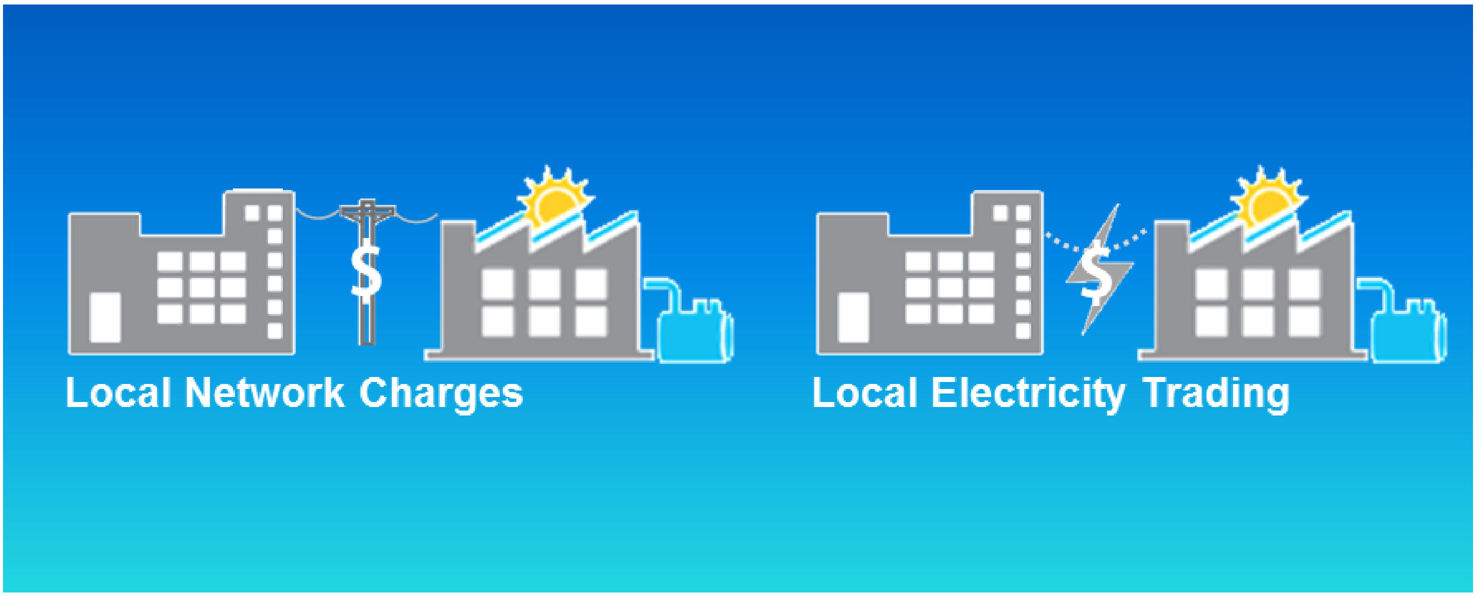

UTS: INSTITUTE FOR SUSTAINABLE FUTURES

VIRTUAL TRIAL OF LOCAL NETWORK CREDITS AND LOCAL ELECTRICITY TRADING: WILLOUGHBY COUNCIL

Case Study Report, August 2016

UTS:ISF
INSTITUTE FOR SUSTAINABLE FUTURES

2016

ABOUT THE AUTHORS

The University of Technology Sydney established the Institute for Sustainable Futures (ISF) in 1996 to work with industry, government and the community to develop sustainable futures through research and consultancy. Our mission is to create change toward sustainable futures that protect and enhance the environment, human well-being and social equity. We seek to adopt an inter-disciplinary approach to our work and engage our partner organisations in a collaborative process that emphasises strategic decision-making.

Authors: Jay Rutovitz, Dr Sven Teske, Alison Atherton, Lawrence McIntosh and Edward Langham.

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DISCLAIMER

This paper is prepared as part of the ARENA funded project 'Facilitating Local Network Charges and Virtual Net Metering'.

The project is due to be completed by August 2016 and results and papers are publicly available on the project webpage: http://bit.do/Local-Energy

For further information visit: **www.isf.uts.edu.au**

Contact: Alison Atherton, E: Alison.Atherton@uts.edu.au, T: +612 9514 4909

Institute for Sustainable Futures
University of Technology Sydney
PO Box 123
Broadway NSW 2007
www.isf.edu.au

CONTENTS

FIGURES AND TABLES

LIST OF ABBREVIATIONS

AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
ARENA	Australian Renewable Energy Agency
ISF	Institute for Sustainable Futures
kW	kilowatt
LET	Local Electricity Trading
LGC	Large-scale Generation Certificate
LGNC	Local Generation Network Credit
LNC	Local network credit
LRMC	Long run marginal cost
NEM	National Electricity Market
PV	Photovoltaic
SRES	Small-scale Renewable Energy Scheme
TEC	Total Environment Centre
TOU	Time of use
UTS	University of Technology Sydney
VNM	Virtual Net Metering

SUMMARY RESULTS AND CONCLUSIONS

The Willoughby Council trial tested the economic impact of Local Network Credits (LNC) and Local Electricity Trading (LET) on a proposed Council cogeneration energy project, and assessed the real-world requirements for these two measures to be applied.

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 Concourse (netting off site)
Generation/customer model	Single entity, 1-to-1 transfer between two Willoughby Council sites, the Leisure Centre and the Concourse
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 both a new cogeneration plant, including capital cost, and for a changed operational regime for the existing plant.

What the trial looked at

The trial compares the business case for new generation in current conditions, as well as with and without a LET arrangement and an LNC. The trial scenarios look at the impact on the proponent, the network business, and the retailer. 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 energy 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 in place for the exported electricity.
- **LNC and LET:** cogeneration as per current market, with both measures in place.

