DIPARTIMENTO di INGEGNERIA

LA RICERCA DENTRO UNIME

PhD Cycle XL - II Year of the PhD Programme

Comfort and Wellbeing as Impact Criteria of the Smart Readiness Indicator

***PhD Candidate*: Alessandra Gugliandolo**

Supervisor: Prof. Fabio Minutoli
Co- Supervisor: Prof. Mauro Prestipino

18 dicembre 2025

Subject of the Research and Scientific Context

Climate Challenge

Rising temperatures and climate change require efficient solutions for ***summer cooling***.

University Residences

Ideal contexts characterised by high occupant density with different needs and habits.

Energy Impact

Summer air conditioning has a significant impact on energy consumption and greenhouse gas emissions.

KEY WORLDS: ENVIRONMENTAL, PROTECTION, WELL-BEING, COMFORT

It is therefore essential to integrate a joint assessment of subjective comfort, objective environmental conditions and energy performance.

The **SMART READINESS INDICATOR** as an instrument to measure the smartness of a building.

Relevance of the Research: Three Main Profiles

Scientific Profile

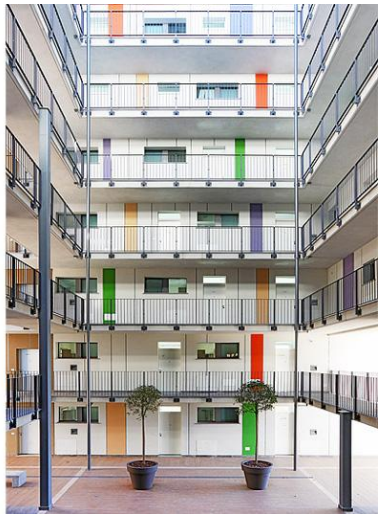
It helps to fill a gap in the existing literature, still limited in describing the potential of SRI with respect to the issues of **indoor comfort** and **adaptivity of buildings**

Application Profile

It provides useful elements for the design of user-oriented management and redevelopment strategies, with a view to optimizing consumption and **improving the quality of living**

Regulatory and Policy Profile

It **is part of** the **European framework** for the evolution of energy assessment tools, providing potentially transferable indications in the national implementation processes of the SRI



State of the Art: Gaps and Critical Issues

For Italy, the **Smart Readiness Indicator national Testing Phase** is currently underway, conducted in coordination with the MASE (Ministry of the Environment and Energy Security), with the participation of the ENEA working group, of which I am a member, for the analysis of the results of the first certifications on the national territory.

Lack of Systematic Studies

No direct links between SRI and thermal comfort, especially during the cooling period

Limited Integration

Poor combination of objective data (instrumental monitoring) and subjective assessments (questionnaires to occupants)

Lack of Climate Analysis

There is limited research on the climatic conditions in the Mediterranean area, which has long summers and high temperatures.

Need for Real Case Studies

Urgency of applied research capable of producing robust technical evidence for operational guidelines

Structure of the Thesis

The thesis is organized in seven main chapters that guide the reader through a logical and progressive path, from the theoretical framework to the final evaluation of the interventions implemented. Each chapter contributes to the construction of a solid and scientifically rigorous methodological framework.

01

Regulatory and Theoretical Framework

Analisi del raffrescamento estivo, comfort termico e Smart Readiness Indicator nel contesto normativo europeo e italiano

02

Research Methodology

Detailed description of the selected case study and the data collection systems implemented

03

Occupant Perception

Qualitative and quantitative analysis of the questionnaires administered to resident students

04

Pre-intervention environmental monitoring

Collection and analysis of instrumental data on microclimatic conditions before efficiency measures

05

Efficiency Measures

Description of the interventions aimed at cooling implemented on the building envelope and on the systems

06

Pre and Post Intervention Comparison

Comparative evaluation of the conditions and impact on the Smart Readiness Indicator

07

Discussion and Recommendations

Summary of the results obtained, operational recommendations and future research perspectives

First investigation

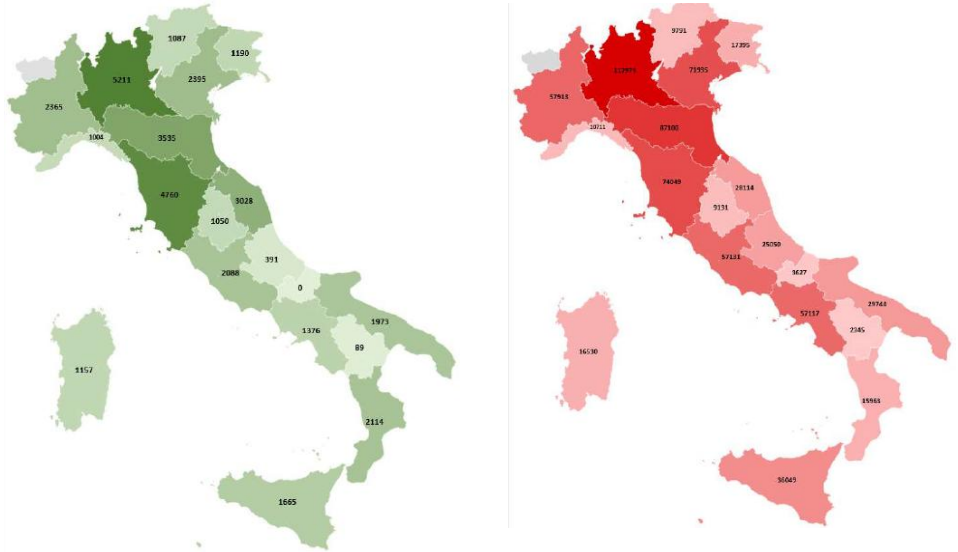
REGION	STUDENT ACCOMODATION	RESIDENTS OUTSIDE PROVINCE	MISSING ACCOMODATION	AVAILABLE ACCOMODATION
Piemonte	2365	60278	57913	3,92%
Lombardia	5211	123184	117973	4,23%
Trentino Alto Adige	1087	10878	9791	9,99%
Veneto	2395	74330	71935	3,22%
Friuli Venezia Giulia	1190	18585	17395	6,40%
Liguria	1004	11715	10711	8,57%
Emilia Romagna	3535	90635	87100	3,90%
Toscana	4760	78809	74049	6,04%
Umbria	1050	10181	9131	10,31%
Marche	3028	31142	28114	9,72%
Abruzzo	391	25441	25050	1,54%
Molise	0	3627	3627	0,00%
Lazio	2088	59219	57131	3,53%
Basilicata	89	2434	2345	3,66%
Puglia	1973	31717	29744	6,22%
Campania	1376	58493	57117	2,35%
Calabria	2114	18077	15963	11,69%
Sicilia	1665	37714	36049	4,41%
Sardegna	1157	17687	16530	6,54%
ITALIA	**36478**	**764146**	**727668**	4,77%

Student accommodation in university residences (2022)

Paper: "Public University Residences as a driver for energy renovation. Reflections on summer thermal performance"

Colloqui.AT.e 2025 — ENVISIONING THE FUTURES — Progettare e costruire per le persone e l'ambiente — Trento, 11-14 giugno 2025

It is important to remember that national legislation on the right to study allows non resident students - enrolled within a year beyond the normal course duration and with certain merit requirements - to apply for these places.



