



Towards carbon neutrality

How Sweden's offering for sustainable cities can support China on its path to carbon neutrality



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Executive Summary

Although the world's cities are estimated to occupy merely 3% of the Earth's surface, they are responsible for 75% of the world's carbon emissions and up to 80% of the overall energy consumption. As a consequence, the climate is reacting to a rapidly increased urbanization with temperatures rising across the globe. It is estimated that around 60% of the world's population will be living in urban areas by 2030, with the figure expected to rise to around 68% worldwide and to 80% in China by 2050¹. There is therefore a need to shift to a more sustainable way of life to reduce emissions contributing to global warming, but also adapt to challenges that come from it, such as warmer temperatures, extreme weather events and sea-level rise.

China and other countries have set ambitious carbon neutrality goals, where China aims to become carbon neutral before 2060. As the first country in the world to pass an environmental protection act in 1967 and reaching its carbon emission peak in 1979, Sweden is an early pioneer in addressing emissions harmful to the environment. Today, Sweden is seen as a global leader in the area, ranked as one of the most sustainable countries globally in terms of CO₂E emissions and has shown that it is possible to combine the reduction of carbon emissions with economic growth. Since 1990 (until 2019) Sweden has reduced its CO₂ emissions by 29% while at the same time grown its economy with 87%. This has largely been achieved in consensus between the public sector and private industry.

Sweden is looking to further advance the sustainability agenda and to become the first fossil-free OECD country. Private companies have joined together in a unique venture as part of the program 'Fossil Free Sweden' with clear roadmaps across 22 industries to help remove obstacles on the journey towards carbon neutrality and to facilitate more rapid reductions in CO₂E emissions, including industries covering urban development. Also Swedish cities have initiated similar initiatives bringing together companies that cooperate across

sectors and competitions to create the best opportunity to reach the target goals. These types of collaborations and ways of working follow the Swedish model that has enabled Sweden to become a frontrunner within sustainability.

The most famous project that embodies the Swedish model is the development of Hammarby Sjöstad that today is known worldwide as a prominent example of sustainable urban development, with experts and delegations from across the world visiting. One of the more prominent visitors to Hammarby Sjöstad is President Xi Jinping, who in 2010 visited then as vice president of China.

There are amongst other six areas that have evolved as part of the Swedish model and that have enabled Sweden to get to where it is:

- A shared vision and holistic approach to urban development
- Collaborations to drive innovation and handle complex challenges
- Utilization of city symbioses and synergies
- Carbon lifecycle management and circular economy becoming part of urban design and development
- Use of pilots and transferring of learnings and experiences between projects
- Innovative solutions leveraged in urban development

However, the Swedish model and its key components are not only success stories in Sweden, but has also been proven to be able to be leveraged abroad. Two examples of developments in China applying the Swedish model are the Yantai Hammarby Eco City development and the Jinan North expansion.

Yantai Hammarby Eco City is a 4.6 km² urban redevelopment project that incorporates the proven Hammarby Sjöstad planning concept, integrating Swedish innovations, lifestyle and sustainability thinking. Scheduled to be delivered to residents in 2022, the project has already satisfied customer

¹ United Nations: World Urbanization Prospects (2018 revision)

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needs and reduced environmental impact, achieving a BREEAM rating of “Very Good” whilst also becoming one of the most desirable residential areas in Yantai by ranking on the top sales list since launch.

Jinan City is expanding the city northwards over the yellow river, choosing a masterplan following the Swedish model for urban development. The vision is to create a national level pilot project for the transition from the old to the new economy, including high ambitions to become a sustainable and smart city. The application of the Swedish collaborative model and approach has contributed to formulating suitable planning strategies and generating innovative ideas and concepts for the project.

Contributing to reaching climate goals can therefore not only be seen as something that is done for a good cause, but also as something that can benefit business by strengthening competitiveness. However, this requires both innovation as well as collaboration – something that the Swedish model focuses on.

The China-Sweden Hammarby Eco City Alliance, founded by White Peak, Envac, Sweco and Business Sweden, can help bring this Swedish model to China. The Alliance is committed to supporting Chinese developers and to develop urban areas in a sustainable manner for the future, leveraging both its members and their solutions, as well as its connections to a wider network of Swedish companies with innovative and effective solutions for a sustainable urban development.



中国-瑞典哈马碧生态城联盟
CHINA - SWEDEN
HAMMARBY ECO CITY ALLIANCE



Introduction

Much of our environment is at peril due to new and more complex challenges, as well as over-exploitation of resources. The world's cities are estimated to occupy merely 3% of the earth's surface, but are at the same time estimated to be responsible for 75% of the world's carbon emissions and up to 80% of the overall energy consumption. At the same time, it is estimated that around 60% of the world's population will be living in urban areas by 2030 and the figure is expected to rise to around 68% worldwide and to 80% in China by 2050¹.

The climate is reacting to a rapidly increased urbanization with temperatures rising across the globe. To avoid global warming exceeding 1.5 degrees Celsius, global carbon emissions must be reduced by 45% worldwide by 2030 compared to 2010 levels. Societies all over the world do not only need to shift to a more sustainable way of life to reduce emissions contributing to global warming, but also to adapt to challenges that come from it, such as warmer temperatures, extreme weather events and sea-level rise. New ways to produce, consume and conserve energy moving forward will therefore be needed, requiring collaborations on a new scale. But these new ways must be sustainable both for the preservation of the natural environment and for sustaining and developing our societies.

As a response to the ongoing climate crisis the United Nations has called for enhanced efforts and international collaborative actions referring to "The Decade of Actions", with its 17 sustainability goals. One of these goals addresses Sustainable Cities and Communities.

China has already in its 13th five-year plan put strong focus on tackling environmental issues, with carbon emission reduction targets set, spanning from 12% to 20% depending on province, where primarily high income and coastal provinces saw the highest emission reduction targets. China has now set important policy frameworks as part of its 14th five-year plan to drive its sustainability agenda towards carbon neutrality before 2060, with a carbon peak before 2030.

These policy frameworks include amongst other things improving the quality of green and low-carbon development of urban and rural areas, controlling energy consumption nationwide, improving reuse, recycling and use of renewable resources, the promotion of water recycling, and establishing of a water-saving society. However, to reach these goals, a new type of urban development with innovative, collaborative and locally adapted solutions and processes are required to enable a green, circular, and low-carbon development.

"The Paris Agreement on climate change charts the course for the world to transition to green and low-carbon development. It outlines the minimum steps to be taken to protect the Earth, our shared homeland, and all countries must take decisive steps to honor this Agreement. China will scale up its Intended Nationally Determined Contributions by adopting more vigorous policies and measures. We aim to have CO2 emissions peak before 2030 and achieve carbon neutrality before 2060."

- President Xi Jinping, September 2020

1. United Nations: World Urbanization Prospects (2018 revision)

Examples of China’s policies driving towards carbon neutrality		
14th Five-Year plan (2021-2025)	Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality (2021)	New Energy Law (currently in draft)
Strictly control the total energy consumption nationwide Improve energy efficiency Increase the share of non-fossil energy in primary energy consumption Energy self-efficiency at 80% Promote circular economy, improve recycling rate of renewable resources, promote water recycling and establish a water-saving society	Promoting low-carbon transformation in urban and rural development and management mode Vigorously promoting energy-conserving and low-carbon buildings Moving faster to improve the energy consumption structure of buildings	Emphasizes the development of new energy, marketization, further opening the energy sector, and international cooperation on environmental protection

Sweden was an early pioneer in addressing emissions harmful to the environment and contributing to climate change. Already in 1969, the Swedish government established incentives for green technologies as well as funding for research in the area. As one of the first countries, Sweden introduced in

1991 a special carbon tax on its industry to reduce the use of fossil fuels. Following this, a series of similar policies and government initiatives have been put in place that both look to limit emissions but also to promote the use of sustainable solutions.

Examples of Sweden’s policies driving towards carbon neutrality			
Environmental Protection Act (1969)	Carbon tax (1991)	Swedish Climate Act (2017)	National Circular Economy Strategy (2021)
Incentives for green technologies and funding for research	Introduced taxation for carbon emissions as one of the first countries in the world Highest carbon tax rate in the world (US \$126) per metric ton of CO2 in 1995, primarily levied on fossil fuels used for heating and motor fuels	Carbon-neutrality target 2045 enacted in law The framework consists of a climate act, climate targets and a climate policy council Fossil-Free Sweden: government initiative supporting businesses and industry sectors to drive the transition and become fossil-free by committing action plans Triple helix model: business + public + academia	Detailed action plan and concrete measures for circular transition

Being a pioneer in both introducing measures to reduce environmentally harmful emission and adapting the society to a more sustainable lifestyle, Sweden has experience in both developing environmentally friendly technologies and also in applying them in harmony with the societal development. The learnings and best practices that Sweden has accumulated and developed over the years can be leveraged in China to

help set the path towards climate neutrality before 2060, with innovative solutions in urban planning, building design, energy and waste management, mobility and many other areas related to sustainable development.

“The [Swedish] Government will seek dialogue and cooperation with China on policy development and research in areas including renewable energy, sustainable water and ocean governance, reduced greenhouse gas emissions and pollution, sustainable management of chemicals and waste, sustainable consumption and resource use, and biodiversity. Sweden has valuable experience and Swedish companies and agencies have key technologies and expertise.”

– Swedish Government Communication 2019/20:18

This paper aims to provide insight into the Swedish success story, and explain how the Swedish methodology and the Swedish offerings to sustainable city development can be brought to China to help China on its path to carbon neutrality.

