Re-tooling for Climate Change end of project report

Abridged 25th November 2011

Grantee: **WA Composts Pty Ltd as trustee for Bios Unit Trust**

Project Title: **Compost Manufacturing Process Improvement**

Grant Number: **RCC-5-018**

Do you give permission for your *Re-tooling for Climate Change* project to be used as a case study for promotional purposes? Yes

1 Project progress

1.1 Please provide a brief outline of project activities and outcomes.

The project replaced the existing method of mechanical turning for aeration of compost with pulsed aeration of static piles using a ‘mobile aerated floor’ (MAF) system. This has significantly reduced the use of diesel fuel used in moving and turning compost piles during compost manufacture and eliminated the anaerobic conditions often found within active compost windrows. The elimination of anaerobic conditions also eliminates the potential production of important GHG; methane and nitrous oxides (NOX).

1.2 Did you achieve the agreed project objectives, and do you believe that the project was a success? If not, please explain why.

Construction and commissioning of the aerated compost system are complete and the technical objectives have been achieved 100%. The actual outcomes in compost manufacturing have exceeded our expectations. High quality compost is being manufactured using less energy, time and space. Staff engagement in the new process has resulted in greater knowledge about the process and improved attention to detail.

Additional success factors

A 4-day “MAF School” run by Custom Composts has been attended by 5 interstate participants. The syllabus developed for the school provides a framework for ongoing training of our own staff in the new technology and the support required for other potential adopters of the new technology.

Four other MAF systems, in 3 States, have been installed since this project was initiated. These include a manure composter, a regional local government, a farmer and an industrial waste processor.

Our site has been made available to visitors. We have received visits from local government, the waste management industry and the compost industry.

This project has taken on increased significance with the inclusion of manure management in the Carbon Farming Initiative of the Australian Government.

The Clean Energy Bill (Carbon Tax) uses the NGERS (National Greenhouse and Energy Reporting Scheme) methodology for calculating emissions from commercial composting. The Department of Climate Change and Energy Efficiency (DCCEE) technical groups are considering acceptable methodologies for a range of issues associated with the Carbon Faming Initiative (CFI). The CFI particularly considers manure management as a priority area. Manure management and compost manufacture are under scrutiny.

Currently DCCEE considers that compost should be maintained above 10% oxygen in order to avoid GHG emissions. This project supplies important data to demonstrate that oxygen levels can be maintained above 10% in a compost pile and clearly demonstrates that the MAF system is a simple, robust technology that can deliver this result.

1.3 Is there any further work required for the project to become a success? If yes, please describe.

No. The project has achieved 100% of its objectives.

3 End of project data

It is important for us to understand whether your *Re-tooling for Climate Change* project has benefited your organisation. Please answer the following questions.

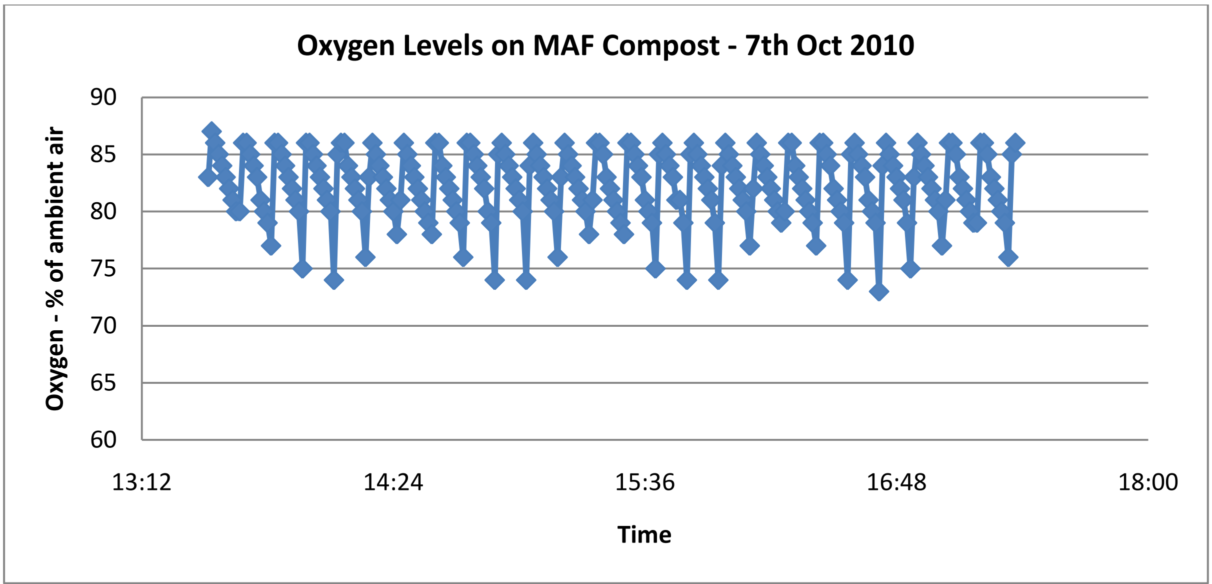
What impact did the project have on the energy and/or water efficiency of the production process, and/or the carbon emissions generated as a result of the production process?

