EDILIZIA

ANGELO BERTOLAZZI, FABIANO MICOCCI,
UMBERTO TURRINI (edited by)

ENERGY FOR HOTELS

Refurbishment strategies in the Mediterranean area among technology, architecture and communication

FRANCOANGELI

FrancoAngeli
Edizioni La passione per le conoscenze

Informazioni per il lettore

Questo file PDF è una versione gratuita di sole 20 pagine ed è leggibile con **Adobe Acrobat Reader**

La versione completa dell'e-book (a pagamento) è leggibile **con Adobe Digital Editions**.

Per tutte le informazioni sulle condizioni dei nostri e-book (con quali dispositivi leggerli e quali funzioni sono consentite) consulta **cliccando qui** le nostre F.A.Q.

ANGELO BERTOLAZZI, FABIANO MICOCCI,
UMBERTO TURRINI (edited by)

ENERGY FOR HOTELS

Refurbishment strategies in the Mediterranean area among technology, architecture and communication

FRANCOANGELI

This book is funded by University of Padova

UNIVERSITÀ DEGLI STUDI DI PADOVA

ICEA

Acknowledgments
Thanks to the whole S.O.L.E.H. team, the project partners and the Department of Architecture (University of Thessaly), for the kind hospitality during the transnational mobility and the summer workshop held in Volos. A special thanks to prof. Giorgio Garau († 2021), with which the first idea of S.O.L.E.H. project started, but unfortunately he could not see the results and this book.

Photo credits
Stefanos Antoniadis: pp. 98, 112, 128, 144, 156, 176
Angelo Bertolazzi: pp. 12, 16, 24, 36, 54, 64, 71,74, 84, 166, 186
Claus Brechenmacher, Reiner Baumann: p. 198
Elisa D'Agnolo: pp. 61, 93
Soumela Makanika: pp. 19, 42
Dimitris Psychogyios: p. 208
Nicolas Rémy: p. 44
Agata Tonetti: pp. 22, 96, 164
Silvia Trampetti: p. 218

Cover image: Fabiano Micocci, Agata Tonetti

Table of Contents

2. ACTIONS

3. SCENARIOS

The energy of S.O.L.E.H.

by *Andrea Giordano*[1], *Kostas Manolidis*[2]

Any architectural or engineering work, a structure defining a space, is certainly delimited by surfaces. The configuration of space then becomes the language of architects and engineers, the basic communicative element by which they express their poetics, allowing them to produce and concretize new and complex shapes. Therefore, if we consider an architectural/engineering artifact, configured thanks to the composition and organization of surfaces, by wich both its formal and structural roles can be recognized. These two characteristics are linked by their interaction and interdependence, where the aesthetic aspect is integrated with the material one, also in relation to their static/dynamic behavior. becoming able to manage a building, from both an aesthetic and structural point of view, remains fundamental the training of the architect and engineer. An interdisciplinary formative articulation therefore must be regarded as a fundamental moment.

This approach becomes central not only as regards knowing how to build – and therefore the conservation and safeguard of buildings – but it must be considered as the basis to develop inventiveness and innovation. A built artefact cannot be thought – or built – without a wealth of knowledge which allows it to be represented as giving life to an idea or a thought. Any creative act therefore stems from the awareness of the surfaces from a generative and structural point of view. Furthermore, it is quite interesting to recognize that the surfaces of a building have an evident energy value, both in terms of energy accumulation and emission: we must consider them in aesthetic, structural and energy-related terms as well.

The research presented by Angelo Bertolazzi, Fabiano Micocci and Umberto Turrini – entitled S.O.L.E.H. (Sustainable Operation Low-cost Energy for Hotels) – can be considered as strictly related to this "syllogism" that

1 Dean, Department of Civil, Environmental and Architectural Engineering, University of Padua.

2 Dean, Departement of Architecture, University of Thessaly.

characterizes and configures the concept of architectural and engineering surface. Funded by the Veneto Region as part of POR/FSE (2014-2020) Program, this research has involved many people both in Italy and Greece, professors, visiting fellows, young researchers and four research fellows, engaged in the development of a topic which, as can be seen from the title is widely current. It aims to boost the economy by promoting efficient energy refurbishment of hotels in Italy and Greece. Appropriate strategies have been developed thanks to innovative and sustainable technologies for the building envelope and solar energy use. Furthermore, the research project implemented an advanced communication system for the regeneration project: the goal is to intercept various areas of the society, increasing their awareness and therefore ability to operate in the market. In addition, it was possible to contribute to the implementation of new strategies for the Smart City management.