The Swedish Success Story

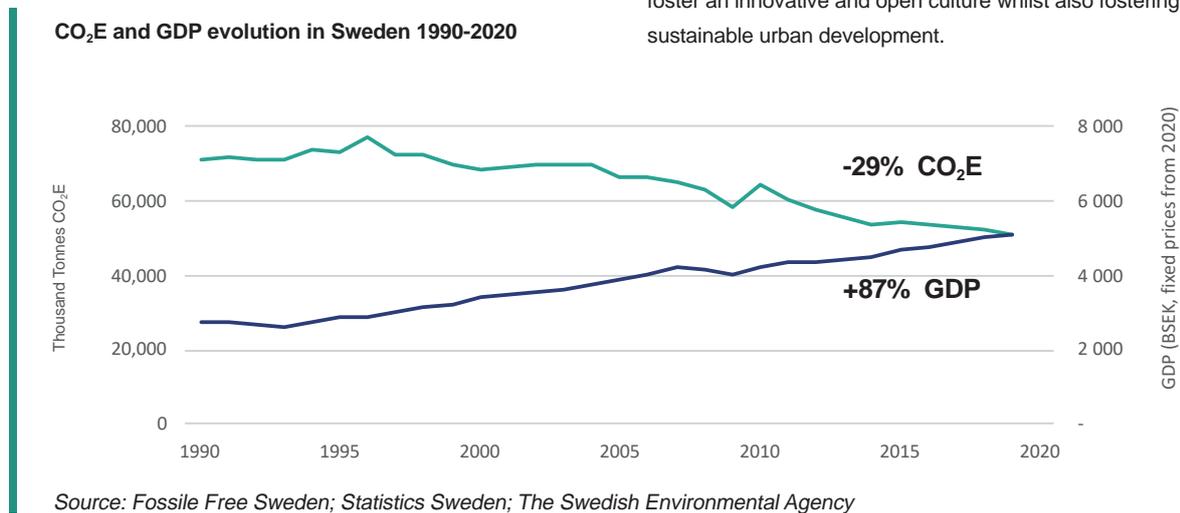
A Global Leader in Sustainable City Development

As the first country in the world to pass an environmental protection act in 1967, Sweden is today seen as a global leader in the area. In 2021, Sweden was ranked for the fourth year in a row as the country that has come the farthest in the shift towards sustainable transformation according to the Climate Change Performance Index¹. In addition to this, Sweden also topped the rankings when it came to efforts to reduce greenhouse gas emissions. Urban development projects focusing on sustainable living and housing, such as the Hammarby Sjöstad development in Stockholm, has positioned Sweden as a pioneer and a leader on the global stage with visitors from all over the world, including President Xi Jinping who visited Hammarby Sjöstad in 2010, then as vice president of China.

Sustainable development not an obstacle for economic growth

Sweden’s advancement within sustainable development has however not come at the expense of stifled innovation, nor economic growth. Both Stockholm and Gothenburg, Sweden’s two largest cities, were named Smart City of the World in 2019 and 2018 respectively and also hold titles regarding environment and sustainability. Stockholm is seen as one of the world’s cleanest capitals, having reduced the environmental impact and greenhouse gas emission per capita by 50% since 1990. Because of its achievements, Stockholm was named the first European Green Capital in 2010². Gothenburg was ranked as number one in the world sustainability ranking in 2018, based on the global destination sustainability index³.

Between the years 1990-2019, Sweden managed to increase its GDP by 87% whilst reducing its CO₂E by 29%, showing that carbon emissions can be decoupled from economic growth. Sweden has thus managed to simultaneously foster an innovative and open culture whilst also fostering sustainable urban development.



1 <https://ccpi.org/country/swe/>

2 <https://ec.europa.eu/environment/europeangreencapital/winning-cities/2010-stockholm/>

3 <https://www.gds.earth/2019-results/>

Solutions Reducing Carbon Emissions

District heating enabling energy efficient cities

Today, district heating is a common heating solution in most Swedish cities and regions after being introduced back in the 1950s. Instead of heating each building individually with electricity or oil, district heating uses heat from waste incineration, renewable power generation and excess heat from industrial production or data centers to heat buildings and public areas. This is a very energy efficient and environment friendly way to heat a city, creating local jobs and reducing the city's dependence on imports of fuels.

Today, district heating in Sweden is almost exclusively powered by locally produced waste, with around 93% of all energy in the system being either recycled or stemming from renewable resources.

The Swedish energy model is to a large extent based on locally available and produced waste streams. This is especially relevant today when energy prices are skyrocketing and countries (like China) are dependent on imported fuel.

Example

Gothenburg's district heating network is almost 1,230 kilometers long and provides around 17,000 buildings with heating, connecting roughly 90% of the city's apartments and buildings. Today, only 11% of Gothenburg's district heating comprises heat from the incineration of fossil fuel, 19% come from renewable energy and 70% from other sources of energy. Gothenburg city has the ambition of becoming fully fossil-free by 2025, leveraging innovation and accumulation tanks to bridge the final percentages.

Source: Smart City Sweden

Efficient waste management for improved sustainability and living

With the escalating quantities and types of waste generated, an efficient urban waste management system is necessary to reduce the impact on both the city and the global climate. With about 99% of all household waste being reused, recycled, or turned into energy and less than 1% going to landfill, Sweden has come a long way in converting waste to resourceful use. Today, Swedes bring most of their household waste and packaging to recycling stations, often integrated as part of the urban design at building, community and / or district level.

Because of a high level of environmental awareness, well-established deposit systems for beverage bottles and cans in society, as well as easily accessible recycling stations, the recycling and waste management levels have increased, and around 70% of all packaging coming out on the Swedish market was recycled in 2018. This has not only helped reduce overall CO₂e emissions but also reduced the need for new material. The remaining 30% has helped drive energy savings through the conversion of waste to energy and its distribution through district energy systems as well as converting organic waste into biogas which is used as fuel for public transportation.

Example

In Linköping City, all local buses use locally produced biogas. There is a national environmental goal to recycle the food waste from Swedish households biologically and Linköping city facilitates biological food waste recycling for its citizens through innovative processes using a green bag technology. This helps to convert food waste into biogas where the only requirement on citizens is to put food waste into the green bag and throw it as normal into trash bins. Collection trucks collect the green bags together with the normal household waste. The green bags are then automatically separated from the other waste types using a technology called Optibag. Thereafter, Svensk Biogas converts the food waste into biogas and biofertilizer.

Source: Linköping City

Ambition To Be The First Fossil-Free OECD Country

Looking ahead, Sweden has the ambition of becoming the first fossil free OECD country, and of becoming carbon neutral by 2045. Although Sweden is a sparsely populated country, it sees its role in the green transition as an inspirational example to showcase the possibilities, methods and concrete solutions in the green transition that other countries could apply. Sweden aims to become a pioneer by charting out the path ahead and inviting other countries to co-create and join. Some of the areas that Sweden sees moving forward when it comes to investments and sustainability are:

- Green steel: To be the first in the world to create steel based on non-fossil resources
- Batteries: Creation of a whole new value chain for sustainable batteries

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- **Electrical Vehicles:** Transition to green infrastructure and transportation solutions
- **Renewable energy and smart grids:** The backbone of electrifying the future, and Sweden being a country of renewables
- **Increased circularity:** Accelerate circularity from a societal as well as material base, with initiatives focusing on increased circularity for batteries, plastics and textile ongoing
- **Eco Governance in urban development:** To get multiple stakeholders to unite around the goal of carbon neutrality and to roll out a collaboration process characterized by innovation and achieving synergetic solutions

Fossil Free Sweden paving the way towards carbon neutrality

To help reach the set carbon reduction goals, private companies have as part of the program 'Fossil Free Sweden' established clear roadmaps across industries to help remove obstacles on the journey towards carbon neutrality and to facilitate more rapid reductions in CO₂E emissions. This is a unique venture to gather industries, associations, companies and government to work in the same direction to reach the set goals. The initiative comes from a change of mindset within industries, where climate requirements are not seen as obstacles or issues, but rather seen as advantages – a way to increase competitiveness on the market.

22 roadmaps have been defined by Swedish industries to date, aimed at pushing boundaries and driving continuous innovation and development, leveraging Sweden's strong

innovation and collaborative culture to help reach the goals. The roadmaps are further strengthened with the help of four strategies, designed to solve how the challenges of realizing all the roadmaps simultaneously can be managed and how the transition can be enabled.

Roadmaps towards carbon neutral urban development

The real estate industry is seen as key in the transition towards becoming fossil free in Sweden. To help Sweden achieve its climate goals, the Sweden Green Building Council has developed a certification for climate neutral buildings that imposes stringent demands. Having both direct and indirect impact through supply chains and development strategies, urban development can help drive change across industries, driving innovation and new solutions. Primarily four areas are impacted when it comes to sustainable urban development:

- The construction and civil engineering sector, aiming to halve emissions by 2030
- The steel industry, becoming fossil free by 2045
- The cement industry, launching climate neutral cement by 2030
- The concrete industry, climate neutral concrete on the market by 2030



Source: Fossil Free Sweden

Each of these industries have developed their own roadmaps on how the carbon neutrality goals will be met, focusing on innovation, collaborations, and policy changes. Highlighted across several of these is the need to employ a systemic approach and life-cycle perspective in terms of planning, design, construction and utilization of the built environment. Therefore, Sweden sees the need for continued collaboration across the value chain, building on the history of innovation and technological advancements.

Example

Within the steel industry, SSAB, LKAB and Vattenfall are making a unique joint effort to change the Swedish iron and steel industry fundamentally. Under the name HYBRIT, the parties are working together to develop the first fossil-free steel, produced by 100% fossil-free hydrogen instead of coal and coke. The first fossil-free steel in the world was produced in a pilot plant and delivered to a customer, Swedish company Volvo Group, in August 2021. The ambition is to hit the market with the world's first fossil-free steel and demonstrate the technology on an industrial scale in 2026.

Source: Smart City Sweden, HYBRIT

In addition to industry roadmaps, some Swedish cities have also developed roadmaps towards carbon neutrality. One such example is Malmö, Sweden's third largest city, where a local roadmap for a climate-neutral building and construction sector has been developed (LFM30) with the goal of net zero CO₂ emissions by 2030 and the goal of a climate-positive building and construction sector by 2035. Similar to the industry roadmaps, this initiative is driven by companies and spans across sectors and competitors to create the best impact.

Innovations within sustainable transportation

Efforts are also made in Sweden to reduce the greenhouse gas emissions stemming from the domestic transportation that

today accounts for roughly a third of all emissions in Sweden, of which road transport contributes roughly with 90%. Sweden has the ambition to reduce emissions by 70% by 2030 compared with 2010 year's level and has managed to reduce them by 20% already by 2019. Three key levers are in focus moving forward to further drive this development: sustainable biofuels, sustainable electrification, and a transport-efficient society.

As part of these efforts the Swedish Transport Administration (Trafikverket) has been commissioned to develop a plan for how 2,000 kilometers of Sweden's busiest roads can be electrified by 2030. The ambition is to help reduce the carbon emissions in transportation and support the overall transition towards electrification of vehicles on an infrastructure level in Sweden.

Example

An electric rail in the roadway has charged freight vehicles since 2017 on a road near Stockholm Arlanda Airport, and already in 2016 the world's first electric road section on a public road was installed on the motorway between the Swedish cities of Gävle and Sandviken as a pilot that was run until 2020 with great success, and visitors from 31 countries. Sweden's first permanent full scale electric highway is now under development with ambition to be opened for traffic in 2025, located in a logistically important area to increase the climate effectiveness of transporting goods in the area.

