

Vision for Sustainable City: The Case of Bo01, Malmö, Sweden

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Abstract

Currently, sustainability has been regarded as one of the key issues in the world. Historically, different cultures have developed environmental design as a means of vernacular architecture and urban design to fit their climatic, economic, political, cultural, and social context. Similarly, sustainable design in contemporary architecture and urban design needs to be developed according to its context and lessons should be learned from past as well as current successful cases. Moreover, local solutions have global importance too. Although, technology is playing an important role providing the same solutions to projects in different regions, yet the challenge is how to translate and combine the hard with the soft aspects of sustainable design. A project such as Bo01- first European Housing Exposition in 2001, in Malmö's West Harbor district, Sweden, has addressed and tested their vision for a sustainable city. The project was able to successfully revitalize the city from a degrading formal shipyard and car-manufacturing city into a liveable, efficient, revenue-generating, high technology city of the future with a well-planned and sustainable-oriented community. It was supported by the Swedish government and EU funded the project to test new methods and techniques for sustainable cities of tomorrow. The goal of this project was to create ecological, social, technical and human sustainability in a high quality development. In the first phase, 522 apartments and 37 houses were constructed in 50-acre site and 1,200 -1,500 people are living. It was started in 1996 and the first stage was finished in 2001. Eventually, 30,000 people will live or work on the 325-acre landfill of the Western Harbor. Bo01 project is a good example of how an experimental sustainable urban development was successfully initiated, processed, implemented in a workable long term model. It pursues high quality design with an integration of technology and sustainable. Although there were positive and negative responses, it is helpful to understand the process of sustainable urban development. Bo01 was a holistic concept of urban planning, including soil decontamination, renewable energy design produced 100% locally, ecocycle, traffic and pedestrian district, embedded in green, as well as innovative water and waste systems. In this paper an analysis of architectural and urban sustainability from the case of Bo01 will be presented, looking into to the historical, political, economical, and social issues involved in a holistic sustainable development. Through the analysis, a vision for a green, sustainable urbanism can be sought.

Keywords: Sustainable Urbanism, Sustainability, Bo01

1. SUSTAINABLE URBANISM

Global attention and effort to make earth a sustainable place has been significantly increased in the last decade. Global pandemics, climate change, natural disasters, poor soil conditions, deforestation - these issues are at the heart of sustainable development. Global warming is possibly an example of what happens when we do not develop sustainably. The year 2000 marked the first time in humankind's history that the urban population exceeded the rural one. Of our global population of six billion, more people now live in cities than in the countryside. Over the past decade, the concern for global warming has been extended to the states of cities as well as environmental and ecological health. Currently, there is a great movement to make our cities sustainable. But then, what is a sustainable city? There is no accepted definition of a sustainable city; however, as is quoted below, the quality of life is at the center of the topic. Some cities have been developing their own sustainability indicators, to try to measure quality of life issues in a meaningful way.

"Being a sustainable city means "improving the quality of life in a city, including ecological, cultural, political, institutional, social and economic components without leaving a burden on future generations....." (Urban21 Conference, Berlin, 2000)

"A 'sustainable city' enables all its citizens to meet their

own needs and to enhance their well-being, without degrading the natural world or lives of other people, now or in the future"(Girardet, Herbert, Cities People Planet, Wiley, 2004)

Increasingly, modern developments are built in large-scale either as redevelopments of existing areas or as buildings in new urban areas. However, the reality is that most of the sustainable projects are about individual buildings or groups the buildings and not about large-scale urban projects. However, these large-scale projects have enormous impact on the environment than the small-scale ones so sustainable development will be more effective in such larger-scale projects. Great consideration of sustainability should be placed on urban and regional scale as well as neighborhood scale. Within the larger-scale, sustainability works more efficiently and systematically integrating transportation, watershed, air etc. Moreover, these larger-scale projects are increasingly complex and have various connections to urban scale design, regional neighborhood design, and building design.

Sustainable development consists of social, environmental, and economic aspects which all relate to each other in order to make the quality of people's life better. If these three elements are separate, sustainability cannot be achieved. As an example, huge economic growth does not mean that there is an improvement of the environment or social benefits. It can create negative

social effects such as more difference between poor and rich and pollution to the environment. Therefore, in the long term, these negative effects can cause many problems that prevent sustainable economic growth. The goal for each element is to pursue mutual benefits and become well balanced in the long term in order to achieve the ultimate common goal of human well-being. As an example, economic goal will be carefully planned to minimize environmental impact and accommodate social need for job, benefits, comfortable commutes and housing. The environmental part will also be planned in connection with the social and economic elements. The most efficient open green space, air, and water will be managed to provide for social health and recreation. This analysis set the basic three elements: environmental, social and economic. From this large and general element, detailed sustainable urban elements can be extracted. These urban design elements are also interrelated and encompassed with others as the three issues of sustainability did.