Trial results – new cogeneration plant

The total cost shown in the Figure 1 is the energy cost, net of costs and income, for the two Willoughby Council sites, the Leisure Center and the Concourse. Table 1 shows the results by stakeholder. The project would have a positive payback even though there is a loss in the first year under the current market conditions (shown in the annual savings). This is because of inflation, which means that the capital repayments decline relative to energy costs in future years. Costs include the energy and network charges, the capital repayments on the cogeneration in scenarios with local generation, and any income the from exports, 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.

These results are for the case where a new cogeneration plant is installed, and have been investigated to make the trial consistent with the others.

Figure 1 New cogeneration - results

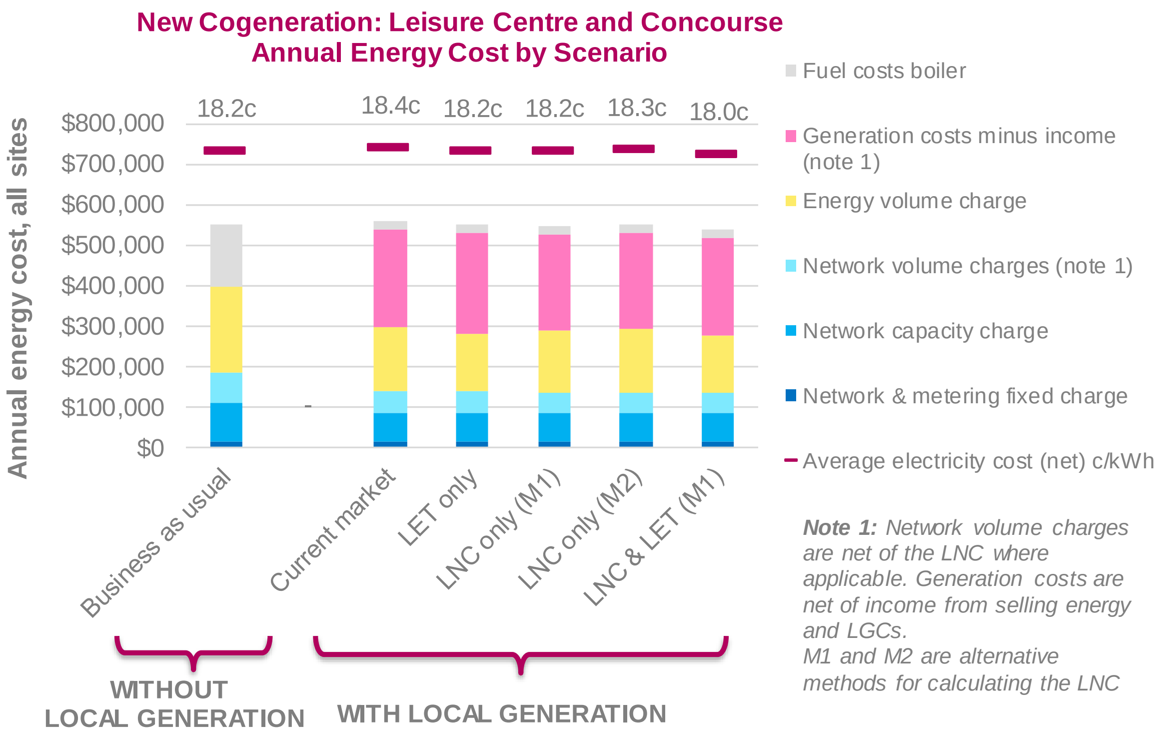


Table 1 Results by stakeholder (new cogeneration)

	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 emission reduction (all scenarios with new local generation)				871 tons/yr

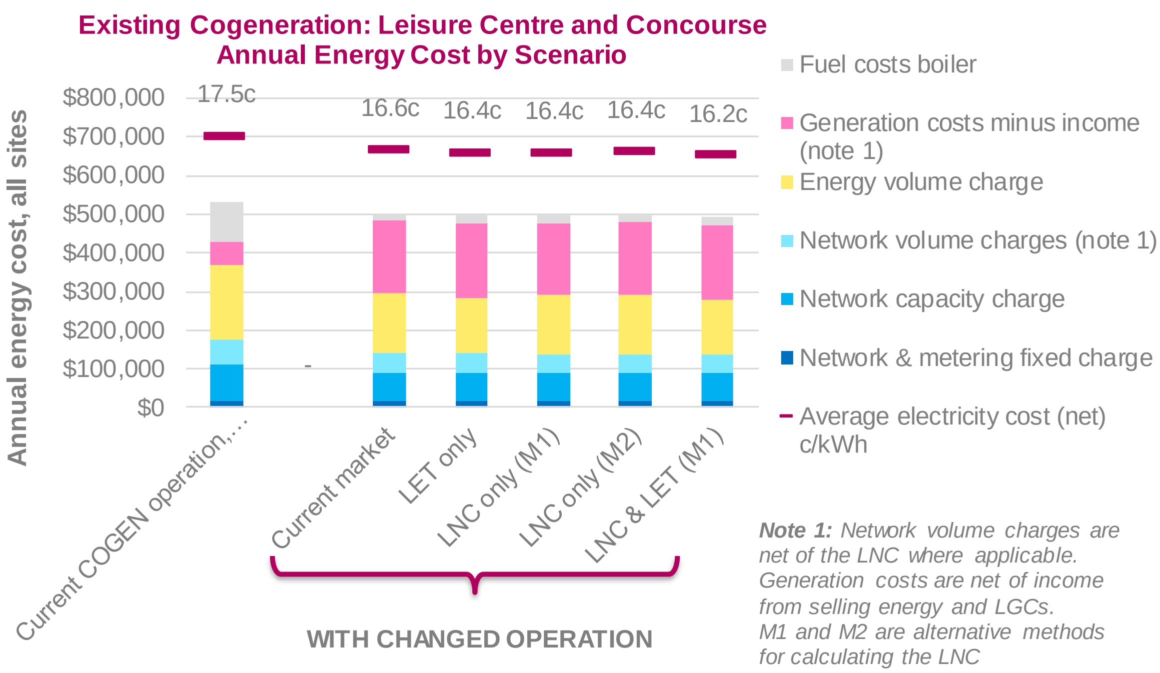
Trial results – existing cogeneration plant with changed operation

