Centre for Environment and Sustainability

UNIVERSITY OF SURREY

The Centre for Environment and Sustainability (CES)

an internationally-acclaimed centre of excellence for sustainable development

A celebration of the work of CES with introductions to our academics, researchers, programmes, projects and industry partners

The Centre for Environment and Sustainability

Foreword by CES Director, Professor Richard Murphy

CES is an internationally-acclaimed centre of excellence on sustainable development. We were first established at the University of Surrey by Professor Roland Clift in 1992. Now in our 25th year, we continue to exert a major influence on the development of industrial ecology, systems analysis for sustainability and on policy-makers and civil society in meeting the challenges in living sustainably and well. The impact of our research and teaching is enhanced by our work in close partnership with diverse businesses and industry on sustainable innovation and implementation issues in practice. Many examples of this are contained in this booklet.

Our research uses inter-disciplinary approaches to the analysis of complex systems, integrating the engineering and science-based disciplines with insights from the economic and social sciences, and from this develop action-oriented, policy relevant responses to long-term environmental and social issues. These activities inform our teaching (Undergraduate, Masters, Doctoral) to enable our graduates to develop the leading-edge knowledge and skills needed for successful careers in all aspects of sustainability. Within the University, CES leads two of Surrey's strategic Research Themes – Sustainability and Urban Living.

CES provides a friendly and supportive environment in which innovative thought and creativity are strongly encouraged and in which our internationally and culturally diverse group of students and staff can flourish. We will be delighted to hear from you and look forward to opportunities to work with you.

Professor Richard Murphy,

Director CES

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‘CES through the ages’
by Emeritus Professor and founder of CES
Roland Clift, CBE

CES originated from a Damascene experience at a conference in January 1991. I was chairing the UK research initiative on clean technology, including several research councils, but becoming disillusioned by the growing realisation that our lack of progress in addressing environmental problems was due not to lack of technology but to lack of sufficient understanding of how to use available technologies. At the conference I met some people who have been significant in CES, notably Tim Jackson and Walter Stahel, and first encountered some of the issues that have been pursued in CES, for example Life Cycle Assessment (LCA). The conference crystallised the conclusion that the solutions to our environmental challenges do not lie within a single academic discipline.

My response to this flash of the blindingly obvious was to seek funding to set up a research centre to bring together engineering and the social sciences. At the time this was seen as a strange idea, but things went well. The Vice Chancellor of the time, Anthony Kelly, saw the point and backed CES from the start; in fact the University has generally been supportive of this foray into transdisciplinary research. In addition to myself as Director, the first academic staff recruited were a social geographer (now a professor at KCL) and a sociologist (still at Surrey) as a joint appointment with the Sociology Department. It was these people, rather than I (already a professor) who took the brave step of gambling their careers on a unusual enterprise. We were funded by the EPSRC for one of the first five Doctor of Engineering programmes, initially run with Brunel University although the shared programme subsequently diverged. Out of the courses for the EngD grew a set of MSc Programmes.

Although my original intention was to set up a small research centre, CES has grown to the size of a modest department with national and international recognition and influence.

Oh, and it has been fun.

Roland

Centre for Environment and Sustainability

CES Academic Staff

- Dr Kate Burningham
- Dr Jonathan Chenoweth
- Mr Ian Christie
- Prof Roland Clift, CBE
- Prof Angela Druckman
- Prof Chris France
- Prof Tim Jackson
- Prof Matthew Leach
- Dr Jacquetta Lee
- Prof Jim Lynch, OBE
- Prof Stephen Morse
- Prof Richard Murphy
- Dr Jhuma Sadhukhan
- Dr Walter Wehrmeyer

Dr Kate Burningham

Reader in Sociology of the Environment, joint appointment with the Department of Sociology

Areas of expertise

Social construction of environmental problems, public environmental knowledge, environmental inequalities and sustainable lifestyles.

Current activities

Kate is Deputy Director of the ESRC funded Centre for Understanding Sustainable Prosperity (CUSP). She is leading the S1 work theme which explores the contested and situated nature of ordinary people's visions of the good life and explores the role of materialism in delivering (and hindering) a sense of prosperity. It will explore how different philosophical understandings of justice and fairness enter lay narratives of the good life and how aspirations for prosperity and sustainability are negotiated in diverse places and circumstances.

Contact: k.burningham@surrey.ac.uk

Dr Jonathan Chenoweth

Senior Lecturer (Associate Professor)

Areas of expertise

Water resources management, indicators of sustainable natural resources development, particularly sustainable water resources management

Current activities

Recent projects have included European funded research on the link between domestic water consumption and wellbeing in the UK together with innovative options for reducing household water consumption. Other research has considered the use of green infrastructure to improve access to green spaces and natural capital in urban areas and options for improving access to improved sanitation in peri-urban settlements in east Africa.

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Mr Ian Christie

Senior Lecturer (Associate Professor)

Areas of expertise

Sustainable lifestyles and values, ethics and political economy of sustainability, policymaking and sustainable development.

Current activities

He is co-supervisor for two of the Practitioner Doctorate students: Abeer Abdalla (Rolls-Royce, dynamics of technology adoption in nuclear industry) and Patrick Elf (IKEA, lifestyle change interventions for consumers). Ian is also a co-investigator in two major research programmes at Surrey: CUSP, the Centre for Understanding Sustainable Prosperity; and CECAN, the Centre for Evaluation and Complexity across the Nexus. He has extensive experience, before coming to Surrey, of senior roles in business, public policy and NGOs in relation to environment and sustainable development.

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Professor Roland Clift, CBE

Emeritus Professor of Environmental Technology,
Founding Director of CES

Areas of expertise

Roland is one of the founding figures in Industrial Ecology, including Life Cycle Assessment, Value Chain Analysis and resource efficiency.

Current activities

Roland's current research is directed at extending the scope of system approaches to sustainability assessment. In addition to system analysis, this includes "absolute" rather than "relative" metrics and targets; incorporating social impacts and benefits (i.e. social LCA); and developing a methodology to include radiological impacts in LCA. In addition to CES, Roland works with researchers at UCL, Chalmers University (Sweden), The University of British Columbia (Canada) and the University of Coimbra (Portugal). Recent published research includes life cycle evaluation of recovering and using energy from waste, recovery of phosphorus from waste water and the environmental consequences of changes in energy systems, sources and demand, including the effects of introducing electric vehicles.

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Professor Angela Druckman

Professor of Sustainable Consumption and Production

Areas of expertise
Systems analysis, industrial ecology, the rebound effect, and food security, safety and sustainability.

Current activities
Angela's research focuses on investigating avenues that may lead towards more sustainable lifestyles using systems analysis techniques. As a co-investigator in the Centre for the Understanding of Sustainable Prosperity (CUSP), Angela is leading work on analysing narratives of sustainable prosperity. This includes, for example, exploring how changes in time use may bring about both social and environmental benefits. As co-investigator in the EPSRC funded Stepping Up project Angela is examining how niche innovations might be 'scaled up' to produce transformational change across the water-energy-food nexus. Amongst her teaching commitments, Angela is module leader for the CES module 'Life Cycle Thinking and the Circular Economy' and the pan-University 'Global Graduate Award in Sustainability' courses.

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Professor Chris France

Professor of Environmental Technology, Associate Director of the Practitioner Doctorate Programme in Sustainability (PDS)

Areas of expertise
Sustainable supply chains; extended producer responsibility; Sector and company level operationalization of planetary boundaries.

Current activities
The word 'sustainable' is pervasive but has come to mean 'slightly less unsustainable' or 'better in one part of a life-cycle but worse overall'. Whereas incremental, 'whole life' improvement is virtuous, it is only by living within the thermodynamic & resource availability constraints of the planet that business & humankind can truly be sustainable. Necessarily, the environmental solutions have to work within the prevailing economic and social constraints to have any chance of application. Chris is fascinated by working with companies on these complex, wicked problems & drawing on experience of working with a wide range of companies including Carillion, Sony, Hewlett-Packard, 3M, Ford.

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Professor Tim Jackson

Professor of Sustainable Development, Director of CUSP

Areas of expertise

Ecological economics, system dynamics and the sociology of consumption.

Current activities

Tim has been at the forefront of international debates on sustainability for almost three decades and has worked closely with the UK Government, the United Nations, the European Commission, numerous NGOs, private companies and foundations to bring economic and social science research into sustainability. He is Director of the Centre for the Understanding of Sustainable Prosperity (CUSP), a multi-disciplinary research network which aims to understand the economic, social and political dimensions of sustainable prosperity. In addition to his academic work, he is an award-winning dramatist with numerous radio-writing credits for the BBC.

Author of 'Prosperity Without Growth – Foundations for the Economy of Tomorrow' (Routledge, 2017)

Contact: t.jackson@surrey.ac.uk

Professor Matthew Leach

Professor of Energy & Environmental Systems
University Research Theme Champion for Urban Living

Areas of expertise

Techno-economic analysis, energy policy, decentralised energy systems, low carbon transitions, Food-Energy-Water Nexus.

Current activities

Prof Leach's research is focused on sustainability analysis (and related policy support) for small scale and local energy and resource systems, often in smart city or 'nexus' contexts, both in the UK and for international development. In partnership with other researchers and development organisations, he has completed an initial techno-economic modelling study of a concept for affordable solar-battery-electric cooking at household scale in Africa, underpinned by falling costs of solar PV and of Lithium-ion batteries. He is now involved in a commercial feasibility study and testing programme in several developing countries, exploring prospects to help tackle indoor air pollution from cooking over wood or charcoal fires, one of the World's most significant health and environmental problems.

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Dr Jacquetta Lee

Senior Lecturer (Associate Professor), Director of the Practitioner Doctorate Programme in Sustainability (PDS)

Areas of expertise

Sustainable systems analysis, design for sustainability, social life cycle assessment.

Current activities

Jacquetta is leading EU funded research into reducing uncertainty of environmental impacts in early product design stages to improve sustainability. This research is focussed on the aerospace sector, but has applicability for any product design process. As Director of the PDS, she is responsible for engaging major industry leaders and high calibre postgraduate researchers to work collaboratively to resolve sustainability issues within industry. She is currently working collaboratively with a number of industry partners. Projects include: the analysis of the construction sector supply network relationships to reduce environmental impacts; the utilisation of sewage sludge in dynamic energy production; developing and assessing methodologies for quantifying product based energy requirements within aerospace.

Contact: j.lee@surrey.ac.uk

Professor Jim Lynch, OBE

Distinguished Professor of Life Sciences (Emeritus)

Areas of expertise

Behaviour in soil of indigenous and introduced microorganisms, including those which have been genetically-modified - for which he was awarded the UNESCO Microbiology Prize. Analysis of the sustainability of agricultural and forestry ecosystems. Earth observation of global landscapes from satellites.

Current activities

Application of earth observation information for assessment of land use change. Translation of remote sensing data into sustainable development indicators. Microbiomes in soil and waste water.

Contact: j.lynch@surrey.ac.uk

Professor Stephen Morse

Professor of Systems Analysis for Sustainability

Areas of expertise

Methodologies for stakeholder participation, methodologies for assessing sustainability, including indices and indicators, natural resource and environmental management

Current activities

Steve has a background in applied biological science, and his research and teaching interests are broad spanning both the natural and social sciences. Steve has helped pioneer a number of participatory methodologies for sustainability assessment, including Triple Task. He has been involved in research and sustainable development projects across Europe, the Mediterranean, Africa and Asia. He is currently working on a number of projects, including food security in Africa, developing and assessing methodologies for quantifying product based energy requirements within aerospace, the environmental impact of confectionary products and assessment of sustainable development indicators using earth observation.

Contact: s.morse@surrey.ac.uk

Professor Richard Murphy

Director CES, Professor of Life Cycle Assessment
University Research Theme Champion - Sustainability

Areas of expertise

Life Cycle Assessment, Life Cycle Sustainability Assessment, bio-economy, bioenergy, biofuels, biodegradation, forest products and plant fibre materials

Current activities

Richard's research focuses on understanding the potential sustainability benefits of mainly bio-based materials and energy using experiments, LCA/LCSA and techno-economic modelling. Current work with research students includes low-carbon electricity production from oil palm residues, sustainability analysis of crude oil operations, municipal waste and water supply systems, sustainability policies in business and government and the use of earth observation in sustainable development. Much of this involves extensive national and international collaboration. He is a member of DEFRA's Hazardous Substances Advisory Committee and has advised the UK Committee on Climate Change, the House of Lords Science & Technology Select Committee and several major corporations on LCA and sustainability analysis.

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Dr Jhuma Sadhukhan

Reader

Areas of expertise

Bioenergy and Bio-refinery systems engineering, process integration, techno-economic and life cycle analyses.

Current activities

Jhuma is the Founder of IBEST (Institution of Bio-refinery Engineers, Scientists and Technologists), undertakes fundamental research in "Bio-refinery" and "Resource Recovery from Waste". She does modelling, simulation and design, across the scale, from molecules to systems. She is the Sustainability theme leader of multi-disciplinary Consortia: METEORR Consortium of the NERC "Resource Recovery from Waste" programme and LifesCO2R Consortium of the EPSRC "Liquid Fuel and bio-Energy Supply from CO2 Reduction". Jhuma has written an internationally acclaimed Wiley's Advanced Textbook "*Bio-refineries and Chemical Processes: Design, integration and Sustainability Analysis*".

Contact: j.sadhukhan@surrey.ac.uk

Dr Walter Wehrmeyer

Reader in Environmental Business Management

Areas of expertise

Corporate Social Responsibility, Sustainability Management, Corporate Culture and staff, Scenarios and pathways, stakeholder engagement

Current activities

Projects with industry partners include: identifying and mapping employee attitude in large and Medium-sized firms, developing guidelines for chemical risk management, understanding the dynamics of sustainability-driven entrepreneurship, intrinsic vs extrinsic CSR practices and strategies, and developing long-term transition pathways for sectorial decarbonisation and developing effective ways to integrate the fight against terrorism with policing with the community.

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CES Associates

Prof Malcolm Bailey

Prof Anthony Clayton

Dr Bronwyn Hayward

Prof Julie Hill

Prof Angela Karp

Prof Gary Kass

Prof Henry King

Dr Stephanie Looser

Dr Andre Loureiro Chaves

Prof George Martin

Dr Elias Martinez-Hernandez

Dr Llorenc Mila I Canals

Prof Walter Stahel

Dr Long Seng To

Eur. Ing. Professor Malcolm Bailey

Visiting Professor, Engineering with Sustainable Resources

Areas of expertise

Industrial Symbiosis/Ecology, Resource Innovation, Flameless Pressurised Oxy-Combustion

Current activities

Malcolm is a chemical engineer who is involved with developing and delivering industrial symbiosis from a practical standpoint. His focus is that of resource innovation, often delivered as multi-party collaborative projects with academia in order to extract the maximum value of waste resources and return the benefits to industrial partners. His company was lead industrial symbiosis exponent in an EU funded project LOCIMAP, (**L**ow **C**arbon **I**ndustrial Manufacturing Parks), examining the structure of industrial parks using best practice benchmarks from across leading parks in the EU.

His current activity is in defining a Grand Challenge to close material loops within the UK economy; an area of research that has its roots in his time with CES in a VP post funded by the Royal Academy of Engineering.