This book therefore proposes a series of contributions – organized in Essays, Actions and Scenarios – which introduce, develop and increase innovative solutions regarding:

- the targeted use of technological tools (BIM, ICT, Smart Devices) to facilitate the regeneration of hotel buildings,
- developing communication in Mediterranean countries by stimulating both supply (hoteliers and construction companies) and demand (hotel users);
- making the hotel building stock more efficient and tourism industry more competitive thanks to a greater attention in the use and management of energy and, therefore, economy-related resources;
- recovering the entire construction sector by focusing on the redevelopment of existing buildings with a view to sustainability and circularity of the Mediterranean countries economy.

A fundamental aspect of the research, which this book accurately highlights, is linked to its implications in terms of learning and training. In fact, the methodologies for communicating the regeneration project and topics related to the development and use of RES (solar, wind, thermal, geothermal) can have a major impact on different cultural contexts, including the tourism industry which is of primary importance.

The "vision" proposed in this book is therefore not a passive device, used simply to "reproduce" a work, but an active, appropriate and articulated process (Conception, Interpretation, Management and Learning).

This work therefore comprehensively summarizes the complex methodological implications related to the management of buildings, offering suggestion on how their energy-related features, if properly assessed, tou-

ght and learnt, can not only prove to be food for thought involving several disciplines tackled at universities, but also and above all can be applied to everyday pratical contexts, thus revealing their all-encompassing potential.

Andrea Giordano

As the current head at the University of Thessaly Department of Architecture, I'm proud to introduce this outcome of a compelling endeavour and a successful collaboration between Italy and Greece. This book is the result of joined forces from the University of Padua, Iuav University of Venice and University of Thessaly. Through the multidisciplinary S.O.L.E.H. project, Italian and Greek academic researchers teamed up to explore innovative solutions and new environmental sustainability guidelines in hotel refurbishment.

The necessity of applying environmental priorities in every aspect of current architectural and engineering activity is both undeniable and urgent. In particular, tourist hospitality is a rapidly growing sector that needs not only immediate adaptation to new sustainability policies but also altogether-new strategies. Towards this goal, in August 2021 our School hosted an intensive student workshop that brought together all the partners of the S.O.L.E.H. project.

The workshop focused on the re-use of the abandoned Xenia Hotel in Tsagarada, on the Pelion Mountain, and investigated new scenarios of flexible temporary inhabitation, sensitive to all the climatic and environmental factors linked with such operations. A collateral objective of the workshop was to envision future scenarios for tourism as well as to scrutinize the possibility of the re-use of abandoned buildings for new hospitality models.

Here documenting the results of the workshop, together with the accompanying essays and research resolutions from the tutors and lecturers involved is more than publicizing a valid scientific work. It is also a testimony to an excellent and compelling academic synergy.

Kostas Manolidis


MED

FSE projects: an operative research opportunity

by *Umberto Turrini*[1], *Giorgio Croatto*[1]

For several years, the Italian University has undertaken a rethinking process of its research activity. This change can be clearly seen from the new project calls, both those on the University funds and those of the MUR (PRIN, SIR, PON) and of the European Union (both the structural funds POR/FSE, POR/FESR and the direct ones of the Horizon, Interreg, ERC programs). All these programs increasingly require a network made up of both research institutions and firms, with the clear aim of making the market more competitive and improving the impact of research on society.

To encourage the transfer of knowledge between the academic and economic sector, the University of Padua established the Uni-Impresa tender in 2017, to encourage all activities aimed at developing relations with the business world. The common goal is the mutual enrichment in terms of innovation and economic and social development of the areas concerned.

A great opportunity is the FSE (European Social Fund) call funded by the Veneto Region. Its goal is the enhancement of the relationship between universities and companies making the research more operative. The transnational project S.O.L.E.H. "Sustainable Operation Low-cost Energy for Hotels" is also part of this innovative and well-established context, whose activities are part of those of the Technical Architecture (ICAR-10) research group of the ICEA Department, also engaged in innovative strategies for building refurbishment. This thematic axis includes the various FSE projects that have seen the group engaged both in terms of structural and constructive intervention[2] and the volume increase of existing buildings for their refurbishment[3].

1 Department of Civil, Environmental and Architecturale Engineering, University of Padua.

2 "Development of innovative and reversible construction systems and related executive details for the construction of the anchoring between wooden floors with crossed axes and the load-bearing walls without inter-floor reinforced concrete curbs" [POR-FSE 105/201/21/1148 / 2013, P.I. prof. Umberto Turrini, 2014-2015].

3 "Development of reversible and innovative construction systems, relatedt o the use of structural wood in the residential buildings can aimed at their refurbishment" [POR - FSE, 2105-23-2121-2015, P.I. prof. Umberto Turrini, 2016-2017].

