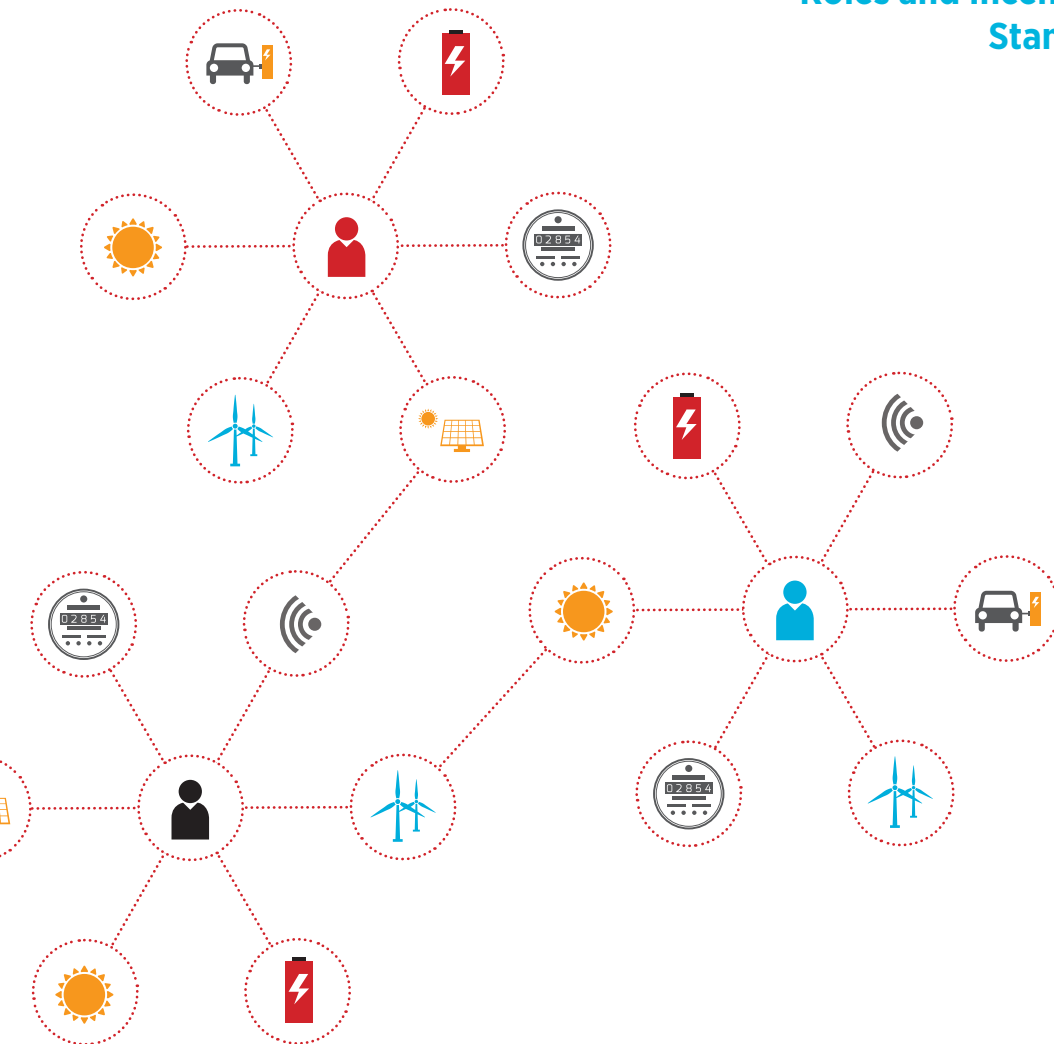




UNLOCKING **VALUE**: MICROGRIDS AND STAND ALONE SYSTEMS

Roles and Incentives for Microgrids and Stand Alone Power Systems



ELECTRICITY NETWORK
TRANSFORMATION ROADMAP



Contact details

The Roles and Incentives for Microgrids and Stand Alone Power Systems report has been prepared by Energeia, for the Energy Networks Association and CSIRO as part of the Electricity Network Transformation Roadmap.

A copy of the full Energeia report is available at the Energy Networks Association website: www.ena.asn.au.

