Horizon 2020

EnTReC Energy Transition Research Center

TECHNICAL UNIVERSITY OF CLUJ-NAPOCA, ROMANIA

LGA hOListic Green Airport

WP4: Terminal Area

(from building efficiency up to biodiversity, dealing with eco-friendly materials and waste reduction)

Ancuța Măgurean, Laura Dărăbanț, Dorin Beu, Bogdan Varga, Dan Doru Micu – EnTReC

November 2025

Grant Agreement n° 101036871

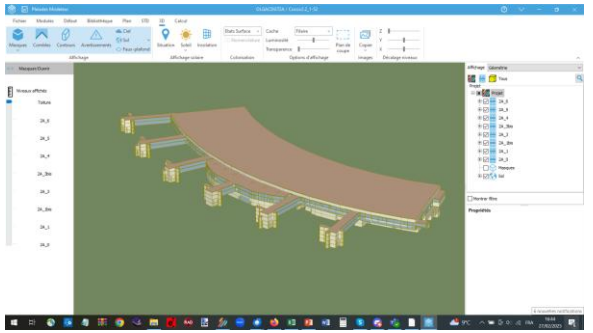
4.1.5- NRJ CO_2 Renovation

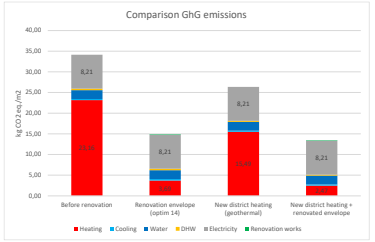
[B. PEUPORTIER and P. SCHALBART (CES) / N. BOUISALMANE and L. LAUTRIDOU (ADP) CLUJ & Zagreb Airport for replication]

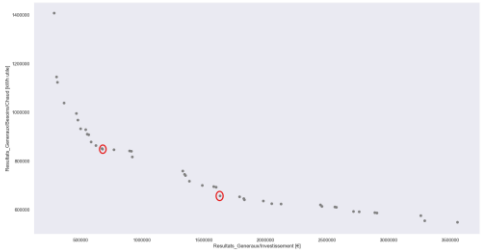
General description of task

- Aiming at improving energy and CO_2 efficiency in complex existing Terminals,
- Developing an innovative methodology based on a software platform developed at CES integrating building energy simulation (Comfie-Pleiades) and LCA assessment (Equer).







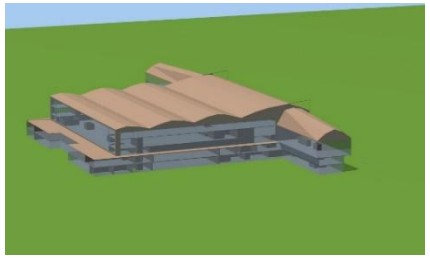


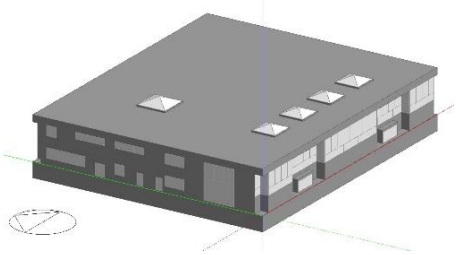
4.1.3b- Replication

[A. MAGUREAN (UTCLUJ), J.CUKELJ (FSB), B. PEUPORTIER and P. SCHALBART (CES), N. BOUISALMANE and L. LAUTRIDOU (ADP)

General description of task

- Replication aims at applying the design methodology to other airport projects and to other BES and LCA tools.
- Feasibility will be explored based upon the feedback from replications in ZAG and CLJ.







CLUJ-NAPOCA AIRPORT ARRIVALS TERMINAL – replication case study

BRIEF DESCRIPTION

Construction year	2008
Gross Area **Gross volume**	10812 m2 56700 m3
Technical data **Building envelope**	○ **Exterior walls**-metal panels thermally insulated with 15 cm PUR ○ **Curtain walls** (double glazed & Aluminum frames with thermal break), U = 0,236 W/m2·K ○ **Skylights** made of three-chamber cellular polycarbonate ○ **Terrace floor** with 25 cm mineral wool thermal insulation (renovated in 2019)
HVAC, DHW & lighting systems	○ **Heating** – 3 x boiler Buderus Logano SK 72, heating capacity 3 x 1320 kW (centralized production in an adjacent technical building, for all the buildings of the airport) ○ **Cooling** – 1 x chiller CGAN 212, cooling capacity 389 kW ○ **Mechanical ventilation** – 5 x AHU with heat recovery, mixing chambers and heating&cooling batteries ○ **Domestic Hot Water** – 1 x boiler Buderus Logano SK 625, thermal capacity 530 kW (centralized production for all buildings) ○ **Lighting** – mainly LED technology (years 2022-2023); $P_{el} \approx 45$ kW



