



RESEARCH AND CONSULTANCY SERVICES FOR SUSTAINABLE AND SMART BUILT ENVIRONMENT

Center for Energy, Environment and Economy

October 2023



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CEEE HISTORY & TEAM

Center for Energy, Environment and Economy (CEEE) was founded as a research and development centre in 2009 at Ozyegin University in Istanbul, Turkey. The centre works on science-based, innovative, and transdisciplinary research, strategy projects on sustainability. CEEE tackles the climate crisis and resource scarcity problems with a holistic system design approach. In order to achieve high performance, resilient and climate resistant built environment, CEEE aims to create and enhance value by multidisciplinary research and work on creating sustainability strategy and planning, conducting building impact assessment, and developing occupant experience design and digital services design. Beside energy efficiency, these research activities aim to leverage demand flexibility both with technical and social factors in order to maximise response potential of demand side management.

Main research areas of CEEE are on energy harvesting concepts and the energy efficiency applications for buildings and cities. During last 10 years, OzU/CEEE has completed several funded projects with both national and international companies involving DHL, Bosch-Siemens Turkey, Arçelik, Onur Enerji, Acciona, Deloitte, RISE, RINE Consulting, Dirco, Cartif, Soltigua, Tecnia, among others. It also completed three EU funded projects related to energy efficiency that NEED4B and BRICKER as FP-7 projects, and TRIBE as HORIZON-2020 Project. In addition, CEEE has already completed a project related to financial risk assessment of building retrofits with Georgia Institute of Technology, USA. This project was co-funded by USA-NSF and Turkish TUBITAK. Beside energy efficiency, CEEE also conducts research in the field of fundamental sciences on nano- and macro-scale radiative transfer and thermal sciences both through EU and TUBITAK-funded projects.



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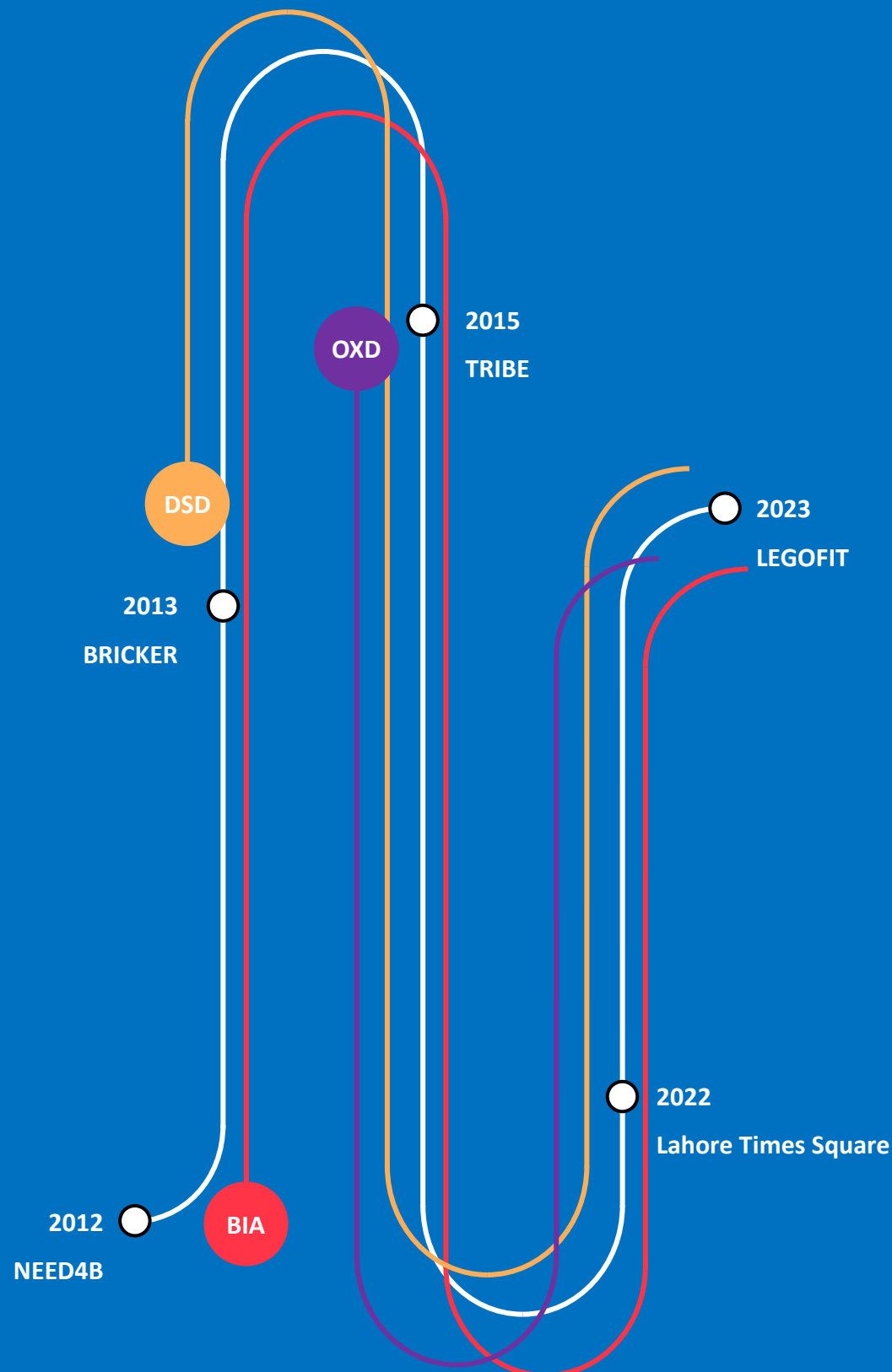


