteries (grid scale) (Powerco, Vector)
- Smart meter mesh control (WEL Networks)
- Time of use tariffs (most EDBs mentioned this)

Commercial arrangements - buying

- **Embedded generation**
  - *'We have contracted an embedded generator to increase their generation to offset a network constraint previously. An agreement on payment was made up front'* - WEL Networks
  - *'We have one embedded generator on a remote rural feeder who by agreement takes advantage of high load network conditions to increase their generation. This is achieved through an automatic voltage feedback mechanism to the generator'* - Network Tasman
- **Export credits**
  - *'we provide credits to customers that export during our periods of peak network loading' 'we expect to provide $16,000 of credits this financial year'* – Orion
- ***Irrigation load***
  - *Access to interrupt irrigation load is procured, as an alternative to investing in rural security of supply upgrades, via a rebate scheme. We have access to about 40MW during the peak of the summer irrigation season'* – Orion

Commercial arrangements - selling

- **Transpower's DRM scheme**
  - '*We presently bid a single 500 kW diesel genset into Transpower's Demand Response Management (DRM) scheme. Transpower call on us to offer this genset in when there is a pre-contingency constraint on part of the 110 kV transmission lines supplying Oamaru*.' – Waitaki
  - *'Transpower request us to control loads to certain levels in some circumstances e.g. Rangitata floods in 2019'* – *MainPower*
- **Reserve market**
  - *'makes load available to the instantaneous reserve market via its ripple control'* – *Wellington Electricity*
  - *'We use Vector to manage our reserves market interaction with the System Operator'* – WEL Networks

Trials – actual

- Vector reported the most advanced trials (detail on next slide)
- Wellington Electricity
  - EV trials - *'trailing a new service which manages battery charging (including EVs) for residential customers. The service provides more precise load management allowing WELL to manage battery charging at an ICP level. This will allow WELL to manage demand at a street level (20 customers) as opposed to ripple control which is at a Zone Substation level (5,000 - 10,000 customers)'* – Wellington Electricity
  - '*in WELL's EV trial, an EV will increase household load by approximately 34%*' – Wellington Electricity
- Unison
  - DR for cool store loads tested as an alternative to grid upgrade
- Orion
  - small residential PV/battery trial in partnership with an electricity retailer
  - batteries owned by customer
  - aim to assess impact on network and understand ability to signal at correct times

Trials – Vector

Trial	Scale	Frequency
Modern direct load control technology (several new options – Vector tested radio mesh system)	Trial yielded 96 kW of instantaneous load resource during peak load periods	Trial recently completed – future use cases being evaluated based on technology able to target load reductions to areas or customers
Behind-the-meter battery system trials (paired with solar PV)	Vendor A - 700: 3.2kW - 6.4kWh Vendor B - 184: 4.5kW – 11.64 kWh	Trial, yet to be determined
Vehicle to Home - V2H	3 x trial products located in Piha to understand consumer use cases and technology limitations	No direct control by Vector. Use managed by customer in response to high price periods (or short-term outages)
Vehicle to Grid - V2G	1 x 7.2 kW test unit installed at Vector headquarters in Newmarket to demonstrate system compatibility in NZ	No direct control by Vector, system was installed to demonstrate compatibility
Behavioural trial – peak time rebate	~600 participants enrolled in “Power Down” trial during the winter, reducing their usage to help manage winter peaks – trial was intended to test NZ response relative to similar overseas trial outcomes.	Trial designed to have up to 10 events during winter testing period, 7 were called.

