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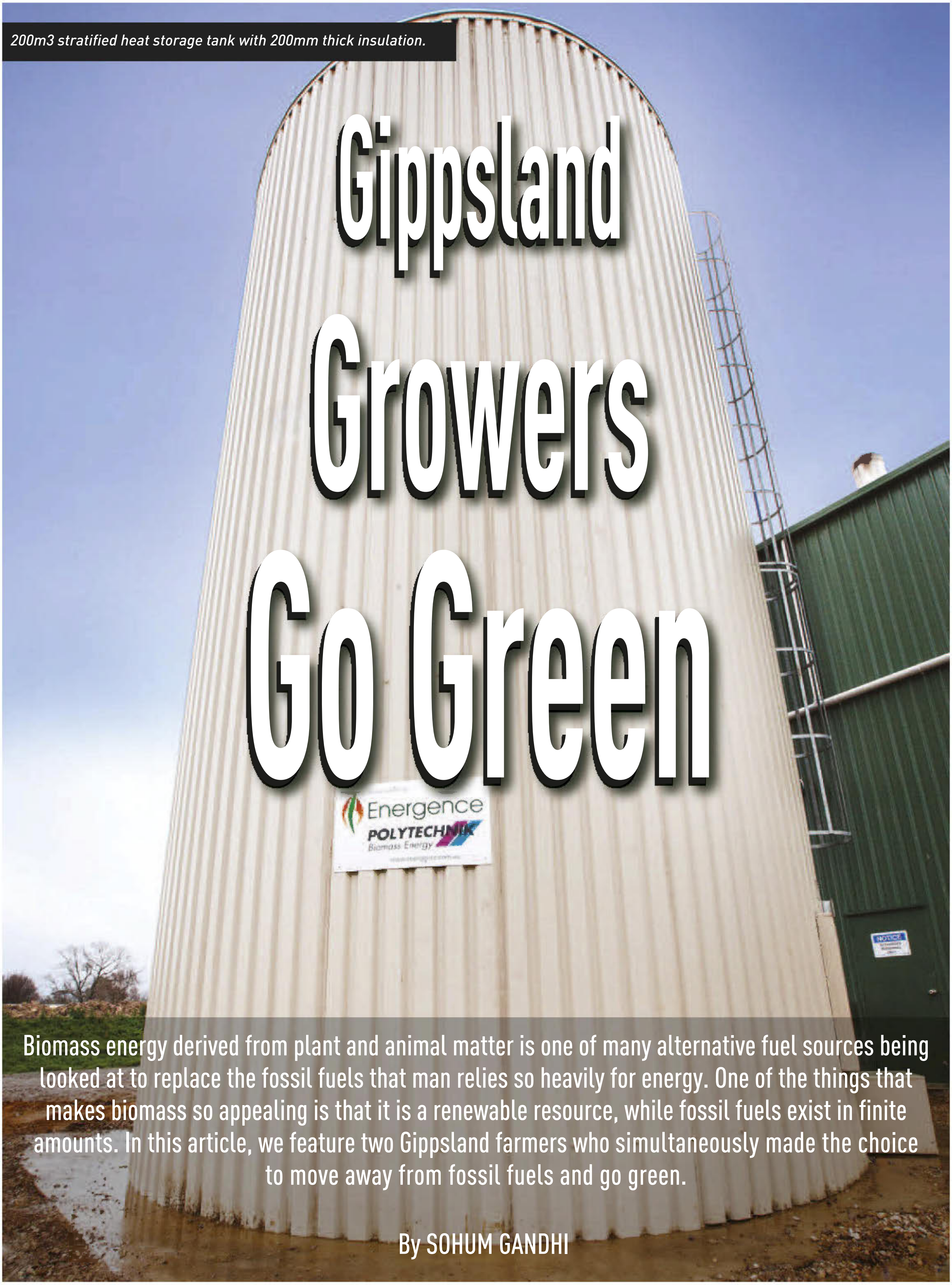
## GIPPSLAND GROWERS GO GREEN




*200m3 stratified heat storage tank with 200mm thick insulation.*

# Gippsland Growers Go Green

Biomass energy derived from plant and animal matter is one of many alternative fuel sources being looked at to replace the fossil fuels that man relies so heavily for energy. One of the things that makes biomass so appealing is that it is a renewable resource, while fossil fuels exist in finite amounts. In this article, we feature two Gippsland farmers who simultaneously made the choice to move away from fossil fuels and go green.

By SOHUM GANDHI

Rising fuel costs, government mandate to cease the combustion of brown coal briquettes and the desire to use a renewable energy source were the driving factors behind Andrew Bayley's and Peter Hobson's decision to purchase a bioenergy system. Operating two separate farms in the Gippsland region of Victoria, both farmers simultaneously made the choice to move away from fossil fuels and go green. At what exact point the decision came into clarity is subject to speculation. It could have been on one of their sooty coal ash cleaning operations over the years or perhaps it was while their navigator was struggling with the sixth or seventh roundabout exit during their research tour on the back roads of southern France. Regardless, it was a big decision for these small businesses, and it was made based on experience of the past and vision for the future.

Andrew Bayley started farming on the family farm in 1984 and currently milks approximately 300 cows on 160 hectares. In 2001, the Bayley's diversified their business and built a 2560m$^2$ plastic greenhouse and began growing tomatoes. This greenhouse was doubled in size in 2003 and last month the business has just completed the construction of a high-tech 1.1 hectare glasshouse, taking the total growing area to 1.6 ha. It is anticipated that this will produce approximately 480,000 kgs of 'Conchita' cherry truss tomatoes per annum.

Peter Hobson (Gippsland Greenhouse Produce) began growing truss tomatoes in a 4000m$^2$ twin skin poly house in 2005, and in 2009 another 4000m$^2$ of glasshouse was built to grow mostly eggplant.

