The Renaissance was a time when intellectuals and philosophers proposed a new image of mankind and of the world, based on empiricism, experimentation and observation. This new birth of mankind acted as an inspiration to teach people to be responsible, citizens with wide ranging abilities.

Today, old dogmas are once again challenged by new demands. Our ecological footprint exceeds the load capacity of the planet - currently it is about 30% higher. Buildings represent an enormous potential to resolve this challenge. However, we must ensure that the actual purpose of the buildings – to provide health and comfort for the users – will not be lost.

This issue of Daylight & Architecture concentrates on how to update the existing building stock. To face this huge challenge of updating, giving renewed value and rebirth to the existing building stock, we must ask ourselves what we could do differently now and in the future. Daylight & Architecture 14 addresses the following question: how do we secure the intrinsic values in our homes and houses and carry these forward to an updated, healthier and carbon-neutral building stock that we define today and hope to realise tomorrow?

The issue contains articles featuring the building stock as it is today, experiments currently taking place and a glance into the future. It starts with a retrospective look at realities of modern-day building renovations by Fred Scott. Georg Giebeler then analyses the architectural qualities of existing residential buildings from four typical epochs, considering their potential for the future. Immanuel Stieß describes the motivations that influence homeowners considering renovation; he summarises the three most important as saving energy, saving money and improving indoor comfort.

Examples of Green Renovation are demonstrated in four redevelopment projects by the VELUX Group and various partners in Germany and Denmark - a school, a cultural centre and two types of housing schemes with potential for mass customisation solutions for sustainable living.

How do we make buildings that people will still value 50 years from now? What processes will lead to such buildings? Daylight & Architecture posed these questions to David Cook, Renate Hammer and Henrik Sørensen. Their replies reveal much about current practices in planning and building. The process of redefining, revitalising and reshaping the history of buildings is about forward-looking design, proportionality, socially acceptable uses, functionality and economic efficiency - the co-creation process covering the whole spectrum of sustainability in contemporary urban development.

In the VELUX Group, we believe that the goal of successful modernisation lies in the concept of Sustainable Living. In essence, that means greater energy efficiency, the use of renewable energy sources and optimal living conditions, particularly through improvements to the indoor climate – with user comfort at the focal point.

Enjoy the read!

The VELUX Group
Green renovation, four experiments

Improving the global climate and the indoor climate, increasing comfort, saving energy and money and usually complying with the rules regarding the preservation of historic buildings as well – the requirements of building renovations are indeed highly complex. Four experiments of the VELUX Group in Hamburg and Copenhagen show how they can be fulfilled.

The ‘Markthäuser’ (market houses) in Mainz by Massimiliano Fuksas are a controversially discussed example of contemporary urban repair. After years of nostalgic reconstruction, the new buildings are a stark, uncompromisingly modern landmark right in the centre of the city. But whether the concept can prove itself over the long term still has to be seen.

What planning processes generate optimum results? What is stopping us from designing better buildings? And how can we know whether the buildings that we are now constructing will still be needed in 50 years time? These and other questions were asked by Daylight & Architecture and put to David Cook (Behnisch Architekten), Renate Hammer (Donau-Universität Krems) and Henrik Sørensen (Esbensen Consulting Engineers).

What do house-owners assign their homes and according to what criteria do they decide whether or not to modernise? The Institut für sozial-ökologische Forschung in Frankfurt has looked at this question in a wide-ranging study. Immanuel Stieß describes the most important results.

How buildings – often contrary to the intention of the original builder – are made to meet the needs of new uses and users again and again is one of the most exciting aspects of architecture. Fred Scott has investigated this process and outlines a vision of how residential buildings can remain fit for the future in spite of all the economic constraints.

Whether a residential building will be able to satisfy the requirements of the 21st century depends on its location as well as on its ground plans and construction. In his article, Georg Giebeler takes a tour through the architecture of residential building in the 20th century and examines the strengths and weaknesses of buildings of different ages and types.

Whether light, form and material can be integrated with each other in ways that surprise the observer again and again – Daylight meets architecture: A fireplace, a museum and a media centre illustrate how light, form and material can be integrated with each other in ways that surprise the observer again and again.

How buildings – often contrary to the intention of the original builder – are made to meet the needs of new uses and users again and again is one of the most exciting aspects of architecture. Fred Scott has investigated this process and outlines a vision of how residential buildings can remain fit for the future in spite of all the economic constraints.

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The things that make architecture tick: projects, events and selected new developments from the world of daylighting.

“We wanted to create something that is beautiful but that does not compete with the art, a building that puts the art first and foremost,” said Thomas Phifer, talking about the new West Building of the North Carolina Museum of Art in Raleigh. The 32,700 square metre building designed by Phifer supplements the old museum building (East Building) built in 1983. A greater contrast would be difficult to imagine: on the one hand, a fortress-like, angular 1980s construction with almost no openings to the outside and, on the other hand, the single-storey, clearly cut new building, with 50 percent of its facade surface consisting of glass. The rest of the building is panelled with satin-finish facade panels, which are over seven metres high, are made of anodised aluminium and make the building look like an outsized jewellery box.

Five completely glazed recesses lend structure to the otherwise rectangular building. Unusually for a museum building, it has four entrances, the most important of which leads directly into a large sculpture hall that, like a backbone, runs through the new building along the central longitudinal axis.

“All of the building’s elements, from the oculi in the ceiling, designed to bring in controlled natural light, to the expanses of glass that bring the outdoors indoors, to the views between and among galleries, have been created with an eye to providing the best possible experience for viewing the diversity of art in the collection,” said Thomas Phifer. The most important source of daylight for the building is 230 skylights that protrude from the roof like waves. On the outside, they have slats that only allow glare-free northern light into the rooms. Textile scenes on the inside of the oculi subdue the entering light additionally. The large facade windows have curtains with three degrees of transparency. The curtains enable adjustment of the daylight exactly to the requirements of the exhibited works of art. Moreover, roller blinds make it possible to completely block out the daylight. Additional electric light is provided by halogen lamps, which are switched on depending on daylight levels. The museum employees also feel the difference in the daylight in the old and new buildings: “Even for me as a curator who has lived with these pictures for more than 25 years, it’s a revelation to see them in this kind of light,” says David Steel, Curator for European Art at the museum on the online portal ArchNewsNow.
They still exist, even in Europe: greenhouses with sports fields on the south side and two traffic intersections in the north. Originally, architects Vicens + Rames intended to erect an elliptical central building containing an affair in the middle, around which the local community would be able to gather for worship. But it was completely different. The altar is right at the end of the nave. The architects succeeded in doing so with a highly effective lighting into the chancel. When light strikes it, the facade of the new media centre of Tours-Nord looks as if it is covered in a layer of fine mist dust. The new building of architects Sophie Berthelier, Philippe Fichert and Bernd Tributsch is located in the Place du Nord, a not particularly attractive square surrounded by flat-stone residential buildings and mainly used previously as somewhere for locals to park. With their publicly used new building, the architects wanted to create the greatest possible contrast with the private, rather monotonous neighboring buildings. They succeeded in doing so with a highly transparent structure that is only two storeys high. It has a double facade whose lightness is intended to be evocative of sheets of paper. A sliding door made of two curved wooden vaults makes it possible to close off the fireplace at night. The wooden construction is stabilised by its own weight. However, it looks light when the daylight enters through the slits during the day or when the reflection of the fire appears to transform the cupola into a finely woven round cover at night.

For economic reasons – the budget was extremely limited – Haugen/Zohar started to look for inexpensive building material for the fireplace and finally found what they were looking for at a building site in the vicinity where there were large amounts of left-over wood. The architects used these pieces of pine as “bricks” for their construction, which was inspired by Norwegian post huts as well as by the regional log-cabin method of building. On a concrete base, Haugen/Zohar placed a total of 80 circular layers of wood, kept at a distance from each other by narrower oak sections. Each circle has a different diameter and together they create the number of “wooden bricks” per layer is always 28. For economic reasons – the budget was extremely limited – Haugen/Zohar started to look for inexpensive building material for the fireplace and finally found what they were looking for at a building site in the vicinity where there were large amounts of left-over wood. The architects used these pieces of pine as “bricks” for their construction, which was inspired by Norwegian post huts as well as by the regional log-cabin method of building. On a concrete base, Haugen/Zohar placed a total of 80 circular layers of wood, kept at a distance from each other by narrower oak sections. Each circle has a different diameter and together they create the number of “wooden bricks” per layer is always 28. A sliding door made of two curved wooden vaults makes it possible to close off the fireplace at night. The wooden construction is stabilised by its own weight. However, it looks light when the daylight enters through the slits during the day or when the reflection of the fire appears to transform the cupola into a finely woven round cover at night.

For a kindergarten in Trondheim, the municipal authorities were on the lookout for ideas for a new outdoor playground. Solar architects Martt Haugen and Dan Zohar proposed the creation of a place where children could make fires, tell stories and play while being protected against the wind and the rain. The new building was to offer protection, while simultaneously conveying a feeling of secrecy but ensuring optimum air circulation on the inside. The latter sold them bronze fittings – waste material from a metal turning workshop – at a very good price. The architects then used the fittings to cast PMMA panels. The degree of shading (opacity) provided by the composite panels thus produced is around 40 per cent. In order to allow for deformation, there are narrow gaps between them. The architects speak of a kinetic effect that the facades are intended to create due to their multiple reflections and the shadows they cast. However, they also refer to their practical benefits: The integrated bronze protection against the sun prevents the interior from overheating while the plastic panels hinder self-declared graffiti artists from gaining access to the inner building shell, which is glazed with insulating glass.
Rehabilitation activities can generate a certain enjoyment particular to the matching of one’s life to an existing building. Similarly, extensive refurbishment of a zone of the city always has implications for the life of those inhabiting it. Future housing typologies will therefore have to be adaptable to changing lifestyles, social shifts and varying degrees of human conviviality throughout their lifetime.

There was a young woman living with an architect in a hundred-year-old house that had been a former worker’s dwelling that he had converted in a dramatic manner, with floors removed and double heights inserted into the modest building, so as to astound the visitor on entering. After their relationship collapsed, the girl moved to a neighbouring district and in her own flat, which had been little changed in many ways for decades, she took to a close and caring attention to the original and existing features, polishing old brass light switches and even the old plumbing pipes, and lived quietly so as to least disturb the place.

Within this tale is a fundamental difficulty regarding new life in old buildings. The classic building is composed of arrangements of rooms, discrete separate spaces, and the Modernist intervention to achieve contemporary credentials, strives to introduce spatial continuity and the transparency of a modern lifestyle. The idea of the room is inimical to the idea of transparency; they represent two different and opposed ethos of spatiality. Their balance, or lack of it, within a particular work of refurbishment is somehow also a measure of how much the work is a commemoration of past lives. Yet of course we can’t live in museums – buildings must be transplanted into the present.

The connection between style of life and style of building is little known, but one suspects that there is such a thing. In re-occupying existing buildings, is there a sense that a definitive occupation is being sought? Or is the original occupation the only one that can be thought of as correct? Is there always an element of the intruder, of a transgression with regard to later interventions? It may be just this sense of transgression that intensifies the pleasure of re-occupation, which suddenly gives the occupant a sense of his transitory nature, of being like a spirit, more ghost-like sometimes than the original denizens; the high ceilings, the tall doors, the encumbered walls. This will always be an attribute that is unavailable in the acquisition of a newly-built property.

There is another drawback of building anew rather than adapting and inhabiting the existing. There is a currently extensive uncertainty in the relationship between house and city – for at least two reasons. One is the now extensive global uncertainty; cities themselves may transform beyond conventional prediction. Even without this Apocalyptic potential, there is also an absence of a credible building type capable of making a contemporary union between dwelling and the urban condition, ruined or otherwise. Nothing now exists like the Haussmann block, a typology with which it would be possible to make the concurrent city. Equally the Corbusian vision, la Ville Radieuse, the impulse to wipe away the old city and start again, has perished along with other Modernist crusades.

**THE DOUBLE-NATURED HOUSE**

**By Fred Scott**

*Photography by Ann Malmgren*

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**THE URBAN CYCLE OF RE-OCUPATION**

But one might wonder if a new typology is needed anyway; it doesn’t seem to be at a point when we might consider that our cities need such radical reconfiguration. The bourgeois insurGENCY into other city centres of recent years has managed to appropriate existing building stock for its purposes. As a result the city itself, although re-populated, pretends to be untouched. By these means, one class has taken over the houses and the history of another, that of the urban proletariat, and in the process has converted it into nostalgia, that most inert and durable of mental conditions.

