Trial results - Willoughby Council Cogeneration

The trial has been undertaken as part of a one-year research project, Facilitating Local Network Charges and Virtual Net Metering, led by the Institute for Sustainable Futures (ISF) and funded by the Australian Renewable Energy Agency (ARENA) and other partners. It is one of five 'virtual trials', in New South Wales, Victoria and Queensland. The trial investigates the potential impact of a local network charge, as well as the effects of netting off energy between the sites.

Local Network Charges

Local network charges are tariffs for electricity generation used within a defined local network area, to recognise that only part of the network is used. These have been applied as a credit to the generator in these trials. In most cases, this would reduce the network portion of the electricity bill.

Local Electricity Trading (LET)

Local electricity trading is an arrangement whereby generation at one site is "netted off" at another site on a time-of-use basis, so that Site 1 can 'sell' or assign generation to nearby Site 2. This would reduce the combined energy and retail portion of electricity bills for local generation.

TRIAL KEY FACTS	
Proponent	Willoughby Council
Network service provider	Ausgrid
Electricity retailer	Energy Australia
Generator	173kW cogeneration installed, operated to supply 85% of heat demand
Location	Willoughby Leisure Centre (generation site) and the Willoughby Council Administration Centre (netting off site)
Generation/customer model	Single entity, 1-to-1 transfer between two Willoughby Council sites, the Leisure Centre and the Administration Centre
Project status at time of trial	The business case is calculated for a new cogeneration plant, assumed to match the Leisure Centre heat load. An existing 173kW cogeneration is currently operated under a connection agreement with a minimum import of 15kW. However, for consistency between trials, results are presented for a new cogeneration plant, including capital cost. The results for a changed operational regime for the existing plant are also presented.

What the trial looked at

The trial compares the business case for a new cogeneration plant in current conditions, and with and without a Local Elecricity Trading arrangement and a Local Network Credit. The trial results include the impact on the proponent, the network business, and the retailer. Results are also presented for a changed operational regime for the existing cogeneration plant. The different scenarios are:

BAU: current electricity and network charges, with results presented for no local generation and also with the existing cogeneration included.

CURRENT MARKET: includes either a new cogeneration plant operated to match the Leisure Centre heat load (compared to no cogeneration in the BAU), with the market as it is now. Results are also presented for a changed operational regime for the existing cogeneration (compared to current operation in the BAU).

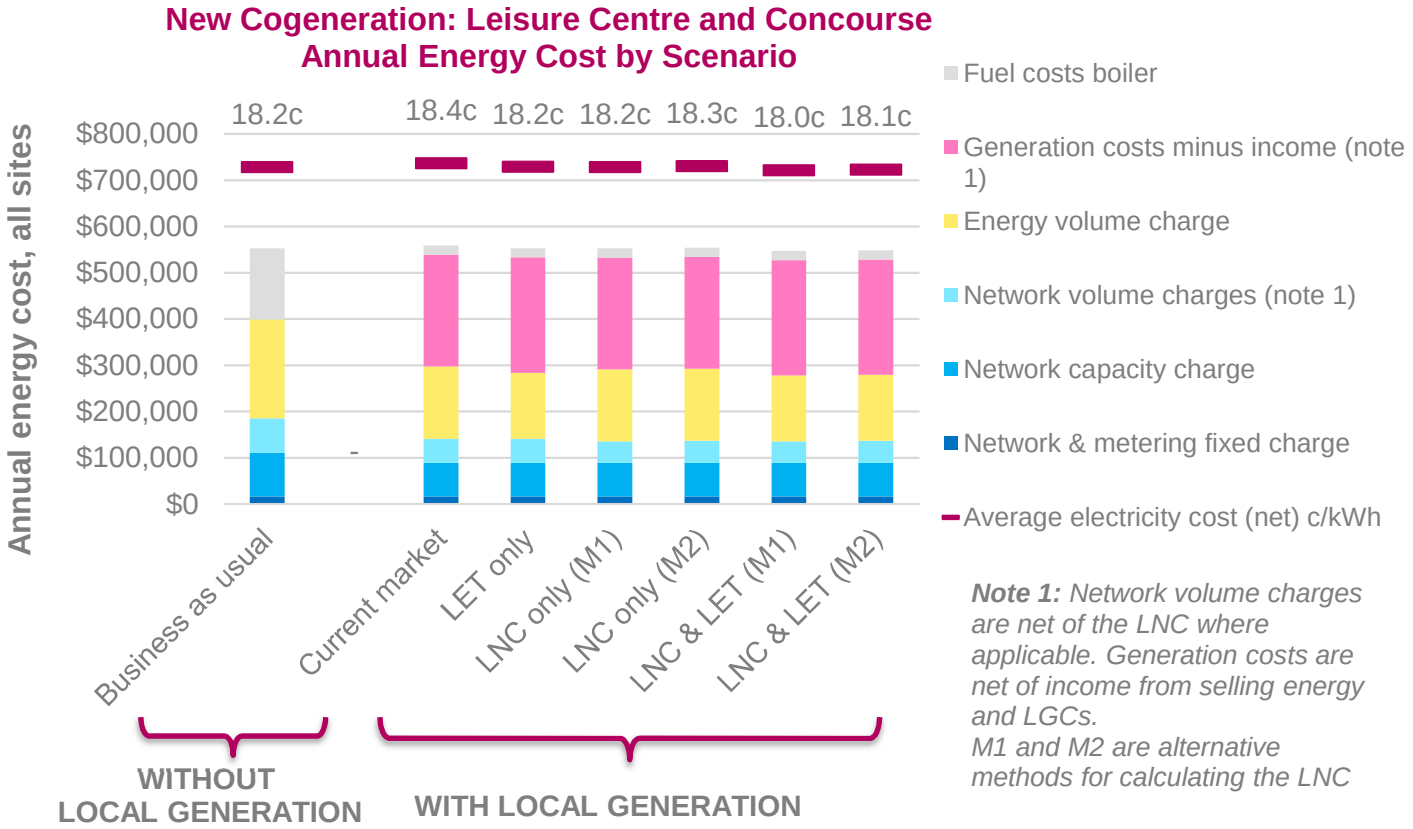
LNC only: cogeneration as per current market, with payment of a Local Network Credit.

