

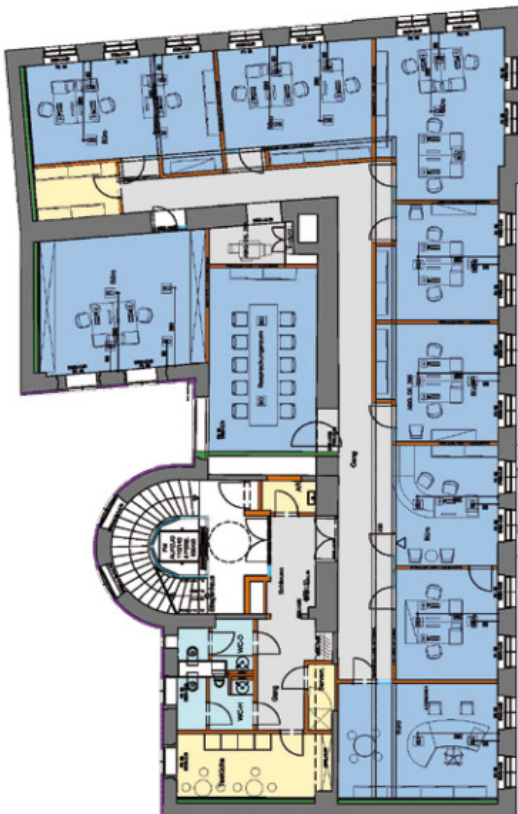
Case Study:

Green renovation of Biberstraße 5 ÖGB Offices¹



The office building “Biberstraße 5” is located in the historical centre of Vienna. Dating from 1901, renovation was necessary to adapt the building to modern standards. Historical buildings are a significant part of Austria’s building stock and dominate the Viennese skyline. The historical façade of this office building had to remain intact and only measures such as cleaning and painting the façade were allowed. Hence, retrofitting measures focused on the interior room layout and thermal retrofitting of the roof and courtyard façades.

The interior layout of the office units has been partially redesigned and additional structural measures (due to a new building code for earthquake security) will be required. To ensure accessibility for all, two modern elevators will be installed. A new ventilation system with heat recovery and cooling ceilings will also be installed in the office area in order to improve the indoor climate.



The energy-efficient refurbishment of the courtyard façade with thermal insulation, window replacement and thermal insulation of the roof and along the fire walls fulfils the **GreenBuilding Program** and **klima:aktiv Initiative** requirements. Specific focus was given to the selected building materials, considering climate and chemical criteria. Defining and implementing environmental criteria, regarding more sustainable materials and construction practices, has played a big role in the project management.

These criteria were further implemented in the procurement process and tender offer. A procedure called chemical management, which has the goal of minimising the use of organic solvent-containing building chemicals like glues, paints or varnishes, was carried out by a specialised consultant.

The renovation will reduce the heating demand by **more than 50% than required by the building code**. Finally, measures for the innovative **energy monitoring** by the future users will be implemented.

¹ ÖGB = Österreichische Gewerkschaftsbund (Austrian Trade Union Federation)

Keywords: energy efficient retrofitting of historical office building, chemical management of building materials, ventilation with heat recovery, klima:aktiv-building standard, Green Building program.

Dates

Planning: 2009-2011

Construction: April 2010 – February 2011

Final interior design and occupation:

September 2011

Process

Definition and set up of targets and including them in the procurement process

The decision to implement an assessment tool in the design and procurement process, to achieve ambitious ecological standards, was made just several months before the official plan submission, after the design process was done. A comparative study on several building certificates (including **GreenBuilding**, **klima:aktiv-Standard**, etc) was presented to the building owner in summer 2009.

Interested to implement these criteria in the renovation process, the owner agreed to set high energy standards, beyond the current building code. Due to a limited budget, a detailed cost-benefit analysis for each ecological measure was carried out. In close cooperation with the klima:aktiv initiative of the Austrian Federal Ministry of Life, a new criteria catalogue was developed, making Biberstraße 5 the pilot project for the category “retrofitting of service buildings.”

The benchmark for implementing these measures was the **energy certificate** of the existing building. During project development several measures and scenarios (e.g.: different insulation thicknesses and implementation methods, efficiency of ventilation and cooling system, lighting design etc.) were considered and the energy certificate recalculated several times to find an optimal solution. All defined klima:aktiv requirements were implemented in the official plan submission and tender process (especially for HVAC, electricity and for measurement and control technology).

