

# 2023 National Energy Research and Policy Conference

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SEAI National Research, Development & Demonstration Funding Programme

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# Poster Session



# Optimising Energy Efficiency Potentials and Compliance in Wastewater Treatment: The ACET Framework

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1. School of Engineering, University of Galway, 2. Ryan Institute, University of Galway, 3. Vortech Water Solution

## Overview of our SEAI RD&D project outcomes and learnings

- ACET – adaptive control for energy efficiency in WWTPs.
- Aeration a key energy consumer in WWTPs.
- WWTPs consume 1% of global electricity.
- Aeration often uncontrolled and can consume 40 – 75% WWTP electricity.

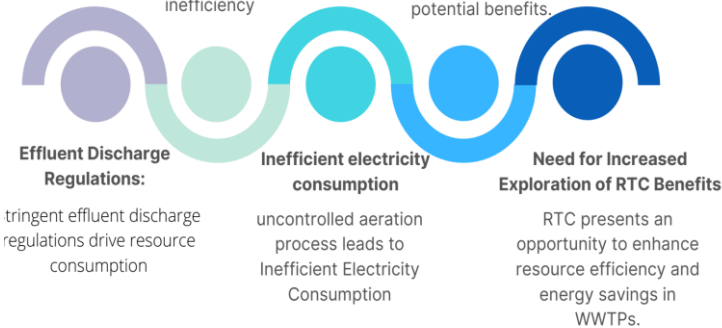


### Constant Operation of Key WWTP Processes

Increased Resource Consumption and inefficiency

### Opportunity for Real-Time Control (RTC)

The adoption of RTC in wastewater treatment has potential benefits.



## Our views on how this research could inform policy making

### Promoting RTC Adoption:

RTC adoption in WWTPs can significantly reduce costs, lower energy consumption and reduce emissions while maintaining compliance

### Holistic Efficiency Framework:

The ACET framework's holistic approach, covering equipment, process design, and sensor integration, offers policy guidance for comprehensive control strategy assessments. Policies should prioritize integrating these aspects to optimise energy savings and regulatory compliance.

### Tiered Classification for Investment:

The development of the tier system enables classification of WWTPs by energy efficiency, aiding policymakers in resource allocation for targeted resource allocation that maximises cost benefits and energy savings. This guides investments towards energy-efficient control enhancements in wastewater treatment.



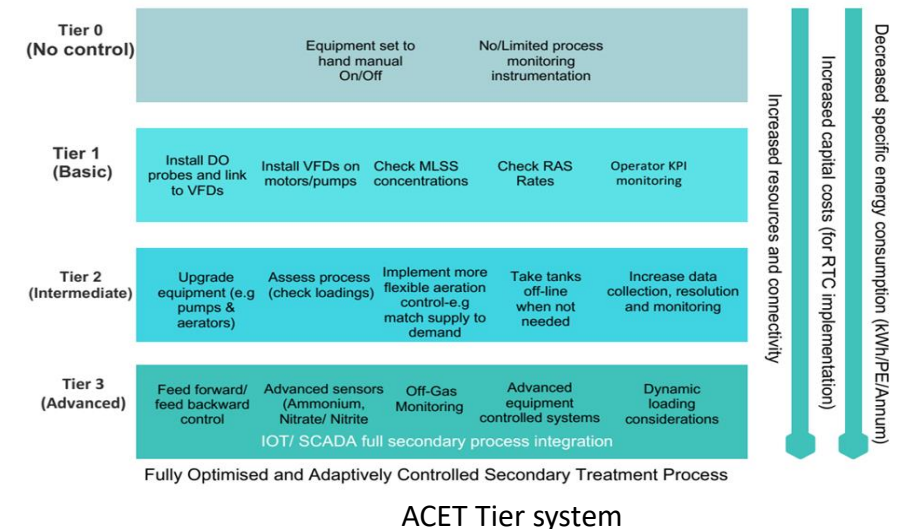
*This project has been funded by the Sustainable Energy Authority of Ireland under the SEAI Research, Development & Demonstration Funding Programme 2022, Grant number RDD/477*

## Our vision for the research required to enable and support energy security in Ireland.

- Advancing wastewater treatment through adaptive control,
- Fostering innovation through technology trials,
- Employing a four-tier framework to classify facilities.

### Research Results

- Stakeholder interviews: Field operators showed potential for improvement by identifying opportunities for energy savings, while awareness of control potential was appreciated.
- Case study: The analysis of energy data shows that upgrading of aeration and control technology in WWTP improved treatment efficiency and energy savings. By optimising the aeration process, operators can achieve improved energy efficiency and make substantial progress towards achieving energy-saving goals.
- Emission reduction efficiency: In carbon emission analysis, lower emissions across all the KPIs were noticed when upgrading from lower to higher tier system.



# Climate Change related Domestic retrofit Overheating Risk Mitigation (CC-DORM)

Principal Investigators: Dr Mark Mulville, Dr Ciara Ahern. Post-Doctoral Researcher: Dr Chibuisi C. Okorieimoh (chibuisi.okorieimoh@tudublin.ie)



## Project Overview

This project aims to address the growing concern of overheating in domestic dwellings associated with climate change and large-scale retrofit. The project will utilise dynamic building simulation carried out on representative dwelling typologies and specifications for Ireland, supported by future weather projections from Met Éireann's TRANSLATE project. Model outputs will be validated by measurement of real-life example dwellings.

Project results will be shared with stakeholders on an open-access basis allowing for informed decision-making.

The Project is being undertaken within TU Dublin's Built Environment Research Group.

