DIFOWT

DE-RISKING IRELAND'S FLOATING OFFSHORE WIND TARGETS

PARTNERS

Rockall Research Limited

MMCC Port Marine Ltd

WaveVenture

WIND ENERGY IRELAND

FUNDED BY

This research was funded by the Sustainable Energy Authority of Ireland under the SEAI Research, Development & Demonstration Funding Program 2023, Grant number 22/RDD/923.

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DURATION:

January 2024 – December 2025

Project Outcomes

The **DIFOWT Project** aims to de-risk Ireland's FOW sector to ensure its timely and economically viable development. To achieve this, the project will engage with stakeholders to identify and confirm current evidence of these risks' impacts, and simulate the future development of FOW in Ireland up to 2050 to understand the broader implications for national targets.

Additionally, the project will disseminate evidence-based recommendations and outputs to stakeholders to mitigate risks and accelerate the development and commercialization of FOW in Ireland.

Project Learnings

The outputs of the **DIFOWT Project** will de-risk Ireland's FOW sector and be used leverage investment for port and infrastructure development as well as the procurement of appropriate vessels and the development of a skilledworkforce.

The outputs will include the results and analysis of simulations designed to model the FOW development pipeline in Ireland. The simulations will put to test general assumptions associated with FOW development and the impact of varying these assumptions. Understanding the risk and quantifying the impact is a key output of the DIFOWT project.

The project will publish regular project updates, which will provide data from the modelling activities for the future use of FOW wind turbines in Irish waters, as well as news from monthly reports from the project partners.

Informing policy

The outputs of the **DIFOWT Project** will be used to guide policy by:

providing stakeholders with the information to aid in the understanding of how the policy decisions will impact the future of FOW development

and

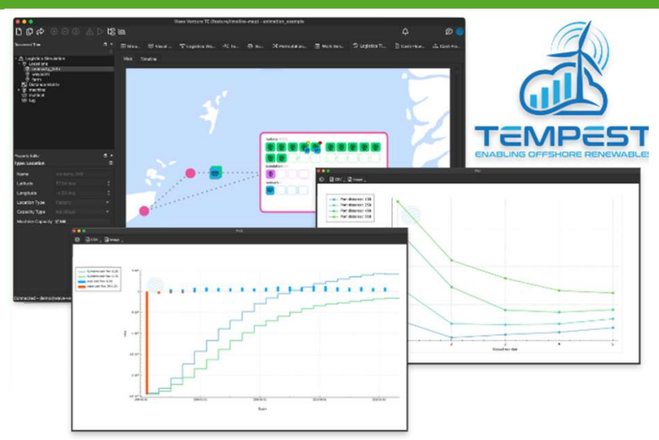
Allowing key policy makers to test their decisions against the evidence to better understand the impact.

Future research

Ireland has ambitious targets to install some 37 GW of offshore wind generation capacity by 2050. This development requires several ports to be developed, a multitude of vessels and operated and the training of a workforce with the skills to install, operate and maintain these units.

Continuous research to evidence the requirements and their impact is needed to make FOW a commercial reality in Ireland. This ongoing commitment will give developers and investors the confidence to make real change and achieve the Irish Net-Zero targets

Check out the **DIFOWT Project** website at **https://info.windenergyireland.com/difowt-project** for info on the project and the project objectives.



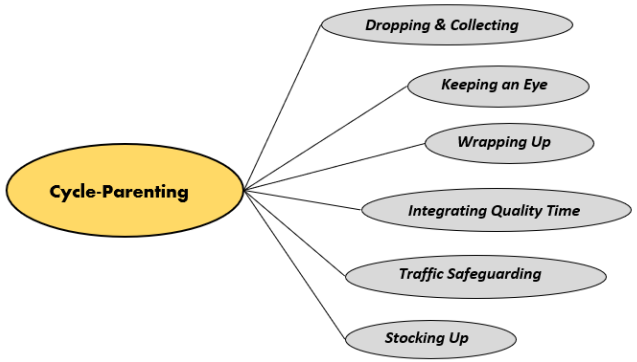
E-Cargo Bikes & Everyday Mobility in Ireland

Dr Robert Egan[ab], Dr Hannah Julienne[a], Prof Brian Caulfield[b]

[a]SEAI Behavioural Economics Unit, [b]Centre for Transport Research, Trinity College Dublin

Provisional Outcomes

- 19 interviews carried out with private e-cargo bike owners.
- E-cargo bikes (ECBs) used to practice 'cycle-parenting'.
- Cycle-parenting involves multiple sub-practices:
- ***Dropping and collecting:*** ECB experienced as more efficient mode for travelling with children compared to escort active/public transport journeys or driving.
- ***Keeping an eye:*** supervising one's child rendered easier by ability to place child(ren) in front of (box) ECB vs back seat of bicycle or car.
- ***Wrapping up:*** ECB enabled the 'cocooning' of one's child(ren) unlike conventional bicycle, protecting child from natural elements, motion, collision, and pollution.
- ***Integrating quality time:*** recreation incorporated into mundane journeys, particularly for children. More stimulation than car from observing/exposure to outside environment. Ability to play, eat, sleep, and read as ECB passengers like car.
- ***Traffic safeguarding:*** parents found ECB's could command more respect from drivers in terms of passing distances vs using conventional bicycles. More confidence taking conspicuous position on the road as ECB considered 'family vehicle' like a car.
- ***Stocking up:*** ECB used by some as primary vehicle to carry provisions from supermarket to home (*more common with box-style ECB). Prioritising carriage of children could compete with 'stocking up' household function of ECB.



