

Decarbonising Heat: Science, Innovation, and the Path Forward

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Extended Abstract

In this keynote, we will explore the pivotal role of heat transfer and thermal energy storage in shaping a decarbonised future. From industrial processes to everyday applications, heat is everywhere—yet often taken for granted. Decarbonising the heat sector is neither easy nor straightforward, but it is essential. At the same time, heat transfer and storage are emerging as key enablers of transformative technologies, from sustainable energy systems (e.g., nuclear fusion) to next-generation computing (e.g., 3D integrated circuits for AI scale-up). Together, we'll embark on a journey through the science and engineering of advanced heat processes, uncovering how heat can move, how it can be stored, and how it can be harnessed more efficiently to support multiscale, intelligent energy systems. Drawing on a wide spectrum of new research—from work at Imperial College London and our global collaborations—we'll delve into fundamental insights and unexpected findings that challenge conventional thinking. Through real-world examples and emerging innovations, we'll reveal how heat transfer and storage are not passive background processes, but active drivers of progress in energy, transport, computing, and the built environment. By the end of the talk, I hope to spark renewed curiosity and engagement—encouraging researchers, engineers, and policymakers to reimagine the role of heat in our collective energy transition and technological evolution, and to recognise the renewed need for advancements in the field.