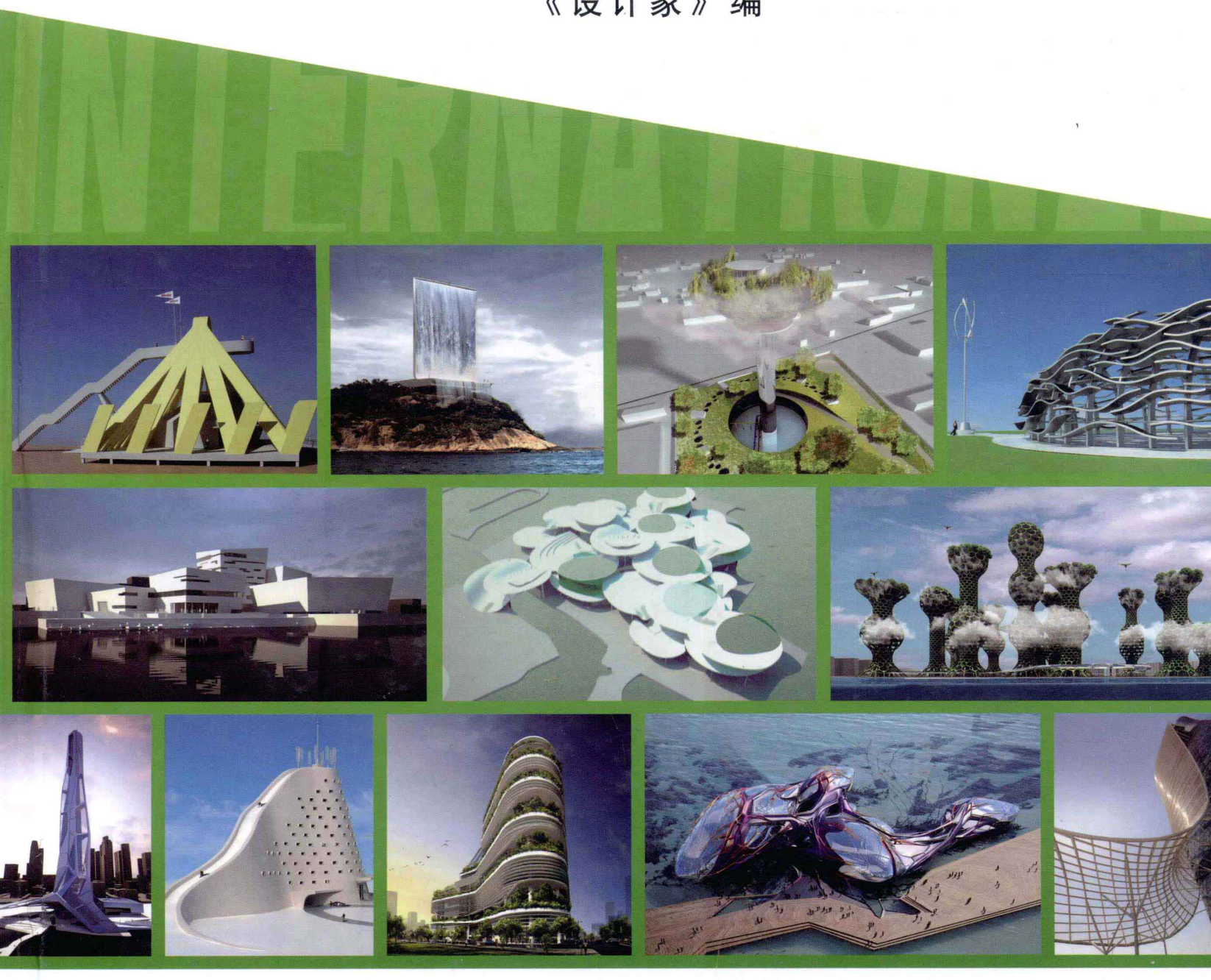
生态建筑实验与实践

International Ecological Architecture

《设计家》编



天津大学出版社
TIANJIN UNIVERSITY PRESS

图书在版编目（CIP）数据

生态建筑实验与实践 /《设计家》编. — 天津:天津大学出版社，2012.2
ISBN 978-7-5618-4218-8

Ⅰ. ①生••• Ⅱ. ①设••• Ⅲ. ①生态建筑—建筑设计—作品集—中国 Ⅳ. ①TU206

中国版本图书馆CIP数据核字（2011）第237808号

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编　　辑　宣　文
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责任编辑　油俊伟

出版发行　天津大学出版社
出 版 人　杨　欢
地　　址　天津市卫津路92号天津大学内（邮编：300072）
电　　话　发行部：022—27403647　邮购部：022—27402742
网　　址　publish.tju.edu.cn
印　　刷　上海瑞时印刷有限公司
经　　销　全国各地新华书店
开　　本　240mm×320mm
印　　张　21
字　　数　296千
版　　次　2012年2月第1版
印　　次　2012年2月第1次
定　　价　328.00元

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FOREWORD
序言

已建成环境的可持续设计

可持续性，是建成环境领域的建筑师及其他设计师在为提升其作品品质的努力过程中广泛使用的术语。关于建筑对景观环境的影响，我们的了解微乎其微，导致我们所赖以生存的自然环境遭受污染、破坏、恶化、停滞。可持续设计的目标在于创造一个平衡且具敏感性的成果——低影响度，保护水资源，减少能源消耗，使用当地现有的材料。可持续性关乎如何确保设计的可持续性，把对未来环境的破坏降至最低程度，同时使它具有功能上的灵活性、可调整性，以持续支持社会和经济的需求。

可持续性设计及建造不仅要考虑项目基地的环境因素，也包括对影响项目设计及施工的社会及经济因素的理解。 通过对基地现状的认识和与周边元素的协作，可持续性设计的过程就开始了。

在设计之初，考量基地状况往往至关重要。在建筑、公园、城镇的设计规划中，人们倾向于利用自然景观来满足使用者、基地内部及周边区域社区的需求。而在此过程中，可能会出现阻碍设计及施工的负面作用力，其中部分因素包括景观地形学、土壤条件、现有植被、水路及野生生物的分布状况。通过最初的基地调研，人们往往会对其特性进行评估，确保最具可持续性的方法得到落实，确保在项目开发的过程中，基地得到细致的对待。

在城镇规划（再规划）、设计（再设计）这个更大的尺度上，可持续性最重要的价值在于它能确保该地长久的生命力与繁荣。这不仅需要考虑环境因素，还要考虑到社会及经济因素。 公共空间的改善为城市的可持续性创造出大范围的效益，从而大大影响城市的宜居性和安全性，有助于城市吸引购房者和观光客，保持经济繁荣。规划师和建筑师倾注心力研究新开发项目中的现有条件，密切关注和利用各种因素，如地形，确保道路系统得到良好的连接，易于识别，布局恰当，来保护现有的动植物生长和栖息之地。山地、山谷、平原等景观的自然构造也对特定功能区域的分布有决定性的影响。

