AARDVARK
Certification Ltd

Peacehill Gas Limited Biomethane Plant

CO_2 Analysis Report

November 2020

Prepared for: JLEN Environmental Assets Group Ltd

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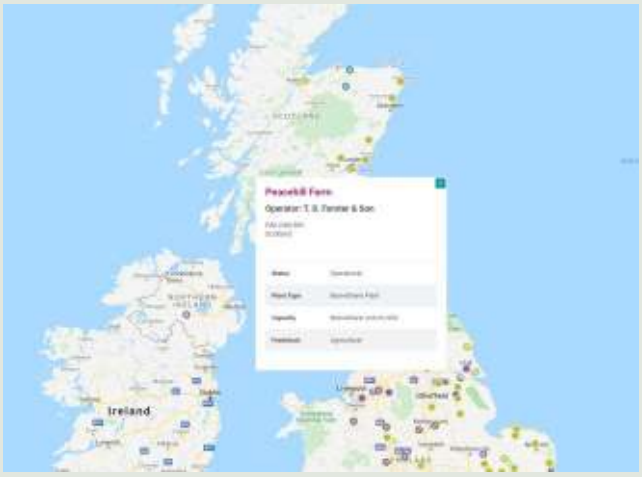
Executive Summary

Aardvark Certification Ltd (ACL) has been instructed by JLEN Environmental Assets Group Ltd to assess and report against the carbon savings achieved by the 550m3/hr Peacehill Gas Ltd Biomethane Plant located at Wormit, Fife in Scotland. 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 Peacehill Gas Biomethane Plant is fed on a menu of 37,000 tonnes per annum of agricultural feedstocks including, rye, energy beet, chicken manure and oat husks and barley grain. The biogas plant has a designed export capacity of 550 m3/hr biomethane with all biomethane produced exported directly to the national gas grid. A 250kW CHP provides heat and power to meet the energy requirements of the plant with any surplus electricity exported to the grid. The plant was commissioned in June 2015 and to date has produced 11,520 MWh of renewable electricity and a further 212,324 MWh of biomethane.



CO2 Savings from Biomethane

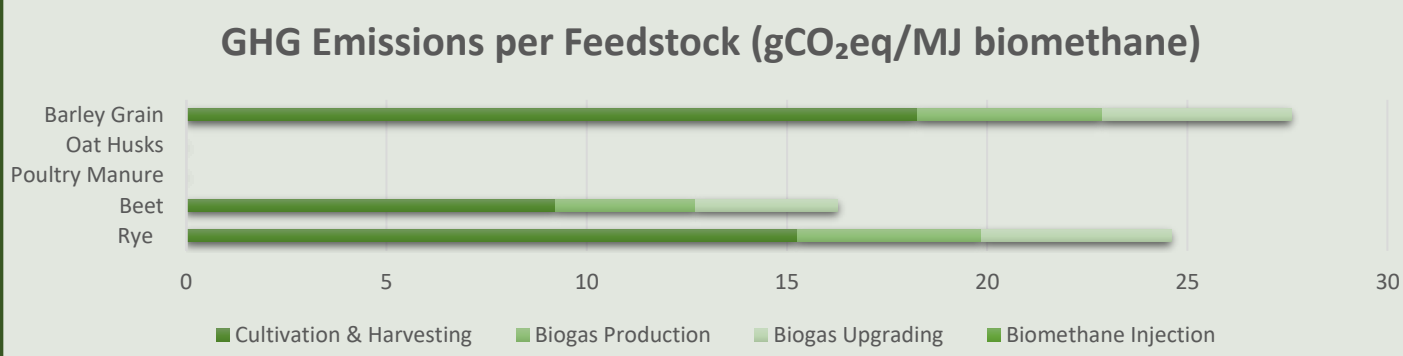
Biomethane offsets significant CO_2 emissions compared with fossil fuel derived gas and electricity. Standard conversion factors for fossil fuel derived electricity, natural gas and biomethane are shown below:
UK Generated Electricity: 0.23314 kg CO_2e per kWh
Natural Gas: 0.18387 kg CO_2e per kWh (gross CV)
Biomethane: 0.000380664 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 Peacehill Biomethane Plant uses a range of agricultural feedstocks to produce energy which comprise of purpose grown crops as well as some distillery residues. 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 crop based feedstock has been assessed to determine the specific GHG emissions associated with their use with emissions at each step in the fuel chain quantified and shown below:



