MINI CO2 HOUSES

THE MINICO2 HOUSES IN NYBORG
– valuable lessons






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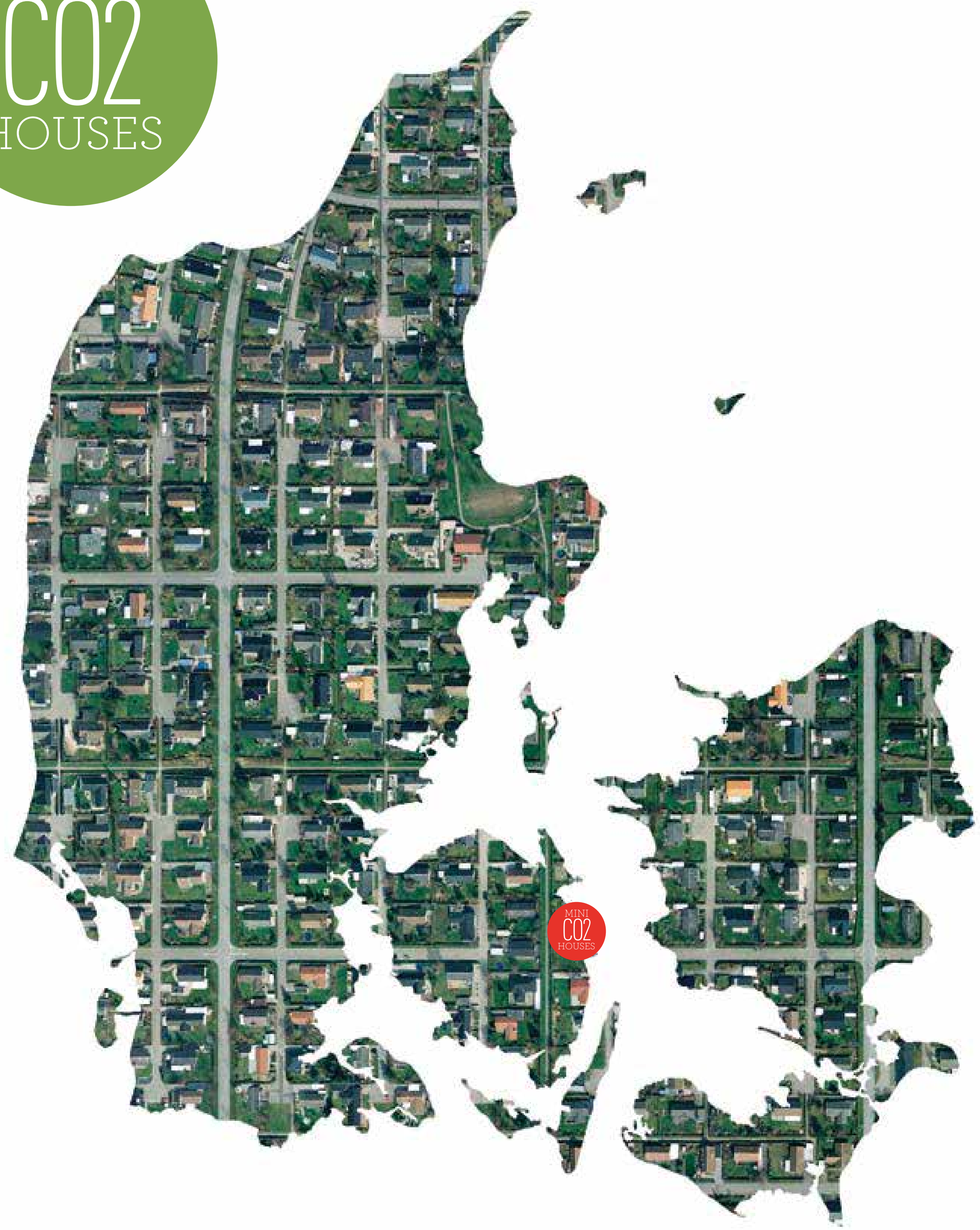


THE MINICO2 HOUSES: A PROBLEM-DRIVEN PROJECT

In Nyborg, on the island of Funen, Realdania Byg has recently built six individually different single-family houses. The impetus has been to demonstrate five extreme ways to reduce the CO_2 footprint in five different houses, as a basis for developing the sixth house; a single-family Mini-CO_2 standard house, combining all the lessons learned.

This strategy solves a three-pronged challenge in one house; it reduces the carbon footprint by 45 percent, compared to a traditional standard house, it offers a number of added architectural, technological and life-improving qualities to the house – and it is available to customers at a price that matches traditional standard houses already on the market.

WHAT'S THE PROBLEM?

It is a well-established fact that climate change is an effect of carbon emissions (carbon dioxide is one of the greenhouse gases). Construction and building account for approximately 40 percent of carbon emissions in Denmark and the world in general. Most of the 40 percent derives from energy consumption for

THE INNOVATIVE MAINTENANCE-FREE HOUSE

The Innovative Maintenance-free House

heating but thanks to strict building regulations in Denmark, which have resulted in increasingly energy-efficient buildings, the percentage has declined in recent years. With heating more or less under control, focus should now turn towards two other factors, which until now have not really been taken into consideration in the carbon-emissions debate: One is building materials, as production of new materials results in carbon emission. During the life cycle of a house various building components will be replaced by new components, adding to total carbon emissions. Eventually, when the house is demolished at the end of its life, the waste materials generate additional carbon emissions, if they are disposed of or processed as waste instead of being reused or recycled.

"This project presents a solution – not the solution. It simply demonstrates that it will be possible to do what we have done in the MiniCO2 Houses, in many other types of constructions, and I hope that houses built within the next five years will have a dramatically different carbon profile from that of houses being built today.
I am pleased that the standard-house manufacturer who built the MiniCO2 Standard House has already decided to include it in his catalogue for future home-buyers to choose from. We would urge other standard-house manufacturers to do the same, as we have clearly demonstrated that there is really no reason why they shouldn't.
So in that respect the MiniCO2 Houses have jump-started the future, making the experience of reducing CO2 in standard houses available to everybody."

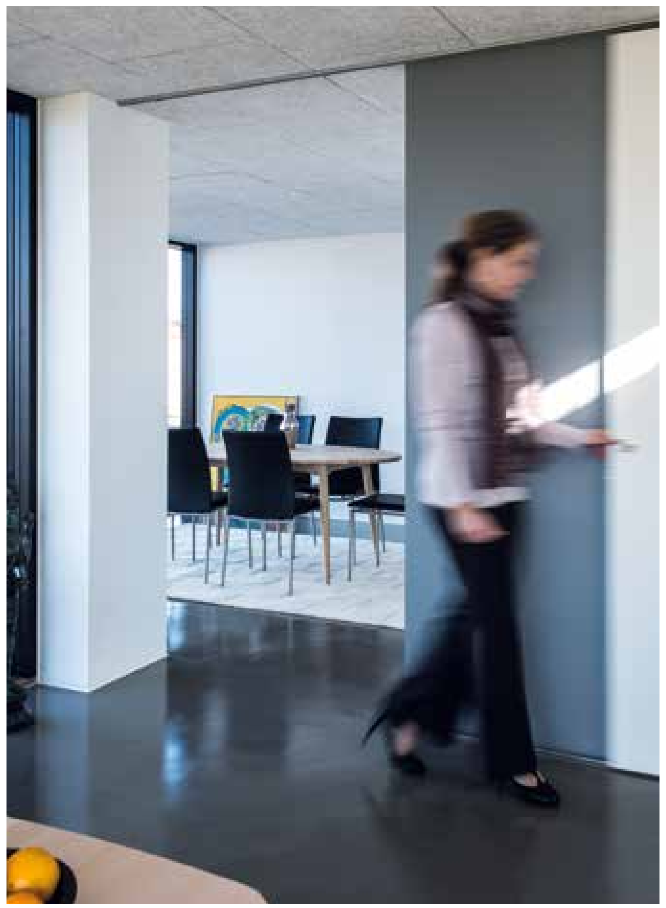
Jørgen Søndermark, Project Manager, Realdania Byg

This is why it makes very good sense to investigate the use of recycled or upcycled building materials, as they have already 'paid off' their carbon-emission price, or to introduce an adaptive and flexible building system, which enables alterations and changes in a house, without destroying the construction and adding new materials in the process. Finally, working with an extraordinarily long lifespan of up to 150 years and a low – or no – demand for maintenance for the first 50 years, means that it is possible to save the carbon equivalent of building two or maybe even three new houses.
The other main factor causing carbon emissions is the people living in the houses – or rather, the more or less considerate behaviour of people living in the houses. Examining the behaviour of the occupants, it becomes evident that it is both necessary – and possible – to guide people to a more sensible behaviour in terms of energy use.

