会刊

国际城市规划与设计工作站 2009年3月14-28日

建设生态健康之城葫芦岛

Session Book 14th - 28th march 2009

International Workshop of Urban Design

DESIGNING AN ECO-CITY PROPOSAL FOR HULUDAO CHINA

les ateliers
maîtrise d'œuvre urbaine

TONGJI UNIVERSITY
CAUP

HULUDAO CHINA

CSTB
le futur en construction

CORNELL UNIVERSITY
FOUNDED A.D. 1865

MINES ParisTech

Liberté · Égalité · Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DE L'ÉCONOMIE DES FINANCES ET DE L'INDUSTRIE

aftrp
la ville en perspective

VEOLIA
ENVIRONNEMENT

epad

工作站介绍

这一会刊展示了2009年3月14日至3月28日在中国葫芦岛举办的城市设计国际工作站的主要成果。本次工作站的主题是：“葫芦岛生态城市设计”。

本次工作站由同济大学建筑与城市规划学院(CAUP)和法国建筑科技中心(CSTB)国际城市形态实验室主办，旨在探讨城市形态对中国生态城市发展的影响，并使这一领域的研究更上一个台阶。

工作站的组织与协调工作由Les Ateliers负责。Les Ateliers是一个法国的无政府非盈利组织，是一个由城市规划设计相关专业的业内人士、大学与决策者组成的国际网络。自1982年成立以来，他们已经在城市设计的各种挑战上取得了丰硕的成果。

为了更有针对性地解决设计规划中产生的问题，同济大学建筑与城市规划学院(CAUP)和法国建筑科技中心(CSTB)邀请了两个科技合作伙伴，美国康奈尔大学的一组城市设计师和Mines ParisTech国际环境管理高级硕士工程师，以此为设计师们提供更多技术支持。

Introduction

This document presents the outputs of an international workshop of Planning and Urban Design that was held in Huludao in China, from March 14th to March 28th 2009, on the theme: “Designing an Eco-City, Proposal for Huludao”.

This workshop is a step forward in the research program led by the College of Architecture and Urban Planning of Tongji University in Shanghai (CAUP) and the International Urban Morphologies Laboratory of the French Scientific and Technical Building Centre (CSTB) on the impact of Urban Morphology in the development of Chinese Eco-cities.

The organization and coordination of this workshop is insured by Les Ateliers, a French non-profit organization animating an international network of professionals, universities and decision makers related to urban planning and design, which has been developing since 1982 a method of collective production dedicated to address urban challenges.

To face the specific issue of designing proposals for an Eco-City in Huludao, CAUP and CTSB proposed to associate to this workshop 2 scientific partners and thus beneficiate from their support: a group of urban designers from Cornell Univeristy – USA, and a group of environmental engineers from Les Mines ParisTech.

Document produced by Les Ateliers.
contact@ateliers.org

目录

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LES ATELIERS 简介

les ateliers 是一个非营利无政府组织。它是一个汇集了致力于城市规划、发展与设计的高校与专业人士的国际网络。

自1982年以来，les ateliers 已与城市，州或地区的当地政府权威共同选择主题组织学生和专业人士的国际联合设计工作站活动。它聚集了来自五湖四海不同国籍不同专业的参与者，包括景观设计师，建筑师，工程师，经济学家等等，使他们组成不同的团队进行合作。在工作站结束的时候，团队将向一个与地方政府官员和国际专家组成的国际评审组展示他们的项目成果。

每一次工作站都提出一些新颖革新的城市发展提议，由评审团成员做出评价并在工作站结束的四个月后合编出版一本综合汇报文本。对于所有参与者而言，无论他们是当地的还是国际的，这些工作站也是一种自身锻炼的机会。

起初，les ateliers 主要专注于在法国大巴黎地区的规划研究。随着我们在亚洲举办越来越多的工作站，我们在亚洲城市的规划研究方面也不断地积累着经验。（我们在亚洲地区已举办过十次工作站，包括河内、 东京、清莱、 广州，、上海、胡志明、金边、An Giang、Can Gio和曼谷）。近期，les ateliers 将他们丰硕的成果更加多元化发展，结合了环地中海地区（卡萨布兰卡、马赛和埃及亚历山大）和南美地区（贝宁，塞内加尔和巴西）的项目。

近期项目

2008	曼谷 - 泰国	河流城市曼谷
2008	赛尔奇蓬图瓦斯- 法国	城市环境中的大型基础设施建设
2007	巴黎机场 - 法国	走向机场都会
2007	An Giang - 越南	湄公河三角洲的发展
2007	马赛 - 法国	港口区域的发展 (160 Ha)
2006	巴黎北部 - 法国	城市再生，高密度化与综合性大都会
2006	卡萨布兰卡 -摩洛哥	城市项目——城中心的老机场 (450 公顷)
2005	Can Gio -越南	一个崭新的生态城市
2005	萨克雷 - 法国	大都会地区的高科技竞争力
2005	Porto Novo - 贝宁	非洲一个首都城市的可识别性与发展

About Les Ateliers

les ateliers is a non-governmental organization that gathers universities, decision makers and professionals dedicated to planning, development and urban design.

Since 1982, les ateliers has been organizing international workshops on topics defined together with local authorities for city or regional planning. The method consists in gathering students or professionals of different nationalities and different specializations (landscape designers, architects, engineers, economists...), and make them work in different teams that finally present their proposals to an international jury composed of local authorities and international experts.

Each workshop offers to local authorities new and innovative urban development proposals, assessed by the members of the jury and transcribed into a synthesis document. It is an opportunity for all local decision makers to discuss specific urban issues and planning strategies without having to commit themselves. These workshops are also a unique source of training for all the participants, whether they be local or international experts.

At the beginning, les ateliers focused on planning issues for the Paris Ile de France Region. Then, they developed a very high knowledge in Asia (we held 10 workshops there: Tokyo, Doi Tung, Canton, Shanghai, Ho Chi Minh, An Giang, Can Gio, Phnom Penh, Bangkok) and recently diversified their fruitful work combining workshops along the Mediterranean Sea (Casablanca, Marseille and Alexandria of Egypt) and in Africa and South America (Benin, Senegal and Brasil).

RECENT EXPERIENCE

2008	Bangkok - Thailand	Bangkok River City
2008	Cergy-Pontoise- France	Great infrastructures in an urban environment
2007	Paris Airports - France	Towards an Aeropolis?
2007	An Giang - Vietnam	Water opportunities and constraints
2007	Marseille - France	Development of the Harbor Area (160 Ha)
2006	North Paris - France	Urban Renewal, integration and densification
2006	Casablanca - Morocco	Proposals for the Innercity Former Airport (450 ha)
2005	Can Gio - Vietnam	A New Ecological City
2005	Saclay - France	A territory of high scientific competitiveness
2005	Porto Novo - Benin	Identity and Development of an African Capital City

前言

葫芦岛生态城市设计

城市形态和能源效率
中国生态城市可持续性的科学设计

在法国财政部FASEP项目的赞助下，Cergy城市研究小组在CSTB（法国建筑科学技术中心）和同济大学建筑与城市规划学院的合作框架内，取得了很多独树一帜的成果。FASEP项目的城市研究旨在和中国的建设者共同探求可持续城市的范例，以适应这个具有人类历史上前所未有的速度和广度的城市化过程。在同济大学建筑与城市规划学院院长吴志强教授的倡导下，这个项目已经开始进行并得到葫芦岛市长的认同。整体项目第一步实施已经在葫芦岛展开，其目标是创建一个零碳排放、零硫排放的城市。

我已经展示了城市规划、环境科学和城市形态设计的有力组合。它不仅在生态城市的设计上，也在可持续设计的整体实践上实现了突破。

城市形态能成倍的影响城市能源效率——这个影响因素可以使中国城市逐渐转变成绿色健康的城市。三组世界高水平的城市研究人员将联合同济大学建筑与城市规划学院的学生参与该项目，其中包括两组来自法国国立巴黎矿业高等学院（Les Mines Paristech）的能源环境工程师以及一组来自美国康乃尔（Cornell）大学的学生，他们将共同探索中国高能源效率的最佳城市形态。这个项目将为葫芦岛甚至中国北方地区提供一个向健康绿色城市转变的独一无二的机遇。

在CSTB的城市形态实验室中，我们坚信只有将环境科学和对城市形态的环境效能进行量化的方法结合起来，才能实现可持续环境的设计。

这种科学的方法贯穿城市规划师团队的工作，而丝毫无损于他们的自由度和创造力，并得出了葫芦岛生态城市的三种不同的蓝图。巴黎矿业高等学院的研究小组详尽评价了葫芦岛的环境问题并找到新的解决办法。7家公司(AMINA compléter)来到葫芦岛向设计团队介绍他们的建筑系统、产品和材料。康乃尔大学的研究小组揭示了传统中国城市中网格形态的规模和组织之间的微妙关系，例如唐代都城长安和葫芦岛附近的兴城古城，以及墨尔本市中心的网格状街道规划模式。这表明了中国城市可以发展成更加国际化的现代城市而同时保留其独特的中国文化标志性。并且，这种城市形态方面独特的传统和现代的结合将会带来环境方面的高效性：它阻碍了冬季的寒风而将最大化获取太阳能（减少了供暖需求并提高了可再生的太阳能的使用）

因此，通过设计高效的城市形态可以将葫芦岛打造成中国最先锋的生态城市之一。过去的经验表明在这样的城市进行投资具有更高的价值和更大的回报。下一步的工作是进行选址并开始建设。我们衷心希望这些研究的进一步深化和建设工作的开展将把葫芦岛和中国北方地区带到世界生态城市的前沿。

Serge Salat
工作站项目技术负责人

Foreword

Designing an Ecocity in Hu Lu Dao

Urban Morphology and Energy Efficiency
Science and Design informing Sustainability of Chinese Ecocities

Partly financed by a FASEP project of the French Ministry of Finance in the framework of a cooperation between CSTB (French Scientific Centre for Building Science) and Tongji University CAUP, this “Atelier International de Maîtrise d’Oeuvre Urbaine” – international workshop of planning and urban design - is exceptional in many respects. The overall urban part of the FASEP project aims at developing with Chinese partners sustainable urban prototypes for the urbanization of China, which is taking place at an unprecedented pace and amplitude in the history of mankind. At the demand of Pr Wu Zhiqiang, Dean of Tongji CAUP, it has been proposed and accepted by the mayor of Hu Lu Dao, M. Sun Zhaolin, that the first application of this overall project take place in Hu Lu Dao with the objective to create a zero carbon, zero sulfur city.

This workshop shows the powerful combination of urban planning, environmental sciences and urban morphology design. It constitutes a catalytic and break-through project not only in the design of Eco-cities, but also in the practice of sustainable design in general.

Urban Morphology has the potential to impact on a city’s energy performance by a factor of two – an influential factor for a sustainable transition towards green and healthy cities in China. By putting together 3 teams of high level international urban practitioners and Tongji CAUP students, with a group of Les Mines Paristech Energy and Environmental Engineers and a team of students of Cornell University devoted to find optimal solutions in terms of energy-efficient urban forms in China, this workshop offers Hu Lu Dao and Northern China in general the unique opportunity to move towards healthy and green cities.

At CSTB Urban Morphology Laboratory, we strongly believe that only the combination of environmental sciences, with a quantifiable evaluation of city forms in terms of their environmental performance, can inform the design of more sustainable environments.

This scientific approach has informed the work of the urban planners’ teams without limiting their freedom and creativity, resulting into 3 different schemes for a successful and vibrant new Eco-city in Hu Lu Dao. The work of the Les Mines Paristech team has allowed a substantial assessment of the environmental issues in Hu Lu Dao and the finding of new solutions. Seven industrial companies (Iosis, AREP, Aereco, Eneovia, Legrand, Aldes and CIAT) came to Hu Lu Dao to introduce their systems, products and materials to the design teams. The work done by the Cornell team has revealed a fascinating coincidence between the sizing and organization of traditional Chinese city grids such as the Chang’An capital of the Tang dynasty or the nearby ancient city of Xing Cheng and the Hoddle Grid in the centre of Melbourne. It has thus shown that Chinese cities have the potential to grow into the modernity of the more vibrant and cosmopolitan international cities while keeping their unique Chinese identity. Furthermore, this unique blend of tradition and modernity in city forms is highly efficient in environmental terms: it blocks the harsh and cold winter winds while maximizing the solar potential of the city (reducing the need for heating and increasing the resources in renewable solar energy).

Thus our work on designing city form in highly efficient ways has the potential to create in Hu Lu Dao one of the pioneering Eco-cities in China. Experience proves that investing in such cities provides higher value and a high return on investment in the long run. The next steps will be its implementation and the start of construction. We all hope that the further development of these studies and the start of construction will bring Hu Lu Dao and Northern China at the forefront of the world Eco-cities.

Serge Salat
Scientific Director of the Workshop

主要合作伙伴

组织合作伙伴

同济大学建筑与城市规划学院
同济大学建筑与城市规划学院成立于50年代，由建筑系、城市规划系、艺术设计系、景观系及多个研究机构组成。生态城市是其主要研究领域之一。

法国科学与技术建设中心(**CSTB)**
法国科学与技术建设中心成立于1947年。它是一个法国政府机构，主要致力于建筑与住房行业的研究项目实施，以提高建筑的舒适度与安全性。

Les Ateliers
Les Atelier是一个非营利机构，由与城市规划设计相关的大学、专家和决策者所构成的国际网络组成。从1982年起，它组织举办了大量学生与专家工作坊。

葫芦岛市
葫芦岛是辽宁省西南部辖市。它是辽西通道的两个重要城市之一（另一个是锦州）。葫芦岛市建立于1989年（最初叫锦西，1994年改名葫芦岛），面积10415平方公里，人口273万（2004年）。

科技合作伙伴

康奈尔大学
康奈尔大学是美国著名长青藤联校之一。
同时作为一所私立大学和纽约州赠地大学，康奈尔在教学和科研上均有着多元化的特点。其伊萨卡校区有来自美国各州以及120个国家的两万名学生就读。在全校11个本科，研究生和职业学院中共开设有四千门课程。

国际环境管理硕士
国际环境管理硕士，作为ISIGE（巴黎Supérieure des Mines学院工程与环境管理机构）与清华大学共同设立的双学位，为年轻工程师提供多学科培养和环境管理领域的国际化视野。

赞助商

AFTRP
AFTRP是个1962年由联邦政府建立的公共设施公司。它的经营范围遍布整个大巴黎地区。自2003年起，它就成为Les Ateliers的主要合作伙伴。

Veolia 环境
Veolia环境是国际领先的环境服务商，经营范围涉及水、环境服务、能源服务和交通运输。它为此次工作的站生态城市研究方面提供了大量的经济与技术支持。

EPAD
这是一个国家机构，主要负责欧洲拉德芳斯商务中心的开发。出于对国际项目开发的热衷，它们赞助了此次Les Ateliers 工作站。

法国经济工业部
法国经济工业部长期投资赞助生态城市的研究。因此它们成为了此次城市设计工作站的赞助商。

Partners

Organizing partners

Tongji CAUP
The College of Architecture and Urban Planning of Tongji University - Shanghai was created in the 1950. It encompasses departments of Architecture, Urban Planning, Industrial Design, Landscape Science and Tourism, as well as several research institutes. It is at the origin of the project of this workshop and takes part to its Scientific Direction.

CSTB
The Scientific and Technical Building Center is a French governmental organization aiming at carrying out research programs for building and housing trade, in order to improve well-being and safety in buildings. It is also at the origin of the project of this workshop and takes part to its Scientific Direction.

Les Ateliers
Les Ateliers is an international network of universities, professionals and decision-makers related to Urban Planning and Design, organizing workshops for students and professionals since 1982. It is in charge of the general organization of this workshop, using the original method of collective production that it has been developing since 1982.

Huludao
Huludao is a prefecture-level city in the Liaoning Province in China. Founded as a municipality in 1989 (first called Jinxi□then renamed Huludao in 1994), Huludao has a total area of 10,000 km² and a population of 2.7 million up to 2004. The Municipality is hosting the workshop and also participated to the definition of the local expectations.

Scientific contribution

Cornell University
Both a private university and the land-grant institution of New York State, Cornell University is the most educationally diverse member of the Ivy League in the United States. Two faculty members and five students from Cornell design and environmental analysis, landscape architecture, city and regional planning, and civil and environmental engineering participate in this workshop as the Urban Morphology Group.

Les Mines Post-Master in Environmental Management
The International Post-Master in Environmental Management is a double-degree between the Ecole Supérieure des Mines de Paris and Tsinghua University – Beijing. It provides young engineers with a multidisciplinary training and an international outlook on the field of environmental management. The 2009 students participated to the workshop as the Environment and Energy Group.

Supporting partners

AFTRP
The AFTRP is a public utility company created by the federal government in 1962. Its territorial jurisdiction covers the entire Ile-de-France region. Since 2003, it has been the main partner of Les Ateliers.

Veolia Environnement
Veolia Environnement is the world leader in environmental services: water, environmental services, energy services and passenger transportation. It sponsored this workshop with a view to supporting research on eco-cities.

EPAD
This State Agency is in charge of developing the prime business quarter in Europe : La Défense. It is interested in international action and thus supports Les Ateliers.

French Ministry of Finance and Industry
The French Ministry of Finance and Industry invests on research about Eco-Cities. Therefore it is taking part to this workshop as a financial support.

工作程序

这一工作站汇集了来自五湖四海，有着不同职业背景的将近60位参与者，其中有Les Ateliers 层层筛选出的专业人士，美国康奈尔大学与中国同济大学的学生以及国际环境管理高级硕士的工程师。

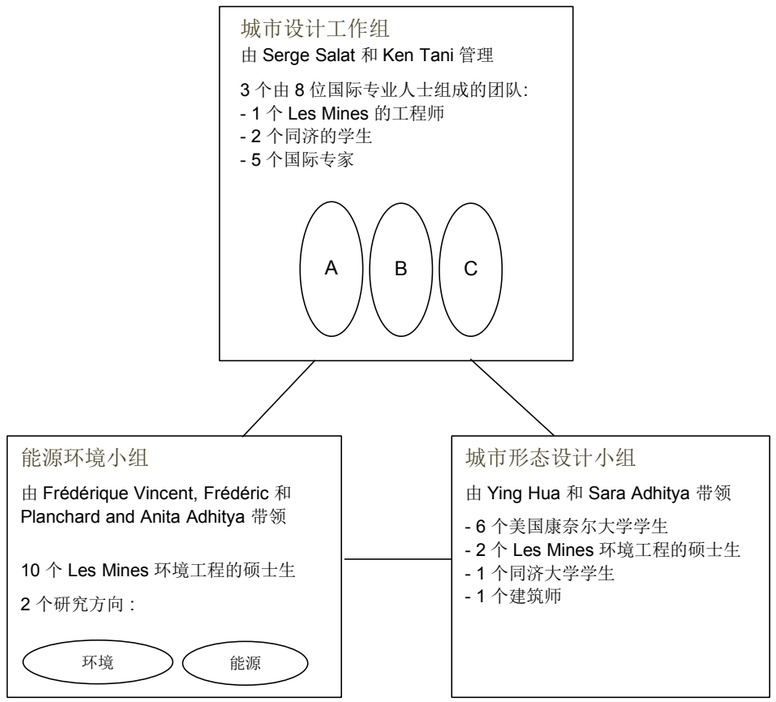
所有的参与者被精心编入五个独立的工作小组：

- 3个城市设计工作小组 他们的任务是对葫芦岛生态城市进行总体的战略规划设计。规划基于对实际情况、城市形态、规划目标、环境和能源问题的深入理解，并通过与其他小组的交流获得数据与建议。

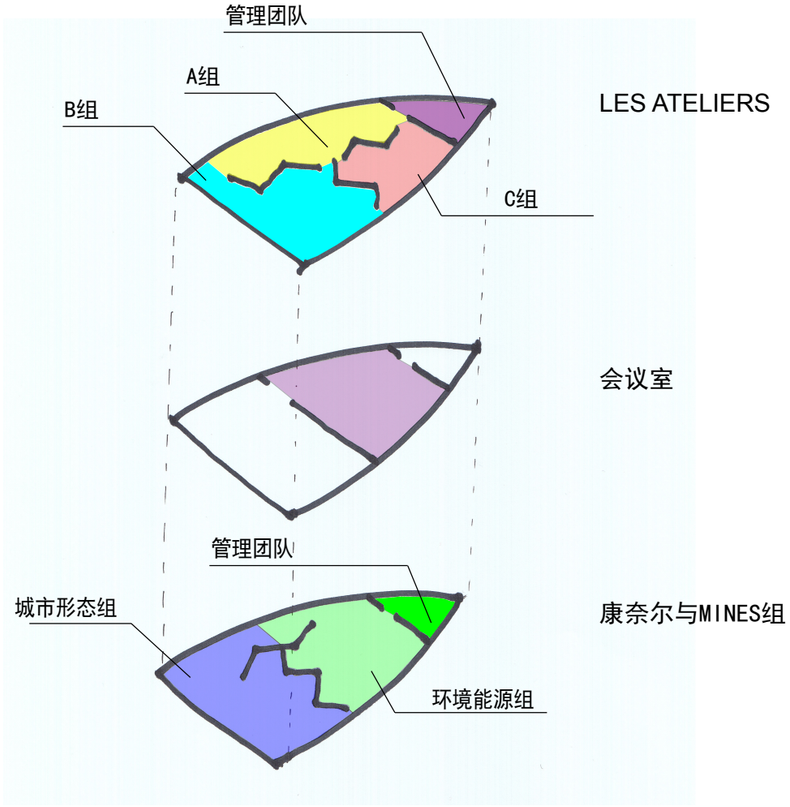
- 城市形态设计小组 主要由康奈尔大学学生进行研究，他们的目标是找到一个适合中国的可持续发展城市原型。

- 环境能源研究小组 由来自国际环境管理高级硕士的工程师负责，他们将会对城市设计工作小组提供技术支持，如基地环境分析；能源、废弃物、水、健康、地方生态与共生研究；提供高效的生态技术及建议。

组间关系



工作空间安排



日程安排

	城市设计工作组	能源环境小组	城市形态设计小组	评审
周六 14	到达葫芦岛，欢迎晚宴			
周日 15	开幕式，工作站简介，基地考察			
	参与者工作汇报	工作	工作	
周一 16	讲座，会议			
	宣布分组	数据分析	工作	
周二 17	工作	数据分析	工作	
	可持续发展技术展示			
周三 18	确定设计概念	数据分析	工作	
周四 19	工作	数据分析	工作	
周五 20	3 个小组设计概念汇报	潜在环境影响报告	工作汇报	
	工作	工作	工作	
周六 21	工作	工作-为城市设计工作小组提供技术支持	工作-为城市设计工作小组提供技术支持	
	派对			
周日 22	休息，参观			
周一 23	工作	工作-为城市设计工作小组提供技术支持	工作-为城市设计工作小组提供技术支持	
周二 24	工作	工作-为城市设计工作小组提供技术支持	工作-为城市设计工作小组提供技术支持	
周三 25	工作 23:00 提交 A3 成果	准备环境评估报告	工作-为城市设计工作小组提供技术支持	到达葫芦岛，欢迎晚宴
周四 26	成果汇报排练 14:00 提交 A0 展板	准备环境评估报告	3 个设计成果的形态评估	参观，介绍，讨论
周五 27	3 个设计成果汇报	准备环境评估报告	3 个设计成果的形态评估	
	结果评定，闭幕式			评定结果宣布
周六 28	退房，离开			
后期工作			3 个项目的深化设计	成果报告

Process of the Workshop

The workshop took place at the Huludao's Planning Department building. The first floor was divided in two aspaces, one for the Energy & Environment Group, and the
other for the Cornell Urban Morphology Group. The second floor was used for the intergroup meetings. At the third floor were the 3 teams of Les Ateliers.

All participants have been left free to move between all spaces. Some data has been provided previous to the workshop, some other has been gathered at the start. Collecting relevant data has been a challenge. Great effort has been done by Tongji University to help all in finding further missing information. A small library with books relevant to the subject have been set in the third floor.

GENERAL SCHEDULE

March 2009	**Teams**
Sat 14	Arrival in Huludao / Welcome dinner at the hotel
Sun 15	Opening speeches – Management Brief – Visit – Individual presentations
Mon 16	Lectures – Conferences – Team Composition
Tue 17	Group Work - Presentation of sustainable technologies
Wed 18	Group work – Intergroup meeting
Thu 19	Group Work
Fri 20	Exchange Forum with intermediate presentations - Special Ateliers Dinner
Sat 21	Group Work – Intergroup meeting
Sun 22	Day off / free visits
Mon 23	Group Work – Intergroup meeting
Tue 24	Group Work
Wed 25	Group Work - 23h : Deadline for A3 delivery – Arrival of jury members
Thu 26	14h: Deadline for A0 delivery - Rehearsal of oral presentation – Visit and lectures for jury members
Fri 27	Final presentations to the international jury - Jury deliberation - Closing ceremony

GROUPS INTERACTION

Urban design workshop

Under management of **Serge Salat** and **Ken Tani**

3 international teams of 8 participants:
- 1 engineer from Les Mines
- 2 Tongji students
- 5 international experts

A B C

Energy & Environment Team

Under management of **Frédérique Vincent, Frédéric Planchard** and **Anita Adhitya**

10 environmental engineers from Post Master Les Mines Paritech

2 groups :

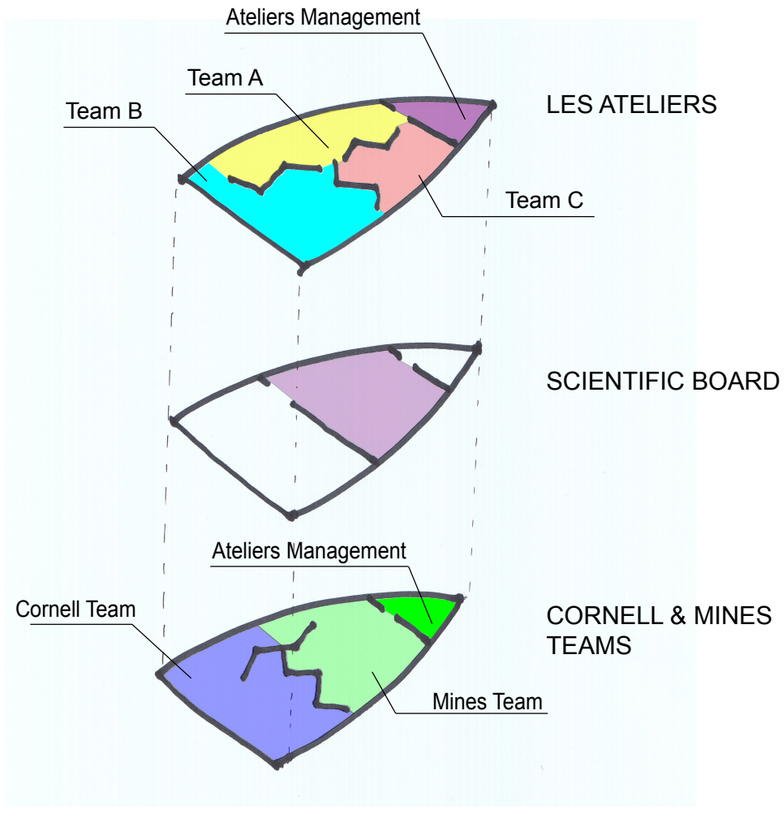
Environment Energy

Morphology Design Team

Under management of **Ying Hua** and **Sara Adhitya**

- 6 Urban Designers from Cornell University USA
- 2 environmental engineers from Post Master Les Mines Paritech
- 1 Tongji student
- 1 architect

LAYOUT OF WORKSHOP ROOMS



第一部分 工作站主题介绍

PART 1 Presentation of the topic

工作站任务简介

各组总体任务

本次工作站的目标是为中国生态城市的发展中最棘手的随着人口急剧增长出现的环境污染与健康问题提出建设性的建议，设计一个利用生态、科学、现代绿色技术和可再生能源降低能耗、节约用地的城市，提高建筑的能源效率以解决公共交通、水、废弃物管理和食物生产的关键问题，并对缓解全球变暖危机做出贡献。

针对葫芦岛，规划要考虑到相当程度的有害物质排放和水污染，并兼顾一系列动态的的城市功能与生活方式，例如人口增长和与日俱增的从郊区向海岸迁移的居民。这一发展还将帮助当地政府实现将葫芦岛建成国内外闻名的海滨度假胜地的目标。

The Brief

Common brief among all teams

The ambition of this workshop is to make proposals for the development of a Chinese eco-city that tackles the most urgent problems of pollution and health for a rapidly growing population. A city that uses ecology, science, modern clean technology and renewable energies to reduce energy consumption and land use, to improve energy-efficiency of buildings to solve the crucial questions of public transport, water and waste management, food production, and contribute to the overall mitigation of the problem of global warming.

More specifically within the context of Huludao, the proposals will have to take into consideration the high level of harmful emissions and water contamination, and include a whole range of functions and types of living as the population grows and migration from the countryside to the coasts will increase. This development should also help the objective of the local government to develop Huludao as a sea resort for Chinese and international visitors.

问题：
对于葫芦岛来说如何最好地实现可持续发展？ （使命与期望）
怎样的城市形态与组织形式能降低城市发展对水与能源的需求？
葫芦岛能成为未来中国城市可持续发展的催化剂吗？

Questions:
What is the best sustainable solution for Huludao? Vocations and aspirations.
How can the form and the organisation of the city reduce water and energy needs?
Can Huludao be a catalyst for future sustainable urban development in China?

Brief for Les Ateliers teams

1. Define Functions/Uses/Area/Density/Population
2. Urban Morphology Strategy
3. Structure Framework/Land-Use Plan
4. Natural and Human Ecology
5. Energy Demand and Strategy.
6. Transport and Mobility
7. Understanding Resources and Materials. Waste and Recycling
8. Architecture and Urban Design / Build Massing and Form
9. Phasing

Les Ateliers城市设计团队任务简介

1. 定义功能/利用/区域/密度/人口
2. 城市形态设计原则
3. 组织功能结构/用地规划
4. 自然人文生态
5. 能源需求原则
6. 机动交通
7. 了解资源优势，废弃物回收利用
8. 建筑与城市设计 / 建造与形式
9. 分期建设

Brief for Les Mines-Paristech

The group of Mines-Paristech will focus on environmental and energy issues. They will study the natural ecosystem of Huludao, the environmental impacts of human activities and will propose innovative solutions for remediation, waste, water and energy management.
They will give support to the Ateliers and Cornell teams. Their work should lead on an environmental and energy perspective for eco-cities in China.”

Brief for Cornell

During this workshop, the Cornell University morphology team has worked on a prototypical plan for a future eco-city. This is based on a synthesis of traditional Chinese urban forms, sustainable urban design, and energy efficient urban morphology. The latter is defined as an urban form that optimizes passive energy and promotes economic and social growth through a careful manipulation of densities, block size and street sections.

在本次项目中，康奈尔大学城市形态小组主要研究了如何在中国当代建立可持续发展的城市原型。此原型是中国传统城市肌理，可持续发展的城市设计以及高效节能的城市形态的有机合成。后者是指一种通过控制密度，街区大小和街道断面来优化被动能源，促进经济和社会发展的城市形态。

葫芦岛概况

葫芦岛是辽宁省坐落在海滨的风景最美的县城之一。

辽宁省是中国第一批工业大省之一， 起初为日本殖民地，随后在1950-1960年期间工业又一次迅猛发展。近年，对于重工业的侧重成为当地一个负担，因为许多大型国营企业正经历着财务困难。

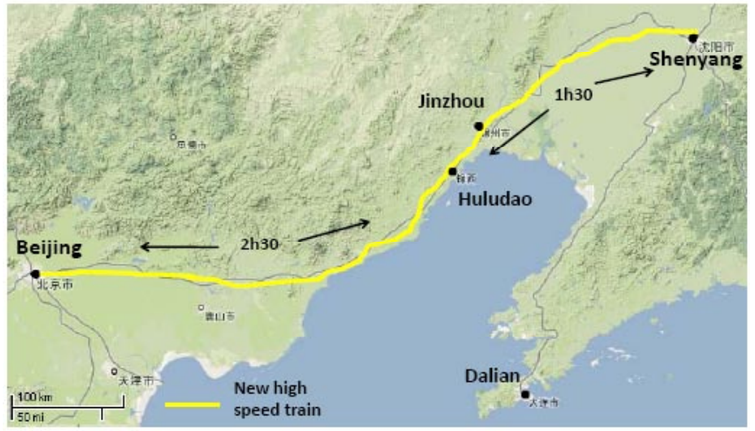
葫芦岛市区最初在1898年只是一个火车站，到1989年已有220万居民。近20年来，葫芦岛的人口迅速增长，至今已达6百万。人口的增长导致了空间上的扩张，以至于在不久的将来葫芦岛将与西南部相邻的兴城连成一片。

作为渤海经济圈重要的组成部分，葫芦岛连接了经济发达的京津塘地区与辽东半岛经济区。这是中国的重工业基地之一，包括石油化工，冶金，建材，机械，造船与发电行业。葫芦岛的乡村地区种植了种类丰富的农作物，并拥有国内最大的果园。此外，当地的渔业，海水渔业和水产养殖业发达。

Description of Huludao

Hu Lu Dao is a prefecture-city situated near one of the most beautiful coastal landscapes, in the Liaoning Province.

Liaoning was one of the first provinces in China to industrialize, first under Japanese occupation, and then even more in the 1950s and 1960s. In recent years this early focus on heavy industry has become a liability, as many of the large state-run enterprises have experienced economic difficulties.
Hu Lu Dao City started as a small train station in 1898, and counted in 1989 a population of 220,000 inhabitants. In the last 20 years the city population has grown very quickly to reach 600,000 inhabitants. This growth translates into spatial expansion which will have the city probably join up the neighbouring town of XingCheng in the near future.
As an important part of Bohai Economic Rim, Hu Lu Dao links the developed Jing-Jin-Tang and Liaodong Peninsula Economic Zone together. It is one of the country's heavy industry bases: petrochemical industry, metallurgy, building materials, machinery, ship building, and power generation industries. The rural areas of the prefecture produce a variety of crops and house one of the biggest single orchards in China. The fishing industry, sea-fishing and aquaculture, is also very developped.



高速铁路 High-Speed Train Connection


工业城市葫芦岛 Huludao : An Industrial City


相邻的古城：兴城 The Old Nearby City of Xingcheng

生态城市设计基地

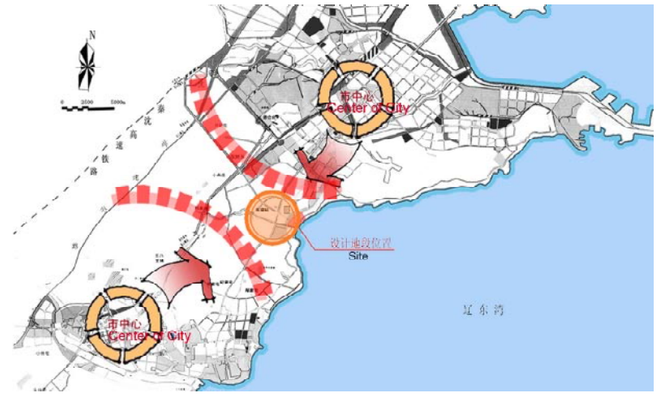
基地坐落在在葫芦岛市区的南侧，龙湾新区的延伸片区。他即将与南部的兴城连成一片。基地的西南部及北部环山，东面沿海。基地内部贯穿东西的月亮河是条季节性的河流，与其说是河流，更像是一条泄洪的渠道。龙湾大街连接基地南北两端，与之平行的还有一条较窄的滨海路和一条年代久远的铁轨。

基地内基本上都是荒地，两个小村庄居住的渔民与农民在土地上从事农渔业。一直以来，海岸附近的地区被用作水产养殖，但现在已被制止了。在基地的北端有一座油气分离工厂，他将依据规划被迁离基地以留出更多的发展用地。基地西部曾是一块工业用地，因此在将来有必要进行土壤整治。南部一座废弃的滑雪场说明这里曾经也企图发展旅游。

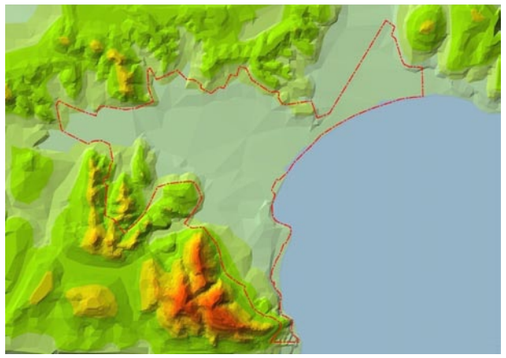
Proposed Site

The proposed site of 8km^2 is situated at the south of Huludao city, in the continuation of the new Longwan District. It is almost joining the neighbouring city of XingCheng. The site is surrounded by hills on its south, west and north sides and by the sea on its east side. The seasonal Moon River, which is more of a flood evacuation than a river, crosses the site from west to east. The site is crossed from north to south by the wide Longwan Boulevard and the narrower scenic coastal route, as well as an old railway line.

The site is almost a greenfield site, two small villages house fishermen and farmers cultivating most of the area. Until recently the area next to the beach was used for aquaculture but this has now ceased. At the northern tip of the site lies an oil and gas separation plant which will be moved to make room for the proposed development. There is a former industrial site at the west where remediation of the soil might be necessary in the future. An abandonned ski resort on the south testifies of former attempts to attract tourism in the area.



The site, halfway between Huludao City and XingCheng
基地在葫芦岛与兴城的中间



Topography of the site
基地地形

Beach of the site
东部313海岸

Site

Current Huludao

Towards XingCheng

0m 500m 1000m 2000m 5000m

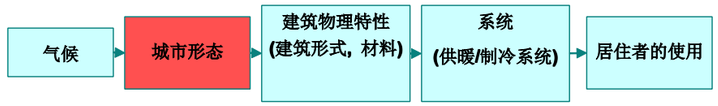
© 2007 Google

城市形态

城市形态和能源效率

特定城市肌理的能源效率可以归结为几个因素，例如建筑技术、能源系统、使用者的行为和城市形态。这些因素的复合作用会使得城市肌理的能效在最高和最低之间差距甚大。

通常建筑环境能源效率的研究往往关注于单个建筑，而城市形态对于减少能耗的潜力被忽略了。然而，我们的研究表明城市形态能成倍的影响能源效率——也就是说，将城市的碳足迹加倍或者减半——这个巨大的杠杆作用已不容忽视。

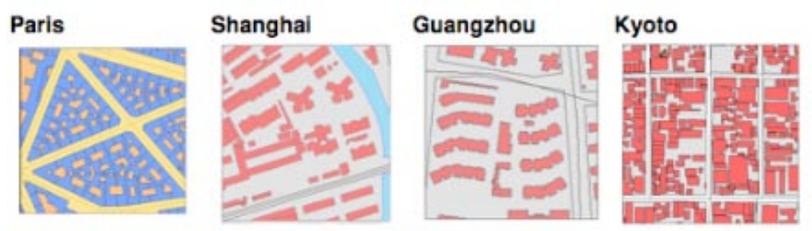


城市形态研究：结果意义深远

CSTB城市形态实验室、同济大学建筑与城市规划学院和香港大学的联合研究项目，通过分析与能源可持续使用最相关的因素：容积率、日光接收度和街道连续性，已经得出了一些初步的结论。

相比中国新发展的城市，香港和巴黎的容积率更高，这意味着空间得到了更有效的利用。中国内地的街道连续性较弱，导致交通引起的能耗增加。相反的，巴黎一些建筑物密集的老城区较少的日晒则能够平衡这种效果。城市设计方案和进一步深化将探讨土地使用和容积率优化的不同方法。

康乃尔大学的研究小组将在城市形态方面为城市规划师提供建议，他们将重新诠释中国传统城市的形态，以使其适应于现代使用，并对规划师提供的每个3D模型方案的能源效率进行初步评估。

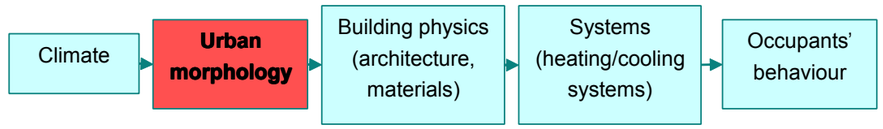


	Paris	Shanghai	Guangzhou	Kyoto
容积率 Floor Area Ratio	4,12	1,74	1,94	2,33
建筑密度 Built Density	65%	30%	23%	49%

Urban Morphology

Urban Morphology and Energy Performance

The energy performance of a particular city fabric can be attributed to several factors, such as building technology, energy-systems, people behaviour and urban morphology. The multiplication of these factors provides an indication of the energy difference between the least efficient and the most efficient classes of city fabric.
While the main focus of research in energy efficiency of the built environment is often limited to that of a single building, the potential for Urban Morphology to reduce energy consumption has been under-utilised. However, with our research showing that the urban morphology alone has an impact on energy performance of the order 2 - ie. the potential to halve or double a city's carbon footprint - it is a lever of change too large to ignore.



Urban Morphology Research: Results Thus Far

Some first conclusions through a joint research program with CSTB Urban Morphologies Laboratory, Tongji CAUP and Hong Kong University were drawn as to energy sustainability thanks to the most relevant parameters: FAR, solar admittance, street connectivity.

Higher FARs in Hong Kong and Paris than in Chinese new developments mean a more efficient use of the space. Weak street connectivity in China mainland also implies more energy consumption for transportation. On the other hand, low solar admittance in some packed old districts of Paris has counter effects, and the proposed Urban Design studio and its further development will explore different scenarios of land use and FAR optimization.

The Cornell Team will advise the urban planners on urban morphologies, they will reinterpret the traditional chinese city form to adapt it to modern use and give a first evaluation of the energy performance of each proposal based on outline 3D models prepared by the planners.

HK. North Point

Built-up area density = 19%

FAR = 3.1

Buildings height = mainly above 30 – 40 floors

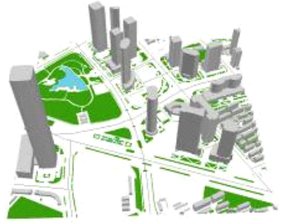
Old Paris

Built-up area density = 61%

FAR = 4.5

Buildings height = about 6 - 7 floors high

Shanghai, CBD



Built-up area density = 11%

FAR = 3.7

Buildings height = mainly abov 45 floors

当地期望

面向未来的可持续远景

未来的葫芦岛将是“面向东北亚的中国东北部的中心”，作为可持续领域的先进领导者，她的发展必将实现这个远景目标。葫芦岛将不仅大大减少能源的使用和碳排放，提高自然环境质量，也将为其居住者和参观者提供卓绝的生活品质，从而实现其健康城市目标和中国政府提出的“和谐发展”的重要目标。

面对激烈的地区和全球竞争，这样的开创性项目不仅将提高葫芦岛对居民和旅游者的吸引力，同时也会吸引更多的国内国际的投资者。生态城市的成功设计将对葫芦岛的经济发展起到推波助澜的积极作用。

该项目将帮助葫芦岛实现国家五年计划所设定的宏伟目标： 将GDP提高8％而能耗降低20％。新的生态城市应该是一个零碳排放和零硫排放的城市，这个问题在工业用煤普遍的中国东北部尤其严峻。城市规划者可以从同济大学进行的一项旨在保护能源、水、空气质量、材料和土地的研究中得到启发，该项研究已经应用于沈阳某个新城区。

对这个独特地域的预期目标

当地政府有切实的规划方法并认识到通常的摩天大楼可能不适合该地区的独特景观以及该城市的特性。对海岸线、山丘和季节性河流的考虑应该被仔细的纳入到方案中。这个城市可以通过学习其他滨水城市从而以最大程度挖掘其旅游潜力。

这个城市也将解决长期污染问题并探索如何将可再生能源纳入其能源系统中。这将提升这座目前还与重工业和军事活动紧密相连的城市的整体形象。

方案还必须考虑目前居民的需要，因此娱乐休闲的特性也将赋予这个地区。为此，一个大型体育馆的建筑设计竞赛已经启动。这个城市将有机会承办在辽宁举行的2013年全国运动会的赛事。

Local Expectations

A Vision for a Sustainable Future

The vision is for Hu Lu Dao to become “the centre of North-East China facing North-East Asia”, and its development as an innovative leader in sustainability will help to achieve this vision. Not only will it dramatically reduce energy usage and carbon emissions, and improve the quality of its natural environment, but in return will offer an outstanding quality of life to its inhabitants and visitors, realising the City of Hu Lu Dao’s vision of health and well□being, and the Chinese Government’s key aim for “harmonious development”.

In the face of fierce regional and global competition, such an innovative proposal will not only increase the attractiveness of Hu Lu Dao to inhabitants and tourists, but also to national and international investors. The successful design of an Eco-city can only boost Hu Lu Dao’s economy.

The proposal should help the city to reach the stringent targets set by the national 5-year-plan: increase the GDP by 8% while reducing by 20% the energy use. The new eco-city should be a zero-carbon and zero-sulphur city, an issue particularly acute in North-East China where coal is used in many industrial processes. The urban planners could draw inspiration from a framework developped by Tongji University and applied in a new district of Shenyang which aims at preserving Energy, Water, Air Quality, Materials, and Land.

Great Expectations for a Unique Site

The municipality has a realistic approach to planning and understands that business as usual skyscrapers might not be suited to the site’s unique lansdscape and the city’s identity. The coast, the mountains and the seasonal river should be carefully integrated in the proposals. The city is eager to learn from other cities situated along the coast to make the most of the tourism potential.

The city would also like to remediate the long-term pollution issues and learn how to integrate renewable energies in its energy mix. This will improve the image of a city associated until now with heavy industries and military activities.

