

FOUR BRICK PASSIVE HOUSES WITH “TOTAL QUALITY” CERTIFICATION



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Summary

Total Quality is the national Austrian implementation of the Green Building Challenge framework. This assessment tool allows for an overall judgement of the sustainability of a building, including all environmental, economical and social aspects. The energy consumption is of course a major criterion for a positive result and best results can only be obtained with passive house standard. The brick industry in Austria wanted to demonstrate that brick passive houses can reach very good results in such a sustainability assessment and has therefore initiated several demonstration projects in cooperation with projects developers and argeTQ. Three residential buildings in Vienna, Linz and Telfs and one office building in Mödling are finished in the meantime and another project in Innsbruck is in the planning state after an architectural competition has been finished. All four finished projects have been certified by argeTQ and have reached very good results.

Keywords: Total Quality, clay, bricks, passive house, certification, energy consumption, sustainability, Green Building Challenge

1 Total Quality

Total Quality (“TQ”) is the national Austrian implementation of the Green Building Challenge framework. This assessment tool allows for an overall judgement of the sustainability of a building, including all environmental, economical and social aspects. The assessment results in a certificate, which makes the sustainability of a building transparent, useable and comparable and by that brings additional value for all involved stakeholders. The certificate itself consists of 4 pages with important general items and includes an inlay of about 20 pages with all detailed assessment results.

The criteria for the assessment are described in the TQ criteria catalogue. They are also used as planning tool for user-friendly, environmentally friendly and cost efficient buildings. Therefore the TQ certification is a quality management system, which supports the marketing and the operation of „better” buildings.

Main quality criteria are:

- Minimisation of resource consumption (e.g. energy)
- Minimisation of loads on people and the environment (e.g. emissions, ecotoxicity of the building materials)
- Comfort for the user (e.g. indoor air quality, acoustic insulation)
- Longevity
- Safety (e.g. fire resistance)
- Planning quality
- Quality control during the erection of the building
- Infrastructure and equipment
- Costs.

The energy consumption is of course a major criterion for a positive result and best results can only be obtained with buildings which fulfil passive house standard.

The TQ assessment and certification tool was developed by the argeTQ on an order from the Austrian Ministries for Transport, Innovation and Technology, for Economy and Labour and the Ministry for Environment and is under continuous improvement and further development. ArgeTQ consists of “Österreichisches Ökologie-Institut”, “Kanzlei Dr. Bruck”, “Österreichisches Institut für Baubiologie und –ökologie” and “Zentrum für Bauen und Umwelt der Donauuniversität Krems”. At the moment all three major Austrian sustainability tools (TQ, klima:aktiv and Ökopass) are brought together in a revised edition of TQ called TQB. Further information about TQ is available in the internet on the website of argeTQ under <http://www.argetq.at/index.htm>.

Clay brick industry in Germany, Austria and Switzerland (D-A-CH) started in 1998 to engage in the field of sustainability assessment of buildings. On order of the three associations of clay brick manufacturers of those three countries a handbook was developed which gives guidance for planners, architects, developers and industry on how to design a brick building with optimised sustainability [1]. As a follow-up the clay brick industry in Austria decided to demonstrate that brick passive houses can reach very good results in such a sustainability assessment and has therefore initiated several demonstration projects in cooperation with projects developers and argeTQ. Three residential buildings in Vienna, Linz and Telfs and one office building in Mödling (near Vienna) are finished in the meantime and another project in Innsbruck is in the detail planning state after an architectural competition has been finished. The following article describes these projects and the results of the sustainability assessment.

2 Project SOL4 in Mödling

The innovative office building in Mödling called SOL4 was finished in 2005. Special attention was paid to the use of the latest developments of environmentally friendly construction materials as extensively as possible. The load-bearing structure is made of locally engineered materials used here for the first time: cement-free concrete and brick masonry with optimised storage capacity. The thermal envelope is assembled with innovative materials as well: mineral foam insulation and prefabricated structural panels made of straw and oriented-strand board (OSB) with a photovoltaic cladding system (prototype of “clip-on” façade system). High-performance windows with gas-filled multiple glazing were installed and equipped with an advanced shutter system for shading

and protecting the office spaces from excessive solar gains. In addition, unfired loam bricks were used for the first time as interior office walls. A specialist on construction biology and chemistry was involved to ensure a minimised negative impact of the finishing materials in terms of health and environmental costs.



Fig. 1 Project SOL4 in Mödling



Fig. 2 Results of TQ assessment of project SOL4 in Mödling

The external walls are clay blocks with 30 cm external mineral foam insulation boards respectively 36 cm straw insulation (behind the photovoltaic panels). The U-value of the external walls is 0.11-0.13 W/m²K, the energy need for heating is 9.56 kWh/m²a. The term “passive solar building” on the whole reflects the objective of making extensive use of the energy resources already available in a building’s basic form and functions, such as the solar gains through windows or casual gains from occupants and equipment, to cover as much of the overall energy demand as possible. Good integration of mechanical and electrical services with passive systems is required to obtain maximum benefit from this

ambient energy. The building services fully respond to the demand for a variety of advanced passive energy-use technologies. The facility's energy management system optimises ventilation and air conditioning by means of a closed-loop heat distribution circuit with ground-coupled and ventilation heat exchangers. Vertical boreholes enable earth-to-air cooling, that is, passive cooling by concrete core activation in the panels of the roof construction. The grid-tied photovoltaic system provides electricity to cover the remaining energy demands of the mechanical systems.

