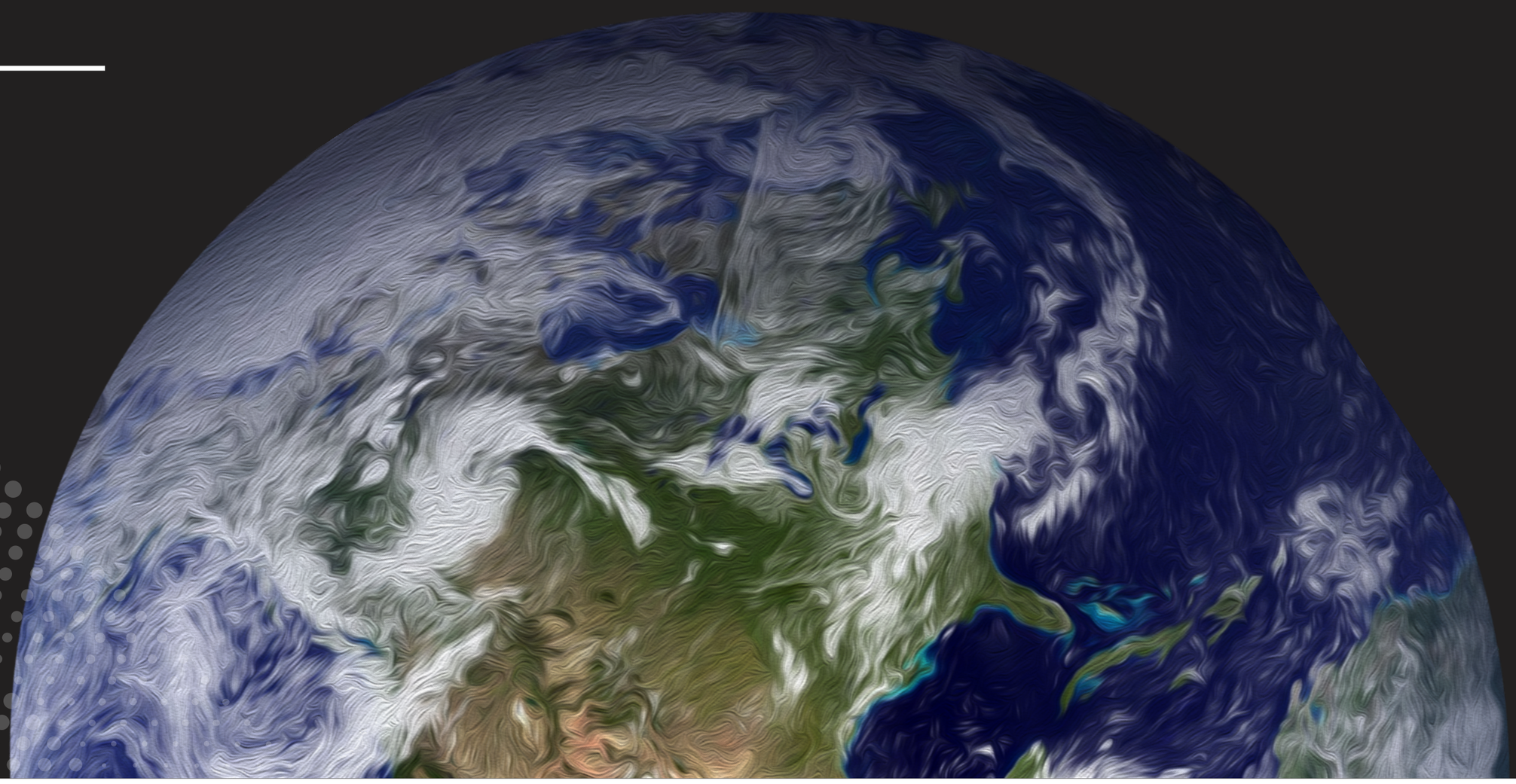
BOOK OF ABSTRACTS



UCC SUSTAINABILITY RESEARCH SEMINAR

SHOWCASING UCC'S SUSTAINABILITY RESEARCH

2pm
30th May 2023
The Shtepps, The Hub, UCC Main Campus

UCC GREEN CAMPUS

Environmental Research Institute

UCC

SUSTAINABILITY RESEARCH SEMINAR

PROGRAMME

2:05PM	***Dorcas Mikindani*** *End of Life Decisions for Wind Farms: An Opportunity for Climate Action and for Energy Communities*
2:20PM	**Dr Ievgen Nedrygailov** *Nanowood: A Renewable, Biodegradable, Natural Material for Energy Industry of Next Generation*
2:35PM	**Daniel Casaban** *Direct Air Capture in Ireland*
2:50PM	**Grace O'Sullivan** *The Impact of Design on Fluid Flow for Duckweed Production Systems*
3:05PM	***NETWORKING & REFRESHMENTS***
3:20PM	**Clarissa Leydon** *Assessing the Environmental Impact of Food Consumption in Ireland – Implications for Health Outcomes*
3:35PM	**Maria del Pilar Cespedes-Davalos** *The Impact of Environmental Compliance on Company Performance: A Simultaneous Equations Analysis of Porter's Hypothesis*
3:50PM	**Dr Damian Tobin** *Resolving the Patents Paradox in the Era of Climate Change: Towards a Patents Taxonomy*