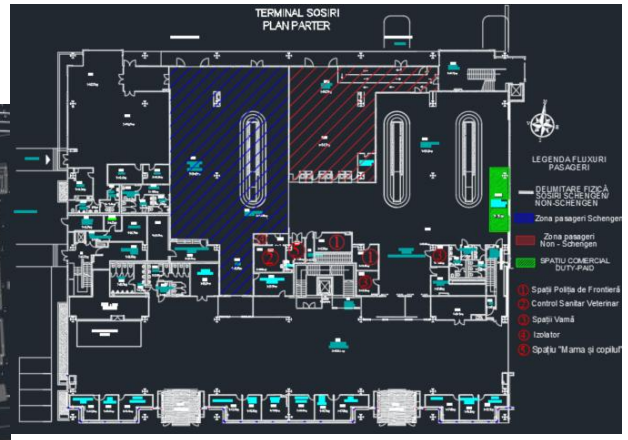


CLUJ-NAPOCA AIRPORT ARRIVALS TERMINAL – replication case study

DATA COLLECTION

AutoCAD file format (.dwg files)



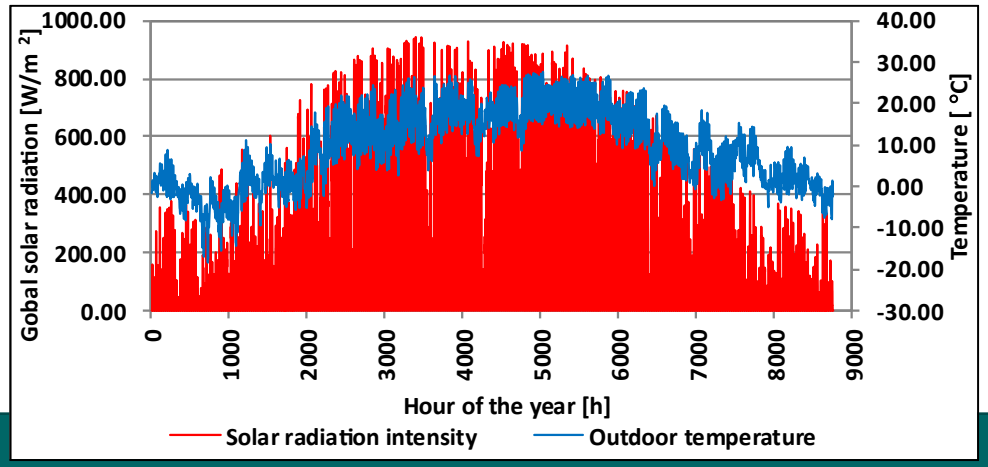


Occupancy scenarios

Data collected refer to:

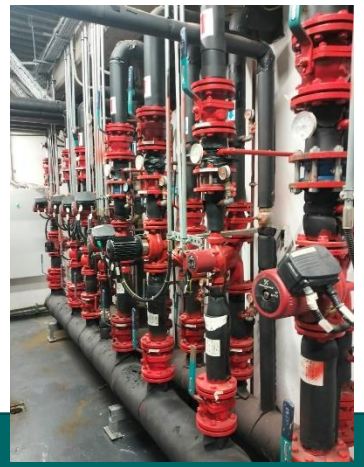
- passenger daily flow history
- number of staff members and their working schedules - for continuously (**24 h/day**) / discontinuously (**8 h/day**) provided services
- the number of employees of companies operating within the terminal perimeter