Source: 2022 National Council of University Students report

First investigation

The criteria for drawing up the ranking list include: student accommodation must provide for the integration of information and multimedia technologies.

This involves an assessment of the available technology and any strategies for **integration with the existing infrastructure.**

LN 1551/1951 e sue applicazioni
Increase in state contributions to universities

→ **L. 6 agosto 2008, n. 133**
Urgent provisions for economic development, ... of public finance and tax equalization

L. 14 novembre 2000, n. 338
Provisions regarding accommodation and residences for university students

→ **D.M. 42 /2007 e D.M. 26/2011**
Procedures for the presentation of projects and for the disbursement of funding

→ **D.M. 43/2007 e D.M. 27/2011**
Minimum dimensional and quality standards and guidelines relating to technical and economic parameters

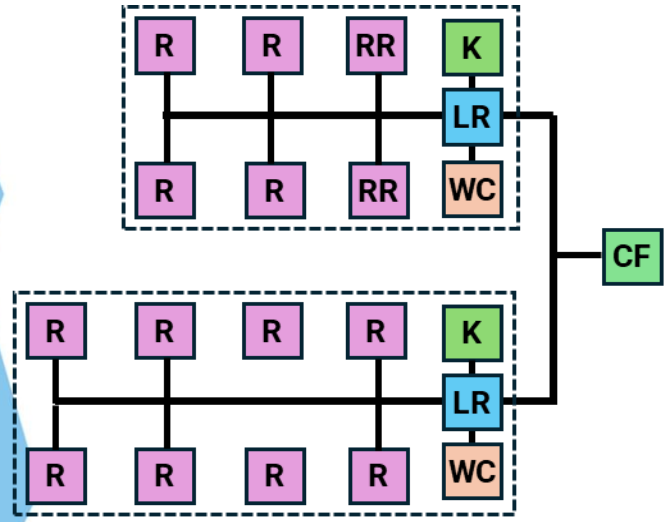
D.M. n. 41/2008
First Three-year Plan, co-financing of housing and university residences

D.M. n. 936 28.11.2016
Minimum standards for the construction of housing and residences for university students

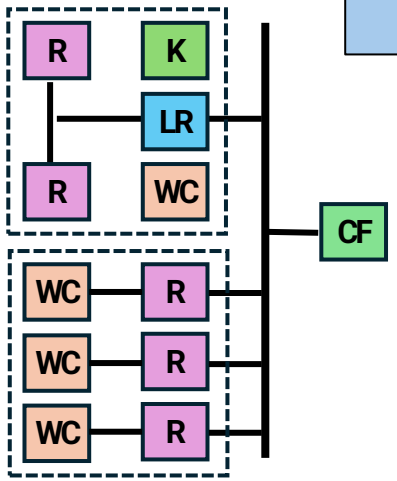
D.M. n. 937/2016
Procedures for the submission of projects

DM n. 481 del 26-02-2024
Acquisition of the availability of new beds in student accommodation or residences of higher education institutions, in implementation of Reform 1.7 - "Student housing and reform of student housing legislation" envisaged by Mission 4, Component 1 " of the PNRR

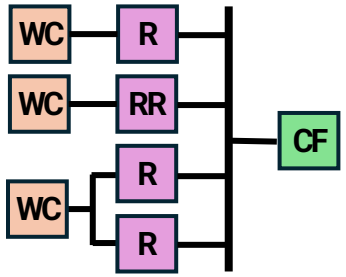
Integrated units



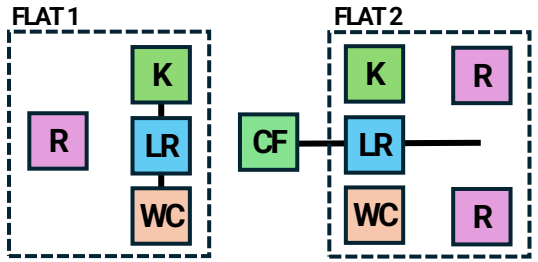
Mixed



Hotel



Mini apartment



PNRR funds:
Resources aimed at increasing the number of beds for university students

Ministero dell'Università e della Ricerca

Ministerial Decree no. 469 of 12-05-2023

Notice aimed at identifying expressions of interest from subjects who intend to make available properties to be used as housing or university residences for students of higher education institutions

MAPPING OF EXISTING BUILDINGS SUITABLE FOR CONVERSION INTO STUDENT HOUSING

+ 595 BUILDINGS

=

+ 67925 BEDS

The aspect most closely linked to energy saving and efficiency cannot be separated from automation **and intelligent regulation tools** (BACS, Building Automation and Controls Systems) that allow you to "control" and reduce overall energy consumption

MISSION 1
DIGITIZATION, INNOVATION, COMPETITIVENESS, CULTURE AND TOURISM

MISSION 2
GREEN REVOLUTION AND ECOLOGICAL TRANSITION

Piano Nazionale di Ripresa e Resilienza
#NEXTGENERATIONITALIA#NEXTGENERATIONITALIA

MISSION 3
INFRASTRUCTURE FOR SUSTAINABLE MOBILITY

MISSION 4
EDUCATION AND RESEARCH

MISSION 5
INCLUSION AND COHESION

MISSION 6
HEALTH

In art. 10 – Methods of evaluation and approval of the interventions of Ministerial Decree no. 481 of 26-02-2024 in the evaluation criteria there is quality of the intervention: **level of functionality and comfort**, also with reference to the degree of environmental sustainability and technological innovation of the solutions adopted

1. RESEARCH OF UNIVERSITY RESIDENCES IN ITALY

INCLUSION CRITERIA

- MANAGEMENT BY PUBLIC INSTITUTION [UNIVERSITY-ERDSU]
- ANY PERIOD OF CONSTRUCTION
- CURRENT USE AS A UNIVERSITY RESIDENCE

2. CREATION OF A DATABASE FOR DATA COLLECTION

DESCRIPTION ITEMS OF EACH UNIVERSITY RESIDENCE

- **IDENTIFICATION DATA**
  Building Denomination; Region; Province; Municipality; Address; Construction Period
- **CLIMATIC DATA**
  Heating Climate Zone; Winter Degree Days
- **TYPOLOGICAL/TECHNOLOGICAL DATA**
  Type of building (according to Ministerial Decree 116/118 of 2001); Number of bed; Technical data; Cooling systems
- **AUTHORIAL ARCHITECTURE DATA**
  Presence in censuses of modern and contemporary architecture; Presence in accredited bibliography

3. SELECTION OF A SURVEY SAMPLE

INCLUSION CRITERIA

- **IDENTIFICATION OF SELECTION CRITERIA**
  1945-75; Heating Climatic Zones B-E; Authorial Architecture; Interventions after National Law 338/2000
- DEFINITION OF COOLING CLIMATIC ZONES

