

Summer School: Smart Sustainable Envelopes for an Energy Efficient Built Environment

The SNUG Summer Research School will take place at Østfold University of Applied Sciences, Campus Fredrikstad from Monday 22nd June to Friday 26th June 2026.

The objectives for this summer school will be to provide the students with a comprehensive understanding of circularity and sustainability in building envelopes, focusing on assessment methods, digital tools, sustainable materials, and techno-economic feasibility. The school is open to both master and PhD students as well as R&D researchers from the industry.

The summer school is grounded in contemporary research on circular economy, sustainable construction, and digitalization of the built environment. It builds upon current European standards and research frameworks for life cycle thinking, performance-based design, and decision support tools. Teaching combines theoretical lectures with applied research exercises, hands-on modelling, and critical discussion of case studies from ongoing European research projects.

Students will learn how modelling assumptions, system boundaries, and data quality affect simulation results and sustainability assessments. Emphasis is placed on interpretation, uncertainty awareness, and critical comparison of digital tool outputs.

Teaching and Learning Methods

The pedagogical approach of the summer school is aligned with the principles of the CDIO (Conceive–Design–Implement–Operate) framework adopted at Østfold University of Applied Science's Engineering Department. While the summer school is positioned at an advanced (PhD and Master) level, CDIO principles are applied to support constructive alignment between learning outcomes, teaching activities, and assessment.

The program emphasizes learning through real-world engineering problems, integration of disciplinary knowledge, and active student participation. Participants engage in conceiving and analyzing circular envelope solutions, designing and modelling performance-based alternatives, implementing and testing selected solutions through applied exercises, and evaluating results from both environmental and techno-economic perspectives.

Modules

1. Environmental assessment and standardization at materials and building level

This module introduces key frameworks for environmental assessment in the built environment, including life cycle assessment (LCA), material flow analysis, and performance-based indicators at material and building scales. Students will critically examine challenges related to harmonisation across European standards, national regulations, and certification schemes. A hands-on LCA exercise based on a case study will allow participants to explore how methodological choices influence environmental performance results, design decisions, and sustainability claims.

2. Advanced and renewable insulation materials for energy efficient envelopes

This module focuses on the material science and performance assessment of advanced and renewable insulation solutions used in building envelopes. Students are introduced to the physical principles governing thermal performance, moisture behaviour, durability, and fire safety of insulation materials, with particular attention to bio-based and hybrid solutions.

The module covers renewable insulation materials such as hemp, wood fibre boards, and mycelium, as well as high-performance composites including aerogels and phase change materials (PCMs). Through lectures and experimental case studies, students will analyse the trade-offs between environmental impact, performance, durability, and applicability in different climatic and regulatory contexts.

Full-scale testing methods and performance validation techniques are presented, allowing students to understand how laboratory and in-situ measurements support research, standardisation, and product development in advanced building envelopes. It also addresses the role of standardisation, certification, and testing procedures for construction materials—particularly building envelope components such as insulation systems—within established frameworks (e.g. EN standards, EOTA guidelines, and ETICS systems).

3. Digital modelling and assessment tools for circular envelope design

This module introduces digital modelling approaches used to support circular and energy-efficient envelope design. Students will be introduced to the principles of generative design and will explore, as a use case, the role of building performance simulation, indoor climate assessment, and life cycle assessment (LCA) as integrated decision-support tools across different design and renovation scenarios. This module will also explore mechanisms for cataloguing and curating material repositories for use in generative design tools.

Hands-on sessions will allow participants to work with digital tools to model and optimise energy demand, indoor comfort, and material-related environmental impacts at the building and component level. Emphasis is placed on defining system boundaries, assumptions, and data quality, as well as on interpreting results critically rather than treating digital outputs as absolute values.

The module includes practical exercises using case studies from demonstration buildings and research projects, including a closed-beta version of the SNUG Digital Tool Assistant, highlighting the opportunities and limitations of digitalisation in supporting circular design and policy-aligned decision-making in the built environment.

NOTE: This module will require the student to sketch a simple building model (using Revit or ArchiCAD) to produce a template of a building energy model to use in the SNUG Digital Tool Assistant.

