



Australian Government
Department of Agriculture



Urrbrae Agricultural High School Integrated Livestock Biogas Generation and Flaring

Final Report APL Project 2011/2206

November 2012

Urrbrae Agricultural High School

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1. Project Summary

This project involved collecting effluent in a closed hybrid tube and covered lagoon anaerobic digester system to enable capture of greenhouse gases (principally methane).

The pipework has been laid and the main pond enclosed with a plastic cover as well as webbing to protect the plastic and manage stretch of the plastic as gas volumes increase. At this stage the closed hybrid tube digester has not been installed due to technical problems by the manufacturer; however it is planned to be installed in Nov/Dec 2012.

In the meantime a scaled version of the tube digester has been made and installed with a replica solar heater to demonstrate the principles of the digester. This model was trialled during winter to test its efficiency in the cooler months and was found to be very successful.

Monitoring of gas flows and flaring of methane has been delayed because of the tube digester delays, however the scaled version has been trialled and shown to be very successful, and a small scale flaring has shown it to be viable. This work has been undertaken by our consultant builders and senior agriculture classes. Calculation of theoretical reduction in greenhouse gas warming potential due to destruction of methane has been done by students for this model system.

Plans for the start of the 2013 school year include:

- The measurement of gas flows and production;
- Publishing the gas volumes monthly for class use and as part of our environmental monitoring program; and
- Flaring of gas intermittently as required.

2. Background

Methane from livestock manures is an important source of greenhouse gas emissions and is critical in terms of atmospheric warming and potential Climate Change. The present Urrbrae Piggery manure management system results in methane emissions to the atmosphere and we are very keen to reduce these emissions and demonstrate to students and industry methods to do this.

This project will develop an innovative hybrid tube digester and covered lagoon system to capture methane emissions from effluent as well as dairy and beef cattle wash down areas. In the first instance, the methane will be destroyed through flaring to eliminate its high greenhouse warming potential by producing CO₂ which has 22-72 times less warming potential than methane - depending on time frame considered. To add to the technology's attractiveness to agricultural enterprises, methane produced (the major component of "biogas") will then be used as a renewable energy source.

3. Objectives

- Develop educational benefits of a modern functioning piggery;
- Demonstrate pond covering and odour control;
- Demonstrate biogas flaring; and
- Monitor biogas production.

4. Activities Undertaken

Project activity	Progress against planned activity
Construct two biogas collection systems	• Trench dug from piggery, dairy and beef feedlot to tube and lagoon biodigester sites. • Laid pipes for effluent, gas and sensors & modified effluent pumping system. Connected biogas piping to transfer gas from tube digester to storage under lagoon digester cover. • Installed gas flow meters. • Built recording system to use data from electronic recorders. • Installed gas collection pipes around perimeter of existing effluent lagoon and covered lagoon with polypropylene cover. Secured with anchored strap system. Work to be completed in Nov/Dec 2012: • Install solar fed heat exchanger pipes in existing concrete basin under tube digester. • Install solar hot water collectors on nursery shed roof. • Construct tube digester and install in concrete basin.
Design and build gas monitoring and flaring system	• Flare for use in small - medium farms and in school curriculum has been designed and construction begun. Flare design takes into account standards and recommendations in the Review of Australian Biogas Flaring Standards (RIRDC). The flare will be installed in December 2012 and tested in the new year when students return. • Monitoring of gas collection and flows will be done at the same time.

5. Results

At this point the effluent pipe work and pond cover has been completed. The pond has been covered and all plumbing work completed. Gas production has begun but due to a sump plug problem in April 2012 we lost 70% of the collected bio-solids in the lagoon. Since then the slow accumulation rate of biomass and the colder temperatures has delayed and hampered our gas production. Student involvement has been high, working with farm staff and the consultant to prepare trenching, lay pipes, trench and secure cover and install tie down straps.

Due to delays in both process and production of items the flaring and gas monitoring has not yet begun. The flarer and monitoring equipment are due for installation in the next weeks. Given the output from the piggery and the warm summer conditions we anticipate highly successful flaring in the new year (2013).

Stephan Tait from the Bioenergy Support Program visited the program in August and offered good advice to us and our consultant. He understood the delays and also corrected some of the sizing and proportion plans we had made to improve the design. These changes have been made to the design and production of the tube digester and flarer.

On 25 August 2012, we held a Year of the Farmer – Farm Expo. As part of this, successful tours of the system to industry personnel and the public were conducted. The displays featured the lagoon system, covers and a model of the tube digester as described above.

