



A2EP – 2xEP Energy Productivity Summit
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Darling Harbour, Sydney

Session 03

2xEP by 2030 by sector – Agriculture

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Doing more. Using less.



Waste to energy options: the business case looks better and better

A2SE – Energy Productivity Summit

Leigh Rostron | 4th April 2017

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About Energetics



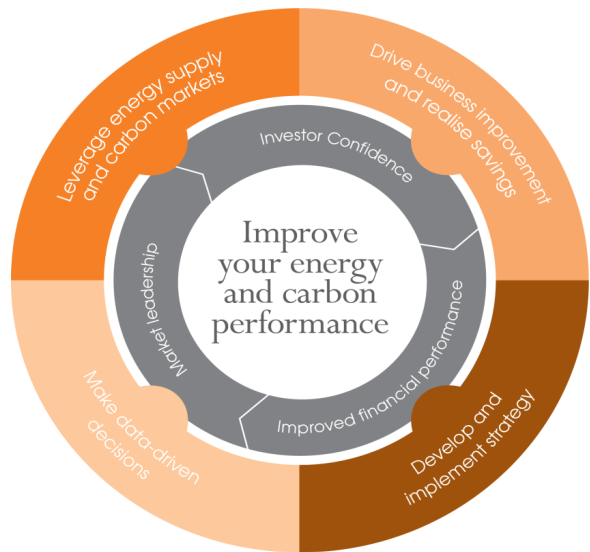
We provide advice to Australian business on ways to reduce greenhouse gas emissions and manage energy more efficiently and productively.

For more than 30 years we have worked with Australia's largest energy users and all levels of government.

Some of our current clients include Woolworths, BHP, Inghams, Teys, Pepsico, BBM, Qantas, TFI and Simplot

Some of major projects we have worked on have included:

- Negotiating over \$2 billion in energy contracts each year
- Developing and advise on thousands of energy projects
- Achieving \$25 million in CTIP and over \$20 million in ESS
- Developing projects for the ERF
- Completing several studies, workshops and business case analyses for biogas and biomass projects.





Agenda

1 Australian
Energy
Situation

2 EfW
Overview

3 Energy
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Comparison

4 Challenges

5 Smart Plays

6 Conclusion



Australian Energy Situation

- Grid electricity prices have nearly doubled in past 7 years
- On the eastern seaboard, natural gas prices are rapidly increasing
- This halves the payback period for energy efficiency projects.
- Gas supply contract – lack of competition and short term only
- Improved economics to switch from natural gas to other fuels such as biogas and biomass.



