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Presents

WEST HUB RESEARCH CAFÉ

SUSTAINABILITY

Wednesday, 25th September 2024

Sponsors and Collaborators:

CAM ZERO$_2$

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RESEARCH

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Cambridge Philosophical Society

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KEYNOTE

Dr Claire Barlow

- Vice President, Cambridge Philosophical Society
- Fellow Emerita, Newnham College

Claire Barlow is a sustainability and materials engineer, currently serving as the Vice President of the Cambridge Philosophical Society for the next three years, having been the President for the last 2 years. Claire also had been a Senior Member at Newnham College since 1980. Claire's extensive experience includes roles as Course Director for the Manufacturing Engineering Tripos, Director of Undergraduate Education, Deputy Head of the Engineering Department with special responsibility for teaching, and Interim Head of the Department.

Claire specialises in sustainability and materials engineering. Her research work has covered a wide range of materials and processes, with a particular interest in the inter-relationships between processing parameters, mechanical properties and material microstructures. The focus is now on end-of-life materials, looking at how to assess the environmental impact of materials usage, and how to improve recycling and re-use, especially of plastics. She is involved in research on technical and organisational aspects of sustainability in the manufacturing industry.

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LIGHTNING TALKS

Production of Feedstock Chemicals by Microbial Fermentation using Sustainable Carbon Sources Marion Short, Department of Chemistry.

The majority of feedstock chemicals in the chemical industry use finite fossil raw materials as the carbon source. To reduce the reliance of the chemical industry on fossil resources, it is essential to explore alternative carbon sources, such as CO_2 which is abundant and renewable. Acetogenic bacteria are capable of converting CO_2 and H_2 into acetate, which is a feedstock chemical used in the production of polymers and textiles. The microbial fermentation of CO_2 and H_2 can be made more environmentally friendly by coupling with solar reforming for sustainable H_2 generation. Solar reforming consists of a photocatalyst which drives the reductive H_2 evolution reaction coupled to oxidation of organic waste materials, such as plastic or biomass. This work demonstrates how solar reforming and microbial fermentation can be combined for the sustainable production of acetate from CO_2 and H_2.

Glycerol can also be considered a sustainable carbon source since it is a by-product of bio-diesel production. During experimental work with *Clostridium ljungdahlii*, which is a model acetogen, a new metabolic pathway was observed, namely the conversion of glycerol to propanoate. Propanoate is used in the production of agrochemicals and pharmaceuticals. This metabolism has not been reported for this strain of bacteria and thus was investigated further.

Therefore, CO_2 and glycerol, both sustainable carbon sources, can be used to produce acetate and propanoate respectively via microbial fermentation with acetogenic bacteria. Hence, these processes offer an alternative carbon source to fossil raw materials and more sustainable routes to the production of feedstock chemicals.

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LIGHTNING TALKS

Unlocking the climate mitigation potential of unit-level efficiency improvements in global coal-fired power plants Peipei Chen, Judge Business School

Transitioning coal-fired power plants involves various strategies, with efficiency improvements being the most feasible in the short to medium term considering economic investment and stranded assets. However, substantial gaps remain in understanding of the potential and contribution of engineering and technological improvements in global coal-fired power plants. Here we develop an assessment framework using artificial neural network and optimization models, incorporating engineering characteristics of 8,883 coal-fired power plant units worldwide. This framework identifies the maximum potential efficiency improvement strategies and assess the mitigation effect for each unit, such as changes in boiler and coal type, and adjustments to steam temperature and pressure. The results find that the average plant efficiency gains through these measures could be 8%. Nearly a third of the capacity (32%) shows efficiency gains above this average, including 44% of subcritical, 24% of supercritical, and 12% of ultra-supercritical capacity. Potential cumulative emission reductions by 2050 are estimated at 31 Gt (range of 24-33 Gt). While these improvements can achieve Nationally Determined Contributions (NDCs) by 2030, they are insufficient for long-term net zero climate targets by 2050, especially in China and India. Therefore, it is crucial to implement deeper decarbonization measures in a timely manner, such as early retirement of plants, carbon capture, utilization, and storage (CCUS) technology, and co-firing technologies.

