



*Dr. Wolfgang Feist with his family in front of the row house in Kranichstein. Simply building a house is stressful enough. The fact that this house would be the first-ever Passive House building, required very special commitment from the builders.*

*Photos: Peter Cook*

## ‘Don’t be talked into expensive upgrades’

### 25 Years of Passive House - Interview with Dr. Wolfgang Feist

The kids were excited – construction meant action! The grandparents were sceptical but supportive. Some experts had however published papers, stating that Passive House could never work. Wolfgang Feist was undeterred: ‘It was immediately clear that you could make a home more energy efficient’. He also knew that he didn’t want to be considered ‘exotic’ in the long-term: ‘exotics have passing value’. The Passive House pioneer has achieved both goals.

***You were actually a Passive House pioneer 25 years ago, in the early nineties you built the world's first Passive House in Darmstadt. Do you still remember the fresh spirit of optimism prevailing at the time?***

Of course I do! Those were turbulent times. And, as is generally the case, people were concerned with things other than the future of the planet. It was the time of the collapse of the so-called "real socialist" dictatorships, when energy policy was almost synonymous with nuclear

energy policy.

#### **The benefits of science**

However, there were a few people who were actively concerned with the essential question as to why we needed to use so much energy: William Shurcliff, Arthur Rosenfeld, and Amory Lovins in the USA, Harold Orr in Canada, Vagn Korsgaard and Joergen Noergard in Denmark, Bo Adamson and Arne Elmroth in Sweden – the list goes on. Most of these pioneers came from different scientific disciplines

and they were committed to disseminating the benefits of science among people.

### **What motivated you to promote the Passive House and alternative building concepts?**

Even as far back as the 1970s it was clear that the era of fossil fuels was coming to an end and that the main problem with this form of energy (which was cheap at the time) was the carbon dioxide being generated. However, during that time the focus was placed on the substitution of fossil fuels by the nuclear age. Only a few scientists, such as my friend Klaus Traube, had gone through the arduous process of correctly assessing the risks of energy from nuclear fission as well.



*For the building physicist Wolfgang Feist, it was clear that a house could be built to a higher level of energy efficiency.*

### **Getting to the root of the problem**

Viewed objectively, it was clear that another substitution strategy for fossil energy was needed. We therefore tackled the problem at its roots: we analysed what these vast amounts of energy being pumped out of the ground, the waste products of which were being released into the atmosphere after combustion processes, were actually being used for. The result was shocking: the largest single share of modern energy consumption was

being used for heating buildings, that's over one third!

### **Shocking result**

It was immediately clear to those well-versed in physics that this could be done more efficiently; it was only a question of implementation. We therefore turned to the practical issues of heating systems, heat distribution, windows, roofs and ventilation systems

### **What did your family have to say about your plans for 'alternative' construction at the time? Were they also as enthusiastic as you? Building a house is already nerve-racking enough. Taking on a pioneering project on top of that ...**

Both our children were still small and were excited about everything happening around them. My wife Witta was a dedicated participant right from the start; after all, we completed most of our learning process together.

### **Sceptic but well-disposed**

The grandparents were a bit sceptic but well-disposed towards this "nonsense" – and supported us as much as they could. That's right: we did have to go through the completely "normal" strains and stresses of a construction process. And the fact that we wanted to build it in a way that was "different" from the usual method did not make it any easier.

### **Conflicts were inevitable**

We did have some support: the architects Professor Bott, Ridder and Westermeyer went along with almost all our wishes (they only made fun of the stringently observed principles in the end). The IWU (German Institute for Housing and the Environment) permitted the associated accompanying research, which was funded by the Ministry of Economics of the State of Hesse.



*A bright and cosy interior that overlooks the garden: In the first two years more than 5,000 visitors came to the Passive House in Darmstadt. Measurements of the building are still regularly conducted today, they confirm that even after 25 years the pioneering project functions flawlessly.*

### **No wireless in those days**

We buried hundreds of sensors in the building components of the building. It was also more complicated than today as "wireless" didn't exist in those days and hundreds of cables had to be correctly wired and laid.