4. Relevance of life cycle costing for advanced insulation materials

This module addresses the economic dimension of sustainable and circular building envelopes. Students will learn how cost considerations across a building's life cycle influence material selection, design strategies, and investment decisions, with particular emphasis on LCC in practice and on the role of LCC in relevant standards and decision-making frameworks.

The module introduces methods for integrating LCC with environmental life cycle assessment (LCA), highlighting why both approaches are relevant for the assessment of sustainable building solutions, and where methodological parallels can be drawn, for example, in life-cycle thinking, and in the need to define scope, boundary conditions, assumptions, and interpretation of results. This combined perspective enables an evaluation of environmental and economic performance. Particular attention is given to advanced insulation materials, where higher upfront costs may be balanced against long-term energy savings, extended service life, or circular business models.

Students will explore business models for circularity, including R-strategies, alternative value chains, and service based or “as a service” models, as well as risk factors affecting economic feasibility. A strong emphasis is placed on practical and applied exercises throughout the module to help students build and apply their knowledge step by step. These exercises will support the interpretation of results in a research and decision-making context relevant to both academia and industry.

Summer School Program

Monday 22nd June

9:00-9:15 Welcome and opening remarks

Dean Susanne Koch Stigberg, Faculty of Computer Science, Engineering and Economics, ØUAS

9:15-10:00 Opening Keynote: *From Static Assessment to Dynamic Decision Support: Digital Twins for Sustainable Building Design*

Haidar Hosamo, Associate Professor, OsloMet.

10:00-10:15 Break

10:15-12:15 Introduction to modules and to the SNUG project

12:15-13:00 Lunch

13:00-14:00 Launch of the ICE BOX Challenge Fredrikstad

15:00-17:00 Visit the laboratories and the Green Research HUB

Tuesday 23rd June

Module 1. Environmental assessment and standardization at materials and building level

9:00-9:30 European and International Standards: Development, Harmonisation, and Application (Florian Traxler, Austrian Standards)

9:30-10:15 Sustainability assessment of buildings (Lars Gunnar Furelid, ØUAS)

10:15-10:30 Break

Module 3. Digital modelling and assessment tools for circular envelope design

10:30-11:15 Building energy simulation and modelling (Elpida Polychroni, Maria Bololia, CRES)

11:15-12:00 Optimising building envelope design - Digital tool assistant (Jose M Peña [Lurtis Ltd])

12:00-13:00 Lunch

13:00-16:00 Digital Tool Assistant (DTA) - Hands on session (Jose M Peña [Lurtis Ltd])

Wednesday 24th June

Module 2. Advanced and renewable insulation materials for energy efficient envelopes

9:15-10:00 Hemp-based biopanel (Enrique Serra, AIDIMME)

10:10-10:15 Break

10:15-11:00 Mycelium-based insulation materials (Yoonhee Cho, Mycobuild project)

11:15-12:00 Phase Change Materials for thermal energy storage (Anna-Lena Kjøniksen, ØUAS)

12:00-13:00 Lunch

13:00-13:30 Aerogel-based insulation materials (Marina Stipetic, U.Stutt)

13:30-14:00 Certification and large scale testing of envelope systems (Marina / Juergen, U.Stutt)

14:00-14:15 Break

14:15-17:00 Life Cycle Assessment (LCA) - Hands on session (Lars Gunar Furelid, ØUAS)

Thursday 25th June

Module 4. Relevance of Life Cycle Costing for advanced insulation materials

9:15-10:00 Life cycle costing and its influence on material selection (Laura Toth-Sonns, Brimatech Research, Vienna)

10:00-10:15 Break

10:15-11:00 Business models for circular value chains (Andrea Kurz, Brimatech Research, Vienna)

11:00-12:00 Practical exercises and decision making: a case based approach (Laura Toth-Sonns and Andrea Kurz, Brimatech Research, Vienna)

12:00-13:00 Lunch

13:00-15:00 ICE BOX Challenge Fredrikstad



Friday 26th June

10:00-11:30 5 minute presentation of your research / interest topic

11:30-12:00 Ice Box Challenge results and awards with pizza

An “Icebox Challenge” will be organized where the participants will work in groups. The challenge will be to design the most insulating small “house” with some of the different solutions developed within SNUG project, as well as commercial products.