In the book, "Planning Sustainable and Livable Cities", (Stephen Wheeler, 2004) suggests a framework for "Sustainable City". This framework includes compact, efficient land use; less automobile use yet with better access; efficient resource use, less pollution and waste; the restoration of natural systems; good housing and living environments; a healthy social ecology; sustainable economics; community participation and involvement; and preservation of local culture and wisdom.

These three elements consist of many other sub-elements. First, the environmental part consists of air, land, and water which are the core elements for sustaining the living nature for animals, plants and humans. Therefore, water management, waste control, and pollution reduction can be the solution for sustaining our environmental core elements. Second, the social part is related with people's safety, health, and equity. Balanced age group, income, ethnicity mix of people, adequate affordable housing, reduced crime, good community service and education system, the dynamic of human interaction, etc. will help the urban community become livable and also sustainable. Third, without satisfying the economical sustainable base other elements can be easily collapsed. Enhancing the opportunity of employment and training, and energy management will be part of the economic element.

Overall, to successfully balance these three elements in a sustainable development, thorough urban design strategies should be planned. Highest and best land use strategies are needed in terms of building mixture, density and location. Green space that can help natural habitat and human well-being should be carefully considered. Also it should take into account journey management such as vehicle transportation, pedestrian space, bicycle path, provision of parking spaces, and the energy and material costs of transportation. Most importantly, in a sustainable development and urban planning the best solution that fits into the local context, history of site, urban characteristic

and politics should be analyzed and implemented. By setting up the most appropriate building assessment method in the developing process, quality of architecture and each design element can be guided and monitored. Ultimately, a sustainable urban development is a long-term process as the concept of sustainability is also a long and broad term. It is also very complex because many urban design issues are interconnected and dealt with through quantifiable and non quantifiable sensitive matters.

In Europe, more advanced and sustainable principles have been applied earlier than any other places in the world. Also, they have been progressively and actively implementing sustainable concept as the global environmental concern is rising. However, still sustainable urban practice is fairly new and very few had been planned.

Currently, sustainability has been regarded as one of the key issues in the world. Historically, different cultures have developed their own environmental design as a means of vernacular architecture and urban design to fit their climatic, economic, political, cultural, and social context. Similarly, sustainable design in contemporary architecture and urban design needs to be developed according to its context and lessons should be learned from the past as well as current successful cases. A project such as Bo01 has addressed and tested its vision for a sustainable city. The project was able to successfully revitalize the city from a degrading former shipyard and car-manufacturing city into a livable, efficient, revenue-generating, high technology city of the future with a well-planned and sustainable-oriented community. Bo01 project showed how an experimental sustainable urban development was successfully initiated, processed, and implemented in a workable long term model. Although there were positive and negative responses, it is important to understand the process of sustainable urban development. By looking into the historical, political, economical, and social issues involved in a holistic sustainable development case in Bo01, a vision for a green, sustainable urbanism can be sought.

2. BO01, MODEL FOR THE FUTURE SUSTAINABLE CITY

Bo01 is the first phase of the European Housing Exposition in 2001 located in Västra Hamnen (Western Harbour). The site is close to the center of the city in Malmö which is the third largest city in Sweden. The city wanted to transform the West Harbor district from a degraded formal shipyard into a high technology center and a new district to live, work and study. Most importantly, it wanted to demonstrate the image of a city of the future with a sustainable oriented society. Although the area is a typical urban industrial land with contaminated as well as affected environment, it has a positive side of it, such as location adjacent to the sea as well as the city center. This new development was

supported by the national government for a local development, and funded by EU to test new method and technique for the sustainable city of tomorrow. The goal of this project was to create ecological, social, technical and human sustainability in a high quality development.



Figure 1. Location of Malmö

In 1996, the first phase was started with 522 apartments, 37 houses, offices, and shops and other services were constructed in a 62 acre (25ha) waterfront site. It was finished in 2001 and approximately 1,200 to 1,500 people are estimated to live. When it is fully developed, this place will be tenanted by 13,000 residents and more than 6,000 workplaces. Eventually, with its completion in 2010, approximately total 30,000 people (10,000 people and 20,000 employees and university student) will live or work in the 395 acre (160ha) landfill of the Western Harbor. Through this development, city will be able to solve the economical, social and environmental problem that had occurred due to post-industrialization and degraded industry. It pursues high quality design,

integration of technology and sustainability. Bo01 also has a holistic concept of urban planning including soil decontamination, renewable energy design which can be produced 100% locally, eco-cycle, traffic and pedestrian district that are embedded in green, as well as innovative water and waste systems.