4. PRELIMINARY ENERGY AUDIT OF A CASE STUDY

ANALYSIS

- CONSTRUCTION HISTORY
- ANALYSIS OF SUMMER BEHAVIOUR
- HYPOTHESIS OF ENERGY RETROFIT

PHASE I
Census of existing university housing stock

PHASE II
Setting up a database identification data, climate data, typological / technological data, authorial architectural data

PHASE III
Selection of a sample of buildings based on established criteria; Definition of cooling climate zones

PHASE IV
Choice of the case study;
Energy audit June-September
State of fact and project

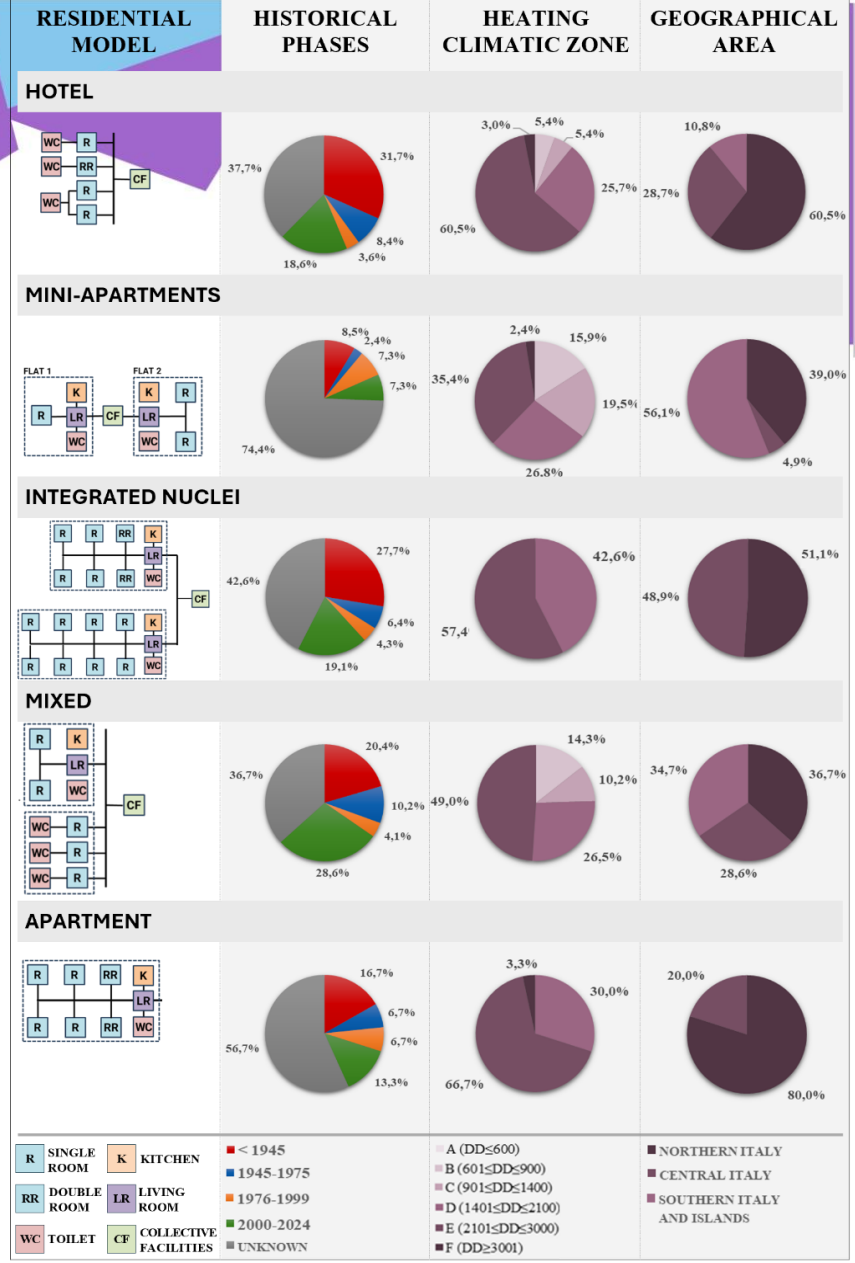


Fig. 1. Methodological approach

Public University Residences as a driver for energy renovation. Reflections on summer thermal performance

A. Cernaro, O. Fiandaca, A. Gugliandolo and F. Minutoli
in Colloquiate 2025 Trento

18 dicembre 2025

1. RESEARCH OF UNIVERSITY RESIDENCES IN ITALY

INCLUSION CRITERIA

- MANAGEMENT BY PUBLIC INSTITUTION [UNIVERSITY-ERDSU]
- ANY PERIOD OF CONSTRUCTION
- CURRENT USE AS A UNIVERSITY RESIDENCE

2. CREATION OF A DATABASE FOR DATA COLLECTION

DESCRIPTION ITEMS OF EACH UNIVERSITY RESIDENCE

- **IDENTIFICATION DATA**
  Building Denomination; Region; Province; Municipality; Address; Construction Period
- **CLIMATIC DATA**
  Heating Climate Zone; Winter Degree Days
- **TYPOLOGICAL/TECHNOLOGICAL DATA**
  Type of building (according to Ministerial Decree 116/118 of 2001); Number of bed; Technical data; Cooling systems
- **AUTHORIAL ARCHITECTURE DATA**
  Presence in censuses of modern and contemporary architecture; Presence in accredited bibliography

3. SELECTION OF A SURVEY SAMPLE

INCLUSION CRITERIA

- **IDENTIFICATION OF SELECTION CRITERIA**
  1945-75; Heating Climatic Zones B-E; Authorial Architecture; Interventions after National Law 338/2000
- DEFINITION OF COOLING CLIMATIC ZONES

4. PRELIMINARY ENERGY AUDIT OF A CASE STUDY

ANALYSIS

- CONSTRUCTION HISTORY
- ANALYSIS OF SUMMER BEHAVIOUR
- HYPOTHESIS OF ENERGY RETROFIT

PHASE I
Census of existing university housing stock

PHASE II
Setting up a database identification data, climate data, typological / technological data, authorial architectural data

PHASE III
Selection of a sample of buildings based on established criteria; Definition of cooling climate zones

PHASE IV
Choice of the case study;
Energy audit June-September
State of fact and project