更具体地说，在确保可持续性设计的原理被整合到特定的、具体的建筑中时，仍需作一些思考。在建筑设计中，许多措施都可以整合到物质结构中去。建造高效节能建筑是建筑师优先考虑的主要目标。有许多种技术可以用来降低能源消耗，然而也有一些途径可用于获取和生成更多的能源。高效供暖、降温及通风系统的利用将有助于降低成本，从而确保更低的能源消耗，以及能源循环使用的可能性。利用太阳能板有助于为建筑供暖、降温和提供热水。在炎热的季节，恰当的建筑朝向使其最大程度地实现通风，有助于降低室内气温，从而减少对空调的需求。

使用可循环的建材，是有助于降低对环境负面影响（如砍伐森林）的又一可持续性措施。尤其是在改造项目中，可以对旧窗户、旧地板进行再利用来保留建筑原先的风格。如今，在大尺度的建筑中，也可使用再生钢来构建框架。

为了确保建筑的可持续性，也需要优先考虑如何把室内空间和功能的灵活性最大化。使用者的需要对应着对空间的一些要求，在设计初期进行空间规划，则有助于使两者相匹配，相得益彰。创新型的室内设计解决方案可能包括可移动的墙，及具有一定适应性及便捷性的储藏空间。从更大的尺度来看，富于智慧、巧妙的空间规划通过防止城市扩张、将城市广场和公共空间最大化，将有助于有助于在建成环境中保障其可持续性。

公共交通运输导向型设计（TOD）是一种规划和设计方式，可强化城市的连接性，集中活动区域并提供交通模式的可选性及更大区域间的到达性。这一易于使用、高度便捷的系统被设计用于连连通中央区域的不同节点，并实现城镇内不同节点与区域间的连通。在这些交通枢纽周围往往有高密度的住宅区，它们拥有高品质的人行及自行车流线。该系统支持建成环境内部的可持续性设计，它旨在通过相互连接、便捷且舒适的高效公共交通将城市串联起来。

建成环境中的可持续性设计看似复杂和十分缜密，然而考量之后，可以发现许多设计都采用了简练、合乎逻辑的方式来应对建筑及环境的演变。只要全面考虑关键的环境、社会及经济因素，创造可持续城市和场所是可以实现的。从细节来说，这些因素正是通过建造和设计的技术而得到支持与强化的。在满足各社区的功能需求的同时，这些具有响应度、平衡的建成环境实现了对自然景观影响的最小化，创造出自然与建成环境之间的和谐关系，促进了社会的长期发展与经济层面上的成功。

范铁
英国皇家建筑协会注册建筑师(RIBa)，
福斯特建筑事务所(Foster and Partners)助理合伙人

SUSTAINABLE DESIGN IN THE BUILT ENVIRONMENT

Sustainability is a popular term amongst architects and other designers in the built environment industry as they strive to improve the quality of their work. The natural environment which within we live has for a long time been polluted, demolished, degraded and hindered because of our inability to understand the affects of building on the landscape. The aim of designing sustainably is to create a balanced and responsive outcome that is low impact, conserves water, reduces energy usage and requirements and utilizes materials that are locally available. Sustainability is about ensuring there is longevity in the design to minimize future disruptions to the environment while being flexible and adaptable in function to continually support the needs of society and the economy.

Designing and building sustainably is about not only considering the environmental factors on the project site, it also involves understanding the social and economic factors associated with the impact of the design and construction of the project. Through recognizing the current conditions of the site, and working with the surrounding elements, the process of sustainable design has started.

Considering the site conditions at the start of the design process is always important. When designing a building, park, town or city, the natural landscape is likely to be manipulated to the needs of user or community within and around the site boundary. It is possible that in this manipulation, adverse affects may arise which hinder the design and constructability. Some of these elements include the landscape typology, soil conditions, position of existing trees and waterways and wildlife. Through the initial site survey, an assessment is typically made which identifies these and ensures that the most sustainable measures are put in place so that the ground is treated sensitively in the development of the project.

At a larger scale where towns and cities are planned / re-planned and designed / re-designed, sustainability is of upmost importance to ensure the longevity and prosperity of place. Not only is the environment considered but also the social and economic factors. Improving public space creates a wide range of benefits to the sustainability of a city. It can greatly affect the livability and safety of a city, making it desirable for home buyers and tourists alike and may also boost businesses. Planners and architects take great care in researching the existing conditions and in the case of new developments, work closely with factors such as landform to ensure that roads systems are well connected, easy to comprehend and appropriately placed to conserve existing flora and fauna habitats. Working with the natural formation of landscape such as hills, valleys and plains can also dictate the location of particular zones of use and function.

At a more detailed level, there are also considerations to be made when ensuring sustainable design principles are integrated particularly to architecture. In building design there are a range of measures that can be integrated into the physicality of the structure. Creating energy efficient buildings are one of the main, prioritized objectives of architects. There are various techniques used to reduce the energy consumption of a building however there are also ways to capture and generate more energy. Efficient heating, cooling and ventilation systems are all able to be utilized to support cost cutting measures ensuring energy consumption becomes less and also may be recycled. Harnessing the sun using solar panels helps to warm and cool buildings and also heat water. The orientation of a building, particularly in hot climates allows wind flow to be maxamised through a building helping to cool the interior and thus reducing the need for air conditioning.

Recycling materials for building is another sustainable measure that helps to reduce the need for negative impacts on the environment such as deforestation. Particularly in renovations, old windows and floor boards may be re-used to retain the same style of the house. In larger scale buildings, it is now possible to use recycle steel for framework.

To ensure sustainability of a building, maximizing the flexibility of interior space and function must be a priority as well. In the early stages of design, spatial planning helps to ensure that the needs of the user compliment the space required. Innovative design solutions for interiors may include movable walls and adaptable, convenient storage spaces. Smart spatial planning at a larger scale helps to ensure sustainable built environments through preventing urban sprawl and maximizing city squares and public space.

Transport Orientated Design is a form of design and planning that strengthens the connectivity of a city, centralizing activities and providing choice in transport modes and accessibility to a wide range of areas. This easily to use, highly convenient system is designed to connect different nodes of transport in central locations and to various nodes and places within towns and cities. Around these transport hubs are typically a higher density of housing where there is a high quality of pedestrian and cycle routes. This system supports sustainable design in the built environment as it aims to bring together cities through efficient public transport in an interconnected, convenient and comfortable manner.

