

Development of a low energy house with vacuum insulation

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Abstract

The objective of Renggli AG is to create spaces with high functionality, durability and beauty, in combination with sustainability. Renggli AG produces Minergie and Minergie-P houses based on wooden constructions. With Minergie-P houses the wall thickness ($U \approx 0.1 \text{ W/m}^2\text{K}$) using conventional insulations is 500mm and more. This is considered as not attractive by many architects and clients.

The use of vacuum insulation can reduce the wall thickness by about 50%. In a project, supported by the Swiss Federal Office of Energy, Renggli AG, together with research and engineering partners, developed vacuum insulation based constructions. Those are applied in the “VIP-Box”, a pavilion of 3.0 to 5.0 meters, which is used for research and demonstration. The pavilion will finally be used as a smallest size living space.

Key words

vacuum insulation, architecture, research and development, demonstration pavilion

1 Renggli AG and its products

Renggli AG is a company with about 130 employees. We work in two departments. Sursee based is the general enterprise and Schötz based is the production plant for wood constructions. Both departments work closely together. Our aim is to create rooms with high functionality, durability and beauty, in combination with sustainability.

We only build Minergie (max. 42 kWh/m²a) and Minergie-P houses (max. 10 kWh/m²a). Our construction are always based on wood. The market at the moment is mainly Switzerland and the south of Germany.

The milestone for Renggli in the year 2006 was the realisation of the first six storey building in Switzerland completely in wood construction (“Holzhausen”). This building fulfils the targets of the Minergie standard.



Figure 1 and 2: apartment house “Holzhausen”

Seite 2 We also offer five fix-priced houses in different styles and sizes. We call them “Concept Houses”. Most of them are also available in the Minergie-P standard.



Figure 3 and 4: Concept House “Futura”

2 Why vacuum insulation for Minergie-P houses?

At the Moment we use for Minergie-P houses between 350mm and 400mm Rockwool to insulate them. That makes for the finished wall at least 500mm thickness. Many architects and clients are not satisfied with this. At first it uses a lot of space and at second it looks not very elegant.

Together with the two engineering partners “Dr. Eicher + Pauli, CH-4410 Liestal” and “Ragonesi, Strobel und Partner, CH-6003 Lucerne” we started to develop a Minergie-P wall insulated with vacuum insulation. The project is supported by the Swiss Federal Office of Energy. As vacuum insulation producer is “Variotec, D-92318 Neumarkt” also integrated in the project.

We are convinced, that there will be a small market for such houses in the future.

3 Required project specifications

First step was to create a list with the required project specifications. The list was divided in two parts:

- Part 1: Economic conditions
- Part 2: Technical conditions

In part one of the project specifications (economic conditions) we examined this points:

- Surrounding field
- Construction unit-cost
- Worth won of the area
- Examination of use and cost
- Ecology

Seite 3 In part two of the project specifications (technical conditions) we examined this points:

- Prefabrication
- Thermic protection
- Damp protection
- Noise control
- Minimum life span
- Replacement of the panels
- Static
- Fire protection

We decided to take the Renggli concept house “Futura” as comparison object. For this type of house we have many different technical calculations as a Minergie-P house. So it was relatively easy to make comparisons. All theoretical calculations based on this house, not the demonstration pavilion.

4 Research and demonstration pavilion “VIP-Box”

We decided to build the research an demonstration pavilion fully equipped in a rather high standard. That means that we needed high quality materials inside and outside. The sanitary facilities are completed in a modern way. The look of the pavilion should be futuristic.

