



INTEGRATING SUSTAINABILITY AND HEALTH IN BUILDINGS THROUGH RENEWABLE MATERIALS



INNORENEW CoE INTERNATIONAL CONFERENCE
2020



INNORENEW CoE

Livade 6, 6310 Izola, Slovenia

IRIC2020 SCIENTIFIC COMMITTEE

Andreja Kutnar
Anna Sandak
David DeVallance
Iztok Šušteršič
Jakub Sandak
Michael Burnard
Miklós Krész

INNORENEW.EU

InnoRenew CoE is funded by the European Commission under Horizon 2020, the EU Framework Programme for Research and Innovation (H2020 WIDESPREAD-2-Teaming #739574), and by investment funding from the Republic of Slovenia and the European Regional Development Fund.



EVROPSKA UNIJA
EVROPSKI SKLAD ZA
REGIONALNI RAZVOJ

WELCOME



As we open the second InnoRenew CoE International Conference, it's hard not to think of all that has changed in the year and a half that has passed since our debut conference.

Although the pandemic has dramatically changed our day-to-day lives, it has not changed society's need to address the rapidly changing climate, reconsider our economic priorities, and refocus our attention on important social issues. Buildings remain part of the solution to many problems, and I think it is becoming clear that we need to consider much more about buildings than the basics of shelter.

As the pandemic kept us indoors, many of us may have realised that our indoor environment plays an even more important role in our well-being and happiness than we previously acknowledged. Likewise, we may have considered more carefully how buildings affect the well-being of those who live in different circumstances. Access to safe, comfortable, and healthy living and working spaces is (and should be) a priority in a just society.

Another major change that will affect our work in the years to come is the introduction of the European Green Deal, which will be a major driver of sustainable development in Europe. The European Green Deal prioritises investment and innovation in building renovation solutions for energy performance and attempts to ensure these solutions reach all members of society. The European Green Deal recognizes the need to establish high-performance housing for all and will support renovation in social housing, schools, and other facilities that are often left behind. This is a step in the right direction for inclusive, high-performing buildings.

I rarely find proclamations of success convincing when it comes to sustainability – especially about buildings. We must continue to drive change through research, development, and innovation to make our built environment a beacon of sustainable development. We cannot be satisfied with the environmental performance of our products or buildings; we cannot allow people to be excluded from our advancements; and we cannot forget that buildings impact the well-being and happiness of their occupants.

At this year's InnoRenew CoE International Conference, we wanted to showcase how renewable materials play an integral role in sustainable construction by highlighting environmental performance, safety, and health as well as the economic, digital, and social links that bind us to the materials in the built environment. Conference presenters will discuss advances in design, material development, health research, retrofitting, environmental assessment, and many other topics that increase the efficiency and performance of the building and renewable materials sectors.

Carlo Battisti, President of Living Future Europe, will weave together these complementary threads in his keynote address, "Healthy, living transparent. The quiet revolution of materials". He works to push for change and supports researchers, architects, engineers, and other construction professionals to achieve it. His efforts have expanded knowledge and acceptance of restorative sustainability and regenerative design within Europe's construction community. We are excited and grateful for his participation in our conference.

Together, the contributions paint a hopeful picture. But we must continue to push the science forward, embed these innovations in normal construction practices, and ensure inclusion of all who can benefit from our hard work.

While I wish these matters could have been discussed in person in Izola, we must embrace new options for discourse on these topics. I hope the conference inspires you to reach out to one another and continue sharing, collaborating, and building communities that embrace the challenge of creating a sustainable and just built environment. You may also consider our new open access and peer-reviewed journal, *Interdisciplinary Perspectives on the Built Environment*, as a place to share the insights your work provides.