Contact: malcolm@link2energy.co.uk

Professor Anthony Clayton

Visiting Professor, Alcan Professor of Caribbean Sustainable Development, University of the West Indies

Areas of expertise

National and citizen security, foresighting and scenario planning, energy security, urban development, development planning.

Current activities

Public policy research and development, policing strategies and operations in highly violent, low-trust societies, counter-terrorism and organized crime strategies, development planning in small island nations, net zero energy strategies, media regulation. Chairman of the Broadcasting Commission of Jamaica.

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Dr Bronwyn Hayward

Visiting Research Fellow
Associate Professor in Political Science and International Relations, University of Canterbury, New Zealand.

Areas of expertise
International expert in the connections between youth politics, sustainability and democracy.

Current activities
Bronwyn currently serves as a Lead Author for the IPCC Special report 1.5 Degrees and has served as an Expert Advisor for the Scoping panels for the 1.5 Special Report and the IPCC Assessment Round 6. She leads a 7 nation study of children and young people growing up in cities with the Surrey University led CUSP project the Centre for Understanding Sustainable Prosperity. Bronwyn also serves on the International Social Science Council is a 2017 Canterbury Fellow to Oxford University College and Blanavick School of Government

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Professor Julie Hill

Visiting Professor

Areas of expertise
Governance, circular economy, waste and resources policy, water policy, regulation of genetically modified organisms, public engagement.

Current activities
Julie has a number of non-executive roles, including being Chair of the Waste and Resources Action Programme (WRAP), a non-executive director of the Consumer Council for Water (CCW), a member of the Council of the Institution of Environmental Scientists and an Associate of Green Alliance where she has a mentoring role and advises on projects. She has written extensively on resources issues, including the book 'The Secret Life of Stuff' (Vintage, 2011) and is currently researching follow-ups.

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Professor Angela Karp

Visiting Professor
Director for Science Innovation, Engagement & Partnerships, Rothamsted Research

Areas of expertise
Crop genetics and breeding for food and bio-renewables

Current activities
Angela leads Rothamsted Research's overall strategy on external engagement and partnerships, and is developing new mechanisms for collaborative innovation, including a new accelerator initiative (AgRIA) to co-develop innovative solutions with businesses to challenges in agri-food. With more than 35 years' experience in crop genetics and breeding for food and bio-renewables, Angela's recent research career focused on optimising the sustainable yield and composition of perennial biomass crops (especially willows) for bioenergy, biofuels and other industrial products, under low-input arable systems. In 2007, she received the Royal Agricultural Society of England Research Medal and, in 2008, the Alfred-Toepfer Prize for her research achievements.

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Professor Gary Kass

Visiting Professor
Sustainability, Science and Futures

Areas of expertise
Environmental and sustainability science; science/policy interface; futures studies and scenario analysis

Current activities
Gary is exploring how Natural England (the statutory adviser on the natural environment in England) makes its legally mandated contribution to sustainable development through its actions to enhance conserve and manage the natural environment. In particular, he is developing an assessment framework based on the UN Global Goals for Sustainable Development. He is also working with the European Environment Agency and others across Europe to develop futures thinking and analysis focussing on socio-technical systems transitions towards sustainability, to inform the EEA's 2020 State of Environment Report.

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Professor Henry King

Visiting Professor, Unilever plc

Areas of expertise
Corporate sustainability, Life Cycle Management, Product innovation and sustainability, Life Cycle Assessment, Climate change, Chemicals assessment and management

Current activities
Implementation of Unilever Sustainable Living Plan: product footprint assessment, and new product design. Improving understanding of uncertainty and variability in product footprinting. Development of new approaches for predictive life cycle assessment. Quantifying the impacts of sustainable sourcing and corporate deforestation commitments. Application of planetary boundary concept for strategic decision-making.

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Dr Stéphanie Looser

Visiting Research Fellow
Head of Town / Department Head for Societal and Social Issues

Areas of expertise
Stakeholder & network analysis, developmental psychology, behavioural marketing, international project & wealth management, social capital, transition pathways & management, business ethics, corporate & public social responsibility, small business values, virtues, & business models, leadership & decision-making, advanced general management, organizational behaviour & global relationship management.

Current activities
Transition pathways including pupils (between ages of 8-12) & students at voting ages, transition pathway management including development of viable, hands-on measures, consulting, change management, implementation of corporate social responsibility projects, employees' & social case management, outreach social & work with the elderly, efforts to shed light on health literacy & triggers for poverty.

Contact: s.looser@surrey.ac.uk

Dr André Loureiro Chaves

Visiting Research Fellow

Areas of expertise

Public Health with emphasis in Environmental Health and Sustainability, active on the following topics: health-environment-society, public health ecological model, environmental management, environmental epidemiology, risk communication and participation.

Current Activities

The role of the Health Sector in improving the environmental sustainability of cities is included in the Healthy Cities Paradigm of the WHO. The overall goal of my current studies is to understand how the Health Sector can promote healthy urban environments through an integrated model of sustainable healthcare system. With the system looking outwards, promoting Environmental Health in Primary Care to coping, prevention and control of local environmental problems that may cause harm to health. With the system looking inwards, outlining sustainable strategies for "care without carbon" delivered, recognizing its role to Climate Change.

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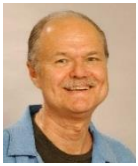
Professor George Martin



Visiting Professor in Urban Environmental Sociology
Emeritus Professor of Sociology, Montclair State University, NJ
Visiting Research Fellow, University of California, Santa Cruz

Areas of expertise: Urban Ecology, Urban Transport
Current activities

- Assessing the sustainability vectors for urban cultivation (Food, Economy, Environment, and Society), and its role in regional food systems.
- Framing the potential sustainability impacts of autonomous vehicles (on Public Health, Public Transit, and Urban Space), and their associated risks (e.g. digital exposure, rebound effect, effective regulation of disruption).
- Identifying the sustainability hotspots of microbrewing (in Resourcing, Processing, and Distribution), and comparing “craft beer” with “real ale”.

Book contract: Autonomous Vehicles and Sustainability: Social and Environmental Impacts and Prospects, Routledge (2018)

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Dr Elias Martinez Hernandez

Visiting Lecturer
Research Scientist in Biomass Conversion, Mexican Institute of Petroleum.

Areas of expertise
Process development and environmental assessment of biorefineries, bioenergy and urban waste processing systems. Local integration of energy, water and food systems and their nexus. Techno-ecological synergy. Systems modelling for policy support.

Current activities
Projects include: process integration, economic and environmental assessment of biofuel and biochemical production, impact of bioenergy production on ecosystem dynamics and services, locally integrated production systems using renewable resources, a food-energy-water nexus simulation tool, integrated processing systems for resource recovery from waste, co-optimization of biomass, food, energy and water supply systems.

Contact: emartinez@imp.mx

Dr Llorenç Milà i Canals

Visiting Reader
Head of Secretariat, Life Cycle Initiative, UN Environment

Areas of expertise
Life Cycle Assessment, Sustainable Consumption and Production, Sustainability Management, Stakeholder engagement, land use modelling within LCA

Current actitivities
Delivering the new strategy of the Life Cycle Initiative (www.lifecycleinitiative.org), hosted by UN Environment, bringing life cycle knowledge and capacity development to technical and policy advice at the highest levels of the public and private sectors, with the aim of positively influencing the delivery of the Sustainable Development Goals. Personal research interests continue within the life cycle impact assessment area (resources and social indicators), as well as application of systems analysis to support sustainable land use, certification standards, and life cycle chemicals management.

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Professor Walter R. Stahel

Visiting Professor, Faculty of Engineering and Physical Sciences

Areas of expertise
Architecture, Risk Management, Sustainability Strategies and Policies, Circular Economy and Performance Economy

Current activities
Promoting the understanding of the structure of an economy in loops and its drivers and obstacles (circular industrial economy); spreading the knowledge about the competitiveness of a performance economy selling goods and molecules as a service; and identifying the levers to speed up the shift from a linear industrial economy managing flows to an economy managing stocks; through workshops, lectures and policy groups; member of the Coordination Group of the European Circular Economy Stakeholder Platform of EESC and European Commission.

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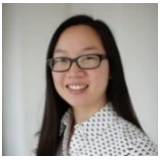
Dr Long Seng To



Visiting Research Fellow, Research Associate at Loughborough University

Areas of expertise
Sustainable energy engineering, international development, energy resilience, energy policy.

Current activities
Long Seng is part of the secretariat for the UK Low Carbon Energy for Development Network where she is supporting the Department for International Development's Transforming Energy Access programme. Her research projects include agro-industries and clean energy in Africa, enhancing community energy resilience in Nepal after the earthquake in 2015, capacity building for renewable energy projects in China, and renewable energy in remote communities in Nicaragua and Australia.

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CES Research Fellows

Dr Mairi Black

Dr Xiaobo Chen

Dr Simon Mair

Dr Mobolaji Shemfe

Dr James Suckling

Dr Susan Venn

Researcher: Dr Mairi Black
Research Fellow

Project: AGRICEN

This is a 5 year research programme exploring how agro-industries in Sub-Saharan Africa could contribute to improving rural energy access. The project combines new approaches to political economy analysis with business development, innovation systems, financial engineering and participatory approaches to understand the potential role that agro-industries can play in widening energy access to rural communities.

The AGRICEN project is in it's final year, led by Professor Yacob Mulugetta, University College London, Prof. Matt Leach at CES and partners in Ethiopia, Kenya, Uganda and Malawi. My role is to co-ordinate Case studies with our project partners for horticultural and agricultural industries in these countries, addressing opportunities and barriers to the provision of rural energy. My own experience has been in the applications of agricultural and forestry materials for non-food uses, which over 20 years has incorporated Life Cycle Assessment and Sustainability of supply chains for biofuels, bioenergy and biorefineries to comply with developing UK and EU policy requirements. I have worked on the issues associated with these developing industries and have put LCA and Sustainability assessment of biofuel and biomass supply chains into practice in Europe, North and South America and Africa. I have most recently been working on projects which benchmarks cement, leather and textile supply chains in Ethiopia and animal feed systems and supply chains for the production of livestock in Ethiopia and Kenya. I will be extending this experience within the AGRICEN project in 2018.

Expected Impact:
The project will report on opportunities for agro-industries to widen rural green energy access and to provide extended systems for energy access on a larger scale in the future, defining how they might become important players themselves in the delivery of clean energy services.

Contact: m.black@surrey.ac.uk

Researcher: Dr Xiaobo Chen

Research Fellow

Project: Reducing uncertainty in early design decisions for Aerospace

I am working with Dr Jacquetta Lee and colleagues for PLEIADES, a project to lead Eco-design integration in aerospace development & engineering system. This project is funded from the Clean Sky II joint undertaking under the EU Horizon 2020. My research focuses on providing methodology to manage uncertainties, identifying hot-spots of important uncertainty, and then reducing uncertainties of environmental impacts in early product design stages. This research is focussed on the aerospace sector, but has applicability for any product design process.

I work collaboratively with multidiscipline experts to develop methodologies to manage uncertainties for decision makers to improve sustainability. The aims are to:

- Develop industry-focused Eco-design tools integrating with engineering workflow in aerospace sectors;
- Develop key sustainable indicators with environmental, business and social considerations, to meet sustainable requirements from aerospace industries;
- Ensure the effective use of primary and secondary data on materials, process and product levels;
- Develop methods to represent uncertainties appropriately that indicates real state of knowledge;
- Develop practical tool to manage uncertainty across different levels of life cycle assessment (LCA) and communicate easily with decision makers;
- Remove the barriers for cost-effective use of LCA approaches in product development to provide more useful input and guidance to the product development process;

We expect to provide a universal tool and guidance to deal with uncertainties/unknowns in industrial practice. This tool will help decision makers to better understand uncertainties and their influences to final results. It also enables to identify the hot spots of uncertainty, which lead to appropriate decision-making process in Eco-design.

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Clean Sky

PLEIADES

Researcher: Dr Simon Mair

Research Fellow

Project: Systems Analysis and Sustainable Prosperity

I work on the macroeconomics of sustainability. I am interested in exploring how we can reshape the economy so that it enables us to live good lives in an ecologically sound way. My research is principally quantitative and uses economic systems models. With the Centre for the Understanding of Sustainable Prosperity (CUSP) I am working with colleagues including Professor Tim Jackson and Professor Angela Druckman to develop ecological macroeconomic models at the national level. These will be used to explore questions around the structure and dynamics of no growth societies. We are also applying global trade models to explore the environmental and socio-economic implications of shifting to more sustainable patterns of consumption and production.

Expected Impact:

The insights from my research will inform CUSP's larger impact programme. The global models should generate insights into the international implications of current sustainability initiatives. For example, we are currently investigating how circular economy policies in higher income countries may impact the level and quality of employment in lower income countries. Likewise, our national level models will provide insights into how low and no-growth economies can provide good lives and low environmental impact. We aim to bring these insights together with others in CUSP to form compelling narratives of sustainable prosperity.

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CUSP CENTRE FOR THE UNDERSTANDING OF SUSTAINABLE PROSPERITY

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Researcher: Dr Mobolaji Shemfe

Research Fellow

Project: Liquid Fuel and bioEnergy Supply from CO_2 Reduction

Mobolaji works within the Liquid Fuel and bioEnergy Supply from CO2 Reduction (LifeCO2R) consortium. The consortium comprises five academic institutions and four industrial partners, tasked with developing an integrated bio/electrochemical technology to convert CO_2 into liquid fuels and chemicals. In this project, wastewater is firstly treated by microbes via oxidation at the anode of a bioelectrochemical system (BES), thereby generating electrons and protons. The electrons, protons and industrial CO_2 are then converted into C1 & C2 organic acids at the BES cathode, and in turn, transformed into medium-carbon chain fuels and chemicals via synthetic bacteria (Sim Cells). The integrated technology, dubbed BES-SIM, will be coupled with existing wastewater treatment facilities, with the aim of minimising requisite energy for wastewater treatment and producing valuable fuels and chemicals from industrial CO_2.

Within the project, Mobolaji's work focuses on the holistic sustainability assessment of BES-SIM for the production of fuels and chemicals. His work mainly involves the development of robust techno-economic, life cycle assessment and social life cycle assessment models of BES-SIM, and surrogate-based optimisation models to aid decision making and policy formulation. As part of the project, he is also developing a tool, trademarked Global Sustainability and Engineering analysis of Resource recovery Technologies (GSERT™), for assessing the life cycle sustainability of various configurations of BESs, and biorefinery systems. The expected outcomes of the project are as follows:

- New knowledge of the economic, environmental and social impacts/benefits the BES-SIM in comparison to other integrated chemical and biological CO_2 utilisation technologies
- An evidence-based decision-making framework to support policy formulation on CO_2 utilisation.
- A tool for assessing the life cycle sustainability of various bioenergy and biorefinery systems

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EPSRC
Engineering and Physical Sciences Research Council

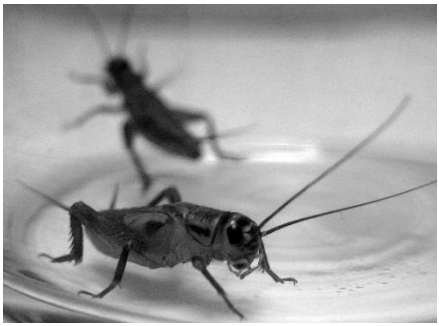
Researcher: Dr James Suckling
Research Fellow

Project: Water Energy Food: Stepping Up

Current systems for providing water, energy and food are unsustainable: each needs overhauling to make them sustainable. Unfortunately this process is hampered by regulation which treats each sector in silos, despite the fact that they are intimately intertwined. However, there are examples of innovative products and services which operate within niches in the current systems which, with the right support, may grow to become a more sustainable mainstream practice.