Emerging Policy Relevance

This study will provide comprehensive insights into the intersectoral policies needed to expand the substitution of private car journeys – and potentially private (first or second) car ownership – with e-cargo bikes.

- Grants and incentives for ECB purchase for families, with particular focus on parents ineligible for 'Bike to Work' scheme.
- Grants and incentives for developing ECB home-end cycle parking facilities.
- Guidance for ECB-friendly cycleway and cycle parking infrastructure design.
- Social marketing for ECBs as alternative electric vehicles for family mobility.
- Guidance on planning requirements for destinations that may involve the collection and carriage of goods (e.g., food and hardware shops) from the perspective of ECB accessibility relative to the private car.

Future Directions

- Complete qualitative phase of study (aim: 25-30 interviews)
- Using Grounded Theory method, develop remaining two major categories of private ECB user experience and practice: i) the challenge of parking one's ECB in public and private space securely and conveniently, ii) the process of committing to purchase and rely on an ECB for private family transport.
- Conduct a nationwide quantitative survey study investigating private ECB user practices/problems and perceived value of different policy measures.


Photo: Robert Egan

Funded by the Sustainable Energy Authority of Ireland under the SEAI Fellowship Pilot Programme 2022, Grant number 22/RDDF/756

The Environmental Impact of Large Scientific Infrastructure

Dr Patrick McBean[1,2], Dr Jonathan JP Peters[1,2], Dr Stephen Dooley[1], and Dr Lewys Jones[1,2*]

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[2]Advanced Microscopy Laboratory, CRANN, Trinity College Dublin, Dublin, Ireland

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Project Overview

- Sustainability labelling of products is common in the consumer sector both in the EU and abroad.
- This work aims to develop a system for auditing and labelling the sustainability of infrastructure such as MRI machines, sintering furnaces, and electron microscopes, among many others.

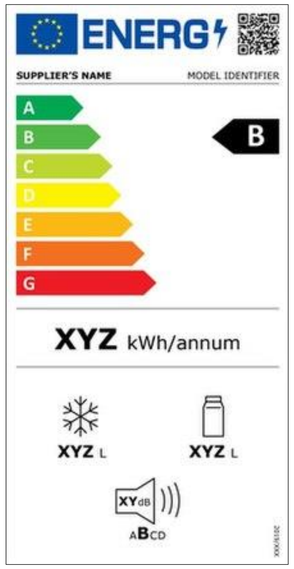


Figure 1: *Example energy efficiency label for consumer appliances in the EU.*

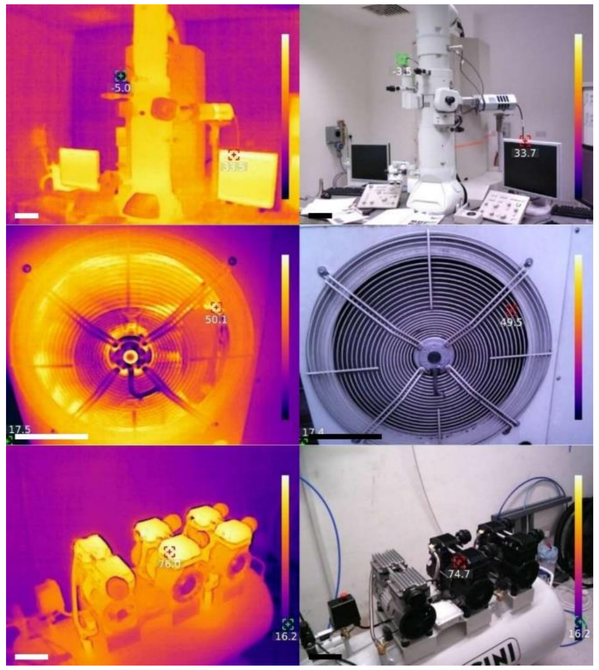
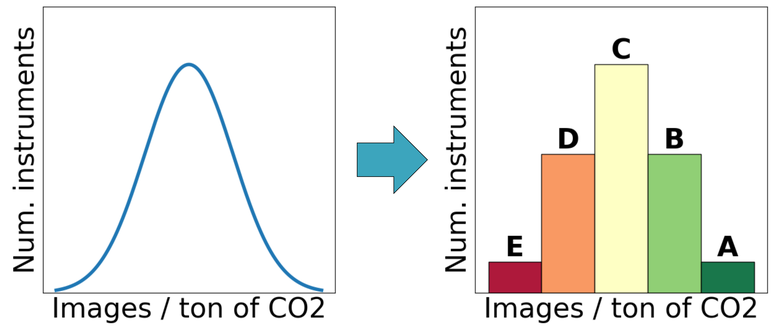


Figure 2: *Thermal imaging of a JEOL 2100 TEM (top), chiller ventilation system (middle), and building air compressor (bottom).*

Informing Policy Making

- By collecting data on the complex energy usage of these instruments, their sustainability can be classified.



- Eventually, we hope this will lead to enhanced policy direction and apply pressure to manufacturers to be more mindful in the future design and manufacture of what is today wholly unlabelled hardware.
- Usage patterns of these instruments can also be adapted to further improve their efficiency.