Fig. 1. Methodological approach

1945-1975

HEATING CLIMATIC ZONES

- A: DD≤600
- B: 601≤DD≤900
- C: 901≤DD≤1400
- D: 1401≤DD≤2100
- E: 2101≤DD≤3000
- F: DD≥3001

LEGEND

- n: BUILDING
- CLIMATIC ZONE

1. Calamandrei e ATER (Firenze)
2. Campus (Modena)
3. Casa della Gioventù (Bressanone)
4. Casa dello Studente (Matera)
5. Casa dello Studente (Bari)
6. Casa dello Studente (Messina)
7. Casa dello Studente E1 (Trieste)
8. Casa dello studente Galileo Galilei (Milano)
9. Collegio Colle (Urbino)
10. Collegio di Milano (Milano)
11. Collegio Don Bosco (Pavia)
12. Collegio E. MATTEI 1 (Camerino)
13. Collegio Gerolamo Cardano (Pavia)
14. Rainerum (Bolzano)
15. Residenza Agraria (Perugia)
16. Residenza Bassini (Milano)
17. Residenza Carducci (Bologna)
18. Residenza Cleto Tomba (Bologna)
19. Residenza David Maria Sassoli (Firenze)
20. Residenza Donati (Modena)
21. Residenza Ex Enav (Forlì)
22. Residenza Giulio Regeni (Roma)
23. Residenza Mattioli (Siena)
24. Residenza Parthenope (Napoli)
25. Residenza Villa Marchi (Reggio Emilia)
26. Residenza Villino Bianca (Firenze)

SELECTION CRITERIA
1945-75 • heating Climatic Zone B-E
Authorial Architecture • Interventions after National Law 338/2000

Public University Residences as a driver for energy renovation. Reflections on summer thermal performance

A. Cernaro, O. Fiandaca, A. Gugliandolo and F. Minutoli
in Colloquiate 2025 Trento

1. RESEARCH OF UNIVERSITY RESIDENCES IN ITALY

INCLUSION CRITERIA

- MANAGEMENT BY PUBLIC INSTITUTION [UNIVERSITY-ERDSU]
- ANY PERIOD OF CONSTRUCTION
- CURRENT USE AS A UNIVERSITY RESIDENCE

2. CREATION OF A DATABASE FOR DATA COLLECTION

DESCRIPTION ITEMS OF EACH UNIVERSITY RESIDENCE

- **IDENTIFICATION DATA**
  Building Denomination; Region; Province; Municipality; Address; Construction Period
- **CLIMATIC DATA**
  Heating Climate Zone; Winter Degree Days
- **TYPOLOGICAL/TECHNOLOGICAL DATA**
  Type of building (according to Ministerial Decree 116/118 of 2001); Number of bed; Technical data; Cooling systems
- **AUTHORIAL ARCHITECTURE DATA**
  Presence in censuses of modern and contemporary architecture; Presence in accredited bibliography

3. SELECTION OF A SURVEY SAMPLE

INCLUSION CRITERIA

- **IDENTIFICATION OF SELECTION CRITERIA**
  1945-75; Heating Climatic Zones B-E; Authorial Architecture; Interventions after National Law 338/2000
- DEFINITION OF COOLING CLIMATIC ZONES

4. PRELIMINARY ENERGY AUDIT OF A CASE STUDY

ANALYSIS

- CONSTRUCTION HISTORY
- ANALYSIS OF SUMMER BEHAVIOUR
- HYPOTHESIS OF ENERGY RETROFIT

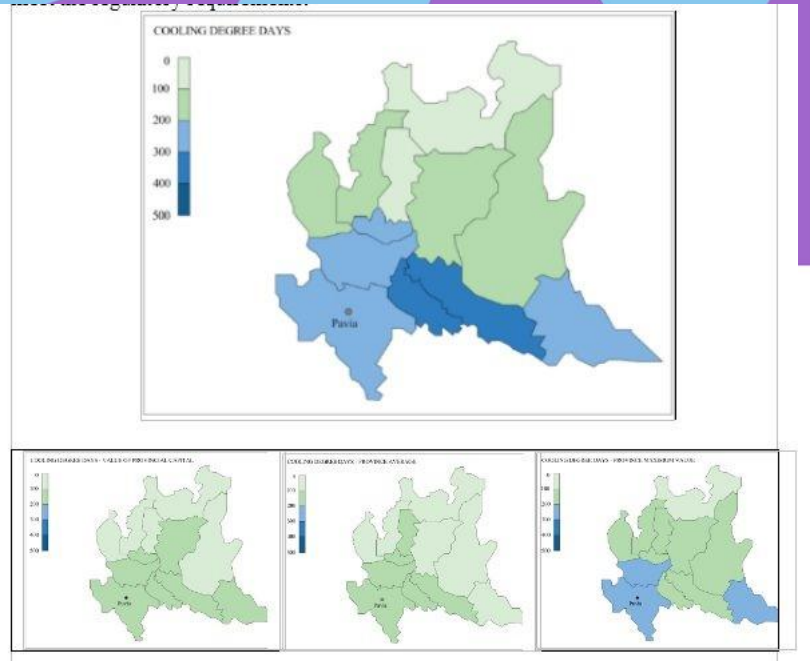
Fig. 1. Methodological approach

PHASE I
Census of existing university housing stock

PHASE II
Setting up a database identification data, climate data, typological / technological data, authorial architectural data

PHASE III
Selection of a sample of buildings based on established criteria; Definition of cooling climate zones

PHASE IV
Choice of the case study;
Energy audit June-September
State of fact and project



A Python algorithm has been developed for the identification of climate zones based on cooling needs and the degree days of heating and cooling have been calculated so as to have a detailed classification of the climatic needs at the territorial level

Public University Residences as a driver for energy renovation. Reflections on summer thermal performance

A. Cernaro, O. Fiandaca, A. Gugliandolo and F. Minutoli
in Colloquiate 2025 Trento

1. RESEARCH OF UNIVERSITY RESIDENCES IN ITALY

INCLUSION CRITERIA

- MANAGEMENT BY PUBLIC INSTITUTION [UNIVERSITY-ERDSU]
- ANY PERIOD OF CONSTRUCTION
- CURRENT USE AS A UNIVERSITY RESIDENCE

2. CREATION OF A DATABASE FOR DATA COLLECTION

DESCRIPTION ITEMS OF EACH UNIVERSITY RESIDENCE

- **IDENTIFICATION DATA**
  Building Denomination; Region; Province; Municipality; Address; Construction Period
- **CLIMATIC DATA**
  Heating Climate Zone; Winter Degree Days
- **TYPOLOGICAL/TECHNOLOGICAL DATA**
  Type of building (according to Ministerial Decree 116/118 of 2001);
  Number of bed; Technical data; Cooling systems
- **AUTHORIAL ARCHITECTURE DATA**
  Presence in censuses of modern and contemporary architecture;
  Presence in accredited bibliography

3. SELECTION OF A SURVEY SAMPLE

INCLUSION CRITERIA

- **IDENTIFICATION OF SELECTION CRITERIA**
  1945-75; Heating Climatic Zones B-E; Authorial Architecture;
  Interventions after National Law 338/2000
- DEFINITION OF COOLING CLIMATIC ZONES

