Oakley Greenwood

Assessment of edge of grid regulatory and policy framework

prepared for:
Energy Supply Association of Australia

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DISCLAIMER

This report has been prepared for the Energy Supply Association of Australia (esaa) to assist in an examination of whether there is a case to amend the policy and regulatory framework for transfer of customer groups currently supplied as part of an interconnected network to off-grid, distributed generation supply. The work has been undertaken collaboratively with esaa members and staff and has relied on significant input from members. Oakley Greenwood disclaims liability for the accuracy of material not developed by Oakley Greenwood

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1. Background and summary of conclusion

1.1. Introduction

This document reports on the basis for our conclusion that it is likely there will be benefit in developing changes to regulatory and policy instruments to allow network businesses to routinely consider moving customers currently connected at the edge of existing grids completely off the grid and supply their load from local generation.

The work was undertaken collaboratively with esaa members and staff.

1.2. Background

The norm within the industry for many years has been for progressive expansion of the main grid to meet new demand and to interconnect existing isolated networks to the main regional grids. While regulatory arrangements allow for individual customers to choose to move off the grid, the arrangements generally do not envisage contraction of the reach of the main grid at the discretion of the network business, or if they do it is treated as a special case.

The assessment has been prompted by acknowledgement that, in theory, dynamic cost reflective tariffs could and should signal where it would be beneficial for customers to choose to move off-grid. However, in practice all customers in larger groups or small townships are unlikely to jointly make this choice. It is also unlikely that prices to each customer can fully reflect all locational and timing considerations and as a result at best will be an approximation.

Changes to existing regulatory arrangements to provide for network businesses to opt for a shift to off-grid supply may therefore be warranted. A primary purpose of this review is to assess the magnitude of net benefit of change to the regulatory arrangements.

Current arrangements envisage distributed generation as back-up supply or for redundancy for areas normally operating connected to the main grids, but are generally subject to limitations designed to maintain separation between generation and network activities. The regulatory arrangements vary by jurisdiction. These hybrid situations were not the primary focus of this current work but, most likely, will be impacted by changes to allow for a shift to full off-grid operation at the discretion of networks.

We also recognised that remote locations in a number of parts of Australia are already served by local generation and these situations may provide points of comparison. However, there would be differences relating to retail contestability and competition in generation that currently apply in on-grid situations.

1.3. Assessment overview

The assessment found that there is very limited data on which to base a bottom up estimate of the extent or value of moving groups of customers at the edge of grids to off-grid supply. The work did, however, collate information about a small number of high value situations where it has been established, or it is likely, there would be value in contracting the boundary of the existing network. We conclude that it is reasonable to assume that as more assets supplying locations at the edge of grids age and where demand is growing, there may be an increasing number of cases where off-grid supply could be an option. This conclusion is consistent with a position where there has been sufficient investment to ensure existing supplies are satisfactory within the current regulatory framework except for the (few) cases where reinforcement is needed in the near term. Advances in distributed generation and storage technology and cost should also contribute to an increasing number of situations where off-grid will be a viable alternative to on-grid.

In the absence of sufficient data to develop a bottom up estimate of value we have instead evaluated the order of magnitude of a small, arbitrary, but conservative saving that might be achieved over time by replacing part of the edge of grid network assets. Information received from esaa members indicates that there is no less than 100,000km of network that could be classed as edge of grid. If a ten percent saving in only ten per cent of these lines (i.e. one percent) were available, the saving would be of the order of $50M, far outweighing the likely cost of regulatory and policy changes needed to facilitate the option.

A similarly conservative assessment of the number of customers is that there are 25,000 customers supplied at the edge of grids. There is no formal definition of edge of grid and thus no standard means to assess either the length of line or the number of customers affected. If edge of grid is determined by whether it is economic to consider a distributed generation solution then the boundary of edge of grid will move progressively deeper into the grid if distributed generation and storage costs fall relative to the cost of grid-supplied electricity. Accordingly, the length of line and number of customers who may benefit from a distributed generation option should be expected to rise and exceed the conservative assumption considered here.

The analysis indicates that with typical costs for network and current generation technologies, there are situations where it would be cost effective for supply to shift from on-grid to off-grid. A shift to off-grid supply is more likely to be warranted where costs for major maintenance or augmentation of an existing network are similar to complete replacement of an existing line. The longer the line the more likely it is that network costs will exceed costs of a distributed generation solution. A shift to off-grid may also be warranted if there is an under-utilised, low cost, source of fuel available for local generation. Examples provided by members noted a number of situations of this type exist now. More such situations are likely to emerge as supply side costs for generation and storage are more likely to fall than network costs. Further, edge of grid situations are likely to offer potential for innovative use of “waste” fuel, such as from agriculture, and have fewer space restrictions for installation of associated plant.

In summary, there are situations now where regulatory and policy considerations are hindering consideration of moving groups of customers to off-grid supply and the number of situations is likely to increase. There is insufficient data available to forecast when, but the longer term potential saving is likely to be significantly more than the cost of regulatory and policy changes needed to remove these barriers.

2. Where might an off-grid supply be beneficial?

In the course of discussion with esaa members a number of types of situations where an off-grid approach may be appropriate emerged, including where:

- Reliability is low, for example due to single circuit supply prone to interruption and often requiring expenditure on temporary mobile generation during planned or extended forced outages;
- High costs for both routine maintenance and activities such as pole replacement;
- Location specific risks such as where bush fire risk is high, possibly leading to switching off supply on high risk days; and
- Situations where distributed generation already exists and feeds the grid or where fuel is readily available, for example a run of river hydro scheme, an untapped geothermal resource or other local resource.