The proposed development should also keep in mind the needs of existing citizens, and it is proposed that a strong leisure and recreational identity is given to the site. To that effect, an architecture competition for the construction of a large stadium has been just been launched. The city has the opportunity to host events of the 2013 national games organised in Liaoning.

第二部分 方案

PART 2 Projects

环境与能源组

Environment and Energy Group

Mines Paris-Tech University

Antoine Daval	法国	能源环境工程硕士, INSA de Lyon 大学
Cameron McQuale	美国	环境学硕士宾夕法尼亚大学
Fanny Vallantin	法国	电信硕士, ENSIMAC Telecom, Grenoble 大学
周红明	中国	环境工程硕士，清华大学
Jared Lucas	美国	环境学硕士宾夕法尼亚大学
Marta Liput	波兰	公共健康学硕士, Silesia, Katowice 医科大学
Natacha Olliver	法国	健康工程硕士, Montpellier 大学
胡舒	中国	环境工程硕士，清华大学
Stéphanie Borie	法国	能源环境工程硕士, INSA de Lyon 大学
Veronica Lee	美国	环境学硕士，宾夕法尼亚大学
陈瑶	中国	环境工程硕士，清华大学
唐颖	中国	环境工程硕士，清华大学

Antoine Daval	France	Master in Energy and Environmental engineering, INSA de Lyon
Cameron McQuale	USA	Master in Environmental Studies, University of Pennsylvania
Fanny Vallantin	France	Master in Telecom, ENSIMAC Telecom, Grenoble
Hongming Zhou	China	Master in Environmental Engineering, Tsinghua University
Jared Lucas	USA	Master in Environmental Studies, University of Pennsylvania
Marta Liput	Poland	Master in Science in Public Health, Medical University of Silesia, Katowice
Natacha Olliver	France	Master in Health Engineering, Montpellier University
Shu Hu	China	Master in Environmental Engineering, Tsinghua University
Stéphanie Borie	France	Master in Energy and Environmental engineering, INSA de Lyon
Veronica Lee	USA	Master in Environmental Studies, University of Pennsylvania
Yao Chen	China	Master in Environmental Engineering, Tsinghua University
Ying Tang	China	Master in Environmental Engineering, Tsinghua University

Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

Building an environmental strategy for Huludao eco-city

Strategy 战略

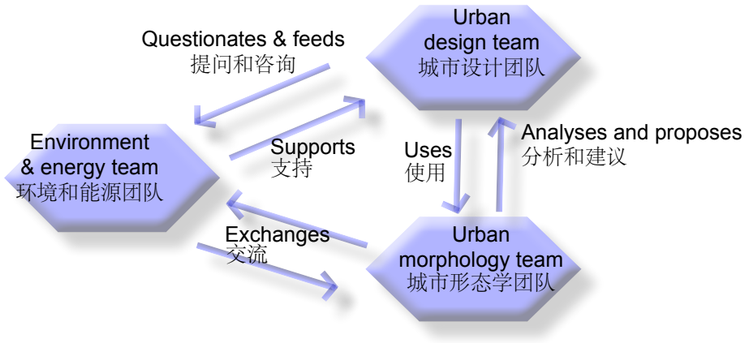
Building an eco-city in Huludao can be an example for the Noth-East coasline region. It should take advantage of the natural and anthropogenic strengths of Liaoning Province, and find innovative solutions to reduce, control and remediate the environmental impacts.

葫芦岛生态城市建设可以作为中国东北沿海区域城市建设的典范。我们应该充分利用辽宁省的自然资源和社会经济优势，寻找创新性的解决方案，以减轻和控制环境污染，并修复人类活动对环境造成的各种影响。

Approach and methodology 途径和方法

Environmental and energy experts have to work together with urban planners in order to improve urban design, services, energy and resources efficiency

环境及能源专家必须和城市规划者一起合作，努力改善城市设计，提高服务设施、能源和资源的利用效率。



Environmental background 环境背景

Huludao is a growing city in the north of Liaoning province. Located between mountains and sea, the ecocity benefits from a strategic site for urban development.

葫芦岛是一个辽宁省北部快速发展的城市，地处山脉和大海之间，该生态城市在葫芦岛城市发展中占据重要的战略地位。

Anthropogenic background 社会经济背景

Huludao is one of the most important industrial city in North-East China. Its second economic strength is its tourist and cultural potential, to be developed.

葫芦岛是中国东北部最重要的工业城市之一，它的第二个经济发展优势是具有丰富的旅游和文化资源，可以充分发挥。

Strengths 优势

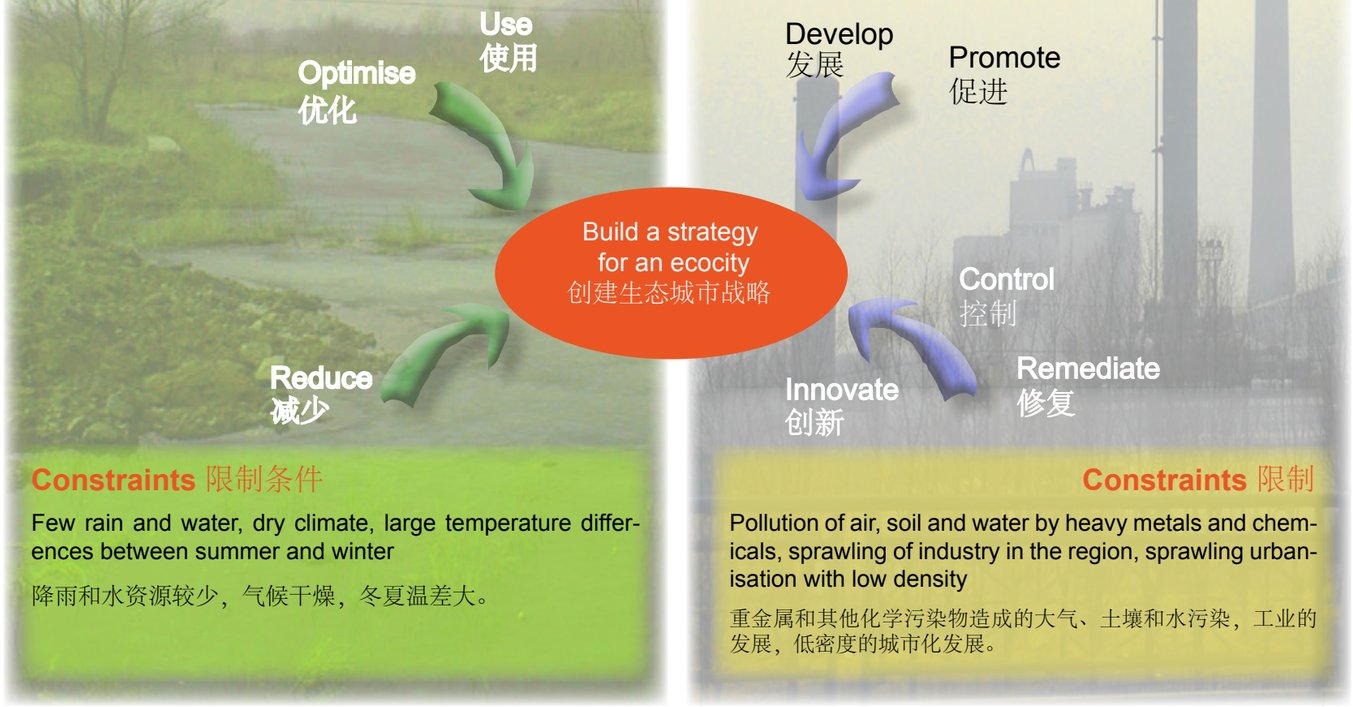
A river that can structure a project, hills, green spaces, a 2 km long beach, sun and wind potential, space for urban development

该生态城市中有河流，山地，绿地，2km长的海岸，太阳能和风能等适合城市发展的空间和资源。

Strengths 优势

Tourism potential, cultural sites in the region, express railway connected to Beijing and Shenyang, high productive heavy industry (metallurgic, shipbuilding, chemicals)

具有旅游及文化资源、京沈高速铁路及高度发展的重工业（冶金、造船及化工等）



Constraints 限制条件

Few rain and water, dry climate, large temperature differences between summer and winter

降雨和水资源较少，气候干燥，冬夏温差大。

Constraints 限制

Pollution of air, soil and water by heavy metals and chemicals, sprawling of industry in the region, sprawling urbanisation with low density

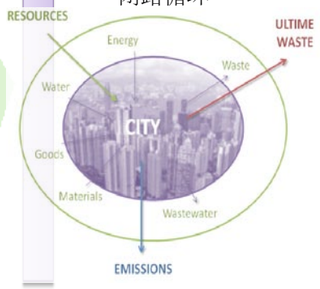
重金属和其他化学污染物造成的大气、土壤和水污染，工业的发展，低密度的城市化发展。

Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

Regional Analysis 区域分析

A city is generally considered only for the main function it provides: a shelter for its inhabitants. It is therefore taking resources out of the environment to achieve this goal and then reinjecting waste, wastewater and other emissions to the environment. Such a linear system will never be sustainable.
As present in China for industry, a city should be considered as part of an anthropogenic ecosystem: the city is an organ among others inside a regional body, evolving in a wider environment . It is therefore essential to get a picture of the whole regional system, determining the interactions and flows between every entity. Sustainability could then be achieved by transforming a linear resource stream to a circular ecosystem mimicing the natural ecosystem by recycling its resources and using as much renewable energy as possible.
一般来说，人们只考虑城市的主要功能：即人类的庇护所。因此，人们不断地从环境里摄入自然资源，加以利用，然后将废物、废水和废气排放到环境中。这样的线性系统不是可持续的。
在中国，城市应该被当做社会生态系统的一部分：如果整个大区域是身体，那么城市应该是身体中的一个器官。因此，了解整个区域的全景及各个组成部分之间的关系是非常必要的。要实现可持续发展，必须将线性资源流动替换成循环的、仿自然的生态系统，循环使用资源，以及尽可能多地使用可再生能源。

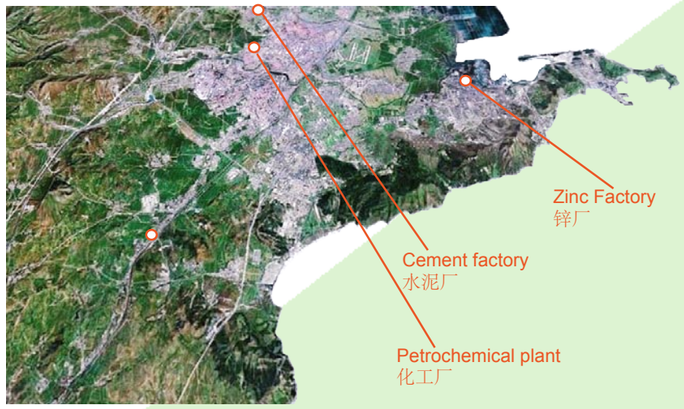
closing the loops
闭路循环



The Region-body 区域的定义

The Region body is a flexible Huludao county (administrative boundaries are not considered). It includes the CBD site plus the present Huludao city, industrial sites, the Moon river watershed, surrounding hills and greenlands as well as nearby cultural attractions.
在这里，区域是指一个灵活的葫芦岛市范围（不考虑行政边界）。它包括CBD、现有葫芦岛市、附近工业园区、月亮河流域、CBD周围的山地、绿地和旅游胜地。

Multiscaling: example of the 1 line 5 spots
The city should become one of the major spots of Liaoning seashore.
多重路标：该区域位于“五点一线”上，将成为辽宁省海滨主要的城市之一。



City 城市

The city shall be considered as a set of functions embodied in a certain geographical, natural and anthropogenic background. To be sustainable the city needs to fully utilize all of the functions into one complete system.
城市应该被当作这样一个实体，它具有一系列的功能，这些功能包含于特定的地理、自然和社会经济背景中。为了实现城市的可持续发展，应当充分地利用系统中的各种功能。

The city ensures a balanced flow of materials. Waste generated by its inhabitants are properly managed. The loops are as closed as possible. 城市应当实现物质流平衡。适当地处理和充分利用市民产生的废物，尽可能地实现内部循环。	The city ensures sufficient access to water for all human needs within its boundaries. Water use is optimized through savings and continuous treatment. 城市应当满足市民所有的用水需求。通过节水和循环利用实现水资源优化。	The city generates its own energy so that each kWh consumed is compensated by the production of 1 kWh of renewable energies. 城市应当实现能源自给。每消耗一千瓦时电，应该通过产生一千瓦时可再生能源来补偿。
The city must provide healthy and safe living conditions to its people. Contamination shall be dealt with at different scale, inside and outside the city. 城市应当为市民提供健康和安全的生活条件。应该从不同层面解决污染问题，比如从城市内部和外部。	The city generates a suitable interface between industrial and natural ecosystems. It must be a support rather than hindrance to biodiversity. 城市应当在工业生态系统和自然生态系统之间建立合适的联系，工业生态系统应当支持而不是破坏生物多样性。	The city is built with optimal urban morphologies to ensure a high density and building are energy efficient and environmentally friendly. 城市应该建立优化的城市形态，以确保达到高的建筑密度和能源使用效率，以及实现环境友好。

The Environment “Liaoning” 辽宁省的“环境”

The study area includes Liaoning and Bohai Sea. It is historically a heavily industrialized area that needs to be revitalized. The province also presents historical and cultural background of high interest as well as a unique natural heritage. It represents a rich but challenging environment to evolve in !
研究区域包括辽宁省和渤海。历来，这里是需要振兴的重工业化地区。辽宁省也具有丰富的历史、文化资源以及独特的自然遗产。该省具有丰富的潜能，然而同时也面临着巨大的环境问题挑战。

The “environment” of China 中国的“环境”

As China is urbanizing at a rate of fifteen million people each year, it is of the greatest importance to establish the basis of a sustainable urbanism.
中国正以每年1500万人口的速度进行城市化，建设可持续发展的城市非常最要。

Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

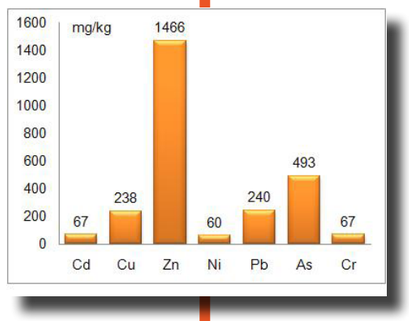
Heath 健康

The healthy environment should be a basis for creating an eco-city. The contamination should be considered at the earliest stage and be remediated. Only with this strategy we can consider the city as one willing to become green and healthy.
健康的环境是建设生态城市的基础。如何对已有的污染进行处理和修复应是最先考虑的问题。只有采取这一策略，这个城市才能真正成为绿色、健康的生态城市。

Air Pollution 大气污染

The local air pollutants are SO2 and heavy metals like atmospheric mercury. These **impact** the region in the form of acid rain, respiratory disease, soil acidification and deposition in water and plants. The **major air polluters** in the region include a large zinc plant, several mining and chemical factories, coal combustion, and transportation. The **recommended solution** to curtail air pollution stems from regulations. They include industrial emission control, desulphurization facilities, clean energy switching, transport modification, and a tourist season bike rental program. Also, restricting indoor tobacco use and smoke free area promotion will greatly increase indoor air quality.

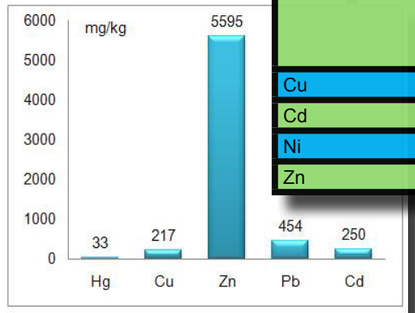
空气中主要的污染物是二氧化硫和重金属，如气态汞等。大气污染所造成的影响主要包括：酸雨、呼吸系统疾病、土壤酸化和水体、植物中的重金属粒子沉降。地区内主要的污染源有锌厂、金属矿场，化工企业、燃煤以及交通。减少室内/外空气污染的推荐方案主要从政策层面入手：制定法规控制工业废气排放；建设配备脱硫装置；推广使用清洁能源以替代传统的高硫煤；改变交通模式，鼓励发展公共交通，并在旅游旺季施行自行车租赁系统。此外通过在室内公共场所设立禁烟区将极大程度地改善室内空气质量。



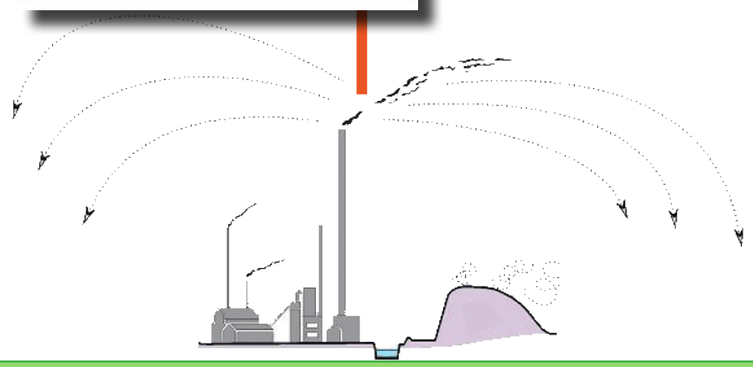
Water Contamination 水体污染

Mercury and cadmium have the highest aquatic pollution levels. They exert negative impacts by degrading the ecosystem, and being bio-accumulated in humans. The major sources come from sediment contamination related to chlor-alkali production, industrial wastewater, and atmospheric deposition. The proposed solution is to integrate treatment and remediation within the local ecosystem.

汞和镉是水体中污染最重的重金属污染物，并对水体造成严重的负面影响。它们可对水生生态系统造成扰乱和损害，并通过在鱼类体内的生物累积威胁人体健康。主要的污染源包括由氯碱生产造成的长期底泥污染，工业企业的废水排放和大气污染沉降。建立污水处理和水系统修复的整合体系将是改善水体污染的可行方案（参见水系统部分）。



HEAVY METALS 重金属	MICROORGANISMS 微生物
Hg	*Pseudosomonas aureginosa*
Pb	*Fucus vesiculosus* *Ascophyllum nodosum* *Rhisopus nigricans* *Saccharomyces cerevisiae*
Cu	*Streptomyces rimosus*
Cd	*Proteus vulgaris*
Ni	*Fusarium flocciferum*
Zn	Aspergillus oryzae



Soil Contamination 土壤污染

Overall toxicity levels from highest to lowest are cadmium, zinc, mercury, lead, and copper. The **impact** from contaminated soil currently represents a low threat to groundwater though the metals are passed on through vegetative growth to humans by consumption. The **sources** are industrial dust, contaminated water and climatic conditions of rain scarcity and high winds. The **proposal** recommends soil remediation.

土壤污染的严重程度从高到低依次为：镉、锌、汞、铅、铜。目前土壤污染的影响对地下水并未造成威胁，但土壤中的重金属粒子通过食物链的富集作用严重威胁着生态系统和人体健康。污染源主要包括工业生产所产生的粉尘的大气沉降，水体污染物的沉积和吸收，并在少水、多风的气候条件下加速了污染物的迁移。解决方案：土壤修复。

Soil Remediation 土壤修复

- Phytoremediation 植物修复

Phytoremediation methods use plants to accumulate heavy metals. Phragmites australis is a reed common to China that can accumulate heavy metals in its roots and stems. Thiaspi cearulescens, commonly known as alpine pennycress, is also a known hyper-accumulator. It can uptake 30,000 ppm zinc and 1,500 ppm cadmium in its shoots compared to normal plants that can be poisoned with as little as 1,000 ppm of zinc or 20-50 ppm of cadmium. The plants are considered as industrial waste, though metals absorbed in this plant can be economically recovered in the process called biomining. The ash from burning the plants is sold as ore. Alpine pennycress ash yield 30-40% zinc.

植物修复采用植物体作为从土壤中吸收、富集重金属。Phragmites australis是中国常见的一种芦苇，它可在其根、茎内富集重金属。另一种推荐采用富集性能极佳的植物是山遏兰菜（Thiaspi cearulescens），它可在芽体内富集高达30000ppm的锌和1500ppm的镉，而一般的植物在锌浓度达到1000ppm或镉浓度为20-50ppm时便因毒性过大而无法生存。山遏兰菜富集的重金属可通过“生物开矿”的方式进行回用。山遏兰菜收割、焚烧后的灰分可作为生物矿石出售，通常可从灰分中回收30-40%的锌。

- Rhizosphere biodegradation 根系微生物降解修复

The second method in-situ is rhizosphere biodegradtation, where plants are used to stimulate growth of microorganisms, which are conducting degradation of heavy metals. The soil content determines the microorganism selection.

根系微生物降解修复通过植物创造利于根系微生物生长的环境，并利用这些微生物对重金属进行生物降解。不同的重金属可通过不同的微生物进行降解。

Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

Ecosystems and Green Spaces 生态系统与城市绿地

Objectives for Huludao 葫芦岛市发展目标

Huludao is rich in natural environments and ecosystems, including the beach, wetlands, woodland and forest, migrating birds and abundant marine life. 葫芦岛市具有优越的自然环境和生态基础，包括海滩、湿地、林地和森林，还有丰富多样迁徙鸟类和海洋生物。

The objective of these eco-city recommendations are to promote Huludao's natural strengths; utilise ecosystem tools to remediate existing anthropogenic impacts on the environment; and design with nature to optimise ecosystem services. 在这丰厚的自然基础之上我们提出生态城市的建设提议：运用生态手段修复人类对自然环境的既成影响，并在设计中考虑自然需求，以实现生态系统的良性循环。

Green spaces offer socio-economic value such as health benefits, recreation, and clean air and water. Green spaces can co-exist with urban environments, and enhance cities by providing eco-system services.
城市绿地能为居民提供多种社会经济服务，例如健康的生活环境、休闲娱乐场所，以及洁净的空气和水。城市绿地能与其他城市环境和谐共存，并通过其提供的生态系统服务促进城市的持续发展。

Smart design works with nature

让设计与自然同行

Ecosystem Services
生态系统服务

clean air 净化空气
plant cultivation 种植植物
encourage animals 提供生物栖息地
conserving biodiversity 维持生物多样性
social and cultural value 社会文化价值
reduction of pollution 减少污染
noise moderation 降低噪音
beach protection 保护海滩
water treatment 净化水体

Wetlands 湿地

Huludao's coastal wetlands provide habitats for birds (rare, migratory, breeding), fish and other animals, and reeds and grasses. Wetlands reduce pollution and eutrophication; attenuate floodwater flow; and store and release water. Additionally, constructed wetlands can be used to filter water for local use.

葫芦岛的滨海湿地不仅为鸟类（包括珍稀鸟类、迁徙鸟类、哺育鸟类等）、鱼类和其他动物提供了栖息地，也为芦苇、蒲草等植物提供了生长环境。湿地能够降低污染和富营养化程度，缓解洪峰和调蓄水量。此外，人工湿地也可用作区域水质净化。

Strategies for wetland conservation
湿地保护策略

- Monitor biodiversity and water quality
  调控水质，维护生物多样性
- Regulate sensitive areas: pollution, loc
  调节敏感区域：污染区，水产养殖区
- Retain wetland buffers zone, e.g. conservative radius of 190-340 m
  维持湿地缓冲区，按保守考虑，至少为190-340米半径的区域
- Nurture socio-economic value
  提升社会经济价值

Fauna 动物区系

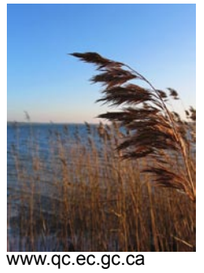
Conserve natural habitats
保护自然栖息地

Connect green spaces throughout CBD
连通所有城市绿地，以创造连续、良好的生物栖息环境

Beach and Marine 海滩

Buffer zones and restrictive zoning : minimise threat to both beach and built development, while allowing for public access, safe use and environmental protection. Regulate pollution (industrial discharge, run-off, waste) and retain wetlands: preserve beach and ocean quality. 通过滨海缓冲区和限建区将对海滩的影响最小化，与此同时保留一定的公众通道，以实现海滩的合理、安全开发和环境保护。通过废弃物管理和控制海洋污染实现对海滩环境质量的保护。

Flora 植物区系


www.qc.ec.gc.ca


www.plantsystematics.org www.hawaiiandreams.net

Wetlands 湿地	**CBD** CBD 区内	**Away from CBD** CBD区外
Phytoremediating reeds 用作植物修复的芦苇	Non-agricultural plants 非农用植物 Pollution-tolerant or phytoremediating 耐污染物种或可用作植物修复物种	Low-bioaccumulating crops 低富集型作物
Phragmites australis 芦苇	*Elsholtzia haichowensis* Sun 海洲香薷 *Commelina coreana* 鸭拓草 Local trees: poplar, locust, pine 本地树种：杨树，槐树，松树	fruit 水果 sweet potato 番薯 pumpkin 南瓜

Phytoremediation sequesters pollutants; then recovery of heavy metals is by biomining.
通过植物修复吸收重金属污染物，并通过“生物采矿”对重金属进行回收

Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

Water 水

Background 背景

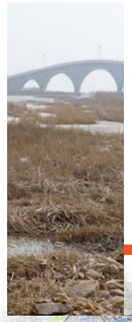
HuLuDao is currently in need of water as 74,000 families cannot be be provided water for a 24 hour period. Presently, all water for HuLuDao comes from outside of the city. The water system proposal creates a method to protect the Moon River, provide potable water, connect the CBD and natural area, add adapted vegetation and upgrade sanitation concerns which are all precise concerns of the local government.

葫芦岛是一个缺水城市，目前，市区有74000个家庭不能实现24小时连续稳定供水，供水主要都来源于城市外部水源。另外，在水系统设计中，CBD当地政府希望在保障稳定充足的供水同时，尽可能地保护月亮河，对付海水入侵以及在沿海开展农业或其他种植业。

Black Water treatment -- Centralized Treatment Plant 黑水处理——集中式污水处理厂

Blackwater is sent to the centralized wastewater treatment plant to produce class three clean water and create a sludge byproduct which can be sent to cement factory as a raw material. The city requires a plant with a capacity of 5000 t/day.

只有黑水将被送往集中式污水处理厂进行处理，生产三类水，副产物污泥可以被送往水泥厂当做原料使用。需要在CBD区域内建立一个处理能力为5千吨/天的污水处理厂。



Water strategy for CBD CBD的水战略

The proposal suggests a new classification of water standards, efficient building use upgrades, a recycled greywater system and utilizing the local rainy season through roof and street runoff collection.

建议使用一种新的给水分级标准，在建筑内使用耗水更少的设施，回用灰水，以及通过屋顶及道路等收集雨季的雨水，然后加以使用。

New Definition of Water Classification 新的供水水质分类方法

In China, drinking water and other domestic use water is supplied with the same quality, which results to a waste of money. So the proposal suggests to supply water according to need.

目前在中国，饮用水和建筑内其他用水都是以同等水质供给，导致资源和成本的浪费。因此，建议实现按需分质供水。新的供水分类标准如下:

New Class（新分级）	Standard of Reference（参考标准）
C1 Potable（一级，饮用水）	European Union Potable water（欧盟饮用水标准）
C2 Residential（二级，其他生活用水）	Chinese Class 3（中国地表水质三类水）
C3 Agriculture（三级，农业用水）	Chinese Class 4 or 5（中国地表水质、五类水）

Water Use 用水

Key assumption: Population of 100,000 capita within an CBD area of 8km². Agricultural area of 6km² is located near CBD. Water will be put into Moon River to make a sight in the CBD (building a dam in the end), changing water for eight times per year is assumed. To deal with the seawater invasion, class two water will be filled back to ground.

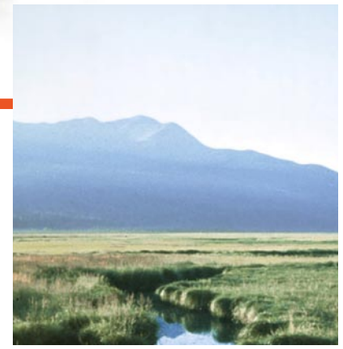
关键假设：在8km²的CBD内，固定和旅游人口总计为10万人；在CBD附近，将开展6km²的农业种植；为了保证月亮河景观，在入海处建坝，每年在月亮河CBD河段内用中水换水八次；为了解决海水入侵，二类水将被回灌到地下。

各类活动耗水量及比例参见“CBD给排水系统”。

Water Supply 给水

The total water supply is 5,536,000 m^3/yr. As the rain mainly distributes in summer, a reservoir (with the capacity of 5M m^3, area of 20ha) is needed to store the treated rain and grey water resource.

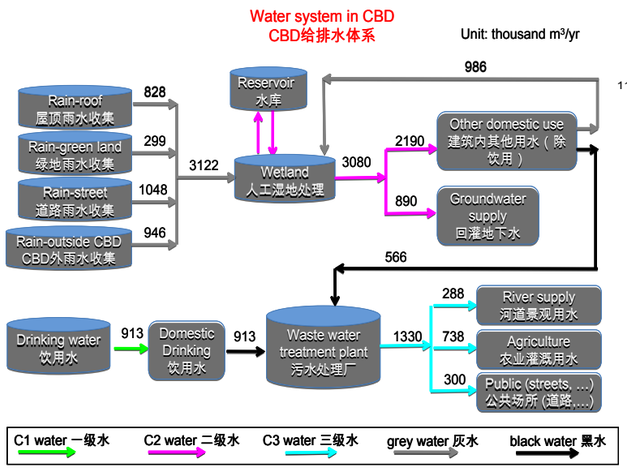
总的供水量为每年5,536,000m^3。具体来源及比例参见“CBD给排水系统”。由于降雨主要分布在夏季，因此需要修建一个容量为5百万立方米（面积为20公顷）的水库，以储存处理后的雨水以及灰水。



Rain and Grey Water treatment -- Wetland 雨水和灰水处理——湿地系统

Grey water and rain are sent to wetland for treatment. Class two clean water is produced here. In CBD, 10 wetlands (10,000m²x1.5m per each) are needed.

灰水和雨水收集后，被送往湿地进行处理，用于生产二类水。在CBD，需要建立10个大小为10,000m²x1.5m的湿地。



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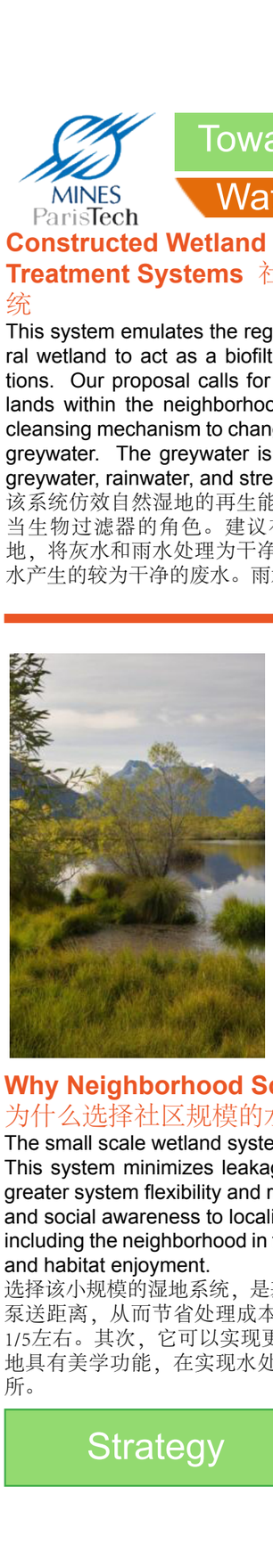
Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

Water 水

Constructed Wetland Neighborhood Treatment Systems 社区人工湿地处理系统

This system emulates the regenerative ability of a natural wetland to act as a biofilter under managed conditions. Our proposal calls for multiple constructed wetlands within the neighborhood structure to act as the cleansing mechanism to change dirty greywater to clean greywater. The greywater is a composite of domestic greywater, rainwater, and street run off.

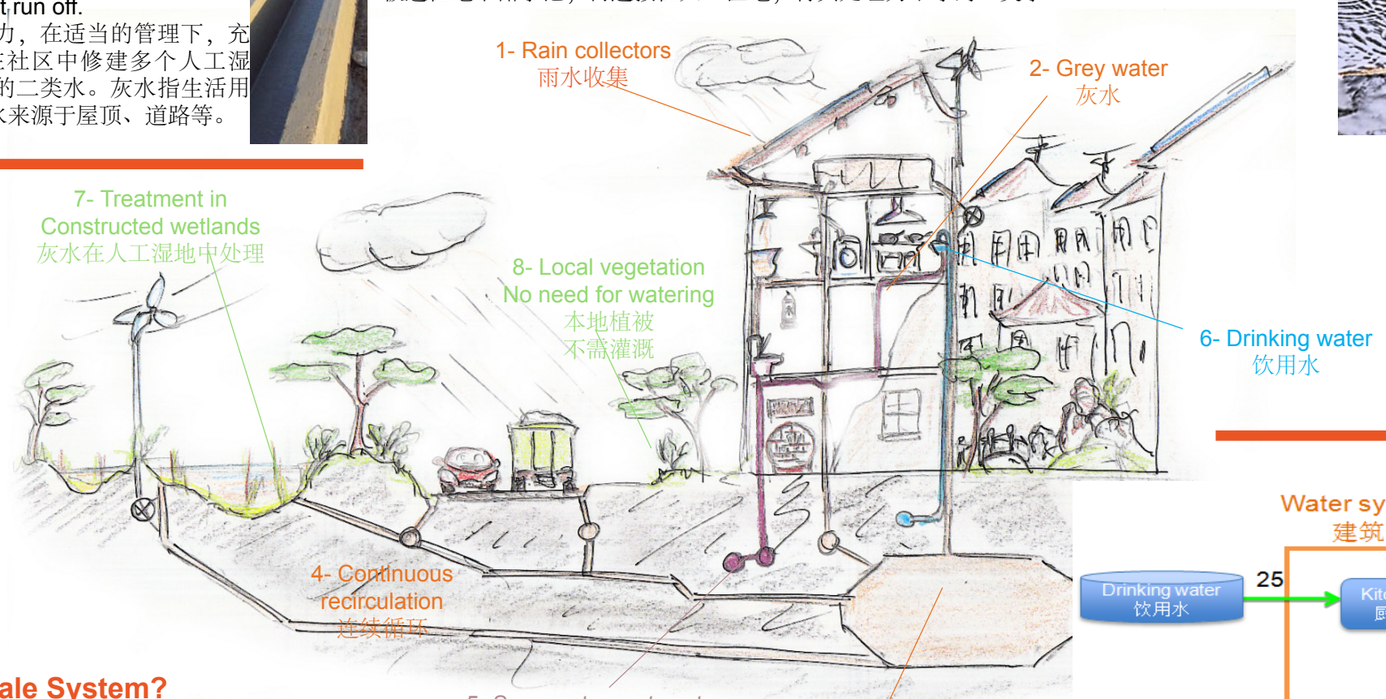
该系统仿效自然湿地的再生能力，在适当的管理下，充当生物过滤器的角色。建议在社区中修建多个人工湿地，将灰水和雨水处理为干净的二类水。灰水指生活用水产生的较为干净的废水。雨水来源于屋顶、道路等。

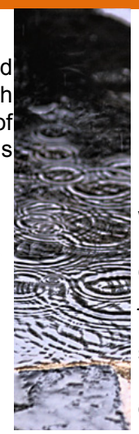


Rainwater and Grey water Harvest 雨水和灰水利用

The main neighborhood water source comes from roof top rain collection, street run off, and greywater recycling. The two systems feed into the underground cistern before passing through the grease trap and settling tank. The rainwater will contain atmospheric heavy metals and roof debris. The street runoff will contain automobile runoff and other toxic materials. The wetlands are capable of removing all of them to create the clean greywater.

社区的主要水资源来源于屋顶和道路的雨水收集，以及回用的灰水。灰水可能含有油脂，屋顶雨水可能将含有重金属及屋顶上的固体碎片，因此也将通过沉降池之后再进入地下储水池。道路收集的雨水可能含有汽车带来的污染物和其他物质，这些雨水在经过油脂过滤器和沉降池后被送往地下储水池，再连接往人工湿地，将其处理为干净的二类水。





How Does The System Work?

系统如何工作？

It begins with collecting rainwater from the roof or street by diverting into the underground neighborhood greywater system. Following a system of filters, the water is passed through the bottom of the container into the constructed wetland system. The wetlands performs its job of cleaning the water. Afterwards, the clean water is passed into the neighborhood greywater withdrawal system that gives access to the buildings in the neighborhood. The clean water is used in the building. It is either cycled back into the system or transfered into the blackwater system.

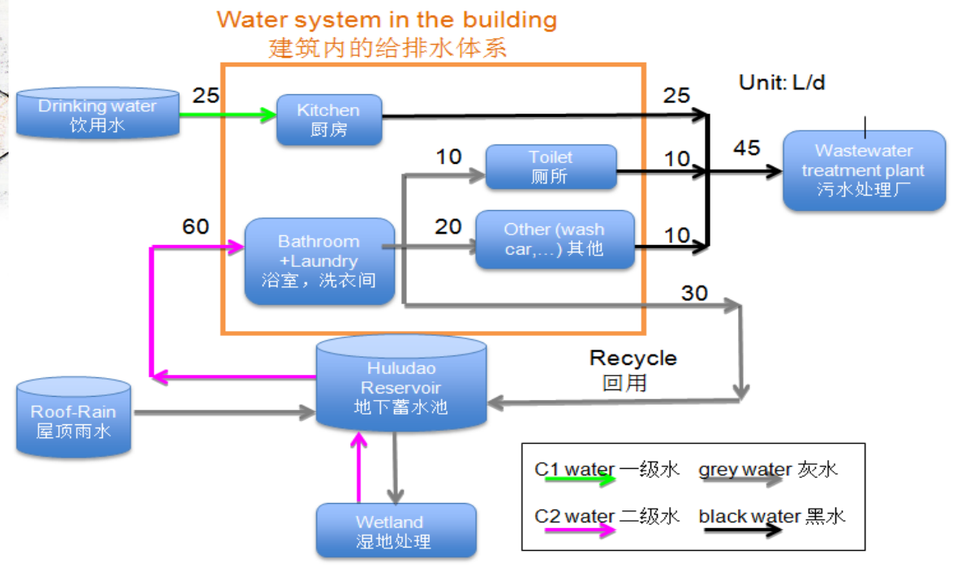
首先，屋顶和道路收集来的雨水及灰水被转移到社区的地下储水池。经过一系列的过滤之后，水经过储水池底部进入人工湿地。人工湿地在2~3天之内实现净化功能。之后，干净的水通过社区的灰水回用系统被送往居民楼中使用。使用完之后，部分灰水可以继续下一轮循环，另外部分的灰水转变为黑水，被送往污水处理厂。

Why Neighborhood Scale System?

为什么选择社区规模的水系统？

The small scale wetland system was chosen due to a multitude of reasons. This system minimizes leakage and pumping distance. It also allows for greater system flexibility and risk control. There is also a regional aesthetic and social awareness to localized water treatment with an idealized goal of including the neighborhood in the wetland management, water conservation and habitat enjoyment.

选择该小规模的湿地系统，是基于多个原因考虑的。首先，该系统可以减少泵送距离，从而节省处理成本，湿地处理系统的成本是污水厂处理成本的1/5左右。其次，它可以实现更大的系统可能性和风险控制。最后，人工湿地具有美学功能，在实现水处理功能之外，也能为居民提供一个休闲的场所。



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Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

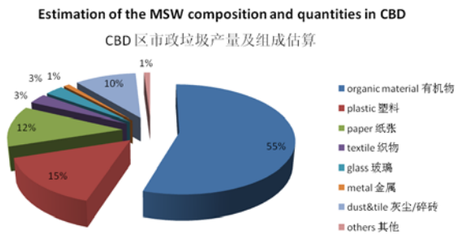
Waste 废物

Principles of Municipal Solid Waste (MSW) management - 生态城市市政垃圾管理原则

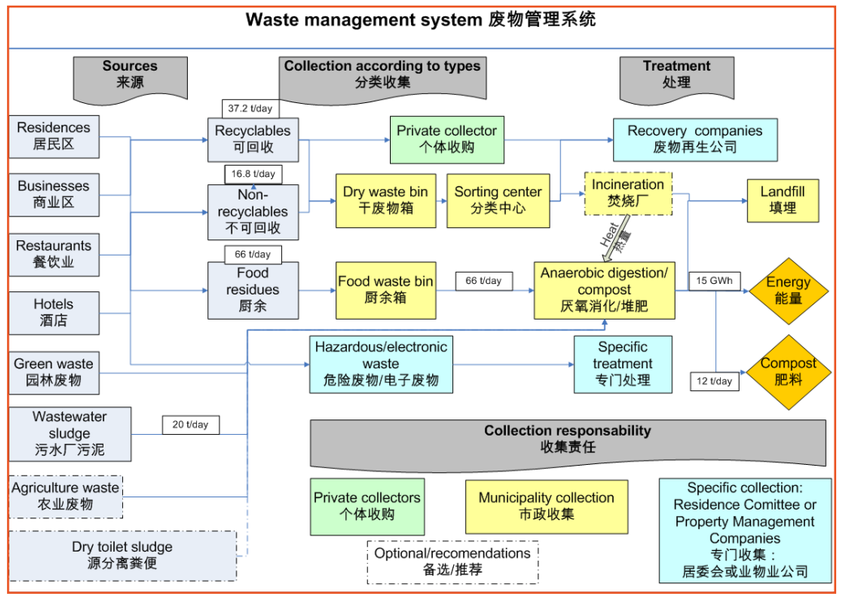
Sustainable MSW management considers waste as a resource that can be reduced, collected, reused, recycled and used to recover energy. Product and material efficiency, and cyclic resource utilization are techniques to reduce consumption and waste generation.
可持续的废物管理认为废物也是一种资源，可对其进行源减量、收集、再用和回用及能量回收。通过资源和产品的高效、循环利用可实现减少消费和废物产生量。

Background - 背景状况

There is limited data about the local parallel collection systems. The municipal sanitation service collects waste and deposits it into landfills with no leakage control or biogas recovery while contributing significantly to the air, soil and water pollution. Meanwhile, private collectors gather a large amount of the recyclable waste and sell it to private recovery companies.
可查的葫芦岛市废物管理数据非常有限。经环卫局收集清运后，废物被运至堆放场或简单填埋场。由于缺乏必要的渗滤液控制系统和沼气收集系统，导致了对土壤，地下水，海水的污染和温室气体的排放。同时，个体废品收购者收购了很大一部分的可回收废物（金属、玻璃、塑料瓶和废纸），并将其卖给废物回收公司。



Production of MSW: 120 t/day
with 1.2 kg/day/capita
CBD区生活垃圾产生量：120吨/天 （1.2 千克/人/天）



Current disposals - 目前的废物处置状况

There are three main locations for landfill waste disposal. The two appointed sites are designated for MSW regional waste, one focusing on the zinc factory and shipping district. The third site acts as a simple waste landfill that is collected by the sanitation service.