CHANGING THE LAYOUT

MOVING YOUR KITCHEN

The Adaptable House was designed to facilitate change. Including the big ones. Moving the kitchen to a different room in a standard house is such a huge project that looking around for a different home might be an easier option. Moving a kitchen is costly, and often options as to where to place it will be limited – and impractical. But changing the layout of the Adaptable House is realistically achievable: You can choose between actually moving the kitchen or handling your changing circumstances by otherwise taking advantage of the flexibility of the layout – and thereby perhaps avoid having to move the kitchen at all.



SPACES AROUND THE KITCHEN

How you use the spaces around the kitchen can alter their functions. For example, you could make the dining room the sitting room and vice versa, or you could move the sitting room upstairs and the bedroom downstairs if that accommodates your routines and wishes.

SLIDING WALLS

The kitchen's sliding walls give you the option of having an open kitchen or shutting it off. In a matter of seconds you have a kitchen opening onto the family room – or an enclosed kitchen if you are planning to fry some fish for dinner.

MOVING THE KITCHEN UPSTAIRS?

The kitchen can easily be moved upstairs thanks to the flexibility of the technical service floor deck. Drilling through the ceiling is not necessary. A hatch gives access to the service floor deck and the service core in the house. In other words it is possible to place the kitchen almost anywhere in the house because of the proximity of the service installation core.

UPCYCLE HOUSE

WHAT'S IN IT FOR ME?

On one hand, this is an idealistic, problem-driven project addressing the climate change by reducing buildings' carbon emissions.

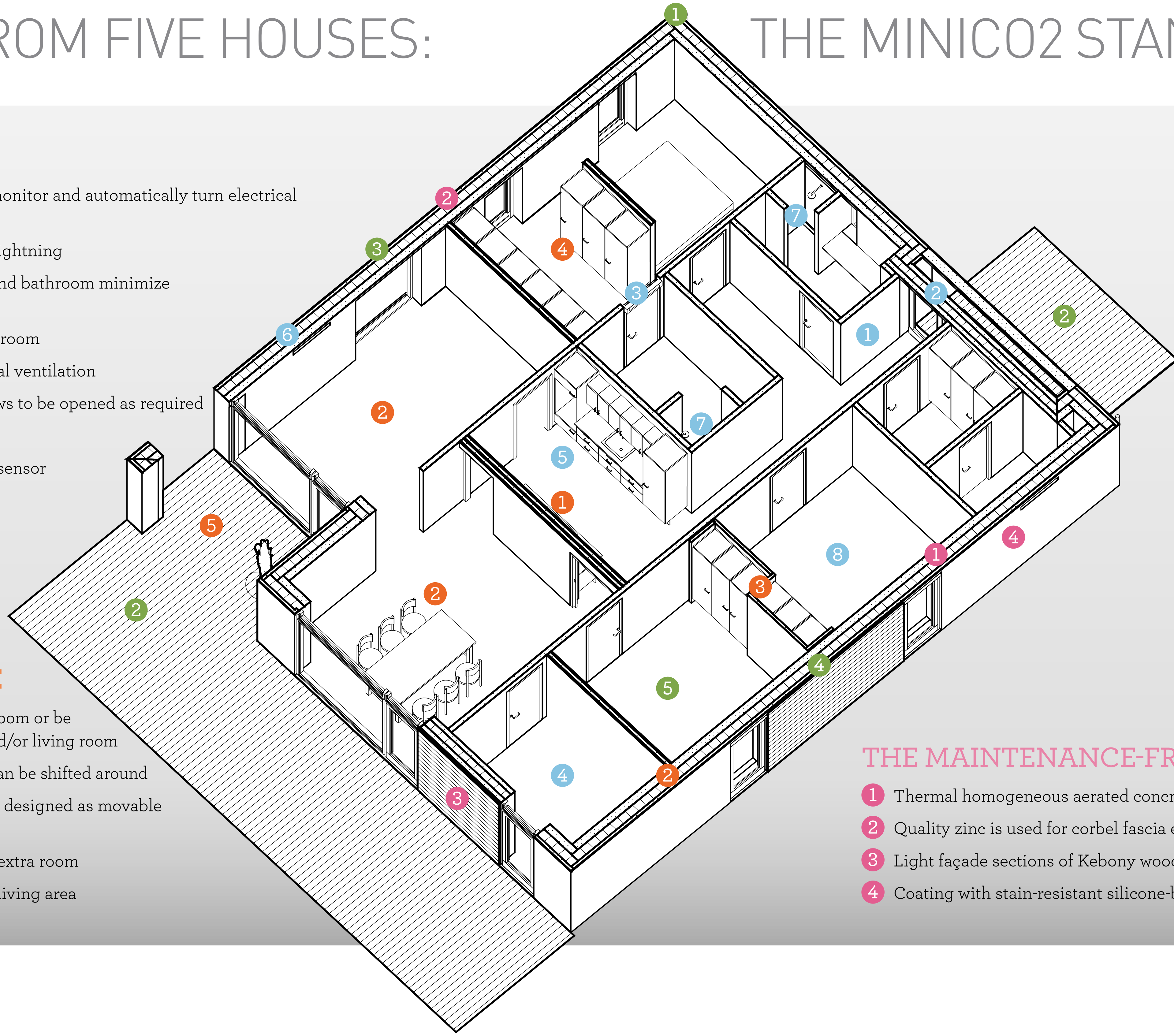
On the other hand, the project also tries to meet the needs of today's buyers and suppliers, by bringing a whole range of new benefits and qualities to the houses. Realdania Byg has adopted this approach in recognition of the fact that reducing carbon is not the first thought that springs to mind, when a person is considering buying a new house.

Instead, a home where you can live your life with your family, a house that easily adapts to the changing needs of a growing – or shrinking – family, a house where you don't have to spend weekend after weekend painting windows or repairing the roof – that is what most people dream of. Lower carbon emissions may help to save the world – but they cannot stand alone as a selling point; it takes appealing aesthetics, efficient functionality, positive signal value, and above all, a reasonable price, to make people fall in love with a house.

But solving all these issues must surely cost a fortune? The short answer is 'no, it doesn't'. In order to be able to make a comparison with prices on the market, the contractors who entered Realdania Byg's competition for the MiniCO2 Standard House, had to come up with proposals that would not exceed DKK 1.7m excl. VAT, an about-average price for a standard house in Denmark. At this price, a house of approx. 145 sq.m. should accommodate a family of two adults and two children. It should lend itself to building with well-tested architectural and technical solutions and standard building materials – off the shelf, so to speak. The chosen method of construction, its materials, its total lifespan and disposal of the house at the end of its life, should result in a significantly reduced total carbon footprint. Equally important, the solutions designed to reduce the carbon should also generate added values, such as money saved and improved quality of life for the family living in the house.

UPCYCLE HOUSE

ELEMENTS FROM FIVE HOUSES: THE MINICO2 STANDARD HOUSE



THE QUOTA HOUSE

1. Zensehome system with sensors that monitor and automatically turn electrical installations on and off
2. Daylight reduce the need for artificial lightning
3. Glass above doors to the utility room and bathroom minimize the need for artificial lighting
4. The office can be set up as multimedia room
5. Skylight with rain sensor creates natural ventilation
6. Micro-hybrid ventilation allows windows to be opened as required
7. Water guide on shower head
8. Quick-acting under-floor heating with sensor that detects the temperature outside

THE ADAPTABLE HOUSE

1. The kitchen can either be an enclosed room or be brought into contact with the dining and/or living room
2. The dining and living room functions can be shifted around
3. On the first floor, the dividing walls are designed as movable cabinet walls
4. The Walk-in closet can be fit out as an extra room
5. Covered terrace can be converted into living area

UPCYCLE HOUSE

1. Paper wool insulation made from newspapers
2. Terrace boards of composite material made from recycled plastic and wood
3. Surplus aerated concrete will be returned to the manufacturer and reused
4. Reusable roofing membrane
5. Flooring of glueless OSB sheets of waste wood

THE MAINTENANCE-FREE HOUSES

1. Thermal homogeneous aerated concrete blocks in the climate envelope
2. Quality zinc is used for corbel fascia edges and gutters
3. Light façade sections of Kebony wood with long service life
4. Coating with stain-resistant silicone-based paint

THE ADAPTABLE HOUSE

CONSTRUCTION, MATERIALS AND TECHNOLOGY

The loadbearing walls are built of solid aerated concrete blocks, with a good insulating effect and with a smaller carbon footprint than traditional concrete, while the roof of the building is a timber structure, insulated with carbon-friendly, recycled paper. The roof is covered with a membrane containing the mineral olivine, which helps neutralise the carbon in the air when it rains – and the membrane is itself recyclable.