Future development of technology for distributed generation may also offer increasing opportunities. For example combinations of solar or wind with storage. There is a strong incentive for technology development to replace diesel in existing remote islanded situations.

3. Number of affected customers and potential economic benefit

A key parameter of interest to this work is the amount of load and number of customers that may be affected. We did not identify a direct measure of the potential to move off-grid. We therefore looked for indirect measures.

The number of customers supplied via Single Wire Earth Return (SWER) lines provides one measure of the size of load and number of customers at the edge of grid. SWER is often (but not uniformly) used to supply customers on the outer edges of the main grids. SWER supply situations may therefore be candidates for transition to off-grid operation. However, not all SWER load may be suitable for transfer to off-grid while some customers supplied on multi- wire systems may be. Nevertheless the customer base supplied by SWER provides some guide as to the amount of load generally at the edge of the main grids.

We understand there is no general record of the SWER customer base and we also understand that the use of SWER varies considerably across the NEM depending on both geography and policy choice.

For example, in Queensland, Ergon makes extensive use of SWER and reported that approximately 85MW of load across 25,000 customers is supplied by 65,000km of SWER line in their region. Ergon also reported that at present there is no compelling case for customers currently supplied on-grid to move to off-grid supply in the short term. A key reason for this is that Ergon, working within the current regulatory framework, has made significant investment in the SWER system in recent years and service quality meets the required standards. The additional costs for local generation would all be incremental additional cost leaving recently upgraded networks stranded.

Earlier government electrification programs in Western Australia included over 30,000km of new network at the fringes of the main grid. Much of that network is now approaching the end of its useful life. As such, major investments in line replacement, development of off-grid arrangements or, where appropriate, implementation of hybrid systems in which distributed generation becomes a significant part of the supply arrangement, are going to be needed.

Aurora reported very little use of SWER in Tasmania, consistent with different geography of the State. However, it has a number of situations where network costs are high and an off-grid option would be attractive, including one affecting 800 customers currently supplied by submarine cable.

A number of other network businesses contacted reported interest in hybrid supply situations that rely on distributed generation while remaining connected to the main grid. As noted this type of situation is more readily accommodated within the existing regulatory and policy structure.

Overall, although data is scarce, for the purposes of this broad policy assessment we consider it is reasonable to presume 100MW and in excess of 25,000 individual customers as a safe working estimate of the minimum amount of load at the edge of grid across all states. Given the scarcity of data we have concluded that there is no direct measure of the potential savings available. However, on the basis of the cases reviewed it is clear there are some benefits and it is reasonable to assume the number of cases will grow. Considering only the 65,000km of SWER lines reported by Ergon and assuming the capital cost of SWER is fifty percent of the cost of multi-wire construction, or $75,000/km, there is approaching $5B of network broadly at the edge of the main networks.[1] For the purposes of considering if there will be benefit in making the regulatory and policy changes needed to facilitate off-grid operation, if it is further (arbitrarily but conservatively) assumed that in only ten percent of the cases there might be a ten per cent reduction in cost, then there is in the order of $50M of savings available.

At this point it is important to reiterate that this value is presented only for the purpose of assessing the case for making regulatory and policy changes to increase the options for network businesses to minimise costs. Although esaa advises that it is likely there may be a mix of single and multi-wire networks and the edge of grid customer base in other states which would result in higher potential benefits. For example, if the potential for conversion of edge of grid network to off-grid in other states is fifty percent of the ratio in Queensland the replacement cost of the affected network would be in the order of $10B. The cost to make the necessary changes will undoubtedly be less than the potential savings deduced by this simple calculation.

4. Generic direct costs and benefits - nomogram

In order to illustrate the trade-off in cost of supply between length of power line and cost of generation for different customer demands, we developed a simple spreadsheet model and nomogram to present the results relating length of line, generation cost and customer demand. A trade-off occurs because in general, generation cost increases more rapidly than network costs with size of customer demand but network costs are more sensitive to distance.

The costs of a distributed generation option will vary by cost of installation of generating units, fuel and maintenance cost. These costs will also be dependent on customer demand profile and the target level of reliability which will determine the level of redundancy.

The cost of networks will vary widely depending on the current state of network infrastructure. In situations where existing network infrastructure is adequate, there may be savings in maintenance costs which can be affected by local conditions for access and length of line. On the other hand there may be costs to either make safe or to remove an existing feeder line if there were to be a switch to off-grid supply. In situations where major upgrade of a line is needed, for example extensive replacement of poles, both capital and operating costs may be saved by switching to off-grid supply with local generation.

Figure 1 presents a generic form of the nomogram for a range of typical network and generation costs and typical customer demand profile.

The nomogram is designed to show the breakeven length of network against cost of distributed generation parameters. More particularly we considered:

1 The cost of a SWER line is typically 50% of the cost of a multi conductor supply and is therefore a conservative valuation.