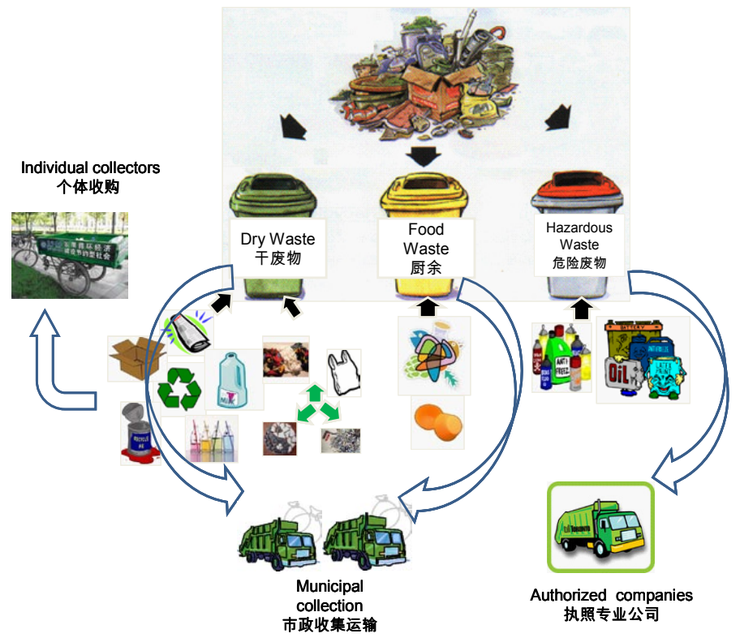
葫芦岛废物处置主要有三个场地：.两个为指定的垃圾堆放场，其中一个用于锌厂、造船厂居民区的生活垃圾；第三个处置点对市环卫处直接清运垃圾进行简单填埋。

Source Reduction - 源减量

Sustainable waste management focuses on waste reduction through education and promotion. The proposal highlights source reduction techniques such as wise consumption, packaging optimization, joint use of appliances and equipments, and office utilization of information and communication technology instead of paper.
可持续的废物管理致力于通过宣传教育实现废物减量。本方案强调了理智消费、优化包装、器具设施合用、用信息交流技术代替纸张使用等源减量技术。

Source-sorting system - 源分类收集

The CBD recyclables will be predominantly collected by the private collectors and is recommended to continue due to its inherent efficiency and social impact. The municipality will provide two types of trash bins in the streets: one for food waste, which has high moisture content, and the other for dry waste, both recyclables and non-recyclables. The bins will be collected daily. This recommendation is proposed to take advantage of the individual collector sorting the waste while the wet-dry separation creates an efficient system to process the organic waste. It is optimal for anaerobic digestion that yields energy capture and compost. For domestic hazardous wastes, a special trash bin will be managed by individual residential committees or property management companies. Authorized hazardous waste transportation and management companies will bring them regularly to an approved site. Electronic wastes will be collected and sent to specialized treatment.
CBD区的可回收废物将首先由个体废品收购者收集，我们建议保留这种集效率与社会效应于一体的系统。环卫局将在街道中放置两种垃圾箱：一种用于收集厨余（高水份含量），一种用于收集干废物（包括可回收和不可回收废物）。这两种垃圾将实现日产日清。这种方案充分利用了个体废品收购对废物的分流。干、湿废物的分离收集使得干废物后续集中式分离和有机废物厌氧消化产能、产肥料变为可能。对家庭危险废物，在居委会或物业公司设置专用收集箱，经授权的专业危废运输和管理公司将定期来收集。电子废物将被收集并送至专门处理公司。



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Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

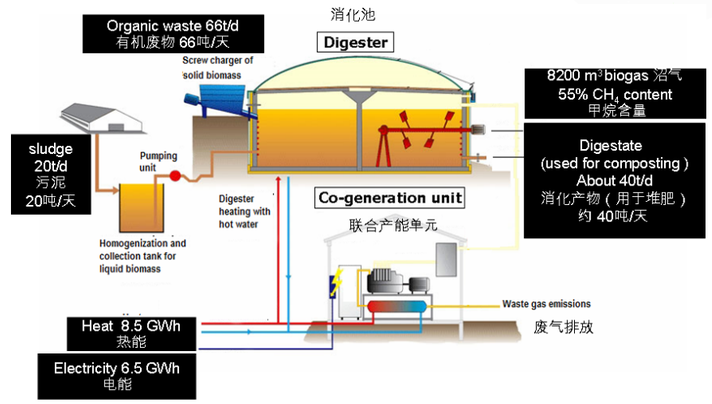
Waste 废物

Hypothesis

1. Population:
70,000 permanent residents
30,000 tourists and/or businessmen
2. Waste management system boundaries: domestic wastes from residential area, business area, hotels and restaurants, green wastes from parks and gardens as well as sludge from wastewater treatment.
3. Production of organic waste:
- 66 tonnes of food residues per day
- 20 tonnes of wastewater sludge

假设

1. 人口：
常住居民：7万人；旅游或商务人员：3万人
2. 废物管理系统边界：生活垃圾、园林垃圾，市政污泥。
3. 有机废物产量：
厨余：66 吨/天； 市政污泥：20吨/天



Anaerobic digestion and composting plant - 厌氧消化及堆肥厂

Once this waste is collected and sorted in order to remove the residual inorganic waste, it can be used in the anaerobic digestion plant followed by composting for aerobic maturation. This way, biogas (mostly methane) is recovered and can be used to produce energy.
厨余垃圾被收集并去除其中的无机杂质后，可用于厌氧消化以后续堆肥腐熟。如此，可收集沼气（主要为甲烷）用于产能。

Composting - 堆肥

Compost quality in China is usually poor. The composting process could be improved, however, by using vermicomposting. Besides a lower operating cost, vermicomposting permits an improvement of the compost quality in terms of the size of the decayed fragments, and the plant nutrients (nitrogen and phosphate) availability and solubility. Thus, the compost can be used as fertilizer by the local farmers.
中国的肥料质量普遍较低。然而，堆肥过程可通过 蠕虫堆肥改进。除了更低的操作成本，蠕虫堆肥能改善肥料粒尺寸和提高营养物质（氮、磷）的可吸收性。如此，肥料可被本地农民使用。

Supporting System - 辅助系统

Environmental education and promotion are needed to enhance public awareness source waste separation. This requires municipality cooperation with residential committees and property management companies. The transportation routes of waste need to be optimized for market of waste recycle and recovery products. Meanwhile, local waste management facilities including sanitary landfills, organized recycling/recovery firms, electronic waste plants, and hazardous waste handling companies need to be utilized.

为加强居民废物源分离意识，环境宣传和教育是必不可少的。这需要市政环卫处与居委会、物业公司的有力合作。同时，需要优化废物运输路线，并对废物回收产物市场提供一定保障。此外，还要利用葫芦岛市及周边地区的相应废物管理设施，例如卫生填埋场、组织有效的回收公司、电子废物和危险废物处理厂。

Implantation of the anaerobic digestion plant - 厌氧消化厂选址

As the current gas storage situated in the future CBD area will be removed, the methanization-composting plant can be situated situated on this land and the surface area would be several hectares.
由于CBD规划区内现存的燃气厂将被搬迁，可将厌氧消化厂设在该址上，从而可利用部分已有设施。该厂占地约几公顷。

Example of implementation (France) - 应用实例（法国）

The proposal suggests to mimic an implemented French anaerobic digestion plant that is showing excellent performance utilizing MSW to produce locally consumed energy and offset landfilling.
本方案建议采用与法国一已投入使用的厌氧消化厂相似的技术。该厂利用市政垃圾产生当地所需能源，并避免了填埋，其处理效果出色。

Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

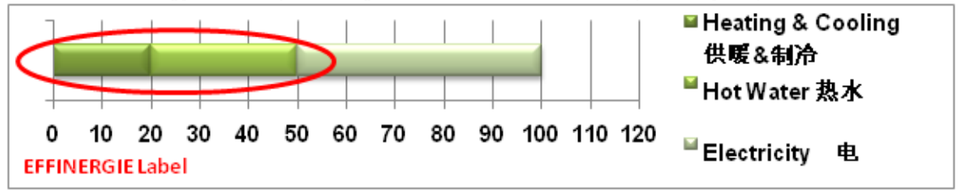
Reduce CO2: Building Energy efficiency - CO2 减排： 提高建筑物能效

Strategy 战略

First step: reduce energy consumption in buildings.
Second step : use renewable energies as much as possible. The actual residential consumption in Liaoning is 220 kW/m²/year. We aim at reaching Effinergie label.

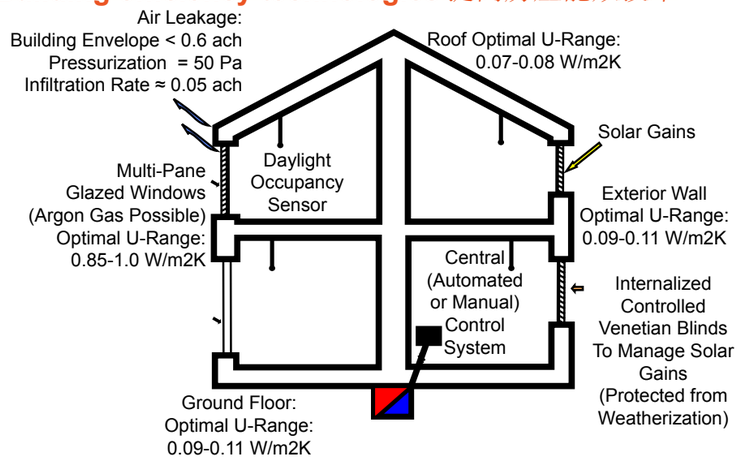
第一步：提高建筑物能效。第二步：使用可再生能源。 现在中国建筑物能耗是220 kW/m/年。我们的目标是达到Effinergie 标志。

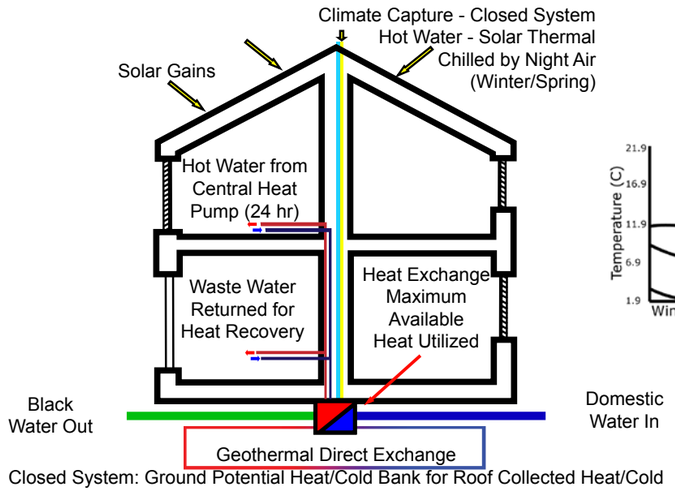
Residential energy consumption targets - 居民能源消耗目标 (kW/m²/year)



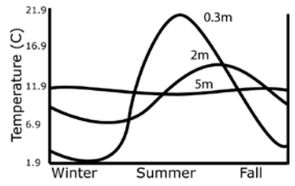
Energy needed for the city 城市能源需求 (for 100 000 inhabitants - GWh/year)	
Heating & Cooling / 供暖&制冷	114
Hot Water / 热水	80
Electricity / 电	156
Total / 总量	350

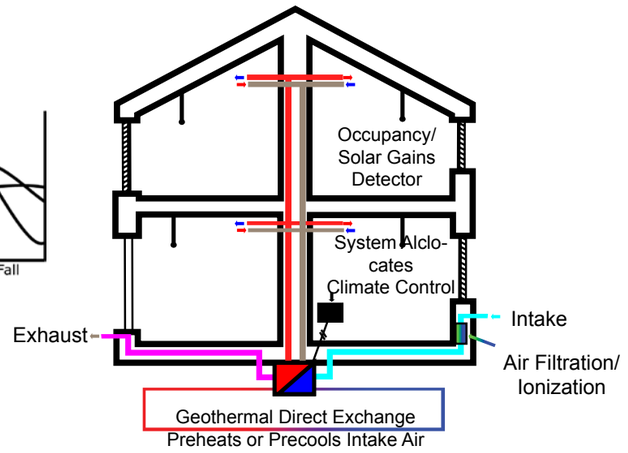
Building efficiency technologies 提高房屋能效技术





Closed System: Ground Potential Heat/Cold Bank for Roof Collected Heat/Cold





Based on the Huludao climate several technologies can ensure maximum efficiency. Each solution's applicability depends on building design. The building envelope should be nearly airtight and the -18 to 31˚C annual temperature range mean heating is a building design priority.
基于葫芦岛的气候条件，有几个技术可保证最高的效率。每个解决方案的适用性取决于建筑设计。建筑围护结构应接近密闭；-18-31˚C 的年均温度范围说明供热系统是建筑设计的首要因素。

In summer windows can control solar gains with adjustable/retractable façades to save 13% on cooling. To avoid the salt/acid rain corrosion - blinds can be built into sealed window panes for maximum control of the solar gains/maximum product life. A smart control system with dynamic sunlight/occupancy detectors can automate blinds and for 40% total savings.
在夏季，窗户可通过可调节/伸缩面板控制太阳能的吸收，从而节省13% 的制冷耗能。为了避免盐/酸雨腐蚀，百叶窗可建在密封玻璃窗内，以实现最大程度地控制太阳能吸收和延长产品寿命。具有动态阳光/占用探测器的智能控制系统可以自动控制百叶窗的启闭，可节省高达40% 能耗量。

To maximize climatic solar gains, heat capture is possible from the roof (or roads/parking lots). Solar heat can be stored in the soil where the heat flux is 1m/month. Two closed water pump systems will reduce the heating/cooling load of the building temperature control. The geothermal direct exchange brings input water and air to residual soil temperatures (11.9 ˚C in Huludao) for up to 30% less in heating costs. Deep soil can store heat from the thermal system during summer days with low hot water demand for up to 20% more savings. Soil can store cold on nights in late winter/early spring resulting in up to 50% for cooling costs. Gains from soil storage can also be achieved passively for lower stories. These closed systems have no drain on the daily water resources and can replace centralized systems.
为了最大限度地提高太阳能收益，可从屋顶（或道路/车位）进行热捕捉。太阳能可以在土壤中（热通量是1米/月）储存。两个封闭的水泵系统将减少建筑温控的供暖/制冷负荷。地热直接换热技术将管内的水和空气温度加热至土壤常温（葫芦岛：11.9 ˚C），从而节约30% 的供热成本。在热水需求较低的夏季，深层土壤能够从热系统中储存热量，从而多节约20% 的热量。在晚冬和早春，土壤可储存夜晚的寒气，从而节约高达50% 的制冷成本。土壤储存的效果也可在低层建筑中被动实现。这些封闭的系统没有每日的废水排放，并可以此代替集中式处理系统。

For ventilation passive house guidelines recommend 30m3 per hour per person with a minimum air supply setting for no occupancy. An air filter/ionizer is needed to removed dust, pollutants, and natural/manmade corrosive compounds. It is important to arrange the supply and exhaust air openings in a way that avoids short circuits. Room temperature/solar gain detection will further maximize efficiency savings.
对于被动节能建筑的自然通风，设计准则建议设置一个无需占用空间、保证每人每小时30m3最小通风量需求的装置。此外需要配备空气过滤器或静电除尘器以去除粉尘、污染物和自然/人工腐蚀性化合物。如何合理地设置进气口和排气口以避免短路是非常重要的。室内温度和检测捕获的太阳能将进一步提高节能效率。

Sources: "The Passive House Building Standard" at greenlineblog.com, "Passive houses in Sweden" by Ulla Janson (2008), SoMfy BioClimatic Façade - Energy Simulation Tool and WeatherTool, and ICAX - Interseasonal Heat Transfer at www.icax.co.uk.

Towards urban sustainability: an environmental proposal - 为实现城市可持续发展的环境建议

Reduce CO2 : technology proposal - CO2 减排：技术展示 (1/3)

Photovoltaic - 光电

Different Designs - 不同的设计

Photovoltaic technology is a way to get electricity from the sun and as an aesthetic concept in the city. It can be added to existing roofs, as well as, for new city, integrated directly into the roof . Efficiency ratios are based on differing PV technologies. Thin film is 7-9%, multicrystalline is 14% and monocrystalline is 15-20%.
光电是从太阳能获得电能的技术，同时也是城市美学的概念。它可以在已有房顶上安装，也可以在新建城市时与建筑一体化安装。不同光电技术的效率不同，薄膜光伏的效率是7－9％，多晶硅的效率是14％，单晶硅的效率是15－20％。

Constraints - 限制

The panels in the proposal should face south at a 55° angle. Panels lose 80% of performance if vertical and accumulate atmospheric particles if horizontal. Restricting shadows is also paramount. One cell in the PV panel under shadow may impact the efficiency of the entire panel by offsetting the performance balance of the other cells. This leads to overall decreased performance and eventurally system failure. The local temperature dictates using crystalline cells. Snow accumulation must also be monitored. These technologies can cause some visual impacts to the buildings.
光电模块的倾角应该朝南55°. 垂直型的光电板会损失80％的能量，水平型的会受到累积灰尘的影响。同时限制周围建筑的遮挡也是很重要的。电网中一块光电板受到遮挡就会影响整个电网的效率。本地的低温以及下雪也会影响光电板的应用。 太阳能热水器的安装可能会影响建筑的美观。

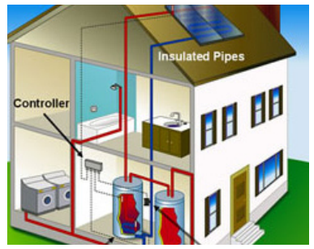
Incentives for Implementation - 鼓励政策

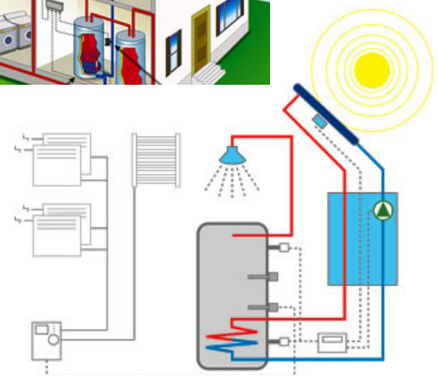
China is currenty the third largest global PV module producer with targets to raise efficiency, reduce cost, expand scale and become an innovative industry leader.
中国现在是世界第三大光电模板生产商，并将努力提高效率，降低成本以及成为该创新领域的的领导者。

Solar Thermal (Hot Water) - 太阳能供热水

Different Designs - 不同的技术

Solar hot water utlizes the energy from the sun to heat the hot water needs of the building. Flat-plate heaters, evacuated tube heaters and concentrated solar water heaters are the three main types.
太阳能供热水技术从太阳能吸收热量给建筑物提供热水。太阳能集热器的类型有平板型集热器和真空管集热器以及聚光型集热器





CHINESE TARGET GRID - 中国的目标

2005	2010	2020	2030	2050
0,07 GW	0,3GW	1,8GW	10GW	100GW

Cost - 成本

The main issue with PV is 1 kW of panel costs around 40,000 Yuan. Currently the EU cost is 3-3.5 Yuan per kWh produced over 20 years compared to the local electricity cost of 0.5 Yuan/kWh. There are no feed-in tariffs.
一个1kW的光电板的成本是4万元。目前光电在欧洲运用的成本是3－3.5元/KWh，而目前辽宁省的电费是0.5元/KWh左右。但是，由于考虑到合理的成本以及合理的效益，对于光电的补贴现在并未加入。

Cost in China - 在中国运用的成本

A family used water heater is, on average, 3000 Yuan with a concentralised heater costing 1400-2000 Yuan/meter squared.
家庭用的太阳能热水器平均价格为3000元，集中式热水器的价格每平方米1400－2000元。

CHINESE TARGETS CHART - 中国的目标

2005	2010	2020
15 million m2	150 million m2	300 million m2

Environmental Benefits - 环境效益

The average local household can replace 0.15 tons of CO2 emission by installing a solar hot water heating system.
当地家庭的一个普通太阳能热水器每年可以减少 0 .15吨CO2的排放。

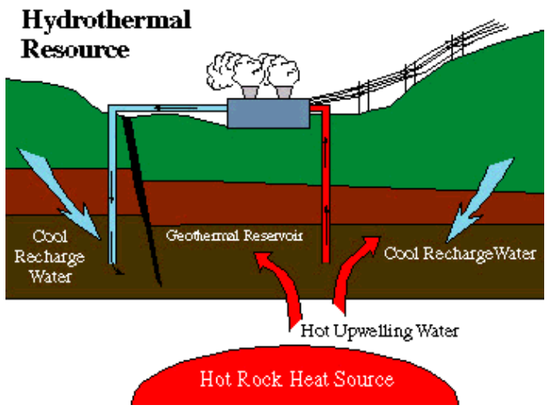
Reduce CO2 : technologie proposal - CO2 减排：技术展示 (2/3)

Geothermal Heating - 地热供暖

Technology Description - 地热供暖技术

Geothermal heating uses the Earth's thermal energy for space and water heating. Ground source heat pumps obtain energy from a depth up to 400 meters. Hydro-geothermal utilizes high temperature water from deep subsurface reservoirs.
地热供暖技术利用土壤的热量为提供暖气及热水。地源热泵从地下400米范围内获取热能。水源热泵从深层地下水源获取热能。

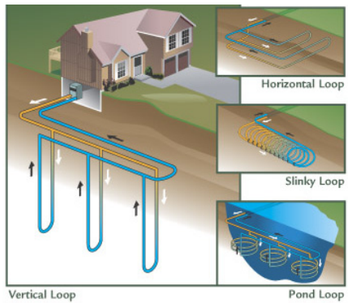
Constraints - 限制



Adversely affect land stability and large geothermal projects may causes problems if the geology is poorly understood.
可能会影响土壤的稳定性，如果对土壤地质条件了解不足可能会带来问题。

Incentives - 鼓励措施

China set utilization goals of 4 Mtce in 2010 and 12 Mtce in 2020.
中国对地热资源的利用在2010年将替代4百万吨标准煤，2020年代替1千2百万吨标准煤。



Cost in China - 在中国运用的成本

Initial investment cost is 10,000 Yuan ($1,300)/KW installed
初投资是10000元/KW。

Environmental Benefits - 环境效益

In 2006, geothermal carbon offsets in China accounted for 6.03 millions tons of CO2, 151.8 kilotons of SO2, NOx and suspended dust.
2006年，由于利用地热，中国减少了6百万吨的CO2， 15万吨的SO2， 以及NOx和悬浮颗粒。

Biogas Production with Biomass - 使用生物质生产沼气

Different Designs - 设计方案

An anaerobic digester provides electricity and/or heat by creating biogas from biomass sources such as agriculture and agro-factory residues, organic household waste, and wastewater sludge. It can be implemented in rural or urban areas.
使用厌氧反应器从各种生物质，如农业和农产品的残余物、有机生活垃圾和污泥中获取沼气，进而转化为电能和/或热能。这种厌氧反应器在城市或乡村都能使用。

Explain the Technology - 技术说明

(Anaerobic Scheme - 厌氧反应示意图)
The residue can be reused as fertilizer depending on the P and N levels. Roughly, the equation is 100 kgOM (50% C) = 50 m3 biogas (50 % of CH4) + 50 kgOM
根据反应后残余物的氮、磷含量，可选择合适的部分用作农业肥料。反应方程式可大致表述为：100 kg 有机质 (50% C) = 50 m3 沼气(50 % of CH4) + 50 kg 有机质

Constraints - 限制条件

The system must not allow any oxygen entering the system to remain anaerobic, remain agitated, and the productivity depends on the C/N/P mix.
Other needs include a power plant, proximity to the source and rationalizing the space, odor and visual impacts.
反应系统须严格限制氧气的进入以维持绝对的厌氧环境并维持搅拌，沼气的生产量取决于碳/氮/磷的混合比。系统的其它要求包括一家发电厂，邻近生物质产生源，并合理考虑空间布置、气味处理和视觉美观。

Incentive - 激励措施

Priorities for biomass energy development will be biomass power generation, biogas, biomass pellets as direct fuel source, and liquid bio-fuels.
国家优先发展生物质能，包括生物发电，沼气，直接用作燃料的生物质，以及液体生物燃料。

China Targets - 中国的目标

2005	2010	2020
2 GW	5,5 GW	30 GW

Environmental Benefits - 环境效益

Fossil fuel consumption reduction. Waste treatment. Fertilizer production potential.
可减少化石燃料的消耗。可进行废物处理。可用于化肥的生产。

Clean Development Mechanism is a creation of the Kyoto Protocol. It creates a CO2 market that allows China to sell carbon credits generated by projects that reduce the emissions of CO2. CDM are applicable to energy efficient production, fossil fuel shift, and renewable energy development project under certain conditions.
清洁生产机制是京都议定书创造的。它创造了一个可以使中国通过项目CO2减排从而售碳点数的市场。清洁市场机制适用于高效能量生产，化石能源替代，以及某些条件下的清洁能源项目发展。

Reduce CO2 : technologie proposal - CO2 减排：技术展示 (3/3)

Wind Energy - 风能

Different Designs - 不同的设计

Wind turbines are able to produce electricity from wind. They are varied in design and location. They can be on roofs or out on the ocean and can scale from small to very large farms, from a few kilowatt hours to a few megawatt hours.

风机利用风能发电。风机有不同的设计和放置位置。风机可以放置于屋顶或者海边，规模大小不一，发电能力从几千瓦时到几百万千瓦时不等。

Constraints - 限制

The chosen area must be evaluated for wind speed and prevailing direction. Bird migratory paths, road access, noise pollution and visual impact must be determined. Also, wind acts like water flowing over rocks, so potential obstacles must be outlined to determine correct wind flow. Then it is possible to determine turbine type, size and spacing.

选址应该在风速、风向适宜的地方。候鸟迁移路线，道路，噪声污染以及对景观的影响都是选址需要考虑的因素。同时，由于风和水经过岩石的作用相似，决定风场时应该考虑可能的障碍物。考虑以上因素后，才能决定风机的类型，大小以及位置。

Incentives - 鼓励措施

China plans to develop grid connected large scale wind farms, accelerate wind energy technology and industrial development to promote Chinese market competitiveness of wind power.

中国计划将大型风电场与电网联网，加快风能技术和改行业的发展，增加中国风能市场的竞争力。

Chinese Progress Chart - 风能在中国的发展

2005	2010	2020
2 GW	5,5 GW	30 GW

Cost in China - 在中国运用的成本

Currently, the total initial investment is 8,300,000 Yuan/MW

目前，总的初投资是8,300,000 元/MW

Environmental Benefits - 环境效益

Wind energy offsetting coal energy reduces CO2, SO2 and solid particle emissions.

风能的利用减少了煤的消耗，从而减少了CO2, SO2以及颗粒物的排放。

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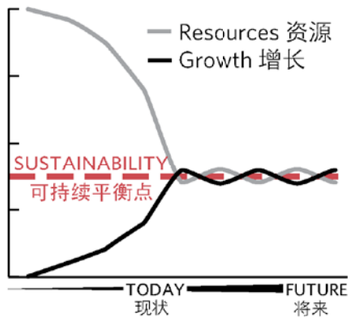
CORNELL UNIVERSITY +
URBAN MORPHOLOGY TEAM

BEYOND SUSTAINABILITY: TOWARD REGENERATIVE DESIGN
超越可持续走向可再生

SUSTAINABLE DESIGN

Sustainable design maintains a level of environmental, economic and social capital that does not further deplete the resources and systems of a site or project



可持续设计

可持续设计的模式是避免环境、经济以及社会资源在发展中不会遭到进一步的破坏

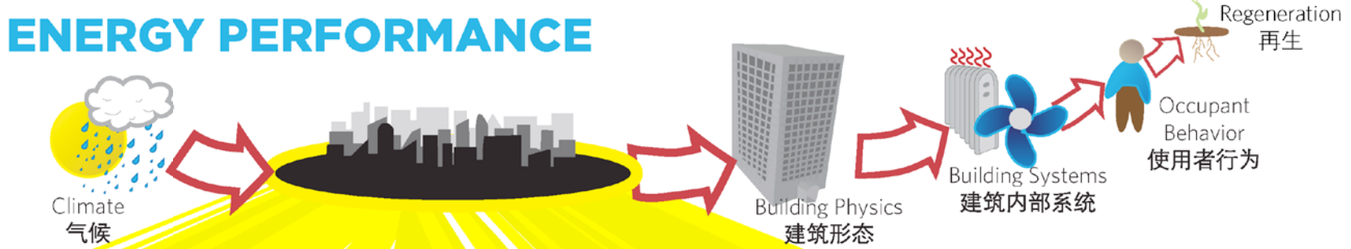
REGENERATIVE DESIGN

Regenerative design uses the resources and processes of the site to promote continuous environmental, economic, and social capital growth

可再生设计

可再生设计的模式是利用场地的现有资源去刺激环境、经济和社会的发展

FACTORS THAT INFLUENCE BUILDING ENERGY PERFORMANCE 影响建筑耗能效率的因素



URBAN MORPHOLOGY 城市形态

Urban Morphology, or the form of a city's fabric,has been shown to have the potential to improve a city's energy performance by a factor of 2. Four sets of morphological parameters influence the energy efficiency of Green Buildings. They are as follows:[1]

I. Building mass organization

Built-up area: Amount of land on a site that has been built upon

Floor Area Ratio (FAR): Number of floors per surface area of footprint

Contiguity: Connectedness between the surfaces of neighboring buildings.

Building Height: Height of structures on a site

Compacity: A measure of the contiguity defined by the following equation:

$$C = \sum_{buildings} \frac{A_{ext}}{V^{2/3}} [/]$$

where C is compacity, A_{ext} is the area of external walls and V is the volume of the building

II. Openness to the sky

Occlusivity: Sunlight blocked by the built or natual environment

Solar Admittance: Amount of solar energy entering a space.

III. Passive volume - volume of a building less than 6m from the building envelope

IV. Street networks - *Number of Intersections:* a measure of walkability

城市形态，也常被称为城市肌理，已被证明有可能加倍或者减半城市能源使用的效率。以下是四套城市形态学参数对绿色建筑的能耗使用的影响：

I. 建筑群体的组织关系

建成区：场地中建筑物的用地面积

建筑容积率：指一个小区的总建筑面积（每层面积乘以层数）与用地面积的比率

接触性：建筑表面之间的接触

建筑高度：场地上建筑物的高度

容纳性：一种衡量接触性的参数，用以下公式计算 C是容纳性，A是外墙的面积，V是建筑的体积

II. 空间的开放性

遮阳性：被自然环境或者建筑环境所遮挡的太阳能

太阳能吸纳性：进入建筑内部的太阳能

III. **被动量**：建筑体积少于6米的建筑围护结构

IV. **街道网络结构**

Case Studies of REGENERATIVE DESIGN
可再生性设计的案例分析

ENVIRONMENTAL *Wind Energy in Denmark*

Denmark found itself with relatively high CO_2 emissions per capita, largely to coal-fired electrical power plants. To remedy this problem while promoting growth and improving quality of life, Denmark started to develop alternative energy in the form of commercial wind power during the 1970s. Today wind energy is one of Denmark's main energy sources. The country is less dependent on imported energy, and is able to produce enough energy for both domestic use and export, providing a new source of revenue.

环境再生：丹麦的风能

在70年代，由于燃煤发电厂，丹麦的二氧化碳人均排放量相对较高,丹麦必需发展替代性能源　当前风能是一个主要的能源来源。丹麦较少依赖进口的能源供应。丹麦生产的能源可以供国内使用甚至可供出口。

ECONOMIC *Ruhr Valley in Germany*

The Ruhr Valley is famous for its industrial history. Collieries, steel works and tall chimneys characterized the Ruhr region. Now the old industrial ruins have been converted into cultural venues. The valley is able to benefit from its mix of industry, energy production, environmental technologies and modern service industries.

社会再生: 德国的鲁尔山谷

鲁尔山谷是著名的工业区. 现在老工业遗址已被转换成文化场馆。 这也得益于其产业结构的能源生产，环境技术和现代服务业。

SOCIAL *Beijing 798*

Beijing 798 Art District, arranged in a square 800m x 800m block, was previously an electronics factory, and has since been rebuilt by the former East Germany. It is a typical example of Bauhaus-style buildings. Now it is one of the most fashionable districts in Beijing, with over 100 art galleries, bars, retail and more than 60 artist studios.

经济再生：北京798

北京798创意区总占地23万平方米，是一个800乘800米的方阵。原为798电子工业厂区，由原东德援建，建筑多为包豪斯建筑风格，目前有 超过100个艺术画廊、酒吧等单位和超过60个艺术家工作室。

BENEFITS of a FINE GRAINED GRID

Extrapolations from the work of Serge Salat

A city's morphology has implications on more than just energy consumption. The fabric of a city also impacts its walkability, potential for economic and social diversity, livability, identity, imageability, and occupant behavior.

城市的形态影响的不仅仅是能源消耗，也会影响到城市的步行性，经济的发展潜力和社会的多样性，可居住性，城市身份，城市意象以及居民的行为。

ENERGY CONSUMPTION

- Fine grained grid morphology can halve a city's energy consumption
- Contiguous building surfaces reduce compacity, the proportion of exterior walls, and lower heating and air-conditioning costs.
- Low-rise buildings do not require elevators, use less construction materials, and do not shade streets or neighboring buildings.
- The grid can be oriented to impede wind and distribute sunlight.

WALKABILITY

- Neighborhoods require about 100 intersections per km^2 to be walkable, which is usually not achieved in car-centric cities.
- The dense road network allows for man-powered transportation, reducing the amount of energy consumed by motorized traffic.

SOCIAL INTERACTION

- When people walk, streets become public spaces integrating diverse groups of people.
- Interaction creates a vibrant cultural experience for all users.

LEGIBILITY AND HUMAN SCALE LEAD TO PLACE IDENTITY AND IMAGEABILITY

- A fine grid is designed with the size of humans in mind. Properly scaled streets create a more legibile and easily understood city.
- With smaller, more legible and intimate streets, place identity and imageability can develop more readily.

ECONOMIC DIVERSITY

- A mixed economy brings a variety of services in close proximity to residents, while it maintains stability in an uncertain global economy.

HISTORICAL CONTINUITY

- The fine grid is an ancient urban form that survives in the most beautiful modern cities, such as New York, Paris, Amsterdam, and Beijing.

LIVABILITY

- Noise and air pollution, long commutes in traffic, and limited access to nature make many modern, car-dependent cities difficult to live in.
- The fine grid promotes regenerative modes of transportation with positive externalities, and lower noise and air pollution and travel times.

Coarse Grid 粗网格

Fine Grid 细网格

网格系统的优势

能源消费

- 网格形态可以减半城市的能源消耗。
- 联排建筑可以减少拥挤感， 外墙的比例，降低暖气和空调的耗费。
- 低层建筑物不需要电梯，施工耗材少，并且不遮挡街道和周边建筑的阳光。
- 网格可以通过调整方向来阻止寒风和分散阳光。

步行性

- 社区每平方千米需要约100个交叉路口才能达到步行畅通，这在汽车城市中是经常都达不到的。
- 密集的路网可以降低交通的能源消耗。

社会互动

- 人们步行时，街道则变为各类人群互动的公共场所。
- 这样的互动为旅客以及当地居民都创造了一个充满活力的文化体验

特性，人的尺度和私密性 与意象和庄严性 （小尺度与大尺度）

- 好的城市设计会比较这两个尺度，并提供一个适宜的比例供市民享用。
- 网格系统考虑到人的尺度而创造了相对私密的街道和社区空间，与周边的露天广场和公园形成对比。

经济的多样性

- 混合商业为临近居民提供各种各样的服务，同时也可以在波动的全球经济体系中抱起相对的稳定。

历史延续性

- 虽然网格系统是一种古代城市的形态，却在许多著名的城市中保留至今，如罗马，巴黎，阿姆斯特丹和北京。

可居住性

- 噪音和空气污染，堵塞的远距交通，有限的亲近自然通道使许多现代汽车城市生活困难，同时也进一步推动郊区化。
- 网格系统则通过积极的外部设计促进再生型运输方式，降低噪音、空气污染和旅行时间。

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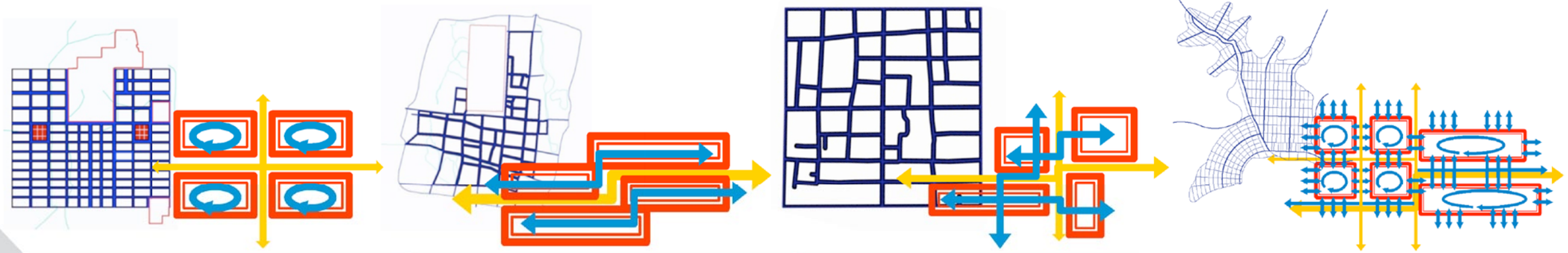
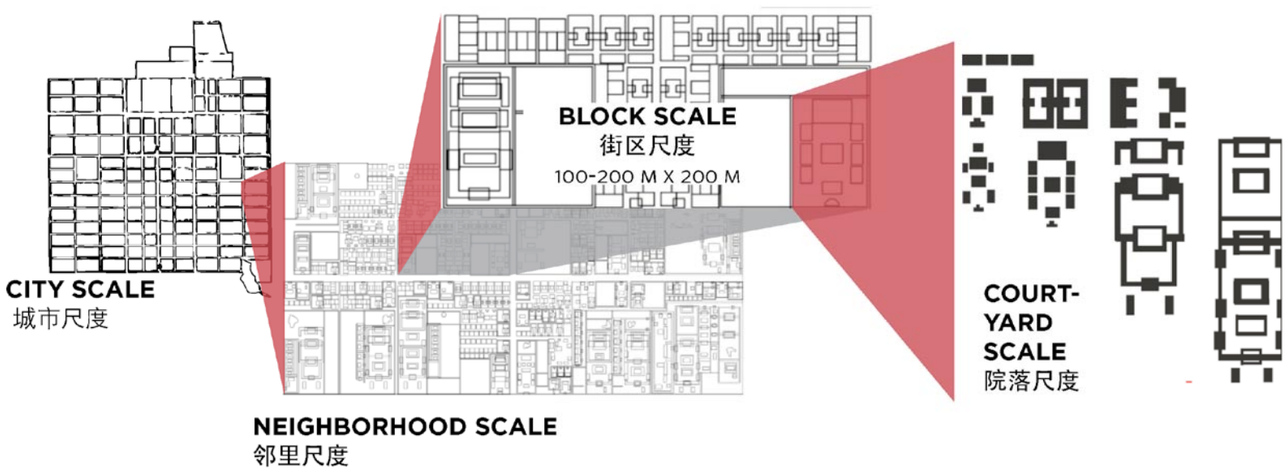
VERNACULAR *of* CHINESE MORPHOLOGY



	Tang Chang'an 唐长安	Song Bianjing 宋汴京	Ming Xing Cheng 明兴城	Future Cities 未来城市
① System of Division 分布系统	Districts 里坊制	Street Block 街坊制	Grid 网格制	Mixed Grid 混合型网格制
② Shape of Divisions 分布形态	Square 方形	"Organic" plane 自然形态	Square & Organic 方形&有机形态	Square & Organic 方形&有机形态
③ Organization of Commercial Activity 活动组织形式	Commercial Activity only in two markets 商业集中在东西两角	Commericial activity along the streets 商业活动沿街发生	Commercial activity along primary streets 商业活动沿街发生	Mixed use along primary streets 城市街道融休闲娱乐商业为一体

SCALES *of* ANALYSIS



PRINCIPLES DERIVED *from* CHINESE SPATIAL ORGANIZATION:

中国城市空间组织的几个特点

Fine-grained systems can promote:
- Social cohesion through denser spaces.
- Economic and social growth result from spaces that are more easily adapted to changing needs.
- Increased energy efficiency is acheived through more flexible options of movement due to higher connectivity.

Courtyard houses provide:
- Social spaces for private and semi-private use, connecting neighbors and providing a sense of identity and safety

Street life should be:
- Vibrant, creating stronger social cohesion
- planned to the human scale, with the single resident in mind and not the car, industry, or the greater network

Transportation planning should promote:
- Walking as a preferred transportation mode over all
- Mechanical, electric, or zero-emissions vehicles over car use

网格系统：
- 通过较高密度的空间增强社会凝聚力
- 因更适应不断变化的外部环境而促进经济与社会发展
- 道路系统之间紧密的连接提供了更灵活的流动方式以及更高的能耗效率

街道生活应该：
- 提供热闹多样化的街道活动以增强社会凝聚力
- 按照人的尺度设计，以人为本的思想，而非以车或工业为中心

交通规划应该：
- 提倡步行系统
- 鼓励机械化的，电子的或者零排放的交通工具

Les Ateliers – international network of planning and urban design – contact@ateliers.org

SITE 场地压力 PRESSURES

NATIONAL国家

Huludao's new CBD will serve as the gateway to a revived northeastern region of China.

Huludao will host events for the 2013 national games

The CBD will absorb up to 350,000 rural immigrants, including a transient 'floating' population.
新开发的CBD将会使葫芦岛市发展成为中国北部地区的门户城市
葫芦岛市被定为2013年全运会的分会场
CBD开发区需要容纳350000来自农村的新城市人口，这其中还包括拆迁住户

SOCIOECONOMIC 社会经济

The CBD will help China achieve 8% growth in GDP with a 20% reduction in energy intensity.

Developments opportunities will be auctioned to private firms and thus must be marketable.

The CBD will be a domestic and international tourist destination.

The city should withstand economic restructuring within 15-20 years.
CBD开发区将帮助中国在减少20%能源损耗的情况下增长8%的GDP
开发项目的机会将会拍卖给私企因此会很有市场价值
CBD地区还会称为一个面向国内和国际的旅游胜地
城市经济结构也会在15到20年之内有较大改变

ENVIRONMENTAL 环境

The prospering middle class will increasingly demand private automobiles.

The soil, water and air are already heavily polluted with heavy metals and sulphur from existing heavy industries, posing a threat to human health.
日益壮大的中产阶级会对私人汽车有更大的使用需求
土壤，水以及空气也会因现存的重工业而进一步遭到污染从而威胁人们的健康

生態旅遊 ECO-Tourism

"responsible travel to natural areas that conserves the environment and improves the well-being of local people
以保護環景和提高當地居民康樂的旅遊方式去參觀自然地"

ECONOMIC INCENTIVE 經濟誘因

The daily expenditure of cultural tourists 50% higher
70% would pay $150 more for a two-week stay in an environmentally-friendly hotel.
Sun-and-sand resorts a "matured market"
自 1990 以來，生態旅遊增長每年平均有 20-34%
天然景色造就了一個 "成熟的市場"

ECOTOURIST PROFILE 生態旅遊簡介

Higher education
Higher income bracket
Opinion leaders that define world image
高等教育
高收入階層
界定世界形象的領袖地位

NURTURING MORPHOLOGY 培育形態

Vibrant streets and diverse marketplaces to provide cultural experiences
Small footprint to preserve the surrounding hills, Moon River and beach.
充滿活力的街道和市場提供不同的文化體驗
減低步行足跡以保持四周山巒，月亮河和海灘

Source: The International Ecotourism Society Fact Sheet

NATIONAL国家

The CBD must develop a unique character and identity to represent the region's prosperity.

The CBD must include a sports complex, including a soccer stadium.

Morphology must be dense and adaptable, while providing a variety of housing options.
的开发必须走出一条拥有自己地区特色的发展道路
CBD地区还需要包含一个综合体育馆和一个足球场
城市形态必须具有密集性和可变性，同时应该提供多样化的住房类型

SOCIOECONOMIC 社会经济

The growing new economy must be based on education, technological innovatio alternative energy production and other less energy-intensive industries.

A dense, low-rise morphology will provide high property values and low buildin costs for developers.

The city should encourage "ecotourism", which preserves natural assets, such as beach, surrounding hills and the Moon River basin, while creating opportunities f cultural experience.

The fine-grained grid can be efficiently adapted to a variety of economic uses.
经济发展应该建立在教育、技术创新、新型能源的开发以及其他能源高利用的产业之上
一个密集且低层的形态将会为开发商提供高回报低成本的开发形式
城市也应该大力提倡生态旅游业，它是一种在包揽当地人文景观的同时保护自然地区，比如海滩，周围的群山以及月亮河盆地的旅游形式
细网格系统可以有效地根据不同经济用途而改变和调整其形式

ENVIRONMENTAL 环境

High density and pedestrian-friendly streets with efficient transit along with disincentives with diffuse demand for private cars.

An integrated biological wastewater treatment system can remediate existing pollution while providing recreational space and biomass for electricity generation.
高密度和方便行人的街区上应加设大众交通站点以此来减少对私家车的需求
一个综合的污水生物处理系统可以修复现有的污染，同时提供休闲空间和生物质能发电

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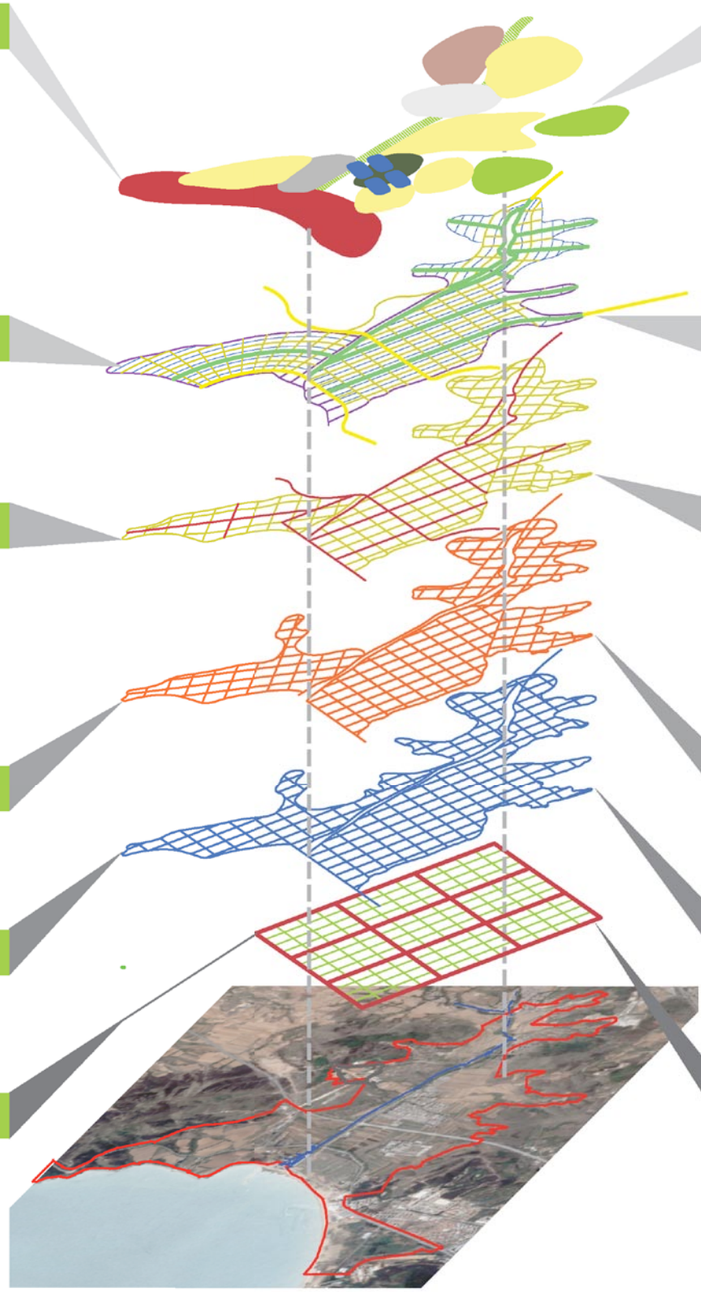
METHODOLOGY

for developing a Northern Chinese

REGENERATIVE URBAN FABRIC



7 INTRODUCE MUNICIPAL SYSTEMS

The design of transportation and environmental systems will depend on the urban structure. Public transportation should be available from within 400m of every point in the city. Natural water treatment systems should be coordinated with connected green spaces where water is available. Our primary green space runs along the Moon River, where gray water is naturally treated for reuse.

