Nutrients in a Circular Economy Summit 2022

2nd NiCE Summit

Organised by

Australian Research Council

Nutrients in a Circular Economy Research Hub

University of Technology Sydney

17 November 2022

Summit programme

17 November 2022, 1:30 PM – 6:30 PM

Venue: UTS (UTS Aerial Function Centre, Building 10, Ultimo campus)

Those unable to join the summit in person, can join the session live online via zoom. Zoom link will be sent to all those registered participants attending online.

Time	Speakers	Presentation title
10:30 am – 1:00 pm ARC NiCE Hub launch followed by lunch		
Session 1 (Chaired by Sherub)		
1:30 PM	Sherub Phuntsho	Session moderation
1:35 PM	Hokyong Shon, Hub Director, UTS	NiCE Hub update & summit introduction
1:50 PM	Lisa Mclean, Circular Australia	Keynote: Building Australia's Circular Economy by 2030
2:10 PM	Li Gao, South East Water	Transitioning water industry with the circular economy
2:25 PM	Jing Guan, Origin Water	Application of Membrane Technology in Resource Recovery
2:40 PM	Behzad Fatahi, UTS	Novel Sustainable Soil Stabilisation Adopting Calcium Carbonate Precipitation Using Urine
2:55 PM	All	Discussion
3:15 PM	Tea break	
Session 2 (Chaired by Leonard)		
3:40 PM	Leonard Tijing, UTS	Session moderation
3:55 PM	Mikel Duke, VU	Demonstrating innovative technologies for industrial wastewater treatment supporting the circular economy
4:10 PM	Dana Cordell, UTS	Creating viable markets and governance for a thriving circular nutrient value chain
4:25 PM	Gary Leeson, Organic Crop Protectants	The "Pee" in Consumer Perception?
4:40 PM	Bernadette McCabe, USQ	Optimisation of urine-derived and biosolids-derived biofertilisers
4:55 PM	Liu Ye, UQ	Managing the carbon footprint of urban wastewater treatment in the nitrogen circular economy era
5:10 PM	All	Discussion
5:30 PM	Stefano	Closing remarks
5:30- 6:30 PM	Social networking drinks	All are invited.

Nutrients in a Circular Economy Hub update

Ho Kyong Shon*, Sherub Phuntsho, Leonard Tijing and Ibrahim El-Saliby
University of Technology Sydney. *Email: Hokyong.Shon-1@uts.edu.au

Brief bio of lead CI/presenter

Professor Hokyong Shon is a Head of Discipline, Environmental & Water Engineering, a Director of ARC Research Hub for Nutrients in a Circular Economy at the School of Civil and Environmental Engineering, **University of Technology Sydney, and an ARC College of Experts member**. His research interests include circular economy, sustainability, resource recovery, desalination and water treatment since 2000.

Abstract

Increasing population growth and rapid urbanisation is placing increasing pressure on existing water infrastructure and agricultural food productivity to meet future supply and demand. The World Bank predicts that by 2050, the global population will be nine billion, placing a 50% increase in agricultural food productivity and 15% increase in water withdrawals. With these fertilise shortages, there is a strong market driver for bioavailable nutrients through a renewable approach. Decentralising the treatment of our wastes is especially interesting as it has the potential of making an industry, notoriously thirsts in energy, water and raw materials, a net producer. It was also demonstrated that the integration of source-separation of urine, faeces and greywater would help to achieve this goal, while also opening new opportunities for building a more flexible and resilient urban wastewater network. Urine valorisation is attractive due to its low volume, high nitrogen (N) and phosphorus (P) concentrations (80% of N and 50% of P inputs into sewers), and relative ease of collection and storage. As such, it has often proven to be a suitable raw material from the production of fertiliser, energy and water (this last one mainly on board of the International Space Station). However, conventional technologies often struggle in dealing with urine alkalinity, high NH_3 and dissolved organic carbon concentration (i.e. 5 to 10 g.L-1) and high salinity (i.e. 4 to 9%). That is why, the strong chemical resistance, small footprint, tuneable selectivity and versatility in the operation of processes makes them an ideal technology to extract value from human urine. As such, this presentation will cover four main research themes from the ARC Research Hub for Nutrients in a Circular Economy (ARC NiCE Hub) in terms of economic, commercial, environmental and societal benefits.