***You were one of four building owners who were committed to the construction of a Passive House as a private initiative. Who were the others?***

A construction site was allotted by the city of Darmstadt and there was a long list of applicants for the long lease plots which were to be allocated there. Those who met the city's criteria could apply for these building plots: they had to be families with a restricted income.

### **Difficult search for homeowners**

Even so, the search for joint building owners initially proved to be difficult. It was only when we finally gathered the courage to build ourselves that inhibitions were overcome and three families came forth who were ready to take part in this project. All of them had completely different professions and we didn't know any of them previously.

***How did you manage to reach an agreement regarding the building every time? Or were there fierce disputes during the construction phase sometimes?***

Client support by "Rasch und Partner" and the architects played an important role here. They elegantly managed to steer around any obstacles. These partners were known to us from previous projects in which they had always managed to counter-balance the centrifugal forces arising during joint construction projects.

### **"We were ridiculed"**

Our first prototype building had to convince everyone of the rationality of the respective solutions, and it did so. Of course, some of these things were ridiculed (in secret as well as openly), but everyone was also curious to see whether it would work: a house that did not need any energy for heating.

***Did you simply divide the construction costs between the four families?***

For the standard version there was a dividing scale. It was possible to order "extras", such as a separate kitchen or a particular type of floor covering which was then paid for by the respective client

family. Generally speaking, the four homes are identically structured, at least with regard to their structural quality. All are of a Passive House standard, even according to the current criteria.

### Special requirements

For the additional investment costs (which were still relevant at that time) amounting to about 90 000 German Marks per housing unit, a subsidy of 50% was offered by the Ministry of Economic Affairs of the State of Hesse. In those days energy was much cheaper than today. For such a research project, the direct economic efficiency of the prototype was not a key focus.



*Even today, interest from specialists and media in the pioneer project remains high.*

### Energy was less expensive

It needed to be tested whether the concept worked. Although the reduction of costs for components was already considered during the selection of the solutions, this had to be kept for later.

It is the same with other technical developments: the first scientific pocket calculators used to cost about 2000 German Marks, but after it became clear how they functioned and that they did function, it was possible to reduce the costs drastically.

**Do the same families still live in your terraced housing complex today?**

One family rents out its housing unit. People have children and go through different phases just like everywhere else in the world.

**Do you all still get on with each other?**

As is mostly the case nowadays, the co-owners have formed a partnership based on convenience. In the pilot project an attempt was made to offer joint use where this was beneficial, e.g. of the laundry room and the drying room. This idea came from Sweden where such facilities are quite common.



*Weather permitting, the Feists enjoy the back garden - and of course, open the windows in their Passive House*

### Convenience or alliance?

To be honest, this wasn't very successful in our case, probably because our societal trends are moving in the direction of more individualisation. Today, one is more likely to go and buy an electric drill rather than borrow one from the neighbours. Such trends also have an impact on these kinds of joint building ventures.

**Your terraced housing complex is often opened to the public and even today it is still the subject of many technical investigations. What is it like to live in such an 'exhibit' and 'test object'?**

Well in the beginning it was fun – in the first two years, we had about 5000 visitors in our homes. Eventually my wife and I felt that all the tidying up and cleaning was

leading to a lot of stress, so we decided to limit it.

### **5000 visitors in two years**

The visitors did not notice the technology and measurements at all. We took care to ensure that, and we also ensured that privacy was respected. All data was anonymised.

### **Was there an archetype? In Scandinavia low energy houses were relatively common at the time...**

The Passive House stands in a tradition which has been evolving for centuries. For example, when you look at the specific values for heat loss from exterior building components, these have been gradually decreasing for more than a hundred years. They started at around 1.5 and have now reached about 0.15 (watts per square metre kelvin) with the Passive House, that's one tenth of that.

### **Scandinavian archetype**

We had been following the developments in Scandinavia and North America with great interest. In fact, in 1980 Sweden already had a building code matching the German EnEV today which is regarded as particularly 'efficient' (namely the equivalent of 7 litres heating oil per square metre and year).

We had close contact with the scientists in Sweden and in the USA. Bo Adamson, my colleague in Sweden, worked on the project with me.

### **Why was the first Passive House built in Darmstadt?**

This was due to a number of coincidences, but it was also done at the express

request of the mayor of the city at that time, Günther Metzger. The city already had a piece of land reserved for "experimental housing construction", most of which was already developed.