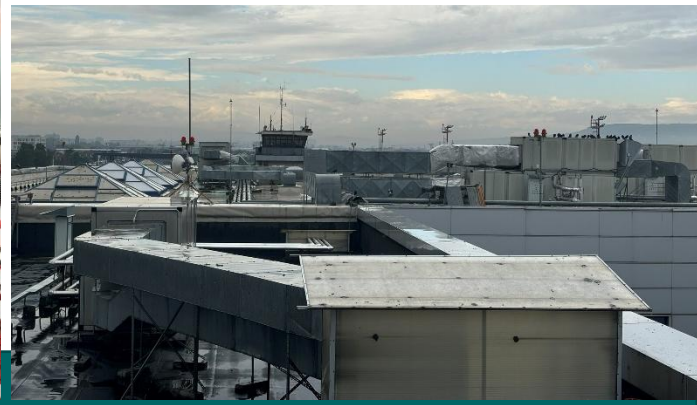
Climate data (hourly)



Equipment data collection & hours of operation







CLUJ-NAPOCA AIRPORT ARRIVALS TERMINAL – replication case study

ENERGY PERFORMANCE ASSESSMENT OF THE ARRIVALS TERMINAL

❖ QUALITATIVE INVESTIGATION OF THE BUILDING'S ENVELOPE THERMAL PERFORMANCE

The **qualitative evaluation** of the thermal bridges & air infiltrations through infrared thermography

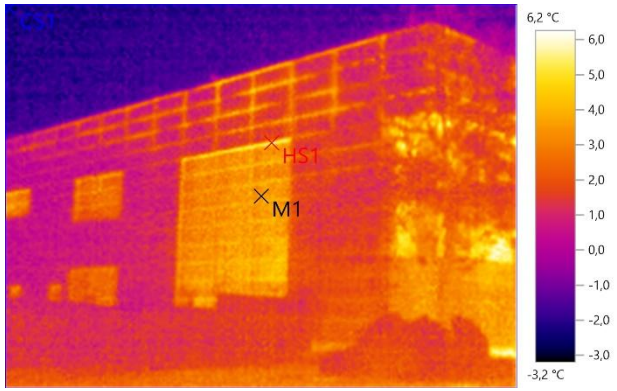


Photo a. West façade

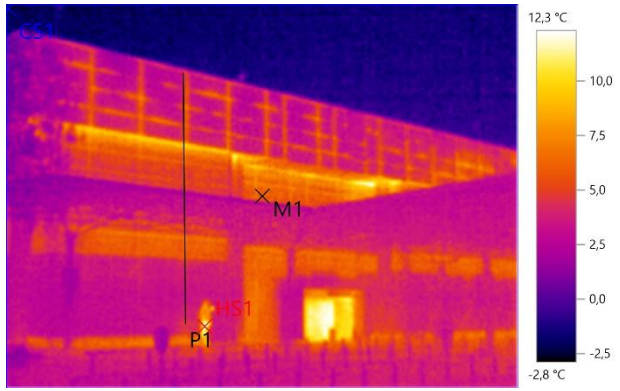


Photo b. South façade

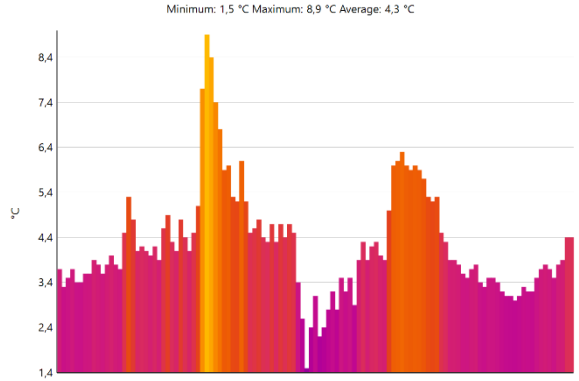


Photo c. Temperature profile for line P1

❖ THERMAL ENERGY AND ELECTRICITY CONSUMPTION HISTORY ANALYSIS (in the last 3 years)

Quantitative analysis of the measured methane gas consumption & electricity within the terminal

CLUJ-NAPOCA AIRPORT ARRIVALS TERMINAL – replication case study

DYNAMIC ENERGY MODELLING OF THE TERMINAL

❖ ENERGY SIMULATION & OPTIMIZATION

- Multizone approach
- Dynamic hourly energy modelling of the building & systems
- Heating/Cooling, Mechanical Ventilation (HVAC), Domestic Hot Water (DHW) & Lighting energy consumptions calculations for a year
- **Development of a data-supported (white box) and calibrated building energy simulation model, to allow accurate forecasting of energy savings and CO_2 emissions when implementing dedicated solutions**

