GREEN SOLUTION HOUSE

EXPLORING CIRCULAR SUSTAINABILITY

We are a conference center and hotel on the island of Bornholm. We demonstrate innovative green solutions in our buildings and landscape.

GREEN SOLUTION HOUSE

At **Green Solution House**
we want to inspire our visitors
by offering a comfortable
stay in a healthy and creative
environment.

Our focus areas are nature, water, light, air, energy and materials.

Vision

At Green Solution House we envision an environment where we all contribute and we all benefit. Our revenue is our knowledge, our clean water, the fresh air we breathe and our renewable materials. Our vision is to redefine what revenue represents.

Mission

At Green Solution House we try out, demonstrate and continuously revisit our green solutions. We believe that iteration creates understanding and leads to innovation. We seek to exchange knowledge with local and global communities to inspire a sustainable future. Our mission is to explore circular sustainability.

Goals

To demonstrate green solutions

We demonstrate green solutions and how an organisation, a building, and a group of people can have a positive footprint. We support a diverse, safe and healthy world; therefore, our model is regenerative – towards increased biodiversity, healthy materials, renewable energy, clean water, and a circular economy.

To promote continuous improvement

We promote continuous improvement as an organisation designed for flexibility. Technologies, materials and methods undergo constant advancement; therefore, our buildings and systems are adaptable and will continuously test and demonstrate new solutions.

To enable knowledge sharing

We enable knowledge sharing as an international platform of diverse people and organisations. Sustainable solutions are born where visions and ideas can cross-pollinate; together we foster new knowledge within the field of sustainability.

Approach

At Green Solution House we explore circular sustainability. The exploration is rooted in three sustainability strategies and constantly informed by local conditions and pragmatic use of resources. Green Solution House is certified to the standards of the German Sustainable Building Council (DGNB). The design is based on the criteria of the Active House vision and inspired by the Cradle to Cradle life cycle concept.

We wanted the best building possible for the times, one that would contribute to the health of both people and nature. Achieving this meant exploring innovative systems and materials plus developing strategies for how to live up to our ambitions. We developed criteria for material selection, in order to exclude harmful substances; materials should be healthy for those using them and carefully sourced – locally if possible. Sometimes our exploration led us to pragmatic, low-key solutions. "If it ain't broke, don't fix it" became our guideline for renovating and everything possible was reused or recycled back into the project. Building upgrades were made with the aim of increasing performance and comfort. The new building is designed to be an envelope enclosing great meeting and learning spaces with outstanding indoor climate and daylight quality. The new building is designed for disassembly, meaning that materials and systems can be updated continuously and reused in the future.

Approach

Triple Strategy
Holistic Sustainability

The design of Green Solution House is based on several parameters to show a holistic approach to sustainability. The building is certified to the standards of the recognised German Sustainable Building Council (DGNB), based on the criteria of the Active House vision and inspired by the Cradle to Cradle life cycle concept. The building and landscape present the latest developments in the field of sustainable architecture; we show that sustainability involves more than aspiring to green certification, and that it is possible to quantify our project's high quality on the basis of several parameters.

Reclaim, Reuse, Renovate
Utilising the Existing

We believe in the value of repurposing and eliminating waste. This thinking has been applied to many aspects of the project. Parking space is built on a base of rubble from the demolished buildings that used to occupy the site. The remaining buildings received a facelift with new energy efficient façades and roofing, although most of the original features remain. Like the buildings, the furniture, light fixtures and much much more were given a facelift and reintegrated in the hotel's interior.

Repurposed Glass
Glass Paths

A one-of-a-kind experiment. Glass paths are very fitting for Bornholm, since the island is well known for its glass production. A local glass artist, Pernille Bülow, donated 12 tons of glass to Green Solution House, which was used to make a paved walking path in the Green Footprints Park. The glass was tumbled in a cement mixer to soften sharp edges sharp edges before being applied as a smooth and glittering glass path.