The patio is clad with planks of a composite of recycled plastic and wood. Being a recycled material, it has a positive impact on the carbon balance. It also requires no maintenance and has a long life span.

Inside, the house is equipped with a whole range of technical installations, helping the family to reduce its consumption of heat, hot water and electricity. For instance, the underfloor heating is equipped with a sensor measuring the outdoor temperature, which permits it to respond quickly to changes in temperature. The shower in the bathroom is fitted with a unique feature: a WaterGuide, which by means of green, yellow and red smileys, and a variety of sounds, suggests when it's time to turn off the hot water. And the house's electrical system is monitored by sensors that give the family consumption feedback and switch electrical installations and appliances on and off automatically. The sensors also control the sockets, turning them off at night and thereby avoiding use of unnecessary stand-by power.

"We do realise that reducing carbon emissions is not a persuasive selling point in its own right, for most people, when they are looking for a house. A client wants to buy a house representing high-quality materials with a long life span, a house with a good lay-out, with sufficient daylight and a healthy indoor climate, possibly even a house with distinctive architecture – but above all, he or she wants to buy a house they can afford. So the economic aspect is a key objective in the project. I believe we have succeeded in demonstrating that it is absolutely possible to build a carbon-reduced standard single-family house without 'hurting' anyone in the process, neither client nor contractor. On the contrary, the contractor gains an opportunity to market his business as environmentally friendly, while matching the prices of his competitors. And the client won't lose out either – in fact, he'll get more value for money because he gets all the qualities of a traditional standard house plus all the extra benefits. On top of that, he'll feel good about the whole thing – because he's helping the environment."

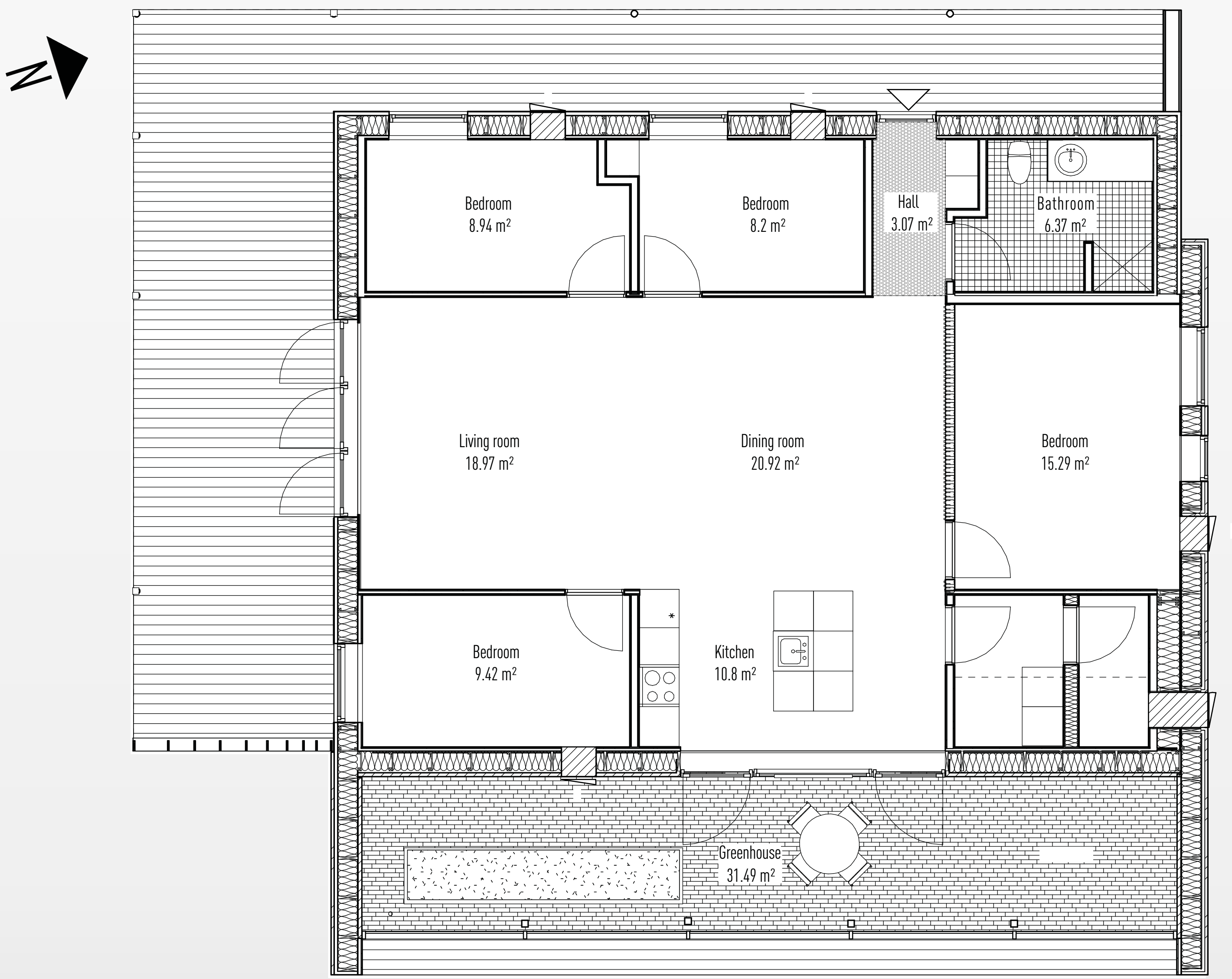
Jørgen Søndermark, Project Manager, Realdania Byg

INSPIRED BY FIVE EXTREME HOUSES – AT REASONABLE PRICES

As the youngest member in the series, The MiniCO2 Standard House has learned from its five predecessors, and has drawn its own conclusions. The outcome of all the effort put into the MiniCO2 Standard House is a 45 percent reduction in the carbon footprint – thanks to the balanced integration of different elements in the first five houses, influencing effect, price and derived architectural, technological and life-improving qualities.

Each of the first five MiniCO2 Houses targets one of the problems concerning carbon emissions in an extreme way. Four of the houses deal with different aspects of reducing carbon emissions from building materials, while the fifth house deals with occupant behaviour and reducing excess energy consumption by means of architectural design, technological innovation and the setting of monthly "quotas" / targets for the monthly use of heating, electricity and hot water.

And each of the five houses has been developed at a very reasonable price of DKK 1.7m excl. VAT.



THE UPCYCLE HOUSE

The Upcycle House stands as proof that it is possible to reduce the carbon footprint to a minimum by using recycled and upcycled building materials. Even the most optimistic calculations have been surpassed by what has proved achievable, when the task has been to build an actual house for people to live in instead of theorising over a desk research project.

By avoiding the use of concrete in foundations and structural elements, replacing the main structure of the house with two former shipping containers resting upon recycled steel helical screw piles, and by choosing only recycled and upcycled materials, the carbon footprint is reduced by 85 percent, compared to a standard single-family house of the same size, built of new traditional materials.

Developing the project has demanded more than a little ingenuity and 'thinking outside the box'. One example is the windows in the house. In order to satisfy existing building regulations on low energy, it was not an option to use old windows, as they do not come with three layers of energy glass. Instead the solution was found in the warehouses of window manufacturers, where piles of factory rejects take up space before being scrapped. The windows are often brand-new; they just don't fit the in-

tended project because of miscalculations or incorrect measurements. Now, if they are fitted on the outside of the window opening instead of within it, and sealed behind the cladding of the facade, size doesn't matter – they simply have to be bigger than the opening. A waste product suddenly becomes a new flexible building component – and no CO_2 is emitted because the glass is not remelted.