Grid Electricity



Pipeline Gas



EfW heat and power



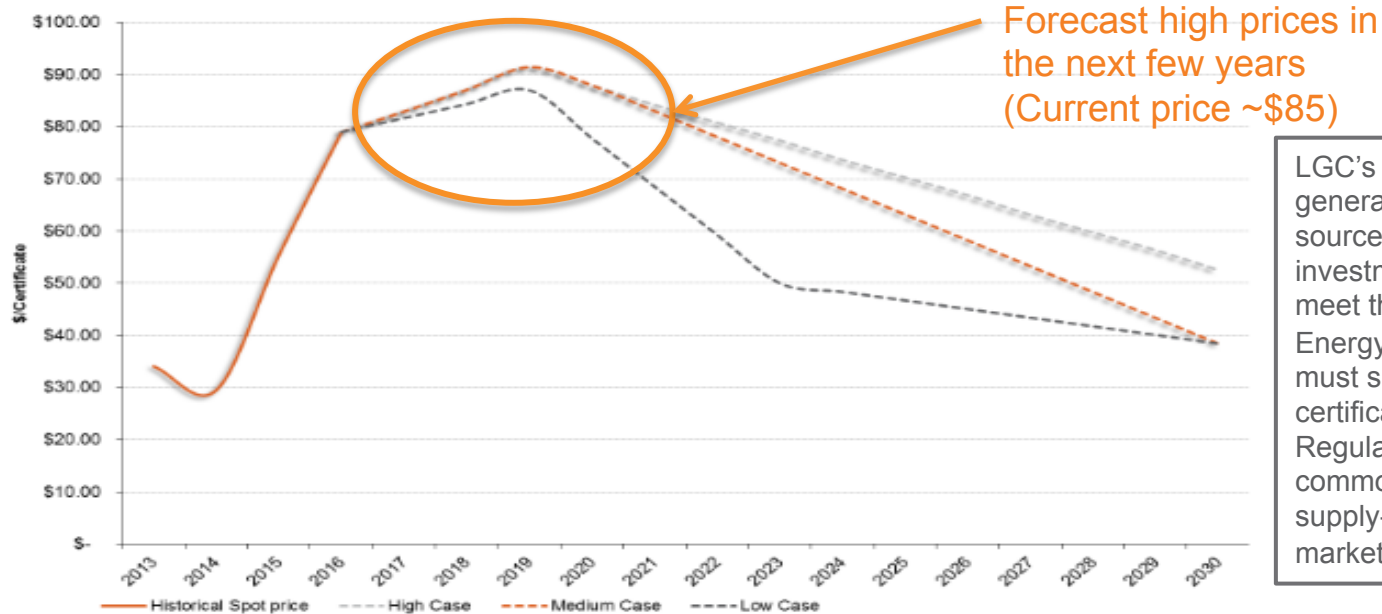
EfW sweet spot

- The high prices of gas and electricity opens the door for EfW projects where waste costs are low enough to compete with existing fuels as energy source
- Due to policy uncertainty reducing investor confidence in large scale renewable projects, the LGC price is very high (>\$85). Renewable power generation is a sweet spot for the next few years.

In this presentation, we will explore how these factors effect EfW opportunities, examine some of the challenges and look for the smart plays.



Key business case driver - LGCs



LGC's are certificates that are created by generating electricity from renewable sources. They are a tool to encourage investment into renewable energy to meet the Government's Renewable Energy Target (RET). Electricity retailers must surrender a set number of certificates to the Clean Energy Regulator every year. It is a traded commodity and the price is based on the supply-demand balance and other market factors.

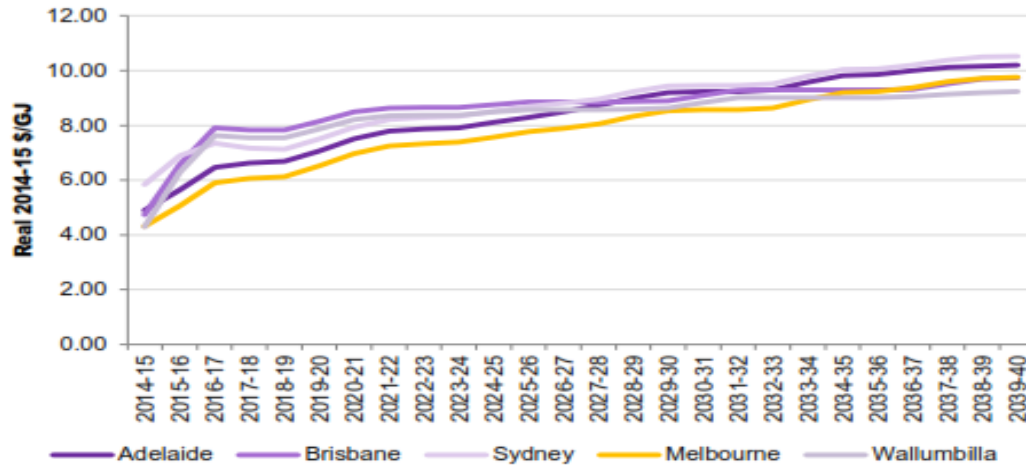
- LGCs can be claimed for renewable based power generation and large scale Solar PV (>100kW)
- These projects should be made a priority to take advantage of the high LGC prices predicted for the next few years