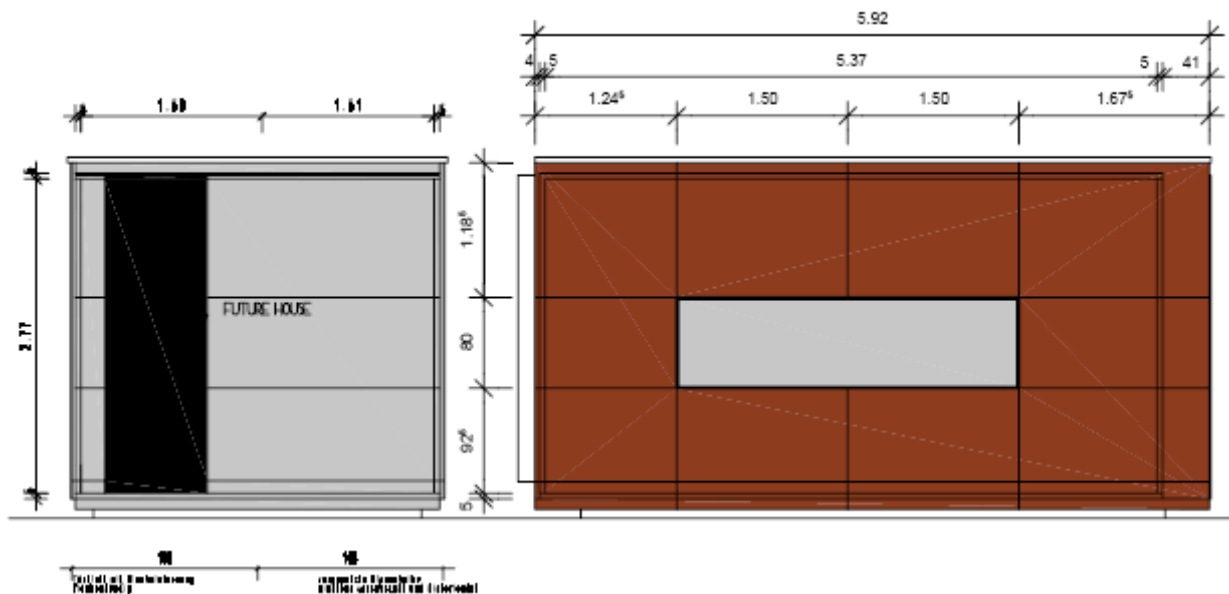


Figure 5: View of the VIP-Box Part 1

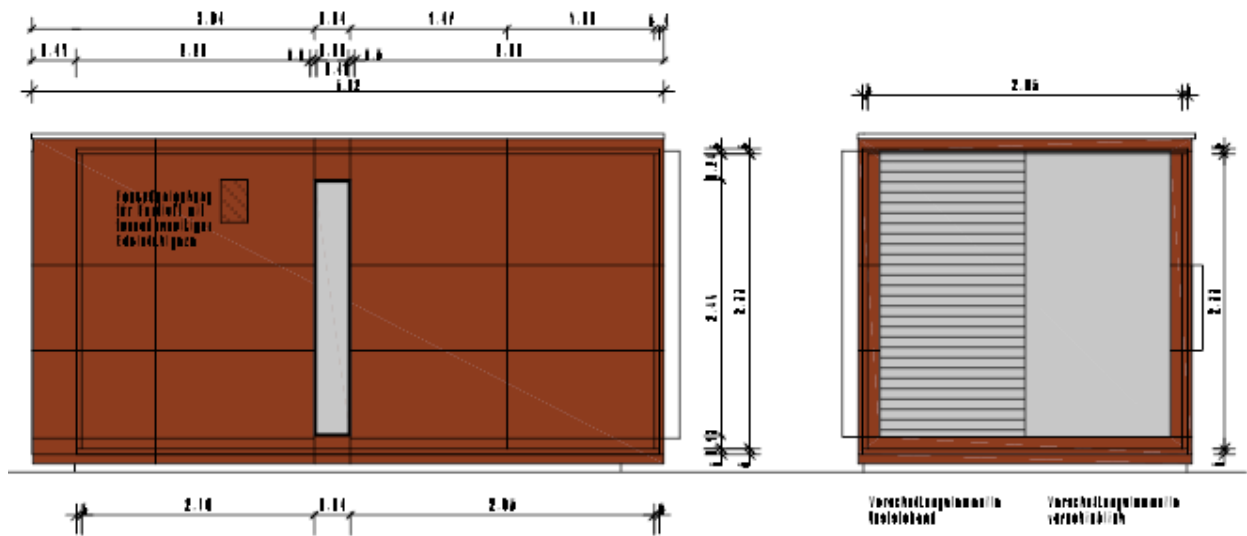


Figure 6: View of the VIP-Box Part 2

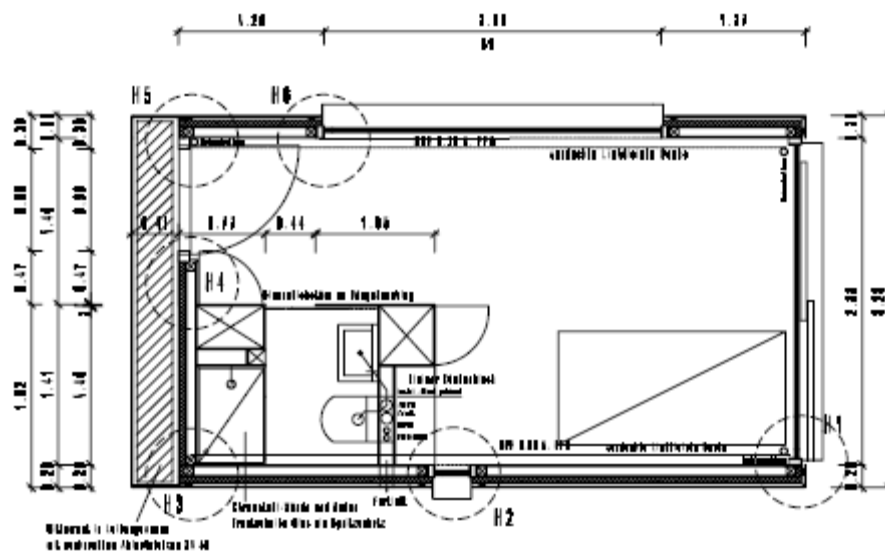


Figure 7: Ground plan of the VIP-Box

5 Measurements in the VIP Box

The research and demonstration pavilion was finished in October 2006. At the moment various different measurements are taking place:

- Damp Control in the vacuum insulation panels
- Control of the settings (pressure on the vacuum insulation panels)
- Heat transfer control
- Humidity control
- Noise control

6 The Future of the VIP-Box

The various measurements will go on for a while. At the same time we presents the VIP-Box on different occasions and exhibitions.

After this, the VIP-Box is going to be sold as a smallest size living space.

Now, our next aim is to build a single family house, for example our type "Futura" with vacuum insulation. So we can extend our knowledge and make a step in a new interesting market.

7 Partners

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