A research institute of the State of Hesse and the city of Darmstadt, the Institute for Housing and the Environment, was responsible for the innovative part. That's where we were working, and due to this we had contacts at the international level where these ideas were discussed.



*As with any new development, there was some friction surrounding the construction of the first Passive House building in Darmstadt. The construction management managed however to avoid the pitfalls.*

### **Unnecessary heat losses**

The Passive House is a consequent further development of the low energy house. The unnecessary heat losses through walls, roofs and windows were reduced to the extent that a heating system became completely irrelevant; the equivalent of just 1.5 litres of heating oil per square metre and year are required.



*The Director and Founder of the Passive House Institute, Dr. Wolfgang Feist, in his home office in the first-ever Passive House building in Kranichstein. The building physicist teaches Energy Efficient Building at the University of Innsbruck.*

**How did fellow experts and other building physicists react to your plans relating to the Passive House?**

Completely differently – my PhD supervisor was reserved but well-disposed and closely followed the developments. Others – whose names I will not mention here – published theoretical treatises explaining that such a concept would never function, in the same year that this terraced housing complex was taken into operation.

**How long did it take you to plan the Passive House concept in your mind and until the decision in the sense of ‘Right, we’re definitely doing this’?**

The basic idea arose from a talk with Bo Adamson that took place somewhere around 1987 in Lund/Sweden. He had just returned from a research trip from Southern China where he had been involved in the improvement of comfort in unheated houses, which he referred to as "passive houses".

**China gave the impulse**

This term is used because these buildings function as a passive system in thermal terms – and everything becomes much simpler, including the scientific analysis. We decided to strive for a research project

in order to find out whether this might also work in Europe with its much colder winters.

**Various possibilities**

We were able to set up a ‘pre-construction research project for Passive Houses’. All conceivable variants were gone through – and in theory it actually seemed to work. First of all it was of decisive importance to develop a reliable procedure with which the thermal behaviour of buildings could be depicted.

**How long did the architectural and technical planning last until the first cut of the spade and the first digger rolled along?**

The architectural planning took about the same time as was usual for that time – not quite a year, and work started in October 1990. We knew that a generally promising concept could not stray too far from the customary construction methods; "exotic" concepts were a passing phase in the building sector that was occupied by medium-sized and small companies

**‘Exotic’ concepts are a passing phase**

We therefore tried to simplify things rather than complicating them. And as far as was possible, we resorted to components that were available, such as the lime-sandstone masonry walls, the rafter roof, wooden windows...

**The components which characterise a Passive House, e.g. triple-glazed windows, were not yet available on the market then, so how did you manage?**

If we look at the example of low-e triple glazing: yes, that wasn't commercially available. I still remember the conversation I had in 1989 with Dr. Ortmanns who was the head of research at the large plate glass company Vegla at the time (Saint Gobain today). "OK – three panes with a coating on 3 and 5 – good, we'll supply them for this project".



*The pilot project, built in 1991, later received a photovoltaic system.*

**'We'll supply them'**

It wasn't always so easy and successful. For instance, we couldn't get the thermally separated spacers so quickly; it was years before the relevant industry recognised the opportunities in this field – of course we

have them now. Other times we had to make the necessary components ourselves – in the laboratory as it were.

**Making components**

This was the case e.g. for the modification of the four central ventilation units, all of which were equipped with direct current fans that were specially developed for the project (which are also taken for granted today) and a control unit for air quality

**How did the joiner react when you asked him to create windows with triple panes of glass? Was he cooperative?**

Well, he refused to accept liability – it was just like it is today with innovations. That most of the involved craftsmen did not agree with the innovations is simply a stereotypical claim.

**Refused to accept liability**

But during the course of the construction process I personally experienced how we stood on ladders together and installed the airtight sheeting in accordance with the Passive House principles which apply even today. The sheeting was applied neatly everywhere without any creases, and was only a little bit crumpled where I had been standing.

**'Crumpled where I had been standing'**

The crafts trade has a long tradition in Germany and it is a huge opportunity for this country to have so many highly competent small and medium-sized businesses on the market.

The carpentry experts in particular responded very quickly to new developments and expanded their expertise and made substantially optimised solutions available.



