

Green Waste Briquetting Trial

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Background

In 2011, the Grampians Regional Waste Management Group provided Ararat Rural City with \$20,000 to conduct a small trial on the feasibility of briquetting green waste, currently being stockpiled at a number of transfer stations around the region. Previously the group had been able to supply shredded green waste to local wineries and farmers as mulch but issues with contamination saw a decline in demand. Some material was supplied to SITA, for the production of commercial potting mix, but transport costs and an oversupply of material in Melbourne also saw that outlet close.

The aim of the briquetting trial was to attempt to produce an alternative to firewood in the form of a briquette composed of compressed green waste. Similar briquettes made from sawdust and timber processing residues are available from hardware stores and supermarkets.

Initial briquetting trials were conducted by Dave Pietsch, owner of Pietschkleen in Murtoa. Pietschkleen is a grain cleaning company and Dave was interested in briquetting the waste his operation produced. He did a small sample of green waste from Ararat with very encouraging results (see photo below). I had a sample tested by HRL and it proved to have almost the same heat output as a commercially available sawdust briquette but with more ash (see attachments 2 and 3).



Green waste briquettes produced by Dave Pietsch

I did plan to have Dave produce a trial quantity of briquettes however, he declined to be involved so I decided to purchase a small diesel powered machine from China. The reasons for purchasing a machine were to obtain a better appreciation of the issues and costs involved in producing commercial standard briquettes (Dave's machine was homemade and did not produce a commercial product).

Ararat Rural City purchased a machine in December 2012, with the assistance of Ballarat company, Ozvalueag Machinery. They import a range of agricultural equipment and have contacts in China.



Briquetter arriving at Ararat Rural City depot

The machine arrived in February this year and I proceeded to make minor modifications to enable more usability. These modifications were additional guarding and an LPG fired die heater. The machine was supplied with a small wood stove that sat over the die. This had the potential to spread sparks to adjoining green waste piles and become an issue if we were to transport the machine.

After some initial trial runs of the machine I found that the existing green waste at Ararat was unsuitable to briquette due to the amount of coarse woody material and the large amount of soil and gravel contamination. The coarse woody material was easily removed by running the green waste through a 12mm screen. The soil and gravel was an unexpected issue and caused a very poor briquette that crumbled easily. The gravel would also result in accelerated wear of the press screw and die in the machine. The rotation speed of the screw also appeared to be an issue as it forced the material through the die too fast for it to adequately heat.

In an attempt to overcome these issues I fitted a larger pulley to the drive gearbox which halved the rotation speed and tried using cleaner feedstock including freshly shredded material.

The slower speed did produce a better quality briquette from a cleaner sample of older green waste but the fresh material contained too much grass and simply turned to dust. I put this down to the lack of lignin in the grass which acts as a binder.

The best results have been obtained with screened material from parks and gardens chippings. I believe this works well because it is free of contamination and contains high levels of woody material. If the grass, soil and gravel were removed from the green waste prior to shredding then resulting material would be similar to the parks and gardens chipping.



Briquette made from parks and gardens chipping

Discussion

The initial results from the trial indicate that:

1. It is possible to briquette green waste
2. The shredded green waste, currently stockpiled in transfer stations, is not suitable for briquetting due to the levels of soil and gravel contamination
3. If managed and processed correctly, a large part of green waste received at regional transfer stations could be processed into briquettes.

Correctly processing the green waste is the key to its suitability for briquetting. This would involve the following steps:

1. Stockpiling as per the current practice with care taken to minimise the amount of contamination occurring.
2. Put the green waste through a 25mm to 50mm screen to remove grass, soil and gravel prior to shredding.
3. The material that passes through this first screen (grass/fines, soil and gravel) would then be diverted to compost (around a quarter of the total volume).
4. The reject material (larger leaves and branches) would then be shredded to less than 12mm in preparation for briquetting.

The briquetting material would then be put through a heater /dryer to reduce the moisture content to below 15% and raise the temperature to 200° C. It would then be immediately deposited into the briquetter for pressing while still hot. This ensures higher quality briquettes with less energy required in the pressing process and less wear on the press screw and die.

The table below shows the likely capital and annual operating costs for a portable green waste briquetting system suitable for processing the regions green waste.

PORTABLE GREEN WASTE BRIQUETTING SYSTEM ANNUAL BUDGET

ITEM	CAPITAL COST	INCOME	EXPENDITURE
Diesel powered briquetting machine x 3 - each 330kg/hour. \$15,000 each including elevator systems (includes value of existing briquetter)	\$ 45,000.00		
One tonne per hour biomass fueled drier (based on quote)	\$ 40,000.00		
Beaver tail trailer to transport briquetters and FEL (web price)	\$ 20,000.00		
Small 20hp frontend loader (web price)	\$ 15,000.00		
6 tonne tipper with covered briquette bin (web price)	\$ 80,000.00		
Green waste/clean timber waste - shredding and screening cost \$20/m3 or \$80/tonne (estimated by contractor)			\$ 116,000.00
Labour - One EFT			\$ 60,000.00
Fuel - 8700 litres @ \$1.50/ltr (briquetters 18L/day, FEL 8L/day, Tipper 10L/day)			\$ 13,050.00
Equipment Maintenance - service briquetters, loader and tipper every 100 hours			\$ 3,500.00
Briquetter consumables - replace press screw every 30 hours @ \$110 each, replace die every 100 hours @ \$40 each			\$ 17,700.00
Overhead costs including capital recovery over 10 years			\$ 48,000.00
Replace briquetter motors every 3.3 years (cost per annum)			\$ 2,500.00
Income from green waste receival (\$8/m3 or \$32/tonne)		\$ 46,400.00	
Briquette sales - 1,450 tonnes (approx. 6,000 m3) @ \$150/tonne		\$ 217,500.00	
TOTALS	\$ 200,000.00	\$ 263,900.00	\$ 260,750.00

Assumptions: Green waste is received and managed as current (separation of grass clippings and dirty material would reduce screening cost). Timber waste that is free from CCA and paint could be included. Expected life of all equipment is 10 years (tipper and FEL would have some residual value). Briquette price per tonne is delivered locally (< 20km from the production site).

Recommendations

1. That the Grampians Regional Waste Management Group considers using briquetting as a way to utilise green waste received at regional transfer stations and kerbside collection, if introduced.
2. The briquetting machine, currently at ARCC depot, is a regional resource for use by other councils and waste management groups.