Building Australia's Circular Economy by 2030

Lisa Mclean
CEO, Circular Australia. Email: lisa@circularaustralia.com.au

Brief bio of presenter

Lisa is a circular economy and zero-carbon business transformation leader. She has been successfully advising industry and governments in developing new policy frameworks and regulations that bring about market change to enable the circular zero-carbon economy over the past 14 years. This work has covered the energy, water, waste and mobility sectors in the UK and Australia. Lisa established and led the Open Cities Alliance, a peak industry association with unique membership from government to private sector and research organisations. Open Cities advocates for the circular economy, prosumer rights and new local utility and mobility precinct approaches. In Australia, Lisa initiated and established the Australian Solar Thermal Association (AUSTELA), advised electric mobility providers, and worked with Flow Systems from a start-up sustainable water utility to its major role in shaping a new sustainable water and now multi-utility market. Starting her career as a political journalist working in the national press gallery, Lisa moved to advising ministers and premiers on education and climate policy, before heading to the UK to help establish the Clinton Climate Initiative. Lisa is currently the CEO of Circular Australia.

Abstract

With Australia's first formal communique on Circular Economy from Australian Environment Ministers to create a circular economy with the private sector by 2030 announced in October - there is now a powerful mandate for change. What does this mean for the transition? What are the drivers, the opportunity and how can businesses and sectors especially the water sector lead this critical transition? Circular Australia Managing Director and CEO will discuss where we are now and how we can be a global Circular Economy leader by 2030.

This is a time of crisis but it is also a time of immense opportunity for Australia. As we transform our economy and make our nation more sustainable and self-sufficient, the role of the circular economy is more important than ever.

While many government, business and research organisations are already catalysing the circular economy through new products, services, solutions, investment and research, there is a need for more collaboration and harmonisation across the States to build consensus, support industry investment especially with consistency across jurisdictions to unlock the $2 trillion economic opportunities circular economy presents.

Last month's Australian Environment Ministers' communique, delivers a powerful mandate for action. Circular Australia is proud to be driving the circular economy agenda with its partners to help achieve this CE objective: ***To work with the private sector to design out waste and pollution, keep materials in use and foster markets to achieve a circular economy by 2030.***

Transitioning water industry with the circular economy

Li Gao
South East Water. Email: Li.Gao@sew.com.au

Brief bio of lead CI/presenter

Li Gao is a Research Strategist at South East Water, managing its strategic research portfolio. He has more than 15 years of research and industry experience in water science and engineering, with technical expertise and research interests in water/wastewater treatment, desalination, membrane technology, algal biotechnology, and emerging contaminant removal. Li is a Fellow and Chartered Engineer of Engineers Australia, and a Fellow of the Royal Society of Chemistry (UK).

Abstract

This presentation will focus on the opportunities and challenges for water industry's transformation into the circular economy, and South East Water's engagement with ARC NiCE Hub to address these challenges to facilitate our transition with the circular economy.

Application of Membrane Technology in Resource Recovery

Tianyu Li and **Jing Guan***
Beijing Originwater Technology, China. Email: jing.guan@originwatergroup.net.au

Brief bio of presenter

Dr Jing Guan is currently working as Chief Scientist of OriginWater Technology Co., Ltd., Director of Originwater International Pty Ltd. and Adjunct Associate Professor, School of Civil and Environmental Engineering. Prior to her appointment, Jing had worked at Centre for Water and Waste Technology, University of New South Wales (UNSW) for ten years since 1998 to 2008. Jing has been engaged in research and project management of environmental engineering for more than 30 years. She has made great achievements in areas such as water treatment engineering, wastewater treatment and reuse, membrane technology development, industrial wastewater treatment and reuse and water resources management. She led and participated in national projects in China, ARC national research project in Australia and the projects involved in the Torch Innovation Precinct at UNSW. She is also a reviewer for a range of SCI journals including Journal of Environment and Pollution; Journal of Hazardous Materials; Journal of Membrane Science; Biotechnology and Bioengineering; Water Research etc.

