AARDVARK
Certification Ltd

Rainworth AD Plant

CO_2 Analysis Report

May 2021

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 2.2 Mwe Rainworth AD plant located at Stud Farm Lane, Rufford, Newark, NG22 9HB. 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 Rainworth AD plant is fed on a menu of circa 40,000 tonnes per annum of agricultural feedstocks including maize, rye, sugar beet and poultry manure. The biogas plant features two CHP gensets of 700kW and 1,500kW which provide heat and power primarily to the nearby Center Parcs holiday village with surplus electricity exported to the grid. The plant was commissioned in September 2016 and to date has exported 69,743 MWh of renewable electricity and 15,219 MWh of renewable heat.

CO2 Savings from Electricity

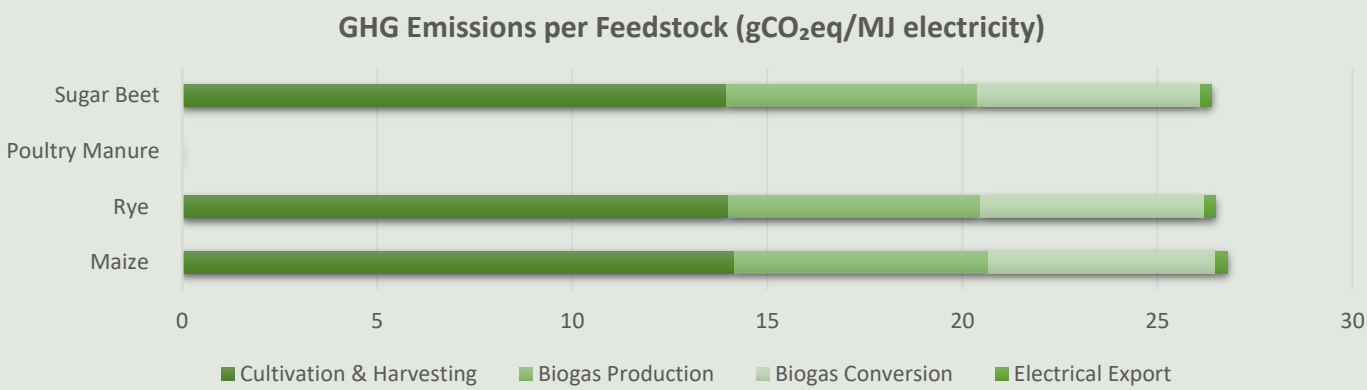
Electricity produced from biogas avoids significant CO_2 emissions compared with fossil fuel derived electricity. Conversion factors for fossil fuel derived electricity, natural gas and biomethane are shown below:
UK Generated Electricity: 0.23314 kg CO_2e per kWh
Natural Gas: 0.18387 kg CO_2e per kWh (gross CV)
Biogas: 0.00021 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 Rainworth AD 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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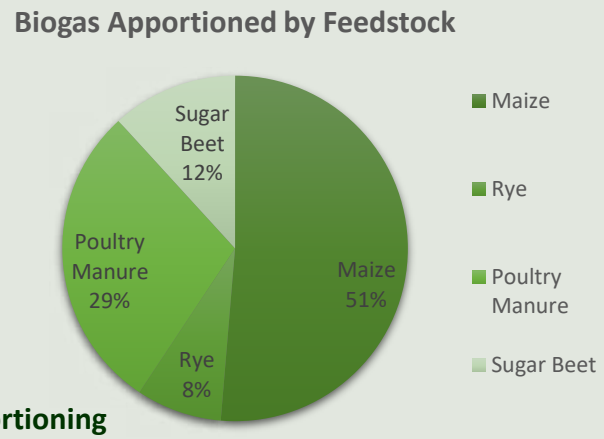
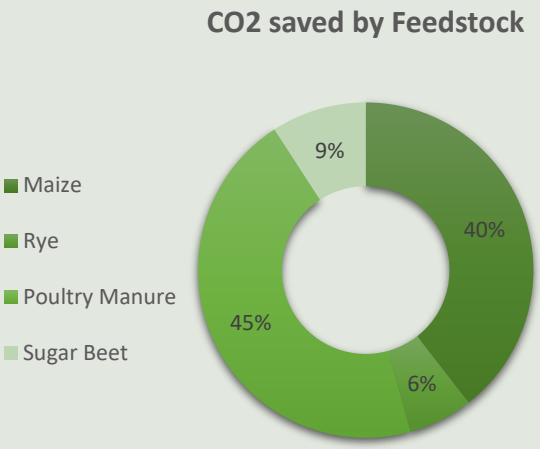
Biogas Apportioning

As the Rainworth AD 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 biogas and the resultant electricity, it is necessary to apportion the CO_2 emissions saved as a result of the operation of the AD plant by feedstock type. This shows that based on the average sustainability calculations for the crop-based feedstocks used, the GHG emissions associated with each crop type are at similar levels and therefore the CO_2 savings achieved by the different feedstock types are aligned with their contribution to biogas production. Poultry manure is however a waste and there are no emissions associated with use of this feedstock. Poultry manure therefore contributes a larger part of the CO_2 savings the plant achieves compared with its contribution of overall biogas.

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 from fossil fuel sources in the UK is shown below along with CO_2 savings made through energy production from the biogas plant. This shows a total saving to date of 13,338tCO_2e has been saved by the Rainworth AD plant through its electricity exports since commissioning in 2016 and a further 2,795tCO_2e has been avoided through supply of renewable heat.

Total Energy Produced				UK Generated Eectricity	Biogas Generated Electricity
			Conversion factors	0.23314	
Electricity	69,743	MWh	CO_2 Equivalient (kg CO_2e)	16,259,883	2,921,255
			CO_2 Difference (kg CO_2e)	13,338,628	
				UK Natural Gas	Biogas Derived Heat
			Conversion factors	0.18387	0.00021
Heat	15,219	MWh	CO_2 Equivalient (kg CO_2e)	2,798,318	3,196
			CO_2 Difference (kg CO_2e)	2,795,122	

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 for the Rainworth AD plant, it is expected to save a total of 95,670tCO_2e. This forecast is based on the current GHG emissions associated with the production of feedstocks and operation of the plant. 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 Rainworth AD plant has to date offset 16,133tCO_2e since commissioning and is expected to offset at least 95,670tCO_2e over its operational lifetime. This equates to:

- Equivalent emissions produced by a mid-sized diesel car driving around Earth's equator 13,757 times over the lifetime of the plant
- Removing 2,196 mid-sized diesel cars from UK roads every year over the lifetime of the project
- Providing enough renewable electricity to power 3,087 average UK homes over the lifetime of the plant

Other Environmental/Social Benefits

The Rainworth AD plant delivers several other environmental benefits. These have included to date:

- The resultant digestate from the plant is used on local farmland as a valuable biofertilizer. The liquid fraction cans been particularly useful for establishment of cover crops, maize and rye.
- Use of the digestate as a direct replacement for traditional fertilisers offsets an estimated 399 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

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