Thank you,

Dr Michael Burnard
Deputy Director, InnoRenew CoE
Assist. Prof., University of Primorska

SCHEDULE AT A GLANCE

MORNING

WELCOME
9:00–9:05

KEYNOTE
9:05–9:35

FLASH TALKS
9:35–10:35

COFFEE BREAK
10:35–11:00

**HUMAN HEALTH IN THE
BUILT ENVIRONMENT**
11:00–12:30

LUNCH
12:30–14:00

AFTERNOON

COMPLEMENTARY TOPICS
14:00–15:30

COFFEE BREAK
15:30–15:55

**SUSTAINABLE CONSTRUCTION
WITH RENEWABLE MATERIALS**
15:55–17:25

CLOSING
17:25–17:30

KEYNOTE ADDRESS



CARLO BATTISTI
PRESIDENT, LIVING FUTURE EUROPE

*Healthy, living, transparent.
The quiet revolution of materials.*

Carlo Battisti has a degree in civil engineering from the Politecnico of Milan, nearly twenty years of experience in construction companies and a master's in management and organizational development from MIP International Business School. His certifications include Certified Project Manager IPMA®; LEED®, Living Future and WELL Accredited Professional; GBC Home AP, GBC Historic Building AP; USGBC® and WELL Faculty™.

Since 2009, he has been working with IDM South Tyrol (Italy) as an innovation manager in the Business Development department, Construction. From 2010 to 2011, he worked with the Energy and Environment Cluster of Trentino as manager of the business unit for sustainable products. From 2015 to 2016, he was the co-owner of a startup focused on LEED consulting. In 2015, he co-founded the Living Future Italy Collaborative.

Since 2017, he has been working with Eurac Research as Chair and Project Manager of COST Action 16114 RESTORE (REthinking Sustainability TOwards a Regenerative Economy). The RESTORE COST Action (2017–2021) will affect a paradigm shift towards restorative sustainability for new and existing buildings and space design across Europe through the collaboration of 160+ researchers from 40 European countries.

Since 2018, he is European Executive Director for the International Living Future Institute and current President of Living Future Europe. The Institute's mission will hasten the change and provide needed direction towards a regenerative design transition in Europe. It is actively pursuing European market alignment and adaptations of the Living Building Challenge (LBC).

AGENDA

WELCOME | 9:00-9:05

Dr Michael Burnard, InnoRenew CoE

KEYNOTE | 9:05-9:35

Carlo Battisti, Living Future Europe

FLASH TALKS | 9:35-10:35

Balázs Dávid, InnoRenew CoE / UP FAMNIT
Using discrete optimization methods in decision support for structural design

.....10

Dóra Zetz, Breuer Marcell Doctoral School,
Faculty of Engineering and Information
Technology, University of Pécs
*Office Building Optimisation Using the Energia
Design Synthesis Method*

.....11

Eva Prelovšek Niemelä, InnoRenew CoE
*Developing temporary housing solutions for
displaced persons – a study of user needs*

.....12

Faksawat Poohphajai, InnoRenew CoE
Evaluation of Biofinish for Wood Protection

.....13

Hajnalka Juhász, University of Pécs, Faculty
of Engineering and Information Technology
*HUNGARIAN NEST+ New type energy spaces in
sustainable architecture**

.....14

Hana Remešová, InnoRenew CoE
*Testing the Thermal Properties of Loose-Fill
Straw Insulation*

.....15

Jaka Pečnik, InnoRenew CoE
*Thermo-Hydro-Mechanical Treatment of
Australian Sawlog and Pulplog Hardwood
Resources*

.....16

Marko Kovačević, Kompetenzzentrum Holz
GmbH
VOC-emission optimized Cross Laminated Timber
.....17

Nežka Sajinčič, InnoRenew CoE
*Sustainability, health, and renewable materials –
Trends in scientific publications*
.....18

Olena Myronycheva, Luleå University of
Technology
*The Influence of Four Commercial Wood-surface
Treatments on Mould-fungi Growth in a Pure
Culture*
.....19

René Herrera, InnoRenew CoE / University of
the Basque Country
*Improving hydrophobicity and thermal stability
of wood by esterification with fatty acids*
.....20