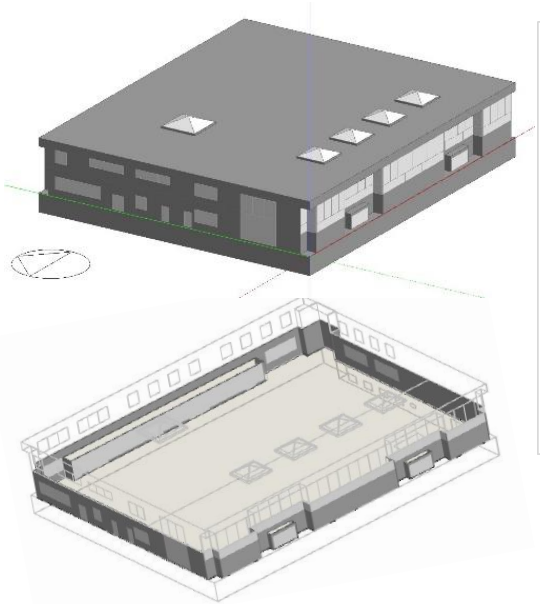


Fig. Geometrical model of the building

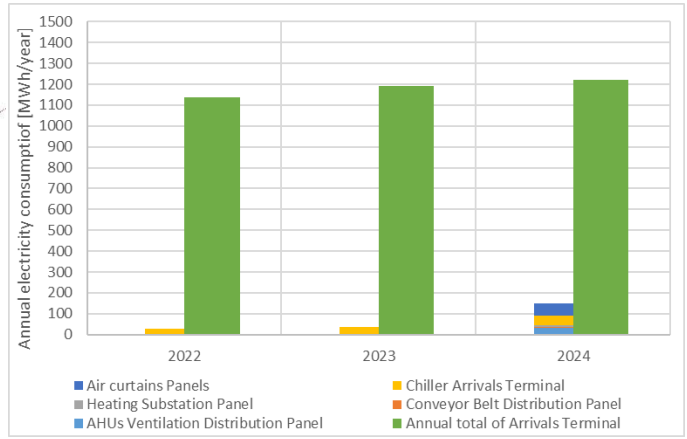


Fig. Electricity consumption history from BMS in the terminal

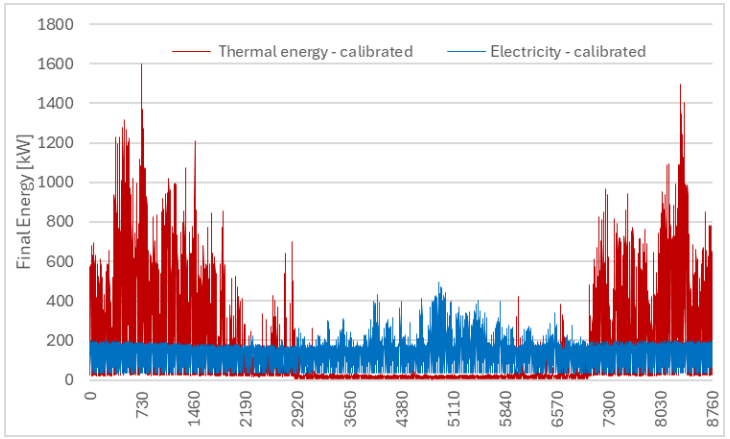
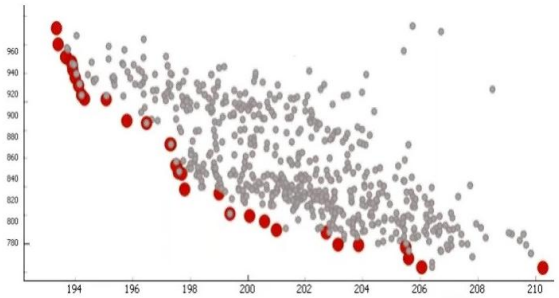


Fig. Hourly final thermal and electrical energy (calibrated model)



Work in progress: multi-objective optimization using genetic algorithms

"Calibrated Physics-based Dynamic Energy Modelling of an Airport Terminal" – paper under review