Local From Bornholm
Resourceful Thinking

Bornholm is a very resourceful island so instead of transporting materials and services from afar we go local whenever possible. Raw materials like granite, wood and glass are used in the landscape. Concrete elements for the entrance area were cast 5 km from the site and the granite is sourced from a quarry 10 km away. Local biotopes are planted in the landscape, strengthening the native biodiversity. Local produce is prepared in our kitchens and served in the restaurant.

Bornholm Granite
Locally Sourced Stone

Granite is a local material and its use throughout the site both minimises transport and strengthens local production. When granite is cut there is always waste – from big chunks to sharp chips and dust – so the approach was to let none go to waste. For instance, chips and dust were made useful in the buildup of the parking lot.

Upcycled Furniture
Gabriel Fabrics

New context, new life – sometimes that is all you need to keep functional products out of the landfill. Directly transitioning products into new life cycles is the most effective way of minimising virgin resource and energy consumption. Therefore, at Green Solution House, much of our existing furniture stayed in place and was reupholstered with Gabriel's environmentally friendly fabrics.

Comfort

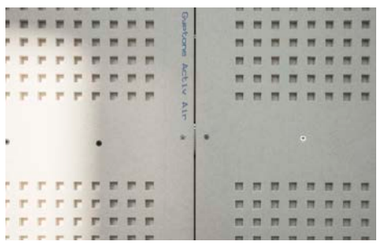
Green Solution House is a place where people can meet, learn and relax. We have created an environment that puts in focus the comfort and the wellbeing of our visitors and employees. To achieve the optimal indoor environment Green Solution House has naturally lit spaces and plenty of clean air in circulation.

Material choices made for Green Solution House focused on finding those that are healthy for both people and the environment. That is, we found materials that do not contain harmful substances or compromise nature's resources, are active and help clean the air, and even some that are so light they were ergonomic to install and easy to transport. Our careful material choices, along with a natural ventilation system, help ensure healthy indoor air quality – plus our roof even contributes to purifying the air on site. The design of the building embraces daylight, creating comfortable, evenly lit spaces. The daylighting goes hand in hand with creating views into nature, which enhance and stimulate wellbeing.

Comfort

Embracing Daylight
Designing with Daylight

The cycle of natural light is fundamental to our wellbeing and ability to maintain a healthy circadian rhythm. When it comes to daylight, improved productivity and focus means saving on energy. The conference rooms at Green Solution House accommodate meetings in broad daylight. Inside the hotel rooms, daylight conditions have been optimised with retrofitted glass balconies. Our focus on daylight has created well-lit spaces and better user experience, resulting in less energy consumption.



Clean Air
Active Materials

Clean air is essential to optimising the quality of indoor environments. At Green Solution House we have created a variety of solutions that contribute to keeping our air fresh and pollutant free. The carpets on the floor absorb dust particles, the plasterboard on the walls take care of formaldehyde, and the roof membrane captures and neutralises pollution particles from traffic. The Green Wall in the Third Climate Zone naturally purifies the air with plants and balances humidity levels.

Thermal Balance
Comfortable Indoor Climate

At Green Solution House we have been successful in balancing the thermal environment for optimal indoor comfort. We achieve comfort by balancing natural ventilation, mechanical ventilation and our heating strategy in response to the seasons. This strategy has resulted in the highest score possible in the Active House analysis of comfort in the building. We use diffuse ventilation to supply fresh air through permeable acoustic panels in the conference center and restaurant ceiling.

Daylit Conference
Naturally Lit Learning Experience

Let the daylight in – anytime. There are no curtains in the conference center, and that's just the way we want it. Daylight is good for learning and focus – we want to offer our guests a comfortable and naturally lit experience, even during presentations. By using LED monitors instead of conventional projectors, we make it possible for guests to both read the slides, see fellow conference guests and enjoy the view of nature – while learning.

Channeling Daylight
Parans Solar Lighting

Redirecting light channels are an element of the daylight design strategy. The reception area was given a boost of natural light with the Parans sunlight system. A rotating solar receiver on the roof captures sunlight throughout the day. Solar cables transport and release daylight into the reception area, reducing electricity requirements and creating a comfortably lit space.