Abstract

Membrane technology has been rapidly developed and applied in water reuse and resource recovery during the last decade. In this presentation, we will focus on the membrane fouling control and membrane unit optimization when using membrane technology in Lithium recovery from Brine and industrial wastewater reuse. Lithium (Li), as the lightest metal on earth, holds an increasingly important position in numerous fields in the 21st century. The remarkable properties of Li facilitate its use in products such as batteries, glasses, ceramics, greases, chemical reagents, pharmaceuticals and nuclear fuels. Industrial wastewater reuse is very meaningful for water resources protection. It will be significant for minimizing wastewater discharge.

Novel Sustainable Soil Stabilisation Adopting Calcium Carbonate Precipitation Using Urine

Behzad Fatahi.
Head of Discipline (Geotechnical and Transport Eng), School of Civil and Environmental Engineering, Faculty of Engineering and Information Technology, University of Technology Sydney.
Email: Behzad.Fatahi@uts.edu.au

Brief bio of presenter

Associate Professor Behzad Fatahi is an award-winning engineer working at the frontier of new infrastructure and building technologies and solutions, in particular, systems that will make infrastructure (e.g. roads, railways, pipelines, large energy storage tanks) and buildings more resilience and sustainable. He was previously named Australasia Young Railway Engineer of the Year by Engineers Australia and the Railway Technical Society of Australasia. He was also awarded the first prize at the Young Geotechnical Professional Night award by the Australian Geomechanics Society. He has been conducting research on problematic ground improvement, soil-structure interaction, intelligent construction techniques and optimising of design and construction of transport infrastructure. Behzad also worked extensively on major infrastructure projects such as Westconnex M8, Ballina Bypass Project, and Brisbane Gateway Upgrade Project, to name few. He has published more than 200 peer reviewed journal and conference papers, and as the principal supervisor has supervised 18 PhD candidates to completion.

Abstract

Many construction sites for major infrastructure projects should be improved by suitable ground improvement techniques in order to perform satisfactorily under applied structural loads. There is a great demand in geotechnical construction to further develop technologies for ground improvement, which are both cost-effective and environmentally friendly, allowing utilisation of materials available in the vicinity of the construction sites for earthworks. In addition, minimising usage of general-purpose cement and similar products is very important from sustainability and environmental points of view. Indeed, the cement production is one of the main producers of carbon dioxide, a potent greenhouse gas. In this project, which is a collaboration between ARC, UTS and EIC Activities (CIMIC Group), Microbially Induced Calcite Precipitation (MICP) is proposed as the biogeotechnical process for strengthening the soil in which calcium carbonate is precipitated within the pores of the soil from urine. Using the right bacteria (e.g. Urease), urea is converted to carbonic acid resulting in the precipitation of the calcium carbonate. Then the precipitated calcium carbonate would coat soil particles, cementing the soil matrix, and fill the soil void space, increasing its strength and stiffness. It should be noted that Calcium hydroxide $Ca(OH)_2$ will be added to urine to maintain high pH to prevent early urealytic reaction to keep urea in urine solution, and as a source of Calcium (Ca^{2+}) required to form cement. Indeed, calcium hydroxide is easily produced commercially by treating lime with water and in the laboratory, it can be prepared by mixing aqueous solutions of calcium chloride and sodium hydroxide. This research involves conducting laboratory investigation to assess the impacts of calcium carbonate precipitation adopting treated urine, on strength, compressibility, hydraulic conductivity, and physical properties of stabilised crushed shale, and clayey and sandy soils. It is expected that this research project contributes to the reduction in the use of general-purpose cement and thus carbon footprint in geotechnical construction particularly ground improvement and stabilisation projects, by proposing an alternative solution creating biocementation using urine. This project will help the infrastructure and construction industries secure a new sustainable source of material to address the issue of construction on problematic grounds or materials that need improvement. Moreover, this research also aims to enhance the environmental image and credentials of the construction industry by using sustainable building materials. This proposed research project

addresses six Sustainable Development Goals (SDGs) including Industry, Innovation and Infrastructure (SDG 9), Reducing Inequality (SDG 10), Sustainable Cities and Communities (SDG 11), Responsible Consumption and Production (SDG 12), Climate Action (SDG 13), and Partnerships for the Goals (SDG 17).

