2121 Finlay Road, Tongala

Greenhouse Gas and Energy Impact Assessment for Natural Protein Plant

Prepared for:

H.W Greenham & Sons Pty Ltd
May 2019

Project No: 30491

H.W GREENHAM & SONS PTY LTD

GREENHOUSE GAS AND ENERGY IMPACT ASSESSMENT

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Revision History

Revision	Date Issued	Document Status
01	19/3/2019	Draft
02	9/4/2019	Draft rev01
03	11/4/2019	Final
04	21/5/2019	Final rev01
05	31/5/2019	Final rev02 for public consultation

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GLOSSARY

TERM	DEFINITION
DAF	Dissolved Air Flotation
EPA	Environment Protection Authority
FREME	Flash Recovery Energy Management Equipment
GHG	Greenhouse Gas
PLC	PLC Consulting Pty Ltd
NGA	National Greenhouse Accounts
Site	2121 Finlay Rd, Tongala, Victoria

1 Introduction

PLC Consulting has been engaged by H.W Greenham & Sons Pty Ltd (Greenham) to conduct a 'Greenhouse Gas and Energy Impact Assessment' for a rendering plant as part of an environmental works approval application. Greenham currently operate abattoirs at 2121 Finlay Road, Tongala (the Site) and are proposing to build a rendering plant.

The proposed rendering plant will convert waste from animal by-product into tallow and meat-meal. The process uses steam from gas fired boilers to heat the input material and equipment. The Site has an existing wastewater treatment system and Dissolved Air Floatation (DAF) tank. A biofilter will be installed to treat captured air and recover heat. The heat recovery will provide an alternative energy source for the Site.

Greenham are also in the process of installing a cogeneration system at the Site (subject to a separate EPA approvals process). The cogeneration system will produce heat and energy for on-Site use from a captured biogas from anerobic ponds and natural gas. The fuel source proposed is biogas capture from three existing anaerobic digester ponds. These ponds are fed waste material from abattoir operations. The cogeneration supplier is Simons Green Energy.

1.1 Objectives

The objective of this assessment is to evaluate the environmental impacts of the existing abattoir's greenhouse gas (GHG) emission and energy use and compare those to the proposed investments to be built at the Site. The key objective is to evaluate the opportunity for GHG reduction by establishing tallow, meat-meal and biogas recovery processes at the facility and harnessing resources that are currently not utilised.

1.2 Scope

The scope of this report is to calculate and compare the energy usage and conservations of two scenarios against current operations. The two scenarios are:

- Abattoir operations with rendering plant; and
- Abattoir operations with both rendering plant and cogeneration plant

The scope of the GHG and Energy Impact Assessment includes:

- Calculation of energy consumption for abattoir, rendering plant and cogeneration plant;
- Determine energy recovery and conservation for rendering plant and cogeneration plant;
- Calculation of GHG emissions for abattoir, rendering plant and cogeneration plant;
- Comparison of energy use and GHG emissions for two scenarios against current operations; and
- Preparation of report with findings

2 Definitions and sources

This assessment framework is based on the National Greenhouse Accounts (NGA) Factors (2017) and incorporates the principles of the Greenhouse Gas Protocol. The assessment has not used the National Greenhouse and Energy Reporting (Measurement) Determination as a framework because the scope for the assessment includes emission sources and data constraints that are outside the reporting requirements specified in the Determination.

The NGA factors utilised in this report have a general application to the estimation of a broader range of GHG inventories that are more suited to environmental impact assessments. The GHG Protocol provides an internationally accepted approach to GHG accounting. The Protocol provides guidance on setting reporting boundaries, defining emission sources and dealing with issues such as data quality and materiality. Relevant definitions are included in **Table 2-1** below.

Table 2-1 Definitions

Term / Concept	Definition
Greenhouse gas	According to the Kyoto Protocol, greenhouse gases include: • Carbon dioxide (CO2); • Methane (CH4); • Nitrous oxide (NO2); • Hydrofluorocarbons; • Perfluorocarbons; and • Sulfur dioxide
Scope 1 emissions	Direct emissions occurring from sources that are owned or controlled by the reporting entity. The reporting entity has a high level of control over Scope 1 emissions.
Scope 2 emissions	Emissions from the generation of purchased electricity consumed by the reporting entity. The emissions can be reported easily and can be significantly influenced through energy efficiency measures.
Scope 3 emissions	Indirect emissions are a consequence of the activities of the reporting entity but occur at sources owned or controlled by another reporting entity (e.g. outsourced services). Scope 3 emissions are estimates only and may have a relatively high level of uncertainty, unreliability and variability.

3 Current operations

Table 3-1 describes the current annual usage for electricity, water and gas for the current abattoir operations.

