AARDVARK
Certification Ltd.

Biogas Meden Biomethane Plant

CO_2 Analysis Report

November 2018

Prepared for: John Laing Environmental Assets Group Ltd

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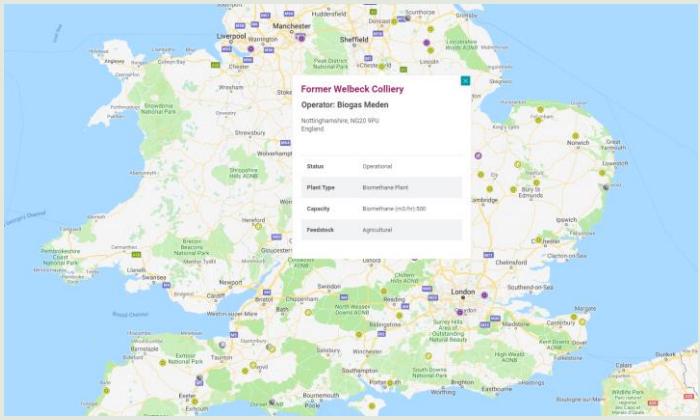
Executive Summary

Aardvark Certification Ltd (ACL) has been instructed by John Laing Environmental Assets Group Ltd to assess and report against the carbon savings achieved by the 450m3/hr Biogas Meden Biomethane Plant located at the former Wellbeck Colliery site on Elkesley Road, Meden Vale, Nottinghamshire, NG20 9PU. This assessment considers the CO_2 savings made as a result of this biogas plant as well as the wider environmental benefits the project has delivered.

Asset Introduction

The Biogas Meden Biomethane Plant is fed on a menu consisting of 38,450 tonnes per annum of agricultural feedstocks including whole crop maize, sugar beet, vegetable residues and farm derived manures. The biogas plant has a designed maximum export capacity of 450m3/hr biomethane with all biomethane produced exported directly to the national gas grid. A 360kW CHP provides heat and power to meet the energy requirements of the plant. The plant was commissioned in March 2016 and to date has exported 7,838MWh of renewable electricity and a further 100,168MWh of biomethane.



CO2 Savings from Biomethane

Biomethane offsets significant CO_2 emissions compared with fossil fuel derived gas and electricity. Conversion factors for fossil fuel derived electricity, natural gas and biomethane are shown below:

UK Generated Electricity: 0.28037 kg CO_2e per kWh

Natural Gas: 0.18396 kg CO_2e per kWh (gross CV)

Biomethane: 0.00037703 kg CO_2e per kWh (gross CV)

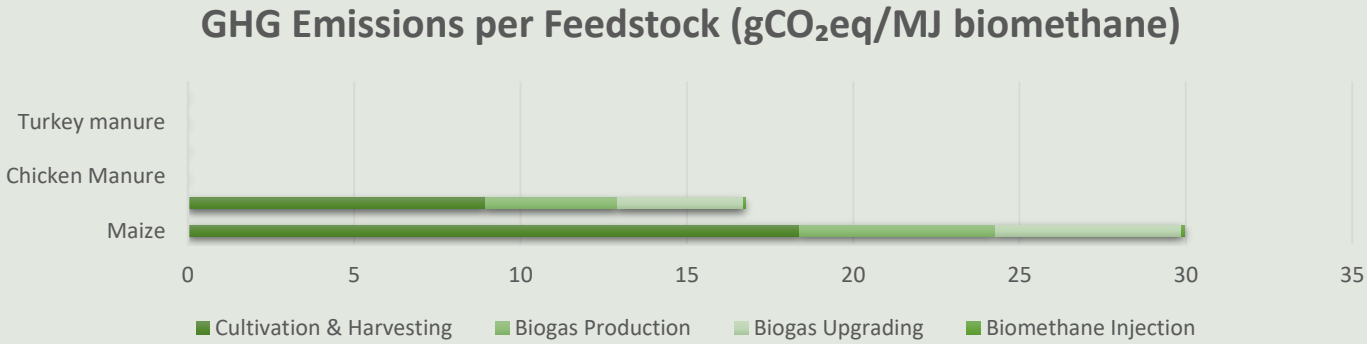
The calculated CO_2 savings shown within this report are based on the actual savings achieved by the site.