Demonstrating innovative technologies for industrial wastewater treatment supporting the circular economy

Mikel Duke
Institute for Sustainable Industries and Liveable Cities, Victoria University, Werribee Campus, Hoppers Lane, Victoria, Australia. E: Mikel.Duke@vu.edu.au

Brief bio of lead CI/presenter

Prof. Duke has worked for 22 years in materials and applications research of membrane technology for sustainable foods processing, resource recovery and water/energy saving applications at the University of Queensland, Johnson Matthey Technology Centre (UK), Arizona State University (USA) and Fudan University (China). In 2007, Prof Duke received a Linkage International Fellowship from the Australian Research Council, and then in 2010 he received an Endeavour Executive Award and the Victoria University Vice Chancellors Peak Award for Excellence in Research and Research Training. In 2016 he received the inaugural Anthony Fane Award for his outstanding contributions in membrane science and technology from the Membrane Society of Australasia. Prof Duke is a former panel member of the Australian Research Council College of Experts, the founding President of the Membrane Society of Australasia and currently co-editor of the international journal Desalination. He is also the President of the World Association of Membrane Societies.

Abstract

Industrial wastewater despite being regarded as “waste”, is rich in valuable materials such as minerals and nutrients. Recent advances in water treatment technologies including membranes has provided interesting and potentially valuable new directions for recovering these materials in a more cost viable way but need to be demonstrated in practical conditions. Research at Victoria University has explored durable ceramic and metallic membranes, as well as innovative applications of more conventional commercial polymeric membranes and processes to simultaneously deal with industrial waste while recovering valuable components. For example, nitrogen nutrient recovery from wastewater by vacuum membrane distillation shown to be effective at lab scale was demonstrated on site at a wastewater treatment plant. Other examples include a new application of conventional nanofiltration and temperature swing reverse osmosis for herbicide recovery from concentrated wastewater verified at bench scale then applied to the industry site, and a new process train including ceramic membranes to treat organic-rich firefighting training wastewater to be utilised repeatedly saving the use of potable water.

The new project in the ARC Research Hub for Nutrients in a Circular Economy (NiCE) will investigate a range of processes, including innovative aeration and membrane based technologies, as well as aMES® which has been developed to enable the effective processing of typically highly concentrated solutions which occur either naturally or as a result of industrial processes such as desalination, mining and industrial refinery operations (https://pwnps.com/collections/next-generation-technologies). In working towards a circular nutrient economy, a key focus of the research project is to recover a range of products from the waste streams, including fertilizer products (including potassium and organic based), as well as the potential to produce other critical products such as lithium. The project will feature a series of tests using bench and pilot scale equipment, including membrane and non-membrane equipment located at Victoria University, Werribee campus and Parkway’s operating facilities, in Melbourne. These tests will have defined objectives related to demonstrating various key performance indicators such as solution chemistry, product yield and purity, by-product formation and energy usage. Additional objectives of the tests include investigation and assessment of physical and biological properties.

Creating viable markets and governance for a thriving circular nutrient value chain

Dana Cordell and Jason Prior
Institute for Sustainable Futures, University of Technology Sydney. Email: Dana.Cordell@uts.edu.au

