

Knottingley Hydropower Project CO₂ Analysis Report

November 2020

Knottingley Hydropower Project

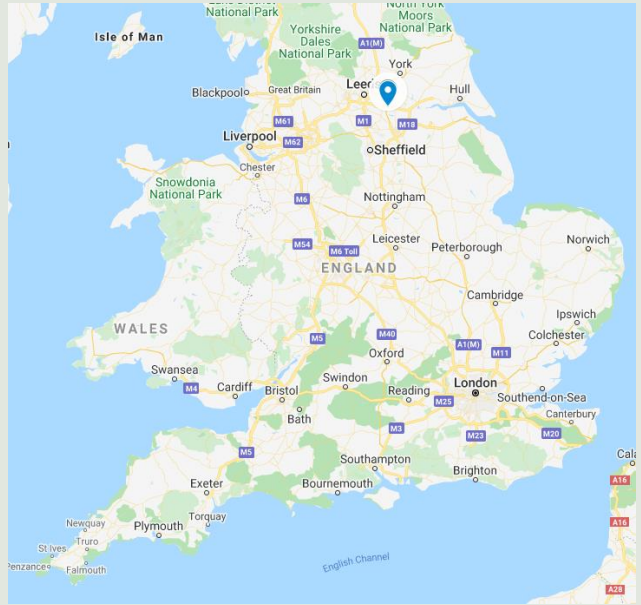
CO₂ Analysis Report

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 their 500kW hydropower project located alongside the River Aire near Knottingley. This assessment considers the CO₂ savings made as a result of the hydro turbine's energy production and export to the grid.

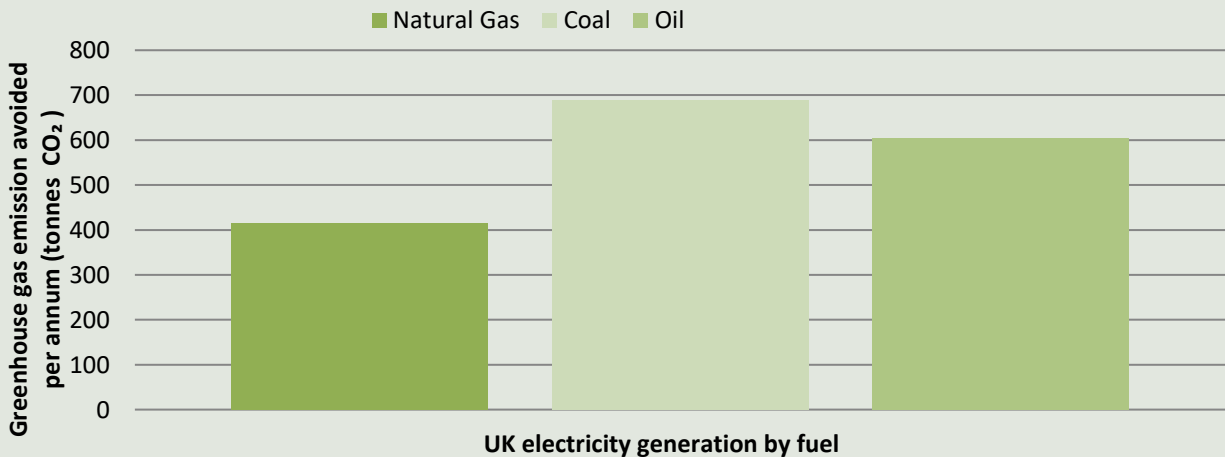
Asset Introduction

The Knottingley Hydropower Project consists of low head dual Kaplan turbines located alongside the River Aire, Knottingley. Adjustable inlet guide vanes allow it to maximise its energy yield to suit the flow rate of the river. The turbine has a design capacity of 640kW which is limited to 500kW to sit within FiT bandings. Each year an average of 2,255MWh of renewable electricity has been produced. Since commissioning in November 2017, the turbine has produced 6,202MWh of electricity. During the course of the installations total lifetime it is anticipated that up to 149,597MWh will be produced. The renewable energy generated by the turbine is fed directly to an adjacent flour mill via private wire with surplus energy exported to the grid.



CO₂ Savings

The preceding summary of energy generation from the turbine enables illustration of the quantities of CO₂ that have been avoided had the Knottingley Hydropower Projects annual electricity production (2,255MWh) been produced by conventional fossil fuel sources.



GHG Emissions Avoided

Fuel Type	Average Annual (tonnes CO ₂ e)	Lifetime Saving (tonnes CO ₂ e)
Natural Gas	415	20,072
Coal	689	29,275
Oil	604	33,946

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Energy Production

As there are no green house gas emissions associated with the operational phase of a hydro turbine, the renewable energy produced by the Knottingley Hydropower Project offsets 100% of the equivalent fossil fuel derived energy.

Total Energy Produced				UK Generated Electricity	Hydro Generated Electricity
			Conversion factors	0.23314	0.00000
Electricity	2,255,138	kWh	CO ₂ Equivalent (kg CO ₂ e)	525,763	0
			CO ₂ Difference (kg CO ₂ e)	525,763	

What do these savings mean?

The forecast CO₂ savings the Knottingley Hydropower Project will achieve over its lifetime is equivalent to:

- removing the combined emissions of 241 medium sized diesel cars every year from UK roads for the lifetime of the asset.
- Power 672 residential properties every year based upon the national average electricity consumption statistics.
- Provide enough power to drive a Nissan Leaf 6,632,759 miles a year – equivalent to driving 266 times around the circumference of the earth
- Boil enough water for 395 million cups of tea

CO₂ Forecast

Based on the quantity of electricity the turbine produces each year, an average of 526 tonnes CO₂e per annum will be avoided compared to the emissions associated with electricity produced for the UK Grid. It is expected that during the course of the turbine's remaining 57.3 years of operational life, a further 30,100 tonnes CO₂e will be saved.

Other Emissions to Air Avoided

In addition to offsetting CO₂ emissions, other greenhouse gas emissions are also avoided including CH₄ and N₂O. Based on the amount of electricity produced by the Knottingley Hydropower Project per annum, emissions of these gasses which have been avoided have been calculated and shown below.

CO ₂ e of CH ₄ emissions avoided kg/yr	CO ₂ e of N ₂ O emissions avoided kg/yr
1,488	3,450

Additional Benefits

As well as the various environmental benefits the Knottingley Hydropower Project delivers on it's own, a recent addition of a co-located 1.2MW lithium ion battery now enables the energy produced by the turbine to be stored and discharged to the flour mill or grid at times of peak demand. The battery not only enables energy to be supplied to the grid in times of peak demand but plays a part in enabling the transmission network to shift from large-scale centralised sources of fossil fuel generators to accommodate small-scale distributed sources of renewable generation such as wind, solar and hydro.

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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 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.

Liability

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