Localised networks and demand side participation

The National Electricity Market (NEM) has been traditionally set up as a two sided market which allows for participation from the Supply Side and the Demand Side. With the rapid and continuous uptake of distributed generation and storage, the terminology and regulatory framework surrounding the "two sided" approach will have to change significantly. This article examines some of the market mechanisms recently established to increase participant flexibility.

Embedded Networks

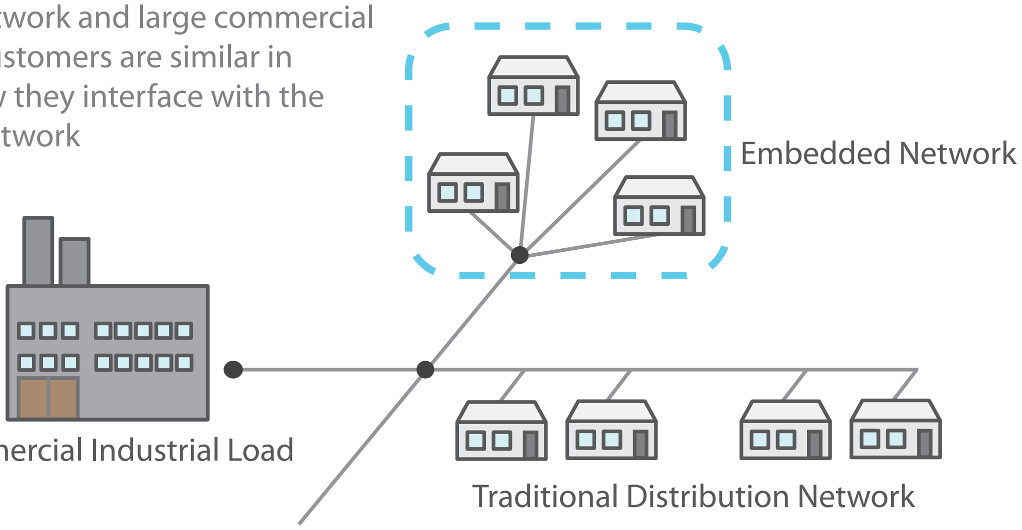
An Embedded Network is a small distribution network operated by a private entity. They are used in situations where there are many users consuming energy within a single building or complex, such as shopping centres, housing estates, educational campuses, large apartment blocks, retirement villages, industrial complexes, and so on. Exemptions can be obtained from the Australian Energy Regulator to allow the Embedded Network Provider (ENP) to operate as both a network service provider and an energy retailer.

The Embedded Network market mechanism allows for the ENP to negotiate a much better rate from energy retailers since the aggregation of multiple end users under the single entity reduces the service effort and risk profile. This rate benefit can then be passed to the end users or can serve as a revenue stream for the ENP (which may be an asset manager, property developer, community council, etc.). Many Embedded Networks also choose to install distributed (often renewable) energy generation on their networks in order to reduce the amount of energy that must be purchased from their electricity retailer. This further reduces their costs and increases the end user benefit and/or profit as an ENP. For the same reason, it is envisaged that ENPs will also begin to install energy storage systems for load shifting and peak demand reduction.

Microgrids

A future benefit of the Embedded Network mechanism is that it encourages the creation of grid subsets which are well positioned to become microgrids.

Embedded network and large commercial or industrial customers are similar in relation to how they interface with the distribution network



A microgrid is a localised portion of the traditional grid which is able to operate autonomously if necessary. A national grid with a large percentage of generation, storage and consumption aggregated into microgrids creates an extremely robust and flexible network. Microgrids are able to satisfy the demand for all customers within the microgrid, and even export energy to the surrounding distribution network. A microgrids ability to be a net energy exporter when required has led to the coinage of the term Topological Power Plant (TPP) which ultimately could be able to participate directly on the NEM as a consumer or generator.