Source: Sweden.se, Trafikverket.se, Region Gävleborg

In addition to making private transportation more sustainable by driving innovation, the initiative also puts emphasis on making the society more transport efficient as a whole. Towns and cities have much to gain by reducing traffic through improved public transport, increased cycling and walking, as well as smarter urban planning – applying the Swedish model for urban development.

The Swedish Model

Hammarby Sjöstad, a run-down industrial area in the 1990s located adjacent to Stockholm inner city, has from the end of the 1990's successfully been transformed into an extension of the city center with a strong sustainability focus, leveraging an eco-governance and Symbio-city approach.

Hammarby Sjöstad is today known worldwide as a prominent example of sustainable urban development, where The

Economist has called it "one of the world's highest profile examples of Sustainable City Development". As an embodiment of the Swedish model, Hammarby Sjöstad shows that an urban district can be built with a far lower environmental impact than traditional projects.

Example

The Hammarby Sjöstad district has become a global standard for sustainable and livable city planning due to its blend of efficient and sustainable infrastructure, good urban design and an integrated planning and development process. This district in Stockholm has resulted in 30-40% lower carbon emissions than corresponding levels for housing areas from the 1990s, 40-45% lower water use than reference areas, and 30-40% less extraction of non-renewable energy sources. The area has 14% lower car use than in comparable districts in Stockholm and half of the energy needed for the district will be produced locally when the lakeside town is complete. Hammarby Sjöstad has been used as a role model for developments globally as an embodiment of the Swedish model for sustainable development.

Based on the Hammarby Sjöstad and other similar developments, the following characteristics constitute the foundation for the Swedish model:

- A shared vision and holistic approach to urban development
- Collaborations to drive innovation and handle complex challenges
- Utilization of city symbioses and synergies
- Carbon lifecycle management and circular economy becoming part of urban design and development
- Use of pilots and transferring of learnings and experiences between projects
- Innovative solutions leveraged in urban development



A Shared Vision and Holistic Approach to Urban Development

In order to be successful, sustainable urban developments require a holistic and shared vision to act as a common guidance for decisionmakers, industry and communities, motivating all stakeholders to cooperate in order to meet challenges they often face. Instead of reacting to problems as they emerge, a proactive approach builds on parties' common needs and desires through a shared vision that helps save money and avoid disasters.

The shared vision is formulated at the very beginning in sustainable development projects in Sweden, encompassing as many stakeholders' perspectives as possible. Objectives and strategies are developed in the sustainable/environmental programs to assemble an effective collaboration to fulfill the vision. New ways of organizing and new business models are often required to be able to realize the cross-sectional synergies - enabling a broader approach than normally achieved in organizational silo structures.

Example

In the Stockholm Royal Seaport development, one of the visions was to become a fossil fuel free city district by 2030 and in Hammarby Sjöstad the overall environmental goal was to reduce the environmental impact by half until 2020. Both visions were designed and manifested in sustainable/environmental programs in a joint process that included city offices of urban planning, land development, environment & health, transport, municipal companies of water, energy and waste as well as actors from the private industry.

An integrated approach towards sustainable city development is key, aiming at getting vital stakeholders to see the situation from a wider perspective than just from their own roles and functions enabling new forms of synergies and cross-sectoral innovations to emerge. This type of holistic thinking with the emphasis on collaboration is embedded in the Swedish system from a broad institutional perspective, including legislation, policy, and organizational structures, and individual management processes.

A more integrated approach has therefore been developed and applied in Sweden to improve cross-sector coordination on sustainable issues in the daily practices of various sectors, for example by increasing authorities' and agencies' mutual accessibility by sharing knowledge, sector information and data. As a result, many comprehensive plans and strategies in Sweden today have the long-term and holistic perspectives required for sustainable development, as well as the cross-sectoral coordination often realized via activities or projects managed by joint task teams. This type of existing, or new, project-based cross-sectoral organizations have been proven to be effective in several sustainable urban development projects, such as the developments of Hammarby Sjöstad and Stockholm Royal Seaport.

Model of project based cross-sectoral organization



Collaborations to Drive Innovation and Handle Complex Challenges

Integrated system solutions, together with a holistic understanding of municipal infrastructure and environments, are essential to address the environmental, social and economic challenges of modern society.

Many urban development projects are today conducted in a triple-helix model, involving collaborations between academia, industry as well as the government. During the development process of Hammarby Sjöstad, the Swedish government, the private sector, and academia all interacted and took part, resulting in the development of the now famous Hammarby Ecocycle Model that focuses on the ecocycle of water, energy and waste.

Building on this model, collaborations in Sweden have also been extended to include individuals and citizens, forming a quadruple-helix model that helps encourage proactive engagement and contribution from individuals leading to new types of innovation. By empowering and engaging the local community, well-adapted and long-lasting urban solutions that work for everyone can be developed and easily introduced.

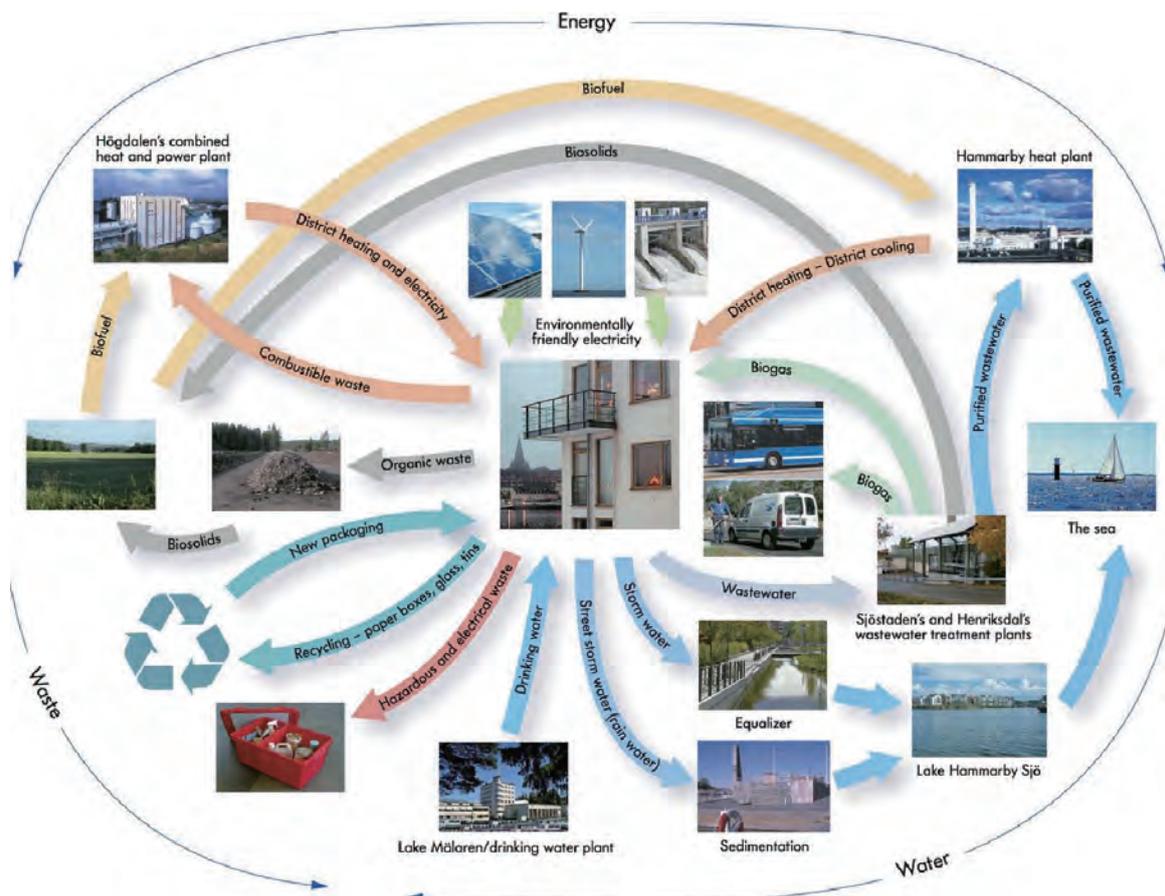
Example

Within the Hammarby Sjöstad community, local residents have initiated an effort called Hammarby Sjöstad 2.0 with support from the local government aiming to continuously improve the sustainability of the built environment in Hammarby Sjöstad, leveraging the quadruple-helix model.

A platform called ElectricITY has been developed within the Hammarby Sjöstad 2.0 effort to enable cooperation between universities, research institutes, businesses and residents in Hammarby Sjöstad in order to continuously upgrade the area with new technology and methods improving all areas of sustainability.

Source: Hammarby Sjöstad 2.0

The Hammarby model applied already from start of the project securing the sustainable circularity of excess energy, waste and water



Utilisation of City Symbioses and Synergies

In order to enhance symbioses and synergies in urban development projects in both Sweden and globally a Symbio city methodology that applies a holistic concept for dealing with complex challenges through a cross-sectoral and multi-dimensional approach has been developed. The approach involves the integrated consideration of spatial, social, cultural, economical, and environmental planning, as well as considering technical dimensions and factors. By doing so, multifunctional spaces can be designed to benefit and increase the vitality of cities, whilst at the same time contribute to biodiversity. This also promotes the development of economic, ecological as well as social benefits.

Example

Hammarby Central Landscape Park was designed by a multi-disciplinary team from Sweco to help create a multifunctional space for its community with a variety of ecosystem services. This has created a public space for residents, an important ecological corridor for wildlife and vegetation, whilst also having the function of stormwater management by channeling water into the Baltic sea after multiple purification steps, including greenery along the road with a special bedding soil, a stormwater purification pond, and purification by green space.

Source: Sweco

However, there is no one single solution that can be applied everywhere, meaning that local interpretation and adaptation is vital and necessary to be able to transfer new technologies or concepts between cities and countries. This requires not only know-how from professional experts, but also knowledge from the local actors involved. As such, an integrated and collaborative approach between stakeholders is needed to enable the generation of innovative and relevant sustainable solutions, adapted to the local contexts – something that the Symbio city approach uses.

Carbon Lifecycle Management and Circular Economy as Part of Urban Design and Development

Nowadays, the way that lifecycle carbon reduction is approached globally is changing. In Europe, decades of focus and regulations focusing on the operational carbon emissions have resulted in significant emission reductions in these areas. However, embodied carbon, i.e. the greenhouse gases emitted during the manufacturing and transportation of products, materials, and systems, has commonly been ignored when designing for low carbon development. In Europe, 60-70% of all lifecycle emissions for a typical newly built development are now embodied rather than operational.