Sustainable design in the built environment may appear to be complex and meticulous however when considered, much of the design is a simple and logical approach to the evolution of architecture and the environment. Creating sustainable cities and places is very achievable as long as key environmental, social and economical aspects are considered. In the detail, these elements are supported and strengthened through building and design techniques. These responsive and balanced built environments minimize impact on the natural landscape while meeting the needs and functions of the communities, creating a harmony the natural and built elements, promoting the longevity of society and success of the economy.

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Pubic

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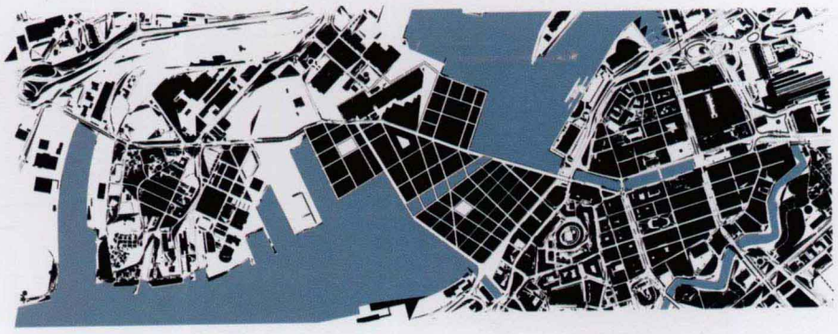
5 酒店|住宅

Culture |Education

Hotel |Residential

1 Planning

规划



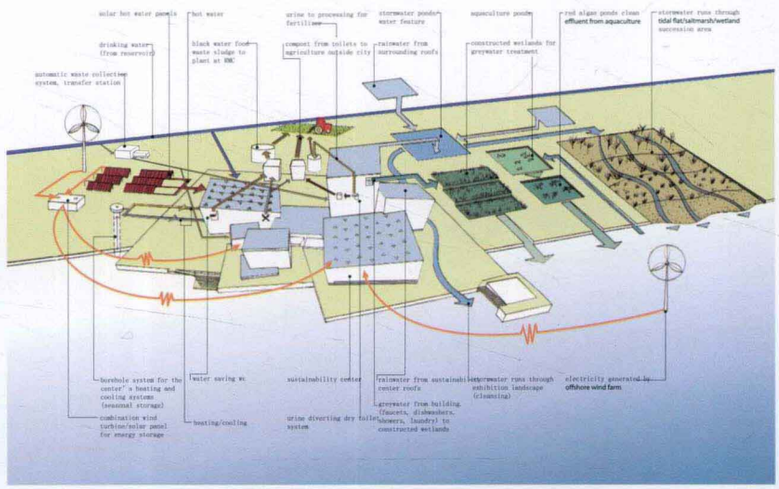
Caofeidian Sustainability Center

曹妃甸国际生态城可持续发展中心

Sweco

项目地点	中国，唐山
项目时间	2008年—2009年
建筑主创设计师	Johannes Tüll, Anna Hessle
建筑设计主创团队	Johannes Tüll, Anna Hessle, Alessio Boco, Anna Markström, August Wiklund
景观设计主创团队	Shira Jacobs, Staffan Sundström, Anna Gustafsson, Helena Eriksson
室内设计团队	Johannes Tüll, Barbro Sjöfall, Bo Lundberg, Sonia Garbajosa, August Wiklund
建筑设计配合团队	Lis Kjaer, Elsa Dahlman, Elin Mossberg Johan Svanholm, Elsa Dahlman, David Essinger, Petter Appelfeldt, Bosse Lundberg
专家配合团队	Ulf Ranhagen, Gunnar Nordberg, Lars Olof Matsson, Thomas Nordh, Henrik Berg von Linde,David Essinger, Peter Wiss
3D效果设计	August Wiklund, Petter Appelfeldt, Fredrik Ericsson
当地设计研究院建筑工程师	中国建筑设计研究院，张通

Project Location	Tangshan, China
Project Milestones	2008-2009
Chief Architects	Johannes Tüll, Anna Hessle
Architecture Main Design Team	Johannes Tüll, Anna Hessle, Alessio Boco, Anna Markström, August Wiklund
Landscape Main Design Team	Shira Jacobs, Staffan Sundström, Anna Gustafsson, Helena Eriksson
Interior Design Team	Johannes Tüll, Barbro Sjöfall, Bo Lundberg, Sonia Garbajosa, August Wiklund
Architecture Support Design	Lis Kjaer, Elsa Dahlman, Elin Mossberg Johan Svanholm, Elsa Dahlman, David Essinger, Petter Appelfeldt, Bosse Lundberg
Supporting Expert Team	Ulf Ranhagen, Gunnar Nordberg, Lars Olof Matsson, Thomas Nordh, Henrik Berg von Linde, David Essinger, Peter Wiss
3D -images	August Wiklund, Petter Appelfeldt, Fredrik Ericsson
Local Architects and Engineers	CADG, Zhang Tong



唐山曹妃甸国际生态城由瑞典Sweco集团规划设计，可持续发展中心作为生态城的一部分，是生态城的展览和信息建筑。这座占地2万平方米的中心将展示有关这座生态城的开发信息以及瑞典的环境技术和智慧。

可持续发展中心的建筑体型受到盐粒结晶的形状和聚集方式的启发。盐从咸水中析出，不断扩大，这就是晶体方案建筑和景观设计的背景。可持续的盐的生产是这个可持续发展的建筑的创作灵感。晶体的体型组合考虑了当地日照和风向的条件，创造出有庇护的空间、宜人的尺度和对可持续发展未来的美好憧憬。

场地分为三个不同的区域，各自的特点稍有不同。景观设计的目的围绕着三个原则：节约用水，展示可持续技术和曹妃甸地区不同的生态系统，并提供一个世界级的公共空间。

功能组织

可持续发展中心是曹妃甸生态城的标志。建筑将展示技术、交流总体的远景和传递唤起公众意识的信息。建筑中的常设展厅、多媒体视频大厅和用于临时聚会的活动厅，都会展示并促进可持续发展的系统解决方案和城市的远景发展。中心还向公众展示了一个功能良好的可持续发展的建筑，包括所有内部系统和一个新系统及新设备的展示区域。