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LIGHTNING TALKS

Vulnerability of Road Network to Rainstorms in London and surrounding regions Jie Liu, Department of Engineering, Profile page

The short-term impact of intensive rainstorms on road traffic is investigated here. Three effects of rainstorms on the free-flow speed are modelled, including waterlogging, visibility and slipperiness, as well as traffic signal failure caused by power substation disruption during rainstorms. The cascading effects of extreme weather across the infrastructure of power substations and road transportation are considered. Travel time, OD connectivity, and weighted travel time are selected as indicators to assess network performance, while the reduction in network performance is used to evaluate the network's vulnerability to rainstorms. The model is demonstrated with a case study of London and surrounding regions in South East and East of England, covering 26 local government areas. The impact of 1 in 30, 100, and 1000 years of rainstorms occurring in each area is analysed at local and network levels. The result suggests that visibility and slipperiness commonly affect roads, while waterlogging leads to road closure and disconnects places significantly in Greater London, Thurrock, Reading, Slough, Luton, and Bracknell Forest. The traffic signal failure is shown to be a minor effect that only dominates in clusters of districts in some areas, such as Greater London and Southampton. At the network level, rainstorms in Kent, Essex, Hampshire, and Oxfordshire have a significant impact on road topological performance, as suggested by the results. Additionally, it shows that extreme rainstorms significantly impact OD connectivity, dominating network efficiency as the network becomes fragmented.

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LIGHTNING TALKS

Equitable and Sustainable Mobility in Latin America: The Case of Lima and Santiago Andrea Costa, University College London, Profile page

Large metropolitan areas with high levels of spatial segregation face the complex challenge of addressing the mobility needs of millions of residents in an equitable, sustainable and efficient way. This is the case of Latin American cities, including Lima, Perú and Santiago de Chile. There is a gap in the mobility literature regarding structural factors shaping the configuration of mobility systems. The research aims to fill this gap by identifying the main drivers and barriers to Equitable and Sustainable Mobility (ESM) transitions in these cities. A multidisciplinary approach, including insights from history, political science, economics and urban studies, will contribute to the study of sustainable mobility in these cities.

Semi-structured interviews were conducted during four months of fieldwork in Lima and Santiago. Policymakers, academics, and experts from various perspectives were interviewed to investigate structural factors behind mobility transitions. It also entailed observations of these cities during fieldwork and revising reports, news, and literature. The findings show that state and institutional capacity, governance, political economy, and financial constraints are key drivers and barriers to ESM transitions. These findings add valuable insights to the literature and can help countries accelerate urban mobility transitions.

Against the Odds: Innovation System Dynamics for Circular Economy Transformation in Himalaya Curie Park, Institute for Manufacturing, Department of Engineering

This study investigates how a CE Transformation is facilitated in the adverse conditions. We analysed the experimental case of establishing business clusters Himalaya, Nepal that aims to set up innovation systems for distributed remanufacturing businesses in the remote areas to transform local plastic waste into housing products. The empirical data collected through participatory action research approach is analysed based on the Innovation Systems theories. The study presents the Innovation Systems Dynamics framework for CE Transformation in the Global South. The presented framework consists of four components: missing innovation constructs; 5-stage entrepreneurial innovation process; iterative knowledge creation and diffusion activities; and the challenge-driven business clusters. The study concludes with a rich set of learning to guide the innovation systems and CE researchers on how to instigate the innovation systems for CE transformation in the Global South; understand what works and what doesn't; and how to address the gaps. This study empowers practitioners and policy makers in the Global South regions for CE transformations in the absence of supportive resources and conditions.

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LIGHTNING TALKS

Public and Local Approaches to Cambridge's Energy Transition (PLACE Transition) Stefano Magariello, Anglia Ruskin University, Profile page

Through a survey and a series of workshops, PLACE Transition seeks to explore public perceptions of Cambridge City Council's 2021-2026 Climate Change Strategy. We are particularly interested in the relevance of the council's 6 'key objectives' to the day to day lives of publics within Cambridge and creating the space for publics that are not usually able to impact policy to input into the council's future strategies.

A survey link and workshop invitations were distributed to more than 30 community groups. These groups were either geographically bounded on Facebook, or in person (Communities of Place), or socially bounded (Communities of Interest).

Overall, we obtained 110 survey respondents, all of which with Cambridge postcodes. Consequently, we managed to organise 6 workshops (CB1-5 plus one at Anglia Ruskin University Campus). Both our survey and our deliberative workshops were open to members of the public. The workshops specifically were designed as deliberative and will result in findings coproduced with publics.

Main research objectives include:
- Feed into future climate change strategies for Cambridge City Councils.
- Illustrate that climate change strategies benefit from being coproduced.
- Explore public perceptions of climate change generally and Cambridge City Council's Climate Change Strategy, specifically amongst those publics that the strategy impacts.