Yet, these recent trends may obscure a more general rule. If one looks at a quarter of London such as Notting Hill, largely made up of 19th century terraces, many as grand as on a Parisian boulevard. Many of these houses, although built for the rich, stood empty for decades from their beginnings before being later colonised by immigrant workers, first from Ireland and later from the Caribbean. When we taught together at the Architectural Association in the 1970’s, Robin Evans would tell me stories of great houses taken over by the poor in earlier times, in Drury Lane in the centre of London, by velvet waist-coated impecunious dandies and others, the original oil paintings still hanging in the rooms of the appropriated mansions.

So in these two contrasting phases one sees the rich taking over the houses of the poor and, conversely at another time, the poor taking over the houses of the rich. This may be the recurrent law, the means by which the city is resurrected, the two tendencies part of the same dynamic, that are interdependent and inexorable. The prompt for such shifts will be, as...
A crusade against conviviality

The prescription for the family home that emerges during the 20th century from its 19th century roots can be understood in certain aspects as an intent to make a definitive template for the conduct of life, which in its refinements sets out to exclude certain aspects of behaviour that were considered undesirable by those drawing up the description. One might guess that paranoia lurked in these plans regarding the manners of the lower classes, for it was for them that the rules were to be devised. Thus the names of the rooms define the expected correct behaviour in any given part of the house—sitting room, bedroom, dining room. By the one act of thus defining proper conduct, the delinquent is also identified. Our age values quietism with regard to housing, which seems sometimes almost like a longing for the grave. As a result of this craving, we collectively brand anything approaching rowdy behaviour as anti-social. But it is the quietism that is anti-social; commonly people are now stigmatised for their vigorous sociability, which is then wrongly branded as anti-social. In spatial terms, one might trace the progress of such a crusade against conviviality in the evolution of the modern house in the 20th century. It will seem reasonable to many to protest at this point that there was no such conspiracy to wring vivacity from the house, but one may answer that it was part of the trend towards Modernism and that in itself may be as an unrecognised and so unchecked conspiracy.

The architectural contradiction at the heart of the great post-war public housing programme is that the projects tend to be big, often monumental buildings but they contain minimal spaces, the tight rooms of the prescribed house. Access in particular, being easily ascribed as functional, holds to the rule of the minimal. Consequently these are immense works of architecture from which a sense of promenade, of wandering, has been suppressed. One might comment that Modern architecture can make large or small spaces, but is not well suited to making anything in between.

Peter Reyner Banham used to refer to ‘That Old Sixties Future’. Has it arrived? If not, where has it gone? Within it were proposed habits that will now become untenable. The city, not the suburbs, will be central, the air-conditioned gipsy lifestyle only available to the rich. With the possible collapse of industry, whatever other consequences may arise, the house is liable to re-assert its place at the centre of human affairs. It will then less a sanctuary from the outside world, and become more of a primary setting for the ongoing human drama. Such a place would also need to be more than something tailored strictly to the nuclear family.

The house of hidden grandeur

We can only prescribe new housing in terms of the Modernist menu—all the systems are in place and long practiced to deliver what we in the United Kingdom call ‘Parker Morris standards’. The all too usual parade of diminutive kitchens, bedrooms, dining and sitting rooms must be rolled out or nothing at all will be built. Is it possible to conceive of a house at two scales? One the scale of the established everyday, but packaged and placed within not a sentinel concrete frame as in the Unité d’Habitation, but within a deeper gestalt, a hid-
Every old building is a store containing all kinds of memories – and every act of conversion or reuse will interfere with these. The ability to accommodate both old memories and new uses is an indicator for architectural quality.

Den building at a grander scale that might one day become revealed? Might it not be, when considering mass housing, that the architect may design as though a reverse of a multi-occupied large 19th century house, or something even larger like a palace perhaps, or a public housing scheme, in which the original prescribed minimum may be demountable to reveal an underlying spatial generosity? What if, through ingenious planning as well as rooms that can be hived off for the private realm, meandering sequences of interior spaces can become revealed through some future insurgency, brightly lit from unexpected sources, often from on high, the building stripped back having the chance to achieve its full flowering, both spatially and socially? Cavity wall construction is well suited for these purposes. This may seem to be in favour of the rich acquiring the houses of the poor, but its opposite is also possible, depending on other wider factors.

I’m not sure exactly what such a place might be like, or the post-industrial city even, but as Palladio once said, a large house is a small city. One can suppose that the future will be information-rich, so not requiring the explicit plan of Modernism or its precision of purpose, and everyday life will be under surveillance, so that such a mass dwelling should be like a maze rather than a villa, with a less stark division between public and private; instead, an ambiguity, an intrigue and complexity that is both social and spatial. Behind the façade humanity goes about its business, in the public realm mankind flitting between ancient shadows.

By such means, the architect might see his role as an enabler of future occupations, beyond his own time, to fit the modest model of the modern house within a structure of greater scale. Within it, at some future time when perhaps property has lost its value, and through the relegation of modernity, a new conviviality and beauty may be revealed. In addition to what may be thought of as a typology suited to the intensification of urban life, this different form is potentially amenable to the existing; that is it may be used to repair the ravages of the last sixty years or so, and may give an equanimity between the new and the existing. The city’s continuous processes of migration will perhaps be made easier by these means; the acts of rehabilitation are of course related to the past, the present and necessarily also to the future.

Fred Scott is a writer, designer and teacher who taught for many years at the Architectural Association in London. He was a collaborator with the Archigram Group and wrote for Architectural Design in the 1960s. Later he ran the Interior Design course at Kingston University, and is Visiting Professor in Interior Architecture at the Rhode Island School of Design in Providence. He is the author of On Altering Architecture, published in 2008 by Routledge. Currently he is working on his second book, Dwelling: a Socio-spatial Inquiry.
RENOVATING RESIDENTIAL BUILDINGS: CHANGE IS THE ONLY CONSTANT

By Georg Giebeler
Illustrations by Lisa Fleck
It is frequently said that renovation of old buildings is a complicated matter. But this is not really true—at least in most cases. The situation is made unnecessarily complicated by some seemingly inextinguishable false assumptions and prejudices, which often prevent the right thing from being done and negative results from being avoided. Three of the most widespread assertions are examined in this article and refuted.

Firstly: It is best to leave building renovation to construction companies and technicians. From the point of view of the architect, this is a grossly negligent attitude. The fact that the planning volume of European architects’ offices in the new building sector is stagnating or is already decreasing is the pragmatic side of the issue. The other side relates to the—already, unfortunately, heavily loaded—idea of sustainability and is illustrated by the combination of four apparently randomly selected statistics:

– 25% of all waste material comes from the construction and demolition of buildings
– 40% of our energy is used for heating or cooling buildings
– 25 years is the average length of time that windows and facades fulfil the requirements of the people living and working behind them
– 95% of residential buildings were built more than 25 years ago

Whether renovations, particularly in respect of energy, are a planning task for architects is up to the architects themselves. The opinion that this is a purely technical undertaking still predominates. A regrettable error of judgement. Regrettable because renovation is inextricably intertwined with design, with the appearance of our buildings and cities. This is radically demonstrated in the regions of northern Europe, where brickwork facades disappear behind plastered-over thermal insulation panels—a deplorable situation. And yet renovation of the energy aspects of a building can be the trigger for extensive modifications of the entire structure. This is shown by the frequently observed renovations of open-plan offices in the 1970s, where only architects were able to bring out their—admittedly few—positive qualities.

Secondly: In the last hundred years, the job of the architect has fundamentally changed. This is far wide of the mark. The task that clients used to entrust the architect with and still do today is to plan and design a building that can be erected in the shortest possible time at the lowest possible cost and that can then be used for the longest possible time. The fact that, towards the end of the nineteenth and beginning of the twentieth century, an architect had to handle this task differently than we do today does not affect this basic truth.

If it had been possible to make reinforced concrete ceilings at a reasonable price in 1885, buildings from that time would not have wooden-beam ceilings. If it had been possible to order large, horizontally pivoted insulated-glass sash windows from a factory with a quality monitoring system, single-glazed transom windows with poor sealing qualities would not have been installed anywhere. Arrogance, however, is inappropriate in this context; the technical solutions used at the time were the best that could be afforded and the architects were well aware of their advantages and disadvantages.

But the technical possibilities were not the only important factor; the zeitgeist played an important role as well. The very small kitchen as the workplace for a full-time housewife did not appear until the modernist period and then disappeared again when the post-modernist era arrived. Before and after, the kitchen was merged with the dining room, although for different social reasons.

The renovation of residential buildings is not merely a technical task; design is also an integral and extremely important factor. It can only be done successfully if the existing building is known thoroughly, together with all its inherent potential and weaknesses. A chronological consideration of residential building construction over the last 140 years shows that structure, ground plans and building materials are logically interrelated.
Thirdly: exploration of the history of building is of purely academic interest. On the contrary, it quickly becomes clear that knowledge of the historical conditions and those specifically relating to building is not only of scientific interest but also has tangible advantages when it comes to renovation planning. Without an understanding of the way in which buildings were created, for example towards the end of the nineteenth and beginning of the twentieth century, the evaluation of an existing structure itself presents a problem. Before an architect is engaged, he or she must therefore provide a relatively certain answer to the following questions:

– what modifications are necessary and which ones can be dispensed with?
– what construction measures are possible and which ones are excessive in terms of “quick + good value for money + durable”?

When these queries are answered, measurable factors such as energy efficiency and daylight supply have to be taken into consideration as well as factors that can be assessed qualitatively such as health and comfort. However, other factors such as attractiveness and fashions which are very difficult to define also play a role. If knowledge about the expected weaknesses and qualities of the existing building can be used to answer these questions before planning is actually started, the risk involved in renovation for architect and client is only insignificantly higher than that involved in the planning of a new building.

The following examination of the strengths and weaknesses of four different epochs shows typical areas of action. The epochs are not so much oriented to the usual historical sequence of political events as to transitions that have occurred in the culture of building, even though similar terminology is used.

A REQUEST
Adapting the residential buildings of the last hundred years to new needs succeeds to a greater or lesser extent, depending on how previous architects designed and built them. Other factors such as the location and social factors cannot be altered and provide new prospects for districts that people wanted to flatten 40 years ago in western Europe. The fact that this is not only due to the inner-city location and the trendy bars but also the not-exclusively-functional ground plan design is a great advantage for renovations today. The biological neutrality of pre-war and early post-war buildings that have not yet been renovated is another benefit.

However, this is also to be understood as an appeal for renovations today: 75% of the construction waste mentioned at the beginning of this article can be recycled because such waste comes from a time before the introduction of synthetic materials and plastic. But what about full thermal insulation and other composite building materials, today massively subsidised by the state? The lifetime of a facade is 25 years and the next generation of architects will have to renovate our renovations in 2035. Perhaps one of them will write about us in the same way as I have written about the past when asbestos was used without any consideration of the harm it could do: ‘Because it was cheap’.

Georg Giebeler (*1963) has been head of the 4000architektenarchitekten office in Cologne since 1995. Since 2004, he has also been professor of building construction and design at Weimar university. He is co-author of Atlas Sanierung (Birkhäuser/Edition Detail 2008). The main focus of his work and research is on building with (and in) existing structures and on the exploration of the works of Ulrich Müller, the pioneer of the concrete-boarding method of building.
The first great building boom took place in the era of industrialisation: mass housing construction on the outskirts of cities, which had frequently been left unchanged since the Middle Ages. No consideration was given to the topography and little attention was paid to the needs of the tenants. The beautiful large rooms were, in the best case, the living space for an entire family of four. To set limits to the worst outgrowths of profit maximisation, building regulations stipulated minimum room heights and prohibited basement apartments, for example. Today, these districts are highly sought-after and will remain so. That they are now located within the city, in wide streets often lined with trees in a dense urban setting, makes them attractive.

The building topology chosen was in line with the interests of the investors at that time. The expensive homes were fitted out with a richly adorned front, a spacious stairwell and oriels or balconies. The windows are generously sized. This contrasts with the rear houses, which were set back from the street and featured unplastered brick facades, narrow stairwells and rooms that were badly lit via courtyards and allowed access only on one side. The advantages and disadvantages of this system can only be balanced out by combining the apartments to make larger homes.