4. PRELIMINARY ENERGY AUDIT OF A CASE STUDY

ANALYSIS

- CONSTRUCTION HISTORY
- ANALYSIS OF SUMMER BEHAVIOUR
- HYPOTHESIS OF ENERGY RETROFIT

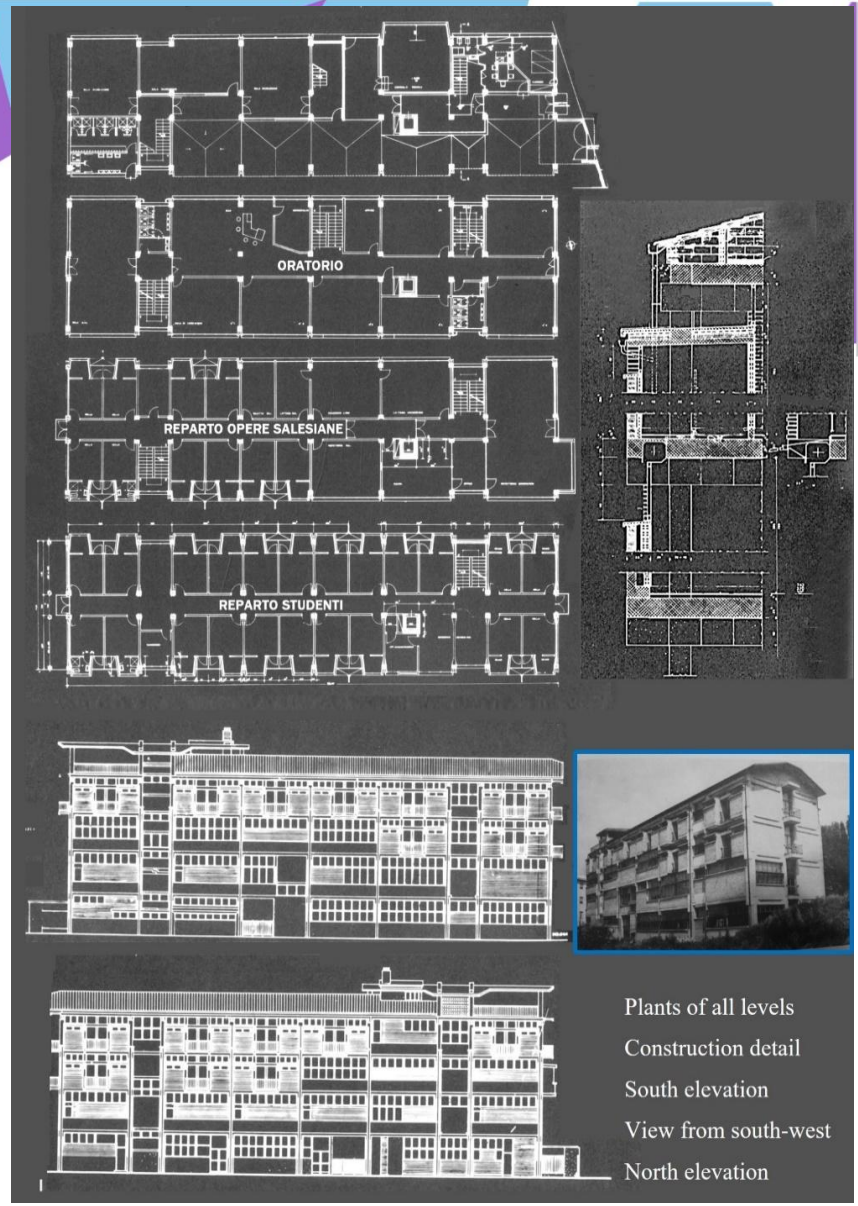
PHASE I
Census of existing university housing stock

PHASE II
Setting up a database identification data, climate data, typological / technological data, authorial architectural data

PHASE III
Selection of a sample of buildings based on established criteria; Definition of cooling climate zones

PHASE IV
Choice of the case study;
Energy audit June-September
State of fact and project

Fig. 1. Methodological approach



Public University Residences as a driver for energy renovation. Reflections on summer thermal performance

A. Cernaro, O. Fiandaca, A. Gugliandolo and F. Minutoli
in Colloquiate 2025 Trento

18 dicembre 2025

CATALOGUING PROTOCOLS

an international filing model MINIMUM FICHE

a national filing model CENSIMENTO DELLE ARCHITETTURE ITALIANE DAL 1945 AD OGGI

do.co.mo.mo_ International

Direzione Generale Creatività Contemporanea MiC

FILING PROJECT FOR AN ENERGY AUDIT

Post-World War II University residences in Italy

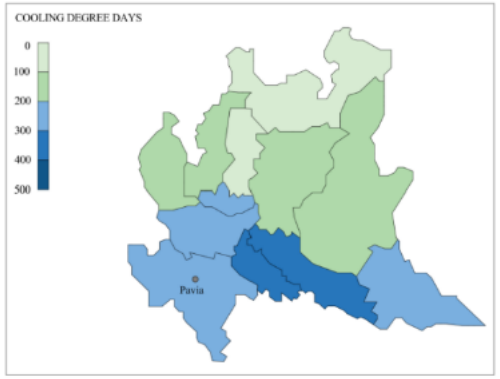
UNIVERSITARY COLLEGE DON BOSCO

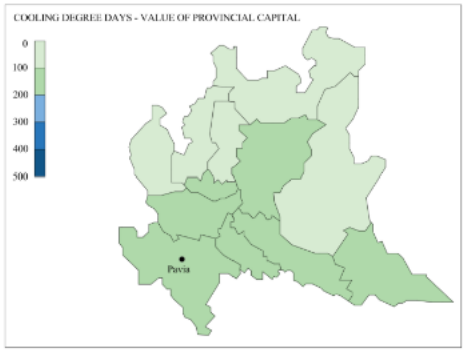
Original name	Centro assistenziale giovanile Opere Salesiane	
Original building type	Multi-use centre / Collective residence	
Dates of the procedure	***Original project (OP)*** 1962	***Variant (Vr)*** --
	Execution (Ex) 1962-1965	***Inauguration (In)*** --
Designer/s	eng. Ottavio Bonomi	
Building Company	Garbelli	
Original ownership	Catholic religious body - Salesiani	
Client	Società Salesiana di Don Giovanni Bosco	
Location		
Address	Via San Giovanni Bosco, 4 - Pavia	
Geographical coordinates	45.18090057424019, 9.17137349999464	
Heliothermic axis	Parallel major fronts	
Functional description	Building with 4 levels (L) plus basement. Original organisation: ground floor with recreation rooms protected by portico; first level with classrooms for teaching; second floor with refectories and 10 lodgings for priests; third level with 22 student accommodations. The living units are paired and divided into: entrance, bedroom, bathroom and terrace. The internal functions are legible from the outside due to the different treatment of the facades: between the projecting structural grid there are large windows for the common areas, loggias and bow-windows for bedrooms and bath-rooms, three stairwells with recessed elevations that emerge from the roof. Some architectural elements, such as projecting volumes, wall partitions and openings, complete the formal articulation of the building.	
Construction features	***Load-bearing structure:*** reinforced concrete skeleton	
	Horizontal partitions: reinforced brick concrete slab	
	Flooring: porphyry (L0/outside); grès (L1; Resilient L2-L3)	
	Roof: falde in laterocemento + manto in tegole marsigliesi	
	External walls: in rough solid bricks	
	Windows: in ferro a bilico; frangisole in alluminio a sud	
Architectural lexicon	Brutalist Architecture	
Current name	Collegio Universitario Don Bosco	
Current intended use	University residence	
Current ownership [management]	EDISU- Ente Regionale di Diritto allo Studio Universitario	
Main interventions over time	Purchase of the University of Pavia 2023 with PNRR funds	
Conservation status	Decent (Excellent – Good – Decent – Very Bad)	
Protection measure	None	
Evaluation of passive cooling factors		
1. Cooling Day Degrees (CDD)	137	
2. Shading systems	Cementitious overhangs of 50/70 cm above window openings	
3. Vegetation: species and location	Conifers on the northern front for half of the facade	
4. Perimeter surfaces	Porphyry floor covering	
5. Winds: direction-speed	North-East /8-10 km/h	
6. Ventilation Towers/Channel	Absent	
7. Opposing ventilation	Present for the living units	
8. Envelope surface mass	397 kg/mq	
References	***Archive:*** Elaborati EDISU-Progetto opere interne 2023 [14]	
	Bibliography: [11-13]	
Attachments	Plants of all levels - Photos	
Credits	Research Group CEAR08-A UniME/ENEA Bologna	