Whole Life Carbon Assessments can help map the carbon footprint of a development from start to finish by looking at every stage of a development's life cycle, analyzing embodied carbon as well as operational carbon as these are intrinsically linked and need to be considered jointly to arrive at the optimal carbon position. There is therefore a need to include this in the design and development process to enhance the potential impact, applying knowledge and experience of carbon coefficients¹, tools, and processes, combined with pragmatic engineering expertise across all relevant disciplines.

As the potential for carbon reduction diminishes over the course of development and the most influential design decisions (such as material requirements) are made in the early stages of the development process, carbon and cost reduction potential of up to 50% can be achieved by incorporating sustainable solutions in the design stage. The urban development carbon footprint therefore needs to be analyzed at the earliest stages and looked at from the lens of the full value chain taking into account more than just the options for carbon reductions in themselves. Synergies and correlations between carbon reduction, project cost and other sustainable aspects need to be well considered in order to figure out a more efficient and strategic route towards zero carbon development.

Another way to achieve the zero-carbon goal is through developing a circular economy with its focus on recycling and reuse. Instead of the traditional 'take make waste' model of development, the Swedish society makes efforts on ensuring that resources and materials remain in a functional cycle for as long as possible. Once the full potential of circular economy

¹ Carbon coefficients is an emission factor which allows to convert activity data into GHG emissions. It is the average emission rate of a given source, relative to units of activity or process/processes.

is utilized, there will be a large reduction of carbon emissions, but it needs engagement from the whole society.

Use of Pilots and Transferring of Learnings and Experiences Between Projects

Taking experiences and learnings from previous projects has proven to be a successful strategy in Swedish urban development strategies. Hammarby Sjöstad was an early pioneering test bed that has been used as basis for several other modern developments in Sweden, providing insights to further develop the concepts and techniques.

The most important learning from Hammarby Sjöstad was that the strong focus on the environment didn't result in higher costs for buildings, nor in a less attractive neighbourhood. On the contrary. Hammarby Sjöstad is today one of the most popular residential districts in Stockholm.

Stakeholders involved in Stockholm Royal Seaport took experiences and learnings gained from Hammarby Sjöstad and adapted and applied them in this new project. As a whole, good sustainable practices have been gradually developed, refined and applied in new demonstration areas.

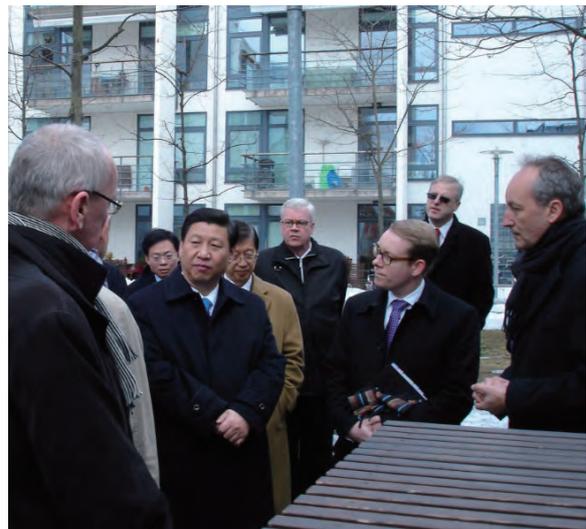
Example

The success and lessons learned from Hammarby Sjöstad have managed to accelerate definitions of higher environmental requirements as new basic standards within development of new urban areas in Stockholm, reducing demands on energy consumption by 45% (from 200 to 110 kWh/m²/year) in the Stockholm Environmental Program 2008-2011. Additionally, it has also inspired and led to new sustainable demonstration projects, such as Stockholm Royal Seaport. This further drives high climate ambitions of Stockholm City: since 2012, energy requirement for 55 kWh per m² A_{temp} is demanded for new buildings on city-owned land, with an aim to reach to 45 kWh/m²¹. This energy demand is about 30% lower than the Swedish National Board of Housing, Building and Planning's building regulations (BBR).

1 The requirement is defined in the City's budget for 2013

2 UNESCO Institute for Statistics, 2021

Beyond its influence on Stockholm's sustainable urban planning, Hammarby Sjöstad still serves as a model project to national as well as international visitors. City planners, builders, mayors, and ministers come to Hammarby Sjöstad to be inspired. The project's sustainable development approaches and the environmental integrations have not only inspired many urban developments around the world, but also helped Swedish companies market their products to these developments. Therefore, pilot projects play a great role in promoting innovation as well as achieving the goal of sustainability and carbon neutrality.



Innovative Solutions Leveraged in Urban Development

Despite the Swedish population only representing 0.13% of the global, Sweden has managed a disproportionate amount of influence on global innovation.

Sweden generally invests more than 3% of its GDP in R&D, which made it the country with the third highest R&D expenditure as a share of GDP in 2018, only superseded by South Korea and Israel¹. Sweden ranks highly on international innovation indexes, ranked 1st in the European Innovation Scoreboard in 2021, an index published by the European Commission, and 2nd among the 131 economies featured in the Global Innovation Index in 2020. Green technology and life sciences are two fields in which Swedish researchers and companies excel, being a focus area of innovation for both research institutes as well as the private sector.

Example

A strategic innovation program called *Viable Cities* has been initiated by Vinnova, the Swedish Energy Agency and Formas and coordinated by The Royal Institute of Technology, as the largest investment to date in Sweden in research and innovation on climate-neutral and sustainable cities. Its mission is to accelerate the climate transition in Swedish cities by 2030, leveraging digitalization and citizen engagement as enablers together with municipalities, authorities, industry, civil society and one hundred organizations.

Nine initial Swedish municipalities and their partners are part of an EU program called the *climate neutral cities initiative 2030*. The program aims at testing new ways of working and new solutions, learning from each other and working for the mission to create cities that work well for the people who live there, that are good for the economy of citizens, businesses and society as well as for the climate.

Source: *Viable Cities*

Sustainable construction

When it comes to green buildings and infrastructure, Swedish companies are known for applying innovative methods and techniques in the construction process. Sweden has especially managed to take a leading role when it comes to wooden building technologies and low energy-housing, having built the country's first passive house already in 2001.

One example is the long tradition of using wood when constructing one- and two-story buildings. Using wood in the construction process not only leads to less energy needed than with other materials, but also has substantially lower embedded carbon due to the CO₂ storing capabilities of wood. Consequently, Sweden has in recent years increased its use of wood in various types of constructions built around wooden structural frames. Cities have also increasingly adopted this mindset, with Växjö city developing a general strategy known as "The Modern Wooden City". Växjö's ambition is to reduce the city's carbon footprint by using wood as the main construction material, aiming for at least 50% wood-based new buildings from 2020.

Furthermore, IVL (the Swedish Environmental Research Institute) has together with project partners established the Center for Circular Construction (CCBuild). The goal of the center is to contribute to more circular construction through knowledge dissemination, collaborations and development of digital tools that support the reuse of construction material.

Sara Cultural Centre in Skellefteå

Opened in the fall of 2021, the center will be entirely made out of wood and stand 80 meters high, making it one of the tallest timber buildings in the world, using locally sourced timber to create a smaller carbon footprint. Swedish companies ABB and Skellefteå Kraft are working to ensure low energy consumption and efficient energy use in the center by integrating and optimizing the energy use with the central energy supply, by means of solar panels, batteries and heat pumps.

Source: Smart City Sweden

Vallastaden in Linköping

Vallastaden in Linköping has been designed and built as a neighborhood for the future with alternative energy systems, smart buildings and using wood as building material to create a pilot four-story building. In order to facilitate changes over time an underground culvert system has been installed in the area, providing good service access to all utility basic infrastructure such as electricity and internet cables, the vacuum waste system, sewage and water pipes etc.

Source: Vallastaden, Tekniska Verken

Hoppet in Gothenburg

As part of the climate strategy program in the City of Gothenburg, Hoppet is Sweden's first project with the purpose of creating better conditions for fossil-free construction. The first milestone of the project is to build a preschool that is constructed to the largest extent possible with fossil-free material and processes, ranging from resource extraction to construction site and operations.

Source: Göteborg Stad

Sustainable transport

Globally, the transport sector is facing enormous challenges with the environmental impact and fuel prices that continue to steadily rise. Sweden has a long history of sustainable transportation. Already in the development of Hammarby Sjöstad in the late 1990s, a multitude of public transportation solutions were integrated. Together with having special green stretches for walking and separate bicycle lanes, these solutions created optimal conditions to reduce the dependence on private cars. Today, around 60% of the population in Sweden over 6 years old is fully or partly dependent on the public transportation for trips where they cannot walk or take bicycles.

The Swedish public transport is already on a good way to become fully fossil free with almost 80% of all buses using renewable fuel, around 90% of the train traffic is electricity driven and the Swedish tram and subway system is driven fully by renewable electricity.

Examples

Einride

Making Fast Company's annual list of the World's Most Innovative Companies for 2021 in the transportation category, Swedish company Einride was founded in 2016 with the vision that the age of autonomy and electrification provides the opportunity to create a better future. Einride is developing the first fully-electric, totally autonomous transport vehicle to operate on a public road in the world, without need for a human driver onboard.

Source: Einride

Scania

Sweden's first hydrogen-powered refuse collection truck that will pick up recycled materials from local businesses was introduced to the streets of Sweden's second largest city Gothenburg in August 2021. The vehicle is the result of development by a consortium consisting of Scania, truck bodybuilder JOAB, fuel cell developer Powercell Sweden and the waste and recycling company Renova, supported financially by a grant from the Swedish Energy Agency. The truck is completely silent and only emits clean water, helping create better city air and noise quality.

Source: Scania press release

Polestar

With the car model Polestar 2, CO₂E emissions can be reduced by between 14-28% over the car's lifecycle depending on electricity mix (~10-15 tons CO₂E), or up to 53% if utilizing wind power compared with a modern ICE (Internal Combustion Engine) vehicle, helping in the transition towards net-zero greenhouse gas emissions. Taking a holistic approach to sustainable production in China, Polestar recognizes social responsibility and includes the local community. Its production center is the first car factory in China to attain Gold status in LEED ratings, as it is 100% powered by renewable electricity.

Source: Polestar

Sustainable energy

Today, renewable energy technologies are used across all sectors in Sweden, from industries to real estate, resulting in both economic growth and reduction in greenhouse gases. By combining waste-to-energy production with district energy networks, additional benefits can be achieved.