In the first project, we focused the research on reversible technological solutions for the connection of simple masonry and crossed-axes wooden floors. The research analyzed their use in the construction of new buildings and the restoration of structures belonging to the historical and cultural heritage.

In the second one, we focused on the theme of the elevations to be built resorting to stuctural crossed-axes wood panels (CLT). This system not only has advantages both at a structural level and thermo-acoustic performance, but also, through correct modularity, reduces execution times. Subsequently, the possibilities of light constructions were also investigated for the building refurbishment resorting to 'nested building' techniques and in the design of new architectures, including emergency ones[4].

Alongside these issues, the research has been developed on energy retrofit. The 2010/31/EC Directive "Energy performance of Buildings" of the European Union established the energy standards for new buildings, setting the 2030 Agenda and the Horizon Europe 2050 objectives: nearly-Zero Energy Buildings (nZEB), the almost total reduction of energy consumption of buildings and the adoption of the circular economy paradigms as regards construction[5].

All the member states of the European Union have begun to adapt their current legislation to the 2010/31 EC Directive, though their deadlines, norms and efficacy are not uniform. In particular, eastern Mediterranean countries (such as Italy, Greece and Cyprus) have found it difficult to implement their own legislation, mainly as regards the economic viability of the interventions, above all with reference to refurbishment. Fewer economic resources, different industrial set up, technological drawbacks, but above all different weather conditions if compared with northern and central European countries have caused a less determined approach to upgrading their building stocks; to this it is to be added finding financial instruments and technologies capable of making upgrading economically sustainable.

4 The use of lightweight materials, such as CLT, already explored in the previous project, was also addressed with particular attention to the construction and production aspects within the projects "CORE-WOOD COMPetitive REpositioning of WOOD sector" [POR-FESR 2014-2020, R.S. prof. Umberto Turrini, 2014-2020] and "HELP Veneto - High Efficiency Emergency Living Prototipes" [POR - FSE 2105-0025-1463-2019, P.I. prof. Giorgio Croatto, 2020-2021], focused on the potential of CLT for health modules, adaptive and emergency buildings, and for nested-building buildings.

5 In 2011, the "Roadmap for Efficient Europe" identified the 20th century building stock refurbishment, specially the residential one, as a strategic priority of the 8th Framework Plan (2013-2020).

The lack of results in the refurbishment in operational terms and economic sustainability in the Mediterranean area have suggested to shift the attention to hotel construction. This is a sector that can trigger experimenting technological solutions, as well as economic and regulatory tools capable of making economically sustainable redevelopment, the results of which can be transferred, adapting them, to residential buildings. With this in mind, the biennial BIRD 2019 project "Design tools and guidelines for sustainable hotel buildings refurbishment in the Mediterranean area" was launched. The goal was to develop a first set of guidelines and intervention criteria for the redevelopment of hospitality buildings on the basis of a typological, functional and constructive analysis of Italian and Greek hotel buildings and their energy modelling for performance evaluation according to the Italian and Greek legislation.

The S.O.L.E.H. project, thanks to its operational and multidisciplinary approach, led to the implementation of an open-source tool capable of providing hoteliers with an initial check of the energy needs for their buildings and thus facilitating the energy requalification of hotels. In addition, the four case studies analysis (two in Italy and two in Greece) was implemented creating a complex BIM model. This was configured as an open-source tool and organized in consequential steps. The first step towards a more conscious and efficient management of energy and economic resources led to an initial verification of hotel energy needs, also related to the comfort quality and consumption. Below, through its smart and open interface, the interoperable model was addressed to a broad market, ranging from operators in the hotel sector (owners, managers, investors) to those in the construction industry (professionals, construction and plant companies).

The collaboration within the POR-FSE programming of the Veneto Region, which places the partnership between the Academy and the firms as a requisite for participation, turned into a concrete action for the consolidation of the University and business network, whose objectives of future technological development can – and must – be shared from the outset.

S.O.L.E.H. project: an international account

by *Angelo Bertolazzi*[1], *Fabiano Micocci*[2]

This volume collects the results of the project POR FSE entitled "S.O.L.E.H. (Sustainable Operation Low Cost Energy for Hotels). Innovative tools and Guidelines for the Sustainable Renovation of Hotel Buildings" that had involved the University of Padua, Iuav University of Venice and the University of Thessaly during the period 2020-2021[3].