6 DEFINE NEIGHBORHOODS BY ACTIVITY

Various activities should be distributed throughout the city to reduce transportation needs and maintain economic and social growth. The commercial district and public services should be centered and accessible via primary roadways. Offices should buffer high traffic areas. Schools and sports facilities should be accessible but where open space is available. Recreation areas should be designated where interesting topography and wildlife exist. On our site we proposed a site for the commercial district along a primary road acting as the central axis of the city and a primary road along the beachfront for tourism and recreation. We placed schools and a sports complex at the edge of the city where land is cheaper but near primary roads for ease of access. We designated the beach front, surrounding hills and moon river for recreational activity.

5 SUBDIVIDE BLOCKS WITH PEDESTRIAN WAYS

Permeability and seclusion must be appropriately balanced within blocks according to use. Residential blocks should have fewer tertiary roads to reduce traffic and help create semi-private, secluded spaces. Commercial blocks should have a dense tertiary network to maximize storefront area and permeability.

4 IDENTIFY STREET HIERARCHY

A hierarchy of roadways should be defined and strategically positioned. Primary roads provide external access to highways, train stations and nearby towns. Secondary streets connect the primary roads and favor pedestrians and transit over private automobiles. Tertiary streets divide blocks created by secondary streets and provide mainly pedestrian access. On our site we identified four primary roads, two of which connect the site to the existing city and two of which connect the site to the highway and train station. The secondary streets make up the remainder of the grid and the tertiary streets are defined in the individual block models.

3 ADJUST ORIENTATION OF BLOCKS

The blocks in areas of irregular topography are then rotated or morphed to maintain an appropriate street density and accessibility. On our site in Huludao, we rotated the grid below the Moon River and in mountain valleys and relaxed the grid to organically form to natural disruptions.

2 EXPAND THE GRID TO DEFINED LIMITS

Limits of the city must be defined by slope of topographical features and a maximum of an hour walk from the city limit to the city center (a 4.5 km distance). The grid is then extended to these limits and 200m x 200m secondary grid is layed over the city within its defined limits.

1 APPLY A BASE GRID TO THE SITE

Studies of urban morphology have shown a 3 x 3 grid of 800m x 800m neighborhoods to be an efficient, adaptable, and culturally referential model. From this we derive a base grid for eco-cities in Northern China. The grid is first aligned appropriately on the site to minimize wind in the city, and maximize solar access and alignment with natural site features. In Hu Lu Dao, the sun, wind, consideration of the oceanfront and surrounding mountains informed grid placement.

市政系统简介 7

交通和环境系统的设计取决于城市结构。公共交通应满足可从城市中的任何一点出发400米的范围内都可达。天然水处理系统应与绿化空间相联系，因为这些空间内水源相对丰富。我们的主要绿化空间沿月亮河布置，在这个空间内中水通过自然手段净化回用。

通过活动定义邻里单元 6

在整个规划区的范围内对各种活动进行分布，以减少交通需求，保持经济和社会的良性发展。商业中心区及公共服务区应该位于中心位置，且通过主要道路使其具有良好的可达性。休闲区应该位于地形丰富和野生生物聚集的区域。在我们的设计基地内，我们选取作为商业区的用地是在主要道路沿线，作为城市的中轴线。滨海的一带也将成为旅游目的地和娱乐用地。我们把学校和一个综合体育场馆选址于城市边缘。这里的土地使宜，且附近的主要道路，可达性良好。我们将海滩、周边的山以及月亮河流域作为娱乐活动的场所。

用步行道路细分地块 5

渗透和隔离必须根据地块的使用进行适当的平衡。居住街区周边应该有较少的支路，以减少交通，并帮助创造半私密，幽静的空间。商业街区应该有一个密集的支路路网，以最大限度地提高店面临街的面积和渗透性。

确定道路的分级 4

道路系统的分级需要被定义和被战略定位.主要道路联通城市和高速公路、火车站以及临近的城镇。次级道路连接主要道路和主要的步行区，供私人自驾车流通。支路再次划分由次级道路划分的街区，连接主要的步行区。在本设计基地中，有四条主要道路：连接葫芦岛市中心以及高速公路和火车站。次级道路对网格进行了细分。支路则划分了每一个街区。

调整街区的方向 3

处于的不规则地形中的街区通过旋转或变形，以保持适当的街密度和无障碍环境。在葫芦岛基地内，我们旋转月亮河南部和山谷中的网格,放宽部分网格形成了自然环境中的有机形式

扩展网格定义边界 2

城市的边界必须通过地形的坡度和从城市中心步行一小时的最大距离（通常取4.5公里）来界定。然后网格就在这个边界的范围内展开，在此基础上划分了200x200米的二级网格网格.

在基地中运用基本网格 1

通过研究,我们发现,3x3的网格,800x800米的邻里单元是高效的，具有很好的普适性。目前作为参照的模型。从该基本网格，我们发展出了适合于中国北方城市的生态城市基本网格。然后，将该网格适应于城市最小风向、最大光照和基地的自然特征。在葫芦岛市，设计考虑了光照、风和城市背山面海的地理环境，对网格进行了相应的调整。

WEAVING *the* URBAN FABRIC

Street dimensions determine the border of the block.

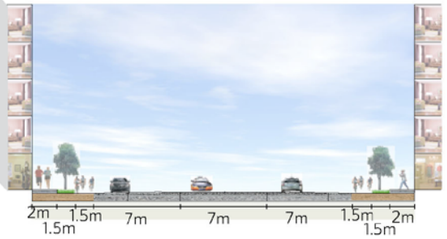
编织城市结构 街道的宽阔决定街段的边沿

The grid is defined with the 200 x 200 m divisions as the centerline of streets. Thus the street widths determine the size of blocks. These sections show the dimensions for the different types of streets. The dimensions reflect an agenda of maintaining human scale in the streetscape while promoting walkability through constricting vehicular access, maintaining solar access and exposure to green space.

网格系统是由200米乘以200米的单元格组成，主干道是中心轴。 因此道路宽幅就决定了街区的尺度。以下是不同街道断面尺寸。这些街道尺度都建立在“以人为本”的基础上，鼓励人们步行而非车行，同时保证足够的日照和绿色空间。

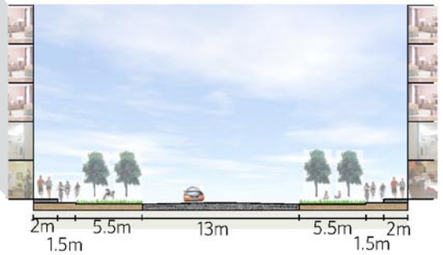
PRIMARY STREET - THRUWAY 主干道- 一般通道

- High density mixed-use retail and residential buildings along primary streets
- 2% slope on each side and porous road surface allow rainwater to penetrate and replenish natural water system
- 道路两旁是高密度混合性商业区和居住区
- 道路两边2%的斜坡以及多孔的铺面材料可以吸纳雨水并补充自然水循环系统



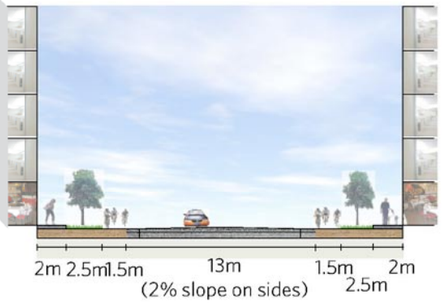
PRIMARY STREET - GREENWAY 主干道-绿色通道

- Expected building heights: 5+ stories
- 2% slope on each side and porous road surface allows rainwater to enter natural water system
- Wide greenways act as linear parks and facilitate social gathering and outdoor activities
- 道路两旁建筑层高：五层以上
- 道路两边2%的斜坡以及多孔的铺面材料可以吸纳雨水并补充自然水循环系统
- 宽阔的绿色通道可以作为线性公园为市民提供室外活动空间



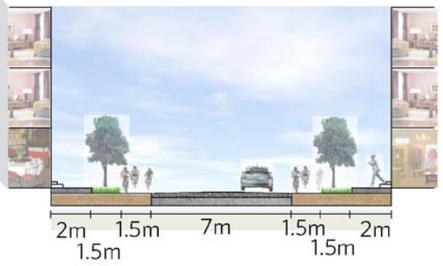
PRIMARY STREET - HIGHWAY 主干道-高速公路

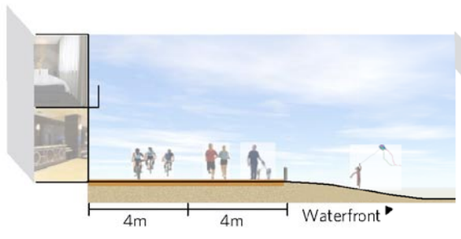
- High density mixed-use office and retail buildings along the highway
- 2% slope on each side and porous road surface allow rainwater to penetrate and replenish natural water system
- Mass transit along the center of the highway
- Private vehnicles on the two sides of the road
- 高速公路两旁是混合性办公用地以及底商建筑
- 道路两边2%的斜坡以及多孔的铺面材料可以吸纳雨水并补充自然水循环系统
- 高速公路的中心是公交专用道
- 私人汽车在道路的两旁



SECONDARY STREET 二级干道

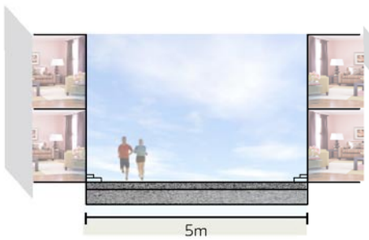
- Expected building heights: 3-4 stories
- 2% slope on each side and porous road surface allows rainwater to penetrate and replenish natural water system
- Greenbelt along sidewalk provides buffer between vehnicular traffic and pedestrians
- 道路两旁建筑层高：三到四层
- 道路两边2%的斜坡以及多孔的铺面材料可以吸纳雨水并补充自然水循环系统
- 人行道旁的绿带将汽车与行人自然分隔





BOARDWALK 滨海景观道

- Luxurious hotels and retail along the boardwalk
- Hotel customers and pedestrians enjoy the waterfront along the boardwalk
- 在木板铺成的滨海景观道两旁是高级酒店和零商
- 酒店住客和旅客可以在亲水平台享受无限海滨乐趣



TERTIARY STREET 三级道路

- Pedestrian, bikes and occasional vehicle access
- Expected building heights: 2-3 stories
- Porous road surface allows rainwater to penetrate and replenish natural water system
- 供行人，自行车和少量汽车通行
- 道路两旁建筑层高：两到三层
- 多孔的铺面材料可以吸纳雨水并补充自然水循环系统`

BLOCK TYPOLOGIES

Guidelines

SOLAR ACCESS 日光照射入口

- A table of building height limits and setback codes was produced respecting Huludao's latitude and our grid orientation.
- Buildings should be constructed contiguously to minimize compacity and 12m thick to allow passive lighting.
- 建筑高度的限制和退界将尊重葫芦岛的维度以及网格的方向.
- 一般地,建筑相邻建设,保证最小拥挤程度.同时相邻建筑的最小间距为12米,以保证被动照明

HUMAN SCALE 人性尺度

- Streets should never be fully shaded and human scale is maintained along the central axis.
- 街道保证不会处于完全被遮蔽的状态.沿中轴线保持人性尺度.

MIXED-USE 混合使用

- All blocks should have accessible street fronts for commercial activity.
- 所有的街区都有可达的用于商业活动的街道界面.

SECLUSION 解决方案

- Blocks in more residential areas should have fewer tertiary streets, creating semi-private courtyards resembling the local vernacular but at a larger scale.
- 居住街区周边尽量少支路,以创造一个半私密的院落,在更大范围内营造了传统的空间

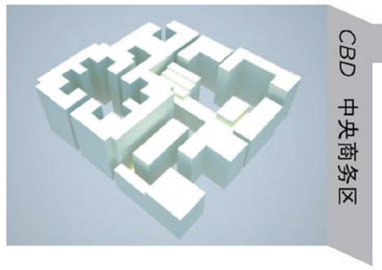
ACCESSIBILITY 可达性

- Blocks in more commercial areas, particularly along primary streets and near the coast, include high-rise buildings and more tertiary streets to maximize accessibility.
- 商业街区,特别是靠近主要道路以及滨海的区域,包括了高层建筑,高密度的支路以保证可达性的最大化.

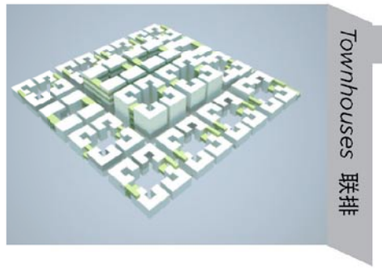
The different blocks show a diversity of form with different FAR's. These forms led to different land uses, from predominately residential to large scale commercial. Using the street hierarchy provided for by the gird methodology, these patches can be mapped onto the city forming a quilted urban fabric. By having different patches in close adjacency the urban fabric acquires resiliency through providing the opportunity for many social and economic niches in close proximity. Clustering the higher density patches around open space creates energy nodes for social contact, be it mass exercise, festivals or commerce

不同的地段有不同的容积率。这些形态会影响用地的方法，例如住宅用地跟大规模的商业用地。从网格系统中演变出来的道路分级，可以编织出紧密的城市结构，而这个密切邻接的城市结构能提供具有弹性的机会，让社会和经济紧密地发展。此外，把密度较高的发展聚集在空地附近能制造能源节点，让人们可以透过集体早操，节日或商业活动来增加接触。

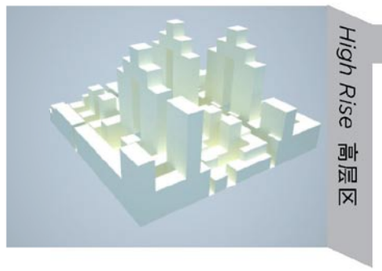
1. MOON RIVER WETLAND PARK
2. ORCHARD HILL 果树园
3. MID RISE 中层区
4. CBD 中央商务区
5. PLAZA 广场
6. GREEN STREET 绿色通道
7. TOWNHOUSES 联排



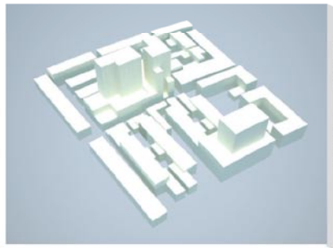
CBD 中央商务区



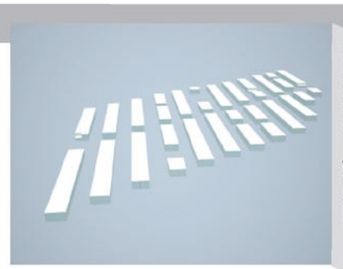
Townhouses 联排



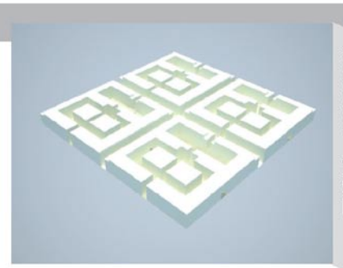
High Rise 高层区



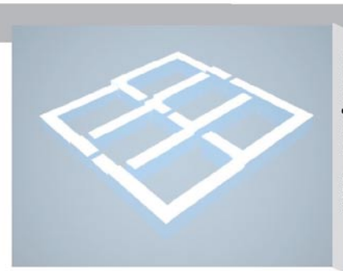
Circle 中心区



Low Rise 低层区



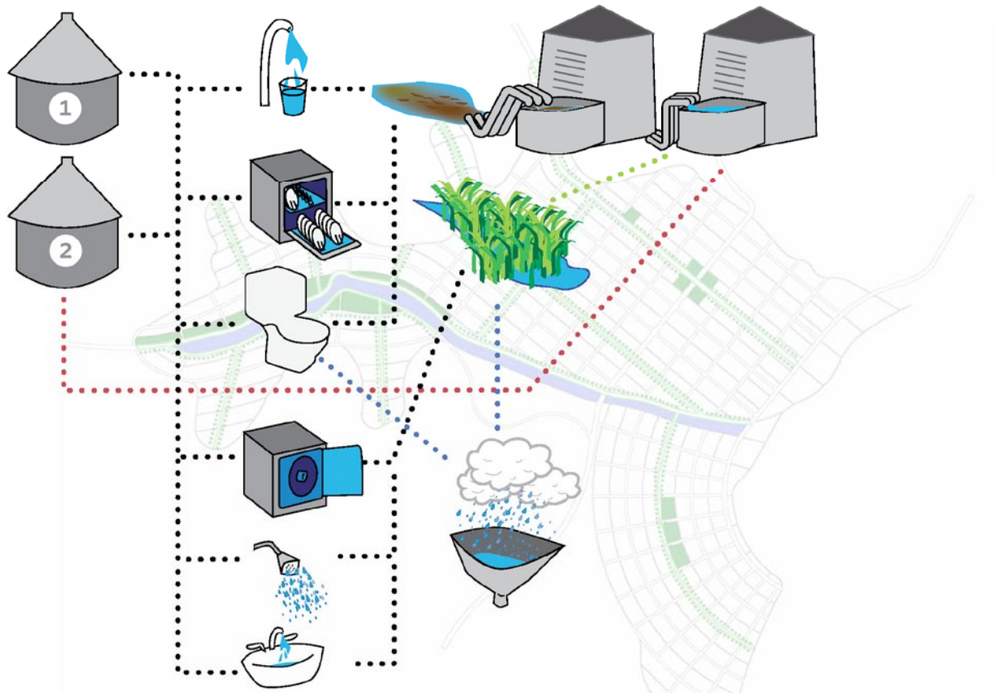
Mid Rise 中层区



Courtyard 院落

Intended Uses 使用功能	# of 3x3x6m units 方块的数量 3x3x6m	Area (m^2) 面积 (平方米)	Block footprint 建筑基地面积	FAR 容积率	Potential Population 规划人口
Residential 居住 Small commercial 小商业 Hotel 旅馆	6684	1200312	24918	4.83	3008
Office 办公 Large Commercial 综合商业 Hotel旅馆 Civic文娱 Residential居住	14461	260298	40000	6.51	6507
Residential居住 Small local commercial 小型地方商业 Agriculture support农业	2503	45054	49994	0.90	1126
Sesidential居住 Small local commercial 小型地方商业	4382	78876	40000	1.97	1972
Residential居住 Small local commercial 小型地方商业	3550	63900	40000	1.60	1598
Hotel旅馆 Commercial商业 Residential居住	4576	82368	40000	2.06	2059
Residential居住 Small local commercial 小型地方商业	684	12312	40000	0.31	308

TECHNOLOGY *within the* GRID 网格中的技术



GREY WATER RECYCLING 中水处理

Wetlands are used for filtration of all household water excluding blackwater (toilet and kitchen sink water) before retention in a reservoir for later reuse (1 & 2). The wetlands serve as the initial phase of water treatment and save 40-50% of water treatment costs per year as a passive system.

湿地系统可以处理除厨房和厕所用水的其他所有生活用水。它可以节省40%到50%的人工水处理费用。

Rainwater would be either captured and used within the buildings or captured and reused for municipal water through the green streets and porous paving. The water that does not infiltrate the urban landscape of street trees and plantings would be channeled into the grey water wetlands and eventually be added to the reservoir.

雨水可以被建筑物直接再利用，或者通过绿色廊道和多空性铺面材料被回收，并用于市政用水。没有被街道景观树吸收的雨水也可以回流到湿地系统，经过净化后再次循环利用。

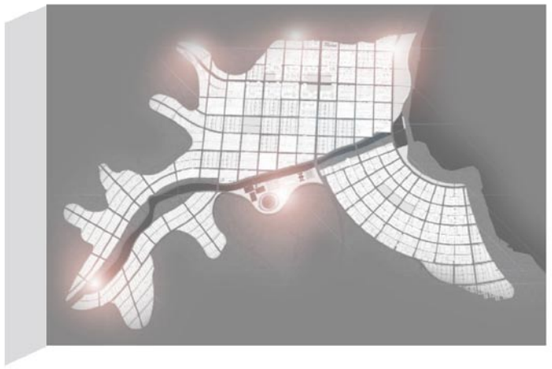
TRANSPORTATION 交通

A REGENERATIVE CITY CANNOT BE CAR-DEPENDENT.
一个良好的城市不能台依赖轿车

MINIMIZE 使减到最少

Noise and congestion to promote livability 噪音和拥挤
Space to encourage density and human-scale streets 空间密度和小街道
Emissions to improve human and environmental health 污染对人类和环境健康
Cost for universal feasibility 推广的成本


ACTIVITY NODES


PARKING STRUCTURES

APPROACH 方法

- Restrict private cars
- Congestion tax
- Promote biking and walking
- Develop transit in phases
- Utilize Electric taxis
- Evolving bus system
- Light Rail
- Provide parking at city edges so that visitors abandon private vehicles use other forms of available transportation within the city
- 限制私家车
- 拥挤税
- 鼓励骑自行车和步行
- 逐步建立交通运输
- 电动出租车
- 不断发展的公交系统
- 轻轨系统
- 在城市边界处提供集中停车场以限制私家车入城，鼓励人们使用城中提供的其他交通工具。提供停车

An EXPERIENTIAL City
经验为主的城市

To promote maximum resiliency in the urban fabric the entire city needs to be treated as a mixed use development. Within this framework different locations are likely to have different concentrations of respective uses based on landscape and urban features. Blocks along the ocean will have the highest concentration of hotels and tourism-based business while the intersection of the two largest roads will be lined with the highest concentration of office and commercial use.

为了提供一个可塑性强，可变性高的城市空间形态，混合性社区是最值得提倡的。不同地区的 混合性社区在不同的自然和社会背景下可以有相应的功用重点。沿海地区可以将重心放在酒店和旅游业，而市中心的两条主干道交接处则可将重心放在办公和商业用途上。

街道的体验 • STREET EXPERIENCE

Streets are compact and walkable. Ample room for bikers and pedestrians allows for greater sociability. Building heights are lower near the street than on the inside of the block allowing for visibility, solar access, and ease of orientation. Streets feel cozy while maintaining interest through allowing pedestrian access, outside seating, store displays, and street vendors. • 简洁的设计令街道变得容易步行。另外，旁边的单车道及行人道路提供足够的空间作为社交用途。在道路两旁的建筑物高度较低，距离街道较远的建筑物高度较高，这种设计除了让阳光能渗透建筑物，也照顾到视线和建筑物的方向。舒适和有趣的街道设计提供宽敞的行人通道和座位，商店展示，和街头摊贩的空间。

海滩的体验 • BEACH EXPERIENCE

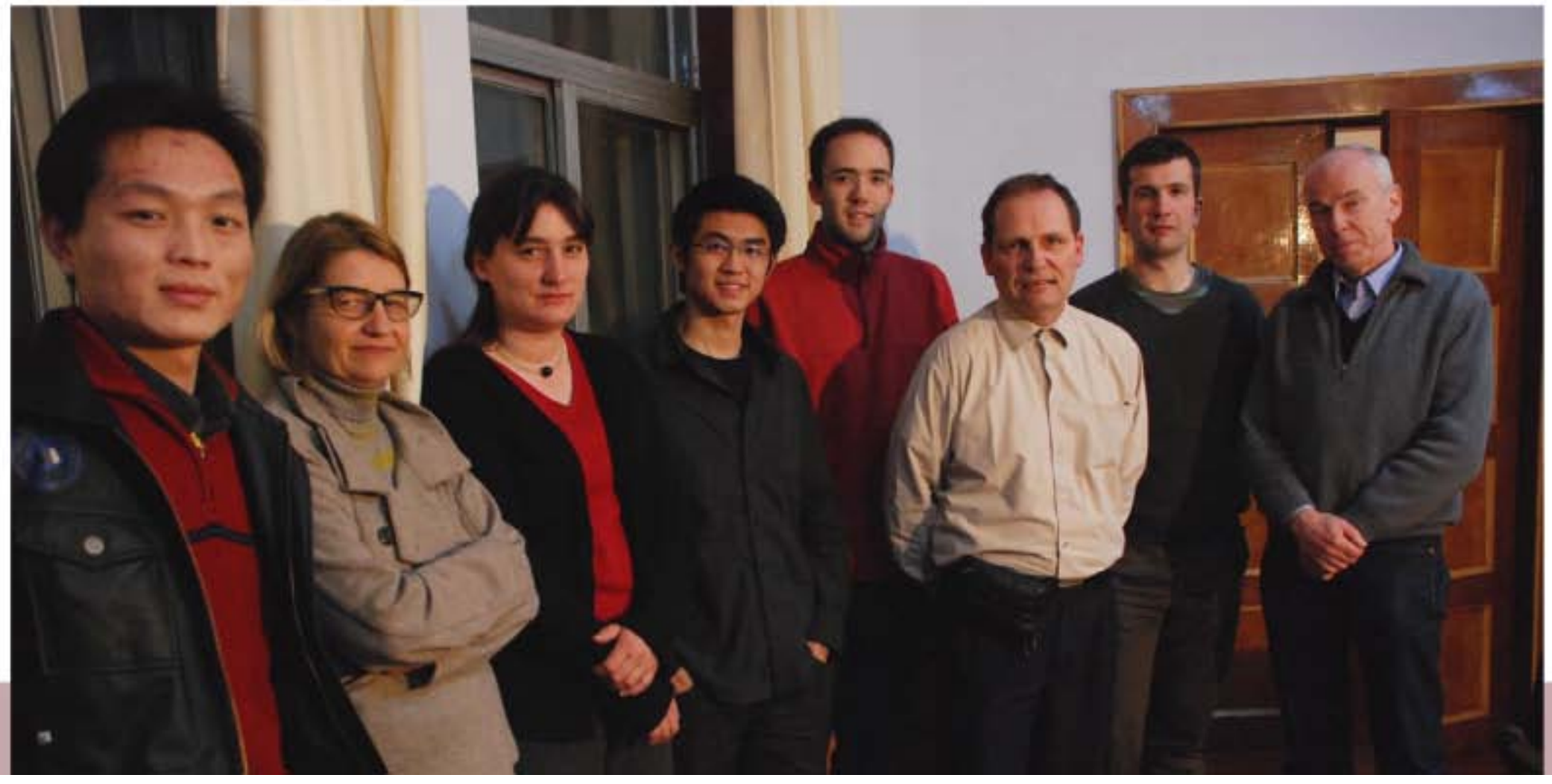
A tourist destination in the summer, the beach at Hu lu dao is full of activity. Hotels and restaurants along its shores create enough room for the influx of tourists in the summer months and the nearby green way and surround windmills remind visitors and residents of the city's eco-mission.
作为夏天的重要旅游地点，葫芦岛的海滩能让你经历很多不同的活动种类。沿岸的酒店和餐厅，环岸的风车和绿色通道提醒夏天的旅客和葫芦岛当地居民葫芦岛环保目标。

湿地的体验 • WETLAND EXPERIENCE

The Moon river serves as a wetland remediation area for the city and an ideal space for calm reflection. With small walking paths for visitor access with minimal impact on the ecosystem the moon river wetland can be accessed along nearly the whole length of the city almost all year round.
作为葫芦岛的湿地修正面积，月亮河也是一个让市民休憩的好地方。沿河的小径设计让游客一年四季都能亲近湿地生态区，同时也减低游客对湿地生态的影响。

This project devised a formal process to develop a fine gained grid city that makes use of existing site features, regional processes and historical precedent to create a system that promotes growth independent of resource depletion. The grid creates the opportunity for social and economic growth by providing an organized space for a rapidly urbanizing Chinese population. Wetlands, green streets, and natural areas within the grid encourage a managed program for ecosystem services and environmental regeneration. The scale of the streets encourages walking while providing space for regenerative infrastructure. The various typologies of building envelopes allow for a heterogeneity and density of living conditions. The devised methodologies for city design presented here can be applied to other cities in Northern China and adapted for site specific conditions to maximize the benefits of a fine grained grid.

此项目设计了一个如何应用网格系统来进行有效地城市规划的过程。它利用场地的现有资源，特点和区域历史创造了一个可以刺激城市生长的系统。此网格系统利用有效地空间组织为快速城市化的中国创造了一个 刺激社会和经济发展的城市系统。生态湿地，绿色廊道和自然野生地区为生态系统服务和环境可再生提供了良好的基础。街道的尺度适宜步行和加设可再生的市政基础设施。多样化的建筑和地形为居民提供更多不同的选择和居住密度。 中国北方的其他城市在应用此方法进行城市设计的时候，可根据当地的特色和特殊条件进行适当的调整。



A组
Professional Team A

A 组

Christiane Wunderlich	德国	建筑师，城市规划师；韩国任教 在亚洲有多个设计项目经验.
Florence Bougnoux	法国	建筑师，城市规划师 – 获 2008 年 SIMI 奖. 法国 Douai 生态社区的主创设计师
Luc Raimbault	法国	工程师， Deputy-Director of 法国 Cergy-Pontoise 规划与公共建设部副部长
钱川	中国	同济大学城市规划专业硕士研究生
Roland Karthaus	英国	城市设计师，资深讲师； 参与 NDC Clapham 公园总体规划
Stellan Fryxell	瑞典	建筑师，城市规划师； 负责斯德哥尔摩“Hammarby Sjöstad” 生态城市实际项目
Thomas Vandenbogaerde	法国	工程师，Les Mines / Tsinghua 环境管理硕士研究生.
杨辉秀	中国	同济大学城市规划专业硕士研究生

Team A

Christiane Wunderlich	Germany	Architect and Urban Designer. Professor in Korea. Worked on numerous projects in Asia.
Florence Bougnoux	France	Architect / Urban Planner – SIMI Prize 2008. Chief architect of eco-neighborhood in Douai, France.
Luc Raimbault	France	Engineer. Deputy-Director of Planning and Public Construction of Cergy-Pontoise, France.
Qian Chuan	China	Student of Tongji University. Postmaster of Urban Planning.
Roland Karthaus	British	Urban designer. Senior lecturer. Experience of the masterplan for Clapham Park NDC.
Stellan Fryxell	Sweden	Architect – Urban Planner. Realization of the “Hammarby Sjöstad” Eco-city in Stockholm.
Thomas Vandenbogaerde	France	Engineer and student at the Post-Master in Environmental Management, Les Mines / Tsinghua.
Yang Huixiu	China	Student of Tongji University. Postmaster of Urban Planning.

Huludao Eco City:

A changing city for active minds

创新思维 永续之城 —— 葫芦岛生态城

Introduction: The challenge of a sustainable urban development for the future generation

The growth of urban population happens at a hectic pace in China: every year the large urban metropolis have to accomodate 13 to 15 million new inhabitants. However the model of urban growth of the last 20 years – 10 billon m2 of building were built between 1985 and 2005 – is unsustainable for China due to the accelerated exhaustion of natural ressources, of greenhouse effect gas emissions and their consequences on health and the balance of population and the natural environment. The challenge that town planners and urban designers face, in China as in all around the world, is to design new models for the city – Eco-cities – capable to drastically reduce their impact on the environment in order to accomodate the exponential growth of urban population of the next 20 years. The project we propose to develop for the Eco-city of Huludao is fully in line with this approach, so as to answer the needs of the Liaoning Province and the City Authorities.

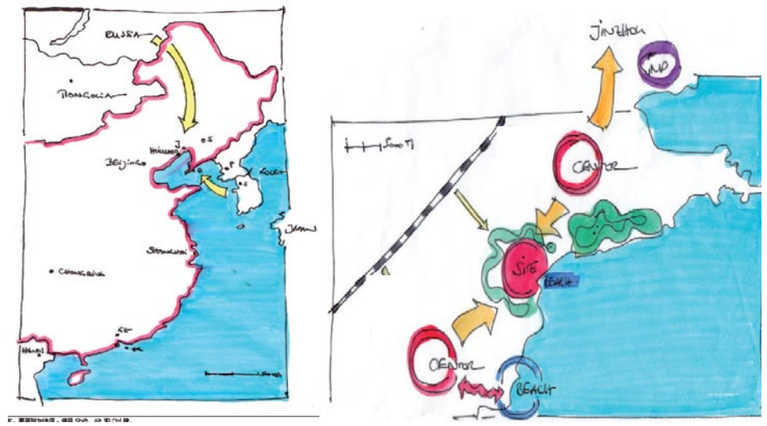
导言：子孙后代面临的城市可持续发展挑战

在中国城市人口的增长加剧：每年大型城市都要容纳13至15万新居民。

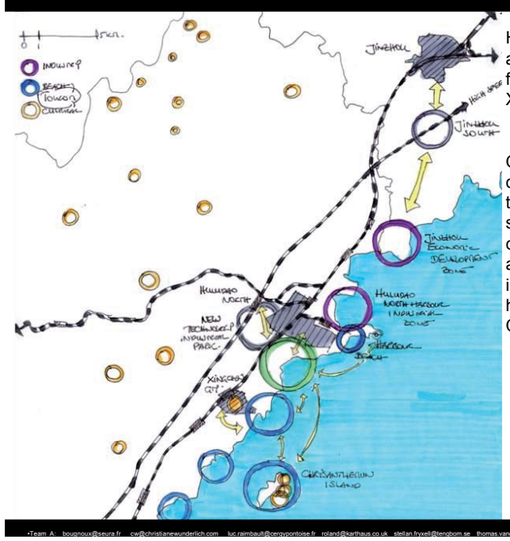
在过去在1985年至2005年20年间，城市增长10亿平方米的建设是是不可持续的，由于我国加快用尽自然资源，温室效应气体的排放，其后果对健康和平衡人口与自然环境带来巨大挑战。在我国在世界各地城市规划师和城市设计师的任务是设计新模式的城市-生态城市-能够大幅度削减其对环境的影响，以适应在未来20年迅速增长的城市人口。

我们建议该生态城市葫芦岛项目的开发，完全符合这一趋势，以便符合辽宁省和市当局的需要，

1st Part



HULUDAO'S CROSS-BORDER CITY POTENTIAL葫芦岛的跨区域潜力



HULUDAO is located within a cross-border city ranging from Jinzhou in the North to Xincheng in the South.

On the site will be a combination of 2 kinds of tourism, related both to sports, leisure, health, culture and research, within an overall framework integrating XingCheng historical city and the Chrysanthemun island, .

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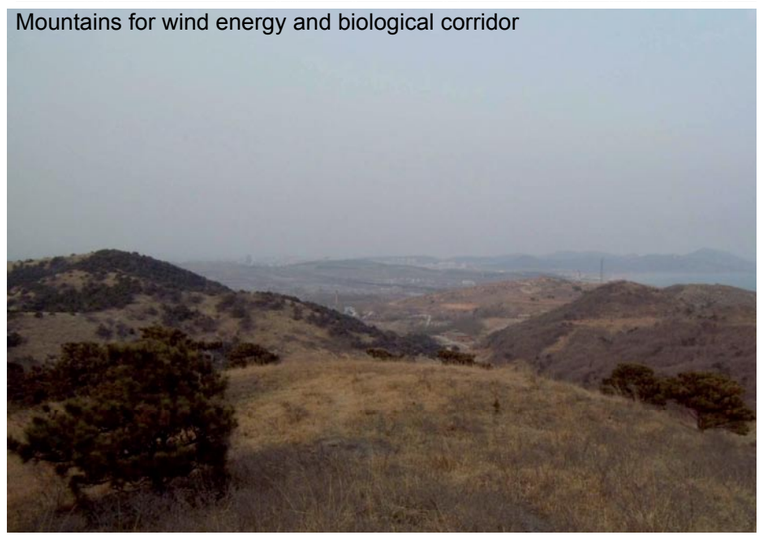


Mountains for wind energy and biological corridor

An ambitious and innovative urban project in symbiosis with its environment

1. A new era for Huludao and the Liaoning Province

The chinese central government has decided to revitalise the Liaoning Province and the industrial city of Huludao by investing and developing the most recent technologies to allow the mutation of its many industries towards the excellence required in the XXIst century by international competition.

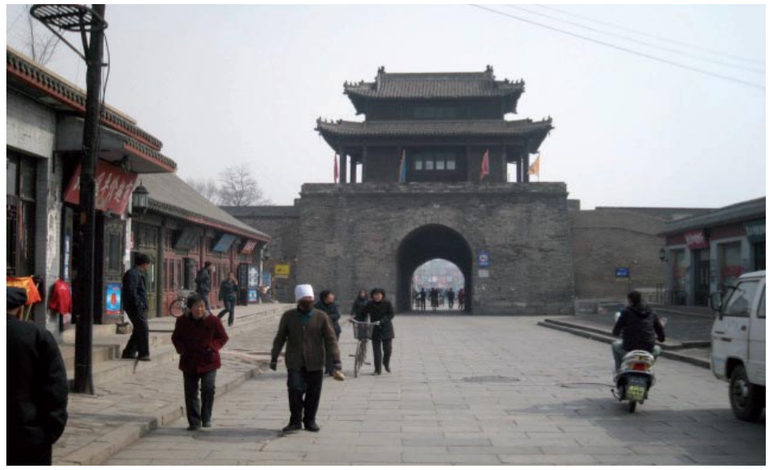
The first chinese manned space flight achieved in 2003 by a taikonaut from Huludao, Yang Liwei, constitutes the symbol of the launch of this new era for the city and the whole Liaoning Province.

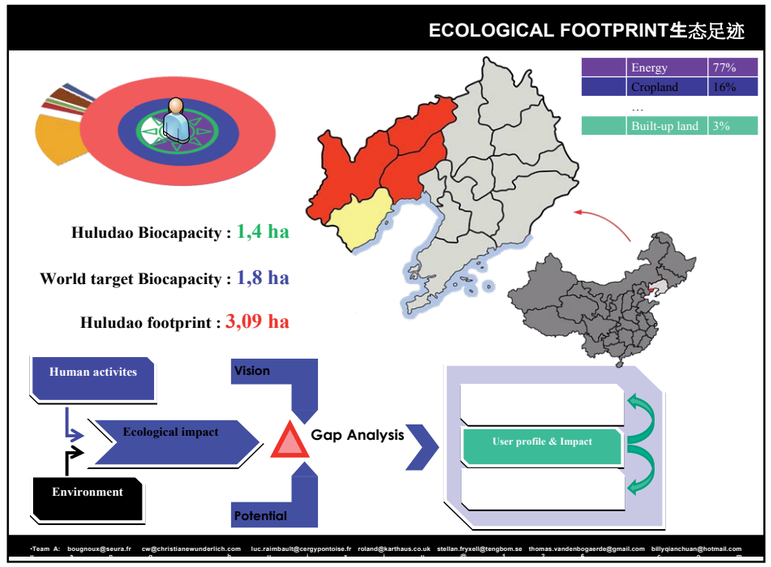
Today the Liaoning Province and the city have decided to provide Huludao with a new asset in the ruthless competition against the other cities of the Bohai Sea, to differentiate itself and be even more attractive to the national and international investments: build an eco-city on the principles of sustainable development in order to host a new latest generation Central Business District and offer its new inhabitants and the many tourists and visitors arriving by the new high speed train a new way of life where well-being, heath, high technologies and respect of the great ecological balances could merge in a natural site of exceptional qualit

第一部分

1、中央政府已决定，振兴辽宁省和葫芦岛市的 通过投资发展的最新技术，使许多行业走向卓越，满足在二十一世纪的国际竞争给工业带来的新要求。 首任华人载人航天飞行在2003年实现了，太空人杨利伟就来自葫芦岛。这象征着这个新时代的城市和整个辽宁省在二十一世纪的国际竞争中将会腾飞。 今天，辽宁省和市已决定提供葫芦岛的一个新的增长点，从而在与其他渤海湾城市的竞争中胜出，并吸引更多的国家和国际投资：建立一个生态城市的可持续发展的原则，以形成一个最新一代中央商务区，并提供新的新的高速列车，使得居民和众多游客和到港的访客以新的方式生活在幸福，健康，高科技而且尊重生态平衡的新城，并形成一个自然的特殊品质社区。

Sea for leisure, tourism, desalination,…





2. A unique natural site at the heart of the future Jinzhou – Huludao – Xingcheng conurbation

Located on the border of the Liaodong Gulf, facing Dalian, former harbour and russian seaside town next to Corea, Huludao is one of the many cities dotted all along the Bohai Sea coast, where industrial and touristic sites can be found in turn, today connected by a common road and high speed rail infrastructure network.

Huludao is bound in the next twenty years to form a great conurbation with the historical town of XingCheng at the south and the large city of Jinzhou at the north, the latter having already started to expand towards the sea.

The site chosen to built the eco-city benefits from remarkable landscape caracteristics: located at the south of Huludao on the seafront between the existing city and Xingcheng, it is a large valley of about 8 km2, bordered on the east by a magnificent beach very busy in summer, and surrounded inland by a string of hills forming an amphitheatre, which enshrine the site in a natural case. The site is naturally protected without it being isolated, it is well exposed to the sun and widely open on the sea. Hills, sea and river merge together to give the site a strong landscape identity, unique in this province, and particulary favourable to the development of an eco-city

2、锦葫都市区核心的一个新的自然环境节点 位于辽东湾的边界，面对大连（毗邻韩国，从前的港口和俄罗斯的海边小镇），葫芦岛是许多星罗棋布沿渤海海岸城市中的一员，产业区和旅游业较为发达，今天，一个共同的公路和高速铁路基础设施网络正在形成。 葫芦岛必将在未来的二十年，形成连接南方大都市的历史名镇兴城和北部的大城市锦州的重要纽带，后者已经开始扩大朝大海方向。 该基地选择建立在一个拥有最能体现生态城市的好处的景观特征的地点 ：位于葫芦岛南部的海滨城市之间的现有和兴城，这是一个大峡谷，约8平方公里，毗邻的东湾泳滩拥有非常宏伟忙碌的夏天，并由一个内陆的丘陵包围形成了露天剧场型的空间，体现该基地的自然情况。 该基地受到了自然的保护但是却不是孤立的，它是暴露在良好的日照和广阔的海面景观下。山，海，河融合在一起，使该基地最强大的景观特征，在这个独特的地点，尤其有利于发展的生态城市。

3. The existing outline structures of the lanscape

The beach: the seafront, formed by a crescent-shaped, magnificent fine sandy beach and bordered by overhanging rocks at each extremity, constitutes an exceptional lanscape patrimony to be preserved in its integrity.

The Moon River: acting mainly as a storm evacuation plain of the drainage basin enclosed by the hills, the Moon River only experiences high flows a dozen days a year, in June. Its bed is wide, in a straight line, but receives very little water most of the year.

The hills: two villages are located on the site, withdrawn in the valley. Built a couple of decades ago, their population consists mainly of fishermen for one and farmers for the other. Whereas the sea-fishing seems bound to disappear, the greenhouse farming practiced today could be strongly developed.