Willoughby Council has an existing cogeneration plant which is operated under an agreement which requires a minimum import at all times of 15kW, which means the unit is operated sub-optimally. Figure 2 and Table 2 give the outcomes for removing the minimum import requirement, and include the cost of improving the connection arrangements in order to export electricity.

Table 2 Results by stakeholder (existing cogeneration with changed operation)

	Current market	LET only	LNC only (M1)	LNC & LET (M1)
Annual savings compared to BAU	$27,200	$32,900	$33,100	$38,800
Lifetime benefit	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 emission reduction (all scenarios with new local generation)				573 tons/yr

Figure 2 Existing cogeneration with changed operation - results



Conclusion - new cogeneration

The installation of new 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 just $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 capital payments reduce compared to the savings on energy costs. 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. Results are highly dependent on the cost of gas.

Conclusion - existing cogeneration

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 cogeneration, as the plant is already installed, and the associated costs to improve the connection are slight. There would be even greater benefit if the two new measures are in place, but all scenarios pay back within a year, and annual savings of between $27,200 and $38,800.

The marginal case for co-generation when the electricity would be exported would be changed by the existence of either an LNC or a LET arrangement. At present, with the Willoughby Council gas price, it is not economic to export electricity, even when the heat can be used onsite. However, either netting of the electricity, the payment of an LNC, or negotiating a higher buy back rate from Energy Australia make operating worthwhile.

Recommendations

We recommend that Willoughby Council:

1) Proceeds with arrangements to remove the requirement to import 15kW to their existing cogeneration plant,

2) Explores the possibility of a LET arrangement with their Energy Australia,

3) Continues to actively support a rule change to introduce an LNC.

1 INTRODUCTION

This report provides results of the virtual trial undertaken for **Willoughby Council** on the effects of Local Network Credits and Local Electricity Trading on the viability of a proposed cogeneration energy project.

The trial is part of a one year research project, *Facilitating Local Network Charges and Virtual Net Metering.* The project is led by the Institute for Sustainable Futures (ISF) and funded by the Australian Renewable Energy Agency (ARENA) and other partners, and is investigating two measures aimed at making local energy more economically viable:

- Local Network Charges for partial use of the electricity network
- Local Electricity Trading (LET) (previously referred to as Virtual Net Metering or VNM) between associated customers and generators in the same local distribution area.

The project includes five 'virtual trials' of the two measures in New South Wales, Victoria and Queensland.

Local Network Charges/ Credits

Local network charges are reduced network tariffs for electricity generation used within a defined local network area. This recognises that the generator is using only part of the electricity network and may reduce the network charge according to the calculated long-term benefit to the network. The rationale is to address some aspects of inequitable network charges levied on a generator/consumer pair; dis-incentivise duplication of infrastructure (private wires); and maintain use of the electricity network. Following previous work on the practicality of applying a reduced network charge for electricity sourced locally or paying a network credit to local generators, the latter was recommended as a means to deliver reduced network charges for local electricity[1], and was the mechanism investigated in this project.

Local Electricity Trading (LET)

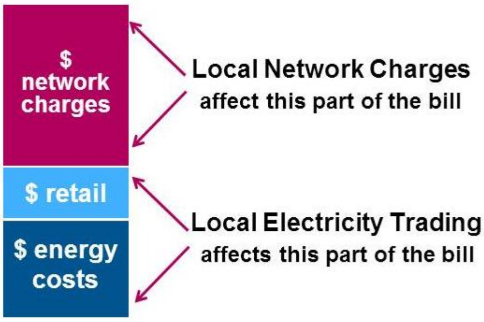
LET is an arrangement whereby generation at one site is "netted off" at another site on a time-of-use basis, so that Site 1 can 'sell' or transfer generation to nearby Site 2. The exported electricity is sold or assigned to another site for billing purposes. LET can be applied in a number of different ways:

- A single generator-customer can transfer generation to another meter(s) owned by the same entity (e.g. a Council has space for solar PV at one site and demand for renewable energy at a nearby facility);
- A generator-customer can transfer or sell exported generation to another nearby site;
- Community-owned renewable energy generators can transfer generation to local community member shareholders; and
- Community retailers can aggregate exported electricity generation from generator-customers within a local area and resell it to local customers.

[1] Rutovitz, J., Langham, E. & Downes, J., 2014. Issues Paper: A Level Playing Field for Local Energy, Prepared for the City of Sydney

The interaction of Local Network Credits and local electricity trading

Local Network Credits and LET are independent but complementary concepts with different effects on a consumer's energy bills. In most cases, the LNC will reduce the network charge portion of electricity bills, while Local Electricity Trading may reduce the combined energy and retail portion of bills for local generation.



About the project and trials

The objective of the project is to create a level playing field for local energy, by facilitating the introduction of local network charges and Local Electricity Trading. The key outputs are:

a. Improved stakeholder understanding of the concepts of Local Network Credits and Local Electricity Trading;

b. Five 'virtual trials' of Local Network Credits and Local Electricity Trading in New South Wales, Victoria, and Queensland (see Figure 1);

c. Economic modelling of the benefits and impacts of Local Network Credits and Local Electricity Trading;

d. A recommended methodology for calculating Local Network Credits;

e. An assessment of the metering requirements and indicative costs for the introduction of Local Electricity Trading, and consideration of whether a second rule change proposal is required to facilitate its introduction; and

f. Support for the rule change proposal for the introduction of a Local Generation Network Credit submitted by the City of Sydney, the Total Environment Centre, and the Property Council of Australia.

