Evaluation ENERBUILD-Tool – existing buildings

EWZ Zermatt

[Pictures from Lauber IWISA AG]

1 Basic information about the building

Name of the building	Verwaltungsgebäude EWZ Zermatt
Address of the building	Metzggasse 44, CH-3920 Zermatt
Owner/investor	Elektrizitätswerk Zermatt AG (Electric Power Company)
Year of construction	2004-2005
Building type	New administration building with school/ class rooms at 1‘631m a.s.l.
Building method	Massive construction with wooden cladding
Number of buildings	1
Number of levels above earth	5
Number of levels underground	-
Kind of the public use	Administrative and school building
Effective area for public use in m ² (net)	1’852 m^2
Additional private uses	-
Effective area for private use in m ² (net)	-
Total effective area in m ²	1’852 m^2
Source of energy for heating	Electrical heat pump with air ventilation recovery system with additional solar collectors
Heating system	As before; additional PV elements contribute to the coverage of the power consumption
Water heating system	
Date of the building evaluation	2010/2011

2 Execution of the building evaluation with the ENERBBUILD tool

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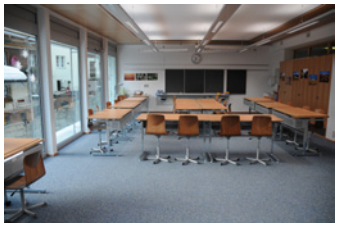
Temperature for thermal comfort in summertime: 25°C

Local limits for heating demand: in Switzerland, the local limit for the heating demand is determined by the building's location (mean annual temperature), the building surface-to-heated floor area ratio, and its use. Also the limit differs according to the energy standard. Since the treaded floor area is calculated differently and the basic data is also taken into account differently, the values cannot be directly compared to the values of the calculation via PHPP. (The calculation according to Minergie(-P) standard usually achieve lower values (refer to: Zentrum für Energie und Nachhaltigkeit im Bauwesen. Minergie und Passivhaus: Zwei Gebäudestandards im Vergleich – Schlussbericht. 2002. Page 6)
The limits for this administration building are:
New building, administration: 60 kWh/m^{2}a (according to SIA 380/1:2001,converted from 217 MJ/m^2)

3 Results

Nr.		Title	Must criteria (M)	max. points	**evaluated points**
A		Quality of location and facilities		max. 100	**62**
A	1	Access to public transport network		50	**12**
A	2	Ecological quality of site		50	**50**
B		Process and planning quality		max. 200	**106**
B	1	Decision making and determination of goals		25	**16**
B	2	Formulation of verifiable objectives for energetic and ecological measures	M	20	**20**
B	3	Standardized calculation of the economic efficiency	M	40	**0**
B	4	Product-management - Use of low-emission products		60	**0**
B	5	Planning support for energetic optimization		60	**50**
B	6	Information for users		25	**20**
C		Energy & Utilities (Passive house)		max. 350	**350**
C	1	Specific heating demand (PHPP)	M	100	**76**
C	2	Specific cooling demand (PHPP)	M	100	**100**
C	3	Primary energy demand (PHPP)	M	125	**125**
C	4	CO2-emissions (PHPP)		50	**50**
D		Health and Comfort		max. 250	**65**
D	1	Thermal comfort in summer		150	**65**
D	2	Ventilation - non energetic aspects		50	**n/a**
D	3	Daylight optimized (+ lighting optimized)		50	**n/a**
E		Building materials and construction		max. 200	**0**
E	1	$OI3_{TGH-lc}$ ecological index of the thermal building envelope (respectively OI3 of the total mass of the building)		200	**0**
Sum				max. 1000	**583**



[Pictures from Lauber IWISA AG]

4 Conclusions from the building evaluation with the ENERBUILD-Tool

a) Generally

Retrieving the required information was quite difficult. Different sources had to be requested, reviewed and compared. If further tools are needed as part of the ENERBUILD-Tool evaluation (particularly PHPP and the OI3 calculator), the corresponding data for those tools has to be gathered, determined via auxiliary calculations, or estimated if not available.

b) About the planning process

The information about the planning process of the building, further data concerning the location, health and comfort was requested from architects/ planners of the building using a questionnaire. If available, they kindly provided the relevant information, so the values could be implemented into the ENERBUILD-Tool.

c) About the building itself

Since not all data, which the PHPP calculation would need, could be retrieved, there might be deviations. Also, the Swiss Minergie-P standard consults other floor areas (heated gross floor area) and calculates the demands differently. Thus, a comparison between the results of PHPP and Minergie-P cannot be taken to draw conclusions from. Since the PHPP only accounts to about one third of the possible points of whole ENERBUILD-Tool, those deviations were considered to be insignificant. Assigning e.g. the value of of “C1 - Specific heating demand”, the target value of 15 kWh/m^{2}a is based on PHPP calculation, while the initial value (local limit for heating demand) is based on other national calculation methods (SIA 380/1). Therefore, determining the score for the ENERBUILD-Tool will most likely always be subject to deviations.

d) About the evaluation process

The relevant information about the building consists of gathered results (e.g. national/ local certification standards) and, thus, calculated values, which depend on their calculation method. This means they

cannot be transferred directly into the ENERBUILD-Tool. Tracing them back to their origin to finally use them for PHPP and OI3-Index calculations, which themselves are part of the ENERBUILD-Tool, is quite time-consuming.
Also, the evaluation relies on the help of planners and architects, who need to provide further information which was not relevant for the local certification process (e.g. the “Ecological quality of the site”). If data is missing, there is little room for estimates.

