CELLULAR GLASS ENGINEERING AG / SA

OEKO - PRIORITY®

THE QUALITY LABEL FOR THE OPAQUE BUILDING ENVELOPE WITH

A MINIMISED OVERALL ENERGY CONSUMPTION

FOR AN ECOLOGICALLY OPTIMISED THERMAL BEHAVIOUR!

THE LABEL

The protected quality label OEKO - PRIORITY® is based on the following necessities and objectives:

• The optimal thermal behaviour for a building envelope generally forms an individual factor. This refers not only to economical but also to ecological aspects. Next to function and climate it is influenced by civil engineering and construction parameters as well as the client´s ideas about the design.

• The ecological optimum corresponds with a minimal energy consumption. It derives from the grey energy for the optimal insulation layers as well as from the resulting indoor heat loss during the total service life.

• The eco -optimal U - value of the building is calculated and among other things based on the favourable distribution of the different thicknesses of insulation according to structural members. The participation of the client in determining the relevant factors is guaranteed within a certain range (see below).

THE PROCEDURE

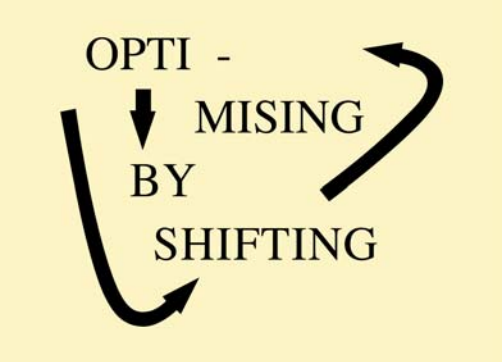
The association of the project with the ecological quality label OEKO - PRIORITY® must be provable. The proof automatically derives from a sequence of planning steps:

• Defining the construction and design of the building envelope.
• Calculating the grey energy requirement for the needed insulation layers referring to different necessities and objectives.
• Eco - optimal distribution of the insulation thicknesses within the different structural members concerning the relevant U - value of the building envelope.

Cellular Glass Engineering AG/SA offers cost-effective and partly gratis tools and services for calculations and documentations.

The result of the optimisation is not influenced by further consumption components (ventilation loss, coefficient of performance loss, usable energy gains) and it is independent of any normative consumption limits. It is also independent of building material prices and energy prices.

The principle of the eco-optimal thermal behaviour for the building envelope can be used for new building projects as well as for renovations. The methodical process automatically leads to rather moderate insulation thicknesses in case of renovation, which finally is the interest of economically reasonable refurbishment solutions.



Usually a foamglas sandwich-system is used for the constructive application of the OEKO - PRIORITY® label. Selected complementary insulation materials on mineral base or high quality plastics are added in certain cases. The constructive solution is based on standard implementation recommendations of the manufacturer or within the regulations. The application of the construction principle is generally seen as the standard case.

The responsible contractor can transfer the result of the optimisation to the normal <official thermal insulation calculation>. The documents of the optimisation form an optional addition for the building permit process. An according dimensioning document is required for claiming the label OEKO PRIORITY®.

INFLUENCE COEFFICIENTS, DETERMINATIONS AND TOLERANCES

The energetic-ecological optimum for the building envelope is determined by the following influence coefficients:

- **Conditions defined by climate, location and function.**
- **Determinations referring to the planning horizon (service life of the building) as well as the service life of its components (prognosis), including the estimated demolition costs.**
- **Influence of the existing U_0 - value of the building envelope, not including the insulation.**
- **Furthermore the optimised building envelope is influenced by the (time-dependent) percentage of grey energy in the specific insulation and by the repetitive loss of heating energy through the building envelope.**

EXAMPLE OF A NEW BUILDING

The shown example of a new building envelope according to specifications has an ecologically optimum U-value of approx. 0.179 W/m²K , which results from the correlation of arbitrary $U_{required}$ -values (see table on the right) and their corresponding discounted grey energy sums (S') for minimised insulation volumes.

The resulting optimum $U_{result.} \sim 0.179$ W/m²K is transferred to a special <shift program> and forms the favourable distribution of the insulation volume according to the building components (see table below):

roof	terrace	exterior walls	underground walls	floor against ground	S'
198 mm	195 mm	180 mm	216 mm	120 mm	29556 1

EXAMPLE OF A RENOVATION

Renovations with ecological objectives can be realised according to the same principle as opaque building envelopes. Determined by the often lower U_0 - value the ecological insulation optimum needs less extra insulation than a new building. The existing envelope, as far as it remains, becomes the new "building shell without insulation".