In the front houses, it is always the longitudinal walls, two outer ones and one in the middle, that bear the load. The rear houses are the same but often have only two load-bearing walls. Because rigidity is achieved by means of the fire walls and the ceilings (anchored with tie rods to the outer walls), most inner walls have no structural function whatsoever. The large ceilings were made up to six metres wide and the floorboards on the top floor, accordingly thick and solid on the lower floors. On the top floor, they are at least 25 cm thick and, every second floor downwards, they become 13 cm thicker. Their ability to store heat is very good, with the exception of the attic walls. Together with the solid middle wall and the large amount of space, apartments from this epoch have a very well balanced indoor climate. The thermal insulation, however, is inadequate, and renovation is not completely without its problems. If insulation is applied to the inside of the outer walls so as not to cover the stucco facade, the advantages of heat storage are lost. The thermal bridges, in contrast, can be ignored due to the wooden ceilings. What is more of a problem is the requirement that, after renovation, the new windows be air-tight and water-tight. Inadequate ventilation of the ends of the wooden beams in the ceiling can lead to rotting of the previously undamaged sections and thus to structural hazards.

RESIDENTIAL BUILDING CONSTRUCTION (1870–1920)

This grand building with large apartments and a brickwork facade shows signs of the German "Heimat" style and the beginnings of expressionism. At the same time, it has certain features that are typical of many residential buildings from the time before 1920. This includes the elongated ground plan, which, in this case, is filled up by means of two small atriums, and the load, which is borne primarily by the longitudinal walls.
These five-storey apartment blocks are a typical example of national-socialist estate building. Each stairwell enables access to two apartments on each floor, each with 75 to 90 square metres of floor space – very spacious at that time. The apartments receive light from both sides. Between the blocks, gardens where the occupants could grow vegetables were provided.

Forstenrieder Straße residential estate/
Fürstenrieder Straße, Munich
Architects: Fritz und Sep Ruf, Hans Holzbauer
Year built: 1939-1942

RESIDENTIAL BUILDING CONSTRUCTION DURING THE INTERWAR YEARS (1920 – 1940)

Revolutionary times were followed by revolutionary approaches to building. Central demands of the new social movements were not only better working conditions but also, and above all, better places to live. Aix, sun and one’s own four walls were being called for. The experience of the war years resulted in small-scale farming coming back into the suburbs. New clients in the form of cooperatives were asking for new buildings: cooperative estates with low density due to large interior courtyards and few floors as well as estate houses with relatively large gardens. The only economical way of erecting such buildings was to build them on the least expensive pieces of land. This is one of the reasons why such residential areas are on the outskirts of cities. The advantages and disadvantages at that time are still noticeable today. Many of the estates are strangely cut off from the rest of the municipal area. They have retained their suburban character and appear somewhat conservative or, in the worst case, petty-bourgeois. On the other hand, they are full of green areas, airy and cheerful and often have an economical but fully committed design such as proven by the well-known estates of Ernst May or Bruno Taut.

It was also possible to enhance the economic efficiency of the residential buildings by means of rationalisation. Rationalism was not only a fashion but also an economic necessity. One expression of rationalisation is the famous Neufert estate, the first version of which appeared in 1936 and was sold out after only three weeks. Very small bedrooms and living rooms, low ceilings, thinner outer walls and steep, narrow indoor staircases were features incorporated in the houses on the estate. In the apartment blocks, many rooms, especially the kitchen, were now assigned clear functions and the room dimensions were correspondingly minimised. A perfect example of this is the completely rationalised ‘Frankfurt kitchen’ of architect Margarete Schütte-Lihotzky.

This ground-plan rationalisation often collides with the wishes of present-day users. The lower ceiling heights compared to the late 19th-early 20th century, together with the associated deterioration of the lighting, are problematic. As they are identical in terms of the load-bearing longitudinal walls and the building materials used, their advantages and disadvantages are also similar. In order to eliminate their smallness when they are converted, however, much greater efforts are needed than for buildings from the late 19th-early 20th century.

The ‘modernism’ frequently associated with this epoch, in contrast, did not play a role in mass housing construction. The new method of building with reinforced concrete or steel skeletons combined with a great deal of glass was reserved for factories, warehouses and office buildings. In the area of residential building construction, only the intellectual upper classes could afford and wanted such high-tech luxury. The renovation of such buildings is therefore also a subject for art historians and is often accompanied by the loss of their original use as homes.
Residential building construction in the post-war period (1950 – 1965)

Thriftiness was the prime virtue of the post-war period. Apart from workers, the building industry lacked practically everything: infrastructure, building material and, above all, time and money. The lack was made up for by the use of innovative techniques specially developed for this situation: the wooden-beam ceilings were replaced with prefabricated ceiling sections with small span widths fitted along just a single axis. Due to a large amount of shuttering, ceilings made of site-mixed concrete were minimised in terms of the amount of material needed as the example of ribbed floors shows. The outer walls that used to be made of solid bricks gave way to constructions made of building materials such as porous concrete or breeze blocks, which had been known for a long time but had hardly been used until then. The reason for this was described by building construction professor Franz Hart in 1951: “The hollow brick, as opposed to the solid brick, enables thinner walls with the same degree of thermal insulation, a larger format with the same weight, and thus saves on materials, gains space, increases the brick-laying rate and reduces moisture in the building. (Hart, Franz: Baukonstruktion für Architekten. Stuttgart 1951, p. 41)

What was not new, in contrast, were the urban-planning principles and the tendencies towards rationalisation: the ideas of the garden city were even upheld in Nazi Germany, a fact that is often overlooked in one-sided views of the Third Reich’s crazed infatuation with monumental architecture. After the war, these ideas were put into practice on a large scale throughout Europe, albeit with planning that was even more rationalised than before. Ceiling heights less than 2.5 m and children’s rooms with seven square metres were a result of the unconditional desire to save space. The disentanglement of the world of work from the world of living which now took place—a result of the Athens Charter produced in 1933—went a step further in order to enhance the previously described advantages and disadvantages of such estates compared to their predecessors from the 1920s.

The use of innovative building techniques that saved material in post-war residential buildings is a source of considerable problems today when renovations are carried out. An example of this is a standard type of ceiling, which, after the war, was almost always made of concrete but brought about hardly any improvement in respect of sound insulation and fire protection compared to the pre-war period. Directly applied wash floors do not provide any footfall sound insulation, ribbed ceilings—some as thin as 6 cm—are practically useless as insulation against air-borne noise and the minimal concrete covers do not comply with today’s fire protection requirements. Moreover, the reinforcing elements are already subjected to the maximum amount of stress and therefore loads cannot be increased. A wash floor or a suspended ceiling are therefore also ruled out as well. Another fact not yet considered is that such renovation measures would further reduce the height of rooms in which the ceilings are already low. The technically possible renovation of the ceiling/floor by means of retrofitted reinforcement is not economically feasible in mass-produced residential buildings and is therefore not done. These are the reasons for only renovating such buildings to a moderate extent and otherwise not endangering their protected status. Residential buildings of the post-war period—still accounting for 30% of today’s residential buildings in Germany, by the way—are therefore mostly renovated in respect of energy and technical aspects and are only rarely subjected to extensive structural modifications. This reduces opportunities to increase the financial gains to be made. On the other hand, these estates often have social structures that have been stable for a long time. This will ensure their survival for the next few decades.

Lighting, indoor climate and building biology should not prove a hurdle to this as the materials used are almost exclusively of a mineral nature, unless the buildings were already renovated in the 1970s.

Residential building construction in the post-war period (1950 – 1965)

The four-storey building with its double-pitch roof is aligned in a west-east direction. Two stairwells on the north side provide access to the four apartments on each floor. With 57 to 67 square metres for 2 ½ to 3 ½ rooms, they are considerably smaller than those in pre-war estate construction. In compensation, there are loggias on the south side for the occupants.
The economic boom in western Europe after 1950 made people affluent. The confidence and trust that was placed in technological progress at the time boosted innovation and thus secured this affluence for the west over the next several decades. People treated themselves to a little luxury on the dining table as well as in their home: the average living space per inhabitant in Germany doubled from 24 (1950) to 28 m² (1970). The buildings of the pre-war period remained in a terrible condition far into the 1970s as they were regarded as old-fashioned. Because the inner cities were unable to cope with the growing, self-created, mind you – lack of living space, new towns were dreamed up in the form of the garden city: open, bright, in green areas but close to a motorway, with an underground garage and a shopping centre. Most of these ‘satellites’, as they were called, only functioned for a short time. It did not take long for their fragile social system to fall apart and leave behind a ghettosied subculture of the socially displaced.

This could not have been due to the way the cities were constructed, given that the residential buildings built in the middle of the 1970s were the first to come at least close to present-day standards. New regulations regarding air-borne and footfall noise insulation were introduced in this epoch as well new requirements for thermal insulation. Trust in the new was quickly engendered in the choice of building materials as well. Research provided architects with materials, whose properties, in many cases, were an improvement on the old, for example in terms of their economic efficiency. The fact that these materials were also accompanied by harmful substances previously unknown in the home was often blithely accepted, as the example of asbestos, the miracle material, showed. Asbestos was present in nearly all parts of the building, such as thermal cladding, fire protection insulation, roof panels and parquet adhesives, even though the deadly nature of this substance had already been known for a long time. And yet the new ways of building dispensed with some of the old ways of doing things. In residential building construction, the load-bearing direction of ceilings was rotated by 90° so that transverse walls now bore the load, making it possible to design the facades without restrictions. This creates a number of problems for renovation today. Because the transverse walls bear the load, alteration of the ground plan is practically impossible and it is no longer possible to enlarge the rooms along the facade.

Because the distance between load-bearing walls was mainly chosen for functional and not so much structural reasons, conversions of such buildings for new uses are almost impossible or the result is unsatisfactory; a children’s room cannot be made into a conference room. A second difficult problem of renovation is caused by the massive thermal bridges. The load-bearing transverse walls often penetrate the outer skin in order to form loggias on the outside of the building. These thermal bridges are extremely difficult to eliminate retrospectively, even if the loggia ceiling is separate from the ceiling inside, something which is not always the case.

In 1970, the triumphal march of reinforced concrete began in the east and west of Europe, albeit according to different methods of construction. The advantages were evident: excellent load-bearing qualities, very good sound insulation and protection against fire, as well as a high heat storage capacity. In conjunction with the large glazed, lintel-free surfaces on the outer facade and the loggias that served to provide protection against the sun, the homes in these estates were very comfortable and the social milieu was less desolate than it had been for a long time. The position of these estates on the outskirts of cities helped to encourage people who could afford it to move away. The prognosis of above-average energy price increases – in the short term and the long term – is also a prognosis that these estates will not be retained. Effective renovation in terms of energy will hardly be economically feasible given the rents currently being paid and the non-central location additionally increases the cost of living for the inhabitants due to the long distances they have to travel. Terraced houses are a special example in that they have much greater thermal bridges. A bet that the total lifetime of this type of building would be much shorter than that of buildings from the end of the late 19th-early 20th century would probably attract very low odds.