Table 3-1 Annual abattoir usages

Item	Consumption/emissions
Electricity	11,525,827 kwh/year
Water	260 ML/year
Gas	42,836 GJ/year

4 Rendering Plant Operation

A rendering plant processes animal by-product into tallow and meat-meal. Rendering, as a process, can refer to any processing of animal products into more useful materials, or, more narrowly, to the rendering of whole animal fatty by-product into tallow. As well as the fat commodity, rendering also yields a meat-meal.

4.1 Heat Recovery

The rendering process uses steam produced from boilers to heat the input material and equipment. Greenham propose to install a number of energy saving / recovery systems as part of the rendering plant, including:

- **Boiler Flue Gas Economiser**: designed to take waste heat from the boiler flue gases (typically around 250^{o}C) and make use of this normally wasted energy by preheating boiler feedwater. Actual energy savings achieved by this system will most likely be in the vicinity of 4%. This can be a substantial and ongoing saving, especially from a plant this size. The economiser is fabricated from Cupro Nickel tube with stainless steel fins, with brass flow and return headers, housed in an insulated steel enclosure, all designed for a long service life with minimal maintenance; and
- **Flash Recovery Energy Management Equipment (FREME)**: This is a heat recovery system that delivers major energy savings by recovering waste heat from the condensate return system on the cooker; also using it to pre-heat boiler feedwater. It will also reduce the occurrence of flash steam plumes. Actual energy savings of 10-20% are expected to be achieved by this system.

Greenham have decided not to install a waste heat recovery system for the cooking vapour from the rendering plant, as there will be enough hot water supplied from other on-Site systems, particularly the cogeneration plant. Waste heat from the cooking vapour is proposed to be rejected through an air condenser. However, if more hot water is required in the future, waste heat recovery equipment can be retrofitted to the plant to utilise waste heat from the cooking vapour.

4.2 Electricity

The proposed rendering plant will have a processing capacity of 110 tonnes of abattoir by-product per day, having an expected yield of 45%, with 55% of the mass boiled off in the cooker.

The rendering plant will have a maximum connected load 630kW and the condemned room will have a maximum connected load of 170kW. Lastly, the biofilter will be have a connected load allowance of 110kW, including the bio-filter fan, humidifier pump and roof extraction fans. Therefore, the total connected load for the proposed rendering plant is 910kW of operation.

A diversity factor of 70% is applied over the total connected load because not all motors and machinery will be operating at the same time within the rendering plant. Additionally, not all motors and machinery run at full power

when in use. Therefore, the expected energy consumption for the rendering plant per hour will be 637kW, totalling 3,146,780kWh per year.

4.3 Gas

Gas consumption for the plant will be approximately 237,160Mj per day, totalling 61,662Gj per year.

4.4 Transportation

The proposed rendering plant will also reduce truck movements from the Site to the current rendering plant in metropolitan Melbourne. It is anticipated that truck traffic may reduce from approximately 25 trucks driving a return distance of 450km to Laverton (a total of 11,250km) to possibly 5 trips of approximately 112km to Shepparton (tallow) and 5 trips of approximately 194km trips to Bendigo (meat-meal) (a total of 1,530km). This equates to a reduction of 9720km in truck traffic per week. Using an estimated fuel consumption of 47.62litres per 100km, the estimated current and future fuel consumption for transport is as follows:

- Current fuel consumption: 5360 litres per year; and
- Fuel consumption with rendering plant: 730 litres per year.

This equates to a reduction in transport related diesel consumption of approximately 4630 litres per year, equivalent to 13 tCO_2-e (carbon dioxide equivalents).

4.5 Water

Approximately 15,000kL of additional wastewater will be generated by the operation of the rendering plant. The additional water is generated through the cooking process as water is evaporated off the process material. Greenham already have in principal approval from Goulburn Valley Water (GVW) to increase their Trade Waste Agreement from 300ML to 315ML. The draft trade waste agreement is supplied with the Works Approval attached. It is noted that the agreement is yet to be finalized, however is not expected to change materially.

No additional potable water is required to operate the rendering plant. Water requirements for cleaning and wash-down will be available through the existing 300ML Water Supply Agreement with GVW.

5 Cogeneration Plant

5.1 Electricity

Greenham intend to install a cogeneration plant at the Tongala facility as part of a separate EPA approval process. Cogeneration is the simultaneous production of two forms of energy - electricity and heat - from a single fuel source. Due to the utilisation of both the electricity and heat produced, a cogeneration system can be up to 88% efficient.

The proposed cogeneration systems will generate power and heat for use within the existing abattoir facility. Greenham propose to install two units with a combined capacity of up to 1500kW of power and up to 1700kW of heat.

5.2 Biogas Recovery

Greenham propose to cover the three existing anaerobic ponds at the Site to harvest biogas as fuel source in the cogeneration system. It is estimated, based on the volume of the three digesters, and the quantity of wastewater entering the ponds, that there is the potential for up to 100m^3/ hour of biogas available.