The virtual trials aim to test the impact of Local Network Credits and Local Electricity Trading on local distributed energy projects, particularly the economic impacts, and to assess the real-world requirements for the measures to operate.

Figure 3 The Virtual Trials

2 WILLOUGHBY TRIAL – KEY FACTS

Table 3 Trial description

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 Concourse Centre (netting off site)
Generation/customer model	Single entity, 1-to-1 transfer between two Willoughby Council sites, the Leisure Centre and the Concourse 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, including capital cost. An existing 173kW cogeneration is currently operated under a connection agreement with a minimum import of 15kW. The results for a changed operational regime for the existing plant are also presented.

Table 4 Key financial and market inputs

Technology		Co-generation
Electrical capacity	kW	173
Generator cost/ kW	$/kW	4,335
Generator cost (total) (business case for new cogeneration only)	$	750,000
Costs for works to existing generator connection (business case existing cogeneration only)	$	25,000
Generator O&M Cost (variable)	c/kWh	1.89
Generator O&M Cost (fixed)	$/a	3,600
Interest rate	%/a	5%
Discount rate	%/a	5%
Inflation rate	%/a	2.43%
CO2 equivalent - replaced power	kgCO2/kWh	0.97
Gas emission factor	kg/GJ	51.3
Other charges (AEMO, RET, SRES, NSW EES)	c/kWh	1.20
Retailer buy back rate	c/kWh	3.5[1]
Retailer margin	%	7.0% [2]
Network connection level		2 (Distribution Substation)

Note 1: Estimated by ISF

Note 2: Estimated by ISF from the published retailer margins in Queensland.

3 METHODOLOGY

This section gives a brief summary of the methodology used across all five trial sites. For a full description of the methodology, please see the Trials Summary Report[2].

An excel business case model was constructed to compare local generation projects under the current market conditions with the same generator installed with the two measures under investigation in the trials, namely Local Electricity Trading (LET) and a Local Network Credit (LNC) using two methodologies. The measures are considered together and separately. In order to see the effect of these measures, eight different scenarios were defined.

The model calculates the changes in costs for the proponent sites as a result of the new generation, including the local generation site (LG site) and whatever trading sites are included in the trial (called the LET sites). The model also calculates the financial impact on the network business and the retailer (this does not include implementation costs).

The projects were generally at various stages of development, but all the installations are under serious consideration by the proponents, and it was expected that the trial would assist with decisions on whether to go ahead, as well as with project sizing.

Table 3 gives summary information for the Willoughby trial, including the project status.

In the excel business case model, all input data for the local generation side (LG) was arranged in one sheet, so specific parameters such as payback time or interest rate could be changed easily to test the influence on trial results.

Both the generation profile(s) and all demand profiles – from the local generation site (LG) as well as the LET “netting off” sites were uploaded in hourly steps. The netting off step includes can include up to 10 different demand profiles.

The third step of the calculation involved detailed input of consumption tariffs and the Local Network Credit (LNC) tariff. The LNC tariffs were calculated from each network partner’s data, using the methodology developed for this project. The consumption tariffs include times for shoulder, peak and off peak, and the energy and network charges, including capacity, volume, and fixed charges where applicable.

Due to “time-of-use” dependent tariffs and LNCs, the shape of generation and demand profiles have a significant impact on the trial results and whether or not a project is profitable.

The local network provider (AUSGRID) provided the load curve for the two Willoughby Council Sites. However, the Willoughby Leisure Centre load curve was only available as a residual load, the underlying demand minus the existing cogeneration. Unfortunately there were no measurements of the actual cogeneration, thus neither the underlying demand profile nor the actual cogeneration profile was available. These profiles were developed in consultation with technicians from Willoughby council, and the actual generation curve (and therefore the underlying demand) may vary from the one which has been developed for use in this trial.

Steps four and five processed all inputs of LG and LET sites in sub calculations, which are summarized in a comprehensive result overview for each scenario, and connected to a module for cash flow calculations.

Finally, a standardised report sheet provides an overview to key results in the form of tables, texts and figures.

[2] Rutovitz, J., Langham, E., Teske, S., Atherton, A. & McIntosh, L. (2016) *Virtual trials of Local Network Charges and Local Electricity Trading: Summary Report*. Institute for Sustainable Futures, UTS.

3.1 The scenarios

The Willoughby Council trial was unique because there is an existing cogeneration plant in operation. The Council wished to investigate the option of increasing the operating regime to export to one of their nearby sites. It emerged during the trial that the existing cogeneration plant was operating under an agreement for a minimum import of 15kW, which appears much less than the optimum operating hours.

The scenarios are presented for a theoretical case, in which a new cogeneration is installed, and for a changed operating regime. The case for the new cogeneration includes the estimated full capital cost of a new installation, in order to make the results more comparable with the other four trials. Results are also presented for a changed operating regime, including the capital costs of upgrading the connection.