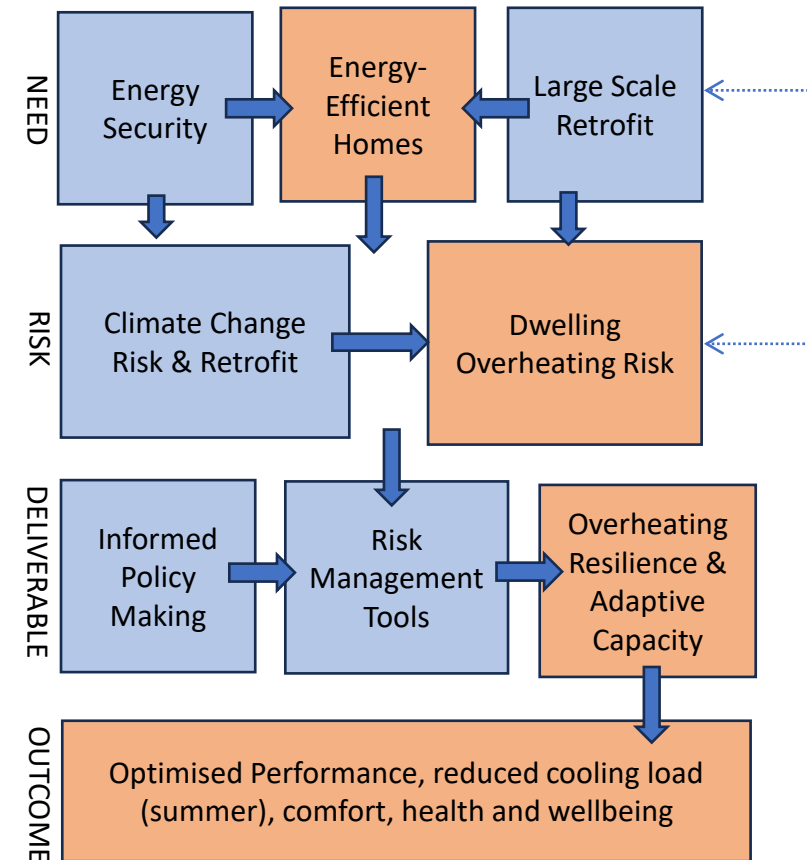
## Project Objectives Include:

- Determining the level of overheating risks in dwellings in Ireland now and in the context of future climate scenarios, by dwelling type and specification (pre and post-retrofit)
- Developing an accompanying overheating risk assessment tool for stakeholders
- To support research-informed decision making

## CC-DORM will inform policy-making by:

- Appraising the adequacy of the existing regulatory framework in relation to overheating risk.
- Providing an evidence base for overheating risk in dwellings in Ireland.
- Identifying dwelling typologies, configurations and specifications at high risk of overheating, enabling suitable policy and regulatory interventions.
- Presenting mitigation and adaptation strategies.

## Vision Towards Supporting Energy Security in Ireland with CC-DORM





# Floating Offshore Wind (FLOW) Arrays

## a key step in achieving Ireland's energy security

### Research needed to support energy security in Ireland

- FLOW is a key step in Ireland's decarbonisation pathway & attaining energy security
- This is an emerging industry & there is little experience or reliable data
- **The IDEA-IRL project** will fill the research gaps



Website



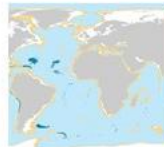
### Expected project outcomes



Supporting IEA Task 49 - IDEA & placing Ireland at forefront of international collaboration to facilitate FLOW development



Open source site datasets; FMECA datasets; and FLOW array reference designs



Marine Spatial Planning – gather best practices, open questions & potential innovations



Engage Irish Stakeholders – identify supply-chain gaps/opportunities & raise awareness of FLOW



Scenario-based modelling and a roadmap for the sustainable development of FLOW in Ireland

### Informing policy making

Provide recommendations including:

- Level of financial support and/or seabed leasing fee
- FLOW specific amendments to the MSP regime
- Realistic local content requirements
- Supports, policies and programs to max local content
- Strategic infrastructure & investment timelines



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# Remote and autonomous inspection and maintenance of onshore and offshore wind turbines [REMOTE-WIND]

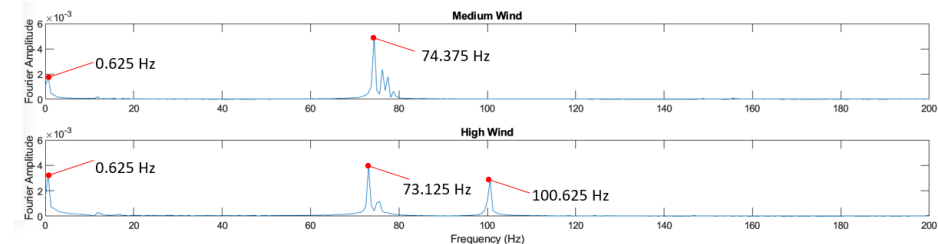
## REMOTEWIND – A Rigorous and Comprehensive Irish Evidence Base on Non-Contact Monitoring & Inspection of Wind Turbines

REMOTEWIND demonstrates how we can use advanced technology to rapidly assess the condition of onshore and offshore wind turbines throughout their life – from concept stage to decommissioning and sustainable reuse. We demonstrate this with Multi-Point Laser Doppler Vibrometry, Drones and Remotely Operated Vehicles, supported by edge communications and bespoke data analytics with real-time capability, creating a robust performance benchmark.

## REMOTEWIND LEADS TO PATHWAYS TOWARDS STANDARDISATION

- Guidance for onshore and offshore health monitoring of onshore & offshore wind turbines
- Guidance for advanced and rapid inspections of wind turbines
- Evidence base for better operations and maintenance (O&M) solutions for national companies
- Engagement with normative organisations and groups globally
- Creating operational procedures for non-destructive assessments of turbines throughout life-cycle

## REMOTEWIND: Rapid Wind Turbine Assessment Using Mechanics, Sensor Technology & Cutting-Edge Data Analytics



This project has been funded by the Sustainable Energy Authority of Ireland under the SEAI Research, Development & Demonstration Funding Programme 2022, Grant number 22/RDD/613. Additional support from Science Foundation Ireland NexSys 21/SPP/3756

## Overview of the project outcomes and learnings:

ICOS (IoT2Cloud Operating System) is a European funded project which features more than 20 organizations across 11 EU countries.