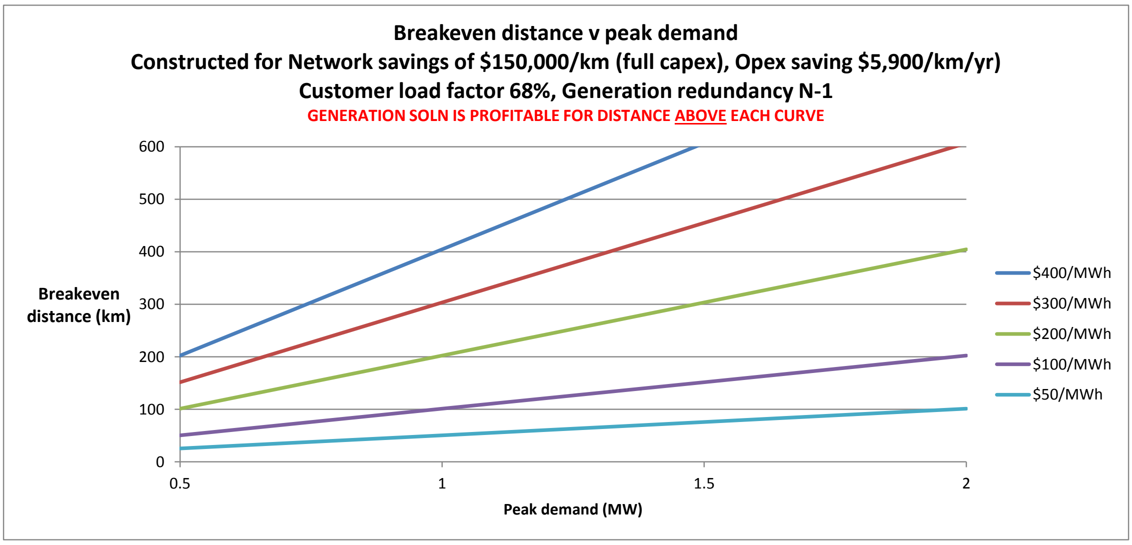
- The variation in capital and operating cost with length of line;
- Generation capital and operating cost;
- Generation fuel cost;
- Reliability in the form of n-x generator redundancy;[2] and
- Customer load (energy and load factor)

The model allows for up to three different generation technologies with multiple numbers of units and redundancy up to n-2.

The nomogram gives indicative results only as the conditions around each case will vary.

For the typical conditions shown it will be cost effective on the basis of direct costs to use a distributed generation solution if the combination of size of demand and length of network appears above the curve of generation cost. For example, for a demand of 1MW peak with an average load factor of 68% and a generation option with a cost of production of $300/MWh, typical of external diesel based production, the generation option will be cost effective if the network length is more than 300km. Subsidised or developmental technologies with higher base costs could be deployed on a one-off basis but have not been considered for the more general analysis in this review. This outcome is consistent with typical operating conditions suggesting on-grid is more cost effective for most edge of grid situations if the alternative is generation from diesel. If generation cost is lower, or network cost savings are higher, a full off-grid approach would be viable at shorter distances.

Figure 1 Generic distance v generation cost breakeven chart



2 N-x is the conventional industry terminology for the number of generators that need to be out of service before the peak customer demand cannot be served. The model allows for N-0, N-1 or N-2.

4.1.1. Local generation requirements and costs

In practice generation costs are likely to vary considerably and be dominated by the cost and availability of fuel. The highest cost we considered was diesel which is often used for generation in remote sites where there is no alternative fuel. Generation costs will be lower if there is access to fuels such as natural gas from via either pipeline or trucked compressed natural gas (CNG) or liquefied natural gas (LNG), or if local small hydro or an agricultural or manufacturing by-product is available such as bagasse.

Hybrid combinations comprising a low cost but variable local resource and higher cost diesel are also likely. Recent developments in storage also offer the potential for low cost generation (including renewable resources such as solar and wind) together with storage.

4.1.2. Network costs

Network costs can also vary significantly. Network costs need to relate to avoided costs. At the high end, network costs may relate to complete reconstruction and replacement of an old line. Much lower costs (saving) may be involved if the saving relates only to maintenance of a depreciated asset that is still serviceable.

For the generic study we used a typical cost of a distribution line of $150,000/km. As noted, a SWER line equivalent might cost 50% of this value and Aurora reported a case where construction (and maintenance) costs approach double this due to difficult terrain. The model allows users to apply the values relevant to each case, including where there are only savings in on-going maintenance costs. Input from industry during the preparation of this assessment noted that in some locations access to manage clearances from vegetation can be much higher than average. This situation highlights the need for case by case analysis and also the need to consider intangible benefits such as reduced need for vegetation clearance, which may however have a cost in that fire access may then not be available to other authorities.

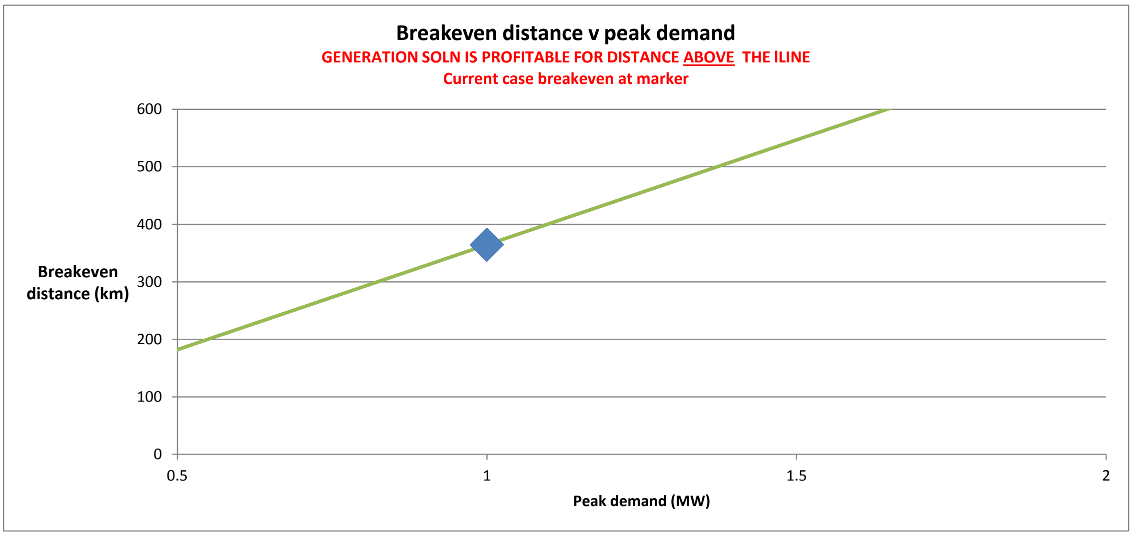
4.2. Charting the impact of variability in cost

Figure 2 and Figure 3 illustrate how changes in both potential network savings and generation costs impact the breakeven distance of edge of grid lines. The figures confirm that the most likely candidates for off-grid operation are where existing lines are at the end of their economic life and require replacement or upgrade at an equivalent cost.

