



CreativeDenmark



Beyond Buildings

Buildings as a key element for sustainable cities

Inside this white paper

Constructing sustainability

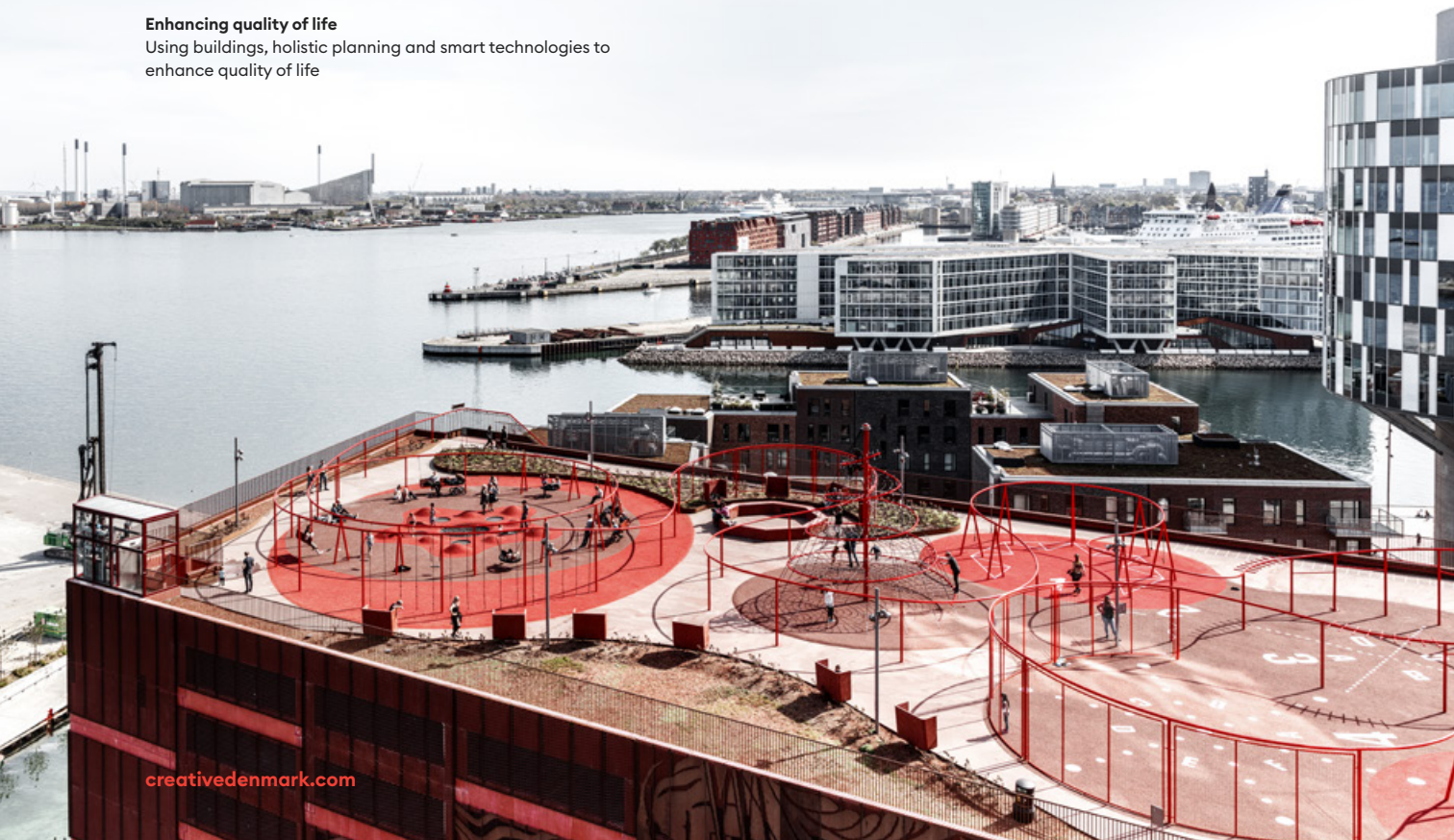
How to create sustainable solutions, valuable spaces in between buildings and circular processes in the built environment

Innovative partnerships

Establishing holistic partnerships across industries to enable innovative practices and solutions

Enhancing quality of life

Using buildings, holistic planning and smart technologies to enhance quality of life



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Nordhavn Lüders Konditæg

Photo: Rasmus Hjortshøj for JAJA Architects

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Executive summary

With the ever-quickenning pace of urbanisation, demographic changes and climate change globally, our cities and their buildings are facing immense challenges. In response to this, creative and innovative thinking offer a competitive advantage when solving complex problems, allowing us to question habitual thinking and enabling us to create novel solutions. This way of thinking and problem-solving can lead us towards a more sustainable approach to designing, creating and using the buildings that form the basis for our everyday lives, to the benefit of both our planet and the people that populate our urban centres.

Enhancing quality of life for the population at large

As urbanisation continues to accelerate globally, the demand for cities and buildings that can enable better health and well-being for their inhabitants rises. Holistic, cross-sectoral partnerships and new technologies are needed to create buildings that enable people to thrive, both individually and as communities. Chapters 1, 3, 6 and 7 of this white paper illustrate a framework for holistic project planning that goes beyond a single building and the use of smart technologies to address the question of how to create buildings and spaces in between buildings that can improve health and overall quality of life for the many and not only the few.

Combating climate change through buildings and the spaces in between

Knowing that the global built environment is responsible for up to 40 % of global waste and 39 % of energy-related CO² pollution, we must rethink how we design and use the built environment. Therefore, we must find creative ways of reducing the CO² footprint of the built environment and enhancing the lifecycle performance and sustainability of buildings. Through climate adaption projects, smart reuse of resources, and holistic renovation processes, buildings and the spaces in between them hold the potential to drive forward the green transition and the 17 UN Sustainable Development Goals (SDGs). Chapters 2, 4 and 5 showcase novel solutions where habitual thinking and processes have been challenged to foster more sustainable buildings and practices in the built environment.

Sharing creative solutions for your inspiration

This white paper features lessons learned from the built environment with regard to increasing sustainability and quality of life through buildings and the spaces in between them. State-of-the-art cases from climate adaption, circular economy, renovation, smart building technology and city planning illustrate how buildings can become highly valuable components that benefit both our planet and our societies globally. 'Beyond Buildings' is intended to enrich and inspire your next project with creative solutions from the built environment.



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From disadvantaged residential area to attractive urban district

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Case

Combining recreational spaces, biodiversity and cloudburst protection

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To go beyond buildings requires creativity

A building is more than just a building and Danish companies, architects, planners, and designers know that. There is a massive potential in the holistic approach to building – for economic growth, for good jobs and of course for a more sustainable tomorrow for us all.

Once upon a time a building was just a building. It was drawn, built and used on its own terms. Without much regard of the world around it. That is no longer how the world works.

A building is no longer just a building. It is part of its surrounding and it has to take responsibility for its place in the world. As part of a world challenged by climate change, by changes in extreme weather and demands on durability and functionality. As part of a world where materials should be considered through a lense of sustainability and stability of the supply chain. As part of a world where building and cities should be measured on a human scale – where liveability and not merely functionality is key.

Danish cities, architects and buildings are at the forefront of this development. By building liveable cities in Copenhagen and Aarhus have shown that we can decouple growth and CO2 emissions. That you can build cities that work for families with small children, students and the elderly at the same time. And that you can implement nature and sustainable balances to create a city that is more than simple the sum of its buildings. Danish cities are not the only ones in the world, but they are certainly in the top of the class.

It requires creativity, cooperation and innovation to achieve it. It requires development of everything from insulation to material use in buildings. From plans for municipal waste to temporary pocket parks. From bicycle infrastructure to affordable housing. And of course everything in between. In short: It requires a holistic approach that can adapt solutions to specific needs of anything from a large metropolis to a small village.

Denmark has a lot to offer in the coming years when it comes to buildings and the space between them. Our companies and industries are trained in lateral thinking to solve complex problems. Our architects and designers know how to work on a human scale. To create sustainable buildings and sustainable cities we need to focus on quality of life. And we need to spread that not just around the globe, but also to every small hamlet in Denmark.

This white paper highlights leading enterprises and solutions that use creativity as a crucial catalyst to support the development of sustainable and innovative practices and solutions in and around the built environment. Solutions that are crucial to our future.

We are a creative country and we are known for it in the entire world. Danish design, urban planning and architecture is already world famous. We need to build on that position of strength, so Danish companies can grow strong, create thousands of good jobs and of course create a more sustainable world where a city is more than the sum of its buildings.



Morten Bødskov
Danish Minister for Industry, Business and Financial Affairs

The challenge

Buildings and the built environment are crucial tools in our efforts to create a better future for society and our planet. We need healthy, resilient and accessible buildings that are environmentally friendly and that ensure equity and opportunity for everyone.

The United Nations Sustainable Development Goals define the challenges we must meet if we are to achieve a better world for all people. The design professions that shape the built environment – urban planning, architecture, and landscape design – influence and interact with every one of these seventeen goals. Already, we see many architectural solutions that contribute to sustainable communities and improved lives for many people. But, the designed environment also remains a central part of our present challenges – much remains to be done.

Buildings are not just buildings; they are homes, workspaces, educational facilities, places for healing, cultural exchange, worship, and many other human needs and purposes.

The infrastructure that connects us to buildings is also vital to our wellbeing, and forms an integrated part of meeting the challenge of providing affordable housing, equal economic opportunity, clean air, adequate sanitation and basic safety, all at the same time. We can, indeed we must, build more responsibly, with emphasis on conserving resources, using more efficient construction methods, promoting sustainable renovation projects, and enhancing quality of life for all people. We know that building design can propel our efforts to protect heritage and to halt damage to the global environment.