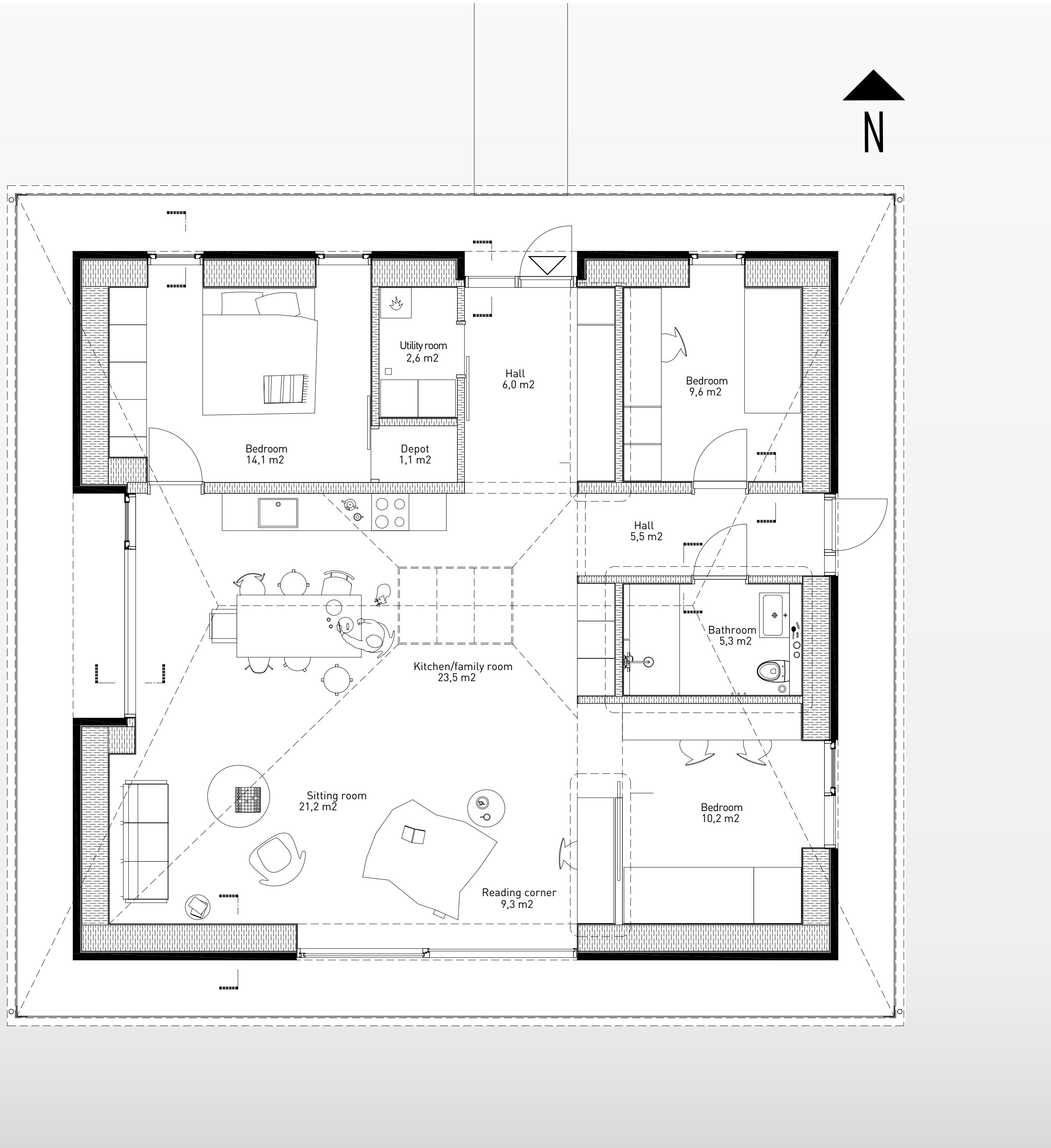
By any measure, the Upcycle House serves as a showcase for a variety of recycled and upcycled materials, ranging from well-tested components, such as plasterboarding of recycled gypsum, through paper-granulate insulation, recycled bricks and facade cladding of recycled aluminium, to more experimental upcycled materials. Part of the facade of the house is clad with boarding of paper-based fibre composites, and the covered porch is built of planks of a composite of recycled plastic and wood. Inside, the floor of the kitchen is covered with slices of recycled corks from a wine cork factory, and a translucent partition wall is constructed from water-filled jerry cans, curtained on both sides by white cotton fabric. Besides allowing daylight deep into the living room, it doubles as a thermal mass, releasing heat when the temperature drops outside.

DESCRIPTION OF THE HOUSE

This single-storey house has a floor area of 104 m2 (gross area 129 m2) and contains a sitting room, kitchen/family room, four bedrooms, utility room, separate pantry and one bathroom. An outdoor patio and greenhouse have been built on as integral parts of the house. The foundations of the house consist of recycled steel helical screw piers, and two reused 40-ft. High Cube shipping containers serve as load-bearing structural elements. The roof has aluminium sheeting, and facades are faced with a composite material.

Ceiling and wall insulation is paper wool. The interior floors and walls of the containers are faced with OSB wood panels. The windows in the building envelope are triple glazed with low-emissivity glass.

All building materials for the house are either reused items (for example, a discarded window has been reused as a window in the Upcycle House) or upcycled materials processed into new materials (for example, paper waste used in the production of facade panels).



THE TRADITIONAL MAINTENANCE-FREE HOUSE

A key question for every house owner is how to maintain the property over the years, without too much time and effort being invested in painting and repairing – and how to avoid major damage and defects. While the house owner naturally focuses on protecting his or her investment, keeping it a safe setting for the family, there is also another aspect of the matter: a house with a very long life span approaching 150 years with and a low – or no – need for maintenance during the first 50 years of its life, means that it is possible to reduce carbon emissions, equivalent to building two or even three new houses.

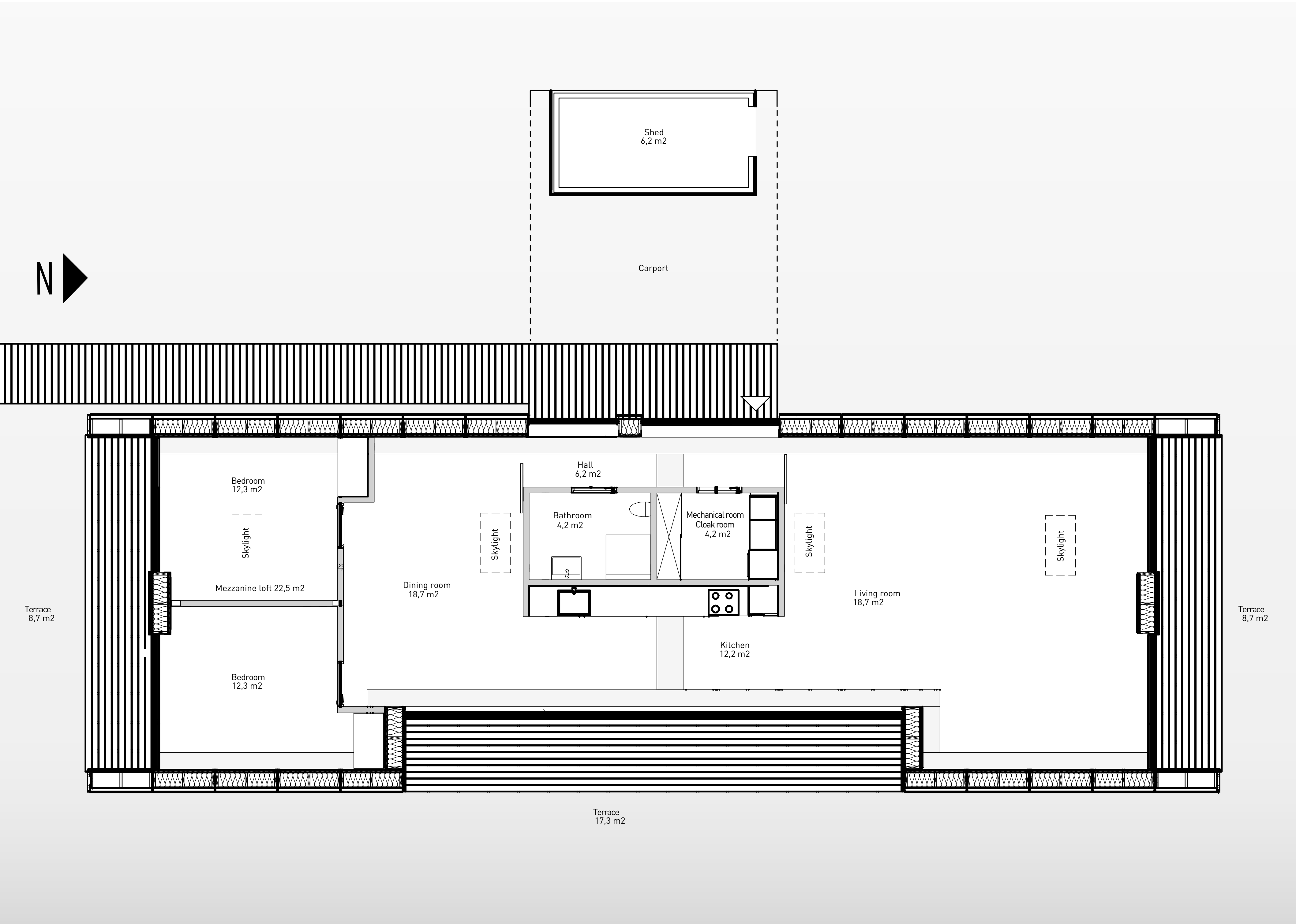
The key question in building the Traditional Maintenance-free House was therefore: what causes defects to occur in a traditional brick house? Not the brick itself, of course; it has proven its durability and value as a building material over a thousand years. The problems begin when the brick is part of a complex building construction of different materials with different temperature coefficients, working against each other. In time the construction will tear apart, producing tiny cracks, allowing water and insects to penetrate the building envelope.