The trial compares the business case for the new generation, or for the changed operating regime, in current conditions, and with and without the new measures. Costs are calculated for the generation site and any netting off sites included in the trial in all scenarios. All scenarios except BAU (no 1) include the new local generation. The different scenarios are:

1. **BAU**: current energy and network charges, with results presented for no local generation and also with the existing cogeneration included.
2. **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).
3. **LET only**: cogeneration as per current market, with Local Electricity Trading in place for the exported electricity, but no LNC paid. Exports from the generation site are netted off at whatever LET sites are included, and any remaining residual exports are valued according to the retailer buy-back rate.
4. **LNC (M1)**: cogeneration as per current market, with payment of a Local Network Credit using methodology 1 (volumetric only).
5. **LNC (M2)**: cogeneration as per current market, with payment of a Local Network Credit using methodology 2 (combined volumetric and capacity payment)
6. **LET and LNC (M1)**: cogeneration as per current market, with both measures in place, using the LNC methodology 1.
7. **LET and LNC (M2)**: cogeneration as per current market, with both measures in place, using the LNC methodology 2

The Local Network Credit methodology was developed as part of this project. The Trials Summary Report[3] describes in detail the LNC methodology and the calculations we performed for the various scenarios. Briefly, the calculation of the LNC has two parts:

- Value setting (the base value of the LNC). We used the same value setting methodology that network businesses use for regular tariffs i.e. the Long Run Marginal Cost (LRMC) of the network.
- Tariff setting (the application of a tariff structure to the base LRMC value). We applied two different tariffs:
    - Volumetric tariff (methodology 1)
    - Combined volumetric and capacity tariff (methodology 2)

[3] Rutovitz, J., Langham, E., Teske, S., Atherton, A. & McIntosh, L. (2016) *Virtual trials of Local Network Charges and Local Electricity Trading: Summary Report*. Institute for Sustainable Futures, UTS.

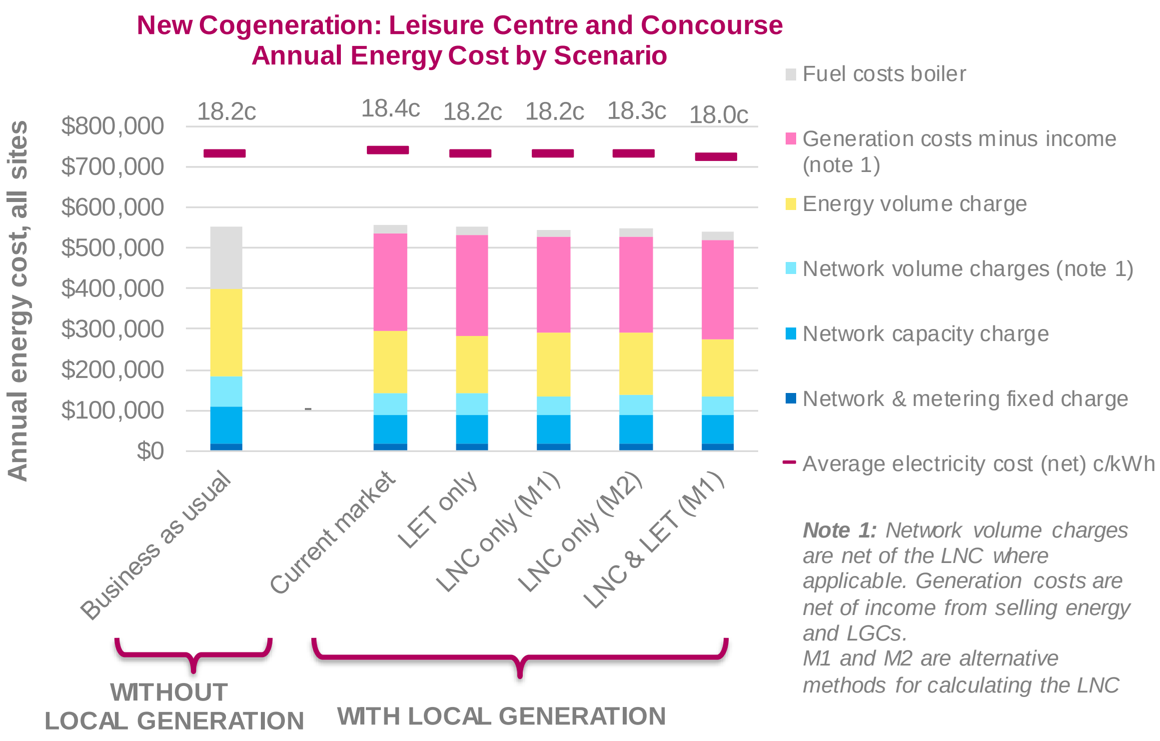
4 RESULTS

4.1 New cogeneration

The net energy cost for the two Willoughy Council sites is shown in Figure 4 for each scenario. This includes the energy and network charges, capital repayments on any new infrastructure, such as the cogeneration plant and any income the generator may receive. Income includes renewable energy credits, the new LNC, and any buy back income from electricity which is exported and not used at the netting off site. Detailed costs are given in Table 6.

All scenarios except the current market conditions result in a saving compared to business as usual, so the project would have a cost benefit with either of the new measures in place, or with a private wire, with the assumptions used.

Figure 4 Willoughby Leisure Centre and Concourse annual energy cost by scenario



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

Table 5 gives the annual savings, the lifetime benefit, and the Internal Rate of Return for the project in each scenario. The LNC and LET scenario results in the greatest benefit, with estimated annual saving of $5,600. The next most advantageous is the scenario with LNC in place (method 1).

Table 5 Summary effect on Willoughby Shire energy costs by scenario

	Current market	LET only	LNC only (M1)	LNC only (M2)	LNC and LET [1]
Year one annual savings	-$6,000	-300	-$100	-$1,500	$5,600
Lifetime benefit	$302,000	$447,000	$452,000	$415,000	$596,000
IRR	6.8%	7.9%	7.9%	7.7%	9.0%

The current market scenario still appears to have a lifetime benefit, despite showing a loss in annual savings. This is because annual savings are for the first year, and include the capital repayment on the generation system. The lifetime benefit includes the effect of inflation, and over time the capital repayments remain the same while energy and network costs increase as a result of inflation.

