Energy From Biogas in Northern Inland NSW

The production of energy (electricity, heat, gas and cooling) for business and residential use in Northern Inland NSW represents an outstanding regional development opportunity that will:

- ***Reduce energy costs to businesses and households;***
- ***Reduce our exposure to ever-increasing electricity costs due largely to under-investment in the grid;***
- ***Produce renewable energy by converting waste to energy;***
- ***Generate highly-skilled, highly-paid jobs to retain youth in our region;***
- ***Diversify farm businesses and economic activity;***
- ***Reverse the flow of dollars and jobs out of our region.***

Technically, How Does it Work?

Biogas is 52% methane and is produced from the fermentation of organic material. In our region, the organic feedstock can include:

- Purpose grown energy crops (e.g. forage maize, triticale, beet);
- Abattoir wastes;
- Commercial food wastes;
- Poultry manure;
- Municipal green waste.

Biogas digester and feedstock stockpile

Cogeneration turbine ('Energy Centre')

'Applied Energy' (not just electricity)

Biogas is piped into a turbine at an 'energy centre' to generate electricity. Heat, steam, CO_2 and biomethane (cheaper than bottled gas) are by-products of the process and can be used for heating, cooling and accelerating plant growth in glasshouses.

The electricity can be used on-site, for example by a large industrial user (e.g. a meat processing plant), or fed into the electricity distribution network. Similarly, the other forms of energy can be used on-site, or piped elsewhere (for example, at James Cook University in Townsville, the energy is piped for cooling. In Europe, it is piped for heating homes).

Energy production efficiency is about 85% - extremely high compared to the less than 20% efficiency of our electricity grid.

What is the Scale?

There is no 'standard module' size. Biogas plants are described in terms of their kilowatt or megawatt energy equivalent (kW_e or MW_e). Plants can be as small as 200 kW_e or as big as 50 MW_e. There are 1,000 kWs in a MW.

Guyra = 5.8 MW peak

Liddell Power Station = 2,000 MW

For perspective, Guyra has a peak electrical load of around 5.8 MW. Liddell Power Station has a generation capacity of 2,000 MW.

Does it Stack Up as a Business Proposal?

The technology of producing applied energy from biogas is not an issue – over 7,000 biogas plants in Germany supply electricity to 5 million homes. Total installed electrical capacity from biogas is 2,780 MW – larger than Liddell Power Station.

Some large commercial electricity users currently pay around 15-26 cents/kWh for electricity from the grid, although most businesses will pay in excess of this rate. Households now pay in excess of 30 cents/kWh.

Using purpose grown energy crops, abattoir waste and commercial food waste, a biogas project in our region could generate electricity for larger industrial energy users for **7-10 cents/kWh**, including income from renewable energy certificates (RECs). In addition to electricity, the process would supply them with heat and cooling energy, and gas.

A biogas plant of this type would have the following financial parameters:

- Capital cost = $22.5M;
- Working Capital Requirement = $3.5M;
- Annual operating cost @ 100% finance = $8.46M;
- Annual income (biogas & electricity sales) = $11.75M;
- **Annual profit = $3.29M (=14.6% return on capital).**

These figures are based on buying in purpose-grown energy crops at $35/tonne.

How Much Energy is Produced?

A biogas project of this size would produce:

- 26.5 million m^3 of biogas;
- 52% is methane = 138 million kWh of total energy;
- 40% of energy is converted to electricity = 55 million kWh electricity;
- Electricity is generated 24/7, 365 days/year = 8,760 hours of generation;
- **= 6.3 MW of electricity generation.**

Feedstock Supply – A Diversification Opportunity for Farmers

A 6.3 MW biogas plant as described above would require **150,000 tonnes of organic feedstock per annum.**

If this were entirely supplied from purpose-grown crops, with yields of 80-200 tonnes/ha (depending on location and whether the crop is irrigated or not) this would require a crop area of **1,500-3,750 hectares** (the required area is doubled to build a stockpile and ensure continuity of supply). This is a very small area, and supply can be supplemented from other organic wastes.

Farmers in the Northern Inland region largely sell their crop commodities on a volatile international spot market. While some make use of hedging and forward selling strategies (cotton growers), they are often at the mercy of world prices.

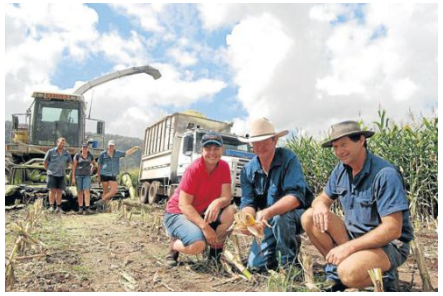
Growing energy crops specifically for biogas production would have the following advantages:

- Diversification of farm income streams, growing energy crops alongside food crops;
- Long-term supply contracts;

- Agreed price contracts;
- Potential for farmer consortiums to own the biogas business and further increase/diversify their income.

