# THE ENERGY OF SPATIALITY

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## ▶ RESEARCH INFORMATION

### KEYWORDS
Passive house, low-tech, storage mass, ventilation, lighting, spatiality.

### INTRODUCTION / CONTEXT
The physicist, Dr Wolfgang Feist, established the possibility of building houses in a central European climate with a heating demand of 15 kWh/m²a or less. His statement encountered skepticism in the early 90s. The first prototype from Darmstadt Kranichstein (figure 1a), as the multiples passive houses built since, has demonstrated the feasibility of guaranteeing thermal comfort without a "conventional" heating system. Passive houses, as this prototype, add the heating load to the hygienic supply air by a obligatory balanced ventilation system with heat recovery [1]. 25 years later, the passive house standard, with its technical recommendations of insulation, airtightness and ventilation is largely established. The initial incredulity gave way to a broad consensus, so that it seems nowadays almost impossible to design energy efficient buildings without a series of technical "recipes", as in particularly the heat recovery on ventilation losses.
be2226 (figure 1b), a prototype built in 2013 by the architects Baumschlager Eberle, demonstrates precisely this: reaching the performances of the passive house standard with a natural ventilation system, without heat recovery. And the skepticism is again back on the spot. Where the passive house standard, imagined by physicists, has showed the responses and solutions of technical equipment, the concept be2226, designed by architects, refocus on the energy reflection around an architectural approach. Dietmar Steiner says about be2226: "*What is special … is the elimination of classic building services, which have dominated architecture. The new philosophy of energy planning which has been applied …, once again gives architecture its dignity… 2226 shows us that building is possible today which is sustainable from an energy standpoint on the basis of its materiality and architecture alone.*" [2]

### QUESTION / GOAL
At the question if the be2226 is a new standard that could replace that of the passive house, Tobias Waltjen replies "no", because the design of any building that would not be a true copy of be2226 must be resumed from scratch [3]. How can this concept than be transposed in another context? The mean goal is to understand and master the parameters that are decisive for the conception such as: compactness, size, occupancy density, air change rate, ratio of glazed surface, materiality, climate, etc.

### HYPOTHESIS / METHODOLOGY
Among the principles of the building envelope and internal storage mass, the regulation and natural ventilation, the use of daylight and in contrary to the compactness favored by the passive house standard (figure 2). The spatiality with the increase in ceiling height seems to be one of the most important hypothetical conception keys of the be2226 building. The research project is based on three main steps (figure 3). The first step focuses on the detailed understanding of the be2226 concept with the validation of a dynamic simulation tool for the entire workflow [5] of two building projects in different locations. The second step runs the two models with different strategies and parameters. The research try to recognize new relationships between the previous listed principles with a dynamic parametric algorithm based simulation tool. The conception, construction and monitoring (research by design) of a prototype in Belgium is optional and can enrich the research, but is not indispensable for it.

### EXPECTED RESULTS / CONCLUSIONS
The expected results on the third step concern the influence of the paradigm of spatiality on a low-tech energy concept with a high user comfort and reduced global building costs. Therefore the development of methodologies to design a user-friendly transposition of this strategy on a large scale in Belgium for new constructions as renovations can be seen as the main goal of this research.