Natural gas price forecast

Medium energy consumption from a centralised source

Figure 19 **Projected gas prices for major load centres: Medium case**



Note: Delivered prices to city-gates

Source: ACIL Allen GMG Australia modelling

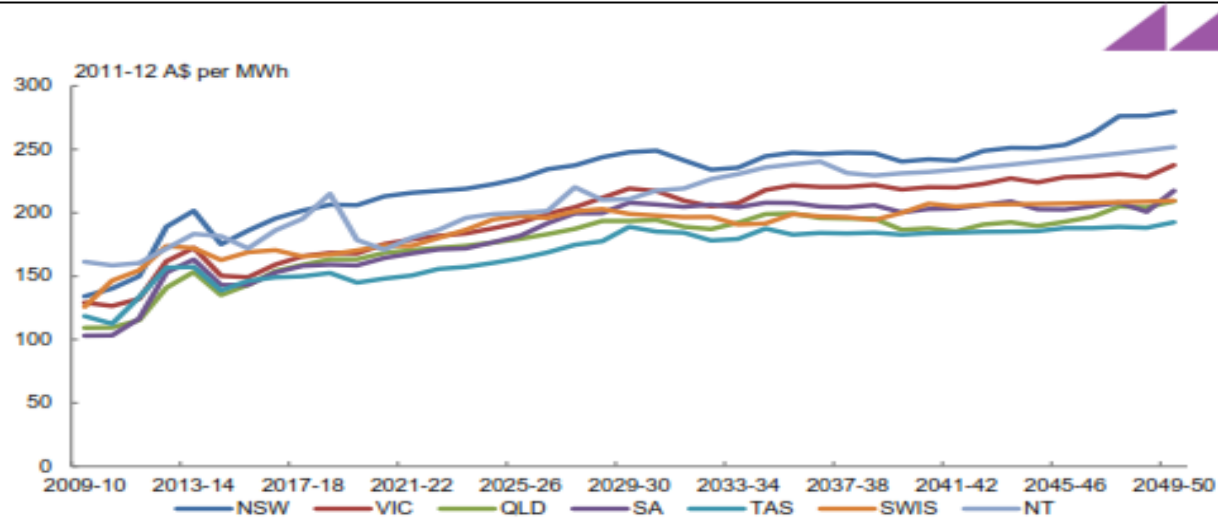


LNG exports increasing
local gas prices



Electricity price forecast

Figure 33 Industrial Customer electricity prices – Central Policy scenario



Note: Industrial customers have a great variety of load profiles and network charges, and therefore the series presented here is a stylised price indicative of an industrial customer.

Source: ACIL Allen

ASX futures show electricity prices rising for next few years

Volatility in spot price causing uncertainty in the market

Businesses showing interest in on-site generation and battery storage particularly in S.A.



EfW fuel sources

Most common wastes for direct combustion and power generation

- Anaerobic digestion from wastewater and solid wastes - Very common in red meat processing plants
- Landfill biogas - Municipal tips
- Wood waste - Timber processing plants or plants near plantations
- On-site waste material – crop residue or food processing plants (e.g. bagasse)





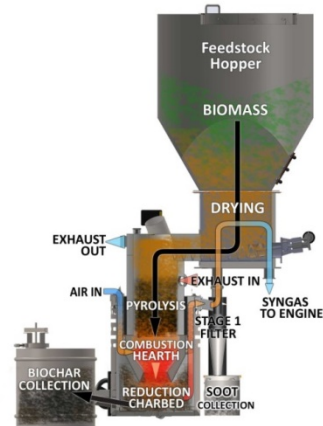
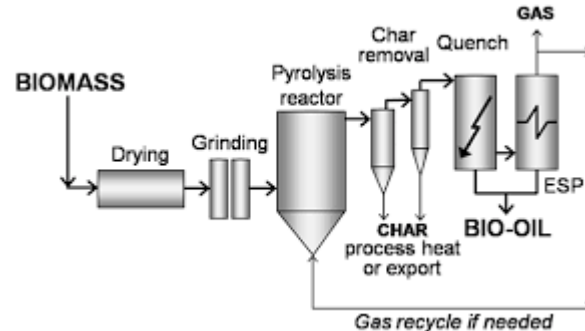
EfW systems