Progress against planned outcomes of this project includes:

1. To Keep the Urrbrae Piggery in Operation for the Educational Benefit of Students and for the Benefit of Industry in Having the Public See a Modern, Well Designed and Well Operated Piggery.

The piggery has successfully continued operation and shown to be more efficient in effluent removal from the pig rooms using the new plumbing system. The number of students showing interest in the operation of pig systems at the school has shown a marked rise.

2. To Demonstrate how Covered Ponds Contain Odour.

Successfully demonstrated. The pond has been covered, secured and gas collection ring installed. Although gas flaring for the large system has not yet occurred, small quantities of gas have been collected now in the covered dam. This gas is trapped and the odour also trapped. This has resulted in almost zero odour emanating from the dam and complaints by neighbours have declined to nil in the past 5 months. Comments and complaints by staff and students alike on the property have reduced to almost nil. When the project was on display to the public on 25 August 2012, we received very favourable reports about both the design and odour reduction.

3. To Demonstrate how Methane Might Be Collected in a Lined and Covered Pond.

Collection has been demonstrated. Although small at this stage due to the size and volume of the dam in relation to effluent volumes, the gas collection from the tube digester is assured to be significant. This gas will then form volumes which can be flared.

4. To Demonstrate the Safe Use of a Methane Flare.

The plan to have this in place by 25 August 2012 was stymied by the delay on the tube digester. In its place, the model digester demonstrated the anticipated gas collection and showed small scale gas flaring.

5. To Demonstrate that Methane Production Can Be Measured and whether that Gas Can Be Used to Heat Other Operations within the School and Reduce Electricity Requirements.

This too has been delayed and as originally planned will take 1-2 years of full production to evaluate the potential.

6. To Educate Students in the Building, Construction and Operation of the Whole Project.

Students have been and will continue to be actively involved.

6. Implications & Recommendations

The project will benefit the pork industry by providing a small scale demonstration of biogas generation and management in a readily accessible site, to industry and the general public. Urrbrae is located close to the centre of Adelaide. This means that visiting groups and industry to SA will and do find it easily accessible when visiting SA on business. We have had several industry group inquiries. Three tours for local and overseas education providers have been undertaken. Zero Waste SA has a planned visit in the new year to investigate use of a small scale digester for food scrap wastes for potential energy production. Stephan Tait from the Bioenergy Support Program visited the project in August 2012 and offered good advice to us and our consultant. The learning and development opportunities for future producers and like-minded individuals as school students and visiting TAFE students to Urrbrae clearly identifies up to 2000 individuals per year.

The project has been advertised through school and education publications. In addition, information has already been publicised through the Stock Journal and Pig Industry newsletters.

In the future it will be important to investigate further reduction of greenhouse gases such as reducing carbon dioxide through some simple forms of sequestration.

7. Acknowledgements

This project is supported by funding from Australian Pork Limited and the Department of Agriculture.

Budget and Works Program - Biogas Project November 2012

Process	Cost	Start Date	Completion Date
Clear and clean existing ponds	\$1,500	2/12/2011	3/02/2012
Adaptation of underground tank	\$1,000	3/12/2011	3/02/2012
Construction of 60m trench for pipeline from piggery to the pond	\$1,000	15/12/2011	16/12/2011
Purchase and installation of the 200mm PVC pipe	\$2,100	1/02/2012	3/02/2012
Secondary waste input (includes plumbing to wash in food wastes, excess straw and poultry litter)	\$3,500		
UV resistant 0.5mm polypropylene cover, build & install tube digester and connect systems	\$15,000	1/01/2012	3/04/2012
100mm PVC methane collection ring	\$3,000	2/02/2012	3/04/2012
Gas metering system and link to record system	\$7,000	2/02/2012	4/12/2012
Flare unit (plus fan etc)	\$7,500		
Concrete base of flare cage	\$1,500	6/07/2012	30/07/2012
Make flare cage safe and secure	\$2,000	6/07/2012	31/07/2012
Sludge removal pipe	\$1,000	4/05/2012	20/05/2012
Solar panel and heating system for tube digester	\$3,500		
Publicity and signage	\$5,000		
Consultancy and labour	\$20,000		
Site safety infrastructure	\$5,000		
Heat energy conversion units	\$9,500		
Curriculum experimental modelling	\$10,000		
Modification to piggery for increased energy efficiency	\$7,500		
Secure existing ponds	\$2,500		
Administrative costs	\$2,100		
TOTAL	\$109,700		