Air Cleaning Carpets
Desso AirMaster

Desso's carpets do not emit harmful chemicals, and the final product captures fine dust particles in the air – four times more effectively than conventional carpets. These carpets are installed as tiles that can easily be replaced. Desso designs its carpets for disassembly, which means the yarns can be separated from the backing and recycled separately.

Innovation

At Green Solution house we like being on the verge between technology and nature. For instance, we clean wastewater with biological processes and we produce energy and nutrients from organic waste. We have integrated technology into our buildings to help us achieve the best performance possible. We also want our buildings to inform and influence behaviour, which is why we developed an app where people can learn from and control the indoor environment themselves.

We produce renewable energy on-site, with a pyrolysis plant, solar thermal plant and integrated photovoltaics. Excess heat is stored in an on-site energy storage system. We keep an eye on our operations, and our visitors can too with our energy monitoring system. Our custom-built system tracks and visualises energy consumption and its sources, both on-site and off. Technology helps us innovate, but what has been the main driver for innovation is collaborations across industries. When designers, producers and strategists come together and are given parameters of locality and sustainability, exciting things happen. To name a few: Footpaths made of glass, a Third Climate Zone with algae generators, hotel rooms with wireless and remote climate control, solar cells integrated into ventilating skylights and walls designed for disassembly are the results of good collaboration and iterative design.

Innovation

Third Climate Zone
Connecting People and Nature

The east wing of the conference center is a unique spatial experience, connecting our visitors with nature. The Third Climate Zone hosts algae generators as part of our on-site biological water purification system. Our green wall, a key feature of the space, works to improve the indoor environment. The stone floors can be heated by hot water stored in a repurposed swimming pool. The Third Climate Zone is a place for meetings, quiet reflection and inspiration – from nature and each other.

Energy From Waste
Pyrolysis Plant

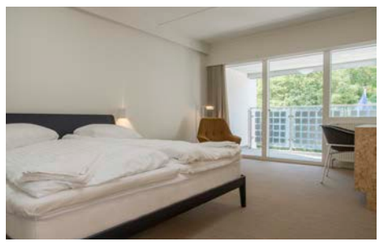
All food scraps and organic materials from the main building are fed into our own stationary pyrolysis plant. The process heats the waste, breaking it down to produce natural gas and biochar, which is valuable as a soil additive for the gardens. The gas is combusted in a combined heat and power engine, generating heat and electricity for the building. Excess heat is stored onsite as hot water in a swimming pool, repurposed as a thermal energy storage system.

Water Cycle
Biological Water Purification

Water from the sinks and toilets in the main building is collected and flows through anaerobic, clarifying, and biological filtering stages to enable on-site reuse. The first stages of purification are hidden below ground, after which the system emerges into view and is assisted by sunlight and LED lighting. Here, the water flows through algae tubes that absorb CO_2 and continue the water cleansing process. The ambition for the system is to obtain drinking water quality through the biological purification process.

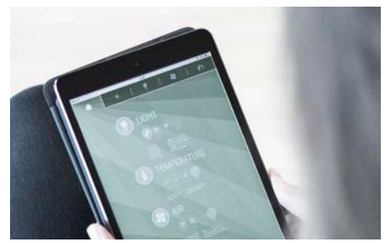
Green Wall
Natural Greenwall System

A large green wall integrated into the Third Climate Zone helps create a good microclimate, thanks to the plants' natural ability to freshen the air, stabilise humidity levels and cool the space in summer time. The wall is planted with ferns, which are chosen due to their prevalence in the surrounding nature on Bornholm.



Smart Room
The Hotel Room of Tomorrow

Two guest rooms were retrofitted with intelligent climate systems and a focus on quality interiors. The rooms are controlled by our custom mobile app, which tracks the impact of your stay, monitoring consumption and indoor environment. Air cleaning carpets, recyclable tiles, recycled plastic fixtures and low energy lighting demonstrate our focus on recyclability and sustainability certifications. Plus the rooms are delightfully daylit with skylights and Sun Tunnels.



