

ENERGY EFFICIENCY OF MOUNTAIN HUTS



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Bern, 30.08.2013

Alpine 'Passivhaus' buildings

Landmark projects in the Alpine zone take the discussion to the efficiency of building huts in Europe

1. Dobratsch Gipfelhaus OeAV
2. Schiestelhaus ÖTK
3. New Monte-Rosa-Hut SAC
4. Refuge Dôme du Gôuter CAF



‘Passive‘ does not necessarily mean efficient!

- the question of efficiency is not explicitly incorporated in the principle of the ‘Passivhaus‘
- a ‘Passivhaus‘ requires more building components and systems.
- The question whether the material and technical effort pay off in relation to the actual energy saving has not been concluded up to today.



Can minimising mean more efficiency?

- is reduction more efficient than high tech ?
- is a low tech hut more efficient than a 'passive' one ?
- is it necessary to insulate a summer hut?
- does a building which remains unused for 250 days need to be a high tech building tailored to perform at -25° C?



Questions without straight forward answers!

- no specific calculation method exists today
- a tool would need to cover specific areas like: electricity generation, sewage treatment, transport, supplies etc.)
- partial use of huts is very common
- climatic data very difficult (e.g. heating periods)



Project brief EEH

- generation of a calculation tool specific to huts
- conceptualise specific set of requirements
- test calculation tool in 4 case studies, i.e. 4 huts
- user group: experts (architects / energy consultants, engineers)



Question asked by EEH

- Energy usage in operation
- Efforts in relation to supplies
- Efforts in relation to technology
- Efforts in relation to creation / dismantling
- CO₂–assessment comparing usage and built volume
- Evaluating component age (attenuating CO₂ balance)



Layers of assessment EEH

- Location data)
- Context)
- Building data) incl. CO2 assessment
- Technical data) embodied energy
- Operation data)
- Usage data)



Choice of criteria for case studies

Choice of 4 huts based on following criteria

1. Different types (large to small)
2. Well known and unknown (by assessors)
3. Conversion, extension and at least 1 new built
4. On varying heights, levels of access and use
5. Different building construction methods
6. Covering all types of energy generation

Choice of case studies

1. Olpererhütte DAV

(site visit Sep 2012)

Section:	DAV Sektion Neumarkt
Built in:	2007 (replacement)
Height:	2153m a.s.l.
Access / climb:	no vehical access / climb 2.0h
Supplies:	by helicopter and by foot (2.0h)
Energy supply:	comb. heat & power plant, PV cells
Sewage treatment:	membrane filter sewage plant
Bed spaces:	65 (beds and bunks)



Choice of case studies

2. Solsteinhaus OeAV (site visit Sep 2012)

Section:	OeAV Sektion Innsbruck
Built in:	2008 (most recent extension)
Height:	1805m a.s.l.
Access / climb:	no vehical access / climb 2.0h
Supplies:	by cable car (not com.) and foot (1.0h)
Energy supply:	comb. heat & power plant, PV cells
Sewage treatment:	Biological sewage plant (SBR)
Bed spaces:	108 (beds and bunks)



Choice of case studies

3. Wildstrubelhütte SAC (site visit July 2012)

Section:	SAC Sektionen Kaiseregg / Wildhorn
Built in:	1928 (building), 2002 (most recent extension)
Height:	2793m a.s.l.
Access / climb:	no vehical access / climb (3.0h)
Supplies:	by cable car (not commercially)
Energy supply:	Electricity grid / ventilation (Minergie Standard)
Sewage treatment:	TC plant Ecosphère
Bed spaces:	70 (bunks)



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Choice of case studies

4. Rifugio Quintino Sella (site visit July 2013)

Section:	CAI Sektion Saluzzo
Built in:	1905 (Building), 1991 (most recent extension)
Height:	2640m a.s.l.
Access / climb:	no vehical access / climb (2.0h)
Supplies :	by helicopter and by foot (2.0h)
Energy supply:	power plant micro water power station
Sewage treatment:	3-chamber-sedation
Bed spaces:	90 (beds and bunks)



Project Structure EEH

Project members	=> Members of Clubs CAA
Project lead	=> P. Büchel, BN-Arch
Structure Assessment	=> P. Büchel, BN-Arch
Data collection refuges	=> CAA, BN-Arch, KIT
Data collection CO2	=> Anna Kühlen, KIT
Integration into system	=> Daniel Dahinden, BN-Arch
Programming/Software	=> Daniel Dahinden



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Status of project EEH

1. Project start April 2011
2. Data matrix (Dummy) (06.11 – 03.12)
3. Decision cooperation KIT (03.12)
4. Assessment & calculation of programme basis (03. – 09.12)
6. Data collection Wildstrubel, Solstein & Olperer (08. – 09.12)
7. Reworking assessment / questionnaire (10. – 12.12)
8. Generation of CO₂e values and formulas (12.12 – 10.13)
9. Calculation tool running in parts (since 06.13)
10. Data collection Rif. Quinttino Sella (08.13)
11. 2nd reworking assessment / questionnaire (08. – 09.13)

Following tasks EEH

- 2nd assessment of question – in progress
- Adjustments to matrix based on last data collection - in progress
- Critical assessment of building components based on data KIT – in progress
- Extended programming of matrix - in progress
- Support information for using matrix follows from 10.13 onwards

Überwachungs-Komponenten

Überwachungs-Komponente	Überwachung	Überwachung
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...
...