Session 1

2:05pm - 2:20pm

End of Life Decisions for Wind Farms: An Opportunity for Climate Action and for Energy Communities

Dorcas Mikindani, Peter Deeney, Paul Leahy and John O'Brien

At the end-of-life of a windfarm a decision must be made whether the farm should be decommissioned, have its life extended or be repowered (new turbines). By analysing the value of wind farms as they age, Wind Value aims to develop two decision support tools, one commercial and one for the community.

The first decision support tool is for wind farm owners to decide between the three choices as endof-life approaches. It uses real options to estimate the value of these choices. The second decision support tool is for local communities who may wish to invest in their local wind farm at a reasonable cost, the tool provides an estimate of the level of risk involved. We examine the possible ways in which citizens can invest in existing windfarms as they approach end-of-life by using equity crowdfunding and other investment methods, and examine the risk profile of such investments.

The presentation covers the first paper of this project which examines the financial risks due to repairs to wind turbines. It uses failure data to estimate the numbers of fails for generators, gearboxes and blades for a typical turbine over its lifetime.

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Session 1

2:20pm - 2:35pm

Nanowood: A renewable, biodegradable, natural material for energy industry of next generation

Ievgen Nedrygailov, Darragh O'Brien and Justin D. Holmes

School of Chemistry, University College Cork. AMBER Centre, Environmental Research Institute, University College Cork.

The rapid increase in the temperature of the Earth's atmosphere, caused by man-made factors, is one of the most serious threats of our time. The most important measures to mitigate this threat include: 1) reducing carbon emissions through the energy transition, i.e. switching from fossil fuel energy sources to renewable energy sources that produce very limited, if not zero, carbon emissions, and 2) introduction of new "green" technologies for the production of critical materials. These new materials should replace existing materials that require too much energy to produce or are not environmentally friendly. In this presentation, we show that natural wood, a by-product of the woodworking industry, can be converted into a new energy material called nanowood. Nanowood is an inexpensive, 100 % renewable, biodegradable, environmentally friendly material that can form the basis for a range of applications including electronics, sensors, energy generation and storage. We will talk about technologies related to the isolation and functionalisation of nanowood, as well as its practical use for the production of next generation thermoelectric materials.

Session 1

2:35pm - 2:50pm

Direct Air Capture in Ireland

Daniel Casaban, Elena Tsalaporta

Direct Air Capture (DAC) is a novel technology with the potential of removing large quantities of atmospheric CO2. The role of DAC in the energy transition is supported by the Intergovernmental Panel for Climate Change (IPCC) and the International Energy Agency (IEA). Depleted oil and gas fields can store the CO2 abated and reduce its concentration in the air; this process is called Carbon Dioxide Removal (CDR). Moreover, this technology can also offer solutions to the sectors that find difficulties to decarbonise. The CO2 can be synthesised into e-fuels as for example PtLkerosene. Renewable energy alone cannot fill all the needs of our society. Yet, powered by renewable power, this ground-breaking technology will offer diverse solutions in the fight against Climate Change. The feasibility of DAC has been demonstrated by diverse companies in the world, and diverse nations such as China, United States, United Kingdom or Switzerland, are showing very keen interest. During the last two decades, these countries have been investigating how to improve the process. Their contributions to the scientific field made possible the first scale plant in 2020. This encourage other nations as for example, Scotland, which plans to build the first commercial plant with a megaton capacity. DAC is not a siler bullet, yet its role in the next decades is essential to meet the climate targets.

Session 1

2:50pm - 3:05pm

The Impact of Design on Fluid Flow for Duckweed Production Systems

Grace O'Sullivan

Duckweed (Lemnaceae) is a high-protein, aquatic plant, that is found ubiquitously in Ireland. Its dry matter consists of up to 40% protein, making it very attractive for human and animal nutrition. Duckweed can grow on agricultural waste streams, through the consumption of excess nitrogen and phosphorous pollutants in the wastewater.

The rising need for sustainable agriculture magnifies the importance of a circular economy approach to farming. This project involves the design and optimisation of an outdoor duckweed growth system to be deployed on farms. It offers farmers a plausible solution to managing the large volumes of nutrient-rich wastewater produced on farms, whilst also generating high-value biomass. At present, two styles of growth systems are used in the production of duckweed; ponds and raceway systems. A literature survey revealed no studies have been compiled comparing the two styles of systems in terms of duckweed production.