Oxygen Status and Methane Production

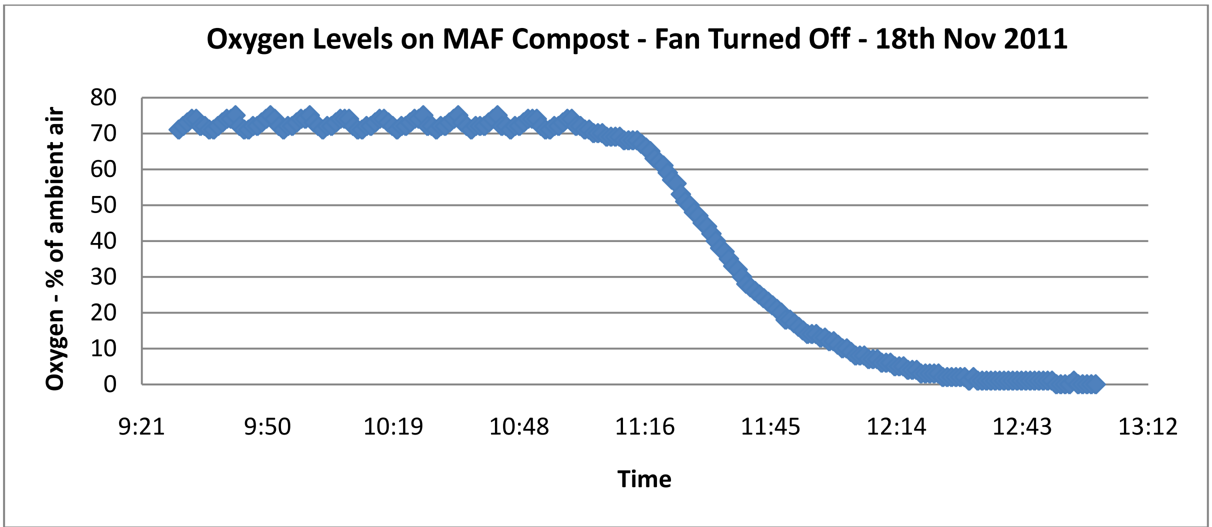
The new aerated compost system is able to maintain oxygen levels in the centre of the pile at a known concentration. We are running our compost process at >10% oxygen (approx 50% of ambient air). This maintains aerobic conditions and eliminates (or at least minimises) the potential for methane formation. This has implications for the Australian Government's Carbon Faming Initiative.

Prior to installing the new system the oxygen status of the compost piles would decline rapidly after turning. Oxygen levels could easily be 0% and certainly below 5%; conditions which encourage methane production.