ICOS aims to develop an operating system connecting different computer processing and storage capabilities (IoT, Edge and Cloud) where data will be managed in a secure, sustainable way.

SSE Airtricity will help design an Energy Management and Decision Support System (EMDS) which will use IoT technology and AI to help consumers reduce energy waste and costs.

The EMDS will be tested in Irish households equipped with SMART technologies, with automated decisions tailored to customer needs.

## Views on how this research could inform policy making :

- Artificial Intelligence and smart connected devices can play an important role in decision making for more efficient and sustainable energy management.
- The knowledge attained during the ICOS trial will enable energy providers to assist domestic and business users by providing more detailed energy reporting.
- ICOS outputs could support development of new customer offerings and viable energy solutions for optimal, cost effective and predictable energy usage.



## Vision for the research required to enable and support energy security in Ireland:

The ICOS system will allow customers to navigate through the complex and dynamic environment of the energy market.

Customers with Electric Vehicles, Heat Pumps, PV systems and storage capabilities will play a fundamental role in the transition towards net zero emission energy systems.

The ICOS AI 'brain' will shape the future of the Prosumers with the aim of reducing energy waste and costs, flattening the demand curve by removing demand on the grid at peak time and boosting energy usage at night-time.

ICOS will improve demand flexibility (e.g., the capacity of demand-side loads to change their consumption patterns on a time scale) making the electric grid more reliable (avoid grid loss) and increasing the usage of renewable energy sources.





TRACT

# Shared Mobility Hub Trials in Dublin Suburban Region – TRACT Project

Tushar P. Choudhari, Ubaid Illahi, Brian Caulfield, Margaret O'Mahony

Department of Civil, Structural & Environmental Engineering, Trinity College Dublin, Dublin, Ireland



Scan QR code or [Click here](#) to learn more

## Expected Outcomes

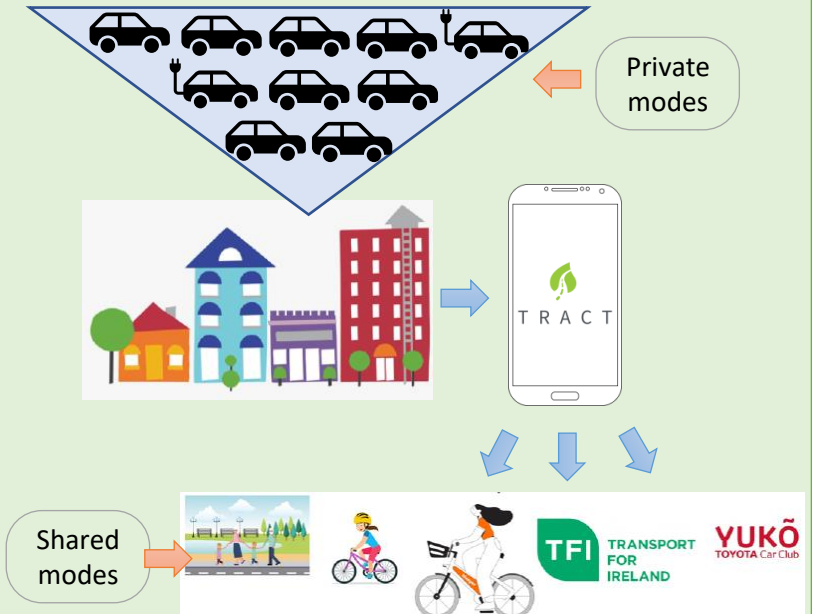
- **A shared-car that replaces 10-16 private cars** on road which is beneficial for Ireland's decarbonization mission
- Research Highlights the need for **holistic functioning of mobility service operators** which are currently operating individually
- Develop TRACT **smartphone app** that will **merge Yuko/Toyota (shared car) and Bleeper (shared bike)** app platform
- Record **user's choice** and analyse **perceived barriers** using a questionnaire survey
- **Learn nudging techniques** that will encourage users adopting shared mobility services

## Policy Making

- Inform policy makers **the benefit of shared mobility options** in car-centric areas
- Provide **success-fail matrix** of **nudging techniques** while encouraging behaviour **shift** towards shared cars/bikes
- Suggest **possible locations** where successful nudging techniques can be implemented
- Evaluate **emission savings** with active travel modes and shared cars
- Help **disseminating the awareness** among private car users such as reduced car ownership and carbon emissions due to shared cars/bike
- Suggest whether **provision of subsidies** would change **perception** towards shared mobility

## Vision

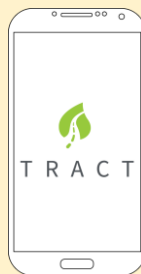
- To encourage private car-users to **shift** towards multi-modal and shared transportation systems through reliability and evidence-based analysis





## 1 Expected Outcomes

- Collect **one of the largest datasets on EV** usage potential in Ireland



- Highlight the importance of **interdisciplinary and holistic approach** for emission mitigation and decarbonisation of transportation sector

- Provide evidence from **five use-cases** where the EV uptake has been slow



- Estimate **emissions savings** and determine its **potential national impact** through scenario analysis.