We urgently need more effective design and planning policies, along with new design solutions. We know that architecture can help to bring better lives to all people. Representing 3.2 million architects around the world, the International Union of Architects' (UIA) basic purpose is to unify architects worldwide, influence public policies on building and urban design, and advance architecture in service to society.

On all three of these notes, it is a rich source of inspiration to follow policy developments in Denmark, and to see the progress of the Danish preparations for the 2023 UIA World Congress of Architects in Copenhagen (UIA 2023 CPH). This white paper showcases a wide variety of themes and inspiring examples of how buildings can help to make the changes we so urgently need if we hope to accomplish the UN Sustainable Development Goals by 2030. The paper signals the wonderful substance and hope we can all anticipate for UIA 2023 CPH.



Thomas Vonier

FAIA RIBA, President of the International Union of Architects.

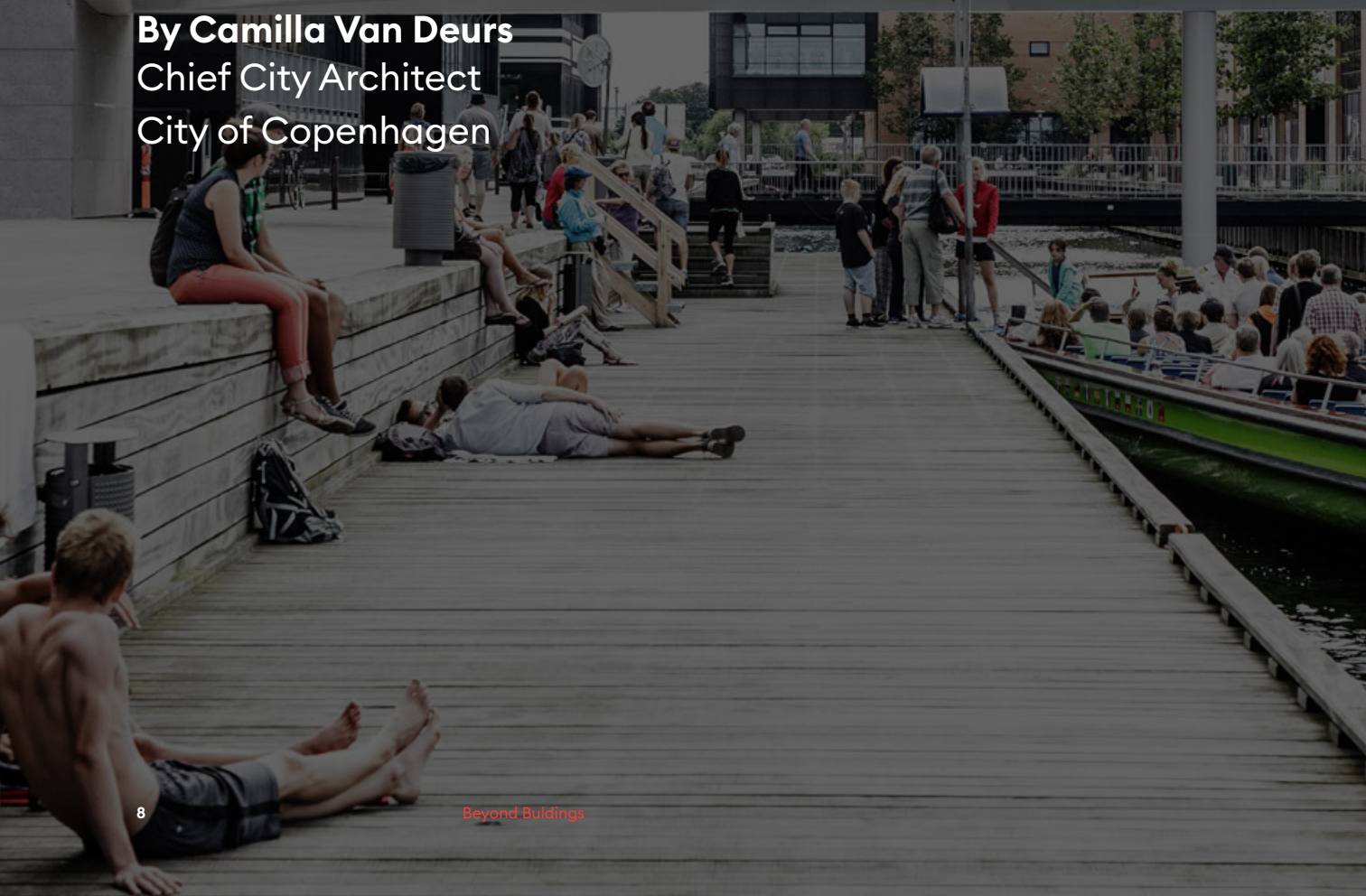
During the 2017 World Congress of Architects in Seoul, Thomas Vonier FAIA RIBA was elected president of the International Union of Architects (UIA), the global organisation representing the world's 3.2 million architects. An architect in private practice, with offices in Paris and Washington DC, Thomas is a former president of the 94,000-member American Institute of Architects.

Building quality of life

A strong tradition for quality of everyday life in city planning and architecture

Buildings are the building blocks of our cities and the foundation of our daily lives. If planned, designed, and developed in the right way, they have the power to raise quality of life for city inhabitants and contribute substantially towards sustainability.

By Camilla Van Deurs
Chief City Architect
City of Copenhagen



Introduction

The population of Copenhagen is expected to grow by 20 % in the next decade. This creates an opportunity to combine infrastructural changes with green growth toward carbon neutrality in 2025. In order to achieve this, we are looking to increase sustainability in several ways, including the city's energy consumption and production, prioritising green mobility such as public transportation and bicycling, as well as working within the building sector to ensure more sustainable growth. On a global scale, about 40 % of all greenhouse gas emissions are related to the built environment, so the way we build, maintain and use our homes, workplaces and infrastructure has an enormous impact on our limited planetary resources.

Solving more than just one problem

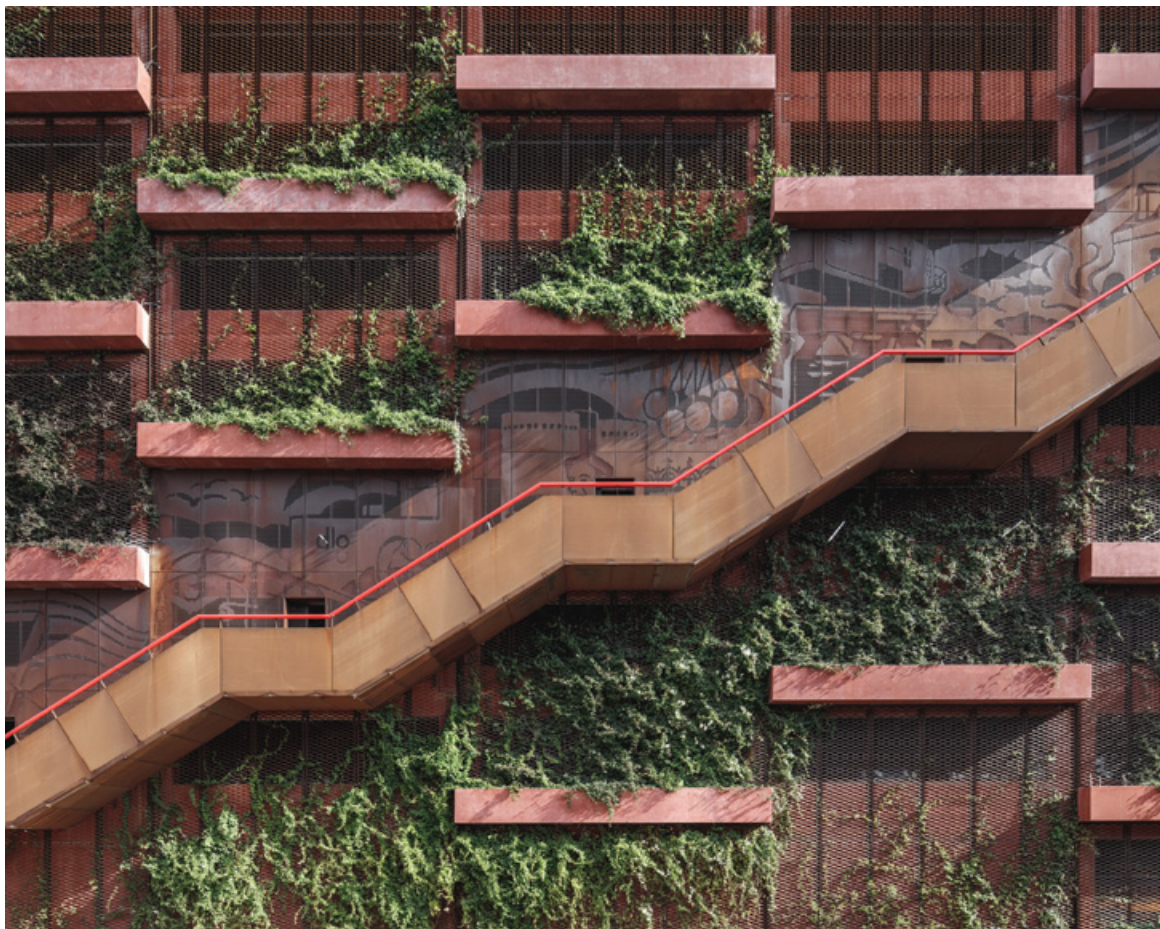
Architects and city planners play an essential role in how Copenhagen is trying to implement greener solutions while maintaining the high liveability and quality of life which the city is known for. Here, creative thinking can enable novel ways of combining sustainable solutions as the building blocks of our cities and thus help to answer two essential questions: what makes a sustainable city and how do you ensure that it at the same time is beneficial for the many and not only the few? The key to answering these questions is to stay true to the ambitious political goals that guide the city's overall development. At the same time, we must be attentive to the everyday life of Copenhageners. We must materialise the vision for our city in ways that add more value to the solutions and therefore solve more than just one problem.