The project S.O.L.E.H., established within the framework of the RIS3 Sustainable Living – a guideline for Research and Innovation Strategies for Smart Specialisation of the European Commission –, was grounded on three main axes: "Intelligent sustainable building and cities", "Energetic management of buildings" and "Development of sustainable solutions and integrated systems for the management of the Smart City". Along this agenda, the research had challenged the theme of the energetic re-development of the hotel sector as a driving force for the recovery of the construction sector in the Mediterranean countries (with a focus on case-studies from the regions of Veneto in Italy and Central Macedonia in Greece).

The strategy to reach this objective was based, at first, on the development of innovative and sustainable technologies for the building envelope and, secondarily, on an effective and successful communication of the rrefurbishment project directed to multiple stakeholders.

1 Department of Civil, Environmental and Architectural Engineering, University of Padua.

2 Department of Architectuire, University of Thessaly.

3 POR FSE S.O.L.E.H. (Sustainable Operation Low Cost Energy for Hotels). Innovative tools and Guidelines for the Sustainable Renovation of Hotel Buildings. POR-FES 2014-2020 [DGR 1463/2019; Cod. 2105-014-1463-2019]. Academic partner: Università degli Studi di Padua (UniPD), Università Iuav di Venice(Iuav), University of Thessaly (UTH). Scientific Committee: Angelo Bertolazzi (P.I., UniPD), Fabiano Micocci (UTH), Giorgio Osti (UniPD), Federico Neresini (UniPD), Nicholas Remy (UTH), Massimo Rossetti (Iuav), Aris Tsangrassoulis (UTH), Angelo Zarrella (UniPD). Company Partners: ANCE Padova, Assindustria Veneto Centro, Achab Srl, Bortoletto Serramenti Srl, Contec Ingegneria Srl, Fondazione Fenice, Foréma Steam Srl. Research fellows: Elisa D'Agnolo (UniPD), Petra Muneratti (UniPD), Maria Celeste Piazza (UniPD), Agata Tonetti (Iuav). Territorial animation fellows: Stefanos Antoniadis (UniPD), Giorgia Betto (Iuav), Eleonora Bordon (UniPD), Giulia Lombardo (UniPD).

The medium-term objective was to provide an efficient and dynamic tool to evaluate and program the energy efficiency of a building and, at the same time, to draw some guidelines of intervention in order to encourage hoteliers to decide if they would like to engage in the process of refurbishment of their property. Differently, the long-term objective was to stimulate the construction sector, that includes entrepreneurs and professionals, introducing innovative and smart technologies with the scope to facilitate the redevelopment process itself.

In particular, the evaluation tool was designed for the survey, the elaboration and the visualization of input and output data related to the re-developement of the building. Afterwards, the tool was re-shaped and adapted according to needs of the various stakeholders (professionals, owners, investors and companies). Finally, various stages of the communication of the re-development project addressed to these stakeholders had accompained the development of the tool with the scope to enhance the efficiency of the stakeholders to operate within the market and to persuade them to implement new appropriate strategies for the management of the Smart City.

In order to reach these ambitious objectives, the collaboration among the various parts involved in the project was crucial. At the one hand, the exchange of technological skills between Academia and partner companies had stimulated the circularity of the partnership with the scope to embrace a multi-disciplinary approach. At the other hand, the collaboration with the international partner was relevant to verify the results of the research and to widen the cultural and scientific horizon of the team. The encounter with the construction sector and the enterpreneural dimension of another country that faces similar problems for what concern the energetic upgrade of buildings on warm climate, has directed to design the evaluation tool in a way that it is useful and adaptable to the different actions of a refurbishment project.

The structure of the book follows the overall development of the project in order to promote the many contributions of all the participants involved. The first part gathers the essays by the professors that had supervised the young italian researchers (research and fellowship fellows) both in the research activities conducted at the Italian universities as well as at the Indoor Environment and Low Energy Building Design Laboraty (IELEBD) of the Department of Architecture at the University of Thessaly during the part of the program of the international mobility. These essays offer an initial framework that introduces the theme of the re-development of existing buildings within a multi-displinary approach. Moreover, they introduce the content of the actions investigated by the research and fellowship fellows during the project.

International Summer Workshop

TOURISM HABITAT

THE RE-USE OF THE ABANDONED XENIA HOTEL IN TSAGARADA, PELION

Monday, August 30th – Saturday, September 4th, 2021

Department of Architecture, University of Thessaly

These latter contributions are collected in the second part of this volume that illustrates the research path that had been followed and that concluded with two substantial oucomes: the first is the creation of the evaluation tool and the drafting of the guidelines of intervention for the re-development of hotels while the second deals with the identification of the communication strategies to transmit both the evaluation tool and guidelines to third parties. To reach these objectives, the smart and open-source character of the evaluation tool was decisive. Indeed, after the initial test on the energy requirements of an hotel in relation to comfort and consumption qualities, the evaluation tool encourage a conscious and efficient management of the energetic and economic resources of an existing building. For this reason, the tool is addressed to a wide market that spans from the operators in the hospitality sector (hotels owners, managers and investors) to the ones involved in the construction process (professionals, construction and technical system companies).

