Hamburg ahead

INTERNATIONAL BUILDING EXHIBITION HAMBURG

Hybrid Houses

Hybride Development
Hybrid House
igs centre

December 2013

IBA_HAMBURG Building the City Anew

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Content

A Introduction

What are Hybrid Houses?

Today's cities face countless challenges. Social change is taking place due to new communication technologies, the break-up of traditional family structures, rapid fluctuation within urban districts, and rising immigration. As Georg Diez shrewdly observed in his column in Der Spiegel, the burning issue is " [...] how to make the city of the 19th century, the city of the bourgeoisie and their spacious apartments with stucco and parquet flooring, and the city of the 20th century, a city of the masses and their cramped apartments with tiny windows, long corridors, galley kitchens and mini bathrooms, into a 21st-century city."[1]

His column was a response to the unfortunate decision to cancel the Internationale Bauausstellung IBA International Building Exhibition Berlin 2020. He criticises the lack of vision and models for a "[...] city of the many [...] a city of hybrids, fragmentary and temporary, where living and working are brought together [...] a city that, at its best, makes the open city ideal a reality."[2] The goal should be to develop forms of living that are adapted to their users, rather than the other way around. We need to respond to the question of how we want to live in the 21st century.

A mere glance outside Berlin could provide some answers to this pressing and important question. In the years running up to 2013, the IBA Hamburg developed and implemented models that showcased forward-looking methods of construction and types of living. The "Hybrid Houses" are one of these models. Here, "hybrid" refers not to energy supply, but to the different options for use. The IBA Hamburg used the "Hybrid Houses" project to tackle the social challenge of formulating a new way of combining living and working. If it were to succeed in developing buildings that brought these different demands, which are often at odds with one another, together by employing all possible synergies, this could bring a whole new meaning to the idea of urban life. Mixed use, much vaunted over the years, was thus incorporated into individual buildings, and implemented with sustainability in mind. The proposals for the "Hybrid Houses" included the creation of architectural prototypes that interpreted anew the objectives of living and working under one roof and translated their changing demands into adaptable layouts.

A Changing Society

In today's society, the organisation of working processes and the nature of jobs are undergoing major changes that make it necessary to consider new typologies for residential and office buildings. Among professionals there is an ever greater shift towards entrepreneurship and self-employment. The workplace is moving closer to the home. Increasingly, companies are shifting their services to their workers' private sphere, as workers themselves aim for synergies by bringing their home and working lives closer together.

Classic types of work are also being altered by the total or temporary outsourcing of functions. Location- and time-independent work requires more flexibly structured office facilities and completely new types of space that go beyond classic arrangements such as offices and conference rooms. Residential needs are also undergoing considerable changes.

New workplace designs are not the only opportunity on the table. Constantly changing living conditions also demand forward-looking types of housing with residential designs that are as flexible as possible. Buildings must be adaptable, multi-purpose, expandable, and easy to reduce in size or split into separate parts. Typologies that allow temporary living, as well as providing family homes for several generations, are required. Buildings need to make use of room structures based on modular systems. As the levels of living and working activity vary in intensity over the course

[1] Diez, Georg: S.P.O.N. - Der Kritiker: Deutschland baut lieber Mittelmaß. Abrufbar unter: http://www.spiegel.de/kultur/gesellschaft/georg-diez-kolumne-deutschland-baut-mittelmass-a-908380.html , veröffentlicht am 28.06.2013, letzter Zugriff: 24.07.2013.

[2] Ibid.

of the day, combining the two modes means that the building can greatly increase its usability, as infrastructures and room plans can be reused multiple times.

Life in urban areas therefore requires ever more adaptable typologies, such as living and working under one roof or converting properties from double-income lofts into family homes. Hybrid houses act as a response to changing space requirements.

How flexibly can and should architecture react to modern lifestyles? And, speaking of flexibility, the overall ecological balance is playing an increasingly important role in construction. The lifespan of standard buildings is ever diminishing, greatly impairing their ecological balance. It is therefore vital to minimise the primary energy requirement and ensure sustainability in terms of sites, construction methods, and materials.

The IBA Hamburg's "Hybrid Houses" project furthered the design principles of mixed usage and flexibility coupled with sustainability. It sought to create adaptable buildings that are durable in terms of options for use, cost effectiveness, and ecology. The "Hybrid Houses" aimed to bring tomorrow's flexible forms of living to life, while demonstrating that greater flexibility can also mean greater energy efficiency, coupled with innovative architectural ideas for the configuration of the metrozone.

Usage programmes and a construction solution informed by an aesthetic design were developed for the three sites in Wilhelmsburg Central, with the aim of responding to the shift in working and living patterns, their most striking feature their new forms of mixed use.

As fundamental social changes place radical new demands on the structures of our buildings, it has been necessary to develop an ideal programme of layout and function that provides flexible spaces for new, forward-looking ways of working. This might mean offices sharing infrastructures, using communication and infrastructure platforms as meeting places for nomadic businesses, or boarding offices connected with boarding houses . In terms of construction, this will lead to switchable rooms or the creation of spaces that can be used for myriad activities. "Hybrid Houses" seek to develop layouts for living and working, meeting the requirements of each type of use and encouraging a cooperative synergy within one building.

In this respect, it was important to reconcile with each another in an innovative way the conflicting aspects of lighting and sunlight, openness and protection of privacy, and noise from the outside and soundproofing within the building. Approaches that sought to resolve possible conflicts of use were also incorporated into the development concept for the building. The extent to which the division of uses within the building, the different heights required between the floors, and the varying sizes of the window openings gave the block a strikingly „hybrid" appearance is an architectural and aesthetic issue that the approaches presented as part of the IBA Hamburg sought to solve.

IBA Hamburg 2013 – Three Approaches to Hybrid Houses

The "Hybrid Houses" aimed to implement the IBA excellence criteria based on the three key themes of the IBA Hamburg:

- Cosmopolis: the building can respond to the changing needs of its users.
- Cities and Climate Change: high energy standards are maintained across different types of use.
- Metrozones: the building's flexibility allows it to adapt to changing urban contexts and social needs.

The following overview outlines the three completed "Hybrid Houses" and sets out the essential principles for creating flexible-use buildings. The

building concepts are then explained in detail, the planning process and the challenges that arose when implementing the hybrid building technologies are described, before each section concludes with an evaluation of the process, covering the following points:

- Can the three "Hybrid Houses" serve as models for flexible-use buildings?
- To what extent have the goals set out before the beginning of the planning process been achieved?
- What were the biggest obstacles? How were these overcome?
- Where is there still room for improvement?
- What role can hybrid houses play in twenty-first century cities?

This White Paper seeks to answer these and other questions, and to make the concept of flexible-use hybrid houses more widely known as a type of housing for the 21st century.

Fig. 1: Aerial view of the Hybrid Houses from the north, July 2013

Fig. 2: Hybrid Development, west side, May 2013

The first of the "Hybrid Houses" projects presented here, called „Hybrid Development" was built to the south of Strasse Am Inselpark, on the edge of the Island Park and beside the Kanukanal. This building ensures maximum flexibility across each floor, and is essentially based on a sophisticated, accessible structure. Living and working can be kept clearly separate from one another, allowing them to coexist, but they can also be connected together with little effort. Within the building several units can be joined together horizontally, and even vertically, in the form of maisonette units.

Project details from page 8

Fig. 3: Hybrid House, south side, May 2013

Right next door is the simply named "Hybrid House", consisting of two structures and containing 12 maisonette units. Featuring innovative ground plans and intricate modules, the most striking feature of the building is that it offers different lighting conditions for living and working over the course of the day. Every unit has a view in all four directions, as in a detached house, and thus responds to the needs of people who sometimes work from home.

Project details from page 19

Fig. 4: igs Centre, north side, May 2013

The first "Hybrid House", the four-storey hybrid house hamburg / igs Centre, opened in 2011 and was used as the offices and visitor centre for the igs (international garden show hamburg 2013) until the end of 2013. This first cycle then came to an end, and the building is ready for a mix of uses. Only now will the building's special features become fully evident, as changes in use will be made at as low a cost as possible. A system of supports and modular upper floors will allow individual areas of the building to be adapted to the changing needs of its users: for instance, offices can be divided up into apartments or converted into commercial units.

Project details from page 30

B Hybrid Development

Fig. 5: East view, May 2013

Fig. 6: West view, April 2013

Projektbeteiligte

Investors	Wernst Immobilien, Hamburg / Deutsche Immobilien AG, Hamburg
Design	Bieling Architekten, Kassel/Hamburg
Technical building equipment	Planungsbüro für Haustechnik GmbH & Co. KG, Norderstedt
Specialist static engineering	Bollinger + Grohmann Ingenieure, Frankfurt a.M.
Specialist fire protection engineering	WTM Engineers, Hamburg
Other stakeholders	bauart, münchen (façade fire protection) breimann+bruun (landscape design) Hamburg Energie GmbH, Hamburg

General building data

Use	Residential and office building
Plot size	2.181 m²
Gross floor area	2.302 m²
Number of floors	4
Number of units	20
Size of units	43 - 120 m²
Energy standard	Energy conservation regulations (EnEV 2009), minimum requirement minus 30%
Energy supply	Wilhelmsburg Central Integrated Energy Network
Construction period	07/2012 to 03/2013

Structure

Foundation	Reinforced concrete floor
Primary structure	Reinforced concrete skeleton frame
Outer walls	Wooden frame elements with inlaid installations and back-ventilated larchwood façade cladding
Floor and ceiling elements	Reinforced concrete
Interior walls	Non-bearing: lightweight construction
Staircase walls	Reinforced concrete

B.1 Hybrid Development Concept

Bieling und Partner Architekten devised a hybrid design with a sophisticated access structure based on the systematic division of living and working space within the building. Their design therefore allowed the two areas to coexist flexibly and in parallel, while avoiding conflicts. The clear division between residential use and commercial use begins at the two entrances to the building.

Access is from the north. The paths to the separate entrances, to the commercial areas on the western side and the apartments on the eastern side, divide at the northeastern corner of the building. A flight of stairs directly beside the entrance to the apartments leads to seating steps within the garden, at a slightly lower level, which transitions into the Island Park. The driveway to the underground car park is on the northern side.

The block is arranged in such a way that it can have six apartments per floor, centred on an internal staircase that forms the key to the building's concept. This stairwell has two separate entrances and accommodates two interlocking flights of stairs. As such, the stairwell is like those found in shopping centres, where two staircases run in opposite directions. When transposed to a residential and office building, this results in two parallel staircases designed to go in opposite directions and open up the building.

