On farm power generation

Gas fuelled power generation

Natural gas and liquefied petroleum gas (LPG) can be used to fuel engines to generate power, heat and cooling.

SUMMARY

The study considered three types of on-site power generation using reciprocating engines:

- Simple generation (ie electricity only)
- Cogeneration of electricity and process heat
- Cogeneration of electricity and process cooling

The key issue for viability is the cost of gas. This analysis found that simple or cogeneration requires fuel prices that can compete with the amount paid for electricity. Additional heating or cooling from cogeneration can provide another potential benefit. The capital cost and payback periods are less important than the cost of fuel, which dominates the financial performance.

Only network delivered natural gas is priced to reasonably compete with most current electricity prices. For example, a gas-fuelled generator with a capacity factor of 50% or more should be viable when the price being paid for electricity is more than **10c/kWh**, provided that it consumes fuel with a price of **10 $/GJ** or less.

With LPG not viable, on-site engine generation will not be viable for growers who do not have access to network delivered natural gas.

THE TECHNOLOGY

The combustion of both natural gas and LPG in reciprocating engines can result in significantly lower emissions of greenhouse gases and regulated pollutants than coal and diesel. Natural gas also has a significantly lower price than diesel in Australia.

Reciprocating engines are suited to hybrid power generation in combination with renewable resources such as wind, solar and biomass. These hybrid systems have significantly lower greenhouse gas emissions than fossil fuelled plant, and usually significantly lower costs than renewable plant.

Key strength and benefits

- Well understood and reliable form of distributed power generation
- Can be used when required to meet peak power demands during the day
- Networked natural gas is significantly cheaper than diesel on an energy basis
- The regulated pollutant emissions from natural gas and LPG fuelled power generation can be significantly lower than those of diesel fuelled power generation
- Environmentally sound, with potential marketing benefits to the use of cleaner energy

There are drawbacks however:

- Natural gas prices in the eastern states of Australia are anticipated to rise significantly in the coming years, and LPG prices are likely to follow
- Network delivered natural gas has a significantly higher price in NSW and Qld than in Vic and Tas
- Many growers do not have access to the natural gas network
- With the price of LPG usually comparable to diesel on an energy basis, LPG fuelled on-farm power generation does not pose significant financial benefits over diesel fuelled generation
- Emissions from natural gas and LPG fuelled power generation can be easily managed, but require approval from government prior to commissioning

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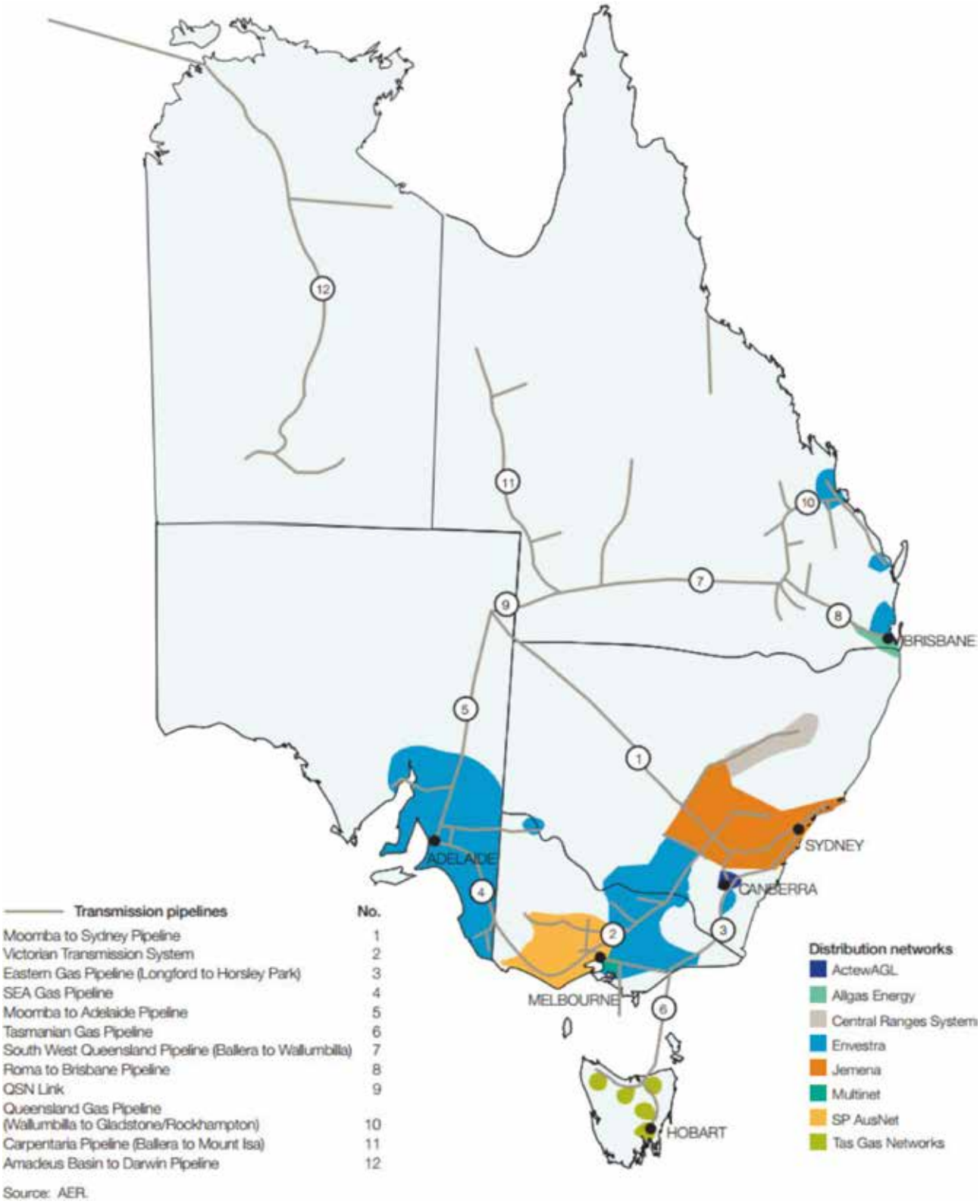