The results of the TQ assessment of that project are very positive. In fact the overall result – a value of 4.21 points – is the best result ever reached for a TQ project. The main reasons for this very positive result are the indoor comfort (loam bricks, cement-free concrete), the longevity (massive construction) and the quality of the planning process.

3 Project Linz Hamoder

12 semi-detached houses in Linz have been finished in 2005. The external walls are cavity walls with 2 layers of clay blocks and 24 cm mineral wool insulation. The U-value of the external walls is 0,15 W/m²K, the energy need for heating is 13,2 kWh/m²a. All the houses are equipped with controlled ventilation systems with heat recovery. The remaining energy need is covered by a heat pump. Solar energy is used for the preparation of hot water.



Fig. 3 Project Linz Hamoder

The results of the TQ assessment is 3.38 points, a good result but significantly worse than the result of SOL4. The reason is a low value for safety as well as for infrastructure and equipment. On the other hand the indoor has a very positive value of 4.57.

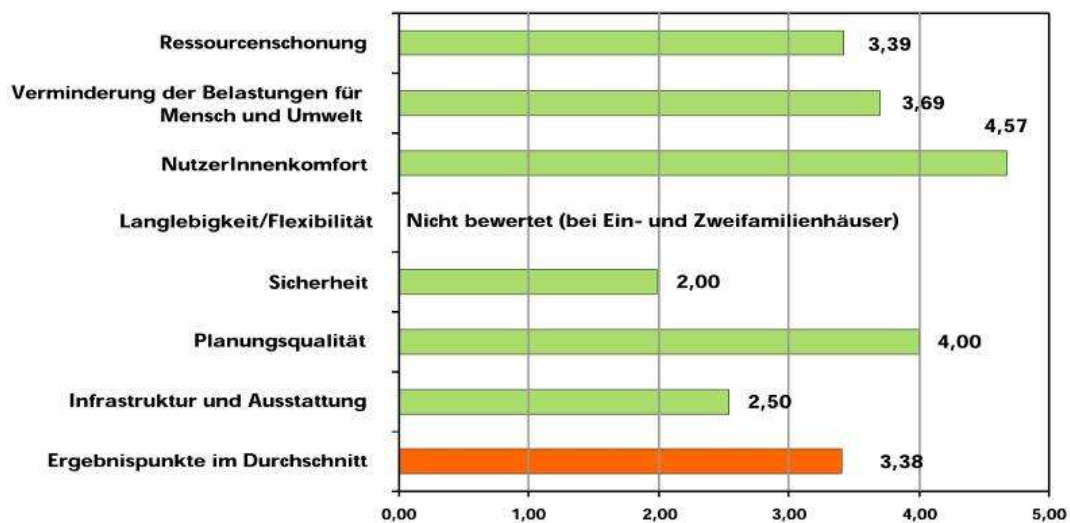


Fig. 4 Results of TQ assessment of project Linz Hamoder

4 Project Telfs Puite

Two 4 storey apartment buildings with together 36 apartments in a big residential development project in Telfs in The Tyrol were finished in 2004. The external walls are cavity walls with 2 layers of clay blocks and 22 cm mineral wool insulation. The U-value of the external walls is $0.16 \text{ W/m}^2\text{K}$, the energy need for heating is $14.4 \text{ kWh/m}^2\text{a}$. The remaining energy need is provided by small gas radiators. The TQ assessment resulted in a value of 3.78 points, especially positive are the planning quality and the longevity.



Fig. 5 Project Telfs Puite

5 Project Wienerberg City

The 9 floors residential building in Vienna with 97 apartments was finished in 2003. The load bearing structure is reinforced concrete with clay block masonry as infill; the 2 top floors are monolithic load bearing clay block masonry. The thermal insulation is 25 cm mineral wool; the façade is partly aluminium, partly mineral render and partly clay tiles. The U-value of the external walls is $0.14 \text{ W/m}^2\text{K}$, the energy need for heating is $14.8 \text{ kWh/m}^2\text{a}$. The building is equipped with a controlled ventilation system with heat recovery; each apartment has its own system. The remaining energy need is covered by district heating. The TQ assessment resulted in a value of 3.44 points, positive were especially the planning quality, safety and longevity.



Fig. 6 Project Wienerberg City



Fig. 7 Project Sieglanger in Innsbruck

6 Architectural competition Sieglanger (Innsbruck)

The latest demonstration project is the result of an architectural competition for a new residential area in Innsbruck. The project will again fulfil passive house standard. Additional to the high architectural quality, the project will also demonstrate the various possibilities of fired (and unfired) clay products. Total Quality certification will be carried out in parallel to the planning process. The project will be realised in 2007/2008.

7 Conclusions

All four finished projects have been certified by argeTQ and have reached very good results of between 3.38 and 4.21 TQ points (out of maximum 5 points). The TQ result of 4.21 points for the project SOL4 in Mödling is so far the highest result ever reached.

The demonstration projects of the Austrian clay brick industry have proven that

- it is possible to reach passive house standard with external clay brick walls and
- “Total Quality” of such buildings is very good and in combination with innovative building services (technical equipment for heating, cooling and ventilation) excellent assessment results can be reached in sustainability assessments.

References

- [1] DR. MANFRED BRUCK, *Ganzheitliche Qualitätskriterien im Wohnbau*, GBC-Handbuch der Ziegelindustrie, Wien April 2000

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