5 Suggestions for improvement of the ENERBUILD-Tool

There could be an option to adjust the maximum score if not all criteria could be evaluated, so that with a potential maximum “800 points” and achieved “600 points”, the overall achievement would still be 75%.

Furthermore, e.g. for “D1 - Thermal comfort in summer” the maximum score cannot be reached without dynamic calculation. Thus, maxing out the potential score, another more complex tool would have to come into consideration. This seems not to be very user friendly, comparing the cost-benefit ratio.

Another suggestion is to clarify the distribution of the score for each portion of the ENERBUILD-Tool. The descriptions how to distribute the points of the “Prescription ENERBUILD-Tool Criteria” are diverse: one uses a formula, while another one has to be interpolated, and a third one needs another complex tool etc. Also “D2 – Ventilation – non energetic aspects” two times lists the same criteria for sound imission measurements while assigning different scores.

Providing a list and overview of the required (sub) tools to convert basic data/ information into scores for the ENERBUILD-Tool would be helpful as a checklist for involved institutions or planners/ architects etc.

The “E1 – $OI3_{THG\text{-}lc}$ ecological index…” uses contradictory indices. All of the following indices are mentioned: $OI3_{TGH\text{-}lc}$, $OI3_{TGH\text{-}BGF}$, $OI3_{TGH\text{-}BGF\ WG\ Ref.}$ → there should be clarification. Maybe also the possibility of (just) calculating the surfaces and their specific OI3 of the construction *without* another tool would help to lighten the process. If Ecosoft is used, the OI3 index for “construction & maintenance” could also be an interesting addition to the broad approach of the ENERBUILD-Tool.

Detailed evaluation of criteria

A Quality of location and facilities

A 1 Access to public transport network

The analysis of the public transport network shows one bus station with lines leaving in two directions within the given radius of 300 m. Two electric bus lines operate within the area of the community, while each of them takes different routes to its destinations. Due to seasonal tourism and traffic, the dates were taken from the summer schedules (valid May, 1st – December, 11th 2010). Only one of the lines could be considered according to the evaluation system. [Two railway stations would be found within 700 m distance.]

[www.google.com/maps; distances shown: 300m, 500m]

Line Winkelmatten to Matterhorn glacier paradise, distance 300 m, < 1 departure/ hour	6
Line Winkelmatten to Spiss, distance 300 m, < 1 departure/ hour	6

A1 Access to public transport network	(max. 50 points)	**12**

A 2 Ecological value of land used for construction

Before construction, the function of the site was buildings, infrastructure, streets, or rubble (“Code a1 – area with zero ecological value”). Thus, the pre development ecological value of the site was calculated “1.0”, resulting in the maximum performance score of “5.0” using the “Land ecological value calculator”.

A 2 Ecological value of land used for construction	(max. 50 points)	**50**

B Process and planning quality

B 1 Decision making and determination of goals

A documentation of the decision making process is existing		(max. 10)	10
Variants were not considered and evaluated		(max. 5)	-
The “0-variant” was not considered		(max. 5)	-
A documentation of the evaluation scheme of the variants is existing		(max. 4)	4
It contains:	Urban planning	(max. 2)	-
	Access to public transport	(max. 2)	-
	Use of land area and ground quality	(max. 2)	-
	Energy efficiency	(max. 2)	2
	Ecological use of materials	(max. 2)	-

B 1 Decision making and determination of goals	(max. 25 points)	**16**

B 2 Formulation of verifiable objectives for energetic and ecological measures

- A space allocation plan, including the determination of values concerning room size, use, temperature, and ventilation rates was defined for the whole building
- Energy and energy efficiency goals were set according to the Swiss Minergie-P (passive house) standard. The planning was certified by the Minergie-P association. Among others, the goals included the specific heating demand, the specific cooling demand, the specific total primary energy consumption, and the air tightness.
- No ecological goals were set

B 2 Formulation of verifiable objectives for energetic and ecological measures	(max. 20 points)	**20**

B 3 Standardized calculation of the economic efficiency

No life cycle cost or economic efficiency was calculated.

B 3 Standardized calculation of the economic efficiency	(max. 40 points)	**0**

B 4 Product-management – Use of low-emission products

None of the aspects required by the ENERBUILD-Tool have been met.