The 21-storey high-rise residential buildings were regarded at the time as a pilot project of the concrete-slab building method in the GDR. A passageway in the middle of the building enables access to the twelve apartments on each level. All the apartments receive light only from one side. None of the rooms is wider that the slab size of 3.60 metres. The apartment sizes are 42 square metres for two-room apartments, 62-65 square metres for three-room apartments and 75 square metres for four-room apartments.
### Housing stock: Basic data on the residential building stock

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Residential buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m² U.A.</td>
<td>Number of dwellings</td>
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<tr>
<td>Austria</td>
<td>8.206 500</td>
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<tr>
<td>Finland</td>
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<td>France</td>
<td>60.561 200</td>
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<td>16.305 000</td>
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<td>Sweden</td>
<td>9.011 400</td>
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<tr>
<td>Switzerland</td>
<td>7.618 000</td>
<td>330×10^6</td>
</tr>
<tr>
<td>UK</td>
<td></td>
<td></td>
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<tr>
<td>European stock</td>
<td>9.858×10^6</td>
<td>113 876×10^6</td>
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### Housing stock: Basic quality of residential building stock

<table>
<thead>
<tr>
<th>Country</th>
<th>Running water (%)</th>
<th>Laver (°C)</th>
<th>Bath/Shower (°C)</th>
<th>Central heating (%)</th>
<th>Average number of rooms</th>
<th>Floor area (m²)</th>
<th>Average number of persons (2003)</th>
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<tbody>
<tr>
<td>Austria</td>
<td>99%</td>
<td>98</td>
<td>97.5</td>
<td>87.3</td>
<td>3.3</td>
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<td>Finland</td>
<td>98</td>
<td>96</td>
<td>99</td>
<td>92</td>
<td>3.8</td>
<td>85.7</td>
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<tr>
<td>France</td>
<td>99%</td>
<td>99.2</td>
<td>99.2</td>
<td>96.3</td>
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<td>90</td>
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<td>n.a</td>
<td>n.a</td>
<td>n.a</td>
<td>n.a</td>
<td>n.a</td>
<td>2.2</td>
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<tr>
<td>Netherlands</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>90</td>
<td>4.2</td>
<td>71</td>
<td>2.1</td>
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<tr>
<td>Sweden</td>
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<td>100</td>
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<td>88.2</td>
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<td>3.6</td>
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### Dwelling stock: by type of building

<table>
<thead>
<tr>
<th>Country</th>
<th>Single-family dwellings</th>
<th>Multi-family dwellings</th>
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<tbody>
<tr>
<td></td>
<td>30%</td>
<td>70%</td>
</tr>
<tr>
<td>UK</td>
<td>30%</td>
<td>70%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>32%</td>
<td>68%</td>
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COMFORT, MONEY AND GOOD INTENTIONS: REASONS FOR MODERNISING BUILDINGS

By Immanuel Stieß
Photography by Bert Teunissen

Whoever wishes to improve the energy efficiency of more buildings in Europe must, above all, be aware of an important issue: the wishes and priorities of the buildings’ owners. These wishes and priorities are by no means always of a financial nature. The degree of desired comfort, economic considerations and a sense of ecological responsibility all combine to create a wide range of individual but allied motivations. And the advice offered, the financing and planning must be equally individual if the aim is to increase the proportion of modernised, retrofitted buildings over the longer term.
More than half of all households in Europe live in detached, semi-detached or terraced houses. In Germany, these types of houses account for just under 60 per cent of all households. A significant number of owner-occupied houses were built in the 1960s and 1970s. Around one quarter of all homeowners in Germany live in a building built before 1978. It is expected that, in the next few years, there will be a considerable need to modernise and retrofit these buildings. Houses built in the 1960s and 1970s in particular will undergo their first big renovation.

These renovations and modernisations represent a great potential for saving energy and reducing CO2 emissions. In Europe, approximately 70 per cent of the energy consumption of a private household goes on heating and hot water. The energy-efficient renovation of a detached or semi-detached house can decrease the amount of energy consumed by 50 to 75 per cent. The decision of homeowners whether to opt for or reject energy-efficient renovations will have an important impact on the climate policy goals that can be achieved in the building sector in the coming decades.

Compared to new buildings, the motivations driving homeowners when they consider their options to renovate their house are less well known. One reason for this is that the initial situation in existing houses is far less clear. In contrast to the situation with new buildings, the persons renovating older buildings are not necessarily young families. Renovations may affect homeowners in very different situations and phases of their life. Having said that, this article will present a range of motivations and decision criteria which may affect the homeowner’s decision to renovate and retrofit.

Living in your own home: what does their home mean to homeowners?

The construction or purchase of an own home is a decision with long-term implications. The decision is not necessarily always linked to the intention of remaining in the same house for the rest of the owner’s life. Younger homeowners in particular tend to view their house more as a “house in which they will spend a certain period of their lives”, a dwelling that will be gladly and intensively used during a certain phase in their lives. But even if the homeowner is not planning to spend the rest of his or her life in the house, an own home still rep-
Reasons for renovation

The decision to repair, exchange or renew the heating system, facade, windows or roof is associated with typical situations. Upcoming maintenance and repair work are the most common reasons to consider one’s own house in more detail. But buying a house or extensive rebuilding can provide the occasion for a more sweeping transformation.

In general, only individual parts of buildings and facilities are renewed when carrying out ongoing maintenance. The catalyst for carrying out maintenance work may be serious damage, for example when the heating breaks down. But more commonly old or damaged structural components and units are replaced before they are defective. There is rarely a direct or urgent need for action. In most cases, a time slot of several years is available for planning and carrying out maintenance work.

With maintenance work the emphasis is usually on functional considerations. But there is still some latitude for technical and energy-efficient improvements as old building elements are generally not simply exchanged for new ones but, instead, are usually replaced by state-of-the-art components.

"Technology is constantly progressing; when it makes sense to me that it would be good if I purchased it, then I will do it. Technically I would like to have it state-of-the-art but without any fancy nonsense."

conventional renovator, 64 years old

In addition to functional aspects, the wish to beautify the house is a central motivation for carrying out maintenance work. Older homeowners in particular set great store by ensuring that their houses are not merely in good order but that it also looks ‘decent’ from the outside. And finally, upcoming maintenance work, for example the need to replace a heating system, may lead the homeowner to focus more intensively on the topic of energy and energy saving.

In view of the massive increases in energy prices, many homeowners view a renovation as an occasion to reduce the energy consumption of their houses. Particularly with older houses many homeowners are very conscious that these buildings consume an unnecessary amount of energy due to their insufficient heat insulation and outdated technology.

"What is particularly important about living in your own home? Being undisturbed, having enough room, the opportunity to change things, with nobody who will interfere."

Conventional renovator, 49 years old

"...the house is no hobby. I associate the house with a feeling of home, I feel comfortable here. It is the place where I belong. But having to look after the house is more of a chore."

Woman who renovated her house to improve its energy efficiency, 52 years old
It was quite clear to us that […] the status of the house was about that of 1960 and that a lot of energy was being lost, and we thought it would be possible to make some improvements.”

Woman who renovated her house to improve its energy efficiency, 48 years old

Many homeowners hope that lower energy consumption will result in a perceptible reduction in their living costs. The wish to save energy is often supported by traditional thriftiness: older people especially want to avoid wasting energy and not simply heat their homes ‘to let the energy dissipate up the chimney’.

Climate protection can be another important reason prompting owners to renovate their house. Homeowners with a strong sense that sustainability is necessary believe that they must behave responsibly and take the opportunity when renovating their homes to do something for the climate. Solar collectors on the roof are not merely a practical expression of climate protection – they also epitomise an affiliation to a forward-looking low-carbon lifestyle:

“…I have watched a lot of programmes on Arte and 3Sat [two German TV channels] about the melting of the polar ice caps. It’s really not a sham and it is generally just played down whereas in fact it is a real catastrophe. […] Of course I have to do something, who else should do it?”

Woman who renovated her house to improve its energy efficiency, 52 years old

The wish to be independent of energy obtained from fossil fuels indicates a similar mindset. Many homeowners would like to reduce their longterm dependence on limited resources and hope that they can cut their connection to the unpredictable developments on the energy markets. The idea of being able to autonomously satisfy their energy needs is a particularly fascinating concept.

“And that is why we would like to be self-sufficient to a certain extent and not only grow our own vegetables in our garden and have our own fruit trees, but also utilise the sun a bit, because the sun never runs out.”

Woman who renovated her house to improve its energy efficiency, 33 yrs

And finally, a fascination with new technology can also be a motivation for renovation and should not be underestimated. Male homeowners in particular are fascinated by the possibilities of innovative technology. Often this enthusiasm for new technologies reinforces the decision taken in favour of innovative energy concepts or to utilise renewable energies.

“What would really interest me is the passive house. I don’t know how it works, but I think it is really great. Yes, it does fascinate me, just like heat pump systems do.”

Man who renovated his house to improve its energy efficiency, 50 years old

A different point of departure for renovation occurs when the owner plans to fundamentally alter the house, for example after recently purchasing or because of planned remodelling. We are dealing here with future oriented solutions that require more extensive planning and execution. For many homeowners, such a renovation offers an opportunity to improve the quality of living in the house. The objectives and starting points differ, depending on the living arrangements and requirements. In buildings where nothing has been modernised for many years, the desire for modern comforts typically focuses on modernising the electrics and sanitary installations or the supply of warm water. To feel comfortable in one’s own home, the arrangement of the floor plans may be changed, small rooms knocked together to make larger rooms, or bigger windows and doors installed to improve the lighting in the living space.

“The house used to be very dark. And so I put in a few doors instead of windows.”

Man who renovated his house to improve its energy efficiency, 37 years old

Windows do not simply influence the atmosphere of the room, they also play an important role in determining the quality of life. Particularly in areas with high noise levels, heating insulation and noise insulation often go hand in hand.
Renovations may often create a better interior climate. Measures taken to improve the thermal insulation of a house will result in a more comfortable climate both in summer and in winter. Many homeowners are surprised to discover just how much their living quality improves after carrying out renovations to improve the energy efficiency of their homes. Similarly, the range of utilisations may expand, for example when a workroom in the top storey can be used all year round following the installation of roof insulation.

“...it was important because it was so difficult for us to get this living room warm. It’s a question of comfort.”
Woman who renovated her house to improve its energy efficiency, 48 years old

**Combined motives and type of renovation**

Particularly when considering large-scale renovations, the decision to renovate is rarely based on a single objective or motive – usually, many different goals come together. The various motives of homeowners wishing to improve the energy efficiency of their homes differ considerably from those homeowners who do not introduce any particular energy-saving measures. This was borne out by a standardised poll of homeowners renovating their homes.

The most important motive for carrying out renovations to improve energy efficiency is the wish to reduce energy consumption and its associated costs. The renovation should not merely reduce current expenses but also reduce the long-term costs. Usually additional motives play a role in the decision to carry out energy-efficient renovations, for example the wish to improve the quality of living or an enthusiasm for innovative technologies. Climate protection and the aim to reduce dependence on fossil fuels are also important motives behind renovations to improve energy efficiency.

The inducements and objectives of homeowners who carry out conventional renovations without any particular energy measures tend to be of a more pragmatic nature. Conventional renovators often simply carry out necessary maintenance work or replace defective components to safeguard their house. If something is done that goes beyond what is strictly necessary, then the goal above all is to beautify the house and expand the living area.

**Renovation process and cooperation partners**

The maintenance or renovation of a house requires detailed specialist and technical knowledge and even experienced homeowners may reach the limits of their own knowledge. They need to obtain information from elsewhere, and the range of sources and paths of information are very wide. In addition to talks with workmen and tradespeople, homeowners rely on the advice of the people around them. Discussions with relatives, neighbours or colleagues with the relevant experience who have already gone through similar situations play a particularly important role. These people are often very willing to help and constitute a sort of mutually supportive group of house modernisers, in particular as homeowners living in the same street or area – due to the year in which the houses were built – often face or have faced similar problems. Their statements and recommendations are considered credible and unbiased and are commonly scrutinised less critically than those given by professionals.

“...I tend to act more based on my gut feelings. If I get the impression that something sounds coherent, then I also assume that that person knows what he is talking about.”
Woman who renovated her house to improve its energy efficiency, 41 years old

Many people turn to tradesmen to answer their questions about renovations. Plumbers, fitters, heating contractors and carpenters are consulted particularly often. This often creates a bond of trust over many years. But this loyalty has its downsides: many tradesmen tend to give pragmatic assessments that reflect their own horizon of experience and that are limited to their own trade. Their recommendations are therefore not always optimal with regard to renovations aimed at improving energy efficiency.

Architects, engineers and energy consultants offer profes-
When homeowners consider renovating their own homes, attention to the solar collectors, we had to do all of it required energy to make and would take a long and basically also against the insulation, saying that “The architect militated against solar collectors – “The architect militated against solar collectors –

Little is known about energy consultants, both as regards Little is known about energy consultants, both as regards

inclined to focus solely on energy efficiency, even though the inclined to focus solely on energy efficiency, even though the

homeowner may have other and additional goals and preferences. Even among homeowners who are convinced of the need to improve energy efficiency, only around one half will call upon the services of an energy consultant.

One reason for this is also that the profitability of the renovation depends on factors such as the future development of energy prices, which are difficult to predict. Many homeowners are therefore convinced that the precise savings can only be roughly estimated. One reason for this is also that the profitability of the renovation depends on factors such as the future development of energy prices, which are difficult to predict. Many homeowners are therefore convinced that the precise savings can only be roughly estimated.