3. HISTORY OF MALMÖ

Sweden, due to its geographic location, it has severe long winters, cold weather and short daytime. Traditionally, sustainable design has always sought to maximize the use of energy and daylight. Also, in Sweden, as one of the best social welfare nation in the world, the government seeks to provide every citizen with a decent housing with an affordable price. As a part of these efforts, since 1930, governmental programs for housing expositions have been held in various cities in Sweden. In these housing expositions, innovative ideas of modern and future living were presented. In 2001, Malmö became the host city of housing expo in Sweden. Malmö was the former industrial city with population over 250,000. It was once the largest shipyard in Sweden and a major car maker of Saab's manufacturing factory which was located in the waterfront. Throughout 1970s, shipyard business was a big success, but after the oil crisis, the business started to decline and eventually the shipyard was closed in 1979. Moreover, with the closure of Saab factory in 1990, Malmö went through a hard economy recession. Since then, the city of Malmö struggled to re-boost the economy and re-develop the post industrial area. Nevertheless, Malmö has a strategic advantage and tremendous potential benefits due to its location. Especially in 2000, the Oresund Bridge was opened which connects the two metropolitan areas of the Oresund Region: Copenhagen, Denmark and Malmö, Sweden. On the bridge, four lanes of European route E20 and double track of Oresund Railway Line runs across the area. Upon opening of the Oresund Bridge, Malmö became a gate way and important geographic point linking the business between Scandinavia and continental Europe. The second advantage of the site is that the new Malmö University is located in the district and it continues to expand so that it will enhance the city as a center of technology and education. The third advantage is that it is adjacent to the beautiful waterfront and the beach which provides the unique character in the city and attracts visitors. Housing exposition in Malmö provided a great chance to revitalize the city's economy and became an international leading example for the sustainable city of tomorrow.

4. MASTERPLAN OF BO01



Figure 2. Malmö's historical Photograph in 1970's
1548

This project was funded by the Swedish government, European Union, city of Malmö and Sydkraft (a regional power company) to improve the environment and to help



Figure 3. Aerial Photograph of Västra Hamnen

stimulate the local economy in western harbor area. Master plan was done by Klas Tham and the main idea started with the conceptual distorted grid system. The 'distorted grid' creates a surprising view or accidental space which creates diverse human experiences and social interaction within the city. This irregular streets pattern is not a foreign or new concept; it is a normal form of



Figure 4. Master plan of BO01

organic urban street pattern that can be easily found in the context of historical old cities. The urban form and its architectural vocabulary of intimacy, compact, and

efficiency are the reinterpretation of typical northern European cities into contemporary urban design. It successfully maintains the traditional old cities scale and typologies of the building reflected on the existing urban form.

Bo01 site is located in a place which is widely exposed to the sea and strong winds from the west. Master plan is designed to protect and reduce the cold wind from the sea in the winter but at the same time, to take advantage of the sea, the wind and the light. By placing higher buildings (between five to seven floors) at the south and west outskirt of the site facing the sea, heat loss is minimized and it serves as a protection wall from the strong sea wind. It also creates a comfortable space for the small scale interior buildings (two to three story building), courtyard and pedestrian path. This variation of scale of building makes the place curious and exiting. Canals and promenades are placed at the perimeter of the site, defining the site. At the southern part of the site, as one of the entry points to the site, a new marina brings the water further into the urban environment. Its distinctive waterfront character is also integrated into docks, waterfront promenade and recreational harbor design. Throughout the entire site, the network of pedestrian spaces, alleys and courtyard spaces are carefully designed to incorporate with views to the water and natural light and wind breeze. Within the complex, building heights are gradually reduced creating human scale spaces towards the center of the block and finally it opens up



Figure 5. Bird eye view of BO01 complex

with landscape. The change in scale of the building also helps to establish a natural hierarchy of urban space - from the big scale avenues and waterfront promenades to the side lanes and small squares. There are clear structures in the fronts with entrances onto hard-surfaced public space and the backs with backdoors into carefully planted gardens.