District heating and cooling are good examples of how public and private actors can cooperate to realize cost effective and climate smart energy solutions for its citizens. One such example is the waste-to-energy project in Swedish city of Västerås, which has reduced the city's energy related CO₂ emissions by almost 60% since 2014, going from an average 600,000 tons per year to 250,000 tons.

Examples

Envac

Östermalmshallen, a traditional food market hall in central Stockholm, has installed a vacuum waste system by Envac to remove the huge amounts of food waste generated, eliminating all manual handling. Waste is thrown into conveniently located inlets and transported via pipelines by means of under pressure to a refrigerated storage. Once there, a thick sludge is formed which then gets collected by a suction truck and transported to a biogas production plant. The cost of the investment is rapidly paid back thanks to lower operation and maintenance costs, improved hygiene and better use of space in the kitchen facilities.

Source: Smart City Sweden, Envac

SaltX

SaltX EnerStore stores excess renewable power from wind and solar as thermal energy and releases it in the form of pressurized hot water, creating a flexible solution that can be integrated in cities' district heating systems. Most recently, SaltX won the global competition Helsinki Energy Challenge with the best solution for a fossil-free city and will in a next step begin to discuss the implementation phase(s) of the proposed solutions with Helsinki city.

Source: SaltX press-release, SaltX

Northvolt

At the end of 2021, full-scale production of the world's greenest battery cells will start in the north of Sweden. Using renewable energy, recycled components and sustainable processes, Northvolt will produce its lithium-ion batteries on a giga scale. Billions of SEK have been invested in the project and several thousand new jobs have been created in the process.

Source: Pioneer the Possible

The Swedish Model in a Chinese Context

The Swedish model and its integrated approach has been applied in various urban development projects with proactive collaboration between Swedish and Chinese partners.

Yantai Hammarby Eco City

White Peak, a Swedish fund manager and real estate developer and one of the founding members of the China-Sweden Hammarby Ecocity Alliance, signed a framework agreement with the Yantai government on the redevelopment of the Yantai Hammarby Eco City, a 4.6 km² urban redevelopment project that will incorporate the proven Hammarby Sjöstad planning concept and integrate Swedish innovations, lifestyle and sustainability thinking. The project is comprised of eight land parcels that will be developed in different phases. In December 2018, a land auction for the first two land parcels was won which will be developed into a 220,000 m² development project with a site area of 43.7 hectares with expected delivery in 2022-2023.

The basis of the Yantai Hammarby Eco City development leverages and localizes the Hammarby Sjöstad model in a Chinese context, resulting in a development with many

similarities to the original:

- Both locations are close to the inner city, with access to excellent public transportation, preventing urban sprawl and minimizing the need for use of private cars
- Both locations have been dilapidated industrial areas that required careful planning and urban renewal, where the Yantai location used to be an old city industry area, occupied by outdated factories and warehouses, that the city is looking to revive and rejuvenate to bring back to life
- Both developments apply the Hammarby model leveraging technologies, procedures and approaches throughout the project focusing on the eco-cycles of water, waste, and energy

To bring the Swedish model to life in China, the China-Sweden Hammarby Ecocity alliance and its members were engaged in the design, planning and management, including amongst others Sweco, Envac and Business Sweden. By doing so, the development was able to create a platform of Swedish advanced environmental technologies and methodologies, taking the Swedish model to China.



A vibrant district built on four unique systems and well-designed strategic layers

The Yantai Hammarby Eco City development is built on four interconnected systems that differentiate it from other developments, carefully building on the Swedish way of life whilst taking into account the local adaption of the Swedish lifestyle to a Chinese context.

The interconnected systems of Yantai Hammarby Eco City development



Green

Aimed to promote environmental protection concepts and to utilize renewable energy, recyclable resources, and green building materials to create sustainable

communities, and utilizing technical solutions to close the loop of the waste, energy, and water and sewage eco-cycles. Biodiversity is also carefully considered to preserve native plants and the natural landscape.



Community

The hallmark of the Hammarby Eco City in Yantai, seamlessly integrating versatile community engagement platforms and rich spaces for socializing. Outdoor reception areas,

outdoor playgrounds for kids and jogging tracks dot and crisscross the Eco City to provide residents with access to not only nature, fresh air and safe exercise for all ages, but also a common space for interaction.



Safety and Comfortability

Design to create a safe and comfortable living environment both physically and psychologically to make residents feel that their community is working with them and for them

to improve their quality of life with for example barrier-free designs and charging piles for electric vehicles to encourage mobility and eco-conscious choices.



Digital Technology

Employ advanced digital technology to ensure a SMART and intelligent community, leveraging China's technological advancements to build on the original Hammarby model with

China's rapidly changing technology landscape, including for example a 5-layer security system including fence, unit gate, public space, inside and outside the community, and household emergency call button. There is also an electric car charging station, an intelligent lighting system and a smart door lock system.

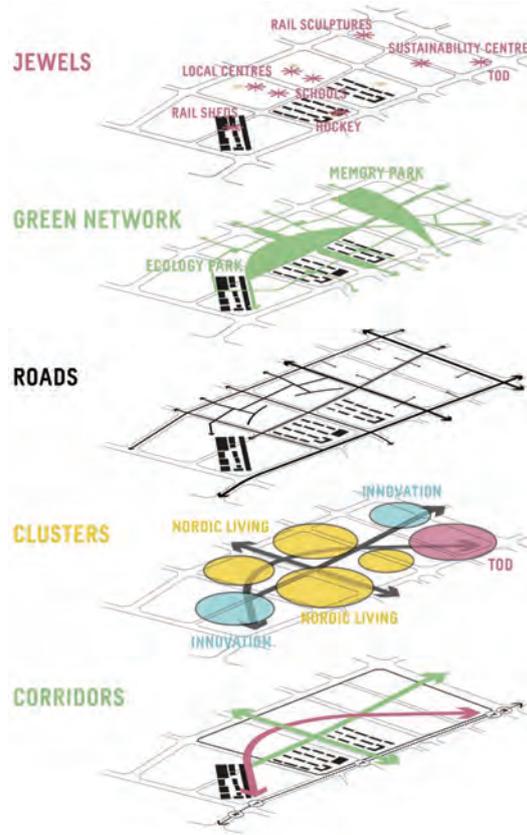
TOWARDS CARBON NEUTRALITY

In terms of planning and design, the Yantai development is organized by five strategic layers:

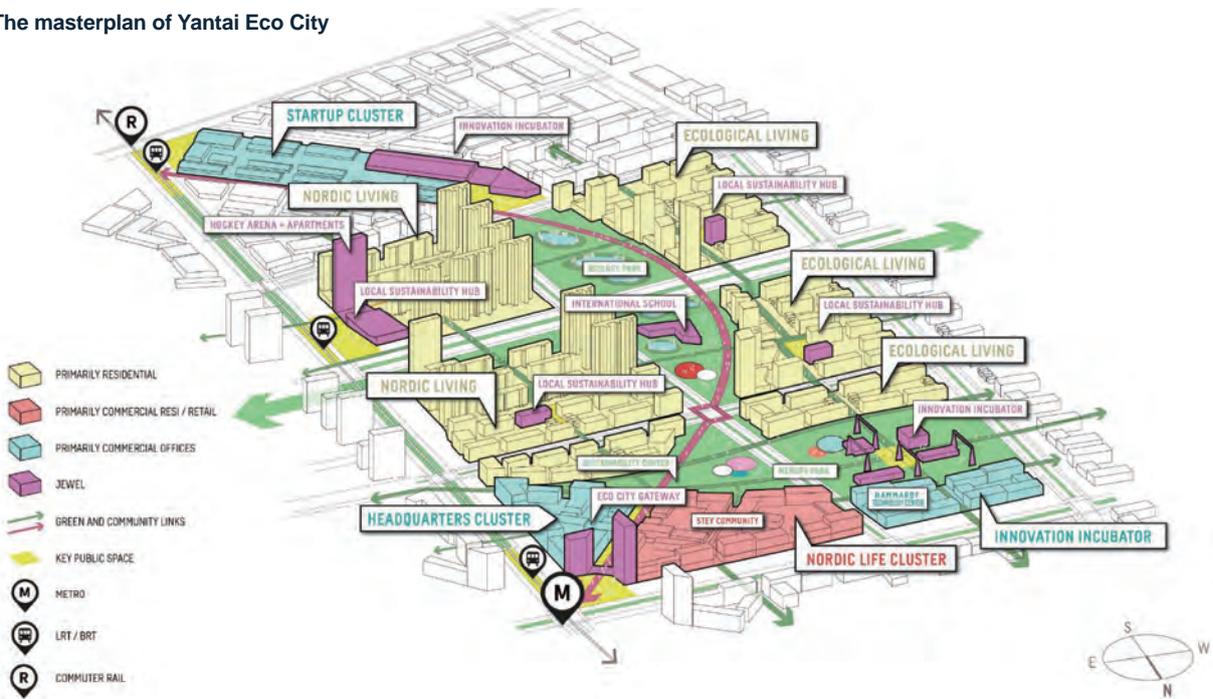
- Local Jewels are located as landmarks and focal points in key locations
- An integrated green network permeates the whole site, inclusive of major parks, heritage areas, small local spaces at community focal points and a high-quality walking & cycling network
- A road network to service the site and connect to surrounding urban flows
- Land use clusters respond to this structure, with the highest densities around the transit-oriented development (TOD) nodes
- The livability/ecocycle corridors form the backbone of the district, connecting to key transit nodes and following the site contours

Based on the four unique systems and the well-designed strategic layers, the Hammarby Eco City in Yantai is designed to contain a vibrant community with rich functions including, but not limited to, technology incubators, headquarters, Hammarby technology center, Stey Co-living, Nordic retail, an ice hockey arena, Nordic living, an international school, and various community services.