B 4 Product-management – Use of low-emission products	(max. 60 points)	**0**

B 5 Planning support for energetic optimization

A space allocation plan, including the determination of values concerning room size, type of use, time period of use, intensity of use, and temperature was defined	(max. 5)	5
Air ventilation rates were determined separately for each room according to hygienic needs	(max. 5)	5
The internal thermal loads were determined	(max. 5)	5
Thermal bridges were considered (using a default value of 0.03 W/m^{2}K or a detailed analysis)	(max. 5)	5
Energy aspects and requirements were described at the call for tenders	(max. 5)	5
Offers were controlled to conformity with the call for tenders (regarding energy aspects)	(max. 5)	5
The site manager was supported by on-site meetings on energy aspects	(max. 5)	-
A blower-door test was conducted and recorded in writing	(max. 5)	5
The initial measurement of the ventilation system was conducted and recorded in writing	(max. 5)	5
The heating system was hydraulically adjusted and recorded in writing	(max. 5)	5
Upon completion of the building and after the blower-door test the energy demand calculation will be updated	(max. 5)	-
Upon completion of the building, an independent evaluation of the energy demand calculation was conducted	(max. 5)	5

B 5 Planning support for energetic optimization	(max. 60 points)	**50**

B 6 Information for users

The users were informed and given a handbook that covers space air temperature (adjustment of heating/ cooling), mechanical ventilation and window ventilation, glare and sun blinds, general lighting and localized lighting. It does not cover the energy efficient use of appliances and power consumers (e.g. computers).

B 6 Information for users	(max. 25 points)	**20**

C Energy & Utilities

Since not all data, which would be needed for an absolute concluding PHPP calculation could be retrieved, the values given must not be equated with an official Passive House (PHPP) certification!

C 1 Specific heating demand (PHPP)

Local limits for heating demand: in Switzerland, the local limit for the heating demand is determined by the building's location (mean annual temperature), the building surface-to-heated floor area ratio, and its use. Also the limit differs according to the energy standard. Since the treaded floor area is calculated differently and the basic data is also taken into account differently, the values cannot be directly compared to the values of the calculation with PHPP. Still, due to lack of other limits, this value has been taken as base for the determination of the ENERBUILD-Tool points.

The limits for this administration building are:

New building, administration:	60 kWh/m^{2}a (according to SIA 380/1:2001, converted from 217 MJ/m^2)
For comparison the following limits are also given:	
Minergie (low energy) standard, administration:	40 kWh/m^{2}a (according to SIA 380/1:2009)
Minergie-P (passive house) standard, administration:	25 kWh/m^{2}a (according to SIA 380/1:2009)
Specific heating demand Minergie-P:	s25 kWh/m^{2}a (calculated according to SIA 380/1:2001)

Specific heating demand PHPP: **27 kWh/m^{2}a$_{EBF}$** (calculated with PHPP)

C 1 Specific heating demand (PHPP)	(max. 100 points)	**76**

C 2 Specific cooling demand (PHPP)

The building was built with its north facing backside close to a vertical rock surface. So the gap space is used to cool incoming air during summer time.

Specific cooling demand: **0 kWh/m^2$_{EBF}$a**

C 2 Specific cooling demand (PHPP)	(max. 100 points)	**100**

C 3 Primary energy demand (PHPP)

Including warm water, heating, cooling, auxiliary power and balance power

Primary energy demand: **110 kWh/m^2$_{EBF}$a**

C 3 Primary energy demand (PHPP)	(max. 125 points)	**125**

C 4 CO2-emissions (PHPP)

CO2-emissions: **28 kg/m$^2_{EBF}$a**

C 4 CO2-emissions (PHPP)	(max. 50 points)	**50**

D Health & Comfort

D 1 Thermal comfort in summer

Relation of opaque surfaces (73%) to transparent surfaces (27%) of the façade.
Since the portion of the transparent surfaces is less than 35%, overheating was analysed with PHPP – temperatures of more than 26°C must not occur more than 5% of the time.

The result of the overheating frequency is: 0%

D 1 Thermal comfort in summer	(max. 150 points)	**65**

D 2 Ventilation – non energetic aspects

Neither prognosis nor measurements on sound immission were conducted.

D 2 Ventilation – non energetic aspects	(max. 50 points)	**n/a**

D 3 Daylight optimized (+ lighting optimized)

The mean daylight factor was not determined, but the lighting is daylight controlled by sensors.

Daylight optimized (+ lighting optimized)	(max. 50 points)	**n/a**

E Building materials and construction

E 1 $OI3_{TGH-lc}$ ecological index of the thermal building envelope (respectively OI3 of the total mass of the building)

Using Ecosoft, the OI3-index was calculated. No further adjustments according to the life span of materials have been done.

$OI3_{TGH-BGFh}$ = 363 [$OI3_{TGH-lc}$ = 214]

points = 2 * (0.0007 * $OI3_{TGH-BGFh}^{2}$ – 0.623 * $OI3_{TGH-BGFh}$ + 123)

Since more than 295 points have been calculated, the OI3-Index results in 0 points.

E 1 OI3 ecological index of the thermal building envelope	(max. 200 points)	**0**