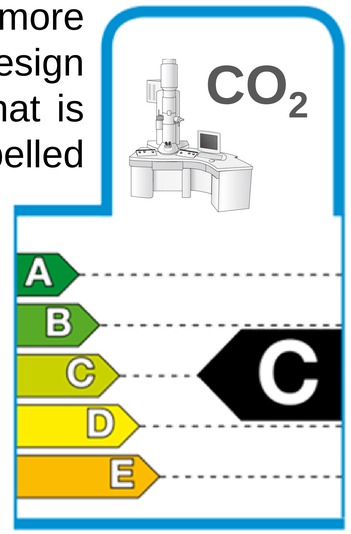


Figure 3: *Workflow for the creation of a new labelling system (for TEMs in this example).*

Future Research

- Assessment of non-TEM infrastructure is needed.
- If you manage large scientific equipment, please get in contact with us either over email or access the assessment tool using the QR code below.

- This is still an early alpha version, and we are grateful for any feedback or data submitted.
- Improvements to building design in new facilities would be a major improvement to the energy footprint of this instrumentation such as:
  - Recycle waste heat
  - Shading of building to reduce summer heat
  - High quality insulation and air sealing

Funding

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/836.

ISCycle: Inclusive Sustainable Cycling

Outcomes and learnings

Modal shift: Interim analyses at Site 1 (*n*=60) revealed that participants cycled 7km more per week during the loan period. Those who never cycled pre-loan demonstrated larger increases. Among 104 participants who have completed the ebike loan, 70% agreed the ebike enabled them to cycle more often and over half used routes they had not previously cycled. Formal analysis will indicate the full extent of modal shift that can be attributed to the ebike loan.

Circular economy: The fleet of 56 ISCycle ebikes so far has had no battery or motor failures, with repairs falling into the range of "normal" bike repairs. Studying the circular economy of ebikes revealed several learnings, including facilitating repair, resale and recycling of ebikes through measures such as ebike mechanic training.

Inclusion: ISCycle participants have so far included a balance of women, people with childcare responsibility, and people who never used an ebike before. The wide range of ebikes available, including light folding, cargo, and commuter ebikes has widened access to a range of users, e.g. with specific transport needs such as transporting children, thereby widening inclusion in a low-carbon energy future.

Relevance to policy

- Modal shift data will identify the potential for ebikes to reduce our dependence on high-energy transport modes. Interim results highlight the potential utility of ebikes to previous non-users. Some participants so far have listed fuel cost savings and reduced impacts on the environment as perceived advantages of ebiking.
- Regarding utility of ebiking in everyday life, so far 78% agreed ebiking can replace private car trips to work, 42% agreed for grocery shopping, 72% agreed for leisure, and 20% agreed for transporting children/passengers, highlighting the diverse functions of ebiking as a car replacement across settings (*n*=104 responses collected to-date).
- ISCycle has generated several recommendations for enhancing existing bike schemes to ensure inclusiveness and sustainability in Ireland's low-carbon energy future. These include widening and diversifying access to support families with changing bike needs, as well as people outside of current employment-based subsidies, and including second-hand bikes in line with circular economy principles.

Vision for energy research

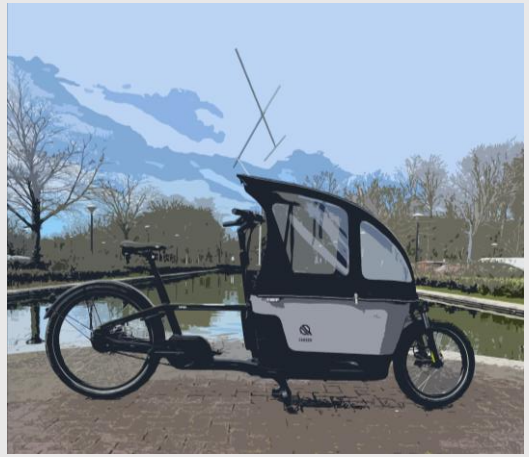
Multidisciplinary

Inclusion

Sustainability

Behavioural focus

Policy-relevance



Contact us: iscycle@ul.ie
Follow us: @iscycle_ie
Website: www.iscycle.ie

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)

Revolutionising Offshore Floating Wind Technology in Ireland

Overview of Project Outcomes and Learnings

DeepWindDemo

- Develop two 5kW helical VAWTs
- Install and test the turbines on a single floating platform
- Decarbonise Fish Farms by providing an alternative to fossil fuel generators

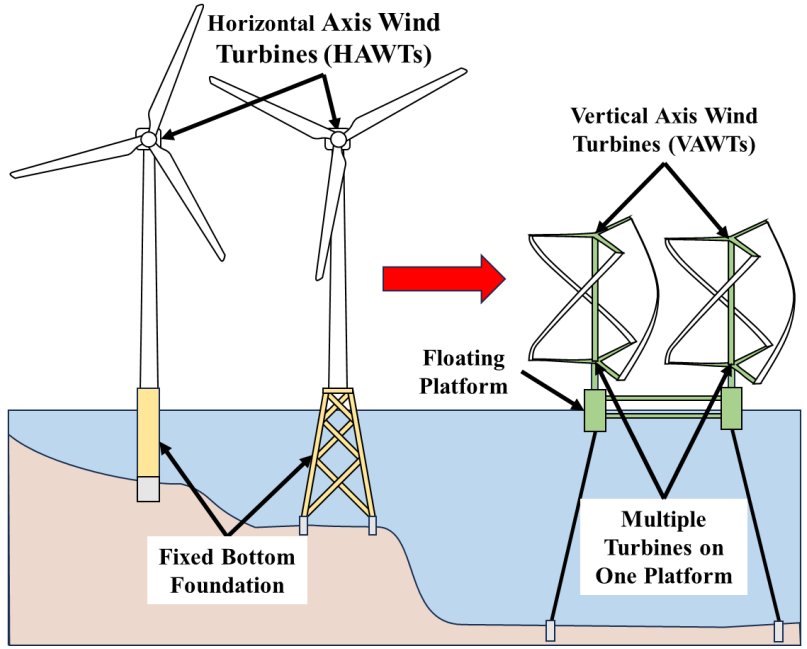
Mega 4Wind

- Find pathways for developing MW scales floating VAWTs in deep water
- Reduce levelised cost of energy through simplified turbine design
- Install multiple VAWTs on a single platform

