EUROPEAN COMMISSION
Executive Agency for Small and Medium-sized Enterprises (EASME)
H2020 SME

biowave

Grant Agreement Number: 691404-biowave

Upscale and demonstration of an integrated novel microwave pre-treatment system for efficient production of biogas from anaerobic digestion of pig manure to create a sustainable waste management system

Deliverable Report Nº: D 7.1

Title: On site slurry treatment system.

Due Date:	31st Jan, 2018
Actual Submission Date:	08th August, 2018
Project Start Date:	1st April, 2016
Project End Date:	31st July, 2018
Project Duration:	28 months

Project Coordinator: Ashleigh Farms (Environmental) Ltd

Project co-funded by the European Commission within the Horizon2020 (FTI Pilot-2015-1)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

DOCUMENT CONTROL

Document Version	Change Made	Reason for Change	Date of Change	Change By
1	Initial version		07July2018	EOH
2	Minor edits	Final Review	08August2018	KM & EOH

Executive Summary

This report provides an overview of the planning and licencing of the microwave assisted AD facility at Ashleigh Farms in Dungarvan Co. Waterford and outlines the sequencing and build methodology of the on-farm biogas facility and subsequent full integration of the Biowave pre-treatment system. A brief overview of the operational characteristics of the full system integration is also provided.