Trials – planned

- PowerNet – *'plans to run trials with a range of customers and partners (e.g. peer-to-peer trading) to understand the incentives schemes necessary:*
  - *to influence customer behaviour to achieve desired change in energy usage*
  - *for a customer to permit a third party to directly control their flexible service and automate the change.'*
- Network Tasman
  - Currently trialling a system what can control residential battery storage for tariff based reward. The inverter will discharge to the grid at peak time.
- Network Waitaki
  - planning on running a trial on a small number of heat pumps
- Centralines and Unison
  - planning an EV pricing trial in 2021 which will look at commercial arrangements

Opportunities

- Some EDBs see flexibility as an **opportunity**
  - *'active network management is responsive to customer needs and can lead to a more affordable, dynamic and resilient electricity system delivering on New Zealand's decarbonisation goals' – Vector*
  - *'We believe storage loads provide the best opportunity to adjust demand and voltage without adversely impacting our customers' activities.' – Orion*
  - *Notification of EV installations would provide an opportunity to engage customers in flexibility projects – Wellington Electricity*

Barriers

- Four main barriers were identified:
  - Economics 
  - Information 
  - Technology 
  - Regulation 

Barriers - economics $

- Currently not economically **viable**:
  - *'new flexibility solutions are very expensive compared to conventional hot-water control.'* – Unison and Centralines
  - Cannot use *'grid scale batteries due to commercial reasons'* – Top Energy
  - *'Reasons why flexibility services do not meet our criteria include price*' – Orion
  - PV with battery storage – *'This is currently not economic'* – Waipa
  - *'current PV & battery technology is not economically viable for Electra to deploy within the network'* – Electra
  - Powerco have been considering using batteries but are unsure about the value propositions
- **Cost** of trials is a barrier for smaller EDBs

Barriers – information

- **Visibility** of services and grid-wide constraints
  - *'EDBs don't have knowledge of potential flexibility resources, and end-users, for whom provision of flexibility services is not part of their business'* - Centralines and Unison
  - *'in the timeframes that EDBs have to make upgrade decisions to meet large new customer demands, the information on latent flexibility capability does not exist to allow a flexibility solution to be developed'* - Centralines and Unison
  - Lack of industry-wide price signals (Horizon, Wellington Electricity)

- Access to **data**
  - *'Realtime access to smart meter performance data from Retailers or MEPs at a reasonable price would support us'* – Network Waitaki (also flagged by Horizon, Electra, Vector)
  - '*we believe one of the largest impediments to the development of a widespread and well-functioning flexibility services market is barriers to data*' – Orion
  - *'in order to build the value for flexibility services, detailed modelling is needed down to the low voltage level of the network*' – Vector (also flagged by Wellington Electricity, Network Waitaki and Orion)

Barriers – technology

- **Smart meters**
  - Smart meter rollout a missed opportunity as it didn't mandate load management functionality – Unison and Centralines
- **Uncertainty**
  - *'we would be interested in control of EV chargers, grid connected batteries for investment deferral but currently no systems are available'* – MainPower
  - *'if a significant number of drivers begin to charge up their vehicles at say 9pm, then the sudden undiversified increase in load at that time may cause significant voltage issues'* – Orion
- **Reliability**
  - *'flexibility responses often do no not come with the same level of security or reliability as a network solution'* – Orion
  - *'EDBs need to ensure that the use of flexibility services provide similar power system reliability as traditional investments*' - Vector

Barriers – regulation

- **Differing opinions**
  - *'We don't think there are material regulatory or technological impediments to obtaining flexibility from consumers' resources'* - Unison and Centralines
- **Standards**
  - *'Transpower does not have responsibility for third party supply quality or supply standards at the distribution level.'* – *Wellington Electricity*
  - *'Ideally regulations would allow load control down to an ICP level'* – PowerNet
  - *'important to ensure regulations do not limit EDBs from directly engaging with consumers'* – Unison and Centralines