The 5 layers of Yantai Eco City



The masterplan of Yantai Eco City

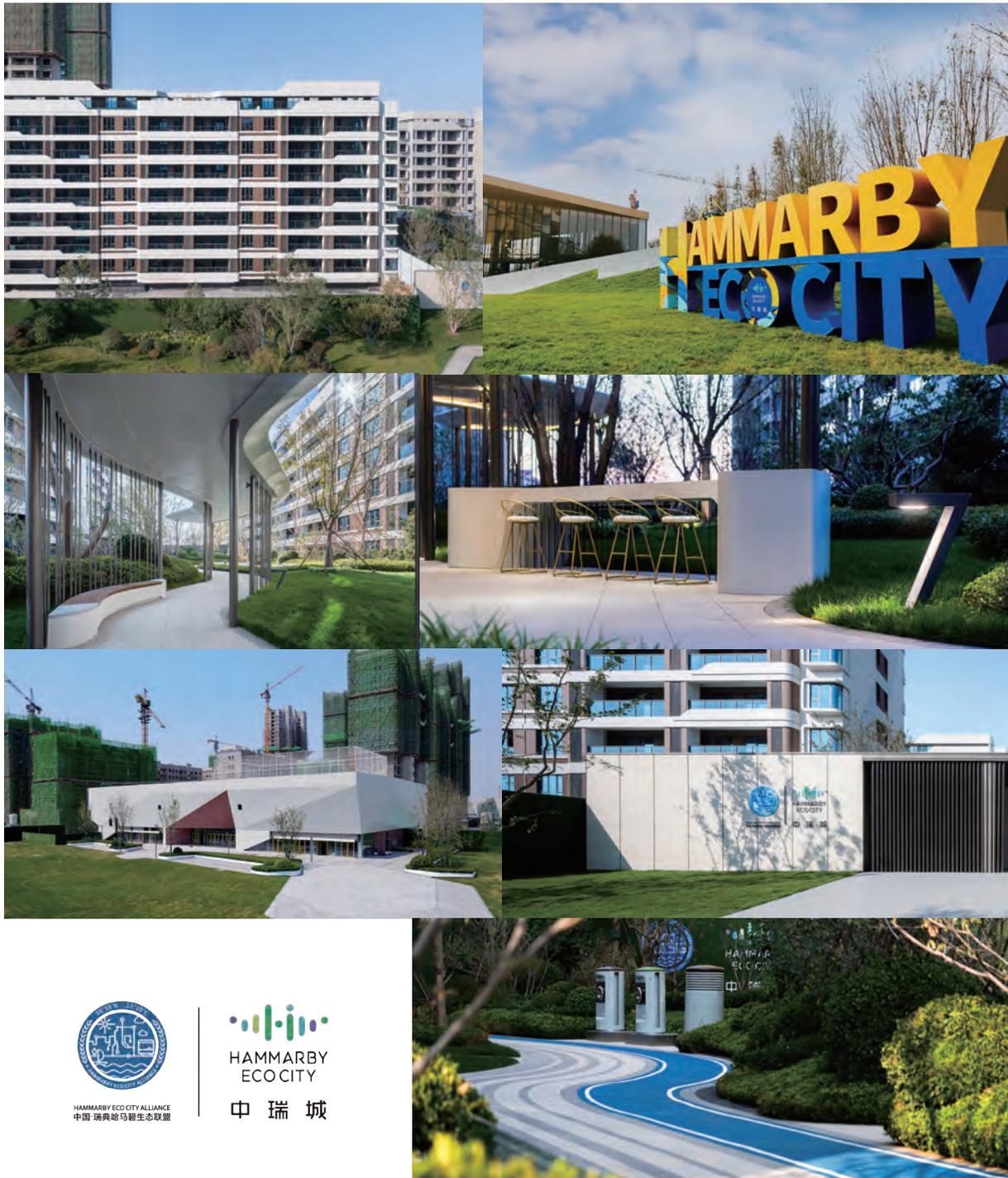


Note: the master plan was completed by Sweco

The first phase of the Yantai Hammarby Eco City

Given the large scale of Yantai Hammarby Eco City the project has been developed in phases, where the first phase of the 220,000 m² development project is proceeding smoothly according to the development schedule.

By the first half of 2021, 65% of the residential units on site A-2 in the Yantai Hammarby Eco City project were sold, proving to be one of the most desirable residential products in Yantai by ranking on the top sales list since launch. The high degree of customer appeal and recognition reflects the positive synergy between well-designed products. The ice hockey stadium in Site B is under construction and the sales of residential apartments was launched in September 2021.



HAMMARBY ECOCITY ALLIANCE
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Green Technologies applied in the first phase of Yantai Hammarby Eco City

Given the application of the Hammarby model in the Yantai Hammarby Eco City, the ecocycle of water, waste, and energy has been leveraged with solutions for each. In 2021, White Peak entered into preliminary agreements with ABB, IKEA, ASSA ABLOY and Envac related to the procurement of Swedish technology and products to be used in the Yantai Eco City project.

Waste

To efficiently manage waste in the Yantai Eco City, an underground waste collection system by Swedish smart waste management solution provider Envac was installed. Through a network of pipes, this system collects two waste types from both households and businesses:

- Mixed residual waste including food waste
- Mixed small and light recyclables (paper, carton, newspaper, metal and plastic)

To make the area friendly for walking and cycling and to improve the quality of the outdoor public space, the terminals that collect waste have also been placed underground.

Energy

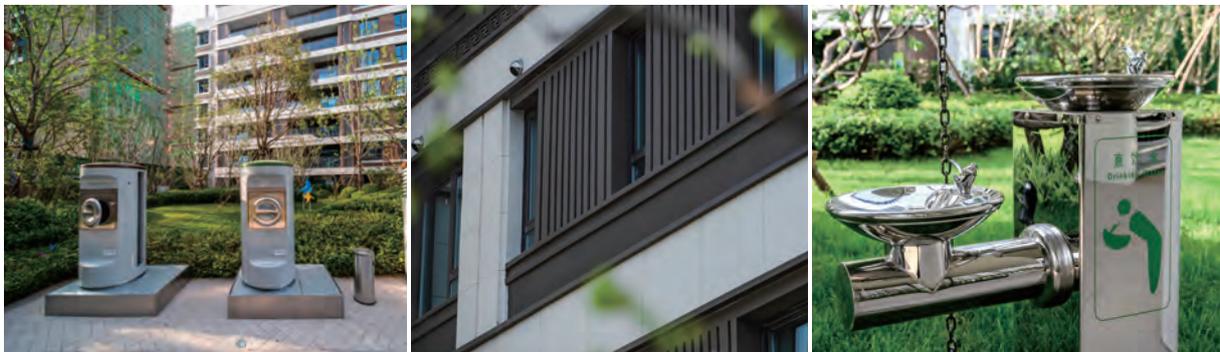
When it comes to energy, solar panels, air source heat pumps and energy-saving insulations all contribute to the efficient use of energy on the Yantai Eco City site. These solutions feature amongst other things an air-source heat pump system in the residential units that enables indoor temperatures to be set at the most comfortable temperature ranges for humans, 18-25°C in winter and 23-28°C in summer. Moreover, Hammarby Eco City apartments incorporate a facade and window thermal insulation system, effectively preventing heat conduction as well as a solar water heating system that is employed to guarantee environmentally friendly domestic hot water.

As for the energy-saving insulation, triple-glazed window construction and the insulation of the slab and floor constructions will improve the thermal bridges of the building which lead to lower heating and/or cooling demand.

Water

To manage greywater collection, treatment and reuse efficiently in the Yantai Eco City, a greywater recycling system will be positioned under the two locker rooms in the ice hockey arena. When the city greywater system becomes available, water from the sinks and showers will be piped to the treatment system, from where the treated water will be piped to the toilets with a system capacity sized according to the estimated demand from the toilets. In addition to this, the project also applies rainwater collection and recycling, as well as a green roof design to reduce and reuse water.

Advanced technologies have a long way to go to be fully applied in practice, but an effective mix of existing standard technology and future proofing gives the opportunity to promote and develop the Hammarby Eco City model and attract Swedish technology suppliers.



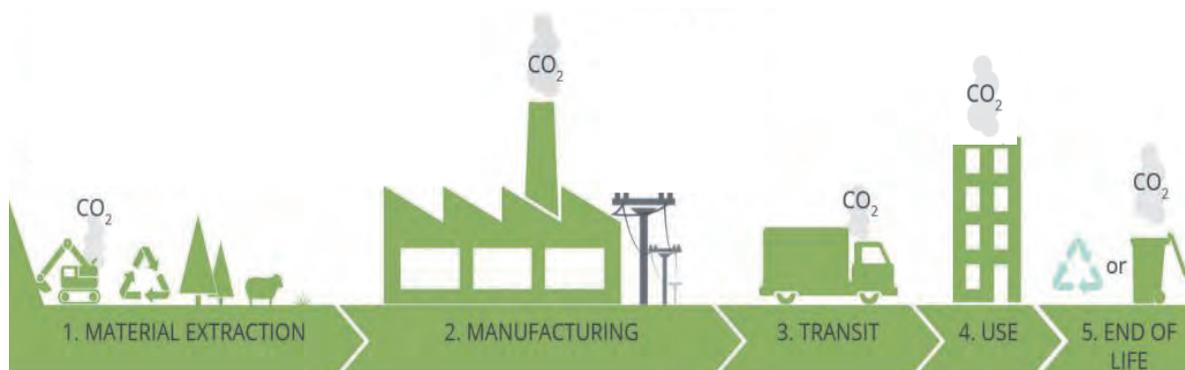
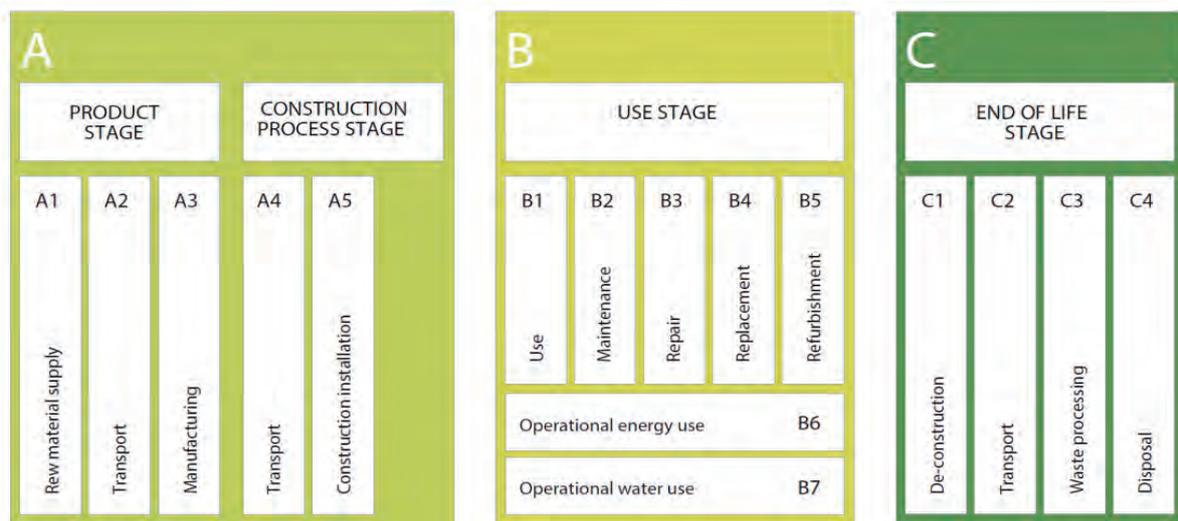
In line with central government targets: carbon peak before 2030 and carbon neutral before 2060