The main street network: two main roads cross the site: on the one hand a road running along the beach which joins XingCheng by the coast, and on the other hand the new main road, parallel to the sea but set farther in the valley, whose rectillinear route links directly Huludao to Xingcheng through the hills.-

3 、现状景观结构

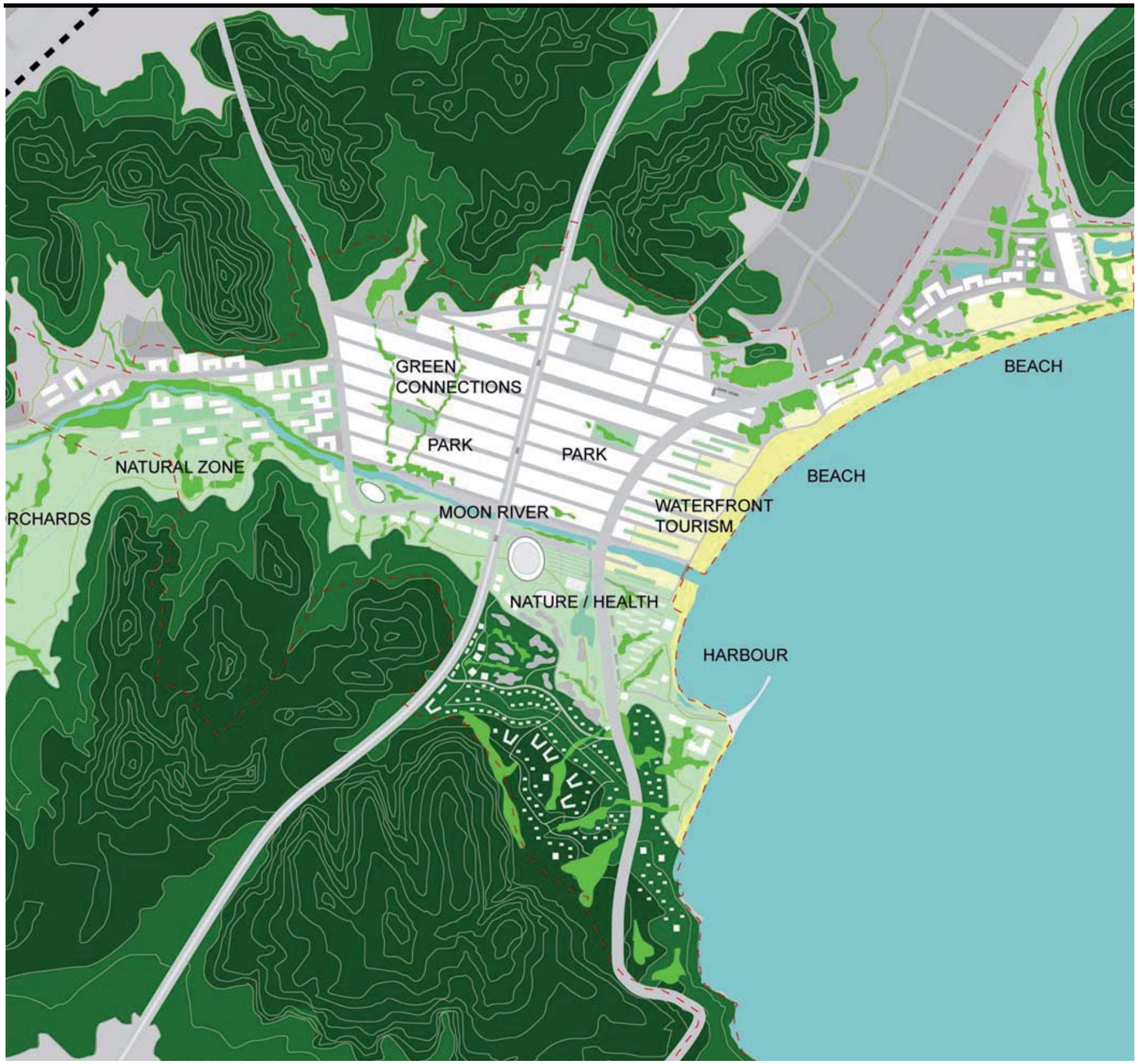
沙滩与海边，形成一个新月形的，壮丽的良好沙滩和岩石海岸，构成了特殊的景观，因此保存其完整性相当重要。 月亮河：主要是因为雷雨过后流域封闭的山区的雨水汇聚在月亮河，每年该河流的高水位时间很短，每年6月。它的床很宽，形成一条直线，但大部分时间流量极小。 山丘：两个村庄都位于基地之中，坐落在山谷中。建立于几十年前，其人口主要是渔民和农民组成，其他。鉴于海上捕鱼似乎必将消失，可以预见温室农业今天将可以大力地发展。 主要街道网络：两个主要道路穿过基地：一条滨海道路将兴城连接到海边，另一条平行于海岸线的主要道路穿越山丘，从而把形成和葫芦岛市区相连接。


Moon river as biological corridor, to limit the urban area


Valley for growing local food and biological corridor


Valleys and villages for growing local food within edible gardens or orchards

Eco-City masterplan: immersion in the natural landscape
save a natural area on the south of the Moon river with sports installations, and build high density area on the north side, linked to the railway station



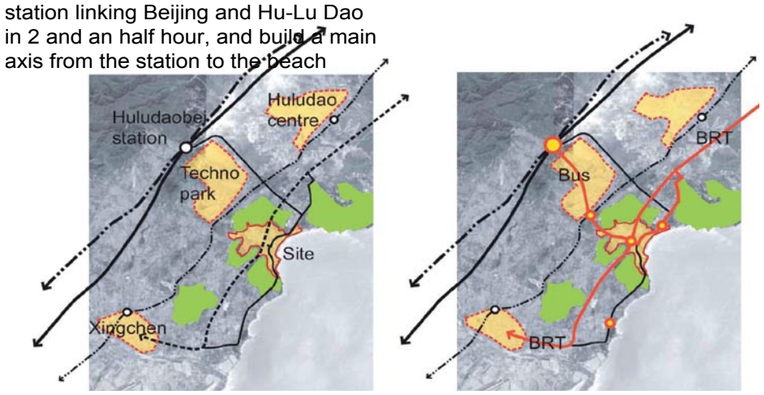
4. The urban project anchor components

a. Landscape

Our purpose is to develop the town on the North side of the Moon river, to let the south side open to the natural area made by the ills and the south side of the valley, which is a real major biologic corridor at the scale of the conurbation, linking from the railway to the sea.
That's the reason for what we put on the sports installations on the south side, the best way to preserve this natural site and depollute it; so we develop the dense urban area on the north side, oriented to the sun and open to the ill, with a fabric going down to the seashore.

b. Street network and public transportation

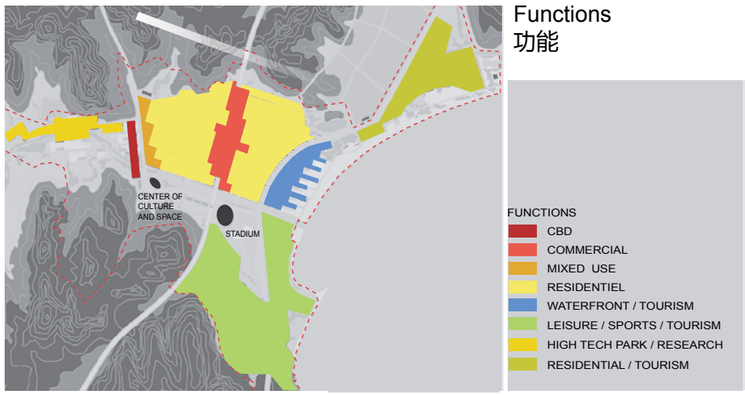
Take the opportunity of the new station linking Beijing and Hu-Lu Dao in 2 and an half hour, and build a main axis from the station to the beach



Main street network :

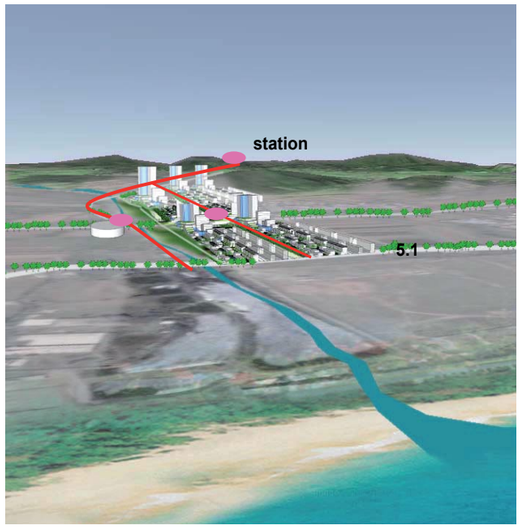
We suggest to maintain the two existing main roads: the first one serves the beach and coastal area, the second one – which is only a link between Huludao and Xingcheng so far - is meant to be a backbone for the Ecocity, since it will specifically serve the Central Business District and the Great Stadium.

It will be necessary to create a new axis as a direct link between the Ecocity and the new fast-train station, which would serve on its way the first railway station and the classical railway network as well as the new technological and industrial park.



The urban pattern relates to the flow of water through the site and connects the mountains to the sea
我们的城市模式充分尊重了月亮河的流向和景观，同时将山体和海联系起来

Low to high buildings from the sea to the mountains;
High buildings connected with the main roads , to Huludao down town and Huludao fast-railway station



Main street through the CBD

secondary street

Views on the streets 街区景观

Streets and spaces are pleasant places to be
每一个角落都充满这欢声笑语和愉快的生活场景

The traditional pattern of housing in Xingchen old city is dense, well-oriented and adaptable. The Eco-city dwellings adapt this pattern to increase density, to follow the site and accommodate the existing village
兴城的传统城市的居住机理非常的紧凑，拥有良好的朝向和适应性。我们的生态城市沿承了这样的机理同时增加了密度，结合了基地同时适应了现状。

Urban block pattern

Reed beds between typical housing blocks

Local square in the housing blocks

Street onto Moon riverfront

Natural area on the south side of MOON River, to link sea to mountains

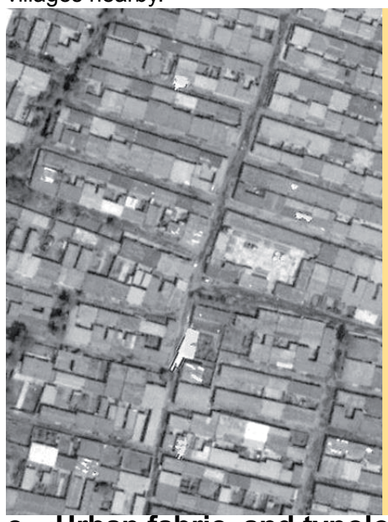
In addition to cars and soft traffic, a public transportation system with dedicated lanes or tracks will be implemented on this road, so as to enable tourists, researchers and businessmen to reach the Ecocity from the fast train station.

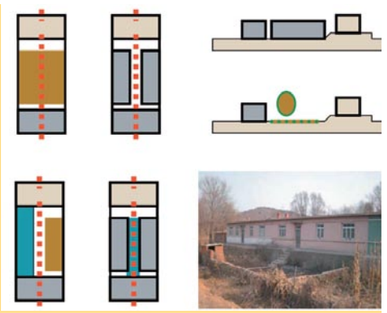
This road may lie between two hills on the North-West of the site and go through a pass which will play the role of a threshold, given the significant relief along the lanes. At the entrance of the valley, the axis of this new road will open a perspective through the CBD high rise buildings towards the new Center for Culture and Space, up against the hills and beyond the Moon River

second street network

It would be relevant to position the secondary roads in parallel with the natural direction of the Moon River's bed. The position of the fishermen village located on the site also follows this axis, and so on the south orientation of the chinese housing buildings.

We suggest to make up a contemporaneous urban texture so as to provide all the ecological functions that are necessary in an Ecocity's public and private spaces – such as water management, soft traffic, flora diversity… - while referring to the Chinese traditional lamellar grid street pattern that can be found in the neighbouring fortified city of Xingchen and in the rural villages nearby.





Understanding the way of living in North China, solar orientation, courtyards,…used water treatment, to learn about the tradition and link the old ways of saving and the new ecological way

c. Urban fabric and typology

In this urban area, the secondary street network develop mixed blocks of 90m * 300 to 400m ; these proportions permit to reinterpret the urban traditional urban fabric, and authorize 3 constructible building plots in a band of 24m , that means 3 building plots of 24m*30m, or more when individual housings.
On these building plots, according to building height limitation, individual houses can be developed on a traditional way, with court-yard on the south of the plot building(first building on the North part of the plot building, then in a second time, in the south part of the plot building); the collective buildings can also be built around courtyards, with a lower building on the south side and higher building on the north side. Buildings will be most of 5 floors to avoid to build with a lift, that is expensive and takes a lot of energy; this allowed also a good mixity in the buildings;

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4、城市项目的主要组成部分

道路网络：

主要道路网络 我们建议保留两条主要的道路 ：第一条服务于滨海区域，第二条（目前仅仅是作为连接葫芦岛和兴城）将作为生态城市的脊梁道路，因为它将尤其重要地支撑中央商务区和大型体育馆。将有必要建立一个新的轴作为之间和新的生态城市快速火车站的直接联系，同时将连接新的高科技产业园。除了汽车和软交通，公共交通系统与专用车道或轨道将执行这条道路上，以使游客，研究人员和企业家达到生态城市的快速火车站。这条道路可能位于基地西北部的两座丘陵之间，起到重要的咽喉作用。因此这条道路周边的地块就显得格外重要。因此新的CBD地区将从这里开始崛起，新的高层建筑将为这一条街道提供令人震撼的城市形象，在这条道路的末端，视角逐渐打开，展现在我们面前的是新的文化和太空博物展示中心呢，面对的是丘陵和美丽的月亮河。

次级道路网络：

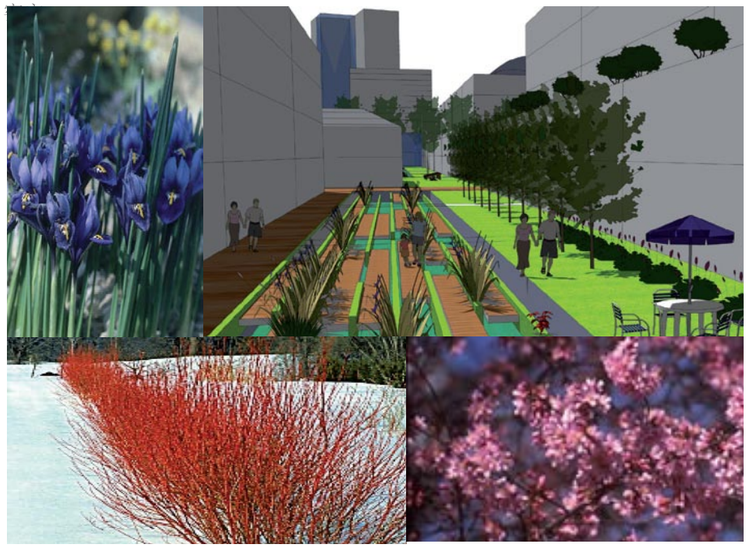
次级道路网的方向和月亮河的流向和河床有着非常密切的联系，同时，我们基地内原有的渔村同样非常符合我们确立的这一城市机理。

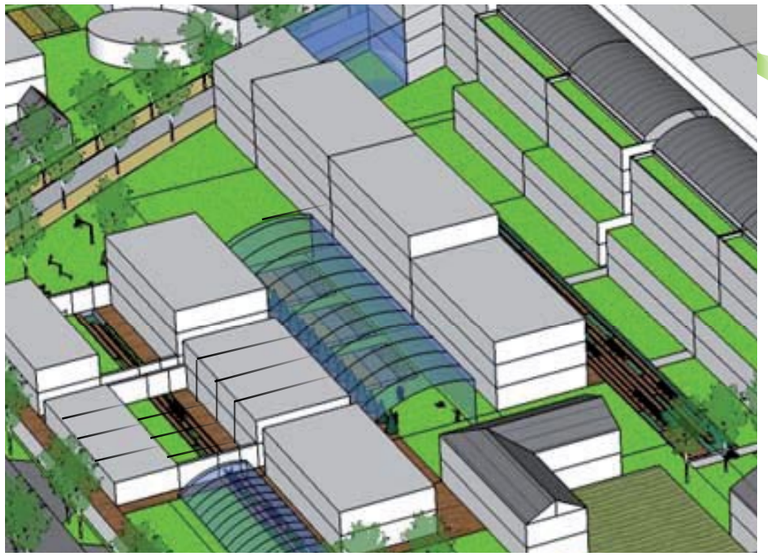
我们建议建立一个同时代的城市机理的同时提供所有的生态功能，保证所有的公共和私人空间，同时也有利于水资源的有效利用，软交通的合理运用，植物多样性等等。我们只需要把眼光放到临近的中国历史名城——兴城，就能够发现这一传统的层网格街的完美模式。

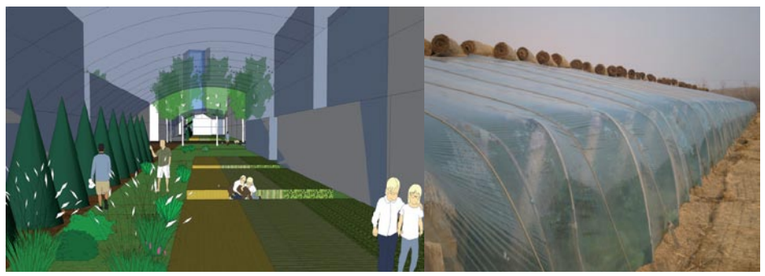
主要城市功能：

中央商务区：沿着城市主要道路安排商业以及零售业的开发，串接着新高铁站点、新工业科技公园，打造功能复合的城市文化以及公共活动轴线。它一直延伸到具有研究中心以及高科技主题公园的山谷，是基地中开发量最大，高度最高的区域，一些办公和总部建筑高度可以在100米以上。 大型运动场，港口以及高尔夫乐园 基地内月亮河南岸，将建成大型运动设施，迎接2013全运会，充分考虑了运动场的人流集散与交通组织，在高尔夫周围发展新社区，这些社区都将拥有海景。海滩的南端，将建一处码头，用来服务赴周边岛屿观光旅游的人群，同样也会建一些酒店和住宅。最多1500套住房将会在这一社区建设。 沿海的海滩观光旅游 基地内风景独特的海滩资源是葫芦岛发展旅游观光经济的宝贵财富。它不仅要被保留下来并且要强化为周边的休闲圣地，它将集聚服务、餐饮设施，同样将会建设坐拥海景的高档酒店及度假村，这个目标将会通过建设6000—8000的住房单元来实现。 沿着中央干线道路的生态城市，这是为青年才俊和企业家度身打造24小时的城市新生活的中心，而白天，它也是一个活跃的商业街区。在范围内，建筑物可以达到45米高。

中部地区的住房安排了向南的4至7层的建筑物，结合了传统的街区形式的构筑方式同样提供了较大的灵活性，从而可以非常丰富的营造出多样性的公共和私







Grey waters are treated on the plot building, with reed bed (1square meter per inhabitant), black waters can be treated also by living machine;
We find then green houses for living machine in the campus and in the golf area, and green houses in the urban area for edible gardens

d. Main urban functions

The Central Business District:

This new business and retail neighbourhood is developing along the main road which links the Ecocity to the new fast-train station and the new technological and industrial park, as far as the new Center for Culture and Space. It extends to the end of the valley with a research center and a high-tech activity park. It is the highest area in town : offices and headquarters buildings may be higher than 100m.

The Great Stadium, the marina and the golf area:

South of the Moon River, the site will host the Great Stadium that will be built for the 2013 Games and will be directly accessible by road and public transport, and of a new neighbourhood developed around the golf and looking down on the sea.

The southern end of the beach will host a marina which could also be used to welcome cruise boats heading to neighbouring islands, as well as hotels and housing. About 1,500 top-of-the-range flats will be built in this neighbourhood .

The beach and touristic pole of the seafront

The site beautiful beach is a very important patrimony for the development of Huludao touristic economy. Not only must it be preserved but it will also be reinforced and completed by the creation of nearby light leisure, catering and services equipments, as well as by the development of hotel and leisure reasorts with a view on the sea, and by the building of 6000 to 8000 housing units.

The commercial neighbourhood of Huludao Soho

Placed along the central arterial road of the eco-city, it is the new night life centre of the hype youth and businessmen, as well as it is a lively commercial neighbourhood during the day. At the site scale, the buildings can go above 45 meters high.

The housing districts in the heart of the city

The central housing districts are made up of south-oriented 4 to 7-floors buildings and arranged following a lamellar traditional p offering a great flexibility to organise and arrange public and private spaces.

e. The key figures of the urban project 项目的关键数据：

Built-up area ratio: CBD 80%, Campus 50%, housing from 30-50%

各功能用地比例：

CBD中央商务区80%， 高新技术教育研发园区50%， 生态居住社区30%至50%

Built-up floor area for housing: 2 000 000 m² 住宅建筑面积：2000000平方米
Built-up floor area for offices and activities: 1 000 000 m²

办公建筑和活动场所建筑面积 1000000平方米

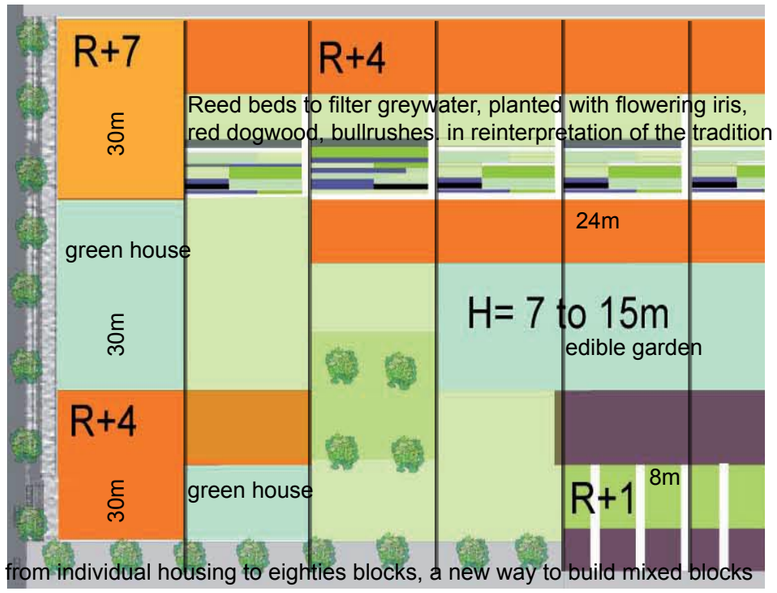
Estimated residential population (including tourists and businessmen): 100 000 pop 大致居住人口数量（包括游客和商务人士）：100000人

FAR residential block: Low density Housing areas:1.0 High density Housing areas : 1.5 容积率：低密度住宅区：1.0 高密度住宅区：1.5

FAR commercial block: 3.0 (typical)

Block dimension: 90m X 400m 街区尺寸： 90米X 400米

Urbanized area: 3 km² (golf and stadium included) 城市化地区：



2nd Part

Huludao, a model of eco-city conception for a sustainable development

The Eco-city model we propose for Huludao is fully inscribed within the framework of sustainable development developed in order to contribute to the formidable challenge posed by urban growth in the next 20 years in China.

The urban project is built on a resolutely scientific approach calling on the most recent works of environmental research, often developing high technology processes, the only ones able to deliver the performance level aimed for.

Four main topics allow to evaluate and define the environmental objectives to be reached in an Eco-city:

1. Ecological footprint and Energy
2. Water
3. Biodiversity and the well-being of inhabitants
4. Waste

Each of these main topics has been studied in depth in order to propose innovative solutions that find their full application and integration in the urban fabric.

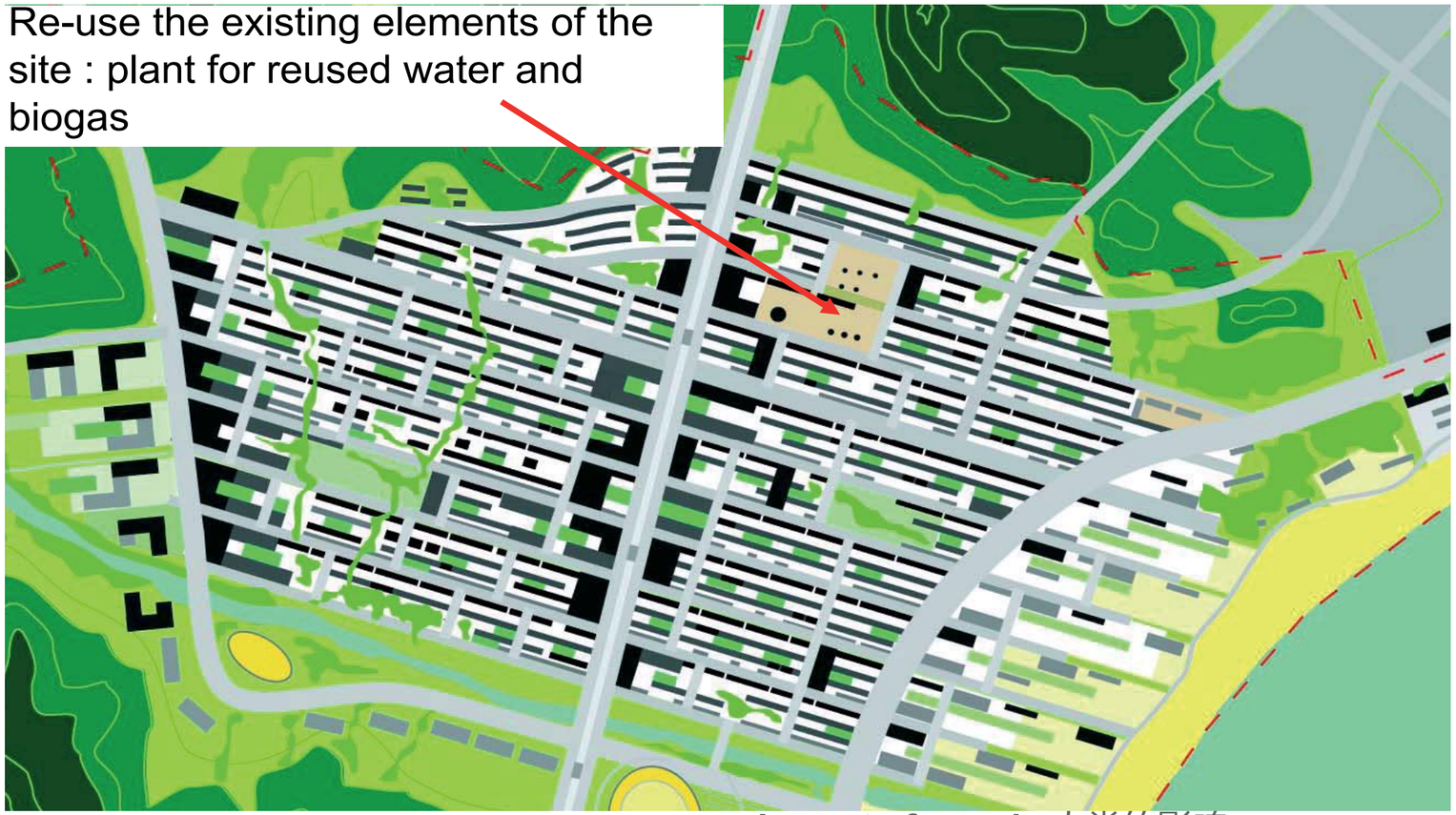
Therefore, for each research axis, the proposed processes are detailed in technical figures and precisely located on the masterplan allowing to understand their integration in the urban project.

Water is one of the major issues of the site due to its scarcity and pollution, yet worsened by the rain coming in contact with polluted air and contaminated soils.

At the global scale: to provide drinking water, we propose to realise a seawater desalting plant whose energy needs would be covered by the neighbouring biomass plant. Polluted streaming water and blackwater discharged by the buildings will be treated in a waste water treatment plant built on the site.

At the local scale: grey water discharged by the building will be locally treated in the urban fabric through a system of successive filtering basins. Rainwater and greywater are collected in distinct networks. For low-density housing neighbouhoods, we propose to use autonomous water treatment systems covered by greenhouses.

The handling and treatment of the water has been an important organising principle for the masterplan. The remaining topics are explained through the report



葫芦岛，可持续发展的生态城市概念模型

葫芦岛生态城市模型的提出，完全是在可持续发展理论的指导下，该发展模式有助于城市在未来20年的发展过程中，应对由于城市增长带来的挑战。 该项目的研究方法建立在科学、严密的基础上、以近来对环境数据的研究作为支撑，此种研究方法常应用于高科技的研发，从而力求方案在各方面具有很高水平。 生态城市，主要从以下四个方面进行环境评价：

1. 生态足迹和能量
2. 水
3. 生物多样性以及居民福利和幸福度
4. 废物

为了提出解决问题的新措施，并且确保它们的实施能够较好地与城市建设结合起来，以上四方面都进行了深刻的研究。所以，在该项目中，任何措施的提出，都有详细的数据以及同总体规划密切的结合作为支撑，并且每一项措施都详细的落实在了总平面图之上。 水污染严重和短缺决定了水将会是基地内最重要的问题之一。由于地形等特殊原因雨水和受污染的水源融合到了一起，使得这一问题显得更为关键。 全球视角：提供饮用水，建议用生物燃料作为动力，对海水进行脱盐处理。污水、生活废水等由建在基地内的生物污水处理中心进行净化处理。 区域视角：在城市中产生的中水通过一套过滤系统进行净化。通过不同的收集网络收集城市中的雨水和中水。人口低密度区，建议使用自治的水处理系统，该处理系统设置在温室中。总体规划中，科学地进行水处理已经成为了重要的组织实施原则。在该方案中，很多的措施将在总平面图上加以完善。

Impact of people 人类的影响

Eco-city design can reduce the impact of people on the environme
生态城市设计能够减少人类对环境的影响

2. Our strategy tremendously reduces impact as regards:
我们的策略非常显著的减少了如下方面的影响：

Footprint (energy): We can first reduce 40% of this impact through energy efficiency, urb compacity and renewables. Transport or industry are out of scope for us.
生态足迹（能源）：通过高效率的利用能源、紧凑的城市形态和循环利用的方式我们能先少40%的能耗。

Water use : We manage to become independent for water supply focusing on grey and black water recycling and seawter desalination
水资源利用：通过专注于对生活污水循环利用和中水的有效回用以及海水脱盐流程的努力们实现了水资源的自给自足

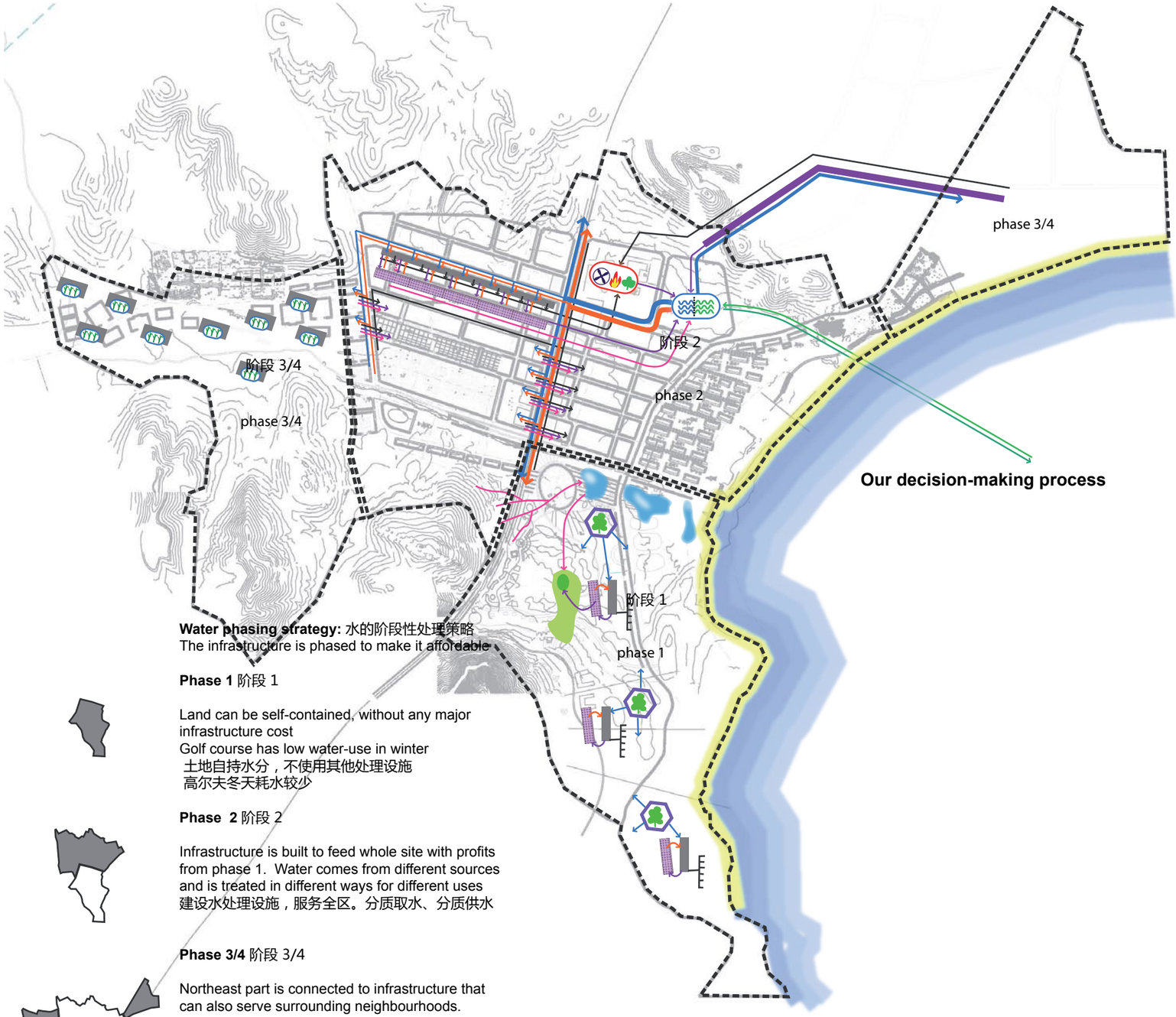
Waste : We help closing the materials loop for recycling and use organic for energy valoi sation
废物：我们尝试通过生物的方法来完成材料的循环实现能源的转换。

Social well-being and biodiversity : We ensure human health and nature respect
社会福利和生物多样性：我们保证了人类生存空间的健康和自然的多样性。

3. Our eco-city uses and respects natural potential. It divides environmental and energy costs on the long run.
我们的生态城市充分利用和尊重了自然的潜能。从长远来看，这同时有效的控制了环境和源的消耗。
Our calculations will be provided as appendix for future development.
我们将会在附录中提供相关的具体的计算和数据。

Sustainable water systems 可持续的水资源系统

Existing water is scarce and polluted 现状的水源稀少而且被污染



Water phasing strategy: 水的阶段性处理策略
The infrastructure is phased to make it affordable

Phase 1 阶段 1

Land can be self-contained, without any major infrastructure cost
Golf course has low water-use in winter
土地自持水分，不使用其他处理设施
高尔夫冬天耗水较少

Phase 2 阶段 2

Infrastructure is built to feed whole site with profits from phase 1. Water comes from different sources and is treated in different ways for different uses
建设水处理设施，服务全区。分质取水、分质供水

Phase 3/4 阶段 3/4

Northeast part is connected to infrastructure that can also serve surrounding neighbourhoods. Western part is self-contained campus for eco-research 东北部和基础设施相连接，同时也能服务其周边的 社区 西部是一个自给自足的生态研究园区

living machines in buildings and water treatment plant
建筑内部的生物温室以及水处理装置

Water sources: 水资源

Sea water , contains NaCl and some heavy metal contaminants
含盐分及重金属成分的海水

Rainwater run-off, contains heavy metal contaminants含有来自于空和土地的重金属污染的雨水

Rainwater from houses may be clean in near future屋面雨水（将来有 给予净化）

'Grey' water from buildings 建筑中水

Black' water from people
生活废水

Supplies to buildings 建筑供水

potable (drinking and cooking) water
饮用水

Household water (non-potable)
生活用水（非饮用水）

Systems and processes 系统和过程

Biomass energy centre 生物燃料处理中心（见能量图）

Water treatment plant 水处理中心

Individual buildings 单体建筑

Constructed wetlands for summer storage 用于储存夏季雨水的人工湿地

Seawater greenhouses: produce water and grow trees for street海水温室：用于处理水并且种植落叶 树种，能够美化街道、遮蔽阳光、保 障生物多样性

Autonomous office building with living machine in atrium 中庭配备生物温室从而实现生态平衡的办公建筑

Reed beds for greywater treatment: 1 metre sq per person 种植芦苇湿地处理中水：以每人1平方米计算

Soakaway treatment system
浸润式排放系统

Irrigation sources for:灌溉方式：

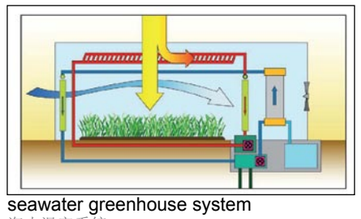
Street trees 街道绿化

Golfing greens (all year)
高尔夫果岭草皮（全年）

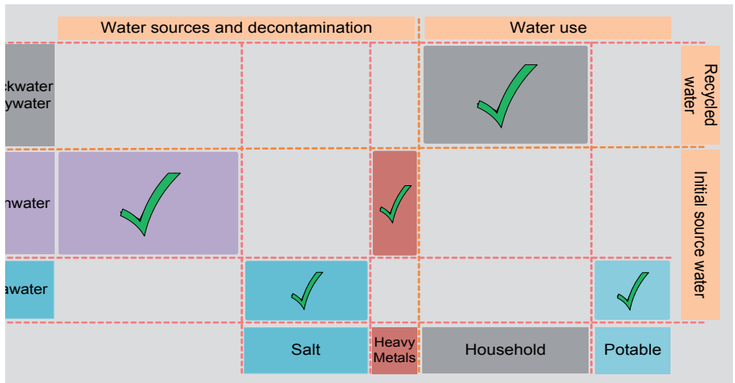
Golf course (summer)
高尔夫球场绿化（夏季）

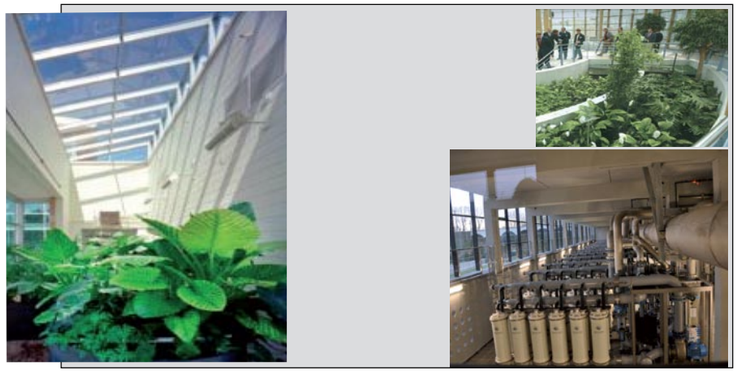
Evacuation: 排放

returned seawater (110% concentrate 海水萃取后排放（以110%倍浓度排放）



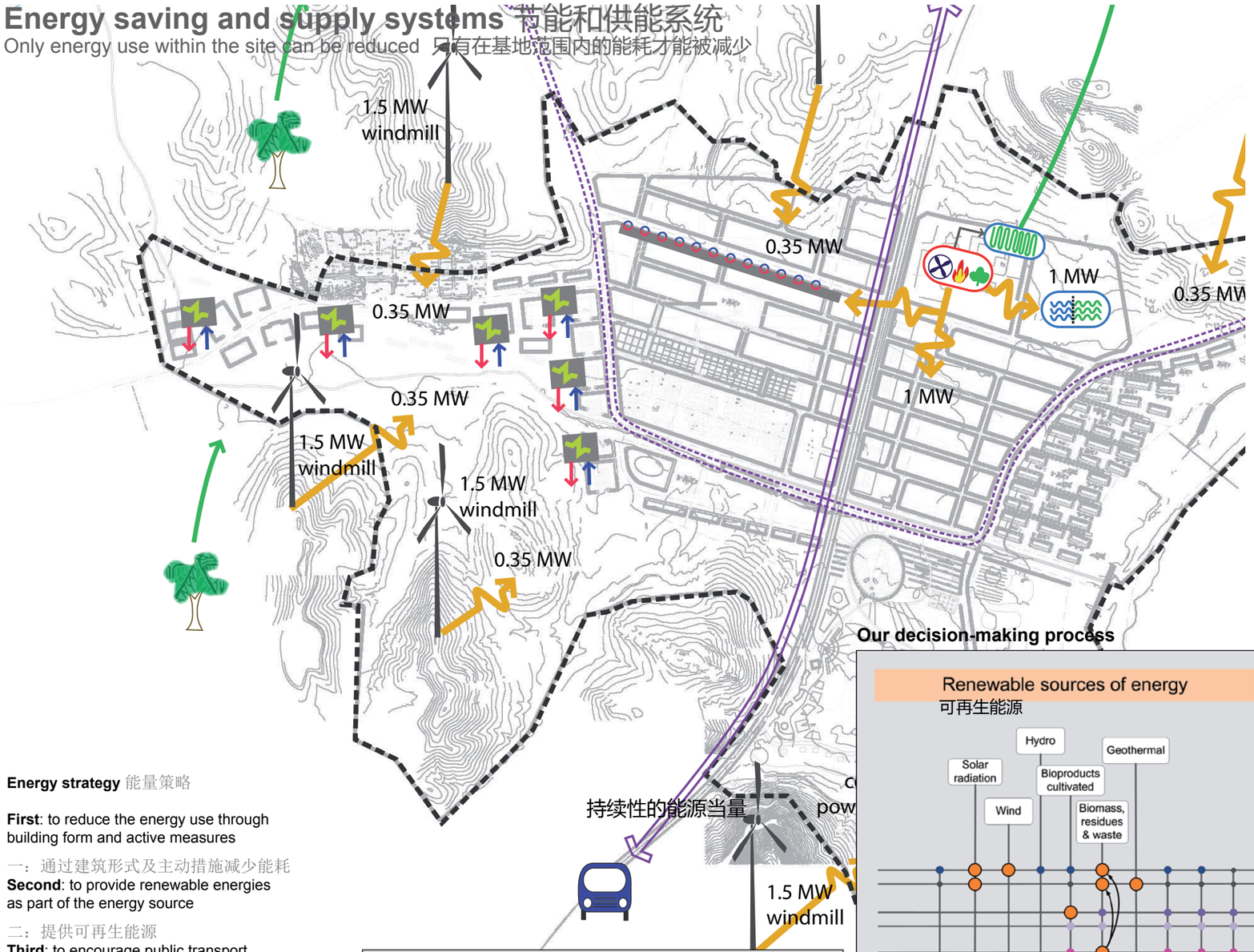
seawater greenhouse system
海水温室系统





Energy saving and supply systems 节能和供能系统

Only energy use within the site can be reduced 只有在基地范围内的能耗才能被减少



Energy savings: 能量节省

Heat exchangers in all houses

所有家庭安置热交换器

micro electricity generation via photovoltaics and wind turbines

cooling via geothermal for all office buildings 所有办公建筑利用微电以及风涡轮制冷和取暖

Eco-city strategy for low-energy appliance use eg. light bulbs

采用低耗能设备（如节能灯泡）的生态城市策略

Biodiesel public transport:

生物 燃料公共交通

red: shuttle bus 红色：往返公交

blue: BRT 蓝色：快速公交

Energy supplies:

Biomass power plant provides energy for water treatment plant, plus energy for buildings

process: biomass produces methane+CO2 through anaerobic digestion

methane is burned to produce power. CO2 is used to grow algae 生物燃料为水处理中心、建筑物（正能量）提供所需的能量过程：1、生物能源处理中心通过厌氧性生物作用产生CO2和沼气（甲烷）2、沼气燃烧来产生能源，而 CO2被排向藻类生长的管道

Algae growing tubes feed on CO2 from biomass plant, plus sunlight

生物燃料燃烧后的co2以及阳光，促进管道内的藻类生长

storification process converts algae to biodiesel use new estorification plant proposed off site in Huludao在基地外增设酯化作用的设施，使得藻类通过酯化作用转化成生物燃料

1.5 MW Wind turbine on exposed hilltop: constant equivalent power 0.35 MW

1.5MW风涡轮设置在山顶：能够得到相当于 0.35MW的能量

Power from national electricity grid national target to change mix to increase renewables and reduce coal 来自于国家电网的能量，国家能源策略改变能源组成，增加可再生能源的利用，减少煤的消耗

Forest management: woodland thinnings to biomass incineration power plant offsite

森林策略：适度降低森林密度扩大植物生长空间，多余树木运往基地周边的生物能源处理中心燃烧产能。

Energy strategy 能量策略

First: to reduce the energy use through building form and active measures

一：通过建筑形式及主动措施减少能耗

Second: to provide renewable energies as part of the energy source

二：提供可再生能源

Third: to encourage public transport, to compensate for increasing car use

三：鼓励公共交通从而缓解小汽车剧增带来的压力

Fourth: link to national strategy to increase renewables in energy mix

四：结合国家策略，增加可再生能源的比例

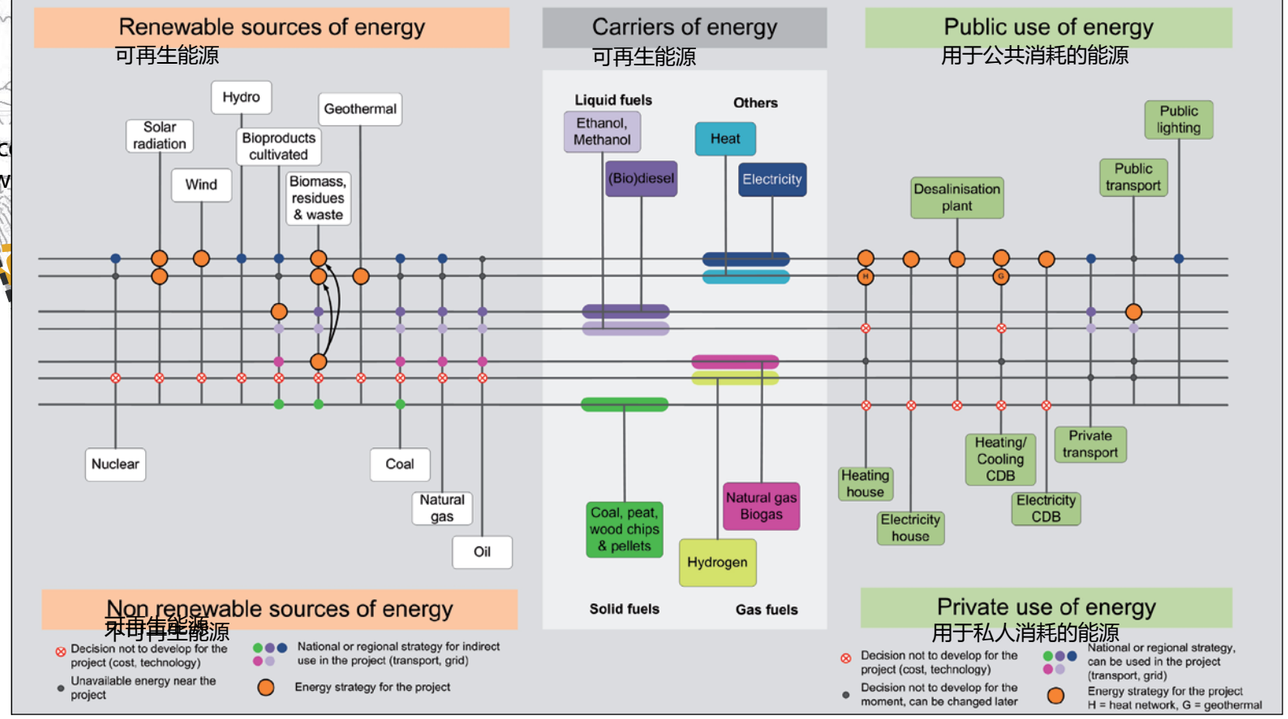
Phasing: 阶段策略

The energy strategy can be phased and scaled: the measures are all independent and can be added at any point