LET only: cogeneration as per current market, with Local Electricity Trading for exported electricity.

LNC and LET: cogeneration as per current market, with a Local Network Credit and Local Electricity Trading in place.

Trial results - new cogeneration plant

The total cost shown in the graph is the net energy cost for two sites: the Leisure Center and the Concourse. Costs include the energy and network charges, the capital repayments on the cogeneration in scenarios with local generation, and any income the generator may receive, such as the new LNC, or 'buy back' income from electricity which is exported and not used at the netting off site. Fuel costs for the heating boiler are included in all scenarios.



Note 1: *Network volume charges are net of the LNC where applicable. Generation costs are net of income from selling energy and LGCs.*
M1 and M2 are alternative methods for calculating the LNC

Willoughby Council	Current market	LET only	LNC only (M1)	LNC & LET (M1)
Annual savings compared to BAU	-$6,000	-$300	-$100	$5,600
Lifetime benefit	$302,000	$447,000	$452,000	$596,000
Effect on network charges (annual)	-$43,900	-$43,900	-$49,700	-$49,700
Effect on retailer income (annual)	-$21,200	-$25,600	-$21,200	-$25,600
Greenhouse emissions reduction (includes export)	871 tons/yr			

Conclusion

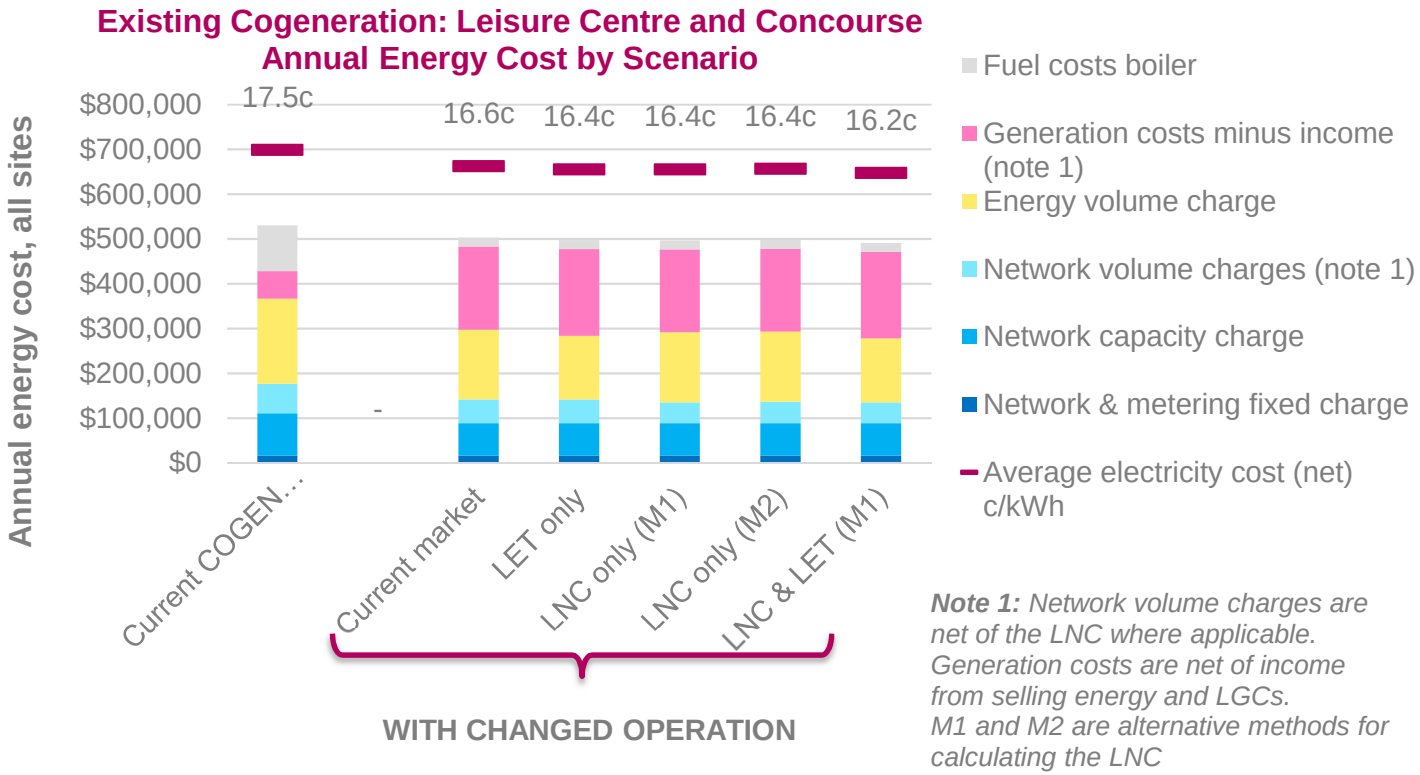
The installation of cogeneration is marginal with the assumptions used, although there is still a benefit where there is both Local Electricity Trading and a network credit. The lifetime impact ranges from a benefit of $596,000 in the scenario with both Local Electricity Trading and the LNC, to $302,000 under current market conditions. There is a positive lifetime benefit despite the loss in the first few years because of the effects of inflation, whereby the captial payments reduce compared to the savings on energy costs. Results are highly dependent on the cost of gas.