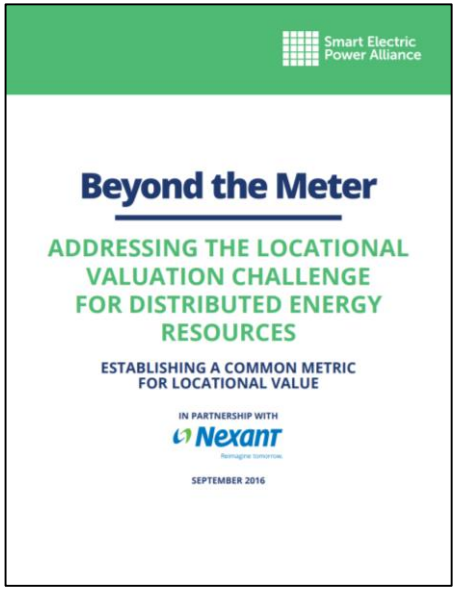
Incentives

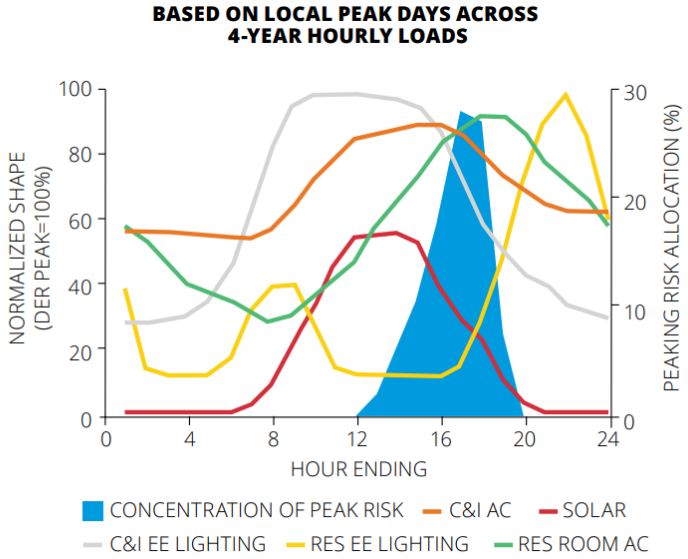
- Concern over funding investment
  - *'The expected exponential increase in energy demand from EVs will mean that EDBs will need to make new investments not covered by the current allowances'* – Wellington Electricity
  - *'it will be difficult for EDBs to purchase demand management services […] as they will not have an allocated regulatory allowance. Allowances for operating costs are based on historical spend and are only adjusted for new expenses if they apply across the industry…'* – *Wellington Electricity*
  - *'the current DPP/CPP frameworks have created minimal incentives for EDB investment to date'* - *Vector*
  - *'Other pricing models that legislation doesn't allow (low user fixed charges)'* – WEL Networks

Nexant and SEPA report

- Vector drew our attention to a report titled - ‘Addressing The Locational Valuation Challenge For Distributed Energy Resources’

- The report describes an approach for assessing the capacity deferral value provided by various DERs so their value can be stacked and combined





Source: Nexant

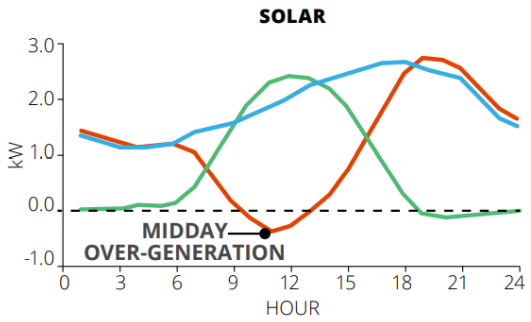
Method is based on four key concepts

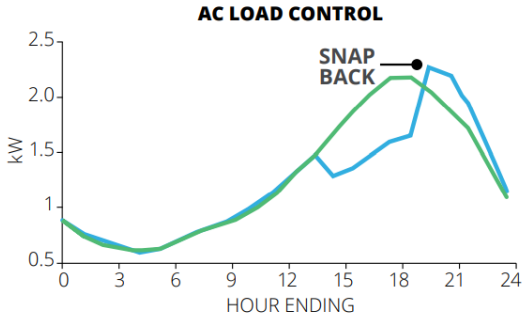
- **Excess capacity**
  - (or lack thereof) and the magnitude of distribution investments are key drivers of locational value
- **Projected load growth**
  - rates and deferral benefits are closely linked
- **Load shape attributes**
  - distribution area load shapes and the concentration and timing of peak demand vary substantially and matter
- **Timing, duration, and magnitude of need**
  - How many hours of relief are needed? When do they occur? For how long must production (or reductions) be sustained? How much production (or reduction) must be provided?