Sona Rahmian Sarıjeh



Canan Özsoy

CEEE is led by Prof. M. Pinar Menguc and the team is composed of 3 administrative staff (purple), 4 academia partners (red), 4 full time employees (blue), and various researchers that are undertaking their PhD (green) or master studies. CEEE core team and partners bring custom, impactful and applicable solutions to the table taking advantage of cutting-edge science, engineering and design literatures and best practices. To run corresponding activities time and cost effectively, CEEE develops novel methodologies and tools. These are briefly explained in the following pages.



BIA – Building Impact Assessment

DSD – Digital Services Design

OXD – Occupant Experience Design

PREVIOUS PROJECTS

NEED4B was funded by the EU 7th Framework Programme that had started in 2012 and completed in 2018. The project has various partners from Spain, Belgium, Italy, Sweden, and Turkey. Özyeğin University was one of the demo site providers with the SCOLA Building at the university campus. CEEE was responsible with **Building Impact Assessments** in this project, and it has completed with a huge success that the building is one of the most energy efficient buildings in Turkey.



BRICKER was funded by the EU 7th Framework Programme in 2013, and it was completed in 5 years in collaboration with several project partners from Italy, Spain, Belgium, Germany, Poland, and Turkey. Its purpose was to effectively apply and generalise energy efficiency concepts through deep renovation in public buildings. With the BRICKER Project, a comprehensive system was put together to reduce energy consumption by at least 50% in a functioning public building. CEEE's scope was **Digital Services Design** in BRICKER.



The EU-Horizon 2020 **TRIBE** project focuses on increasing the energy efficiency of public buildings by developing a mobile game. Therefore, behaviour of occupants towards energy use can be displayed and modified. The TRIBE game was designed to be played in virtual buildings that are similar to the 5 pilot buildings selected within the scope of the project in terms of energy performance as well as their designs. **Occupant Experience Design** was the main focus of CEEE team in this project. The behavioural scientific background of the game is based on the goal of improving the real-life behaviour of the players, who direct the energy use of avatars in buildings, through this interaction.