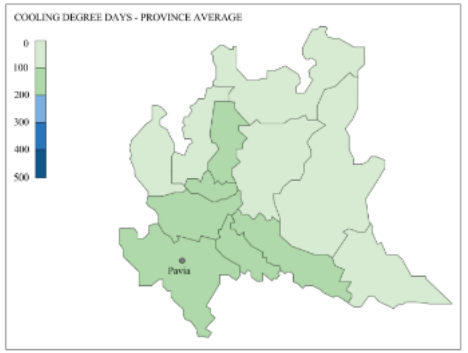
Legend on the description items taken from the reference protocols for cataloguing project: ● **derivation with high conceptual and terminological affinity** ● **derivation with partial conceptual and terminological affinity** ● **no derivation but new introduction**

Note Fields with blue and underlined text are links for further information

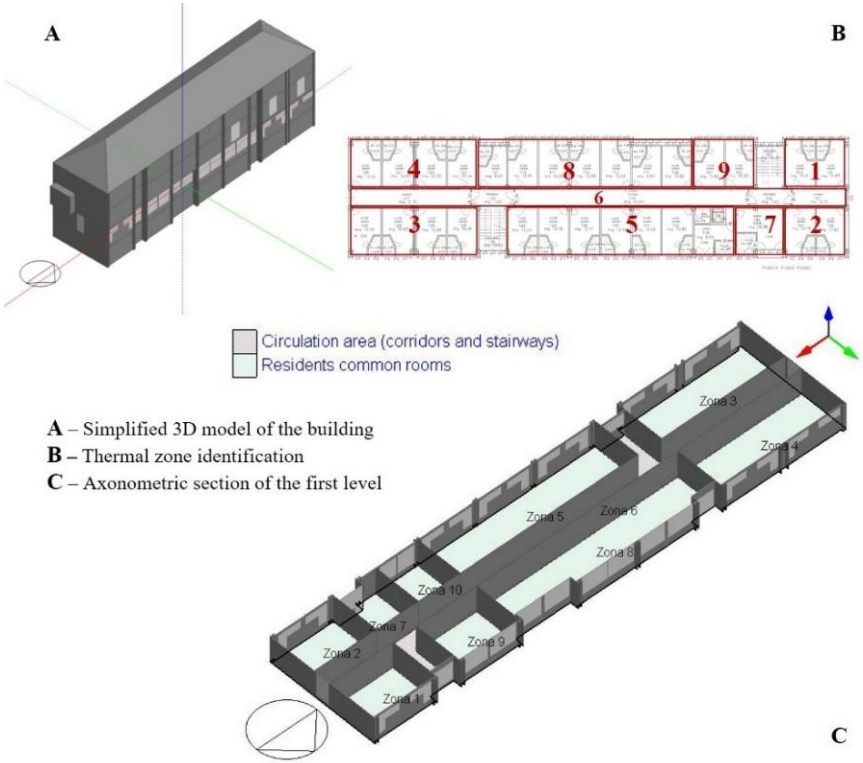
Descriptive sheet elaborated on the basis of Angileri, G., Cernaro, A. e Fiandaca, O. (2024). Una mostra virtuale per le sale cinematografiche. Un progetto di documentazione digitale della realtà messinese anni '50. In: Boffill, Y, Lombillo, I, Blanco, H. (a cura di) Rehabend 2024 Construction Pathology, Rehabilitation Technology and Heritage Management, Atti del 10th Euro-American Congress Rehabend 2024, Gijon (Asturias, Spain), 7-10 maggio 2024, Circulo Rojo, Spagna, pp. 2405-2413



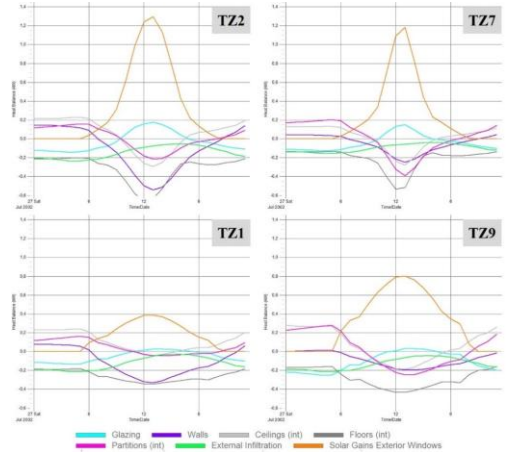




Comparison between the CDD evaluation of the EUROSTAT study and 3 different methods based on the ENEA one (provincial capital value, provincial average value, provincial maximum value)



A – Simplified 3D model of the building
B – Thermal zone identification
C – Axonometric section of the first level