Greenhouse Gas Emissions

The Biogas Meden Biomethane Plant uses a range of agricultural feedstocks to produce energy which comprise of purpose grown crops. The cultivation, harvesting and conversion of the crops to energy requires an element of fossil fuel use. The actual CO_2 savings achieved therefore need to account for the associated GHG emissions produced through the use of the crop based feedstocks. A simplified illustration of the fuel chain shows each step at which GHG emissions are produced through use of crop based feedstocks.

GHG Emissions by Feedstock

Each feedstock has been assessed to determine the specific GHG emissions associated with their use with indicative emissions at each step in the fuel chain shown below based averages for crop type. Manures and residues are deemed to have zero emissions:



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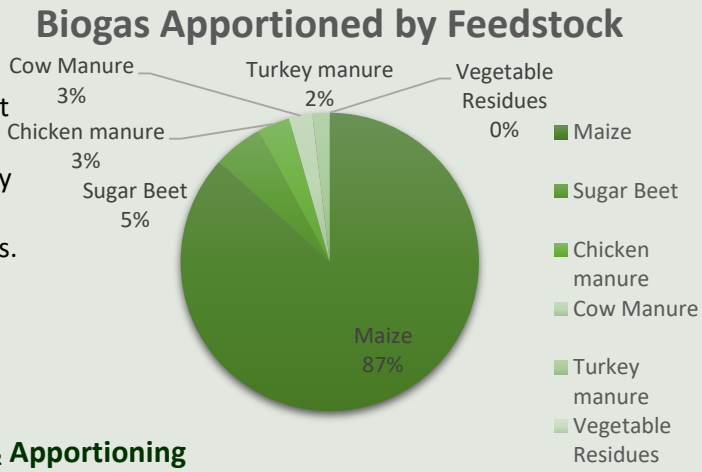
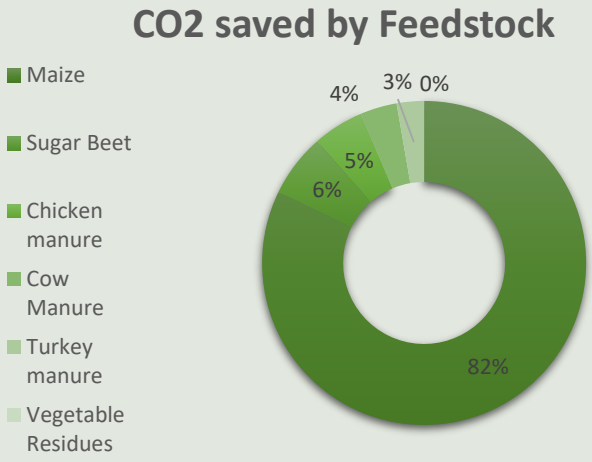
Biogas Apportioning

As the Biogas Meden Biomethane Plant uses a range of agricultural feedstocks, it is necessary to understand what proportion of the biogas produced is derived from each feedstock in order to quantify the CO_2 savings achieved by the plant. To do this we apportion the biogas across the range of feedstocks based on their individual biogas yields.





CO_2 Apportioning

In order to account for the associated GHG emissions resulting from the use of purpose grown crops to produce the electricity and biomethane, it is necessary to apportion the CO_2 emissions saved as a result of the operation of the biomethane plant by feedstock type. This shows that whilst some feedstocks contribute more to overall biogas production than others, these are not necessarily delivering equivalent levels of CO_2 savings for the plant as emissions associated with their production can be greater or other feedstock types have zero emissions.