节能环保

下列系统将应用在本建筑中或以展览方式展示：

良好的外围护系统；

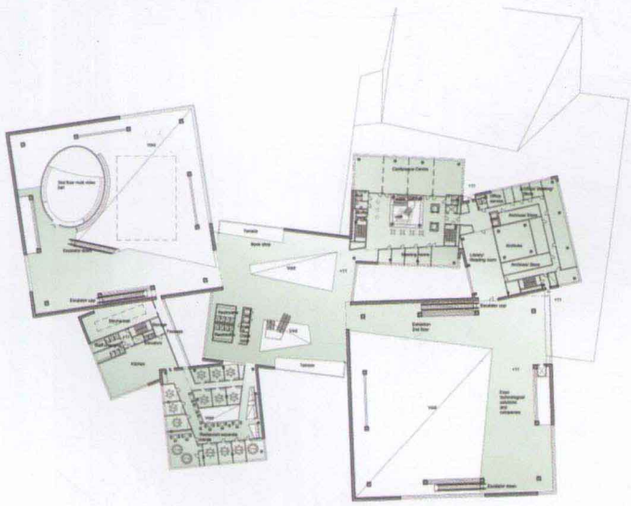
节能型照明系统；

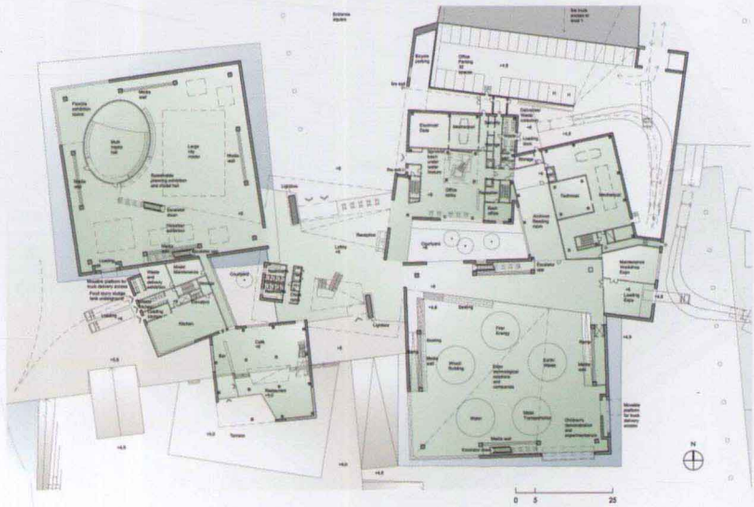
用于外立面和室内装饰照明的LED照明系统；

节能型通风和空调系统；；

节能型设备；

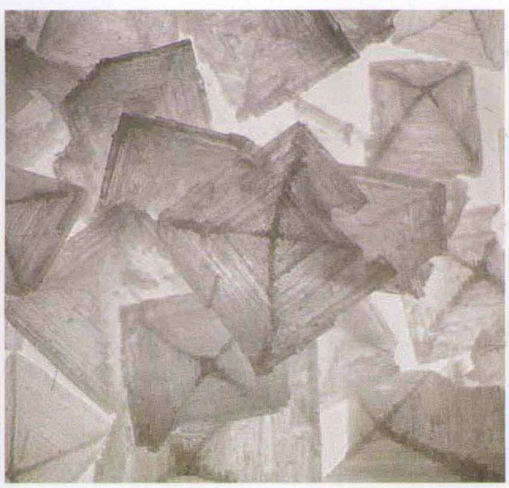
太阳能电池、燃料电池和风车的组合，用来展示一个应急电源的解决方案的新系统；

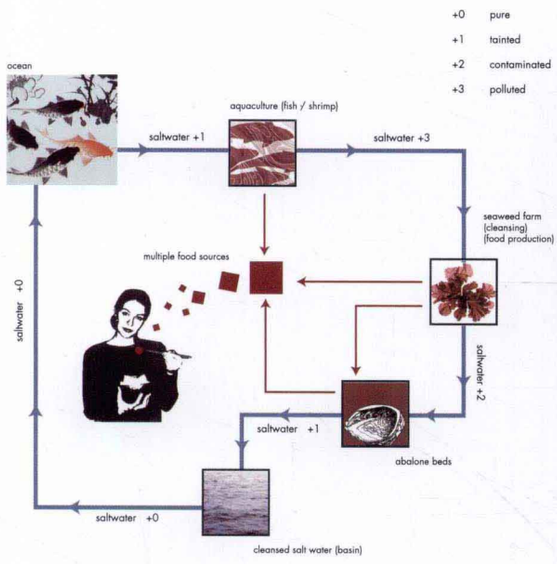




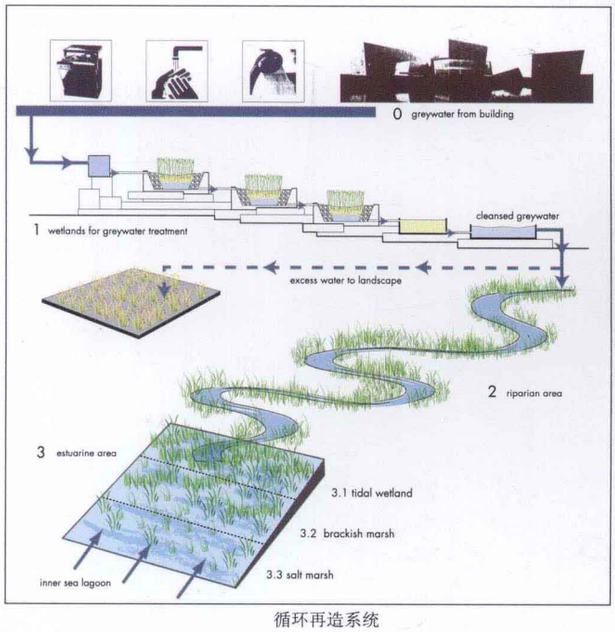
LEVEL 1
+ 11

平面布局图

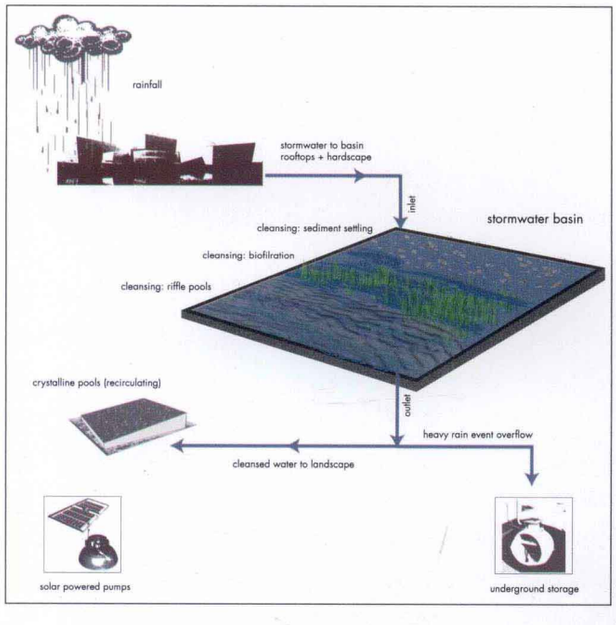




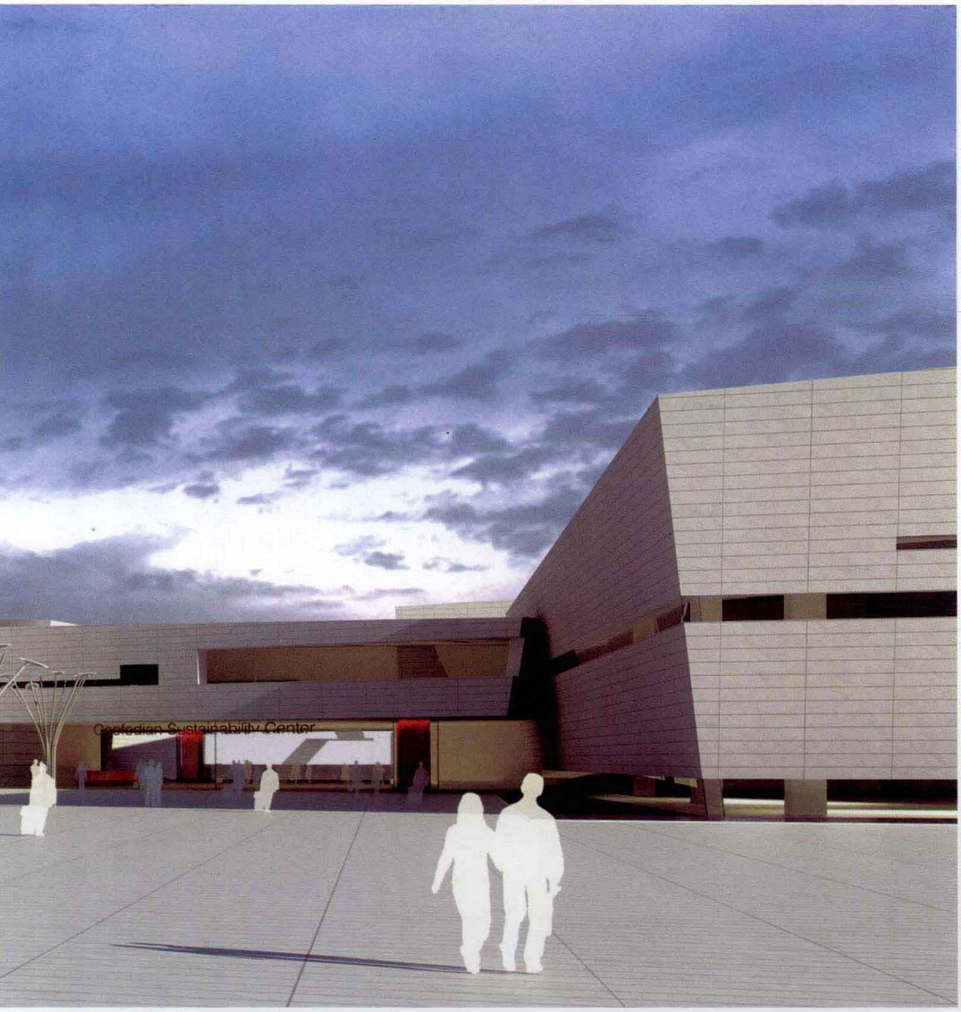
海水养殖系统

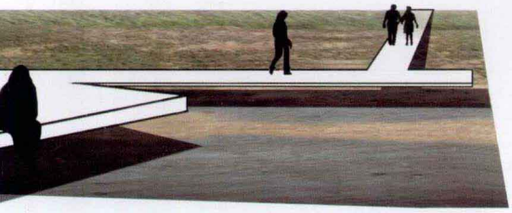


循环再造系统



雨水循环系统





采用深井进行季节性能量储藏，用于供热和供冷；

环保的垃圾收集和处理系统；

连接城市和农村的生态循环的可持续发展的解决方案（食物垃圾粉碎和黑水系统）；

有利于节水的系统；

不同类型的可持续发展的卫生设备和污水处理系统，包括一个人工湿地。

建筑特点