Impacts of the Research on Policy Development

- Support Ireland's 2024 Climate Action Plan targets to generate 37GW of offshore wind energy by 2050
- Decrease dependency on fixed-bottom HAWT turbines in shallow water by providing alternative technologies to harness the vast wind energy resources in the deep oceans around Ireland
- Data collected from simulations and experimental trials will better inform policy on the suitability of floating VAWTs and where they can be installed
- Reduce the levelised cost of energy for deep sea turbine developments.

Vision for Enabling Ireland's 2050 Energy Targets



Academic and Industry Partners

ÉIRECOMPOSITES

Ollscoil na Gaillimhe University of Galway

UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh

These projects have been funded by the Sustainable Energy Authority of Ireland under the SEAI Research, Development & Demonstration Funding Programme, grant numbers: 21/RDD/655 and 22/RDD/873

Winning hearts & minds

Bringing Social Science to the core of Renewable Energy Developments

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

Our SEAI RD&D project shows how the integration of social science and community development into renewable energy project designs can remove many of the community opposition obstacles facing energy infrastructure. This results in a significantly changed engagement approach: Social science is added from the outset as a fourth project development pillar alongside financial, technical, and environmental, delivering successful developer - community relationships that enable renewable energy roll-out onshore and offshore.

Your views on how this research could inform policy making.

This research underscores the necessity of embedding social science principles and realities into renewable energy policy. By enforcing early, meaningful community engagement - as defined by social science - opposition to projects can be reduced, and planning processes streamlined. Implementing these strategies will be pivotal in achieving Ireland's renewable energy targets and ensuring a just transition - independent of what changes are undertaken with the planning law.

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

Future research should focus on building cross-stakeholder trust and capacity in engagement models: developers need to see that enhanced procedural and distributional justice delivers more renewable energy projects. This includes benchmarking against best practices for integrating community voices and values early in the development process and creating frameworks that align renewable energy developments with community vision.

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/874

Offshore Renewable Energy (ORE) Technologies Group

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Projects

FLOAT-EOB	Developing a 200kW floating wind platform deployed in Cork Harbour, providing a globally unique test infrastructure.
MARINERG-i	Coordinating a Distributed Research Infrastructure of European test facilities to accelerate the deployment of ORE.
RISENERGY	Access programme to testing facilities, identifying and promoting ways to scale up renewable energy technologies.
IDEA-IRL	Developing reference Floating Offshore Wind (FLOW) Array designs and a long-term roadmap for sustainable development in Ireland.
Atlantic Float	Testing FLOW platform technologies that can survive the dynamic conditions of the Atlantic Ocean.
Wet Storage	Examining the requirements and potential sites for wet storage of FLOW units prior to installation.

WIND → WAVE → TIDAL → SOLAR → MULTI-PURPOSE

1. DESIGN PHASE	2. PLANNING PHASE	3. OPERATIONAL PHASE
Hydrodynamic & numerical modelling; Physical model testing	Resource assessment	Operations analysis
Device assessment	Site Planning	Logistics & financial modelling
Fixed substructures	Metocean Assessment	Port Facilities
Floating Platforms & Mooring Systems	GIS Mapping	
Array design & optimisation	Big Data Analysis	
Electrical Control		

Our research supports the development of innovative ORE technologies, helping to ensure the sustainability, efficiency, and security of Ireland's energy future.

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

TRACT

2024 National Energy Research & Policy Conference

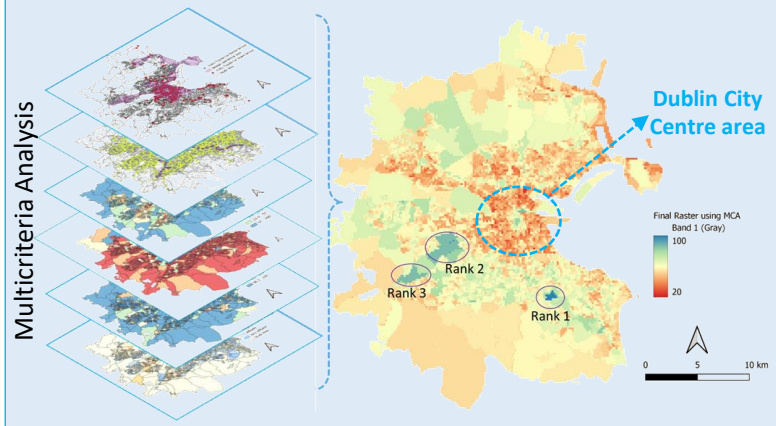
TRACT - Mobility Hub Trials in Sandyford

Tushar P Choudhari[a], Ubaid Illahi[b], Brian Caulfield[a], Margaret O'Mahony[a]
[a]*Department of Civil, Structural & Environmental Engineering, Trinity College Dublin, Dublin, Ireland*
[b]*Department of Civil Engineering and Construction, Atlantic Technological University Sligo, Sligo, Ireland*