## 2 Informing Policy Making

- Emphasise **piloting** and use of **tech tools** for spreading mass **awareness**
- Understand **perceived barriers** beyond those related to financial towards EV adoption and **motivations** thereof to tackle them
- Analyse **second-hand EV market** that has little to no evidence
- Formulate **tailored** as well as **integrated policy instruments** specially focussing on population/sectors with slow EV uptake
- Suggest **policy frameworks** required to maximize the estimated impacts towards achieving 2030 and 2050 emission reduction and **climate change targets**

## 3 Future Research on Energy Security

**Vision: Optimise EV adoption through evidence-based solutions, policies, and sustainable infrastructure, emphasising reliability and environmental impact across the lifecycle.**

Future research recommendations:

- Understand and stimulate EV uptake in **Commercial sector**
- Test policies that encourage **intermodal solutions** by integrating EVs with public transit, shared mobility services, cycling, and walking
- Conduct pilots to capture public response towards **smart charging** and **advanced EV infrastructure**
- Push uptake of **sustainable energy** and determine potential of upscaling it

# Community owned/co-owned onshore wind farms: Examining the extent and the determinants of citizens' willingness to participate under different types of arrangements

Dr. Gordon Sirr, Dr. Bernadette Power, Dr. Geraldine Ryan, Dr. John Eakins and Dr. Ellen O'Connor

## Key learnings

The following key learnings are based on a 2022 survey of 826 Irish citizens who lived within 10 km of a onshore wind farm in operation, construction or planning/pre-planning:

- 1) Irish citizens are generally willing to participate in community owned/co-owned projects, though only a minority are "very willing" to participate.
- 2) Irish citizens tend to prefer shared revenue arrangements over wholly community-owned projects, joint ventures and split ownership agreements.
- 3) Irish citizens are generally more willing to participate in community ownership/co-ownership arrangements in later stages of a project's development (e.g., construction and operation stages).
- 4) Factors including citizens' (i) knowledge about wind farm development, (ii) trust in the wind farm developer, (iii) level of support for a project, (iv) general business acumen, and (v) age, all impact their willingness to participate in projects.
- 5) Other factors such as procedural justice and community spirit also impact citizens' participation decisions.

## Implications for policymaking

- 1) Community co-ownership has the potential to increase acceptance of developer-led onshore wind farms, especially through shared revenue arrangements.
- 2) Community co-ownership could be facilitated by allowing citizens to participate in such arrangements at a later stage in a project's development.
- 3) While community ownership/co-ownership generally appeals to Irish citizens, policy interventions may be needed to encourage more active citizen engagement.
- 4) Government supports to improve citizens' knowledge about wind farm development could help to promote increased citizen participation in deeper forms of community ownership/co-ownership including wholly community-owned projects, joint ventures and split ownership arrangements.
- 5) Measures aimed at developing trust between communities and developers, such as increased community engagement by developers, information campaigns and communication initiatives, could help to promote more active citizen engagement in co-ownership arrangements.

## Future research

In relation to community ownership/co-ownership of onshore wind farms, future research is needed to address the following questions:

- 1) Would learning about the benefits of community ownership/co-ownership increase citizens' willingness to participate in such projects?
- 2) Would guarantees over energy security and prices increase citizens' willingness to participate in community owned/co-owned projects?
- 3) How can skilled intermediaries (e.g., government bodies) best be utilised to assist communities in establishing community owned/co-owned projects?
- 4) How can existing community organisations and networks best be utilised to foster more active citizen participation in onshore wind farms?
- 5) Would acceptance of future planned wind farms be enhanced by enabling community ownership/co-ownership of existing projects?

*This project has been funded by the Sustainable Energy Authority of Ireland under the  
SEAI Research, Development & Demonstration Funding Programme 2018 (Grant Number: 18/RDD/281).*

# FabTrads

## How can this research inform policy making

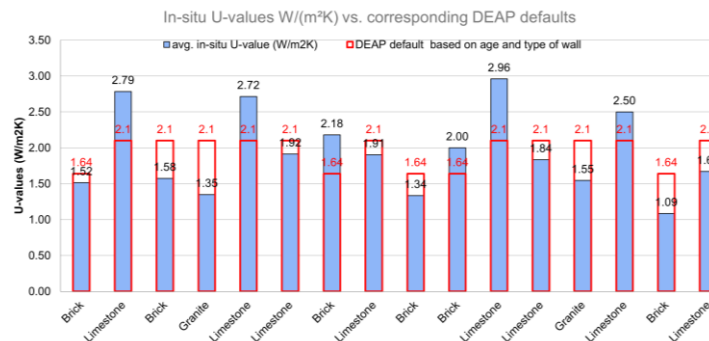
More than 15% of Irish buildings is of traditional construction; there still is insufficient understanding of their material characteristics to assess conservation strategies and their energy performance ratings.

The FabTrads project looks to improve BER (DEAP) assessments of such buildings and to support more precise hygrothermal modelling by measuring the full hygrothermal properties for a range of building materials in use in Ireland between 1700 and 1940 through laboratory testing, and by measuring the in-situ U-values of traditional walls.

## Hygrothermal Properties of Traditional Irish Building Materials

### Project outcomes and learnings

BER assessments of the pre-thermal-regulation building stock (pre 1978) currently rely on default U-values.