Prior to these research and consultancy projects mentioned above, CEEE has involved in various events:

- **Integrated Engineering and Architecture (USA/NSF 2011)**
- **Sıfır İstanbul 2010.**

CURRENT PROJECTS



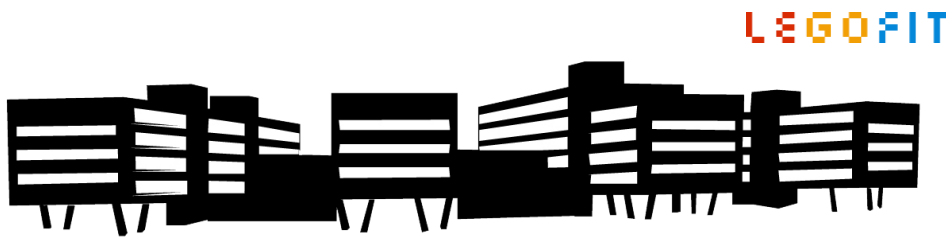
REEM Heights by Lahore Times Square (LTS) is a luxurious mixed-use development project with a total area of 1.13 million m² in Lahore, Pakistan. It consists of multi-layered buildings such as residential units, hospital, hotel, mosque, school, commercial units, offices, and shopping mall. As a high-impact project, LTS Project affects many people’s lives with ambitions to generate revenue, increase health, well-being, and comfort and to increase manufacturing, local development, and economic growth keeping in mind the action for climate and equal living communities. CEEE takes responsibility as Sustainability Program Manager in the project from the beginning of the masterplan design. Due to Pakistan’s high vulnerability to the climate crisis and the capacity of the proposed development that is almost in the size of a district, it is as challenging as it is critical to improve the design, construction, and operation of the buildings in terms of sustainability. LTS project is likely to create a significant impact on its surrounding environment. This impact is generalized under the topics of 3 pillars; people, profit, and the planet. CEEE consultancy services, comprising a total of five work packages, have been extensively pursued.



Fener House is a renovation project on a historic building in Istanbul, Turkey. The project aims to decrease the energy demand by carefully implementing sustainability measures from initial stage to the post occupancy phase. To reach this goal, the key steps are to specify the sustainability strategy, to conduct passive design analysis and life cycle analysis as well as socio-economical evaluation and occupant behaviour analysis, to achieve high standard and quality during the construction in implementation of energy efficiency features, and finally to finalise the project with soft landing to the occupants.

Lahore House

Lahore House development aims to achieve high standards of sustainability; therefore, building envelope parameters are of great importance. To achieve a good practice as CEEE we propose slightly improved U-values of thermal performance. Relatedly as the building envelope gets thermally more efficient, thermal bridges and airtightness barrier are also requires extra attention.

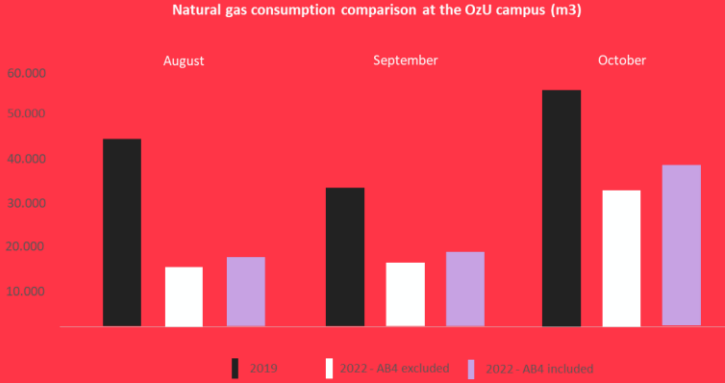


LEGOFIT as CEEE’s new project is entitled to receive a grant within the scope of the first chapter calls of the year initiated by the Horizon Europe Program in 2022 (under Cluster 5: Climate, Energy, Mobility). The project started in May 2023, and it is planned to be concluded in 4 years. The aim of the LEGOFIT project is to develop, to put into practice and to test an advanced and dynamic integrative methodology for achieving EPH, based on smart and novel solutions that are highly replicable and scalable for building construction and retrofit. There are 19 partner organisations that will be involved in total from Spain, Italy, Belgium, France, Sweden, Hungary, Serbia, Luxembourg, and Ireland. Among them, competent organisations like R2M and IES will take part in various stages. CEEE is responsible for building performance modelling, developing passive and active environmental design solutions and design recommendations, and behaviour change program. On the other hand, Özyeğin University provides the Turkish demo site for the project.