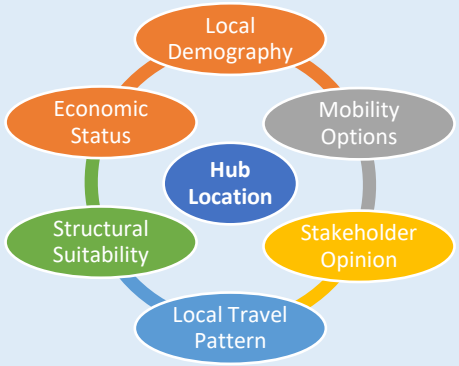
Scan QR code or Click here to learn more about TRACT project

Outcome & Learnings

- **Study location** identified for **TRACT** context
  - Location: ***Sandyford*** (👇 : Rank 1)

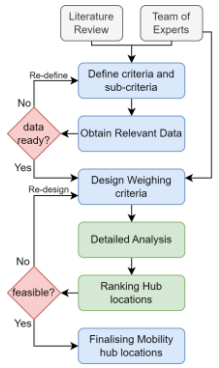


Identification of ***hub location*** varies with these criteria 👉



Policy Making

- Suggest ***Context-based Methodological*** flowchart to identify suitable hub locations
- Provide ***success-fail matrix*** of ***nudging techniques*** while encouraging behaviour ***shift*** towards shared travel modes

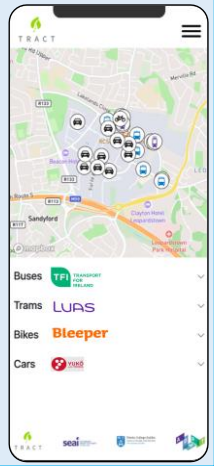


- Evaluate ***emission savings*** with active travel modes and shared cars

- Suggest whether ***nudges*** related would change ***perception*** towards shared mobility

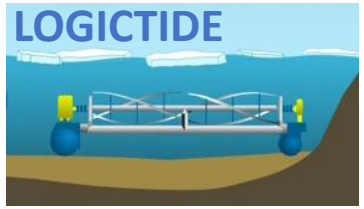
Vision: Future Research Directions

- Adoption of ***TRACT methodology*** to obtain ***evidence-based hub*** location in Suburban regions
- Development of ***network*** of mobility ***hubs*** for different counties to push their uptake
- Conducting more ***behavioural change pilots*** to nudge people encourage hub usage
- Preparation of ***Single Holistic App (Super App)*** facilitating:
  - All ***shared travel modes*** (such as bus, tram, rail, shared bikes and cars)
  - Booking and ***payments***
  - ***Emission savings*** with selected travel mode
  - ***Networking*** between hubs



TRACT *(**TRA**nsport Behaviour **C**hange **T**rials) project has been funded by SEAI and the Department of Transport under the SEAI Research, Development & Demonstration Funding Programme 2021, Grant number 21/RDD/597*

ÉireComposites – helping Ireland reduce Carbon Emissions Sustainably through SEAI funded R&D projects

Projects	Sector	Overview of project outcomes:	Informing policy making by demonstrating:	Enabling and supporting energy security in Ireland by:
	Renewable Wind	• Retrofit Irish wind blades at end-of-life with new, innovative wind turbine blades. • Novel leading edge (LE) protection system to prevent LE erosion and eliminate repair. • Improve end-of-life solutions for wind blades by incorporating recyclable blades and circular material.	1. The ability to reduce the Levelized cost of electricity (LCOE) through lower maintenance costs, wind farm life extension and additional renewable energy sources. 2. A reduction in environmental impacts with recyclable and sustainable turbine blades that will help protect our natural environment. 3. A decrease in energy consumption in the shipping industry that will help lower the transport sector carbon footprint and improve the competitive edge of the industry.	1. Helping to build a larger, more reliable and efficient renewable energy market in Ireland, while sustaining increased energy demand in an environmentally friendly manner. 2. Helping to facilitate the electrification of the transport sector by reducing energy consumption in shipping and thus, helping combat the anticipated increase in energy demand, while reducing carbon emissions to net zero by 2050.
	Renewable Tidal	• Further develop a 2MW high-potential crossflow tidal energy turbine for clean, predictable energy in Ireland.		
	Transport: Shipping	• Develop a bow-foil constructed out of novel composite material to reduce energy consumption of sea fairing vessels.		

National Energy Research, Development & Demonstration (RD&D) Funding Programme 2021, 2022 & 2023,
Grant numbers: 21/RDD/630; 22/RDD/783; 22/RDD/876; 23/RDD/1006; 23/RDD1019.

Revving up Renewable Integration: Standardizing Smart Connections for EVs and Renewables