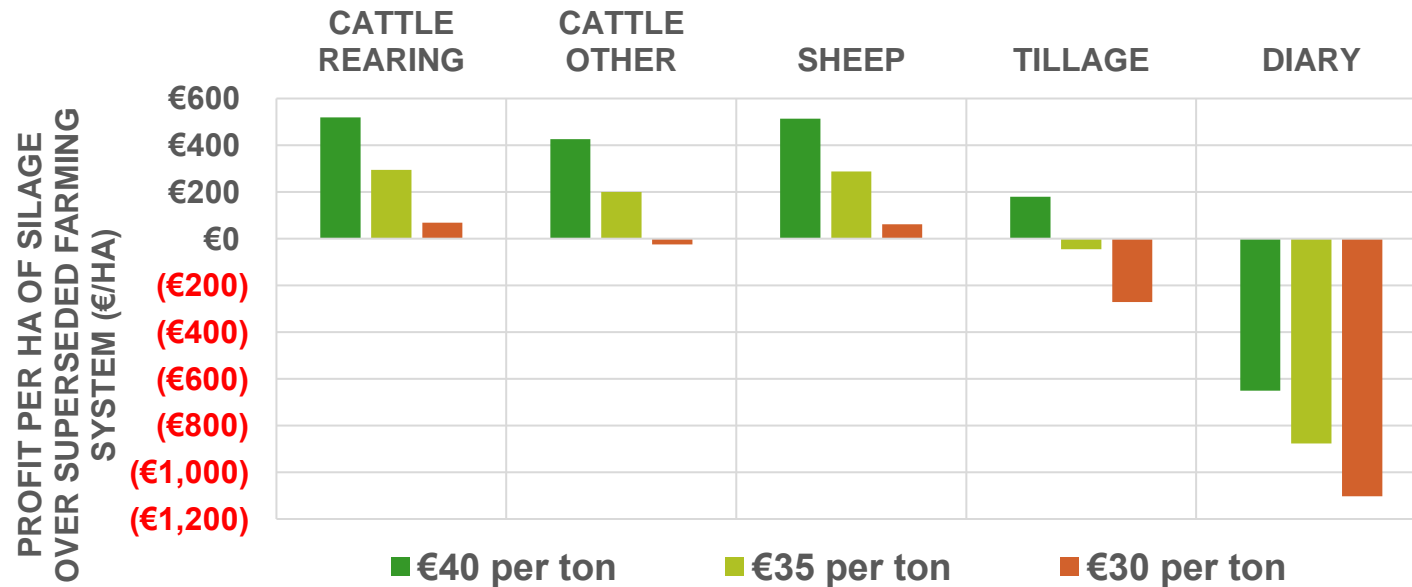
In-situ U-values of traditional walls and thermal conductivities measured in the FabTrads project confirm issues with such defaults and highlight the importance of the moisture content, determined by the hygrothermal properties of the materials.

### Outlook on research in the field to support energy security

The outcomes of the project will allow further research into appropriate retrofit strategies for existing buildings and into establishing the effect of better moisture management on their thermal performance.

By enabling successful retrofits, the embodied energy in those buildings is not lost, less energy will be required for the provision of high-quality habitable buildings, and more of the building stock can be operated at a lower energy demand.

# Analysis of producing silage for AD in Ireland



## Policy implications

Grass – red clover silage for AD is a net producer of organic nitrogen fertiliser per ha. This could reduce Ireland's dependency on imports of chemical nitrogen.

20% of farmers surveyed stated willingness to supply AD plants with feedstock, highlighting the risks which include social acceptability and farmer inertia to change.

## Vision for the research in AD

Digestate and nutrient management will be crucial to ensure sustainable production of feedstock in the circular bio-economy.

In depth spatial and enterprise analysis required to evaluate how AD could complement existing farm enterprise in terms of three dimensions of sustainability; economics, environmental and social.

## Bio-economic Model & National Farm Survey Results (2018-2020)

Silage made from grass – red clover reduces the cost of production compared to perennial rye grass only, particularly in high input price year such as 2022. The red clover reduces the GHG emissions associated with silage production.

Provided a suitable price of €35+ per tonne is paid for grass – red clover silage, supplying an AD plant with silage may be more profitable than the existing farm enterprise during the reference years of 2018-2020.

# HAWK: Hibernian Airborne Wind energy Kites

## Overview of your SEAI RD&D project outcomes and learnings

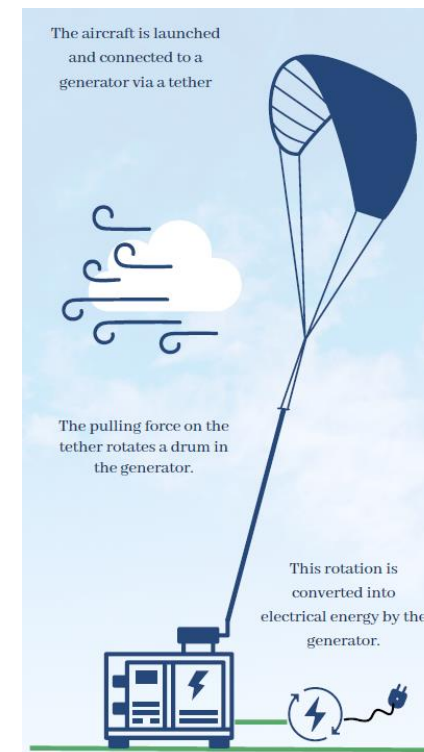
*Airborne Wind Energy (AWE) is a novel technology which aims to harness the wind's energy using tethered kites. This technology is a new source of renewable energy, which will compliment traditional windfarms. This project will shed light on the key barriers and research gaps associated with bringing AWE systems to commercialisation. This research into AWE is relevant to Ireland's energy security because a new source of renewable energy will increase indigenous energy generation.*

Funding acknowledgement e.g. *This project has been funded by the Sustainable Energy Authority of Ireland under the SEAI Research, Development & Demonstration Funding Programme 2022, Grant number 22/RDD/893*

## Your views on how this research could inform policy making

- *This research into AWE is relevant to Ireland's energy security because a new source of renewable energy will increase indigenous energy generation.*
- *The HAWK project aligns well with the Irish Government's Research Priority Areas 2018-2023 as it falls under two research themes: Energy, Climate Action and Sustainability; and Manufacturing and Materials.*

## Your vision for the research required to enable and support energy security in Ireland.



# Predicting GREEN electricity generation potential from wind and solar for optimised GRID management (GREEN-GRID)

**GREEN-GRID will develop near real-time wind and solar maps for power systems modelling, optimal location of power generating units, and cost-benefit analysis for residential solar.**

- New, detailed wind resource maps will assist in optimising the placement of turbines for onshore wind, reducing installation lead times and feasibility costs, and accelerating installation.
- The impact of widespread intermittent residential solar on the grid at fine scaled temporal resolution will be fully modelled for the first time.
- The developed wind and solar maps will allow for energy systems robustness modelling. The solar maps will provide *advanced and accurate* cost-benefit analysis methods for residential homeowners accelerating the contribution of micro-generation.

