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Pilar Mercader-Moyano · Manuel Ramos Martín

Sustainable Renovation of Buildings

Building Information Modelling

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Preface

Climatic emergency and socioeconomic crisis caused by recent events—COVID-19 and hydrocarbons crisis derived from Russia–Ukrainian war—are the two principal struggles we face as society. European politics, embodied by National Energy and Climate Plans (NECPs) developed by each region, give the way to the green transition of different productive sectors.

Our building stock is responsible for approximately 36% of the CO_2 emissions in the European Union [1]. For this reason, these policies focus a large part of their efforts on economically incentivizing a new development model for the building sector that is committed to the large-scale renovation of the existing real estate stock and that, through the reduction of energy demand and of emissions, manage to reduce the environmental impact of these.

Next generation EU is the new recovery instrument that aims to mobilize investments towards strategic sectors for the reorientation of the production model that, among other measures, contributes to decarbonization through the promotion of energy efficiency and the deployment of renewable energies [2].

However, it should be noted that these environmental objectives are not circumstantial and have been present in European policies since 2002 [1, 3, 4, 5]. 2020 targets [5], which sought to reduce energy consumption and GHG emissions by 20% and increase renewable energy production by the same proportion by 2020, have been shown to be effective at European level, having exceeded the emission targets by 1% and fulfilled the purpose of producing renewable energy [6]. However, the medium- and long-term strategy includes more ambitious objectives that seek a reduction in net emissions of at least 55% by 2030 compared to 1990 data [6]. This requires additional measures that project a reduction in emissions for the construction sector of approximately 20% compared to the data for the year 2020 in a period of nine years.

Spanish National Energy and Climate Plans (NECPs) define through measure 2.6 the strategy to address this ambitious target [7], which recognizes the promotion of public support programmes as a prior mechanism to renovate urban areas of cities with an important number of dwellings, becoming density and urban dimension additional topics to consider in residential buildings stock renovation. As answer to

this NECPs and the Recovery, Transformation and Resilience Plan, it published RD 835/2021, which regulates support programmes to residential renovation and social housing [8].

Despite these plans, the construction market continues promoting mainly new buildings instead of refurbishment buildings, as shown in the national statistical data of building construction. According to number of building licences given, a 68% of this (283.324) were given to construct new buildings. The refurbishment licences given (131.373) were addressed to perform the facades (42%), roof (40%) and foundations (18%) [9].

Most of the existing national stock of residential buildings were constructed without considering the current Basic Document on Energy Saving of the Technical Building Code (CTE-DB-HE) that transposes energy efficiency European Directives. The 91.6% of buildings were constructed before 2006 [10], year of code publication. Through this obsolescence, the average life expectancy of Spanish dwellings is 80 years and the end of lifespan of 30-years-old dwellings has been calculated during the period 2063–2081 [11].

Moreover, the numbers of second-hand mortgages have been increased the last decade, representing an 87.7% in the last 2021 trimester [12]. This reason, the huge stock of second-hand dwellings, its long lifespan expected, its necessary refurbishment and the economic incentives to make it, lets us think in perfectible models of information that makes it possible to generate knowledge through the proposals of intervention and prioritize the maintenance actions.

Urban and building renovation must be a priority in present context, and it is why we need tools to achieve the objective. The present book presents and contextualizes (from a regulatory and recent studies view) a methodology proposal that considered climate change perspective and social criteria on building renovation interventions.

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Contents

Abbreviations

BEDEC	Product construction database developed by ITEC
CDW	Construction and demolition waste
COINT	Initial cost
COMA	Maintenance cost
CYPE	Architecture, engineering and construction software
DGT	Spanish directorate-general of traffic
DIT	Technical suitability document
DO	Design option
DOC	Design option combination
EAA	Equivalent annual annuity
EPD	Environmental product declaration
EWL	European Waste List
FQM	Final quantitative model
GC	Global cost
IDEA	Spanish Institute for Diversification and Energy Saving
IPCC	Intergovernmental Panel on Climate Change
IPREM	Public Indicator of Multiple Effect Income
IQM	Initial quantitative model
ITEC	Technic Institute of Construction
LCA	Life cycle analysis
LCC	Life cycle cost
NAI	Not assessed indicator
NAM	Not assessed module
NPV	Net present value
OMIE	Iberian electric market operator
PGOU	General Urban Development Plan
PVPC	Voluntary prices for small consumers
REE	Spanish electric net
RITE	Spanish Regulation on Thermal Installations in Buildings