The most common energy conversion systems

- Direct combustion in boilers
- Biogas combustion in engines/turbines with waste heat recovery

Due to low energy density of some fuel sources, processes such as compacting, gasification and pyrolysis can enhance the value of fuel (biodiesel, bio-oil, syngas, biochar, pellets)

- Increased energy content (MJ/m^3 or MJ/kg)
- Improved storage ability
- Mobility





Energy Source Comparison

Energy Source	Price	Comment
Grid electricity	\$120/MWh to \$250/MWh or \$35/GJ to \$70/GJ	Highly variable depends on location
Solar PV	<\$100/MWh or \$28/GJ	Reducing price
LPG	over \$20/GJ	Locked to international oil price
LNG	\$18/GJ to \$25/GJ	Better price than LPG in some areas
Natural gas	\$8/GJ to \$18/GJ	Rising and limited long term supply contracts
Coal	\$6/GJ to \$12/GJ	Highly variable costs and transport cost depends on distance to site
Wood Waste	\$3/GJ to \$8/GJ	Transport costs biggest issue
On-site food waste	-\$3/GJ to \$4/GJ	Husks, spent grain - Cattle feed or landfill charges
Biogas from wastewater	LCOE \$5/GJ to \$15/GJ	Mostly used in boilers however cogeneration can provide power at LCOE of \$100/MWh plus heat recovery



Case Studies

Darling Downs Fresh Egg, Queensland

- 390,000 chooks producing 130t/week manure – was sold as fertiliser
- Now passes through onsite anaerobic digestion to produce power and heat
- Reduce onsite electricity use (60%) and LPG for heating

Australian Tartaric Products

- Diversion of 50,000tpa grape waste product from landfill into a biomass boiler
- Reduce energy costs by ~70%
- Generate ~60% of onsite energy needs

Rainbow Bee Eater

- Demonstration plant uses pyrolysis to convert wheat straw and other crop residues into syngas and biochar

References and more examples

Rural Industry Research & Development Corporation

<http://biomassproducer.com.au/projects/>





Network Connection Challenges

Network capacity charges

- \$/kWh versus \$/kW

Electrical connection costs

- Metering and switches/relays
- HV/LV transformer ownership
- Local substation capacity issues if generator fails

Export prices

- Low value of power export
- Wheeling to another site may not be available





Fuel Challenges

Biogas, Syngas

- Maintaining gas production
- Gas cleaning – quality? Engine reliability
- Compressor sizing/maintaining pipeline/control set-points
- Natural gas displacement - adjust ACQ

Biomass

- High equipment costs < 10 MW
- Fuel quality and moisture
- Space for materials handling
- Particulate emissions



Smart Plays

Business context #1

- High natural gas costs and high electricity costs
- Existing biogas generation

Smart Play

- Move from biogas in boilers to biogas for power generation and heat recovery (cogeneration)
- Potential payback 2 to 4 years

Business context #2

- Wastewater treatment plant upgrade to meet regulations
- High BOD values

Smart Play

- Consider AD and cogeneration
- Potential payback 3 to 5 years



Key conditions for EfW success

- The waste fuel is cheap (<\$5/GJ)
- Waste is available from inside site operations, part of supply chain or in immediate proximity
- Supply is consistent and available for more than five years
- Conventional fuel is expensive (>\$10/GJ for combustion)
- There is a need to replace or upgrade existing equipment (e.g. boiler) or infrastructure (e.g. wastewater treatment plant upgrade)
- Funding and/or financing support is available.
 - SAEPP funding available 2017
 - NSW CCF – earmarked for late 2017 (advanced energy)
 - ARENA if innovative project introducing new technology or application across sectors
 - SV \$2 million fund for project implementation support