*There is huge interest in the Passive House Standard worldwide. Impressive projects exist even in countries such as China and Mexico. The Institute's Director Dr. Wolfgang Feist therefore regularly answers questions on the energy efficient building concept. His tip: 'Don't be talked into expensive upgrades!'*

### **What would you do differently today, with regard to the construction of your Passive House?**

Today I would orient the pitched roof slightly towards the south, because huge progress has been made in the field of photovoltaic technology. And I would obviously use the certified Passive House components which are available today, that are almost 50 % better than the solutions we constructed ourselves, for instance the windows.

#### **'I would alter the roof'**

I would simplify the ventilation system further, although the solution we used proved quite successful, and I would use heat pumps for heating. But it would definitely be a Passive House again. That has proved most successful: constantly fresh air, a permanently comfortable indoor climate, and negligible heating costs.

### **What advice would you give to private homeowners today who are interested in building a Passive House?**

What matters is the planning! A full PHPP calculation should be performed and the planning should be certified; it won't cost much, but it will ensure that everything functions as it ought to afterwards.

### **Don't be talked into expensive extras**

Don't let yourself be talked into expensive extras. All Passive House components are available at fair prices today. Investing in a well-planned Passive House isn't much more expensive than investing in an ordinary house. Make sure that the ventilation system is simple and that a certified ventilation unit is used, and insist on high quality fresh air filters for the sake of your health.

### **What matters is the planning**

Give attention to the calculation of summer comfort in the PHPP. Summers will be hotter in future; a Passive House can be planned so that it stays at a comfortable temperature.

### **You were a Passive House pioneer. Today you teach energy efficient building construction at the University of Innsbruck. Much has happened since then.**

My teaching work incorporates a basic course in physics among other things – after all, I am a physicist! That's great fun with the students. Today, science forms the basis of our civilisation, which relies very heavily on technology; but science also has a cultural duty: understanding where we as humans fit into the overall picture in the cosmos.



## Where is mankind's place in the cosmos?

As the astrophysicist Carl Sagan once put it beautifully: "We are a way for the Cosmos to know itself". We have a responsibility for this great development and it is our duty to treat the planet and our fellow humans with respect.

**You travel worldwide for the Passive House cause and are constantly on the move. Are you planning a small Passive House at edge of a beautiful lake somewhere in order to settle down one day?**

"If the swift moment I entreat: Tarry a while! You are so fair..." Johann Wolfgang Goethe recognised and described the contradictory nature of the human soul. For me, fulfilment does not lie in passive relaxation, not at the moment. I derive pleasure from ever-increasing insight; I would like to have more time for that and it would be good to be less worn out by the daily grind. No, I'm not planning to retire from the hustle and bustle of life just yet.

## How do you relax?

Innsbruck lies in the midst of high mountains – one can reach the top in a couple of hours, and up here, daily problems seem so small.

## What is your wish for the future?

A continuation of the process of self-realisation which is described so accurately by Ernst Bloch in his *The Principle of Hope*: "... which is why we become". We humans have just started this process of self-discovery. We have made substantial progress since our first attempts at using fire, not only in technical terms but also culturally.

## "...which is why we become"

We have realised that we are one species – with only slight differences from the Cape of Good Hope up to Alaska. We have triumphed over hunger and disease

to a large extent and we should see it as our primary task to keep on improving at that.

## 'Keep on improving'

We have been able to bring peace to our daily lives to a great extent – but we have not overcome wars. However, a humanity which still needs thousands of years for its cognitive process is dependent on international peace agreements. An understanding of the concerns and motivations of the people is the key to this.



*Passive House - yes, passive relaxation - no: Passive House pioneer Dr. Wolfgang Feist.*

## Peaceful daily life, but wars have not been overcome

We must destroy the remaining nuclear weapons or place these under international control. The present generations must end dependence on fossil energy sources. We will then be able to advance the cognitive process, extend our life spans in dignity, multiply our possibilities for communication, exploit the solar system, and even travelling to distant stars will come within reach for coming generations.

Are these wishes for the future sufficient? Well, some things cannot be grasped at present; Ernst Bloch was right when he said "...which is why we become".

*Interview by Katrin Krämer.*