1 Deliverable7.1 On Site Slurry Treatment System

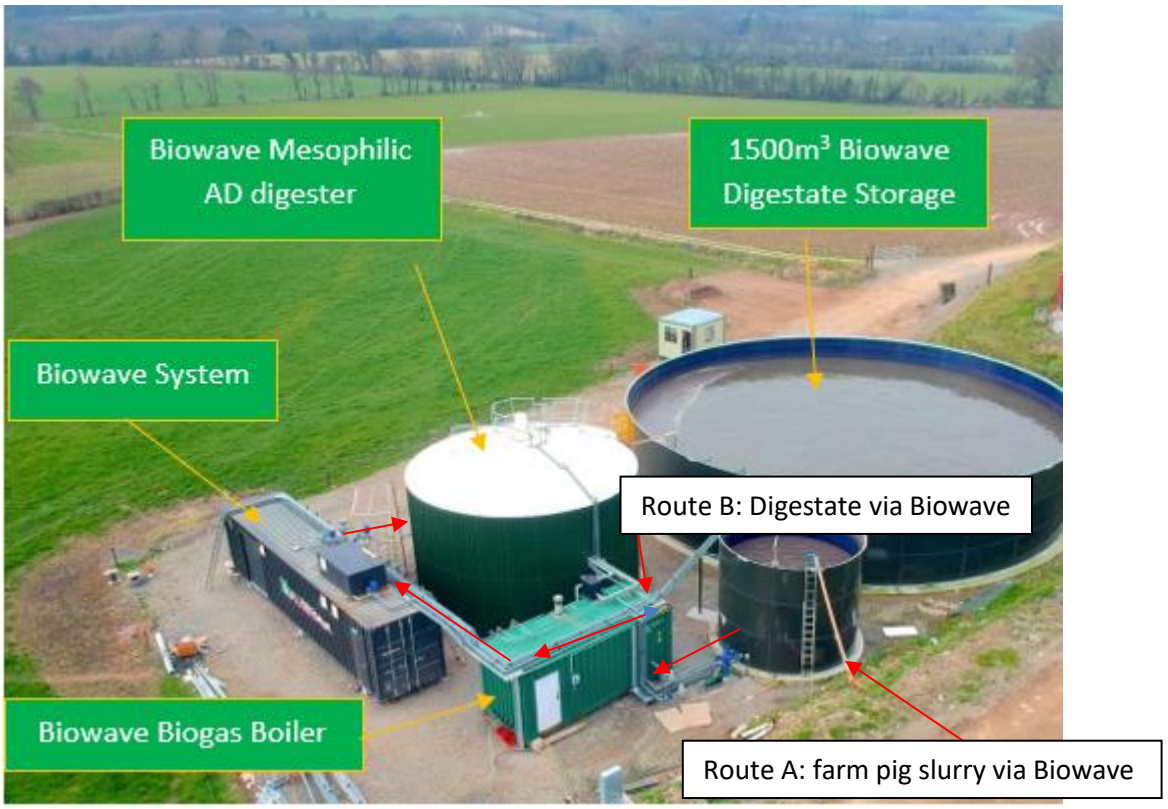


Figure1. Over view of complete Biowave AD facility at Ashleigh Farms

The full Biowave facility has been in 'pilot' operation since March 2018 having been fully constructed and commissioned by Ashleigh Environmental and it Biowave project partners. The following pages briefly outline the work flow to accomplish the on-site slurry treatment system. Two options are available: Route A takes a volume of the daily pig slurry and processes it via the biowave system to increase the valorisation of the substrate or with route B digestate can be taken, processed and re-circulated via the biowave system again to maximise the valorisation of the more recalcitrant fraction of the substrate to maximise the biogas potential.

Planning permission for construction of Anaerobic Digestion plant at Ashleigh Farms, Ballinameela

What is Anaerobic Digestion?

- **A simple, natural breakdown** of slurry/manure in a sealed tank.
- **Reduces existing odour pollution**.
- **Prevents emission of existing gases** into the atmosphere.
- **Processed slurry is a nutrient-rich substance that can be used as a fertiliser.**
- **Produces renewable energy** by capturing the green house gases from the slurry and converting to renewable energy in the form of electricity and heat. This will in turn reduce reliance on fossil fuels and provides security of energy supply.
- The new system being developed at Ashleigh Farms will include a treatment phase using a microwave to **improve the renewable energy output** (electricity & heat) from the slurry
- The plant is being developed as part of a European funded innovation project to design and build a **new sustainable energy system for farmers**.
- Plant to be constructed **behind farm and at same height existing buildings.**

Contact details

- If you have any questions or concerns please don't hesitate to contact me.
- Ken McGrath - tel:087 3927876 - email: ken@ashleighfarms.ie

An overview of the technology

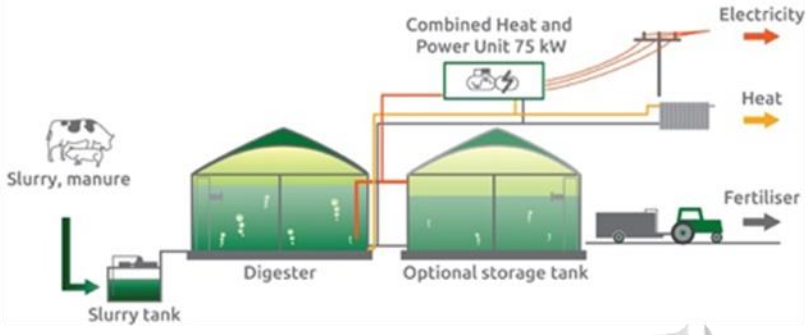


Figure2. Public relations flyer given to all neighbours within 5km radius of proposed facility