Intelligent Indoor Climate
Smart Room App

Interact with your room! At Green Solution House we custom-built a mobile app to track resource consumption and easily control the indoor environment in our Smart Rooms. Energy, light, air and water are the four themes on which live feedback is provided to our guests, helping to inform behaviour by increasing awareness at a personal level. When it comes to indoor comfort, the app helps our guests correlate their own experience in the hotel rooms to the quality of the air and daylight levels.

Nature

At Green Solution House, we strive for a mutually beneficial relationship with nature. We believe that our buildings can support the natural processes of the landscape and can in turn benefit from the resources in our contextual environment. We welcome both our guests and the public to explore our Green Footprints Park where the landscape is designed to support the local climate, mitigate flooding, complement the existing forest and maximise biodiversity. Green Solution House is in, and a part of, its environment, hence a symbiotic relationship emerges.

We work to support our local environment, which in turn supports the operations of our buildings. Beyond contextual relationships with nature, we employ biologically based technology to clean our wastewater and augment the quality of our soils with biochar made from our organic waste. Inside the Third Climate Zone we use an algae system to supplement the water cleaning process and absorb CO_2, while a green wall creates an appealing environment. At Green Solution House there is great access to nature – from inside out to our own publically accessible park, through the forest and out to the beach. We know that strong connections and good access to nature can have a great effect on people's physical and psychological health – not to mention the mere pleasure it brings both our visitors and our employees at Green Solution House.

Nature

Green Footprints Park
Sustainable Landscape Concept

The landscape around Green Solution House features local materials, manages on-site storm water and demonstrates sustainable landscape solutions. Water is the main organising factor. New topography defines rainwater reservoirs that become seasonal ponds and thriving habitats for local wildlife – not to mention opportunities for human delight. By using local biotopes the site is kept low maintenance and the planting is left to grow wild, helping to increase biodiversity.

Water and Soil Balance
Rainwater Landscaping

The high water table on the site poses a challenge, but instead of fighting nature and treating this as a problem, the landscape was designed around the element of water. The soil excavated for the foundation of the new building was retained on site and used to sculpt the land. Various watershed designs guide rainwater to seasonal ponds, creating an easy to maintain landscape, which increases biodiversity, provides natural irrigation, has a cooling effect in the summer months.

Symbiosis
Building in Balance with Nature

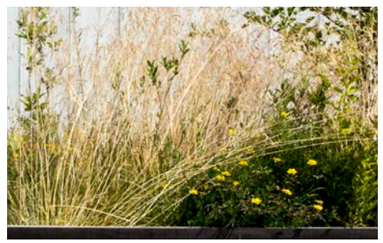
We strive for a mutually beneficial relationship with nature. We gain energy, food, clean water and healthy air from our environment by properly managing these on-site resources. Within our buildings we maximise natural ventilation, recover heat, take advantage of daylight and use exterior planting to reduce solar heat gains, all of which is made possible by how the design responds to and leverages nature. With the help of technology we augment nature's own processes to clean water and produce energy.

Bitumen Free Landscape
Natural Hardscape Design

Bitumen is a waste product from crude oil processing, and the binder of asphalt. Green Footprints Park is a bitumen free landscape, and the parking lot at Green Solution House demonstrates that it is possible to make a robust paving surface for driving, without asphalt. Where needed a plant-based binder, called Vegecol, is used as an environmentally friendly alternative to bitumen – elsewhere aggregate surfaces are simply compacted fill.

Local Biotopes
Native Planting

Embraced by nature, Green Solution House is amidst woods, wetlands, meadows and commons, which have been elaborately composed to create a diverse landscape. The Green Footprints Park is planted with biotopes native to Bornholm. The biotopes can be left to grow wild, which increases biodiversity, expands biomass and keeps maintenance requirements to a minimum. Local biotopes are adjusted to the specifics of the Bornholm climate and as such do not require irrigation beyond that of natural rainfall.