晶体建筑考虑给建筑内部的不同功能赋予不同的空间体量。每一个体量的大小、形状和特性又受到不同内部功能的影响，比如是否需要自然光、对视野的要求、对内部小气候的要求、空间净高要求以及对灵活性的要求。

建筑布局时重点考虑组织清晰，使人在建筑中能容易找到方向。通过不同体量的组合，创造出自然的人流、物流路线。建筑成为一个讨论可持续发展理念的聚会场所，包括随意使用的聚会空间，从而鼓励可持续发展理念的讨论和发展。

立面系统

该立面系统基本上是一个微通风立面，由硬质保温材料和石材饰面板组成。用螺丝把不锈钢构件固定在合适的框架上构成的点状固定系统（外面看不见），将石材（切成板状）固定在外墙上。下层结构固定在外墙内的竖向钢梁上。这种多层的外墙可以避免任何冷桥/ 热桥点，并达到最好的内部气候效果。

景观设计概念

可持续技术包括了尽量减少能源和水的消耗；利用无毒，回收，循环再造以及当地最好的材料；以及利用现有的废水作为进水，寻求“闭环回路”。可持续发展中心的景观计划能满足所有这些标准。通过储存雨水，废水回用和日益增长的食物与盐水，全部进行计算废水、雨水和海水系统，以减少淡水的需求。露水收集器演示了如何从空中收集水和从当地获得铺路材料。

室内设计概念

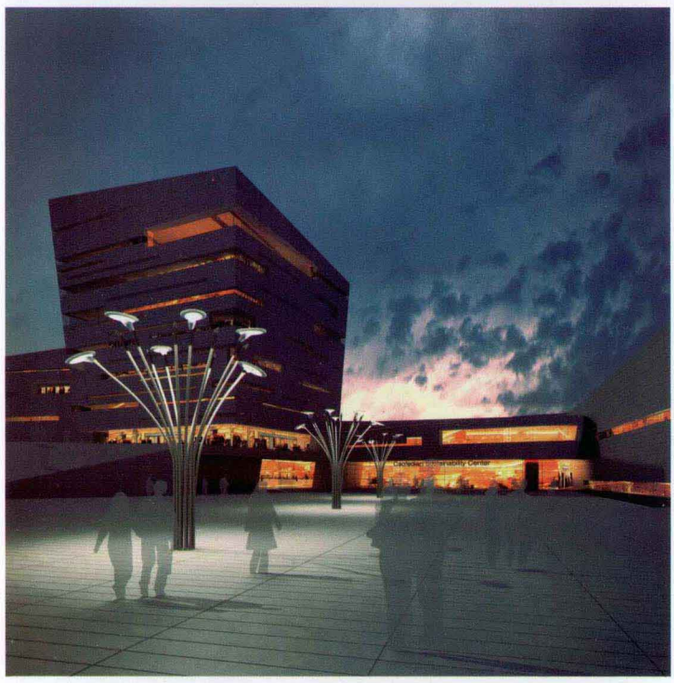
可持续发展中心的室内设计概念从唐山当地的文化和自然环境中获取灵感，并融合了北欧斯堪的纳维亚的设计哲学，从而创造其独特的风格。设计中的一些元素的灵感来自当地三角洲的自然环境、盐湖湿地和石楠丛生的田野。当地海边的鸟类以及海洋生物也是图案装饰和织物的灵感来源。