CEEE has an ongoing project with Özyeğin University management and FIBA Group to minimise energy dependency at the campus. There has been a three-staged plan prepared for the campus. This first step was quick actions to decrease energy consumption by behaviour analysis and energy management and it has succeeded to decrease energy consumption considerably.

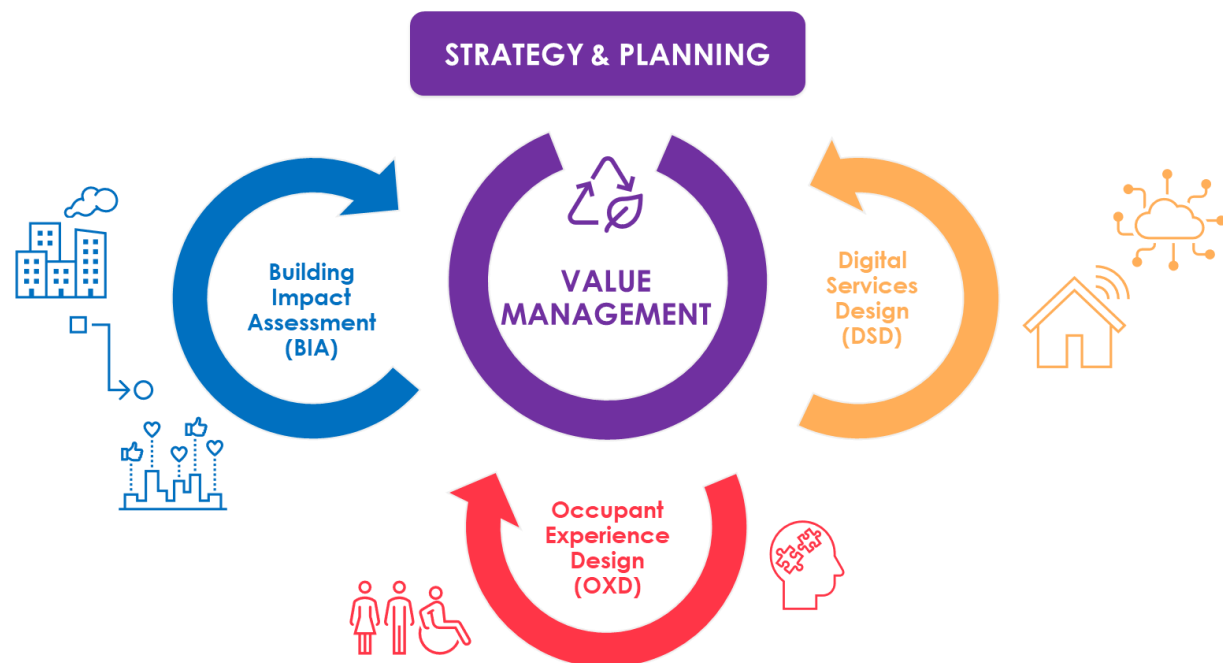
The other two stages of the project requires more long-term actions such as deep energy retrofit in all buildings and integration of renewable energy systems within the campus.



CEEE SERVICES

Given its ever increasing scale and impact, the real estate development projects are among the major industries to shape the economy, society and the environment. The need for sheltering has always been the fundamental demands of society. The increasing pace of urbanism and human population during the last decades reinforced the demand for the new buildings, districts and cities that are expected to be not only resilient but also healthy and comfortable. Beside economic and social challenges, human beings should handle this issue with rigid environmental concerns to mitigate climate risks. Hence, new perspectives and ambitious efforts are needed for the sector to contribute sustainable development.

To deal with the intrinsically complex nature of sustainability, CEEE has developed a comprehensive framework to facilitate synergy among distinct realms of the disciplines and propose novel solutions to prestigious research and commercial projects. The framework is based on five pillars in total (below): **Building Impact Assessment**, **Occupant Experience Design** and **Digital Services Design** are comprehensive inter- and trans-disciplinary specialisations that address physical, social, and technological aspects of the building design process. On the other hand, **Sustainability Strategy** and **Value Management** are consolidative specialisations to establish the links among them in a unique way for a given real estate development.