Earth Lung
Natural Deodouriser

The Earth Lung is a part of the biological water purification system that purifies the blackwater from the Green Solution House. The Earth Lung's role is to remove odourous biogas which is generated during the anaerobic digestion stage of the water cleaning process. The design is simple – biogas is fed into the bottom of a plant box, which has a soil buildup that secures a porous composition. The roots of the plants consume the gases, which also act as fertilisers, promoting growth.

Resources

One of our biggest aims at Green Solution House is to eliminate waste, not only from day-to-day life, but the concept of it altogether. We have selectively employed materials and systems that can be disassembled into their elemental parts and returned to prod-uctive resource cycles in the future. We like to think of it as borrowing resources, rather than using them up.
Being ever inspired by Cradle to Cradle methodologies, we have a waste-equals-food approach when it comes to resources. For example, during renovation we demolished some of the old on-site structures. We considered the rubble from the demolition a resource rather than waste, and used it to build a foundation for our parking lot.

Our concept of no waste also applies to those less physical resources such as energy and water. We do not waste energy when natural systems suffice, we clean our own water and wait for the day when we can legally close the cycle and reuse it in our toilets, for now it irrigates our gardens. Our organic waste is processed by pyrolysis to generate heat, energy and biochar, supp-orting operations and on site soil quality. In addition, our day-to-day operations minimise waste through biodegradability, digital admin-istration, and sustainable hotel management.

Resources

Eliminating Waste
Waste Equals Food

Waste? What waste? Reuse, upcycling, recyclability, and the use of local material resources are always prioritised at Green Solution House. All new constructions and renovations considered principles of Design for Disassembly, maintaining material value into the future. Existing furniture was reupholstered, glass offcuts from local industry became a landscaping material. As long as materials can be separated and cleaned, they remain nutrients for other cycles and support our goal of zero waste.

Design for Disassembly
Investing in the Future

To us design for disassembly means valuing building systems for their current purpose and also their future beyond Green Solution House; as such, our approach supports the eventual recycling and reuse of building components.
The design of the conference center and landscape prioritised accessible mechanical fastenings over the use of adhesives and other permanent systems. At Green Solution House our design for disassembly strategy informed the earliest design decisions through to final detailing.

Recyclable Facade
VELFAC Windows

Save energy and reduce waste. Is it too good to be true? Firstly, the north and south façades of the renovated building are triple glazed, saving over 50000 kWh compared to the pre-renovated façade. Secondly, they are designed for disassembly. This means that after a very long life in the building, the aluminum window frames by VELFAC will be taken apart and recycled.

Material Filter
Parameters for Material Selection

We developed criteria to select materials, prioritising certifications and environmental labels, recyclability, social responsibility, use of resources, safety of compounds, and energy in production, to name a few. As a result we have many solutions that are designed for disassembly, Cradle to Cradle certified, and have a positive impact beyond their mere function.
If a material or product has harmful substances or a negative production footprint, we source alternatives. Locally sourced options take priority.

Building with Wood
Lilleheden Glulam Construction

The environmental footprint of constructing a building is usually substantial, so we lowered ours by using wood, as opposed to steel or concrete. A laminated wood construction forms the fan shape giving the spaces a comfortable and warm aesthetic. Wood is a natural and renewable material if it comes from responsible and sustainable forestry operations.

Recycled Glass Insulation
Isover Insulation

This mineral wool insulation is made from 80% recycled glass. Even better, some of that glass came from the façade of the building before renovation. The insulation contributes to a healthy indoor climate, being chemical free, sound insulating, and able to keep damp and draught away. Isover insulation is lightweight and compressible, making it ergonomic to install and easy to transport.

Performance

We have put a lot of thought into Green Solution House – how it can be good for the people and the environment. We have carefully integrated high quality materials – recycled, recyclable, regenerative, active and local. We have integrated systems and processes that generate energy, save energy, monitor energy, circulate fresh air and clean water – utilising both nature's own processes, emerging technologies and trusted solutions. As a result we hold a DGNB certification and Active House validation. We have integrated Cradle to Cradle inspired systems and many Cradle to Cradle certified products and materials. We hold the Green Key, a tourism ecolabel, awarded for sustainable operations as well as an ecolabel for the organic food we serve in the restaurant.