RevRenew

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

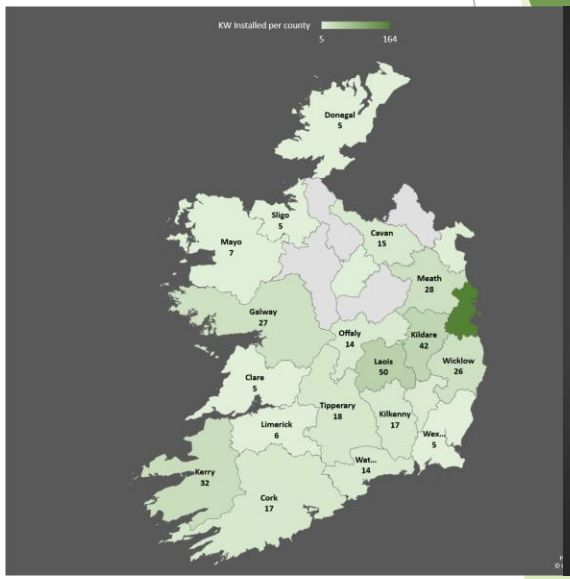
Project Overview

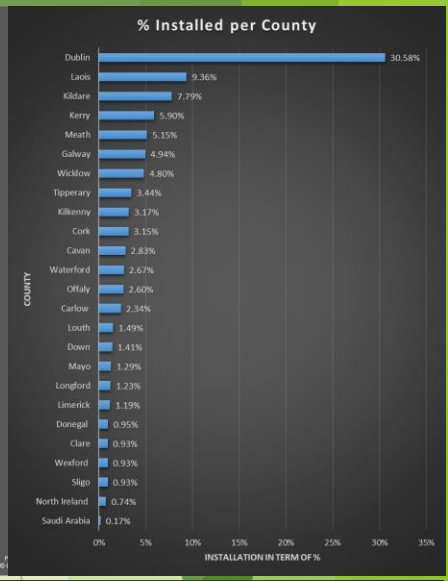
The potential for optimising and standardising smart connections within the home, including vehicle to house connections and solar PV is an important topic in the context of Ireland's sustainable energy future. This study explores the integration of renewable energy technologies into the smart home network with the aim of enhancing efficiency and streamlining the process of integrating renewable energy sources.

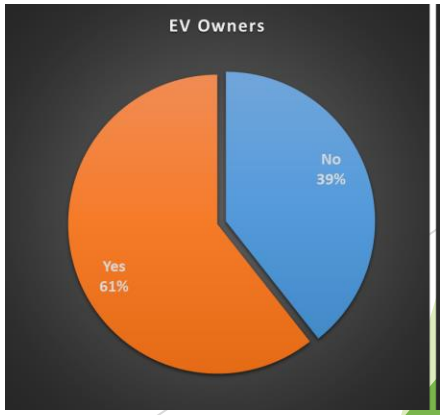
Research for Inform Policy Making

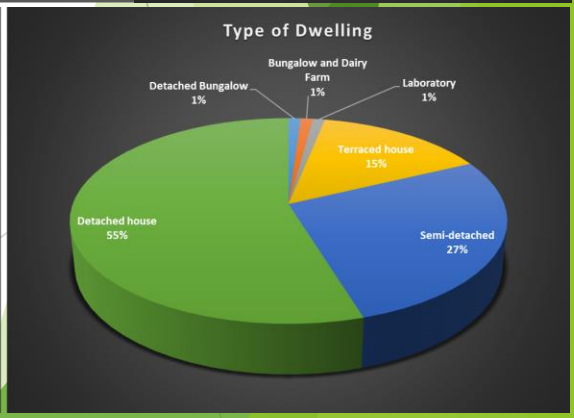
- *Measuring the electrical and thermal loads in 50 buildings in order to create demand profiles.*
- *The integration of electric vehicle (EV) charging with home energy systems will be assessed, exploring how EVs can serve as both energy consumers and storage units, further enhancing energy efficiency and flexibility.*
- *Identify key challenges and opportunities in optimizing and standardizing smart home connections, addressing issues related to interoperability, security, and privacy for renewables, EVs, and home/grid integration.*

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









seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

This project has been funded by Project 214658, Award 18395 from Sustainable Energy Authority of Ireland (SEAI) entitled "RevRenew: Revving up Renewable Integration: Standardizing Smart Connections for EVs and Renewables.".

Sol-gel materials for fouling prevention on wind turbine blades (SOLOBLADE)

[1] Manasa Hegde, [2] Joseph Mohan [2] Brendan Duffy, [1] Edmond Tobin
[1] South East Technological University Carlow
[2] CREST, Technological University Dublin

Overview of your SEAI RD&D project outcomes and learnings

Understanding Enhanced Erosion

The project enhances understanding of how Water Droplet Erosion (WDE) and biofouling impact GFRP composites, identifying key properties that affect sol-gel coating resistance.

Development of Optimized Coating Solutions

The project develops multilayer sol-gel coatings, enhancing resistance to WDE, biofouling, and contamination, with novel nanoparticle solutions boosting durability.

Impact on Wind Energy

The findings will have significant implications for the wind energy industry, providing solutions to extend the lifespan and reliability of turbine blades.

Your views on how this research could inform policy making

Environmental Protection Guidelines

The study could guide policies to reduce the environmental impact of wind energy by cutting down on harmful cleaning chemicals through advanced coatings.