Many of the creative solutions in Copenhagen, such as a ski slope on top of a waste-to-energy plant, aim at providing citizens with direct benefits in their daily lives from initiatives aimed at meeting the sustainability agenda. For example, this can be done by enabling better access to green and blue public spaces through Copenhagen's climate adaptation strategies, or by gaining cleaner air and health benefits as a result the city's more than 430km of bicycle infrastructure. Likewise, benefits can be gained by providing a comfortable and affordable indoor environment in homes and workplaces with the help of the city's district heating system.

A multi-disciplinary approach

One of the city's newest districts 'Nordhavnen', built for 40,000 inhabitants and 25,000 workplaces, is an example of a green-tech district showcasing many sustainable solutions such as solar panelling, water cooling, shared mobility services, recycling of building materials, 25 % affordable homes within the district and access to fantastic public institutions and public spaces along the waterfront. The architecture of Nordhavnen is rooted in the use of brick materials and replicating the scale of the existing five- to six-storey courtyard block typology in the older parts of Copenhagen, thus providing a connection to the architectural heritage of the city.

One of the most prominent buildings in Nordhavnen is the parking structure Konditaget Lüders (Sports roof Lüders), which demonstrates the multi-functional approach. The building, which is home to a large variety of climbing plants on the exterior facades, consists of a community-based recycling centre, a supermarket, parking for 785 cars, and an enormous battery which can store and recycle solar energy back into both electric cars and heating systems. The building is 'topped off' with an iconic rooftop public playground and sports training facilities. To me this 'sandwiched' solution demonstrates how future urban buildings will need a multi-disciplinary and multi-functional approach to creating more liveable and sustainable cities



The multi-story car park that comes alive

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How do we create a functional parking structure that is also an attractive public space? That was the challenge that led to Konditaget Lüders ('Sports roof Lüders').

Instead of concealing the parking structure, the architects proposed a concept that enhances the beauty of the structural grid. A system of plant boxes introduces a new scale to the massive facade, while also distributing greenery across the entire building. The grid of plant boxes on the facade is broken by two large public stairs, whose continuous railings lead up to a fantastic playground on the rooftop. The stair railings expand into a world of swings, ball cages, jungle gyms, and more. From the street level, the railings literally take the visitor by the hand and invite them on a trip to the rooftop landscape with amazing views of the Copenhagen Harbour.

Konditaget Lüders on the Lüders multi-story car park has been well received by Copenhageners and is used every day for exercise, yoga, and as a hangout spot. In 2020, the project won the Danish Design Award in the category 'Liveable Cities'.



From disadvantaged residential area to attractive urban district

Contributors

Case submitted by

City of Aarhus, Integration and Urban Development

A cooperation between

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Owner and housing association for the area

City of Aarhus

Local government

For years, the City of Aarhus and Brabrand Housing Association have wished to transform Gellerup/Toveshøj from a disadvantaged residential area into an attractive urban district. The overall objective was to create a mixed urban area consisting of districts with a diverse residential composition.

In 2010, a joint strategic plan for the residential area was adopted by the City Council and the housing association, which proved to be a step change for the area. New roads have opened up the area to the rest of the city, and the construction of private housing, the completion of a new city park and a 3G football pitch have also added new life to the area. In addition, a massive sport and culture campus is under construction. A new office building for 1000 municipal employees opened in 2019, as did a new headquarters for the housing association, alongside purpose-built managed student accommodation. Three apartment buildings have been renovated in a pilot project, while five buildings have been demolished.

Based on the work already completed, a development plan has been produced. The plan includes:

- demolition of a further 600 apartments
- construction of private housing – with focus on townhouses and community
- renovation of existing housing
- attracting and developing urban functions
- focus on the creation of neighbourhoods, splitting the area into several neighbourhoods with their own individual identity and characteristics



Nordhavn – the sustainable borough of the future

Contributors

Case submitted by
Ramboll

Carried out in collaboration with
COBE
SLETH
Polyform

With its prime location and an area covering the size of 625 football pitches, Nordhavn in Copenhagen, Denmark, is an ambitious city development and a game changer when it comes to urban development. The overriding vision for Nordhavn is to become the sustainable city of the future, and it is the only new urban district in Denmark to have received the prestigious gold certification for sustainability from the German Sustainable Building Council (DGNB), a de facto standard for certification of urban plans and buildings .

To promote liveability and sustainability, Nordhavn has been designed as a ‘five-minute city’, making it possible to reach shops, institutions, work places, cultural facilities and public transport within five-minutes’ walk from any point in the district. Nordhavn makes it possible for 40,000 people in Copenhagen to have nature at their doorstep - right in the centre of the city. Nordhavn has been planned as a neighbourhood that drastically rethinks how ways of living can be combined with sustainable energy, environment, traffic and cityscape solutions.

The area will be serviced by an elevated metro track and a bicycle network, which together create a green artery. The elevated track functions as a cover for the bicycle highway. Ramboll are urban planning advisors on the plan for Copenhagen’s Nordhavn area.

The 'Bike Snake': prioritising green mobility

The six-meter-high bicycle bridge 'Bike Snake' connects a previously isolated area behind a shopping centre and has created more space for pedestrians and swimmers in the harbour bathing facility below.

The City of Copenhagen's bicycle report from 2017 shows that the 'Bike Snake' collectively saves Copenhageners 380 hours daily and at the same time has eliminated 1,400km of daily car traffic from Copenhagen's streets, which is equal to 87 tonnes CO2 per year. Additionally, the health benefits of bicycling save Copenhageners over 400,000 sick days per year. According to the bicycle report from 2019, the creation of bicycle paths will lead to 15-20 % more cyclists in cities.



Constructing sustainability

The architecture of our cities and buildings is key to sustainable development

The United Nations has defined 17 Sustainable Development Goals (SDGs) that are to be achieved by 2030. No poverty. Quality education for all. Tackle climate change. Improve life on land and in the oceans – and many more. The challenges are huge, but so are the benefits that can be made by turning these challenges into opportunities.

To do so, we need to challenge habitual thinking and produce new ideas, methods and designs.

By Peter Andreas Sattrup
Senior Advisor, Sustainability,
Danish Association of Architectural Firms

Introduction

Architecture plays an enormous role in achieving the Sustainable Development Goals, as it shapes the everyday life of billions of people around the world. Take a look around you. Wherever you are – unless you happen to read this white paper somewhere deep in the Amazon forest or on the inland ice of Greenland – the chances are that you will find yourself surrounded by architectural design, with or without architects, from urban planning and landscaping to the design of buildings and interiors.

These cities and buildings keep you comfortable, healthy and safe. But the same cities and buildings also have a huge environmental impact and constitute a third of the world's resource use.

Architecture creates value

The heat is on. In the face of climate change, biodiversity loss, and new challenges to public health, we need creative thinking to enable novel solutions that foster more sustainable buildings and practices in the built environment. The big question is how investors and architects can work together and use the SDGs as a tool to create long-term value for users and society, while at the same time making a good business case. To find ways to move forward, the Danish Association of Architectural Firms initiated a series of case studies documenting the value created by architectural design in terms of economic, social and environmental impact in the life cycle of buildings and urban spaces. Analysing the 75+ cases, it became evident that architectural design can create value in many and surprisingly powerful ways. The problem is that such value is only rarely documented, and therefore important learning and business opportunities are missed.

Holistic use of the Sustainable Development Goals

All value is based on perceptions, and with today's research methods and technologies, even social value can be quantified in different ways. The fundamental aspect to keep in mind is to base project development on dialogue with multiple stakeholders that represent the value perspectives of investors, users and communities, from early planning and design to implementation, and to follow up once the project is in use. Most of the value is essentially created in the planning and design stages, and it is delivered through the construction stage. To achieve success and long-term value, we must invest time and money in the preparation, in the design stage, and in the follow-up processes, also known as Post-Occupancy Evaluations. By doing so, investors and architects can develop a much more precise understanding of the sustainability performance of the built environment, make more well-informed decisions, and ensure better long-term business cases for the future.

By applying these methods in practice, we can move from using the SDGs as a source of inspiration, to instead using documented experience as our foundation for improving cities and buildings when we assess, discuss, and measure progress.

The United Nations SDGs pose challenges and create opportunities. The businesses that will succeed in shaping a more sustainable tomorrow will be the ones that use the SDGs strategically in their own business development. Such businesses will create internal processes in their businesses that contribute directly to meeting the SDGs, and will deliver projects, products and services that help their clients, customers and communities contribute to creating a sustainable world.



Teaching the world how to walk on water

Contributors

Case submitted by
THIRD NATURE

Developed in collaboration with
IBF
ACO Nordic
Technological Institute
Kollision
Orbicon
City of Copenhagen

The Climate Tile can help us adapt our dense cities to the impacts of climate change. The Climate Tile is a sustainable water management system for future pavements that can be scaled and does not interfere with pedestrians or with the urban landscape. The pilot project in Copenhagen includes a 50-metre-long pavement that mitigates the effects of increasing precipitation by absorbing up to 30 % of the annual rainfall and thereby taking the load off the sewer system. The individual tiles have a system of holes, tunnels and ridges that collect and manage rainwater, funnelling it away from pavements – where it can cause damage – to a preferred use such as irrigating nearby plantings.

The Climate Tile makes the pavement an important contributing element in climate solutions by collecting and managing stormwater runoff from roofs and paved areas. The tiles have been tested and monitored over four seasons and have shown good results. People in the local area value the tiles and the urban green spaces that are part of the project.