Fig. 7: Layout #1

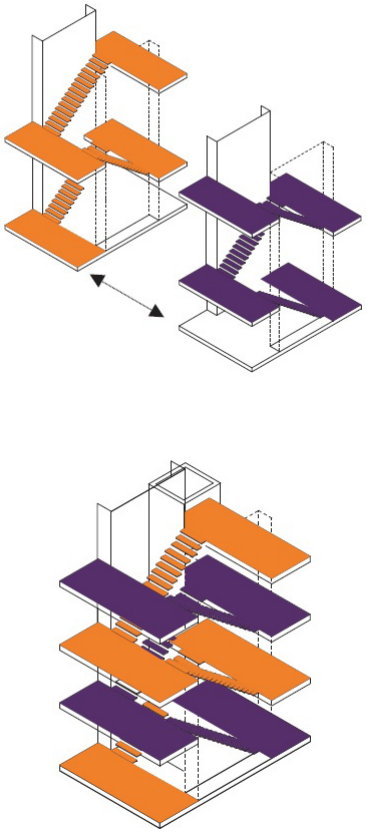

Fig. 8: Staircase sketch

The staircase ascending from the western entrance is intended for the part of the building that contains the offices, while the eastern stairs are meant for the apartments. The staircases are not connected, so there is no chance of accessing the residential staircase from the office entrance and thus intruding on the semi-private living areas. Conflicts of use between residents and workers are therefore impossible. The interior access area is enhanced by a central lift shaft; the lift serves all levels of the building.

Due to the structure – only the access core plus supports standing in a grid formation, 5.6 metres apart, and the floor and ceiling elements are load-bearing – the layouts are highly flexible,

permitting spaces that do not have a predetermined purpose. The building is based on a grid plan that allows for considerable variability in the arrangement of individual ground plans. Residential and working units are laid out over one floor and function as separate entities, but due to their method of construction can be joined together with very little effort. The interior walls are lightweight constructions and can easily be adapted to fit the needs of the building's users.

Units can be combined in order to meet the hybrid use concept: it is possible to create passages between units on one floor that are accessed by the office or the residential staircases respectively. This creates a set-up in which, for instance, a lawyer might have his office in the same building as his apartment. This makes it possible to keep an eye on children while also advising clients, who do not have to walk through the apartment, but simply enter a professional office. Using the staircase also means that clients have no contact with the office-user's residential environment. As Prof. Thomas Bieling says:

"I enter the building through the residential entrance. Pictures hang in the hallway, shoes lie outside the doors and I almost stumble over a toy car belonging to my neighbour's child before I reach my apartment. When I have to meet clients, I simply go through the connecting door and receive them there – they have reached my office through the other staircase intended for the work-related part of the building – in a professional setting."

The "Hybrid Development" concept is particularly innovative because it completely separates the working and living modes from one another, while also allowing them to coexist under one roof or be connected together, thus contributing towards reducing road traffic and promoting a more sustainable urban structure.

Fig. 9: Layout #2

Fig. 10: Layout #3

B.2 Architectural Implementation

Fig. 11: View from the northwest, March 2013

The basement, containing the cellar rooms, bicycle storage and 20 car parking spaces, is formed like a mound and topped by four upper floors. The driveway down to the underground garage is a ramp along the narrow northeastern side of the building. In terms of area, the basement is larger than the floors above ground, incorporating the private outdoor areas of the ground floor zone as well as the semi-public entrances to the staircase.

This design features a single building block within a greater master plan. The block is set within the park and surrounded by green spaces and the waters of the canal. Its shape sets it strikingly apart from the rest of its immediate environment. Notches and recesses such as covered balconies break up the façades. The deep recesses on all façades bring daylight into the inner part of the building. These niches serve as balconies and offer covered outdoor areas for the residents. The highly segmented façade is defined by layered ribbon windows, enclosed areas and curtain-like surfaces featuring disc-like cladding made of rough-edged, untreated larchwood.

The basic square grid, each side 5.60 m, is applied over a rectangular floor area across all floors (building measurements: 5 ✣ 4 grids – 22.40 ✣ 28 m). This structure forms the backbone of the building structure and provides the basis for implementing a ground plan that allows flexible use. This makes it possible to connect four to six units to the central element on every floor, while permitting units to be linked horizontally (room chains) or vertically through different floors (e.g. maisonettes on the second and third floors).

The units can thus be placed beside or above one another, enabling living and working modes to be brought together within one unit, while also remaining separate. Numerous recesses on all four sides of the building bring light into the interior and thus into the interlocking units of the cuboid structure. These recesses also function as balconies. Due to the combination of enclosed surfaces and large window elements, some of which are grouped into bands of windows, the building appears as a highly segmented structure with an almost typecase-like look. The shell is punctuated in places by slanting window reveals and breast walls with rear-ventilated metal lining. This means that the block, which appears compact from a distance, has an eclectic appearance up close, while the grid that informs the whole structure is discernible.

The outer walls are fitted with vertically structured façade lining made of larchwood panels. The top of the building features a flat roof with large

green areas.

Structure

From the basement floor up, the building was constructed as a skeleton frame with all of the load-bearing and buttressing building components made of reinforced concrete around a staircase core made of the same material. The shell, a natural wood frame construction, is non-load-bearing and set in front of the mineral structure. The wood frame elements used are fire-resistant and placed immediately in front of the reinforced concrete supports and floor and ceiling elements. The installation level extends inwards into the mineral part of the building's cubature. At the transitions between the floors the connections are securely fitted between the horizontal reinforced concrete and vertical wooden building elements as notches that help to prevent fire from spreading.

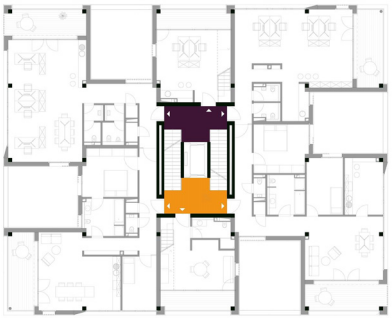

Fig. 12: Ground plan, 2nd floor

Fig. 13: Ground plan, 1st floor

Inside, the installation level is fitted with a double-layered covering made of plasterboard and is insulated without any cavities. The wall of the wooden frame elements is based on structural timbers measuring 8 ✣ 26 cm. The elements are also cavity-free and fitted with mineral insulating material, as well as a vapour barrier behind an oriented strand board cover. A 15 mm thick plasterboard firecheck wallboard encloses this part of the building.

An aluminium substructure was fixed to the wooden elements of the ventilated façade cladding, with black-coated fibre cement slabs on top. In turn, these were fitted with larchwood panels. The wooden façade is segmented by horizontally arranged sheet moulding, placed immediately above each floor and ceiling element, which also acts as fire protection (preventing fire from spreading along the façade). Despite the four-storey design, it is possible to have a façade made solely of wood (prefabricated wood frame elements) due to the smart positioning of the window openings. The possibility of fire spreading from floor to floor is prevented by the shift between open and closed areas. Both of the building's escape routes within the solid staircase core also contribute to a positive outlook from a fire safety point of view.

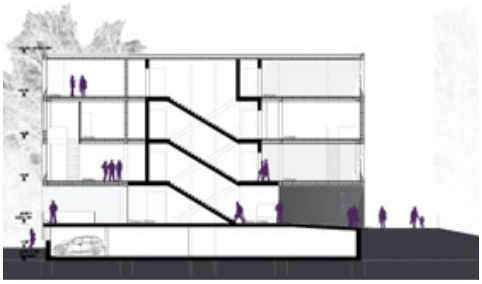

Fig. 14: North-south cross-section

Energy Concept

DDue to its compact overall system and structural form (minimisation of thermal bridges, including in the mineral structure), the building falls 30 per cent below the requirements set out in the energy conservation regulations (EnEV, 2009). Energy is primarily supplied via the local heat grid run by the Wilhelmsburg Central Integrated Energy Network. Part of the concept is that every unit is fitted with mechanical ventilators with heat recovery that can be adjusted separately. The units are ventilated through the living or working rooms, while deaeration occurs in the kitchens and toilets. In addition, all of the apartments have underfloor heating. The roof of the building is covered with soil and a large area is planted.

Heat insulation and the façade concept are measured according to the apartment in question and feature a certain overcapacity that would not be necessary in the case of purely commercial use. The commercial areas thus have better standards in terms of heat and sound insulation. The noise protection standard is also designed for apartments, so as not to preclude units from being used as homes.

As far as the façade is concerned, this means that on average the sound insulation is 5dB better than properties used for purely commercial use, and the building is fitted with triple-layered insulation glazing. The maximum permissible sound level of 30dB inside (in the bedrooms) at night with the window open has been verified in all units, assisted by special ventilators in the façade.

All of the units comply with the raised sound insulation level according to DIN 4109, supplementary sheet 2.

Building Services Concept

The building services design is key to the functioning of the hybrid concept and flexible use. In order to achieve the desired level of flexibility, the building must be considered as both a purely commercial building and as a purely residential property. The building services concept required the following aspects to be implemented in the construction:

- Shaft concept: The main shafts run upwards through the staircase core to the units. These supply the units with heat, electricity and telecommunications. Water and waste water are carried through additional shafts on the floors, allowing the sanitary facilities to be set up in different ways (kitchens, full bathrooms, shower rooms, tea kitchens, toilet facilities for workers). The shafts are arranged in such a way that they allow the ground plan to be changed easily to fit around them. All of the shafts have overcapacity in their cross-sections so that subsequent upgrading can be carried out.

- Overcapacity: In order to accommodate both types of use – commercial and residential – the supply and disposal lines were set out according to the worst case scenario. Electricity and telecommunications were installed in such a way that an office with several workstations or a medical practice could be set up within each unit. If units are combined, then the capacity doubles.

- The building's floor finishes all have a load of 5 kN/square metre and a thickness of 8 cm. Higher loads due to appliances, shelving

Fig. 15: View from the west, May 2013

or storage facilities can be projected. The height of the floor finish allows a system of ducts and tanks to be installed if the unit is to be used commercially, and thus to supply every desk directly.

- The units are ventilated through the façade in the case of both residential and commercial use.

B.3 Planning Process

Joint peer review by the IBA Hamburg and the igs 2013 took place in the second quarter of 2009, with "Hybrid Houses" as its theme, and involving five firms of architects. It concluded on 22 June with the selection of the design by Nägeliarchitekten, based in Berlin, for the planned igs exhibition and office building (see Section D.1-4). The two remaining plots of the "Hybrid Houses" site, which contained a total of three plots, was put out for tender by the IBA Hamburg, in conjunction with the Hamburg Department of Finance and building and property management companies, in another two-stage plot divestiture process.

Investors teamed up with a firm of architects and other expert planners to develop a sophisticated design concept, a business model with a financial plan, a price offer and the figures for any subsidies or additional funds required. The winner was chosen from the six offers in two stages. First, the quality of the design concept was assessed by a selection committee. Second, the economic parameters of the tender were reviewed by another selection committee in close conjunction with the assessment from the first round (development concept). The committee finally recommended the tender by Bieters Deutsche Immobilien AG (Hamburg), to be implemented by Bieling und Partner Architekten, subject to successful negotiations.