SUSTAINABILITY STRATEGY

Several global challenges such as climate change, social injustice, population increase, resource depletion and major losses in biodiversity are becoming more apparent day to day. Given their dynamic nature, they have been evolving by the time and always new challenges and opportunities appear. To address the specific issues, transformative long-term strategies and benefits must be set instead of immediate and short-term approaches. In accordance, developing the sustainability strategy for a real-estate development (or a development company) as a part of project pre-evaluations is an essential step for a 360-degree sustainability integration and development. CEEE provides tailor-made sustainability framework and roadmap planning to help stakeholders embedding sustainability vision into the value proposition of the projects.

The process for developing a sustainability strategy must rely on understanding the current situation through effective communication with all the corresponding stakeholders to develop an early strategy for finding risks and opportunities. As part of these efforts, CEEE organises a series of sustainability strategy workshops with the active participation of stakeholders to identify the issues and innovative solutions.

The integrated nature of the strategy necessitates involvement of stakeholders from all disciplines to reach durable and sustainable solutions collaboratively. In this way, ideas and suggestions carry a big diversity and inclusivity by keeping an open dialogue to identify new issues that can affect the project. Stakeholders' opinions also provide the possibility to detect and assess the risks and opportunities and bring innovation to the processes unlike traditional systems.

Being among the most impactful industries, sustainability strategies related to urban development should cover the planetary boundaries that means considering social, economic, and environmental impact beyond the projects' physical boundaries. This is an inevitable way to substitute a culture of trust, empowerment, and growth for the planet and the stakeholders (including the customers, the suppliers, the investors, and the community).

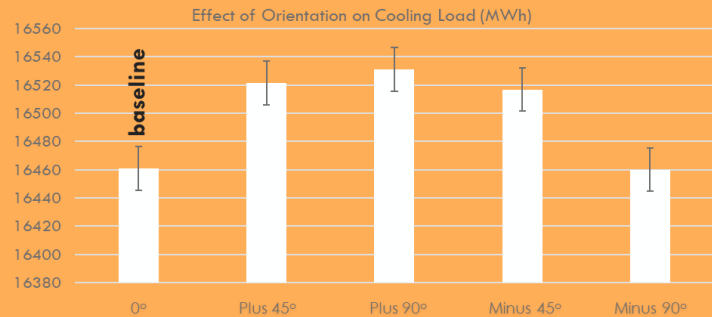
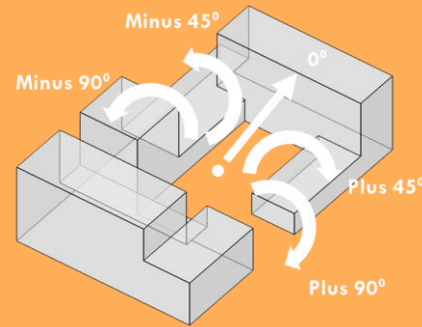
This can also support the development of inclusive economic opportunities and ensures that the people and businesses persist resilient and applicable for future generations. Accordingly, multi-stage yet integrated CEEE methodology aims to create a baseline for objectives to become measurable short, mid, long-term targets. These targets turn into the KPIs that provide successful long-lasting values for the project and/or company.