Notably, the figures are for situations with reliability of supply from off-grid distributed generation of N-1. In practice existing edge of grid reliability from networks can often fall below that level. As a result the benefits of distributed generation will be greater than the simple comparison used to derive the figures.

Figure 2 illustrates a case that is relatively unfavourable to distributed generation. The case has a peak demand of 1MW with load factor of 68 per cent, but relatively low savings available from disconnecting the network and high generation costs (based on diesel). It would be typical of situations where the existing network was satisfactory and no low cost distributed generation option was available. In this case the breakeven line length is approximately 360km.

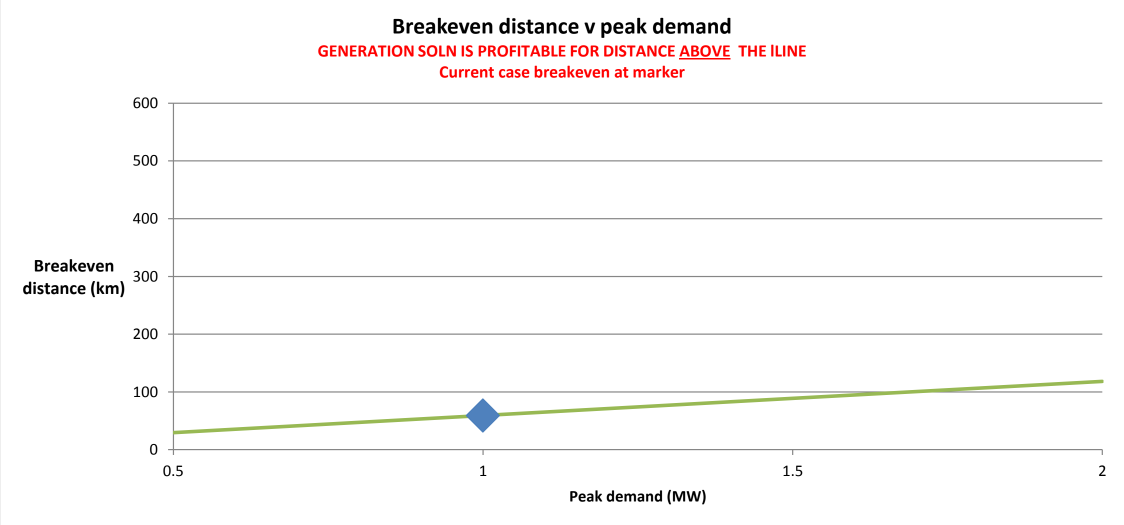
Figure 2 Low network savings and high generation cost



Case summary		
Annual peak customer demand (MW)		1
Customer load factor		68%
Generation redundancy	N-	1
Network (capex + opex) saving $/p.a/km		5,900
Generation LCOE ($/MWh)		360.27

Figure 3 illustrates a more favourable case for distributed generation for the same demand but where network savings are significantly larger and generation costs lower. In this case the breakeven distance is 59km. The generation cost is based on a hybrid combination of high utilisation of a low variable, but high capital cost plant (e.g. hydro), supplemented by diesel. Clearly lower cost combinations might also be possible using wind or a local fuel source. The network savings in this case (expressed in annual costs) are typical of a situation where major refurbishment or line replacement would be required.

Figure 3 High network saving and moderate generation cost



	Case summary	
Annual peak customer demand (MW)		1
Customer load factor		68%
Generation redundancy	N-	1
Network (capex + opex) saving $/p.a/km		20,900
Generation LCOE ($/MWh)		207.25

4.3. Case studies and examples

4.3.1. Western Australia - SWIS

Between the late 1950s and the 1980s, approximately 30,000km of network was constructed by the State Energy Commission under rural electrification policies. A number of these assets are now approaching the end of their useful life and putting service standards at risk. As a result, potential for off-grid and local generation support is being examined for small (less than approximately 50kWh/day) affected loads. There are regulatory barriers, however, that would need to be addressed before the full advantage of local generation can be realised.[3]

In three cases small townships are connected to the grid of the SWIS by long rural feeders, up to 270km in length in one case. A fourth is a separate stand-alone wind-diesel power station and local grid near, but separate to the SWIS.

3 Interview with OGW 12 March and email correspondence to OGW/esaa 27 March 2014

Over a number of years supply to the grid connected townships has varied between diesel and diesel-wind hybrid facilities and extended periods of off-grid isolated supply even after the townships were originally connected to the grid. Changes in the cost of diesel and reliability of the network connection have been the main reasons why the arrangement has changed from time to time. Reliability of supply has been and remains variable for these grid-connected townships because of the incidence of network outages and failures and long response times associated with long and remote lines. Notably, reliability can be significantly higher and more stable when the townships are supplied by off-grid arrangements.

The affected townships have been at the edge of the grid for many years and highlight the trade-offs between cost, reliability (and reliability standards) and the impact of external factors such as diesel fuel price.