Under the carbon neutrality targets, the real estate sector will be under pressure to make its operations more environmentally friendly, and carbon neutrality will become a must-have for developers. In line with China’s national goals, various workstreams have already been initiated to make the operations of the Eco City Alliance developments more sustainable. Since 2020, the following achievements have been made:

- Disclosed the scope 1 and 2 greenhouse gas data of corporate offices and sales centers in the annual report and sustainability report
- Initiated work on scope 3, involving its supply chain into the scope

To help evaluate the carbon footprint for projects, White Peak has initiated a project focusing on in-depth building carbon footprint Lifecycle Assessment for a typical White Peak project. To begin with, the benchmark of carbon footprint is determined for a typical White Peak project, creating a way to measure current performance in carbon footprint. Thereafter, the work of carbon accounting includes carbon emissions from the following sources:

- Carbon emissions in the production process of building materials: Collect carbon emissions data from suppliers on building materials, deriving carbon emissions data that match the actual materials and usage in projects
- Carbon emissions in the building operation phase: Conduct energy consumption simulations during the operation phase of the project to obtain carbon emissions data that match the design attributes of the project



Scope of building LCA (GHG Protocol, EN15978, ISO21930)

Calculations of the total carbon footprint are then conducted and the results compared with the benchmark for improvement plans and actions. To help build this insight, White Peak also cooperates with consultants and provides trainings on carbon footprint Lifecycle Assessment to local contractors in Yantai.

What the Yantai Hammarby Eco City has achieved

The project has satisfied customer needs and reduced environmental impact and has achieved a BREEAM rating of "Very Good", showing that the Swedish solutions are key to the happiness of the community through healthier and greener living. In addition to this, the project has managed to achieve decreased environmental impact, namely:

- Renewable energy heated water accounting for 100% of the water used indoor

- HVAC system saving 14.3% energy compared to Shandong provincial standard, while the reduction in carbon during operating stage is 10.3%
- Water efficiency in the washroom has reached national second grade
- 90% of the landscaping uses water saving devices, such as humidity and raindrop sensors
- The greening rate is 46% on site

White Peak has cooperated with Bureau Veritas on a preliminary carbon accounting study on the first phase of Yantai Hammarby Eco City, and more thorough studies that are under way, including embodied carbon accounting, to help set the benchmark for comparisons and improvement plans. In the future, White Peak and the China-Sweden Hammarby Ecocity Alliance plans to expand the Hammarby model to more cities in China, starting with its existing markets in Shandong, Liaoning and Hebei.

Example

Happy customers: Thoughts about Yantai Hammarby Eco City from a new homeowner

"It was love at first sight," says Lisa Dong, whose family bought a three-bedroom (98m²) apartment at the Yantai Hammarby Eco City in the summer of 2020. They looked at several projects in Yantai before making their choice.

Their timing was significant, shopping in the wake of the early stages of the COVID-19 pandemic. Lisa's family was forced to self-isolate for almost three months with only brief spells outdoors. "Such a long time in the same place really focused us on its shortcomings. It felt like a prison for the three of us. We noticed how poor the ventilation was and were desperate for fresh air."

Lisa, her husband and her teenage son currently live in a decades-old apartment building not far from the Eco City. Among the drawbacks of such older buildings is the collection of household rubbish in dumpsters on the street outside. Lisa was delighted to see that this would not be the case at Eco City.

Eco City apartments employ a vacuum waste-collection system, which whisks the garbage into an underground holding area. "I'll be so happy not to endure smelly garbage as we come and go from our home."

Indoors, the apartments have a two-way air purification system. "Though some developers claim to sell fresh air, Eco City shows you how it's done. We could see the system working in the Product Experience Zone. It was exactly what we wanted."

Even though their move-in date still lies in 2022, Lisa now considers herself part of the Hammarby Eco City community and even brings homemade food to share with the salespeople, who have begun calling her the Eco City's "unofficial spokeswoman." The couple are so in love with the Eco City that they frequently bring their friends to see Hammarby and explain how it perfectly balances the Swedish and Chinese lifestyles while being eco-friendly.

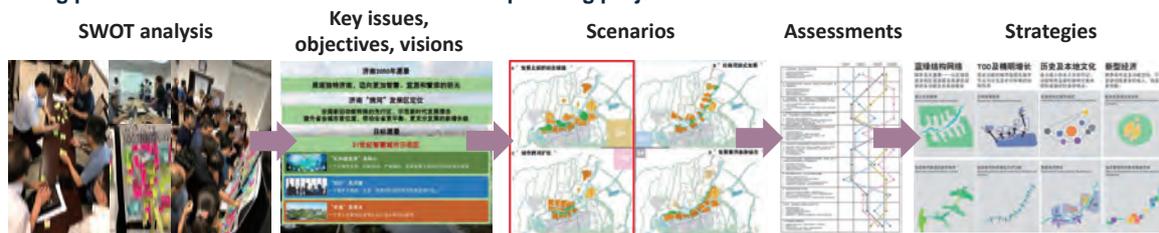
"We've been thinking about how we live, and the Hammarby concept is where we want to go. We feel that in our own small way we're helping address China's environmental problems."

Jinan North

In 2016, Jinan City took a historic and important strategic decision to expand the city northwards over the yellow river, deciding that the area would become a national level pilot project for the transition from old to new economy, including high ambitions to become a sustainable and smart city.

A conceptual masterplan proposal by Sweco, a founding member of the China-Sweden Hammarby Eco City Alliance, that build on the Swedish model was chosen in 2017 to be the base for further development of the area. Since then, a large multidisciplinary team including planning, urban design, transport, energy ecology and water has been working on projects within the area, enabling collaboration with the Swedish methodology to enable collaboration between different experts and handling the multidisciplinary challenges in the project. From SWOT analysis to strategy formulation, the ultimate purpose of the process has been to develop a sustainable planning proposal adapted to local conditions while still being resilient for the future.

Working procedure and tools utilized in Jinan North planning project



The fundament of the master planning was to have the green infrastructure network be the base of the urban development through an analysis of the existing green-blue structure, with the yellow river and waterways at its core. Throughout the process, the key focus was on how to safe-guard a robust green-blue structure that would contribute to urban resilience and make the city healthy and attractive. To this end, a framework of strategies in four themes was developed to work with the masterplan on a different scale:

- Green and blue: A sustainable city with respect of ecological spaces and limitations
- Transit-oriented development (TOD) and smart growth: An efficient and polycentric development structure
- History and local culture: The unique Jinan with its roots in culture, history and identity
- A new economy: Mix of functions that support a shift from old to new economy

After the masterplan work, opportunities to work on other different urban design projects within the larger area following the same Swedish model collaboration methodology were given as a way to follow-up the overall strategies on a more detailed level, including a proposal for a 3 km² start up area along the Yellow river called "The Balcony". Key strategies reflected in this proposal focus on transit-oriented development nodes along an urban spine, ecological green corridors as a part of the larger green network, and a fine meshed multifunctional urban structure to support innovations and local economy.

Besides the work on the urban planning from 1030 km² down to 3 km² scale, experts from other subjects provided professional support in a number of specific plans and studies work according to the same work methodology, such as green infrastructure study, ecological plan, energy plan, bridge and road design.

Jinan North First Practice Area of Economic Transition, 2017-2019, 1030/50/3 sqkm



Jinan "Xiehe" Development Spatial Planning and Urban Design

Jinan North Balcony Area Urban Design and key buildings

Jinan North first practice area of economic transition, 2017-2019, urban governance



Jinan City faced several challenges working on this large and complex project that had high expectations:

- Tight schedule led to urgent decisions, with high risk of losing track of the ultimate goals
- Many daily tasks required efficient allocation of various resources
- Many stakeholders and multi-disciplinary parties involved in the development process that had to be managed
- New/sustainable development concepts and principles had to be learned, understood and implemented, requiring time to be done properly

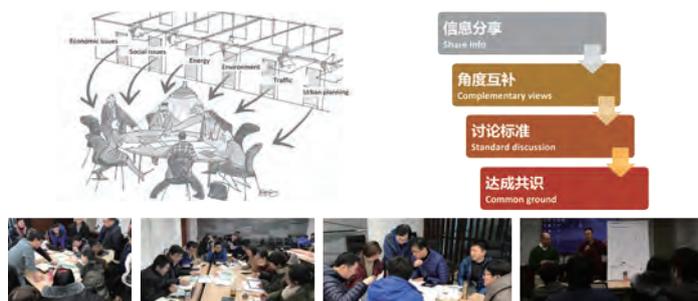
Jinan City used an innovative working method to deal with these challenges, using a general planning consultant that leverage the Swedish model for the hundreds of planning works made by various planning and design institutes. The purpose of this was to gradually integrate and implement the concepts and goals from the overall conceptual plan into a series of specific plans and planning works at different scales.

An important part of the task was to involve local stakeholders in the process where the Swedish collaborative model was applied. For this enormous project, thousands of local experts and consultants were involved in different studies and design tasks, where the Swedish model was used to facilitate an eco-governance process for Jinan City's continuous masterplan support.

New concepts had to be understood and discussed, and the workshops and training were crucial activities to form a common ground to safeguard the key ideas of the masterplan throughout the many rounds of studies and design. Between January 2018 and March 2019, 14 large workshops were organized and 45 different plans were coordinated.

Sustainable urban development cannot be achieved only by a well-thought through concept design, but also needs involvement and clear governance process throughout the different stages of implementation. The application of the Swedish collaborative model and the approach has contributed to formulate suitable planning strategies and generating innovative ideas and concepts for the project.

Cross-disciplinary workshops and collaborations used by Sweco as part of the Jinan North project



Conclusion

The world is changing quickly with increased urbanization, energy consumption and new habits affecting the world and environment around us. Consequently, China and other countries have set ambitious sustainability goals and policies to be able to build for the future in a sustainable manner.

To realize this however, new innovative and synergistic solutions as well as top of line design strategies are needed. It is therefore important to encompass a broader view to development than just by applying sustainable solutions and smart technologies to reach the set goals, but also by taking a holistic system view to design and planning.