The solution to this problem has been to construct the building with a homogeneous and solid brick wall. It is half a meter thick and is built by interlacing two different types of brick, which

DESCRIPTION OF THE HOUSE

The single-storey house has a floor area of 114 m2 (gross area 136 m2) and contains a kitchen / family room, bathroom and three bedrooms. It also has a separate mechanical room. The walls of the house are interlacing masonry with an inner wall of hollow clay blocks and an outer wall of ordinary bricks. This construction does away with the need for an insulation cavity. The roof is tiled with traditional clay roof tiles and has no openings for, for example, roof windows. The overhangs project from the roof around the whole facade.
Interior floors and ceilings are of wood. Interior walls are either plastered or untreated clay blocks.

lock into each other: the inner wall is made of large cavity clay blocks with their own insulating effect while the outer (facade) leaf is a traditional brick wall. This simple construction reduces the structural details to an absolute minimum, ensuring a long life – and, at the same time bringing a number of unexpected qualities and bonus effects to the house: The wall is constructed without any vapour barrier, this leaves the wall open to diffusion, which helps balance humidity in the room better and thereby greatly improves the indoor climate. And thanks to the wall's thermal mass, it is able store heat during the day, distributing it to the rooms when the temperature drops at night. These two added qualities were not part of the original building programme; but they have become a much appreciated side effect of reducing building defects.
Behind the strong wall and under the tiled roof, the house offers a large living room, combined with a kitchen under a double high canopy, formed by the hipped roof. On two sides, the living room is surrounded by bedrooms and a bathroom, almost the effect of small buildings in narrow streets surrounding the town square. The other two walls of the living room face the garden, with a view through two large sliding glass doors, revealing the impressive thickness of the outer walls of this reinterpreted traditional brick house.



THE INNOVATIVE MAINTENANCE-FREE HOUSE

In the case of the Innovative Maintenance-free House the goal was the same as in the brick house: to build a house that would last at least 150 years, with minimum demand for maintenance during the first 50 years. The challenge however, was of a very different nature, as the house was to be built of new and innovative materials that still have to prove their durability and reliability over time – or at the very least, the construction of the building had to be innovative.

This points to the main issue: How to ensure the necessary precision in the building components – precision is key to a long life span. Here the solution was found inside a factory, producing prefabricated building components – in wood. The overall plywood frame of the house was prefabricated and transported by truck to the building site and assembled within two days, literally by means of a screwdriver.

A wooden house was perhaps not the obvious choice for a long-life house, but when sufficiently ventilated, wooden structures are seen to have survived for centuries in Denmark. However, as it is evident that a plywood house is not weather proof, it required a building envelope which is.

DESCRIPTION OF THE HOUSE

This single-storey house has a floor area of 156 m2 and contains a kitchen / family room, bathroom and four bedrooms. It also has two mezzanine loft spaces and a mechanical room. The house was constructed using self-supporting modules in the form of timber box units on pad foundations. The floor of each box module is insulated with expanded foam / mineral wool, wall and roof areas with mineral wool. Module facades are clad with toughened glass. Windows and doors have been recessed under the overhanging roof. Floor surfaces, walls and ceilings are clad with wood, and interior walls are in plasterboard/drywalled.

The whole house is enclosed in sheets of glass, on the sloping roof and on the vertical facades, protecting all degradable building components against rain. The wooden structure also had to be adequately ventilated in order to keep it dry, which is why the house is lifted half a meter off the ground on stilts of concrete and why there is a gap between the plywood structure and the glass skin. The gap creates a natural chimney effect, sucking in air at the bottom and letting it out at the top of the roof. No complicated mechanical ventilation system is needed – natural forces are at work here.
Inside, it's a wooden box that follows the overall form of the house, creating a generously large space with views from one end of the house to the other. The inside surfaces won't need any maintenance other than the occasional wipe, and installations are readily accessible for repairing or updating, placed under a floor panel along the facade.

THE ADAPTABLE HOUSE

The need for flexibility in a house is mainly centred on three things: redoing the kitchen, changing the size and layout of the rooms, and extending the house. All three scenarios cost resources and CO2 to execute because building a new wall requires new materials which have to be produced, generating carbon emissions. Also if a wall is demolished, it creates waste, figuring heavily in the carbon accounts, when disposed of.

Not so in the Adaptable House. It is built to be rebuilt, recognising that a house is not a constant but must be capable of change over time to accommodate the full life cycle of a family: as a young couple without children, as a family of four or more, when the children move out, and finally in old age, when the need for care arises. Thanks to the house's flexible layout, which changes easily by means of sliding doors, movable cabinet walls and facade elements, it is possible to alter and extend the existing layout with a minimum of effort, time and money – and with little or no carbon emissions as a direct result. The house's structural

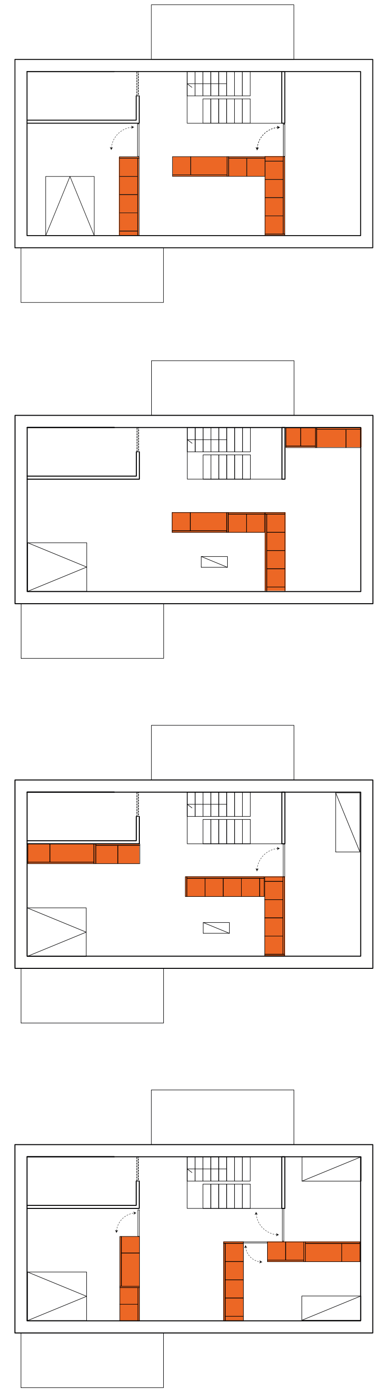
DESCRIPTION OF THE HOUSE

The two-storey house has a floor area of 147 m2 (gross area 160 m2) and contains a large kitchen/family room and a bathroom on the ground floor and a second bathroom, roof patios and three bedrooms on the first floor. The building has a strip foundation and a reinforced concrete solid ground floor. External walls and facades use both lightweight concrete panels and a light timber-panel construction. Window areas are triple glazed in frames of a glass-reinforced composite, and the roof is clad with roofing felt. Floor surfaces on the ground floor are polished concrete; upstairs floors are in bamboo parquet. Internal walls consist of flexible drywall modules

components can be dismantled without destroying existing components, and the replaced components can be reused because they are uncomplicated, produced in standard sizes and from standard materials.

On the ground floor the kitchen and two same-size living areas can be divided into three separate rooms or combined into one big living area – just by operating the kitchen's three sliding doors. On the first floor, a continuous wooden floor and three movable cabinet walls ensure that the area adapts to any configuration: one large space, a master bedroom, two rooms for the kids and common playroom, or an office and walk-in closet. All the technical and electrical equipment runs along the facade wall, and sockets are stick-ons that can be placed anywhere.

In other words, the Adaptable House offers flexibility with a 50-year perspective, and fits any change in living conditions – or maybe just the next party.



