IES
Intelligent Energy Systems

25 March 2019

Mr Declan Kelly
Project Leader
Australian Energy Market Commission

Dear Mr Kelly

AEMC Ref: ERC0247: Wholesale Demand Response Mechanism

Intelligent Energy Systems (IES) requests that you accept and publish this late submission on the consultation paper of December 2018 and the workshop held in Melbourne on 5 March 2019.

IES is an Australian consulting and software company that has supported market reform in Australia since the mid-1980s. IES staff have advised on various aspects of market design in Australia and internationally. For example, IES designed the current ancillary service market arrangements and payment mechanisms in 1999. Some IES staff members have also had direct experience with demand-side management while working in general industry.

We understand a key take-out from the 5 March workshop was the unworkability of baselines as a mechanism for measuring demand-side response. On 20 March 2019, IES presented to the AEMC an alternative mechanism for supporting wholesale demand response that does not require baselines. The mechanism is essentially a compromise that exposes willing participants to short term spot price volatility without exposing them to long term spot price risks.

The presentation also briefly covered two other matters that will be key to bringing forth the much higher level of wholesale demand response that the system will need in future:

- the importance of supporting an option for small consumers to interface directly with the wholesale market without requiring a middle man to aggregate and schedule them, and how to do it while maintaining and enhancing system stability; and
- the case for a Distribution Market Operator (DMO)

IES's presentation to the AEMC on these matters is attached to this submission. It provides a brief outline of these concepts only. More work is required to demonstrate the utility of the approaches described, to clarify what the mechanism can and cannot do, and to explore implementation issues. One thing the mechanism definitely can do is accommodate loads, generation and batteries equally well.

I commend the approach for AEMC consideration. IES stands ready to expand the analysis if the AEMC wishes to take it further.

Yours sincerely

Hugh Bannister
CEO, IES

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OUTLINE OF A DEMAND RESPONSE MECHANISM THAT AVOIDS DEMAND BASELINES

A PRESENTATION TO THE AEMC

Hugh Bannister – CEO, IES

20 March 2019

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Intelligent Energy Systems

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

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

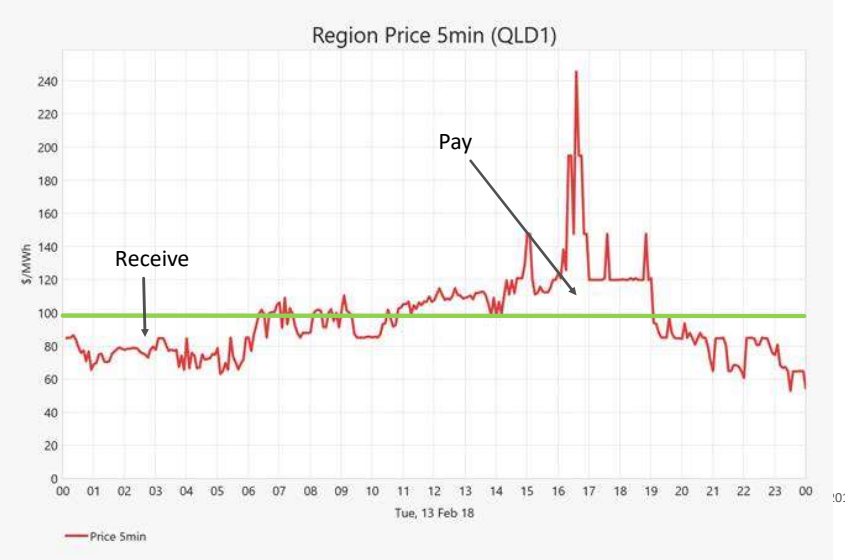
THIS PRESENTATION WILL ADDRESS…..

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

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

WDR SWAP CONTRACT – SIMPLIFIED (WHOLE DAY PERIOD)



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 = sum(p(t)*x(t)) – pav*sum(x(t)) = sum(p(t)*x(t)) – n*pav*xav
  - But Correlation_coefficient = (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!)

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 = 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 = sum[(p(t) – pav)* (-xbase)]
  - Which is always zero from the definition of pav!

COUNTERPARTY TO THE PROPOSED WDR SWAP CONTRACT

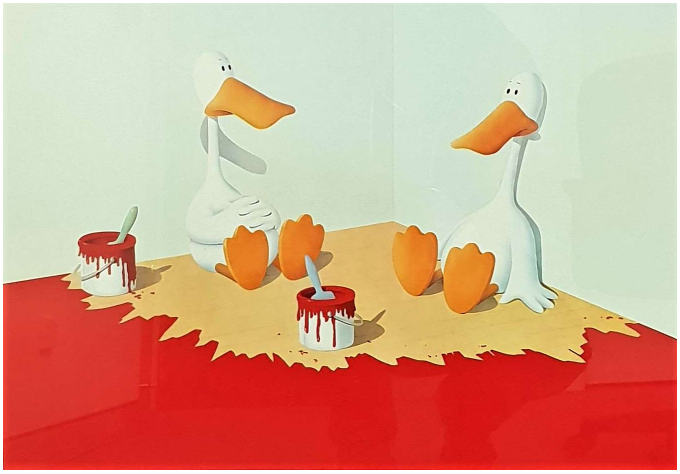
- The party affected and the natural counterparty is the customer's retailer
  - The effect of WDR contract on retailer is to convert a volatile spot price (with loss adjustments) paid on behalf of the customer over the period to a time average price
  - If the customer does not respond, other retailers/customers 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

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

HOW ARE WE GOING?

WE LIKE WDR BUT….



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

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!

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

REMOVING ARTIFICIAL PRICE VOLATILITY BY IMPROVING THE DISPATCH ENGINE

Figure 3: Offer Stack with Elastic Demand

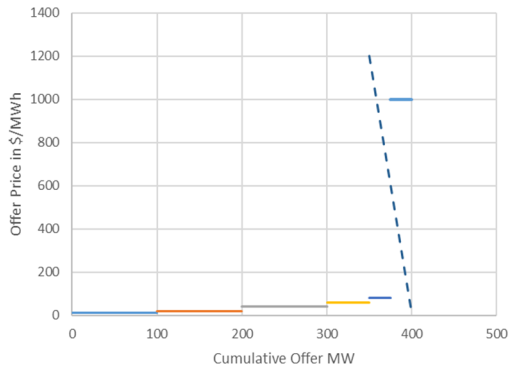
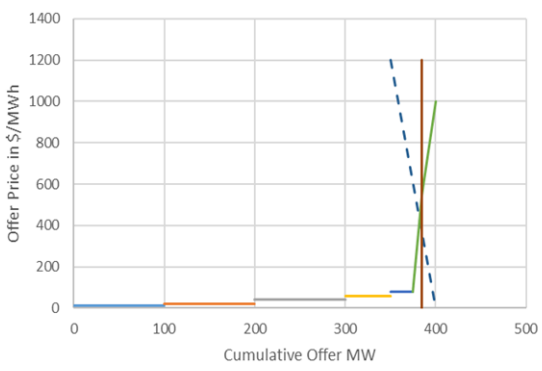


Figure 4: Modified Offer Stack with Elastic Demand



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.

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.

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

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.

DISCUSSION