



Webinar: Energy Opportunities for Wastewater Treatment Plants

Thursday 15th April, 4pm

Introduction

Wastewater Treatment Plants (WWTPs) account for a significant proportion of energy use in Ireland and globally. As the focus on the contribution of energy production to climate change increases, the need to identify opportunities for energy saving, energy generation and supporting the wider energy system becomes increasingly important. This webinar highlights the opportunities for wastewater treatment plant to play a role in the energy transition through reducing their energy requirements, supporting the electricity system through demand response and showcasing the role of data analytics to support decision making. Aspects such as operational costs and ensuring environmental standards are core components of the integrated approach to these energy opportunities.

Chair

Professor Eoin Casey, Head of UCD School of Chemicals & Bioprocess Engineering, UCD

Presentations/Speakers

- Climate, land-use and wastewater treatment - Eoghan Clifford, NUIG
- Opportunities for energy savings and generation in WWTP - Recep Kaan Dereli, UCD
- Modelling demand response from wastewater treatment plants in an integrated energy system - Dana Kirchem, ESRI
- Digital Twins: How Wastewater System Operation Flows From Data to Intelligence- Majid Bahramian, UCD
- Q&A

Abstracts

Climate, land-use and wastewater treatment - Eoghan Clifford, NUIG

Wastewater infrastructure plays a central role protecting the environment, human health and ensuring economic growth. Such infrastructure is facing challenges including the need to meet demographic and economic growth while mitigating the impacts of climate change and meeting regulatory requirements and net zero-carbon targets. This presentation outlines these key issues and discusses, using case-studies, how rainfall data can be used to model future flows in wastewater treatment facilities.

Opportunities for energy savings and generation in WWTP - Recep Kaan Dereli, UCD

A WWTP can interact with the energy grid in two ways; (i) providing flexibility due to redundancy in process and regulating the electromechanical equipment, (ii) renewable energy production (heat recovery, biogas, incineration, micro-hydropower, power to methane). In the last two decades, the wastewater treatment sector has been changing as a result of sustainability drivers on resource recovery and energy efficiency. Today, it is even possible to operate WWTPs with energy neutrality and to recover several products (water, nutrients, biopolymers and biogas) out of sewage. This has been achieved with the deployment of new processes and technologies which will be discussed in this talk.

Modelling demand response from wastewater treatment plants in an integrated energy system - Dana Kirchem, ESRI

Abstract: The potential of waste water treatment plants (WWTP) to provide demand response (DR) has been shown by several case studies to date. So far, studies have assumed power system operation and energy prices as a prerequisite for DR action, which distorts results for the DR potential. In order to correct for this, we introduce an integrated modelling approach, which, for the first time, takes the activated sludge process into account for optimising the system operation.

Digital Twins: How Wastewater System Operation Flows From Data to Intelligence- Majid Bahramian, UCD

The digital twin understands and interprets demand, flow and performance, so it is possible to consider these insights to mitigate risk, maintain discharge standards, minimize costs and ensure the most efficient approach for wastewater management.

Moderator and Speaker Bios:

Professor Eoin Casey, Head of UCD School of Chemicals & Bioprocess Engineering, UCD



Eoin Casey was awarded the BE (Chemical) and PhD degrees from University College Dublin in 1994 and 1999 respectively. He has worked in R&D roles in TU Vienna, Austria and Scale-up Systems Ltd. He is currently Professor at the UCD School of Chemical & Bioprocess Engineering. He is also co-founder of OxyMem Ltd, He has particular interest in developing the research and innovation agenda for the Water-Energy nexus. His laboratory-based research programme aims at developing new and improved processes for water treatment. One of his flagship achievements was the development of

the reaction engineering framework and scale-up strategy for the MABR, a wastewater treatment technology that uses 75% less energy than existing technology. OxyMem systems are now deployed world-wide and the company has won numerous awards including Innovation of the Year at the Irish Lab Awards (2013), Innovation of the year at the 2014 Irish Times InterTrade Ireland Innovation Awards (2014), overall winner at the Intellectual Property awards (2014), Knowledge Transfer Ireland, Spin-Out Company Impact Award (2015). Significant personal awards and achievements include a European Research Council starting grant (2011), Fellowship of the IChemE (2014), NovaUCD Innovation award (2015) SFI Investigator (2016).