THE QUOTA HOUSE

The Quota House sets out to demonstrate that the occupants of a house play a significant, though unpredictable, part in the overall emission of CO_2 – but also that this uncertainty can be reduced by smart thinking. While some families are very conscious of how much heat, hot water and electricity they use, most people aren't – , but if house and occupants work together, a potentially substantial reduction can be achieved in carbon emissions.

The Quota House supports and guides the behaviour of family members on three different levels. First of all through its architectural design – on the one hand reviving old virtues, on the other introducing new thinking. Across the centre of the building a 'climate zone' adds four new functions, improving the family's quality of life and helping to reduce carbon emissions. A roofed courtyard offers the means to dry laundry outside, giving the tumble dryer a break. Inside the house, an insulated larder reintroduces the idea of cool storage for groceries and vegetables, eliminating the need for a big refrigerator. Opposite the larder, a greenhouse is integrated into the building, but thermally insulated from it. In connection with a vegetable garden outside the building, the greenhouse gives the family a great opportunity to grow their own vegetables and herbs all year round.

The second level of guidance is about integrating smart technology. A monitoring system controls all electrical sockets and outlets, and provides direct feedback from every energy-consuming operation taking place in the house. It also provides a range of convenient services such as a 'turn it all off' button at the exit and an 'imitate last week's lighting pattern' switch for when going on a holiday trip. In the shower, a 'water guide' suggests when it is time to turn off the hot water. All the thermostats display the actual temperature in a room, instead of numbers on a scale from 1 til 5, and they automatically turn the heating off, when someone opens the window.

At the third and final level, the family decides on a yearly budget for their energy and water consumption – a quota. The ambition level for this tar-

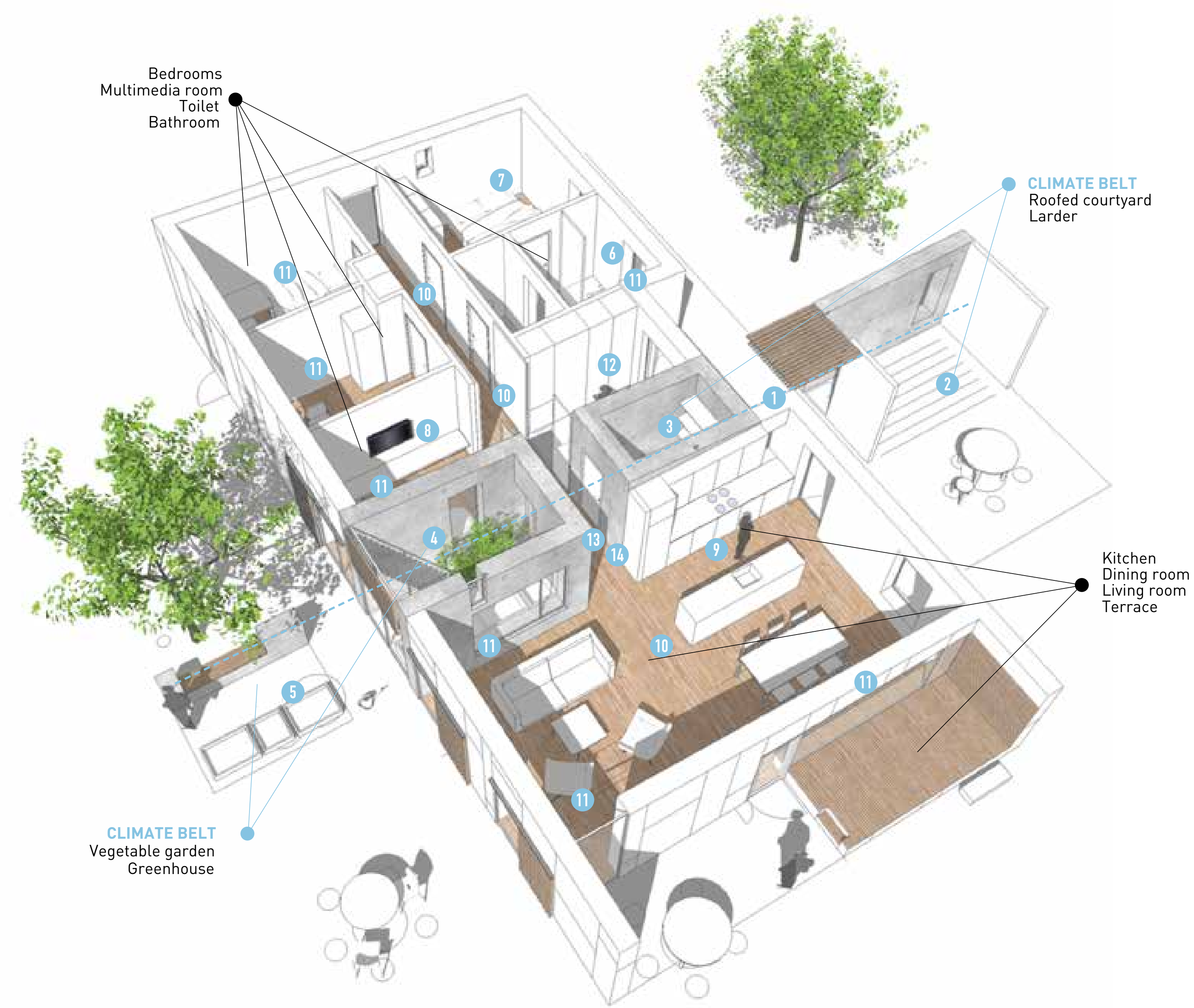
get is entirely the family's choice. Based on a complex algorithm, the annual quota is broken down into monthly, even daily, figures for 'allowed' carbon emission, differentiating between hot and cold water, electricity and energy for heating. The figures are accessed through the family's smartphones and tablets, a graphic interface displaying how much is left for the rest of the day and month. This gives the family relevant feedback on its consumption, enabling it to respond immediately to any anomaly.

The overall goal of all this is of course to help the family cut back on excess energy use in order to save money – and carbon emissions – and at the same time provide a number of new qualities and functions a traditional standard house cannot offer.

