BUDAPEST MESSAGE

of the Euro-CASE Annual Conference,

held in Budapest, 23 September 2024,

at the Budapest University of Technology and Economics on

European Engineering for Sustainability
New Solutions for Environmental, Urban and Health Systems

No engineering, no sustainability

The timely Conference reminded all of us about the critical role engineering should play in ensuring a sustainable future. While the Sustainable Development Goals (SDGs), agreed upon by all the Member States of the United Nations a quarter of century ago, chartered the way ahead it is clear by now that they will not be reached by the target date of 2030. The participants of the conference shared a strong conviction that sustainability, and the SDGS in particular, cannot be achieved without actively engaging engineering expertise and solutions in a more pronounced fashion.

It is essential, therefore, that technological insights as well as engineering sciences and diplomacy at international level are to be integrated into any responsible societal decision-making processes.

The challenges we face in sustainability are multifaceted, spanning various sectors. As the Conference addressed some of the most pressing SDGs in the European context, namely environmental challenges, including waste recycling and water management, energy transition, as well as healthcare, mobility, and urban systems. These issues demand a multidisciplinary and systems-based approach that can address the growing complexities of modern society. Through collaboration, modelling, and systems engineering, we can better understand and manage these challenges, especially in areas like connected transportation systems, energy storage, and circular economy practices.

Take away messages

One of the conference's major takeaways is the understanding that the SDGs can only be reached by leveraging principles of engineering sciences and technology across the above challenges. Engineering, in particular, is essential in quantifying complex systems, addressing synergies and trade-offs, and creating solutions that are adaptable to future uncertainties. These solutions range from improving waste-to-energy systems that minimize landfill usage to enhancing the sustainability of healthcare systems through digital innovations.

As the world's population continues to grow, inequities in resource access, especially in energy, water, and nutrition, are becoming more pronounced. Therefore, governance reforms are urgently needed to secure water and energy supplies and to manage urban growth sustainably. All of these are to be implemented in a systems approach framework. The need for intelligent management of resources, such as critical water resources and energy systems, is clear. Engineering solutions should not only address immediate resource needs but also ensure long-term resilience against the accelerating climate change noting the increased frequency of extreme floods and droughts. Without proper engineering technologies, such as redesigning the concept of design values in a nonstationary environment, sustainability cannot be reached.

The conference also emphasized the need for innovation in healthcare systems. The proper integration of digital and physical technologies in healthcare systems to make them more resilient, adaptable, and sustainable. Computational medicine, image processing and in-silico trials are transforming how we approach healthcare, offering a more sustainable alternative to traditional clinical trials. These advances reduce the reliance on animal testing and provide a more cost-effective, timely, and human-centred approach to medical innovation.

In the energy sector, one need to recognize that the transition to a net-zero future requires more than just electrification. A holistic systems approach to energy, which includes sustainable heat production and storage, is necessary to meet the demands of both industry and society. The chemical sector, in particular, plays a significant role in this transition and must adopt sustainable production methods to reduce its environmental footprint.

The participants of this conference highlighted the critical importance of urban sustainability, with a focus on the integration of Intelligent Transportation Systems (ITS) and autonomous vehicles to optimize the use of existing infrastructure. These technologies can help reduce traffic congestion and pollution, contributing to more liveable cities.

A key issue in achieving the above goals is communication. Not only with the policy making and political community, that so far was unfortunately asymmetric, but perhaps even more importantly with larger public.

Key Statements of the Sessions

FIRST SESSION: Current environmental sustainability challenges (water resources management, waste recycling, industrial and nuclear decontamination)

- Waste management is key to sustainability, with recycling and waste-to-energy (WtE) technologies reducing landfill usage, contributing to lower greenhouse gas emissions, and supporting the circular economy.
- WtE and plastic pyrolysis complements mechanical recycling and recovers valuable materials, aligning with EU regulations.
- Global population growth and inequities in resource access threaten sustainability. Urgent governance reforms are required to address critical challenges like water and energy security.

SECOND SESSION: Sustainable healthcare management: technical needs and engineering solutions

- Disruptive healthcare innovations must combine digital and physical technologies with a human-centred approach to ensure resilience and sustainability in future healthcare systems.
- Continuous improvement in healthcare management is essential for creating adaptable, patient-centred systems that address complex healthcare needs with resilience and agility.
- Computational medicine and in-silico trials are transforming healthcare, enhancing sustainability, and reducing reliance on traditional clinical trials.

THIRD SESSION: Monitoring and controlling urban transport and utility systems

- Urban sustainability challenges require multidisciplinary systems engineering, with modelling, simulation, and formal approaches to effectively manage growing complexity.
- Sustainable mobility focuses on better utilizing existing infrastructure. Intelligent Transportation Systems (ITS) and autonomous vehicles offer solutions for optimizing traffic flow and reducing congestion.
- The energy transition must address both electricity and heat. Sustainable heat sources and storage solutions are necessary for achieving a net-zero future beyond electrification alone.

Outlook

The Budapest Conference has again reinforced the importance of multidisciplinary collaboration and systems approach in achieving the SDGs and addressing the relevant global challenges. The engineering profession stands at the forefront of this effort, offering the creativity, innovation, and technical expertise needed to drive meaningful change. As we look to the future, we must continue to advocate for the inclusion of technological perspectives in societal decision-making, ensuring that engineering diplomacy and responsible innovation guide our path toward a sustainable and equitable world.