The Icebox Challenge functions as a problem-based research exercise where student groups formulate design hypotheses, select materials based on performance and circularity criteria, and evaluate results against predefined assessment indicators. Outcomes are discussed in relation to real-world research challenges in envelope innovation.

Learning Outcomes:

Upon successful completion of the summer school, participants will be able to:

LO1. Analyze assessment methods for building materials and envelopes at material and building level

LO2. Evaluate advanced and sustainable insulation materials based on performance, durability, and environmental impact

LO3. Apply and critically interpret digital modelling and assessment tools for circular envelope design and decision-making

LO4. Assess techno-economic feasibility and life-cycle costs of envelope solutions using integrated LCA–LCC approaches

Module	Main Learning Outcomes Addressed
Module 1 – Assessment methods at material and building level	LO1, partially LO3
Module 2 – Advanced and renewable insulation materials for energy-efficient envelopes	LO2, partially LO1
Module 3 – Digital modelling and assessment tools for circular envelope design	LO3, partially LO1
Module 4 – Life Cycle Costing and techno-economic assessment of advanced insulation materials	LO4, partially LO3

The modules are designed to progressively build competencies from assessment frameworks (Module 1) and material performance (Module 2) toward applied digital analysis (Module 3) and integrated economic evaluation (Module 4). Together, the modules ensure that

participants achieve all learning outcomes through a combination of theoretical input, applied exercises, and research-oriented case studies.

Assessment: Participation, poster presentation, and a short reflective report

Grading: Pass/Fail

The students will get a certificate confirming participation in the school, with a workload equivalent to 2 ECTS (approx. 50–60 hours workload) . The ECTS has to be validated at their own institutions.

Teaching Staff and Expertise

The summer school is delivered by academic staff and industry experts with expertise in circular construction, sustainable materials, building performance assessment, and digital modelling. Teaching staff are actively involved in European research projects, ensuring that course content reflects current research and applied practice.

- Anna-Lena Kjørniksen [Østfold University of Applied Sciences] – Advanced insulation materials, experimental testing of building envelopes
- Susana Garcia [Østfold University of Applied Sciences] – Building performance simulation, digital tools, indoor climate modelling
- Lars Gunnar Furelid Tellnes [Østfold University of Applied Sciences] – Circularity assessment, LCA, sustainability assessment of buildings
- Jose M Peña [Lurtis Ltd] – Artificial intelligence, generative design in engineering and construction.
- Luis Peña [Lurtis Ltd, UDIT University] – Artificial intelligence, design innovation and technology.
- Andrea Kurz [Brimatech Research gGmbH] - Life Cycle Costing, techno-economic assessment, circular business models
- Laura Toth-Sonns [Brimatech Research gGmbH] - Life Cycle Costing, techno-economic assessment, circular business models
- Marina Stipetic, University of Stuttgart, Aerogel-based insulation materials and certification
- Florian Traxler, Austrian Standards, European and International Standards.

Practical information

Travel: Oslo Airport to Fredrikstad via Vy train or FB11 bus.

Before the Summer School

Travel funding (Erasmus+ & short-term doctoral mobility)

Many European doctoral candidates can fund short-term mobility (5–30 days) to attend summer schools through Erasmus+ via their home university. You can apply via your own Erasmus/International Office and check national/ institutional rules.

Location

Østfold University of Applied Sciences
K.G. Meldahls vei 9, 1671 Kråkerøy
Building: S (SMIA)

Accommodation

Accommodation is not provided by the summer school and must be booked independently by the summer school participants. We recommend SiØ student housing as well as Quality Hotel Fredrikstad, Scandic City Fredrikstad, Hotel Fredrikstad. All of them are central in Fredrikstad.

Food & Social Programme

There will be a welcome dinner. The exact location will be announced later.

The school is sponsored by SNUG project (<https://snugproject.eu/>)



Innovative circular economy & AI methodology for sustainable high-energy performance buildings



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