AARDVARK
Certification Ltd

Vulcan Renewables Biomethane Plant

CO_2 Analysis Report

May 2020

Prepared for: John Laing Environmental Assets Group Ltd

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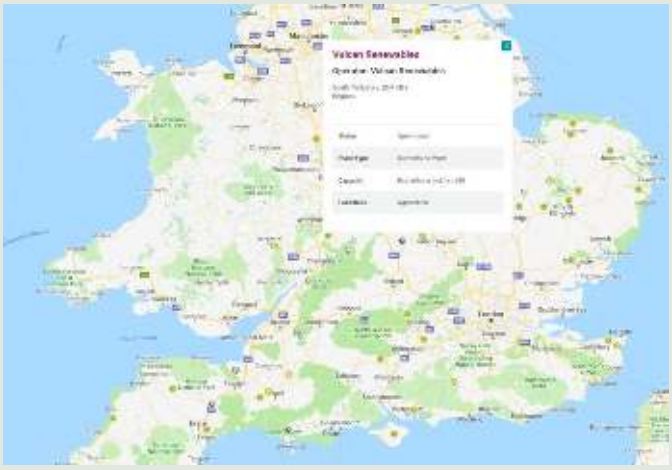
AARDVARK Certification Ltd.

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 900m3/hr Vulcan Renewables Biomethane Plant located at Bawtry Road, Lindolme, Doncaster, DN7 6BY. 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 Vulcan Renewables Biomethane Plant is fed on a menu of circa 70,000 tonnes per annum of agricultural feedstocks including whole crop maize, rye, sugar beet and grass silage. The biogas plant has been expanded to an export capacity of 900m3/hr biomethane with all biomethane produced exported directly to the national gas grid. A 500kW CHP provides heat and power to meet the energy requirements of the plant with surplus electricity exported to the grid. The plant was commissioned in October 2013 and to date has exported 22,750MWh of renewable electricity and a further 325,500MWh 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: 0.2556 kg CO_2e per kWh

Natural Gas: 0.18385 kg CO_2e per kWh (gross CV)

Biomethane: 0.00037703 kg CO_2e per kWh (gross CV)

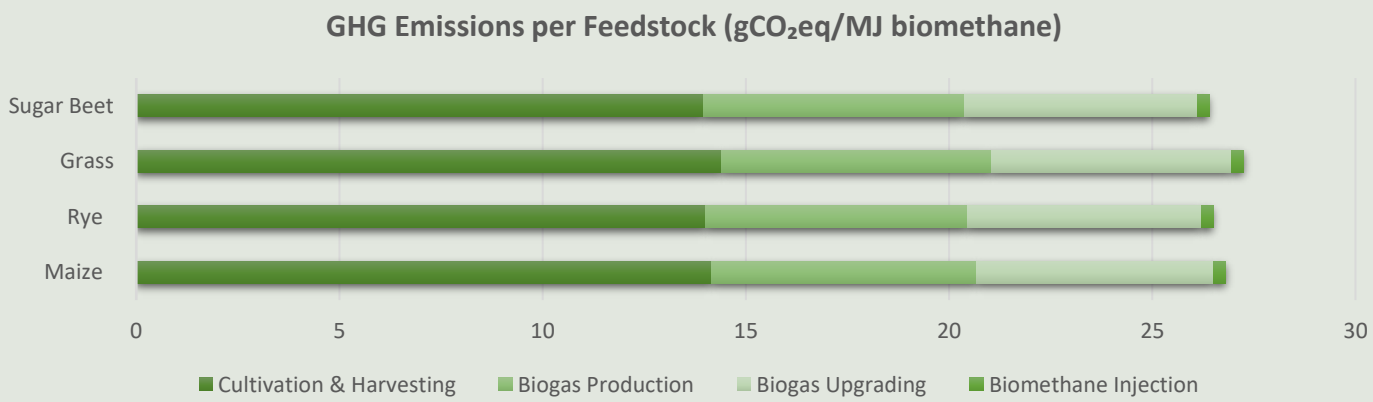
The calculated CO_2 savings shown within this report are based on the actual savings achieved by the site.

