Passive Cooling Approaches in Net-Zero Energy Solar Buildings: Lessons Learned from Demonstration Buildings

Laura Aelenei[1*], Roberto Lollini[2], Helder Gonçalves[3], Daniel Aelenei[4], Massa Noguchi[5], Michael Donn[6], François Garde[7]

[1,3]National Energy and Geology Laboratory, Paço do Lumiar 22, 1649-038 Lisboa, Portugal;[2] Institute for Renewable Energy of EURAC research, Viale Druso 1, I-39100 Bolzano (Italy); [4]Faculty of Science and Technology, Universidade Nova de Lisboa, 2829-516, Caparica, Portugal; [5]MEARU, Mackintosh School of Architecture, The Glasgow School of Art, Glasgow, United Kingdom; [6]Victoria University of Wellington, 139 Vivian St. Wellington, New Zealand; [7]University of La Réunion, 97430 Le Tampon, La Reunion, France

[*] Corresponding Author: laura.aelenei@lneg.pt

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Abstract

Zero Energy performance buildings have gained more attention since the publication in 2010 of the recast of the EPBD [1]. Meanwhile the USA promotes "marketable zero energy homes in 2020 and commercial zero energy buildings in 2025" [2]. Japan proposes "carbon neutralized buildings", including existing buildings, by 2050 [3]. The UK government aspires to achieve a zero carbon standard by 2016 [4]. With countries well on the way to putting this new standard into effect, worldwide around three hundred buildings are already claiming Zero Energy or similar performance [5]. Successful implementation of such an ambitious target depends on a great variety of factors. For designers and code writers these include: balancing climate driven-demand for space cooling with climate-driven supply for renewable energy resources and/or matching building design to shade from the sun in summer while providing for good daylight. With a literature full of theoretical advice and a building industry rife with myths about the value of technologies, the study of these existing buildings may be decisive in establishing the best strategies for achieving true Net Zero energy performance. The authors of this paper, who are active participants in the IEA Task 40/Annex 52 ("Towards Net Zero Energy Solar Buildings") [6] intend to present and discuss the strategies used for cooling a number of selected buildings identified in the project database as zero-energy balance, with the aim of defining solution sets and indicators of relative performance. The buildings, which incorporate solutions for passive cooling, have been divided into three functional component sets: overheating prevention, heat rejection, and modulation and control. The IEA NZEB buildings demonstrate a range of passive solutions for both residential and non-residential situations to show that it is possible to reduce cooling loads through passive design. This has contributed to reduction of the size of the active systems with the aim to cover the residual energy demand through Renewable Energy Systems, getting the overall building energy balance to zero. This paper will review the insights that this classification process has revealed.

References

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