OUTLINE OF A DEMAND RESPONSE MECHANISM THAT AVOIDS DEMAND BASELINES

A PRESENTATION TO THE AEMC

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20 March 2019

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INTRODUCTION TO IES

- IES is software and advisory company specialising in electricity markets
    - Founded 1983
    - Deep involvement in advising on reform processes since early 1990s
        - Project Manager for the wholesale market in Victoria from 1993
    - Did consultancy on design of FCAS markets and devised causer pays for the NEM in 1995.
    - Audits of market engine, causer pays and other software for NEMMCO/AEMO
    - Market design in international markets
        - Vietnam, Philippines
- Check out website www.iesys.com
- Market design, optimisation and control are IES specialties

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IES HAS SEEN AND WORKED ON MULTIPLE ATTEMPTS TO INCREASE THE AMOUNT OF DEMAND RESPONSE

THE WDRM RULE CHANGE – WHERE ARE WE?

- My assessment from the Consultation Paper, a sampling of submissions and feedback from the public seminar….
  - Big gentailers are generally OK with the status quo and warn against the risk of change, especially the use of baselines
  - Big users like the option to save money but want as little to do with the market as possible.
  - AEMO is OK with more WDR, as long as it's all aggregated and scheduled to look and behave like large, dispatchable generators
  - AEMC seems OK with AEMO's thinking in that respect
  - Everyone sees benchmarks as a huge stumbling bock but there's no other viable approach in sight.
- In short, the current rule changes could fail or, if enacted, be ineffective

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THE RULE CHANGE SEEMS VERY SIMILAR TO AEMO'S ATTEMPT TO SCHEDULE LOADS PERHAPS 5 YEARS AGO   25/03/2019   3

THIS PRESENTATION WILL ADDRESS…..

1. An alternative to benchmarking for the WDRM

2. The case for supporting non-scheduled responses free of the middle man, and how to do it while maintaining system security

3. The case for a Distribution Market Operator

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ITEM 1 DOES NOT APPEAR TO HAVE BEEN CANVASSED!   25/03/2019   4

AN ALTERNATIVE WDR CONTRACT

- Consider a retail customer that:
  - is interval metered, is on a ToU tariff with possible demand charges, a possible export option (because it has PVs) and perhaps some flexible load such as aircon or batteries;
  - Desires to save costs be gaining access to, and responding to, wholesale prices.
- Consider each DNSP/retailer defined time period during a day separately
  - typically peak, shoulder and off-peak periods, not necessarily contiguous
  - TOU periods will usually mirror local network-defined time periods
- We manufacture and allocate to this customer a swap contract that obliges him/her to pay, in addition to normal retail charges:
  - the difference between the 5 minute spot prices (adjusted for MLFs and DLFS); and
  - the time average of the spot prices over the period (adjusted for MLFs and DLFS), calculated ex post.
  - Premium is zero from the definition

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AN IMPROVEMENT, BUT NOT IDEAL AS IT CAN MISS SOME 'BIG' OPTIONS SUCH AS SHUTTING DOWN FOR THE DAY   25/03/2019   5

WDR SWAP CONTRACT – SIMPLIFIED (WHOLE DAY PERIOD)

Region Price 5min (QLD1)

Pay

Receive

Tue, 13 Feb 18

Price 5min

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HOW DOES A RETAIL CUSTOMER SEE THIS WDR SWAP CONTRACT?

- At first glance, this WDR swap contract would seem to give full exposure to spot prices
  - If so, it could be highly risky and in any case some retailers already offer a pass-through tariff.
- BUT defining the wholesale price as relative to the average ex post price removes the longer term risk
  - so all that remains for the customer are the wholesale price ups and downs (volatility) within the time period.
- Some simple statistical analysis puts this into perspective:
  - Payment = $\text{sum}(p(t)*x(t)) - pav*\text{sum}(x(t)) = \text{sum}(p(t)*x(t)) - n*pav*xav$
  - But Correlation_coefficient = $(\text{sum}(p(t)*x(t))/n - pav*xav)/(psdev*xscdev) = $ Payment/$(n*psdev*xsdev)$
- The incentive is to make the Payment negative (as much as possible)
- So, if a customer can make his/her load operate with a negative correlation coefficient or, put another way, a negative covariance with respect to the wholesale price (adjusted for losses) he/she can make money
- This means increasing load when prices or down or, particularly, decreasing load when prices are high
  - Kind of obvious and not so hard to do? - to be tested.
  - Retail tariff will also influence behaviour
  - We would expect most responses to be automated by monitoring 5-minute dispatch prices (relatively easy!)