At its core, the original design – with two interlocking staircases – is unchanged. Due to new building owners and various technical reasons some alterations were made to the design. While the building was originally planned as a solid timber construction, ultimately only the wooden façade was retained. The timber construction was planned as a skeleton structure of supports and beams on the same grid. The ceilings were to have been composed of insulated panel elements. This modular design would have meant considerable advantages in terms of flexibility, but also disadvantages for sound insulation and fire prevention, which led to adjustment of the

Fig. 16: Visualisation for competition

concept. A casing was necessary in order to avoid moisture seeping into the shell of the building. As urban timber constructions are still an exception in Hamburg, and the fire safety regulations would have required exemptions, waivers and compensatory measures, a pure timber design was rejected. The initially planned cavity floor was also turned down for this reason, and the previously mentioned floor finish solution chosen in its place.

The planned use of grey water and the fitting of the window frames with photovoltaic elements in the façades were not implemented for economic reasons. Upgrading with photovoltaic elements will, however, be possible at a later date, without conversion. Rainwater is completely drained and the building is supplied with water from the public mains,

A not inconsiderable amount of planning work is necessary to build and run hybrid houses. The provision of technical systems for combined commercial and residential use is more complex than for buildings that are intended for one mode of use alone. The additional planning and construction expenses that this entailed amounted to less than 10 per cent of the total cost and were covered by the IBA's promotion of excellence programme. However, the double-access design enables the space to be used flexibly and sustainably over the long term, as the units can be adapted

Fig. 17: View of the construction phase, autumn 2012

to social change with little effort. This means that the higher construction costs are compensated for in the medium term.

Relatively large demands were placed on the building in other areas, too: fall protection on the upper floors, for instance, was more complicated due to the potential commercial use, as for offices it must be more than for housing. The location – close to Wilhelmsburger Reichsstrasse – and the hybrid structure also meant that the sound insulation requirements were significantly higher. The implementation of this block has demonstrated that when planning hybrid buildings the approach must always be aimed at the highest requirements for both types of use, which leads to more intensive planning and higher overall costs.

During the planning process the key question was: "Which type of use should we cite when applying for planning permission?" The application took an unusual route (see page 17), as it cited only the possibility of splitting residential and commercial space according to a quota. Applying for an area as a hybrid space is not an option according to the building regulations. In the future, change of use will therefore be possible only if a request for a change is made. In this case the building application cited 100 per cent residential use, and this influenced the subsequent marketing of the project, as any change towards commercial use would have required requests for an amendment.

B.4 | Evaluation

Fig. 18: Hybrid Development, May 2013

The results of the "Hybrid Development" project are overwhelmingly positive. Some aspects of the original concept were not implemented, but the key idea of split access and flexible-use spaces could be carried out as planned. As only the access core, supports and ceilings are load-bearing, the block can be altered relatively easily. It was thus possible to construct a building that combines different uses without any conflict, while allowing it to be adapted to the needs of its users and ensuring high quality with low operating costs.

If the building concept is implemented in future, the following improvements should be considered:

- Alternative construction methods.
- Integrated development of the building concept by investors and planners.
- Various design aspects, such as the design of the staircases.
- Joint marketing for commercial and residential units.

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According to the original plan, the supporting structure was to be made of wooden beams and wooden composite flooring. A sophisticated beam structure meant that smooth wooden undersides had to be produced. The oblique position of the wooden ceiling beams would have allowed an optimal load distribution, enabling the rooms to be used in many different ways. This was also possible with the concrete structure, but aspects relating to sustainability would have been better addressed if wood had been used.

The implementation process for the building could be improved. Smooth coordination between architects, expert planners and investors is absolutely vital if the implementation is to be a success, particularly in view of the complex planning required. "Hybrid Development" has higher construction costs than conventional residential or commercial buildings, but it compensates with the advantages that come from its flexible options for use. If a change in use is required, there is no need for major conversion work: the task can be carried out easily. In order for this to happen there needs to be mutual understanding about this new typology and solution-oriented project.

Improvements to the structure mostly relate to the design. A different design for the staircase would allow either a working or living space to be created. Later efforts should incorporate heat recovery with automatic ventilation to ensure sound insulation, which will also lead to greater energy efficiency.

The units were not jointly marketed as flexible-use residential and commercial spaces, but rather either as apartments or as commercial units. The classic mediation process through estate agents, who market either residential or commercial properties, does not work for the hybrid concept. A marketing approach regarding the building as property units is not ideal in this case. For the "Hybrid Development" project this has meant that at present most of the units in the block are used as apartments. The joint sale of apartments and commercial units would have worked better if the units had been marketed differently: the building concept only really comes to life if it is seen and experienced in person. The use of the property model made this impossible, as the bank required this type of preliminary marketing in order to grant credit. However, this should not be seen as a shortcoming, as the typology of the "Hybrid Houses" was specifically created around the idea of flexible-use units that could be used according to demand. Given the current state of the housing market in Hamburg it is no surprise that the majority of the units are being used as apartments.

Hybrid houses are an emerging sector, but they have yet to become a really established part of the overall market. The demand for such hybrid residential and commercial buildings exists, as proven by the reaction to the "Hybrid Development" concept. There is a need for the units to be jointly marketed as residential and commercial properties, as well as for greater awareness of the hybrid use concept.

One example of the lack of understanding about this typology is the experience of the owner of a unit within "Hybrid Development". A psychologist bought two units that were approved for residential use. As he wanted to use one of them for his practice, he had to redesignate the use via an application for an alteration. Such additional hurdles could be significantly reduced by determining a quota for splitting the building – or, better, by making building regulations law more flexible.

C Hybrid House

Fig. 19: View from the west side, May 2013

Fig. 20: View of the courtyard, May 2013

Stakeholders

Investors	HTP Hybrid House GmbH & Co KG, Hamburg (Hamburg Team)
Design	Brandlhuber + NiehüserS Architekten, Berlin Kleffel Papay Warncke Architekten Partnerschaft, Hamburg
Technical building services	HB Ingenieure, Braunlage
Specialist static engineering	ahw Ingenieure, Hamburg
Other stakeholders	Haubich Freiräume, Hamburg Hamburg Energie GmbH, Hamburg

General building data

Use	Combined residential and office units
Plot size	2.040 m²
Gross floor area	2.488 m²
Number of floors	4
Number of units	16
Size of units	65 - 150 m²
Energy standard	KfW-70 standard (energy conservation regulations, EnEV 2009)
Energy supply	Wilhelmsburg Central Integrated Energy Network
Construction period	12/2011 bis 03/2013

Structure

Foundation	Ferroconcrete floor
Primary structure	Reinforced concrete skeleton frame
Outer walls	Plastered ETICS, varnished aluminium for the window surrounds
Floor and ceiling elements	Reinforced concrete construction
Interior walls	Non-load-bearing: lightweight construction

C.1 Hybrid House Concept

Fig. 21: Isometry of a unit within the Hybrid House

The basic principle of the "Hybrid House" is to provide versatile units that can be used for living or working, adapting to the changing needs of their users. The spaces allow the areas that fall between the two uses to be expanded or contracted dynamically, thus offering the residents the highest possible degree of flexibility.

The key idea here is responding to the different light requirements for each unit, depending on the time of day and the type of use. A central concern when developing the "Hybrid House" was to accommodate the different needs of the users within the living and working areas as well as possible. This was implemented through a smart and sophisticated architectural design, with innovative ground plans. A total of 16 units, most of them maisonettes, combine an east-west module with a north-south module, so that they face all four directions. Due to this approach, each residential unit offers views in all directions and has four different amounts of light – something that is otherwise the sole preserve of detached houses. Balconies and gardens provide a connection to the outdoors. A roof terrace gives the upper maisonettes yet more views, including over the neighbouring Island Park.

Offering a range of spaces, the "Hybrid House" is ideal for both working and living. The aim is a split between 50 per cent residential use and 50 per cent office use, with the office use predominantly housed in the areas oriented north-south on the ground and second floors, as these offer

Fig. 22: Horizontal structure of the building, southern façade, May 2013

direct access to the units. The residential areas are mainly located in the areas oriented east-west, which represent a private retreat and are accessed via an internal staircase. However, it is also possible to use the units purely as offices or as homes. A main outdoor access point up a communal staircase and an arcade allow the modular system to be implemented throughout the building, while the ground plans can be divided up at the user's discretion.

Both blocks of the building offer additional units on the first and third floors that can be knocked together with the neighbouring maisonettes, offering even more options for configuring the ground plans. The building's versatility in terms of the dimensions and division of units means that it can respond to the changing circumstances and needs of its residents and its surroundings.

The structural work involved in changing the use of a unit is very limited in comparison with conventional residential units, as it is an integral part of the flexible use concept. As a result, time and money can be saved if units are knocked together, reduced in size or repurposed, while the consumption of material is also kept as low as possible. Modifications that need to be carried out due to the changing living circumstances of residents do not, therefore, impact on the whole building. Indeed, quite the opposite is true: accommodating such eventualities is part of the sustainable overall concept of the building.

C.2 Architectural Implementation

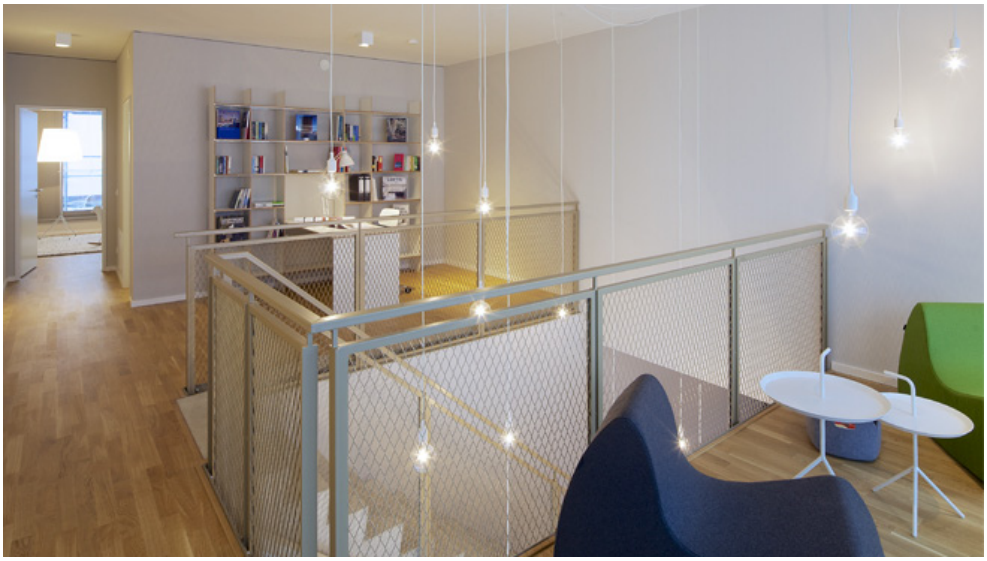

Fig. 23: Interior view of a module oriented north-south, 1st floor

The building shell of the "Hybrid House" is divided into two cubes of equal size, each containing eight residential and commercial units. Here, ensuring flexible use means opening the building up even more: the ground floor units not only have an entrance from the east (the side of the block where the main entrance is located), but also additional entrances from the west. The ground floor units are therefore the most versatile. The maisonettes on the second and third floors have only one entrance from the east, via the arcade. The other small modules located on the eastern side of the building (oriented north-south) are also accessible only via that arcade on the eastern side. The main entrance at the east has a lift, allowing large loads to be carried to the upper floors. The lift shaft also houses the central services connections, as the building does not have a basement. All of the units are accessible.