能量策略可以分阶段实施：任何措施是互相独立的，可以独立实施

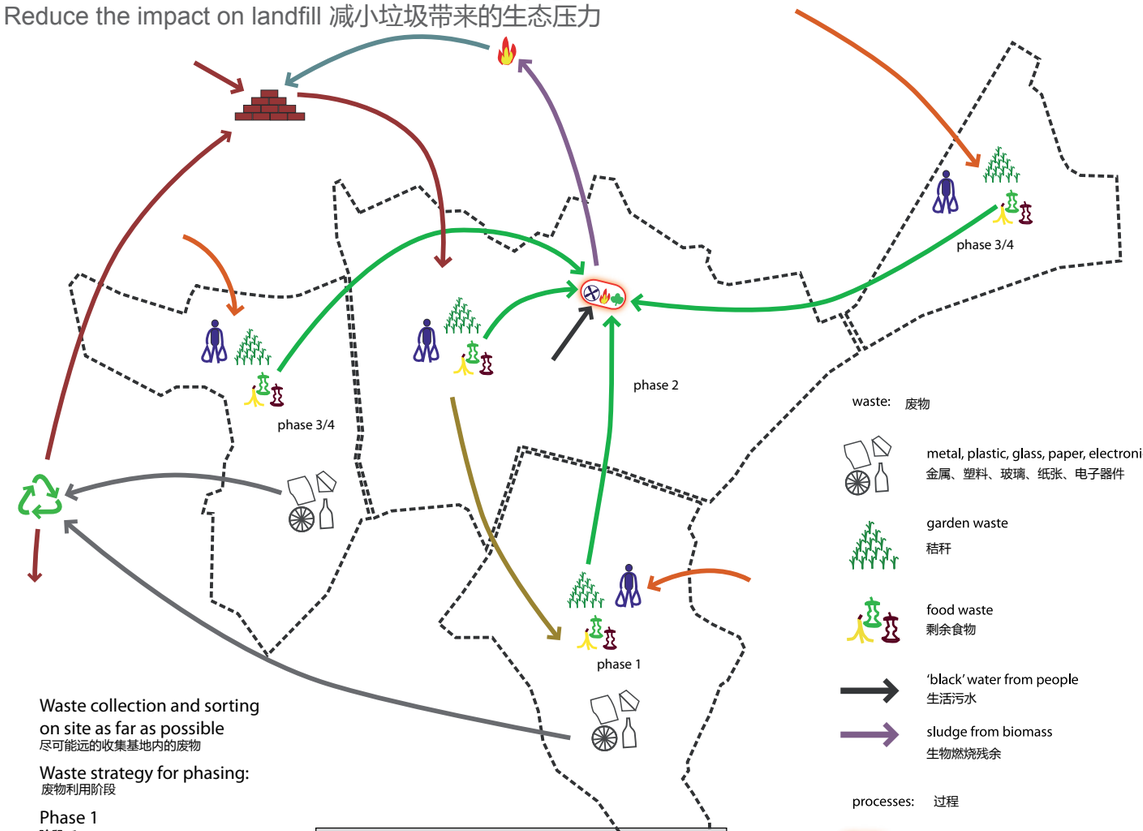
Algae growing in tubes and CH2 office building, Australia using renewable energy sources 藻类生长的管道和CH2办公建筑，被澳大利亚作为可再生能源策略

Our decision-making process



Waste and materials 废弃物和材料

Reduce the impact on landfill 减小垃圾带来的生态压力



Waste collection and sorting on site as far as possible
尽可能远的收集基地内的废物

Waste strategy for phasing:
废物利用阶段

Phase 1
阶段 1

Composting on site for organic waste to create fertiliser for golf course
在基地范围内处理有机废弃物为高尔夫球场提供肥料

Phases 2,3,4
阶段 2、3、4

Connect to biomass facility
与生物燃料设施相连接

waste: 废物

metal, plastic, glass, paper, electronics
金属、塑料、玻璃、纸张、电子器件

garden waste
秸秆

food waste
剩余食物

'black' water from people
生活污水

sludge from biomass
生物燃烧残余

processes: 过程

biomass plant
生物燃料处理中心

recycling plant (off site)
循环处理中心（基地外）

incinerator (off site)
焚化处理中心（基地外）

products: 产出

ash for building materials
灰渣作为建筑材料（基地）

building materials (off site)
eco-city strategy to use materials with high recycled content
建筑材料（基地外）
使用高回收成分材料的生态城市策略

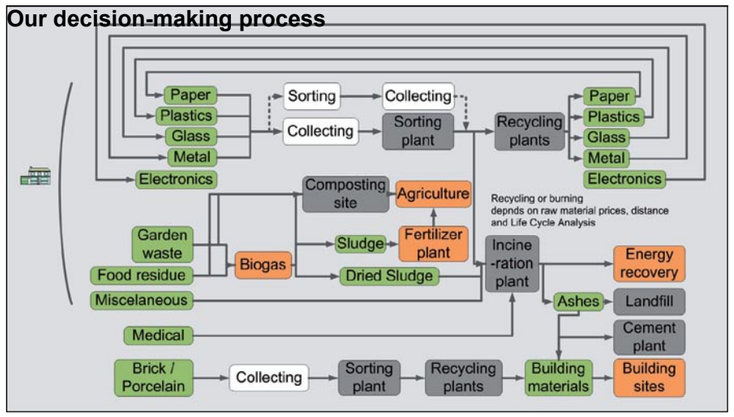
excavated soil for landscaping
为营造景观而挖掘土壤

goods including food from off site
Liaoning province produces surplus of food
来自基地外（辽宁省域范围内）的货品（包括食品在内）产生剩余的食品

activities: 行为

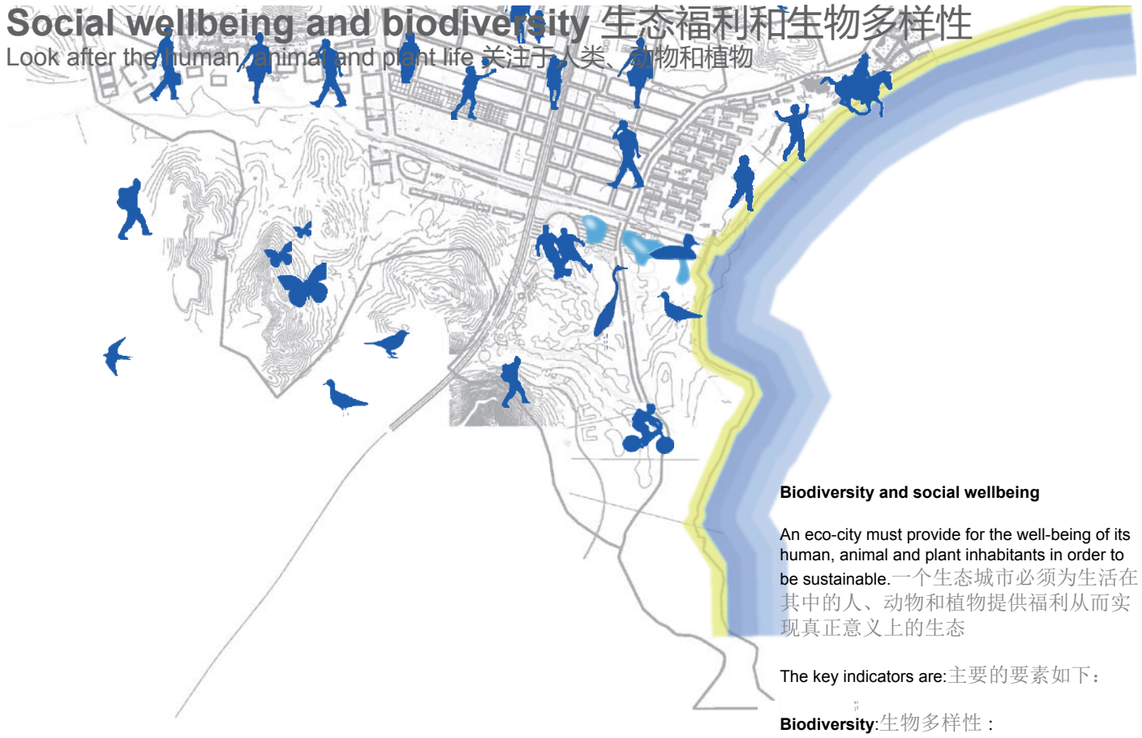
eco-city material and waste reduction strategy through education
通过宣传教育实现的生态材料以及废物回收利用

Our decision-making process



Social wellbeing and biodiversity 生态福利和生物多样性

Look after the human, animal and plant life 关注于人类、动物和植物



Biodiversity and social wellbeing

An eco-city must provide for the well-being of its human, animal and plant inhabitants in order to be sustainable.一个生态城市必须为生活在其中的人、动物和植物提供福利从而实现真正意义上的生态

The key indicators are:主要的要素如下：

Biodiversity:生物多样性：

Mixture of trees planted in the surrounding area with more broadleaf and less pine. Forest management to encourage biodiversity
在周边地区混合地栽植树木，鼓励种植 阔叶林减少种植针叶林从而增加生物多样性。

Trees on every street
每条街上的树木

Extensive open hillsides with no buildings退台建筑屋顶绿化

Saltwater wetlands for birds, plants and insects
为鸟类、植物和昆虫专设的咸水湿地

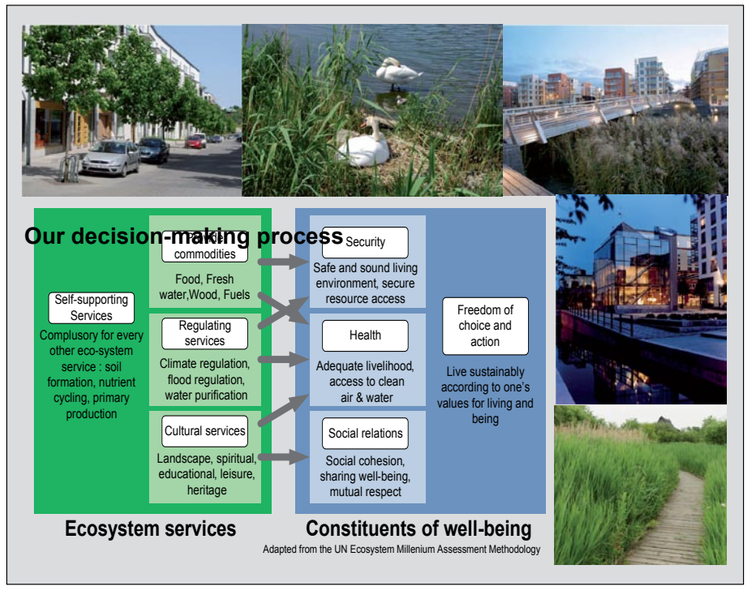
Natural river estuary自然河口

Social wellbeing社会福利：

Walkable streets and public transport
适宜步行的街道和公共交通

Cycling, walking and sport facilities
自行车道、步道及运动设施

Schools, nurseries and play areas
学校、托儿所和游乐场



B组
Professional Team B

B 组

Aurélie Sol	法国	工程师，Les Mines / Tsinghua 环境管理硕士研究生.
Benoit Vernière	法国	工程师，城市规划师； 巴黎北部国家规划院任城市交通规划方面负责人
Jean-Michel Vincent	法国	工程师，城市规划师； 大巴黎地区城市可持续发展战略总规划师
Nicolas Samsoen	法国	城市发展咨询师 370 000 人城市的规划局局长
Rémi Ferrand	法国	建筑师，工程师； 生态气候与基础设施问题方面经验丰富
Susanne Otto	德国	建筑师，城市规划师； IOSIS 公司生态社区概念设计
熊俊	中国	同济大学城市规划专业硕士研究生
张立鸣	中国	同济大学城市规划专业硕士研究生

Team B

Aurélie Sol	France	Engineer and student at the Post-Master in Environmental Management, Les Mines / Tsinghua.
Benoit Vernière	France	Engineer / Urban Planner. In charge of urban transport policies for a state planning agency at the South of Paris.
Catherine Gatineau	France	Geographer / Economist Head Manager of Development and Strategy at AREP
Jean-Michel Vincent	France	Engineer and Urban Planner. Director of Strategy and Sustainable Development for Paris Region.
Nicolas Samsoen	France	Urban developer. Director of state planning agency for 370 000 inhabitants.
Rémi Ferrand	France	Architect and engineer. Experience in bioclimatic urban planning and infrastructure issues.
Susanne Otto	Germany	Architect and urban designer. Works for IOSIS Concept on eco-neighborhoods.
Xiong Jun	China	Student of Tongji University. Postmaster of Urban Planning.
Zhang Liming	China	Student of Tongji University. Postmaster of Urban Planning.

Moon city 月亮之城

The team B would like to thanks the authorities that allow us to work on this city project, on this side of the planet and for allowing us to present you the outline of our proposal.

A strong ambition

You raised the question of an attractive eco-city, able to provide you with the means to develop a territory endowed with a long industrial and military history.

For this, you defined a strong ambition in 3 points:
- **Global responsibility**: a low carbon city
- **Local sustainability**: a city pleasant to live in, which works in the long run
- **A new image** which favours touristic development: Huludao: Beijing's Beach

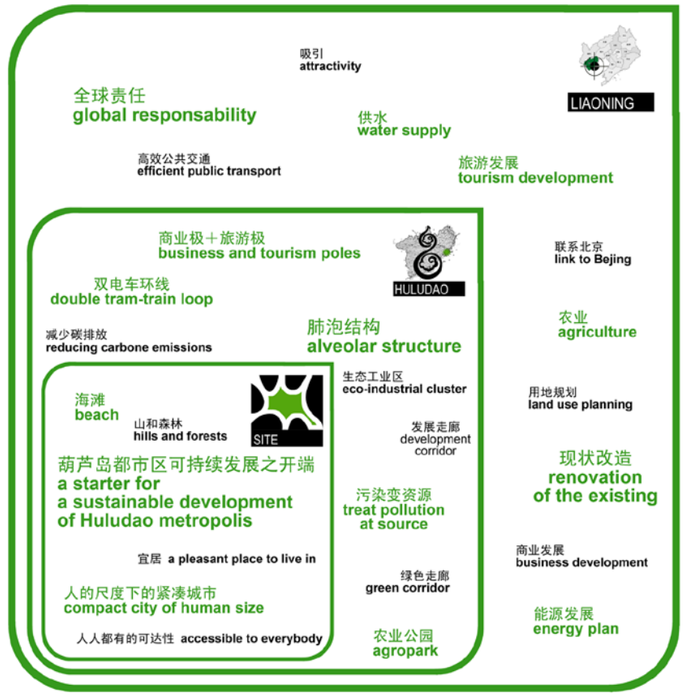
In the current context of strong economic and urban growth, 10% per annum, urban population is very likely to triple by 2020.
The Eco-city, that we decided to call the Moon River, represents **a year's worth of urban growth**.

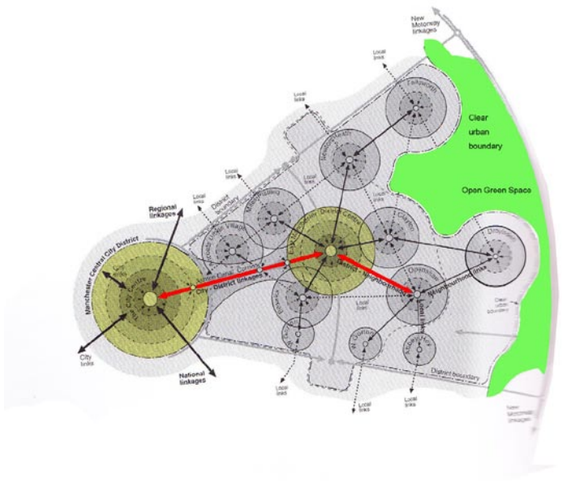
The proposed strategy

Global responsibility: If there is no action undertaken, the forecast emission for 2020 is 6.6 million tonnes of carbon per annum: there is a need for policies on building, transport and energy…
Local sustainability: Traffic jams, lack of water and raw materials shortages limit capital investments. Sustainability requires working at the scale of the Greater Huludao in addition to that of the Moon River.

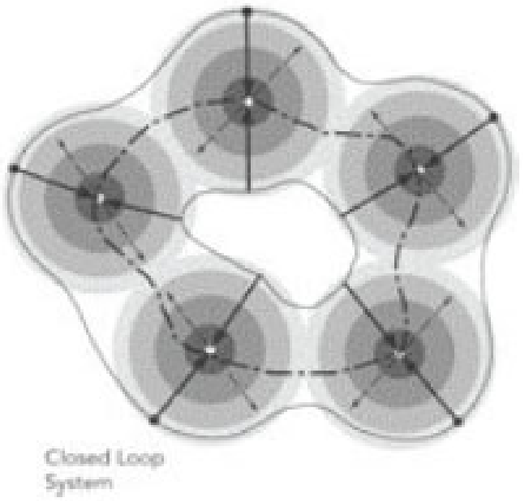
Touristic image: Our plan is to turn a weakness into strength by creating an eco-industrial cluster, to combine business and seaside tourism throughout the whole year and to endow the eco-city with a strong image of economic and ecological development. To achieve this, trade and business will be brought up to the sea.

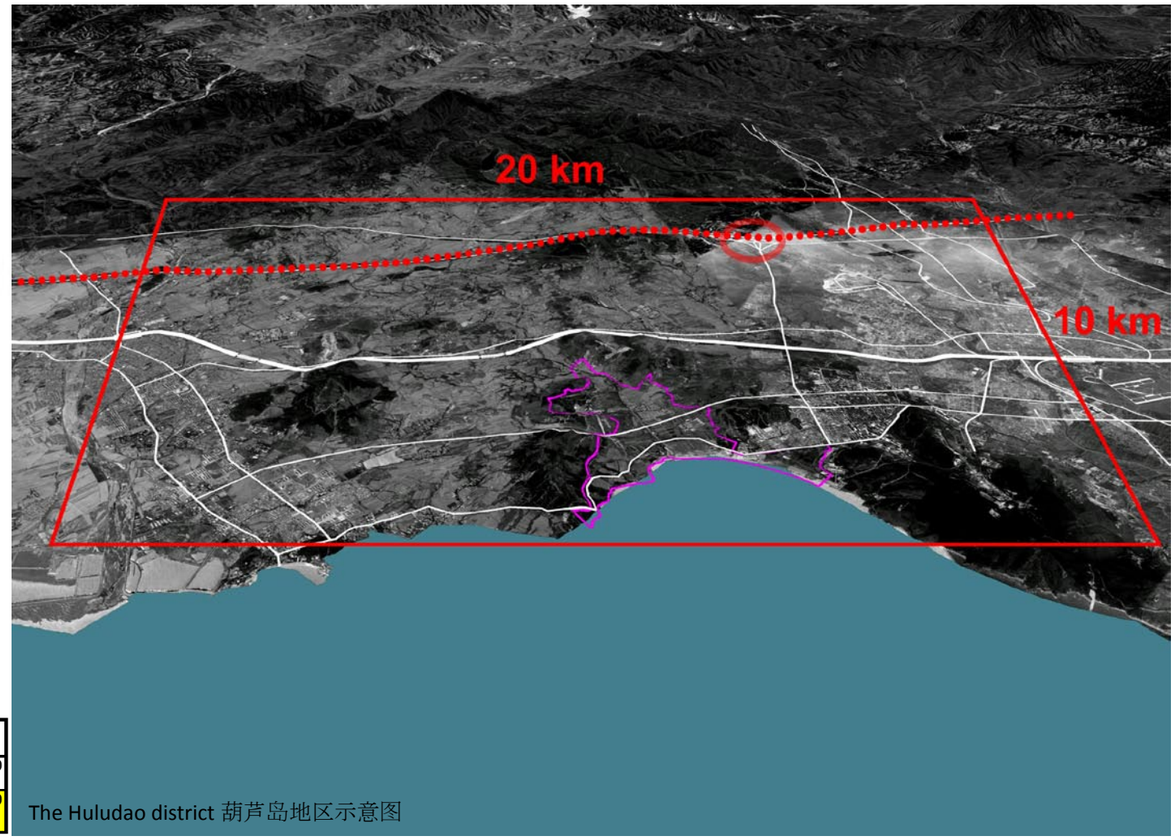
This leads us to define the 3 million built m2 of the Moon River eco-city as a starter of the sustainable development of the Huludao Metropolis, adaptable to different eco-technologies, economically viable.





The alveolus network 发展结构图





The Huludao district 葫芦岛地区示意图

Buildings		kg CO^2/kWh	kWh/m^2	m^2/person	population	**total** (teq CO^2)
2008	Heat	0.40	100	5	600,000	**390,000**
	Elec	0.90	100			
2020	Heat	0.40	200	10	1,800,000	**3,060,000**
	Elec	0.90	100			

Transport	g CO^2/km	km/year	person/ car	% move/car	population > 6 years	**total** (teq CO^2)
2008	200	3,000	2.0	10%	500,000	**15,000**
2020	300	14,000	1.4	80%	1,500,000	**3,600,000**

Moon River Eco-city: a Starter

A compact city, which fits in its natural environment, its topography and its history: 3 million square metres developed on 300 hectares by:

- A street network at the human scale
- A morphology in line with of history: oriented north-south, rectangular, preserved traces…
- A built environment acting as a façade on the orchards-planted hills, as well as on the sea
- A city profile (3 to 5 storeys high) adapted to the location, rising exceptionally to 100 meters: in the north, the built environment is higher to take the most from the south exposition and from the sight, without casting shadows on the city.

An open city, making the most of its fringes in a natural way: orchards and vegetable farms at a long term punctuate the transition between City and Nature.

A mobility oriented city: Organise places of convergence and reduce the role of individual cars: 30 km/h speed limit, parking dedicated to short stay, unloading, ambulances and taxis.
The multi-modality is developed by giving priority locally to public transport and innovative solutions: car-sharing, electrical bicycles and rickshaws.

A dense and close-knit street pattern allows the inter-neighbourhood links and a great fluidity of travel paths.
Public spaces of mobility (places big and small, pedestrian streets) favouring soft transport modes and eco mobility. Pedestrians find their place.

The size of the built city makes it possible for the most remote citizens to reach an access to these urban and agricultural parks, less than 500m away.

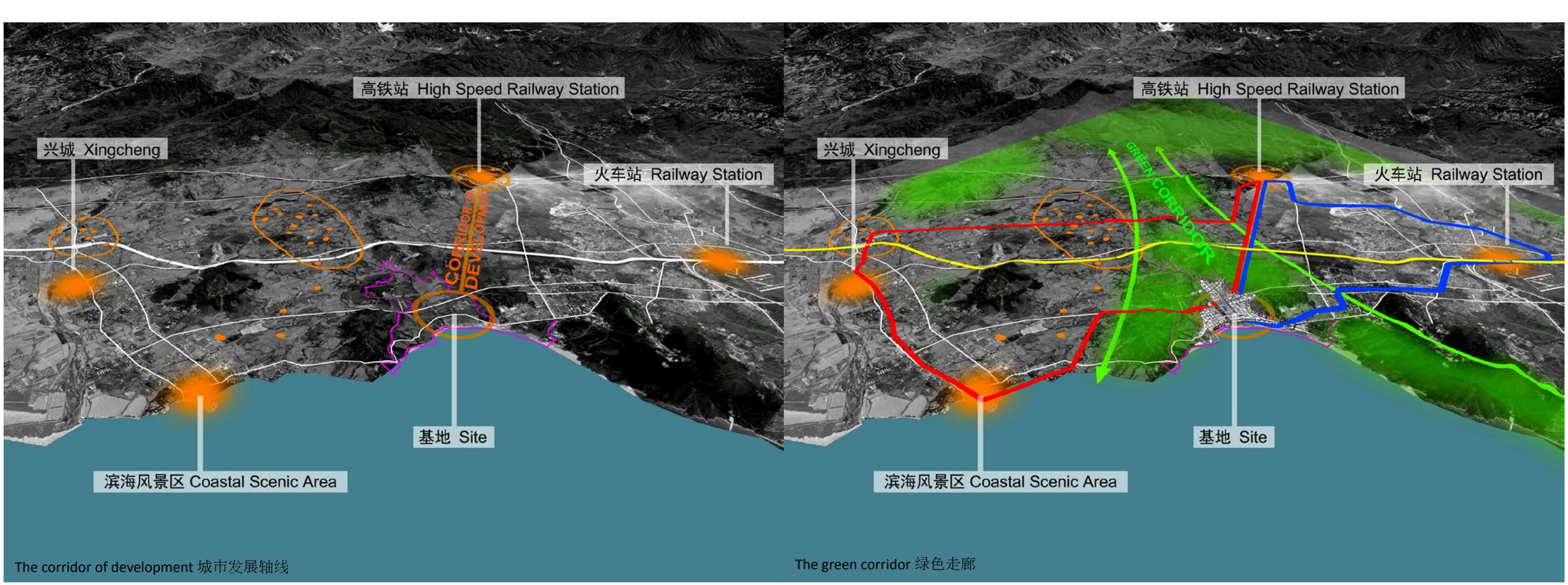
Huludao prefecture: an alveolar structure to accommodate urban development

An alveolar structure polarized by the high speed train station is envisaged for the territory of 10 by 20 km including Huludao, XingCheng and the Eco-city. Thus, alveolus by alveolus, the City will be built for short distances travels, by foot or by bicycle to fit in the model of no emissions eco-city. This alveolar organisation fits naturally in the topography of the Prefecture site, between the sea and the big hills, from which small hills emerge acting as fences at the scale of the larger landscape.

The alveolar organisation and the high speed train link allow limiting the Prefecture carbon emissions.

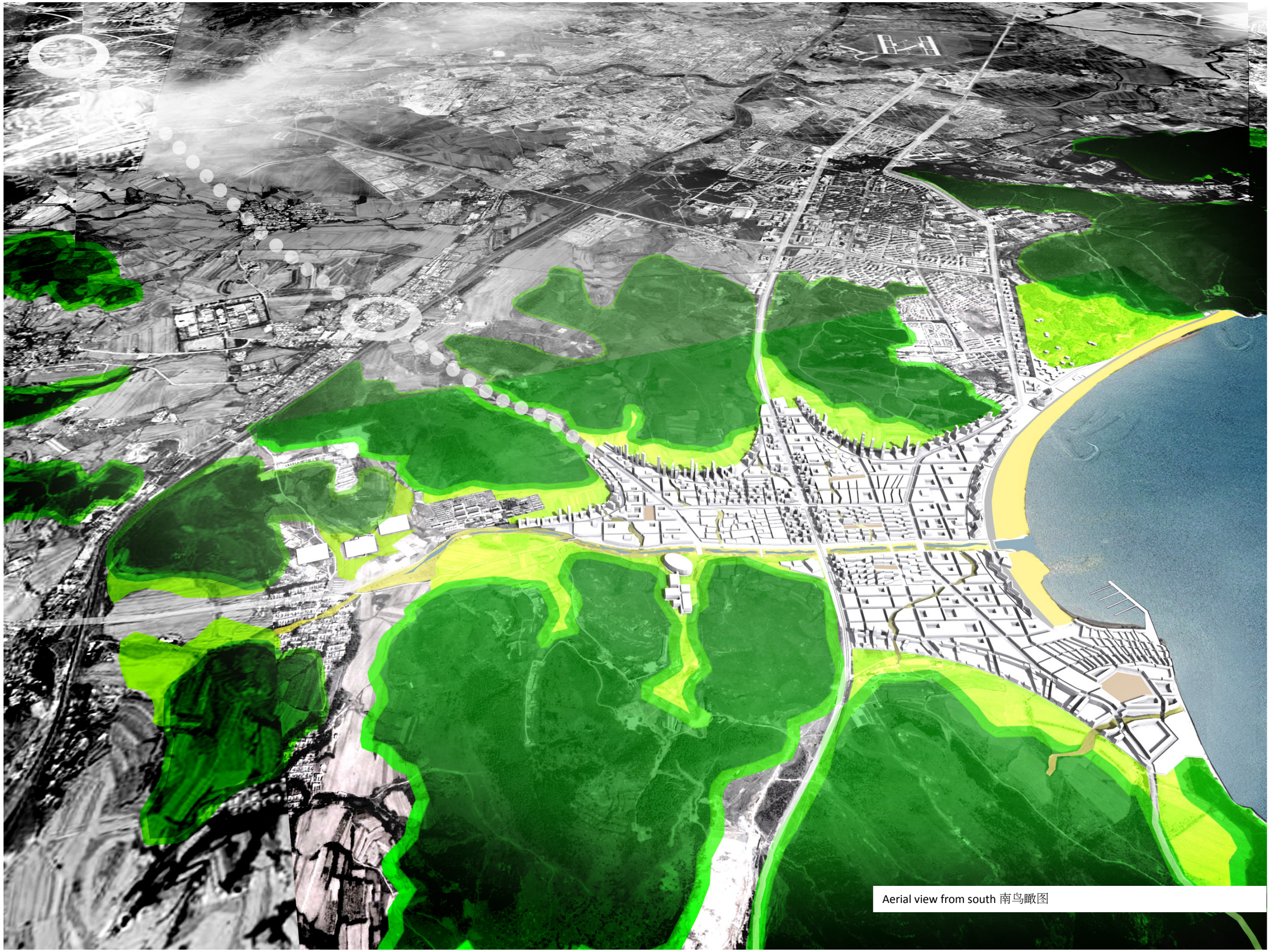
On the Prefecture territory can be found:

- The first of the alveoli: Moon River
- A Development Corridor irrigated by a tram-train, linking in 20 minutes two districts of high urban density, capable to accommodate several years of growth: Moon River and the district of the high speed train station
- An Eco-industrial Cluster, called carbon cluster, multi-sites, linking universities and companies, reducing the economical costs generated by pollution and climate change, carrying a real ecological image.
- A Fast Regional Train on the old railway, a hub station at the crossing with the tram-train.
- A Double tram-train Loop, fast and with high capacity, using as much as possible existing railways, linking the current Huludao and XingCheng; the high-speed train station and Moon River.
- Water Engineering against shortages: water saving devices to reduce consumption, watershed rainwater reservoir, recycling of water.
- A Green Corridor: for promenade between the hinterland, the surrounding hills and the sea.
- An Agropark of 4 to 5,000 hectares.



The corridor of development 城市发展轴线

The green corridor 绿色走廊



Aerial view from south 南鸟瞰图

The moon river 月河

The moon edges 月翼

The moon beach 月滩

Panoramic balcony 阳台全景效果图

References urban neighborhood in Germany 德国城市街区案例

A contrasted City where living is easy and enjoyable

What could CEOs and executives expect to find here apart from a more pleasant and relaxed life than in the Greater Beijing and in Shenyang, for them and their children?

This requires places in the city, where one can practice tail-chi, listen to the elders playing music, sing, drawing water characters, right next to one's flat. This also requires to be able to take the tramway without worries, go windsurfing or hiking joyfully on the hills on Sundays, practice one's sport on the way back from the office, go to the restaurant, the pictures or to the theatre. Secondary schools, a research and development organised with a direct link with companies, executives teaching part-time in the schools, teachers allowing students to work on local companies' projects to open up recent fields of knowledge and know-how are natural features of knowledge economy.
Built environments typologies are diversified: garden cities, villas, fishermen villages, university campus...and urban atmospheres are punctuating daily life.

A mixed and equitable city

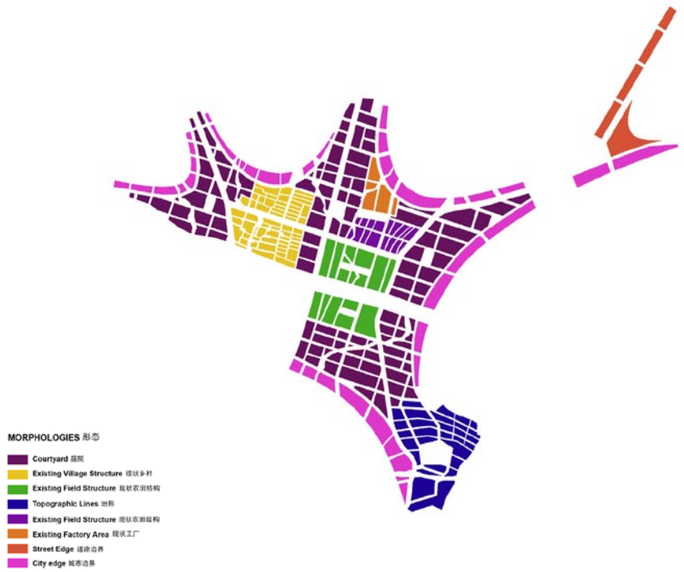
The active city throughout the year combines a seaside tourism with a business tourism to make a mixed and vibrant city: a congress centre, a forefront of a carbon cluster, a festivals compound, an auditorium, a botanical garden, offices, housing, hotels, markets, and... the beach.

- To work in, offices are situated on the main transport axis, Congress Centre.
- To live in, with districts endowed with contrasted and rich atmospheres, residential routes: from high-end to social housing.
- To shop in, with a fruit market at the north, along the orchards, and a fish market next to the sea, retail on the ground floor.
- To stay in, hotels and tourists' residencies on the seafront
- To take care of oneself, (Spa, Health centres...)
- To entertain oneself with the Cultural Factory (art gallery, concerts, exhibitions...)
- To train-in: carbon cluster (universities, R&D)

The 18 big plants of the Prefecture are an economic asset, generating increasing investment costs to treat pollution: heavy metals deposits on the ground and in the sea on dozens of km2, accumulating in the food chain – vegetables, fish and shellfish – suspended particles in the air breathed by the population, carcinogenic PAHs. This pollution generates public health costs growing at a geometric rate – hospitals, drugs... - but also disproportionate economic costs: soil remediation before development, excavation and soil treatment prior to any construction, without mentioning the marketing impact on sales or the number of visits to a seaside resort.

The treatment of pollutants emissions at source is the most economical and most investment-friendly solution. This requires ground work with the industrials. Depollution is necessary; engineers need to be present from the start of the works. The cluster can therefore be launched as early as the first development works.

More widely, the carbon cluster carries an image of ecology, of sustainable development, the nature of which will ensure credibility of the Greater Huludao in this area, will differentiate it from metropolis worldwide that are busy doing green washing. Its immediate start is favourable to investment.



MORPHOLOGIES 形态

- Courtyard 庭院
- Existing Village Structure 现状乡村
- Existing Field Structure 现状农田结构
- Topographic Lines 地形
- Existing Field Structure 现状农田结构
- Existing Factory Area 现状工厂
- Street Edge 道路边界
- City edge 城市边界

MAIN FUNCTION 主要功能

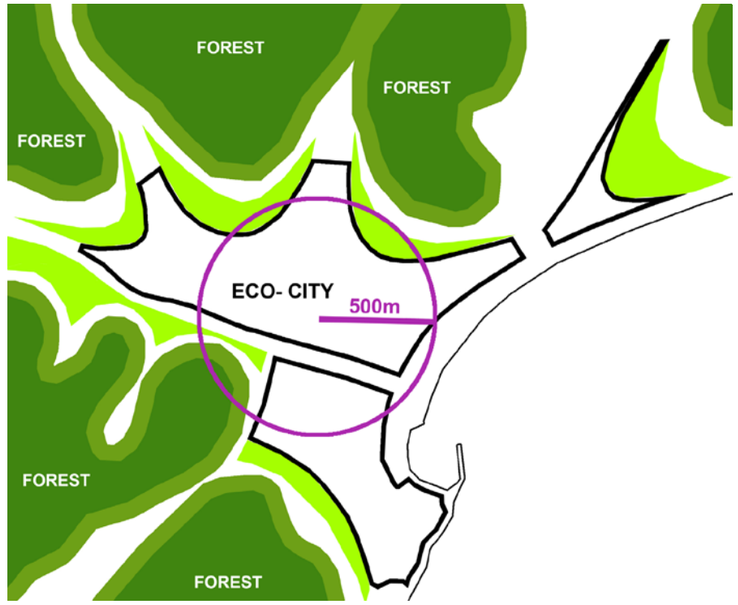
- Housing 居住
- Offices 办公
- Hotels 酒店

Main Facilities: 主要设施:

- University - Cluster 大学城
- Congress Hall 会议中心
- Culture Factory 文化工厂
- Health Centre 保健中心
- Fair 游艺中心
- Sport and Swimming Facilities 运动设施
- Botanical Garden 植物园
- Festival Centre 节庆中心
- Markets (Fruits and Fish) 市场（水果和鱼）

DENSITY - FAR 容积率

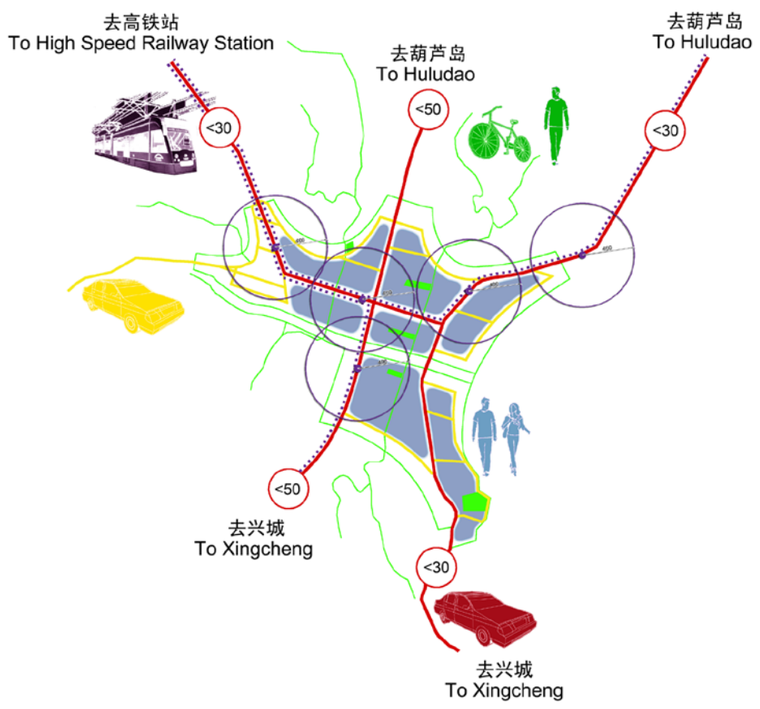
- 2.5
- 2
- 1.5
- 1
- O.5



- Forest 森林
- Edge of the Forest 森林边界
- Public Park: 公园:
  Orchards, 果园,
  Botanic Garden,... 植物园…

EDGES OF THE FOREST
森林界面

NEIGHBOURHOOD AREAS
街区



Master plan 总平面图

Why it is effective

1 - A low-carbon eco-city

a- Passive houses, heating network from renewable

Oriented in a bioclimatic manner, buildings to up to the 4th storey are built in wood, buildings of more than 4 storeys built in mixed wood and concrete. Well-isolated buildings, comfortable in winter as in summer, without air-conditioning, equipped with energy-saving appliances and bulbs make it possible to greatly cut at source the energy needs and reach the passive house standards. The hot water will come from solar water heaters on the roof of each building. The heating network will come from the methanisation/power plant in the north west of the city in a first approach. The technology of passive geothermal GSHP may be investigated further since there is a real potential for it in the region and may provide a neighbourhood heating.

b- A compact and diversified urban morphology: people-oriented transport modes

The Moon River, designed for walking, soft traffic, almost carless, linked to the outside world by the tram-train and the high speed train, emits next to none car-generated greenhouse gases; infinitely less than the average recorded in the Greater Huludao.

Map of food agriculture and biodiversity 粮食农业及生物多样性规划图

2 - Too much water?

Water savings, rainwater collection and recycling are the main keys of the water policy. The collection of only a tenth of rainwater on 10% of the surface of the Greater Huludao allows to collect more than a million of m3, enough to provide for 4 million inhabitants at current consumption rates (250 litres / inhabitant). This shows the importance of rainwater which will be collected to provide drinking and grey water to the eco-city. The Moon River, in which the used grey water will be sent, will treat the effluents thought constructed wetlands and will be displayed in the city landscape.

The hydric stress situation of the region as well as the city and agriculture needs will be matched and solved by the reuse of grey waters. Part of the water of the moon river will be sent to the sea to bring to the phytoplankton the necessary nutrients and sediments.

3 - Electricity Production

The main source for greenhouse gas emissions is electricity obtained by firing coal: 900g of CO2 per kWh compared to 300 with oil and 100 in France with nuclear energy. That is why our policy is that for 1kWh consume in the eco-city, 1 kWh of renewable energy is produced in the Great Huludao. From the beginning of the project, solar farms, wind power, solar panels, methanisation of sewage sludge and organic waste and cogeneration of heat and electricity have to be implemented. The electricity production will contribute to improvement of the greater area by reusing the waste which is currently simply dumped in open air areas.

Another important point is the policy is to lower the energy production through passive houses and to improve the level of comfort by maintaining constant temperature in the buildings.

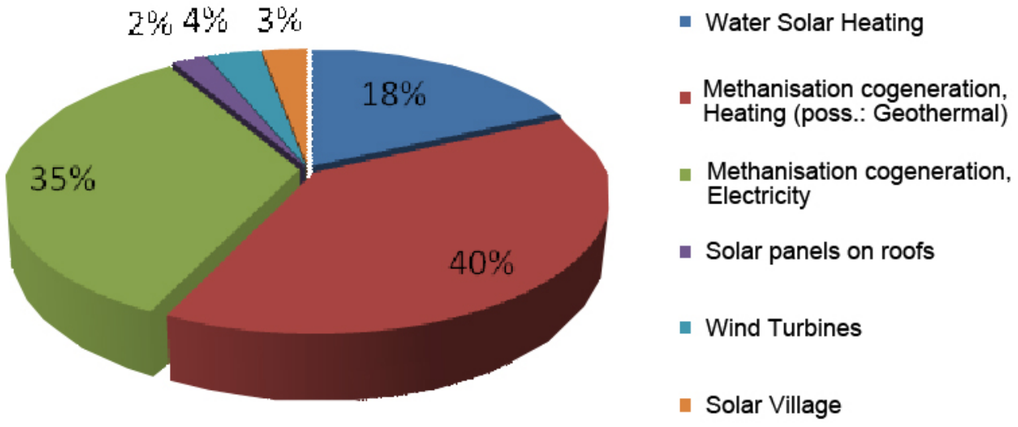
Finally we propose to build an experimental mini coal-fired plant with carbon capture by mono-cellular algae which could be used as an incubator for the coal-fired plant of the Greater Huludao.

4 - A carbon balance divided by 5

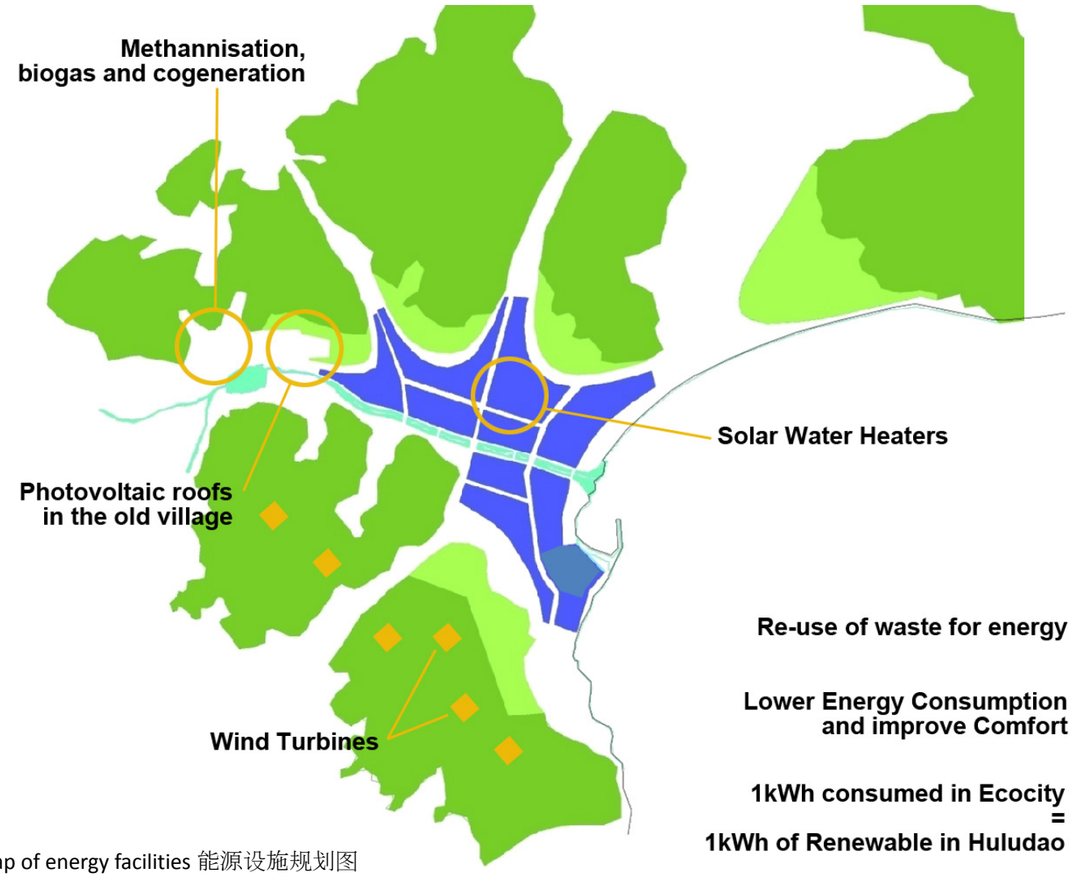
In total, these actions allow to reduce building and transport greenhouse effect gas emissions from 6.7 to 1.2 million tonnes a year compared to a do-nothing policy, i.e. a division by 5.

The water system 水系规划图

The grey water close loop 中水循环利用图



Energy mix 能源组合图



Map of energy facilities 能源设施规划图

How to do it

1 - Where to start:

- decide the tram-train between the high speed train station and Moon River
- decide the carbon cluster in agreement with the industrials, launch pilot projects
- decide to plant orchards and landscape the hills
- design the water engineering; bio-remediation with the Moon River
- develop and build the seafront
- organise waste sort and collection
- Desulfurization of air emissions from the industries, apply circular economy principles to minimize discharge.

2 - From now to 2013, development of the corridor:

- In the district of the high speed train station, of a great accessibility, from Beijing to Shenyang, shop window and front door to the Greater Huludao, the national stadium, and an exhibition park adding value to the technological park, sharing videoconference rooms, TV studio, and events programming.
- In Moon River, a congress centre, at the forefront of the carbon cluster (university, research & development, interface with the industry), the festivals compound, the auditorium, the botanic garden, the markets, and...The beach.
- Between the two, the tram-train and the new station on the old railway line.
- Energy, Water, Carbon, Pollution: deal with the scale of the Greater Huludao.
- Organisation of tourism at the regional scale

3 - Main difficulty and necessity

One of the main difficulties of the location is the air, water and soil pollution. This issue has to be treated with industrials at the right government scale to lower or stop the CO2, SO2 and NOx emissions. Indeed, the wind orientation is such that 50% of the time and mainly in summer, the gas effluents from the industries in the existing part of Huludao are transported towards the eco-city. Additionally, no vegetables, absorbing the heavy metals, should be grown on the contaminated ground. The surface and ground waters are also contaminated with heavy metals and should be treated through constructed wetlands before consumption. The Bohai Sea is contaminated as well and because of military presence, the sea area cannot be used as energy source.