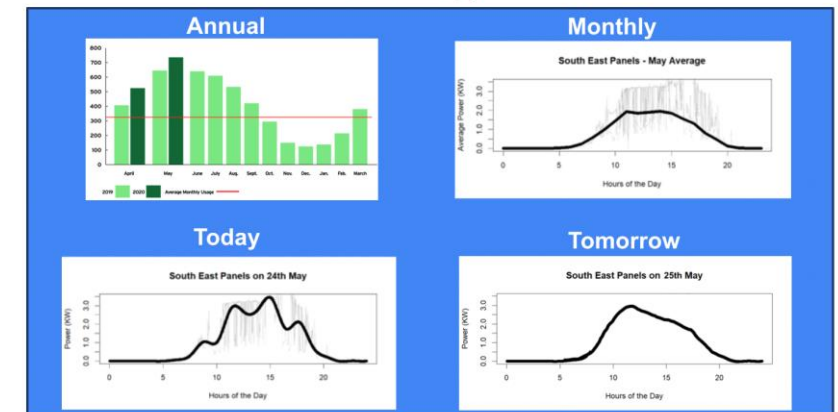
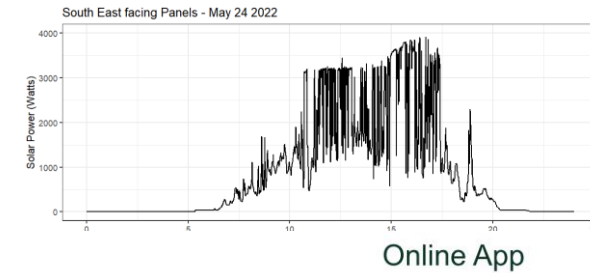
**The GREEN-GRID project will lead to accelerated installation of power generating units and expedite the uptake of residential solar.**

**GREEN-GRID will:**

- Assist Eirgrid and ESB networks in optimising grid preparedness for incorporating additional renewable sources of energy generation.
- Engage with community-led wind power representatives to reduce costs and timescales of feasibility studies for local communities wishing to contribute to the green transition.
- Develop finely detailed solar maps at a national level that will allow for accurate cost-benefit analysis for solar installation by residential homeowners and comprehensive financial evaluation of the contribution of solar grants provided by the SEAI.

**Using the example of solar, the GREEN-GRID project will use data from sensors and data contributed by stakeholders.**

Sensor data will be modelled using state-of-the-art spatio-temporal statistical models and projected to fine scaled temporal resolutions at the eircode level usable by homeowners.



# GEBTech Plus: Green Energy Boosting Technology for Sustainable Pig Production

Dermot Hughes, S. Nolan, C. James, R. Friel, V. O’Flaherty, K. McGrath

## Overview of your SEAI RD&D project outcomes and learnings

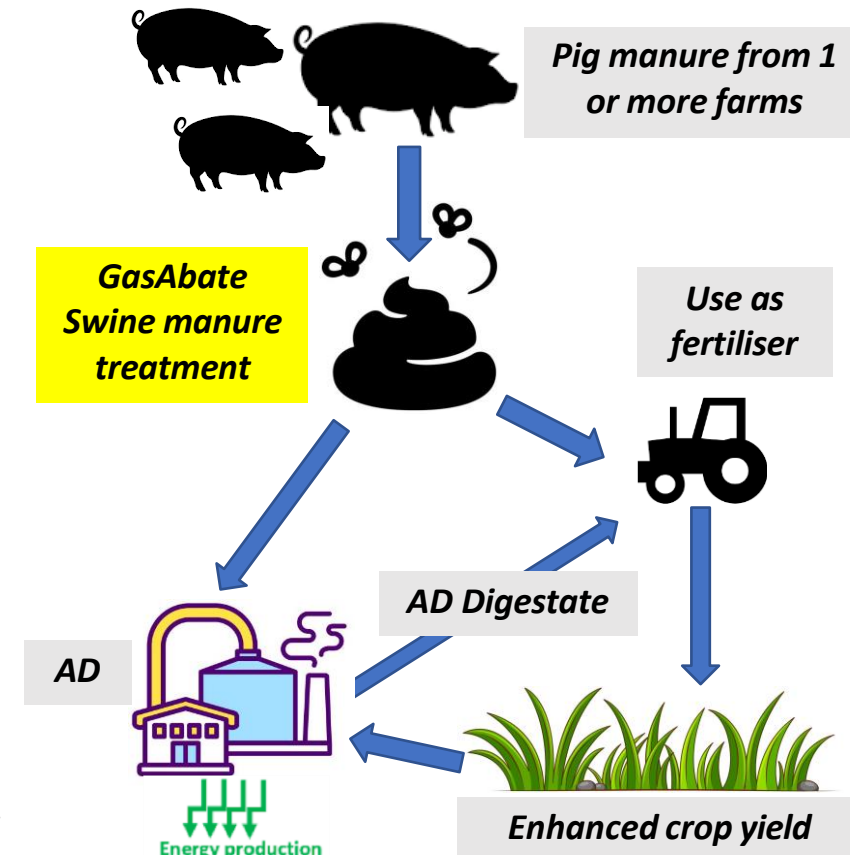
GlasPort Bio’s additive - **GasAbate Swine** is used on stored pig manure to halt gaseous emissions **↓75% methane, ↓78% nitrous oxide, ↓50% ammonia**, positively impacting odour emissions **↓76% hydrogen sulphide**, energy output using anaerobic digestion (AD) **↑100% biogas** and nutrient content **↑100% Carbon, ↑75% Sulphur, ↑20% Nitrogen**.