PLACE Transition is a research project co-led by Anglia Ruskin University and Global Sustainability Institute's postdocs Stefano Magariello (sociologist), Ami Crowther (geographer) and Tom Hambley (environmental psychologist).

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LIGHTNING TALKS

Sustainable mobility for all: Enhancing cycling participation across diverse demographics Khashayar Kazemzadeh, Department of Engineering, Profile page

Cycling is an environmentally friendly mode of transport that mitigates issues associated with motorised vehicles, such as traffic congestion, environmental hazards, and sedentary lifestyles. However, in countries like the UK and the US, cyclists are predominantly young male adults, leaving several groups—particularly women, children, and older adults—underrepresented.

This research aims to understand the mechanisms that deter these underrepresented groups from participating in cycling and to develop policies that enhance their involvement. We conducted a systematic review to assess the landscape of equity, diversity, and inclusion in cycling, and evaluated existing policies aimed at improving participation. Following this, we will conduct an experiment using various video scenarios to collect data from cyclists on different types of cycling infrastructure. This will help us understand the factors influencing participation, such as pavement quality, lighting systems, and the likelihood of harassment. Our analysis will explore how demographic characteristics interact with these factors.

In conclusion, this research will provide planners and policymakers with tools to assess the current quality of cycling facilities and to design future infrastructure that is more inclusive. This research ultimately contributes to enhancing the inclusivity of cycling and promotes sustainable mobility for society as a whole.

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LIGHTNING TALKS

Mapping Low-Traffic Neighbourhoods Martin Lucas-Smith, CycleStreets (also Department of Geography)

Since the COVID pandemic, the media has been full of stories about Low-Traffic Neighbourhoods (LTNs), and the modal filters which implement them, exaggerating the opposition to them. Often, the impression has been given that these are a radical new form of traffic engineering.

Yet, LTNs have existed for decades, with only the name 'Low-Traffic Neighbourhood' actually new. Ask those who live in well-established LTNs and you will find few people who want the traffic let back in.

However, until now there has been no national mapping data on where they are. It turns they are in fact extremely common, found in pretty-much every town or city. They are not a 'radical' or new measure. At CycleStreets, we set out to prove this, and for the first time, have mapped them.

We have analysed street data from OpenStreetMap to determine the locations of modal filters across the UK, as well as which streets are through-streets (i.e. capable of having through-traffic from one main road to another).

The data on streets will also enable new research to be undertaken on the socio-demographic effects of LTNs, for instance, whether they disproportionately benefit or affect particular groups.

https://www.lowtrafficneighbourhoods.org/

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Location & Contacts

Address: West Hub, JJ Thomson Avenue, Cambridge, CB3 0US

Event location: West Hub, 1st Floor, East 1 room.
Direction will be available upon arrival.

Do you need help or information?

West Hub, Information Desk
Library and Events teams 9am-5pm
library@westcamhub.co.uk
01223762725

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NEXT OPPORTUNITIES

Dates to save!

28.11.2024 Research Café on Tour
25.02.2025 Research Café
30.04.2025 Research Café
18.06.2025 Research Café

http://bit.ly/research-cafe

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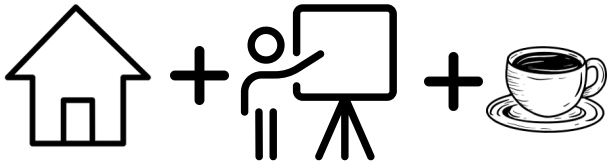
EVENT ITINERARY

RECEPTION

11:30

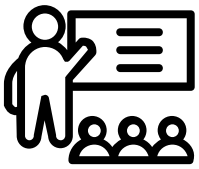
Welcome & Exploring



TALKS

12:00

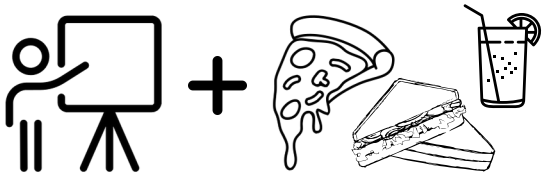
Keynote & Lightning Talks



LUNCH & NETWORKING

13:30

Questions & Social



PRIZES & SOCIAL

14:00

Prize Draw & Social Tea Break

14:30

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WEDNESDAY, 25TH SEPTEMBER 2024

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