

# Final Report on the Beaufort Hospital Biomass Heating System

## Executive Summary

In February 2014 a 110kW Hargassner wood chip fuelled boiler supplied by Living Energy was installed at the Beaufort Hospital (Figure 1) at a cost of \$428,937. The system took over most of the heating load from the existing LPG boilers which have been retained as backup and to cover peak loads.

After 12 months of operation LPG use was reduced by 37,041 litres compared to the previous 12 months creating a saving of \$44,228 at current prices. After deducting the cost of wood chips, maintenance and servicing of approximately \$17,430, the final net saving was approximately **\$26,798**.

Hourly figures were not kept on the boiler maintenance but have been estimated by hospital staff to be one day per month. At current LPG prices, payback on the installation is 16 years. Analysis of current LPG figures showed the potable hot water system uses approximately \$25,000 worth of LPG per annum. The wood boiler has the capacity to also provide most of the hot water needs for the hospital if an additional hot water system was installed. This would reduce the payback period to 12 years.

There was only one delivery of woodchips outside specifications from the local supplier and a number automatic shut downs of the boiler due to problems with the boiler sensors. Living Energy has now rectified these issues and the boiler is performing very well.



Figure 1: Beaufort Hospital

## System Description

The bioenergy system installed at the Beaufort Hospital had an installed cost of \$428,937. The 110kW Hargassner boiler is housed in a 12.0 metre shipping container which also included a fuel store and filling system (see Figure 2). The fuel is hardwood chips produced by a local sawmill. The boiler is plumbed into the existing hydronic heating system with the LPG heating system retained as back up. The biomass boiler system handles most of the heating load for the hospital with the LPG system only operating during periods of peak load (very cold weather) or when the biomass boiler is offline. The biomass boiler has delivered a financial benefit of approximately \$26,798 per year through reduced energy costs. In addition to reducing the energy costs for the hospital, the biomass system will also reduce its greenhouse gas emissions by approximately 56 tonne per year.

Safety and comfort of the public will also be ensured with the boiler system fully containerised and refuelling occurring well away from the hospital and homes.

The financial benefit is estimated as a simple payback of 16 years and the project will provide a reduction in hospital operating costs.



**Figure 2: Boiler house and fuel store**

## **History of the Project**

Across the region there has been substantial investigation and active interest in bioenergy application led by the Central Highlands Agribusiness Forum (CHAF). The Beaufort hospital was flagged as a semi commercial entity to demonstrate the bioenergy concept. This proposal developed by the Project Manager as part of the Regional Bioenergy Project. Advice from consultants, various stakeholders and interested members of the public was sought in the development process.

The selection of a containerised boiler system allowed for a more flexible installation process with minimal disruption to hospital operation. It also gives the hospital the option to remove or relocate the system in future if required. Due to a lack of biomass boiler system suppliers in Australia, tender options are limited and it's an issue that potential users will need to consider.

The planning process is another area that could be difficult. Local authorities have no experience with these types of systems and residents are also unfamiliar with them. Providing detailed information on the likely appearance and amenity impact of any proposed system will help get through this process.

## **Technical changes required**

The biomass boiler was plumbed into the existing hospital heating circuit parallel to the existing gas boilers. It is connected via a separate heat exchanger so heating fluid in the biomass boiler does not mix with fluid in the hospital system.

The biomass boiler control system is linked to the gas boiler controls to ensure the biomass boiler operates as the primary heating source. The gas boiler will only operate if the biomass system is off line and for brief period each month for maintenance purposes. The boiler system is connected to the internet and has an automatic notification system to alert hospital staff of any problems. Maintenance contractors can access the boiler system remotely, assess any problem and advise hospital staff accordingly. The system automatically activates the gas boilers in the event of a failure

The boiler hose/fuel store is located in Walker Street with easy access for fuel delivery vehicles. Fuel deliveries generally require the attendance of a hospital staff member to access the fuel quality and to operate the fuel store filling system.

Approximately 12 days per year of additional time is needed from hospital maintenance staff to clean and maintain the boiler. This additional expense is included in the boiler operating costs.