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I ASSERT THAT YOU WOULD HAVE TO WORK REALLY HARD TO DO BADLY UNDER THIS ARRANGEMENT; TO BE TESTED   25/03/2019   7

WHAT ABOUT ADDING A BASELINE?

- The proposed WDR swap contract would operate on a customer's entire load.
- Given this deliberate exposure of load to (manageable) price risk, one might hypothesise that some form of baseline on that load might limit that risk.
- We analyse the case with a baseline defined as a constant (xbase) over the period.
- Payment = $\text{sum}[(p(t) - pav)*(x(t) - xbase)]$
- The first set of terms that include x(t) is the payment without the baseline, so we need only examine the behaviour of the terms involving xbase.
- Payments involving xbase = $\text{sum}[(p(t) - pav)* (-xbase)]$
  - Which is always zero from the definition of pav!

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A BASELINE WOULD ADD NOTHING   25/03/2019   8

COUNTERPARTY TO THE PROPOSED WDR SWAP CONTRACT

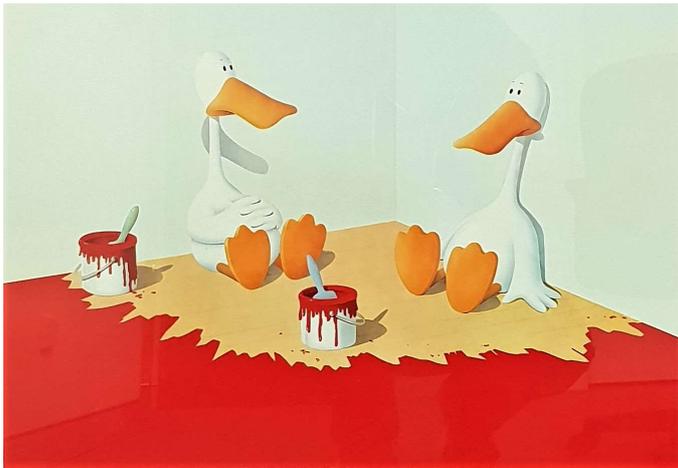- The party affected and the natural counterparty is the customer's retailer
  - The effect of WDR contract on retailer is to convert a volatile spot price (with loss adjustments) paid on behalf of the customer over the period to a time average price
  - If the customer does not respond, other retailers/customers would be entirely unaffected
    - If the customer does respond, it should be to the benefit of the whole market
- Consider the following cases (on a single period, to simplify):
  1. WDR contract would settle negative; could pay to move even with no further action.
  2. WDR contract would settle about neutral; could pay to move if have flexible load.
  3. WDR contract would settle positive; likely to remain unless has highly flexible load.
- Each of these cases appears fair to the retailer (which is not to say they will like it)
- Analysis of possible outcomes on a range of real load profiles would clarify the issues

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IN ESSENCE, THE RISK WOULD GO TO WHERE IT IS BEST MANAGED; THIS CAN BE MUTUALLY BENEFICIAL   25/03/2019   9

OVERVIEW OF WORKING OF THE WDR CONTRACT MECHANISM

- A customer decides she might benefit from some exposure to wholesale spot price volatility
- Customer registers with AEMO (or a Distribution Market Operator (DMO)?) directly, or through an adviser, a retailer or aggregator
  - Her retailer may not block or hinder this registration or later operation
- Customer operates under her normal retail contract with the WDR swap contract superimposed. Details to be decided
  - Can the customer opt in and out and under what conditions?
  - Is there scope for a moderate level of "forgiveness"? If so, how?
- AEMO (or DMO) settles the transaction with the customer and her (counterparty) retailer
  - Net payments to AEMO (DMO) over a settlement period could be viewed as failure, to be avoided.
  - Therefore, a financial buffer may be maintained to deal with operational risks – prudential requirement

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MANY MORE DETAILS AND SUB-OPTIONS TO BE FILLED IN AND CONSIDERED   25/03/2019   10

HOW ARE WE GOING?