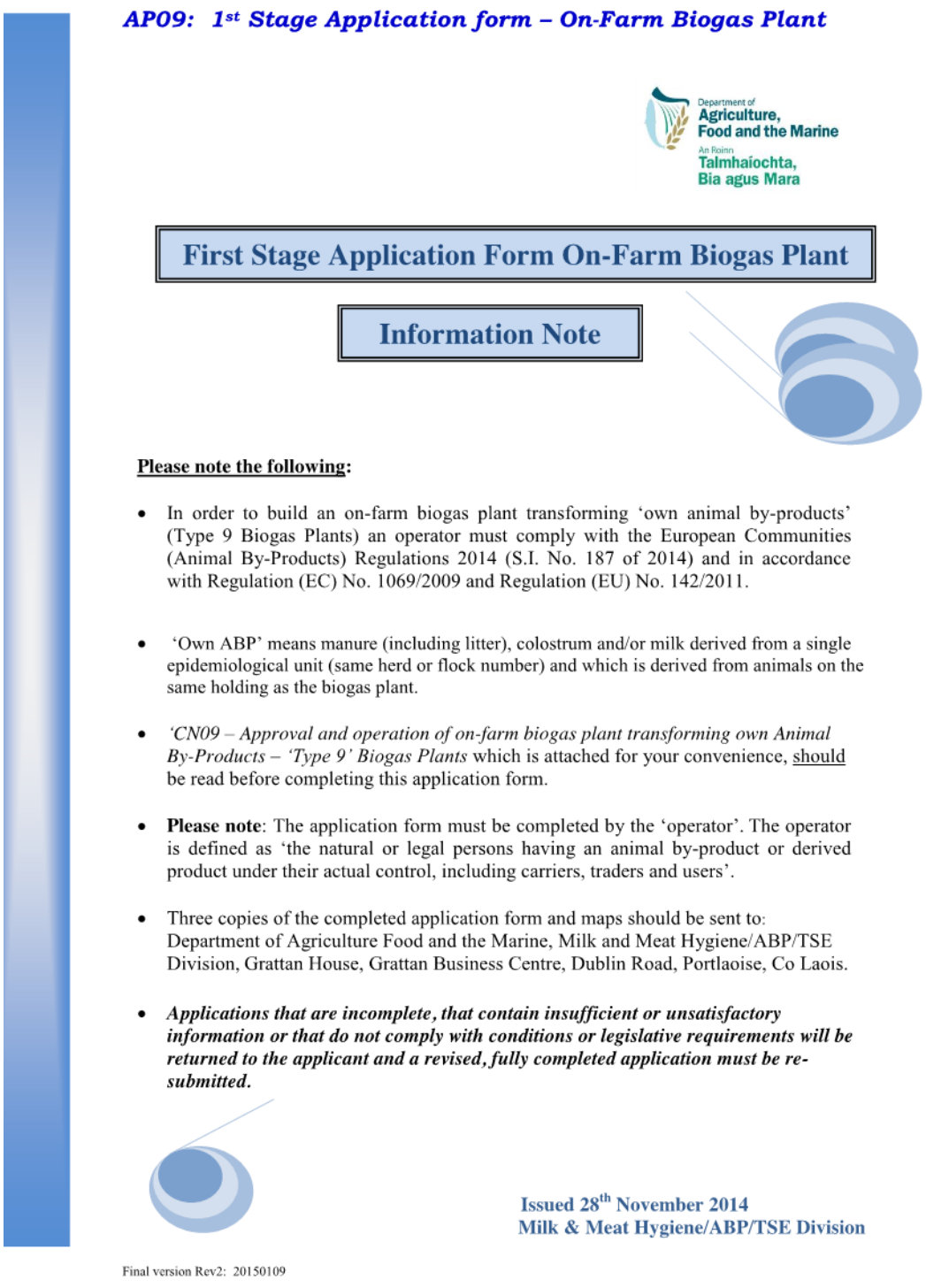
1.1 Planning and Biogas Plant Applications

WATERFORD CITY AND COUNTY COUNCIL **Planning & Development Act 2000 (as amended)** **PLANNING APPLICATION FORM**	**Planning Department,** **Menapia Building,** **The Mall,** **Waterford.** **Phone: 0761 102020 Fax: 0761099701** **Email: planning@waterfordcouncil.ie**

1. WATERFORD CITY AND COUNTY COUNCIL

2. LOCATION OF PROPOSED DEVELOPMENT:	
1.1.1.1.1 Postal Address or Townland or **1.1.1.1.2 Location (as may best identify the land or structure in question)**	Ballynameelagh, Cappagh, Co. Waterford
1.1.1.1.3 Ordnance Survey Map Ref No (and the Grid Reference where available)[1]	6024 (616312,594792)

Figure3. Front page of planning application



AP09: 1st Stage Application form – On-Farm Biogas Plant

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

First Stage Application Form On-Farm Biogas Plant

Information Note

Please note the following:

- In order to build an on-farm biogas plant transforming 'own animal by-products' (Type 9 Biogas Plants) an operator must comply with the European Communities (Animal By-Products) Regulations 2014 (S.I. No. 187 of 2014) and in accordance with Regulation (EC) No. 1069/2009 and Regulation (EU) No. 142/2011.
- 'Own ABP' means manure (including litter), colostrum and/or milk derived from a single epidemiological unit (same herd or flock number) and which is derived from animals on the same holding as the biogas plant.
- *'CN09 – Approval and operation of on-farm biogas plant transforming own Animal By-Products – 'Type 9' Biogas Plants* which is attached for your convenience, should be read before completing this application form.
- **Please note**: The application form must be completed by the 'operator'. The operator is defined as 'the natural or legal persons having an animal by-product or derived product under their actual control, including carriers, traders and users'.
- Three copies of the completed application form and maps should be sent to: Department of Agriculture Food and the Marine, Milk and Meat Hygiene/ABP/TSE Division, Grattan House, Grattan Business Centre, Dublin Road, Portlaoise, Co Laois.
- ***Applications that are incomplete, that contain insufficient or unsatisfactory information or that do not comply with conditions or legislative requirements will be returned to the applicant and a revised, fully completed application must be re-submitted.***