The criss-crossing, interlocking arrangement of the two modules that make up each unit serve the different daylight needs of the separate living and working areas. Areas that do not require direct sunlight can use the northern side, with areas that require most intense daylight accommodated on the western and southern sides. Due to the design of the modules' connection and the need to provide optimal lighting for the inner parts of the building, the spaces between the two floors of a module are located in different places, so the units are structured differently. This affords users the possibility of determining the use of the areas within the unit in an even more individual way. Of the three models, this typological "Hybrid House" exemplifies the variability between living and working functions to the greatest extent. Is this a living or working area? The transitions between the different modes are fluid here.

A two-storey air space containing stairs connects the floors. Together with windows in the façade and roof, this space allows light to flood into the interior. Each unit is fitted with two ducts, 5.60 metres and 4.80 metres wide respectively, creating two different types of maisonette, covering either 135 square metres or 148 square metres.

Another aspect of the building's versatile approach is the way in which adjoining units can be combined. Two or more maisonettes can be connected to form up to one whole unit over two floors, lying directly above one another. Conti-

guous areas of up to around 500 square metres could potentially be created. A maisonette could be combined with a single module to form a small office with a large apartment, or a large office with a small apartment. This is made possible by open floor plans and easy to dismantle interior walls between the residential units. The open plan allows users to configure the units to their own taste, using the versatile design of the living and working spaces.

Alongside versatile use, individuality is paramount. In its basic form, the block has no dividing walls, only cleverly positioned cores for bathrooms and kitchens. Buyers or tenants can customise the layout and fittings according to their own needs. The spatial structure, design and window arrangement allow the units to be divided up, even in small buildings. The residential and commercial units have ceilings at least 2.75 metres high. Some of the technical installations are visible, provided they are not housed in the floors or walls.

Structure

Due to the ground conditions, pillar foundations were used and the building could not have a basement. The load-bearing components of the block consist of reinforced concrete wall slabs and ceilings. The wall slabs form part of a structure made of pilasters, beams, and casings, in order to ensure that the partition walls between the modules are interchangeable, allowing the modules to be combined. The main load transfer takes place at the crossing points of the respective bulkheads for each module. The module spans do not require any supports. The outer walls and partition walls between the modules (infills in the reinforced concrete structure) are brick-built. Rooms are divided by dry, mortarless structures. The interior stairs are made of prefabricated reinforced concrete. The balcony slabs are reinforced concrete and are thermally separated from the rest of the building. The roof is a waterproof concrete structure produced according to guidelines for watertight structures. It was built as a flat, inverted roof, and parts of it are used as a roof terrace. The remaining parts of the roof are mostly planted.

The building's structure is evident from the façade, due to the alternation of plaster wall surfaces (on the long sides of the modules) and large windows (on the short sides). The plastered façades are designed as a thermal insulation system. The short sides feature large floor-to-ceiling aluminium-framed windows with triple glazing and special ventilation flaps to ensure that the interior sound level does not exceed 30 dBA at night with the windows open. The windows are framed by aluminium elements (Eloxal E6/C32). Numerous functions are housed within these large frames, including sun protection elements and fall protection for the windows.

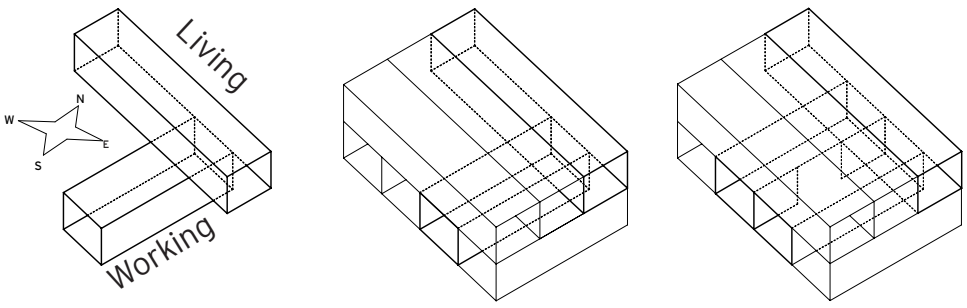

Fig. 24: Hybrid House draft concept

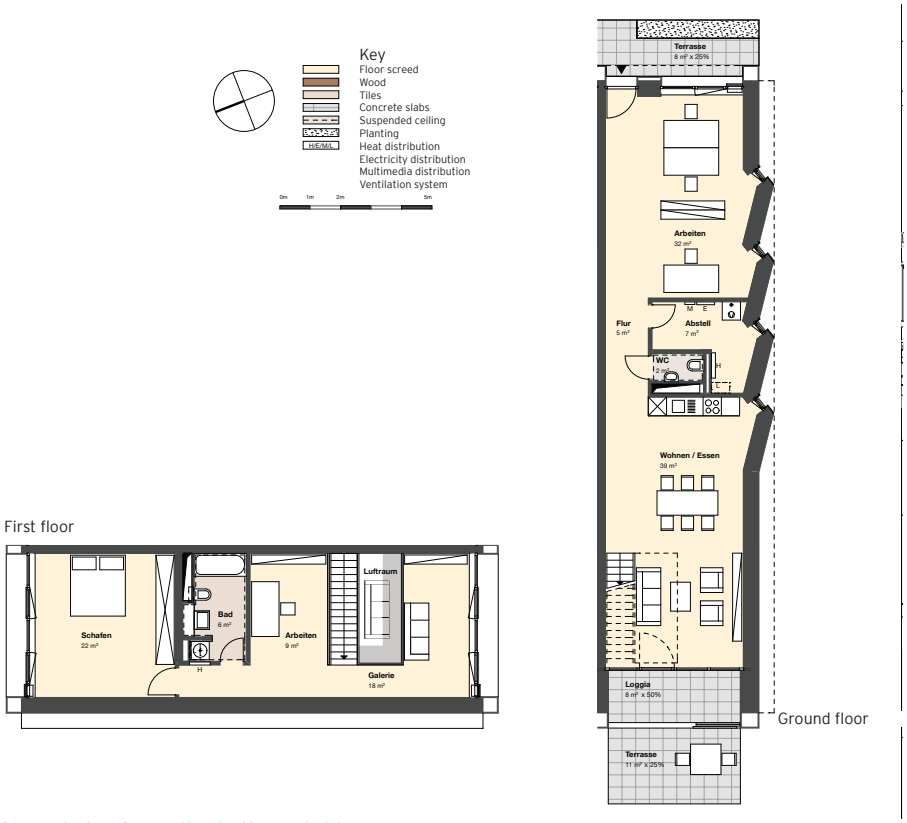

Fig. 25: Ground plan for Unit 11 in the Hybrid House

Energy Concept and Sound Insulation

The "Hybrid House" was built to KfW-70 standard and meets the IBA minimum standard of 30% below the level stipulated in the energy conservation regulations (EnEV, 2009). The block is completely supplied with heating and hot water from the local heat grid operated by Wilhelmsburg Central Integrated Energy Network, and is thus heated by renewable energy sources. It has a ventilation system with heat recovery.

The heat protection system and the façade design were devised on the basis of residential use, and have a certain overcapacity that would not be necessary if the block were used purely as offices. The commercial spaces thus have better heat and sound insulation standards than would otherwise be the case. The sound insulation standard also corresponds to the requirements for housing, so every unit can potentially be used as a home.

For the façade this meant that sound insulation was 5 dB better on average than in properties used solely for commercial purposes and without systematic provision of triple-layer insulating glazing. The maximum permissible sound level of 30 dB inside (in the bedrooms) at night with the window open is adhered to in all units, assisted by special ventilator flaps in the façade.

All of the units observe the raised sound insulation level according to DIN 4109, supplementary sheet 2.

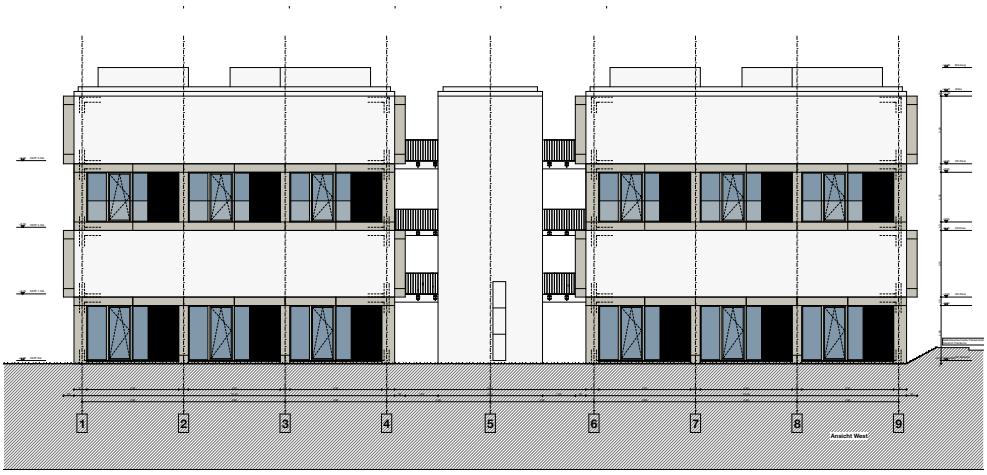

Fig. 26: Cross-section of the façade

Building Services Concept

The building services concept is crucial to the smooth operation of the hybrid concept. In order to achieve the desired level of versatility, it is necessary to consider the block both as a purely commercial property and as a purely residential property.

According to the building services concept for the "Hybrid House", the individual units are designed separately, so that they perform at 100 per cent for both modes of use:

- The core zones allow the sanitary facilities to be arranged in different ways (kitchens, full bathrooms, shower rooms, tea kitchens, toilets for workers).
- The shafts are set up in such a way that ground plans can easily be altered around them.
- Overcapacity: In order to accommodate both types of use – commercial and residential – the supply and disposal lines were set out according to the worst case scenario.
- Ventilation is set up so that air exchange rates for offices are met.
- The floor finishes have a load of 5 kN/ square metre.
- The lift is intended for commercial use.
- The outdoor facilities are aimed at the requirements of both commercial users (e.g. the high number of parking places) and residents (e.g. private areas including balconies) or act as design elements for dual access on the ground floor (e.g. bell systems and differentiated design for the different entrance areas).

C.3 Planning Process

Joint peer review by the IBA Hamburg and the igs 2013 took place in the second quarter of 2009, with hybrid houses as its theme, and involving five firms of architects. It concluded on 22 June with the selection of the design by Nägeliarchitekten, based in Berlin, for the planned igs exhibition and office building (see Section D.1-4). The two remaining plots of the whole "Hybrid Houses" site, which contained a total of three plots, were put out for tender by the IBA Hamburg, in conjunction with the Hamburg Department of Finance and building and property management companies, in another two-stage plot divestiture process.