[Full Research Profile](#)

Dr Eoghan Clifford, Senior Lecturer, School of Engineering, NUI Galway



Eoghan Clifford is a chartered engineering and currently works as a Senior Lecturer in Civil Engineering, NUI Galway. He graduated with a BE and PhD degrees (both Environmental Engineering) in 2002 and 2010 respectively from NUI Galway. He is the Academic Director of the CÉIM Programme within the School of Engineering and a member of the CUSP Executive Board at NUI Galway. He is a visiting research fellow at the Athlone Institute of Technology. Since 2010 Eoghan's research group has directly coordinated projects with a value of €13 m (e.g. Waternomics, ENERGE, MOREFISH) and been technical lead or workpackage lead on projects worth an additional €18 m (e.g. NEPTUNUS, INNOQUA). His key research and educational interests lie in the areas of wastewater and water engineering, fluid dynamics, cycling aerodynamics, and the development of sustainable technology. He has won awards for technology development from Enterprise Ireland (2008, 2011), the HEA (2009), Engineers Ireland (2018), SEAI (2020) and the Irish Times Innovation Awards (2021). He was recognised with an alumni award for achievements in sport by NUI Galway (2016) and nominated for the RTÉ sports person of the year award in 2016. He has served on the boards of directors of Paralympics Ireland and is currently on the board of Muscular Dystrophy Ireland and An Meitheal Comhshaol.

[Full Research Profile](#)

Dr Recep Kaan Dereli, Assistant Professor, School of Chemical and Bioprocess Engineering, UCD



Recep Kaan Dereli works as an Assistant Professor at UCD School of Chemical and Bioprocess Engineering. He holds a joint doctoral degree in Environmental/Sanitary Engineering from the Delft University of Technology (The Netherlands) and Istanbul Technical University (Turkey). His doctoral dissertation focuses on the treatment of industrial wastewaters by Anaerobic Membrane Bioreactors (AnMBRs). His research interests are the biological treatment of wastewaters, energy and resource recovery, and mathematical modelling. To date, he has accumulated a publication record of 36 peer-reviewed journal papers and received more than 900 citations. He has taken a role in various research and consultancy projects and taught several courses (i.e. Energy Efficiency in Wastewater Treatment, Bioprocess Engineering Principles) at bachelor and graduate level.

Dana Kirchem, PhD Researcher, ESRI & UCD



Dana started as a PhD researcher within the work package MSP1: “Integrated, Electricity, Gas and Water Modelling” in September 2017. She holds both a BSc and MSc in Economics from the University of Muenster, where she focused on energy and environmental economics in her master’s studies. She has previously worked as a research assistant at the Chair for Energy and Resource Economics of the University of Muenster. Within ESIPP, her research topics are the energy-water nexus in general and demand-side flexibilities from wastewater treatment plants in an integrated energy system in particular.

Dr Majid Bahramian, Postdoctoral Research Fellow, UCD



Majid Bahramian was awarded the Ph.D. degree from Yildiz Technical University (Turkey). His doctoral thesis was focusing on the dynamic assessment of the environmental performance of the residential buildings with focus on the energy and indoor environmental qualities. The pursuit of his thesis is to develop a local Life Cycle Inventory Database for residential buildings in Iran and Turkey, which is financed by Iranian Ministry of Science, Research and Technology and Turkish Academy of Science (TUBA). He also was awarded M.Sc. degree of Civil and Environmental Engineering from

University of Tehran (Iran). In his MSc thesis, he used dynamic models to predict the on-site energy consumption and Greenhouse gases emissions in wastewater treatment plants. He has authored 10 papers in internationally recognized peer reviewed journals.

Majid joined the University College Dublin in August 2020 as a Postdoctoral Research Fellow in the Energy Systems Integration Partnership Program (ESIPP) project. His research interests include the environmental footprint of the construction industry with focus on the indoor environmental qualities, life cycle assessment of water and wastewater treatment plants, soft computing methods in engineering with particular focus on environmental systems, modeling biological treatment processes and energy efficiency in wastewater treatment plants.