The theme of the energetic re-development of hospitality buildings was also the pretext to widen the interest towards the crucial role of architectural design of touristic facilities in the Mediterranean region. Indeed, the project offered the chance to study new touristic models that could face the actual climatic and energetic crisis. Scope of this approach was to widen the field of the undertaken research from the technological upgrading of existing buildings towards rethinking the consumption methods of tourism. This has been considered a fundamental approach to preserve and valorize local environments and landscapes that are some of the main resources of Mediterranean countries. The thematics have been challenged within the international workshop "Tourism Landscape. The Re-use of the Abandoned Xenia Hotel in Tsagarada, Pelion" organized at the Department of Architecture of the University of Thessaly in the framework of the research and fellowship fellows' three-months international mobility[4]. The workshop focused on the re-use of the Hotel Xenia in Tsagarada, a traditional village in the Pelion peninsula, that was design in 1957 by the architect Charalampos Sfaellos (1914-2004), and that since 2000 has been in a state of abandonement.

4 Workshop Coordination: Angelo Bertolazzi (UniPD), Fabiano Micocci (UTH); Scientific Board: Angelo Bertolazzi (UniPD), Fabiano Micocci (UTH), Giorgio Osti (UniPD), Nicholas Remy (UTH), Massimo Rossetti (IUAV), Aris Tsangrassoulis (UTH); Organization support: Soumela Makanika (UTH); Senior Tutors: Stefanos Antoniadis (UniPD), Stefanos Adamakis (UTH), Efthymia Dimitrakopoulou (UTH), Dimitris Psychogios (UTH), Nicholas Remy (UTH); Junior Tutors: Elisa D'Agnolo (UniPD), Petra Muneratti (UniPD), Agata Tonetti (IUAV); Lectures: Kostas Adamakis (UTH), Giorgios Mastrominas (K-Studio), Luigi Stendardo (UniNA), Nicholas Remy (UTH), Efthymia Dimitrakopoulou (UTH), Stefanos Antoniadis, (UniPD), Elisa D'Agnolo (UniPD), Petra Muneratti (UniPD), Agata Tonetti (IUAV).

Twenty seven students of Architecture coming from various Greek universities had participated in the workshop, supervised by the Italian research and fellowship fellows together with tutors from the hosting university. They had worked on researching new scenarios and strategies for a sustainable tourism investigating the potentialities of the selected case-study. The proposed scenarios explore new forms of temporary dwellings, flexible and inclusive, proposing an idea of comfort charachterized by a low carbon footprint and reduced consumption. At the same time, the proposed design projects focus on the specific climate and environmental conditions, trying to adapt the touristic offer to the unique ecologic and social qualities of the place.

The final aim of the workshop was to stimulate the reflexivity of the local community (touristic operators, architects, public administrations, citizens) towards the urgency to look for alternative paradigms to mass tourism throught the transformation of the existing building stock re-using abandonement buildings.

Therefore, the third part of the present volume collects the results of the one-week workshop: essays by Italian and Greek professors that participated in the event giving lectures about the theme of the re-use of buildings and hotel are followed by the presentation of the projects completed by the 6 groups of students, each of them introduced with a short presentation by their tutors.

To conclude, the investigation developed along the framework of the research project S.O.L.E.H. has brought to the fore the necessity and the urgency to open a multi-disciplinary dialogue that could facilitate the gathering and the exchange of ideas and knowledge between different points of view (technological, architectural, ecological, climatic and social) that aim to reach an eventual synthesis in the architectural project.


MEDITERRANEAN HOTELS ANALYSIS
HOTEL
HOLIDA

1. |ESSAYS


ΠΩΛΕΙΤΑΙ
ΤΗΛ.
6981450871

Refurbishing by hotels

by *Angelo Bertolazzi*[1]

The refurbishment of 20th century building stock is still one of the main strategies for achieving the 2050 primary goals of the European Union [EC, 2014]. The opportunities for the entire construction sector have already been highlighted for some time, by the transdisciplinary approach and the possibility of developing and integrating new technologies into the existing buildings [Latham, 2000; Pearce, 2012]. At the same time, the European Union has increased its actions by research programs relying on direct funds (7PQ, H2020, Horizon Europe, or Interreg and LIFE) and on structural ones (FESR, FSE), encouraging process and product innovation thanks to a multiscale and multidisciplinary approach.