“…do not pay off in the sense that the resulting energy savings would not pay for the entire scheme. We thought...” "I have not calculated the possible savings accruing from the insulation. I am not going to do it either, because I cannot foresee how energy prices will develop.”

In this situation many fall back on simple rules to justify their decision. The emphasis is on advantages that are difficult to calculate in purely monetary terms, such as the advantage of no longer being dependent on fossil fuels or of being less dependent on price developments in the energy markets. Some homeowners also see a benefit in that a renovation that improves energy efficiency may have a positive impact on the value of the house if it is sold at some later time.

"Cuts do play a role when making choices, also the long-term costs, above all, whether it will pay off in the long term, that is, not just in two or three years but in twenty. Long-term benefits, durability, longer term utilisation. I haven’t worked it out to the last penny but we have already done a rough estimate and looked into it, particularly into which form of energy supply is sensible over the longer term.”

The conviction is often voiced that modernisation to improve energy efficiency is worthwhile because it will not make the homeowner worse off than if the measures were not effected. For example, the expectation that energy prices will rise makes measures undertaken to save energy appear economically sensible, even if their concrete financial benefit cannot be precisely assessed. The reason for extensive modernisations to improve energy efficiency not being carried out in many cases is primarily the result of a lack of an awareness of the problems and an unwillingness to finance the necessary expenses. Many homeowners are also not prepared to take out a (further) loan to cover the high financial costs of such renovations – or they may not obtain a larger loan from their bank due to their age. For many homeowners, a renovation to improve energy efficiency is not of interest because they believe that their house is already quite energy efficient and that there is therefore no need for further action. As the poll showed, however, this assessment depended less on the actual energy consumption of the building itself than on the homeowner’s subjective belief that he/she had already done enough, for example, if insulation had been installed in the house some years previously. It made no difference whether the insulation measured up to current standards or not. Homeowners with no previous experience with modernisations to improve energy efficiency in particular often harbour prejudices, fears and apprehensions with regard to such renovations. Many are afraid of being unable to cope with the planning and realisation of such renovations, fear structural damage or fret about being ‘taken for a ride’ by unreliable contractors.

CONCLUSION

Decisions on the maintenance and renovation of privately owned homes are not taken solely on technical factors or economic considerations; subjective preferences and needs decisively influence the decision. This also applies to renovations aimed at improving energy efficiency. Many homeowners are open to the topic and may be prepared to invest quite considerable sums of money. The wish to reduce energy consumption and its associated costs is a central motive. Many homeowners do think in the long term and are prepared to do more than is economically profitable in the short term as long as they can perceive a clear benefit for themselves. In most cases, the decision to modernise in order to improve energy efficiency is influenced by additional motives.

In addition to the wish to protect the climate, the utilisation of renewable energy sources is a fascinating prospect for many homeowners as it allows homeowners to become independent of finite resources. The utilisation of solar heat, the installation of heat pump systems and the utilisation of geothermal energy therefore appear to be attractive options to many homeowners. This also applies to their use in existing buildings, despite the fact that the realisation of such measures may be difficult for technical or financial reasons. The wish to improve the quality of living or a fascination with innovative technology may often play an important role when deciding to renovate to improve energy efficiency. But numerous homeowners also have reservations and misgivings about renovations to improve energy efficiency. Despite the increases in energy prices and many years of public awareness campaigns on the topic, many homeowners see no need for action because they underestimate the savings potential in their own home and are not prepared to seize opportunities to act. This is not due to the fact that only those owners who are already convinced of the benefits of renovating to improve energy efficiency will enlist the services of professional consultants. Only a fraction of renovations are carried out under the aegis of professional experts or energy consultants. To increase the awareness of the range of possible measures among the homeowners who only carry out ‘regular maintenance’, a further differentiation of the range of consultancy services and the targeted use of ‘low-level consultancy services’ would be helpful. In view of the coexistence of numerous grant programmes, some assistance in obtaining an overview of financial support programmes and how to access them (‘financial advice’) would also be desirable.

Man who renovated his house to improve its energy efficiency. 57 years old.

Man who renovated his house to improve its energy efficiency. 37 years old.

Man who renovated his house to improve its energy efficiency. 56 years old.

Man who renovated his house to improve its energy efficiency. 57 years old.
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Note
1. The article is based on the results of the research project ‘EnEf-Haus – Energieeffiziente Modernisierung im Gebäudebestand bei Ein- und Zweifamilienhäusern’ (EnEf-Haus – Energy-Efficient Modernisation of Existing Single and Double-Occupancy Homes), supported by the Federal Ministry for Research. For this research project, 44 homeowners in Germany, who carried out general maintenance or renovations to their heating systems or to the outer shell of their homes during the period 2005 – 2008, were questioned by the Institute for Social Ecological Research (ISoE) by means of qualitative in-depth interviews. In addition, an opinion poll of 1,008 homeowners who had renovated their homes was conducted using a standardised questionnaire. EnEf-Haus was carried out by ISoE in cooperation with the University of Applied Sciences Lausitz and the Institute for Ecological Economic Research (IÖW). The study aimed to compile recommendations on how to support homeowners in their decision to carry out renovations and to motivate homeowners to carry out renovations that will improve the energy efficiency of their homes. The reports and opinion polls are available online at: www.enef-haus.de
The city centre of Mainz suffered enormously in the past. After 85 percent was destroyed in the Second World War, everything was first cleared away although some foundation walls still existed. In the 1950s, Mainz first tried undemanding functional architecture and then, a decade later, attempted to create a dynamic city setting with monumental architecture, as it was called at the time – rough lumps of buildings that, apart from Arne Jacobsen’s town hall, gave no consideration to the surrounding architectural context. A few years later, historicising facades, some of which were copies of copies, decorated banal purpose-built buildings and satisfied the sensibilities of citizens shocked by the inappropriately sized blocks, and at the same time gave tourists something to photograph as well. The result of all these efforts is somewhat chaotic: a mismatched conglomeration of buildings, with the most annoying examples in terms of urban planning having been repaired – but only on the outside and not in their substance. Apart from this, there is a lack of new concepts in Mainz, accompanied by indolence and, all too often, lazy compromises. All this, one would think, should constitute a perfect starting point for a bold, spectacular or even avant-garde project that, in addition to the architectural benefits, could enable urban development to make progress. The Mainz market houses facing the cathedral, which is over 1,000 years old, are such a bold, avant-garde project. Their design comes from the pen of Roman architect Massimiliano Fuksas, who, in the cathedral city, has shown a preference and talent for extravagant forms, unusual materials and technically advanced innovations to stir the feelings of the citizens. “An explosion of lines and colours”, explains the master on his homepage.

He says that his main concern was to create a contemporary building that shows respect for history without falling into the trap of historicising rhetoric. For example, by taking into account the roof landscape and height contours of the surroundings without wanting to expose himself to the compulsion of ubiquitous gables and eaves, the alternative partial hip end roof or the ridge roof. Fuksas, of course, abstracts the context and transforms it in a very unconventional manner, whereby, like a high-fashion couturier, he clothes the new building in an iridescently sensual silk shawl in the form of a highly original and also subtly profound hybrid of sloping roof and variegated, multiply divided facade. Who can avoid thinking of framework constructions when confronted with the apparently thousands of thin rods, the vertical inclinations, the seemingly tiny windows? Who, when confronted with an urban mixture of shops, catering establishments,
offices and apartments, all under a shared outer shell, can fail to be reminded of the town houses of the Middle Ages that combined all possible functions hidden behind a gothic gable? Who will the multiplicity of windows and the completely glazed ground floor not encourage to think of the shining crystal about which Paul Scheerbart and Bruno Taut were so enthusiastic at the beginning of the 20th century?

Mainz and its progressive thinkers have been waiting for an architect of international renown for a long time. Ernst May made a significant contribution to the city in terms of urban planning. Arne Jacobsen, mentioned earlier, dedicated a large expressive sculpture to the city in the form of the hulkling yet very sensitive town hall, which many people hold to be the Mainz building of the 20th century. Now, at the beginning of the 21st, jet-set master architect is set to endow Mainz with cosmopolitan flair and metropolitan stylishness. The selection procedure was organised completely in favour of Fuksas, who was then working on the spectacular shopping centre called myZeil in Frankfurt, practically next door. He had nothing to fear from well-known competitors from Germany and abroad and even the client, Mainzer Wohnbau GmbH, let slip its preference for the star architect. However, the city insisted that the historicising facades of market houses 11 to 13 be retained at all costs, “no exceptions being possible”. The fact that the facades were merely surface adornment and, in reality, concealed a trivial purpose-built edifice – a dilapidated cinema with rather uncomfortable apartments above it – and the fact that the height levels of apartments and windows were often horribly different, did not bother the city fathers. Ridiculed by many as “cardboard baroque”, the symbol of Mainz-type neo-historicism had admittedly become brittle. The facades were slowly but steadily crumbling, moisture was making inroads and the insulation was rotting. Then came the solution: Fuksas had to completely re-build the entire complex – including its market facades. The resulting building is therefore a compromise. The historical fronts have been completed – painted more attractively, more perfectly reconstructed and even featuring a thermally separated balcony. This shell is composed of white glazed ceramic rods, most of which are one metre long and, with a cross-section of 5x5 cm, somewhat thicker than those used by Sauerbruch Hutton for the Brandhorst collection in Munich. This shell, which encloses a six-storey building and a high atrium, is borne by a standard wooden roof construction. Fifty centimetres under the skin, which is not only composed of the aforementioned rods but also of flush-
mounted ceramic panels and glass, there is a normal reinforced-concrete construction with numerous roof windows. Two passages in addition to the main entrance lead into the hall, with the elongated luminaires on the ceilings of the passages resembling the ceramic rods on the facade. The atrium itself is a surprise – a public place exposed to the wind and weather. Three striking columns, which admittedly support nothing else but themselves, attract the attention of visitors through two kidney-shaped openings in the ceiling between the 3rd and 4th floor and the roof, which is partially open to the sky. Access to the 14 apartments, most of which are maisonettes, is gained via a lift in Korbgaße and through a 4th floor piazzetta, which is reserved for the residents. The attractive apartments incorporate exceptionally good fixtures and fittings such as bathrooms with lustrous black tiles, glass walls in some cases and open floor plans. The roof facade elements, by the way, can be pushed upwards like window blinds.

It must also be mentioned that the building does have some weak points, for which the architect is only partly responsible. This primarily concerns the concept of use and the tortuously narrow basement, with the escalator that leads there ending at a glass wall. As a result, the basement is still not being rented, even months after completion of the building. What is more, there is no underground car park – a deficit that nothing makes up for as far as the target apartment clientele is concerned. All the shops on the ground floor except one have direct access to the outside. The atrium, which is closed at night, is therefore often empty during the day. On top of this, there was no marketing plan for the houses, which explains why tenants for the relatively expensive apartments are still being sought. Yet, after the initial outcry, the building is finding more and more acceptance among the people of Mainz. Whereas some people speculate whether Fankas has again written architectural history in the city, some investors in the surrounding area are revaluing their properties upwards. Nevertheless, in spite of this ambivalence, the fact remains that Fankas has succeeded in transforming the historical.

Along the narrow alleys to the west and north of the new buildings, there are rows of nondescript post-war houses. It is here that the Fankas building enters into an exciting dialogue with its neighbours. Previous spread “I wanted to keep the skyline of the city with the roof, but I didn’t want to do a vernacular roof”, said Massimiliano Fankas. Glazed ceramic rods form the outer skin of the roof. In between, roof windows that can be opened supply the apartments with light and fresh air.
European starlings have a way of appearing in unexpected places – the United States, for example, where they are not native but share their origin to a brief reference in Shakespeare’s “Henry IV, Part 1.” In 1890, a drug manufacturer who wanted every bird found in Shakespeare to live in America released 60 starlings in Central Park. After spending a few years nesting modestly under the eaves of the American Museum of Natural History, they went from a poetic fancy to a menacing majesty. There are now upward of 200 million birds across North America, where they thrive at the expense of other cavity nesters like bluebirds and woodpeckers, and an abundance of grubs – as well as harmful insects – and occasionally bring down airplanes.

