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Methodologies for Supporting Sustainability in Energy and Buildings. The Contribution of Project Economic Evaluation.

E. Fregonara[a,*]

[a]*DAD – Politecnico di Torino, Viale Mattioli 39, Torino 10125, Italy*

Abstract

The aim of the paper is to highlighting economic-evaluative approaches involved in regulations and policies supporting sustainability in energy and buildings. Attention is given to Directive 2010/31/EU (EPBD recast) and following Commission Delegated Regulation (EU) n.244/2012, which require MS to set minimum energy performance requirements on the cost-optimal level. Focus is placed on ISO 14040:2006, ISO 15686:2008 and ISO 21500:2012, respectively on Life Cycle Assessment, Life Cycle Costing and Project Management. Sustainable Design principles and Life Cycle Thinking approach are assumed. The study aims to support decision making processes, public authorities in planning and in territorial governance, designers, real estate investors.

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Keywords: Economic-environmental sustainability; Project Economic Evaluation; Life Cycle Thinking; Life Cycle Costing; Project Management; Risk Analysis

1. Introduction

This paper is relevant to the current scientific debate on project sustainability. Project sustainability includes:

- the international energy policies framework, and the guidelines laid down in Agenda 20-20-20

* Corresponding author. Tel.: +39-011-090-6432; fax: +39-011-090-4374.
E-mail address: elena.fregonara@polito.it

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- a multidisciplinary approach that involves disciplines such as Building Physics, Materials Science, Environmental Technology, with special focus on Real Estate Appraisal and Project Economic Evaluation [1]
- recent studies on Architecture Sustainable Design concept [2]
- studies on the real estate market, specifically on the analysis of buildings' energy efficiency as a determinant of asset prices, and on the economic impacts of energy retrofit [3,4]

The aim of the paper is to give a contribution to valorize the methodologies developed in Project Economic Evaluation for supporting sustainability in energy and buildings. Specifically, this work uses the potentiality of the evaluative theories and operative approaches for: orienting designers in selecting the preferable building options from an environmental and economic point of view, from the early design stages; supporting managers in defining coherent policies and strategies for reducing energy consumption, specifically in the case of existing buildings; supporting public authorities in planning and programming activities, through actions to improve buildings' energy performances on the urban scale, including public properties.

The paper refers to the state-of-the-art in economic evaluation of projects theory and practices in Italy, and it considers the international regulatory framework on energy and environmental sustainability in the building context. It considers European experiences and researches related to policies and practices. It orients the operative tools for the economic-financial evaluation and risk analysis of projects, towards a "technological-economic approach". In fact, considering energy-environmental aspects beside the economic-financial ones, it is possible to support a feasibility analysis of a project or part of a project, or processes of option selection, from the early design stages, both in the case of new buildings and in the retrofit of existing ones including cultural heritage. The reasoning proposed focuses on "cost" and "life cycle" concepts, strictly correlated. These are assumed as crucial aspects for the decision making process in the presence of alternative technological options, at different production/construction scales (single material, single component, building systems, entire building) or at different territorial levels (major complex transformation projects scale, district scale, urban scale).

The work attempts to provide a significant contribution in two main directions: providing elements for growing the literature on sustainability in energy and buildings, outlining an overall framework of the evaluative approaches and tools suited to respond to the legislative guidelines; providing insights to jointly develop approaches and methods that usually are applied in separate areas. These two addresses represent, to a certain extent, an original aspect of the work presented.

Section 2 presents the most recent international legislation in the context of the energy sustainability of buildings, highlighting the concepts of cost and life cycle. Section 3 focuses on the cost concepts and their calculation for energy-environmental-economic sustainability, starting from Standards, regulations and methodological guidelines. Section 4 looks at to the approaches deriving from the Life Cycle Thinking approach, such as the Life Cycle Costing approach for economic sustainability and the Life Cycle Assessment for environmental sustainability. The use of both approaches together is also considered. Section 5 presents the Project Management approach, starting from the EU Standard, considering relations with life cycle phases. Attention is given to the potentiality of Cost Control and Cost Risk Analysis, in conjunction with Discounted Cash Flow Analysis, as a tool to support management activities and decision making processes, in the presence of risk and uncertainty components. Finally, section 6 discusses and concludes the paper[†].

2. Regulatory framework for building energy performance and economic-evaluative methodologies

In the European and international context, the recent regulatory documents related to buildings' energy performance which imply economic and management aspects, are:

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[1] [†] This paper represents a summary, partially updated and adapted to the SEB Conference topics, of the main contents of the book Fregonara E. Valutazione sostenibilità progetto. Life Cycle Thinking e indirizzi internazionali. Milano: Angeli; 2015. For further discussion, please see the cited publication.