4 – A Great Opportunity

Organise the management of the development corridor on the long run, driving the technical implementation of major decisions taken by the authorities: an extension of the planning institute competencies to the various aspects of sustainable development?

早上好，感谢政府在地球的这一端为我们从事这项城市规划项目提供条件。并且再次感谢允许我们向你们介绍我们的建议的要点。

一个宏伟的愿景
你们提出了一个富有吸引力的生态城市的议题，这个议题能提供如何发展一个有着长期工业和军事历史的地区的方法

针对这个议题，你们从三个方面定义了这个愿景：

全球的责任：一个低碳排放的城市

全球的责任：如果不采取行动，预计到 2020 年碳的排放量将是 660 万吨/年。因此有必要颁布关于建筑、交通和能源的政策。
本地化的可持续：交通堵塞，缺水和原材料的缺乏限制了投资。可持续就要求在葫芦岛市域更大的范围研究，而不只是月亮和地区。
旅游的意向：我们的计划是变弱势变优势，包括培养环保的工业群从而把商务和海滨的旅游在全年联系起来，并且赋予生态城市经济和生态发展的强烈意向。

因此，我们认为应在基地内建设 300 万M^2 的建筑面积量作为葫芦岛市域可持续发展的第一步，这些建设应该能适应不同的生态技术以及具有经济上的可行性。

葫芦岛市：一个适应城市发展的有机的蜂巢结构
在高速铁路站相交的两个蜂巢结构正对着 $10\times20klm^2$ 的区域，包括葫芦岛、兴城和ECO-CITY。因此，一个接着一个地，城市将为短途出行而建立，运用步行或自行车的交通方式以适应零排放的生态模型。这个蜂巢结构的组织适应了本地在海和大的山体之间的自然地形，从更大的景观角度看，小的山体像栅栏一样围绕着大的山体。这个蜂巢结构和高速铁路的连接能够限制区域内碳的排放。

我们能在基地中发现：

- **首先就是月亮河**
- 围绕区际轨道交通发展走廊，在 20 分钟内连接了两个高密度的城市地区，这可以适应数年的发展:月亮河和高速铁路站地区。
- 一个生态工业群：综合的和少量碳排放的地方，联系这大学和公司，减少了由于污染和气候变化带来的成本。
- 建立在旧有的铁路线处的快速区际轨道交通，并且在与南北向的线路交叉处设置中心车站
- 双向的区际交通环线，快速并且具有大容量，尽可能的利用现有的铁路线路，把基地与葫芦岛市和兴城市联系起来。
- 水系统以解决短缺问题：减少浪费的节水设备，雨水收集系统，水循环系统
- 绿廊：方便在基地、周边山地和海边步行
- 一个农业公园：4000 到 5000 公顷

月亮河生态城市：一个开端
一个紧凑的城市：它契合所在的自然环境，地形和历史。300 公顷的土地上 3 百万的建设量中包括：

- 适合人的尺度的街道系统
- 符合历史的空间形态：南北朝向，矩形，现存的机理
- 一个建成的环境在果树种植山体和海的前面
- 城市断面从 3－5 层高到个别的 100 米：在北面，建成环境较高以尽可能获得南面的景观和阳光，并且不在城市中造成阴影。

一个开放的城市，以自然的方式最好的利用它的周边资源：在城市和自然间以果园和蔬菜种植作为过渡

机动性导向的城市：组织集中发展的地区并减少私人汽车的使用，车速应限制在 30 km/h 以下，为行人、救护车和出租车让道。
交通的高峰应通过给公共交通优先路权和其他一些新的方法，包括拼车、电动车和人力车等。
一个紧凑和密集的街道模式使得紧密的邻里关系和广泛分布的步行小径成为可能。
公共的交通空间包括大小的道路和步行街道更倾向与软性的和生态的交通模式。提供给了步行者以空间。
城市的尺度使得大部分的居民可以方便的到达城市中和农业的公园，这个尺度在 500 米以内。

一个生活容易和愉悦的城市：

本地化的可持续：能长期提供愉悦生活的城市

一个新的意向：旅游业的发展，葫芦岛－北京的沙滩

在强大的经济和城市化增长（每年 10%）的背景下，城市人口十分可能在 2020 年达到现在的三倍。

生态城市，我们认为叫月亮河更好一些，代表了城市在未来一年内的增长的价值所在。

倡导的策略

什么能使 CEO 和职业经理人们认为在这里，他们的家庭能过上比北京或沈阳更快乐和舒适的生活呢？

这就要求在城市中有空间让人们从事各种活动，打太极拳、听演奏、唱歌、绘画等等。这也同样的要求能够方便的乘坐公共交通去冲浪、在山上徒步旅行和在下班后去锻炼，以及餐馆、美术馆和剧院等场所。中学和与公司有着直接关系的研究机构，经理人们在学校兼作教学工作，老师允许学生在当地的公司中工作，广泛的交流促进知识经济的发展。
建成环境的形态应是多变的：花园城市，别墅，渔民村，大学校园等等，城市的氛围融入日常的生活中。

混合和公平的城市
城市是富有活力的，将海滨旅游和商务旅游结合起来创造一个混合的城市：一个会议中心、碳排放的研究前沿、节日的场所、植物研究公园、居住、宾馆、市场等等，以及海滩。

针对工作，办公场所放置与主要的交通轴线上，包括会议中心。
针对居住，有各种类型的居住，包括高标准的私人住宅到社会住宅。
针对购物，在北面沿着果园有一个水果市场，以及一个海产品市场在海边。
针对商务，宾馆和旅馆放在海边。

针对休闲，有 SPA、疗养中心等
针对一些文化产业，有艺术馆、音乐厅和展览中心等等
针对教育，大学和一些研究发展中心。

18 个大的工厂是重要的经济资产，产生了不断增长的针对污染治理的投资：渗入土壤和海中的重金属通过食物链进入蔬菜、鱼和贝类中–以及空气中的悬浮物中，还有产生的各种致癌物质。这些污染产生了以几何倍数增长的公共健康的成本，如医院、药物等等，以及不成比例的经济成本：土壤的处理、建设前的处理工作，更不用说对旅游市场造成的巨大冲击。

变污染物为可用资源是最经济和最有投资价值的方法。这要求一些和工厂间的基本工作。放置污染是必要的，工程师必须从一开始就介入。产业的链条从一开始就能形成。

更广泛的说，碳产业群是生态的，可持续的，可以在整个市域范围内应用的，区别于世界上许多只是从事绿化工作的大都市地区。第一步就是进行投资。

为什么这是有用的

一个低碳的生态城市

被动式住宅，可更新的加热系统
从生物和气候导向的角度看，4 层内的建筑使用木材，4 层以上的建筑混合的使用木材和水泥。一些个别的高层建筑，并不使用空调系统，使用节能的系统，它们在冬天和夏天同样舒适，这样使其能够减少对能源资源的需求以达到被动式住宅的标准。热水可以从太阳能热水器获得。加热的能源从西北面的沼气工厂获得。地源热泵系统技术也许可以在未来条件更加成熟的情况下建设。

一个紧凑的和混合的城市形态：以人为导向的交通模式
为步行，软性交通或很少汽车的，通过轨道交通连接的城市，排放很少的温室气体，明显的少于周边地区的水平。

太多的水？
节水、雨水收集和循环是水处理的主要措施。如果能收集整个葫芦岛市域 10%的面积上的 1/10 的雨水就能获得超过一百万吨的水，这足够提供 4 百万人口在正常水平下的用水（250 升/人）。这也说明了雨水收集以提供饮用水和中水的重要性。用过的中水排入月亮河，在周边建设的湿地中被处理，并且作为城市的一种景观。
缺水的压力包括城市和农业的需要将会通过中水的重新利用而被解决。一部分的河水会进入海洋给浮游植物带去食物。

电力的生产

温室气体主要的来源是燃煤的火电厂：一千度产生 900 克二氧化碳，而石油是 300 克，在法国用核电是 100 克。这就是为什么我们的策略就是：每一千度的电在生态城市中被消耗，另外在葫芦岛市域生产出一千度的更新的能源。从这个项目的一开始，太阳能、风能、沼气能和有机废物产生的热能就被考虑在内。重新利用废物来生产电力将为更大的地区做出贡献，这比只是把废物扔在外面好得多。
另外一个重要的方面就是这个政策是通过被动式住宅去减少能源的生产并达到室内舒适的温度。
最后我们建议建设一个实验性的小型燃煤电厂，用海藻吸收其中的二氧化碳。这将作为葫芦岛其他地区的电厂的示范。

碳排放达到 5
总的来说，这些步骤能够减少建筑和交通的温室气体排放，从每年 6.7 百万吨到每年 1.2 百万吨，相比不采取任何措施，减少了 5 百万吨。

怎么做

从哪开始
- **区际轨道交通，在高速铁路站和基地间**
- **碳产业群，与工业间的合作以及实验的计划**
- **种植果园，改善山体景观**
- 设计水的系统和生物的补救方式
- **发展和建设海滨**
- **组织垃圾分类收集**
- **工厂气体的脱硫处理，遵循循环经济的原则以减少排放**

从现在到 2013 年，发展走廊的发展

- 在高铁站地区，由于与北京和沈阳具有极大的可达性，是葫芦岛的窗口，我们建议将体育馆和一个展览中心放在这里。
- 在基地内，一个会议中心，碳产业群（包括了大学，研究中心和与工厂的联系），节日场所，礼堂，植物园，市场和海滩
- **老铁路线上建立的新的交通系统和车站**
- **能源，水，碳，污染**都应从葫芦岛市域以及更大的范围来考虑
- **东北地区的层面来考虑旅游的组织**

主要的困难和必要性

选址的主要问题是气候，水和土壤的污染。这个必须要由政府与工厂共同协调来减少或停止二氧化碳、二氧化硫和氮氧化物的排放。当然，全年一半时间以上（主要是夏季）风向是东北向，这将会把工业区的污染带到基地内来。另外，吸收重金属的蔬菜不能种植在污染的土壤上。地表和地下水也被重金属污染，这些水必须在人工湿地内经过处理后使用。渤海也被污染。而且由于军事方面的原因，海洋的能源资源也不能被使用。

一个巨大的机遇
最后，组织发展走廊的建设，推进政府重大决策的执行：赋予可持续发展各个方面继续执行的能力。

Aerial view from east 东鸟瞰图

The future？ 未来展望图

C组
Professional Team C

C 组

Ela Dokonal	美国	城市设计师，艺术家；主要从事社区设计和步行空间设计
Emilie Cam	法国	建筑师，景观设计师； 参与法国 Ile-Saint-Denis 零能耗城市规划
Javier Esquillor	西班牙	工程师，Les Mines / Tsinghua 环境管理硕士研究生.
Keizo Okamoto	日本	建筑师；在北京 Graft 工作室工作. 参与重庆生态度假胜地项目设计
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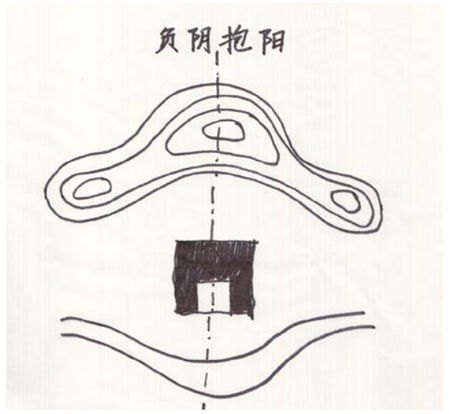
Rafael Pizarro	哥伦比亚 澳大利亚	城市规划师，设计师； 现于悉尼任讲师 致力于可持续城市规划设计
Viraj Chatterjee	印度 香港	建筑师，景观设计师； 香港 Strata 景观建筑事务所所长
杨芳	中国	同济大学城市规划专业硕士研究生

Team C

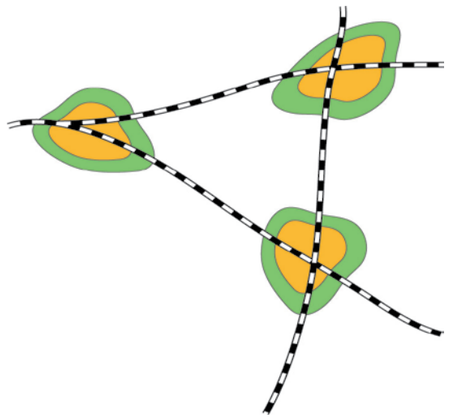
Ela Dokonal	USA	Urban designer and artist. Expertise in Neighbourhood Design and walkable spaces.
Emilie Cam	France	Architect and Landscape Designer. Experience of zero-energy planning for Ile-Saint-Denis, France.
Javier Esquillor	Spain	Engineer and student at the Post-Master in Environmental Management, Les Mines / Tsinghua.
Keizo Okamoto	Japan	Architect. Works for Graft in Beijing. Experience of eco-resort project in Chongqing province.
Ling Xue	China	Student of Tongji University. Postmaster of Urban Planning.
Rafael Pizarro	Columbia Australia	Urban planner and designer. Lecturer in Sydney. Expertise in sustainable urban planning and design.
Viraj Chatterjee	India / HK	Architect and Landscape designer. Director of Strata Landscape Architects, Hong Kong.
Yang Fang	China	Student of Tongji University. Postmaster of Urban Planning.



1. Settling on the site: The Spirit of the Place

Drawing on Chinese ancient philosophy, the site seems like the perfect place to found a city. If one can imagine a person standing at the centre of the site facing the sea, according to Chinese way of thinking, this person would feel a sense of serenity and harmony with nature as he/she would be feeling the rising sun's warmth on the face while being embraced by the surrounding hills.

基地介绍——片富有“场所精神”的热土。根据中国古代风水学说，此汉葫芦岛CBD生态城市的基地是建设城市的风水宝地。北靠青山，南临大海，背阴负阳，金带环绕。

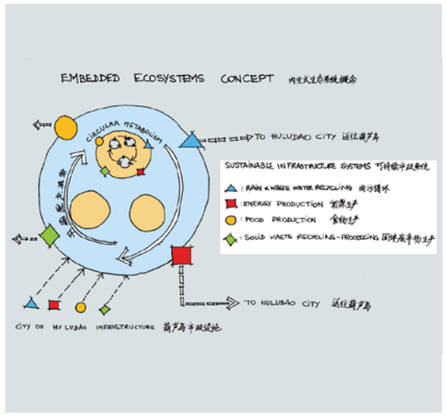


2. Ecological Regional approach:

To avoid encroaching by the growing urban areas of Xingcheng and HuLuDao, the ecocity has a defined boundary marked by a phyto-remediation greenbelt (with trees that absorb heavy metals and other pollutants from the soil). The phyto-remediation 'forest' extends to protect the Moon River's 3500 km2 watershed helping to ameliorate pollution in the region.

区域生态规划策略

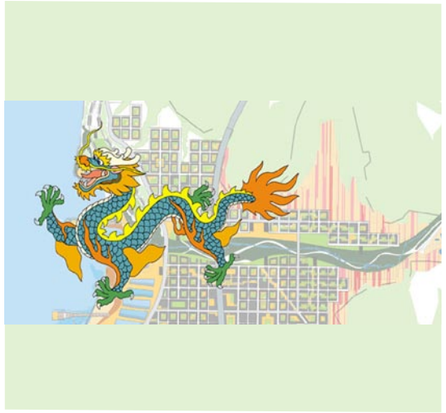
为避免该地区被逐渐膨胀的兴城和葫芦岛蚕食，生态城市的外围的广袤的原始森林被用作隔离绿带。同时，在基地边缘根据山势种植可净化土壤的林木，并设想种植该林木的地区还应延伸到整个月亮河流域3500km2的区域内。



3. Supporting Systems:

Embedded ecosystems Concept: The project mimics the functioning of planetary ecosystems where there is a symbiotic relationship between biotic communities and the resources that support them within a hierarchy of scales. In the HuLuDao Ecocity there are systems (equipment, facilities, and spaces) to produce food and energy, to catch and recycle rain and waste-water and to collect and reuse solid wastes at the city, neighbourhood, block and building levels making the ecocity almost self-sufficient.

生命支持系统：内生式的生态系统概念。该方案模拟了生态系统中的共生原理，建立了不同级别的城市生态能源系统。这个系统运作后，可以生产食物和能源、进行雨污和固体废弃物循环利用，并且在城市尺度、社区尺度和建筑尺度内进行物质能量的平衡。



4. “ Dragon Spine”:

According to Chinese thought, the “head of the dragon” is at the south-east end of the site (on the ocean shore) and that suggests that the Moon River is the “spine of the dragon”. This central axis along the river structures the project spatially and functionally. All human activities, life supporting systems and north-south streets converge in this central elongated space. Along the spine, there are food-producing greenhouses and orchards, waste-water treatment, biogas energy-producing facilities, and 40 hectares of silkworm industry trees and micro-factories.

脊
沿月亮河建立一个名为“脊”的带形游憩、种植景观区。沿着“脊”，分布着温室、果园、废水处理中心和沼气制造站，还有四十公顷用地作为桑树种植区和小型制丝工厂。

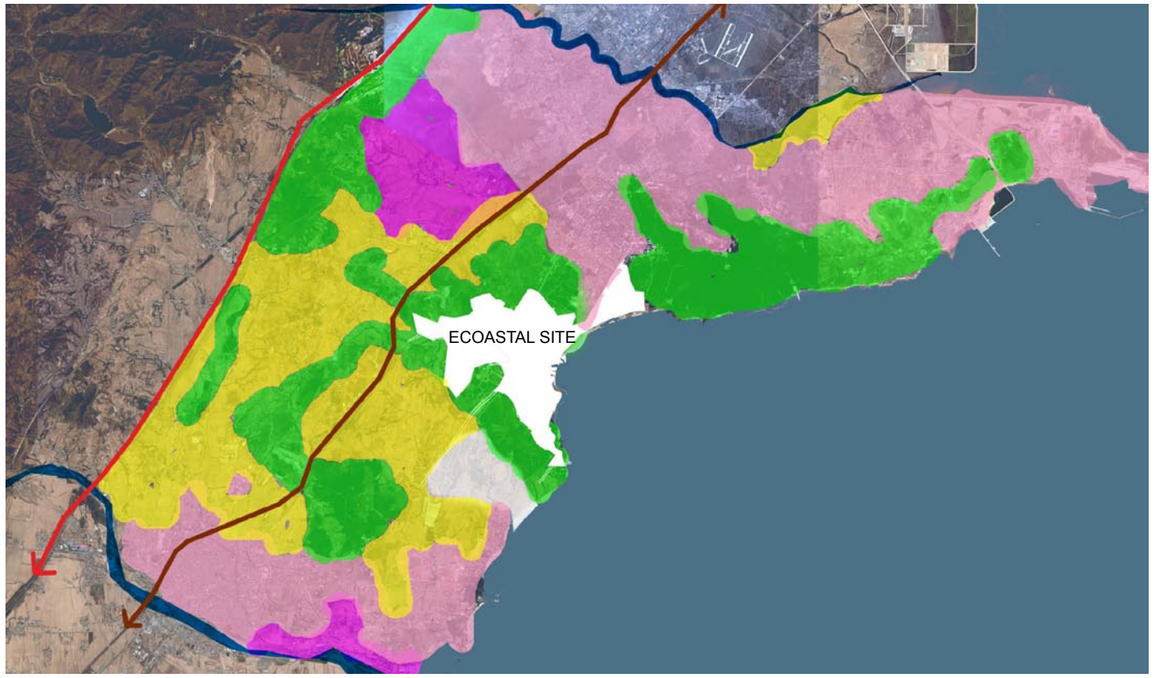
5. Coastal Development:

This coastal eco city is an eastern gateway to China and is positioned to attract and develop tourism. Its waterfront is developed as a major resort, leisure and entertainment district with areas on the hillsides reserved for high-end residential development, while an area of 650 hectares of the Moon River estuary is preserved as a wildlife sanctuary and for fish farming.

滨海设计
滨海区定位为休闲度假胜地，包括山区的高端居住用地和位于月亮650公顷的渔场湿地。

ECOCITY BASIC DATA:
TOTAL (WORK-DAY) POPULATION: 140,000 (120,000 residents +20,000 outside daily workers)
NET RESIDENTIAL DENSITY: 49 residential units/hectare (170 persons/hectare considering 3.5 family members)
(net residential area = total site area – neighbourhood parks and public spaces, cropland, agricultural fields, sports complex and life supporting systems facilities)
BUILDING FAR PER 200X200 BLOCK: 2.0 (Avg. bldg. height: 6 storeys)
OPEN SPACE: 420 hectares (neighbourhood parks and public spaces, cropland, agricultural fields, sports complex and life supporting systems facilities - 52% of total site)
TOTAL GROSS BUILT SPACE : 7.0 million m²
COMMERCIAL/OFFICE SPACE: 3.1 million m²
RETAIL SPACE: 1.1 million m²
RESIDENTIAL SPACE: 2.75 million m²
FOOD PRODUCED: 68% of ecocity population needs
FRESH WATER PRODUCTION: 80% of ecocity population needs
ENERGY PRODUCED: 93% of ecocity population needs
TOTAL SOLID WASTE: 100% recycled/reused

工作日人口：14万人（约12万居民和超过1万居住在本区外的通勤者）
人口净密度（根据GB 50180-93）：49个居住单元/公顷（170人/公顷，按每户3.5人计算。）
容积率：2.0（平均建筑高度按6层计算）
开放空间：100公顷（包括居住小区小游园、田地、林地、体育文化设施等）
建筑总占地：7 X 106平方米
居住面积：2.75 X 106平方米
商办面积：3.1 X 106平方米
零售面积：1.1 X 106平方米



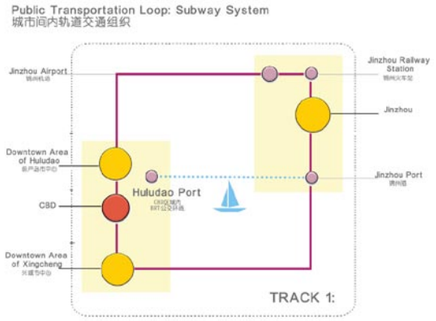
Phyto remidiation/reforestation

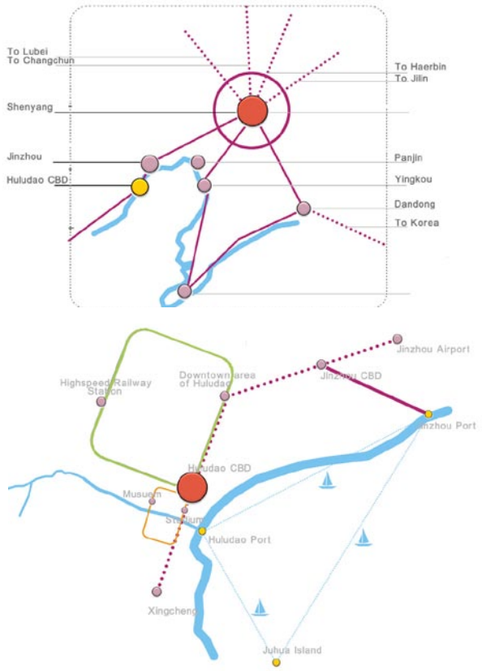
Agricultural land

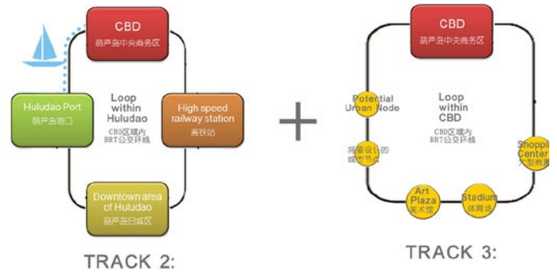
HuLuDao, XingCheng urbanised areas

HuLuDao, XingCheng future growth

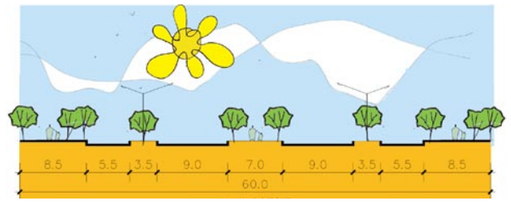
CBD II



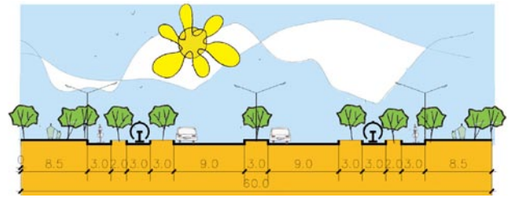




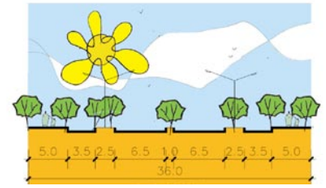
STREET SECTIONS



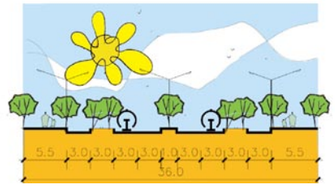
STREET SECTION “A” BEFORE



STREET SECTION “A” AFTER



STREET SECTION “B” BEFORE



STREET SECTION “B” AFTER

II. REGIONAL STRATEGY

The project proposes a balance-with-nature bioregional development by soil-cleaning (via phyto-remediation) and by restoring and protecting the headlands of the existing water-sheds. Given the scarcity of water in the region, and the drier outlook for the future, this strategy ensures a minimum of water resources for the project. Watershed restoration and protection and agricultural production will also benefit HuLuDao and the neighbouring XingCheng. The phyto-remediation/protection areas also work as a green buffer to contain urban development around the ecocity so that future population growth in neighbouring urban areas do not encroach upon it.
Urban infill in HuLuDao and Xingcheng will help to contain urban development resulting from population growth within their urban boundaries.
HuLuDao ecocity plays a critical role in structuring the economic health of the region.

III. TRANSPORT

A Bus Rapid Transit (BRT) network will link the cities of Jinzhou, HuLuDao, the Huludao Ecocity, and Xingcheng; another internal BRT will link the ecocity’s sports and cultural complex, the HuLuDao Town Centre and the HuLuDao High Speed Rail station. An internal light rail circulation network will connect all ecocity neighbourhoods.

The road infrastructure inside each neighbourhood is designed exclusively for pedestrians, bicycles, ‘segways’, and for small non-motorized or electric personal vehicles (allowing access to emergency vehicles).

II. 域规划策略

本方案提出了通过规划区内部物质能量循环达到人与自然平衡的规划策略，并保护了分水岭和水源地。基于该区域水源日益匮乏的现实，我们希望最大程度的节省区域用水量。为此，本方案划出大量用地用于保护分水岭和农业生产，这样做有利于整个葫芦岛地区的发展。

同时，我们提出了产业植入的策略为葫芦岛市居民提供更多的工作机会。

III. 交通规划
（包括断面设计）

交通系统规划包括了连接锦州、葫芦岛老城中心、葫芦岛CBD、兴城的BRT系统；连接葫芦岛CBD内体育馆、文化馆等城市节点的BRT系统；连接CBD地区内7大片区的轻轨系统。

该生态城市的社区内循环式市政设施要求街区内为纯粹的步行空间，仅允许自行车、电动车等小型交通工具通行。

For the two major roads planned to run in approximate N-S direction through the site (alreday under construction), we are proposing alterations of the sections, in order to accommodate public transportation and include more generous road medians. The purpose of medians is to visually narrow the road profile and decrease the speed of vehicles through the city, to increase the permeable surface of the road, to provide pedestrian refuge at street crossings, to increase pedestrian safety and to raise the amount of tree canopy for more pleasing street experience.

REGIONAL AND TRANSPORTATION STRATEGIES

IV. SUPPORTING SYSTEMS

The ecocity features advanced sustainable infrastructure technologies, equipment, and facilities designed to produce food, energy and fresh water, and to collect and recycle rain, waste-water and solid wastes.

FOOD PRODUCTION (68% of ecocity needs):
Combined output of food-producing systems (using bio-intensive organic agriculture methods) has potential for securing a minimum of 13,000 tonnes of corn, fruits and vegetables per year.
City scale: Corn fields, apple orchards, and greenhouses.
Neighbourhood scale: Vegetables and poultry vertical farms.
Block scale: Courtyard orchards and building rooftop gardens.
Sea front: Corn and vegetable salt-water green houses and fish-farms (247,000 tonnes/year).
FRESH WATER PRODUCTION (56% of ecocity's population needs):
6,000 m³/day of drinkable water will be supplied by the plant located at the middle of the reservoir built upstream of the spine on the Moon River.
WASTE WATER RECYCLING (recycles and treats 92% of ecocity waste water):
10 "Living machines" (advanced water bio-filter systems) along the "green spine" will collect, treat and recycle up to 13,000 m³ of household wastewater, runoff and industrial water daily to be diverted towards the Moon River, towards the gray water city system or to be used for irrigation.
ENERGY PRODUCTION (93% of ecocity requirements):
City scale: 13 wind-turbines on the site's hilltops to produce 2 GWh/year.
Block scale: 11,52 hectares of photovoltaic panels (on building rooftops) to produce 18,48 GWh/year.
SOLID WASTE RECYCLING (to generate 30% of ecocity energy needs and all heating needs):
The objective is to produce 4,000 tonnes/year of compost suitable for agriculture, and 63 tonnes/day of water recovered for treatment in the "living machines."
District scale: Biomass digesters, co-generation turbines and "living machines" will treat 73 tonnes/day (26,700 tonnes/year) of household, green, fish and crops waste to generate 4,40 GWh of electricity and 5,03 GWh of heat. Seven of these implants occupying 8,000 m² will accomplish the management of all organic/inorganic waste and treatment of all wastewater in the ecocity.
Block scale: a system using dry toilet waste and compost will allow 20% of water savings as well as a production of fertilizer suitable to enrich almost a hectare of soil.

IV. 生命支持系统

生态城市的市政设施和技术可以用于食物生产、能源生产、水和固体废弃物处理，并极大的减少了温室气体的排放。
生产食物（使用有机农业的生产方法）可以每年至少生产13，000吨玉米、水果或者蔬菜。
食物生产满足该地70%的需要
城市尺度：玉米地、苹果园和温室
社区尺度：蔬菜、家禽和垂直农场
街区尺度：庭院果园和屋顶种植
滨海：玉米、蔬菜、咸水温室和年产247吨鱼的渔场
淡水生产（满足该地80%的需要）
月亮河上游的"脊"上种植的植物可提供淡水6000m3/天

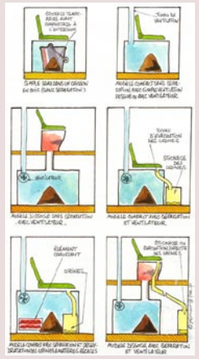
废水循环（可处理该地92%的废水）
十个"居住机器"（现进的生物处理器）分布在"绿脊"上，每天可收集循环13000m3家庭污水，工业废水，得到的中水可以用于灌溉月亮河绿带的农田，并可直接排放到月亮河中。
能源生产（满足该地93%的需要）
城市尺度：山上的13个风涡轮可以年产电2x 106千瓦时/年
街区尺度：总面积达11.52公顷的光电板（放置在屋顶）可以年产电18.48 x 106千瓦时/年

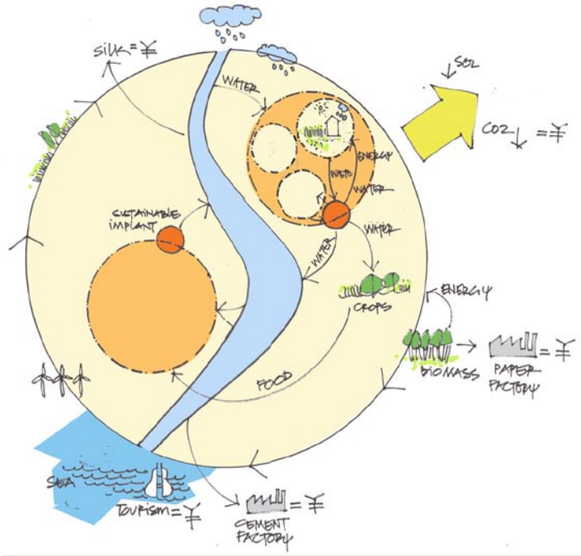
固体废弃物循环
满足该地30%的能源需要和所有的供热需要
为农业发展每年生产4000吨的有机肥
"居住机器"每天处理63吨水

区域的尺度：生化处理和"居住机器"等可以处理73吨/天（26，700吨/年）的废弃物，产电4.40 x 106千瓦时/年，产热5.03 x 106千瓦时/年
8个8000 m2的生物垃圾处理站可以处理整个城市的废弃物
街区尺度：干厕所系统可以每年节省20%的水并且作为有机肥料的收集中枢

BUILDING

Waste, energy, food, water



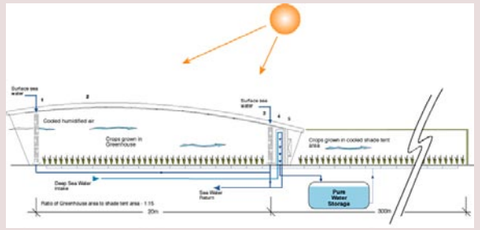


DISTRICT

Sustainable implant : Water, waste, energy

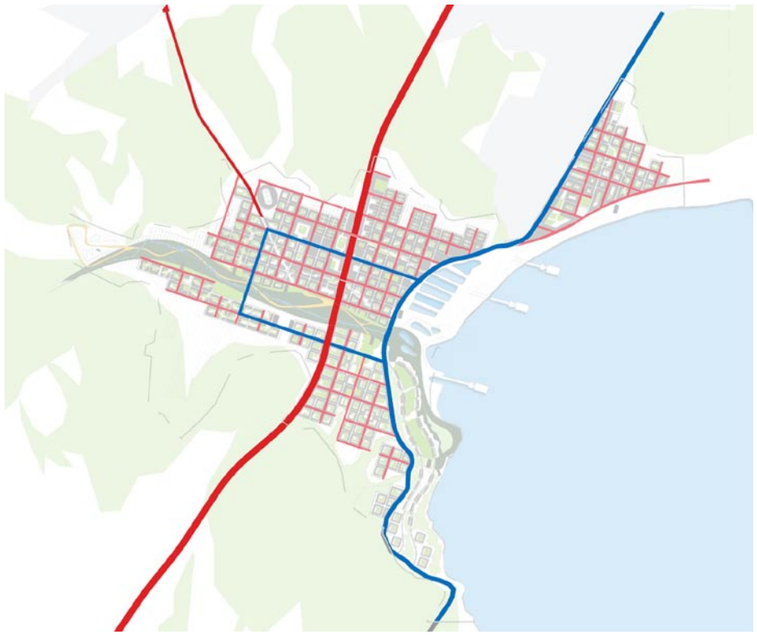
CITY

Water, food production



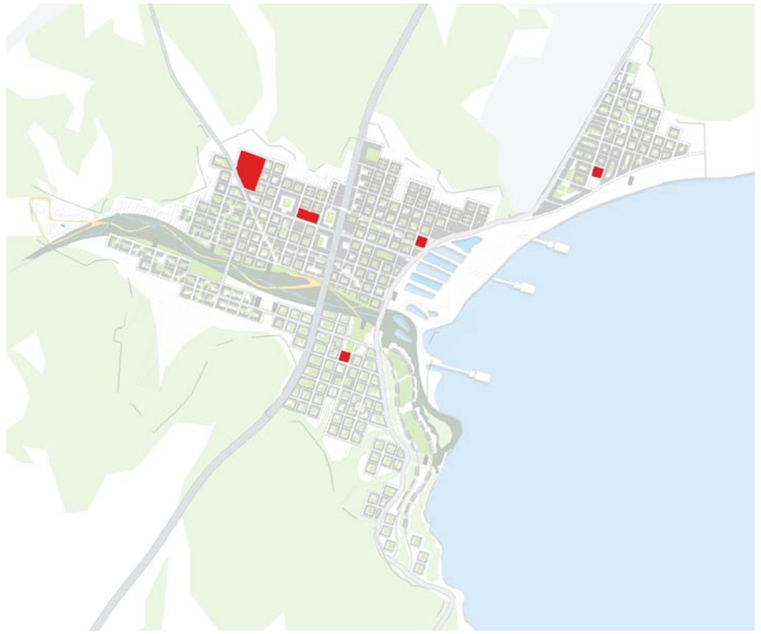
Energy production

ROAD SYSTEM
道路系统



WASTE AND ENERGY MANAGEMENT
废弃物利用和能源再生规划

SPORT FACILITIES
体育设施



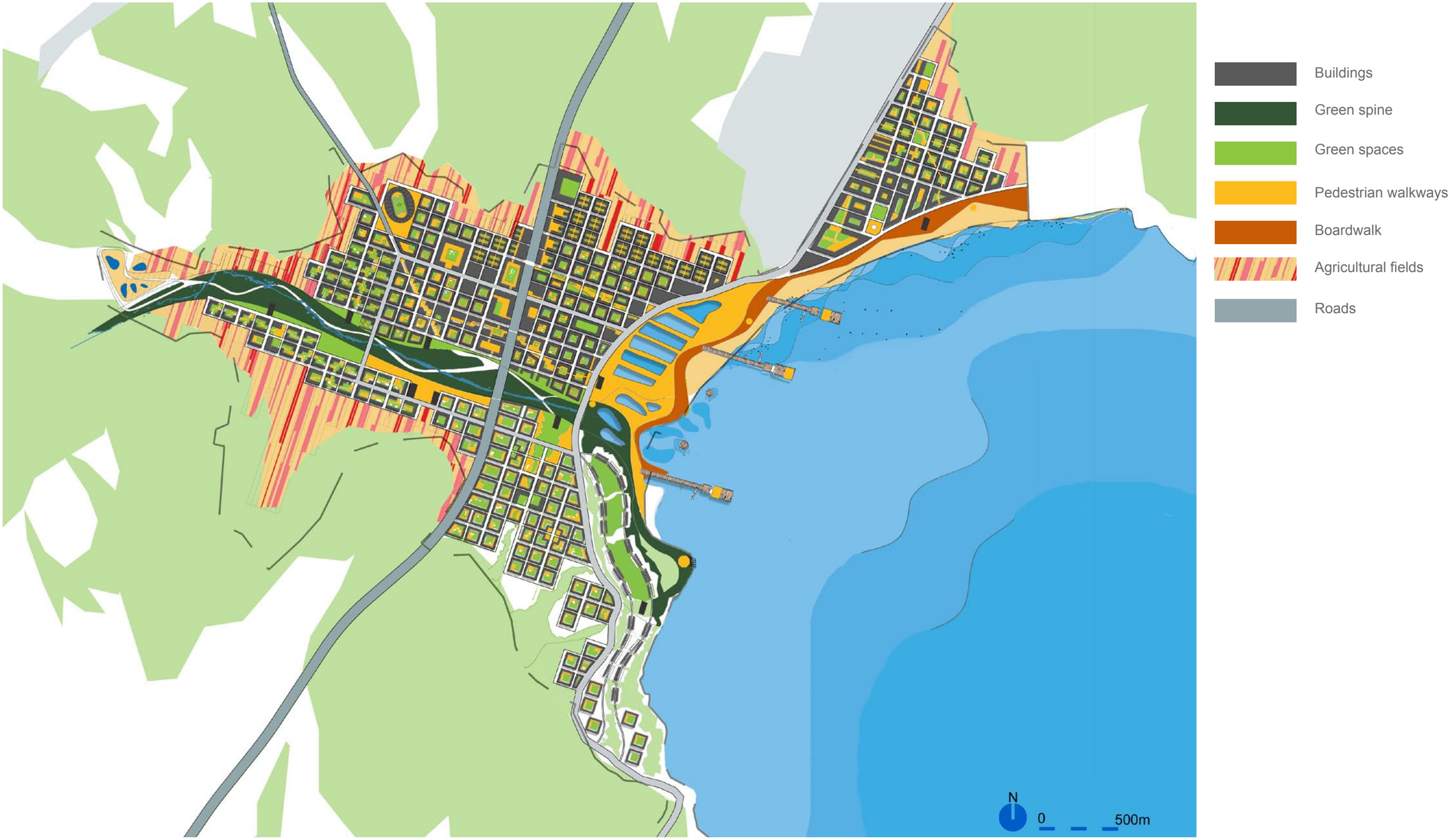
FOOD AND SILK PRODUCTION
食品和蚕丝生产

SCHOOL SYSTEM
教育设施

RESEARCH AND DEVELOPMENT FACILITIES
研发中心

MASTER PLAN CONCEPT

ECOSTAL CITY OF HULUDAO



V. MASTER PLAN

The project features urban form and arrangement of land uses that ensures energy efficiency in all buildings and neighbourhoods, a walkable environment, the feasibility of mass public transit, a lively humane environment and the availability of developable areas for all possible land uses in a large city (i.e. residential, commercial and office space, cultural, institutional and sports facilities, food, energy production and waste management facilities, and biodiversity-enhancing areas).

V. 总体规划

该方案使每栋建筑、每个街区、乃至城市尺度都实现了节能环保的目标，创造了人性化的步行环境，用地混合、工宿平衡的生活环境。

URBAN MORPHOLOGY- BIRD’s EYE VIEW

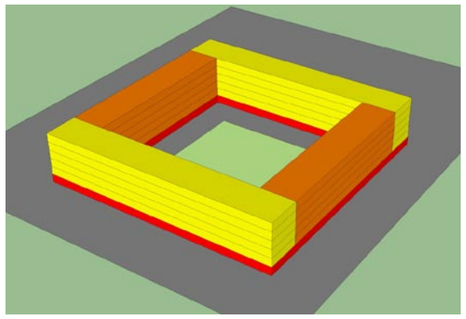
ECOSTAL CITY OF HULUDAO

VI. URBAN MORPHOLOGY

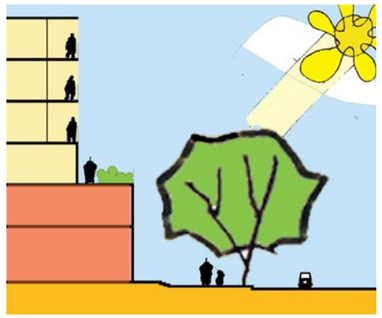
A basic 100m x 100m traditional grid system provides an urban fabric that encourages a pedestrian environment with high degree of permeability, connectivity, a high number of intersections and a high cyclomatic number (maximum number of possible routes between two points of the city). The orientation of the grid is maximizing a southern exposure and providing a maximum protection from the strongest regional winds.

VI. 城市形态
100m x 100m 的网格提供了一个连续性良好、交叉口数量多的交叉口的城市肌理。

Since the local way of development is to subdivide parcels by a minimum of 200m x 200m, this plan demonstrates the way the proposed grid of 100mx100m can be utilized to create manageable and flexible blocks of courtyard buildings. The green spaces are weaving through the blocks and breaking them, exchanging private space for public, bringing the “spine” deep into the city. The two tall buildings at the North entrance of the city offer a monumental gateway with their living walls or green facades, and a directional aim that guides a view of a visitor into the heart of the city and its “spine”.
The ecocity should promote diversity on many levels, vital for its vibrancy and functionality. Diversity of population is encouraged by provision of live-work-play spaces and activities for people of all age groups, with different backgrounds and incomes. Mix of uses and a building typology that maximizes funcionallity and flexibility (both vertically and horizontally), supports such model. The building heights are averaged at six stories, but the further analysis of energy performance will determine the maximum building height. Various business models are suggested to increase the land value in order to provide for public benefits and built-in affordability. The possibility of an increased active edge within the block allows for more exposure of commercial uses, necessary for their economic vitality. General design guidelines should be developed to ensure the building form.



MIXED USE- BUILDING LAYOUT



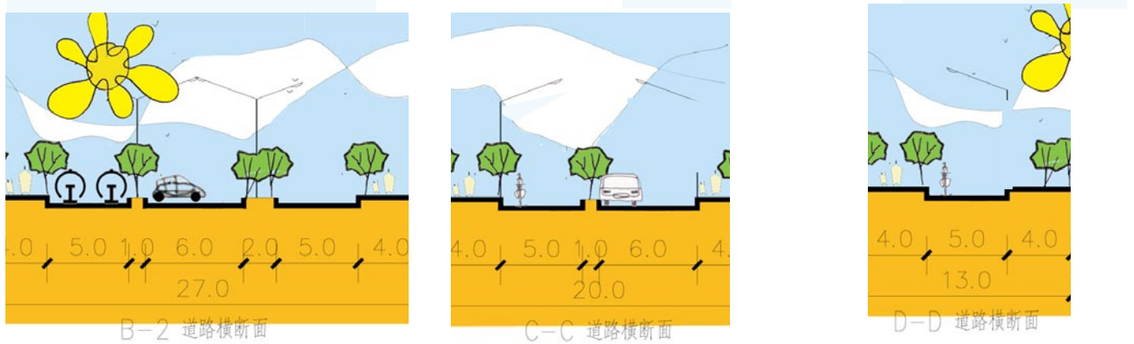
MIXED USE- BUILDING SECTION

The 200m x200m envelope is surrounded by the city streets of wider section that allow higher number of transportation mo (Street B-2, Street C), while the inner streets (Street D) are reserved for pedestrain and bicycle movement only.