Greenhouse Gas Emissions

The Vulcan Renewables 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 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:



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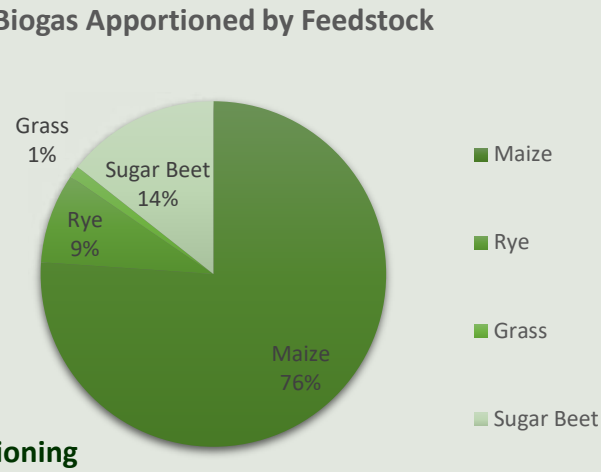
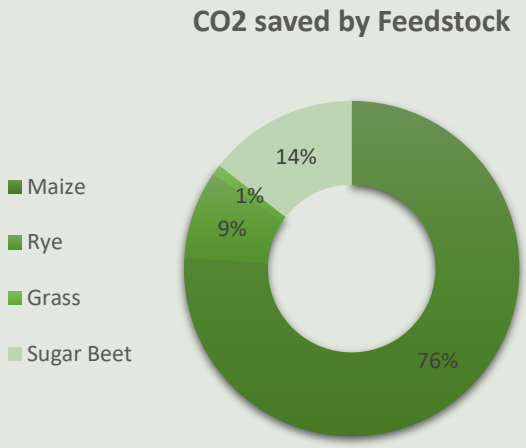
Biogas Apportioning

As the Vulcan Renewables 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 based on the most recent sustainability calculations for the crop-based feedstocks used, the GHG emissions associated with each crop type are at very similar levels and therefore the CO_2 savings achieved by the different feedstock types are aligned with their contribution biomethane production.

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 4,744tCO_2e has been saved by the Vulcan Renewables plant through its electricity export and a further 28,467tCO_2e has been saved through biomethane production.

Total Energy Produced				UK Generated Eectricity	Biogas Generated Electricity
			Conversion factors	0.25560	
Electricity	22,750	MWh	CO_2 Equivalient (kg CO_2e)	5,814,900	1,070,859
			CO_2 Difference (kg CO_2e)	4,744,041	

Total Energy Produced				UK Natural Gas Emissions	Biomethane Emissions
			Conversion factors	0.18385	
Biomethane	325,500	MWh	CO_2 Equivalient (kg CO_2e)	59,843,175	31,376,450
			CO_2 Difference (kg CO_2e)	28,466,725	

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 and the additional biomethane capacity added in December 2019, the Vulcan Renewables plant is expected to save a total of 276,112tCO_2e. This forecast is based on the current GHG emissions associated with the production of feedstocks and operation of the plant. Since the expansion, the plant is able to operate more efficiently and greater CO_2 savings are being realised. Furthermore, 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 Vulcan Renewables Biomethane Plant has to date offset 33,211tCO_2e since commissioning and is expected to offset at least 276,112tCO_2e over its operational lifetime. This equates to:

- Equivalent emissions produced by a mid-sized diesel car driving around Earth's equator 39,703 times over the lifetime of the plant
- Removing 6,338 mid-sized diesel cars from UK roads every year over the lifetime of the project
- Providing enough gas for heating and cooking in 5,901 average UK homes over the lifetime of the plant
- Providing enough renewable electricity to power 14,484 average UK homes over the lifetime of the plant

Other Environmental/Social Benefits

The Vulcan Renewables Biomethane Plant delivers several other environmental and local community benefits. These have included to date:

- £5,000 paid to a local community benefit fund in the last financial year which has been used for:
    - new playground equipment for a local primary school
    - payment of brownie and girl guide annual subscriptions
    - purchase of a trailer for the local scout group
    - a new boiler for the local Methodist Church
    - Payment of rent for the local gardening society
- 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 734 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 2019.

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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