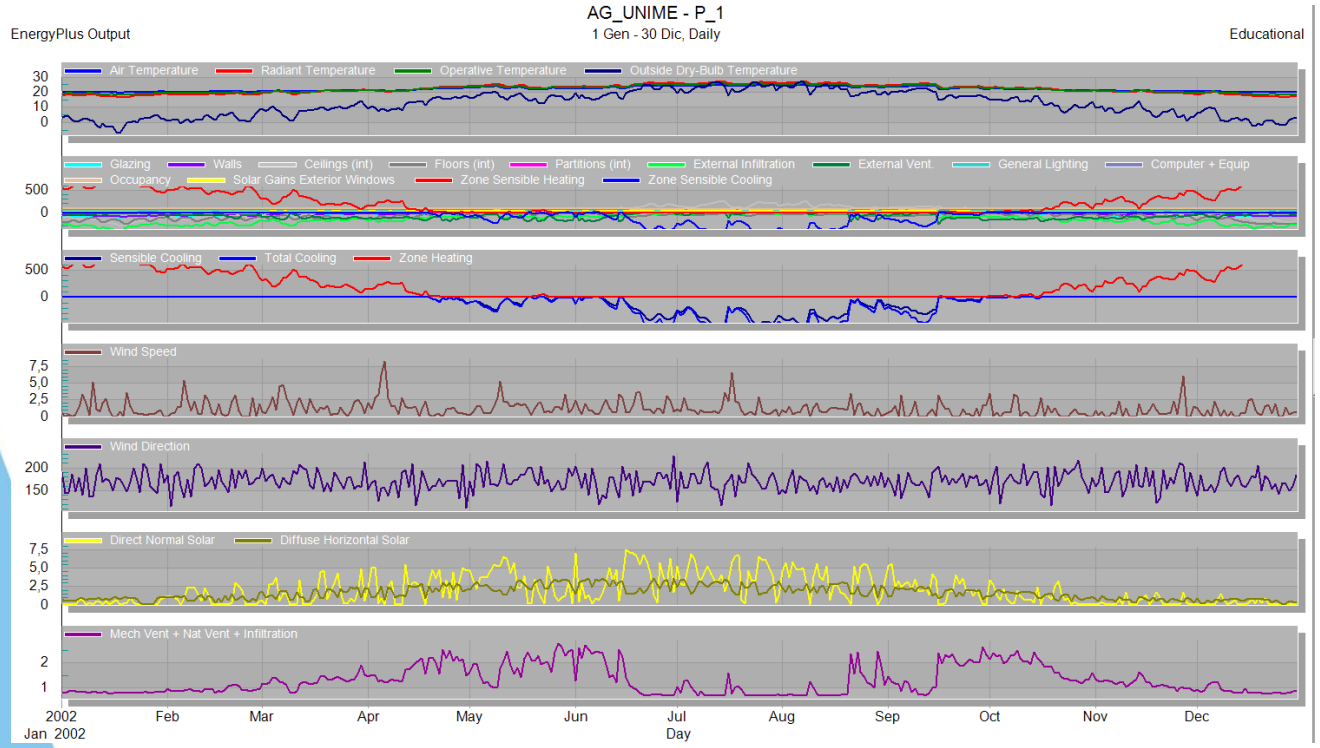
PERIOD	ANTE-OPERAM		POST-OPERAM (PHASE 2)	
	Glazing	Solar gains windows	Glazing	Solar gains windows
June	-785,44	3506,70	73,42	466,68
July	-730,61	3707,26	157,78	495,52
August	-767,19	3526,71	78,45	461,89
September	-835,89	3046,17	-52,54	386,95