## Cost/Benefit analysis

### Costs

Item	Value	Assumptions and accuracy
Purchase of boiler system and fuel store	\$418,150	Contract price
Other installation costs	\$10,787	Relocation of overhead power line to allow installation of boiler house/fuel store – actual cost.

### Financial and other benefits

Item	Value	Assumptions and accuracy
Hospital Heating Cost Saving	- \$26,798/ annum*	Includes wood chips, 12 person days maintenance and an annual boiler service cost of \$4,400.
Reputation	Not included in this estimate	The resulting reduction in energy and greenhouse gas emissions by the hospital will ensure it is well ahead of current government emission reduction programs and places it as a leading in the area of sustainable health.

\*Based on current LPG prices (\$1.19 per litre). There was a significant rise in the price of LPG since the boiler was installed and the price is likely to rise even more in the future. This forward value has not been included in the calculations.

Total costs = \$428,937      Quantifiable benefits = \$26,798

Approximate simple payback on the project is 16 years without inclusion of co-benefits such as fuel security and hospital reputation. If a potable hot water system had also been installed at an estimated \$20,000 additional cost then the payback would have been 12 years.

The installation of new condensing gas boilers in 2011 significantly reduced the hospitals' gas consumption. If the wood chip fuelled boiler with potable hot water system had been installed instead of these gas boilers then the expected payback could have been as little as 3.7 years.

Consideration of a wood boiler should be done prior to installing any new gas boilers and any installation should maximise the usage of the wood boiler.

## Project risks

A risk assessment has been conducted in accordance with internal procedures. A summary of key risks and how they were managed is described below.

Risk	Mitigation strategy
Safety during installation	Risk management plan was in place and standard operating procedures were followed,
Impact on hospital operations	The boiler system is standalone and was not connected to the existing heating system until the installation was almost complete. Disruption to normal operation while the final connections were being made was minimal.
Savings not achieved	Based on case studies from similar installations overseas there was a high level of certainty that the savings would be achieved. The financial saving is likely to be higher in future due to likely increases in LPG prices.
Local wood chip fuel becomes unavailable	The boiler system is able to utilize a range of fuels and there are suitable alternate fuels available in Beaufort and in the region. Commercial wood pellets are also an option and would still be cheaper than LPG.

## Conclusions

The main conclusion from the biomass boiler installation at the Beaufort Hospital is that bioenergy (biomass heating) works. The system as installed did produce significant reductions in heating costs for the hospital and if an additional hot water system had been included then the savings would have been even larger. To gain the best value from a biomass heating system, any installation should maximise the use of the boiler output.

The local supply of the wood chip fuel worked well with minimal concerns for hospital staff. Getting the wood chips from the local sawmill has improved its viability and benefited the local economy by retaining funds in the region. It has also improved the energy security of the hospital itself. The only issues of significance with the installation have been a number of sensor related shut downs and the failure of two circulating pumps. Living Energy has now solved the sensor issues and the boiler has been operating well ever since. Anyone installing a bioenergy system needs to be aware that they do require additional maintenance and this additional cost needs to be factored in.