CO_2 Savings

With the preceding analysis, it is possible to calculate the CO_2 savings the plant has achieved over its lifetime had the equivalent quantity of energy derived from fossil fuel sources. Total CO_2 emissions which would have come from an equivalent quantity of electricity or natural gas from fossil fuel sources in the UK is shown below along with CO_2 savings made through energy production from the biomethane plant. This shows a total saving to date of 1,438tCO_2e has been saved by the Biogas Meden Biomethane Plant through electricity production used onsite and a further 9,248tCO_2e has been saved through biomethane production.

Total Energy Produced				UK Generated Eectricity	Biogas Generated Electricity
			Conversion factors	0.28037	
Electricity	7,838	MWh	CO_2 Equivalient (kg CO_2e)	2,197,461	758,579
			CO_2 Difference (kg CO_2e)	1,438,881	

Total Energy Produced				UK Natural Gas Emissions	Biomethane Emissions
			Conversion factors	0.18396	
Biomethane	100,168	MWh	CO_2 Equivalient (kg CO_2e)	18,426,909	9,179,041
			CO_2 Difference (kg CO_2e)	9,247,868	

CO_2 Forecast

An anaerobic digestion plant is typically designed with a 20 year operational lifetime. In practice this may go on well beyond the planned 20 years. Based on the expected 20 year operational forecast, Biogas Meden Biomethane Plant is expected to save a total of 80,151tCO_2e. This forecast is based on the current GHG emissions associated with the production of feedstocks and operation of the plant. In practice it is expected that improved technology and efficiencies over the remainder of the lifetime of the plant will enable it to reduce its own emissions thereby increasing the overall CO_2 savings it contributes.

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What do these savings mean?

The CO_2 savings achieved by the project can be difficult to comprehend and relate to real world understanding. We therefore equate the savings to every day scenarios such as vehicles, and homes to assist readers in interpreting the data.

The Biogas Meden Biomethane Plant has to date offset 10,417tCO_2e since commissioning and is expected to offset at least 80,151tCO_2e over its operational lifetime. This equates to:

- Equivalent emissions produced by a mid-sized diesel car driving around Earth's equator 11,525 times over the lifetime of the plant
- Removing 1,840 mid-sized diesel cars from UK roads every year over the lifetime of the project
- Providing gas for heating and cooking in 1,713 UK homes for twenty years

Other Environmental/Social Benefits

The Biogas Meden Biomethane Plant delivers other environmental benefits, namely offsetting fossil fuel derived fertilizer use and improving soil health.

The resultant digestate from the plant is used on local farmland as a valuable biofertilizer. The liquid fraction has been particularly useful for establishment of cover crop, oilseed rape and grass.

Use of the digestate as a direct replacement for traditional fertilisers offsets an estimated 314 tCO_2e per annum.

The use of energy crops as feedstock for the biomethane plant has not resulted in any change in land use type.

Methodology

This report has been prepared in good faith by Aardvark Certification Ltd based on data obtained from the owner/operator of the asset reviewed. Our calculations of GHG emissions associated with the production of biogas from the plant has been through the UK Solid and Gaseous Biomass Carbon Calculator (B2C2), V2 Build 36 updated in October 2015. Our GHG emissions assumptions for this plant are based on an annualised average emissions value for the plant by feedstock type. Biogas yield data is based on that reported by the plant operator over a 32 month period.

Our calculations of CO2 savings are based on IFI Approach to GHG Accounting for Renewable Energy Projects. Baseline Emission Factors used in this analysis are taken directly from the Department for Business, Energy & Industrial Strategy Greenhouse gas reporting: conversion factors 2018.

Energy usage statistics are taken from OfGEM - https://www.ofgem.gov.uk/gas/retail-market/monitoring-data-and-statistics/typical-domestic-consumption-values

Mileage travelled per vehicle in the UK was taken from the RAC Foundation.

Digestate NPK values sourced from Defra's Fertiliser Manual 2017 (RB209) 9th edition

Liability

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