In addition to collecting rainwater for 1 % of the time – i.e. during extreme rainfall events – during the remaining 99 % of the time, the tiles contribute to quality of life in the city. After completion of the new pavement, the local coffee shop has seen a 40 % increase in turnover.



Combining recreational spaces, biodiversity and cloudburst protection

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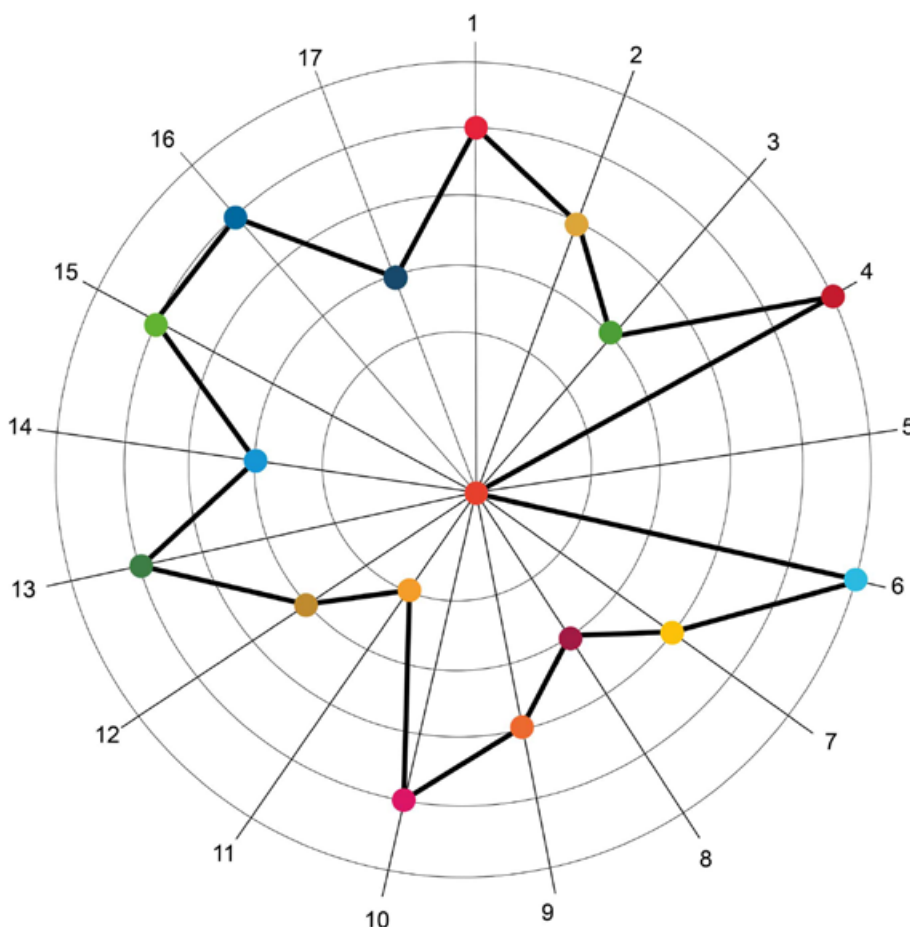
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SLA's combined climate adaptation and public space project 'Sankt Kjelds Square and Bryggervangen' is one of Copenhagen's largest and greenest cloudburst adaption project to date. The project enhances biodiversity in the city, increases health and quality of life for local citizens, and reduces air pollution and the urban heat island effect. The project shows how protection against cloudbursts can go hand in hand with green and recreational urban spaces that reduce traffic and strengthen biodiversity.

The project creates new nature in the city that is aesthetic, functional, biodiverse and sustainable. The planted area with 586 new trees of 48 local species gives Copenhageners a strong aesthetic feeling of nature right on their doorstep.

The project protects the area from flooding by containing and delaying rainwater in numerous specially designed green urban spaces. Instead of channelling rainwater into overfilled sewers, the rainwater is instead dealt with locally and thus gives life to plants and trees as well as creating new blue-green nature experiences - in the heart of the city. The city nature solves some of the great challenges the city faces such as noise and air pollution, climate adaption and the urban heat island effect. While the project at Sankt Kjelds Square and Bryggervangen centres around climate adaption, the project also focusses on the additional benefits we get from climate adaptation and nature-based design: the blue, the green, the healthy, the active and the social. In short, all that makes life in the city worth living.



SDG Barometer: Assessing how architectural projects contribute to the 17 United Nations Sustainable Development Goals

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Case submitted by

Danish Association of Architectural Firms

Developed by

Danish Association of Architects
Danish Association of Construction Clients

The International Union of Architects' Dhaka Declaration outlines how architecture can contribute to the UN SDGs. For example, "Architects can promote measures that help to make cities more inclusive, safer and more resilient, and adaptive to anticipated climate change, with special attention to vulnerable segments of society" (SDG 11, Sustainable Cities and Communities), while also contributing to SDG 9, Industry, Innovation and Infrastructure: "Architects can seek to use services, products and systems that pollute less, use less energy, produce less waste, and provide solutions that are safe, healthy and less costly."

The Danish Association of Architects and the Danish Association of Construction Clients used the Dhaka Declaration to develop a "SDG Barometer" – a tool to assess any projects' contribution to the SDGs in qualitative terms.



Climate partnership model to reduce CO² emissions of buildings

Contributors

Case submitted by
State of Green

In 2019, the Danish government initiated 13 so-called 'climate partnerships' that represented all areas of the Danish private sector. The aim of these unique partnerships was to encourage the private sector to contribute with recommendations and solutions for how CO² and greenhouse gas emissions could be reduced in the individual areas of the private sector. The climate partnership on building and construction presented recommendations that would reduce CO² emissions by 5.8 million tonnes per year. These recommendations are based on a plan with five green pillars:

1. Intelligent control and energy renovation – 1.25 million tonnes CO²/year

By introducing intelligent monitoring and control systems, the energy consumption of buildings can be reduced by 20-25 %. This can reduce CO² and energy costs, and improve the indoor climate and people's health.

2. From black to green heating – 1.8 million tonnes CO²/year

Fossil heat sources for buildings must be replaced with green and sustainable heat sources. This could entail using heat pumps, electricity for heating and energy renovation to reduce heat loss.

3. CO² budget for buildings – 1.13 million tonnes CO²/year

A new standard and regulation must be established for CO² budgets for buildings that gives an overview of the total CO² emissions from the materials used in the building.

4. Fossil-free construction sites – 0.53 million tonnes CO²/year

Construction sites can become fossil free by moving from petrol- and diesel-powered to electric construction vehicles, plant and machinery. Furthermore, the partnership also recommends increased use of biofuels and other sustainable fuels.

5. Implementation of energy labelling for all buildings

Energy labelling should be implemented for all buildings in Denmark to ensure a platform for energy savings and recommendations for more optimal energy consumption in buildings.

Beyond smart buildings

A shift from input-based to output-based thinking can make smart buildings even smarter

How do we use new technologies in and around buildings to support the green transition and the well-being of citizens?

Let us take a look beyond sensors and tools and explore how smart technology can help us rethink and create much more than just a smart building.

By Kristine Barenholdt Bruun
Chief Communications Officer
BLOXHUB

Digitization has been a driving force in the built environment in recent decades – but digitization is about to change character – fundamentally. From a strong focus on workflows, on the building itself, and on individual devices, we will move towards a focus on the end-users, the impact, and value creation.

By using data and digital tools, new technologies have enabled us to design, model, and measure patterns of use. We can track where people and assets are. We can make it easier to document how and by whom buildings are used. We can measure and describe how people perceive the value of buildings. We can track whether the operation of the building supports the green transition, and we can see if unexpected patterns of use make the building less sustainable.

Furthermore, we can see how the indoor climate affects how well children learn in schools, measure how workspaces affect a company's success, or track how the space planning and design in a kindergarten affects children's motor coordination.

Using smart technology more intelligently

The functions offered by smart technology can be used a lot smarter than they are today. But, to realise their full potential and create long-term value for end-users – and a sustainable future for the building industry - we may have to rethink fundamental practices.

One way of rethinking practices is to create new contract types and new incentive models based on actual performance, and evaluation by end users. We can change remuneration structures into a model in which actors in the construction industry are rewarded based on how well people thrive in the buildings once they are occupied – instead of being based solely on how many hours or products are put into a construction project.

Another way to rethink practices is to create new 'smart policies', for example digital licensing and 'permissions of space' for spatial information infrastructure. This would make it possible to change the way we own our buildings, squares, parks and other facilities – allowing us to share the benefits of and the investments in the many common buildings and spaces that serve as the backbone of all liveable cities.

From input-based to output-based thinking

By using existing smart technology in more and better ways, we can create a new reality where construction and management of the built environment are driven by an output-based thinking.

We need to use our smart technology to create buildings that operate in the best possible way: for children to thrive in a good indoor climate, for students to learn better, or for employees and enterprises to excel through optimal workspaces. And by sharing the investments in and benefits of building projects with our fellow end-users, we can motivate actors in the construction sector to create a built environment that provides more value for citizens and our cities.

By moving beyond smart buildings and starting to use technology to change the entire built environment from input-based thinking to output-based thinking, we can help achieve our goals for a green transition and we can create a built environment in which people thrive.