Brief bio of lead CI

Associate Professor Dana Cordell leads the Food Systems research group at UTS's Institute for Sustainable Futures. She directs and undertakes collaborative international and Australian research projects on sustainable food and phosphorus futures. A/Prof Cordell co-led the collaborative P-FUTURES project across Australia, Vietnam, Malawi and the U.S with 90 local stakeholders to investigate phosphorus vulnerabilities in urban food and water systems and local opportunities to transform through circular nutrient value chains and other initiatives. In 2008 A/Prof Cordell co-founded the Global Phosphorus Research Initiative - the first global platform to undertake research, policy and public engagement to ensure food systems are resilient to the emerging global challenge of phosphorus scarcity. A/Prof Cordell led the Sydney Food Futures project, which brought together key stakeholders such as NSW Farmers, Department of Primary Industries, Department of Planning, and RDA-Sydney to increase the resilience of Sydney's food system to challenges from climate change to urban growth, through participatory stakeholder workshops and geospatial mapping scenarios. As a global phosphorus and food security expert, A/Prof Cordell provides expert advice and commentary to the UN, Australia's Chief Scientist and the UK Parliament. A/Prof Cordell's research contributions have been recognised with one of Australia's top science prizes, the Eureka Prize for Environmental Research (2012) and a position in the AFR's 100 Women of Influence (2013). She is frequently interviewed for media, including ABC Radio National, Lateline, BBC and The Guardian.

Abstract

What is stopping nutrient value chains from being viable at scale? Overcoming market and governance barriers are two understudied opportunities. Circular economy research and initiatives have historically focused on technical aspects and been driven by waste management and environmental concerns. From a food security and sustainability perspective, developing commercially competitive products like fertilisers at scale will also be crucial. This means that before investing in efficient and cost-effective technologies to extract nutrients from organic waste streams, it will be critical to identify viable end-use markets, connect value-chain stakeholders and ensure appropriate policies and governance structures are in place. For example, developing waste-derived fertiliser products for a high-end indoor tomato horticulturist might require the development of a high-quality liquid fertiliser, while developing products for a home gardener or Council landscaper will have different implications in terms of form (liquid, pellets), but also price point, nutrient profile, quality required and contaminants.

The Institute for Sustainable Futures' first NiCE project, 'Circular markets for a thriving circular nutrient value chain: A market feasibility and perception study', will work with industry partner OCP (Yates/Dulux Group) to understand and overcome key barriers to forming a circular market that supports a viable circular nutrient value chain. This will first identify potential raw material supply chains (from urine and other organic wastes), followed by industry and end-user engagement across the value chain to investigate stakeholder bottlenecks, such as securing reliable raw material volumes and establishing a sustainable marketplace for commercial products like renewable fertilisers.

The second project, 'Governance for a thriving circular nutrient value chain: An integration study', will identify and learn how: international leading governance structures for nutrient and non-nutrient circular economies may be adapted to the Australian context; understand regulatory and other governance

barriers within the Australian context that currently limit how stakeholders can integrate well in nutrient circular economics; and how perceptions of stakeholders in the circular nutrient value chain enable or impede the effective governance of nutrient circular economics.

The “Pee” in Consumer Perception?

Gary Leeson
Innovation & Business Development Manager, Organic Crop Protectants subsidiary of Yates Australia. Email: Gary.Leeson@ocp.com.au

Brief bio of lead CI

Gary comes from a third-generation farming background and is tertiary trained in Hort Science. In 1993 Gary joined Organic Crop Protectants and over 25 years built the company into a leader in Organic farm and garden inputs. In 2018 Gary sold OCP to Yates Australia where he continues to innovate and develop new products.

Abstract

We are living in a time of massive and rapid change spurred on by the pace of technology, information generation and transfer. Society is also rapidly coming to the realisation that the natural resources we extract to convert into consumables has major downstream consequences on our future quality of life. As a result, for businesses to survive and prosper they need to think about the types of products they want to make from a lifecycle perspective. We need to shift the dial from thinking about products from a sustainability perspective to one that considers their circularity and regenerative qualities at their core.

Rather than thinking about if a product is carbon neutral, but rather is this product carbon negative? Does this product have a positive impact on species biodiversity? Does this product help to restore and regenerate the natural systems that we have disrupted?

Food production and gardening have a major role to play in restoring and regenerating our planet and products developed using circular economy principles will play a major part in meeting the challenges we face. OCP and Yates are committed to developing innovative products that surpass the sustainability challenge and this is why as a good corporate citizen operating in these market sectors, we are so excited to be a part of the NiCE Hub.

