

MULTI-ACTIVE- FAÇADE – CLOSER TO A ZERO EMISSION BUILDING

DI Stefan Sattler, BSc.

University of Natural Resources and Life Sciences, Vienna

Peter-Jordan-Straße 82, 1190 Vienna, Austria

Phone: +43 47654-87536

E-Mail: s.sattler@boku.ac.at

5

1 SUMMARY

10 The Multi-Active-Façade is a prefabricated wooden pillar-beam façade with a main application in residential building refurbishments. It consists of a ventilated glass front with a honeycomb structure at the rear (see *Figure 1*) and an integrated heat recovery ventilation system. Because of the honeycomb structure, passive solar energy can be gained during winter whilst shading is provided during summer. The solar gains are used by the integrated photovoltaic cells in the glass on the outside of the ventilated façade. The generated energy is stored in batteries to power the ventilation system and to cover the electricity demand of the general areas of the building. Residents benefit from only one to two days on site refurbishment time per unit and an increased comfort, which can be compared to a passive house standard.

15

Photovoltaic, Refurbishment, Passive house, Passive- and active solar gains, residential buildings

2 INTRODUCTION

20 For the first time a housing complex of the City of Vienna with 54 units will be renovated to passive-house standards by means of a special façade developed by the University of Natural Resources and Life Sciences (BOKU) and the research company alpS in the earlier COMET research project “B02 eVELOP/ MULTICover – Multifunctional envelop for thermally renovating façades and buildings.” The façade layer serves two purposes: mounted onto the existing outer walls, it forms the new building envelope according to a passive-house standard and - at the same time - includes all building appliances needed for the passive-house standard. Therefore, no additional construction work has to be done inside the individual apartments.

25

A quick way to highly efficient refurbishments is crucial, as the construction and operation of buildings is responsible for about 40% of the CO₂ emissions [1] and a higher refurbishment rate is needed to reach current and future environmental goals. Much of the energy used in buildings is still provided by fossil fuels, causing climate-related greenhouse gas emissions. Demographic changes following the move towards cities and the associated increase in housing demand require a special focus in the area of housing in urban areas. Reducing the energy demand, enhancing the efficiency and creating decentralised building integrated electricity supply by renewable energy, are strongly needed.

30

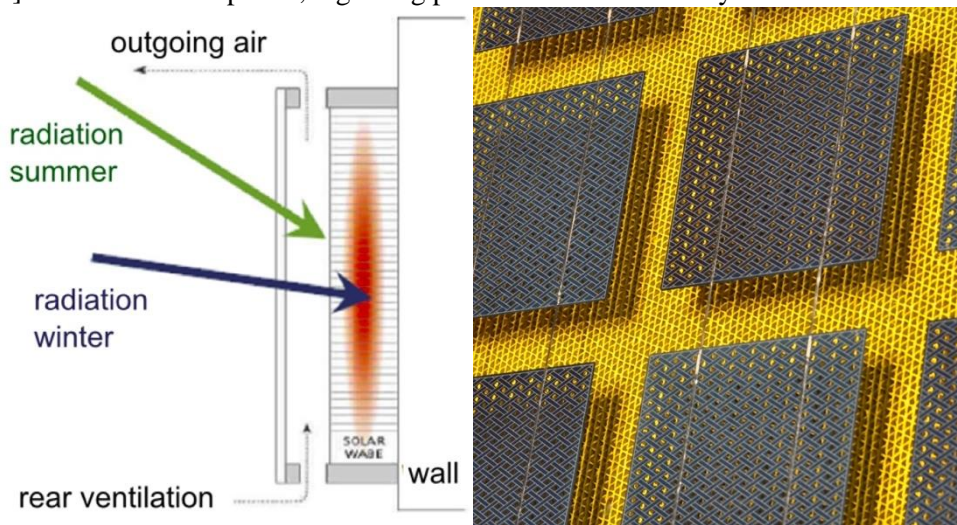
3 FAÇADE SYSTEM

35 The Multi-Active-Façade combines all these requirements. The reduction of heating energy demand is facilitated by thermal insulation and the honeycomb structure, which also uses the passive solar gains during the winter period due to its innovative design. The sunbeams can penetrate deep into the construction, heat up the building and reduce the building’s energy requirements. During the summer, the honeycomb structure provides shading to the wall because the steep rays of sun cannot penetrate into the construction (see *Figure 1*). The Efficiency of the building is enhanced by the integrated ventilation system with heat recovery, which increases the comfort of the tenants because they do not need to rely on window ventilation. Open windows result in noise pollution at this location because the *Hütteldorfer Straße* is a very busy street with noise from car traffic and a tram line.

40

In order to use the façade as an active element, there are transparent, frameless glass/glass photovoltaic modules integrated into the façade to generate energy for the general electricity demand of the housing complex (i.e.

45 lighting for corridors) and the ventilation system. An energy management system in combination with a battery storage ensures operation when there is no solar radiation available. The storage system is designed to cover the energy demand for at least 24h. The Multi-Active-Façade was tested with different degrees of transparency with a computational fluid dynamic simulation and also in an experimental laboratory test carried out by the FH Technikum Wien [2] so that the best options, regarding passive and active solar yield is found.



50 Figure 1 Functionality of the Multi-Active-Façade [3]

The accompanying LCC and CO₂ analysis will show how much energy compared to an ordinary façade insulation can be saved over the building's lifetime.

4 CONCLUSIONS AND OUTLOOK

55 Currently the construction of the refurbishment has just started and in the upcoming months, the Multi-Active-Façade will be installed for the first time in a future passive house.

In a next step, the potential for replication is examined and the energy and CO₂ savings will be assessed to provide the City of Vienna a detailed analysis of the Multi-Active-Façade. It should prove, that the system can be highly beneficial in the application of residential refurbishment projects and thus add to a more environmentally friendly city, where less energy is needed, and energy is efficiently used. The project partner *Stadt Wien – Wiener Wohnen* is aiming at implementing this innovative, prefabricated façade system in future refurbishments, if the framework conditions are suitable and the building orientation allows on site solar energy generation.

5 ACKNOWLEDGEMENTS

65 The project „Multi-Active-Façade“ has been funded under the framework BUILDING OF TOMORROW by the Austrian Research Promotion Agency (FFG) under the project number 840645.

6 REFERENCES

- [1] World Business Council for Sustainable Development (WBCSD), Energy Efficiency in Buildings Transforming the market, WBCSD, Geneva, 2009
- [2] B., Leitner, K., Leonhartsberger.: Experimentelle Untersuchung der GAP-Fassade. FH Technikum Wien 2017.
- [3] GAP SOLUTION. „Gap Fassaden – Technische Unterlagen“. Linz, 2017.

7 CONFERENCE TOPIC

Please indicate here to which of the Conference Topics this abstract refers:
Innovations for the Decarbonisation of Buildings and Quarters