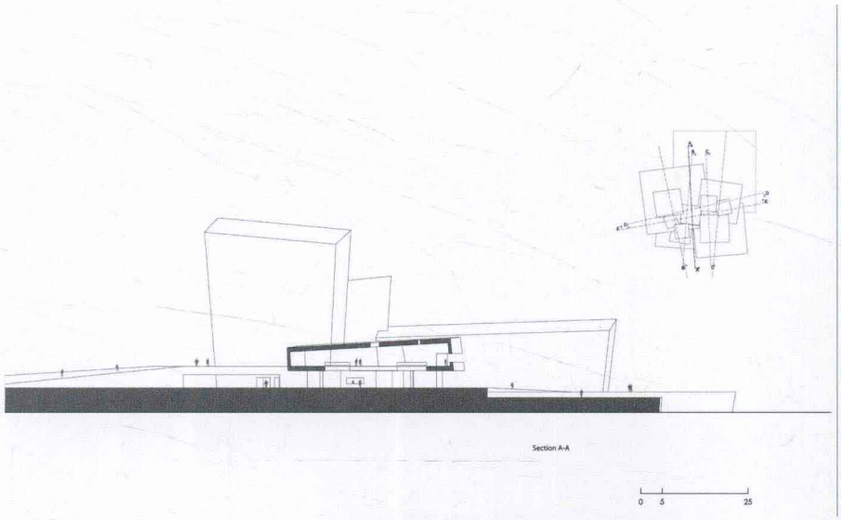
室内设计概念的另一部分特征元素来自唐山当地文化的形象、京剧的脸谱和色彩、中国织物和壁纸的图案以及当地悠久的陶瓷生产历史。我们以这些图案、色彩和图像为基础，把它们以斯堪的纳维亚的方式进行解构和诠释。建筑的不同功能区域有不同的主题。

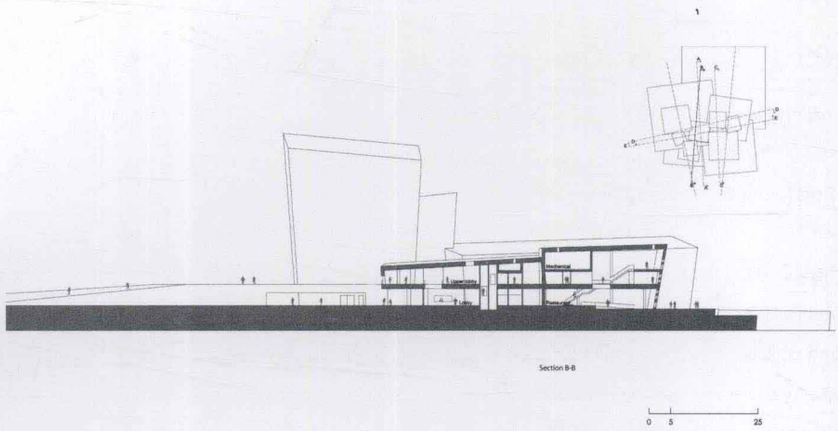
Background

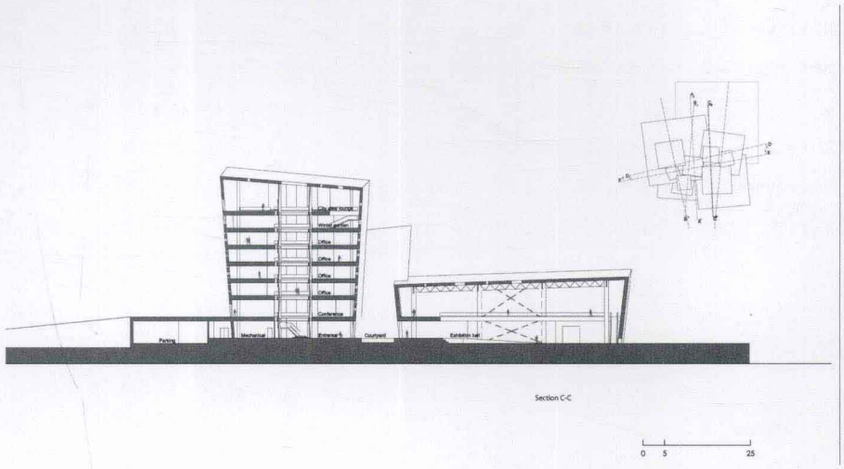
Tangshan Caofeidian International Eco-City is planned and designed by Sweco. The Sustainability Center being part of the new Eco-City, is the building for exhibition and information exchanging in the Eco-City. The Sustainability Center will be a symbol of the International Caofeidian Eco- City's founding principle of economically, socially, and environmentally sustainable urbanism. The Center's mission is to demonstrate cutting edge environmental technologies through temporary and permanent exhibitions, communicate sustainable principles through public education, and showcase successful climate-neutral construction through integrated building design.

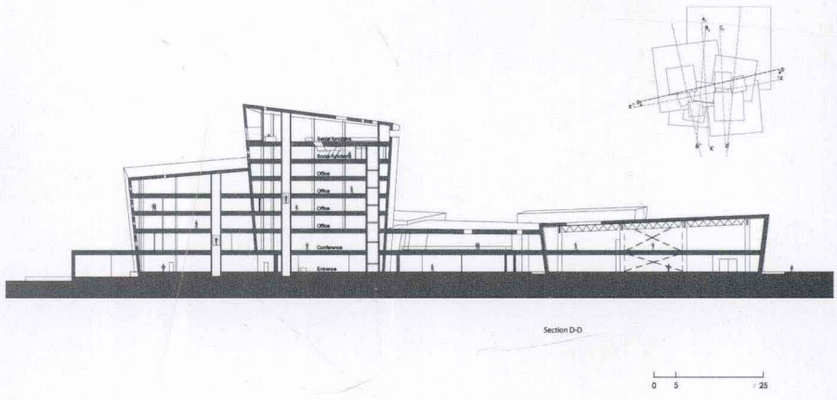
This climate-neutral Center will showcase the eco-cycle model of the Caofeidian Eco-City; the building's construction and function will demonstrate both applied and experimental technical solutions including small-scaled renewable energy production. Event spaces accommodate both permanent and temporary exhibitions while a business arena and expo will showcase innovative companies and products within the field of environmental technology and serve as a venue for the presentation and promotion of the Eco-City. Some of the municipality's administrative functions responsible for monitoring the ongoing construction of the Eco-City will also be housed in the building. This establishes the Center as a

