

CLIMA 2022 conference papers on the theme ENERGY

The following papers have been acknowledged as high ranking on the theme ENERGY.

Included in this issue:

Going active How do people envision the next generation of buildings?

Elli Nikolaidou, Ian Walker, David Coley, Stephen Allen, Daniel Fosas
(Best paper award for the theme Energy)

Performance of a mixed-use ground source heat pump system in Stockholm

Jeffrey D. Spitler, Signhild E. A Gehlin

Design of highly compact indirect evaporative coolers

Francisco Comino, Jesús Castillo-González, Francisco J. Navas-Martos, Pablo E. Romero, Manuel Ruiz de Adana

A common European EPB Assessment and Certification scheme. U-CERT's proposal

Pablo Carnero, Dick van Dijk, Niccolo Mignani, Gabriela Ana

The other papers can be accessed on-line:

Intelligent building envelope solutions in Finnish new and old apartment buildings

Azin Velashjerdi Farahani, Juha Jokisalo, Natalia Korhonen, Kirsti Jylhä, Heikki Ihasalo, Jaakko Ketomäki, Risto Kosonen

This study investigated the effects of intelligent building envelope solutions (automated blinds, openable windows, and awnings as well as electrochromic windows) in Finnish old and new apartment buildings. Moreover, the results are compared to the passive solutions (manual blinds and solar protection windows). The main goal was to compare the performance of each solution in improving the indoor temperature conditions in Finland's current climate.

<https://proceedings.open.tudelft.nl/clima2022/article/view/438>

Potential of WASTE WATER HEAT RECOVERY in reducing the EU's energy need

Pavel Sevela, Johannes Frenger, Jürgen Schnieders, Rainer Pfluger

Waste-Water Heat-Recovery (WWHR) technology was identified as the most promising technology to unlock the under-addressed potential in reducing the energy need for water heating.

Particularly interesting application of WWHR is for showering, which accounts for about 70 to 82% of the daily residential hot water tapping profile. Shower-wise installed heat-exchangers offer a cost-effective way of utilizing otherwise wasted heat for preheating cold fresh water, thus reducing the temperature span covered by the water heater. The total energy demand savings for hot water heating can be up to 40%.

<https://proceedings.open.tudelft.nl/clima2022/article/view/439>

Advanced solutions to improve heat recovery from wastewater in a double heat exchanger

Mihnea Sandu, Aamjed Albaiyati, Ilinca Nastase, Paul Danca, Florin Bode, Cristiana Croitor

Usually, heat recovery from wastewater is designed to recover residual energy from the hot drainage water and this recovered energy is used to preheat incoming cold water or to heat pumps. The paper presents numerical simulations using a SST $k-\omega$ turbulence model in order to compare a regular geometry with a helicoidal one. The second one provides a more turbulent flow that allows an intensification of the outer flow, thus allowing the enhancement of the heat transfer from the inner heated flow to the outer flow.

<https://proceedings.open.tudelft.nl/clima2022/article/view/429>

Optimal design and operation for heat prosumer-based district heating systems

Haoran Li, Juan Hou, Natasa Nord

This study aimed to break this economic barrier by introducing water tank thermal energy storage (WTTES) and optimizing the operation of heat prosumers with WTTESs, considering the widely used heating price models in Norway. Firstly, a generalized heating price model was introduced, which could represent the current widely used heating price models in Norway. Secondly, the WTTES was integrated into the heat prosumer to improve the self-utilization rate of the prosumer's heat supply from its distributed heat sources, meanwhile, shave the prosumer's peak load.

<https://proceedings.open.tudelft.nl/clima2022/article/view/347>

Concise cycle test methods to evaluate heating/cooling systems with multiple renewable sources

Robert Haberl, Maike Schubert, Thibault Péan, Iván Bellanco, Francisco Belio, Jaime Salom, Daniel Carbonell

The goal of the project TRI-HP is to develop systems based on electrically-driven natural refrigerant heat pumps coupled with photovoltaics to provide heating, cooling and electricity to multi-family buildings with an on-site renewable share of 80%. The implementation of different energy sources for such a system often leads to a complex architecture of the overall system. The performance evaluation of such systems is not trivial and cannot be done via steady-state measurements of individual components. Instead, dynamic measurements using the hardware in-the-loop approach are performed to test the performance of the newly developed system