SCI-Network Context

Working Group 1: Innovation in Sustainable Renovation – Environmental Assessment Tools

This detailed case study illustrates a practical application of environmental assessment tools (**Green Building** program and **klima:aktiv**) in an office building renovation project.

The focus is on:

- Definition and set up of targets and including them in the procurement process
- Cost/benefits of specific technical solutions
- Interaction between stakeholders and effect of the tool in the procurement process

For further information on this Working Group, or to get involved:

<http://www.sci-network.eu>

Interaction between stakeholders and effect of the tools on the procurement process

Before the negotiated procedure started, a consultant company, specialised in building materials (“BauXund” – further information can be found under “Organisations involved”) was contracted to perform a **chemical management for building materials** analysis.

Specifications for the tender were revised and adapted according to the requirements of this analysis and the klima:aktiv standards (see below).

This led to additional coordination efforts for the project managers, as well as the contractors and consultants. With regard to the building materials and construction practices, despite the consideration given within klima:aktiv to market availability of defined ecological products, it was found that a limited number met all of the requirements.

Before the construction process started, an introduction about “chemical management for building materials” and the specific certification and set targets was given to the companies involved.

Receiving a sufficient number of tenders for cost and quality comparison to choose the best offer turned out to be challenging in some cases. For example, only one manufacturer offered wood-aluminium windows that met the defined requirements (HFC-free insulation material) in the required dimensions at the time of procurement. For the specified sealed hardwood floors, with organic seal which fulfils the high user demand, only one manufacturer was found.

Measures Implemented

Energy efficient renovation measures, specific selection of building materials and chemical management were implemented in the renovation of Biberstraße 5 to achieve the GreenBuilding and klima:aktiv standards.

The measures to achieve GreenBuilding and klima:aktiv standards are described below.

GreenBuilding



GreenBuilding is a voluntary programme started in 2005. It is meant to enhance the realisation of cost-effective energy efficiency potential by creating awareness and providing information,

support and public recognition to organisations whose top management is ready to show commitment to energy-efficient measures in non-residential buildings.

The programme assists owners of non-residential buildings to realise cost-effective measures which enhance the energy-efficiency of their buildings in one or more technical disciplines.

Reduction of heating and cooling demand is achieved through energy-efficient retrofitting. Final energy demand of the building can be decreased by at least 33% compared to current consumption.

Measures implemented:

- Thermal insulation of courtyard façade, roof and along the fire wall.
- Improvement of building services (HVAC)
- New ventilation system with heat recovery and cooling ceilings in office area.
- Shading devices in box windows to reduce cooling demand in summer
- Replacement of windows facing courtyard and restoration of box windows in historic façade (by improvement of new seals)
- Decentralised hot water

klima:aktiv

Klima:aktiv is an Austrian initiative by the Ministry



of Life to support sustainable development and reduce the total energy demand and CO₂ emissions in the building sector. The programme aims to raise awareness and trigger additional investments in energy efficiency and renewable energies and to give advice and public recognition to those who are ready to implement ambitious measures in their buildings, resulting in substantial energy savings.

This project is a pilot for the category “service building renovation” in the program “Building and Renovation”. In close cooperation with the Austrian Energy Agency and klima:aktiv a new criteria catalogue has been developed and will be used for similar projects in the future. Implemented measures to be certified by klima:aktiv are carried out according to the newly defined criteria catalogue. The assessment is carried out on the basis of a 1000-credit scheme. These measures are divided into four categories:

A: Planning and construction

- To avoid individual transportation by car, additional areas for bicycle parking for visitors and employees will be built. Available public transportation system in the area gives incentive to reduce individual car traffic.
- Product management: use of low emission construction material and building products. This aspect is verified by the defined environmental specifications in the tender, a list with ecological building material (“baubook” see section “Tools used”), a report on the on-site quality management during construction

- An appropriate and well designed ventilation and cooling system
- Avoidance of thermal bridges in the renovated building envelope
- Energy monitoring to measure energy use during the building life time. A concept and necessary monitoring stations are part of the renovation concept

B: Energy use and supply

- Heating and cooling demand will be reduced through energy efficient renovation. Final energy consumption is expected to be reduced by a minimum of 33% compared to consumption before renovation.