Figure 1: Major natural gas pipelines in eastern Australia. Australian Energy Regulator, 2013, "State of the Energy Market", http://www.aer.gov.au/node/23147, last accessed 14/03/2013

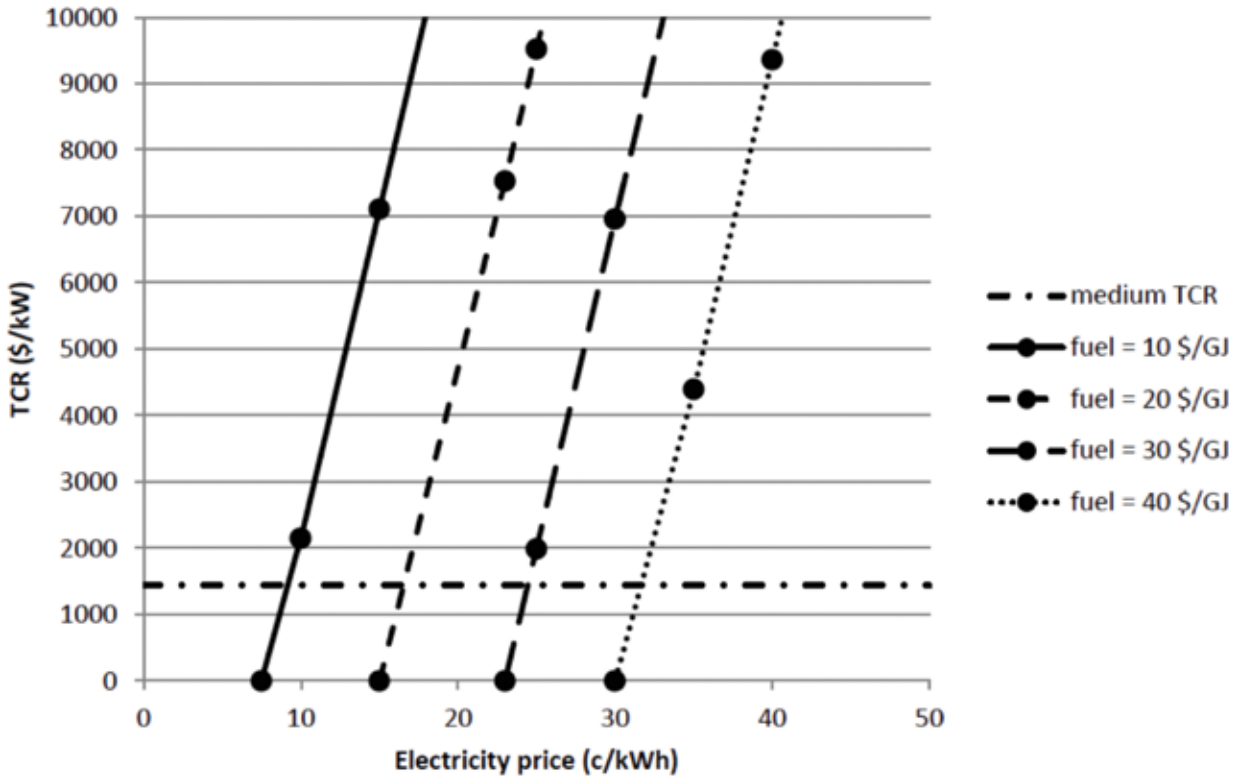

Figure 2: Electricity price required for gas generation to be viable at a range of fuel prices. A medium installation capital cost is also shown on the figure.

ECONOMICS OF NATURAL GAS AND LPG FUELLED POWER GENERATION

The economics of natural gas and LPG-fuelled generation can be positive in some situations. The key factors in determining economic viability are:

- The cost of fuel (most important)
- A connection to the natural gas grid
- Cogeneration (electricity heat or cooling) can be an added benefit where these are required
- Most of the power must be used on site

Some key indicators:

- If **natural gas** is available for **10 $/GJ** or less, then gas generation can be viable if electricity costs more than **$10/kWh**. Figure 2 shows economic viability at the range of expected fuel prices.
- **Subsidies:** Gas generation attracts government subsidies in the form of STCs under the Renewable Energy Target.

CASE STUDIES

The economic viability of cogeneration is limited to areas where farms can connect to the natural gas grid.

A study of a leafy vegetable farm in southeast Gippsland, Vic, with 210 ha under cultivation, found that simple generation of electricity is marginally viable at best but that the cogeneration of electricity and cooling may be viable.

A key uncertainty to the financial performance was the cost of natural gas network connection. Binding quotes on the gas price, network connection charges and on-site plant investment would be required in order to be confident of an investment in cogeneration.

Financial details are available in the detailed case studies report.

This project is funded through Horticulture Australia Limited (HAL) by the National Vegetable Levy with matched funds from the Australian Government.

Cover photo: Paul Hudson; *Gas Flame;* https://flic.kr/p/bv935V