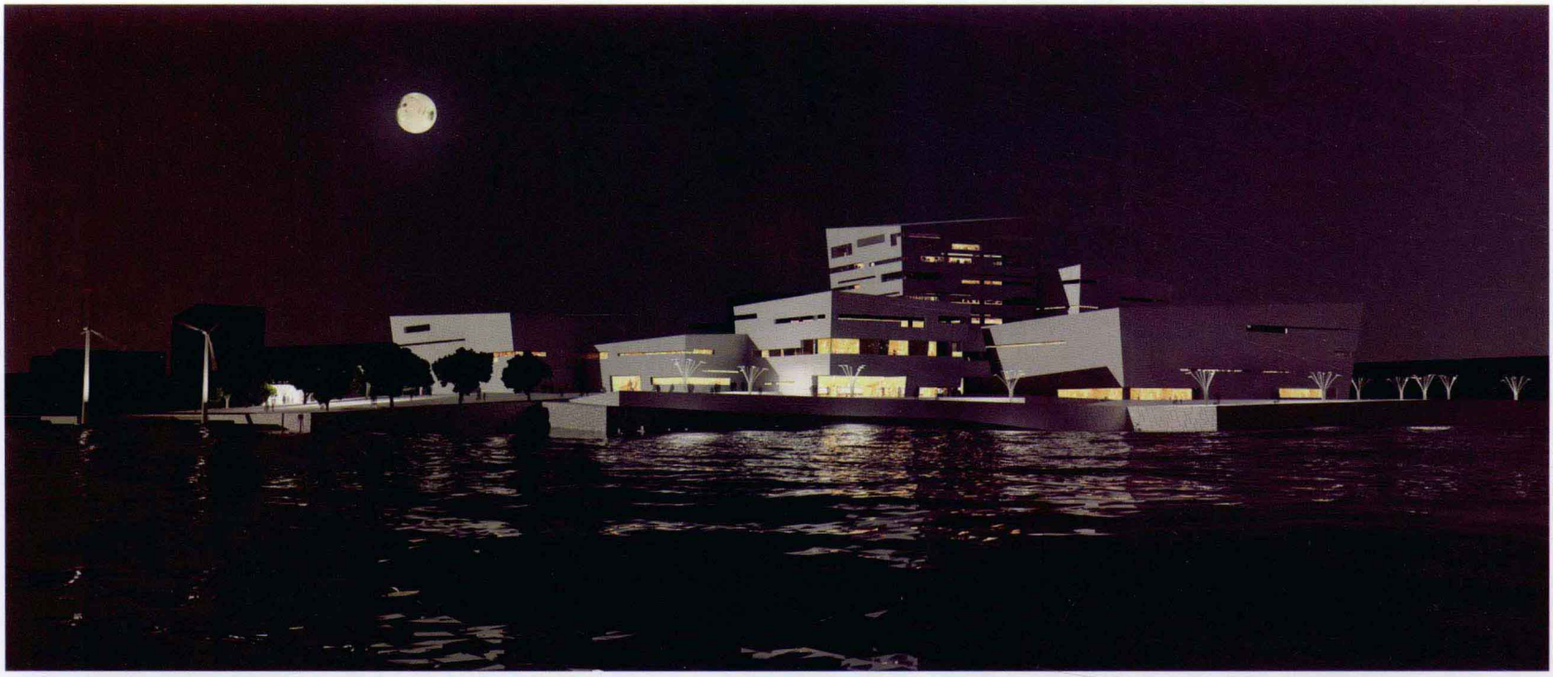












main node in a valuable feedback loop, where information, research and assessment of completed phases informs the City's future development.

Sustainability goals and objectives

The goal for the Center is to address all social, economic, and ecological factors impacting human health, safety, and quality of life, to create an arena for a continuous dialogue between international developments in sustainable practices and the Caofeidian community, and to embody the soul and character of the Caofeidian heritage.

Urban context

The Center is strategically located along the green diagonal axis in the Intermediate Area, along with other significant venues such as the administrative center, the cultural center and the civic center.

Set on a peninsula in the lagoon area of the Eco-City, the Sustainability Center engages both the diagonal city grid and the coast. The restaurant, café, public landscape, and shops will draw visitors day and night, encouraging activity along the quays and public parks. Pedestrian, bicycle and public transportation methods are encouraged through the strategic location of monorail, bus station and bicycle parking adjacent to the Center.

Conceptual idea

Local salt production, with its references to both the history of the site and the physical location of the Center on the edge of the sea, provides inspiration. The geometric shape, and clustered formation of salt crystals also underlie the conceptual foundation for the Sustainability Center and indeed the entire Caofeidian Eco-City. Just as salt crystals join and divide, gradually spreading and growing, the Eco-City will develop outwards from the Sustainability Center and the core area around it. Just as salt is traditionally formed into mounds, rising from pools of seawater, the context for the Center and its surrounding landscape forms. The building volumes are clustered to adapt to the local conditions of wind and sun, creating sheltered spaces and a human scale.

Architectural character

The unique silhouette and sculptural appearance of the Crystalline Building, inspired by the behaviour and geometry

of salt crystals, becomes a focal point of the harbour with its open, inviting and architecturally distinct form.

Crystalline's clustered volumes rest on clean horizontal planes. Some clusters appear to rise from planes of shallow water, their volumes and tilted roof —planes mirrored on the reflective surface. Their facades and skylights evoke a light and crystalline character with the use of light natural stone cladding and irregularly placed horizontal openings.

Clustered, varying spatial volumes create dynamic, sheltered and human-scale spaces experienced both inside and outside the building. Two courtyards formed by the juxtaposition of the volumes are designed to help regulate the temperature of the building.

Organisation/ Function

Each interior function is represented by a unique building volume and composition. The size, shape and character of the volumes adapt according to considerations of daylight, views, microclimate, roof height, and use.