Tagesplan

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Winterraum / Schürfen

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Schürfen

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Process of using the tool

1. Collection of data on site
2. Collection of basic data from the local section or main club
3. Assessment mass balance of building (m², m³, EBF, etc.) based on drawings and data collection
3. Collection and integration of data from manuals, archives, etc.
4. Examination of key data
5. Start calculation

It is generally possible to test options, however a new project needs to be created for each option.

Documents

- Questionnaire for site visit (Word file or printed copy)
- Assessment matrix (Excel)
- Support & FAQs (.pdf)

 Club Arc Alpin
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Bewirtschaftungsdaten

Übernachtungen Kundenspezifisch

Übernachtungen pro Jahr	Durchschnitt Übernachtungen aus 3 Jahren	
	Sommer	Winter
Total Übernachtungen		
Anzahl Personen	Pers.	Pers.
Wanderer	%	%
Mountainbiker	%	%
Alpinisten	%	%
Kletterer	%	%
Skitourenfahrer	%	%
Schneeschuhgänger	%	%
Pistenfahrer	%	%
Total pro Saison	100 %	100 %

Tagesgäste

Tagesgäste pro Jahr	Durchschnitt 3 Jahren	
	Sommer	Winter
Total Übernachtungen		
Anzahl Personen	Pers.	Pers.
Wanderer	%	%
Mountainbiker	%	%
Alpinisten	%	%
Kletterer	%	%
Skitourenfahrer	%	%
Schneeschuhgänger	%	%
Pistenfahrer	%	%
Total pro Saison	100 %	100 %

Gästerfrequenz und Personaltage pro Monat

Monat	Durchschnitt Zahlen aus 3 Jahren			
	Anzahl Betriebs-tage	Übernachtungen	Tagesgäste	Personal
Januar				
Februar				
März				
April				
Mai				
Juni				
Juli				
August				
September				
Oktober				
November				
Dezember				
Total pro Saison				

Übernachtungspreise

Landeswährung Euro Schweizer Franken

Durchschnittlicher Übernachtungspreis Mitglied Nichtmitglied

Grunddaten Hütte

Hüttenstandort Einheit/Auswahl

Datum:

Land:

Bundesland / Kanton:

Region:

Gemeinde:

Hütte:

Sektion:

Hüttenchef / wirt:

Hüttenwart:

Begutachtung durch:

Koordinaten:

Höhe m.ü.M.:

Baujahr Hütte:

Letzte Erweiterung:

Eigenumsverhältnis:

Versicherungssumme: Auswahl

Letzte Anpassung: €/CHF

Beschreibung

Stützflüsse (Erfassung mittels Sonnenkompass)

Ausrichtung (in Grad mit Kompass)

Freier Horizont (in Grad ab Horizont gegen Süden)

Beschatteter Bereich unter 10 m Ostanz

Besonders:

Wind

Staubschichtung

Richtung

Geschw. durchs.

Nutzare Geschw.

Staubwindausbreitung

Richtung

Geschw. durchs.

Nutzare Geschw.

Besonders:

Lage Hütte

Hüttenlage

Wind exponiert

Sonneneponiert

Nähe Gletscher (< 100m)

Nähe kleiner See (< 50m)

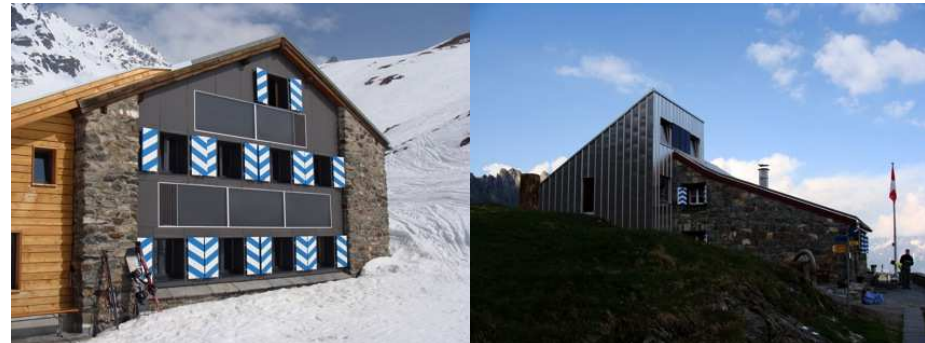
Nähe grosser See (< 100m)

Ausrichtung Hütte

Besonders:

First results from tests of segments

- definition for climatic location (HGT)
incl. definition of days of operation (adjustments ongoing)
- Generally speaking timber construction appears more efficient than masonry (CO2 savings wood has a clearly beneficial effect)



First results from tests of segments

- Threshold of efficiency of thermal insulation thickness not clearly defined as dependent on location and type of operation (only possible in complete version)
- Mass balance of supply buildings is relevant
- Transport system will give main indication, whereby it is still uncertain whether cable car or helicopter preferable
- Mass balance for sewage treatment is relevant



The future of huts is more efficient

The construction of mountain huts is far more complex than building in valleys and hence not directly transferable.

What might seem right when constructing in valleys might not be in the high mountains – and reverse.

Efficiency needs to be defined based on the specific location rather than by a generic method of calculation for heating/energy requirements (heating, etc).



Things might be more efficient than they seem



Our special thanks for great support of the energy project to:

Anna Kühlen

Georg Unterberger

Robert Kolbitsch

Georg Simeoni

und the whole team of EEH

Thank you for your attention