The calculations do not include a carbon price of any sort, and it is interesting to note that the emissions reductions come at a cost which ranges from $7 per ton under current market conditions, to -$3 per ton with LET and an LNC in place.

Note that costs are modelled, and may be different from actual project outcomes.

Trial results - existing cogeneration plant with changed operation

The total cost shown in the graph is the net energy cost for two sites: the Leisure Center and the Concourse. Costs include the energy and network charges, the capital repayments on alterations to allow export in all but the 'current cogen' scenario, and any income the generator may receive, such as the new LNC, or 'buy back' income from electricity which is exported and not used at the netting off site. Fuel costs are included in all scenarios.



Note 1: *Network volume charges are net of the LNC where applicable. Generation costs are net of income from selling energy and LGCs. M1 and M2 are alternative methods for calculating the LNC*

Willoughby Council	**Current market**	**LET only**	**LNC only (M1)**	**LNC & LET (M1)**
Annual savings compared to BAU	$27,200	$32,900	$33,100	$38,800
Simple payback	1 yrs	1 yrs	1 yrs	1 yrs
Effect on network charges (annual)	-$35,200	-$35,200	-$41,100	-$41,100
Effect on retailer income (annual)	-$12,600	-$17,000	-$12,600	-$17,000
Greenhouse emissions reduction (includes export)			573 tons/yr	

Conclusion

Changing the operational regime of the existing cogeneration and removing the requirement to import is very beneficial. The greatest savings come from reducing the requirement for boiler fuel as waste heat from the cogeneration can be effectively utilised. It should be noted that this business case does not include the capital costs of the cogen as it is already installed, and the associated costs to improve the connection are slight. There is a greatest benefit where the two new measures are in place, but all scenarios payback within a year, and annual savings of between $27,200 and $38,800.