For the Phase I, 50 acre of waterfront site is divided into 46 plots and designed by 21 different international and Swedish well-known architecture firms, hired to create variety of sustainable design model and to guarantee high set target of architectural quality. Although developers usually prefer bigger plot development, 19 developments

and construction teams participated to develop an individual small parcel. Diversity in architects and developers make it possible to carry out the entire project with diversity and add variety to the architectural expression. This project took advantage of architects from completely different areas of the world, all buildings have a different look but diversity works well within a single, simple and unifying concept of master plan. Overall layout is compact and efficient without introducing high-rise building. The 600 houses have 58 different types of housing with medium, low-rise, terraced, detached, and mixed tenured occupancy. Around 80 various sizes of companies are established in Västra Hamnen area. As other phases go further, construction of facility i.e. a private and public schools, daycare center, a library, offices, retail shops and other services are planned to follow.

5. IMPLEMENTATION OF SUSTAINABLE URBANISM IN BO01

Västra Hamnen (Western Harbour) is composed of a landfill site to accommodate growing harbor and expansion of the city which went through various stages from the end of the 18th century till 1987. Since Bo01 is built on this reclaimed post industrial land, a significant soil remediation program took place to eliminate contamination and to rehabilitate the site. Soil in Bo01 eventually has of equal or better quality than that of Malmö. Developing an existing brownfield site itself already helped protect the natural environment by avoiding development in greenfield.

Most importantly, the district is ecologically sustainable as well as socially sustainable. Human interaction with the environment is an important factor in the planning of the district. Access to the water and green area and maximum usage of daylight are carefully considered to create a good environment for the living. The new district uses 100% local renewable energy source. Bo01 has very successful energy implementation compared with other sustainable cases. In order to bridge the time-lapse of the energy usage, the new electricity grid and district heating network link to existing systems in the city. The green space optimized the bio diversity using guideline such as "green space factor" and "green point". Transportation issues are emphasized on pedestrians and bicycles, carpool, and public transportation.

(1) Land use and management

Housing size varies from one to four bedrooms. There are mixed tenured occupancy of rental, owned, shared ownership, affordable housing and student housing. In addition to housing, a school, daycare center, community hall, a library, offices, retail shops and other local services are built to complete the district. These building are not only used for one function but also flexible to be use by the community. As an example, schools are also used for

residents' continuing education after school hours and school library used for community. Overall density is 118 units per hectare. The planning density and compact design without having a high rise tower helps to reduce unnecessary travel, traffic, social segregation, land consumption, energy and impact on natural environment.

(2) Transportation and Mobility

The area is planned to promote walk and bicycling and reduce the dependency on cars. Pedestrian and bicycle path networks are prioritized over the car. There is no parking area in the complex, other than loading, delivery and drop-off area. The whole site is pedestrian only and parking of residents' cars (0.7 car per household) is located at the designated parking areas outside the housing complex. Carpool of the district is organized through the internet so that residence can book from their computers. Design emphasized alternative transportation by providing easy access to public transportation and systematic network of public transportation such as bus, train, and tram. Digital displays are installed at the bus station indicating the schedule. Such design is intended to discourage the car use and people to choose to use public transportation. Public transportation is also operated by environmentally friendly fuel.

(3) Energy management

Bo01 is an energy self-sufficient district using 100% local renewable energy source. The renewable energy is created from wind, sun, bio-fuel, geothermal and biogas from sewage and waste. Large proportion (85%) of energy for heat is produced from the seawater and groundwater. 1,400m² of solar collectors which are placed on top of the ten buildings will supplement the rest of the



energy needed (15%). Energy for summer cooling is produced also from the seawater and groundwater. Electricity is mainly generated from 2MW of wind turbine placed in the northern part of harbor, and a minor part of electricity comes from 120m² of photovoltaic panels. Bo01's energy system is connected to the city of Malmö's energy grid system which enables to export and import

the electricity according to its peak and non peak energy using time. The building is designed and equipped with advanced high technology to be energy efficient. Each apartment has the target energy use of 105kwh/m² per year which is around half the typical Swedish energy consumption.

(4) Environmental water management

Rainwater run-off is infiltrated on site which is independently controlled and is treated locally using the method of green roofs, channels, retaining pond and swales. Through the information technology, people can monitor and consumption of the water and energy from their house. The waste water is send to Malmö's central plant to be treated and discharge into Sea.