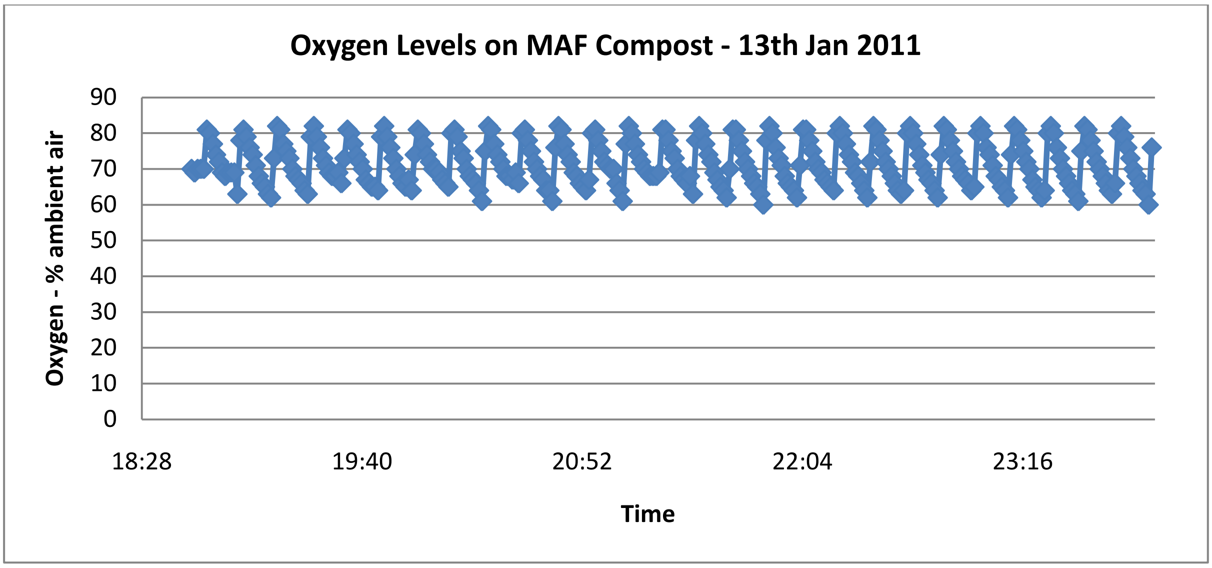
The first graph below shows the oxygen levels in the pile. The cycling of the aeration fans can clearly be observed as the oxygen levels rise and fall due to the fan operation.



The second graph dramatically demonstrates the effect on oxygen levels in a static pile. When the fans were turned off the oxygen levels dropped to 0% within 2 hours. This simulates the effect of a turned windrow (current conventional practice) directly after turning. A windrow turning operation introduces oxygen into the pile but this is rapidly consumed by the active microorganisms in the pile.



The third graph shows the oxygen levels after 4 months of operation. Frequent short pulses of air are clearly maintaining the oxygen status of the pile and delivering a high level of process control.



In the grant submission we assumed that 80% of the GHG emissions would be eliminated from the compost process. This figure is more likely to be closer to 100%.

The MAF system avoids significant CH_4 /N_2O emissions. The rationale is described below;

<u>Additional avoidance of GHG from composting process</u>

Section 4.2 of the NGA Factors (2) provides emission factors for the composting process. The new process monitors oxygen levels in the compost pile and provides air as required. This eliminates the anaerobic conditions responsible for generation of methane. The calculations of GHG from conventional composting, using the NGA Factors guidelines is as follows;

Volume of feedstock = 62,400 m^3/year

Bulk density of feedstock = 0.65 t/m^3

Weight of compost feedstock = 40,560 t/year

CH_4 emissions = 40,560 tonnes x 0.08 = 3245 tonnes of CO_2-e

N_2O emissions = 40,560 tonnes x 0.09 = 3650 tonnes of CO_2-e

Total GHG emissions from 40,560 tonnes of solid waste = **6895 tonnes of CO_2-e**

Whilst measurement of these savings was outside of the scope of this project we have collected data that clearly demonstrates oxygen levels inside the MAF compost pile are consistently above 10%. The DCCEE methodologies require that manures and composts are maintained above this 10% level in order to avoid GHG production and for carbon credits to be available.