In Europe, where the birds are native – Mozart had a pet starting that could sing five bars of Beethoven’s concerto in G major – they still have the power to baffle heads. Each fall and spring, vast flocks gather in Rome. They put on breathtaking aerial displays above the city, banking in nervous unison, responding like a school of fish to the way they seem to be inscribing some sort of language in the air, if only we could read it.

Richard Barnes’s photographs capture the double nature of the birds – or at least the double nature of our relationship to them – recording the pointillist delicacy of the flock and something darker, almost sinister, in the gathering masses. Many of Barnes’s photographs were taken over two years in EUR, a suburb of Rome that Mussolini planned as a showcase for fascist architecture. The man-made backdrop only enhances the sense of the vast flock as something malign, a sort of avian Nuremberg rally.

It is, of course, natural for birds to surrender individual autonomy to the flock, according to the Roman ornithologist Claudio Carere, who has studied the flight patterns of birds to divine the will of the gods; part of the fascination of the starlings is the way they seem to be scripting some sort of language in the air, if only we could read it.

A consortium of ornithologists, physicists and biologists in Italy and other European countries has in fact begun studying the birds with the aim of learning not only about the relationship of individual birds to the surrounding flock but about human behavior as well. The project, named StarFLAG, entertains hopes of using the birds to illuminate herding responses in human beings with a particular eye on stock-market panics. When humans contemplate animals, the question is always who is imitating whom. The starlings that so fascinated the editor-director of Nextbook in 2000, “The Life of the Skies,” was published in 2008.
Although there is a considerable need for renovation in buildings in Europe, the rate of renovation continues to be very low. In order to change this, affordable solutions are needed that not only reduce the CO₂ emissions of buildings but also enhance their comfort and improve their indoor climate. Together with its partners, the VELUX Group has come up with four solutions that ‘activate’ existing buildings for their occupants in precisely this way.

Introduction by Christian Bundegaard
Project texts by Jakob Schoof
Photography by Michael Reisch

Among the many figures related to climate change, one in particular stands out – over 70% of the average city’s greenhouse gas emissions derive from buildings. As new buildings account for just a tiny fraction of the total building stock, sustainable refurbishment or renovation of existing buildings is paramount to any efficient CO₂ emissions reduction strategy.

Thus, UN data shows that building upgrades are among the most effective ways to reduce greenhouse gas emissions. In a review of over 80 studies on buildings and energy use, the UN Intergovernmental Panel on Climate Change determined that cost-effective energy efficiency measures in buildings could reduce building emissions by 30% from the 2020 estimated baseline.

Unfortunately, research and development have hitherto primarily focused on new buildings, whereas what may be called ‘green renovation’ is a field in need of extensive programming. One obvious reason for this is the high complexity in dealing with existing buildings, e.g. regulations, preservation orders, technical and design issues in connection with structural modifications, the interests of the tenants (as buildings are often in use) and many other aspects. Another reason for the lack of development in green renovation is financial, as resistance towards sustainability measures resulting in a rent increase (with the owner passing on the cost to the tenant) can be strong. What is more, the economic advantage related to investments in energy saving measures that go beyond standard is often either limited or long-term. Progressive government policies, subsidised programmes and full-scale experimental research and development are therefore necessary in order for the building sector to deliver its contribution to CO₂ emissions reduction.

The four projects later described all result from close collaboration between the VELUX Group and partners with strong views on green renovation. They show how the many other good reasons for focusing on renovation interact with sustainability issues in a manner calling for a holistic approach.

The potential for improvement in many housing estates and villas of the 1950s to ’70s is quite large. In many cases the construction standards of that time are relatively low, and many houses simply need thorough structural renovation if they are to survive another 50 years. But the main challenge is to update these buildings architecturally in line with sustainable measures and technical issues, providing more living space and a better indoor climate. In the years that have passed since the houses now due for renovation were built, the architectural needs changed fundamentally. With the massive migration from the countryside to the big cities, the rising welfare society shaped new family patterns and created a leisure culture that was directly reflected in architecture. The need for larger, brighter rooms that integrate accommodation, cooking, children’s homework etc. in an aesthetic and useful way, also during the day, has created some very specific requirements for the design of dwellings.

As people spend more time at home and pursue more activities there, they require rooms that are attractive, robust, well lit and ventilated – and still affordable. Interestingly, during the same period the workplace became more ‘residential’, stressing the need for an attractive, well-designed environment featuring some of the same qualities as our homes. The time spent at work went from being a more or less necessary evil to a place where we develop an important part of our identity and are recognised not just as professionals but as human beings. In order to play this enhanced role in our lives, the environments of offices and factories have to live up to our notions of an attractive living space.

This expansion of the requirements for the layout of the physical environment has
not only taken place within the confines of buildings; it includes the urban space that has become an extension of our homes and workplaces.

The architectonic element of our culture is not just an aesthetic issue. The role of design in everyday life becomes clear through the integration of function and aesthetics with sustainability, and the efficient use of energy resources, including daylight and natural ventilation. Here the advantage of renovating and refurbishing existing buildings becomes clear. It is within the framework of the inherited tradition that the architectural layers become visible; not only the temporal but also the functional layers. A building’s former function – as a workshop for example – will always affect the perception of the possibilities of the new layout. The outdated features and construction of the old are challenges that inspire and direct the renovation process. In fact, these layered structures may influence the design to such a degree that in some cases the building’s new architecture comes into being as a direct consequence of the value of the traditional.

All four of the following energy renovation projects were designed with a holistic approach to refurbishment. As modern homes and workplaces must accommodate the changing needs as described, the design aspects of the renovation are inseparable from construction issues and sustainability – hence the stress on a holistic approach. However, even if the trend of renovation is getting stronger, there is still a great need for experimentation and for proven new solutions and experiences.

LichtAktiv Haus in Hamburg and Solar Prism in Albertslund near Copenhagen are both renovations of post-war residential buildings, and both are based on integral planning in which architects and energy planners worked together to incorporate concepts of use, indoor climate, daylight provision and energy supply. Both existing buildings were originally conceived as system solutions. The renovation concepts applied to them are thus suitable for mass customisation. In both projects the goal is to increase energy efficiency as well as the social value of the building.

In Copenhagen, the Osram Culture Centre provides a pleasant learning and working environment through a renovation using thermal-insulated glazing, new roof windows, and the solar-chimney function of a two-storey entrance hall.

In Guldberg School, also in Copenhagen, interactive touch panels and screens teach the schoolchildren about the energy consumption levels and the amounts of energy obtained from renewable energy sources installed in their own school building.

In all four cases, sustainability, design, function and new knowledge are integrated in a carefully planned and executed holistic renovation. Their design is focused on optimal indoor comfort and based on the combined goals of providing better buildings for the daily users in their urban environment and contributing to a reduction of CO2 emissions through energy efficiency and extensive use of renewable energy sources.
The LichtAktiv Haus in the Wilhelmsburg part of Hamburg is one of six buildings that VELUX is constructing in Europe in the framework of the Model Home 2020 project. At the same time, the house is an official part of the Internationale Baumausstellung (IBA = International Building Exhibition) in Hamburg.

Like all the experimental buildings in Model Home 2020, the LichtAktiv Haus is intended to function neutrally as regards CO2 emissions and to offer its occupants a pleasant and healthy indoor climate with a minimum use of technology. For the Hamburg project, these aims represent a special challenge in that, in contrast to the other five ‘model homes’, the Wilhelmsburg project involves renovation of an existing building. Like all its neighbours, the house at Katenweg 14 was erected in the 1950s as a two-family house and a typical example of contemporary housing-estate homes: one and a half floors with a gable roof and an almost quadratic ground plan. On the gable side, the neighbouring house is attached and, on the other, an extension that originally housed a stall, a WC and a wash house.

The plot of just under 1,100 m² was chosen to be this size so that the residents could grow their own fruit and vegetables. Unlike the large piece of land, the rooms inside are narrow and dark. It was therefore evident that a renovation concept for the house would not only have to address energy consumption but also bring about a substantial improvement in terms of space utilisation and daylight.

Self-sufficiency as a design motif
The idea of the housing-estate resident and the associated food autonomy of the occupants was a central source of inspiration for the design of the LichtAktiv Haus. Under the supervision of Manfred Hegger, Professor of Design and Energy-Efficient Building at the TU Darmstadt, architecture students initially developed ideas, concepts and models as a closed competition. The winner, Katharina Fey, took the idea of self-sufficiency and independence and adapted it to notions of house occupants of the 21st century. Instead of vegetables, energy is now ‘cultivated’. Large living areas and windows connect the house of the future to its surroundings.
"For me, what is special about the Model Home 2020 experiment is the idea of combining quality of living, function, climate protection and good design. Although it is a truism of any form of integrated planning, such a holistic view is often neglected in actual practice. User comfort, energy efficiency, good materials and attractiveness are basic premises of sustainable building."

Prof. Manfred Hegger

**Below and right** Traces of life in an estate of detached houses: In the 55 years after being built, many of the houses in Katenweg were modernised by their occupants. The handwriting of every single one is unmistakable. Nevertheless, the serial character of the estate houses can still be easily detected.

"Living in the green" with a great deal of privacy – the central ideas according to which the Katenweg district was planned are still unmistakable today. Retaining these qualities and nevertheless making the houses fit for the 21st century in respect of comfort and efficiency were the main goals of the conversion project "LichtAktiv Haus".
"Daylight is a source of psychological well-being and physical health. As a source of energy in the scientific sense, however, daylight also supports the efforts of architects and planners to build sustainably. The VELUX Model Home 2020 combines both these aspects."

Prof. Peter Andres, light planner and honorary professor at the Peter Behrens School of Architecture, University of Applied Sciences, Düsseldorf

The design, which is to be implemented before the end of 2010, re-zones the piece of land. Whereas the basic structure of the residential building is largely retained, the old extension is replaced by a new section that divides the garden into a part for rest and recreation and a part that serves as a kitchen garden. In addition, the new section considerably increases the living space and useful floor area of the LichtAktiv Haus and plays a central role in the overall energy concept. A single-floor intermediate building with a flat roof functions as a connective piece and as a “distributor” between the old and new building. The new building is modular and can be built in sequences, in separately financed modules, and with prefabricated elements.

The new open vertical room structure functions as a daylight lantern. Roof windows shed natural light into the house and make it possible to experience the different times of day. The staircase is integrated into the central space like a piece of furniture and enables views into the garden through a window front that is almost five metres long. The new extension building, made of prefabricated wooden frame construction, is linked to the existing building by means of a vestibule. Its southern and northern facades consist of a combination of opaque and transparent elements. On the inside of the extension, the living, cooking and dining areas are one continuous room divided up by various items of furniture. At the west end of the new rectangular section, there is an open carport and, at the east end, there is a covered outdoor area that creates an uninterrupted transition to the garden.

The aim of CO2-neutrality: energy concept

In order to meet the standard of the German energy-savings directive (EnEV), the limestone outer walls of the existing building are insulated on the outside. Modern facade windows replace the old windows. A new prefabricated roof structure completely replaces the existing one. The extension ensures that the LichtAktiv Haus is supplied with energy and compensates for the restrictions of the existing structure. Renewable sources of energy provide all the energy required for heating, hot water, house equipment, lighting and household electricity. An air-water pump powered by solar collectors is the heart of the technical equipment in the house. The overall system uses solar and environmental heat for energy supply the whole year round, running on natural ventilation and using solar thermal energy for heating.

Photovoltaic elements integrated in the roof glazing compensate for the power consumption of the heat pump and all the household appliances of the occupants. An automatic control system enables all the rooms to be ventilated naturally, making a mechanical air-conditioning system superfluous. A cistern in the front garden collects rainwater that is used for the toilets, watering the garden and the washing machine. As a result, water consumption decreases dramatically.

Focus on the user

The results of the experiment will clarify how the vision of optimum living conditions with a pleasant indoor climate, daylight and optimum energy efficiency turns out in practice. This vision stems from the conviction that the focus of planning should be on the person as the user of a building in order to make sustainable living ready to meet the demands of the future.