A number of changes were made to the design in the second phase of the tender and in the subsequent adaptation phase, right up until the building application. These changes had less to do with the concept and more to do with its implementation. The winning concept, entitled "2-level 4-direction module", by the Berlin-based firm Brandelhuber + NiehüserS was devised on behalf of the investor Hamburg Team and adapted by the firm Kleffel Papay Warncke Architekten Partnerschaft after the tender, to be built on the middle plot. This was due to a recommendation by the jury.

Given this context, the decision was made to dispense with the creation of a basement level and the pillars and structure for an underground garage. Parking spaces were instead planned for the eastern side of the building. Access to the two parts of the block, which had been planned for the same point as the garage, was relocated to the western side. As part of the changes to the design the original diamond shape of the buildings, based on the shape of the plot, was transposed to a rectangular shape on a new plot. At the same time, the axis spacing of the apartments was increased from 4.2 metres to 4.8 metres. A total of 16 units were created, of which 12 are maisonettes running crosswise. The remaining four units have a separate entrance via the arcade and can be connected to the neighbouring

Fig. 27: Visualisation for competition

units. In the original concept, the access point between the two buildings allowed the small individual modules to be positioned flexibly between the maisonettes.

The open plan layout that featured in the original design, intended to bring light into the interior space on the long sides of the modules, was rejected, as this was not enough to provide sufficient light. Instead, light slits were created on the wall panels along the long sides so that enough light is provided even when the rooms are deep.

The inner courtyard was reduced in size due to the increase in the axis grid, in order to provide more space within the units. The placement of the arcade on the western side ensured better lighting on the ground floor.

The plan was set out in such a way that each type of use – residential or commercial – met the standards for whichever mode had more stringent requirements. Examples of this are the high number of car parking spaces, anti-glare shields, the cleaning arrangements for the façades, which are necessary for commercial units, the sound and heat insulation, and the provision of a ventilation system. Due to the building's proximity to Wilhelmsburger Reichsstrasse, it had to meet high sound insulation requirements. In order to ensure sound insulation in the bedrooms at night, even with the windows open, it was necessary

Fig. 28: Interior view, ground floor

to devise special window and ventilation flap designs.

The planning application for the building cited that it would be mixed-use, with 63 per cent residential use and 37 per cent commercial use. Any changes of use within the "Hybrid House" will also require a corresponding change of use application. The key points to consider here are the following:

- Car parking entitlement (in order to change to purely commercial use at a later date, it would be necessary to provide about twice as many car parking spaces. This means that the car parking entitlement can only be granted through replacements or through a change in commercial law, not through office use).
- Clearance spaces (the spaces intended for commercial use were also subject to the clearance regulations for residential use).
- Sound insulation and lighting (lower structural requirements were implemented in accordance with housing construction standards, but at the same time the building was subject to additional measures, such as anti-glare shields, sun protection, and façade cleaning).

An energy subsidy was granted to the building by building society Wohnungsbaukreditanstalt Hamburg (WK). Due to the hybrid nature of the project, this funding could be granted only on a provisional basis:

- Only some of the units could receive funding, as commercial spaces are not eligible. If the use is changed, funding already granted would have to be paid back.
- Due to mixed use, the current size of the units is above that stipulated under the terms of the subsidy, so there is a cap on the subsidy for spaces above 120 square metres.

The original concept of a passive house was amended during the planning process to the IBA minimum standard of 30 per cent below the energy conservation regulations (EnEV, 2009). The reason for this was problems relating to building services when simultaneously designing a passive house as a residential building and as an office and commercial premises. The focus of the project is on the implementation of hybrid construction to produce a versatile building that can adapt to changes in society.

C.4 Evaluation

Fig. 29: Hybrid House, west view, May 2013

First and foremost, it is important to point out that higher initial investment was required due to the extra access features (in the structure and the building services) and the incorporation of two different types of use. However, over the course of the building's life cycle, this investment makes the project more cost effective. The relatively high level of flexibility allows the block to be adapted to new usage requirements quickly and at low cost.

The "Hybrid House" typological model is ideal for those who require a close connection between their home and working lives, as the private and commercial spheres are incorporated into all areas and can only be separated with difficulty. The crosswise module offers a unique typology that integrates living and working in a striking way. Overall, the project does not represent a typology for family apartments in which work can also take place; that would be possible only if modules were combined.

The concept's strengths really become evident over the building's whole life cycle, despite the higher costs of planning and implementing the construction. Once complete, the model is particularly suitable as a rental property, as it is easy to join up individual units and thus react to changing demands in the housing market.

Nonetheless, the "Hybrid House" is a successful example of flexible-use residential and commercial units contributing towards a smarter city that can adapt to the needs of its users.

Various general lessons can be learned from the results of the "Hybrid House" planning process and applied to other hybrid buildings:

- Hybrid buildings are not provided for in planning law: in all categories of the German Land Use Ordinance (BauNVO) they come up against obstacles, as the basic concept relates to 100 per cent residential or commercial use.
- Flexible typologies designed with change of use in mind are not provided for in the building regulations. It is possible to apply for a change of use, but there is no legal certainty that this will be approved. Basically, this is to stop residential spaces being converted into commercial premises.
- Multiple and additional access points are essential due to requirements for commercial and residential property development.
- Despite the hybrid concept, there needs to be a division between living and working at the level of the whole building or the apartment, in order to prevent conflict between the two domains.

Fig. 30: Hybrid House, interior view, ground floor

- A typology that allows use to be changed cost-effectively and with little effort is key to the success of the concept.

It should be noted that the implementation of hybrid buildings represents not inconsiderable risks for investors due to planning and building regulation requirements (clearance regulations, sound insulation, etc.). The high level of complexity and more stringent requirements also make hybrid projects more expensive than conventional, single-purpose buildings, which could mean a financial risk for the building owners.

Space within the "Hybrid House" is sold at an average price of approximately € 3,500 per square metre, which is only slightly below the Hamburg average (according to the LBS figures for new-build freehold apartments, March 2013: approx. € 3,700 per square metre).

Fig. 31: Hybrid House, west view

D hybrid house hamburg / igs Centre

Fig. 32: View of the west side

Fig. 33: View of the south side

Projektbeteiligte

Investors	Otto Wulff Bauunternehmen GmbH, Hamburg wph Wohnbau und Projektent-wicklung Hamburg GmbH, Hamburg
Design	Gudrun Sack, Walter Nägeli NAEGELIARCHITEKTEN, Berlin
Technical building services	Otto Wulf Bauunternehmung GmbH & Co. KG, Hamburg
Static engineering	IB Mei, Berlin
Fire protection engineering	Halfkann + Kirchner, Berlin
Prime contractor	Otto Wulf Bauunternehmung GmbH & Co. KG, Hamburg Hamburger Sparkasse
Project partners	Hamburg Energie (district heating grid)

General building data

Use	Flexible-use office and exhibition building
Plot size	1,900 m²
Gross floor area	2,400 m²
Number of floors	4 + basement half-floor (parking spaces)
Number of units	12
Size of units	102-124 m²
Energy standard	KfW-70 standard (energy conservation regulations, EnEV 2009)
Energy supply	Wilhelmsburg Central Integrated Energy Network, soil probes
Construction period	07/2010 to 09/2011

Structure

Foundation	Reinforced concrete floor on pillar foundation in the basement
Primary construction	Reinforced concrete skeleton frame
Outer walls	Timber frame elements with panel construction , without diffusion barrier; interior with installation level and plasterboard lining, exterior with rear-ventilated aluminium panel façade and additional insulating layer
Floor and ceiling elements	Reinforced concrete with floating floor fill
Interior walls	Bearing and reinforcing: sand-lime brickwork Non-bearing: lightweight construction Skeleton frame with sand-lime refractory lining

D.1 hybrid house hamburg Concept

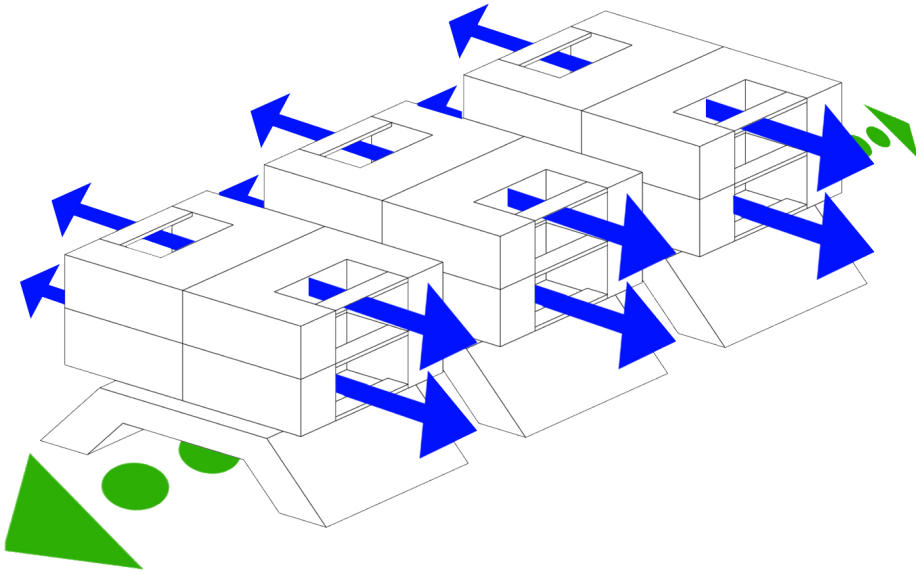

Fig. 34: Isometry for integration into the landscape

The hybrid aspect of the concept behind the "Am Inselpark 1" building, currently in use as the igs Centre, has three components:

To begin with, the materials used – wood and concrete – are resource-efficient. When optimally combined, they are proven to provide a good indoor environment, while ensuring lower heat consumption costs due to insulation. The exterior walls were made of timber for its heat insulation properties and sustainability, while the building's supporting structure was made of concrete in order to ensure large spans and effective sound insulation and fire protection.

The base of the building and the slanting outer façade of the ground floor are planted, like a mound, and integrate the building with its surroundings. The block and the landscape merge into one another. This effect is carried forward on the upper part of the façade, which features a glistening green mosaic made of aluminium panels. The colour of the façade alters depending on the light. The building thus reflects the fusion of architecture and nature in its form and colour.

The energy concept also complements the close connection between the block and nature. Its energy needs are met by geothermal energy and renewable local heat from the Wilhelmsburg Central Integrated Energy Network, as well as heat recovery from the room air. This energy mix completely eliminates heat generated from fossil fuels.