C: Building materials and construction

- Avoidance of substances harmful to the climate and avoidance of PVC
- Use of certified building products
- Consultation support through experts during planning and construction, with specific focus on building materials (“chemical management”)

D: Comfort and Indoor air quality

- Reduce cooling demand in summer through shading devices in the box windows
- Ventilation system with heat recovery and air conditioning system
- Compliance with air quality guidelines and independent measurement of indoor air quality after construction is finished

Construction started in 2010 and will be finished in September 2011. Besides a better work environment for employees and reduction of energy costs, the building owner saw an additional marketing effect and welcomed public visibility to raise awareness of the environmental impact of buildings and deliver high quality and innovation.

Tools Used

The **Baubook** is an online database and can be used as a tool to select building products for planning, invitation to tender and execution. The building materials are assessed step by step. For every process step, material, transport and energy inputs as well as emissions into air, soil, water and waste are determined. This database can be used to select building materials focusing on health and environmental aspects. It offers help to implement ecological criteria in tendering. The database is constantly updated and extended.

The tool can be used to:

- Get example sections of building components
- 3D-layout of building components
- U-Value calculation
- Draft and manipulate individual building components
- Compare different building components
- Calculation of OI3-Index
- Prefabricated building components
- Add and combine different materials to individual building components
- Organise and save the individually designed building components

ÖGNB (Austrian Sustainable Building Council) is a non-profit organisation founded to contribute for widespread implementation of knowledge on sustainable construction. The ÖGNB launched the **TQB (Total Quality Building)** system. This is the most extensive building certificate in Austria, according to their database.

The first development of this model (TQ) was aligned with international trends and in

harmonised with other Austrian building assessment systems (such as klima:aktiv haus). TQB allows evaluation of residential buildings, offices, commercial buildings; schools, hotels, and shopping centres. TQB is applicable in the design phase as well as for quality assurance during construction and occupancy.

ÖkoKauf Wien (“EcoBuy Vienna”) is a program by the City of Vienna to exert an influence on the quality and properties of products (from laundry detergents and office supplies to construction service). The Vienna City Administration purchases its goods and services according to ecological considerations. Due to their high spend (approximately five billion Euros per year) an impact can be made.

A central management tool for this is the eco-criteria list created by ÖkoKaufWien. It lists the requirements for products and services in terms of environmental friendliness, usability, efficiency, quality and occupational safety. This ensures that ecological considerations are taken into account over the course of public procurement and tendering by the Vienna City Administration. In addition, the results contribute to sensitising the Vienna City Administration employees and serve as a means of orientation for the economy as well as private households.

Ö.B.U.S (“ÖkoKauf Wien Bau Umwelt-Schnellrechner”) is an Excel-based tool and was developed by Bauxund for the city of Vienna to apply the ÖkoKauf Wien criteria. Ecological requirements for building products can be calculated and presented in graphs comparing different scenarios as well as the environmental reduction.

The Excel based tool "Ö.B.U.S" was used to calculate and communicate the ecological requirements for products used – by assessing the whole building. Three scenarios were compared for Biberstra ("worst case", "business as usual" and "ÖkoKaufWien") show CO2-reduction potentials.

Figure 01: Comparison of environmental impact reduction by applying "ÖkoKauf Wien" criteria