4.3.2. Tasmania

Transend provided details of an evaluation of shifting a small load in a remote tourist area to off-grid supply as the existing 16km single circuit 110kV transmission line constructed in 1939 requires replacement. The evaluation considered a range of network options including major refurbishment, replacement and local generation with n-1 redundancy. The site is in an area where small hydro is a possibility and the generation options included a number of combinations of hydro, diesel, wind and biomass. The evaluation concluded off-grid supply was likely to be more cost effective than options to continue connection to the main grid.[4]

Aurora provided information about three situations that are highly prospective for off-grid supply:

- Supply to a remote town currently supplied by line across difficult terrain with high construction and maintenance costs where there is a need to upgrade the existing line;
- Supply to Bruny Island which is currently supplied by submarine cable and affects 800 customers; and
- Supply to Crotty Dam a small remote load currently supplied via a 13km 22kV line requiring major upgrade.[5]

4.3.3. Queensland

Ergon reported there are approximately 25,000 customers with 85MW of load supplied by 65,000km of SWER lines in its region. Ergon also reported that recent upgrades to the SWER network mean that there is little economic justification for considering switching to off-grid distributed generation on a broad scale.[6]

4 Derwent Bridge Alternative (Non network and Distribution) Options Analysis, Transend, 25 March 2013

5 Email correspondence dated 19 February 2014

6 Email correspondence to OGW/esaa 7 February 2014

4.3.4. Other regions

Network businesses in other regions, who contributed to the work, indicated interest in hybrid solutions where distributed generation would operate at the end of feeders that remain connected to the main grid rather than separation to off-grid supply. As noted, this type of situation is more readily accommodated under the existing regulatory and policy framework. Other network businesses observed that they consider that the limited number of hours that supply may need to be curtailed during a bushfire event would not justify the costs of distributed generation[7]. Clearly the more hours per year where disconnection is needed the greater the case for distributed generation.

5. Regulatory and policy considerations

5.1. Current regulatory arrangements

Network businesses are subject to both national and state regulatory regimes. These regimes are broadly aimed at ensuring separation of regulated network activities from competitive market activities, variously requiring separate licenses, legal and accounting separation and compliance with ring fencing requirements. In some cases the regimes presume or are limited to on-grid activities and place restrictions on shifting to off-grid. Changes to the regimes therefore will be complex, involve parallel changes in different jurisdictions if uniformity is to be achieved and also involve changes to regulatory asset bases and to roles and responsibilities for generation and retailing.

Appendix A and Appendix B (both provided by esaa) summarise the current regimes in the NEM and relevant features of them. Regulatory barriers in the WEM are largely a consequence of the statutory functions of each of the Government Trading Enterprises, which restrict the functions and operational jurisdiction of the network service provider, Western Power, and the government-owned gentailer, Synergy.

The following sections discuss the impact and nature of change to regulatory regimes of greater potential to shift existing on-grid to off-grid distributed generation.

5.2. Who will own and operate the distributed generation?

This is a key question but it is best answered by accounting for generation and retailing at the same time.

Currently networks can own or contract for generation for the purposes of network support. However, the local generation needed to supply the energy requirements of an off-grid network would be different in nature given the scale and role. Licensing and regulatory arrangements generally prevent network businesses from controlling generation and as a result, the businesses are generally not resourced to be generators per se.

7 Although bushfires will generally occur on high temperature, high demand days, they will only affect a small number of the high demand days per year and then only in the immediate locality of the fire.

5.2.1. Mechanisms for competition in generation would probably need to change

Typically generation within an isolated network would comprise only a very limited number of facilities and therefore competition for generation would in all likelihood be limited to the investment stage. Some form of tendering or auction process would be likely with some form of regulatory oversight of the level of competition and if necessary regulation of revenue. However, this situation begs the question as to who is the buyer?

Looking first at a retailer: full retail contestability applies in all parts of the NEM and for larger customers in the WEM. Assuming an isolated grid will be too small to sustain a wholesale energy market, then competitive retailing is also unlikely.

Impact on current competitive generation markets

Facilitating transfer of customer load away from interconnected grids also moves demand from the existing wholesale markets for generation and for retail. The analysis developed for this report suggests the magnitude of change will be relatively small. The analysis also suggests that embedded generation using the same technology within existing interconnected networks is more likely, but is already feasible within the existing regulatory framework and will have a larger impact. While regulatory and policy initiatives have impacted wholesale markets in Australia in recent years, the changes envisaged in preparation of this report are premised on capturing genuine economic benefits of technology developments and removal of long standing regulatory barriers.

5.2.2. Retail contestability would be problematic

A consequence of moving off-grid would be that retailing most likely would need to be regulated and competition would be unlikely. This would be a significant change for the affected customer base, although aligned with other electrically islanded networks.

A single (regulated) retailer could then be the buyer. A vertically integrated gen-tailer model would seem most likely, but also possibly result in a single dominant business acting as both generator and retailer.

In principle a single buyer model could be considered at the tendering stage if there was the prospect that multiple generation entities could provide supply.[8] For example, a combination of a local resource and supplementary higher cost new entrant is possible. The Derwent River case study provided by Transend and described above is a good example of the potential for such an arrangement combining local hydro and diesel.

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8 In a single buyer model a single entity (the single buyer) contracts with generators to purchase all wholesale energy. The single buyer then on-sells to one or more retail entity(ies), but usually only one in each geographic area. Typically the single buyer enters long term power purchase agreements (PPAs) with generators. These contracts usually give dispatch rights to the single buyer and may include performance incentives. The contracts have strong similarities to PPAs entered into by utilities where they supplement their own portfolio with purchases from independent generators.

An alternative would be for a fully integrated business running generation, retail and networks as is the practice in many isolated networks. In principle the existing network owner could be authorised to be such an entity but this would be a significant policy shift for businesses that are currently only regulated distribution entities. However, if the present network owner was not required to operate the (now) isolated network, presumably it would be free to sell it. This would entail a regulatory process to determine the value of the affected assets. A sale to a fully integrated entity would, however, then be possible. On the other hand the incumbent network business would have operational cost advantages over other potential owners as it would be serving nearby areas that remain part of the interconnected grid.