Certain (standard) settings are proposed in a separate input data sheet. The client can define own specifications for the calculation considering "his" ecological point of view within a certain range. This guarantees that the individual ecological position is considered - also in case of restrictions defined by the client. The tolerance range for claiming the quality label OEKO - PRIORITY® is limited to a deviation of ±10% from the optimum value $U_{result.}$.

	m²	U_0 [W/m²K]	d_{opt} [mm] für U_{soll} = ... 0.125	0.150	0.175	0.225
roof	425	3.0	293	278	209	157
terrace	75	2.5	290	275	206	155
exterior walls	950	1.1	278	202	183	133
underground walls	230	[1)]0.86	336	243	220	160
floor against ground	375	[1)]0.33	201	190	121	75
[2)] grey energy sum S'			45477	36892	30373	22012

[1)] underground level 3.0 m, floorplan 25 x 15 m, EN ISO 13370
[2)] heating oil - equivalent [l] for discounted grey energy sum (S')

- grey energy - content insulation materials generally 2000 MJ/m³
- lambda value of the insulation materials generally 0.040 W/mK
- reduction factor temperature gradient (b) generally 1.0
- service life according to building components: above ground 40 years
  Under ground 75 years
- demolition compared to new construction (f) generally 0.5
- planning horizon for the building 75 years
- discounting percentage for grey energy 2.5% (heating oil - equivalent)
- discounting percentage for heating energy 0.0% (heating oil - equivalent)
- degree days p.a. 3500 (Kd)

If the predefined U_0 - values "above ground" are set to U ~ 1.10 W/m²K each for the above demonstrated example of a renovation building, the optimum value for the renovation building envelope amounts $U_{result.} \sim 0.191$ W/m²K (not including windows and with the special condition that extra underground insulation and indoor insulation are not possible)!
According to this, the optimised thicknesses of (additional) insulation are depending on the structural members (see table below):

roof	terrace	exterior walls	underground walls	floor against ground	S'
173 mm	173 mm	173 mm	0 mm	0 mm	22243 1

LIMITATIONS OF OPTIMISATION AND FURTHER SPECIAL CASES

The concept of a building envelope is often determined by certain constraints or the compliance of a certain (at most approved) consumption of heating energy. Therefore the resulting U-value with an appropriate loss of energy during the heating period is accepted after determining the thickness of insulation.

The optimisation of the insulation thickness (for same requirement of heating energy) also creates a certain "gratis" potential for savings by reducing the use of material as well as the energy needed for the production.

A calculation example:

The opaque building envelope according to the table data (below) has a mean U-value of 0.238 W/m²K and a real grey energy content of S ~ 15739 l (heating oil equivalent in liters) for the intended insulation materials.

	m^2	U_0 [W/m²K]	d_{vorh} [mm]	U_{vorh} [W/m²K]	S [l]
roof	425	3.0	120	0.300	2833
terrace	75	2.5	80	0.416	333
exterior walls	950	1.1	200	0.169	10555
underground walls	230	[1)]0.86	60	0.375	767
floor against ground	375	[1)]0.33	60	0.220	1250
				∅ ~ 0.238	Σ ~ 15739

After <shifting> the insulation volume (table top right), a reduction of the grey energy demand to 89% of the basic situation and a saving of 11% can be achieved (without any additional costs or changes in the choice of materials)!

	m^2	U_0 [W/m²K]	$d_{optimal}$ [mm]	$U_{optimal}$ [W/m²K]	S [l]
roof	425	3.0	138	0.264	3258
terrace	75	2.5	135	0.265	563
exterior walls	950	1.1	127	0.245	6703
underground walls	230	[1)]0.86	152	0.201	1942
floor against ground	375	[1)]0.33	74	0.205	1542
				∅ ~ 0.238	Σ ~ 13930

In a similar manner gratis savings can be realised for insulation concepts with the accumulated grey energy - volume S). An according reduction of the mean U - value of the building envelope can be achieved by optimising the insulation thickness.

Finally also the "special case" should be mentioned, in which the client does not choose an ecologically motivated solution because of severe reasons, but a solution based only on economical (at most normative) reasons.

As far as the involved parties of a project are able to define a unit price for insulation materials as well as the price of heating energy including the periodical increase, the (modified) concept of OEKO - PRIORITY® offers here also the optimum solution for a specific object.