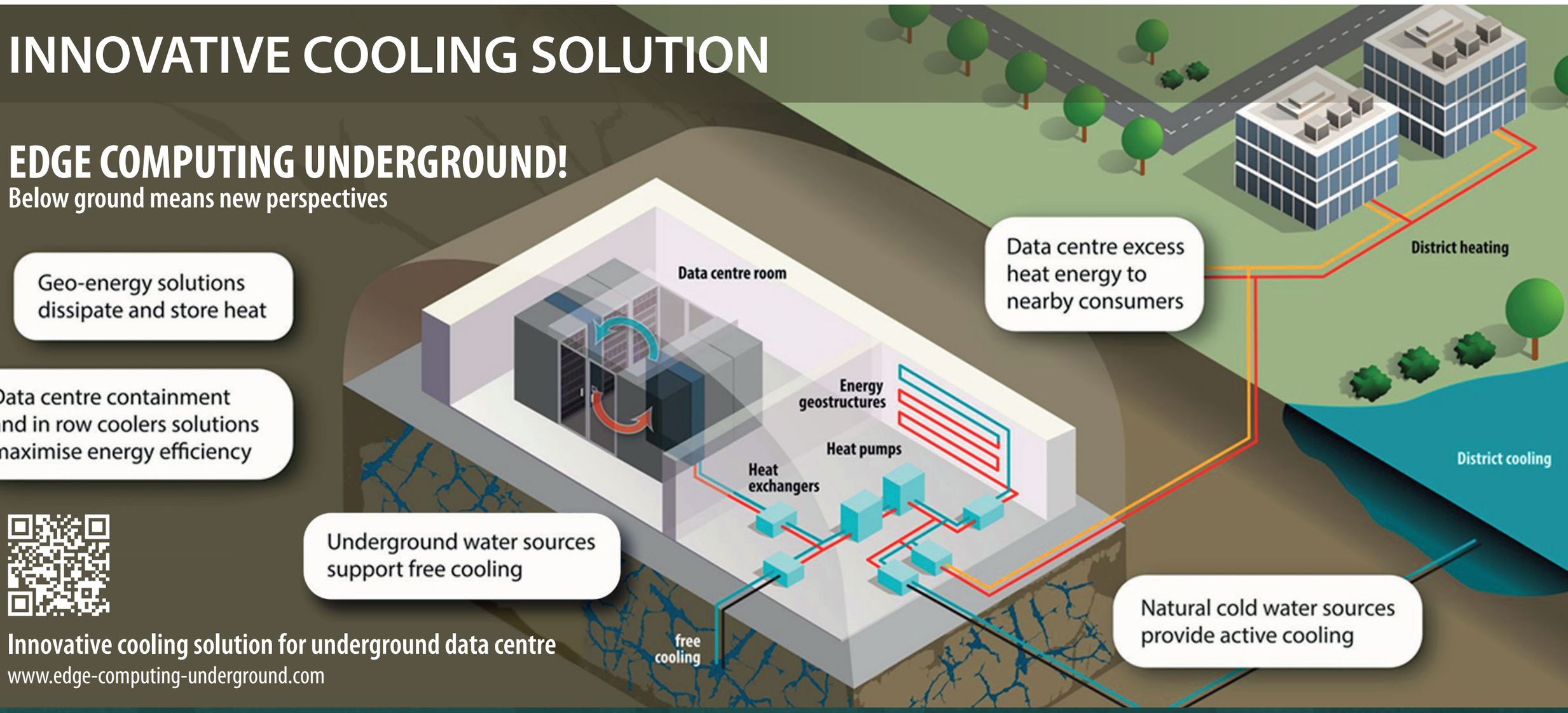
Department of Civil Engineering
The University of Hong Kong



Distinguished Public Lecture

Smart Exploitation of the Renewable Energy Situated Under Our Cities

Date: 4 July 2023 (Tuesday)

Time: 6:00p.m. – 7:30p.m.