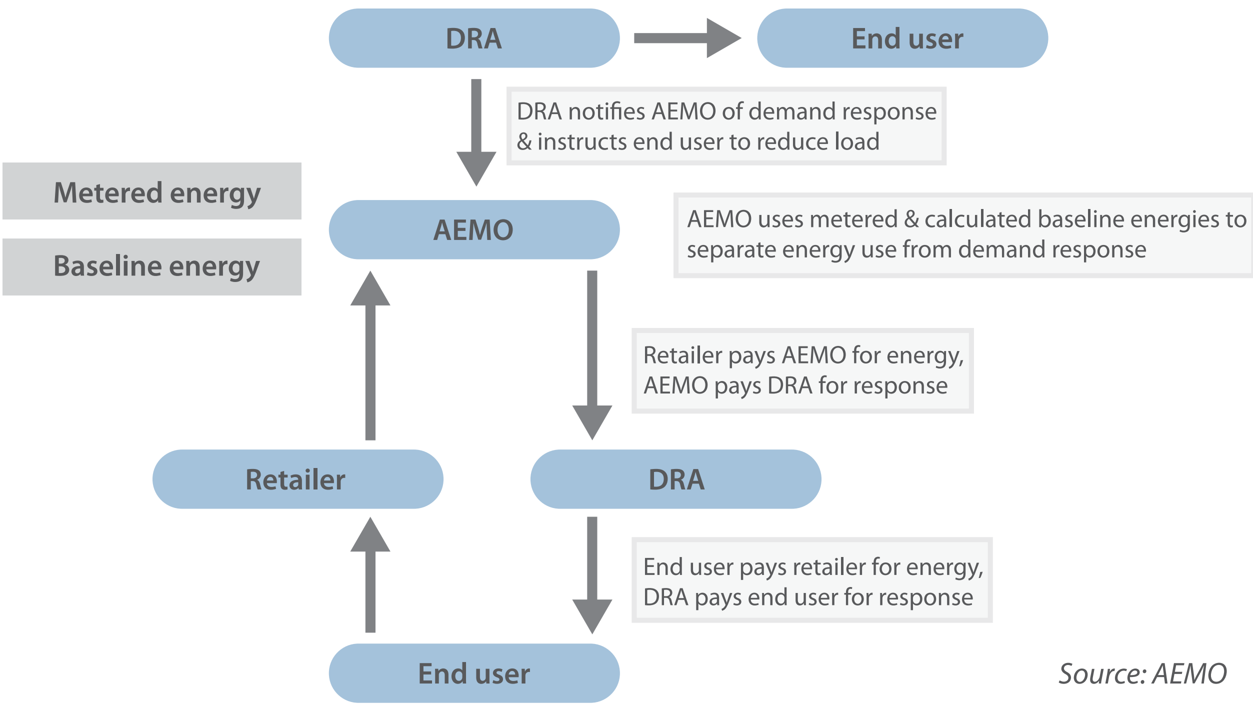
The grid/microgrid configuration benefits customers regardless of their point of connection. The microgrid setup fits into the Nash Economic Equilibrium model where market choices are made based on what is best for the individual AND the collective. In this way microgrids are most efficient and cost effective when they operate in parallel with the main grid, but are capable of operating in an islanded mode should there be a fault on the main grid. Through main grid support and microgrid autonomy, reliability is greatly increased for all customers in the network.

Microgrid development will be in an important aspect of grid evolution as the cost of energy storage decreases over the next decade – particularly for 'fringe of grid' applications. For more information on microgrids, check out the GSES publication "Microgrid: A solution to the aging grid infrastructure".

Demand Response Mechanism (DRM)

Economic dispatch is determined in the National Electricity Market (NEM) through generators bidding in the amount of power they are willing to supply for a given price. As the amount of demand in the market increases, more generators are brought online and the price of all energy in the market increases. This process is a constant balance between the demand and supply of electricity. (For more information on how the NEM works check out the AEMO fact sheet).

The Demand Response Mechanism (DRM) recognises that withdrawing demand from the market has the same effect to this balance as adding generation. The DRM works by paying an end user for reducing demand during periods where the NEM experiences high overall demand in a similar way to how a generator is paid to increase their level of generation. Under the mechanism, end users are



Source: AEMO

able to be rewarded via the wholesale electricity market for demand response that would be provided through a Demand Response Aggregator (DRA). A user can reduce demand either through eliminating certain loads, or employing onsite generation to reduce the amount of demand they require from the grid.

The benefit of the DRM is that it is an extremely efficient way of incentivising load levelling on the NEM. This is because the DRM is purely a market mechanism and does not require additional infrastructure.

Ancillary Service Unbundling (ASU)

ASU allows a Demand Response Aggregator (DRA) to register and sell Frequency Control Ancillary Services (FCAS) using aggregated loads/generation independently of the retailer. Participation of DRAs in the FCAS market can either be in the form of demand response (i.e. removing demand to increase voltage or frequency), or dispatching generation from distributed resources (such as a large group of energy storage systems). This allows traditional consumers to participate within the NEM and creates a revenue stream for distributed resources they have installed without having to go through a retailer. Providing a mechanism for distributed resources to participate within the FCAS market also increases the ability of the grid to respond quickly and dynamically to power quality issues.

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