With the Model Home 2020 project, VELUX wants to build climate-neutral houses of the future that adapt themselves dynamically to their environment in order to create an optimum indoor climate – the Active House principles. In the case of the German model home, these goals are particularly ambitious because the project in this case involves modernisation of an existing house.
The Osram Cultural Centre of today was first erected in 1953 as an administration and warehouse building for the Danish branch of the lamp manufacturer of the same name in Nørrebro, a Copenhagen suburb where many working-class and immigrant families live. The company’s name and logo, a light bulb made of coloured glass, still decorate the front entrance facade but the building has not been used for its original purpose for a long time. In 1982, it was taken over by the Municipality of Copenhagen and converted into a cultural centre. Finally, in 2008, it was decided to renovate this former industrial building and 21 other urban properties in order to improve their energy efficiency. On the one hand, Copenhagen wanted to send out a signal for the climate summit that took place at the end of 2009 and, on the other, the users of the building were to be provided with a more pleasant learning and working environment with a better indoor climate, more daylight and – where necessary – better sound-proofing.

The Osram cultural centre was one of the first buildings in Denmark to be built with prefabricated concrete sections. Its entrance facade with visible facade supports, infills made of shaped concrete panels and window grilles’ composed of extremely slim concrete sections, is now under a preservation order. For this reason, an external layer of thermal insulation did not even come under consideration by the planning team (T-Plus architects and Wissenberg engineering). Instead, the facade facing the street was fitted with ceiling-high thermal insulation glazing on the ground floor as a second, inner skin. The other facades were insulated from the inside with mineral wool, and only the rear side of the building, where the demolition of a former annex used for storage purposes had left an ‘open wound’ in the facade, received external insulation and was covered with green and grey panels.

The rooms inside the cultural centre are now much more open and brighter than they were before the conversion. Anyone entering the building for the first time notices this immediately. Entering from the street, a visitor first comes into the stairwell which then takes him to the left and into the entrance hall, where part of the intermediate ceiling has been removed and new roof windows have been installed in order to allow more daylight into the interior. From here, a corridor along the street facade leads to a large multi-purpose room and three smaller meeting rooms. They are all lit by daylight, either directly via the facade facing the garden or indirectly via interior walls with glazed cut-outs near the top of each wall. This way of dividing up the interior also has climatic advantages. In spite of the inner...
The glass facade, the corridor is not as well insulated as the other areas and thus serves as a buffer zone between the inside and outside. The two-storey section at the entrance functions as a solar chimney in which used air becomes warmer, flows upwards and escapes through the roof windows high above under the roof ridge.

On the top floor, the previously existing division of space has been essentially retained. In the centre, there is a large hall, which is big enough to hold 120 people and also allows daylight in through 16 new roof windows. Together, the latter form two large light openings in the ceiling and make the roof truss construction visible. This was concealed by a false ceiling for many years (and still is in many places).

In addition to their lighting function, the roof windows also make a contribution to the interior climate in that they ensure the hall is adequately ventilated during special events. Their specification is exactly matched to the climatic requirements. The ones that face the north were fitted with high-performance thermal-insulation glazing while those looking towards the south are made of standard Low-E glass, which is mainly intended to maximise the solar energy gain. Electrically-operated awningblinds reduce overheating and glare in the summer. They can be controlled either directly by the user or by an automatic control system. The latter is also part of the building’s nervous system, which controls 28 roof windows and their associated shades and also operates four facade windows in relation to the interior and exterior temperature, the CO₂ content of the air and the use to which the building is put at any particular time. The cultural centre is divided into several ventilation sections, each of which features different ventilation parameters and is fitted with its own sensors. In addition, a mechanical ventilation system with a heat recovery function was installed in the building. It primarily supplies fresh air to the meeting rooms and also acts as a back-up system for especially hot or cold days.

The entire building is equipped with LED lighting whose light output is balanced with the daylight intake via the control system. The elements water and heat round off the energy concept of the Osram cultural centre: thermal solar collectors on the south side of the roof are intended to meet up to 70% of the building’s hot-water requirement. On the garden side, there is a rainwater basin that collects water running off the roof to water the garden and thus reduces the amount of water entering the drains.

Building type: Cultural Centre
Client: the city of Copenhagen, DK
Architect: Karl Weidemann Petersen/t Marke, Copenhagen, DK
Architects (conversion): tegnestue t-Plus, Copenhagen, DK
Location: Valhallgade 4, Copenhagen, DK
The Copenhagen district of Nørrebro is undergoing a process of change: the city of Copenhagen is investing a lot in the former workers’ district in order to retain its social mix and persuade families with children to remain. The measures being taken also include renovation of Guldberg School with its two premises located 500 m apart in Sjællandsgade and Stevnsgade. It was no coincidence that it was completed just in time for the UN Climate Change Conference that took place in the Danish capital at the end of 2009. For the conference, the municipal council had planned several showcase projects on the themes of climate protection and the preservation of resources (Guldberg School being one of them). In addition, some of the delegates of the UN’s Youth Climate Change Forum were to be accommodated in the school. Even after the conference, the school is to be used as a ‘climate school’, integrating this subject in the daily lessons.

One of the main objectives of the conversion project was to make climate change comprehensible to the schoolchildren – not only intellectually but in real concrete terms as well. The aim was also to make it clear that reducing CO₂ emissions does not always mean having to do without things, but can also be associated with gains in comfort and room quality. Everywhere in the buildings, interactive touch panels and screens that show the schoolchildren specific energy consumption levels (for example, for lighting or hot water in the changing rooms) as well as the amounts of energy obtained from renewable energy sources have been installed. The individual renovation measures are not only tailored to the typology of the buildings, their location and the available degree of sunshine, but also to the didactic goals of the overall project: in the building in Stevnsgade, where sixth-form students are taught, photovoltaic modules have been integrated into the facade and LED lighting has been installed in the rooms. In the classrooms facing south, different lighting concepts are employed. They range from ‘low-tech’ to ‘high-tech’ and their energy consumption is monitored continuously. This is intended to make it possible for the schoolchildren to draw conclusions regarding the fluctuating interrelationships between daylight, artificial light and energy consumption.

The two brick buildings built in Sjællandsgade in 1913-14 accommodate the elementary school and the middle school. A look at the roof reveals that a new era has commenced for the Guldberg school in Copenhagen. Solar collectors provide hot water for changing clothes. The roof windows are now considerably larger than before the conversion.
the existing openings in the roof have been enlarged, the previous windows have been moved further down and, above them, new automatically controlled roof windows have been installed. This means that, in future, the children will enjoy an unobstructed view of the outside and the rooms will receive considerably more daylight than before.

The roof windows are also crucial for control of the indoor climate. Together with their external motorised awning blinds, they are integrated in an automatic control system for the indoor temperature and ventilation. The control system ‘knows’ when it is time to admit fresh air, reduce incoming sunshine or provide maximum thermal protection. The three attic classrooms are divided into three climate zones, each with its own room sensors for indoor temperature and the amount of CO₂ in the indoor air.

A weather station reporting wind direction, speed and outdoor temperatures is mounted on the roof. A calendar module regulates the ventilation in relation to the time of day and the season. With its fresh air function, for example, which is activated shortly before lessons begin as well as in the breaks, the system automatically ensures that the classrooms are thoroughly aired. The ‘pulse ventilation’ program works in a similar way, having been specially designed for brief bursts of ventilation during the winter months. For longer warm periods, there is a different program that ensures a continuous gentle flow of (fresh) air in the rooms.

In ‘night cooling’ mode, the windows are opened in order to allow the heat stored in the building to dissipate. How long this lasts is regulated automatically in relation to the level of heat caused during the day by the sun shining through the windows.

Of course, all these functions can be manually overridden by the user if so desired. During stormy and wet weather, the windows also close automatically. All the control parameters can be checked and altered via the Internet. Moreover, the children can use the Internet as well as the touchscreen in the school to look at the most important key data relating to the energy supply and the interior climate such as temperature, CO₂ level and the performance of the solar collectors.
For decades, renovations in respect of energy aspects were regarded as exceedingly complex and this is still true in many cases. However, there is often a lack of money, especially in small building projects, for an interdisciplinary, individual form of planning that would guarantee the necessary quality of the solutions.

In order to resolve this dilemma, at least for part of all existing buildings, VELUX joined forces with Danfoss and other industrial partners to develop Solar Prism, a modular system of building components. The triple requirement of making the result as simple as possible, as complex as necessary and as comfortable as feasible determined the way in which the joint development work was approached. The aim was to divorce energy saving from the old idea of doing without and rather to link it to a decisive improvement in living comfort.

The modules, which can be combined with each other flexibly, are placed on a flat or inclined roof and contain all the essential components for supplying the building with renewable energy. The energy consumption of an average home, say the project partners, is to be reduced by around half as a result, even with no further renovation measures such as thermal insulation. And yet Solar Prism is much more than just a technical centre for the roof. Roof windows allow light into those areas in the middle of the building that were previously inadequately lit. In addition, they are an efficient way of ventilating the building, especially in spring and autumn.

Other components of the Solar Prism are thermal solar collectors and a 160-litre water tank for storing solar heat, two photovoltaic modules for supplying electricity, a 3.5 kW heat pump and a ventilating unit with a heat exchanger that recovers 90% of the heat in the used air and uses it to heat the incoming air. All these technologies have also been tested in renovation projects many thousands of times but are usually installed in the form of more than half a dozen different systems. In the case of Solar Prism, they are unified in a single, completely prefabricated and well-insulated building element. This makes for considerable savings in terms of planning, construction costs and time, and thus reduces the hurdles for clients new to the idea of energy renovation for existing buildings. Given that the needs of house owners almost always differ, Solar Prism can be extended with additional modules according to wishes and can be given other surfaces or the devices can be configured differently on the inside. The later replacement of components is also possible at any time, for example if the family situation – and therefore the energy consump-
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Building type: Prefabricated modular system for renovating and upgrading residential building

Partner: VELUX A/S, Danfoss A/S, BO-VEST, KUBEn Management, ROCK WOOL A/S, Teknologisk Institut

Consultants: RUBOW arkitekter, CENERGIA Aps

Suppliers: Racell solar A/S, EcoVent Aps, Kingspan Denmark A/S, OTU Byg

Adaptation and requirements regarding comfort and indoor climate – change. Adaptation of the concept to sloping roofs is also conceivable. In this case, the modules would be built in flush with the surface of the roof in such a way that the equipment would be integrated in the attic and thus be invisible from the outside.

Its modular structure makes Solar Prism a supreme example of mass customisation, which is currently beginning to gain ground in the construction industry. In order to exploit this potential, the project partners want to develop an online platform in the next few years with which clients can configure and order their own Solar Prism to suit exactly their needs.

First implementation in Albertslund near Copenhagen

Solar Prism was tried out for the first time in a residential building in Albertslund near Copenhagen. The community is one of the numerous dormitory towns that originated around the Danish capital in the 1960s and 1970s. Several hundred houses of the same kind made of fair-faced concrete with inclined roofs are to be found in the Hyldespjaeld district and, throughout Albertslund, there are thousands of buildings with exactly the same problems: little daylight, low indoor comfort and an exorbitant level of energy consumption. 2,200 of them are to be renovated in the coming years in terms of energy efficiency.

The Hyldespjaeld district is the perfect opportunity for an idea such as Solar Prism. A residential district for wide layers of the population, where the need for renovation is tangible. But it also constitutes a market for simple and low-cost solutions. Solar Prism combines both these qualities. In the next few years, VELUX and Danfoss want to try out their joint concept at other locations in Denmark before it is made available to final customers.

Right: Although no longer in keeping with the time in terms of their technical construction, the houses in Hyldespjaeld are characterised by their human scale and their relatively high density. Seen from the street, the Solar Prism is almost invisible but primarily exerts its effect in the rooms inside.

Next spread: The view over the Hyldespjaeld quarters reveals the potential of the Solar Prism. As here in Albertslund, thousands of flat roofs or even sloping roofs are waiting to be used as sources of energy and daylight.
What distribution of roles in planning processes and what competences are required to design more sustainable buildings? What political framework is needed to achieve better planning results? Daylight & Architecture put these and other questions to David Cook (Behnisch Architekten), Renate Hammer (Danube University Krems) and Henrik Sørensen (Esbensen Consulting Engineers).

One conclusion of these talks was that we are living in a time where time itself is in short supply – and this has serious consequences for architecture. Yet time is a key criterion when planning more sustainable buildings: it takes time to listen to planning partners and users, and it takes time to adapt buildings to the needs of the people even after they have been completed.
around people

we should

build buildings

around people

D&A: Planning a building is a collaborative effort, much like playing in an orchestra. What should be the distribution of roles in this ‘planning orchestra’ in your opinion?