Venue: Chow Yei Ching Building, G/F, Lecture Theatre A, The University of Hong Kong

Prof. Lyesse Laloui

Swiss Federal Institute of Technology, EPFL

About the Speaker

Prof. Lyesse Laloui is an active scientist at the Swiss Federal Institute of Technology, EPFL, a full member of the Swiss Academy of Engineering Sciences and serves as the European Vice President of the International Society of Soil Mechanics and Geotechnical Engineering. Prof. Laloui has dedicated much of his career to understanding the natural world for the benefit of society. His research and exploration of the mechanics of geomaterials and other geology has made significant contributions to our understanding of the physical mechanisms of these materials. From this, he has developed innovative and sustainable technologies for today and the generations to come. His efforts in areas such as sustainability, climate change, renewable energy and the optimisation of natural resources have been recognized and awarded by the European Research Council with a prestigious Advanced ERC Grant. As founder and honorary Editor-in-Chief of the Elsevier Geomechanics for Energy and the Environment journal, he is a leading scientist in the field of geomechanics and geo-energy. His research portfolio includes 13 written and edited books and over 400 peer reviewed papers; resulting in more than 10000 citations. Two of his papers are among the top 1% in the field of Engineering. Prof. Laloui has given keynote and invited lectures at more than 40 leading international conferences. He has won many awards in recognition of his work including the 30th Roberval Award at the French Academy of Science and the “Vienna Terzaghi Lecture”. In 2022, Prof. Laloui has been recognized for his commitment to global sustainability with a doctorate honoris causa from Heriot-Watt University (UK) and another one from Technical University of Cluj (Romania).

Prof. Laloui has four patents that he is developing in the context of four technological start-up.

Abstract

The world is changing at an incredibly fast rate. Digital technology is driving robotics, machine learning, and artificial intelligence that is transforming our society in unimaginable ways as we grow more fluent and consume more resources. Our planet too is changing in an unprecedented way as we consume its natural resources and, by doing so, change its climate. To avoid the worst impacts of changing climate we must stop emitting greenhouse gases and use our planet’s limited resources in a more sustainable way. Yet how do we do so while ensuring a safe and equitable future for us all?

We clearly need to shift to a low-carbon economy. Recent data show that the construction and building sector dominates global energy demand, requiring 34% or 135 exajoules (1018 joules) of all global energy use (EIA, 2021; IEA, 2022).

There is an opportunity to significantly reduce both global energy consumption and CO2 emissions through smart utilization of the energy available under our cities by incorporating innovative energy efficiency technologies which can significantly impact building heating and cooling regimes which can account for up to 50% of a building’s energy use (PNNL, 2017). The key to making these advances is geotechnical innovation through the use of energy geostructures, an innovative, multifunctional technology that can be used to address the aforementioned challenge.

Energy geostructures provide low-carbon, cost-effective and local energy solutions to structures and infrastructure, opening a new era for the practice of geotechnical engineering, extending the conventional role of geotechnical design to address the major energy challenges of our century. (Laloui and Rotta Loria, 2019). By coupling the role of the ground structures with that of the geothermal heat exchangers, energy geostructures such as so-called energy piles, energy walls and energy tunnels can serve as structural supports as well as heating and cooling elements for buildings and infrastructures. The analysis and design of energy geostructures requires the integrated knowledge of various, multidisciplinary aspects in the broad field of engineering. The reason for this is because energy geostructures are subjected to the unprecedented combined action of both thermal and mechanical loads, which govern their energy, geotechnical and structural response via multiphysical interaction with the subsurface. Typical questions that arise in this framework are as follows: Which multiphysical phenomena are associated with the geothermal and structural support operations of energy geostructures? How should energy geostructures be analysed and designed from an energy, geotechnical and structural point of view? What will be the behaviour and performance of energy geostructures over time?

Scientific research activities on energy geostructures to answer these questions started more than 30 years ago and involved different types of geostructures. Several studies were initially carried out with the aim of understanding the energy, geotechnical and structural performance of energy piles with the first in situ tests (Laloui et al., 2003; Mimouni and Laloui, 2015; Rotta Loria and Laloui, 2017; Rotta Loria and Laloui, 2018) and the subsequent development of analytical solutions and design tools (Knellwolf et al., 2011; Rotta Loria and Laloui, 2016; Rotta Loria and Laloui, 2018; Ravera et al., 2020a; Ravera et al., 2020b). These studies were then extended to other types of geostructures such as walls (Zannin et al., 2020a; Zannin et al., 2022) and tunnels (Cousin et al., 2019; Peltier et al., 2019).

On a sound scientific basis, energy geostructures can then leave the research area and enter engineering practice. The increasing practical applications of energy geostructures show that their implementation can be achieved in a highly efficient and cost-effective manner for any project.

The aim of the presentation is to uncover the great potential of energy geostructures on the road to less dependence on fossil fuels and to emphasise the new critical role of geotechnical engineers to take full advantage of this technology.

Registration is required only for participants who require attendance certificate:
https://hkuems1.hku.hk/hkuems/ec_hdetail.aspx?guest=Y&ueid=86622

An electronic certificate of attendance will be issued to registered participants after the public lecture.

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