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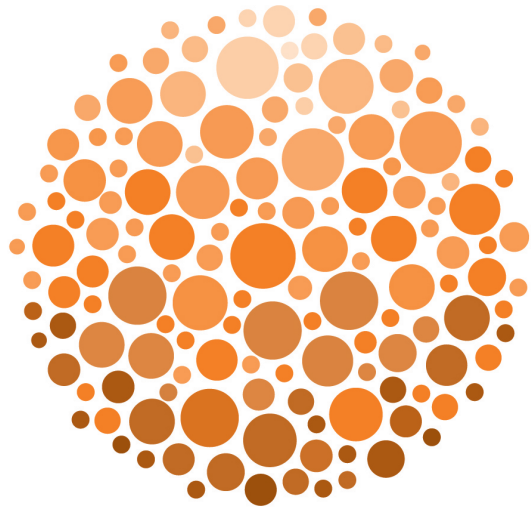
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Biomass and Gasification Costs

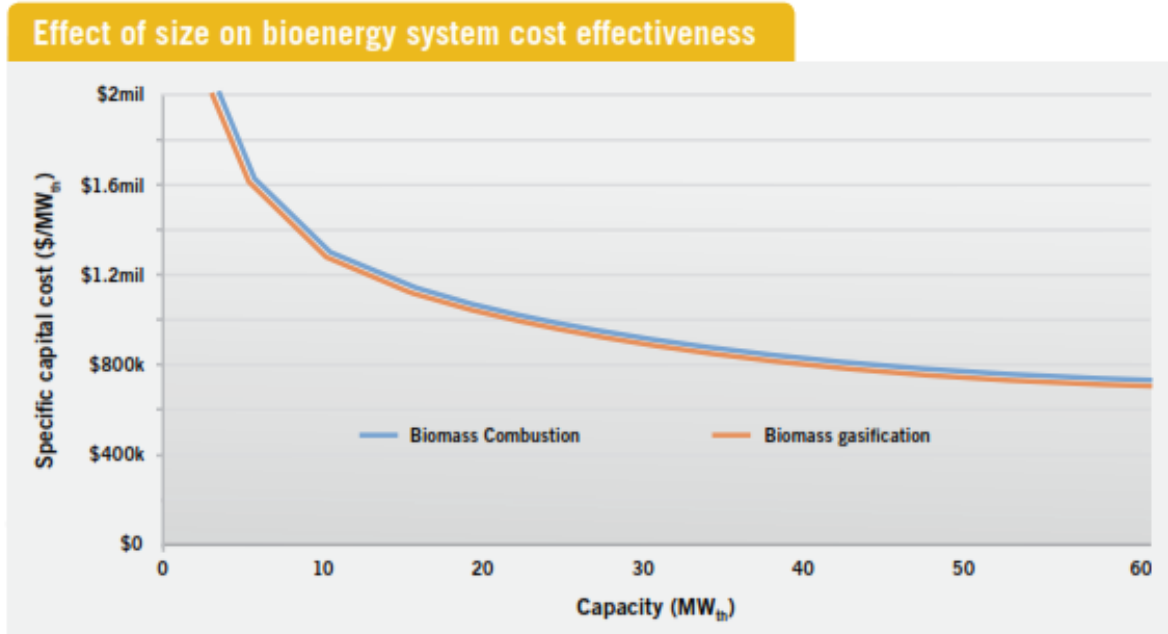


Figure 10. Specific cost of a bioenergy system as a function of thermal capacity

LCOE

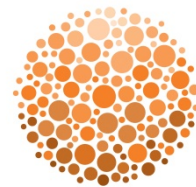


Figure 9: Updated LCOEs for AETA 2013 Model technologies, values for 2020 (NSW), with carbon price set to zero.