## Your views on how this research could inform policy making

- GEBTech Plus has showcased the **viable use of pig slurry feedstock in a mono-digestion AD set-up**.
- Project outcomes **validate the use of additives** as means of reducing GHG emissions for stored agricultural manure.
- Policy-makers have access to an operational on-site demonstration of manure treatment – energy production – agronomy enhancement at an Irish commercial pig farm.

Your vision for the research required to enable and support energy security in Ireland.





# ELSA

Earning Local Support Academy  
for Energy Projects



## Overview of your SEAI RD&D project outcomes and learnings

*As pressures mount, it's crucial for Ireland's 'Just Transition' to build competence to enable adherence to **both** its foundational goals of transition **and** justice. The absence of enough of the latter leads host communities to go into opposition to seek protection from what they term 'irresponsible projects'.*

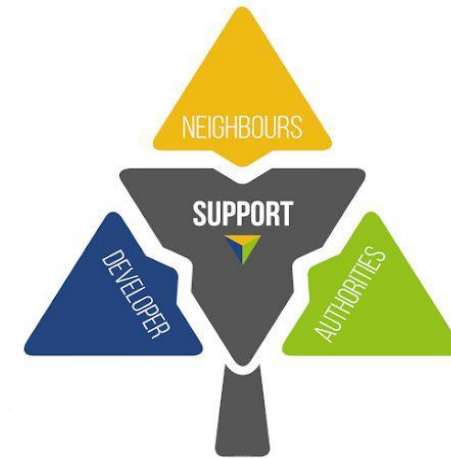
*This RDD helps bridge this gap through fostering mutual understanding between **host communities** and **developers**. It leads to the delineation between welcome & unwelcome projects. This enables them to guide renewable energy designs in line with mutually agreed sustainable development principles.*

## Your views on how this research could inform policy making

*This research crisply demarcates between why some projects are locally acceptable, and others not. It offers policymakers key pointers to enhance existing guidance to support both developers and host communities. An example is the inclusion of the OECD & AA1000 stakeholder engagement standards during early project design (currently only recommended for the Offshore Community Benefit Fund).*

*This RDD demonstrates the role of co-design in creating renewable energy projects that not only foster community development and cohesion, but are also attractive to investors.*

## Your vision for the research required to enable and support energy security in Ireland



*Effective collaboration and credible information that empowers the above groups to craft renewable energy initiatives that secure local approval - while aligning with Ireland's climate and other national goals - is a key pillar going forward.*



# Developing Cascading Biomethane Biochemicals and Biofertiliser Systems for a Circular Bioeconomy in Ireland (CABBBIE)

## Overview of your SEAI RD&D project outcomes and learnings

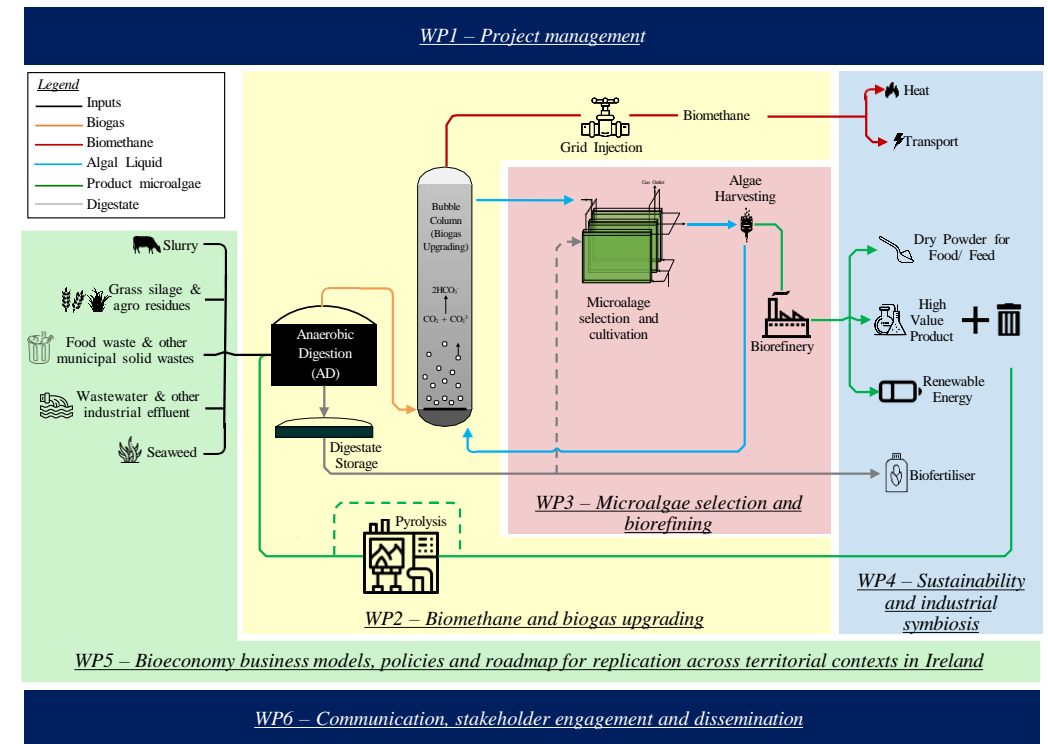
*Photosynthetic biogas upgrading using microalgae, may overcome the economic and environmental obstacles of biomethane production via a Cascading Algal Biomethane Biorefinery System or CABBS.*

*By allowing flexibility in the choice of bio-products derived from microalgae, this process can be adapted to local requirements within a bioeconomy system and can also possibly develop into a negative emission technology.*

## Your views on how this research could inform policy making

- The project aims to provide a scalable and commercial process to decarbonise the economy and ensure economic security.*
- The project will advise targeted policy development to address technological, environmental and social barriers.*
- This should stimulate policy development and support for AD, microalgae biotechnology and polygeneration systems in the EU and Ireland.*

## Your vision for the research required to enable and support energy security in Ireland.





# Energy Consumption and Indoor Environmental Quality in Naturally-Ventilated A-rated Dwellings: An Irish Context

Ibrahim Alhindawi<sup>a</sup>, Miriam Byrne<sup>a</sup>, Divyanshu Sood<sup>b</sup>, James O'Donnell<sup>b</sup>, James McGrath<sup>ac</sup>

<sup>a</sup> Physics Unit, School of Natural Sciences and the Ryan Institute's Centre for Climate and Air Pollution Studies, University of Galway, Galway, Ireland.