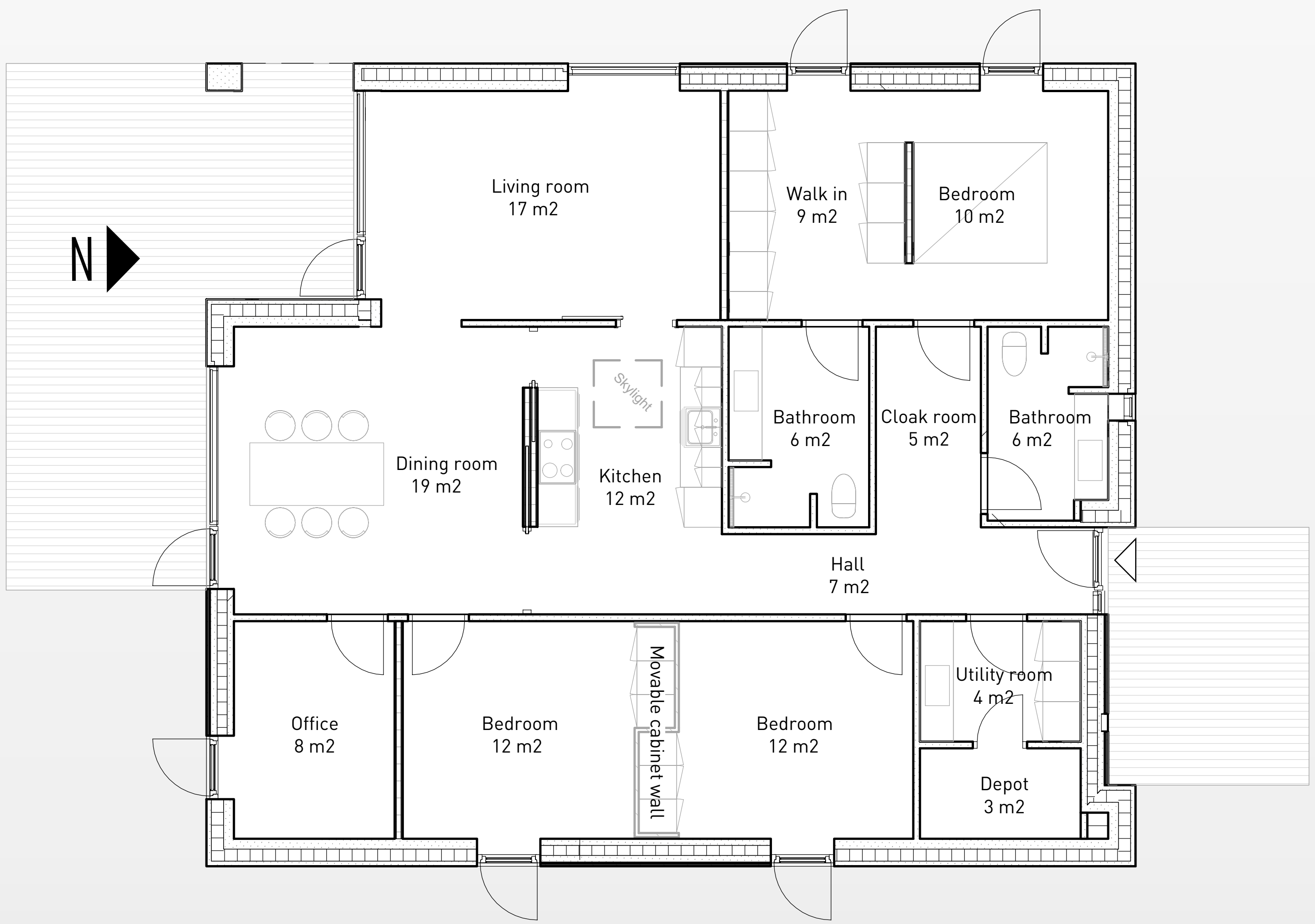
DESCRIPTION OF THE HOUSE

This single-storey house has a floor area of 104 m2 (gross area 138 m2) and contains a kitchen/family room, bathroom, three bedrooms, a multi room and a utility room. A separate larder and greenhouse are not included in the net floor area of the house but are integrated in the building. The building has strip foundations and a solid concrete ground floor. External walls are primarily of aerated concrete panels faced with fibre-cement cladding. The external walls of the larder and greenhouse are brick. The roof is clad with roofing felt. Insulation in walls and roof is mineral wool.

The Quota House



1. Climate Belt
2. Roofed outdoor drying courtyard
3. Larder
4. Greenhouse
5. Vegetable garden
6. Regulatory shower
7. Climate controlled bedroom
8. Multimedia room
9. Double oven
10. Plenty of daylight
11. Smart thermostats
12. Intelligent washing machine
13. Eco-feedback, CO2 consumption registration - electricity, water and heating
14. Emergency start button



AN ANSWER TO THE QUESTIONS: THE MINICO2 STANDARD HOUSE

As it turned out, the competing contractors rose to the challenge, and the MiniCO2 Standard House, which is now built and ready for sale, holds proof of the sustainability of the overall concept: the MiniCO2 Standard House represents a commercial example of a house which can be built in large numbers around the country, thereby reducing carbon emissions on a large scale.

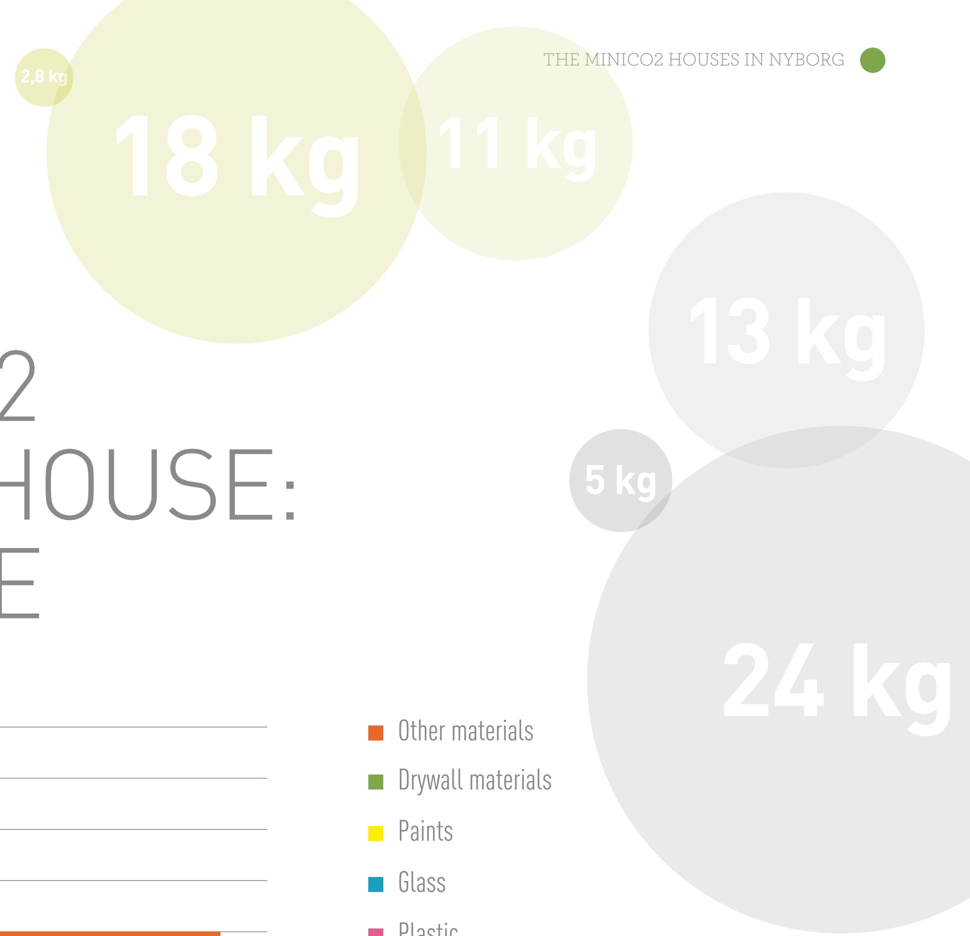
The result is a compact and functional house, with the smallest possible building envelope relative to volume, which is important because the envelope has a major impact on the overall level of carbon emissions generated by heating homes.

The house has a flexible layout, accommodating three or four rooms, depending on the needs of the family. Two of the rooms are separated from each other by a movable cabinet wall, enabling the space to be divided into two rooms of the same size or one larger and one smaller room – or even one very big room. Flexibility is also a keyword in the kitchen area. Thanks to two sliding doors, the kitchen can be either separated from the living rooms when cooking or integrated into them, forming one large space when the family is at home or entertaining.

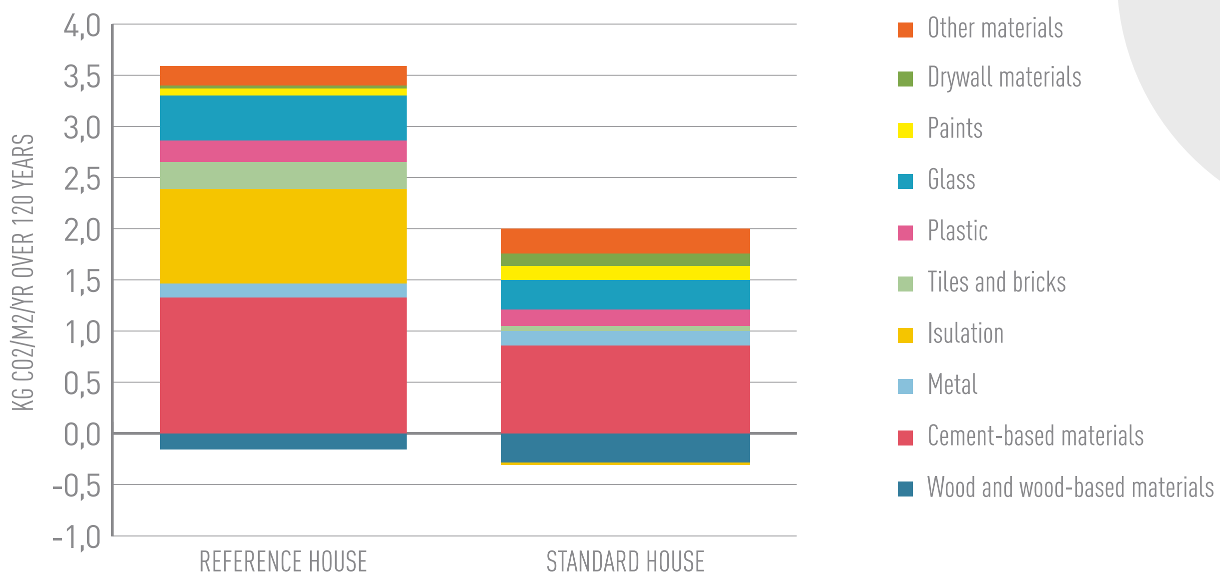
To the south west, a covered patio area is integrated into the overall plan of the building. This space can easily be made part of the living room area, by extending the building and moving the window element outwards. Daylight plays a major role in the house, both as an architectural quality and as a means of reducing the need for artificial lighting. A roof window over the kitchen area brings light into the centre of the house, and glass doors opening to the garden allow daylight to fall on the floors. The glass doors also create views across the house, from the entrance to the garden.