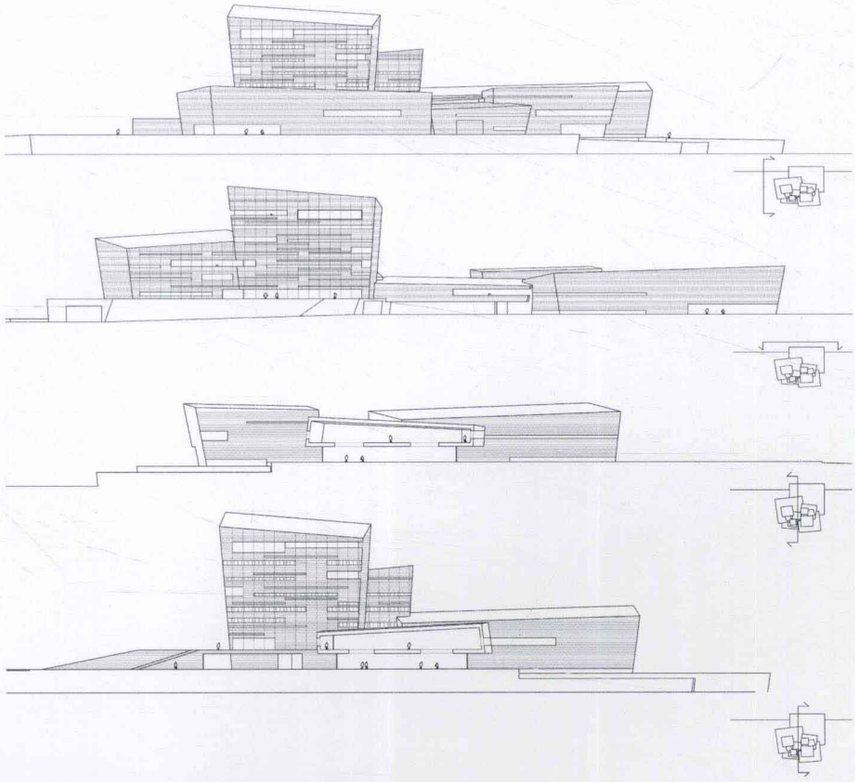
The building's entry plaza extends beneath a lifted crystal volume into the main lobby, capturing sea views. The lobby is approachable from both the entry plaza and the quayside.

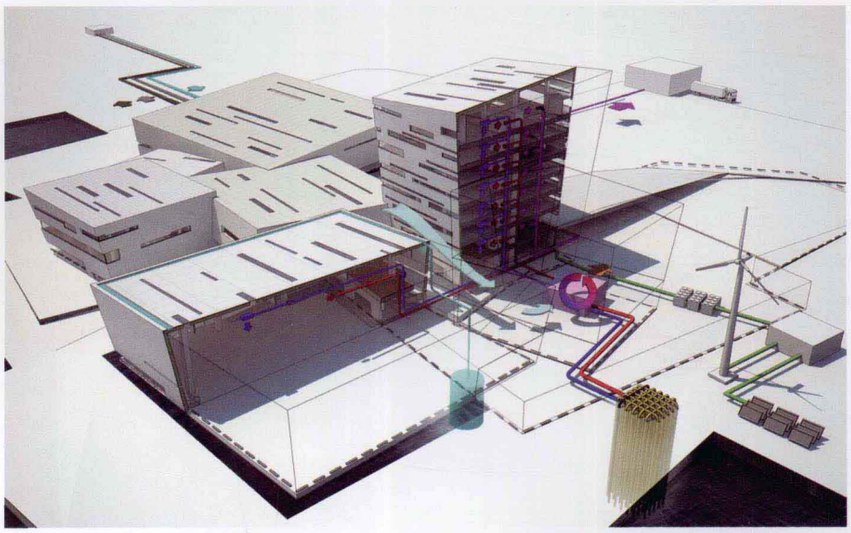
The two main exhibition halls are accessed directly from the main entrance lobby. The first contains the Multi-Media Hall and models of the Eco-City. The second contains an exhibition of sustainable technologies. Both exhibition spaces are large, flexible, and lit by skylights. Horizontal openings in the facades afford views to the landscape.

The restaurant, easily accessed from both the lobby and the outdoor public entrance, offers an open space ground floor with café and bar.

The higher building volumes containing offices and archives are accessed to the east of the main entrance lobby. Central light wells ensure adequate daylight. Geological conditions prevent basement structures; as an alternative, office and archive volumes sit on a common podium containing parking, mechanical facilities and delivery access. This allows the building to maintain a close connection to the boardwalk, thus avoiding high quay edges at the sea.

The building is organized to encourage intuitive navigation and spontaneous interaction, creating multi-use interior spaces to allow for various scales of use. The dynamic, modular form of the building allows for new volumes to be constructed in the future, maximizing the flexibility of the





complex.

Interior design

The interior design is inspired by the Tangshan culture and local natural ecosystems: delta, salt wetlands, and heather fields. Bird and sea life lend inspiration to patterns and textiles, as do the masks and colours of the Chinese opera, traditional Chinese textiles and wallpapers, and a long local history of fine porcelain production. Filtering these local patterns and colours through a Scandinavian design philosophy marries simplicity with the richness and beauty of the Chinese heritage, creating a unique interior atmosphere.

Landscape architecture

Three main goals inspire the landscape architectural design for the twelve hectares surrounding the Sustainability Center: prioritize water conservation, showcase sustainable technologies appropriate to Caofeidian ecosystems, and create a world-class public space.

Fresh water is a finite resource. Caofeidian, a coastal city in a relatively arid region, will be designed with systems in place to enable the conservation and recycling of fresh water. The Sustainability Center will lead by example, capitalizing on the value of grey water, stormwater, and saltwater to alleviate fresh water demands. Dew-catchers collect water from the air, edible plants are nourished with salt water, and grey water from the building is rerouted and cleansed for use in the landscape.

There are three special ecosystems along the coast of Caofeidian; the Sustainability Center's landscape strives to demonstrate, through stylized forms, their function and appearance.

The first is the intertidal zone where molluscs and other aquatic animals live in shallow waters, mudflats attract migratory birds and salt marsh species sculpt the sand into protective dunes. The second is the river itself, with riparian flora and fauna. The third is the individual and collective chain of tidally influenced wetlands upstream, brackish marshes, and saltwater estuarine habitat. Each of these is represented in the design, making the landscape a teaching tool rooted in the context of place.

While the landscape supports exhibition space, demonstration areas, and the Caofeidian ecosystems, it also showcases the building and provides visitors with a world-class public space. The large space in which the building rests functions as an exterior extension of the building, allowing growing and colliding "crystals"to flow between inside and outside. The esplanade, crystalline pools, overlook, water stairs, and marina provide a welcome respite from the bustle of the city.

A climate neutral building

An objective of the Center is to demonstrate how a climate