<sup>b</sup> School of Mechanical & Materials Engineering and UCD Energy Institute, University College Dublin, Dublin, Ireland.

<sup>c</sup> Department of Experimental Physics, Maynooth University, Maynooth, County Kildare, Ireland.

## Overview of the Project

The project assesses the capability of natural ventilation to reduce energy consumption while maintaining indoor environmental quality (IEQ) within energy-efficient (A-Rated) buildings.

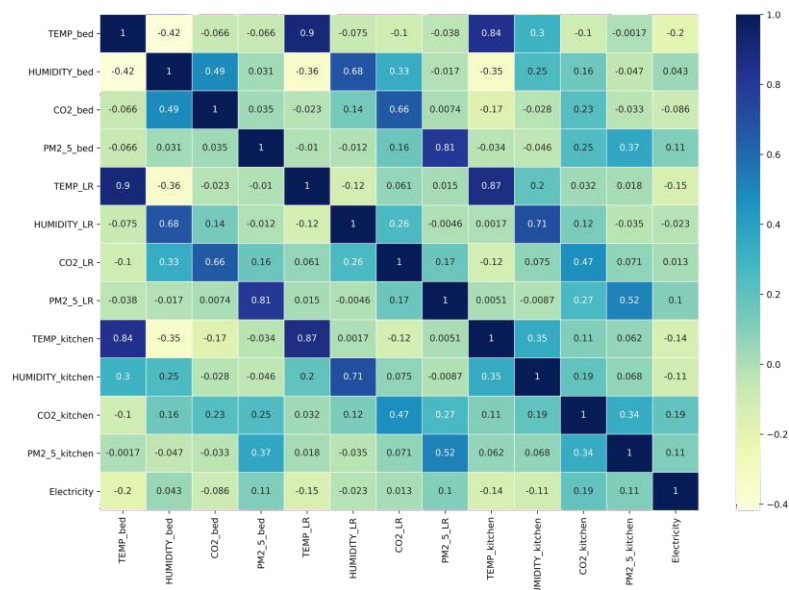


Figure 1: Results Example: IEQ parameters vs energy consumption

## The Project and Policy Making

In order to avoid policy failure and adverse human health effects, there is a need to ensure that regulatory measures are framed to achieve multiple objectives. Trade-offs between thermal comfort, human health and energy performance need to be considered from a realistic perspective, if the current policies are to be effective. This research aims to inform policy making via creating a realistic dataset and providing recommendations that overcome the human comfort/health vs energy efficiency dilemma.

## The Project's Vision

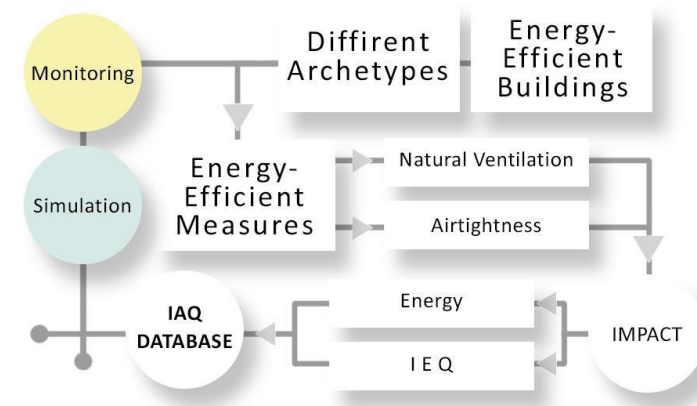


Figure 2: Project's Vision

This dataset will form an open access repository that is available to all relevant stakeholders. An accessible dataset of this scale will have exceptional potential for wide-ranging analysis in areas such as building performance studies, economics, and health risk assessment.

# Inclusive Sustainable Cycling (ISCycle): Inclusive Ebike Uptake and Sustainable Use

## Core research team:

James Green (PI)  
Yvonne Ryan  
Colin Fitzpatrick  
Catherine Woods  
Stephen Kinsella  
Louise Foley  
Darren Garland

## Overview of SEAI RD&D project outcomes and learnings:

ISCycle is a multidisciplinary research project with two central aims:

- To examine the effectiveness of an ebike loan behaviour change intervention to increase active travel and reduce private vehicle use.
- To understand the environmental impacts of increased ebike ownership in Ireland, including waste sector and circular economy impacts.

## How this research could inform policy making:

- ISCycle will generate evidence on the potential substitution effect of ebikes in the Irish context, informing policies relating to ebike loan and purchase schemes.
- Findings will highlight the preparedness of the waste management sector for increased ebike use, informing policies on repair, reuse and recycling.

## Research required to support energy security in Ireland:

Multidisciplinary

Inclusive transition

Sustainability

Behavioural perspectives

Policy oriented



PAfH

Physical Activity for Health  
HRI Research Cluster  
University of Limerick



An Roinn Iompair  
Department of Transport

*ISCycle is supported with financial contribution from the Department of Transport and the Sustainable Energy Authority Ireland under the SEAI National Energy Research, Development and Demonstration Funding Programme 2021 (Grant Number 21/RDD/736)*