Network charges are the most significantly affected in the LNC (Method 1) case, with a loss of $55,600; this can be compared with the total distribution bill for the two sites, which is $168,000. The bulk of the lost revenue to the network is as result of decreased capacity and volume charges at the generation site, and only approximately 10% of the revenue change is due to the LNC.

Table 6 Detailed effect on Willoughby energy costs by scenario (new cogeneration)

	BAU	Current market	LET only	LNC only (M1)	LNC only (M2)	LNC & LET [1]
Network volume charges	$74,325	$52,362	$52,362	$52,362	$52,362	$52,362
Network capacity charge	$94,154	$72,262	$72,262	$72,262	$72,262	$72,262
Network fixed charge	$16,425	$16,425	$16,425	$16,425	$16,425	$16,425
LNC	-	-	-	-$5,887	-$4,450	-$5,169
AEMO, RET, Other	$38,857	$29,883	$28,503	$29,883	$29,883	$28,503
Energy volume charge	$174,979	$126,141	$113,844	$126,141	$126,141	$113,844
TOTAL ENERGY BILL	**$398,739**	**$297,074**	**$283,397**	**$291,187**	**$292,624**	**$278,229**
Fuel costs boiler	$153,749	$19,991	$19,991	$19,991	$19,991	$19,991
Capital repayment	-	$57,657	$57,657	$57,657	$57,657	$57,657
Fuel and O&M	-	$191,702	$191,702	$191,702	$191,702	$191,702
Buy back	-	-$7,976	-$0	-$7,976	-$7,976	-$0
Average electricity cost (net) c/kWh	18.2c	18.4c	18.2c	18.2c	18.3c	18.0c
Total supply costs	$552,506	$558,467	$552,766	$552,580	$554,017	$547,597

Note 1) The LNC value for the combined LNC and LET payments is taken as the average of the method 1 and method 2 payments.

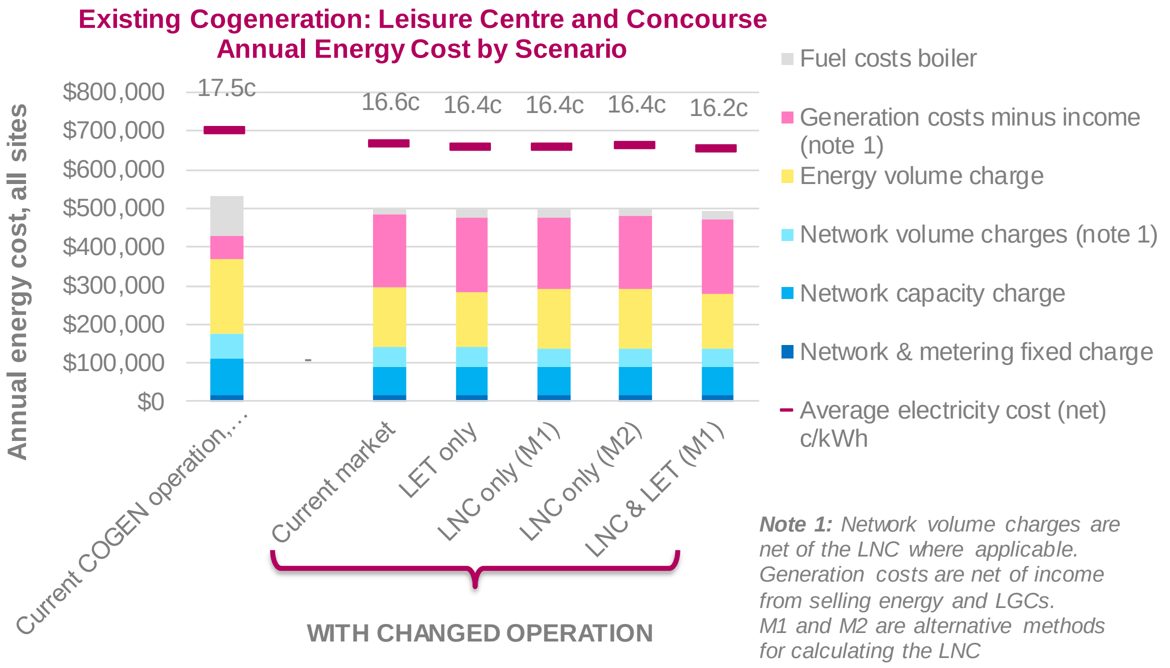
4.2 Existing cogeneration plant with changed operation

Willoughby Council has an existing cogeneration plant which is operated under an agreement which requires a minimum import at all times of 15kW, which means the unit is operated sub-optimally. Figure 2 and Table 2 give the outcomes for removing the minimum import requirement, and include the cost of improving the connection arrangements in order to export electricity.

Table 7 Results by stakeholder (existing cogeneration with changed operation)

	Current market	LET only	LNC only (M1)	LNC & LET (M1)
Annual savings compared to BAU	$27,200	$32,900	$33,100	$38,800
Lifetime benefit	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 emission reduction (all scenarios with new local generation)				573 tons/yr

Figure 5 Existing cogeneration with changed operation - results



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.