The third and most important component is the spatial design, involving a modular concept that offers flexible use in a range of different areas within the building. Whether they act as office, residential or exhibition spaces, all of the units can be adapted to the needs of their respective users in a flexible way. The block's first cycle of use as an exhibition space and office building for the igs 2013 ends after 2013. Thanks to the hybrid concept, however, the building offers myriad options for mixed residential and commercial reuse, or community living for people of all ages.

The ground floor is a prime example of this flexibility, as it currently houses the exhibition space.

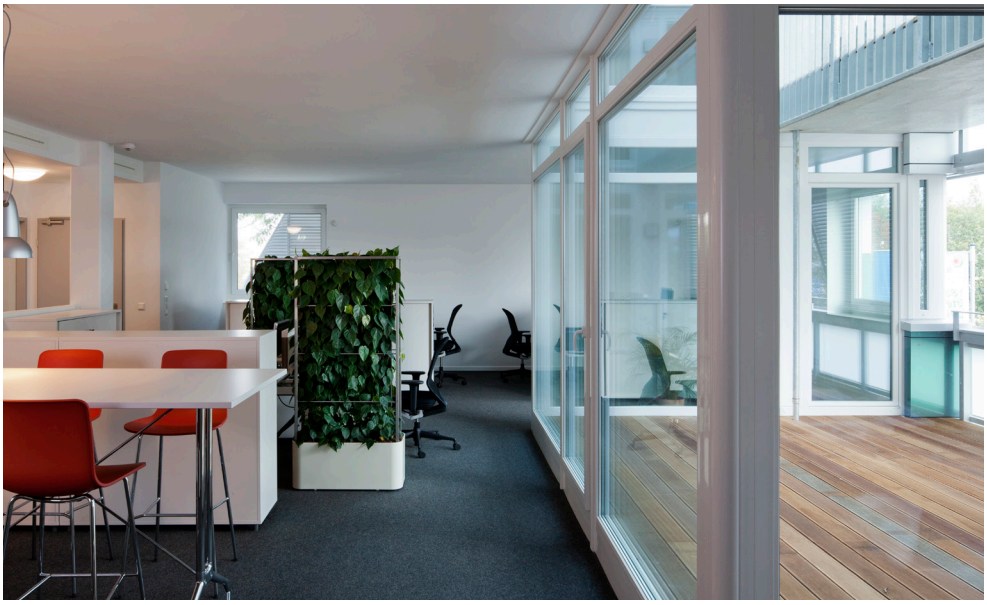

Fig. 35: Interior view of an office unit, first floor

It can be divided up into small offices and commercial units with very little effort, thus saving resources. The building's conversion to a hybrid house at the end of 2013 will require only a modicum of alterations, and will take up only about 3 per cent of the total volume of the building.

A system of supports and different access elements allows the upper floors to be split up flexibly and adapted to changing needs. Offices can be converted into apartments and subsequently used as offices again. Each of the 12 units is U-shaped and arranged around an atrium. These atria not only bring daylight into the depths of the building all year round, but can also be opened and used as balconies.

In terms of typology, the building is made up of the outer U-shaped modules and an inner access and supply zone. The modular part is built on top of the sculpturally shaped mound and is crossed by the access zone. From the outside the building appears enclosed, as the façade covers the atria that form recesses on its sides. Internal access stairs provide fast connections between spaces for workers and visitors. The ground plan, which is currently open, fosters communication among the igs management in addition to the privacy required at single-user workstations.

The igs Centre was awarded the silver seal of quality by the Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB, German Society for Sustainable Building) for its sustainability and energy concept.

D.2 Architectural Implementation

Fig. 36: Interior view, ground floor

ÜAbove the basement, which is located within the mound and has external dimensions of 29.60 ✣ 27.20 metres, and the partly slanting external components on the lowest level, four floors are arranged over six floors (23 ✣ 26.65 metres), laid out as split levels. Five car parking spaces are integrated into the basement, which is a multi-purpose area, spread over one and a half storeys, with no connection to the upper floors apart from access via the central staircase at the core of the building.

On each floor above the mound, the units are arranged as U-shaped modules around the central staircase with its lift shaft. The modules are based on a grid of irregular yet similar dimensions. The three floors of the hybrid house hamburg comprise 10 units, each measuring 102-124 square metres, divided into U-shaped modules. Each of these modules is arranged around an atrium. The modules in the northern part of the building can be accessed from two sides via the second staircase. A U can therefore be used by two different occupants: they may either divide the third space in the middle, or one of the users may use two of the three rooms. The smallest possible unit therefore has an area of approximately 35 square metres, with its own entrance, lavatory, and adjoining room.

In addition to the main entrances to the north and south (access area), the mound has four additional entrances on the eastern and western sides. This means that the mound area can be subdivided into a maximum of four more separate ground-floor units, but the lavatories and utility rooms on the mezzanine floor must be shared.

The typological principle behind the hybrid house hamburg is geared towards maximum compartmentalisation of separate units. From a single room for living or working to the close blend of living and working in a U-shaped module or the use of a module purely for living or working, any combination is possible. The block is even suitable for cross-storey use, as is currently the case for the igs 2013, where visitors are welcomed into the open entrance area.

Inside the building, the two access cores and all of the sanitary facilities and utility rooms are on the walls of the U-shaped modules that face away from the atrium. An access area cuts through the mound from north to south, and also contains the entrances to the main staircase at the centre of the building and a second staircase to the north. A bridge on the northern side extends this access element even further, all the way to Neuenfelder Strasse. This core zone is designed in such a way that both types of use, working and living, are pre-installed in the layout concept for the shafts. The utility room design allows them to be converted into office lavatories and apartment bathrooms with little effort, while server rooms can be transformed into storage areas for the apartments.

The light required for residential use is brought into the depths of the building through the atria.

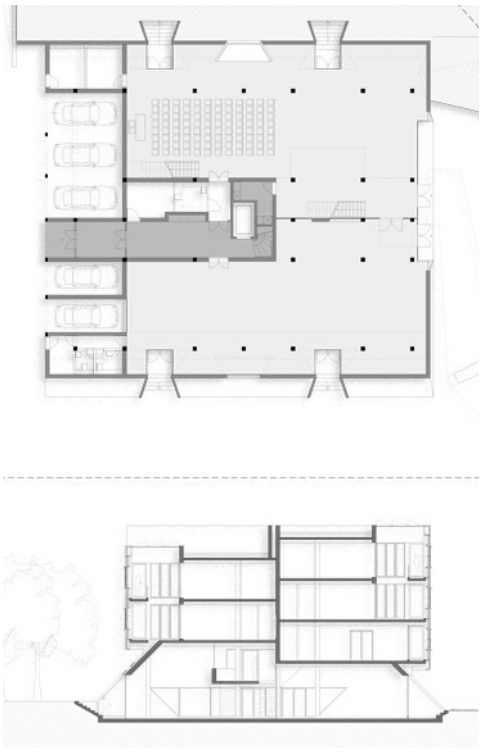

Fig. 37: Ground floor ground plan and cross-section (free scale, oriented north)

These have an all-glass façade running along the inner side of the U-shaped modules, while their open side is enclosed by the block's façade. From the outside, the building therefore appears as a compact, solid shape atop the green mound. The façade also extends to the area around the offset flat roof surfaces, acting as attics on the unit level. The roof terrace on the western side of the building thus acts as an inner courtyard on the roof. Certain parts of the façade can be pulled back around the atria, so that the sliding panels provide a sound insulating effect for the atria and balconies or terraces belonging to the units. The roofs of the atria are covered over with glass.

The colour scheme featured on the façade aims to reflect the colours of the building's natural surroundings. The greenery on the mound changes with the seasons, and the colours of the aluminium façade panels also change their hue according to the direction of the sun and its brightness. The sliding façade panels, which provide sound insulation and opacity, also give it a constantly changing appearance.

Structure

The building was planned and built as a hybrid construction made of reinforced concrete and brickwork, plus prefabricated wooden board elements. The primary structure is a reinforced concrete skeleton frame offset inwards about 1.50 metres from the edges of the upper floors, on an irregular grid of maximum size around 6.80 ✣ 5.00 metres. The foundations and load transfer use driven piles.

The floor and ceiling elements and the flat roof structure are prefabricated, reinforced concrete ceilings with grout topping in cast-in-place concrete (total thickness: 18 cm). The base plate is 20 cm thick. The flooring comprises 5 cm impact noise insulation, 4.5 cm floating floor fill and a 1.5 cm thick covering made of parquet or synthetic resin. Electricity is supplied via conduits and floor tanks integrated into the flooring. The undersides of the ceilings contain sound insulation plaster.

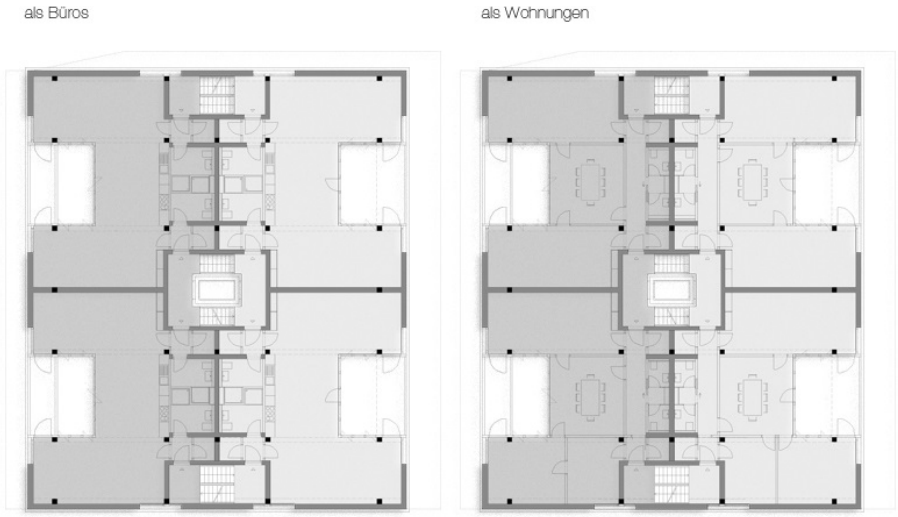

Fig. 38: Ground plan variations on the upper floors

The outer walls were constructed as non-bearing timber frame elements – large, prefabricated panels with sizes of up to 3 ✣ 11 metres. These components contain an extra level of insulation, are diffusion-open, and are placed in front of the skeleton frame. The supports for the outer wall components are mounted on the ceilings above the basement. Aluminium plates cast on site and fixed to an aluminium substructure provide ventilated façade cladding. The windows are synthetic and triple glazed.

The sloping roof of the mound was designed as a classic insulated rafter roof structure, and is planted with great deal of greenery. Above the planted surface, the base of the building slopes like a roof structure, and has a metal covering (classic standing seam). The roofs were also designed as flat roofs planted with extensive vegetation. The heat insulation beneath is 30 centimetres thick. The roof terraces have an ashlar panel covering. The bearing and reinforcing interior walls are built as KS designs, while the non-bearing interior walls are lightweight structures.

