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CCU EXPOSES THE NEED FOR A NET ZERO MINISTER

ADBA DECLARATION ON CLIMATE CHANGE DELIVERED TO PM

METHANE HOLDS THE KEY TO HALTING CLIMATE CHANGE

THE ULTIMATE BUSMAN'S HOLIDAY FOR AD OPERATORS

MEET THE NOMAD – MOBILE DIGESTATE TREATMENT

ENGINE INNOVATION POWERS MOBILE DIGESTATE ENHANCEMENT

AD developers have created a new multi-fuel engine to unlock the full potential of digestate for small AD plants. Meet the NOMAD.

The fertiliser produced by anaerobic digestion is an excellent product as it contains a high degree of nitrogen in a form that is readily available to crops. This product, known as digestate, can be utilised whole or it can be separated into a liquid and a solid fraction. The solid fraction is typically used on ploughed land, or it can be used as a soil top-dressing.

The liquid fraction is utilised in a manner similar to any other liquid fertiliser, deployed to land up to a specified nitrogen loading rate, ideally utilising low emissions spreading equipment.

Nevertheless, digestate does suffer from several challenges:

- It contains a great deal of water (typically 95%-97%), thus increasing the costs of transport and deployment;
- Its nutrient content is variable and, since it is a closed system, corresponds directly to the original anaerobic digester (AD) feedstock, which itself is variable;
- Depending upon the feedstock source, the digestate can potentially contain unwelcome contaminants such as antibiotics, plastics and heavy metals.

The capital cost of creating bio-fertiliser products is prohibitive for many small AD plants. Thus, a group of engineers, academics and businesses came together to design and build a '**N**ovel **O**rganic recovery using **M**obile **AD**vanced technology' or 'NOMAD' system.

NOMAD's aim is to create an integrated, small-scale, modular, mobile solution to recover fibre and specific nutrients from digestate. Because the system is mobile, it could serve multiple small AD plants, sharing costs that would make it more viable than individual installations. It could also service large AD operators with tankerage/storage issues.


Mobile fruit juice processing by Alvan Blanch Development Co Ltd

Grey water a key goal

Fifteen partners from Greece, UK, the Netherlands, Romania, Malta, Germany, Italy and China form part of this EU Horizon 2020-funded project. The three-year project, which runs from 2019-22, will carry out field trials in four countries: on digestates from animal residues in Greece, crop wastes in Italy, municipal wastewater in Malta and food waste in the UK.

Each country has its own specific challenges ranging from regulatory bottlenecks through to challenging geography and specific contaminants. Malta, as an island, presents an interesting opportunity to divert digestate from landfill and to recover water, particularly as the country has dry soil conditions and limited land mass for growing food. Malta currently sends all organics to landfill to protect its water table.

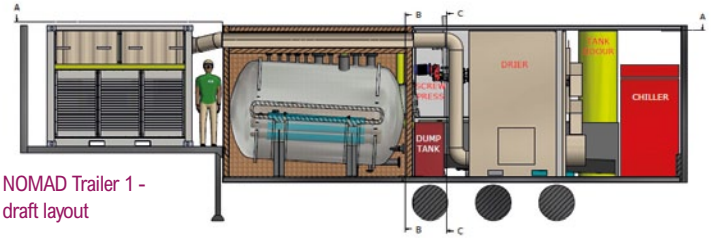
Development Engineer Guy Blanch brings more than 25 years' experience working for companies as diverse as the family business, Alvan Blanch Development Company and Loowatt, co-founding LEAP Micro AD with Rokiah Yaman in 2017. He enjoys the challenges of this project which combines both the engineering and the bio-chemical aspects, but also the deeply entrenched cultural norms and taboos surrounding human and animal waste.

Guy, who has engineered diverse equipment such as mobile fruit processing and pasteurisation systems in sub-Saharan Africa, bio-fuel systems, human waste pasteurisation equipment in Madagascar and micro-AD systems, is well-placed to tackle the engineering of the NOMAD system. He outlined some of the varied challenges, "Previous mobile projects that I've been involved with - such as processing fruit juice - have fairly strict parameters in terms of inputs and outputs and capacity, but they can still get quite complicated by having to merge batch and continuous processes."

However, processing and preparing digestate for the NOMAD trials is even more challenging for the LEAP team. Guy continues, "Where we potentially have antibiotics in the digestate which could be transferred to the organisms in the soil, we need to have a different approach to, for example, removing contaminants such as these and micro-plastics which occur in some food waste digestate. Ultimately, we want to end up with 'grey water' which could be used for a number of purposes such as re-use in the AD plant or for irrigation where expensive potable water is not necessary."

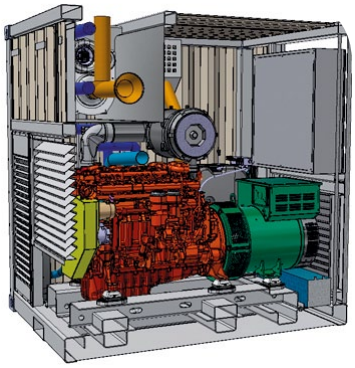
Inside the NOMAD

The mobile unit will macerate, pasteurise and separate the digestate into liquid and fibre fractions and then tackle the nutrient recovery and antibiotic removal from the liquid fraction. The solid fraction will be dried for use in the NOMAD compost trials as a soil amendment. The project aims to reduce the volume of the digestate by a minimum of 25% to reach the project scope targets.