Similar to Bayley, brown coal briquettes were used to heat the farm through a hydronic system. In 2013–14, they invested in a biomass waste-to-energy plant to complement their build of a high-tech 1.25 ha glasshouse and produce thermal energy for their entire operation. It is anticipated that this site will now produce 980,000 kgs of eggplant per annum.

**System specifications**

At the heart of the heating system is a 1.6/2.0MW (Bayley/Hobson) biomass heater plant produced by Polytechnik, Austria. This system is responsible for creating thermal energy from the biomass.

This thermal energy is extracted from the heating plant and delivered to a 200,000/300,000 litre insulated heat storage tank for load buffering as well as the various greenhouse zones through a metered pumping and valving system. Within the greenhouses, this thermal energy is expelled evenly throughout the

*Food production with lower inputs of: energy, water, fertiliser.*

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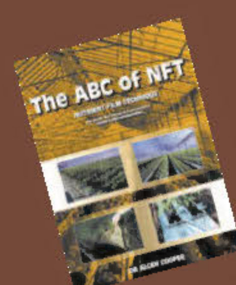

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*Eggplant at Gippsland Greenhouse Produce.*

*Furnace, inside of which combustion of biomass occurs on a reciprocating step grate.*

environment by a network of steel piping acting as an enormous radiator.

The grower can decide the optimal temperature for growing, and maintain this year round. Even in sub-zero external conditions, the uninsulated glasshouses can be maintained at temperatures in excess of 20°C.

For the farmer, the energy production process begins by tipping the waste biomass into their concrete fuel bunker. From here a series of hydraulic rams and conveyors shuffle the material into the furnace and onto the top of the step grate. With the help of more hydraulics, a water cooled grate, primary, secondary and induction fans, as well as electronic monitoring of temperatures, pressures and levels, the energy extraction commences. Sounds simple so far? The combustion process continues through multiple passes of the furnace and heat exchanger, which are optimised by computational fluid and thermodynamics. The performance of the entire process is further increased by an exhaust gas recirculation system, an air preheater, air-cooled furnace jacket, heat exchanger bypass duct and roof space air intake snorkel.

Although there is regular maintenance procedures, the day to day cleaning and ash removal happens automatically. The compressed air system provides a high velocity air jet down tubes of both the main heat exchanger and the air preheater when the software deems it necessary. Ash from the air preheater and multi-cyclone grit arrestor is automatically stored in respective waste bins, while furnace ash is deposited in another bin located under the front of the furnace and removed with a small gantry crane. Due to the efficient combustion and uncontaminated source fuel, the ash levels are in the order of 2-3% of fuel input and bin emptying is infrequent.

## The biomass

The system is designed to handle a range of fuel sizes in order to allow greater fuel flexibility to the farmers. Both farmers viewed this as one of the most important features in their bioenergy plant.

By having greater fuel flexibility, lower cost fuels can be sourced from a wider range of providers.

And unlike the fossil fuel alternative, this allows them to protect themselves from rising fuel costs by having many potential suppliers. Though the exact fuel specification is more in depth, it basically states that the system can handle

*1.6MW heat plant showing (left to right) the furnace, muticyclone, air preheater, ID fan, pump unit.*

*Cross conveyor pushing fuel from the bunker into the furnace.*

*Fuel bunker with automatic walking floor.*

natural timber and woody biomass residues. These residues can be made up of chips, bark and a percentage of sawdust. Strings of bark up to 600mm and wood chips up to 350mm maximum length can all be accepted as a fractional quantity. The exceptionally significant aspect of the system and the reason behind the great mass of refractory as well as the air preheater system, is in its ability to handle high moisture content biomass up to 60% without a loss of efficiency. High moisture content is a common attribute to low cost biomass and must be catered for if one is to source low cost fuel. Currently, these farmers are sourcing their fuel from one of the many sawmills, timber or forestry processing industries in Gippsland.

## Environmental and financial benefits

While energy buy prices vary from region to region and user to user as well as delivery distances, and as fired calorific values, an approximate comparison between common fuel sources follows. To illustrate the annual thermal energy costs comparison between different fuels, a typical two hectare glasshouse example is used:

*Control room for onsite and remote monitoring of the energy plant.*

*Fuel delivery onto walking floor.*

| | |
|---|---|
| LPG as source fuel | $840,000 / annum |
| Natural Gas as source fuel | $330,000 / annum |
| Coal Briquettes as source fuel | $280,000 / annum |
| Biomass waste as source fuel | $120,000 / annum |

So the financial case behind the biomass investment is evident. The payback period can be under two years when the baseline case is using a fossil fuel such as LPG. However, the dollars and cents incentive is not nearly as substantial as the positive environmental impact.

Although these particular farmers were not granted government subsidies for their contribution to the environment due to the cessation of the funding program, there are government incentives available if certain criteria are met. And through one particular grant suitability process facilitated by federal AusIndustry consultation, these two projects have been officially projected to save over 150,000 tonnes of $CO_2$-e (based on a 25-year lifetime assessment). This is a significant and beneficial worldwide impact from these two produce growers from the Gippsland region of Victoria.

### *About the Author*

*Sohum Gandhi has a Bachelor's of Engineering degree from the University of Victoria, Canada. Since 2004, he has been working within the Australian protective cropping industry. His pro-active approach has helped various clients around the country evolve in their designs and energy systems. Over the past years, Sohum has been increasingly involved with biomass fuels in an attempt to provide his clients with renewable and low cost energy alternatives. His installed projects to date offset many thousands of tonnes of $CO_2$ emission annually, and save clients millions of dollars in fossil fuel costs.*

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