Urška Smrke, University of Ljubljana, Faculty
of Arts / University of Maribor, Faculty of
Electrical Engineering and Computer Science
*Aspects of Residential Environment Included
in Residential Satisfaction Questionnaires: A
Systematic Review*
.....21

Veerapandian Ponnuchamy, InnoRenew CoE
*Molecular Dynamics Investigation of Capturing
Paracrystalline Cellulose Phase from mixed
Crystalline and Amorphous Cellulose under
Constant Load*
.....22

Zsolt Benkó, University of Szeged,
Department of Technology
*Practical education of Smart Home Systems
emphasizing sustainability*
.....23

COFFEE BREAK | 10:35-11:00

*Unable to present



HUMAN HEALTH IN THE BUILT ENVIRONMENT | 11:00-12:30

Aarne Johannes Niemelä, InnoRenew CoE <i>Development of outdoor environment in schools with natural materials – a response of future users</i>	26
Anja Jutraz, National Institute of Public Health <i>Ensuring the health of users with the integrated approach to the renovation of school buildings</i>	27
Anna Sandak, InnoRenew CoE <i>Bioinspired building materials – lesson from nature</i>	28
Dean Lipovac, InnoRenew CoE / UP IAM <i>Psychophysiological and attention restoration in a wooden office: A pilot study</i>	29
Nastja Podrekar, InnoRenew CoE / UP <i>School Furniture as a Risk Factor for Musculoskeletal Pain among Slovenian Students</i>	30
Veronika Kotradyová, Faculty of Architecture, Slovak University of Technology in Bratislava <i>Appreciation/acceptance of traditional and modern appearance of materials and products by users</i>	31

LUNCH | 12:30-14:00

COMPLEMENTARY TOPICS | 14:00-15:30

Benedikt Neyses, Luleå University of Technology <i>Continuous densification of solid wood – the band press approach</i>	34
Dennis Jones, Luleå University of Technology <i>A Review of Wood Modification globally – Findings from COST FP1407 and 2019 updates</i>	35
Gregor Lavrič, Pulp and Paper Institute <i>Optical and abrasion properties of plasma treated and UV LED printed wood samples</i>	36
Laetitia Marrot, InnoRenew CoE <i>Towards Smart Textiles for Civil Engineering Application</i>	37
Marco Fellin, CNR-IVALSA (former) <i>Cross Laminated Timber furniture providing shelter during earthquakes. Lifeshell public domain release.</i>	38
Michael Mrissa, InnoRenew CoE <i>Distributed Ledgers and Decentralized WoT Architectures</i>	39
Stefania Fortino, VTT Technical Research Centre of Finland LTD <i>Numerical simulation of moisture transport in thermally modified wood exposed to rain</i>	40

COFFEE BREAK | 15:30-15:55

IRIC2020 AGENDA CONTINUES ON THE NEXT PAGE

AGENDA

SUSTAINABLE CONSTRUCTION WITH RENEWABLE MATERIALS | 15:55-17:25

Erwin M. Schau, InnoRenew CoE
*A European reference house for Life Cycle
Assessment of wooden residential buildings*
.....42

Giulia Pelliccia, Università degli Studi di
Perugia, Dipartimento di Ingegneria Civile ed
Ambientale (DICA)
*HYGROSCOPIC COFFER. Digital parametrization
and realization of timber bilayer composites for
passive dehumidification in built environments*
.....43

Kristóf Roland Horváth, Marcel Breuer
Doctoral School, University of Pécs, Faculty
of Engineering and Information Technology
*Residential Building Optimisation Using Passive
Design Strategies*
.....44

Tim Mavrič, InnoRenew CoE
*Energy Efficient Retrofitting – A comparative
analysis of implemented strategies in Bosnia-
Herzegovina and Slovenia*
.....45

CLOSING | 17:25-17:30

THANK YOU FOR ATTENDING IRIC2020!