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JUST CHECKING....

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WE LIKE WDR BUT....

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"THE FAILURE SOCIALISM" – HANGING THE WALL IN OUR OFFICE TO REMIND US

25/03/2019   12

AGGREGATION AND SCHEDULING

- AEMO and AEMC appear to be in lock step on this issue, along with other parties
- The general approach to small and large customers is essentially the same
  - A small customer must go with a retailer or aggregator to get her load aggregated into a block that can be offered into the wholesale market, broadly under the current rules (order of MW size)
  - That block must make offers, be scheduled, take part in an STFM (perhaps optional), and comply with the schedule (strict linear ramping to a target) and other instructions i.e. behave like a large generator dedicated to the NEM.
- This approach (which was considered by AEMC in 2016) has severe disadvantages
  - A requirement to operate under another party will "erode the value proposition" for the customer
  - The performance requirements imposed on the retailer/aggregator, inevitably passed though to the customer in some form, lead inevitably to highly conservative compromises by both parties
- These rules have discouraged, and will continue to discourage, a large slab of potential demand response

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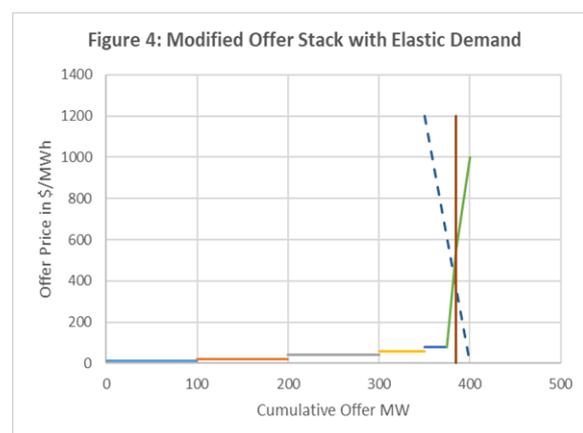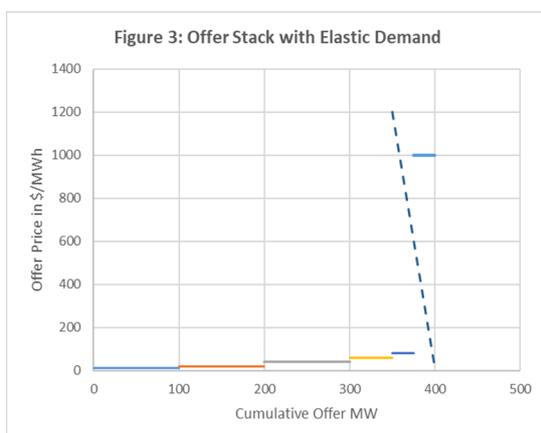IT LOOKS LIKE AEMO IS HAVING ANOTHER GO AT REQUIRING LOADS TO BE SCHEDULED   25/03/2019   13

AEMO DOES FACE CHALLENGES WITH UNCONTROLLED LOAD RESPONSE!

- Forecasting errors, especially when supply is tight
  - Gives artificial price volatility, system security risk
  - In earlier rule change on scheduling loads, AEMC told AEMO "Improve your forecasting"!
  - There is often no stable price-volume equilibrium when only discrete bid blocks are supported, which can be noticeable at the top end.
- The core problem is and will be 5 minute ex ante pricing with no compensating price adjustment within the 5 minutes
  - Unscheduled loads can currently, and could in future if allowed, respond to a fixed 5 minute ex ante price to an uncontrolled and unknown degree
  - This is a real problem for pricing and system security
- However, aggregation and scheduling of all participating loads to ramp linearly is not the only solution!

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AEMO'S CURRENT LOAD FORECASTING CHALLENGES ARE REAL AND GROWING, BUT WHAT TO DO?   25/03/2019   14

IMPROVING THE PRICE FORECAST BY IMPROVING NEMDE

- Part of the price forecasting problem is the discrete nature of market offers, especially at the top end.
- This problem could be removed by supporting continuously priced offers:
  - Joining the offer price-quantity pairs with straight lines, rather than stepwise functions
- The change from block offers to continuous offers could be optional
  - even down to the individual offer level
- This makes the NEMDE linear program a quadratic program, an absolutely standard task
  - This is a very minor change to implement, and probably also at the participant end.
  - Optionality would greatly reduce the costs and complaints on that score
- This concept was set out in IES Insider 31, March 2018, available on IES's website