James works on the EPSRC-funded project Stepping Up with Prof Angela Druckman and seven other institutions. It looks at niche innovations to understand the factors that may help or hinder scaling up. By taking a holistic view over all of the water, energy and food sectors we can understand the potential benefits and also unintended consequences of such growth. The innovations are anaerobic digestion for waste treatment and energy production; insects reared for protein; and the recovery of surplus food fit for human consumption from within the supply chain by charitable organisations.

James' role within the project is to work with specific case studies of each innovation to better understand the systems surrounding them and the factors governing their expansion. He further works with local governments to see those same systems from their perspective. He



assesses the innovations to understand if they are really more sustainable than the incumbents they might replace. The outcomes of the project will include a decision support tool for local government to support the growth of sustainable innovation across the water, energy, food nexus.

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STEPPING UP

EPSRC
Engineering and Physical Sciences Research Council

Researcher: Dr Susan Venn

Research Fellow

Project: Situated Understandings of the Good Life

Susan's work take place within Theme S1 of CUSP, The Centre for the Understanding of Sustainable Prosperity (www.cusp.ac.uk) which focuses on the social and psychological dimensions of prosperity. The key objectives of "Situated Understandings of the Good Life" are to:

- Explore the diverse visions of the good life within neighbourhoods where social inequalities and distinctions are already apparent
- Explore how varying material, spatial and structural contexts within neighbourhoods impact on visions of the good life
- Explore whether and in what way visions of the good life vary intergenerationally and/or by gender
- Explore in what ways concepts of social and environmental justice enter moral accounts of the good life
- Explore how the 'sustainable prosperity' of particular places is understood differently by different residents
- Analyse points of consensus and divergence within residents' diverse accounts and narratives of the good life

The project uses a mixed-method case study approach in three sites, Stoke-on-Trent, Hay-on-Wye and Woking. In each site, an in-depth desk-top analysis is being undertaken, followed by interviews with local informants to understand the key issues in each site. Finally a series of focus groups are being conducted with local residents. In conjunction with other themes within CUSP we will map the emerging divergent accounts and narratives around ideas of the good life, and identify points of consensus and common ground.

Expected Impact:

Working collaboratively with representatives from local government, charities, businesses, social enterprises, arts and cultural organisations as well as local residents we will develop visions of what makes for a good life in each of our cases study sites and consider how to translate these visions into practice, and to provide insights for policy makers.

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CUSP CENTRE FOR THE UNDERSTANDING OF SUSTAINABLE PROSPERITY

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

CES Professional Services Staff

Gemma Birkett
PA to Professor Tim Jackson - CUSP

Laura Church
Practitioner Doctorate Administrator

Moira Foster
CES Administrator & PA to Director

Catherine Koch
CUSP Centre Coordinator

Deidre Richardson
Industrial Doctorates Manager & CES Promotions

Our Industry Partners & Research collaborators include…

Centre for Environment and Sustainability

Sony Interactive Entertainment Europe Limited

PhD in Environment and Sustainability

PhD overview

Since its establishment in 1992, CES has gained an outstanding international reputation for multi-disciplinary research and teaching in all aspects of sustainability. CES's interdisciplinary outlook allows our PhD research students to draw on research approaches from a variety of fields, including amongst others engineering and natural sciences, economics, environmental psychology, sociology and geography. Research plans and application methods involving both quantitative and qualitative data are developed and supported by appropriate research methods training.

Research themes

The diversity of Surrey's interests in environment and sustainability research, and the breadth of our staff means that we can support PhD studies ranging across a broad spectrum of sustainability research including social science approaches, natural sciences and engineering. Most of our research in these areas adopts multi-disciplinary approaches which we have pioneered for many years.

Research areas

The following give some examples of areas that our PGR students work on:
Sustainable development policies and practices
Energy, water, food nexus
Behaviour change
Waste systems
Sustainable transportation
Built environment
Social research on sustainability
Lifestyles and resource consumption
Resource consumption and land use
Sustainable systems: design and modelling
Life cycle assessment, including social LCA and Life Cycle Costing
Carbon and water footprinting
Low carbon energy supply
Energy demand and efficiency
Policy and strategy: for governments and businesses

For further information about the PhD programmes please contact
Moira Foster m.foster@surrey.ac.uk

www.surrey.ac.uk/ces

Centre for Environment and Sustainability

Practitioner Doctorate in Sustainability (PDS) Programme

Building on over 25 years' experience of undertaking cutting-edge applied research with leading industry partners, this programme delivers practical impact and outstanding academic output in sustainability research.

Our ultimate goal is to produce professionals who understand the diverse and challenging nature of sustainability and who are well placed to move the agenda forward in their respective industries. We are experienced in bringing academic expertise from across the university, encompassing a wide range of engineering disciplines and natural sciences alongside social scientists, environmental psychologists, and management, as well as highly experienced sustainability practitioners to match the specific project requirements. Each project has two academic supervisors, generally one with experience in aspects of sustainability relevant to the research topic, and the other with the discipline-specific skills necessary to successfully support the research. These are augmented by at least one industrial supervisor who brings the 'real world' view.

The research projects are developed collaboratively between the Partner Organisation (PO) and University, ensuring that the project is focussed on a real-life problem and yet meets the requirement for a contribution to knowledge, necessary to graduate with a doctoral degree. The Doctoral Practitioner is located with the PO to fully integrate their research within the business.

"*Such symbiotic partnerships create the opportunities to help change business strategy and practices and government policy to deliver economic and environmental benefits.*"
Professor Max Lu, Vice-Chancellor and President, University of Surrey

Admissions to the PDS programme is only by prior enquiry to the PDS Manager, Deidre Richardson d.richardson@surrey.ac.uk

www.surrey.ac.uk/pds

UNIVERSITY OF SURREY

Centre for Environment and Sustainability

Masters Programmes

- ❑ **MSc Corporate Environmental Management**
- ❑ **MSc Environmental Strategy**
- ❑ **MSc Sustainable Development**

As leaders in environmental and sustainability related research and postgraduate teaching in the UK, and with a very wide range of disciplines involved, we offer three MSc taught courses as part of a modular programme. Our MSc courses can be taken as full-time or part-time.

The programmes are delivered through a series of intensive, week-long modules followed by a dissertation, with the option of a placement in industry or the public sector. The modular structure means our courses are also very well suited to those who want to combine both study and work. Students who undertake specific modules on these programmes are eligible for graduate membership of the Institute of Environmental Management and Assessment (IEMA).

As well as the MSc degrees, most modules are available to be taken singly as part of continuing professional development or can contribute to the award of a Postgraduate Certificate or Postgraduate Diploma.

Students are accepted onto the programmes from a full range of academic backgrounds, including the engineering, natural and social sciences, with each of these backgrounds bringing different strengths which are built upon during the MSc.

Students on our programmes are encouraged to undertake a placement with a company, NGO or public sector body as an integral part of their MSc degree. The contacts and experience gained from these placements help our students and the University maintain one of the highest rates of graduate employment of any UK university.

For further information please contact the Programme Director, Dr Jonathan Chenoweth j.chenoweth@surrey.ac.uk

www.surrey.ac.uk/ces

UNIVERSITY OF SURREY

CUSP CENTRE FOR THE UNDERSTANDING OF SUSTAINABLE PROSPERITY

Prosperity Matters

Our guiding vision for sustainable prosperity is one in which people everywhere have the capability to flourish as human beings – within the ecological and resource constraints of a finite planet. Our work will explore not just the economic aspects of this challenge, but also its social, political and philosophical dimensions. We address the implications of sustainable prosperity at the level of households and firms; and we will explore sector-level and macro-economic implications of different pathways to prosperity. We are paying particular attention to the pragmatic steps that need to be taken by enterprise, government and civil society in order to achieve a sustainable prosperity.

CUSP Work Programme

The CUSP work programme is organised around five core themes: (M)eaning and moral framings of the good life; the role of the (A)rts and culture in delivering prosperity; (P)olitical and organisational dimensions of sustainable prosperity; (S)ocial and psychological understandings of the good life; and (S)ystems analysis to explore narratives of sustainable prosperity.

CUSP Network

The Centre takes the form of a rich international network, drawing together expert partners from academic and non-academic institutions as co-producers of the work programme. The research programme of CUSP is coordinated from the University of Surrey under the direction of Professor Tim Jackson. CUSP's academic partners include: University of Surrey, Anglia Ruskin University, Keele University, Goldsmiths College London, University of Leeds, Middlesex University, York University (Canada), University of Canterbury (Christchurch, NZ). We have established a vital link to industry and policy by including as a co-investigator the Aldersgate Group – an alliance of leaders from business, politics and society that drives action for a sustainable economy; and also the World Future Council – an NGO working closely with business leaders to envision An Economy That Works.

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

The Centre for the Understanding of Sustainable Prosperity is funded by the ESRC

www.cusp.ac.uk

cecan Centre for the Evaluation of Complexity Across the Nexus

Imagine you're responsible for a policy that affects every household in the UK, but the goal-posts keep changing and you're unsure whether the policy is still working. Contributing to the design of public policy that can respond to the UK's societal problems is challenging. Policies are difficult to design and it can be near impossible to assess their success.

That's where CECAN comes in...

CECAN will pioneer, test and promote innovative evaluation approaches and methods across nexus problem domains, such as biofuel production or climate change, where food, energy, water and environmental issues intersect.

The 'Centre for the Evaluation of Complexity Across the Nexus', a £3m national research centre hosted by the University of Surrey, brings together a unique coalition of experts to address some of the greatest issues in policy making and evaluation.

Nexus issues are complex, with many diverse, interconnected factors involved. This presents a major challenge to policy making because changing one factor can often have unexpected knock-on effects in seemingly unrelated areas. We need new ways to evaluate policy in these situations.

There is a recognised need to develop a culture of evaluation and evidence based decision making across Government so that civil servants are better able to address the frequent gap between policy development, implementation and subsequent evaluation. CECAN will support the Civil Service Reform Plan to ensure that decision makers have the "skills and expertise they need to develop and implement policy, using up to date tools and techniques, and have a clear understanding of what works in practice."

The Centre will promote 'evidence based policymaking' by finding ways for the results of evaluation to both inform policy and reflect back onto future policy design - something greatly desired in political and public circles.

Centre Director & Principal Investigator: Professor Nigel Gilbert CBE, Department of Sociology

Co-Principal Investigator: Mr Ian Christie, CES

www.cecan.ac.uk

NERC SCIENCE OF THE ENVIRONMENT

Environment Agency

Department for Environment Food & Rural Affairs

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Food Standards Agency food.gov.uk

Department for Business, Energy & Industrial Strategy

Centre for Environment and Sustainability

Doctoral Practitioner Research Students

Abeer Abdalla

Patrick Elf

Ceri Fenwick

Nesma Hegzay

Mauro Lafratta

Yulia Lazareva

Alex Jiean Ling

Paschalena Mavrou

Erica Russell

Ben Sandles

Researcher: Abeer Abdalla

Programme: Practitioner Doctorate in Sustainability

Project: Technology Adoption in Nuclear Energy

The nuclear industry and its demands on technology are unique. The high cost associated with nuclear is a symptom of the long development cycles, numerous risk factors and complexity associated with the technologies themselves. In addition, the rising cost and time investments in demonstrating the reliability of a technology are difficult to justify against uncertain regulatory approval and application opportunities. The latter can be attributed to the volatility of the energy market and state policies. The demands of the industry have placed significant pressure on human and financial resources, and in recent years these resources have diminished. Since safety and quality cannot be compromised, the industry seems to be substantially constrained in efforts to innovate and drive down costs, and has reached a point at which nuclear power projects seem prohibitively expensive to the industry, consumers and government. Therefore, for this relatively slow-moving industry in a competitive energy market, R&D and innovation are key to enhancing the industry's ability to deliver an affordable low-carbon energy system, but there appears to be little clarity and confidence in emerging and proposed technologies.

This complex interplay between time, cost and risk within the nuclear industry presents numerous challenges to technology development and adoption. Drawing on new qualitative research in the UK nuclear sector, this research will highlight the current barriers to technology adoption within nuclear and examine methodologies in development that might help to mitigate their effects, drawing lessons from similar, heavily regulated industries.

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This research is funded by Rolls-Royce Power Engineering Plc

Researcher: Patrick Elf

Programme: Practitioner Doctorate in Sustainability

Project: Sustainable Lifestyles in a Flat Pack? The IKEA Live LAGOM case

Live LAGOM is a 3-year experimental project together with IKEA UK & Ireland and Hubbub UK exploring potential opportunities to facilitate sustainable lifestyles for IKEA's customers.

Making a positive impact on people's lives

With sustainability related problems mounting, there is now more than ever a pressing need for strategic leadership from all sectors to ensure that a sustainable future is possible.

Human behaviours and industrial practices play a key role here. For example, accounting for over one-third of all carbon emitted, human behaviour represents a major impact on the environment.

As a result, the Live LAGOM project is ideally placed to unfold what is needed to facilitate and nurture sustainable lifestyles. Through various interventions including workshops, home-visits, products and information material we are testing opportunities to raise awareness, change behaviours and facilitate kinder everyday routines.

Our research sheds new light on how IKEA as a trusted partner can take on a crucial role in facilitating sustainable lifestyles, and how to create a bi-lateral partnership between company and customers – what we coined Lifestyle Support System.

The project's ultimate goal is to enable people to live sustainable lifestyles at home; to make them attractive, desirable and affordable for the many, and to create a movement of like-Minded people across the UK & Ireland pursuing a LAGOM lifestyle.

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This research is funded by **IKEA**

Researcher: Ceri Fenwick

Programme: Practitioner Doctorate in Sustainability

Project: Circular Economy Strategies for Games Consoles

The aim of this project is to investigate the relative environmental impacts and benefits of various strategies and approaches to Circular Economy. There is much discussion within academia, and amongst policy makers, on how to make a transition from an economy mainly based on a linear form extraction of virgin resources to final product disposal at end-of-life, to a circular model where materials, components and products are kept in use. The assumption behind this approach is that it will, due to reduction of raw material use, lead to the reduction in environmental impacts.

Increasingly policy-makers are looking to industry to find and implement solutions to make a transition to a more circular economy. Using materials efficiently is a corner stone of sustainable development, and it is of key importance to ensure that activities implemented under circular economy, or more broadly material efficiency, deliver on their aims.

By taking practical case studies within industry, the doctoral practitioner will be in prime position to be at the cutting edge of research in this area. It is expected that the research investigate and put various underlying assumptions behind 'circular economy' to test, as well as determine and refine the best approaches to sustainable materials management within industry.

The Doctoral Practitioner comes from a educational and professional background in physical geography and corporate environmental management. In particular, previous experience implementing ISO standards will assist in testing, assessing and evaluating upcoming materials efficiency standards in regards to games consoles. An important starting point in improving and standardizing resource efficiency is to develop the overall aims of the Circular Economy and ensure that materials management is truly sustainable.