DESCRIPTION OF THE HOUSE

This single-storey house has a floor area of 157 m2 and contains a kitchen / family room, 2 bathrooms and four bedrooms. It also has a utility room, a store room and a cloakroom. The external walls of the house are built of blocks of aerated concrete of two different densities. The aerated concrete blocks obviate the need for an insulation cavity. The roof is insulated with paper wool and clad with roofing felt. Much of the ground floor has been constructed as a floating floor on sheets of rigid insulation in preference to a traditional solid concrete ground floor. Interior floors and ceilings are of wood; some walls and floors are tiled. Interior walls are constructed from aerated concrete or light drywall panels.



THE MINICO2 STANDARD HOUSE: CO2-PROFILE



CATALYTIC POTENTIAL

The point to be drawn from the MiniCO2 project is that it is possible to build, buy and live comfortably in a MiniCO2 Standard House, with a 45 percent reduction in carbon footprint, at a price that easily matches that of a traditional standard house.

The project has demonstrated that low-carbon houses are no more complicated for the standard house manufacturer to build than a traditional house, and could easily be included in his catalogue alongside other houses on the market. It has also been documented that it will not cost a fortune for the client to buy a house like this. In the final analysis, the buyer gets his money's worth and more – all the features and qualities of a traditional house, plus the extra architectural, technological and life-quality improving benefits of living in a MiniCO2 Standard House, with the added benefit of saving money on energy, and the awareness of doing something good for the environment. In other words: there are no reasons not to do it.

Thanks to...

Upcycle House

Architect:	LENDAGER ARKITEKTER
Engineer:	MOE
Contractor:	EGEN VINDING OG DATTER, MAKVÄRKET
Knowledge partners:	DANISH BUILDING RESEARCH INSTITUTE - AALBORG UNIVERSITY, URETEK FUNDERING, GAMLE MURSTEN, MUNCHOLM, BLEILE KORK, RICHLITE, HOMATERM, HISBALIT

The Traditional Maintenance-free House

Architect:	LETH & GORI
Engineer:	BURO HAPPOLD ApS
Contractor:	EBBE BERNTH MURER & TØMRER
Consultant:	THE DANISH TECHNOLOGICAL INSTITUTE, MASONRY, BUILDING AND CONSTRUCTION
Knowledge partners:	DANISH BUILDING RESEARCH INSTITUTE - AALBORG UNIVERSITY, DANSKE TEGL, NINI LEIMAND, THE ROYAL DANISH ACADEMY OF FINE ARTS, SCHOOL OF ARCHITECTURE – INSTITUTE 2

The Innovative Maintenance-free House

Architect:	ARKITEMA ARCHITECTS
Engineer:	SLOTH MØLLER
Contractor:	ENEMÆRKE & PETERSEN A/S
Consultant:	THE DANISH TECHNOLOGICAL INSTITUTE, MASONRY, BUILDING AND CONSTRUCTION
Knowledge partners:	DANISH BUILDING RESEARCH INSTITUTE - AALBORG UNIVERSITY

The Adaptable House

Architect:	HENNING LARSEN ARCHITECTS, GXN
Engineer:	ANDERS CHRISTENSEN
Contractor:	BENÉE HUSE
Knowledge partners:	DANISH BUILDING RESEARCH INSTITUTE - AALBORG UNIVERSITY, KEBONY, HTH, YTONG

The Quota House

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The MiniCO2 Standard House

Architect:	LUPLAU POULSEN
Client consultant:	KUBEN MANAGEMENT
Contractor:	BENÉE HUSE
Knowledge partners:	DANISH BUILDING RESEARCH INSTITUTE - AALBORG UNIVERSITY, YTONG, INVENTILATE, ECOLAB, LOOP, DERBIGUM, ZENSE TECHNOLOGY

The MiniCO2 Houses in Nyborg
– valuable lessons

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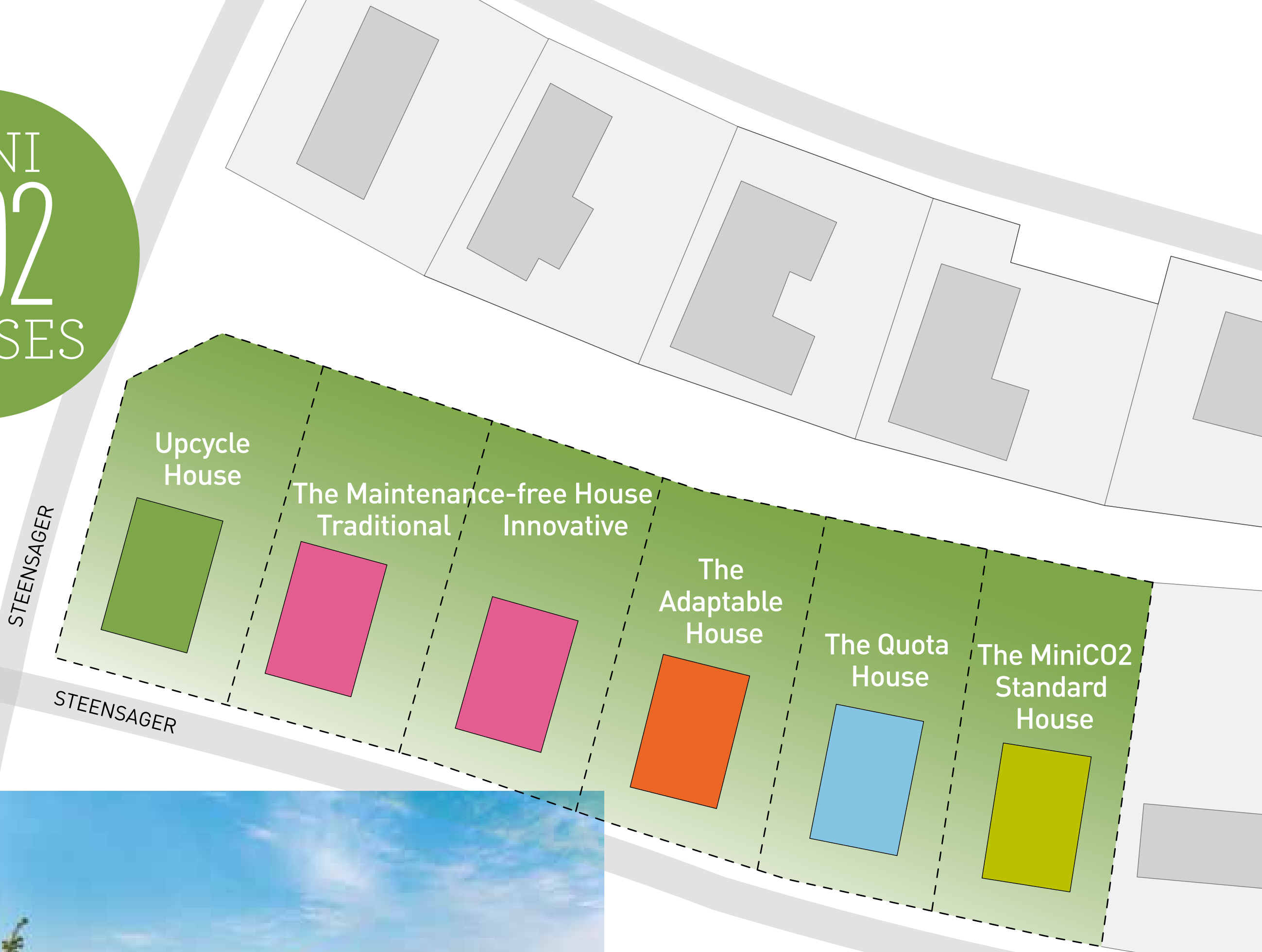
MINI CO2 HOUSES



THE MINICO2 HOUSES

During 2013 and 2014 in Nyborg, on the Danish island of Funen, Realdania Byg has built six different single-family houses. They demonstrate five different ways to reduce CO2-emissions as a basis for developing the sixth house; a single-family Mini CO2 Standard House combining all lessons learned – and at a price that matches traditional standard houses already on the market, that is.

The project targets construction, operation and end-of-life phases, and focus on carbon emissions from materials, maintenance, alterations – and investigates how to improve userbehavior patterns in order to reduce resource consumption.

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