These actions have found new life in the Circular Economy paradigm [Ellen MacArthur Foundation, 2015], taken as a model for European technological development. It requires – however – updating the cultural and technical coordinates of refurbishment-and-building-reuse-topics so as to give a new centrality, in order to lay the foundations for the achievement of community objectives as well [Nogueira et al., 2019].

Despite the building sector being identified as one of the engines of the European economy in order to make effective and durable post-crisis economic recovery possible, the circular approach is adopted only for new buildings and components (i.e. systems, windows). Little attention has been given instead to the existing building stock as a whole, even if this is responsible for the emission of gasses, the consumption of energy and raw materials and the production of waste. Instead, refurbishment (meant as environmental, social and architectural) can also become the main factor for the economic recovery of European countries and for the improvement of the quality of life of their inhabitants, according to the provisions of Objective 11 of the 2030 Agenda (Making cities and human settlements inclusive, safe, long-lasting and sustainable).

1 Department of Civil, Environmental and Architectural Engineering, University of Padua..

The quantitative aspect of the existing 20th century building stock, especially as regard the residential one, makes it necessary to apply the circular model also to building refurbishment, preferring a holistic vision where innovative design and technical solutions are chosen, rather than to traditional categories of specialized intervention.

1. Building refurbishment in the EU: projects and strategies

Following the EU commitment, an intense response has grown from the academic research and the industrial sector as underlined by numerous projects. The 7PQ and H2020 programs, concentrated their efforts first on the regulatory aspects leading to the Guide Technique for issuing ETAs to ETICS (External Thermal Insulation Composite Systems) and the Guidelines for European Technical Approval of External Thermal Insulation Composite). Later they focused on the processes and tools for the nZEB refurbishment of existing, as well as residential buildings (SouthZEB, HELIMED, ABRACADABRA), hotels (XENIOS, HES) and public (RePublic_ZEB) and on sharing good practices among European regions and cities (EU-GUGLE and SINFONIA).

This intense planning and the numerous projects highlighted the need to improve and widen the knowledge of the 20th century building stock, where quantitative and qualitative aspects make the traditional approach to refurbishment very difficult. Among the projects funded by FP7 and H2020 for the development of building analysis tools, the ones of particular relevance were TABULA[2] and EPISCOPE[3].

The former led to the identification of national building typologies and to the publication of a national dossier. Here, the data related to construction and plant types are presented, while a specific section, organized as an illustrative sheet, is devoted to the energy analysis of building-types, with an indication of the energy savings achievable following energy-efficient interventions on the building envelope and on the heating systems [Figure 1; Figure 2].

2 TABULA project (Typology Approach for Building Stock Energy Assessment, 2009-12) aimed to create a harmonized structure of European building types which, starting with residential construction, also involved other building categories. Accessed May 22, 2021 https://areeweb.polito.it/ricerca/episcope/tabula/.

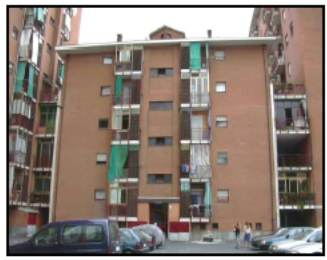
3 EPISCOPE project (Energy Performance Indicator Tracking Schemes for the Continuous Optimization of Refurbishment Processes in European Housing Stocks, 2013-16) aimed to make energy saving processes in the European housing sector more transparent and effective, guaranteeing their achievement also thanks to come corrective actions required. Accessed May 22, 2021 http://episcope.eu/monitoring/overview/.

Regione/Zona climatica: Area climatica media

Classe di epoca di costruzione: 5 (1961-1975)

Classe di dimensione edilizia: Edificio multifamiliare

V [m³]	S/V [m⁻¹]	$A_{f,l}$ [m²]	Numero di appartamenti	Numero di piani climatizzati
3074	0,54	934	10	5



STATO ORIGINARIO

TIPOLOGIA COSTRUTTIVA

COPERTURA

Tetto a falde in laterizio [sottotetto non climatizzato]

PARETI

1. Muratura a cassa-vuota con mattoni forati (30 cm)

2. Muratura in mattoni forati (25 cm) (verso ambiente non riscaldato)

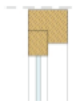
SOLAIO (superiore, verso ambiente non riscaldato)

Solaio latero-cementizio

SOLAIO (inferiore, su ambiente non riscaldato)

Solaio latero-cementizio

SERRAMENTO



Vetro singolo, telaio in legno

COPERTURA	PARETI		SOLAIO (superiore)	SOLAIO (inferiore)	SERRAMENTO	
U [W/(m²K)]	U_1 [W/(m²K)]	U_2 [W/(m²K)]	U [W/(m²K)]	U [W/(m²K)]	U [W/(m²K)]	$g_{gl,n}$ [-]
2,20	1,15	1,52	1,65	1,30	4,90	0,85

