Journal of Fundamentals of Renewable Energy and Applications

D'Orazio and Giuseppe, J Fundam Renewable Energy App 2016, 6:4
DOI: 10.4172/2090-4541.1000e110

Editorial Open Access

Uncertainties in Life Cycle Cost Analysis of Buildings Energy Efficiency Measures

Marco D'Orazio* **and Elisa Di Giuseppe**

Department of Civil, Architectural and Environmental Engineering, Marche Polytechnic University, Italy

***Corresponding author:** Marco D'Orazio, Professor, Department of Civil, Architectural and Environmental Engineering, Marche Polytechnic University, Via di Brecce Bianche, 60131 Ancona, Italy, Tel: 39-071-220-4587/4248; E-mail: m.dorazio@staff.univpm.it

Received date: Jun 03, 2016, **Accepted date:** Jun 06, 2016, **Published date:** Jun 08, 2016

Editorial

Life Cycle Cost (LCC) analysis in the field of building renovation is considered an important decision support of the design process in order to compare the effectiveness of different energy efficiency measures (EEMs). The importance of using LCC analysis in the field of buildings and building renovation has been introduced at regulatory level in different countries. LCC methodologies related to energy efficiency measures have been introduced in Europe by Directive 2010/31/EU on the energy performance of buildings [1]. The Directive established that Member States shall calculate "cost-optimal levels" of minimum energy performance requirements using a comparative methodology framework according to the consequent Commission Delegated Regulation and its Guidelines [2,3] based on EN 15459:2007 [4].

Unfortunately, accurate Cost Analysis relies on quality of data and data uncertainty is a well-recognised issue associated with LCC deterministic calculation methods [5-8]. In particular results are heavily dependent on future trends for economic data and the corresponding uncertainty (i.e. inflation rate and energy prices). In the methodology framework established by Directive 2010/31/EU, the practice of using constant market interest rate for calculating the discount rate ignores the possibility of variations over the life cycle of the building resulting from changes in national and international monetary and fiscal policies. Also the prediction of inflation rates over a long-term period increases the uncertainty. Another uncertain area in LCC forecasting is determining the service life of building components [9].

If LCC methodologies in the field of buildings are considered as important decision supports, it is then necessary to assess and communicate the problem of uncertainties properly. Otherwise decisions might be made, which are based on faulty assumptions [6].

Several studies exist that deal with probabilistic analysis in building simulation, particularly focusing on Building Energy Simulation (BES) [10-14], in order to overcome the limit of deterministic models and to credit the solutions with "robustness" that is the probability to obtain a certain performance level [15]. Nevertheless, specific literature on probabilistic methodologies in LCC of buildings is still very fragmented. While a deterministic LCC analysis approach requires input variables that are fixed and distinct in both time and cost, in a probabilistic approach variables are modeled using a probabilistic distribution function (PDF) and the quantification of the uncertainty of the outputs is a result of possible variance of the input parameters.

References

1. Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast).
2. Commission Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements (Text with EEA relevance).
3. Guidelines accompanying Commission Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings.
4. EN 15459 (2007) Energy performance of buildings - Economic evaluation procedure for energy systems in buildings.
5. Pittenger D, Gransberg D, Zaman M, Riemer C (2012) Stochastic Life-Cycle Cost Analysis for Pavement Preservation Treatments. Transp Res Rec J Transp Res Board 2292: 45-51.
6. Burhenne S, Tsvetkova O, Jacob D, Henze GP, Wagner A (2013) Uncertainty quantification for combined building performance and cost-benefit analyses. Build Environ 62: 143-154.
7. Wang N, Chang YC, El-Sheikh A (2012) Monte Carlo simulation approach to life cycle cost management. Struct Infrastruct Eng 8: 739-746.
8. Das P, Van Gelder L, Janssen H, Roels S (2015) Designing uncertain optimization schemes for the economic assessment of stock energy-efficiency measures. J Build Perform Simul 1493: 1-14.
9. Rahman S, Vanier DJ (2004) Life cycle cost analysis as a decision support tool for managing municipal infrastructure. CIB 2004 Trienn Congr 2004: 1-12.
10. Burhenne S, Jacob D, Henze GP (2010) Uncertainty analysis in building simulation with monte carlo techniques. Fourth Natl Conf IBPSA-USA 2010: 419-26.
11. Van Gelder L, Janssen H, Roels S (2014) Probabilistic design and analysis of building performances: Methodology and application example. Energy Build 79:202-211.
12. Macdonald IA (2002) Quantifying the Effects of Uncertainty in Building Simulation. PhD Thesis.
13. Hopfe CJ (2009) Uncertainty and sensitivity analysis in building performance simulation for decision support and design optimization. PhD Thesis.
14. Ramos NMM, Grunewald J (2015) Annex 55 Reliability of Energy Efficient Building Retrofitting - Probability Assessment of Performance and Cost - Stochastic Data. International Energy Agency.
15. Janssen H (2013) Monte-Carlo based uncertainty analysis: Sampling efficiency and sampling convergence. Reliab Eng Syst Saf 109: 123-132.