AirBird® - The canary in the mine

Contributors

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In collaboration with

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VELUX Group

Fredensborg Municipality

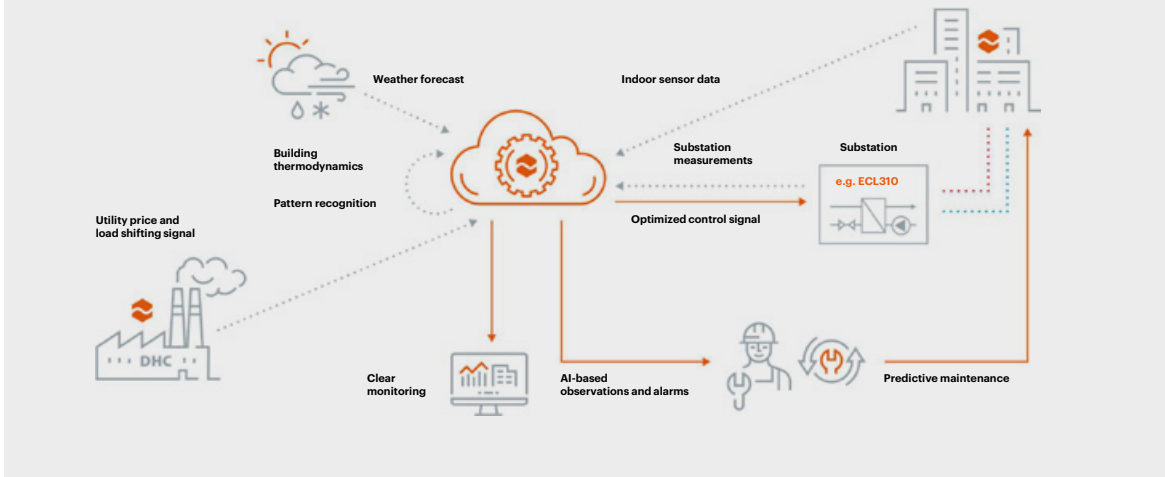
Kokkedal School

CBS Copenhagen Business School

AirBird® is an intelligent indoor climate sensor that helps improve the indoor climate by nudging behavioural change. It can quickly detect poor indoor air quality and helps occupants of a room to take necessary action. It can give feedback via bird sounds or via a soft glow to prompt you to adjust ventilation, heating or cooling. The AirBird was ideated, designed and developed in co-creation between Leapcraft, GXN and the VELUX Group. The AirBird Plus version can also wirelessly connect to a hub to transmit data and generate recommendations via an accompanying app for smart phones.

Industrial researcher Lara Anne Hale has been involved in testing the AirBird as part of her research associated with 'Smart City and Smart Buildings – Balancing Technology and People' facilitated by BLOXHUB and funded by Realdania and Innovation Fund Denmark. Her work facilitated data-driven building renovations to improve the indoor climate as a potential business model, in collaboration with Copenhagen Business School, the VELUX Group, Leapcraft, and Kokkedal School, where the AirBird was tested.

Leanheat uses different data sources to learn the building's behavior and optimizes the heating system



Smart central heating control and maintenance with AI

Contributors

Case submitted by

Danfoss
Leanheat

Traditional central heating systems fail to adjust to changing weather, living patterns and thermodynamic properties of buildings, which results in overheating, inefficiency, high costs and poor indoor climate conditions. Danfoss provides software solutions that use artificial intelligence to optimally control and monitor centrally heated residential buildings.

The solution is scalable and retrofittable to existing building stock with wide integration to various controllers. Data from a heating room is combined with data collected from IoT (Internet of Things) sensors placed in the building's apartments. By processing the collected data with AI, the central heating can be optimally controlled, taking into account the thermodynamic behaviour of the building, weather, ventilation, and inhabitant living patterns. The heating control adapts to the changing environment, which makes the system maintenance free.

The benefits for heat providers and consumers are clear, with a potential saving in energy consumption of 10-20 %. Furthermore, the maintenance costs potentially decrease by 5 %, the peak capacity can be reduced by 15-30 %, the indoor climate improves, and lastly, district heating companies can optimise their production and network.



Transforming the ‘boring’ elements in city development

Contributors

Case submitted by
BLOXHUB (DK)

In collaboration with
Dark Matter Labs (UK)
Smith Innovation (DK)

The world’s first Boring Revolution Lab opened in Copenhagen to bring together the building, property and tech industry to rethink how we own, share and build our cities. The lab looks into how to use new technology to change fundamental practices in the built environment – and thereby help secure the green transition and the well-being of end-users.

The lab is founded on the belief that a transformation is needed in administrative practices such as contracting, property deeds and building codes – the so-called ‘boring’ elements in city development. Thanks to new digital tools and data, we are able to design, model and measure user patterns which makes new types of contracts, incentive models and ways of collaboration possible.

The lab will set up experimental workshops to investigate how smart technologies can help us put behaviour and value creation at the centre. In the lab’s first year, the following topics will be explored:

1. Smart infrastructure and the second great flood
2. Pollution and the performative contract
3. Circular construction and the post-ownership society

The Boring Revolution Lab is open to all and invites everyone to participate in its explorations.



New business models for improved indoor climate

The indoor climate in schools is essential for children's health and learning abilities. Classrooms have excessive levels of CO₂, and estimates show that a student could be 'one year wiser' if they attended school in a healthier building.

This challenge is well documented, and technical means of solving it exist. However, the current revenue model in the built environment hinders sustainable implementation of such solutions.

A new lab in Copenhagen, the Boring Revolution Lab, is looking into new ways of creating visibility and new business models where companies are paid according to the quality of the indoor climate they create rather than how many hours they spend on a project.

Reinventing renovation

Preservation or transformation of the best from the past leads to a more sustainable future

Most of today's buildings will exist for coming generations and require our attention if they are to contribute to a sustainable future. This requires that the building sector finds new solutions with respect to cultural heritage and the embedded values in existing buildings.

By Graves Simonsen

Head of Projects

Danish Association of Construction Clients

Creating a sustainable global future calls for a new approach to the existing building mass. Historically, the building sector has focused on market demand and less on the ecological footprint related to fulfilling that demand; the sector has used virgin resources, generated waste, and neglected the embedded values in existing buildings. Previously, new buildings were the default answer to new physical challenges, and renovation has been the second choice, as it can be more complicated to match the increased demands from users within the given frames and conditions of existing buildings, architecture, and structures.

Today, in a Danish and international context, we see that urban planners, clients, developers, users, and financial institutions increasingly focus on sustainability. This leads to new insights and approaches with regards to both historical architecture and its context. Focus is shifting to the value of embedded materials and energy in existing structures, and reducing waste production by reusing whole buildings or large parts of existing buildings. We also see increased attention on reusing or recycling waste as new resources, mitigation of greenhouse effects by reducing CO₂ emissions in a life cycle perspective, and last but not least we see new insights and approaches to ensuring we benefit economically, culturally, and infrastructurally from existing building stock.

New creative challenges

Architects and building designers who have traditionally focused on new architecture are now facing novel challenges when transforming existing buildings. New features must be adapted to market needs and vice versa, which requires new creative solutions regarding technologies, the combination of existing and new materials, energy optimisation, and improved indoor climate. Sometimes compromises must be found, when not all requirements can be fulfilled. On the other hand, renovated and transformed buildings, which have already had a history in an urban context and are found worthy of preservation, will often be 'pre-accepted' by citizens and users, as they have already proven their value.

The need for renovation and transformation of existing buildings will increase in the coming decades. Danish architects, engineers, and construction companies are facing the fact that about 80 % of existing buildings will remain and have to service the next generations.

When meeting sustainability challenges, for instance climate and energy sustainability, renovation is a vital element, as the potential for energy savings in existing buildings represents the major part of the built environment's environmental footprint.

Attention on resources

Reduction of new-build areas and new heated or cooled square meters will be part of a sustainable future, despite an increasing population. We also need to reduce use of non-renewable resources. We must reframe our approach to existing buildings, structures, products, and materials so that we can discover the elementarily valuable resources they contain and opportunities they offer; resources and opportunities that we might have overlooked in the past will become visible.



Investing in energy-saving skills

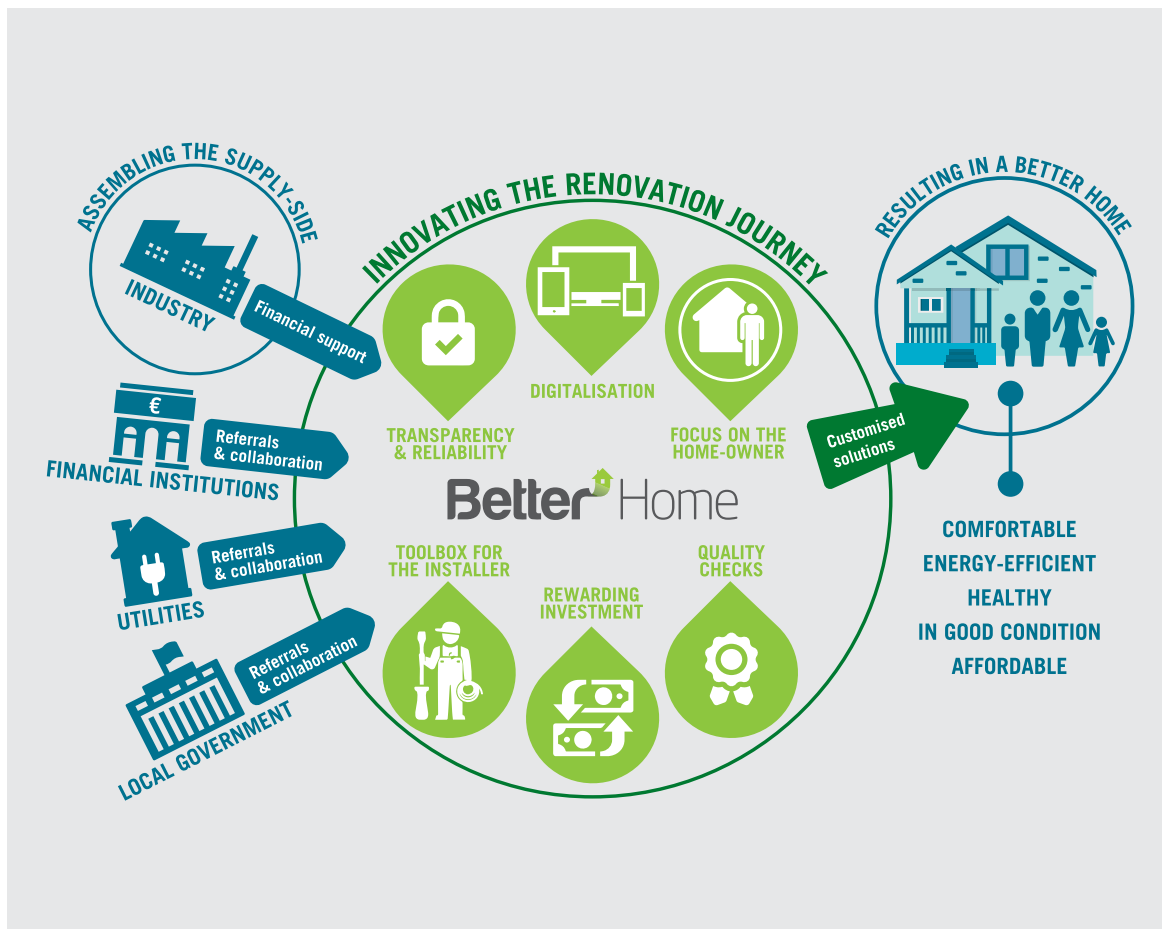
Contributors

Case submitted by
 Knowledge Centre for Energy Efficiency
 in Buildings
 Danish Energy Agency

