



Sustainable Energy Authority of Ireland

National Energy Research,
Development & Demonstration
Funding Programme

FINAL REPORT TEMPLATE

SECTION 1: PROJECT DETAILS – FOR PUBLICATION

Project Title	Demonstration Micro Scale Anaerobic Digester in a School
Lead Grantee (Organisation)	Grian Water Ltd
Lead Grantee (Name)	Kieran Coffey
Final Report Prepared By	Kieran Coffey
Report Submission Date	18 th Aug 2022

	Name	Organisation
Project Partner(s)		
Collaborators		Bandon Grammar School

Project Summary (max 500 words)

MyGug is a product that is at the cutting edge of the smarter and more sustainable energy future. It is a product that embraces the ambitions of a zero waste and circular economy. It reduces the reliance on landfill and provides an immediate solution for the on-site treatment of food waste which will help Ireland meet its ambition of reducing food waste by 50% by 2030 in the Climate Action Plan. One of the commitments in the programme for government is to “continue to work to minimise food waste across the economy and promote food education in the school curriculum. With this project MyGug demonstrates to students this micro circular economy technology. Micro scale anaerobic digestion provides a multitude of environmentally friendly solutions to the problem of food waste. It reduces the requirement to transport waste and associated emissions, it creates a renewable fuel offsetting the use of fossil fuel and the transport emissions associated with that fuel. It creates a usable bio-fertiliser that can be used for growing food locally, reducing emissions associated with the transport of food. It eliminates the requirement of processing and segregation of food waste from other types of waste

such as plastic. No other technology has such a positive effect on the reduction of green house gases.

This project is an education and demonstration project showing children the possibilities of recycling food waste on-site and converting into renewable gas and liquid fertiliser creating a micro circular economy.

Keywords (min 3 and max 10)

Anaerobic Digestion, Biogas, Food Waste, circular economy, climate mitigation, Education

NB – Both Section 1 and Section 2 of this Final Report will be made publicly available in a Final Technical Report uploaded online to the National Energy Research Database.

In the following Section, please provide a clear overview of your project, including details of the key findings, outcomes and recommendations. The section headings below are provided as a guide, please update or add to these as best suits your project.

By submitting this project report to SEAI, you confirm you are happy for Section 1 and Section 2 of this report to be made publicly available. If you wish to request edits to this section in advance of publication, please contact SEAI at EnergyResearch@seai.ie.

SECTION 2: FINAL TECHNICAL REPORT – FOR PUBLICATION

(max 10 pages)

2.1 Executive Summary

MyGug is a fully automated micro scale anaerobic digester for the treatment of all types of food waste. A small commercial MyGug has been installed in Bandon Grammar School. Bandon Grammar has 120 boarding students and 750 students overall. This micro scale digester is located outside the science laboratories and the home economics classrooms. Students from science classes will be assigned the task of taking food waste from the canteen to be fed to the digester every couple of days. The gas that is produced by the digester will be used in the science labs for science experiments and also in one of the cookers in the home economics class. The students will learn first hand the advantages of treating food waste onsite and using the biogas liquid fertiliser locally creating a micro circular economy. .

2.2 Introduction to Project

The MyGug product is designed to tackle the food waste problem at source resulting in multiple benefits for the user and the environment. “MyGug” is a new Micro Scale Anaerobic Digester for use in domestic houses with larger units for small food businesses. There are no other companies supplying digesters with this level of technology in this size range and with the number of features we have designed into our digesters.

These novel features include:

- All our digesters are insulated and will operate in all climates, hot and cold
- Our digesters have a novel heating system to ensure the required temperatures are maintained in cold weather
- External mixing and automatic dosing controls.

The installation of a MyGug in Bandon Grammar School will demonstrate to students, teachers and parents the advantages of treating food waste locally.

2.3 Project Objectives

- 1 Installation of a small commercial digester in a school setting.
- 2 Connection of biogas storage bag to Science Labs for use with Bunsen burners as well as a gas connection to the Home Economics room for use with one of their three gas cookers.
- 3 Demonstration of micro-scale Anaerobic Digester technology will not only show students but teachers and parents the possibilities associated with this technology.
- 4 Educating students in the importance to segregate food waste and not mix with plastics and other wastes.
- 5 Get students involved in operating the digester and learning about anaerobic digestion.
- 6 Demonstrate the microcontroller and IoT capabilities of MyGug.