BUILDING IMPACT ASSESSMENT

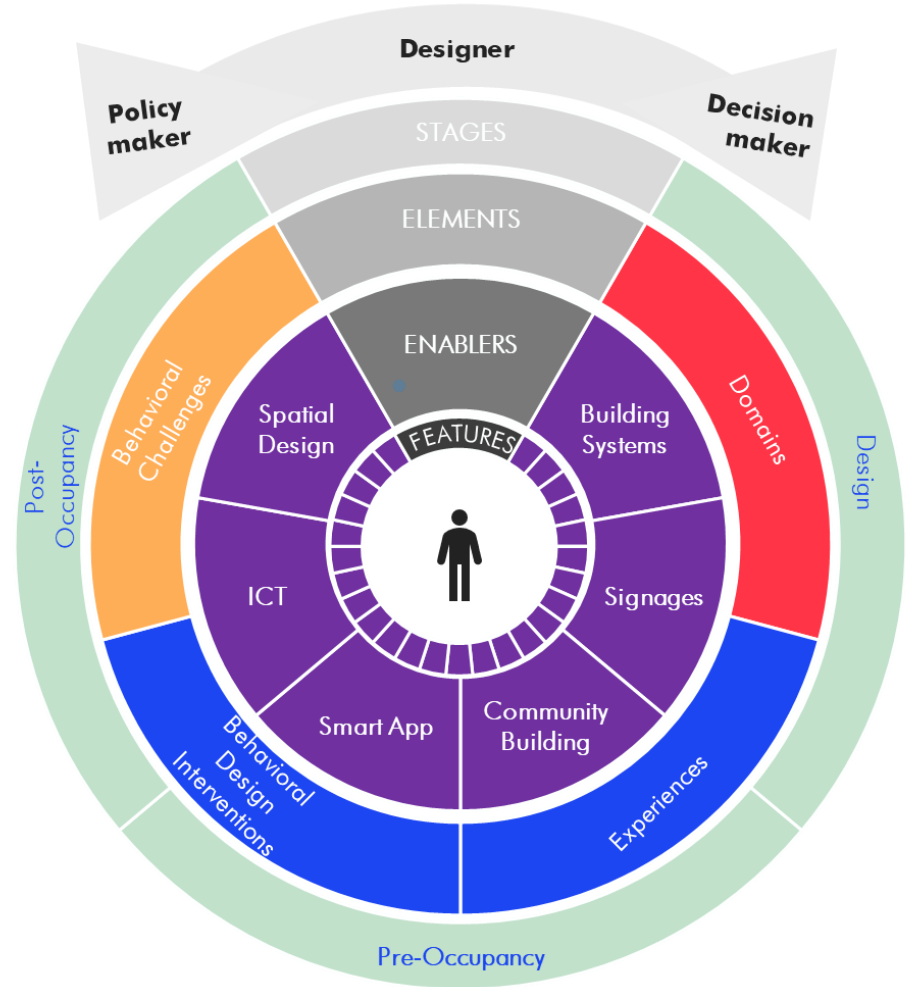
To mitigate the environmental burdens of the real estate sector, a comprehensive set of environmental principles is needed to ensure achieving the established goals as well as the climate resilience and adaptability of the buildings. Although there are several green building standards and certifications, there is a common concern that the sector lags other industries in responding to environmental challenges. The minimization of the impact of resource consumption in the design, construction, operation to final demolition and disposal of the buildings should have resource efficiency and waste elimination strategies.

In accordance, CEEE provides design decision support for projects to optimise their energy and material flow during the whole lifecycle of a building without sacrificing high comfort levels. This assistance is based on a comprehensive strategy and novel methodology for the decision-making regarding selection, classification, and procurement of materials and energy systems.

Three core design principles for increasing environmental performance of a building are (i) minimising both embodied and operational GHG emissions, (ii) reducing use of materials and natural resources and facilitating use of renewables. GHG emissions from the entire building is the sum of operational and embodied emissions for all assets over the life cycle of a building including its disposal. Moreover, resources like water and natural materials are consumed on a significant scale by activities associated with the built environment, during its construction, operation, and demolition. Hence, CEEE offers a whole-life impact assessment for projects to assist their design decision making, value engineering and procurement processes towards net-zero buildings.



OCCUPANT EXPERIENCE DESIGN



Urban development projects often idealised the post occupancy life of the occupants and disregards the relationship between design, occupant experience and responsible behaviour. If not well-conceptualised and implemented during design, it might be impossible or ineffective to gain occupant engagement regarding sustainability interventions. CEEE helps real estate projects to facilitate Occupant Experience Design (OXD) starting from early design stages to develop high-performing built environment. The CEEE methodology aims to align all corresponding stakeholders with behavioural design principles to provide a sustainable living experience by augmenting occupant satisfaction. It aims to achieve the following main objectives collaboratively:

- **Better Occupant Experience:** Identifying reliable and impactful innovations to maximise occupant satisfaction.
- **Behaviour Change for Sustainability:** Ensuring the involvement of enablers for behaviour change towards sustainable living.