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This research is being funded by:

Sony Interactive Entertainment Europe Limited

Researcher: Nesma Hegzay

Programme: Practitioner Doctorate in Sustainability

Project: Driving circular outcomes in the infrastructure sector

Costain is recognised as one of the UK's leading engineering solutions providers. Their goal is to develop innovative- engineering based solutions across the UK's energy, water and transportation infrastructures. Costain is committed to operating their business both sustainably and responsibly within the Rail, Highways, Power, Oil & Gas, Water and Nuclear sectors.

This project will contribute to Costain's mission through the creation of a framework for the circular economy by looking for sustainable and innovative solutions that will help meet critical national needs whilst reducing environmental and cost impacts for Costain and their customers.

Circular economy has the potential to transform industry through use of revolutionary material, business models and technologies. The focus of this project will be to identify key areas for Costain's partners to accelerate the transition towards a circular economy and to develop trials to put these theories into practice. This will involve research on alternative materials, use of waste as resource, developing new business models and testing the power of accelerating & enabling technologies.

Project Deliverables: Develop a framework for circular economy within the infrastructure sector. Exploring materials, technologies and business models investigating the environmental and financial cost factors.

Methodologies: Use Life Cycle approaches to assess and identify innovative technologies that promote circular economy.

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This research is funded by Costain Group Plc

Researcher: Mauro Lafratta

Programme: Practitioner Doctorate in Sustainability

Project: Sewage Sludge, a sustainable flexible electricity provider

The transition to provision of reliable energy from renewable sources is crucial for a sustainable future. However, the renewable energy sources mostly used are intermittent and therefore are not adequate to cope with the dynamic nature of electricity demand.

In the UK, the water industry currently generates around 800 GWh pa of electricity mainly from Anaerobic Digestion (AD). AD is an established technology for the stabilisation and sterilisation of sewage sludge and the generation of renewable energy (in the form of biogas) from the organic content in human waste. The biogas is used in combined heat and power generation plants that are normally located very close to urban areas and so is an example of locally-sourcing.

A combination of technologies alongside AD constitutes the Thames Water advanced sewage sludge-to-energy generation system. It maximises material and energy recovery from the final by-product of the wastewater treatment according to agreed sustainability criteria ([1],[2]), and produces a reliable and steady supply of electricity. The challenge of this project is to develop a system that can rapidly respond to the dynamic nature of electricity demand, and thereby potentially replace existing non-renewable flexible electricity sources.

The dynamic control of AD could constitute the basis for a modern flexible sewage sludge-to-electricity generation. This research will investigate the conditions in which bacteria in the digesters could produce biogas at varying rates and, optimise the entire sewage sludge electricity generation system in order to maximise its flexibility and ability to meet dynamic demand.

Overall, this project aims to increase the contribution of renewably sourced electricity in the UK energy mix, by introducing an effective modern sewage sludge-to-electricity system to meet the demands of the UK electricity supply.

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This research is funded by Thames Water Utilities Ltd

Researcher: Yulia Lazareva

Programme: Practitioner Doctorate in Sustainability

Project: Maximising opportunities at Hampshire Hospitals to support a sustainable health and care system

Hampshire Hospitals provides acute hospital services from Andover War Memorial Hospital, Basingstoke and North Hampshire Hospital and the Royal Hampshire County Hospital in Winchester. The Trust is a major energy user and reducing the use of fossil fuel based energy, supplies and services is a significant challenge. The Trust uses energy to support clinical procedures and the products and pharmaceuticals purchased are manufactured and transported by processes that consume considerable quantities of energy and resources.
Becoming more sustainable in managing these resources will ensure that the Trust can meet the future needs of patients and the people of Hampshire in the future.

Project Aims:
The project will focus initially on evaluating the progress towards meeting a targeted 28% reduction in carbon by 2020 relative to 2013 base level. The project will focus on but is not limited to, energy reduction in buildings, behaviour change, food / food waste and waste products and recycling. This will require understanding the existing methodology and developing it to take account of infrastructure and equipment changes.
The second strand of the project will involve looking at all resource streams within the Trust, including food waste and other waste streams to identify opportunities to improve resource efficiency and sustainability. Implementation and evaluation of selected process/behaviour changes will be a key part of this research strand.

In addition, a detailed assessment of Trust-wide CO_2 emissions is necessary with projections to 2030. This will include a modified and enhanced methodology taking into account a changing Estate which shows progress against targets.

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This research is funded by Hampshire Hospitals NHS Foundation Trust

NHS
Hampshire Hospitals
NHS Foundation Trust

Researcher: Alex Jiean Ling

Programme: Practitioner Doctorate in Sustainability

Project: Environmental impact of current & future wastewater treatment processes

Wastewater treatment processes have been going through dramatic development in recent years, in response to increases in population in cities, tighter environmental controls and demands to reduce energy and cost of the operation. What is exciting is that new technology and approaches are being developed and deployed. However, it is important that whole life cost is considered alongside the environmental sustainability of new processes. This project will do just this and ensure that sufficient analysis is carried out so that decisions on future strategy can be made considering all the facts. This will be a high profile project with significant influence on the future direction of wastewater treatment in Thames Water and in around London a global city with a unique set of challenges.

This project aims at gathering the best practice learnings from the global research community and presenting a comprehensive literature review of the current wastewater treatment processes. This will help to design a framework and approach of assessment that includes the most relevant environmental impact factors. Based on the current state of knowledge, this project will model current and future treatment processes such as Activated Sludge Process (ASP), Dissolved Air Floatation (DAF) and Anaerobic Ammonium Oxidation (Anammox). Furthermore, an economic assessment will be integrated into the sustainability assessment to provide crucial suggestion and recommendations on the future direction of wastewater treatment process.

This project sits within the Wastewater Innovation team which is part of the Strategy & Planning department responsible for key decisions on direction and investment associated with Wastewater Treatment. More recently Thames Water has set up a London 2100 team specifically looking at long-term asset planning in the capital. This project aims to have a significant impact on this team and on medium term investment decisions.

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This research is funded by Thames Water Utilities Ltd

Researcher: Paschalia Mavrou

Programme: Practitioner Doctorate in Sustainability

Project: Modelling moisture migration in multicomponent food systems during storage

Moisture migration in manufactured foods during storage is a common problem of the food manufacturing industry. It can occur between foods and their surrounding atmosphere or between the different compartments of manufactured foods affecting their quality, nutrition and sensory attributes, limiting their shelf life. In particular, the changes in the designed sensory attributes can lead to consumer rejection generating waste. In addition, reducing food waste can have a significant environmental effect as in 2011 WRAP estimated it to contribute an equivalent of 17 million tonnes of CO_2 annually.

The aim of this research is to develop governing equations to describe moisture transfer in multicomponent food systems using a manufactured ice cream cone as a case study. A computational method is being developed to predict the product shelf life using a phenomenological approach with an effective diffusion equation. Using mathematical models to predict moisture migration in such food systems can assist product designers in understanding the source of moisture, allowing for the optimum selection of the product's characteristics.

The main challenge to further progress is that all currently available experimental data has been obtained at room temperature conditions while many manufactured composite foods are stored chilled or frozen. Further experimental and theoretical works are being undertaken to investigate moisture sorption and transfer properties of composite foods at near- and sub-zero temperatures. This will assist in understanding whether moisture migration occurs through the moisture barrier, so the effect of formulation should be investigated, or through imperfections (i.e. cracks or pinholes). Furthermore, understanding the effect of temperature on food mass transfer properties can allow for the improved design of products in order for them to maintain their desired quality and sensory attributes throughout their entire shelf life. This analysis can also assist in identifying the optimum storage temperature allowing for a maximum product shelf life with the lowest possible cooling load, a further environmental benefit.

For this research Paschalia was awarded the 3rd prize in the Young Researcher Award in IChemE's 2017 UK Particle Technology Forum.

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This research is funded by Unilever R&D

Unilever

Researcher: Erica Russell

Programme: Practitioner Doctorate in Sustainability

Project: Investigation into the use of main contractor category management to improve sustainability within the construction supply network

Carillion, a main contractor within the UK construction sector, have a high level of commitment to sustainable business practices. They monitor their carbon emissions, water use, waste production, health and safety standards and social benefits such as community engagement, purchasing locally and from SMEs, and support for industry skills.

In a supply network where contractors and designers are considered to have the most influence in the selection of construction product (Glass, Achour et al. 2011) and to co-ordinate process and relationships (Pryke 2012) there would be an expectation that they would play a leading role in sustainable supply chain management. However social and environmentally responsible procurement is frequently a 'reactive response to external pressure', primarily from legislation or the consumer(client) (Hoejmose, Adrien-Kirby 2012, Berry, McCarthy 2011). Implementing a structured approach to sustainable procurement remains complex as major barriers of cost, project based purchasing, multiple product lines, unique structure creation, sub-contracting and limited awareness of sustainability issues across supply network prevent the levels of collaboration identified as a key requisite for change (Latham 1994, Egan 1998). Carillion have introduced category management within their procurement process and this research investigates if this approach can address some of the barriers identified.

The research work has been embedded into Carillion's corporate sustainability strategy and it has already generated results for the business. Initial research on Ethics and Responsible sourcing has supported changes to supplier registration questions whilst whole life thinking, linked to supply network structure and hotspot analysis, are providing data for a group-wide sustainable procurement strategy and will support Carillion's aim to achieve the new Sustainable Procurement ISO, 20400. Research findings from the final doctoral thesis will be applied to over £3.4bn of annual procurement spend.

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This research is funded by Carillion plc.

carillion

Researcher: Ben Sandles

Programme: Practitioner Doctorate in Sustainability

Project: Using the Sustainable Development Goals to shape the future of ground based engineering

Keller Group Plc is the world's largest specialist ground engineering contractor and the leading independent piling contractor. Keller's business is the solution of soil and foundation problems for the construction industry and they also meet the specialised geotechnical requirements relating to the renovation of existing buildings and the increasingly important environmental contracting market.

The United Nations Sustainable Development Goals (SDG) have the potential to provide a framework for sustainability across all industry sectors. For construction, the contribution towards carbon reduction, a key facet of the SDG, is well evidenced, but much of the research has focussed on what happens above ground. This project will focus on the benefits that could be realised from ground engineering; geotechnical solutions such as heavy foundations and ground improvement strategies.

The body of work will provide a deeper understanding of the contribution, the commercial case and intellectual capital, of the impact of geotechnical solutions, with a focus on embodied energy, and critical materials of the processes necessary to deliver sustainable geotechnical solutions.

This is an opportunity to shape the Keller Group sustainable strategy, and influence the wider industry in this little explored field. Business relevant key performance indicators, covering the full product life cycle (including but not limited to those relating to carbon and critical materials) will be identified to support the alignment of the business with the SDG.

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This research is funded by Keller Group Plc

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Adam Luqmani

Frederick Pask

Helen Skudder

Rupert Zierler

Researcher: Joshua Aslan

Programme: Engineering Doctorate (SEES)

Project: Estimating the energy use of games consoles

The purpose of this study is to estimate the energy use of games consoles (PlayStation®4 and Xbox One) and assess the potential for reducing future energy use. Due to concern over growth in energy use, the European Commission recognised a Voluntary Agreement (VA) on games console energy efficiency in 2015, committing manufacturers to specific power limits and power management features. NRDC, Lawrence Berkeley and US EPA have also recommended numerous strategies to reduce console energy use, including adoption of best-available-technologies (BATs), benchmarking gaming performance and even redesigning consoles with dedicated hardware for video play.

This study uses PlayStation®4 to build a case study for consoles, as it has similar technology to the Xbox One and represents around two thirds of these consoles sold. Existing estimates for the energy use of PlayStation®4 range from 181 kWh/yr (Delforge, et al., 2014) to 103 kWh/yr (Webb, et al., 2014) for the launch model, while subsequent updated models of PlayStation®4 are forecast to achieve 68 kWh/yr by 2020 (Malinowski, et al., 2015). To improve the accuracy of estimates, power consumption of all PlayStation®4 models was measured to calculate Typical Electricity Consumption, together with actual sales data and accurate usage estimates.

Results show energy use has been reduced quicker than predicted, with the most recent PlayStation®4 model halving from 105 kWh/yr (for the launch model) to 51 kWh/yr today. This reduction has been achieved through the adoption of energy efficient BATs, including power scaling, die shrink and automatic power down features. Furthermore, there appear to be few opportunities for further energy reduction, as most of the strategies recommended by the aforementioned bodies are already implemented and those remaining are not feasible. Comparing total energy use to a business-as-usual case (which modelled the power consumption assuming no energy efficient technologies were adopted), energy savings of ~28 TWh in Europe are estimated over the product lifetime, equivalent to the electricity production of Hungary in 2014 (CIA, 2017). These findings have been presented by console manufacturers to the European Commission (EC), NGOs and EU Member States to quantify energy savings achieved through the adoption of the VA, and used to demonstrate the potential effectiveness of the VA approach over alternatives, such as regulation.

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Sony Interactive Entertainment Europe Limited

EPSRC
Engineering and Physical Sciences Research Council

Researcher: Behzad (Bez) Beigi
Programme: Engineering Doctorate (SEES)

Project: Treatment of discontinuous emission of sewage sludge odours by a full scale biotrickling filter with an activated carbon polishing unit

SULPHUS™ is a new design of Biotrickling Filter (BTF) used at a Thames Water's Wastewater Treatment Plant (WWTP), to treat odorous air from two sludge tanks, as a part of Thames Water's strategy to minimise odour from WWTPs. In a BTF air pollutants (odorous or otherwise) are removed by microbial metabolism. In the industry standard implementation of BTFs, this air is then further treated by passing it through an activated carbon adsorption vessel. This secondary treatment of air, known as carbon polishing, is a substantial contributor to costs and environmental impacts of using a BTF that is otherwise the low impact choice. With SULPHUS™, the possibility of satisfactory odour removal without carbon polishing exists and, as part of this project, has been investigated at the full scale at Maidenhead WWTP.
Olfactometry is a method of measuring the odour levels of an air sample based on the ability of a panel of individuals to detect odour from different dilutions of the sample, which is measured in European odour units per cubic meters (ou_E/m^3). In this case study, the SULPHUS™ was designed to obtain odour levels of 2000 ou_E/m^3 or less at the outlet air.

Olfactometry tests were performed at 8 monthly intervals and demonstrated that SULPHUS™ alone was adequate except for the case of sudden spikes in the inlet odour concentration. These were caused by the occasional operation of mixers in the sludge storage. It was shown that these spikes could be dealt with by the carbon polishing unit (Sempere et.al. 2017). There is ongoing work on the mathematical modelling of BTFs including SULPHUS™ as well as lifecycle and cost assessment to ascertain how SULPHUS™ compares to against the alternative technologies being operated in WWTPs. The main challenge of this research is to find the most environmentally and economically viable means of odour treatment.

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Thames Water

EPSRC
Engineering and Physical Sciences Research Council

Researcher: Andrea Botti

Programme: Engineering Doctorate (SEES)

Project: Strategies for future proofing social housing through climate change adaptation

The overarching aim of my research is to provide guidance to building designers on how to avoid, minimise and positively respond to selected climate change impacts on residential buildings in the UK, with a focus on Greater London. The work explores the impact of design decisions on the risk of overheating for present and future climates and it is also aimed at assessing a range of adaptation measures, in both quantitative and qualitative terms.