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## ▶ REFERENCES

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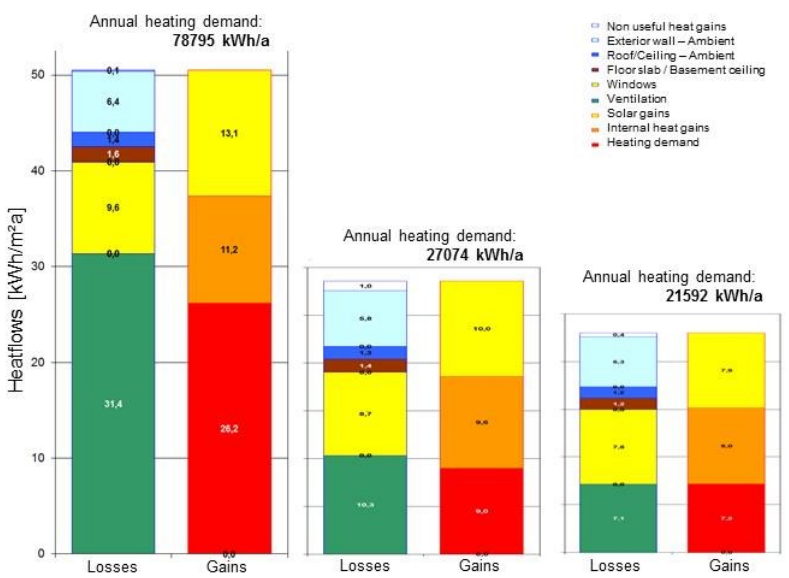
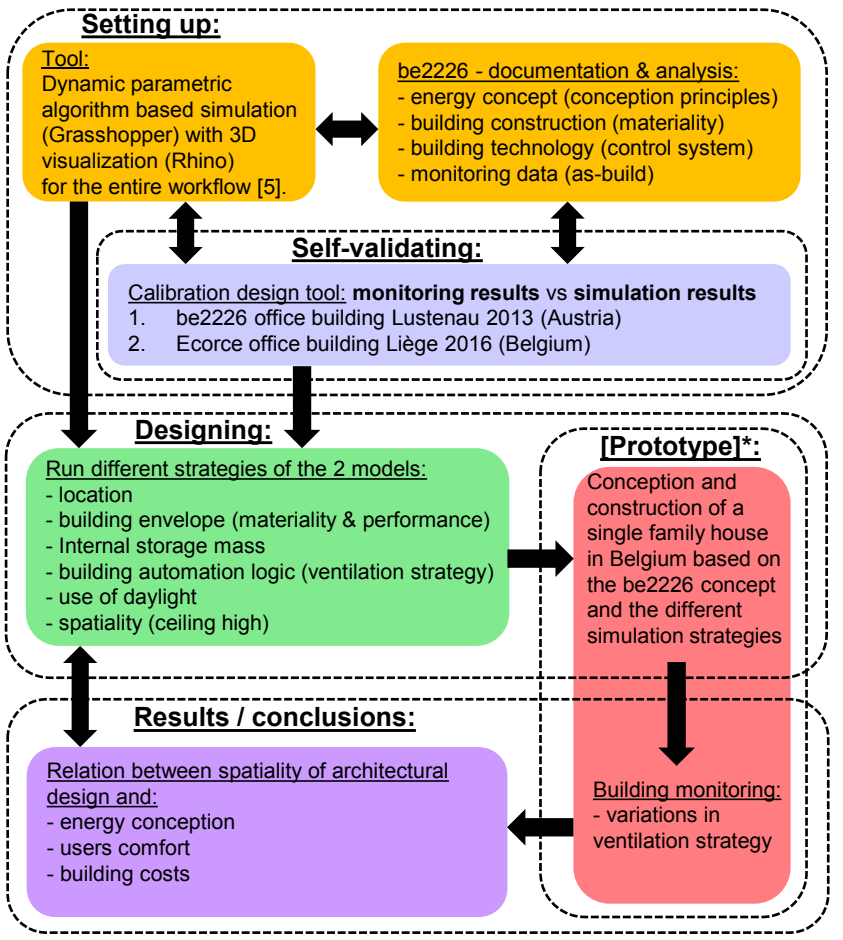
[2] Aicher Florian, Eberle Dietmar, be2226 - The Temperature of Architecture – Portrait of an Energy- Optimized House, Birkhäuser, Basel, 2015.
[3] Tobias Waltjen, 2226 Lustenau, IBO magazin 2/14, Österreichisches Institut für Baubiologie und –ökologie, Wien, 2014.
[4] Passive House Planning Package (PHPP), Passive House Institute, Darmstadt, 2015.
[5] Mostapha Sadeghipour Roudsari, Ladybug: a parametric environmental plugin for Grasshopper to help designers create an environmentally conscious design, Proceedings of 13th Conference of International Building Performance Simulation Association, Chambéry, 2013.

▶ **Fig. 1:** a.) 1991-PH Darmstadt Kranichstein b.) 2013-be2226 Lustenau




▶ **Fig. 2:** Relation between ceiling high and energy balance heating of be2226 according to the Passive House Planning Package (PHPP) [4] (Author)




▶ **Fig. 3:** Research Project methodology (Author) * optional