The approach undertaken in this project involves a systematic analysis of fluid flow using computational fluid dynamics (CFD) and inert tracer response experiments to inform the design of a system optimal for duckweed production. ANSYS Fluent is used to optimise the system geometry and interpret the effects of the geometry on nutrient distribution. The results will be utilised to mimic nutrient distribution in open tanks which in turn will allow for the prediction of duckweed growth performance, mixing, and fluid flow. Subsequent work will involve the scale-up of these optimal growth systems.

Session 2

3:20pm - 3:35pm

Assessing the Environmental Impact of Food Consumption in Ireland – Implications for Health Outcomes

Clarissa Leydon

Food production contributes to global environmental pressure, through natural resources depletion, pollution, and release of greenhouse gas emissions (GHGE), estimated to be over 30%. The current food system is also the global driver of disease burden, in particular obesity and malnutrition.

Methods: Dietary data from the Mitchelstown Cohort, a cross-sectional study conducted between 2010 and 2011 in County Cork, was used to estimate environmental impacts. The data for 1,862 participants; aged 46-73 years, was linked to GHGE (kg of CO2 equivalents) and blue water (BW) (litres) impact factors sourced from life cycle assessment literature.

Results: The daily dietary GHGE was 7.3 kg CO2eq and 631.6 litres of BW, with male's diets being higher in GHGE, but lower in BW compared to females. Participants in the healthiest group had lower GHGE, but greater water use compared to the least healthy group (5.3 kg CO2eq; 665.3 L vs 6.9 kg CO2eq; 584.6L), respectively.

Conclusion: Irish diets need to become healthier and environmentally sustainable. A transition towards healthy and sustainable dietary patterns provide co-benefits for population and planetary health. However, trade-offs may arise between achieving optimal nutrition for long-term health and remaining within planetary boundaries.

Session 2

3:35pm - 3:50pm

The impact of environmental compliance on company performance: A simultaneous equations analysis of Porter's Hypothesis

Maria del Pilar Cespedes-Davalos; Bernadette Power; Geraldine Ryan; John Eakins; Eleanor Doyle; Ellen O'Connor.

Porter and van der Linde (1995) argue that companies can improve their business and environmental performance in response to more flexible regulations. This is known as Porter's hypothesis. Several studies have empirically tested Porter's hypothesis following a step-wise methodology. However, this process fails to include reverse effects in the analysis that can reinforce the impacts of regulations, innovation, environmental, and business performance. The aim of this paper is to contribute to the type of measures and methods used when testing Porter's hypothesis to understand whether complying with environmental regulations boosts innovation and improves firms' environmental and business performance, and if business performance influences compliance and innovation development. We use Irish facility and firmlevel time series data (2016 – 2020), and a three-stage least squares (3SLS) regression with four simultaneous equations. Results show prosecutions and fines per sector, location and business performance as determinants of environmental compliance. Also, we find evidence to support Porter's hypothesis. Finally, we find that it takes one period for eco-innovation activities to have positive impact on business and environmental performance. The results suggest that environmental compliance is reaching the expected effectiveness and that a win-win situation is present between environmental regulations and companies' better performance.

Session 2

3:50pm - 4:05pm

Resolving the Patents Paradox in the Era of Climate Change: Towards a Patents Taxonomy

Dr Juana Bustamante (Tor Vergata, Italy), Professor Christine Oughton (SOAS University of London, UK), Dr Vanesa Pesque-Cela (Liverpool John Moores University, UK) and Dr Damian Tobin (UCC, Ireland)

The presentation will revisit the patents debate in the context of inventions designed to protect global common pool resources (CPRs) such as the environment and public health. It will argue that there has never been a clear consensus amongst researchers on the benefits of the patent system and intellectual property rights. As Joan Robinson notes, " The patent system introduces some of the greatest of the complexities in the capitalist rules of the game and leads to many anomalies." We explore these anomalies by specifying a taxonomy of patents for different classes of inventions, including inventions that reduce externalities, such as, CFC gases and greenhouse gas emissions. In these instances, the effectiveness of innovations depends critically on rapid global diffusion. Our theoretical analysis utilises Ostrom's CPR dilemma to analyse the complexities surrounding innovation and CPRs. The presentation will show that the effectiveness of innovations to protect CPRs depends on industrial characteristics and wider regulatory environment. This is illustrated using a natural experiment on environmental technologies to reduce CFC gases and CO2 emissions with and without an agreed UN Protocol using the cases of the Montreal Protocol and Electric Vehicles. Our analysis suggests the need for a more nuanced approach to patent policy that is embedded in the wider context of innovation systems and takes account of the anomalies raised by CPRs. For CPR innovation subject to positive network externalities, we advocate that policy should prioritise diffusion over private incentives for R&D and use alternative policies to patents to stimulate investment in R&D.