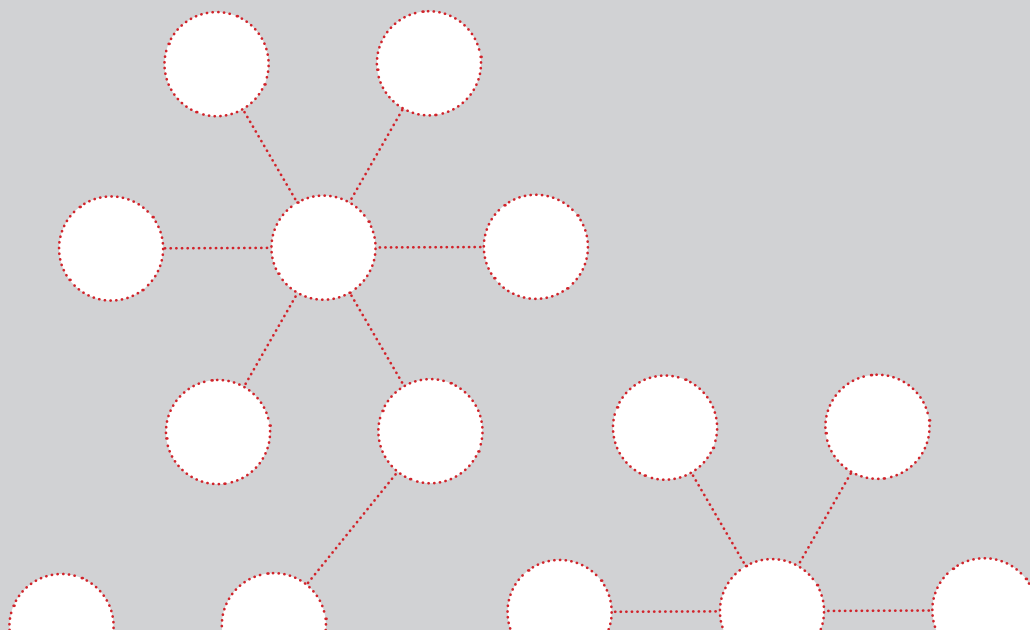
The Energy Networks Association and CSIRO value your feedback and welcomes comments on the modeling.

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THE FUTURE OF MICROGRIDS AND STAND ALONE POWER SYSTEMS

Electricity is an essential service for Australia's households, businesses and the community – and it is going through an historic transformation. Australia's per capita electricity consumption has fallen sharply in recent years; we lead the world in penetration of rooftop solar panels, and our nation is a global hotspot for other Distributed Energy Resources (DER) like battery storage, demand response, standalone power systems (SAPS) and micro-grids.

Customers, rather than traditional utilities, are likely to determine more than a quarter of all system investment decisions between now and 2050. As new services and technology become mainstream, and become cheaper and smarter, there will be an increasing opportunity for customers to move completely off the grid, or to never connect in the first place.

It is essential to give customers freedom to choose, with frameworks that allow the whole community to reap the benefits of technological change and to integrate new technology with the energy system at the lowest cost. This requires policy and regulatory frameworks which allow the best solutions to emerge. For instance, options to substitute a traditional network connection with an 'off-grid' service should be enabled where it is more efficient. Equally, there may be mutual "win-win" benefits for both grid-connected customers and those considering a standalone system if incentives are provided to stay on grid.

To inform the Electricity Network Transformation Roadmap, Energeia has modelled scenarios for customers and communities who invest in technological disruption (including solar PV, batteries and other distributed energy resources) to either disconnect from the grid, or in the case of new customers, to not connect in the first place.

Key Findings

1. New regulatory arrangements will be required to allow innovative service delivery for up to 27,000 new rural connections expected to occur to 2050. Almost \$700 million could be saved by supplying these connections, usually farms, with a standalone power system, yet current regulations would mandate a conventional 'grid connected' service.
2. Without better incentives, up to 10% of customers are likely to leave the grid by 2050, increasing average bills to other customers by \$132 per year.
3. Innovative network incentives, like a Stand Alone Power System tariff, would encourage over 1 million customers to choose to stay on-grid to sell energy using their own Distributed Energy Resources, resulting in lower costs for themselves and other grid customers.
4. Introducing appropriate incentives for SAPS customers saves other customers around \$1 billion in network bills compared to the base case.
5. Solutions which use distributed energy resources to supply energy to a group of customers (microgrids) as an alternative to centralised grid supply can represent the lowest cost solution in some specific circumstances.

KEY FINDINGS

1. New regulatory arrangements will be required to allow innovative service delivery for up to 27,000 new rural connections expected to occur to 2050. Almost \$700 million could be saved by supplying these connections, usually farms, with a standalone power system, yet current regulations would mandate a conventional 'grid connected' service.

It is estimated that by 2020, most small business rural connections greater than 3km from the grid will be lower cost if connected as a standalone power system. Larger, irrigation based agriculture customers will need to be more than 8km from the grid in order for a standalone power system to be viable. In addition to avoiding network expenditure, off-grid SAPS arrangements are likely to encourage investment in over 2GW of solar PV and over 7.5GWh of battery storage across Australia.