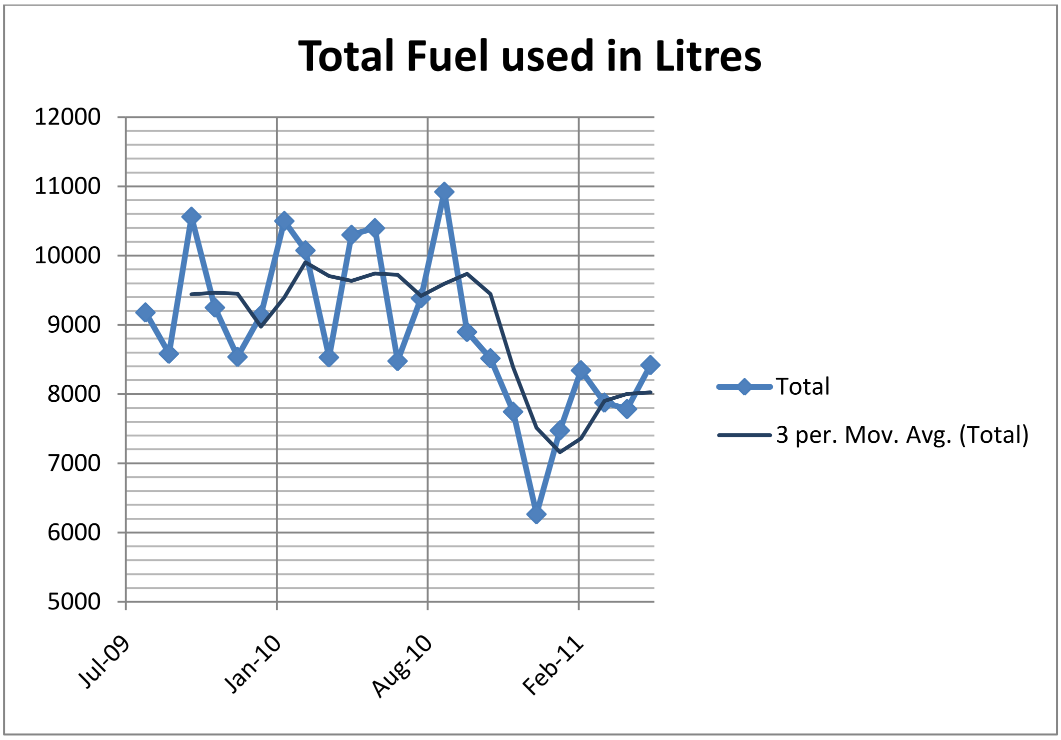
Diesel Fuel Consumption (shortened)

Comparison of fuel usage to estimate fuel savings

Compost manufacture is a 3-month process and conversion of the whole site to the new MAF process was phased in as older batches of compost were moved off site. The graph (below) of total fuel purchased each month from July 2009 through to June 2011 shows a clear decline in fuel use during the implementation of the project.

The first stage of the new MAF system (one batch/fortnight) was commissioned from July 2010 onwards. A noticeable drop in fuel consumption can be observed in the graph below. Prior to implementation of the MAF system fuel consumption was about 9600 litres/month. After implementation of the first stage of the MAF system, fuel consumption reduced to about 6800 litres/month – a fall of about 2800 litres/month (equivalent to 1300 litres/batch of compost).

The grant submission estimated fuel savings of 1288 litres per batch (1388 L/batch before project less 100 L/batch after implementation). The first stage of the MAF project supported this.



Calculation of diesel energy use and CO_2 emissions - post project

Diesel fuel energy content = 38.6 GJ/kL (2)

Fuel used per batch compost = 200 litres = 0.2 kL

Diesel fuel energy use/batch = 38.6 x 0.2 = 7.72 GJ

CO_2 emissions = 69.5 kg CO_2-e/GJ

CO_2 emissions/batch = 69.5 kg CO_2-e/GJ x 7.72 GJ = 536.54 kg CO_2-e (0.54 t)

CH_4 emissions = 0.1 kg CO_2-e/GJ

CH_4 emissions/batch = 0.1 x 7.72 = 0.772 kg CO_2-e

N_2O emissions = 0.2 kg CO_2-e/GJ

N_2O emissions/batch = 0.2 x 7.72 = 1.554 kg CO_2-e

CO_2-e emissions from diesel/batch = 539 kg CO_2-e

In the table below please show the changes in purchased energy and/or water use, and greenhouse gas emission achieved as a result of the project. Both positive and negative impacts of the project must be recorded (for example, if a water saving project leads to increased energy use and CO_2(e), this must be shown).

	Water	**Energy**	**Greenhouse Gas Emission**
	Consumption of purchased water supply (kL per annum)	**Consumption of purchased electricity, gas or other energy (kWh, MJ etc. pa)**	**Tonnes CO_2 (equivalent) emitted per annum**
Baseline before project	**n/a**	**2787** GJ /year	**194.5** (**+6,895** inc DCC NGA Factors)
Forecast at time of application	**n/a**	**350** GJ /year	**49.0** (**+1,379** if assume that GHG for composting is reduced by 80%)
Actual achieved post-project	**n/a**	(7.72+2.95) x 52 = 10. 67 x 52 = **555** GJ /year	**(0.54 +0.69) x 52 = 64.0** (**+0** if assume that GHG for composting is reduced by 100%)

Note: Approximately 7000 tonnes CO_2 (equivalent) GHG emissions have been avoided.