TIPOLOGIA IMPIANTISTICA

IMPIANTO DI RISCALDAMENTO

GENERAZIONE	$\eta_{H,gn}$ = 0,88	*ACCUMULO*	$Q_{ls,H,s}$ = 0 kWh/m²	*DISTRIBUZIONE*	$\eta_{H,d}$ = 0,90	*AUSILIARIO*	$Q_{aux,H}$ = 1,6 kWh/m²
caldaia standard per impianti di riscaldamento autonomi (per appartamento), installata in ambiente non climatizzato		-		distribuzione separata per appartamento / 1961-1976		ausiliario elettrico per caldaia standard (impianto di riscaldamento autonomo)	

IMPIANTO DI PRODUZIONE DI ACQUA CALDA SANITARIA

GENERAZIONE	$\eta_{W,gn}$ = 0,84	*ACCUMULO*	$Q_{ls,W,s}$ = 3,4 kWh/m²	*DISTRIBUZIONE*	$Q_{ls,W,d}$ = 1,07 kWh/m²	*AUSILIARIO*	$Q_{aux,W}$ = 0 kWh/m²
caldaia standard per impianti di ACS autonomi (produzione combinata riscaldamento e ACS, per appartamento), installata in ambiente non climatizzato		serbatoio di accumulo di acqua calda per appartamento - basso livello di isolamento		distribuzione di acqua calda sanitaria separata per appartamento, senza ricircolo - fino al 1975		produzione di ACS per appartamento o separata/individuale	

Fig. 1 – *Building National Typology: the Italian dossier, relating to the construction and plant types. The dossier provides also two scenarios for energy savings [Tabula, 2010].*

18 **Πολυκατοικία** *(GR-ZONEB-MFH-01)*

Ηλικία	**1** 2 3 4
Κλιματική ζώνη	Α **Β** Γ Δ
Θερμαινόμενη επιφάνεια (m²)	1680
Θερμαινόμενος Όγκος (m³)	5712

Περιγραφή κτιρίου

Κτίριο με δύο ελεύθερες όψεις (5 όροφοι). Συνολικά 27 διαμερίσματα. Ο μεγάλος άξονας του κτιρίου έχει ΝΑ-ΒΔ προσανατολισμό. Αστική περιοχή. Έντονη κυκλοφορία οχημάτων.

Κατασκευή

Τοίχοι	Οπτοπλινθοδομή με επίχρισμα. Χωρίς μόνωση
Φέρων οργανισμός	Χωρίς μόνωση
Οροφή	Συμβατικού τύπου δώμα. Χωρίς μόνωση
Ανοίγματα	Μονοί υαλοπίνακες με ξύλινο πλαίσιο
Παντζούρια	Ξύλινα ρολά
Δάπεδο	Σε επαφή με το έδαφος. Χωρίς μόνωση

Συντελεστές θερμοδιαφυγής (W/m²K)

Τοίχοι / Φέρων / Υπόγειοι τοίχοι	2.20 / 3.40 / 3.65
Οροφή	3.05
Δάπεδο	3.10
Ανοίγματα	4.70
g- ανοιγμάτων (-)	0.58

Απόδοση συστημάτων

	Θέρμανση	ΖΝΧ
Παραγωγή	0.72	1.00
Διανομή	0.88	1.00
Τερματικά / Αποθήκευση	0.87	0.98

Συστήματα

Παραγωγή	Κεντρικός λέβητας πετρελαίου, ελλιπής μόνωση, καλή συντήρηση
Διανομή	Δισωλήνιο, χωρίς μόνωση
Ηλ. συλλέκτες	3 m²
ΖΝΧ	Ηλεκτρικοί θερμοσίφωνες

Ετήσια Ενεργειακή Συμπεριφορά

Απαιτήσεις	93.8 kWh/m2
Θερμική ενέργεια	143.8 kWh/m2
Ηλεκτρική ενέργεια	21.3 kWh/m2
Πρωτογενής ενέργεια	219.8 kWh/m2
Εκπομπές CO_2	99.3 tn
Πετρέλαιο	23648.9 lt
Ηλεκτρική ενέργεια	35784.0 kWh
Λειτουργικό κόστος	17.8 €/m2

Fig. 2 – *Building National Typology: the Greek dossier (bottom), relating to the construction and plant types. The dossier has also two scenarios for energy savings [Tabula, 2010].*