4.3 Cogeneration – marginal results

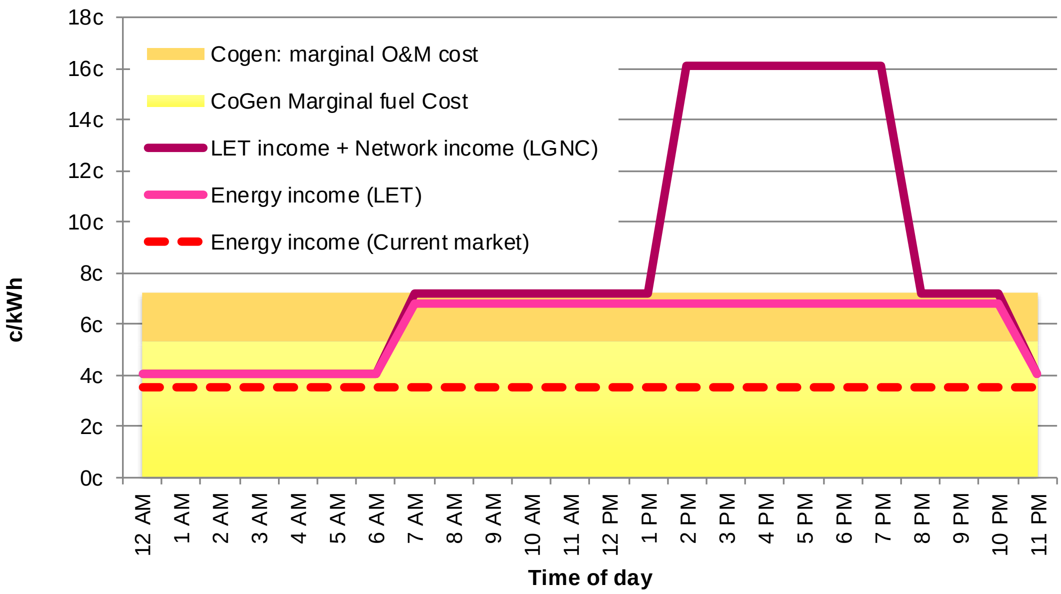
The marginal cost of operation for cogeneration as modelled in the Willoughby trial is just over 7 c/kWh, provided the cogen is also supplying useful heat. The cost for fuel and O&M is 18.6 c/kWh, with a value of heat supplied equal to 11.4c/kWh (electrical).

Table 8 shows the key input parameters for the unit. Cogen operation 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 off peak[4].

Figure 6 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 implication is that current market conditions result in suboptimal operation of cogeneration, as plants may be undersized in order to avoid export, or simply not operated when operation would result in export. This situation would be avoided through the combination of LET and LNC value for cogen operators.

Figure 6 CoGen marginal costs vs income



It is interesting to note that despite the substantial impact on the marginal cost of operation, the measures have a very limited impact on the overall business case for cogen. This is because the LNC and LET are only paid on exports, which represent a small proportion of total generation. So in effect, the payment of a small LNC (helped by the associated LET value) could achieve a transformational change in the design and operation of the cogen system. By ensuring the cogen operator does not lose money on every unit of exported power, the system can be sized efficiently to meet the on-site heat load, and does not need to ramp down every time electrical demand is too low to keep all generation behind the meter. Thus the LNC gives the network business the network support benefit of peak *exports*, and may result in additional reductions in peak grid consumption from demand at local generation sites because of in better sizing of plant.

Table 8 Key parameters for cogeneration as modelled in the Willoughby trial

[4] This includes all volumetric charges: energy, network, AEMO, RET, SRES, and EES.

Gas price	1.7 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)	16.7 c/kWh (electrical)
Cogen value of heat (calculated)	11.4 c/kWh (electrical)
Net marginal cost of operation (calculated)	7.2 c/kWh (electrical)

The marginal cost of cogeneration case demonstrates that even with a relatively low long run marginal cost (LRMC) value as provided by Ausgrid, spread quite widely over 1500 hours a year (2-8pm every weekdays year round), an LNC can send a powerful and meaningful signal to operate dispatchable generation when the network desires support. The more the price signal is targeted to a shorter for more seasonal peak, the higher the LNC value, and the stronger the generator response.

4.4 LNC effects on network businesses (new cogeneration)

Table 9 shows the impact on the charges Willoughby would pay to the network business in each scenario; the LET only scenario is not shown as it is exactly the same as the current market scenario from the network business point of view, and the LNC plus LET scenarios are not shown as they are identical to LNC (M1) or LNC (M2).

The current market shows a reduction in network charges, as some of the output from the generator is used at the generation site (behind the meter).

As soon as an LNC is paid, the LNC payment is added to the reduced charges, with a combined impact of $55,600 in the LNC (method 1), and $52,800 in the LNC (method 2) scenario.

LNC (method 2) results in an approximately 25% lower payment than LNC (method 1). This is driven by two factors. Firstly, the volumetric method was intended to be used with quite narrowly defined peak periods, to act as an ‘availability adjustment’ on the credit value. However, all network businesses selected quite broad peak periods, which effectively meant this adjustment was not applied. Thus the volumetric method LNC payment calculations may be higher than the true value of variable DG to the network. Secondly, the settings on the capacity payment meant if local generation was *ever* not available during a very broadly defined period, it received no credit. However, it is likely that if an LGNC payment was available, the co-generation unit would be operated to take advantage of the benefit available, by exporting at peak times whenever possible, which would result in higher payments.

Table 9 Distribution and transmission network business - net impact (annual)

	Current market	LNC only (M1)	LNC only (M2)
Revenue effect (excluding LNC)	-	-$5,900	-$4,500
Local network credit	-$43,900	-$49,700	-$48,300
Net effect on NSP revenue	**-$43,900**	**-$55,600**	**-$52,800**

4.5 Impact on retailer (new cogeneration)

Table 10 shows the effects on the retailer. The impact in current market conditions is close to $21,000 annually, as a result of the increase in behind the meter consumption. This increases somewhat if netting off is in place. It should be noted that the retail margin is charged on netted off electricity, but an estimated percentage was used for the margin as this is commercially confidential information.

