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Energy performance assessment and heritage value sensitive retrofit of historic Mediterranean houses

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(Sub-Theme: Historic Reality, Digital Fantasy - Energy calculation before and after renovation – Energy consumption data before and after renovation)

ABSTRACT:

Current historic building stock creates an invaluable heritage value and potential to be reused in contemporary life providing embodied energy use of the construction materials. The energy demand increase and the scarcity of energy sources make it an obligation of energy-efficient renovation of historic buildings as well. This study has two aims: firstly, to present an example for energy performance assessment and energy-efficient retrofit of a historic building sensitive to its heritage values, and secondly to convey a comparative literature survey study pertaining to the solutions of energy-efficient retrofit in similar historic Mediterranean house types. The case study building is Paşolar House located in Kuşadası, Aydın, Türkiye, exemplifying the characteristics of Mediterranean region's historic houses with its two-storey form, organized around a *sofa* or *taşlık*, with stone masonry walls at the ground floor and timber frame walls with brick infill and projections at the first floor. The *sofa* and *taşlık* are closed at current state while they were semi-open spaces in authentic state. The effect of this intervention is assessed by the generation of the authentic mass model and comparing the inside temperature values with the current state model. The experimental part consists of the monitoring of thermal conditions between 16th November 2023 and 13th February 2024 and the preparation of calibrated thermal modelling by using DesignBuilder software. Different retrofitting solutions are developed as determined by the literature survey study as insulation application to the roof, to the external floor, to the exterior wall exposing to weather without adjacent building masses and lastly replacement of single-pane windows with double glazing low-e pane. Since it is detected that the closed form of *sofa* and *taşlık* led up to the temperature increase in spaces, the retrofit interventions were applied on authentic state model which promises a better passive energy-efficient behavior for hot Mediterranean climatic condition. The insulation application to the roof and exterior wall are evaluated as effective interventions for energy-efficiency. The change of windows and insulation application to exterior floors belonging to the projections did not have a significant impact on the improvement of energy efficiency. Thus, they were eliminated. Among the examined literature, the studies considering the impact of spatial alterations on energy efficiency of historic houses are limited, and the carried out study creates an example for the integrated approach for energy-efficiency retrofit of a historic house in Mediterranean region both proving the climate-responsiveness of the authentic design and developing its efficiency by modern techniques.