These acknowledgements keep our standards high. Moving into the future we want to keep up the good work, and to achieve this we keep an eye on our operations and continuously reevaluate our performance. It is important to know how we are doing so that we can learn and improve. We secure this with a circular business model, which means that we reinvest our profits into improving existing green solutions and implementing new ones. For us, being transparent means sharing the lessons we have learnt to inform and inspire others.

Performance

Active House
Comfort, Energy and Environment

Active House is a vision for buildings that create healthier and more comfortable lives for their occupants without having a negative impact on the climate – moving us towards a cleaner, healthier and safer world. The main focus areas of the Active House principles are comfort, energy and environment. Green Solution House is based on these principles and performs very well within the three categories.

Cradle to Cradle
Regenerative Thinking

Imagine a world in which buildings – just like trees – use the sun's energy, produce nutrients, provide living space, cleanse water and purify the air. This is a Cradle to Cradle world. Waste Equals Food, is a fundamental theory in Cradle to Cradle, and a principle that inspires Green Solution House's circular design methods. We aspire to eliminate the concept of waste and the Cradle to Cradle principles are an inspiration and a driver in the continuous development of both our buildings and landscape.

Daylight Analysis
Daylight Factor

The daylight conditions at Green Solution House have been evaluated using the daylight factor method in the VELUX Daylight Visualizer and achieved exceptional results. The daylight factor is a recognised performance indicator used to evaluate the available amount of daylight in a room. It expresses the percentage of daylight available on indoor work surfaces compared to the amount of unobstructed daylight available outside, under an overcast sky.

DGNB
Investigating Quality

DGNB describes and assesses the sustainability of the building as a whole, over its entire life cycle. The criteria for the certification addresses the building's qualities in the following categories: environmental, economic, sociocultural and functional, technical, process and site. Outstanding quality is necessary to obtain a DGNB certification and Green Solution House is the first hotel in Denmark to achieve such.

Green Key
Tourism Ecolabel

Green Solution House holds the Green Key, an international ecolabel awarded to hotels, hostels, conference centers, and other leisure organisations that meet a number of environmental requirements. Some of the demands are to limit the production of waste, decrease use of water and electricity, and focus on education and communication – all fields where Green Solution House is successful. Obtaining The Green Key shows the sense of responsibility an organisation has for the environment and for society.

Circular Business Model
Redefining Revenue

We demonstrate resilience and have the business model to do so. Green Solution House is designed to continuously adapt by embracing new green technologies that demonstrate state of the art developments in the building industry. Achieving this requires a regenerative business model; therefore, monetary revenue from the hotel and the conference centre's operations is channeled to fund the ongoing integration of new solutions and the assessment of existing systems and products.

Advisors

Green Solution House has been realised by a team of advisors who worked in close collaboration, bringing their own expertise to push forward innovative solutions.

The advisors are 3XN architects (conceptual design), Steenbergs Tegnestue (architectural detailing), SLA (landscape design), Ramboll (engineering), COWI (client advisor), GXN innovation (consultant on sustainability).

