



LUIAS Distinguished Lecture

Carbon Capture in the Cement Industry - Synergies Between Different CCS Types

Speaker

Professor Paul FENNELL

Professor of Clean Energy
Department of Chemical Engineering
Imperial College London



Scan to Register



Date: 17 November 2025

Time: 4:15PM - 5:15PM
(Registration starts at 4:00PM)

Venue: MBG01, Patrick Lee Wan Keung
Academic Building

Abstract

Decarbonizing the cement industry (responsible for 7 % of global emissions) remains one of the greatest challenges in achieving global net-zero emissions. This talk explores the potential of direct separation reactors (DSRs) as a transformative technology for carbon capture in cement production, and examines how DSRs can be integrated with amine scrubbing systems to further enhance CO₂ capture efficiency.

We begin with a comparison of baseline cement plant configurations, highlighting emissions profiles and energy requirements relative to plants equipped with post-combustion amine scrubbing. The discussion then advances to novel DSR-based configurations, where calcination occurs in a pure CO₂ atmosphere, allowing for inherent capture of process CO₂. Through techno-economic and process analysis, the performance of DSRs is evaluated across several fuel scenarios—natural gas, coal, refuse-derived fuel, and biomass combustion—considering both direct and hybrid integration with amine scrubbing units.

Results indicate that DSR systems offer substantial reductions in energy penalty and capture cost compared to standalone amine scrubbing, particularly when operated on refuse derived fuel, yielding near-carbon-neutral (or even carbon negative) cement production. The talk concludes with an assessment of operational trade-offs, retrofit feasibility, and integration pathways for transitioning existing cement plants toward full-scale deployment of DSR-amine hybrid systems.

Biography

Prof Paul Fennell C.Eng C.Sci F.IChemE conducted his PhD in Combustion Science at Cambridge and has published > 100 papers on a wide variety of industrial and energy engineering subjects with >24000 citations, and has an h-factor of 63. He has advised DECC, BEIS and the Environment Agency and his work was cited more than 20 times in the most recent IPCC assessment report. He has chaired the IChemE Clean Energy Technology Special Interest group and was a member of the government's roadmapping team for decarbonised Iron and Steel production to 2050. He has conducted consultancy in the area of decarbonisation of Cement for BEIS and deployment of Carbon Capture and Storage (CCS) in Industry, as well as CCS readiness. In 2019, he was part of the expert group for the taxonomy of Green Investment Bonds, and helped to secure the place of CCS within it. He is an accomplished science communicator, and in 2015 he won the IChemE ambassador prize. He has delivered multiple courses to industry and government bodies around the world, including a 2025 course on CCS to representatives of Saudi and other government attendees). Lead author on 3 IEA-GHG publications (use of CO₂ in building materials, standards for the use of CO₂ in building materials, co-benefits of CCS for air quality).

Enquiries

☎ 2616 8847

✉ luias@ln.edu.hk

ALL ARE WELCOME

EDUCATION *for* SERVICE

作育英才 · 服務社會