In response to the call for comments on the Open Energy Networks consultation paper I submit the comments below.

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DER submission

The document "Open Energy Networks" acknowledges the benefits that can arise from the use of customer load variation in managing the electricity grid.

Half of our electricity bills are associated with network costs with much of this in the distribution network. For greatest benefit any use of DER should address the constraints in operation of distribution networks as well as addressing issues of energy shortages. The flow constraints and voltage constraints are largely in response to local loads and trading and would be more efficiently handled locally.

Forms of DER impact

DER can impact

1. angle stability between states and major groups of generators,
2. it can assist in the initial response to a frequency drop from loss of generation
3. it can act to alleviate distribution network congestion
4. and can contribution to control of the overvoltage issues arising from solar power or from synchronized responses to battery energy flows responding to high energy market prices

These different forms of impact require different speed of communication of data and different breadth of data gathering to form the desired response. Fast stability issues need a fast response from many customers while voltage control can be slower but the data is only needed for local controlling . These are all reasons for customers to contribute to network operation.

DER Engagement

Most of the demand management schemes to date have been manual intervention to adjust the load of large customers. The rise of solar panels and the impending impact of batteries and possible electric vehicles means that there can be b]great benefit for engaging the smaller prosumers.

One of the possibilities that can be responsive is a neighbourhood distribution market. For a successful application there are several features that are required because of the very many small trades involved.

Emergency and market responses from DER

In Australia we have had a very beneficial scheme of direct control by utilities of hot water heating. There would be helpful contributions to system operation by direct control of customer loads and batteries. However such a scheme would be difficult to create a large take-up by customers so many

trial schemes are examining some form of market incentives for the adjustment of customer energy flow. There is often a delay in negotiating a market response that would be too long for contribution to several power system needs. For fast response I believe we need a fast direct control of portions of loads or a broadcast calling for a strong immediate load response.

In this discussion I am thus splitting DER engagement into two forms based on the required speed of response and the implementation of the required data sharing.

1. A pre-arranged contract for response in a system emergency
2. A market based response to energy shortages , congestion or equipment limits.

In an emergency, signals can be broadcast using one-to-many signalling on Ethernet to all or selected subgroups of customers for demand reduction/battery export. This can command a response in sub second timing even with security protocols applied.

Any other response has a timescale that can be implemented by a market mechanism. It does not matter if it is demand reduction or an increase in battery export, the mechanism of response can be the same. So if it a local congestion is due to excess charging of electric vehicles or an overvoltage issue on a feeder market, mechanisms can be applied to encourage grid positive responses. For example, with the thermal overload limits due to lines or transformers we have tens of minutes to iterate to a resolution.

Appraisal of forms of customer engagement

Given the desirable features of a neighbourhood market introduced above , the different models of engagement are now appraised.

Centralized

In the light of these features we would see that a central national management of DER would have high communication overheads and difficult to determine the value of network constraints and to target corrections.

Aggregator

If we have multiple aggregators interfacing to customers on a feeder we can have a good response to national energy market issues. However there would be increased difficulty in targeting voltage control and flow constraints that spans customers with different aggregators.

Neighbourhood market

The proposed scheme uses automated feeder controllers regulate feeder response by using communication between adjacent customers. The market price is cleared automatically for the feeder and iterations synchronize the market response with other feeders.

Independent DSO

It would not matter greatly whether the automated market system was maintained by a DNSP and a DSO as long as the national system level market signals were passed cleanly to customers

Technical Details of value from DER

The value of DER to network operation in turn becomes a value stream for customers to actively engage with network.

Value Streams

Four value streams for DER in networks can be identified at present,

1. Angle stability requires a subsecond response time for a short period: EMERGENCY RESPONSE
2. Frequency stability, batteries and load reduction can assist the system but will have a limited duration of response , the initial frequency response can be an EMERGENCY RESPONSE but the longer term response into the several minutes is more appropriately a MARKET RESPONSE
3. Distribution Network congestion, whether from sharply rising load or from equipment failure can be addressed by a MARKET RESPONSE
4. Distribution voltage control can be targeted at those who can manage it most and would favour domestic battery charging and reduced energy charge for loads as a MARKET RESPONSE

The value obtained from the first two streams currently can be determined by AEMO while the DNSP is in the position to understand the value of responses for the last two.

The combination of the market value signals results in a market price for power injection. The expectation is that the trading by a customer would be automated by a local intelligence on customer premises operating under parameters set by the consumer. The local computer of the customer undertaking daily optimization of customer loads can respond to system needs by changing the export from batteries or by deferring local load such as swimming pools or clothes drying.

Emergency Controls

The current internet traffic is by sending a packet from source to one customers. For fast emergency control we need to send data packets that replicate at the nodes to become a one- to-many system. This process can reach a high majority of customers to command a level of immediate response. The commanded level needs to be evaluated off line such that we do not command maximum export from all batteries on a feeder leading to an overvoltage issue.