Tools produced by academic research to date have mainly looked at the existing housing stock to inform policy makers. Building designers, however, may struggle translating academic research and high-level guidance into design decisions, particularly when risk and benefits cannot be easily quantified.

The research focuses on the development of a design tool, capable of assessing and communicating the impact of different design decisions on indoor thermal comfort in the light of climate change.

The practice-based nature of the EngD programme provides an opportunity to collaborate closely with architects and sustainability consultants at PRP and to research the most effective ways to assist decision-making during the different stages of building design. The tool seeks to improve communication of overheating risk from the early stages of design, offering a measurement of such risk against current industry metrics without adding undue complexity to the process. Climate change adaptation strategies and measures will be tested, evaluated against the same metrics and presented in order to help designers understand the possible performance of their design in a future climate, including the need to deal with certain uncertainties. For the identified building types, the tool will provide rapid feedback to decisions from an early stage of the design process, reducing the financial barriers that currently limit such evaluations to compliance checks.

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PRP

EPSRC
Engineering and Physical Sciences Research Council

Researcher: Matthew Gear

Programme: Engineering Doctorate (SEES)

Project: Sustainability & the Design Process – a Marriage of necessity

Matt is working with Recycling Technologies in the development of a thermal cracking process for converting mixed plastic waste into 'oil like' hydrocarbons. His work is particularly focussed on the integration of environmental life cycle assessment (LCA) methodologies into the design process. In addition to working on the design for a process to improve the recycling rate of plastics, integration of environmental considerations into the initial design process aids the development of more sustainable processes at lower cost. Technology, while not a panacea to the sustainability problem facing humanity, will continue to play a key role in securing a sustainable future. When developing new process technology various design and performance aspects are carefully considered however, in practice environmental performance beyond regulative requirement is often considered as lower priority to technical and economic concerns and too late in development to be taken into account.

This is clearly a sub-optimal approach from both an environmental and business point of view as changes late in design are often costly, have limited effects on performance, or shift the burdens elsewhere. Proper integration of sustainability with the design process therefore becomes not just a marriage of convenience but a marriage of necessity.

A significant example of a sustainability issue for which new technology offers promise is plastic waste. The impacts of plastic wastes on the environment are currently undergoing intensive research with recent studies providing findings of increasing global concern. Mechanical recycling technologies are unable to recycle mixed, contaminated or degraded plastics eco-efficiently. Recycling Technologies Ltd are developing a thermal cracking process for converting these troublesome plastics into valuable and versatile hydrocarbon products.

Embedding environmental considerations into the design process is core to the mission of Recycling Technologies Ltd, thus a toolkit has been developed to realise this aim. This toolkit enables environmental Life Cycle Assessment (LCA) to be embedded throughout all stages of design of their unit. A process simulation using Aspen Plus capable of generating LCA inventory data across a range of plastic feed compositions is under development with a view to identifying limits on the feed compositions for which sustainability benefits may be realised.

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Recycling Technologies

EPSRC
Engineering and Physical Sciences Research Council

Researcher: Nick Grudgings

Programme: Engineering Doctorate (SEES)

Project: Developing sustainable travel in Surrey: a focus on cycling

Despite the many benefits of cycling to work, both for an individual (health, mental wellbeing, cost, journey time predictability) and wider society (reduced congestion, fewer traffic accidents, reduced pollution levels, lower public health expenditure, lower mortality rates, less noise pollution) few commuters choose to do so. Previous research has used aggregate or ecological studies of cycling to identify determinants of cycling mode share that might explain differences in participation levels between areas and provide information on why people do or do not cycle to work. However, such studies are often unable to explain differences in cycling levels amongst the demographic groups that live in these areas. This is of particular interest in the UK, where it is predominantly just young men who cycle to work.

The first stage of this research project constructs an ecological model of cycling that explores how determinants of cycling differ amongst demographic groups. The second stage moves from an ecological model to an individual level model that examines the likely routes of commuters making short trips to work. The characteristics of these routes can then be described with a set of determinants similar to those identified in the ecological model.

Findings from the two models should provide a wealth of information on determinants of cycling mode share, whether they operate across an area (e.g. parking costs) or along routes (use of cycling infrastructure). Surrey County Council, the sponsoring organisation, and other local authorities can then use these findings to increase the amount of commuter cycling locally and realise some of the benefits associated with a higher proportion of commuters cycling to work. Specifically, local authorities should be able to optimise their expenditure on cycling programs by being able to target the right people, with the right intervention, in the right place.

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SURREY COUNTY COUNCIL

EPSRC Engineering and Physical Sciences Research Council

Researcher: Emilia Melville

Programme: Engineering Doctorate (SEES)

Project: The role of communities and local authorities in the UK sustainable energy transition

This research explores local energy initiatives through the theoretical frameworks of commons and polycentric governance, as theorised by the Ostrom workshop (Ostrom, 1990; McGinnis, 2016; Ostrom, 1999). It uses three case studies, at the neighbourhood, city and bioregional scale to explore the use of Ostrom's design principles to:

- design a neighbourhood flexible energy district
- evolve polycentric institutions in a mature community energy sector with an active City Council
- Include values of equality within the commons and polycentric governance frame

The research establishes that energy can usefully be framed as a commons: it is a resource that can be consumed, and one where exclusion of users is problematic. There are strong positive externalities of universal access for wellbeing and for the economy; there are dispersed negative externalities for air quality, the climate and the landscape; and the economies of scale in energy infrastructure lead to high risk of monopoly rent-seeking. In a neighbourhood context, it found that supportive community accountability for consumption would be welcome, but that this must respect privacy and individual autonomy. At the city and bioregional scale, the research found that strong shared vision, collaboration between multiple organisations, individuals and sectors, and coordination are essential to progress. It was also found that the fragmentation between the governance of the incumbent energy industry, and the sustainable energy transformation community, is a barrier to the transition needed to meet national carbon targets.
Finally, a set of 'design principles' for commons-based polycentric governance of energy systems are proposed, tested in relation to the case studies, and revisited following analysis.

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BUROHAPPOLD ENGINEERING

EPSRC Engineering and Physical Sciences Research Council

Researcher: Abdul Miah

Programme: Engineering Doctorate (SEES)

Project: Product-based environmental metrics for use within aerospace, defence, space and security industries (ADS)

Within the aerospace, defence, space, and security (ADS) industries, there is a growing interest in evaluating and reducing the environmental impacts of products and related risks to business. Consequently, requests from governments, customers, OEMs, and other interested stakeholders, for environmental information about ADS products are becoming widespread. Presently, however, these requests significantly vary in their format and scope. This lack of consistency limits the industries' ability to meet the informational needs of various stakeholders in a cost-effective manner and reduce environmental impacts. In an attempt to standardise the exchange of this type of information, the ADS industries trade association's "Design for Environment" working group established a set of six product-based environmental indicators identified as forming a useful core of environmental information: energy consumption, water consumption, waste production, access to primary resources, hazardous substance use, and recyclability. However, to ensure consistency, agreed methodologies for measuring these indicators was required. The EngD project continued the work of the ADS DfE WG and overall aimed to develop suitable methods for measuring two pre-selected product-based environmental indicators for use within the ADS industries, including test the methodologies for their data collation: (1) energy consumption, and (2) access to primary resources. Following an action research approach, industry tested and consortium agreed methods for reporting the manufacturing energy footprint and material supply risk of ADS products has been established. Overall, the research findings and established methods will support businesses and other sectors optimise the sustainability of their products and value chains, and inform the development of effective industry standards and product-orientated environmental policies which benefit both the ADS industries and broader environment.

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BOMBARDIER
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GRANTA
MATERIAL INTELLIGENCE

ADS

AIRBUS
GROUP

BAE SYSTEMS

Rolls-Royce

EPSRC
Engineering and Physical Sciences
Research Council

Researcher: Linzi Shearer

Programme: Engineering Doctorate (SEES)

Project: A Problem Unstuck? Evaluating the Effectiveness of Sticker Prompts for Encouraging Household Food Waste Recycling Behaviour

This Randomised Control Trial (RCT) investigated the effectiveness of using stickers as a visual prompt to encourage the separate collection of household food waste for recycling in two local authorities in South East England. During a baseline period of up to 15 weeks, separately collected food waste was weighed (in tonnes) and averaged across households in both treatment (N = 33,716 households within 29 defined areas) and control groups (N = 30,568 households within 26 areas). A sticker prompt was then affixed to the lids of refuse bins in the treatment group area only. Weights for both groups were subsequently measured across a 16-week experimental period. Results showed that, in the control group, there was no change in the average weight of food waste captured for recycling between the baseline and experimental period. However, there was a significant increase (20.74%) in the treatment group, and this change in behaviour persisted in the longer term. Sticker prompts therefore appear to have a significant and sustained impact on food waste recycling rates, while being simple, practically feasible and inexpensive (£0.35 per household) for local authorities to implement at scale.

Linzi is a BCTG Construct Project Manager and Lead Researcher, and is an experienced researcher and project manager. Her EngD project focusses on researching how insight from the academic fields of Behavioural Economics and Environmental Psychology can be applied and tested in real world contexts to encourage households to recycle food waste.
Linzi also holds an MSc in Environmental Studies, a PG Cert in Climate Change Adaptation and an MA in Psychology. She previously worked as STEM Development Manager for City of Glasgow College and is passionate about STEM promotion and education, in particular, redressing the gender imbalance within the STEM sector.

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SURREY COUNTY COUNCIL

EPSRC Engineering and Physical Sciences Research Council

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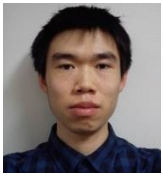

Project: Process Modelling with Limited Data: Application Studies in Waste Treatment Processes

The wastewater treatment process removes contaminants from wastewater so that the treated water can be safely discharged to the environment. It provides an essential service for our society and helps protect the environment. Municipal wastewater treatment processes consume over 2,300 GWh of electricity each year in the UK [1]. As we work towards developing a more sustainable society, we want to not only make sure that the treated water is safe, we want to do this more efficiently and reduce our carbon footprint.

My research is on developing more robust techniques to build accurate Model Predictive Control (MPC) models, and apply these to wastewater treatment processes. MPC is an advanced process control method, based around predicting output trajectories. Past applications of MPC in wastewater treatment have demonstrated over 25% of energy savings in a typical plant [2]. A key component to MPC is the model describing how the output(s) respond to a change in an input. This is used to make output trajectory predictions. Building an MPC model in the wastewater treatment process is difficult because of non-linearity, long time-delays, process disturbances and resource limitations.

I have explored two avenues for my research. The first is grey-box modelling, where process knowledge (from first principles and operator experience) are incorporated as constraints to reduce the search space in black-box modelling. The second is the sequential design of experiments, where the input trajectory for subsequent experiments is designed. An information content criterion is measured for a dataset (the design input and estimated output), which is optimised to design the input trajectory that will provide the most information-rich data.

This is important because a more accurate MPC model gives more accurate output trajectories, which then allows for better process optimisation and greater energy savings for the wastewater treatment process.

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PERCEPTIVE ENGINEERING LTD

EPSRC
Engineering and Physical Sciences Research Council

Researcher: Hristo Dikanski
Programme: Engineering Doctorate (SEES)

Project: Management of Bridge Scour Risk in a Changing Climate

Infrastructure operators are facing the challenges of managing assets under pressures from reduced budgets, aging infrastructure and increasing travel demand. This happens in the context uncertain climate change prompting the need for ever more robust and flexible decision support tools. One major risk to bridges in both current and future climate conditions is bridge scour i.e. the removal of riverbed material at bridge foundations due to the flow of water. Scour is the foremost cause of bridge failure both in the UK and worldwide.

This research explores climate change impacts on the management of scour risk for national bridge stocks, focusing on railway bridges in Britain. To do this a selection of methods is compiled to model the chain of processes linking climate change to scour risk at a network level, exploring the role of key uncertainties.

One finding is that the current scour assessment techniques used in Network Rail may be insensitive to the effects of climate change.

This is a result of a number of factors, including the use of over-conservative models, exceedance probabilities and safety factors.

This conservatism is not well understood and leads to the reduced ability of Network Rail to objectively assess bridge scour risk at a network level, which has repercussions both in the context of current and future climate.

Another key finding is that climate change uncertainty, which is largely aleatory, may in some cases be overshadowed by asset uncertainties, which can be reduced.

This research makes a number of key recommendations that will enable Network Rail and other bridge stock managers to effectively adapt scour risk management practices for national bridge stocks to climate change.

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NetworkRail

EPSRC
Engineering and Physical Sciences Research Council

Researcher: Dr Adam Luqmani

Programme: Engineering Doctorate (SEES)

Project: Sustainability and Innovation: The Case of a Global Carpet Manufacturing Company

What influence does one "green" company have on its industrial sector?
What are the interactions between employee engagement and sustainability?
How should innovation for sustainability be successfully managed?

My work explored these topics, which are based around the concept of "ecological modernisation". The work was grounded by a case study of Interface, a global manufacturing company. The work built an understanding of the economic and social practicalities of implementing sustainability and innovation in practice. The EngD is particularly well-suited to case study research, since as an EngD research engineer I was embedded within the organisation for the duration of the doctoral programme, and I was able to make good use of contacts and internal networks to explore beneath the surface and understand the dynamics at play in the organisation with respect to sustainability.

The following key findings emerged:
I discovered that the company was facing interesting challenges in moving from the "low-hanging fruit" of sustainability reform towards the "tall canopy", where savings are harder to identify, and returns on investment for projects are weaker.

While Interface used to be a clear sustainability leader in past years, the competitive manufacturing sector has now evolved to compete with Interface in this space, which has reduced the market differentiator and has pushed Interface to be even more innovative – while the industry as a whole has become greener.

Net-Works, a radical, innovative recycling project is analysed. The factors that gave rise to *Net-Works* were a combination of a radical goal, deliberate adoption of a social goal, and a safe failure space. Success is owed to developed capabilities, incorporation of the innovation into an existing product, and partnering with an NGO and academia for accountability and credibility.

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Interface®

EPSRC
Engineering and Physical Sciences Research Council

Researcher: Dr Frederick Pask

Programme: Engineering Doctorate (SEES)

Project: Systematic Engineering of Industrial Ovens

Dr Pask's research focussed on sustainable improvements of process ovens in the manufacturing industry. He establishing practical methodologies to reduce energy consumption within industrial ovens using enhanced product and process understanding. It was discovered that in-depth product understanding unlocked energy saving potential that had previously been overlooked. Furthermore, the research analysed the effectiveness of current policy tools at encouraging manufacturers to adopt renewable fuels. It was found that the UK's renewable heat incentives (RHIs) are insufficient at encouraging manufacturers to move away from fossil fuelled process heating in pre-existing process lines.

The research concluded that environmental and economic performance of industrial ovens can, and should, be improvement to help the manufacturers move towards a sustainable future. Dr Pask graduated from the EngD programme in early 2017.

During his four year EngD, Dr Pask implemented projects that cut carbon emissions from manufacturing processes by 836 tCO2 per year, which equated to an annual cost reduction of £121,000 for his sponsor company. Following his graduation, he accepted a full-time position with his EngD sponsor company as an internal energy consultant for European factories, with a specialism on thermal processes. His current role follows on from his Doctoral research and strives to make sustainability improvements within the manufacturing industry.