(5) Waste management

All the wastes are sorted and separated through a recycling system. Having waste separation close to each unit, give the residents easy access to recycling. Items such as cans, glasses, papers collected are sent to recycling plants. The organic and other waste goes to vacuum waste chutes. The food waste is grinded by food waste disposer and disposed of separate pipe. From the collector underground, these wastes finally are sent to the biogas plant and processed to produce biogas which is used for alternate car fuel, electricity and heating or sent back to natural gas grid.

(6) Green space (Landscaping and public space)

Green space has many benefits such as help to increase social interactions, reduce water run-off, and increase bio diversity. The green space within Bo01 housing areas is residential courtyards with small private gardens, balconies or decks and it is visible from every residential unit. In Bo01 development, green space factor combined with green points is used as a planning instrument to ensure that all the courtyards and streets have plenty of vegetation. Also, this system encourages creative



innovative design solutions. 'Green Space Factor' is a European approach to urban sustainability, which encourages sustainable landscape and green spaces in the city. The conventional open space regulation just requires certain percentage of open space; 'Green Space Factor' has points scoring system that is related with plants types and its area. Its point value has a direct connection to its contribution to biodiversity. As an example, lawn and ground cover has a lower point value and bigger trees, green roof, green wall and water feature such as ponds has a higher value. No credits are given to hard surfaces. Developers are required to use 'Green Space Factor' in every apartment blocks. It provides the flexibility of option to developers within the regulation and various approaches to urban landscape. 'Green Point' system includes a 35 list which can be selected to use. In every residential courtyard in Bo01, at least 10 items should be implemented from the list such as installation of bird nest box in apartment block, bat nesting boxes, butterfly flower beds, planting Swedish native plants and providing food for the birds. The district promotes biodiversity attracting broad species by providing diverse natural environmental conditions of water and green spaces. A key for balancing ecosystem is to understand the value, complexity of biodiversity and its equal distribution of all types of diversity from small living organisms to big ones.

(7) Social and cultural aspect

The history of the site is kept by restoring the large old industrial building with significant heritage value into convention center. This contributes to the characteristic of the site and creates a historical identity. The western harbor has become a popular destination for the citizen of Malmö which provides places for various social activities. Especially, during the weekend and summer, promenades and parks are crowded with tourist as well as residents. Moreover, the investment that is used for building waterfront promenades and public space benefits the whole city and Bo01 residents by providing a unique quality.

(8) Architectural quality

The city of Malmö, the expo and the contractors have agreed upon standards for the buildings performance concerning material use, energy and green issues in order to achieve district with environmental design and high quality of architecture. All houses were built to follow the quality program standard. It defines architectural quality, the character of public spaces, the building's performance, and standards of colors, materials, energy consumption, ecology, technical infrastructure and education. As an example, there is no restriction to overall façade design but the color of the building needs to follow the standard to give a character for the area as a whole. Outer buildings have more calm natural colors but inner buildings in the complex have vivid and cheerful colors.

(9) Building assessment method

Malmö's local investment program was used to accelerate the sustainable development. 37 million dollar grant was used for various environmental projects in the district. For instance, the grant was set aside for the land reclamation, environment improvement, green transportation, investments in technical systems and infrastructure.

6. VISION FOR SUSTAINABLE CITY

Worldwide, the cities are growing very fast and our environment is degrading accordingly. As mentioned earlier, the speed of urbanization has been greatest last 50 years, now almost 50% of the world's population lives in cities and by 2035 that is predicted to rise to 80%. Cities are consuming enormous resources and producing multiplies quantities of waste, and pollutions. Therefore, solving cities environmental problems means resolving many other global problems and a key to a sustainable future. To keep the pace of fast urbanization, rapid acceleration of implementing and adapting the best solutions for sustainable development should take place. Also strong political leadership with a vision and people's desire for making livable places are necessary to achieve sustainable urbanism.

Bo01 got lots of global attention. Currently, there are many on-going researches and investigation on this project to learn about their approach to sustainable urbanism. As it applies to any other urban design and architecture, the Bo01 project has pros and cons at the same time. However, we can learn many lessons from this project for future sustainable urban projects. There are many key success factors in Bo01 that can be learned.

First, collaboration of the public and private development was very efficient and effective. Various funds from the government released the big burden from the private developers and ensured the quality of the project. Setting up a common goal and standard for the development enables to bind the development as a whole and bring the level up. Although many developers and architects worked on different plots in pursuing creative innovation and diversity, there is a common direction that can hold it together as one project.

Second, community involvement from the early process of the planning enabled the project more successful. It can slow down the decision making process in the development with time pressure but in the long term it is an essential element to create sustainable urbanism.