Sound insulation

Due to the hybrid house's proximity to Wilhelmsburger Reichsstrasse and the intersection of Dratelnstrasse and Neuenfelder Strasse, outer sound insulation was crucial for the building. To enable residential occupancy without placing any constraints on flexibility of use, the façade had to be designed for residences, and the building had to meet the corresponding sound insulation requirements. As mentioned previously, ventilation in the bedrooms at night had to keep to a maximum interior noise level of 30 dbA. This meant that the following measures were necessary as part of the concept:

- Positioning of the ventilation windows within the atria (the two branches of the U-shaped module could be used as the sleeping areas)
- Limiting the opening of the flaps and integrating scuncheons with absorbent material
- Constructing recesses (atria) in the building, with a second façade as a continuous, even shell running in front of the recesses. This would contain impact panes in the sill and ledge area of the atria or balconies behind, and sliding shutters as moving impact panes that would protect the outdoor balcony

seating areas and individual windows from noise.

Inside, the sound insulation also meets the standards for residential buildings, i.e. increased sound insulation according to DIN 4109. This also applied to the building services appliances and the shafts. As the shafts were pre-installed for both types of use, any change in this respect will not affect the shaft, but only other conduits. Great care was taken over the design of the façade connections (large panels applied to several units), the solid structure, and the need to prevent noise transmission through the façade from one unit to another. This was ensured by the additional insulation on the inside of the façade, as well as the sound-insulated connections.

Fire protection

Fire protection measures were complicated for the interior atria, which were originally designed to be completely enclosed, with additional convector ventilation to preheat the outdoor air. For fire safety reasons the atria had to be made more open in order to prevent any chimney effect. However, the hybrid concept of multiple access points complied with the fire protection requirements, as it provided a second escape route. The mound was originally planned as an open plan space and was also used as a room for events, and once it was divided by a glass wall with fire-resistant glazing, the multiple access concept meant that the requirements for means of escape were met.

Hybridkonzept

The building's hybrid concept works alongside the flexible space typology and thepreviously mentioned themes, with the following technical components:

- Larger floor spans.
- Better floor finishes (ground floor: 7.5 kN/square metre; upper floors: 5.0 kN/square metre)
- Building services components, such as double address generation with double the equipment for bells systems and letter boxes, wiring through floor ducts and tanks, and a hybrid energy generation concept.

Building Services

The building services concept is geared towards meeting the building's thermal heat needs and ensuring that it has a low energy requirement throughout its life cycle.

Hybrid house hamburg receives both local heat from the decentralised Wilhelmsburg Central Integrated Energy Network and geothermal energy from soil probes sunk 80 metres deep. Heat pumps and air conditioning units control an integrated heating and cooling cycle that operates throughout the year, providing a pleasant indoor climate. In winter they pump thermal heat into the building, while in summer cold is extracted from the ground and used to cool the building via the ventilation and underfloor heating (and cooling) systems. Heat recovery from the waste air greatly reduces the primary energy consumption and carbon dioxide emissions. Overall, the KfW-70 standard is achieved, according to the energy conservation regulations (EnEV 2009), which corresponds to 30 per cent below the minimum requirements, and thus complies with the IBA's minimum standard.

The upper floors are heated by an underfloor heating system supplied by the heat pumps. On the ground floor the ventilation system includes monitored aeration and deaeration with heat recovery and obtains its energy from the local heat grid. The central hot water supply also receives energy from local heat. The building is cooled by the ventilation system, which obtains its energy from geothermal sources. The changeover between heating and cooling occurs on the basis of a fixed date (timeframe) and by gauging the temperature outdoors. The heat pump was set to 27 kilowatt heat output and 35kilowatt cooling capability. The basement contains a 1,000 litre heat buffer storage tank and a 1,500 litre cold

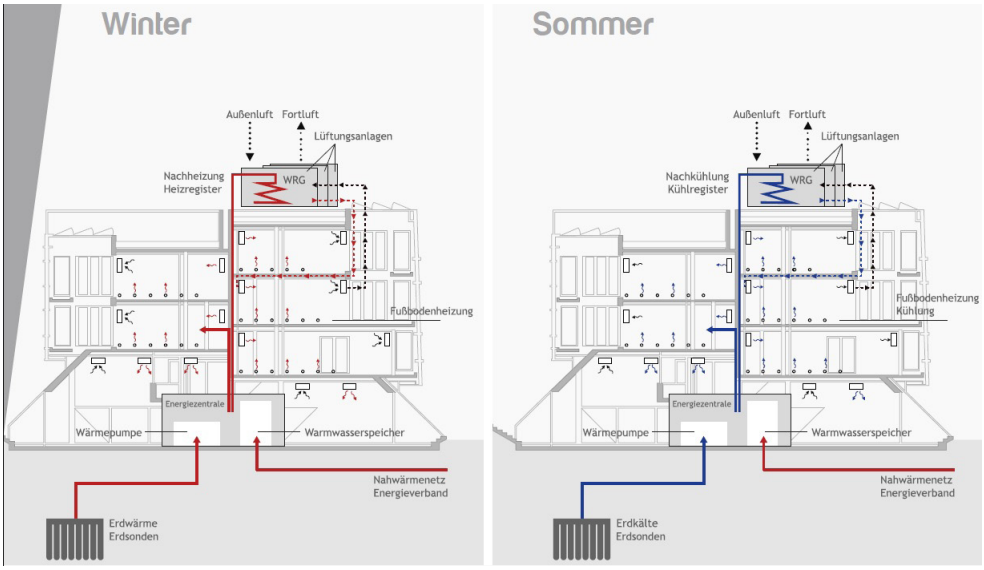

Fig. 39: Energy concept

storage tank.

The distribution system for all of the building services appliances was scaled in such a way that they are suitable for office use and use within the home. The water requirement for an apartment is, for example, higher than that for an office, while the need for mechanical ventilation is lower. The necessary alterations can therefore be made easily within the units. A tea kitchen and male and female lavatories can be converted into a kitchen and an apartment bathroom.

All vulnerable media connections were laid in protective tubes in the earth, and feed into the building services room on the ground floor. The fact that all of the connections are concentrated in one place within the building makes installation and subsequent replacement simple due to easy access. Their position on the ground floor next to the exhibition area also affords the opportunity to display the building's technology.

All of the installations were arranged with sustainability in mind and incorporated in such a way that they will be easy to replace in the future. Concrete-moulded pipe was therefore deliberately omitted. In order to accommodate future developments, all of the installation paths were designed to make later installations within the units easily accessible. All of the ducts are designed with at least 20 per cent extra capacity.

Rainwater that falls onto the roof is stored and used to water the planted mound. Excess rainwater is drained into the nearby watercourse.

Fig. 40: Detailed view of the basement

Sustainability Concept

The building has been awarded a Silver Certificate by the Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB, German Society for Sustainable Building). The key parameters for achieving this certification were the typological basic concept that can react to changes, sustainable material selection, particularly the timber structure with low global warming potential and use of energy, and the energy concept, which is based on a mix of renewable forms of energy with equally high insulation properties.

D.3 Planungsprozess

Joint peer review by the IBA Hamburg and the igs 2013 took place in the second quarter of 2009, with hybrid houses as its theme, involving five firms of architects. It concluded on 22 June with the selection of the design by Nägeliarchiteckten, based in Berlin, for the planned igs exhibition and office building. Construction on the planned plot, called "Am Inselpark 1" and the concept by Nägeliarchitekten were advertised to investors. The tender for the plot and implementation of the concept were eventually taken by Otto Wulff Bauunternehmung GmbH and wph Wohnbau und Projektentwicklung Hamburg GmbH. In conjunction with the IBA and igs 2013 as subsequent tenants, and Nägeliarchitekten as the planners up to the building application, and beyond as design overseers, the project went ahead. The detailed design was drawn up by the Hamburg-based firm Timm + Goullon, while Otto Wulff Bauunternehmung GmbH took over the planning.

During the planning process, a number of changes that had been presented during the tender were made to the project:

- The typological extra access concept was reduced from three staircases in the original plan to two. This led to some concerns among tenants over the flexible concept, as it slightly reduced the possibility of compartmentalising the space, but it did not present an obstacle.
- Changing the material concept was more serious, and was due to the lack of experience of timber construction among the clients and the sound insulation requirements for residential use. The originally planned timber construction was scaled back to a hybrid made of concrete and wood. The original concept of a solid vertical connection between the U-shaped modules could not be implemented (something that was regularly lamented on tours of the building).
- The alterations to the material concept meant that the intended DGNB Gold Certificate could not be achieved. Other changes affected the energy standard. Having originally been planned as a passive house, the building was implemented as a KfW-70 structure that met the IBA's minimum standard of 30 per cent below the level stipulated in the energy conservation regulations (EnEV 2009). This was due to a decision by the clients to reduce the complexity of the project in conjunction with the focus on the core theme of flexible use. The clients may have decided differently had the building been granted funding by the Wohnungsbaukreditanstalt (WK – building society) on the basis of its flexible use concept.
- The atria, which were originally designed as enclosed conservatories that would use the sunlight that entered them to preheat the air supply were altered once the energy concept was revised. Originally, these were designed without geothermal energy and were to release their excess energy into the local grid operated by the Wilhelmsburg Central Integrated Energy Network. However, at the time that the project was completed this was neither foreseeable nor covered by a contract, so it was decided that excess energy would be held in a buffer storage tank in the ground.
- Adjusting the level of insulation the atria met the requirements stipulated in the energy conservation regulations, while

Fig. 41: Visualisation for competition

Fig. 42: Northwest façade, summer 2012

positioning the atria on the outer part of the building meant that the fire safety requirements for the outer façade were fulfilled. A change in the façade materials – Alucobond instead of Trespa – was made for maintenance reasons.

As a building application was submitted for the project before the preliminary deadline for planning approval, it was possible to implement the planning law requirements for the project, including the possibility of constructing a block that would accommodate 100 per cent commercial use in a general residential area. This was due to the possibility of gathering several kinds of commercial use within one part of the hybrid house

The building permit, which was the first to be granted for the "Hybrid Houses" and the "Building Exhibition within the Building Exhibition", had the following features:

- Car-parking spaces:
  Given that the first phase of use would be 100 per cent commercial, a large number of car parking spaces were required. These could not be accommodated on the plot and would have entailed work to the ground floor. An extension was incorporated into the contract until the first phase of the change of use. (NB: The buildings that have since been constructed are missing a number of parking spaces.)
- Fire protection and sound insulation:
  The creation of window openings and ventilation at night were crucial to the sound insulation concept and ensuring that the building complied with the interior maximum sound level of 30 dbA at night. Fire protection measures informed the changes to the atrium concept and the spatial design of the mound, as well as the division of the space instead of an open plan layout.

D.4 Evaluation

Fig. 43: Entrance ramp, first floor

The igs 2013 has used the building for several years as their offices and as an exhibition centre. The positive experience of those who have used the block endorses the expectations that were raised by the model, and testifies to the quality of the design.