Two models could therefore emerge, subject to policy and regulatory adjustments:

- A fully integrated generation, retail and network business similar in nature to the entities that supply many existing off-grid networks. The regulatory regime would need to ensure the integrated entity developed the generation portfolio and network assets efficiently. Third party generators would also be able to connect; and
- A combined generator-retailer entity (gen-tailer) plus a separate regulated network business that could be owned by the incumbent or another network business. In this case the gen-tailer would determine day to day operation of its generation resources. In this model there would be no opportunity for independent generators or retailers;

A third model that would represent a major policy shift would see a business function as network owner/operator and market and system operator, obliged to purchase and dispatch energy from independent generation under a single buyer model selling to a retailing entity. The second model described above would need to move to this form if third party access was to be provided for. While this third model is feasible, the overheads for such an arrangement are likely to be prohibitive for a small isolated network and hence it is unlikely.

5.3. Technical and economic considerations for reliability and technical standards.

Loads at the edge of existing grids may already be exposed to, or at risk of, lower reliability than elsewhere due to the configuration of networks and this may be a reason for considering reinforcement that might trigger an off-grid solution.

Depending on the circumstances, customers on an off-grid network may experience fewer network related outages as the least reliable section of network may be the link to the main grid (this has been the experience in a number a number of cases reported by esaa members), but they may be more exposed to generation related outages. Overall reliability of supply in an off-grid situation will therefore be closely related to generation reliability and the level of redundancy, which can be arranged to suit the conditions and presumably enshrined in regulatory provisions. Ideally these factors would be based on customer requirements and their preparedness to pay for higher reliability that uniform tariff policy precludes.

Clearly high reliability incurs a cost and it would be appropriate to consider the Value of Customer Reliability (VCR) for the particular customers. This may be found more readily from the more limited customer base in an isolated grid. In particular, a more granular form of VCR may also be determined to consider different values relating to the duration, frequency of occurrence and time of day or year when outages have a higher/lower value. This information may be especially useful in designing hybrid distributed generation systems (e.g. hydro or wind supported by diesel) and allow for a lower level of redundancy of the more expensive plant if it were needed only off season or overnight. As a result the portfolio cost of supply would be lower.

Different technical standards are likely to be warranted in a smaller grid due to the cost of providing sufficient reserves to counter the inherently higher sensitivity of small systems compared to larger systems. The experience of existing isolated grids will be valuable in this respect and it is relevant to note the NEM technical standards require different dynamic operating standards when parts of the network are isolated from the rest of the NEM. The WA WEM standards also reflect the smaller electrical size of the network.

5.4. The role of tariffs, capital contribution policy and cross-subsidies

Economically efficient tariffs and capital contribution charges can be expected to create incentives for existing customers to consider shifting off-grid and also to manage their demand. Individual customers have responded to tariffs and taken off-grid supply in a number of situations. However, there are policy and political issues around fully cost reflective tariffs - postage stamp pricing policies for example. Also a premise of this work is that uniform agreement amongst a group of customers to move off-grid may not be possible even where the case is clear.

Within a newly islanded network, there would be a clear policy choice as to whether network tariffs are: made cost reflective immediately; transitioned to a cost reflective basis; or otherwise aligned with practices already in place for existing off-grid situations. Indeed if a uniform tariff policy is to continue for whatever reason, costs and therefore the subsidy should be minimised. If that can now be done with an off-grid solution it is hard to argue it should be different for a newly islanded network.

There will be wide scope to consider how the general question of tariffs will be tackled. Transition between existing tariffs and off-grid may also be needed. These would be matters requiring attention for implementation.

5.5. Community engagement and social licence

The technical and economic issues considered to this point may be perceived as being about the interests of network businesses, and the concept of disconnecting from the main grid seen as a retrograde step. For this reason network businesses consulted in the course of preparing this assessment were very aware of the need to engage with customers, policy makers and the community generally. A number of more qualitative factors and progressive characteristics associated with gaining social and policy licence for a shift to off-grid may include:

- Placing the concept of off-grid supply in context by noting that the industry commenced with a series of electrically separate townships that were progressively interconnected to take advantage of technical and economic developments available at the time from centrally located generation based on lower cost fuels, in particular coal and hydro. Consideration of a shift to off-grid local or distributed generation examines if the most recent developments in distributed generation technology including renewable sources and storage mean it would now be beneficial to shrink the boundary of the current interconnected grid in some locations;
- Highlighting the improvement in reliability from off-grid supply, where that is the case, since this can be the single most important reason for some customers wanting to have an isolated grid power supply;
- Highlighting that efficient, cost reflective tariffs (where these are not already present) would, where appropriate, encourage off-grid operation and include opportunities for demand side response (especially if coupled with smart-grid initiatives);
- Noting that where the local community is a beneficiary of a policy that requires a cross subsidy (e.g. postage stamp pricing – often the opposite of cost reflective pricing) it is reasonable that costs are minimised so that the subsidy is minimised;

- Using the process of engaging customers to determine the VCR to increase awareness and ownership of the cost versus reliability trade-offs; and
- Engage local authorities in bushfire prone areas early to highlight the benefits of reduced risk.

In short, a social licence is more likely to be achieved if a shift to off–grid is a win-win and an opportunity to take advantage of technological advances rather than simply a means to reduce costs, especially in situations where cross subsidies are currently supporting supply to the affected areas.