Peacehill Gas Ltd Biomethane Plant

CO_2 Analysis Report

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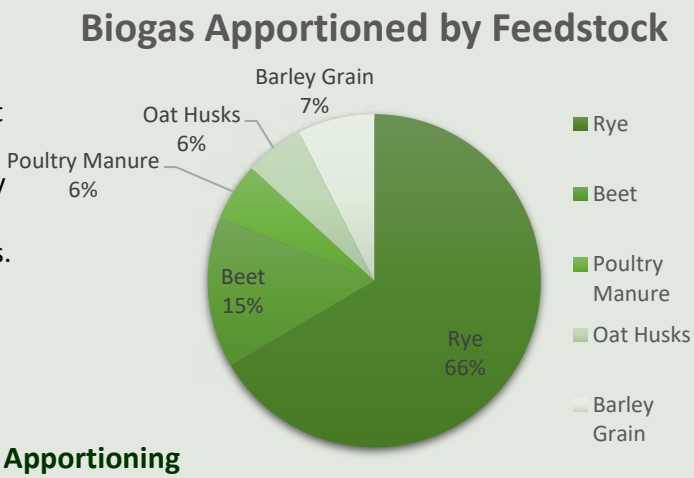
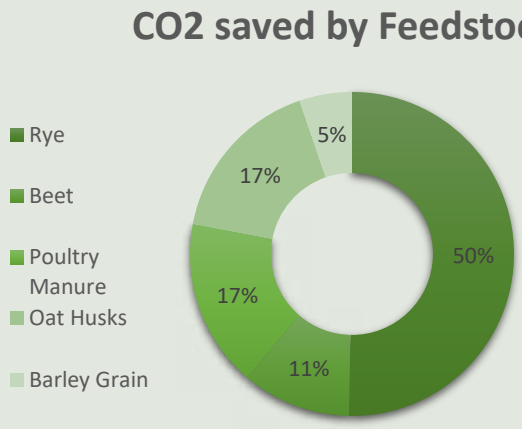
Biogas Apportioning

As the Peacehill 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 the highest levels of CO_2 savings. The use of wastes delivers greater CO_2 savings than higher biogas yielding crop based feedstocks.

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 been 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 2,201 tCO_2e has been saved by the Peacehill Gas Biomethane Plant through its electricity export and a further 27,574 tCO_2e has been saved through biomethane production.

Total Energy Produced				UK Generated Eectricity	Biogas Generated Electricity
			Conversion factors	0.23314	
Electricity	11,520	MWh	CO_2 Equivalient (kg CO_2e)	2,685,773	484,584
			CO_2 Difference (kg CO_2e)	2,201,189	

550297.2397

Total Energy Produced				UK Natural Gas Emissions	Biomethane Emissions
			Conversion factors	0.18387	
Biomethane	212,324	MWh	CO_2 Equivalient (kg CO_2e)	39,039,945	11,465,476
			CO_2 Difference (kg CO_2e)	27,574,470	

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, the Peacehill plant is expected to save a total of 122,741 tCO_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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CO_2 Analysis Report

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 Peacehill Biomethane Plant has to date offset 29,776 tCO_2e since commissioning and is expected to offset at least 122,741 tCO_2e over its operational lifetime. This equates to:

- Equivalent emissions produced by a mid-sized diesel car driving around Earth's equator 17,649 times over the lifetime of the plant
- Removing 56,347 mid-sized diesel cars from UK roads based on the lifetime CO_2 savings the plant will achieve whilst it has already offset equivalent emissions to 15,026 cars.
- Providing enough gas for heating and cooking in 2,623 average UK homes over the lifetime of the plant
- Providing enough renewable electricity to power 5,867 average UK homes over the lifetime of the plant

Other Environmental & Community Benefits

The Peacehill Biomethane Plant delivers another important environmental benefit to the local farms around the plant through provision of a natural biofertilizer they are able to use. This offsets the need for fossil fuel derived fertilisers. The liquid fraction of the digestate has been particularly useful for establishment of cover crop, and grass. Use of the digestate as a direct replacement for traditional fertilisers offsets an estimated 630 t CO_2e per annum.

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 Ricardo Biomethane and Heat GHG Calculator Tool, v 1.1 updated on 09/06/2016. 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 an average of the UKAS accredited laboratory analysis undertaken of the plants specific feedstocks over a three year 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 2020.

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

This document contains information and may contain conclusions and recommendations. Every effort has been made to ensure that the information is accurate and that the opinions expressed are sound. However, Aardvark EM Limited cannot be made liable for any errors or omissions or for any losses or consequential losses resulting from decisions based on the information.

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