Third, political vision for the future and governmental commitment could revitalize the city. Malmö went through a major change from traditional industrial city to a post industrial city to a revitalize educational and high technology center.

However, there are several problems in Bo01 that could have improved and changed.

First, Bo01 has not able to achieve social diversity. The rent and housing price are more expensive than other places which lost their original goal of providing fair market price housing. Sustainability should be for everyone not just a few people. In sustainable city, diverse economic, ethnic, age people should live. In Bo01, only residents with good income, young professionals can afford to live there. The age group in this district is young. Average age at Bo01 is only 33 years compare to 40 years in Malmö. Although a number of students in this district contribute to lowering the average age, still it consists of many young families. As a result, diverse mix of income and age group was not accomplished.

Second, the project was not profitable and economically not successful. Construction cost for Santiago Calatrava's "Turning Torso" high rise condominium was too high and it raised the price of the unit. Sales were slow and return on investment was low. Inability to predict market and economic condition caused the city to bankrupt. Although the city has a star architect's signature landmark building yet they paid too much of a price for it. It brings the question mark for economic of sustainability.

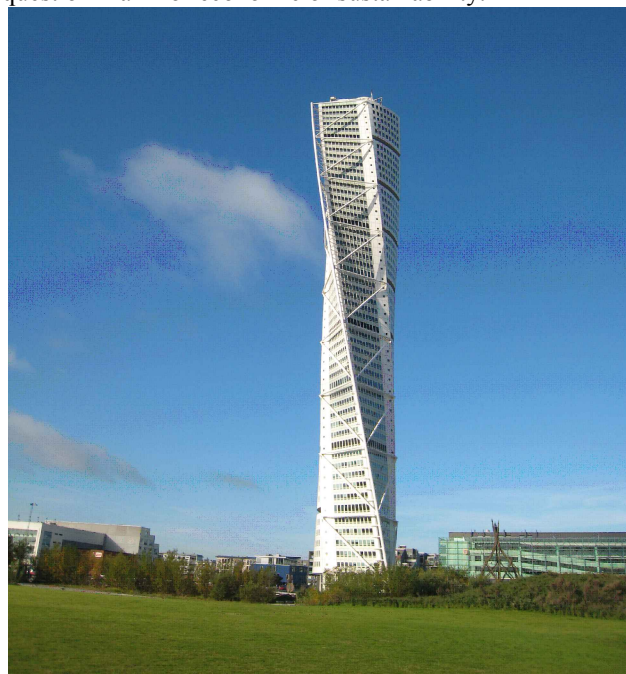


Figure 8. Turning Torso in Bo01

Third, their goal on some criteria did not meet. Even though community involvement was successful for the planning process, their participation in some aspect was not fulfilled. As an example, their ambition for 100% recycling did not work well due to resident's low participation. Educating people and their contribution for protecting environment could be helpful. Environmentalism should be a public pedagogy built into everyday life. People may find that it is not convenient, costly, or complicated to take action but they should know that sustainability is no longer an option or choice but a duty. Also, the target energy use of 105kwh/ m² per year

did not work for the entire apartment in Bo01. Some apartments reached target but some did not. The reason might be related to architectural design issues. Huge glazing to maximize the natural light and the aesthetic of design requires more heating and cooling for the building.

As a conclusion, in the 20th century, we accomplished huge development in technology and economy; however, it was the most destructive time in our history. Therefore, in the 21st century, we need to step ahead of these achievements by finding the solution to cure and heal our environment and a way for humans to live in a sustainable way. Currently, we are in a paradigm shifting transition era from conventional design to sustainable design. Sustainability should move beyond ecology and energy conservation. It should consist of socio-cultural, environmental, and economic aspects which are all related to each other in order to make the better quality of people's life. Sustainable urban development is not only planned to make the place attractive for people to live and work but also a comfortable, pleasant, and exciting life ultimately promoting social sustainability. Closer contact with natural environments i.e. sun, water, visual and auditory impressions helps people to become healthier and happier. The nature and city should harmoniously live as a symbiosis. Cities should get benefits by taking advantage of their site. Sustainability is not a utopian ideal rather it is a reality that we need to face.

Analyzing cases such as Bo01 is a good example of how to implement sustainable ideas to densely built urban fabric. Västra Hamnen (Western Harbour) is still under the progress of shaping the city. It might be too early to try to criticize now and the final evaluation can be possible after its completion in many years. However, from the lesson learned from the first phase of development Bo01, Malmö will continue to realize its vision for sustainable city and other cities in the world with this vision will learn from this.

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