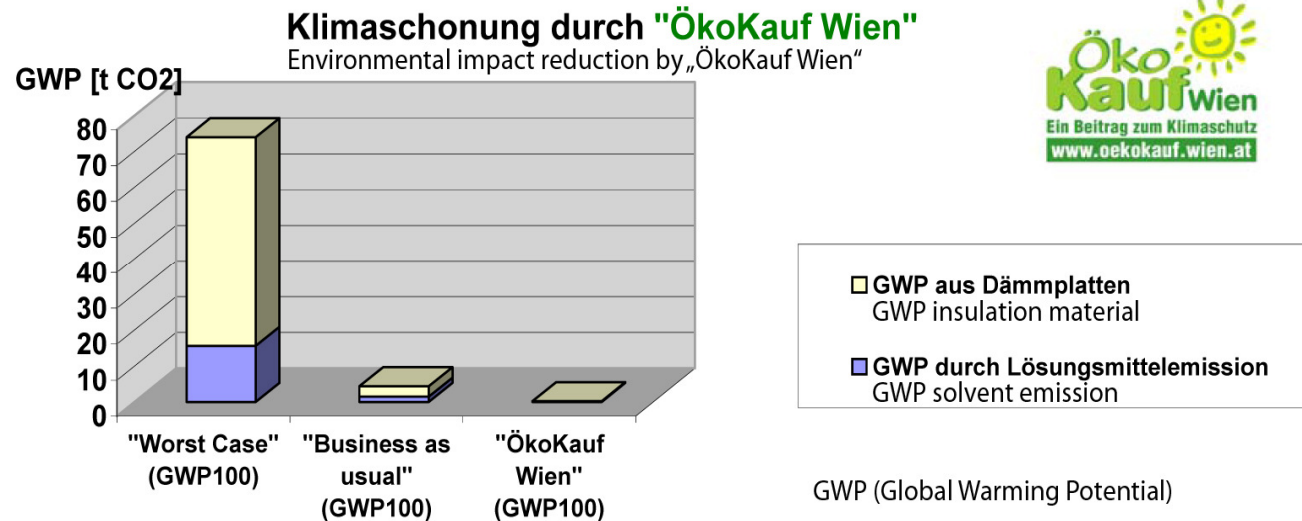


Table 01: Comparison of Volatile organic compound (VOC) emissions for three Scenarios.

Produktgruppe / Products	VOC-Emissionen im Vergleich [kg]:		
	"Worst Case"	"Business as usual"	"ÖkoKauf Wien"
Bitumenanstriche / bitumen coating	48	40	6,7
Bodenbeschichtungen (ohne Belagsarbeiten) / floor coating	4	4	0,0
Holzbeschichtungen / wood coating	8	4	0,5
Innenwandbeschichtungen / interior wall coating	2040	60	10,0
Metallbeschichtungen (incl. Brandschutz)/ metal coating (incl. fire safety)	49	33	0,9
Verlegung Fußbodenbeläge / laying of floor covering	170	65	0,5
Verlegung Sockenleisten / laying of baseboard	0	0	0,0
Summe / Total	2318	205	18,5

Budget and Finances

Construction is underway with an expected completion date of September 2011. Estimated costs are €6,9 Mio (excl VAT) (Building costs approx € 5,6 Mio (Incl. Planning); Design costs approx € 1,3 Mio)

To find an optimal solution, different scenarios were compared considering additional costs, rentable m², heating demand and costs and future market value of the building.

Cost comparison of 3 renovation scenarios:

1st scenario: “GreenBuilding” (no ventilation system in offices, fan coils for cooling)

Additional costs: + € 197.200

Pros: lower costs, no changes in office space (same m²; room height: 3,40 m)

Cons: higher heating demand (HWB* = 21,35 kWh/m³a); reduction in heating costs: 25%; certificate: GreenBuilding, lower market value due to lower indoor air quality.

2nd scenario: “GreenBuilding & klimaaktiv” (ventilation system in all offices, chilled beams for cooling)

Additional costs: + € 404.200

Pros: lower heating demand (HWB* = 18,42 kWh/m³a); reduction heating costs: 40%; first “Klima-aktiv-Certificate” for renovation of office building; higher market value due to improved indoor air climate.

Cons: minor changes in m² due to necessary ducting (total: 3.582,78 m² instead of 3596,43 m²) room height: 3,10 m

3rd scenario: “Luxury” (like scenario 2 plus renovation of box windows facing the street)

Additional costs: + € 649.200

Pros: lower heating demand (HWB* = 16,17 kWh/m³a); reduction of heating costs: 47%

Cons: no significant changes compared to 2nd scenario

The second scenario was chosen as the most cost-efficient option for the sustainable renovation of Biberstraße 5.

Energy Monitoring

The planned energy monitoring at Biberstraße 5 will allow continuous control of energy consumption, especially for the HVAC system. Unexpected increases can be quickly detected and action taken. Recorded data is used to control energy costs, visualise user behaviour and review planned objectives. Data can be recorded in intervals from 15 minutes up to weekly values, depending on user requirements. A minimum of 90% of energy consumption of HVAC-systems will be recorded.

The following measuring points will be installed at Biberstraße 5:

- **Heat supply:** to capture energy supply (eg gas meter, electric meter for heating for example heat pump) and generated heat (heat meters). Heat meters will also be provided for continuous monitoring of solar systems and heat pumps.
- **Electricity:** to capture final electrical demand, depending on set up of installed measuring points (eg ventilation systems, cooling systems, IT)
- **Cold water,** which reduces energy demand for cooling, is covered by a local network or well.

The recorded data will be available to the user and will provide a comprehensive comparison of actual energy consumption to set targets.