The building sector in Denmark has a go-to source of inspiration for guidance on energy savings in buildings. In 2008, the Danish government established a national Knowledge Centre for Energy Savings in Buildings, and since then, the centre has contributed to improving the skills in and knowledge about energy savings among building professionals in Denmark.

Through the Knowledge Centre, professionals in the building industry have free access to information, facts, instructions and guidance about how to choose the right technical solutions and construction methods for achieving energy savings in buildings. The main products of the centre are three catalogues that contain descriptions of 80 energy-saving measures, including insulation of various building elements and replacement of windows, boilers and other technical installations.

The success of the Knowledge Centre stems partly from its network strategy. This means that the centre can develop knowledge and materials, and disseminate results in cooperation with trade organisations and other professional organisations, schools and authorities.



A homeowner-centric one-stop-shop model for energy renovation

Contributors

Case submitted by
BetterHome

BetterHome transforms a complex and fragmented renovation process into a simple and straightforward homeowner-centric experience. BetterHome delivers a comprehensive digital one-stop-shop solution in partnership with key players in the construction value chain: leading banks, utilities and 3500 installers.

The building owner is offered tailor-made solutions based on their specific preferences, covering energy improvements to the building envelope, heating, cooling, ventilation and hot-water systems. The solution offers a holistic planning process that optimises the value chain by minimising efficiency losses, and avoiding miscommunication and customer lock-in effects.

BetterHome started in Denmark in 2014, and today has a network of more than 3500 installers, five banks and four utilities. The main target is deep renovation projects of single-family houses and multi-family buildings. These projects produce average energy savings of approximately 30-70 %. Accumulated indirect turnover in mid 2020 was EUR 133 million, and demand is growing rapidly .



Hotel Herman K – the transformed transformer station

Contributors

Case submitted by

Danish Association of Construction
Clients

Client and architect

Danish Real Estate Management A/S

Energy and installation engineer

Danish Energy Management A/S

Interior design

Mette Fredskild Design ApS
Laboratoriet ApS

Construction engineer

AB Clausen A/S

Contractor

Techniq Installation A/S

This building is from 1962, originally erected as a transformer station, which was in use until 2013. By 2018, the property had been transformed into a hotel and restaurant. The high-strength concrete structures of the transformer station were both a challenge and an opportunity, and the new owner's approach was to preserve as much as possible, so the transformation would leave the historical layers open to view. That included both the main structure and the rustic surfaces of the transformer station's brutalist architectural style. Only small changes were made to the bronze slats on the street facade, and, inside the hotel, many of the structural elements of the original building have been preserved.

By realising the potential for sustainability in preservation and recycling, rather than carrying out demolition and new construction, the building is an excellent example of transformed architecture that is both distinctive itself and at the same time adapts positively into the street scene, where it unpretentiously breaks a row of residential buildings from the previous century. The project was awarded the Danish Renovation Award in 2019.

From shopping centre to public library

The former shopping centre from 1968 has been transformed into Herning Library, a project which has tripled the number of visitors to the municipality's libraries to 40-50,000 per month. Additionally, the library has also generated new life in the town centre, linking public institutions and transportation as an extension of the town's shopping street.

In connection with the transformation, both time, money and CO2 emissions were saved by reusing the concrete structure of the existing building instead of demolishing it and building something new. Typically, approximately 75 % of the energy used on constructing a new building is embodied in the structures of the building. Accordingly, significant climate impacts are avoided when reusing building structures instead of building something new.



Building circularly

Preventing loss of resources throughout the whole building process

The concept of circular economy stems from the sustainability agenda. By integrating sustainable design thinking throughout the whole building process and establishing circular value chains, we can ensure that no resources are lost along the way, or when a building has served its purpose, sometime in the future.

By Anke Oberender

Centre Manager
Knowledge Centre for Circular Economy
in Construction

Building circularly involves a wide range of considerations that can prevent the loss of resources throughout the whole building process.

Building circularly starts in the idea and design phase

The building owner is an important driver in any construction project, as the client's choices and ambitions define the vision for the project – even more so when building circularly.

During the idea and design phase, we need to consider how circular solutions can be achieved. Will focus be on maximum use of reused and recycled materials? Should we focus on reducing a building's environmental impact? Or should we focus on maximizing the potential for reuse and recycling through design for disassembly?

To ensure that circular-economy thinking can be prioritised throughout the entire process, there have to be clear ambitions and objectives from the start, and a close dialogue between relevant stakeholders and parties in the construction process.

Life Cycle Assessment as a tool for construction

Life Cycle Assessment (LCA) is an assessment of the environmental impacts, e.g. from all materials that are part of a building, seen over the life of the building. This assessment can help prioritise how the design of buildings can be optimised in relation to environmental impact - both in new construction and when renovating buildings. LCA can also be used to compare the environmental footprint of different structural solutions or individual building materials.

Renovating and transforming existing buildings often reuses many of the original structures and materials, and environmentally this is often a good strategy instead of building new buildings. The viability of a renovation strategy can be investigated by making an LCA for the renovation and comparing it with an LCA for similar new construction.

Circular design supports circular value chains

We can reduce the environmental impacts over the lifespan of a building by optimising material use, reducing waste and through design and material choices. We can reduce the need for maintenance and replacement by considering the lifetime of materials, ensuring the quality of the products used in construction, and ensuring that materials are functional and free of problematic substances. Design for disassembly allows us to extend the service life of buildings through refurbishment and replacement. Furthermore, it offers the possibility of waste prevention and reduction in waste volumes - materials and components can be dismantled and used again following dismantling, thus ensuring reuse of high-quality recycling. Here, effective cross-sectoral collaboration is essential to optimize the whole value chain, run processes optimally and close all circles.

Buildings as a resource bank

There is a recovery potential for a large number of resources from buildings. Selective demolition plays an important role in this recovery, and it establishes circular value chains as it allows for reuse and high-level recycling of building materials. Pre-demolition audits that identify problematic substances and map materials with potential for reuse and recycling are essential for the efficient harvest of resources and the effective removal and disposal of problematic substances.

Resources from selective demolition can enter the market again – closing value chains, preventing the loss of resources, and thus replacing virgin materials.



Next generations' sheds from recirculated waste

Contributors

Case submitted by
Næste

Strategic partners
Enemærke & Petersen
G. Tscherning
Fremtidens Fundament
Fischer Lighting
Art-Tek Structural Engineers
Danish Technological Institute

Supported by
City of Copenhagen and Municipality
of Frederiksberg
Lejerbo
Realdania
Danish Design Centre

The demand for unheated storage and shelter space is increasing, and so is the need for every building owner to take immediate action on the climate agenda.

Næste offers a low-risk, high-quality, full-service, circular shed solution with a prefabricated building system of waste materials that offers the market's best performance in relation to life cycle assessment (LCA) and life cycle costing (LCC).

The system has the potential to keep up to 50,000 tonnes of wood waste at the highest value rather than incinerating it. This could save up to 40,000 tonnes of CO² equivalents yearly in Denmark – if all secondary buildings are built out of waste materials rather than the virgin steel solution common today.

With a strong sensual tactility and clear inspiration from the history of the local building culture, the design reminds its users to take care of our common resources and local habitats. The sheds are used as learning spaces at schools in Copenhagen, and as spaces for social activities in affordable-housing areas.

With an established value chain ecosystem of industrial partners from selective demolition, prefabrication and end product installation, Næste has already proved a successful and viable circular business case for all partners and customers.



The world's first circular social housing units

Contributors

Case submitted by
3XN

Group Leaders
Lejerbo (Client),
GXN Innovation,
Responsible Assets,
MT Højgaard,
Danish Building Research Institute (SBI)

Supported by
Realdania
Danish Environmental Protection Agency's Development and Demonstration Pool (MUDP)

The Circle House project is constructing the world's first social housing units built according to circular principles. This means, among other things, that the building has a higher degree of flexibility during its lifetime and that 90 % of its materials can be disassembled and reused at a high value.

The building is designed by a collaboration studio comprising 3XN, Lendager and Vandkunsten architects. The project consists of 60 social housing units in Lisbjerg north of the city of Aarhus and is expected to be completed by 2023.

In addition to serving as housing, Circle House is a scalable demonstration project that creates and spreads new knowledge about circular construction across the industry and across silos. Therefore, the project brings together over 60 different companies across the entire value chain.

In September 2018, the project inaugurated a demonstration unit that shows the building system in 1:1 as a proof of concept and an exhibition of circular building materials. The concrete demonstration structure will eventually be built into the final project and thus close the circle.