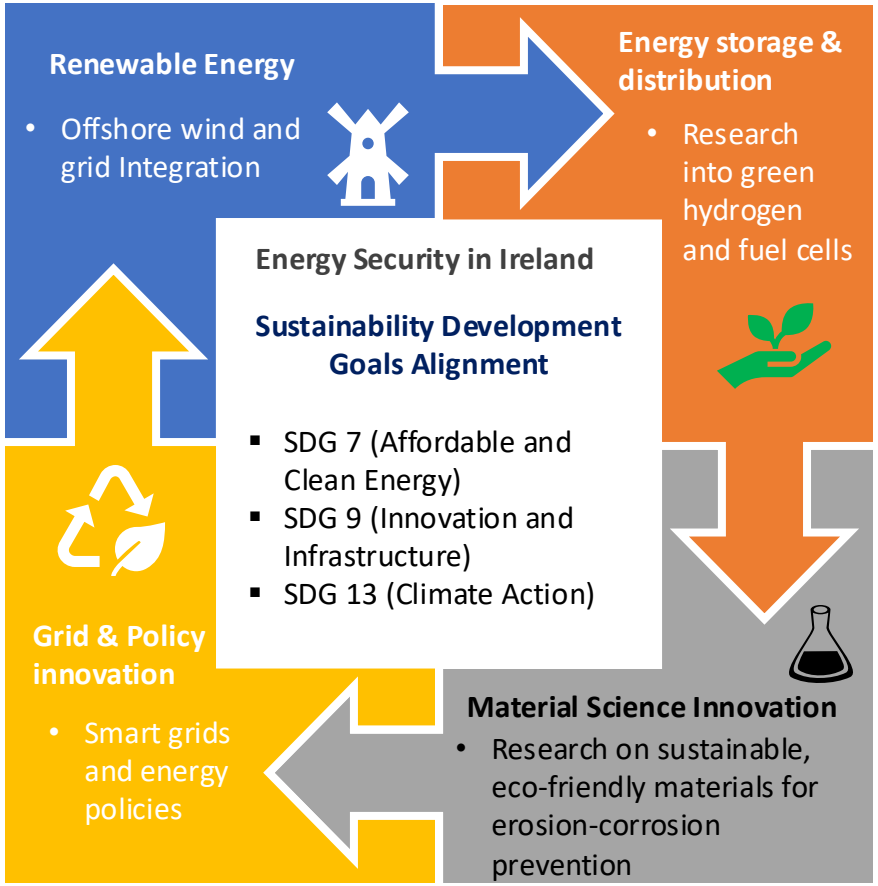
Support for Renewable Energy

The research could drive policies that increase investment and funding in renewable energy by showcasing the advantages of advanced coatings.

Economic Incentives

Effective and durable coatings could lead to cost savings in maintenance and repair. Policies could be adjusted to provide economic incentives for using such advanced materials, potentially influencing industry practices and investment strategies.

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



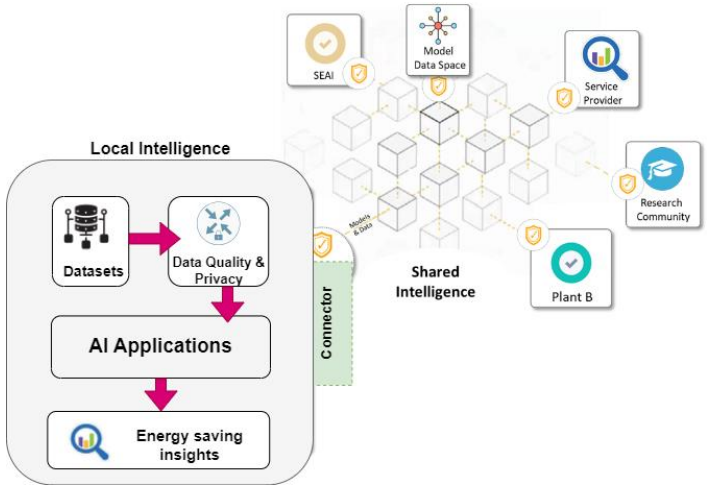
This project has been funded by the Sustainable Energy Authority of Ireland under the SEAI Research, Development & Demonstration Funding Programme 2024, Grant number 23/RDD/973

Collaborative Data Space for Distributed Intelligence supporting Energy Performance Management (CORDS)

Sourabh Bharti, Tharindu Ranathunga, Alan McGibney
Nimbus Research Centre, Munster Technological University, Ireland

Overview of CORDS project outcomes and learnings

CORDS provides a secure and trusted software infrastructure leveraging the concept of **Data Spaces** to enable manufacturing organisations and other stakeholders exchange data & insights in a secure and private manner to promote energy-efficiency.

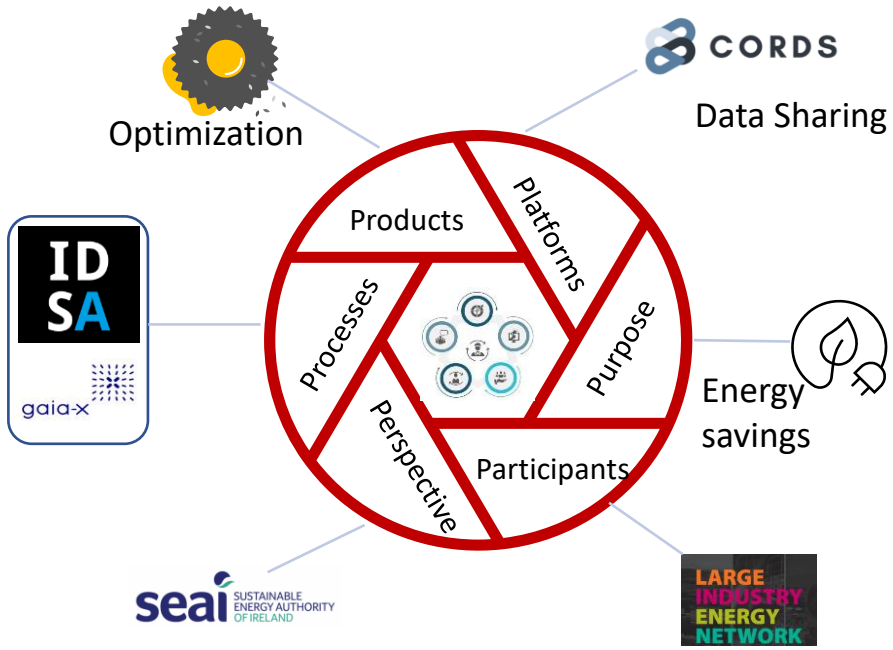


Views on how this research could inform policy making

- CORDS promotes and contributes to the use of **open-standard protocols** for energy data and machine learning model sharing.
- CORDS will support industry to navigate the complexity of advanced **AI technologies** and identify the value that can be achieved through collaborative sharing of data.
- CORDS directly contributes to the SEAI statement of strategy (2017-2021) and its outcomes align with two key pillars of the SEAI vision: **Use less and Innovate**.