Does the Farm Business Proposal Stack Up?

In addition to the advantages listed above:



- Farmers can sell their energy crops for $25-35/tonne to the biogas plant;
- Yields are 80-200 tonnes/ha depending on location and irrigation;
- Gross revenue is therefore $2,000 to $7,000 per hectare;
- Gross revenue for our current most profitable crop (cotton) is around $2,300 (dryland) and $6,000 (irrigated);
- Input costs for energy crops (pesticides, herbicides, fertilizer) are much lower because contamination is not an issue and the digestate from the biogas plant can be re-used as fertiliser.

Energy crops may have the potential to produce higher gross margins than many existing agricultural enterprises in our region.

The Business Model & Profitability

The technical aspects of a biogas project in our region will not be a limiting factor, so long as sufficient feedstock can be sourced.

The business model will be important however. In Germany, farmers are typically involved in all stages of the energy production process. They grow the crops, own the biogas plant, own the energy centre which converts biogas to electricity, and in some cases own the poles, wires and pipes which deliver electricity, gas and heating/cooling to end-users.

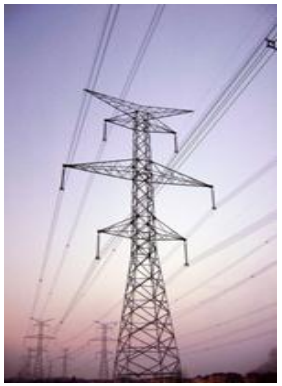
There is potential for developing a similar system in Northern Inland NSW, to supply applied energy (heat, cooling, gas and electricity) to towns in our region and significantly reduce their energy costs. At present, many communities use electricity for the majority of their energy uses, and this is often highly inefficient compared to what can be achieved with biogas.

While the profitability and business model for a regional biogas industry is yet to be determined, the potential community benefits are significant including:

- Establishment of a new industry to boost local economic activity and jobs;
- More efficient energy production/use;
- Reverse the flow of energy dollars and jobs out of our communities (currently, our communities pay the large energy bills of retailers who are not local);
- Reduce greenhouse gas production by reducing reliance on fossil fuels;
- Biogas provides true baseload power – it is not subject to the vagaries of wind or solar options;
- Diversify farm incomes.

Selling Electricity into the Grid

The easiest biogas project options are where the electricity generated is used on-site, with no grid involvement (closed-loop projects). Grid involvement adds a layer of complexity because:



- There is currently a low price paid for the renewable electricity generated;
- To sell the electricity to local customers means the electricity generator must become a retailer and pay Essential Energy for grid access;
- A ‘community retailer’ model may be required to sell the electricity locally. Local Government may become a retailer (as they once were under the old County Council arrangement).

Note however that an application to Essential Energy for a new electricity connection is still required, even if electricity is not exported to the grid. This is to ensure the new connection won't impact the existing grid, and because any existing grid connection contracts are likely to change.

Can the Biogas Model be Replicated in our Region?

The technical aspects of the biogas model are not a problem. We have been working with German-based company MT-Energie who can have technicians come to our region to install biogas projects.

There is ample agricultural land on which energy crops could be grown. This can be supplemented by other organic wastes.

It is possible to envisage a situation where numerous towns in the region have their applied energy needs (electricity, gas, heat, cooling) supplied from a local biogas plant.

The biggest hurdle is energy distribution. Can these projects access the grid at a price which allows them to remain profitable? Can we establish local retailers to sell the energy, particularly electricity (see the RDANI paper on becoming an electricity retailer)? What about the grid access charges which need to be paid to Essential Energy to feed renewable electricity into the grid? What is the cost of establishing piping to distribute heat/cooling energy around towns? These are all issues we need to work on to ensure the business case is sound.

Technical Considerations and Potential Costs for Electricity

Projects which feed electricity into the grid also add a layer of technical complexity to the opportunity. The biggest issue relates to the size of the electricity generation project and the capacity of the existing power-lines to handle the voltage and current.

Projects generating 1-4 MW of electricity can probably feed directly into the local 11-22 kV lines without the need for a transforming sub-station.

A power transforming sub-station may be required if the biogas project generation capacity is sufficiently high, and electricity is to be exported into the existing local grid. This will add signficantly to project costs.

Projects generating more than 4 MWs will likely need a sub-station (cost $6-8M) and access to 66 or 132 kV lines.

Access to existing lines also needs to be considered, as this will impose additional costs depending on the capacity and length of line required to reach the existing lines. 11-22 kV lines cost around $100,000 per km (excluding land acquisition and other costs). 66-132 kV lines cost around $250,000 per km.

Could this be RDANI's Most Effective Regional Development Project?

This project meets numerous objectives within our charter:

- ☑ Economic Diversification
- ☑ Cheaper energy
- ☑ Skilled jobs
- ☑ Environmental sustainability

The next step is to ascertain a solid business case, perhaps based on a case-study of a likely candidate town in our region.