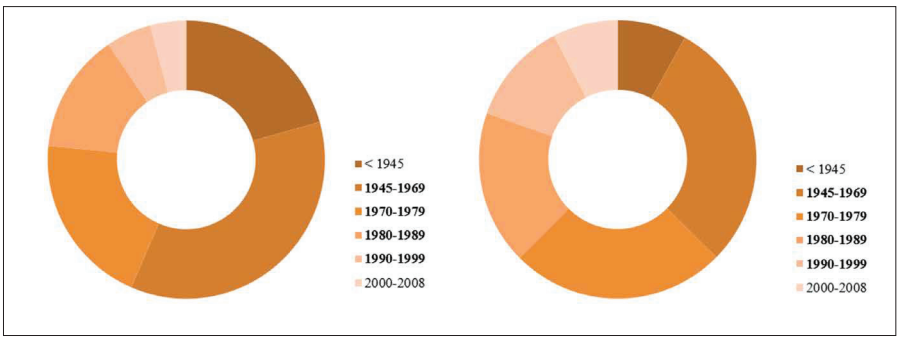


Fig. 3 – *Building Data Stock according to Building Performance Institute Europe (BPIE): both the Italian case (left) and the Greek one (right), show how multi-storey building stock belongs to 1945-1999 period [Entranze, 2009]*

The latter – further developing TABULA – many scenario simulations for residential buildings at different scales were carried out in various European countries. Some of the case studies, based on the 'national typology', focused on locally selected real estate portfolios, others on entire regional or national real estate databases.

The Building Performance Institute Europe (BPIE) is another support tool for building refurbishment. Since 2010, it has been providing quantitative and qualitative data and analyseis of the existing building stock to support national and EU policies. In particular, the BPIE contributed to the development of numerous tools in the context of projects funded by the European Union, by collecting data on the European building heritage [Economidou et al., 2011]. In 2012, these collected informations were made available on BPIE's open data website, including technical data on the performance of buildings throughout the European Union [BPIE, 2012]. The platform – or Data Hub – offers national statistics on buildings, information on policies and access to information sources provided by partner organizations. The store of information and models of the Data Hub was used as the basis for the Observatory of the Building Heritage of the European Union [Figure 3].

In Italy the 2011 ISTAT survey is the building-stock-analysis starting point [Table 1]. Even if it's very useful as a quantitative data source it needs an in-depth analysis that may allow us to get to the scale of the building, linking the results of TABULA and EPISCOPE.

From these data and various academic researches, the Italian construction sector is strongly connected to traditional features until the 1960s. In Italian buildings, an experimentation of modern techniques and materials was developed, becoming the basis of construction-and-structural-typologies moving from tradition to innovation [Poretti, 2007].

Concrete, for example, has been seen as one of several possibilities, like other more traditional structural elements; so it was employed only to replace parts or elements of building structures, in particular masonry or some floor types. The use of the reinforced concrete frame – the actual possibilities of use were not immediately grasped – since the beginning of the 20th century has afforded a wide range of technical solutions that coexisted within a mixed construction, where the traditional masonry played a more important structural and constructive role than a simple infill [Table 1; Figure 4]. The main construction type that emerges from post-World War II-building analysis is the reinforced concrete frame with brick-concrete floors and infill masonry made up of solid bricks and later hollow blocks [Figure 5].

This centrality also characterized Greece where – by different paths but with similar results – since the 1930s the elastic 'structures' with elements able to withstand flexional stresses has been spreading, while solid and hollow brick has been used for the infill. During the 20th century, the reinforced concrete frame became the element that distinguished Greek architecture – through the building type of the *Polykatoikia* – and the symbol of the economic boom starting from the 1950s [Figure 6].

2. Hotels as a privileged observatory for refurbishment

Despite this intense academic research activity and legislative action by the European Union, the expected results in terms of building refurbishment have not yet been achieved. In addition to the substantial differences between the countries of northern and southern Europe, the main difficulties lie in the lack of suitable financial instruments to overcome market failures, of a know-how of operators in the sector – either owners, companies and professionals – and basic economic sustainability able to make refurbishment accessible for all citizens [Kaderják, 2012]. In addition to faster renovation rates, there is the need of a seizable increase in deep renovation in the Eu achieved trough the implementation of national strategies that should set clear guidelines and a review of targeted and measurable actions to verify the objectives set [EC, 2019].

In this perspective of both energy and economic efficiency, hotels play a strategic role from two points of view. The first in the medium term is to make a fundamental sector in the economy of Italy and Greece competitive. In our country, the overall impact of tourism reaches 13% of GDP, employing 1,621,000 workers and can boast of about 33,000 hotels and over 180,000 non-hotel establishments amounting a total of over 5.1 mil-