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

CORDS Collaborative Ecosystem



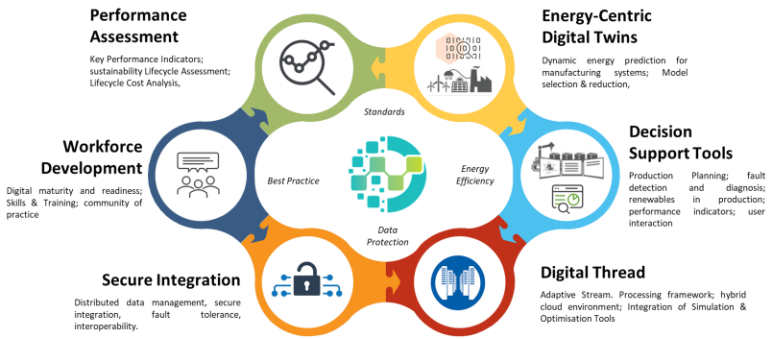
This project has been funded by the Sustainable Energy Authority of Ireland under the SEAI Research, Development & Demonstration Funding Programme 2021, Grant number 21/RDD/688.

Digital Intelligence for Collaborative Energy Management in Manufacturing

Susan Rea, Andrew de Juan, Roman Pospisil, Alan McGibney
Nimbus Research Centre, Munster Technological University, Ireland

DENiM Project Outcomes & Learnings

DENiM has developed a digital intelligence platform that enables the secure collection, contextualisation and analysis of performance related data across manufacturing systems.



DENiM eases the deployment of data-driven services using advanced performance modelling, digital twin and decision support for energy management.

Building Trust Through Transparency: Open communication about data protection, system resilience, and privacy policies is crucial.

Proactive Cybersecurity Integration: From the outset, cybersecurity must be integrated into the design of digital platforms to protect manufacturing systems technologies (AI, digital twin for example) from potential cyberattacks.

Research Informed Policy Making

Data-Driven Decision Making: DENiM provides policymakers with reliable, real-time data on energy use and performance efficiency in industrial settings. This supports informed policy decisions for energy management and industrial efficiency.

Energy Efficiency and Sustainability: The platform supports energy management and renewable integration, helping policymakers promote sustainable practices in manufacturing.

Supporting Advanced Technologies: By utilising digital twin technology and performance modelling, DENiM encourages innovation, allowing policymakers to create incentives for industrial advancements and competitiveness.

Research Required to Enable & Support 2050 Energy Targets

Smart Grid and Digitalisation: Digital Twins & AI, advanced simulation models and AI for predicting energy demand and optimising energy use, improving grid resilience and efficiency.

Community Engagement: Research into community-based energy projects and public acceptance, which is key for social buy-in for large-scale renewable projects.

Social Acceptance: Understanding public attitudes toward renewable energy projects, grid upgrades, and energy policies, to inform public engagement strategies.

Trust in Autonomous Systems: With the potential rise of autonomous or semi-autonomous systems trust in the reliability and security of these systems will be critical.

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Temporal and Spatial Variability Analysis of Offshore Wind Energy in Ireland.

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How this research could inform policy making:

The growing share of stochastic renewable resources can cause operational and planning challenges for the development of a reliable power system. Due to Ireland's net zero ambitions for the entire economy by 2050, it is important to analyse the spatial and temporal variability impacts of large shares of offshore wind farms in this country. In this research, the potential temporal (sub-hourly and hourly) variations in offshore wind generation profiles around the Irish coast were analysed in 2050. Then the variations in offshore wind generation profiles were compared with the similar aggregated onshore wind and solar PV generation profiles over the country in this year. In addition, the targeted offshore wind capacity by 2050 was divided into several clusters of different capacities placed to the west (and far west), east, and south of Ireland to investigate the generation profile variations in different regions.

Overview of project outcomes and learnings:

Comparing the variations in offshore wind generation profiles in the 5-minute and hourly time resolutions shows that the ramp rate in two timeframes differs to a high extent. Therefore, in generation variation studies lower timeframes should be considered since the intra-hour variations are not ignored in lower timeframes. Moreover, 92% of ramp rates in total offshore generation was less than 1% of installed capacity, while this figure for aggregated renewable resources was 95%. The percentage of higher ramp rates (more than 1% of installed capacity) for generation profile of offshore wind farms and aggregated renewable resources was 7% and 5%, respectively. In addition, when most portion (70%) of offshore wind capacity was considered on the far west coast, 91% of the ramp rates were less than 1% of installed capacity. This figure for the west, south, and east coasts was 90, 88.5 and 80%, respectively. This value in the case that the installed capacity was divided equally between regions was 93%.

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

Due to Ireland's geographical situation near the Atlantic Ocean, the utilization of offshore renewable resources (specifically offshore wind farms) can be an attractive solution to produce energy and solve climate issues. Due to the limited interconnections with neighbouring countries, and the low flexibility contribution from online thermal generation, it is important to quantify the generation variability for the future energy system from the temporal and spatial perspective. However, for a comprehensive study, weather windows and cost analysis should be considered to examine the feasibility of offshore wind farm integration on various coasts of Ireland.