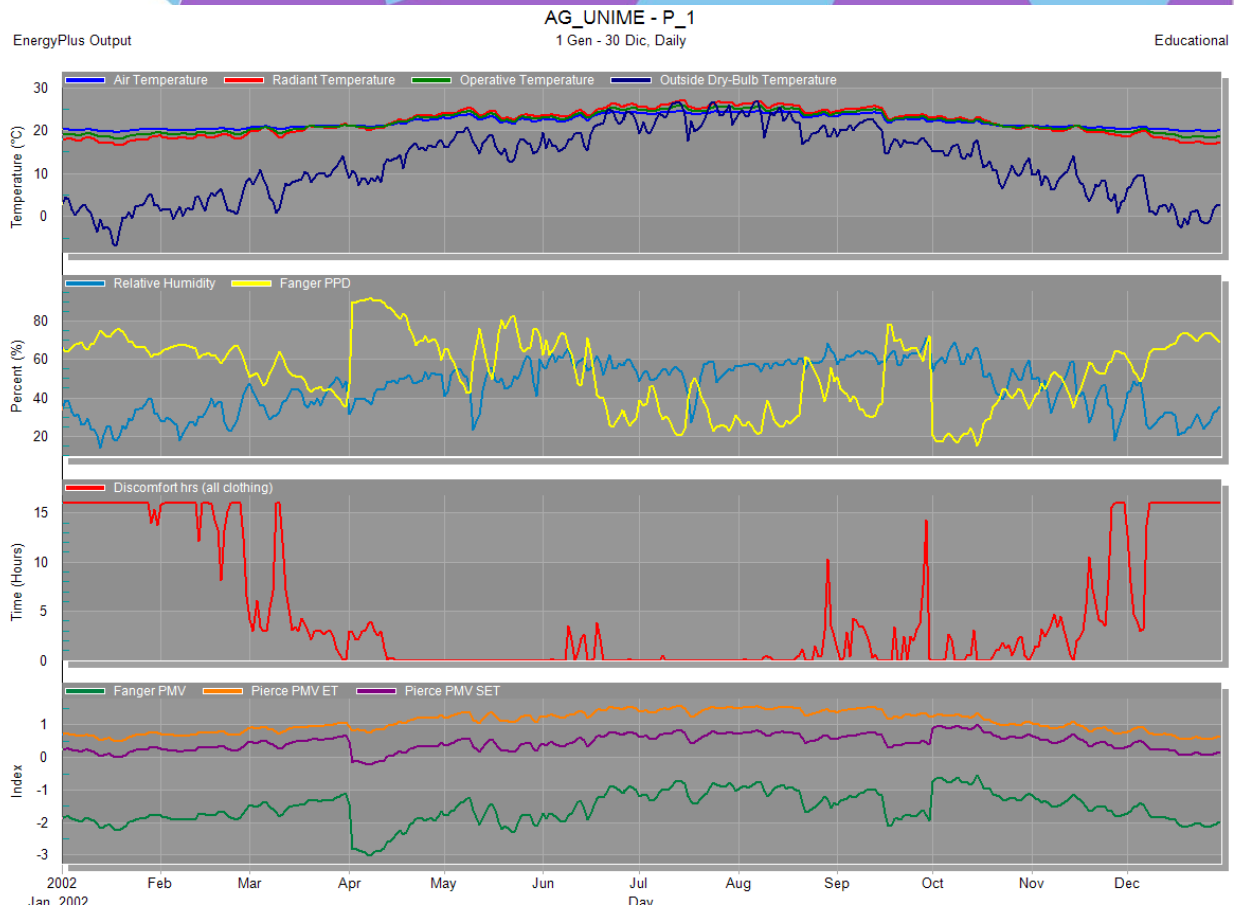
Heat balance for thermal zones

Scheda descrittiva del Collegio Universitario Don Bosco, Pavia

Research Advancement in the First Year

Completed Tasks





Bibliographic Review

Systematic analysis of the state of the art and the regulatory framework

1

Surveys Design

Development of the investigation tool for subjective perception

2

Inspections

Technical visits to the university residence case study

3

Monitoring Configuration

Planning the sensor network and data collection methods

4

Methodological Framework and Future Perspectives

Microclimatic monitoring
Continuous collection of objective environmental data

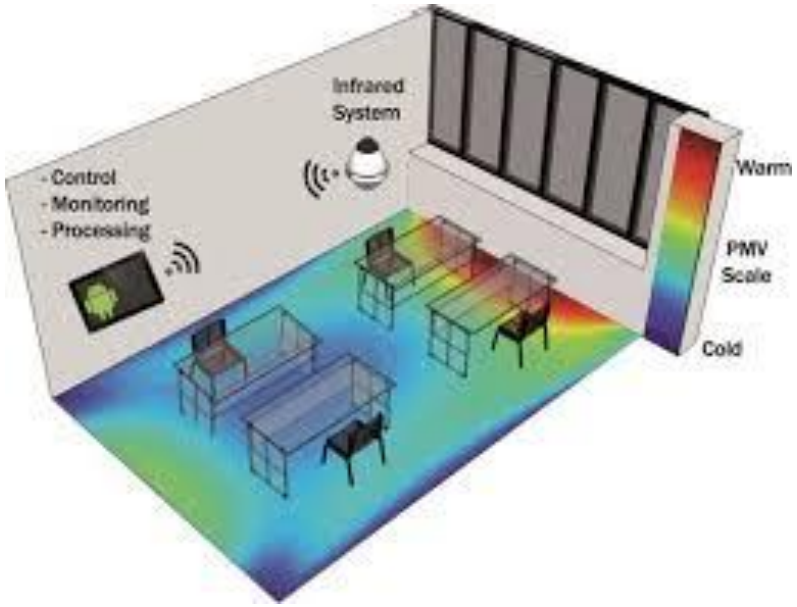
Behavioral Assessment
Analysis of subjective perception through
Structured questionnaires

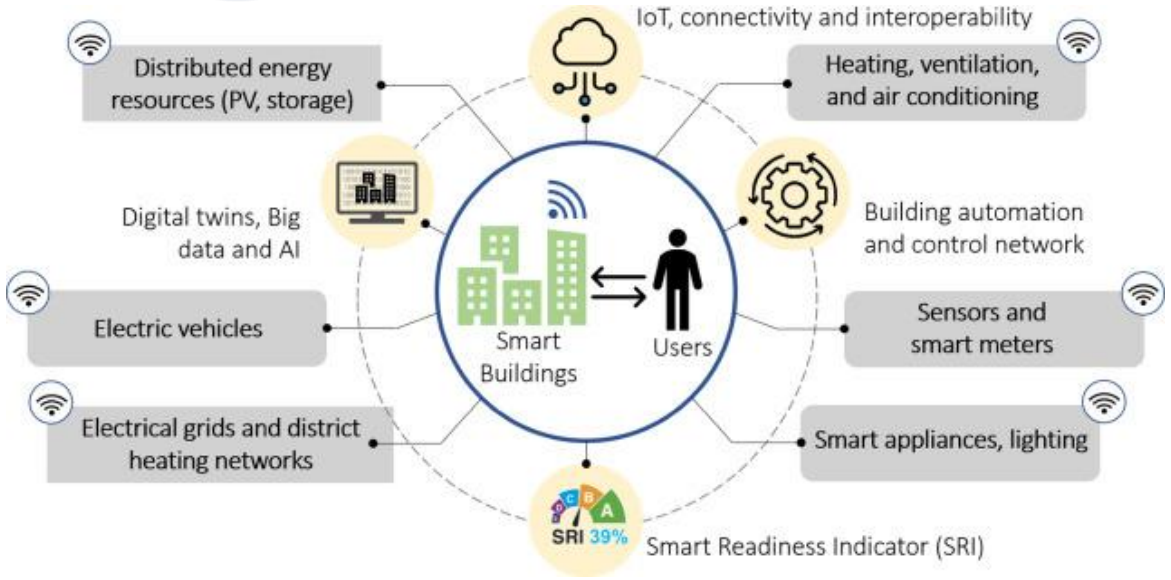
SRI criteria
Integration with the parameters of the
Smart Readiness Indicator

Benchmarking
Comparison before and after efficiency interventions

Energy Efficiency
Evaluation of cooling performance

Next Steps of Research





Bibliography and Scientific References

The research is based on an extensive bibliography ranging from studies on student living conditions and the energy efficiency of residential buildings to the implementation of the Smart Readiness Indicator and assessments of indoor environmental quality. The main scientific references that guided the theoretical and methodological approach of the research are listed below.

Territorial context

Comune di Parma – Università di Parma (2022). *Parma città universitaria. Tre anni di iniziative e progetti: 2018-2021*.

Piferi C (2021). *La qualità dell'abitare a servizio del diritto allo studio*. Edizioni opera universitaria, Trento.

Residential Energy Efficiency

Bianco V, Marmori C (2022). Modelling the deployment of energy efficiency measures for the residential sector. Case Italy. *Sustain. Energy Technol. Assess.* 49, 101777.

Taherian H, Peters RW (2023). Advanced Active and Passive Methods in Residential Energy Efficiency. *Energies*. 16(9):3905.

Diab Z, Younes J, Ghaddar N (2024). Optimal passive interventions for enhancing resilience of naturally ventilated residential buildings in future climatic extremes.

Smart Readiness Indicator

Plienaitis G, Daukšys M, Demetriou E, Ioannou B, Fokaides PA, Seduikyte L (2023). Evaluation of the Smart Readiness Indicator for Educational Buildings. *Buildings,* 13(1), Article 28.

Calandri M, Tafelmaier L, Rathje T, et al. (2025). Smart building assessments: optimizing SRI calculation using a BIM-based data exchange framework. *Frontiers in Built Environment*.

Luo W, Johra H, Borkowski E, et al. (2025). Developing a weighting scheme for building operational performance: A case study from the Netherlands. *Building and Environment,* 257, 113762.

Indoor Environmental Quality

Poyyamozhi M, Murugesan B, Rajamanickam N, Shorfuzzaman M, Aboelmagd Y (2024). IoT—A promising solution to energy management in smart buildings: A systematic review, applications, barriers, and future scope. *Sensors,* 24(5), 1642.

Post-Occupancy Evaluation

Kim YK, Abdou Y, Abdou A, Altan H (2022). Indoor environmental quality assessment and occupant satisfaction: A post-occupancy evaluation of a UAE university office building. *Buildings,* 12(7), 986.

Studies on University Buildings

Maigari M, Fu C, Balodimou E, Kc P, Sudhakaran S (2025). An indoor environmental quality study for higher education buildings with an integrated BIM-based platform. *Sustainability,* 17(13), 6155.

IEQ Analysis on Campuses

AlGaithi S, Kim YK (2021). Analysis of indoor environment quality (IEQ) in UAE University campus building, UAE. In *ZEMCH 2021 – 8th Zero Energy Mass Custom Home International Conference, Proceedings* (pp. 271–284). ZEMCH Network.

The complete bibliography of the thesis will include further references that will emerge during the subsequent phases of the research, with particular attention to the most recent developments in the field of Smart Readiness Indicator and summer thermal comfort in the Mediterranean environment.

Thank you for your kind attention

Alessandra Gugliandolo

PhD Candidate (Cycle XL) – University of Messina

Alessandra.gugliandolo@studenti.unime.it

Alessandra Gugliandolo

0000-0002-0229-2743

Alessandra Gugliandolo