NOMAD Trailer 1 - draft layout

One of the interesting facets of the project is to recover waste heat from an engine on-board the vehicle to utilise it for the pasteurisation phase. To this end, Guy has worked with Project Engineer Hugh Hodgson who was coaxed out of retirement to join LEAP to help design an innovative heat transfer



solution for the system. The NOMAD system needs to be self-sufficient in heat and power to operate the process as it will be tested around the UK and Europe.

The 250kWe / 275kWth multi-fuel CHP developed by LEAP and currently under construction is flexible enough to operate on multi fuels such as hydro-treated vegetable oil (HVO) diesel or gas. The system can use recovered engine heat or utilise heat from an on-site CHP to provide heating for the NOMAD pasteurisation process. It also produces electricity for process or other local uses.

Much of the preparation work was in designing the layout. Guy comments on this phase, "It was great fun. Now that the pictures on the screen are actually taking place in the workshop, it's full steam ahead to get both trailers ready in time for commissioning later in the year."

Exhaust after treatment and Heat Recovery during workshop build on a LEAP CHP

Global Britain

The NOMAD project was fortunate to have been sponsored by Scania engines (UK) at quite an early stage of the project, which has enabled them to stretch the limited budget into building two trailers to house the extra equipment needed for the process.

Guy is working alongside Rokiah Yaman, who coordinates fundraising and project delivery at LEAP Micro AD, a socially minded micro-SME dedicated to developing micro-AD technology as part of a broader circular bio-economy solution.

In addition to being involved in several circular economy projects around the world, LEAP have created several circular economy 'Living Lab' sites that demonstrate the closed-loop ethos in public spaces in central London and elsewhere in the UK. They are also involved with Energy Catalyst projects, focusing on high-rate AD solutions and small- scale nutrient recovery solutions for Africa.

Macerator & Separator in mobile framework, for placement in Trailer 1

NOMAD is being led by the Centre for Research and Technology Hellas (CERTH), one of the largest research centres in Greece. In addition to engineers, communications experts, equipment providers and pilot site hosts, several academic partners are providing a range of skill-sets essential to the project.

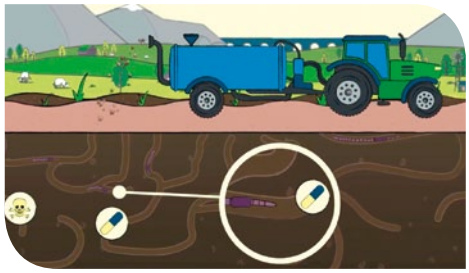
Pasteurisation vessel and 100kWe heater, Trailer 1

These institutions include:

- IHE Delft, who aim to develop a method to reduce the risk of active pharmaceutical compounds;
- University College London, who will carry out a life cycle assessment and utilise their know-how to support project decision-making;
- University of Florence, who will examine fertiliser potential of the products, and assess yields, nutrient cycles and GHG emissions;
- and the Institute of Urban Environment at the Chinese Academy of Sciences, who bring extensive expertise and facilities for the design of an advanced process recovering specific nutrient compounds at reduced cost.

A sustainable and commercial solution

Such a multi-disciplinary project not only pushes forward the engineering technology on many fronts integrating established processes with cutting-edge developments. It also highlights the roles that regulation, public perception and economics play in similar circular economy initiatives, revealing both challenges, as well as a wealth of new opportunities.



Risks and rewards; communication is an integral part of the NOMAD project.

The concept of mobile AD processing originated from the 'Hub and PoD' concept (www.cropgen.soton.ac.uk/Hub&PoD2.htm) developed by Professor Charles Banks et al at the University of Southampton. This was then studied further in a feasibility study (https://bit.ly/3cOOdRg) by the 2012 WRAP 'Developing Innovation in Anaerobic Digestion (DIAD)' project. As industry members of the Environmental Biotechnology Network, the NOMAD team are always keen to bring their skills together with academics in collaborative projects.

Guy concludes, "We seem to have generated a fair amount of interest from our equipment suppliers in this build and this really helps boost the confidence that we are taking a step in the right direction, developing both a sustainable and commercial digestate processing solution."

Anyone interested in the technology can attend a stakeholder engagement meeting which will be held online and at University College London on 16 September 21 from 11.00 am – 2.00 p.m.

Find out more about the NOMAD project here: www.projectnomad.eu/ where further details of the meeting will also be posted in due course or contact Rokiah directly at info@madleap.co.uk. Here is the link to the NOMAD video: https://youtu.be/Ckdj61JhXOI

EBNet Environmental Biotechnology

UKRI Biotechnology and Biological Sciences Research Council

The Research Corner is co-ordinated by the Environmental Biotechnology Network (EBNet), a free-to-join network of academics, industry and government, funded by the Biotechnology and Biological Sciences Research Council (BBSRC). EBNet's remit is in the area of engineered microbial systems for environmental protection, bioremediation and resource recovery. These microbial systems include anaerobic digesters, systems used in wastewater treatment, microbial systems used in remediation of contaminated soils and much more.