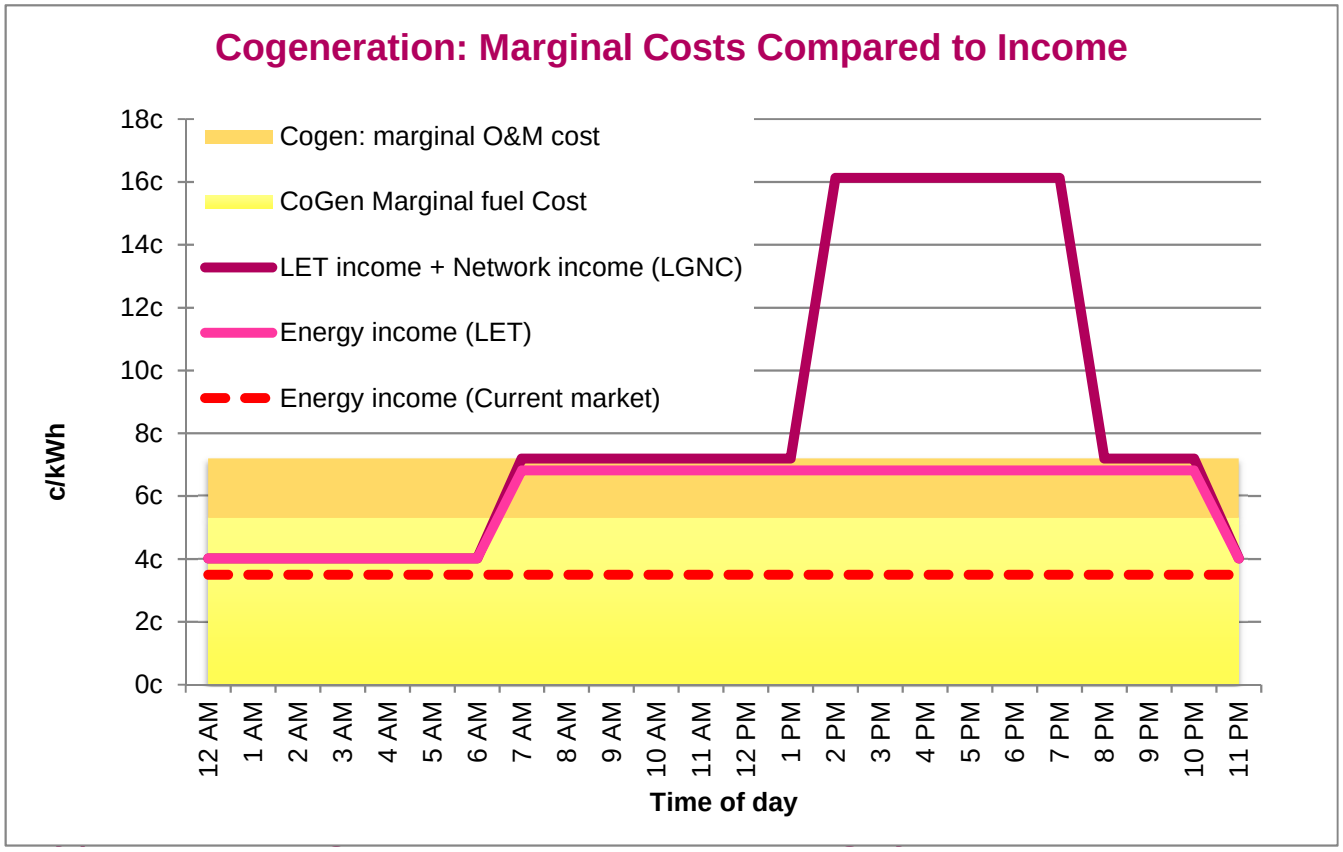
Note that costs are modelled, and may be different from actual project outcomes.

Trial results - marginal costs and benefits of cogeneration operation

The cost for cogeneration operation for fuel, operations and maintenance, as modelled in the Willoughby trial, is 18.6 c/kWh, giving a marginal cost of 7.2 c/kWh provided the cogeneration is also supplying useful heat. This is certainly worthwhile for behind the meter generation, as it displaces both energy and network charges, which vary from about 13.5 c/kWh peak to 7.5 c/kWh offpeak .

The graph shows the marginal case for export. As can be seen, export is not economic under current market conditions, even at peak times, when such export would presumably be useful to the network business. The payment of an LNC alone would make such exports worthwhile at peak times, and the combination of an LNC and electricity trading would make exports worthwhile at shoulder periods.

The results show that there needs to be some additional market mechanisms to make export from cogeneration worthwhile, and to allow for correct sizing of cogeneration plants.Current market conditions may result in plants being undersized in order to avoid export, or simply not operated when operation would result in export. This situation could be avoided through the combination of the LET and LNC.



Gas cost	1.66	c/MJ
Variable O&M: c/ kWh	1.9	c/kWh
Cogen efficiency (electrical)	36% (electrical), 55% (thermal), 90% (total)	
Boiler efficiency		80%
Cogen fuel Costs (calculated)	16.73	c/kWh
Cogen value of heat (calculated)	11.4	c/kWh
Net marginal cost of operation (calculated)	7.20	c/kWh

Note that costs are modelled, and may be different from actual project outcomes.