DIGITAL SERVICES DESIGN

Digitalization has been converting many industries in the whole world including a rising trend of smart buildings and cities. Data-driven solutions have enhanced asset management, facility management and building automation beside augmenting investor, tenant, and occupant experience. However, identification, evaluation, design, and implementation of data-driven operations are getting more challenging as the “solutions” get more complex. Addressing these challenges in smart buildings and cities requires not only a compatible data architecture and infrastructure but also a rigid governance framework. Accordingly, CEEE help projects to enhance their digitalization strategy with the following services:

- designing data ontologies, semantics and architectures customized for smart buildings and cities,
- building maximum data quality, integration and security,
- developing innovative business solutions,
- proposing a data governance framework to define rights, roles, and responsibilities.

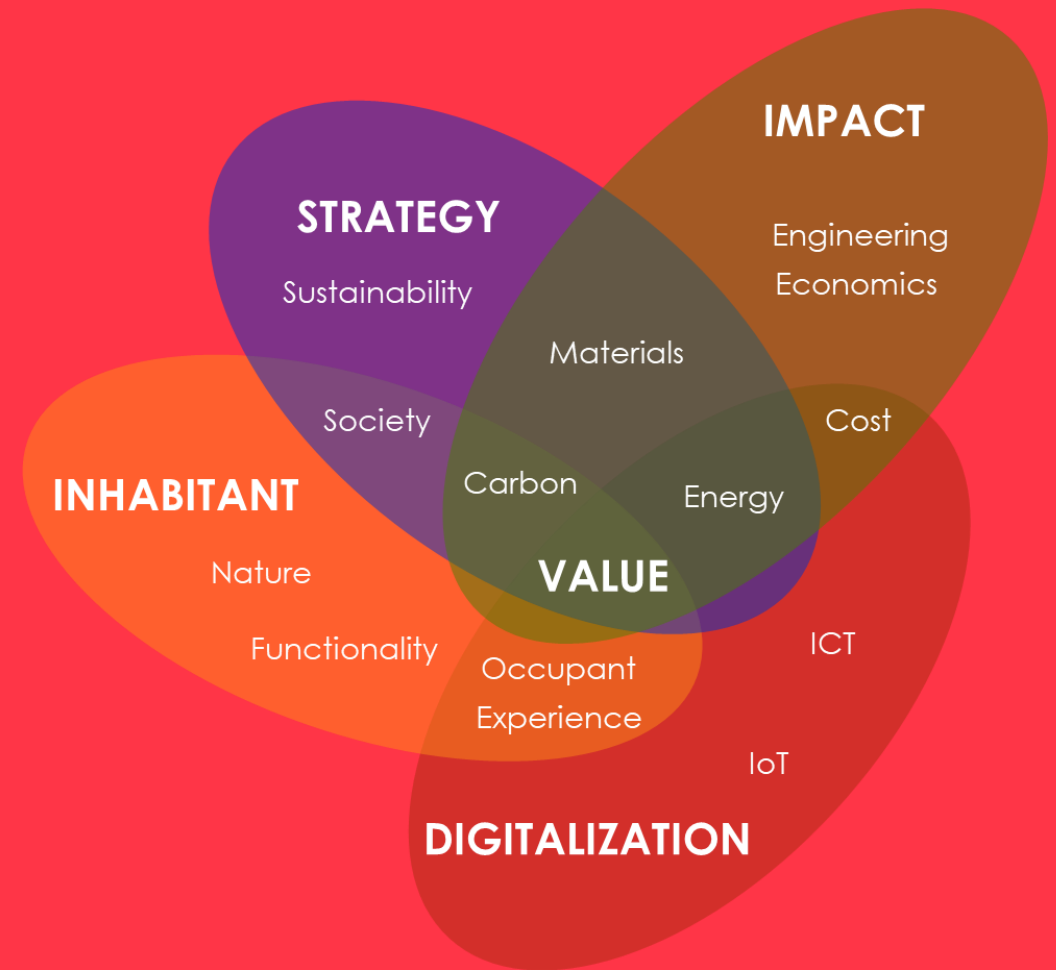


Beside technological and operational aspects, increasing pace of digitalization in built environment brings together challenges regarding legal concerns. CEEE works together with the Connect Legal Lab at Özyeğin University, which is an interdisciplinary research and collaboration space in the fields of law and emerging technologies run by the faculty members of the Information Technology Law Department. CEEE aims with this cooperation to propose legal frameworks that build trust and ethics for all smart service and technology providers while ensuring security and privacy for occupants. In this direction, the following services are offered:

- enabling compliance with local and international data protection laws,
- enabling compliance with the legal aspects of data and information governance and data storage,
- implementing data security and privacy policies,
- securing intellectual property rights,
- developing reliable cooperation strategies among businesses.