Optimisation of urine-derived and biosolids-derived biofertilisers

Professor Bernadette McCabe[1], Dr Dio Antille[1, 2], Dr Serhiy Marchuk[1], Ms Aline Dos Passos Silva[1]
[1] Centre for Agricultural Engineering, University of Southern Queensland; Bernadette.McCabe@usq.edu.au; Serhiy.Marchuk@usq.edu.au; Aline Dos Passos Silva u1138584@umail.usq.edu.au
[2] CSIRO Agriculture and Food, Canberra, Australian Capital Territory, Australia; Dio.Antille@csiro.au

Brief bio of lead CI/presenter

Professor Bernadette McCabe is Director at the University of Southern Queensland's (UniSQ) Centre for Agricultural Engineering (CAE). Bernadette has a background in agricultural biotechnology and has over 25 years' experience as an academic and researcher. Her research investigates technologies to enable intensive Australian farming and food-processing industries to turn their commercial waste into a valuable commodity. She works with these industries to be more profitable by using organic waste to produce biogas, clean recycled water and biofertiliser. Her research has been applied to the livestock and cropping sectors (both on and off farm) and water utilities.

Bernadette collaborates at an international level as Australia's National Team Leader for the International Energy Agency (IEA) Bioenergy program Task 37: Energy from Biogas. Bernadette was a Director on the Board of Bioenergy Australia from 2017-2019 and is an active member of the Bioenergy Australia Renewable Gas Alliance and Circular Economy Committee. Bernadette sits on the Queensland Government's Department of State Development, Infrastructure, Local Government and Planning, Biofutures Industry Advisory Group. She is also a member of the Australian Research Council (ARC) College of Experts (CoE).

Abstract

Disposal of biodegradable wastes through sewer or landfill is regarded as non-sustainable both from the environmental and resource-recovery perspectives. The team at the University of Southern Queensland's (UniSQ) Centre for Agricultural Engineering will undertake two work packages related to the assessment of biofertilisers derived from urine and biosolids. Work Package 1 (WP!) will evaluate and demonstrate Ugold and Urval efficacy in field trials. Ugold and derivatives will be applied to soils at trial sites near Brisbane (including UniSQ sites and City Parklands). Two areas of investigation will be focussed on: 1. The development of specifications for novel urine-derived biofertiliser products that (a) meet the requirements for field application (physical properties) and (b) nutritional needs of plants (chemical composition) and 2. The experimental evaluation of the proposed formulation(s) and product format, determine the fertiliser replacement value (FRV) of urine-derived biofertiliser products and develop guidelines for use on crops and parklands. Multiple application methods will be trialled where appropriate, including surface application, drip feeding and injection. Comparisons will be made with conventional fertiliser treatments for each system.

Work package 2 (WP2) will be optimising biosolids-derived biochar as a biofertiliser and aims to 1. Understand the effect of conversion technology on heavy metals content and mobility in the by-product and 2. Determine the suitability of the by-product as a biofertiliser. This will be performed by assessing:

- Potential risk due to heavy metals (Zn, Cr, Cu, Ni and Pb);
- Nutrient (N and P) leaching in soil treated with by-product;
- Nutrient availability of N, P and K from by-product to soil;
- The by-product as a potential fertiliser with respect to plant yield by determining the agronomic response in glasshouse and field experiments.

The industry benefits include for both work packages include a) Potential income stream through sales of the product and licensing of the technology, or enabling for reduced (avoidance) of costs associated with disposal by increasing agricultural recycling, b) Reduce farmers' reliance on mineral fertilisers, which are likely to go up in price, with the associated benefits in terms of nutrient and organic matter recovery and c) A monetary value in relation to the sale of the product based on the overall urea fertiliser market in Australia which is estimated at AUD1 billion.