5.6. Regulatory and policy reviews and actions

Based on the discussion in the preceding sections, implementation of policy to remove existing barriers to off-grid distributed generation as the basis of supply to edge of grid customers will require:

- A general review of state and national regulatory and legislative arrangements and where applicable, NEM related instruments such as the NER, to identify potential barriers to transfer to off-grid. Arrangements differ by jurisdiction although there is progressively greater alignment. In particular;
    - Requirements that can broadly be described as obligations on either a network business or retail entity as appropriate:
        - To connect;
        - To offer to connect - possibly in response to a connection application;
        - Once connected, to maintain the connection;
        - To supply – although in a contestable environment this would be outdated;

      In each case the review should consider if any of the obligations directly or indirectly refer to connection or supply from a defined interconnected grid, or rather, if any instrument prevents the connection being from an isolated grid or changed to an isolated grid. This may depend on the definition of “grid” in the relevant instrument.
    - Whether the instruments create rights for customers in respect of any of the above matters; and
    - Rights and obligations in respect of retailing.
- Policy decisions in respect of:
    - Ownership, investment and operation of (newly) isolated grids;
    - Ownership, investment and operation of distributed generation in isolated grids, including opportunities for competition between generators to supply isolated grids;
    - Opportunities (or not) for retail contestability in (newly) isolated grids;
    - Tariff and/or market pricing for supply and demand within isolated grids; and
    - Encouraging economic demand side management for the communities in question so that the on-grid or off-grid supply costs no more to provide than necessary. I.e. annual peak demand (and therefore supply capacity) is no higher than necessary and energy consumption from more expensive fuel is no higher than necessary if the off-grid solution is chosen.

- Assessment of the applicability of technical standards for generation, networks and customer facilities and operations currently applying (potentially by default) to isolated networks and the consequent need for amendment.

A number of these provisions may simply need to be aligned with arrangements pertaining to existing isolated grids, however each will need to be assessed on its merits, particularly with respect to commercial and structural issues.

Appendix A Summary of NEM jurisdictional regulatory instruments

Provided by esaa

Queensland	'Electricity Distribution: Ring Fencing Guidelines', developed by the Queensland Competition Authority (QCA) in September 2000 (Queensland Guidelines)
ACT	'Ring Fencing Guidelines for Gas and Electricity Network Service Operators in the ACT' developed by the Independent Competition and Regulatory Commission (ICRC) in November 2002 (ACT Guidelines)
New South Wales	'Distribution Ring Fencing Guidelines', developed by the Independent Pricing and Regulatory Tribunal (IPART) in February 2003 (NSW Guidelines)
South Australia	'Operational Ring Fencing Requirements for the SA Electricity Supply Industry: Electricity Guideline No. 9', developed by the Essential Services Commission of South Australia (ESCOSA) in June 2003 (South Australian Guidelines)
Victoria	'Electricity Industry Guideline No. 17: Electricity Ring-Fencing Issue 1', developed by the Essential Services Commission (ESC) in October 2004 (Victorian Guidelines)
Tasmania	Two sets of guidelines were developed by OTTER; 'Functional Ring-fencing Guidelines' (Tasmanian Functional Guidelines) in October 2004, and 'Electricity Distribution and Retail Accounting Ring fencing Guidelines: Electricity Industry Guideline No. 2.2, Issue No 3', in May 2005 (Tasmanian Accounting Guidelines)

Appendix B Summary of relevant state and NEM regulatory features

Provided by esaa – see following pages

	IPART (NSW)	ICRC (ACT)	QCA (Queensland)	ESCOSA (SA)	OTTER (Tasmania)	ESC (Victoria)	AER Transmission guidelines
Legal separation	Not addressed.	DNSP must not carry on a related business.	DNSP must not carry on a related business within that legal entity.	DNSP must not hold a retail licence or a generation licence (except when generation is carried out for network support purposes and where no revenue is earned from such generation).	Not addressed.	Not addressed.	TNSP that supplies ring-fenced services must be a legal entity and must not carry on a related business, unless related business does not attract total revenue of less than or equal to 5% of the TNSP's total annual revenue.
Accounting separation	Not addressed.	DNSP must establish and maintain consolidated and separate accounts for the provision of distribution services and its other businesses.	DNSP must establish and maintain consolidated and separate accounts for the provision of prescribed distribution services and excluded services.	Not addressed.	Separate accounting ring-fencing guidelines covering how DNSP should present accounting reports and disaggregation statements where they provide contestable services.	Not addressed.	TNSP must establish and maintain separate set of accounts for provision of ring-fenced services and separate amalgamated accounts for entire business.
Allocation of costs	DNSP must ensure costs relating to a distribution service are fully allocated to either prescribed distribution services or excluded distribution services on a causation basis.	DNSP must not cross-subsidise a related business.	DNSP must allocate any costs that are shared between prescribed distribution services, excluded services and other activities in a manner that ensures there is no cross subsidy and according to a methodology approved by the QCA.	Not addressed.	Separate accounting ring-fencing guidelines covering how DNSP should present accounting reports and disaggregation statements where they provide contestable services.	Not addressed.	TNSP that provides ring-fenced service must allocate costs that are shared between any ring-fenced services and any other activity.

	IPART (NSW)	ICRC (ACT)	QCA (Queensland)	ESCOSA (SA)	OTTER (Tasmania)	ESC (Victoria)	AER Transmission guidelines
Access to information	DNSP must provide information relating to the provision of prescribed distribution services to an independent accredited service provider on terms that are no less favourable than the terms on which that information is made available to that part of the DNSP's business that provides contestable services.	DNSP must ensure that, where commercially valuable information is made available to a related business it is also made available to similarly situated entities.	DNSP must not provide distribution network access to a related business on more favourable terms than those it provides to any other customer or Code participant.	DNSP must ensure that any information obtained in the course of conducting a licensed business which might reasonably be expected to affect materially the commercial interests of a related business or provide a related business an advantage over its competitors is disclosed the related business and its competitors in a non-discriminatory manner.	DNSP must establish access controls so that users of DNSP's information systems do not have access to information concerning the distribution service if the user is providing a contestable service.	DNSP must ensure that distribution information it provides to any retail business is available to all retail businesses.	TNSP that provides ring-fenced services must ensure that information it provides to any associate that takes part in a related business is available to any other party, and that preferential treatment is not given to an associate that takes part in a related business.