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A SIMPLE NEMDE FIX CAN REDUCE THE VOLATILITY IN AEMO'S PRICE FORECASTING   25/03/2019   15

REMOVING ARTIFICIAL PRICE VOLATILITY BY IMPROVING THE DISPATCH ENGINE

Figure 3: Offer Stack with Elastic Demand

Figure 4: Modified Offer Stack with Elastic Demand

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YOU DON'T NEED TO SCHEDULE OR EVEN KNOW PRICE ELASTICITY TO IMPROVE PRICE FORECASTS   25/03/2019   16

HOW TO KEEP UNCONTROLLED LOADS/GENERATION UNDER CONTROL

- Two polar approaches:
  - Loads directly controlled by AEMO, retailer or aggregator through market offers or physical mechanisms
  - Versus
  - Loads managed locally in response to a pricing regime that gives immediate feedback if more or less load response would be welcomed. AEMO (and a Distribution Market Operator) would have ex post visibility of individual responses and could allow for such response in its forecasting
- The mechanism to achieve local pricing feedback is called deviation pricing, and was described as a "long term" solution in the Frequency Control Frameworks Review
- In the case of a price sensitive load looking at the 5 minute ex ante dispatch price
  - If there is too much load response, then deviation price would instantaneously drop and vice versa.
  - Loads and AEMO forecasts would adjust to this regime.

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DEVIATION PRICING CAN BE HELPFUL IN THE ENERGY MARKET AS WELL AS WITH FCAS   25/03/2019   17

POSSIBLE STRATEGY FOR THE AGGREGATION/SCHEDULING ISSUE

- The WDR swap contract concept is a concept worth exploring as a "more preferable" option under the current review
- Aggregation and scheduling of loads would be supported, but as an option
- A small customer (i.e. small relative to NEM wholesale market requirements) may operate directly with the wholesale market with a WDR swap contract, provided they also operate with deviation pricing.
- For "go it alone" WDR customers, deviation pricing can be largely self-funding in that:
  - A response that causes frequency to deviate would subtract directly from WDR swap contract earnings
  - A response that helps frequency stabilise would earn, but the source of these funds would need to be determined.

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DEVIATION PRICING CAN ADDRESS A WHOLE BUNCH OF PROBLEMS. DOES NEED TO BE INTRODUCED WITH A "BIG BANG"   25/03/2019   18

THE CASE FOR A DISTRIBUTION MARKET OPERATOR (DMO)

- Under current NEM arrangements, AEMO is the natural party to settle a WDR swap contract
- However, the rule change proposal for a separate WDR operator has merit:
  - However, it would better be extended to a Distribution Market Operator
  - Why? Because its remit could go beyond WDR
- Issues in favour of a separate entity
  - Could work to price all factors relevant to distributed entities e.g. including, local network congestion, local voltage management, etc., etc.
  - Removes the inherent conflict of interest form networks managing demand response to relieve network congestion
  - Recognises that distribution issues go well being AEMO's remit
  - DMO Should facilitate WDR, not "stand in the middle" like current retailers or aggregators

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I CAN PROVIDE A PAPER ON THIS SUBJECT BY DARYL BIGGAR OF THE AER.   25/03/2019   19

CONCLUSIONS

- The proposed WDR swap contract appears to be a practical alternative to any mechanism that requires demand baselines
- While the proposed requirement for aggregation and scheduling appears less controversial, it will be a major factor in dampening response, as it always has been.
  - AEMO's clear desire is to tighten its "open loop" command and control (more compulsion, more direct control, more scheduling, more accurate modelling, etc. etc.) .
  - In my view reality will eventually overwhelm this approach. Closed loop, local control is better
- Direct access to the spot market can be managed with the addition of deviation pricing
- Establishment of a Distribution Market Operator should be considered
  - With a broad remit; WDR, network congestion pricing and settlement, voltage pricing/management etc.

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THE RIGHT COMBINATION OF OPEN AND CLOSED LOOP SYSTEMS IS THE ANSWER. NEEDS ARE CHANGING RAPIDLY.   25/03/2019   20

DISCUSSION

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ONLY 20 SLIDES!

25/03/2019   21