Table 10 Impact on retailer

	Current market	LET only
Energy volume charges (change)	-$48,800	-$61,100
Estimated savings energy purchase	$27,600	$35,500
Net effect on retailer revenue	**-$21,200**	**-$25,600**

4.6 Sensitivity (new cogeneration)

We undertook sensitivity testing on the results for generator cost, LGC price, retailer buy back rate, the LNC value, and the LRMC value. The most significant input to the Willoughby outcomes is the cost of the generation system, as shown in Table 11. We were not able to test for the effects of the consumption tariffs, but these would have a significant effect as well.

	Variation tested	Effect on Annual Energy Cost
Generator cost	80% and 120% of modelled cost	2.1%
Large Scale Generation Certificates (LGCs)	Modelled rate $50/MWh; tested $40 & $60	0.0%
Retailer buy back rate	80% and 120% of modelled cost	0.3%
Gas cost (c/MJ)		6.8%
LNC	80% and 120% of modelled cost	0.2%
LRMC variation	1.08x (increase)	0.1%

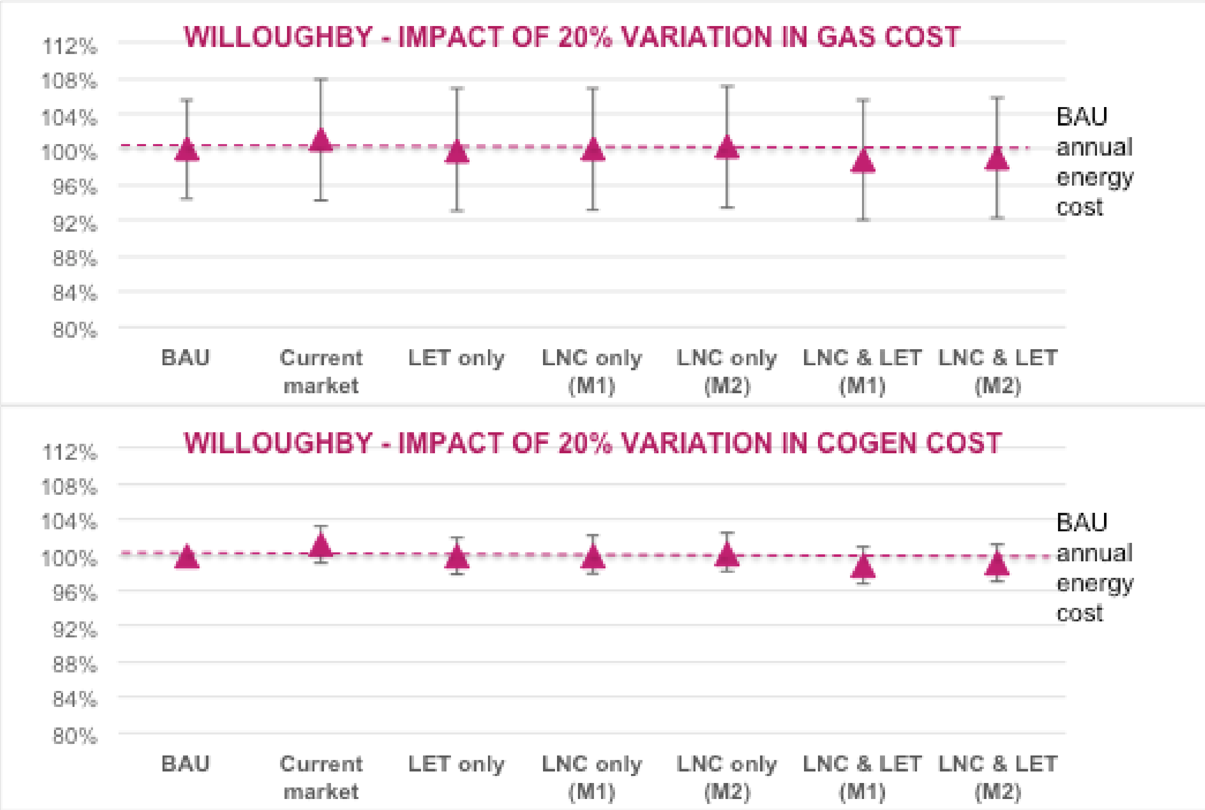
Figure 7 Figure 7 shows the effects of the gas price and the generator cost.

Table 11 Sensitivity testing results, Willoughby Council trial

	Variation tested	Effect on Annual Energy Cost
Generator cost	80% and 120% of modelled cost	2.1%
Large Scale Generation Certificates (LGCs)	Modelled rate $50/MWh; tested $40 & $60	0.0%

Retailer buy back rate	80% and 120% of modelled cost	0.3%
Gas cost (c/MJ)		6.8%
LNC	80% and 120% of modelled cost	0.2%
LRMC variation	1.08x (increase)	0.1%

Figure 7 Sensitivity to gas price and generator cost: Willoughby trial



5 CONCLUSION AND RECOMMENDATIONS

New cogeneration

The installation of new 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 just $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 capital payments reduce compared to the savings on energy costs. 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. Results are highly dependent on the cost of gas.

Existing cogeneration

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 cogeneration, as the plant is already installed, and the associated costs to improve the connection are slight. There would be even greater benefit if the two new measures are in place, but all scenarios pay back within a year, and annual savings of between $27,200 and $38,800.

The marginal case for co-generation when the electricity would be exported would be changed by the existence of either an LNC or a LET arrangement. At present, with the Willoughby Council gas price, it is not economic to export electricity, even when the heat can be used onsite. However, either netting of the electricity, the payment of an LNC, or negotiating a higher buy back rate from Energy Australia make operating worthwhile.

Recommendations

We recommend that Willoughby Council:

4) Proceeds with arrangements to remove the requirement to import 15kW to their existing cogeneration plant,

5) Explores the possibility of a LET arrangement with their Energy Australia,

6) Continues to actively support a rule change to introduce an LNC.

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