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3M

EPSRC
Engineering and Physical Sciences Research Council

Researcher: Dr Helen Skudder

Programme: Engineering Doctorate (SEES)

Project: The Carbon Cost of Crime

Cutting carbon emissions, wherever they occur, is a global priority and those associated with crime are no exception. This research project explores the carbon cost of crime and crime prevention in order to ensure that these carbon emissions can be considered wherever possible.

A lifecycle perspective was adopted throughout, to ensure that all aspects of the carbon footprint were accounted for. The carbon footprint of crime was estimated using Environmentally-Extended Input-Output Analysis (EE-IOA) multipliers, and crime prevention measures were analysed by systematically reviewing Life Cycle Assessment (LCA) environmental declarations.

The study estimated that crime gave rise to over 4 million tCO2e in the year 2011, representing the 'carbon cost of crime'. The falling number of criminal offences has resulted in a reduced carbon footprint from around 7 million tCO2e in 1995 to below 3 million tCO2e in 2015 (a cumulative reduction of over 54 million tCO2e).

To explore burglary prevention measures, the carbon footprint was combined with an indicator of how secure against burglary the products were. Window and door locks were shown to be the highest performing individual measures with low carbon footprints and the highest chance of preventing crime. The highest performing combinations included window locks, internal lighting, door locks and external lighting. Burglar alarms were the worst performing measure, from both environmental and security perspectives.

Overall, it is clear that crime and crime prevention have a carbon cost, and that carbon emissions need to be assessed and reduced wherever possible. The study has contributed towards informing practitioners and policy-makers of this connection between crime and the environment. If a low crime and low-carbon future is to be achieved, the encouraging trend of a decreasing carbon footprint attributable to crime needs to be maintained, and strategies must take into account environmental considerations alongside social and economic benefits.

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Secured by Design
SBD
Official Police Security Initiative

Home Office

EPSRC
Pioneering research and skills

Researcher: Dr Rupert Zierler

Programme: Engineering Doctorate (SEES)

Project: Energy-saving attitudes and behavioural influences in large organisations: The case of Network Rail

My research project looks at how attitudes to energy use and other behavioural influences shape energy consumption practices at Network Rail from a social-psychological perspective. The purpose of this research is to produce guidance for Network Rail's asset managers, and to contribute to a UK-wide staff engagement programme with the aim of reducing the organisation's greenhouse gas emissions.

At the outset of my EngD, I was given the broad brief of embedding sustainability frameworks within Network Rail's business practices. Whilst a parallel EngD project (also at the University of Surrey) is investigating *adaptation* to climate change, my research has the aim of climate change *mitigation*, through reduction in the environmental impact of energy consumption. A series of interviews with asset managers determined that although several engineering projects approached the problem of energy consumption on the railway itself, individuals practices in support buildings (offices and depots) were less well understood. Present research in the field of energy use behaviours tends to focus on small-scale energy consumption practices in the home, and attitudes towards these. However, research into energy consumption practices in businesses tends to view organisations as a whole, rather than as a diverse array of individuals with differing priorities. As such, this research seeks to fill the present knowledge gap regarding engaging employees on energy use in large organisations, whilst providing effective guidance tailored to the needs of Network Rail.

Through a series of interviews with senior managers, and multiple staff surveys, this research has provided guidance to Network Rail's energy and carbon strategy team. Targeting specific groups within the company has enabled staff engagement processes with greater impacts, whilst raising the profile of social-psychological methods and models as an effective management aid.

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NetworkRail

EPSRC
Pioneering research and skills

Centre for Environment and Sustainability

PhD Research Students

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- Raya Al-Masri
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- Mercio Cerbaro
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Researcher: Henry Akinola

Programme: PhD

Project: Participatory Approach to Monitoring Air Quality Case Study Lagos State, Nigeria.

As we can see today, the exposure to harmful environmental pollution, were created by human activity. The environment plays a significant role in life. Obviously, our growing population not only means that people use more resources, people also produce more pollution. Therefore, pollution of the natural environment is the main issue. Today, increasing population growth causes the natural environment to change greatly. The negative influences of population growth on the environment in these areas are: water pollution, air pollution, global warming and ozone depletion, but this paper will focus on air pollution. Air pollution is an acute problem in developing countries especially their megacities. In Lagos the sources include vehicle exhaust aggravated by the rising car population, industrial emission especially from petrochemical industries, use of gasoline generation as a result of unstable power supply, use of fuel wood for domestic use and energy for small industries. Air pollution is generally defined as the presence in the outdoor atmosphere of one or more contaminants such as fumes, dust, gases, mist, odor, smoke, smog or vapors in considerable quantities and duration of which is injurious to human, animal and plant life or which unreasonably interferes with the comfortable enjoyment of life and property. The World Health Organization (WHO) defines air pollution as limited to situations in which the outer ambient atmosphere contains materials in concentrations which are harmful to man and his environment. An average human being requires about 12kg of air each day, which is nearly 12 to 15 times greater than the amount of food consumed. Clean and pure air is very essential for human health and survival. Air pollution, combining both ambient and household air pollution (HAP) is responsible for 6.5 million deaths per year with another 7 million from tobacco smoke and this number will increase if urgent measures are not taken. The most affected people will be children and older people, especially in low and middle income countries. Particularly in cities as 98% of urban areas in developing countries do not currently meet accepted air quality standards.

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Programme: PhD

Project: The Water-Energy Nexus in Jordan: Toward a Public Policy Framework for Sustainable and Integrated Resources Management

The demanding livelihood patterns, population growth, and urbanization have put natural resources including water and energy under pressure. Studying the interrelationship between the two resources in order to investigate and understand the multiple bonds and linkages between them to achieving resource sustainability is thus becoming essential. Studies that investigated the water-energy nexus from a resource use efficiency perspective have been conducted a handful of times. Little research, however, has focused on the policy integration and management aspects of both resources.

Jordan is a water-deprived and energy-stressed country. The lack of integration between water and energy sectors at the policy making and planning levels, besides the lack of effective cooperation between several institutions, influence water-energy deficit and scarcity in the country. Most of the programs and policies in one sector are being implemented in isolation, and coordination between the two sectors is almost fragmented.

This research will attempt to develop a policy framework model for water-energy nexus management in Jordan. The aim is to make theoretical and practical contribution to the understanding of the water-energy nexus from a policy integration and management perspective in addressing resource sustainability, and securing the supply of energy and water to the different sectors (i.e., industrial, commercial, residential, and agricultural sectors).

The model factors that influence the relationships between water and energy policies will be identified using an appropriate theoretical framework and the application of appropriate data collection method. Data will be primarily collected through semi-structured interviews with the relevant sector players, stakeholders, and policy makers; direct observations; as well as the application of Delphi method for data consensus.

The policy framework would assist policymakers to assess different scenarios for water and energy development investments, minimize conflicts of interest in environmental resources planning, and boost collaboration and synergies among different actors responsible for environmental management.

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Project: Translation of Remote Sensing data into Sustainable Development Indicators

The purpose of this study is to critically analyse the potential of Earth Observation (EO) to populate the UN's 17 Sustainable Development Goals (SDGs) indicators and how satellites data can have considerable impact, for instance, delivering measurements and evaluation of progress towards SDGs.

In 2015, member countries of the United Nations adopted 17 Sustainable Development Goals (SDGs) at the Sustainable Development Summit in New York with a main key feature in their post- agenda: 'Leave no one behind'. These goals have 169 targets and 232 indicators which are based on the three pylons of sustainable development: economic growth, social inclusion and environmental sustainability.

Data plays an important role in in achieving the goals by 2030; to create new indicators and targets, and monitor the state of the countries. However, there are still gaps and challenges in obtaining data especially in developing countries. One innovative way to fill the gaps is to use, earth observation.

The benefits of using satellites imagery are immense offering a wide variety of applications including measuring the land use change, managing the impact of natural disasters, monitoring the atmosphere and climate change.

Earth observation (from satellite, airborne, and in-situ sensors) provides accurate and reliable information on the state of the ecosystems and their changes over the time; significantly reduce the traditional monitoring cost, great accessibility (e.g. Sentinels), spatial coverage of measurements, availability (spatially, temporally and thematically), useful in places with poor data. But there are also challenges involved with using earth observation to populate indicators, especially with the more social and economic dimensions of sustainable development.

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Scenario DOCTORAL TRAINING PARTNERSHIP NERC SCIENCE OF THE ENVIRONMENT

NPL National Physical Laboratory

Researcher: Sharon Pearl Bunting

Programme: PhD

Project: Food safety standards in Nigeria: implementation and producer value chain Perspective on Cowpea and Groundnut

Existing studies show that there is an increasing awareness of food safety in developing countries, including Nigeria; however, the implementation of food safety standards has been largely unexplored. This research responds to gaps in existing literature on the need to empirically investigate how implementation and producer value chain behaviour affects cowpea and groundnut food safety standards in Nigeria.

The study also focuses on food safety standards in Nigeria and the on-going three-year exportation ban issued by the European Union in 2016 which is expected to end in 2019. The ban was issued due to various European Union Food safety reports which showed that Nigeria's cowpea and groundnut contained high levels of contaminants which are detrimental to human health.

This research aims to contribute to existing literature in developing countries by attempting to explain whether the cost of food safety standards certification, when compared to the revenue from export is lower. Also, the research will examine whether the local awareness has resulted into a demand for produced in compliance to food safety standards. In addition, this research aims to explore how food safety standards can be used a means to increase the growth of Agriculture export from Nigeria. Lastly, the study will assess whether food safety standards in Nigeria mirrors the two leading countries where they have high import levels of agricultural produce (the European Union and the United States of America).

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Researcher: Alfred Buttigieg
Programme: PhD

Project: Environmental assessment and optimization for GHG minimization of the various port work process operations executed at the seaports

This research investigates the environmental impact of different methods of discharging or loading cargo in the maritime industry. The research concentrates on the sea port terminal ship-to-shore heavy cargo handling equipment which is used to transfer and transport cargo. Several studies have been undertaken to estimate the greenhouse gas (GHG) emissions at Container and Passenger port terminals but GHG emission studies for conventional cargo port terminals are very sparse. The aim of the research is therefore to conduct an environmental impact assessment that focuses on the GHG and other emissions and consumption associated with the applicable methods for discharge or loading of diverse cargoes and represents port work process operations in a multipurpose sea port terminal. The cargo handling equipment and ships are mainly powered by internal combustion engines using fossil fuels. These combustion emissions of the mainly diesel or marine diesel engines during the deployment of heavy mobile hoisting equipment, port terminal tractors and ships affect local air quality and also should be accounted for properly in the whole shipping supply chain. The principal gas emissions are carbon dioxide (CO_2), carbon monoxide (CO), methane (CH_4), nitrous oxide (N_2O), oxide of nitrogen (NOx), non-methane volatile organic compounds (NMVOCs), sulphur dioxide (SO_2) and particulate matter (PM). Several of these primarily GHGs are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The research will quantify such emissions for each port work process operation. Ultimately, the goal of the research is to provide a new understanding of the impact from such operations, to consider options for their minimisation and to place such impacts within the seaport terminal Operators context.

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Researcher: Mercio Cerbaro
Programme: PhD

Project: The application of Earth Observation (EO) information to help manage land use change in Brazil : An analysis of user needs.

Research:
This research aims to analyse the challenges involved in promoting the use of Earth Observation(EO) in Brazil and how this can be enhanced to help inform policy makers. Brazil is a country with some of the most diverse and extensive forest ecosystems in the world. However, the expansion of agriculture, livestock, demand for food production, extractive industries, illegal logging, land conflicts, hydropower projects and fire are some of the main pressures on those ecosystems. Despite the attempts of institutions, such as the National Institute for Space Research (INPE), aiming to promote the use of earth observation (EO) to support land use management and conservation projects in Brazil, the use of such tools could be used more widely. The specific development agenda of different institutions and the capacity of the user to process and apply EO information in different contexts are some of the major challenges in public and private institutions.

This PhD research is sponsored by NERC SCENARIO in a joint partnership between the University of Surrey and the University of Reading. The National Institute for Space Research (INPE) is supporting the PhD research at the national level.

Main interests: Earth Observation, GIS, food security, forestry, agriculture and conservation.

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Scenario DOCTORAL TRAINING PARTNERSHIP
NERC SCIENCE OF THE ENVIRONMENT

Researcher: Marcio De Lazzari

Programme: PhD

Project: Exploring Sustainability-inspired Business Start-ups in the Creative Industries

Marcio's study focuses on business start-ups motivated by sustainability, to improve understanding of how innovation for sustainability can be implemented as a business model.
The business models for Sustainability-inspired Business Start-ups (SiBS) may differ from mainstream start-ups, while business drivers can change over time.
Sixteen British start-ups were examined, covering generic-mainstream and sustainability-inspired start-ups, business lifetimes up to 10 years, and three sectors: portable off-grid renewable energy, gifts and fashion clothing. Qualitative data were collected by semi-structured interviews, direct observation and document reviews.

Expected Impact:
Structured comparison across clusters of cases showed that:

- Drivers differ between sectors: energy sector star-tups see their potential market as defined by long-term cost of energy supplied and originality of the product; brand, lifestyle and product novelty demarcate start-ups in the gifts sector; start-ups in fashion clothing focus on product novelty and lifestyle, aimed at consumers aspiring to a "sustainable" lifestyle.
- Business models endure throughout the growth of start-ups.
- Most start-ups in the energy sector have clear financial strategies but this is commonly lacking in the gifts and fashion clothing sectors.
- Common best sustainable practices can be identified across the three sectors.

Research project funded by Cnpq in Brazil / Science Without Borders programme

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Researcher: Agni Dikaiou
Programme: PhD

Project: Wellbeing at work and Productivity

I am currently investigating the role of economic indicators, such as labour productivity, ICT intensity and organizational changes, in determining the level of individual wellbeing at the workplace. Through an econometric analysis of European survey and industrial data, I regress job satisfaction on the economic indicators and their interactions, controlling for all other factors that help explain the level of job satisfaction, such as intrinsic and extrinsic job facets, demographic and other employment characteristics.
The above project will be further carried on using US panel data during my research placement at the University of Massachusetts, Amherst.
Future research will be focused on the quality of work life, testing the hypothesis that there exists a 'sweet spot' of good work with low environmental impact, high social value and high job satisfaction that could be encountered in the highly labour intensive sector of personal services.

Expected Impact:

A critical evaluation of the indicators for prosperity that leaders prioritise will be one of the outcomes from my work. Furthermore, my research on the importance of sustainable practices at work, emotional wellbeing of employees and the future of work in a highly automated future society, is expected to have significant policy implications for both governments and organizations.

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CUSP CENTRE FOR THE UNDERSTANDING OF SUSTAINABLE PROSPERITY

UNIVERSITY OF SURREY

Researcher: Ben Gallant
Programme: PhD

Project: Testing the Baumol Hypothesis under low growth conditions

Recent research suggesting that the activities of humans are testing and in some cases exceeding the boundaries of the global environment has gained considerable attention. Researchers in the field of Ecological Economics have suggested that human activity can only be brought back in line with planetary boundaries though radically rethinking our approach to economic growth.

Economic growth is partially driven by gains in labour productivity, largely resulting from technology allow companies to produce more output for every hour of work. The simple relation between technology, labour and output growth is central to the economic discussion of staying within planetary boundaries. A particular problem arises from sectors growing at different rates, which has the potential to cause deleterious effects on social as well as environmental harm.