<https://proceedings.open.tudelft.nl/clima2022/article/view/390>

Biomass in District Energy Systems Overview and Perspectives for an Italian Case-Study

Lorenzo Teso, Tiziano Dalla Mora, Piercarlo Romagnoni

This work focuses on the use of district heating networks supplied with energy from biomass as a form of sustainable development for cities and communities, with attention to the Italian situation. To demonstrate how the use of biomasses in district energy networks represents a valid alternative to fossil fuels an analysis of the utilization of forests for wood harvesting in the Italian energy sector is carried out, showing how greenwoods and forests can withstand even greater exploitation for the collection of wood material for energy production. In order to prove the feasibility of the switch, a case study district, representative of the Italian residential building stock, is analysed.

<https://proceedings.open.tudelft.nl/clima2022/article/view/398>

Next-Generation Energy Performance Certificates, What novel implementation do we need?

Lina Seduikyte, Phoebe-Zoe Morsink-Georgali, Christiana Panteli, Panagiota Chatzipanagiotidou, Koltsios Stavros, Dimosthenis Ioannidis, Laura Stasiulienė, Paulius Spudys, Darius Pupeikis, Andrius Jurelionis, Paris Fokaides

This study performed under the H2020 project "Next-generation Dynamic Digital EPCs for Enhanced Quality and User Awareness (D²EPC)", aims to analyze the quality and weaknesses of the current EPC schemes and aspires to identify the technical challenges that currently exist, setting the grounds for the next generation dynamic EPCs.

<https://proceedings.open.tudelft.nl/clima2022/article/view/348>

Heat recovery ventilation solutions for school building renovation case study

Helena Kuivjõgi, Henri Sarevet, Martin Thalfeldt, Jarek Kurnitski

Two solutions with different cost are studied in this paper: classroom air handling unit (AHU), and central AHU. The aim of this study is to determine which solution is better in energy

efficiency if there is demand to renovate ventilation system in school building. The calculations have been done in standard and real use and climate. Study will show the cost-optimality of these solutions in school buildings.

<https://proceedings.open.tudelft.nl/clima2022/article/view/208>

Benchmarking the measured energy use of Nordic residential buildings and their Zero Energy-readiness

Andrea Ferrantelli, Martin Thalfeldt, Jarek Kurnitski

Building energy benchmarking provides information to stakeholders and motivates energy retrofits, by evaluating and comparing a building to similar units and/or to a reference building in terms of energy consumption with the minimum amount of data possible.

In this paper nearly 19000 Estonian Energy Performance Certificates (EPCs) of detached houses have been analysed. By means of a systematic statistical investigation, we determined the time evolution of EPC labels and evaluated the impact of incentives pre/post renovations, drawing a comprehensive and updated picture of the Estonian detached houses.

<https://proceedings.open.tudelft.nl/clima2022/article/view/171>

Assessment of Use Cases Involving Data from the Energy Performance Certification Process for Buildings - From Individual Buildings to Regional Scale

Gerfried Cebrat, Alessandra Manzini, Christiana Panteli, Claudia Julius

The main objective of this paper is to analyse use-cases which are based on data from the Energy Performance Certification (EPC) process. This data, which is often collected for compliance checks by authorities, can be used exploited for multiple purposes. The most basic service is energy consulting by engineers, based on a living document from the EPC process, depicting the buildings thermal characteristics and specification of the HVAC system. But also, the design of regional decarbonization can be data driven, and the drafting of energy policies supported, investigating effect of renovation and decarbonization incentives.

<https://proceedings.open.tudelft.nl/clima2022/article/view/112>

From Diesel to Electric to NZEB, an Energy Performance Contract in a Hotel

João Raposo, Daniel Silva, António Mortal, João Lopes

How could a 1975 4* 220# bedroom beach hotel evolve from an old system with Diesel Boiler and cooling only chiller to become a NZEB building. An Energy Performance Contract, funded by innovation funds, a hotel in south Portugal obtained 60% Energy reduction, a new Chiller and integrated Heat Recoveries results on eliminating diesel consumption with almost free Sanitary Hot Water in the summer and next steps to achieve a NZEB Building. Energy Performance Certificate came from D to B which is already considered NZEB in Portugal.

<https://proceedings.open.tudelft.nl/clima2022/article/view/28>