Current regulatory arrangements are likely to inhibit customers establishing a standard network connection through a Network Service Provider using a Stand Alone Power System. As a result unless the customer is willing to use a market solution, the network will be forced to implement the higher cost solution in these circumstances.

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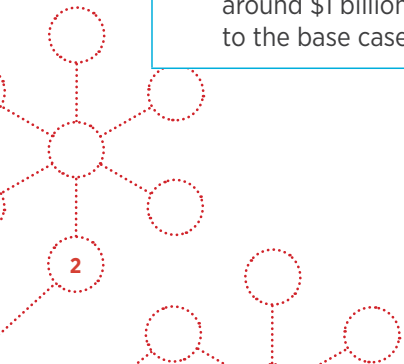
Disconnection from the grid removes any opportunity for the network to buy grid services to support the network. It also increases the recovery of residual costs from other customers. While customers should have the choice to leave the grid, Energeia suggests better incentives to remain connected provide a better economic outcome for all customers in most circumstances.

A standalone power systems tariff provides an alternative to customers with substantial distributed energy resources, to stay grid connected while being compensated for their ability to disconnect from the grid at particular times. In addition to providing these customers additional value, these arrangements are likely to save other customers over \$1 billion in network charges over the same period, equivalent to 4% per annum on average network bills with additional benefits for the distribution energy market.

5. Solutions which use distributed energy resources to supply energy to a group of customers (microgrids) as an alternative to centralised grid supply can represent the lowest cost solution in some specific circumstances.

Microgrids are most likely to be cost effective in the areas with the highest cost to serve, which are also the areas most subsidised under 'postage stamp' network pricing arrangements. These arrangements provide the same network tariff to rural and regional customers as urban customers and are often mandated in government regulation.

Microgrid solutions are therefore challenging to implement in these areas without changes to network cost recovery frameworks and pricing. Alternative SAPS and Microgrid delivery models could still be employed by the network provider to optimise the total delivered costs to all customers. This would require the removal of regulatory barriers to these alternative delivery models.



UNLOCKING VALUE: MICROGRIDS AND STAND ALONE SYSTEMS

Realising the value of technology investment

For those customers who have invested in technology to supply and store their own energy, new incentives to remain connected to the grid provide better value than the off-grid alternative.

The Energeia modelling anticipates between 2020 and 2050 over 1 million customers could benefit from these incentives.

A standalone power systems tariff would provide an alternative to customers to stay grid connected while being compensated for their ability to disconnect from the grid at particular times.

✓ **Lower cost and better value** compared to complete grid defection for most customers.

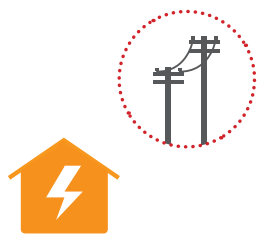
✓ **Market access** allowing SAP customers to sell their power to the grid or to other customers. In a separate report, Energeia estimates that in 2050 up to \$2.5 billion per annum will be paid to customers with DER to support the network.

✓ **Back up services** from the grid when the stand alone power system is down.

Unlocking the value for the community

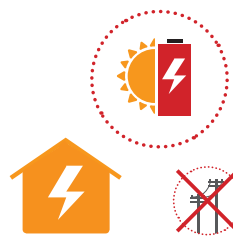
Base Case by 2050

Unlocking Value by 2050



No change

Existing grid connection arrangements continue for all new customers, even though result is \$700 million in higher costs



27,000

New connections with a stand alone power system



1 in 10

Existing customers who have standalone power systems leave the grid



3 in 10

Existing customers who build standalone power systems have concessional tariffs with incentives to sell DER services, saving \$1 billion for others