Sweden has through its history demonstrated that it is possible to realize sustainable economic growth, whilst at the same time do more to minimize our carbon footprint and climate impact. Contributing to reaching the climate goals can therefore not only be seen as something done for a good cause, but also something that can strengthen the economy and benefit business by promoting competitiveness through for example:

- Creation of innovations and new business opportunities
- Reduced operational costs through energy and resource efficiency
- Increased customer demand leading to increased sales

- Stimulate local resilience and job creation by increasing recycling and reuse of resources which reduces the dependency on import of energy and raw materials
- Attracting new residents, investments and businesses

The increased cost per square meter for sustainable urban developments may not always have to be high but would instead increase the value of the property as well as surrounding area, resulting in a beneficial business case for developers, the city, and the environment. The economic benefits of this approach have proven its case in both Hammarby Sjöstad in Stockholm and in the Hammarby Eco City development in Yantai, which have seen the benefits of sustainable development, receiving high attention and becoming one of the top-selling residential projects in Yantai.

The China-Sweden Hammarby Eco City Alliance is ready to contribute to China's ambitious plans to reach carbon neutrality and is committed to continue supporting Chinese developers and officials to develop urban areas in a sustainable manner also in the future. The China-Sweden Hammarby Eco City Alliance can leverage both its members and their solutions, as well as its connections to a wider network of Swedish companies with innovative and effective solutions for sustainable development.

If you are interested in learning how we can help you with your urban development needs, please don't hesitate to reach out to us.

<https://www.ecocityalliance.se/zh-hans/>

About the China-Sweden Hammarby Eco City Alliance

China's unprecedented pace of urbanization, its scale, and its ambition offer great opportunities for Swedish companies to provide their technologies and solutions to support the sustainable urban development in China. In light of this, the four founding members – White Peak, Sweco, Envac, and Business Sweden – decided to join forces and establish the China-Sweden Hammarby Eco City Alliance.

Our mission is to bring more Swedish innovative and sustainable solutions for city design and construction to China, and to promote Eco City projects to relevant stakeholders, enabling replication of the globally recognized Stockholm Hammarby Sjöstad concept in China. The initiative rests on the basic premise that we are stronger when we act together and that collaboration will help amplify the impact and accelerate the transition towards a more sustainable future.

The China-Sweden Hammarby Eco City Alliance has members covering different parts of the urban development process, and can through its network extend beyond the existing scope. The alliance is continuously working to expand its membership base to assist developers in China in the accelerated transition towards sustainable living, bringing innovative solutions as well as sustainable development expertise from Sweden.

“

To establish an alliance of Swedish companies and solutions which can contribute to an innovative and sustainable city design and construction, and to promote the eco city project to relevant stakeholders enabling replication of the concept.

”



中国-瑞典哈马碧生态城联盟
CHINA - SWEDEN
HAMMARBY ECO CITY ALLIANCE

Appendix 1

China-Sweden Hammarby Eco City

Alliance Members



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ASSA ABLOY

Founded in 1994, ASSA ABLOY is a multinational group with nearly 50,000 employees providing innovative access solutions to the global market.

Whether in Europe, America, Middle East, Africa or APAC, ASSA ABLOY is an absolute market leader. The products including doors, door and window hardware, access control, identification technology and entrance automation, providing one-stop service for verticals such as enterprises, government, finance, energy, subway, airport, retail, education, healthcare, hospitality and residential, to help people feel safe and secure so that they can experience a more open world. In 2020, the group's sales were about 88 billion SEK (about 65.5 billion yuan), achieving 5% organic growth.

ASSA ABLOY is committing to science-based targets to further substantially reduce its greenhouse gas emissions across the entire value chain. We will set targets that are aligned to the Paris Agreement, limiting global temperature rise to 1.5°C, by halving emissions by 2030 and reaching net-zero by 2050 at the latest.



Contact:

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www.envacgroup.com



Founded in Sweden in 1953, Envac is one of the most innovative pioneers in the global waste collection industry and inventor of the smart automated waste collection system (AWCS). With innovation and ingenuity, Envac lead the design and implementation of next-generation recycling using resource-efficient waste handling. Our vision is to create smarter cities, improve quality-of-life today, and help secure a greener planet for future generations. Our business covers design, construction, installation, operation and maintenance of the smart AWCS for smart cities, modern commercial and residential buildings, smart hospitals and smart airports. On top of that, Envac is always on the way of developing the most state-of-the-art technologies that are align with the big data and AI application.

One of the features that Envac is so proud of is the reliability of our system and the long and seamless operating history we have. The very first vacuum waste collection system installed in Sollefteå hospital in north Sweden by Envac in 1961 which still runs well today. Envac systems have been installed in more than 1,000 demonstration projects until now. Just like electricity, sewage disposal and water supply, Envac systems are becoming one of the most important parts of city infrastructure.

Envac entered China market in 2004 and since then Envac has successfully constructed over 50 systems for Chinese customers and end users, including many demo projects

like Beijing Sub-center, the General Hospital of Chinese People's Liberation Army (301 hospital), China-Singapore Tianjin Eco-city, Shanghai International Financial Center, Yantai China-Sweden Hammarby Eco City etc.

There are many local governments, hospitals, communities and real estate developers have chosen Envac system, which help enable a greener, easier and smarter solution for waste collection and reduce GHG emission in the long run. Most importantly, by using Envac system, the overall operation could significantly reduce GHG emission by as much as 90% while creating a sustainable community for generations to come.



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Polestar

Polestar was established as a new, standalone Swedish premium electric vehicle manufacturer in 2017. Founded by Volvo Cars and Geely Holding, Polestar enjoys specific technological and engineering synergies with Volvo Cars and benefits from significant economies of scale as a result.

The company is headquartered in Gothenburg, Sweden, and its vehicles are currently available and on the road in 14 global markets across Europe, North America and China. In 2021, Polestar is expanding into eight additional new markets in Europe, the middle East and Asia Pacific. Polestar cars are currently manufactured in two facilities in China, with additional future manufacturing planned in the USA.

In September 2021, Polestar announced its intention to list as a public company on the Nasdaq in a business combination agreement with Gores Guggenheim, Inc.

Polestar China headquartered in Shanghai and now has Polestar Space up and running in major cities like Beijing, Shanghai, Guangzhou, Shenzhen, Chengdu, etc. Polestar 1 and Polestar 2 are both produced in China, Polestar 1 build in Polestar Chengdu Plant and Polestar 2 build in Volvocars Taizhou Plant. Polestar Precept will be build in a new plant under construction.

Polestar produces two electric performance cars. The Polestar 1 is a low-volume electric performance hybrid GT with a carbon fibre body, 609 hp, 1,000 Nm and an electric-only range of 124 km (WLTP) – the longest of any hybrid car in the world. With production coming to an end late in 2021, Polestar 1 has established itself as a truly exclusive driver's car.

The Polestar 2 electric performance fastback is the company's first fully electric, high volume car. The Polestar 2 model range includes three variants with a combination of long- and standard range batteries as large as 78 kWh, and dual- and single-motor powertrains with as much as 300 kW / 408 hp and 660 Nm.

In the future, the Polestar 3 electric performance SUV is expected to join the portfolio, as well as the Precept – a design study vehicle released in 2020 that is under development for future production. Precept showcases the brand's future vision in terms of sustainability, digital technology and design. In April 2021, Polestar announced the important goal of creating a truly climate-neutral car by 2030.



SaltX Technology is a Swedish renewable tech company that has set out to solve the problems of renewable energy supply, demand and timing. SaltX Technology strives to become a significant player in green and sustainable technological development, continuously evolving its business to meet today's and tomorrow's challenges and needs through long-term solutions in a responsible and innovative way from both a climate and an economic perspective.

SaltX has developed nanocoated materials for 15 years and this is our main expertise. It has led to a unique and patented nanocoated salt suitable for high temperature thermochemical energy storage.

The energy storage system is built upon industrial scalable components and technologies which has been used in the energy, processing and chemical industry for many decades. SaltX has tweaked the technology and applies it in a new fundamental way with a few important innovations.

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Sweco is Europe's leading architecture and engineering consultancy. Since starting business in China in 2000, Sweco has participated in various projects in China under the theme of sustainability, focused on urban planning and architectural design, and integrated with energy, environment, transportation etc. to provide the best of European expertise in low-carbon and sustainable solutions for China's urban and rural development.

Tomorrow's communities and cities are facing changes related to climate adaptation, urbanisation and digitalisation. With 17,500 experienced engineering, environment and architecture experts, Sweco offer our clients the right expertise for every situation in the changes.

In the direction of carbon neutral China, innovative green development is the only way, but it is not easy. Sweco is the European knowledge pool for sustainable urban development, from concept to practical experience. Sweco's China project team will continue to build bridges between demanding Chinese customers and ambitious Sweco experts and to perform strategic-level consultancy for low-carbon and high-quality development through win-win/multi-win cooperations.

Sweco wish to promote and participate implementation of high-quality demonstration projects, and to support Chinese cities in achieving healthy and balanced environmental, social and economic development towards a carbon neutral society.

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White Peak is a Swedish fund manager and real estate developer, backed by Swedish institutional investors, and focused on property investment and development in fast-developing cities throughout China.

Established in 2007, White Peak today manages a series of opportunistic funds and operates an institutional grade platform, offering systematic exposure to the continuing Chinese urbanization with end-to-end in-house development capabilities.

White Peak has a strong track record of residential development in China, having built over 20 wholly owned projects representing a total floor area of over 3 million m². With a disciplined investment process and strong emphasis on risk control, White Peak's on-the-ground presence extends to over 400 employees across 10 cities around China.

White Peak is playing a significant role in meeting China's aspirations for future urban development by introducing Swedish technology, processes and approaches towards sustainability and community integration. The latest development of Hammarby Eco City project in Yantai, incorporating the proven Hammarby Sjöstad planning concept and integrating Swedish innovation, lifestyle and sustainability, will serve as a reference for future projects to come.



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Business Sweden is committed to support Swedish companies to strengthen business contacts with foreign enterprises. We help Swedish companies to identify international business opportunities and to enable them to enter the international market smoothly with our competence and resources. Business Sweden has a strong presence in more than 40 markets worldwide with more than 50 offices. The dual ownership between the Swedish government and industry provides access at all levels throughout the world.

Business Sweden operates in Greater China (including Taiwan) since mid-eighties and has now four offices – Beijing, Shanghai, Hong Kong, and Taipei.

In Sweden, our offices are in all regions. We support Swedish enterprises enter the export market, develop existing markets, and help SMEs identify business opportunities to enter the international market. In addition to links with global offices and regional advisers, we also work closely with Swedish embassies, consulates and other partners abroad to help achieve the global development plan of enterprises.

In China, we also help Chinese companies understand Sweden's investment environment and prospects.

Appendix 2

Select Sources

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