To ensure and promote quality of smart building services, CEEE helps projects to gain WiredScore and SmartScore certifications. The former provides benchmarking regarding connectivity of a building whereas the latter provides guidance for smart functionalities.

VALUE MANAGEMENT



Value management, or engineering, is a well-established approach in the real estate sector. It can be implemented starting from the pre-concept design to the end of the construction phase. CEEE aims to position a sustainability-oriented value proposition as the ultimate target of this process whenever it is applied. Extending the definition of value to a broader scope of interest, value management requires utilisation of soft skills while solving problems and optimising targets.

CEEE value management framework comprises five interconnected stages in line with the conventional value engineering methodology: information, analysis, creativity, evaluation, and development. Information is the stage in which the team is built, background information is gathered, and a workshop is organised among stakeholders to work on design objectives. The analysis stage basically focuses on the function analysis in which the technical understanding of the project is improved by identifying and classifying the functions.

PROJECT CONCEPTS

Horizon EU projects are the European Union's flagship research and innovation funding program. It aims to promote scientific excellence and drive innovations that can address societal challenges, foster economic growth, and improve the quality of life for people in Europe and beyond.

The program covers a wide range of research areas that are grouped under clusters. Each cluster focuses on specific challenges and priorities as following:

- Cluster 1: **Health**
- Cluster 2: **Culture, Creativity, and Inclusive Society**
- Cluster 3: **Civil Security for Society**
- Cluster 4: **Digital, Industry, and Space**
- Cluster 5: **Climate, Energy, and Mobility**
- Cluster 6: **Food, Bioeconomy, Natural Resources, Agriculture, and Environment**
- Cluster 7: **Secure Societies and Resilient Democracies**
- Cluster 8: **Global Challenges and European Industrial Competitiveness**

CEEE mainly focuses on Cluster 5 **Climate, Energy and Mobility** as its directly related to the sustainability. However, it is possible to integrate the subjects such as occupant experience design and life cycle analysis in various research projects in other research groups as well.



COST ACTION CA20109

Modular Energy Islands

International Energy Agency



Energy in Buildings and
Communities Programme

ANNEX-84



POTENTIAL CALLS – HORIZON EUROPE 2023/2024

Call	Call Title
HORIZON-CL5-2024-D2-01-04	Emerging energy technologies for a climate neutral Europe
HORIZON-CL5-2024-D3-01-12	Energy management systems for flexibility services
HORIZON-CL5-2024-D4-01-01	Low-disruptive renovation processes using integration of prefabricated solutions for energy-efficient buildings
HORIZON-CL5-2024-D4-01-02	Smart grid-ready buildings
HORIZON-CL5-2024-D4-02-01	Industrialisation of sustainable and circular deep renovation workflows (Built4People Partnership)
HORIZON-CL5-2024-D4-02-02	Robotics and other automated solutions for construction, renovation and maintenance in a sustainable built environment (Built4People Partnership)
HORIZON-CL5-2024-D4-02-03	BIM-based processes and digital twins for facilitating and optimising circular energy renovation (Built4People Partnership)
HORIZON-CL5-2024-D4-02-04	Design for adaptability, re-use and deconstruction of buildings, in line with the principles of circular economy (Built4People Partnership)
HORIZON-CL5-2024-D4-02-05	Digital solutions to foster participative design, planning and management of buildings, neighbourhoods and urban districts (Built4People Partnership)
DUT Call 2023	PED topic 1: Energy Resilience and Energy Poverty



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Further information about CEE projects:

<https://www.ozyegin.edu.tr/pdfviewer/ECM-NanodanGigaya.php>

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