This project seeks to explore the technology-labour-output relationship and its potential outcomes through the use of systems dynamic modelling. Specifically, by testing the impacts of inhomogeneous productivity growth by using a stock-flow-consistent model of the macro-economy. The project aims to expand our understanding of how labour and employment can be made compatible with sustainable prosperity.

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This research is part of The Centre for Understanding Sustainable Prosperity (CUSP), an ESRC funded research project with the goal of exploring how people can live well within environmental limits through multi-disciplinary research.

CUSP CENTRE FOR THE UNDERSTANDING OF SUSTAINABLE PROSPERITY

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Researcher: Anna Godleman
Programme: PhD

Project: Uncovering multiple narratives of community energy in the UK, Germany and Denmark

The community energy movement has blossomed throughout Europe as an active, local response to the prevalent meta-narratives of climate change, resource scarcity, fossil fuel dependency and the rise of low carbon technology. The movement has the ability to influence the transition towards sustainable production and consumption of energy from a grassroots level. Using case study examples from the UK, Germany and Denmark, this research adopts a narrative research inquiry, drawing on qualitative interview data and document analysis to present multiple stories of the community energy movement.

Expected Impact:

The findings aim to weave historical/political meta-narratives with local narratives; discussing how personal stories are intertwined with the influence of wider events and discourse. It aims to unravel the influence of national political narratives on the movement in each of the case studies and provides a comparison between countries. Finally, it discusses how narratives connect to one another; the positive influence of aligning narratives at different levels and; the negative effects of a misalignment such as clashes of political discourse with local concerns.

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South East DTC

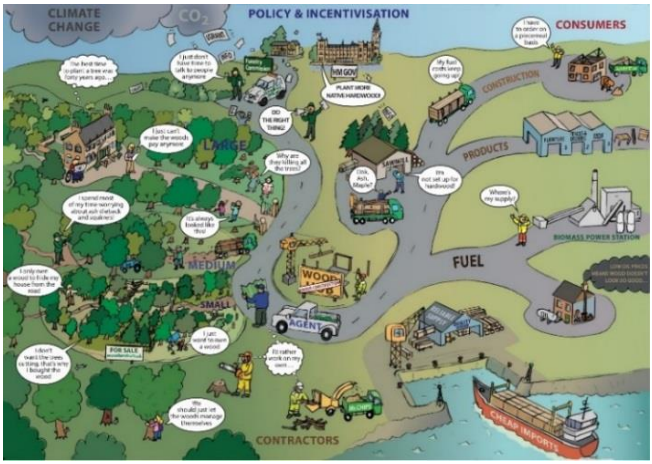
E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Researcher: Caroline Greenslade

Programme: PhD

Project: Seeing the wood for the trees: encouraging greater woodland management in South East England

The South East of England has an abundance of woodland which offers a potential timber and fuel resource in parallel to being a much-loved part of rural life. An ever-increasing quantity of mature broadleaved trees available for harvest forms a sustainably extractable potential, set against the backdrop of only 10% of demand currently supplied from UK-grown resource. There has been little systematic research into what is blocking the sector and initiatives to address the challenge have not had a significant impact on the amount of woodland under management.



The research aims to understand why woodlands are not being managed, identifying the human, structural, financial and environmental issues at play, before identifying the 'trigger points' that move an owner towards management.

The research is based on in-depth interviews, questionnaires and case study analysis of woodland owners, managers, forestry workers, wood users and customers across the sector. It aims to fill a gap in understanding the dynamics of forestry in the South East of England and provide a baseline of evidence for policy makers to develop a package of interventions to result in better utilisation of woodland resource, offering sustainable support to rural communities and economies.

This research at CES is co-supervised by the University of Reading.

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Forestry Commission

South East DTC

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Researcher: Elisabeth Guaaker

Programme: PhD

Project: Towards more sustainable food systems: transitioning to plant-based school meals

My research focusses on how school meals rich in plant-based foods can support more sustainable food supply chains, enhance health and wellbeing and engage school children in active thinking about the meaning of sustainability actions and their own lifestyles. I am examining attitudes, barriers and constraints to such diets in secondary schools in England and plan to undertake analysis of how policies, experiences and behaviours can support beneficial sustainability and wellbeing outcomes. I also intend to analyse the environmental profile and the sustainability benefits of plant-based school meals using environmental and social Life Cycle Assessment methods.

Expected Impact:
This project can provide policy-makers with a more rigorous and comprehensive assessment of the environmental impacts of school meals. It can also provide an analytic framework and a strategic tool for how to develop and implement a new policy for sustainable schools. Schools are key arenas for shaping the values and behaviour of young people and can be one of the cornerstones of a sustainable community. Furthermore a new plant-based diet can promote healthier food choices and improved health in the population as a whole. The overall purpose of the project is to frame a public debate about environment and health with a strong focus on sustainability. We predict that plant-based school meals can yield a significant reduction in GHG emissions and this project will provide a numerical value for how effective a transition to plant-based diets can be.

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Researcher: Olumide Hassan

Programme: PhD

Project: Electrification using renewable energy sources in rural Nigeria : An analysis of the interplay between society, economics and technology in rural electrification

This research aims to analyse the challenges involved in promoting the use of renewable energy in Nigeria, specifically in the rural areas, and how these barriers can be overcome to help inform policy makers.

Nigeria possesses significant deposits of oil and natural gas, along with other natural resources. It is the largest oil producer on the African continent. Nigeria also possesses extensive deposits of sub-bituminous coal and lignite, along with an estimated 31 billion barrel of oil equivalent of untapped oil tar sands. Despite this seemingly abundance of energy resources, Nigeria has acute problems getting electricity to its population, with inadequate generation facilities and inefficient and poorly maintained transmission and distribution networks. As a result of these inadequacies and inefficiencies, is estimated that up to 60% of Nigerians (mostly in rural areas) live in the dark without access to electricity.

Nigeria has a large capacity for renewable energy sources, including hydropower, wind, solar, geothermal, and biomass, however, improving the contribution of clean, modern sustainable energy has proven difficult. There have been plenty of energy policies developed to improve renewable energy generation in rural parts of the country, however these have effectively failed for various reasons, one of them being "policy transfer", which is the use of policies that have worked in developed countries but are not necessarily suitable to local needs. Understanding the relationship between society, technology and economics will go a long way to help identify barriers in the rural electrification process, which will help policy makers construct targeted policies to develop renewable energy electrification.

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Researcher: Amy Isham
Programme: PhD

Project: Flow activities as a remedy for materialistic lifestyles

Consumer cultures promote the acquisition of money and material goods as an essential component of the good life. However, considerable research now links the possession of strong materialistic values to a variety of negative well-being outcomes as well as a reluctance to accept that the world is currently facing environmental issues and engage in pro-environmental behaviours. My project therefore aims to uncover alternative ways of living well within ecological limits. In particular, it focuses on testing Csikszentmihalyi's (2004) proposal that through flow experiences we can live well, sustainably. Flow describes an optimal experience of total immersion in a challenging activity. It involves a disappearance of self-consciousness, an altered perception of time, and the sensation of effortless movement.

My research is made up of three key stages. The first is an assessment of whether flow experiences are (1) linked to greater personal well-being and (2) more likely to occur in activities with a lower environmental impact, using data from US families. The second stage involves an examination of the relationship between the possession of materialistic values and the tendency to experience flow. This relationship will be examined initially using questionnaire measures before conducting a laboratory experiment in order to determine whether temporarily inducing a materialistic mind-set can reduce the extent to which individuals subsequently experience flow in an activity. The final stage of the research will seek to propose and test a theory surrounding why materialistic values and flow may be incompatible, using ideas from theories of self-regulation, temporal discounting, and escapism. The results of this research will help to highlight areas for interventions that seek to aid transitions away from materialistic lifestyles towards more fulfilling, sustainable ways of living.

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CUSP CENTRE FOR THE UNDERSTANDING OF SUSTAINABLE PROSPERITY

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Researcher: Andrew Jackson

Programme: PhD

Project: A stock-flow consistent input-output framework for the analysis of the transition to a low carbon economy and stranded assets

In order to prevent catastrophic climate change, governments have agreed to endeavour to keep the maximum global average temperature increase to within a 2°C threshold above pre-industrial levels. This temperature limit implies a large reduction in the consumption of energy generated from the burning of fossil fuels, and a corresponding increase in the consumption of renewable and other low carbon forms of energy.

Empirical research has shown that to have a 50% chance of remaining within the 2°C threshold, a third of oil reserves, half of gas reserves, and around four fifths of coal reserves will need to be left unused – or "stranded". As well as the stranding of fossil fuel reserves and resources, capital assets may also be stranded, particularly in the transport, power generation and high energy use sectors.

The stranding of assets can be expected to influence the economy through a variety of channels. For example, if a company's share price reflects investor expectations of future profitability, then any factor that might affect these expectations, such as the announcement of a more stringent policy on CO2 emissions or a technological breakthrough in the renewables sector, could lead to a rapid revaluation in the company's market value. Globally, the sectors with the largest CO2 footprints – the natural resource and extraction sector, power utilities, chemicals, construction and the industrial goods sectors – make up around one third of equity and fixed income assets. This means that the stranding of these sectors assets could have a significant impact on financial markets, and through these the real economy.

The aim of this study is to formally model several possible transition paths to a low carbon economy, as well as the mechanisms by which assets could become stranded and the effects that this stranding might have. This modelling is carried using a specially constructed, stock-flow consistent, input output model. It is hoped that this research will help academics and policy makers to better understand the risks and benefits of various transition paths and policies.

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CUSP CENTRE FOR THE UNDERSTANDING OF SUSTAINABLE PROSPERITY

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Researcher: Sophia Kokoni
Programme: PhD

Project: Decarbonisation of the economy through the electrification of the energy system, taking heat pumps as an example

My research is related to the decarbonisation of the UK economy through the electrification of the heating sector. I look at the factors that might lead to a mass-market take-up of heat pumps in the UK residential sector. I am addressing this topic using a combination of techno-economic and econometric modelling approaches. The former approach will help me determine the conditions under which heat pumps would become the most cost-effective option in different segments of the residential heating market. With this modelling exercise, I aim to evaluate if and under which assumptions/conditions heat pumps would become the preferred choice for consumers who could choose amongst a set of heating technologies. With the econometric model, I will evaluate the factors that led to a mass market deployment in a set of countries (Austria, Finland, Germany, France, Norway, Sweden and Switzerland) as well as the factors that have been shaping the UK market. The theoretical background of my research lies in the microeconomics theory of consumer demand.

My work has applicability on policy making and on energy economics both in terms of supply and demand.

The Centre for Environment and Sustainability and Surrey Energy Economics Centre co-supervise this research.

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EPSRC
Engineering and Physical Sciences Research Council

Researcher: Sapanna Laysiriroj
Programme: PhD

Project: Effect of intergenerational transitions and employee's perceptions on CSR activities in family-run business in Eastern Thailand

Many Thai scholars suggest that the Corporate Social Responsibility (CSR) concept has been imported to Thailand by foreign companies, many of which have active CSR programmes which are often formalised. However, there are family-run business in Thailand (FRBT) that practice a form of CSR that is driven by the mentality of "giving back to the society", influenced by religion and culture. This suggests that, while the concept of CSR have been introduced to Thailand over decades by Western and European countries, family-run businesses (FRBs) have practised their own interpretation of CSR. Many scholars assert that first-generation FRBs are primarily concerned with the businesses' survival and growth in order to pass them on to further generations. With sufficient size, its priority often shifts towards improving the company's profitability. Literature has shown that the transition from survival or growth to profitability is often crystallised in the transition from first-generation to second-generation business owners. This could be because successions have acted as focal points where firms' emphasis changes, as a result of a gradual transition, or it may simply reflect differences in priorities as perceived by different owners. In addition, past research has suggested that FRBs, especially small and medium sized ones, approach CSR differently from larger companies and corporations. However, even first-generation FRBs, who have struggled to survive, engaged in CSR-supporting practices. Business successors, who often are more focused on profitability, will be active in CSR differently by emphasising more on treating their employees well and caring for society. Thus, this study intends to explore differences in forming and practicing CSR, how the FRBs practise their CSR activities and how such activities are perceived by their employees.

This research is based on distributing 3,000 questionnaires to employees of 28 FRBs in Eastern Thailand, with 2,352 respondents in total, 707 were from first and 1,645 from second generation companies. SPSS has been used to interpret differences in employee perceptions on CSR activities between the first and second generation owners. factors analysis has been used to reduce number of variables. Lastly, Cluster analysis has been used to identify homogeneous group of respondents into 5 clusters.

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Researcher: Zheng Liang
Programme: PhD

Project: Integrate environmental accounting into traditional accounting system

The main aim of my research is to develop a framework to evaluate corporate environmental performance. Existing systems based on accounting systems have two significant problems, namely what to use to standardise different aspects of environmental performance (monetary units are no reflection of the 'value' of environmental damage or resource use, it suffers from inflation and price chances for external reasons), as well as the common conflation of stocks and flows in accountancy.

Traditional accounting systems tends to focus on the monetary side of business activity while environmental issue has been left out. The environmental side of information needs to be addressed in order to resolve the environmental issue and satisfy different stakeholders. For example, traditional costing system like Activity Based Costing are based on traditional accounting systems, and therefore need to integrate environmental cost.

In my self-funded project, I have picked Energy-service Companies (ESComs) as the focus of my empirical part to apply and test my more comprehensive framework to address the 'currency problem' (monetary or physical), with clearer scope (past or future) and a defined range (short or long run) thus focusing on the micro side of corporate environment accounting.

I expect that the new framework could present a significant contribution to the accounting and sustainability knowledge and provides companies with an essential guidance for the accounting and management. In additional, I expect that such framework could offer a benchmark role and importantly enable companies to make wiser decision in terms of its overall business strategy performance, with further steps in this area to include social and sustainability considerations in due course.

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Researcher: Anastasia Loukianov
Programme: PhD

Project: An ethnographic study of disadvantaged 11-13 year olds wellbeing in relation to consumerism and materialism.

As the wage gap and price of goods and services are growing, children from low-income families have an increasingly hard time accessing basic necessities. At the same time, western childhood is becoming increasingly dependent upon obtaining material and status goods, especially in the context of leisure, care, and identity building. In the UK, consumption is an integral part of everyday life and failure to engage in it might lead to social exclusion. Having the « right » material goods is important to fit in, signal status, and attract potential friends.

But the accumulation of material goods comes at a double cost. First, the consumer mindset of ever acquiring more is having a disastrous impact on the environment. Second, materialistic attitudes - namely the excessive concern with physical comforts or the acquisition of wealth and material possessions rather than spiritual, intellectual, or cultural values - have been repeatedly linked with lower personal wellbeing.
This study aims to understand how young people from disadvantaged backgrounds relate to materialism, what it means for them to do well, and not so well. Through the use of focus groups and participative filmmaking, it explores matters of wellbeing, systems of values, and aims to move away from research *on* children to research *with* children.

This study aims to be empowering for the young participants by allow them to control how they are represented in research, voice their views, and offer an opportunity to learn new skills.