Repurposing abandoned resources

Contributors

Case submitted by
Lendager Architects

Lendager Group has tackled the challenges of urbanisation by using the materials of abandoned homes from rural areas for the construction of new homes in the city. This approach has resulted in newly built homes whose CO² footprint was reduced by up to 70 % in the construction phase, as the building materials had already had a life in another context.

Resource Rows is a housing project in Copenhagen with 92 flats arranged around a shared courtyard and roofscape, which include 29 greenhouses made from recycled wood and windows. In the project, 10 % of the materials are upcycled waste materials, while the overall CO² reduction is 29 % compared to benchmark.

The project demonstrates a radical recycling approach to materials that significantly cuts the construction carbon footprint. The walls are built using upcycled bricks, taken from a demolished Carlsberg brewery. As the brewery bricks were cement mortared and difficult to disassemble, Lendager developed a method whereby large squares would be cut from the old facades. Brick modules in different colours were then assembled in new designs, which gives the building a patchwork-like facade. All internal floors were made of waste wood from the flooring manufacturer Dinesen, which would otherwise have been burned. All external wood was sourced from wood waste from other construction projects. Each brick represents a CO² saving of 500g, and the wood a CO² saving of 77 %.



The spaces in between Aarhus City Council works with methodological and strategic approaches to using the spaces ‘in between’ in regard to both social inclusion and integrated climate change initiatives.

In Aarhus, Denmark’s second-largest city, integrated urban planning helps us mitigate climate change and create urban spaces that are socially inclusive and allow communities to thrive. Our city must be socioeconomically and environmentally sustainable.

By Stephen Willacy
Chief City Architect
City of Aarhus

Introduction

The City of Aarhus aims at supporting sustainable neighbourhoods, community building, citizenship, and the health and well-being of citizens. Urban development projects in Aarhus must harness the social and environmental capital of our city and region. We regard social capital as our combined 'people' resources – we must build in a manner that nurtures strong local communities characterised by trust and people working together to create a liveable city. Likewise, we must nurture our environmental capital – creating green and blue spaces where people thrive and ensuring that our city develops in an environmentally sustainable manner.

It is a privilege for anyone to build in the City of Aarhus, therefore the City Council insists upon continually raising the quality of building projects in Aarhus. If we are to nurture a city where life can unfold, we need more than buildings alone, we must also consider the quality of the urban environment. In Aarhus, urban development projects are started by first prioritising people and the life in the spaces between buildings. To this end, at the outset of projects, Aarhus City Council asks developers the simple question "What does your project give back to the city?" and at the same time the City encourages developers to "think life and activities, before designing urban spaces and before designing buildings". This is not a linear process, rather it moves back and forth, working towards creating places where people want to be and can thrive.

Communities and cohesion

A sense of community is an important identity-creating factor for people. Research shows us that people feel stronger when they are part of a community. People select communities to live in based on many parameters such as social relations, safety, social cohesion, and the frameworks that allow the communities to unfold. Neighbourhoods with attractive urban qualities, pleasant atmospheres, good social infrastructure, associations, clubs, societies, institutions, and shops help to strengthen cohesion of local communities.

While architecture and urban design cannot force people to interact, architects and city planners can use architectural 'nudging' to encourage social interaction by removing restrictions, and making well-designed and useful places that enable serendipitous encounters. Public spaces are neutral forums in which democracy unfolds daily, and in which all kinds of people can interact, or not. This is where people can be seen and observe others, reflect themselves in others, and where respect and tolerance for others can develop, thereby creating meaning for the individual or a group of people.

Urban climate integration

When more space is created for water in the city, we are presented with the opportunity to create more green breathing spaces, urban spaces and connections that invite people to linger and meet people.

For a number of years, urban planning in Aarhus has focussed on climate change, and the City can boast some innovative projects. For example, all local plans must incorporate sustainable urban drainage in their project area. Aarhus sees potential in keeping rainwater separate from wastewater and thereby preserving the rainwater as visible surface water rather than channelling the water into underground pipes and sewers. Being a coastal city, it is a high priority to prepare flood protection measures. In a number of locations around Aarhus, Aarhus City Council and Aarhus Water have, in collaboration with local communities, completed a number of innovative water management projects.



Climate adaption in historic Copenhagen park

Contributors

Case submitted by
THIRD NATURE

In collaboration with
COWI
Platant

Client
City of Copenhagen,
Greater Copenhagen Utility (HOFOR)
Areal Renewal Project

The historic Enghaveparken has been transformed and is now one of the largest climate project in Copenhagen. With a 22,600 m³ water reservoir the park answers the need to handle future water challenges. The challenges have been positively transformed into a large variety of new recreational, relaxation and sensory opportunities that are part of both the everyday experience of the park, and, in the event of cloudbursts, a rainwater management system.

Enghaveparken has been an important green space in the borough of Vesterbro since 1929. The park is designed as a strict neoclassical park with a reflecting pool, geometric axes, playground, and a stage. The structure has been preserved and reinforced with the restoration of the tree alleys running through the park. The various areas in the park have been formed true to the park's original character, while being supplemented with great new experiences. Some of the park's spaces have been lowered to collect water during cloudbursts, and a levee that outlines the park can hold the rainwater – both from everyday rain and extreme rain events. In dry periods, the different elements act as recreational spaces and be used for play and relaxation.



Creating an optimal study environment in between classrooms

Contributors

Case submitted by
Henning Larsen Architects

Architect of Record
KZF Design

MEP / Structural Engineer
BuroHappold

MEP Engineer of Record
PEDCO

Structural Engineer of Record
Woolpert

Civil Engineer
Woolpert

Construction Manager
Turner Construction

The University of Cincinnati, looking to reflect the social nature of learning (be it shared or individual), needed a business school that catered to students of all personality types.

Zones that would be separate in any other institution – interior and exterior, private and public, faculty and student – overlap and mix at Lindner. Comprising four transparent, prismatic volumes that join in a soaring atrium, the building daily sees hundreds of students pass through it. Light is a fixture, with skylights and courtyards bringing light deep into the building. In the most sweeping move, a grand staircase stretches up the full height of a vast atrium abutting the main entrance, linking the Dean's office on the top floor to unfurl into a tribune large enough to seat the entire student body.

The message is clear: the space belongs to everyone.

Lindner Business School's special attention to the learning that happens in the spaces between the classrooms transforms it from a school to a kind of second home, one shared by all.



New York resilience against extreme weather

Contributors

Case submitted by
Ramboll

Carried out in collaboration with
NYCDEP
City of Copenhagen

In collaboration with the New York City Department of Environmental Protection (NYCDEP), Ramboll carried out a 'Cloudburst Resiliency Planning Study' in New York. The study provides insight on ways for New York City to advance climate resiliency projects and traditional stormwater solutions to mitigate inland flooding and accommodate future increases in rainfall intensity through integration with ongoing urban planning development.

Based on this insight, Ramboll was then engaged to take the study a step further and develop a number of pilot projects in the South East Queens catchment area, the area of New York that has more flooding and sewer back-up complaints than any other part of the city. These pilots will be selected for detailed analysis, hydraulic modelling and conceptual designs. This approach makes it possible to flesh out exactly how blue-green infrastructure can function similarly to a traditional stormwater system by retaining and conveying water mainly on the surface.



Creating social inclusion through urban design

Contributors

Case submitted by
City of Aarhus

The development plan for the creative business district 'South Harbour District' demands a holistic approach to urban thinking. Physical planning must incorporate Aarhus City Council's strategic visions for the arts and cultural production, urban life, and business development, and must integrate solutions that add to district's social capital – that is we must ensure plans consider how local communities can be strengthened and given the opportunity to thrive.

We prioritise realising these visions together with the business community. A unique feature in developing this creative business district is the City Council's vision to make South Harbour an inclusive, socially sustainable community that involves the local socially disadvantaged citizens in the planning process. Similarly, an important driver for the development plan is the desire to create spaces for physical activities to support health and well-being.

Social capital can be enhanced between heterogeneous groups by increasing interactions between people from these groups in the public domain. This can be achieved through often subtle aspects of socially inclusive spaces that support universal use and create 'comfortable' spaces where citizens feel safe and secure, irrespective of their age, gender, ethnicity, and cognitive and physical ability. A significant element in achieving the City's ambitions lies in the design of the urban environment, including the hard and soft aspects of the landscape, lighting, street furniture and the ways in which green and blue elements are integrated.

Creating health & well-being

As we spend most of our lives indoors, it is essential to address the importance of indoor environment and its repercussions for human health.

Health is multifactorial and multifaceted and affects us in many aspects of our lives, and while physical health is a vital, mental health and well-being are just as important.

By Professor Torben Sigsgaard and Assistant Professor Grethe Elholm

Department of Public Health
Aarhus University

Associate Professor Steffen Petersen

Department of Engineering
Aarhus University

Introduction

People in the western world spend around 90 % of their lives indoor. Therefore, we need to develop creative solutions that foster a healthy indoor environment in buildings that support essential physical and mental human functions while contributing to economically and environmentally sustainable development.

It is not so much the time we spend indoors but more the quality of the indoor climate in our physical indoor spaces that can affect our health, learning, creativity and productivity. Providing buildings for healthy living is not easy, as we need to create space for different activities such as sleep, leisure, work/education and exercise. Each activity requires different solutions that can stimulate our senses in an appropriate manner and ensure we feel comfortable.

Healthy indoor climate

Fresh air, comfortable indoor temperature, stimulating (day)light conditions, no unwanted noise, and good acoustics are some of the aspects of indoor climate that are known to affect our health. However, maintaining a good indoor climate is a major driver for combustion-based energy consumption and its resulting air pollution. We need to design buildings that consume much less energy to pave the way for a CO₂ neutral society and cleaner outdoor air. The challenge is to minimise energy consumption while improving the quality of the indoor environment. This is not impossible, but it requires knowledge and determination. A special challenge is to ensure indoor air quality when transforming existing buildings and neighbourhoods into modern resource-efficient living and working spaces.