Lessons Learned

Key success factors:

Experience from this project showed that it is important to:

- establish and define energy standards and goals at an early design stage (during project development or preliminary planning stage)
- integrate consultants at the earliest possible date in the planning process (building physics, building service, HVAC, energy optimisation)
- define ecological products and chemical management strategy to be integrated in the procurement process from the beginning
- take additional costs due to optimised building envelope, high quality materials and additional planning and project management costs into consideration in the overall budget.

Awareness by the building owner of the additional costs and willingness to invest in a “green image” for a higher quality, better work environment and decreased energy costs are crucial for a successful implementation.

Barriers effectively addressed:

- The defined ecological standards were successfully implemented in the procurement process (only selected building materials defined beforehand were chosen etc)
- Survey report on pollutants analysis was done before implementing energy measures and renovation measures were defined according to standards (klima:aktiv and GreenBuilding)
- National funding was successfully applied for, to cover the cost of thermal renovation measures

² According to the Energy Performance Certificate

Environmental Impact

Heating demand before:
102 kWh/(m²a)

After renovation:
50 kWh/(m²a)

Waste to landfill:
Approx 100-120 tons

Water consumption:
Savings are projected based on water saving fittings; separate water meters in all units of use; water-saving toilets (2-volume flushing 3/6l / / Start / Stop button, flush volume 6 l) and optimised hand wash basins - (up to 6l)

Final primary energy demand:
240 kWh/a

Final energy demand:²
Before: 189,63 kWh/(m²a)
After: 111,89 kWh/(m²a)

Mistakes made

- Waste management and disposal of construction material on site could have been transferred to a specialised company (additional specifications in tender would be necessary)
- The tools applied did not fully consider the cost implications of the materials identified – but instead focused on their market availability
- As the building is currently under construction it is still an ongoing learning process and further conclusions can be drawn after completion.

Key Contacts

Ing. Klemens EICHER
AUCON REAL ESTATE GROUP
Phone: +43 – 1-/ 878 20
E-mail: eicher@aucon.at

DI (FH) DI Sarah RICHTER
ATELIER HAYDE ARCHITEKTEN Ziviltechniker
GesmbH
Phone: +43-1-/ 89977 ext. 55
E-mail: 467@hayde.at

References

All information was provided by Hayde Architekten
and AUCON Development GmbH.

Date Written: February 2011

Organisations Involved

Building owner: ÖGB (ÖGB-Objektgesellschaft) Biberstrasse 5 Liegenschaftsverwaltungs GmbH, Johann-Böhm-Platz 2, 1020 Wien

Developer: AUCON DEVELOPMENT GMBH, Lainzer Straße 16/1, 1130 Wien, Tel.: (0043-1-) 878 20
<http://www.aucon.at/aucon/development>

Architecture: Atelier Hayde Architekten, Storchengasse 1, 1150 Wien, Tel.: (0043-1-) 89977 – 0
<http://www.hayde.at>

Building services (HVACR): Unitplan Haustechnikplanungsges.mbH, Storchengasse 1, 1150 Wien, Tel.: (0043-1-) 89 28 334 <http://www.unitplan.at>

Construction physics: DSP Dorr – Schober & Partner ZT-GmbH, Ingenieurleistungen im Bauwesen, Linke Wienzeile 10/3, 1060 Wien, Tel.: (0043-1-) 587 61 31 0 <http://www.dsp-zt.at>

Chemical management for building materials: bauXund Forschung und Beratung GmbH, Ungargasse 64-66/Stiege 4/Top 202, A-1030 Wien, Tel: +43/1/36070-841 <http://www.bauxund.at/index.php?id=81>

Links to Tools

Klima:aktiv Program:

<http://www.klimaaktiv.at/article/archi-ve/29292>

Green Building Program:

<http://www.eu-greenbuilding.org>

Baubook list of ecological building materials:

www.baubook.at

ÖGNB Online Declaration:

<https://www.oegnb.net/doku.htm>

ÖkoKauf Wien:

www.wien.gv.at/umweltschutz/oeko-kauf

Ö.B.U.S

<http://www.bauxund.at/451>

The SCI-Network is being co-financed by the European Commission's CIP programme under the Lead Market Initiative for a period of 36 months.



Disclaimer: The sole responsibility for the content of this document lies with the author. It does not necessarily reflect the opinion of the European Union. The European Commission is not responsible for any use that may be made of the information contained herein.