## Recommendations

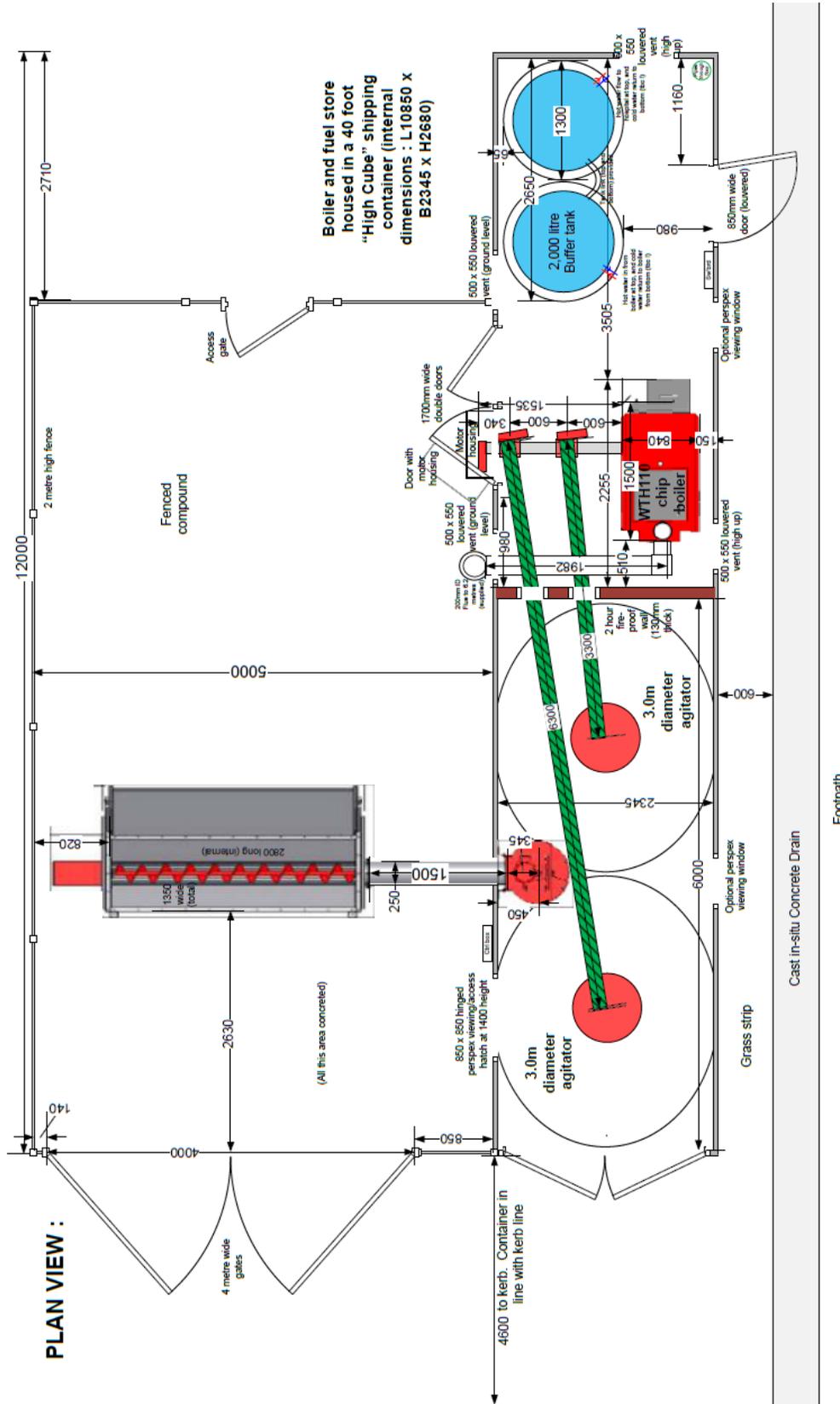
The use of biomass heating should be considered for heating any public facility not connected to natural gas.

The Beaufort and Skipton Health Service should add a potable hot water system to the wood fired boiler at the Beaufort Hospital.

**Attachments**

Engineering diagrams and detailed costings are attached.

# Plan View of Boiler House and Fuel Store



## Breakdown of Installation Costs

Description	Amount (excluding GST)
Project management	\$50,000.00
Site Preparation	\$30,000.00
Construction of Boiler house	\$40,000.00
Supply and Installation of Boiler	\$208,150.00
Fuel Bunker/Silo	\$40,000.00
Fuel Handling and Feeding System	\$50,000.00
Relocation of Overhead Power Line	\$10,787.00
Installation of potable hot water system	\$10,000.00
<b>TOTAL</b>	<b>\$438,937.00</b>

## LPG Usage Figures

Year	LPG Litres	Cost
2011/12 Financial Year	110,000	\$ 83,684.00
2012/13 Financial Year	66,446	\$ 50,550.00
12 months prior to boiler installation	69,174	\$ 51,501.00
12 months after boiler installation	32,133	\$ 38,368.00

## Operating Costs

Item	Quantity	Cost
12 months' supply of wood chips	91.5 tonne	\$ 10,630.07
Boiler maintenance – 1 p/d per month	12	\$ 2,400.00
Annual boiler service – Living Energy	1	\$ 4,400.00