The extent to which re-use and conversion are easy to implement remains to be seen. As the building's first use cycle will end in 2014 with the departure of the igs management, no final conclusion can yet be drawn.

Another positive aspect of the approach was the decision to put the model forward for an assessment by the DGNB. This was considered a desirable goal for all projects that formed part of the "Building Exhibition within the Building Exhibition", and was actually implemented in this case. The "Water Houses" and "WOODCUBE" projects also received DGNB certification.

The whole life cycle of the building was considered when selecting the construction materials, in order to make it as sustainable as possible. Specifically, this was implemented by:

- Carbon dioxide reduction due to choice of materials and construction processes.
- Re-usability due to smart building components and materials.
- Theblock's adaptability to the environment, which – through the use of sunlight, shade, geothermal energy and its integration into the landscape – is the result of a forward-looking approach that was awarded the DGNB silver certificate.

Finally, it remains to provide brief answers to the questions posed at the beginning of this White Paper.

- Is the igs Centre a model for flexible-use buildings?
  From the point of view of flexible use, the project is transferable as a model, even for non-IBA projects.

- To what extent were the aims set out before the beginning of the planning process achieved?
  The project goals were very ambitious. From the very outset it was clear that the project could only be implemented with one partner,

Fig. 44: hybrid house hamburg / igs Centre, interior view, ground floor

meaning that there were often adjustments and changes to handle. However, the overall quality of the building, especially with regard to the hybrid theme, should not go unnoticed. The aims of the project were all met. The tender entry by Nägeliarchitekten made a number of suggestions that merit further investigation (see below). Whether the omission of the third staircase will be beneficial to the project over the long term remains to be seen.

- What were the greatest obstacles?
  The legal framework presented the greatest obstacle. Planning law does not provide for buildings that can change their use from 100 per cent residential to 100 per cent commercial. Exemptions in residential, mixed and core areas did not go far enough to allow the model to be presented in a standard way. As a result, the second major hurdle was the building regulations, as a building permit can only be granted for specific types of use, not for possible uses. Any change in use therefore requires its own change of use application.

- Where is there room for improvement?
  The biggest challenges to the hybrid building concept, which is centred on maximum flexibility of use, related to sound insulation and the building services design. The concept of dividing the units horizontally, and especially vertically, has not yet been completely worked through in terms of the requirements for increased sound insulation according to DIN 4109, supplementary sheet 2, or the VDI guidelines. The choice of construction materials also comes into play here. When discussing the building services, the project repeatedly came up against instances in which the stakeholders had to face the question of whether flexibility of use was to be considered or factored into the building services concepts at all.

hybrid house hamburg has implemented very convincingly the concept of additional access coupled with maximum compartmentalisation and flexible use. The client's property management and leasing model also complements this approach. The building thus demonstrates how its flexible concept allows it to really be responsive to social and market changes.

E Conclusion

Do the "Hybrid Houses" act as models for flexible-use buildings?

All three models demonstrate different strategies for flexible-use buildings that can be changed from residential to work-related, or a mix thereof, with little effort. What all of the models have in common is that they implement the theme using multiple or additional access points, with several access cores, extra entrances and building services concepts that allow diverse modes of use, along with more versatile supporting systems and larger span widths. All of the models are geared towards the highest possible requirements for use as a living or working space, and blend these demands together in their respective approaches.

The aim of the models is to provide typological responses to future social developments (changes in family circumstance, fusing the domains of living and working, sustainability through allowing change over the cycle of use).

hybrid house hamburg pursues this goal by enabling maximum compartmentalisation, with units able to function as a series of homes, office spaces, or a mix of the two. This is supplemented by a hybrid construction concept in timber and concrete and a hybrid energy concept designed to make the building as autonomous as possible.

"Hybrid House" pursues this goal with its innovative loft-type units, oriented in all four directions as maisonettes, which in turn can be divided up to suit their users.

"Hybrid Development" pursues this goal through its complex access system and the possibility of dividing the building up in a versatile way thanks to the dimensions of the units on each floor, without reaching the same level of compartmentalisation as that seen at hybrid house hamburg. Here the hybrid concept is enhanced by a mixed timber and concrete construction concept.

To what extent have the goals set out before the beginning of the planning process been achieved?

The goals set out during the process were implemented from the IBA's point of view, especially in terms of the central theme of hybrid use and versatility. The energy and sustainability goals fell short of targets and expectations, but the standards achieved are still very good.

What were the greatest obstacles, and how were these overcome?

There were major obstacles in terms of legal requirements and building regulations or norms. One example was the fact that changing use is not provided for in the planning or building regulations. A hybrid building must always be seen from two perspectives – living and working. The energy conservation regulations, DIN norms, bodies that offer funding such as the Wohnungsbaukreditanstalt (WK), and required air exchange rates give rise to sometimes conflicting and even contradictory demands, making implementation either extremely complex, or in some cases impossible. If the project is to meet requirements relating to both areas, it must always fulfil the most stringent stipulations pertaining to either mode. During the planning stage this means formulating a detailed design for different variations, due to this two-fold task. The HOAI, for instance, does not provide for such eventualities.

The building services plan represented a special case in all of the projects, as both domains had to be considered. This was not achieved in any of the projects at the outset; the groundwork had to be carried out by trained engineers. Sustainable building services must be adaptable and reversible.

Areas for Improvement

The "Hybrid House" and "Hybrid Development" projects were marketed as property models. This was not considered to be the right approach for the "Hybrid Houses", if they were to meet their future objectives, as designation as private

property weakens the building's adaptability and versatility. Of course, the use within a privately owned unit may change, or the unit may be converted with little effort, but the options for expanding beyond the units defined in the first cycle of use cannot be implemented. Rental solutions or keeping the building under the ownership of the clients would allow the buildings' typological potential to be harnessed much more effectively, which would have a positive impact on the life cycle.

Commercial units are not a matter of concern for the property market, even though these could be transformed into residential spaces with alittle effort in acquiring the necessary permits. The marketing process has shown this clearly, particularly in the case of "Hybrid Development".

Future Viability of Hybrid Buildings

In the future, social change will necessitate new types of buildings that can grow along with a person's own life or daily activities, and can also contract according to their needs. Standard housing offers ever fewer answers and is only able to remain in its present state because there is a massive lack of supply in cities, and users are forced to make compromises when it comes to their lifestyles.

Cost Effectiveness

The IBA "Hybrid Houses" project was based on the idea that flexible-use typologies that could change their use with little effort were more sustainable in the long term, in terms of the environment and the cost effectiveness of the project: buildings would not be left vacant due to social change or shifts in demand within the residential or commercial property market. The building typology is always able to respond. While this requires higher initial investment in structural engineering, span widths, additional access points and "higher" standards, costs are saved with the change of use, as the building has already been prepared for such change. This is particularly true of the building services (over-capacity, flexible connections). Higher standards also tend to mean higher rents. Versatile use, adaptability and flexible leasing capacity (which also applies to individual unit owners) provide a long-term prospect for the building.

The projects have shown that a total of 7-15 per cent additional costs can be expected, depending on the typological concept. Conversion through a change of use application always involves a legal or political risk.

Need for Adjustment to the German Land Use Regulations: BauNVO and BauO

With the possibility of accumulating units over several areas set out in the development plan, the potential for 100 per cent commercial use within a general residential area is built into the design. This is a crutch that worked here only because of the parameters of this specific development plan, so it is not really transferable to other projects. If the aim is for mixed use on a small scale, at a building level, over a floor or within the unit itself, the arrangements set out in the BauNVO are not sufficient. These regulations need to incorporate a Hybrid designation!

As the "Hybrid Houses" were developed according to the "higher" requirements for residential and office use, the building permit does not require any stipulation relating to use, and subsequent change in use does not require an application for a change. Unfortunately, this is not provided for in the BauO and ancillary building law – these are the respective state construction laws, which vary greatly from one another.

List of illustrations

Cover:	IBA Hamburg / Bernadette Grimmenstein
Figure 1:	IBA Hamburg / Falcon Crest Air
Figure 2:	IBA Hamburg / Bernadette Grimmenstein
Figure 3:	IBA Hamburg / Bernadette Grimmenstein
Figure 4:	IBA Hamburg / Bernadette Grimmenstein
Figure 5:	IBA Hamburg / Martin Kunze
Figure 6:	IBA Hamburg / Martin Kunze
Figure 7:	Bieling Architekten, Kassel/Hamburg
Figure 8:	Bieling Architekten, Kassel/Hamburg
Figure 9:	Bieling Architekten, Kassel/Hamburg
Figure 10:	Bieling Architekten, Kassel/Hamburg
Figure 11:	IBA Hamburg / Martin Kunze
Figure 12:	Bieling Architekten, Kassel/Hamburg
Figure 13:	Bieling Architekten, Kassel/Hamburg
Figure 14:	Bieling Architekten, Kassel/Hamburg
Figure 15:	IBA Hamburg / Bernadette Grimmenstein
Figure 16:	Bieling Architekten, Kassel/Hamburg
Figure 17:	IBA Hamburg / Martin Kunze
Figure 18:	IBA Hamburg / Martin Kunze
Figure 19:	IBA Hamburg / Bernadette Grimmenstein
Figure 20:	IBA Hamburg / Bernadette Grimmenstein
Figure 21:	HTP Hybrid House GmbH & Co. KG, Hamburg
Figure 22:	IBA Hamburg / Bernadette Grimmenstein
Figure 23:	HTP Hybrid House GmbH & Co. KG, Hamburg
Figure 24:	Brandelhuber + NiehüserS Architekten, Berlin
Figure 25:	Kleffel Papay Warncke Architekten Partnerschaft, Hamburg
Figure 26:	Kleffel Papay Warncke Architekten Partnerschaft, Hamburg
Figure 27:	Brandelhuber + NiehüserS Architekten, Berlin
Figure 28:	IBA Hamburg / Bernadette Grimmenstein
Figure 29:	IBA Hamburg / Bernadette Grimmenstein
Figure 30:	IBA Hamburg / Bernadette Grimmenstein
Figure 31:	HTP Hybrid House GmbH & Co. KG, Hamburg
Figure 32:	IBA Hamburg / Bernadette Grimmenstein
Figure 33:	IBA Hamburg / Bernadette Grimmenstein
Figure 34:	NAEGELIARCHITEKTEN, Berlin
Figure 35:	IBA Hamburg / Bernadette Grimmenstein
Figure 36:	IBA Hamburg / Bernadette Grimmenstein
Figure 37:	NAEGELIARCHITEKTEN, Berlin
Figure 38:	NAEGELIARCHITEKTEN, Berlin
Figure 39:	Otto Wulff Bauunternehmen GmbH, Hamburg
Figure 40:	IBA Hamburg / Bernadette Grimmenstein
Figure 41:	NAEGELIARCHITEKTEN, Berlin
Figure 42:	IBA Hamburg / Bernadette Grimmenstein
Figure 43:	IBA Hamburg / Bernadette Grimmenstein
Figure 44:	IBA Hamburg / Bernadette Grimmenstein