Strategic Partners

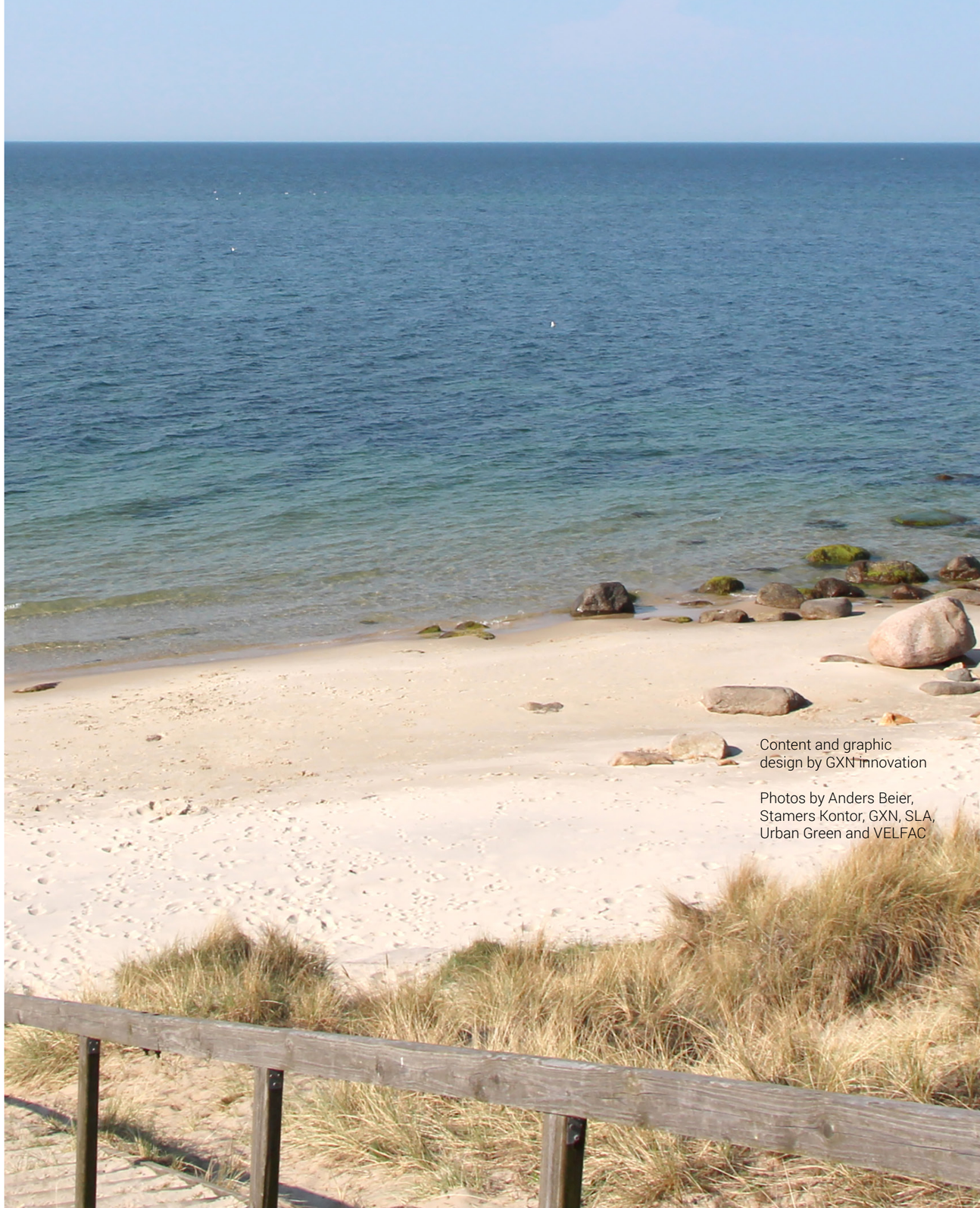
The strategic partners are the key players in the co-creation approach of the Green Solution House and implementation of our green solutions.

The strategic partners are Realdania, VELUX Group, Autodesk Research, GXN Innovation and Saint-Gobain's Danish companies: Weber, Isover, Ecophon and Gyproc.

Financing

Green Solution House has been made possible by the generous support of both local, national and international foundations.

Financing was provided by European Regional Development Foundation, Carl Edvard Mogensens Foundation, Realdania, Brdr. E.S.A. Larsens Grant, Bornholms Business Foundation, Sparekassen Born-holms Foundation, Bornholms Brand, Nordea Kredit, and the Danish Environmental Protection Agency.



Content and graphic design by GXN innovation

Photos by Anders Beier, Stamers Kontor, GXN, SLA, Urban Green and VELFAC

For more information
and booking visit
greensolutionhouse.dk

Green Solution House
2015