SEE YOU NEXT YEAR

[HTTPS://INNORENEW.EU/IRIC2021](https://innorenew.eu/iric2021)



Sustainable Construction with Renewable Materials

Energy Efficient Retrofitting: A comparative analysis of implemented strategies in Bosnia–Herzegovina and Slovenia

Slobodan Peulić¹, Tim Mavrič², Anna Sandak^{3, 4}, Darija Gajić⁵, Črtomir Tavzes⁶, Mladen Slijepčević⁷, Milica Malešević⁸

1, 5, 7, 8 *University of Banja Luka, slobodan.peulic@aggf.unibl.org, darija.gajic@aggf.unibl.org, mladen.slijepcevic@aggf.unibl.org, milica.malesevic@aggf.unibl.org*

2, 3, 6 *InnoRenew CoE, tim.mavric@innorenew.eu, anna.sandak@innorenew.eu, crtomir.tavzes@innorenew.eu*

4 *University of Primorska, FAMNIT, anna.sandak@famnit.upr.si*

Sustainable approaches in retrofitting buildings for energy efficiency are becoming inevitable in the time of global climate change. Retrofitting existing building stock can be effective in reducing global energy consumption and decreasing resource overexploitation. However, less developed EU member states and neighbouring developing countries show reluctance towards healthy and renewable materials and their use in the building recovery process. This can be explained by different influences – a chain effect that goes from legislation and lack of effective strategic programs and action plans to consumers who prefer materials that are more affordable, regardless of their environmental or health impact. This process directly reflects on an industry incapable or not interested enough to produce equally priced materials from sustainable resources. Global issues primarily reflect on developing countries, such as Bosnia–Herzegovina, that cannot afford better or more innovative energy recovery systems. This research aims to display analysis of documents and legislation regarding retrofitting of residential buildings in Bosnia–Herzegovina and Slovenia. To address this broad problem, analysis of differences between good practice environments and environments where resistance towards sustainable retrofitting is present was performed. The analysis tackled indirect causes, studied legal foundations (rulebooks and official gazettes) and examined strategic frameworks (energy strategies, action plans), providing concise insight thereof and pointing out potential barriers to implementation of recommended retrofitting solutions based on renewable materials. Furthermore, this research sets a good platform for further similar analyses of other countries in the region.

Keywords: legal framework, action plans, developing countries, energy efficiency, renewable materials

Acknowledgements: This research paper was carried out through bilateral agreement E-REFIT funded by: (i) Government of Republic of Srpska, Ministry for Scientific and Technological Development, Higher Education and Information Society and (ii) ARRS – Slovenian Research Agency. The authors also gratefully acknowledge the European Commission for funding the InnoRenew project (grant agreement #739574 under the Horizon2020 Widespread-Teaming program) and the Republic of Slovenia (investment funding from the Republic of Slovenia and the European Union's European Regional Development Fund).



2020

CONFERENCE SPONSOR



INNORENEW PROJECT PARTNERS



Inštitut za celulozo in papir
Pulp and paper Institute
Bogišičeva ul. 8, 1000 Ljubljana
tel.: +386 1 200 28 00
fax.: +386 1 426 56 39
email: info@icp-lj.si



RRA LUR

InnoRenew CoE is funded by the European Commission under Horizon 2020, the EU Framework Programme for Research and Innovation (H2020 WIDESPREAD-2-Teaming #739574), and by investment funding from the Republic of Slovenia and the European Regional Development Fund.



The InnoRenew CoE International Conference 2021

HEALTHY AND SUSTAINABLE RENOVATION WITH RENEWABLE MATERIALS

June 10-11 | Izola, Slovenia



2021



JOIN US AGAIN NEXT YEAR

[HTTPS://INNORENEW.EU/IRIC2021](https://innorenew.eu/iric2021) | #IRIC2021



EVROPSKA UNI
EVROPSKI SKLAD ZA
REGIONALNI RAZVOJ

InnoRenew CoE is funded by the European Commission under Horizon 2020, the EU Framework Programme for Research and Innovation (H2020 WIDESPREAD-2-Teaming #739574), and investment funding from the Republic of Slovenia and the European Regional Development Fund.