Managing the carbon footprint of urban wastewater treatment in the nitrogen circular economy era

Liu YE
Affiliation: School of Chemical Engineering, The University of Queensland. Email: l.ye@uq.edu.au

Brief bio of lead CI/presenter

Dr Liu Ye is an Associate Professor at The University of Queensland (UQ) in the School of Chemical Engineering. Her research focused on sustainable environmental engineering and is dedicated to finding innovative and practical solutions to tackle challenges in achieving net zero emissions, climate resilience, and sustainability. She is the Greenhouse Gas research program leader at UQ urban water engineering and work collaboratively with industry partners. She has an established national and international leadership in the research field of net-zero emissions from urban wastewater systems.

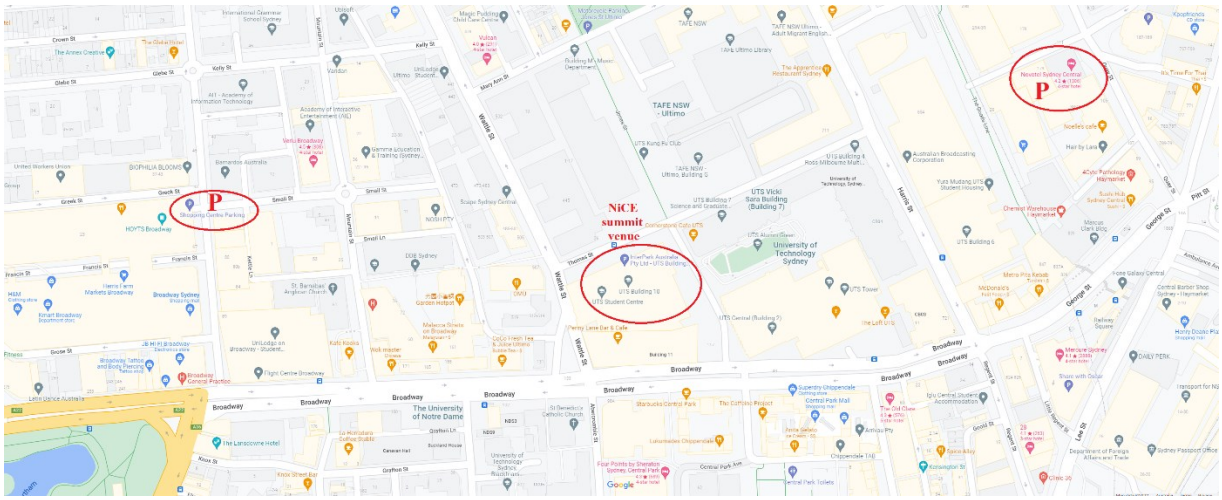
Abstract (300-500 words)

Achieving net-zero emissions by mid of this century is a goal across many industry sectors. How to sustainably manage nitrogen in wastewater will be of great importance for us to achieve the net-zero management target. As the electricity grids become renewable, carbon footprints of many utilities become dominated by fugitive Greenhouse gas emissions from sewage treatment. Nitrous oxide (N2O) is a particularly potent GHG and the most significant sink for stratospheric ozone. In Australia, N2O emissions reportedly contribute up to 80% of the total carbon footprint of wastewater treatment plants. N2O is mainly generated during biological nitrogen removal, with large variations in generation between different treatment processes. It is not sure how the current treatment process will affect its generation. In addition, with new nutrient recovery technologies being applied it is unclear how this, recovery and reuse will affect the total carbon footprint of the water utilities. The aim of the project is to provide the water industry some practical tools to make decisions on carbon footprint management through the nitrogen circular economy era.

This talk will provide an overview of the current knowledge of carbon footprint of urban wastewater treatment system. In the meantime, it will discuss how different nitrogen management technologies may affect the GHG emissions through different nitrogen recovery and removal technologies. Lastly, some potential collaboration work that can be achieved via the NiCE hub platform will also be discussed.

Venue map

UTS aerial Function Centre, UTS Building 10, Level 7, 235 Jones St, Ultimo NSW 2007



Parking options:

- Basement of Building 10 and 11. Car entry from Thomas Street (parking fees apply).
- 2P Street parking available along Thomas Street (paid parking).
- Nearest secured parking include Broadway shopping centre and Wilson Parking, Novotel Sydney Central

Participating Universities

Participating industries

International collaborators