- 7 Demonstrate that MyGug can operate reliably with no specialist qualifications or experience required by the users
- 8 Students can measure the amount of food waste that is diverted from disposal
- 9 Measure the amount of biogas produced
- 10 Record the types of food wastes digested
- 11 Take a number of digestate samples to measure for FOS/TAC, Dry Solids, VFA analysis, and Total Ammonical Analysis.
- 12 Collation of all data
- 13 Demonstrate the CO₂ savings using this technology
- 14 Demonstrate that this technology can be operated all year round

14.1 Summary of Key Findings/Outcomes

There are societal benefits as well as user benefits including:

- Reduced CO₂ emissions associated with reduced waste truck movements
- Reduced CO₂ emissions from reduced processing of wastes (i.e. Processing & segregation of wastes)
- Reduced CO₂ emissions as biogas generated replaces fossil fuel derived natural gas
- Reduced CO₂ emissions from reduced truck movements for delivering gas cylinders
- Reduced CO₂ emissions as liquid fertiliser replaces fossil fuel derived fertilisers
- Reduced CO₂ emissions as no requirement for industrial composting facilities
- Reduced CO₂ emissions as no transport requirement for compost
- Nutrients are recycled rather than being disposed of in a landfill. There are also known to be N₂O reductions due to anaerobic digestion of wastes and slurries. Nitrous Oxide (N₂O) has a green house gas potential 310 times that of CO₂.¹
- Green House Gases are reduced as a result of all of the above!

Innovation 1: MyGug Micro Scale Anaerobic Digesters

- MyGug are the most advanced micro scale digesters in the world. They are automated and insulated so will operate all year round. We are the first company to provide Anaerobic Digestion technology at this scale.

- Innovation 2: Internet of Things

MyGug digesters are connected to the cloud using our proprietary micro controller and printed circuit board. Operation data from this digester is sent to the cloud and can be monitored and controlled remotely.

14.2 Project Impact

It is estimated that each EU citizen produces approximately 92kg of food waste (food and inedible parts associated with food waste) per year. This equates 88 Million tonnes of food waste with 46.5 Million Tonnes being derived from households in the EU28 per year².

Effective management and treatment of biodegradable waste is a topic of increasing concern for governments across the globe. The organic fraction of residual waste which is dominated by food waste is problematic as it is putrescible; it contaminates recyclable material in combined waste collection systems and releases methane to the atmosphere when deposited in landfill sites.

¹ Peter Jacob Jorgensen, PlanEnergi, Biogas Green Energy

² Fusions; Estimates on European Food waste levels 2012 figures

Methane has a global warming potential over a 100 year time horizon of 30 times³ that of carbon dioxide and is a significant contributor to climate change.

Biodegradable Municipal Waste disposed to landfill in Ireland increased in 2015 and 2016⁴. It is essential that adequate treatment infrastructure is provided in the State to manage the increasing targets required in the Landfill Directive⁵. Grian Water's solution is to treat food waste where it arises as the problems associated with treatment of food waste later results in the likelihood of contamination of the biodegradable fraction with other contaminants such as PVC and other micro plastics⁶.

14.3 Recommendations

A 2012 "Regulatory Impact Analysis on household waste collection" (RIA) by the then Department of Environment, Community and Local Government (DECLG) estimated the Irish waste management market to have an annual turnover of at least €500 million. The household waste collection market was estimated to be worth at least €250 million annually. Within the so-called Circular Economy package, EU and Member States are committed to meeting the United Nations' Sustainable Development Goals (SDGs), adopted in September 2015, including a target "to halve per capita food waste at the retail and consumer level by 2030, and reduce food losses along the food production and supply chains".

MyGug will be ideally placed to take advantage of financial incentives and changes in legislation in the EU that are coming down the track to achieve the United Nations SDG⁷.

To protect the environment and human health, the EU [Waste Framework Directive](#) has two key objectives:

- 1. To prevent and reduce the negative impacts caused by the generation of waste**
- 2. Management of waste and to improve resource efficiency.**

The Directive defines a 'hierarchy' to be applied by EU Member States in waste management. Waste prevention and re-use are the most preferred options, followed by recycling (including composting), then energy recovery – this is where MyGug will position itself in the market.

EU research also shows that there is growing awareness among European consumers that improved waste management helps to reduce ill health and environmental problems, reduce greenhouse gas emissions (directly by cutting emissions from landfills), and avoid negative impacts at local level such as landscape deterioration due to landfilling, local water and air pollution, as well as littering. The fitting of the MyGug unit in the gardens, grounds and basements servicing households will also limit the traffic on the street scapes as there will be a reduction in mobile waste collection trucks on the streets and roads.

The MyGug product is in line with the [7th Environment Action Programme](#) priority objectives for waste policy in the EU:

- To maximise recycling and re-use;
- To limit incineration to non-recyclable materials;
- To phase out landfilling to non-recyclable and non-recoverable waste;
- To ensure full implementation of the waste policy targets in all Member States

³ <http://www.ipcc.ch/>

⁴ EPA publication Biodegradable Municipal Waste 2010 - 2016

⁵ Council Directive 1999/31/EC of 26th April 1999

⁶ N.Weithmann, J.N.Moller, M.G.J.Loder, S.Piehl. R.Freitag: Organic fertiliser as a vehicle for the entry of microplastic into the environment, Science Advances 2018

⁷ The efficient functioning of waste markets in the European Union, Legislative and Policy Options