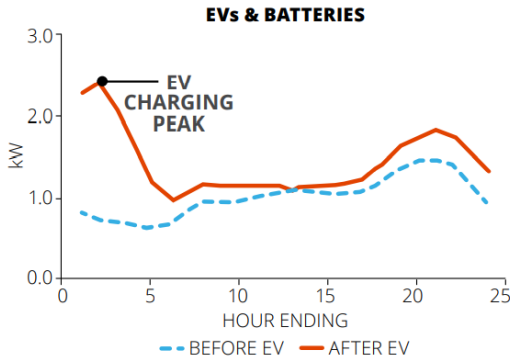
Quantifying locational value for DERs

- How can locational value be included in Integrated Benefit Cost Analysis?
- How can integrated distribution planning capability gaps be addressed?
- How can the need for contractual obligation and guarantees be reflective competitive mechanisms?
- How can distribution planning reflect uncertainty and risk planning?

Determining resource flexibility







Source: Nexant

CRITERIA	EXAMPLE		EXPLANATION AND CAVEATS
Can it be dispatched with different start and end hours?	☑	AC load control	Load control programs can be designed to allow flexible dispatch between a range of hours.
	☒	Solar	Except for curtailment, generation occurs when the sun shines.
Can the magnitude of output be controlled (ramping)?	☑	Adaptive AC load control	If only what is needed is dispatched when it is needed (different amounts in different hours rather than all at once).
	☒	Energy efficiency	Energy efficiency is "always on" and cannot be ramped up or down.
How far ahead must it be scheduled?	☑	Batteries	As long as they are charged ahead of time, batteries can respond almost immediately.
	☒	Day ahead Demand response	DR contracts specify advance notice requirements (can be Day ahead, hours ahead, etc.).

Source: Nexant

Conclusions

- The diversity of DERs and local needs are the main challenges for integrating flexibility resources.
- The overall value of each individual part depends on the other DERs available for bundling.
- Ideally, there are multiple sellers able to compete with each other.

Additional narrative from Vector

- **A key component of our energy future –** *'active network management is responsive to customer needs and can lead to a more affordable, dynamic and resilient electricity system delivering on New Zealand's decarbonisation goals'*

- **Confidence –** *'When we specify a traditional 'poles and wires' solution on the network, we know precisely what it's going to cost, how long it will take to deploy, and how it's going to perform. Distributed energy resource (DER) solutions have not reached the same levels of confidence*'

- **It has to work –** Flexible capacity '*needs to be large enough to actually influence both investment decisions and reliability. Finally, the resources need to target the right hours, must be available to cover all peak hours, and must provide capacity with certainty comparable to traditional distribution equipment. If any of these criteria are not satisfied, the DER portfolio will fail to avoid peaking damage'* – Nexant report

- **Data analysis and modelling are needed –** Need to invest in modelling capabilities to provide confidence, including at the feeder level – this is extremely complex as there are over 2M ICPs where flexibility services could despatch resource.

Current state of flexibility services – a summary

	Current state			
Spot energy/ancillary service alternative				Code changes may be needed in this area to allow more parties to participate. May be a case for introducing different levels of participant.
DER-based hedge				Need a lot of DER to be of interest – this is the biggest barrier. Not clear that any change is needed.
Transmission network alternative				Redundancy in transmission network means flexibility services potentially less valuable than elsewhere. For flexibility services to be used for unplanned outage restoration will need flexibility mechanisms that can respond quickly.
Distribution network alternative				Most EDBs are using legacy ripple control to manage distribution and transmission constraints and investment pressures. There are several trials into new technologies, mostly at a pre-commercial stage of development and involving resources owned by the EDB.
Delivered energy alternative				Need innovative retail pricing offers to encourage more use of flexibility services in this area.

Questions

- What do we think?
- Do you want to see any of the submissions?