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CUSP CENTRE FOR THE UNDERSTANDING OF SUSTAINABLE PROSPERITY

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

Researcher: Ida Fahani Md Jaye
Programme: PhD

Project: Integrated Assessment of Palm Oil Mill Residues to Sustainable Electricity (POMR-SE): A case study from Peninsular Malaysia

The residue from palm oil industries such as empty fruit bunches, palm kernel shells, oil palm trunks and fronds and palm oil mill effluent has high potential to be used in the internal combustion engines, combine heat and power (CHP) and other technological configuration as an alternative resources to partially replace the fossil fuel usage in electricity generation sector. The amount of heat and electricity that can be generated from the available resources capable of meeting the heat and electricity demand of its own milling operations and also to be feed back to the electricity grid. At present, there are little attempts has been made to compare the technical, economic and environmental feasibility to use this resources as the feedstock for electricity generation. The aim of this research is to assess the suitability of the dried empty fruit bunches (EFB) and biogas extracted from palm oil effluent (POME) as a feedstock to be used for electricity generation in Peninsular Malaysia.

Expected Impact:
The outcomes of this research can served as an appropriate business and technical guidelines to support the long term sustainable energy planning and to foster a well-informed bioenergy investment decision making process.
This PhD research study is sponsored by Majlis Amanah Rakyat (MARA), a government agencies under Ministry of Rural and Regional Development.

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Researcher: Oluwaseun Nubi

Programme: PhD

Project: Sustainability of Bioenergy for Power Generation in South West Nigeria

This research explores the potential for electrical power supply in South-West Nigeria from the perspective of the three pillars of sustainability: Environmental, Social and Economic. Energy supply plays a key role in sustainability as an essential ingredient in both economic growth and social development. However, its production and usage has led to various problems ranging from environmental to socio-economic, especially with the current use of energy sources such as fossil fuels which are not only non-renewable but impact the environment e.g. through global warming.

Many developed countries have made concerted efforts to secure a steady supply of electricity with increasing emphasis on harnessing sources of energy that are more sustainable. However, in developing countries such as Nigeria, electrical power supplies which are a major component of societal and industrial development can be both inadequate and heavily dependent on fossil fuels. At the same time Nigeria is endowed with abundant renewable energy potential from resources such as hydroelectric, solar, wind, tidal, and biomass. This research investigates the biomass resources (including from 'wastes') of South-West Nigeria to determine how their supply can be optimised for renewable and sustainable energy provision. It seeks to create a better understanding of the sustainability of biomass energy supply from a whole systems perspective. For this purpose, the Life Cycle Sustainability Assessment (LCSA) approach is being deployed to assess the environmental, techno-economic and social aspects of different biomass feedstocks and their generation capacity in options such as combustion, gasification, anaerobic digestion and landfill gas recovery. The systems understandings gained will also be considered in relation to their potential contribution to meeting the United Nations Sustainable Development Goals. The findings of this research are intended to be useful for diverse stakeholders such as power companies, government bodies, policy makers and civic society.

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Researcher: Richard Afriyie Oduro
Programme: PhD

Project: The Economics of the West African Power Pool: Efficiency of the Electricity Distribution Sector.

My current research carries out a theoretical investigation into the existing methods of measuring efficiency/productivity and constructs a new technique of the Stochastic Frontier Approach (SFA) based on Burr Type X distribution to examine how the peculiarities of the technique can translate into robustness. The second part of the research applies SFA techniques to Electricity Distribution Companies (EDCs) in West Africa. The aim is to model the relative cost efficiencies of 15 electricity distribution companies in Ghana, Nigeria, Togo, Benin and La Cote D'Ivoire. To comprehend the persistent inefficiency problems of these distribution companies, we conduct a Political Economy Analyses (PEA) to understand the status quo and to find possible practicable solutions to enhance efficiency in EDCs in West Africa.

It is anticipated that the SFA based on Burr Type-X could be more robust when applied to different data sets.
It also expected that regulators in West Africa can rely on the technique and the efficiency measurements when setting targets for EDCs at the national level. Finally, the PEA could yield some plausible policy recommendations to enhance efficiency of EDCs in West Africa.
My research is sponsored by the Ghana Education Trust Fund (GETFUND) and supported by Agricen. The Surrey Energy Economics Centre (SEEC) and CES from University of Surrey are collaborating by supervision on this project

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Researcher: Tyler Jay Reynolds

Programme: PhD

Project: Mobile phones and sustainable agriculture based livelihoods: A case study of smallholder farmers in the Ashanti Region, Ghana

As the adoption of mobile phone technology reaches ubiquity in West Africa, a significant portion of the farming population has altered the complex collection of strategies aimed at increasing agriculture production and improving livelihoods. This project aims to capture the specific nature and effectiveness of these behavioural changes using mixed methods based on the Sustainable Livelihoods Approach. Yam farmers in Ghana face a particularly difficult set of challenges including climate change, manual land preparation, and convoluted market protocols. The majority of the study population struggles to conceptualize and address these challenges due to either a lack of information or incorrect information. Mobile phones have the potential to serve as an effective tool by which individuals can mitigate a selection of these challenges according to the extent to which individuals carry out effective information seeking, the availability of quality information, and social networks. Nearly the entire study population either owns or has access to a mobile phone, and agriculture extension services are widely available albeit underutilized. Preliminary results appear to show a *digital divide* in the population whereby individuals making dedicated use of their mobile phone face a decreased challenge in achieving particular critical tasks such as transferring money, organizing labour for land preparation, and obtaining yam sale price information. The move towards the use of the mobile phone to address these challenges has largely occurred over the past five years, and the percent of the population adopting these behaviours is increasing. Today mobile phones are widely used as a means by which individuals maintain their social capital, particularly among families which are increasingly mobile and divided between the rural communities and regional towns. A gender divide also persists in the study population whereby females have lower technoliteracy, decreased access to information sources, and less effective use of mobile phones than males. While the study population generally considers the mobile phone to be an effective tool by which to save time and money on an individual level, significant higher level challenges in improving livelihoods in which the mobile phone is largely ineffective such as access to clean water and subsidized fertilizer persist.

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Researcher: Ms.Khadeejah Saleh

Programme: PhD

Project: Enhanced Air emission profiling for LCI of Kuwait Crude Oils

Research has proven that there is variation in the environmental footprint of crude oils (COs) due to the diversity in CO production systems, production schemes, ages of reservoirs, offshore vs. onshore production scenarios, geographical locations, etc. This variation will affect the environmental footprint of downstream products. This study is therefore undertaking new research on COs produced by the Kuwait Oil Company (KOC) to provide:

i) new insight in the LCA field on the potential variation in environmental footprint caused by specific variations in CO feedstocks.
ii) new LCA-derived information for KOC and other oil companies on the relevance of CO production variations and hot spots on the potential environmental impacts of downstream products.

The research makes use of new, disaggregated data on air emissions from KOC's operations. This data, with further research, can be tied back to CO production volumes for specific supply lines and systems. Additional complementary data is also being acquired from ongoing air pollutant monitoring operations being conducted routinely by KOC and from access that has been granted to KOC 'mobile lab' air monitoring facilities in order to seek a limited number of specific air emission results from defined operational sites.

These emission profiles of specific crude oil extracted and processing are relevant for Life Cycle Assessments of downstream products like fuel, petrochemicals and polymers. The life cycle inventories for crude oil production systems and hot spot modelling is carried out both for KOC who are sponsoring this research and also in the international context of petrochemical products outcomes.
This research is sponsored by the Kuwait Oil Company.

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Researcher: Anne Scholz

Programme: PhD

Project: A Sociotechnical Transition of the Mobility System

Intermodal e-car sharing in the Rhine-Main region

Finding a way to retain economic, individual and social benefits associated with mobility while reducing the substantial negative externalities of transport, including severe environmental damages, social injustice and numerous problems arising from congestion, is one of the most persistent challenges of the 21st century. While technological advancements constitute an integral part of a low carbon transport system, much deeper social and structural transformations are crucial for a transition. Intermodal car sharing challenges conventional mobility practices and ownership relations and has thus the potential to initiate transformative processes within the current transport regime. The integration of electric vehicles (EVs) into car sharing services constitutes thereby a necessary condition for enabling low carbon transport. The study will explore the transformative potential of e-car sharing as part of intermodal mobility in the polycentric Rhine-Main region. It will be evaluated how this relatively new practice modifies conventional transport behaviour and the meaning of (individual) mobility. Relevant policies, spatial dynamics as well as actors and institutions within the socio-technical system of transport will be assessed in order to enable an analysis of the interactions of changes in mobility practices (through e-car sharing) and the wider transport regime in the region. The research aims to facilitate a comprehensive understanding of complex, non-linear and normative transformations within and through changing autocentric practices that have the potential to initiate a transition to a sustainable transport system. The result will identify developments and barriers and will include recommendations for further steps and policy tools to stimulate a transition to a more sustainable mobility system in the Rhine-Main region.

This research is funded by Stiftung der Deutschen Wirtschaft.

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Researcher: Steven R Smith

Programme: PhD

Project: Modelling the expansion of co-operation towards a sustainable future

Prospects for a sustainable future depend on binding commitments that respect biophysical limits, which in turn depend on global/intergenerational levels of cooperation. Research in behavioural economics has shown that although non-excludable resources are often over-exploited, this can be avoided by collective agreement on a unifying goal and an institutional framework. The qualitative element of this research explores what this global unifying goal might consist of. The quantitative element asks two questions: (1) Can we learn global cooperation fast enough? This question is addressed in a socio-historical study that looks at evidence for the global expansion of cooperation using proxies such as social insurance provision and the abolition of slavery, including key influencing factors; (2) What social psychological factors influence the rate of cooperative expansion and the consideration of future generations? In order to address this question, an experimental social dilemma game called AstroZoa is being developed. Preliminary results in the historical study show that the rate of acceleration of cooperation required to ensure sustainability within the available time greatly exceeds the historical trend.

This research aims to provide evidence of use to policy-makers in support of the U.N. Sustainable Development Goals (SDGs), particularly Goal 13, Climate Action. We have at best a single generation to deliver a global agreement to stabilise the climate for future generations. This research will suggest ways to expand global and intergenerational concern.

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Researcher: Nini Sopian

Programme: PhD

Project: Demand-side management strategies for industrial potable water consumption in Peninsular Malaysia: a feasibility study

Potable water issues have not been a major concern for Malaysia in the past. However, as the country continues to move towards establishing itself as a developed country, society, commercial businesses, and industrial developments are expected to be more concentrated in the urban areas, increasing the demand for potable water. In addition to this, a change in the precipitation pattern has been observed in the recent years. The increase in demand, coupled with the decreasing water availability, has placed an added pressure onto the existing water supply system infrastructure, putting Malaysia at a higher risk of socioeconomic drought.

To ensure the sustainability of the water supply system in Malaysia, the government has identified demand-side management as a vital approach to decrease the risk of socioeconomic drought incidents. Although strategies for demand-side management have typically been directed at the domestic sector, reducing industrial water demand could increase the water supply system's resilience as the industrial sector's water consumption per factory/operation (m^3/industry) is higher than the domestic sector's per capita consumption (m^3/capita). On the other hand, reducing the industrial sector's water consumption may require high implementation costs, translating into higher costs of production; this could lead to resistance from key industry players. As such, this research aims to explore practical solutions which are able to balance high economic growth with sustainable water consumption by reducing industrial potable water demand.

This research is funded by the Commonwealth Scholarship Commission, UK and Nini is also a researcher in Environmental Technology Research Centre (ETRC), SIRIM Berhad, Malaysia.

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SIRIM

COMMONWEALTH SCHOLARSHIPS

Researcher: Nittida Sudmai
Programme: PhD

Project: Corporate Approaches towards Sustainability in the Thai Natural Rubber Processing Industry

My research explores and analyses corporate approaches towards sustainability in the Thai natural rubber processing industry. The data was collected from multiple sources including in-depth interviews with key stakeholders, a regional questionnaire survey and case study analysis focusing on corporate sustainability activity. The empirical evidence suggests that sustainability is a substantial challenge for the industry due to the complexity of sustainability related factors and their linkages. It was found that the economic climate, a lack of technology development, environmental problems, and impacts on local community are the major concerns. The evidence indicates that there are different approaches among the Thai natural rubber processing firms responding to sustainability challenges. The participating firms were categorised into four groups based on their strategic approach to sustainability namely *inactive on sustainability*, *caring*, *cost focus* and *profit and sustainability*. The analysis shows the linkages between perceptions, drivers and barriers and activities regarding sustainability in each group. These patterns highlight the existence of distinct sustainability strategy patterns of the sample firms. An analysis of corporate sustainability activities suggests that the activities companies pursue could be narrowed down into environmental management, community involvement and employee engagement. The findings suggest that these activities are not shaped by economical driven but social factors i.e. local community pressure and cultural factor. These findings are significant as they confirm the influence of local community and relative importance of local issues on corporate sustainability activities. It also sheds light on the role of business in the community. This research is partial funded by Walailak University in Thailand.

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Researcher: Yi Zheng
Programme: PhD

Project: Sustainability of Commercial Vehicle Sharing in Urban China: a comparison between car-sharing and e-hailing

It is necessary to develop a more sustainable pathway for a passenger transport system that helps to reduce the burden on the urban environment and at the same time to meet the mobility demand. Two types of shared mobility services are concerned in this research as examples for sustainable transport development, mobile app based car sharing and ride hailing services. Existing studies have demonstrated that car sharing service, also known as car clubs in the UK, is one of the mobility options that can help improve sustainability. Such sharing business model for automobile has just started the operation in Asian countries. A large amount of existing empirical studies has been focusing on the impacts of car sharing on cities in the U.S and Europe, little have been researched in Asian markets. On the other hand, ride hailing services is another form of car sharing with limited empirical research. Therefore, my study is targeting on mainland China to explore the impacts of shared mobility services on consumer behaviour. Interviews with car sharing organisations, drivers from ride-hailing service as well as current and potential users will be carried out to gain an understanding of how such services can contribute to sustainable development in urban transport system. A questionnaire on consumer behaviour with regard to the two types of services is also planned to be constructed. It is expected that there will be different motivations and impacts for people to use such service in China when compared to western markets. The research results can help policy makers to gain a better understanding of the importance of shared mobility schemes in sustainable city development. It can also assist policy makers with decision making to determine whether relevant support system for developing such schemes can be constructed.

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Looking ahead to 2022

UNIVERSITY OF SURREY

The University of Surrey Corporate Strategy for 2017–22

Our strategy is a blueprint for the future that builds on the University's current strengths and presents a clear vision to make the University of Surrey a truly great global institution.

Our vision

The University of Surrey will be a leading global university. We will be renowned for the outstanding quality and impact of our graduates and research, as well as our collective contributions to society. We will build on our distinctive heritage of practice-based learning and excellent student experience, and embrace our future by focusing on digital transformation.

Our mission

The University of Surrey provides excellent education, and advances and disseminates knowledge.

The University transforms lives and shapes the world for a better future by partnering with students, governments, businesses, alumni and local communities.

The University makes social and economic impacts through research and innovation, and provides solutions to global challenges.

Our strategic goals

We will have achieved our ambitions when we have become:

A global leader in higher education and a destination of choice for higher learning in the UK and internationally

A leading research institution with talented staff and students committed to research excellence and to benefitting the economy, society and the environment

A preferred partner for government, business, industry and other universities in creating technological solutions, digital transformation and policy innovation

A financially astute and sustainable institution with diverse funding support, including philanthropy

An engaged and connected university which is the intellectual home for alumni, supporters and the local community.

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