Healthy behaviour

Buildings and urban environments need to allow for and promote healthy behaviour by offering space for physical activities such as exercise and commuting by foot or bicycle. Open, safe places should be available for children of all ages to engage in sports and play. Staircases can invite people to use them by letting in light and providing great views and access to tempting communal areas.

Healthy technology

We know from studies of indoor environment in public as well as private housing that one of the drivers for well-being is the sense of ability to micro-control the indoor environment. Therefore, whenever it comes to new technologies for more resource-efficient living, we need engineers, architects, and residents to align expectations and develop the solutions in new innovative co-creations. Technical solutions must be robust and cater to human needs, behaviour and desires while nurturing good health and well-being.



Healing architecture: Klarahus

Contributors

Case submitted by
ERIK Architects

Client
City of Copenhagen,
Health & Care Administration

Architecture
ERIK arkitekter

Engineering
Strunge Jensen
AB Clausen

In the middle of the Nørrebro district of Copenhagen, you can find De Gamles By (City of the Elderly), formerly a closed neighbourhood of care homes and housing for the elderly. Now open to the public, you can visit the care centre Klarahus.

Today, cooking is recognised as an art, and the meal must be an unforgettable experience speaking to all our senses. So why is the production of food for our elderly citizens hidden in a clinically white room full of stainless steel and non-slip floors? The goal of this project was to show all citizens that care was taken to make high-quality meals for the elderly, and that happy employees make high-quality meals. The chefs were involved in the project from the beginning to ensure an attractive and supportive working environment. That resulted in a building of 250 m² (+ 250 m² conversion of existing building) connected to the main building by glass corridors and a core containing storage, fridge and freezer as well as dishes. An architectural requirement was that the building should be a green element in the garden space and appeal to all the residents with its appearance. The green facades appear naturally chilling and are the first facades in Denmark that are a part of a Local Rainwater Harvesting (LAR) project.

A small building with a strong impact - healing architecture that makes a difference.



Well-being by design

Contributors

Case submitted by
Kvadrat
Danfoss

Well-being is a cornerstone of the design philosophy at the Danfoss offices in Hamburg. Inside the building, Kvadrat Soft Cells acoustic panels, Kvadrat Shade roller blinds and Kvadrat textiles all contribute towards the creation of a healthy, productive environment.

Mindful that good acoustics can improve task motivation by over 60 % and concentration on demanding tasks by 50 % - all while reducing stress levels by 20 % - the architects utilised Soft Cells acoustic panels the offices. These make speech easier to understand, and they facilitate collaboration.

The Kvadrat Shade roller blinds at the premises feature metallised textiles that integrate a nano-layer of aluminium. By enabling us to control sunlight, they support thermal comfort. The roller blinds also deliver visual comfort by controlling glare and providing access to views and natural light.

Adding to the wellbeing-focused concept at the Danfoss offices, Kvadrat upholstery textiles in varied colours create aesthetic harmony with the Kvadrat textiles on the Soft Cells panels and the Kvadrat Shade roller blinds.



Enhancing student achievement through acoustic design

Contributors

Case submitted by
Rockfon

Owner
Lynn University; Boca Raton, Florida

Architect
Gensler; Tampa, Florida

General contractor
Gerrits Construction, Inc.; Boca Raton, Florida

Ceiling systems – installing contractor
Sesco Lighting Inc.; Maitland, Florida

Ceiling systems – manufacturer
Rockfon; Chicago

The LEED Silver-Certified Christine E. Lynn University Center creates a home-away-from-home in Florida for its students who gather from across the globe (LEED: Leadership in Energy and Environmental Design, is a national certification system developed by the U.S. Green Building Council (USGBC)). Within the 465,000 m2 campus, the 6,000 m2 student centre supports the university's goals for sustainability, accessibility, comfort and safety.

In educational settings and open spaces without acoustic wall panels, a high-performance, sound-absorbing ceiling system plays a critical role in student achievement. The design team selected stone wool ceiling panels with a high noise reduction coefficient to increase speech privacy and intelligibility, improve concentration and support a healthy, comfortable learning space.

The white ceiling panels also enhance brighter, energy-efficient interiors. Their surface reflects at least 85 % of all light, helping to carry Florida's abundant natural daylight more deeply into the centre and reducing the need for electric lighting. Stone wool also resists moisture and provides no sustenance for mould, mildew or potentially harmful bacteria and microorganisms, which can otherwise thrive in in Florida's humid climate.



Schooling in sustainable surroundings

Contributors

Case submitted by
AART Architects

Building owner
Municipality of Frederiksberg

Architect
AART
Nordic – Office of Architecture

Landscape
MASU Planning

Engineer
Orbicon

Main contractor
Elindco

Skolen på Duevej (the school on Duevej) supports children in their quest for learning while at the same time obtaining a high level of sustainability. The sustainable-building standard DGNB was used to quantify the design choices and the building was the first educational building in Denmark to obtain a gold DGNB rating. The plot is in the city centre and includes a new gymnastics hall as well as classrooms.

The building is designed with natural materials, as exemplified by the facade, which is clad with durable cedar wood. Cedar was chosen because it is a sustainable material, while also offering the economic qualities of durability and low maintenance. The roof is covered by sedum plants, which retain water and add greenery to the building.

As one of the first buildings in Denmark, the school building was awarded with the distinction for high architectural quality in the DGNB system: the DGNB Diamond. The school received praise for its architectural connection to the local area, its warm and inviting appearance, and the connection of the school yard to the public space in the street.

The foundation of our lives and building blocks of our future

Creating value for people and our planet

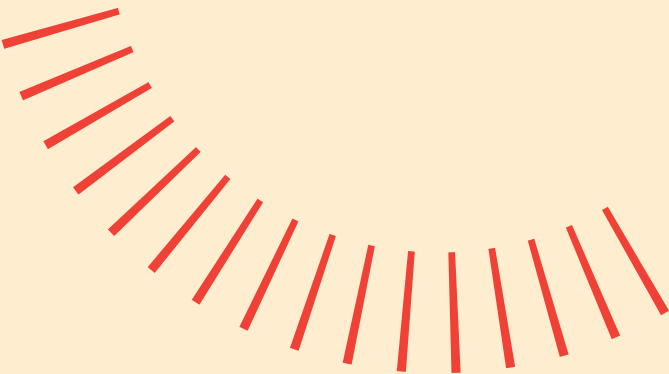
Today, our cities and their built environment are in turmoil, confronted with and defined by major changes. Globally, new technologies, commerce structures and trading patterns are changing the economic foundations of cities, their job markets, and their social and cultural life. These challenges are further compounded by the socio-economic differences between countryside and cities, and between the different districts within cities.

Simultaneously, other pressing issues for cities globally are the changes brought on by climate change – more extreme rainfall and rising sea levels. Here, the built environment is a central component in our efforts to limit and reduce CO2 emissions.

The current demographic development Denmark, although smaller in scale compared to some of the world's larger countries, will still lead to large cities becoming even larger, while many small towns are confronted with a diminishing and ageing population. As a nation surrounded by water, rising sea levels and more extreme rainfall have a strong effect on everyday life in Denmark, and therefore require our immediate action and novel solutions.

The built environment is the foundation of our cities and, therefore, the design and building choices we make when developing our built environment give us the opportunity to tackle the multiple challenges of climate change, sustainability and urbanisation, and can enable us to create value for people and our planet. However, instead of adding sustainability to the design and building process, sustainable principles need to be the foundation of every project in the built environment. While this is an ambitious goal that we have not yet achieved, many new initiatives such as the use of standardised certification and voluntary sustainability categorisations show that the industries involved in creating our the built environment are moving in an increasingly sustainable direction.

Through a holistically designed building process based on the principles of sustainability, and with the human perspective at heart, we can leverage the green transition and increase health and quality of life among inhabitants without compromising on aesthetics or functionality.



The world's creative toolbox

This white paper points towards a number of global challenges and identifies the potential they hold, demonstrated by the cases presented in each chapter. Chapters 4 and 5 show ways of reusing the existing building mass and ways of establishing circular practices to push the green transition forward. Chapters 3, 6 and 7 engage with the issue of the rising demand for quality of life that urbanisation brings. The chapters showcase examples of how buildings can enhance health and well-being, both inside buildings and through the spaces in between them.

Several of the cases originate in Denmark, where cross-sectoral partnerships and an innovative holistic approach form a key design parameter in the developing process. Each case keeps the human perspective at heart. We believe that this approach is key to building the cities of our future.

At Realdania, a philanthropic association with the goal of improving quality of life in the built environment, we believe that partnerships with the right stakeholders provide the best, most anchored, and most efficient solutions. For this reason, collaboration is a central part of Realdania's way of working with philanthropy.

Together, we need to enable all actors in the built environment to access the best knowledge and tools available, so that we may support and foster sustainable development of the built environment and create a more resilient global community.

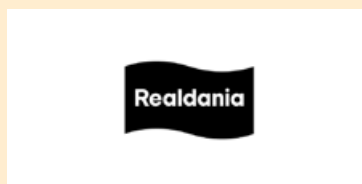
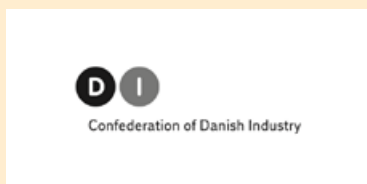
By Realdania



Creative Denmark is a not-for-profit, public-private partnership that creates awareness about Danish creative strongholds internationally. We foster relations between international stakeholders and Danish solutions, products, and competencies across the creative industries.

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