	IPART (NSW)	ICRC (ACT)	QCA (Queensland)	ESCOSA (SA)	OTTER (Tasmania)	ESC (Victoria)	AER Transmission guidelines
Customer information	Not addressed.	DNSP must ensure that information obtained by conducting its business and which might reasonably be expected to affect materially the interests of an existing or prospective customer is not disclosed to any other person without the approval of the existing or prospective customer to whom that information pertains. Exceptional circumstances given in guidelines.	DNSP must ensure that all confidential information provided by a customer or prospective customer is used only for the purpose for which that information was provided and not disclosed without the approval of the customer or prospective customer. Exceptional circumstances given in guidelines.	DNSP must ensure any information obtained in conducting a licensed business is used only for the purpose for which that information was provided or obtained.	Not addressed. However, guidelines provide that when communicating with a customer, DNSP must not communicate in a way that would favour the distribution or related business over another service provider in provision of contestable services, and where appropriate, DNSP must communicate to customer that contestable services may also be obtained from independent service provider.	Not addressed. However, guidelines provide that when DNSP is communicating with a customer, it must make clear that it is a distributor carrying on distribution business, and when retail business communicating with customer, it must make clear that it is a retailer carrying on retail business.	Not addressed.

	IPART (NSW)	ICRC (ACT)	QCA (Queensland)	ESCOSA (SA)	OTTER (Tasmania)	ESC (Victoria)	AER Transmission guidelines
Waivers	Tribunal may grant DNSP waiver from provision of guidelines upon request and after considering factors including costs of compliance, DNSP's ability to achieve economies of scale, the effect of the waiver on competition, and after public consultation (if relevant).	Not addressed.	QCA may waive DNSP's ring-fencing obligations if satisfied that cost of complying outweighs benefit or likely benefit to public. QCA to ask for and consider any submissions it receives.	Commission may grant waiver from ring-fencing obligations if satisfied that the benefit or likely benefit of compliance will be outweighed by administrative cost to Distribution Licensee.	Regulator may grant waiver at request of distributor of any obligation under guidelines after undertaking consultation process and if satisfied that costs of compliance outweigh benefits.	Not addressed.	ACCC may waive TNSP's ring-fencing obligations if satisfied that the benefit to the public is outweighed by the administrative cost to the TNSP of compliance.
Physical and functional separation	DNSP must ensure that the offices from which DNSP staff provide specified services are separate from the offices from which DNSP staff provide contestable services.	DNSP must ensure office space is physically separate from that of related businesses. DNSP must ensure that operational staff involved in providing commercially sensitive services (such as customer connection and meter reading) are not also staff of a related business.	DNSP must ensure that its marketing staff are not also staff of a related business.	DNSP must ensure that any marketing staff involved in the DNSP's licensed business are not also involved in a related business; and any operations staff involved in both the DNSP's licensed business and a related business are shared between the two businesses on a non-discriminatory arm's length commercial basis.	DNSP must ensure that parts of business providing or marketing regulated distribution services operate independently and have separate work areas from parts of business providing contestable services. Also, DNSP must ensure that its employees are not staff of related business providing contestable services.	DNSP must ensure that units marketing or providing distribution services and units within retail business operate independently and have separate work areas with access controls that prevent staff of either unit entering into work area of other unit. Also, DNSP staff must not also be staff of retail business.	TNSP must ensure that its marketing staff are not also servants/consultants of an associate that takes part in a related business, or that its servants/consultants are marketing staff of an associate that takes part in a related business.

	IPART (NSW)	ICRC (ACT)	QCA (Queensland)	ESCOSA (SA)	OTTER (Tasmania)	ESC (Victoria)	AER Transmission guidelines
Non-discrimination	A DNSP must provide a prescribed distribution service to an independent accredited service provider on terms that are no less favourable than the terms on which it provides that prescribed distribution service to that part of the DNSP's business which provides contestable services.	DNSP must conduct business with Related Business at arm's length and in a competitively neutral manner. In particular, where utilities have network use of systems agreements with a Related Business the arrangements: - should be on a contract basis with terms and costs clearly defined - should be transparent - should be on terms no more favourable than would be offered to a third party in the same commercial circumstances; and - must be to the ICRC's satisfaction.	A DNSP that provides prescribed distribution services in Queensland must not provide distribution network access to a related business on more favourable terms than those it provides to any other customer or Code participant.	The Distribution Licensee must ensure that, in providing goods or services for which the Licensed Business is the monopoly supplier to a Related Business or a competitor of the Related Business, those goods and services are provided on a non-discriminatory, commercial basis.	A distributor must not, in conducting its regulated distribution services business, make decisions or act in a manner that unreasonably discriminates either against or in favour of any business providing contestable electrical services or against or in favour of the customers of any business providing contestable electrical services.	In conducting its distribution business, a distributor must not make decisions or act in a manner that unreasonably discriminates in favour of any electricity business or in favour of the customers of any electricity business.	A TNSP that provides ring-fenced services must not make decisions or act in a manner that discriminates in favour of an associate in relation to the terms or conditions on which those services are provided. To avoid doubt, a TNSP providing ring-fenced services must offer those services to its customers on terms and conditions no less favourable than it provides to itself or its associates.