Issued 28th November 2014
Milk & Meat Hygiene/ABP/TSE Division

Final version Rev2: 20150109

Figure4. Application to operate a biogas plant using 'Own ABPs' from the Dept of Agriculture, food and the marine in Ireland.

1.2 Biogas Facility Build

On the 10th May 2017 the construction and installation of the anaerobic digestion plant commenced at Ashleigh Farms. Methanogen were supported by 5 members of Ashleigh Farms throughout the construction and installation phase.

Figure5. Construction work of AD biogas facility at Ashleigh farms

1.3 Operation of AD Facility

The AD facility finished its construction by October 2017 and commissioning immediately commenced under the guidance of Methanogen until the hand over to Ashleigh Environmental once the first phase of commissioning was successfully completed. The first biogas was combusted early October and the facility has been producing biogas since then. The biogas is directly used and combusted in a biogas boiler to provide heat to the anaerobic process to maintain the anaerobic digestion mesophilic process to circa 37˚C.

From figure1 the design of the biogas plant can be clearly viewed from a drone captured image. Pig slurry from various Pig houses is pumped into a 3- day buffer tank (smallest open tank in the image). This buffer tank provides a 3-day reserve of slurry for feeding the AD reactor. The pig slurry is pumped at hourly intervals from the 3-day buffer tank at pre-determined volumes into the anaerobic digester by a progressive cavity pump creating a regular daily feeding regime for the anaerobic microbes to produce methane. The biogas is taken from the head space of the AD tank by a bell over water

pressurizing system which pressurises the gas line to slightly over 1 bar pressure. A water pressure gauge system activates the gas solenoid valves to permit biogas into the gas boiler upon correct pressures being detected.

The hydraulic retention time of the Biowave AD reactor is 10 days. This is the duration that the daily feed of the substrate resides in the AD vessel. A gas mixing system provides an efficient homogenised mixing of the AD substrate to maximise biogas production and efficiency of the process. A gravity overflow pipework system removes the digestate (substrate consumed by anaerobic microbes) into the digestate storage tank where it stored as a nutrient rich fertilizer with low odour for land application.

1.4 Integration of The Biowave Process

Figure6. Delivery and integration of the Biowave system on Ashleigh Farms

The Biowave container arrived on site to Ashleigh farms 09 February 2018. It was positioned by a crane onto 3 concrete plinths with relative ease. The top section was positioned again by crane, sealed and waterproofed on site.

The installation and integration of the Biowave system with the existing AD system occurred over the next three weeks by project partner EMCA. Pipework and pumps were installed from the 3-day raw slurry buffer tank and from the digester to the biowave system. Also, the return and post microwaved sampling pipework from the biowave system was completed in these three weeks along with all electrical and cabling for sensors.

1.5 Fully Operational Biowave System

Fully automated batch microwaving of pig slurry has been achieved by full integration of the biowave system with the on-farm AD process. The SCADA system controls the full system performance and can be fully operated and monitored remotely. Pig slurry substrate is diverted from the AD tank for pre-treatment processing via Biowave system and continues into the AD tank post microwaving. Alternatively, pig slurry digestate can be removed, microwaved and re-circulated back into the AD tank thereby maximising the valorisation potential of the digestate.

An automated sampling control philosophy has been integrated into the biowave system. The sampling occurs as biowave product post microwave flows to enter the AD reactor tank. The sampling process can be configured and automated by the SCADA control system. Samples have been analysed by both project partner LJMU and outsourced to independent laboratories for external validation and analysis which will be discussed later. The complete biowave system is automated with data logging, process alarms and can be operated and monitored remotely as well as on-site by a trained operator.

2 Conclusion

The Biowave project at Ashleigh Farms has been successfully build, integrated, tested and operated since March 2017. Further optimizing and tests are still ongoing as Ashleigh Environmental continues to develop the Biowave process.