ECOS
SCIENCE FOR SUSTAINABILITY

www.ecosmagazine.com

Published: 28 July 2014

Off-grid megashift increasingly likely

Michele Sabto

A future of mass grid defection by domestic and low-use electricity consumers in Australia may be closer than you think.

Credit: Jes BY-NC-ND 2.0

Off-grid power systems are already a familiar part of the landscape in rural and outback Australia where remote farming communities and mine sites rely on a combination of natural gas, liquid fuels and, to a much smaller extent, renewables .

But how probable is a future where a significant proportion of domestic and low-use urban electricity consumers disconnect from the grid, not only generating but also storing their own electricity? According to energy market analysts, this scenario is becoming increasingly likely. In 2013 CSIRO's Future Grid Forum, saw industry players coming together to model energy futures. They projected that by the late 2030s, under business as usual conditions, disconnection could become a mainstream option. Under this scenario, the rate of disconnection will accelerate to the point were the only customers remaining on the system will be those with poor access to capital, and industrial customers whose loads can't easily be met by on-site generation.

Other industry analysts have predicted this future will arrive far sooner. According to a 2013 report from global investment bank UBS, falling solar and battery storage costs means that the average Australian household could find it cost-competitive to go off-grid by 2018 (Source: *RenewEconomy*). Clean energy news website *RenewEconomy*, has recently reported on increasing interest in home storage from domestic consumers across Australia.

From the point of view of power utilities, whether it is 3, 10, or 15 years away, the prospect of mass grid defections is highly challenging.

Energy market analysts discussing large-scale grid defection, talk about a ‘death spiral’. As increasing numbers of customers disconnect from the grid, overall network usage declines. As network usage declines, per unit retail costs increase, prompting more customers to leave the grid. Per unit retail costs increase because the costs of maintaining a system scaled for a larger number of grid-connected customers continues to be passed on to a declining customer base.

Peak demand is one of the main costs associated with electricity supply to consumers.

CSIRO's Mr Paul Graham was lead author of the 2013 Future Grid Forum Report.

‘Most of the network costs are not associated with volume, which is how much of the pricing for domestic and smaller users works,’ says Mr Graham.

‘Rather, they’re associated with peak demand, the capacity to meet demand at peak usage times. And the volume of throughput that goes through all the other days is really neither here nor there for network costs.’

Credit: CSIRO

Peak demand reduction associated with a mass-defection future is not expected to be significant enough to offset retail price rises arising from decreased network usage. So, for example, the cost of maintaining and running peak power plants will remain relatively stable. In addition, distribution infrastructure (the poles and wires) must also continue to be capable of supplying to potentially any customer along the line.

‘Even if it’s a decade away that’s quite close for a network if you own a lot of poles and wires that you’re still effectively paying off,’ says Mr Graham.

‘The idea that those assets might become not redundant but underutilised is quite challenging.’

The regulatory, technological and market forces bringing this off-grid future closer are complex and are canvassed in the Future Grid Forum Report. They include current high retail electricity prices, a system still largely tied to volumetric pricing (i.e. lack of cost-reflective pricing), and increased uptake of solar PV exporting to the grid, driven by government incentives and falling PV module costs.

On the technological side, batteries are a key driver in these shifts, but not necessarily only in terms of energy storage. UltraBattery, a CSIRO-developed adaptation of a standard lead battery, may also have an important role to play in frequency regulation and smoothing of renewable power, affecting the viability of both grid-connected renewable energy (including exports back to the grid) and off-grid systems.

In recent times, power companies in Australia have started to put the brakes on grid-connected rooftop solar, a situation

which may be fuelling increased interest in off grid solutions.

Dr Peter Coppin, leader of the group that developed UltraBattery at CSIRO, believes that the stresses imposed on the distribution system by exports of rooftop solar to the grid (distributed generation) may be partly to blame for the reluctance to continue to support high uptake of grid-connected rooftop PV.

'The grid was designed to deliver power out to consumers from some central location and its tuned to voltage drop as you go further out from the central generator,' explains Dr Coppin.

'So all the devices along the distribution system – the transformers and the like – were designed for decreasing loads as it gets closer to your house. You then put a whole lot of generators on the end of those lines and run the system backwards, and you can get what's called "over voltage"'.

Dr Coppin believes that storage such as UltraBattery could play a power-conditioning role, protecting the grid from problems associated with distributed generation.

'The problem is that at the moment the regulatory system is way behind. Its designed for the old concept of large generators so its difficult to get paid for this kind of grid support role from these storage systems'.

Credit: Hydro Tasmania

On King Island, UltraBattery forms part of the Island's revamped off-grid power system. The King Island Renewable Energy Integration Project (KIREIP), run by Hydro Tasmania, is designed to reduce the Island's dependence on diesel. When complete, renewables (solar, wind and biodiesel) will supply up to 65% of the islands energy needs, augmenting the existing diesel plant. To date, diesel fuel use has been reduced by 45%; from 4.5 million litres to around 2.6 million litres annually.

A three megawatt UltraBattery storage system has been installed as part of KIREIP, the largest battery ever installed in Australia. Supplied by energy storage company Ecoult, the system will extend the periods of 100-percent-renewable-energy penetration by storing energy when there is excess generation and making it available when needed.

'UltraBattery's role on King Island will be multifaceted. It can ramp up quickly when there's a drop in wind and continue for a period to achieve 'zero diesel' operation. It can also provide up to 45 minutes of total backup for the island,' says Tze Masters, Ecoult's CFO.

'Energy storage has a big role to play. A future scenario of increased off-grid power requires cost-effective storage, using the right storage technology in the right applications can give you reliable, clean energy at the right cost.'

From **ECOS** online http://www.ecosmagazine.com/?paper=EC14162