DC: First of all, I think time is the most important issue here because the more time afforded the process of planning, the more refined the actions of the orchestra. Conversely, if time is short, ensuring that all members of the orchestra are performing to expectations may become incredibly difficult.

However, what matters is not just the size of the orchestra, or the time available for rehearsal, but being given the opportunity to select the members of the orchestra that you wish to play with. If their styles of playing are not complementary, then there may be problems.

In an orchestra, you obviously need a conductor, just as you need a first violinist. Now, without wishing to appear arrogant, I believe it appropriate that the architect is best suited to the role of conductor. However, here it is important to respect the role of the architect in different countries and the respective planning cultures. But in general, I think that an architect who fulfils the role of the traditional German ‘Baumeister’, being in control of costs and of the construction on site, can make the most of the role of a conductor.

Other professionals, who may step up to play this role, for example project managers, have a natural tendency to exert bias towards control and restriction. Although the architect should also be in a position to enforce an appropriate degree of control, he is also obliged to ensure that the creative forces within the orchestra are allowed to come to the fore.

D&A: What skills of the ‘musicians’ are needed to design sustainable buildings, and what qualities do your cooperation partners usually have?

DC: If you consider the client being a member of this orchestra, then he needs to have open ears, be accommodating to his fellow ‘musicians’ and not to dominate by shutting down too many avenues of thought too early. The climate engineer obviously has a leading role to play in any such orchestra. (I use this term rather than the traditional ‘MEP engineer’ because to a certain degree they are different disciplines.) Ideally his relationship with the architect is one of a sparring partner, with whom we need to understand how these differences may become reconciled. For us here, because if you haven’t been given the opportunity to work with such ‘musicians’ beforehand, then there is a natural tendency to revert to type; to the tried and tested. However, even to have the tried and tested on a project can be difficult if the ears and eyes of the other members of the orchestra are not open.

D&A: Have the typical roles and competences of the planning partners changed over time?

DC: The role of the climate engineers has become ever more important. Their numbers remain limited. But as the industry recognises their importance, the demands on these firms become ever harder and it becomes difficult to get much of their time. Here we have a certain advantage over some of our colleagues because we have been working with these companies for 15 years or more. Hence they are generous in their time and more accommodating in the way they work for us.

Obviously, our own role has also changed. We too cannot simply revert to past projects and do as we have done before. Objectives must be continually reassessed in the context within which we are working. We must remain aware of what is going on outside our office, our region and open to influences from other countries and cultures. And we need to understand how these different influences can possibly impact upon architecture – or affect our discussions with the first violinist, so to speak. In Central Europe, for instance, we are fortunate enough to have a very accommodating climate in which we can then exploit using a range of different architectural or engineering moves time and time again – or combine them in different ways. But working in different climates often means going back to first principles. And again this requires time in order to properly understand these climates and the corresponding cultures.

D&A: Do you need different competences when dealing with existing stock rather than new buildings?
...
HENRIK SØRENSEN:
WE HAVE TO CHALLENGE THE ARCHITECT FROM TIME TO TIME

D&A: Planning a building is a collaborative effort, much like playing in an orchestra. What should be the distribution of roles in this ‘planning orchestra’ in your opinion?

HS: The ‘orchestra’ is definitely changing in these years. It is both increasing in size and the players are getting more specialized. However, it is not enough simply to have an orchestra – you also have to agree on which tune to play. In this respect, our own role as energy designers is changing from being a more specialized musician to a more supporting function, to keeping the whole orchestra together and being aware of how everything is interlinked. This becomes ever more important because there is a tendency today for the roles in the orchestra to be defined in too narrow a fashion, and for everyone to try to ‘play their own tune’ rather than to contribute to a good overall sound.

This presents a great challenge to the conductor of the orchestra – whoever that may be. Historically, the architect has always played this role and there are good reasons for him to keep on playing it because he usually has the most interdisciplinary function in the planning team. On the other hand, many more instruments are entering the orchestra now, which makes it ever more difficult for the architect to fully exploit its potential. In this situation, I think the architect needs a supporting function and we, as integrated energy designers, can perform this function.

Some architects also have a tendency to want to play all the instruments themselves. But there is no need to. The architect needs rather to come back to the conductor position and make the musicians aware that they are part of a team and have to do more than just fulfill their own little function.

Last but not least, the client is the one who decides what will be played. If he is not fully aware of the possibilities and the potential of the orchestra, then it will be a very simple tune and leave the architect with a quartet rather than a symphony orchestra. Which can be very nice sometimes but often is not sufficient to exploit the full potential of a building.

D&A: What skills of those ‘musicians’ are needed to design sustainable buildings?

HS: Everyone in the team should be well aware of what their role is and what knowledge they should provide at the various stages. In the traditional planning process, lot of engineers wait for the architect to do the drawings first. Then they have their say on what can be done and what can’t, and what would have been a better solution. This corresponds very much to the nature of the engineer as he was brought up in the past – to tell the architect, ‘draw anything you like and we will make it work’. But this option is not viable any more. As good engineers, we have to be much more upfront in the planning process and support the architect rather than waste his time by letting him draw something that is not possible or too expensive, or maybe miss some great potential that might be known only to the engineer.

So what is needed from us is the skill and will to be proactive in the initial design stages. We should also challenge the architect from time to time, just as architects often challenge a technical design, which is usually very helpful. There are some good engineers already who have this challenging ability but there could be more.

D&A: What qualities do you appreciate in your working partners?

Ideally, our working partners need a basic awareness of what matters and what doesn’t. They need such broad and interdisciplinary knowledge as – what can you do with photovoltaic or solar thermal energy, how important is thermal mass in operation. We have seen some bad operation. We have seen some bad...
In the refurbishment of apartment blocks, for example, the residents are tenants and do not own them. This means, should a tenant, age or age to higher rent in exchange for energy refurbishment? The extra energy measures may pay back within ten years but that perspective won’t be very useful to me if I know that I will be out of the flat in five years. So the decision will be between the planning, building and operating a building, a crucial point is to have a common vision and strategy to work on. The refurbishment of apartment blocks for many of the longer-term investments may pay back within ten years but that perspective won’t be very useful to me if I know that I will be out of the flat in five years. So the decision will be between the planning, building and operating a building, a crucial point is to have a common vision and strategy to work on.

D&A: Do you see any obstacles in terms of regulations?

HS: A great deal could be improved through Taxation of energy. Domestic components should be valued or taxed on the basis of how they contribute to the energy efficiency of the building rather than their original purchase price.

D&A: In your opinion, what are the biggest obstacles today in planning buildings differently tomorrow?

HS: I think the greatest obstacle is the different time perspectives of the stakeholders. There is the developer, who usually operates on a very short-term perspective, and the inhabitant, who can adapt a longer perspective – it is a pension fund, for example. In the case of a private investor, the perspective is obvious much shorter. The city, on the other hand has a very long-term perspective, whereas the clients have a short-term view and the tenants an even shorter one. Establishing a financial framework for all these stakeholders, with their different time perspectives, is very hard in practical terms. Another obstacle is that there is no tradition in the business of real estate brokers for setting any value on sustainability. "Sustainability" is a vague term when discussing the price of a building. The criteria are still "location, location, location" and it is very hard to argue for sustainability when you have no precise figures for the additional financial value of, say, a BREEAM Excellent or a LEED Platinum rated building. Some studies from the US already indicate that there indeed is such an added value in monetary terms in buildings that are sustainable, yet typically yield higher rents and being unoccupied for a relatively short period. But currently, the message is only very slowly coming to Europe. The real estate brokers therefore have to understand the added value and communicate its benefits.

One thing is certain, little chance for the various stakeholders in the real estate business to do a proper job, can be re-used and a new building erected with a much better performance.

D&A: What about re-using and re-designing existing buildings or stock?

HS: When more and more buildings from the '70s and '80s are refurbished, there will be a new option that will be important and could be more carefully designed and researched. Another aspect with technical innovations is that they are usually replaced long before the buildings themselves. In this case, it is therefore important that the current installation is made in a way that it can be adapted or modified. One could agree on how to measure and calculate the value of sustainability in the built environment. Research in this field is currently being carried out. The added value of all the new technological issues being launched. Of course, we need to develop the technological stuff, but the aspects related to politics, financing and evaluation need much greater research efforts than in the past. Otherwise we will end up producing what the world’s best architects and developers will never be sold because we haven’t managed to bridge the gap between technology and the market.

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One thing is certain, little chance for the various stakeholders in the real estate business to do a proper job, can be re-used and a new building erected with a much better performance.
RÉNÉTE HAMMER:
AN ARCHITECT IS NOT ONLY A CONDUCTOR, HE IS ALSO A COMPOSER

D&A: Planning a building is a collaborative effort, much like playing in an orchestra. What should be the distribution of roles in this planning orchestra in your opinion?

RH: When considering this question we should not lose sight of an important point: the first job of the architect is to write the score for the orchestra. I think it is a symptom of our times that the discussion often only focuses on who will take on the role of conductor. In reality, the important thing is the piece of music itself, the creative effort which – and here I think everyone would agree – only the architect can provide.

Consequently, the person conducting must really have an intimate connection with music. It is quite conceivable that the designing architect can take on this role, at all events it is conceivable that the designing architect can provide the creative effort which – and here I think everyone would agree – only the architect can provide.

Moreover, if the only conductors are persons who are capable of judging the merits and qualities of a ‘piece of music’, if you take music as an example, it is immediately evident that the person writing the conductor’s baton cannot be the same person as the person who is responsible for the orchestra’s finances. If the only conductors are persons who administer the budget, then the music will be unrecognizable unless the musicians are extremely talented and capable of transcending a poor or unqualified conductor.

D&A: What skills should ‘musicians’ have to design sustainable buildings?

RH: Those required in music you have to be able to listen really well and know your capabilities but also your limitations and those of the others involved. Given these conditions, it should be possible to do justice to a ‘piece of music’ together. We should never forget that, historically, the separation between design and technical planning is quite young. Originally, all knowledge relevant for the design of a building was literally inside someone’s head – that of the architect or master builder. Nowadays, this knowledge is distributed between several different heads, all of whom nevertheless have to work together as though the separation had not occurred. The biggest mistake we can make is to shift the timing of work phases between disciplines. Usually the design is created first and the technology is applied at a later date. This is a far cry from the planning process as it used to be practiced in architecture. Doubts have often been voiced as to whether it is still possible to have concurrent processes today, but I am convinced that it is possible. It has only become more difficult as the technical demands made of buildings have become increasingly diverse and sophisticated. And it requires changes, both to the capabilities of planners and in their definition of their own role.

D&A: Do you need different skills and expertise when dealing with existing stock rather than new buildings?

RH: I think that the necessary basic understanding is very similar in both cases. It is important to carefully consider two separate thematic areas: firstly, the cultural meaning an architect can give to a new building or which he must be capable of perceiving when he is working on an old building. And secondly, the functional

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solutions he can offer. The difference as to whether the existing building were still definitely important for the overall context? or is it not require an even indoor temperature of 20°C all year round and at all times, no limits and standards on ‘adaptive comfort’, in many areas it would sensibly be reworked? or is it not. Or is it even that we are aware that we may playable daylight and the thermal, and climatic and optimisation of buildings. Renate Hammerbach is head of the Division for Architecture and Engineering at the University of Technology in Vienna. Her key research areas are the architectural and urban planning of daylight planning and the thermal, civil and mechanical optimisation of buildings. Renate Hammerbach is head of the Division for Architecture and Engineering at the University of Technology in Vienna. Her key research areas are the architectural and urban planning of daylight planning and the thermal, civil and mechanical optimisation of buildings. 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The six BIA projects described in this book were designed and implemented by architects in the context of the IBA Hamburg project. The project was initiated in 1998 and was completed in 2002. The six BIA projects are: Hamburg Messe Hamburg, Metropoliten Hamburg, Hamburg Oberhafen, Hamburg Binnenalster, Hamburg Hafencity, and Hamburg MediaHafen. Each project was designed by a different team of architects, and the book provides an overview of the project's design process and the challenges faced by the architects. The book also includes case studies of the projects, with a focus on the environmental and social aspects of the projects. The book is intended to provide a comprehensive overview of the IBA Hamburg project and its impact on the city.
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