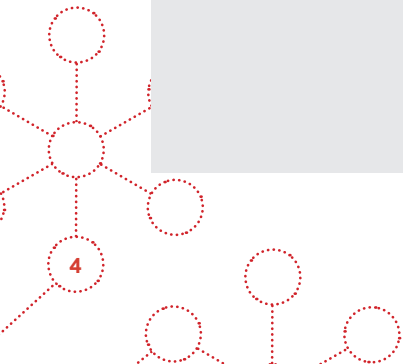
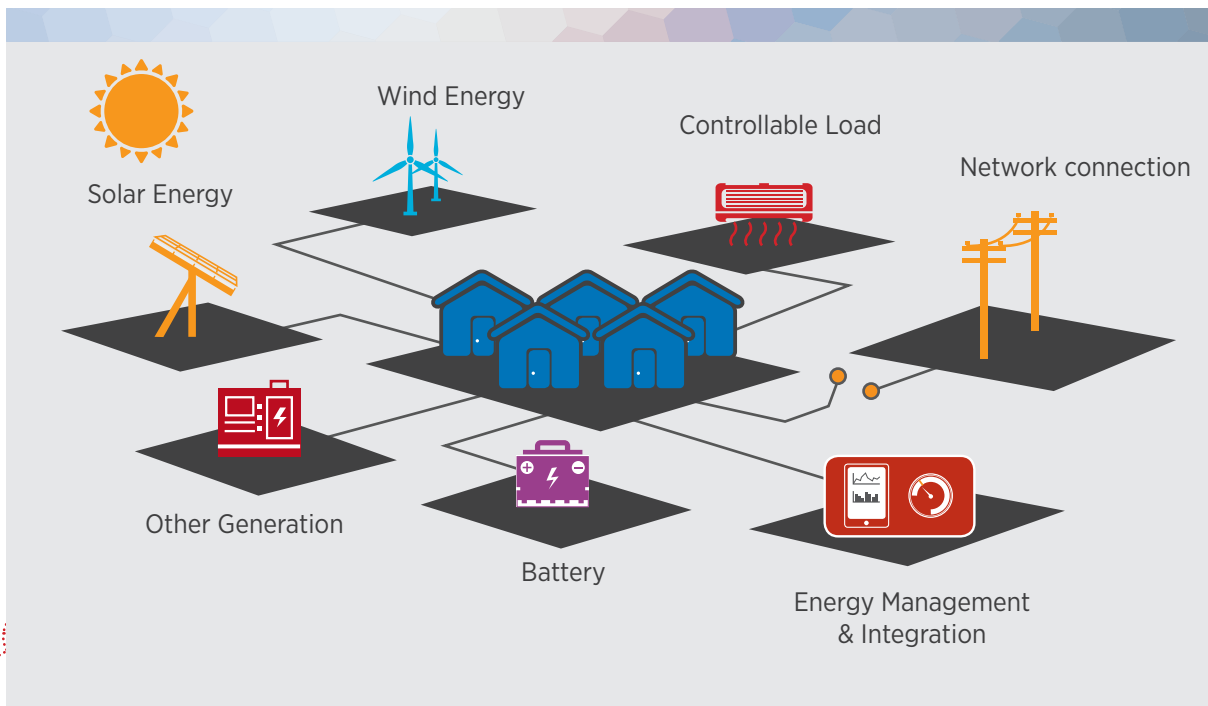
USING STANDALONE POWER SYSTEMS TO SUPPORT CUSTOMERS

Standalone power systems use a mix of different technologies to allow individual customers continuous energy supply without the need for grid connection. Microgrids use similar technologies to provide continuous energy supply to a group or community of customers.

Stand alone power systems are already being used as a non-network alternative to support customers in specific circumstances.

Advances in technology are fundamentally transforming the way in which energy services can be provided, and are allowing services to be provided more efficiently. Technologies such as standalone power systems create the potential for customers to rethink their electricity service – but they also provide opportunities for more efficient network services, particularly at the ‘fringe of grid’. The use of new technologies, including standalone power systems, by network service providers in delivering distribution services can deliver cost savings that can be passed onto customers through lower prices.

Figure 1: Microgrid system





For example, over the last year Horizon Power built stand alone power systems for several customers around Esperance as a cheaper alternative to restoring grid infrastructure after bushfires hit the region in 2015.

Current regulations require customers to be connected to “poles and wires” even where it is less efficient. Networks may be able to meet their “obligation to connect” in smarter ways.

In its rule change request to the Australian Energy Market Commission, Western Power estimates lower network costs of over \$380 million could be achieved over the next 10 years if stand alone power systems could be installed as an alternative to replacing network assets. In addition to lower costs, Western Power estimates that this would also provide more reliable outcomes for over 2,700 customers across the network.

About the Roles and Incentives for Microgrids and Stand Alone Power Systems Report

To inform the network transformation roadmap the role of microgrids and standalone power systems in delivering a fair system of prices for all customers into the future was examined. Energeia and CSIRO have developed a joint modelling capacity to test the impact of various policy scenarios on the efficient uptake of microgrids, and the associated impact on customer bills and equity.

The model represents the largest scale, network cost price forecast model known to the authors. Energeia used this model to identify how different tariff structures and incentive arrangements affect the rate of customers or communities disconnecting from the grids (or never connecting in the first place).

A copy of the full Energeia Report is available at the Energy Networks Association website at www.ena.asn.au

Figure 2: Horizon Power stand alone power system



Image courtesy of Horizon Power

ELECTRICITY NETWORK TRANSFORMATION ROADMAP