The captured biogas extracted from the ponds will be supplemented with Natural gas (from the gas grid) to power the cogeneration units proposed.

If the cogeneration units are operational, this gas will be directed towards the 1MW unit, reducing its Natural gas consumption by up to 25%. If the unit is not operational, the gas will be directed to a gas flare system.

5.3 Heat recovery

Excess heat from the cogeneration system will be used in a newly installed pond heating system. Currently, the ponds fluctuate between 5 degrees in winter and 20 degrees in summer. The heating system will bring the temperature up to 37 degrees. The higher temperature will significantly increase biological activity in the ponds, leading to enhanced biogas development and recovery.

The ponds will require a lot of heat initially, but heat demand will drop once the system is warmed up.

6 GHG Assessment Methodology

To compare the emissions and energy usage for the three scenarios (see Section 1.2 Scope), the Emissions and Energy Threshold Calculator was used. The calculator can be used to obtain an estimate of scope 1 and scope 2 greenhouse gas emissions, energy production, and energy consumption based on data entered by the user. **Table 6-1** shows the input values for each item.

Table 6-1 Assessment input values (annual)

Item (annual)	Current (Abattoir)	Rendering plant	Rendering Plant with Cogeneration plant
Diesel (L)	278,577	37,886	37,886
Natural gas (GJ)	42,836	61,662	45,242
Biogas (tCO_2) (Fugitive Emissions)	12,876	12,876	129
Biogas (GJ) utilised	-	-	18,624
Electricity (kWh)	11,525,827	3,146,780	Negligible
Water (kL)	260,487	275,500	275,500

6.1 Assessment

Table 6-2 below shows the calculated emissions for the three scenarios and energy consumption and production.

Table 6-2 Calculated emissions

Scenario	Scope 1 emissions (tCO_2-e)	Scope 2 emissions (tCO_2-e)	Total emissions (tCO_2-e)	Energy consumed (GJ)	Energy produced (GJ)
Current (abattoir)	15,841	12,448	28,289	95,081	-
Abattoir and rendering plant	18,364	15,846	34,210	158,780	-
Abattoir, rendering and cogeneration plant	7,948	negligible	7,948	157,081	18,624 (biogas recovery)

It is noted that the assessment has not considered the commensurate reduction in energy consumed by the rendering facility currently receiving Greenham's raw by-product. Should this be accounted for, the net change in energy consumed to process the raw material, would be much lower than the results presented in the above table.

7 Conclusions

Based on the assessment undertaken, the following conclusions are made with regard to GHG emissions and water consumption:

- The construction of a rendering plant at the Site will result in an increase the consumption of energy at the Site by up to 90% and increase greenhouse gas emissions by approximately 6,000 tCO_2-e per year. However, there will be a commensurate reduction in energy consumption at the Laverton based plant currently receiving the raw by-product from the Site.
- The installation of a cogeneration system along with the rendering plant will reduce the GHG emission by approximately 20,000 tCO_2-e per year. This will also reduce the fugitive emissions of methane and reduce the risk of nuisance odour generation at the Site.
- The proposed rendering plant will reduce truck movements from the Site to the current rendering plant in metropolitan Melbourne. This equates to a reduction in transport related diesel consumption of approximately 4630 litres per year, equivalent to 13 tCO_2-e (carbon dioxide equivalents).
- Approximately 15,000kL of additional wastewater will be generated by the operation of the rendering plant. The additional water is generated through the cooking process as water is evaporated off the process material. Greenham already have in principal approval from Goulburn Valley Water to increase their Trade Waste Agreement from 300ML to 315ML.

8 References

Australian Government Clean Energy Regulator. (2019, March). *Calculators*. Retrieved from National Greenhouse and Energy Reporting: http://www.cleanenergyregulator.gov.au/NGER/Forms-and-resources/Calculators

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Thodey, J. (2018). *Quotation for the supply, install and commission of 2 Cogeneration systems and Biogas system for Greenham Tongala.* Simons Green Energy .

9 Limitations

This report was prepared for the sole use of the H.W Greenham & Sons Pty Ltd and should not be relied upon by any other person. None of PLC Consulting Pty Ltd or any of its related entities, employees or directors (each a **PLC Person**) owes a duty of care (whether in contract, tort, statute or otherwise) to any third party with respect to or in connection with this report and no PLC Person accepts any liability for any loss or damage suffered or costs incurred arising out of or in connection with the use this report by any third party.

The report has been prepared with the objectives and scope of work outlined in the proposal. The work was carried out in accordance with the PLC Consulting standard terms of business.

The conclusions and recommendations provided in this report are based on available information and it is possible that different conclusions and recommendations could be made should new information become available, or with changing site conditions over time.

The report will not be updated if anything occurs after the date of this report and PLC Consulting Pty Ltd will not be obliged to inform any person of any matter arising or coming to its attention after that date.

APPENDIX A Greenham GHG Data

APPENDIX B GHG Calculator