STREET B-2

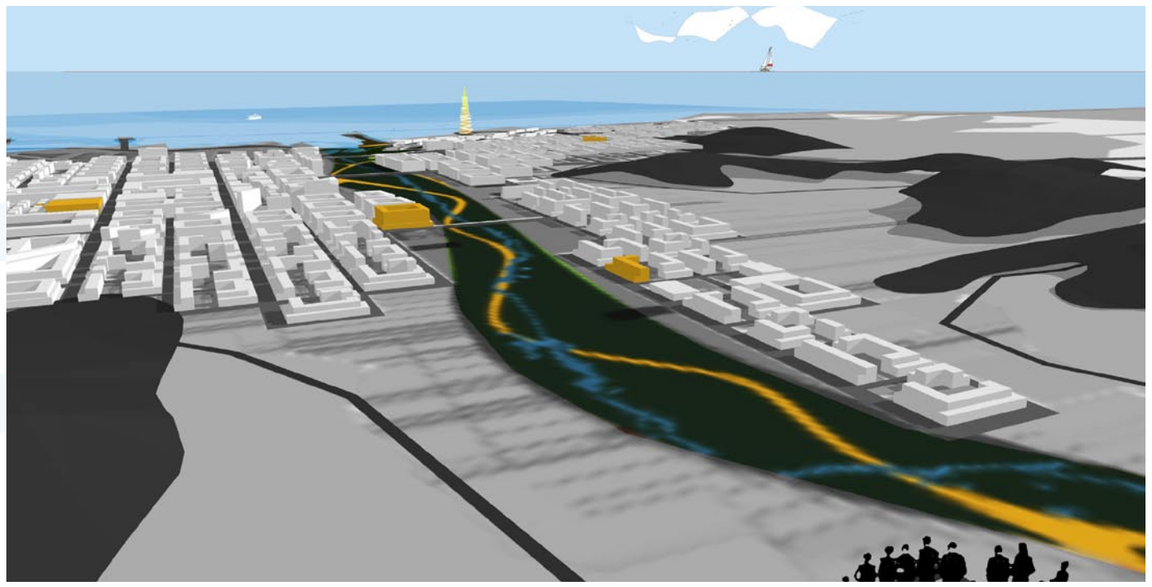
STREET C

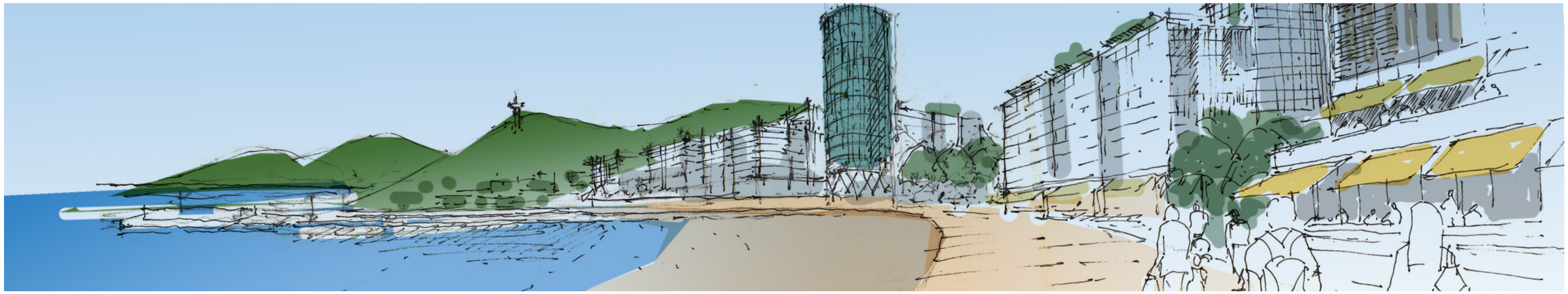
STREET D

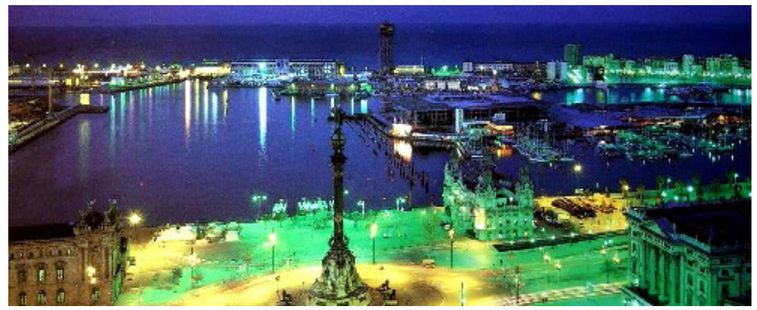


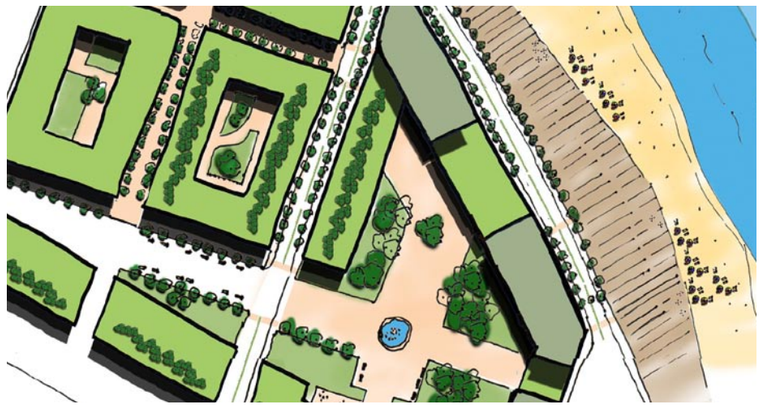
THE CITY GATEWAY

VIEW
ALONG THE SPINE









The waterfront becomes a major resort, leisure and entertainment district with areas on the hillsides for high-end residential development, and an area of 650 hectares of wetlands at the mouth of the Moon River for fish farming.

Space for 8,500 hotel-beds are accommodated along the north side of the Moon River. Along the 4 km light rail-served boardwalk, cafes, restaurants, bars, spas and shops create a lively pedestrian environment to be enjoyed all-year-round. Four floating piers will have spaces and facilities for small water craft and sailboats.

An area of 300 hectares of fish-farms act as a natural flood control system and as another source of food for the ecocity.

The waterfront development is raised 800mm above the highest tide to allow for anticipated sea-rinsing levels in the area.

亲水区设计

沿月亮河北岸建立了一条有8500个床位的宾馆带。沿4km轻轨可以服务到的社区，滨水步行道、咖啡馆、餐馆、酒吧和商店形成全年活跃的步行环境。在入海口为游憩用第设计了四个浮动的码头。

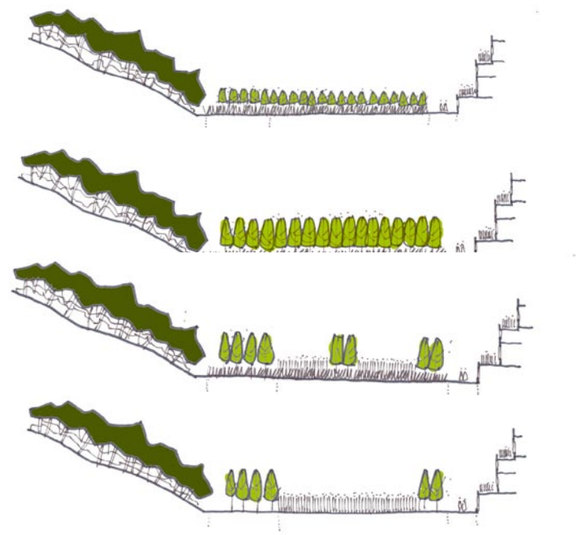
300公顷的渔场一方面成为泄洪区，一方面为生态城市提供了食物来源。

URBAN MORPHOLOGY WATERFRONT DEVELOPMENT

ECOSTAL CITY OF HULUDAC

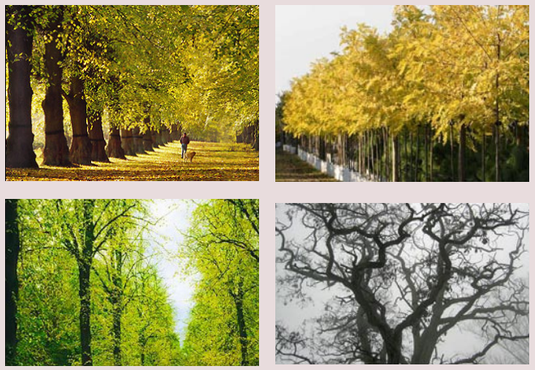
GREEN SPACES 绿地

PHYTO REMEDIATION
可供土壤更新的植物



GREEN SPINE 绿色脊柱

STREET TREES 行道树



DECORATIVE AND PRODUCTIVE LANDSCAPE

EDIBLE PLANTS

COURTYARD 庭院

GREEN CORRIDOR TREES 绿色通廊

ROOFTOP GARDEN 屋顶花园

EDGE&PHYTOREMEDIATION 边缘区种植的可供土壤更新的植物

CROPS 谷物

VII. LANDSCAPE DESIGN

The central spine is the main landscape feature on the site. It is a productive landscape planted with a variety of indigenous local species organised in a hierarchy that responds to the “spine’s” natural topography and proximity to land uses on the developable area. The orchards contain tree species that can grow all-year-round. The landscape in the spine is part of the process of phytoremediation for recovering the land.

VII. 景观设计

位于基地中央的脊作为主要的景观带。这是一个能够生产食物和能源并且种植大量当地植物，可供大量当地物种栖息的功能景观带。“脊”的设计符合基地地形，同时提升了周边用地的价值。果树品种丰富，可以保持四季常青。

VIII. ECONOMY

HuLuDao Ecocity offers a magnificent opportunity for investment. The privileged location of the site (fronting the sea, nested between rolling hills, and with a seasonal stream running along its main axis) secures advantageous sites for all possible land uses with above-market land values.

葫芦岛有很好的投资前景。葫芦岛的区位和生态城市的设计为投资提供了多种可能。

The circular metabolism of the city (producing, recycling and reusing food, energy, water and wastes and regenerating surrounding lands) results in substantial savings to the municipality in the provision and maintenance of services and facilities. The occasional surplus food and energy can also be fed back into the regional grid representing further financial gains.

依靠城市自身的新陈代谢可以节省的资金可以用于更新当地的基础设施，真正实现可持续发展的目标。渔场提供的海产品可为当地带来更多的资金支持。

The silk, tourist, R&D and agricultural industries will secure financial vitality for the ecocity as well as the large sellable areas of office, commercial, retail and residential space.

丝绸、旅游、研发和农业生产可以为生态城市带来极大的经济活力。

The establishment of Sustainable Technologies R&D companies in the R&D Zone will also attract investment into the ecocity.
可持续发展技术的应用会吸引相关公司在该地建立研发中心，进而建立当地的研发区吸引更多的投资。

National and international sports and cultural events held at the sports and cultural complex will help position the HuLuDao ecocity as an international place for innovation and development related sustainability.
国内国际体育赛事的举办能够提升葫芦岛的城市地位，弘扬当地可持续建设发展的创举。

Opportunities for commercial land development
土地开发的机遇：
The block size structure allows the government to sell a minimum of 4-hectare blocks with the provison that the developer adheres to a block subdivision system where two minor (small-vehicle or public pedestrian) roads are included in the block layout. This strategy allows the government to derive a large revenue from selling the land while encouraging developers to take advantage of the large areas of commercial developable land as follows:
格网规划的划分方法对政府和开发商均极为有利：

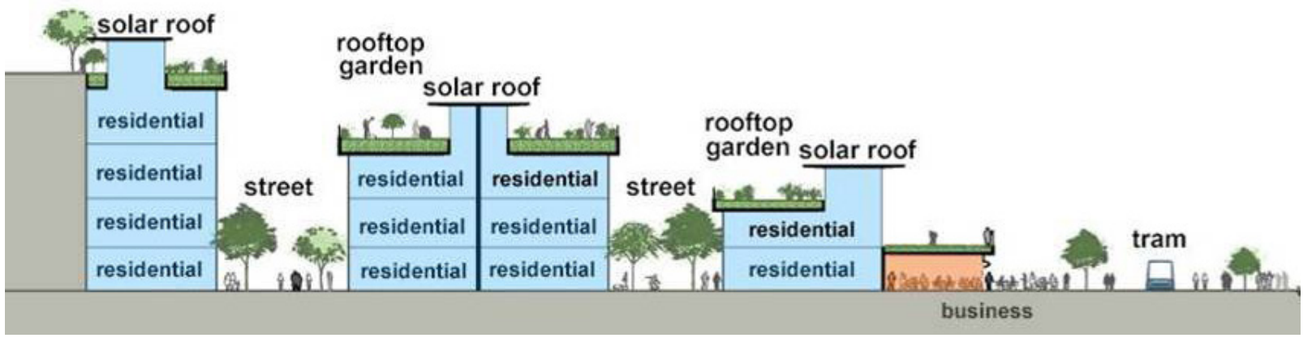
Office space: 2’400,000 m2 x 4,000 RMB/m2 = 9’600,000,000 RMB
办公空间收益: 2’400,000 m2 x 4,000 RMB/m2 = 9’600,000,000 RMB

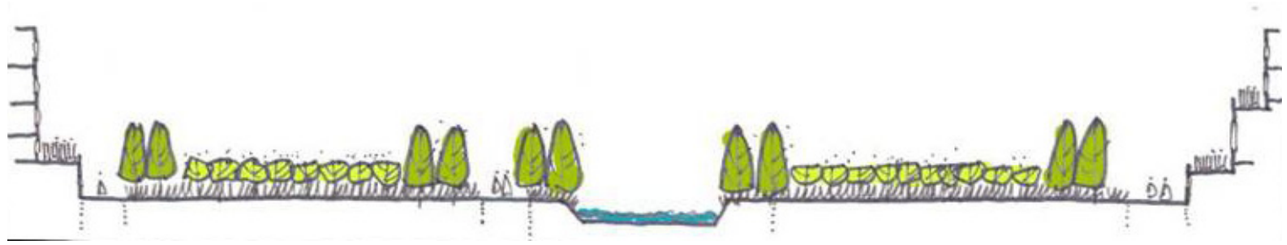
Commercial space: 6’900,000 m2 x 4,000 RMB/m2 = 27’600,000,000 ¥
商办空间收益: 6’900,000 m2 x 4,000 RMB/m2 = 27’600,000,000 ¥

Retail space: 1’700,000 m2 x 4,500 RMB m2 = 7’650,000,000 RMB
零售空间收益: 1’700,000 m2 x 4,500 RMB m2 = 7’650,000,000 RMB

Residential space: 2’750,000 m2 x 4,000 RMB /m2 = 11’000,000,000 RMB
居住面积: 2’750,000 m2 x 4,000 RMB /m2 = 11’000,000,000 RMB

Notes:
1. All areas are gross areas including all developable space within the envelope of the buildings on a block and including circulation and service areas.
2. Developable areas in a 100m x 100m block are per diagram below
3. Calculations are based March 2009 prices as follows:
   a. Residential space: 2000-4000 RMB/m2 (new residential space 6000-7000 RMB/m2)
   b. Office/ Commercial space: 3000-4000/m2
   c. Retail space: 3000-4500 rmb/m2 (upscale 6000rmb/m2)
注明：
所有建筑的单位面积价格均基于2009年3月数据





第三部分 评委

PART 3 Jury Deliberation

评委组成

评审团主席

1	吴志强	中国	教授，博士生导师，现任同济大学建筑与城市规划学院院长，2010 上海世博会总规划师
2	Pierre-André Périssol	法国	*Les Ateliers*,主席 Moulins 市市长，前法国住房部部长

当地代表

3	陈晓琨	中国	市委书记
4	孙兆林	中国	市长
5	邓爱平	中国	规划局局长
6	吴小舜	中国	规划院院长

专家团

7	曹曙	中国	教授，博士生导师，现任同济大学建筑与城市规划学院城市规划系教授
8	李京生	中国	教授，博士，现任同济大学建筑与城市规划学院城市规划系教授
9	庄宇	中国	教授，博士，现任同济大学建筑与城市规划学院城市规划系教授
10	邵甬	中国	博士，副教授，现任同济大学建筑与城市规划学院城市规划系副教授
11	李麟学	中国	博士，副教授，现任同济大学建筑与城市规划学院城市规划系副教授
12	Camille Chammas	法国	建筑师，城市规划师； 巴黎拉德芳斯CBD规划局
13	Serge Salat	法国	建筑师 – 经济学家 – 工程师，可持续发展城市研究专家，工作站技术总监
14	Alain Sallez	法国	城市经济学家，ESSEC 名誉教授. “城市观察”杂志总编.
15	Nguyen Ngoc Tran	越南	总设计师 Mekong 三角洲发展研究中心， 越南外事部前副主席
16	Michael Gies	德国	城市设计师， 参与 FreiburgVauban 生态城市设计.
17	P.V.K Rameshwar	印度	Ahmedabad 大学研究生院院长.
18	Jean-Louis Charron	法国	旅游胜地规划师. Director of City Star 集团会长，在海滨胜地规划营销方面经验丰富
19	Jean-Luc Nguyen	摩纳哥	摩纳哥海滨开发区规划设计主创设计师
20	Philippe Jonathan	法国	建筑师，在中国设计过多个项目，如江苏太平新城研究
21	Vincent Bourjaillat	法国	城市规划师，主要从事城市更新研究，现负责大巴黎地区概念设计

Composition of the jury

Chair of the jury

1	Wu Zhiqiang	China	Professor and Dean of the CAUP of Tongji University. Chief planner of the World Expo 2010 in Shanghai.
2	Pierre-André Périssol	France	Chairman of *Les Ateliers*, Mayor of Moulins, Former French Minister of Housing.

Local Representatives

3	Chen XiaoKun	China	Secretary, Huludao Civic CPC Committee
4	Sun ZhaoLin	China	Mayor of Huludao
5	Deng Ai Ping	China	Director of Huludao Planning Department.
6	Wu XiaoShun	China	Director of the Planning Institute of Huludao

International Experts

7	Alain Sallez	France	Urban Economist. Emeritus professor at ESSEC. Chairman of the “Observatory of Cities”.
8	Camille Chammas	France	Architect and Urban planner for the Development Agency of the CBD of La Défense – Paris.
9	Cao Shu	China	Professor atTongji CAUP. Former associate professor in Strasbourg architectural College of France.
10	Jean-Louis Charron	France	Resorts Developer. Director of City Star, a promotion group specialized in seaside resorts.
11	Jean-Luc Nguyen	Monaco	Director of the project of extension in the sea for Monaco Principauty.
12	Li Jingsheng	China	Professor at Tongji CAUP. Planning Director of Tongji Urban Planning and Design Institute in Shanghai.
13	Li Linxue	China	Associate professor at Tongji CAUP, columnist of "Architecture Time" magazine
14	Michael Gies	Germany	Urban designer. Contributed to design the Vauban eco-neighborhood in Freiburg.
15	Nguyen Ngoc Tran	Vietnam	Director of Mekong Delta Development Research Centre. Former vice chairman of the Foreign Affairs Committee of Vietnam's National Assembly.
16	Philippe Jonathan	France	Architect. Carried out many projects in China, such as a study about a new town in Taiping, Jiangsu.
17	P.V.K Rameshwar	India	Head of Masters Programsof Urban Planning in Ahmedabad University.
18	Shao Yong	China	Associate professor at Tongji CAUP, member of the academic committee of China Historical and Cultural City Protection.
19	Vincent Bourjaillat	France	Urban planner. Experience of urban renewal and now working on the "The Great Paris" concept.
20	Zhuang Yu	China	National First-Class Certified Architect in China, Director of Urban Space and Environmental Research Center in Tongji Architectural Design Institute

评审结果

总体意见

短时间内完成这样一个项目是一项挑战：定义一个生态城市，平衡的考虑基地、环境、现有城市，以及“生态”的全球概念，同时考虑经济、能源和当地资源的利用。

此次工作站的目的是设计理念的生成。从这个意义上来讲，各团队的工作成果值得赞赏。

康奈尔与Mines的环境和城市形态分析强有力的贯穿到三个方案当中。他们因而对方案的技术层面和概念的形成提出了较高要求，这些要求有可能限制了三个团队的想像空间。

三个方案的主要优点

- 三个方案都重点考虑了环境与生态，同时关注了生态系统。这表明它们都很好的发展了“生态城市”的概念。
- 三个方案提出了高密度与紧凑的策略，这是对CSTB所阐释理念的正确理解。
- 所有组都很好的考虑了基地现状及其特性。地形尤其被重点考虑，方案与山体的关系和谐。
- 高水平的提出了环境技术策略，水利用和废水处理策略，尤其是雨水的重复利用。
- 很好的分析了碳排放问题。
- 考虑了与服务设施的连接及便捷通道。

三个方案的局限

- 与海的关系较弱。几乎没有提出城市与海滨的有机联系。也几乎没有涉及城市对于海的感知。
- 几乎没有对于基地吸引力的建议。应该发展什么样的休闲娱乐活动？
- 对于旅游者与短期访客的服务管理考虑很少：如旅馆、交通、娱乐活动等。
- 怎样应对冬天的气候？如何借鉴北欧与北美城市的经验？
- 很少涉及经济基础及城市活力的问题。
- 每一组都试图在多个主题上提出策略：城市形体、能源系统、水和废弃物管理……因而很难清晰的表达出强有力的策略选择。
- 对于海洋生态系统考虑较少。
- 在城市的社会和文化方面没有给予足够重视。
- 污染问题应更坚定和直接的面对。
- 尤其对于中国评委来说，方案缺乏强烈的形象和中心。

评委讨论中提出的问题

- 海滨应该成为城市中心吗？如果不，怎样连接两者？
- 这里应成为商务区吗？
- 各组没能始终准确把握该城市的本质：这是一个其他两城市的卫星城，一个链接体，还是一个边缘城市？
- 该城市的主要职能和经济基础是什么？它是一个旅游村还是该区域新的财政中心？
- 是否应该设置城市生态农业？
- 所以组都提到中国传统的城市肌理，这是否必要？
- 气候变化会怎样影响基地？
- 穷人怎么办？城市中是否有为移民和贫穷人口设置的地方？

中国评委的特别评论：城市规划设计的方法上具有文化差异。如今在中国，城市规划方案图由工程师绘制。三个组均提出了小规模城市的高密度发展策略，这与中国并不一致。这项工作的关键是如何在未来利用其成果。此次工作坊只是一个开端。

各组方案的亮点

A组 — 大胆创新的概念

- 选择强烈的东西方向，从而制造了：
  - 与海的特殊关系：城市面向海边；
  - 建筑物均朝南向，这在中国是非常重要的；
  - 对南北强风的抵御；
- 多样的居住模式，为居民提供选择。
- 考虑了渔民和他们的迁移。
- 线性结构可能使城市难于理解。
- 对街区形态进行了详细设计。

B组 — 与基地和周边很好的融合

- 有趣的区域策略。
- 很好的连接了葫芦岛与兴城，提出了详细的交通系统。
- 一个倚靠山体的城市：很好的融合了基地环境。
- 对城市经济基础的理解。
- 对中心性和高度的有趣策略。
- 可能较容易发展，与已有设计方案相匹配。

C组 — 有趣的邻里模式

- 街道尺度与人的尺度的精细途径。
- 符合中型城市的需要：道路和人行网络。
- 与中国人的意愿相匹配。
- 关于循环的有趣提议：连接、道路网格、人行网络。
- 基于方案涉及的庭院，提出了关于类型学强有力的建议。
- 方案中有大量农田，使未来发展更具灵活性。
  与月河的联系。

Deliberation

General opinion

The time was short for such a challenge: defining a project of eco-city that promotes an harmonious balance between the site, the environment, the existing city and the “eco” global concept, taking into account the economy, the energy and the use of local resources.

The purpose of this workshop is the generation of ideas and in that sense, the teams did a commendable work.

The environmental and urban form analyses led by the Cornell and Les Mines groups are powerful and penetrate into the 3 projects. They thus participated to set high requirements on technical proposals and formulation of concept, which might have limited the imagination of the 3 teams.

Positive common features to the 3 projects

- Environment and ecology have been very much taken into account in the 3 projects. Attention was also paid to the ecosystems. This shows that the concept of “eco-city” has already gone a long way.
- The 3 projects propose a high density and compacity, which demonstrates a good understanding of the brief set by the CSTB
- All teams took well into account the existing situation and the specificities of the site. The topography has been particularly taken into account and the 3 projects connect well to the hills.
- A very high quality of the propositions about environmental techniques and uses for water and waste treatment, especially with the re-use of rain water.
- Good analysis of the issue of carbon emissions.
- Concern for connectivity and easy access to services.

Limits of the 3 projects

- A weak relation to the sea. The teams have developed few organic links between the city and its seaside. Also Few items about the perception of the sea from the city.
- Few proposals about the attractiveness of the site. What leisure and entertainment activities should be developed?
- Few elements about the management of tourists and short term visitors: hotels, transport, recreation..
- How to deal with the winter climate? How to use the experience of cities of Northern Europe or North America?
- Few elements about the economic basis and vitality of the city.
- All teams managed to make proposals on many topics: urban morphologies, energy system, water and waste management… and thus it is difficult to feel strong strategic choices do not appear clearly.
- Little consideration was paid to the marine ecosystem.
- Not enough importance given to the social and cultural aspects of this city.
- The issue of pollution could have been faced more strongly and more directly.
- Especially for Chinese jury members: the projects lack of a strong image and a strong centrality.

Interrogations raised during jury debate

- Should the seaside be the city center? If not, how to link both?
- Shall the city be a business district?

  The teams were not always precise about the nature of the city: is it a satellite town of the other two towns, a connector or an edge city?
- What is the main function and economic basis of the city: is it a tourist village or the new financial centre of the region?
- Should be set an urban and ecological agriculture?

  All the teams referred to the traditional Chinese urban fabric. Is that necessary?
- What will the site become with climate change?
- What about the poor? Is there place for migrants and poor population in this city?

Special comments from the Chinese jury members:

There are cultural differences in the approach of city planning and design. Today in China, the engineers are the ones drawing the city plans. The 3 teams proposed high density developments for a small sized city, which is not commune in China.

The key to this work is how can we use this workshop output for the future. It’s just a start.

Highlights of each team's proposals

Team A – An audacious concept

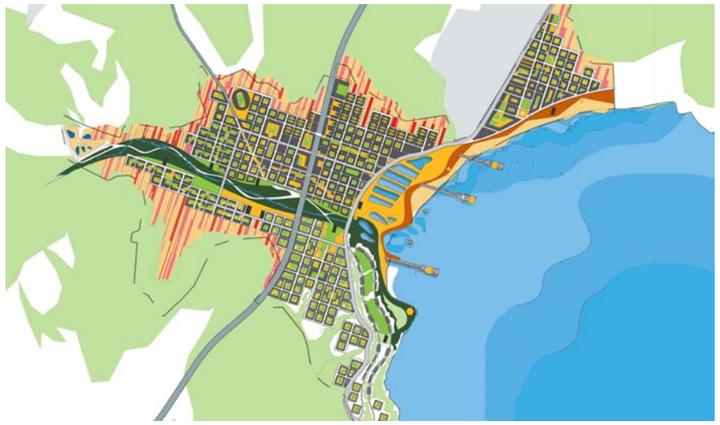
- Strong choice of a West/Est orientation, which therefore promotes:
  - a special relation to the sea: the city glances towards the seaside,
  - a Southward orientation of the buildings, which is essential in China,
  - a rampart against the strong North/South winds.
- Variety of habitation modules. Choice offered to the inhabitants.
- Considered the fishermen and their relocation.
- A linear typology which might make the city difficult to understand.
- Detailed proposals on block morphology.

Team B – A good integration to the site and the surroundings

- An interesting regional approach.
- Good links the cities of Huludao and Xingcheng / Precise proposal about the transport system.
- A city that leans on the hills: good integration to the site.
- Apprehension of the economic base of the city
- An interesting approach on centralities/heights.
- Possibility of easy evolution and adaptation of the designed project.

Team C – An interesting model of neighborhood

- Precise approach of the street scale and human scale.
- Project that meets the requirements of a mid-sized city: road and pedestrian network.
- Well adapted to the will of the Chinese population.
- Interesting proposals about circulations: connectivity, street grid, pedestrians' network.
- Strong proposal on typology, based on courtyard reference.
- Many farmlands in the project, thus flexibility for the future.
- Connexion to the Moon River.



第四部分 附录

PART 4 Appendix

中期交流

3月20日星期五，五个工作小组汇报了各自的工作进展状况与中期成果。葫芦岛城乡规划局邓局长以及齐科长等当地代表出席并旁听了此次交流。

1. 环境管理工程硕士汇报

一、自然环境现状：包括水资源稀少；月亮河流量的季节性变化限制了基地的一些发展。
二、渤海生态圈：发觉潜在的丰富的风能、太阳辐射能与降雨。
三、人类活动对环境的影响：基地内的水、空气、土壤都受到附近重工业工厂的污染；大量的水用于灌溉；煤炭是发电的主要的原料。

城市设计团队将将以上环境因素纳入设计范畴。此外，工程师们还介绍了一些可再生能源的利用技术。一旦城市设计团队给出他们的设计，工程师们就能计算出潜在的能耗范畴。

2. 康奈尔城市形态小组汇报

该小组对比研究了中国传统与现代的城市形态（宋汴京、唐长安、兴城古城、西安、和现代CBD），从而产生他们自己对基地的规划设想。兴城古城是一个由若干100*200米街区组成的800*800米尺度的城市空间，是符合城市形态导则的适当城市建筑尺度。
这些城市街区将根据限制条件、风、日照、交通和环境系统的空间需求被布置成方格网。学生们还设计了前沿的可堆起的电车和个人快速交通系统。

3. 城市设计A组汇报

A组主要介绍了他们的设计方法和一些初始设想：他们将使人类活动对自然的影响控制在基地的生态承载度可承受的范围内。 建造一个真正的生态城市不仅要一个完善的技术系统，更要综合考虑政治与经济因素。
独一无二的景观资源有利于提高用地密度从而减少城市扩张的可能。他们的设计目标是通过建造蓄水屋顶平台尽可能留住水资源并融入景观。此外，基地的建设对经济发展也提供了很多机遇，CBD可以服务于基地北面即将建设的科技园

4. 城市设计B组汇报
葫芦岛： 21世纪生态城

2013年，葫芦岛即将举办全运会，加之美丽的风景，咫尺之遥的兴城古城，这都将给当地的发展带来前所未有的机遇，而环境污染、冬季严寒及稀缺的水资源也给发展带来了挑战。他们通过设计一个由一条新铁路线路联系的城市核心网络组织城市扩张。

对于城市设计，他们有更大胆的设想： 森林与城市空间由果树树篱与城市公园分隔， 而城市公共空间将更多留给硬质空间从而节约用水。一条发展走廊，一个维护农田景观且带来经济效益的的绿色通廊。

5. 城市设计C组汇报
植入生态系统

该组设计了一个综合的生态系统：自产食物、 废弃物处理、土壤修复、能源利用……一个雄心勃勃的多期土壤修复计划为未来基地的农业发展打下基础。用地的规划居住人口精确为6.7万人，但还有待更新。该组应用了城市形态地方法以增加城市空间的渗透性与联系性。

邓局长十分赞赏此次交流并期待最终成果。他承认环境污染呈逐年上升趋势，建议参考鲁尔工业区的发展， 指出设计应兼顾中国北方城市文化传统。他对如何进一步降低能源需求十分关注，并希望此生态城市模型能在更多相似城市复制应用。

Exchange Forum

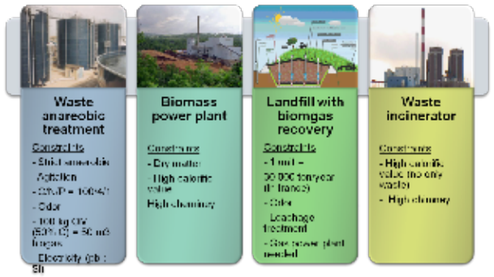
On Friday 20th, the five working groups presented their first findings and ideas regarding the site development. Mr Deng, Chief of Planning for Huludao, along with other members including Mr. Qi were in the audience and took part in the exchanges.

1. Presentation Mines Paristech Tsinghua

The environment and energy team first investigated the natural background of the site: .Water resources are scarce, the moon river is seasonal and poses several constraints to the site development. The team highlighted the richness of the Bohai Sea ecosystem and mapped the potential of the site in terms of wind, solar radiation and precipitation.

The team then presented the impact of human activity on the environment: the area suffers from air, water and soil pollution due to the nearby localization of heavy industries. Most of water resources are used for agriculture and coal is the primary fuel for power plants. Teams will need to include these constraints into their design.

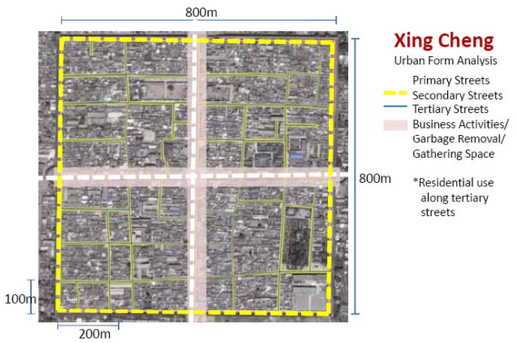
The students finally suggested the introduction of several renewable energy production technologies to make the city a true ecocity. Once the urban design teams will have precised their proposals, the engineers will calculate the energy requirements of the urban forms under a range of scenarios.



2. Presentation Cornell
- Urban Morphology Team

The team first studied the urban morphology of traditional and modern chinese urban morphologies (Tang Chang'an, Xingcheng, Xian, modern parts of Xian and a modern CBD) which will be reinterpreted in a proposal for the site. The team observed that the Xingcheng district is a 800 x 800 urban block composed of smaller 100 x 200 m urban block, the right scale for city archetypes studied under the urban morphology discipline.

These urban blocks will be disposed in a grid taking into account the site constraints, wind, sun exposure; transport, and environmental systems spatial requirements. Several transport systems have been proposed for the city, including leading-edge stackable electric cars and personal rapid transit.



3. Presentation Team A

Team A mainly presented their methodology to design their proposal as well as some initial specific ideas: they will reconcile the human footprint of the proposed development and the biocapacity of the site. They outlined that building an actual ecocity is not only about technological systems but also about getting the economics and politics right.

They stressed that the unique landscape is an opportunity to intensify land use and avoid common urban sprawl. The design should strive to retain the scarce water resources, wherever they come from. Terraced housing is proposed to adapt to the lanscape. The site also presents good economic opportunities and the CBD could be linked to the proposed technology park north of the site.

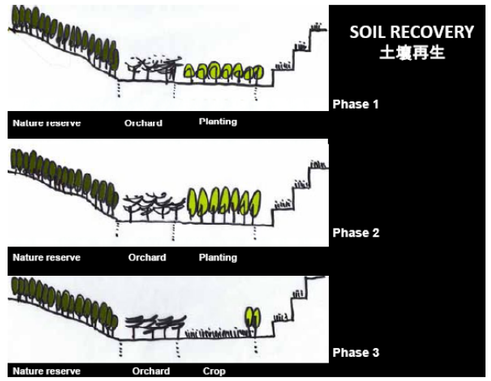
4. Presentation Team B:
- Huludao, an ecocity for the XXIth century

The team highlighted the opportunities of the site including the national games of 2013, the beautiful landscape, the nearby old city of Xingcheng, as well as threats such as pollution, the scarce water resources and the harsh winter climate. They propose to fight against urban sprawl by creating a network of urban cores linked by a rejuvenated and new railway (freight, mass and light transit).

On a more local scale, the team made bold and innovative proposals: the forests will be preserved and protected by a hedge of orchards and parks, whereas inside the city the public spaces will be mineral due to the pressures on water use. A development corridor, a green corridor and an agroparc will preserve the landscape while providing for economic development and food security.

5. Presentation Team C
- Embedded Ecosystems

The team proposed a comprehensive ecosystem for the site, incorporating food production, local waste treatment, soil recovery, energy production,...An ambitious multi-phase plan was proposed to remediate soil pollution and prepare it for further agriculture use. The team made precise proposals to house 67,000 residents; but this can be extended in the next stages of presentation. The team took on board the urban morphology approach and will strive to increase permeability and connectivity of the city compared to current developments.



Mr Deng was very impressed with the presentations and is looking forward to the final one. He outlined that pollution had improved in recent years, suggested to look at the Ruhr remediation in Germany for inspiration, pointed that local north china customs should be taken into account, wanted to know how to further reduce energy demand and hoped that the ecocity could be modelled from and applied to other cities in similar locations.

方案环境计算与评估 Environment Data

TEAM A

Appendix : Assumptions and calculations for design of TEAM A proposal

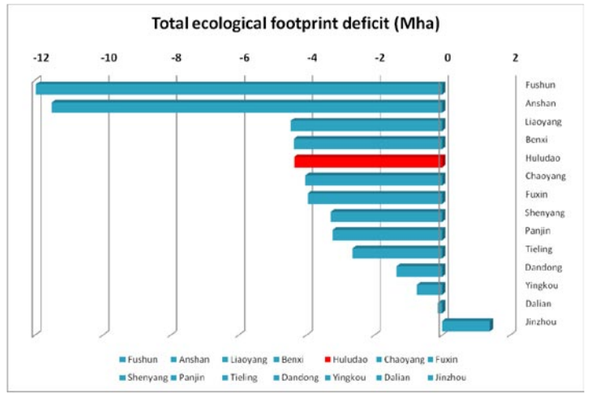
This document explains a bit further what were the assumptions and calculations taken into account for the design of some facilities or schemes included in the proposal for Team A. It is not so much a justification than a reference to be checked and improved in the future if the study of his proposal is to be further undertaken.

Footprint Analysis

The purpose of our study as explained in the others documents was to do a gap analysis. Our starting point was the ecological footprint, and we extended this methodology to other topics to be able to have targets and stablish an action plan for the design and construction of the city.

The basic data for ecological footprint was found in a scientific peer-reviewed publication : *Geographical distribution of ecological footprint and sustainability analysis for Liaoning Province*, published in : *Journal of Geographical Sciences 14, 3 (2004) pages 303-312.*

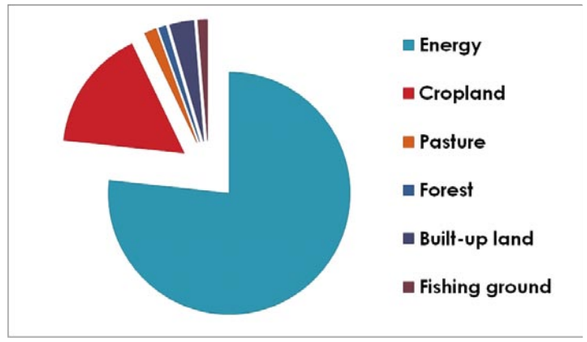
	Pop (M)	Footprint (ha/cap)	Biocap (ha/cap)	Deficit (ha/cap)	Total deficit (Mha)
Province	41,47	2,4195	1,1042	-1,3154	-54,54
Fushun	2,262	5,6791	0,3883	-5,2908	-11,96
Anshan	3,442	4,1265	0,7842	-3,3423	-11,50
Liaoyang	1,818	3,3465	0,8948	-2,4517	-4,45
Benxi	1,565	3,2206	0,43	-2,7906	-4,36
Huludao	2,698	3,0668	1,4529	-1,6139	-4,35
Chaoyang	3,346	1,6678	0,4635	-1,2043	-4,02
Fuxin	1,926	2,6139	0,5601	-2,0538	-3,95
Shenyang	6,893	1,2371	0,7621	-0,475	-3,27
Panjin	1,229	4,2422	1,622	-2,6202	-3,22
Tieling	2,989	2,2125	1,3318	-0,8807	-2,63
Dandong	2,41	1,6261	1,0707	-0,5554	-1,33
Yingkou	2,274	1,2415	0,9178	-0,3237	-0,73
Dalian	5,546	2,2782	2,2564	-0,0218	-0,12
Jinzhou	3,072	1,154	1,6126	0,4586	1,40



Ecological footprint analysis compares human demand on nature with the biosphere's ability to regenerate resources and provide services. It does this by assessing the biologically productive land and marine area required to produce the resources a population consumes and absorb the corresponding waste, using prevailing technology. As one can see, Huludao is not the worst of the districtsof Liaoning province. However, the deficit is about 43 500 km², which is approximately the cumulated surface of the 3 districts around Huludao. This is how we can easily understand it is not a sustainable way to use the natural resources.

If we look deeper and made the breakdown analysis of this footprint, based on the data provided in the document, we can see that ¾ of the footprint comes from the energy. It is to be noticed that in the methodology, the space needed for the sequestration of CO2 emissions by forest land is taen into account. This means that this huge surface is the mirror of very high Green house gases emitting fuel consumption (especially coal and oil)

Ecological footprint (ha/cap) for Huludao	
Energy	2,4
Cropland	0,5
Pasture	0,1
Forest	0,0
Built-up land	0,1
Fishing ground	0,0



Thanks to our strategy, we can reduce this footprint down by almost 40%. Because some of leverages (especially for private transport and grid energy) we cannot have direct control, it means that the reduction will go further with change in people's behavior and national strategy for the grid (renewables, nuclear). For the leverage we have investigated, here arethe details for footprint reduction:

	OLD				NEW	
consumption target		N/A	divide by 3	+0%	**1,45**	
Part of the current footprint		**25%**	**50%**	**25%**		
Breakdown		**Industry**	**Housing+CBD**	**transport**		**Reduction**
Energy	2,37	0,59	0,133	0,5925	1,32	
Savings Building Materials					0,79	25,5%
Savings Building Geo+PV+Wind					0,03	0,8%
Savings renewables					0,24	8%
Savings national grid						
Forest planting mitigation					0,01	0,3%
Cropland	0,5				0,50	
Pasture	0,05				0,05	
Forest	0,03				0,03	
Built-up land	0,1				0,00	
Density built-up savings	0,002				0,10	3,2%
Fishing ground	0,04				0,04	
TOTAL	3,09				1,93	
				Total	-37,5%	

The main assumption done for the conversion back into ha of energy savings for instance is the calculation made by the Friends of the Earth for the Ecological Footprint about Hong Kong. More information can be found here : http://www.foe.org.hk/welcome/eco_1997ef.asp. Especially, as it is very hard in such a small amount of time to compute the carbon sequestration of a forest, the following quotation was used (keeping in mind that "fossil fuel" is not very precise…)

"" Energy: Using 1TJ of fossil fuel would emit 18 metric tons of carbon each year, and 10 hectares of forest would be needed to absorb this. Thus, the conversion factor is 10 forest hectare per 1TJ of energy consumed. ""

Converted back into MWh, we thus assumed in all our calculations that 10 hectares of forest could mitigate 278MWh produced with fossil fuels. Of course to have the impact per capita, we used the figure of 100 000 inhabitants. (70 000 inhabitants + 30 000 floating : business and tourists)

Water

The water issue has two main aspects: **availability and usability**. That is what we usually call quantity and quality. The environment impact assessment shows high levels of pollution of heavy metals in the water and soil. It is not located pollution, it is subsequent of air pollution through the rain. Mercury presence is 90% in the sediment, and 10% dissolved in water.

Quantity (Supply): The Moon river is a river only a few days per year, as one can see on the rainfall chart for Huludao. Moreover the wide waterbed tends to prove it is used for heavy rainfall evacuation. The rainwater is **600mm/m²/yr**, and the watershed is **30km²**. This means that 18 billion liters of water can feed the area, and shared between human consumption, vegetation consumption, runoff to th river/sea and infiltration in the water table.

Quantity (Demand): We take as a drinking and cooking water demand of **25L/day/cap** and **75L/day/cap** for other uses. The amount of 100L/day/cap is below national average availability but we must take into account the water shortage of supply which has already put the area into a situation of hydric stress. For now the water mainly comes from remote and polluted reservoirs. This situation is not acceptable to us.

➔ The watershed can supply 5 times the demand. However, collecting rainwater on roofs of built-up area (30% of 8km²) can cover only 26% of all needs, even before considering quality problems. This is why we are developing a strategy focused on recycling household water, to close the loop and keep it closes for as many cycles as possible.

Quality (Supply): The water (rainfall and seawater) is polluted by heavy metals. It is not safely drinkable as it is.

Quality (Demand): the demand is divided between drinking & cooking water (25L/day/cap) and household water (75L/day/cap). The standards are not the same, and we can save energy, investment cost and price for tap water with setting up two water systems, as it is already the case for many countries in which potable water supply is critical.

➔ As explained in our A3 document, we set up several systems. There are flexible to use directly rainwater when it is not be polluted by heavy metals anymore. The main idea is to remove heavy metals from the loop of water for human use, and to ensure a steady supply of potable water through a desalinization plant to get rid of the problem of seasonality of rainwater that could be

Provided safe tap water is a main public-health issue. Moreover it indirectly reduces the impact of drinking bottled water (200 times more impact as calculated by the Swiss Gas and Water Association in 2005 www.esu-services.ch/download/jungbluth-2006-**LCA**-**water**.pdf)

Golf: an average golf course is **40ha** (this is the area targeted by the developer on the site). A golf course is very water-consuming **(3200m3/ha/yr)** but only **2%** of surface is "green" surface and should be watered all year long. It means only around 7000L/day which can be easily provided with grey water from the houses inside this high-revenue residential area. (Source for calculations : French Federation of Golfkeepers)

Energy

The energy issue cannot be solved completely within the site, for 2 main reasons: private transport will use oil from outside the site but the emissions will be accounted for individual footprint, and one cannot change the national or regional electric grid energy mix. However, our goal towards a low carbon and low sulfur atmosphere can be achieved through several techniques: **energy efficiency**, and **local energy production** for the most carbon-intensive needs.

Supply :

Here is the calculation for the waste to biogas unit that will be located on the current oil&gas station that is to be converted after 2012. An anaerobic biodigestor does not accept cellulosic matter so no green waste or forestry waste will be used in that unit. We do not want to create competition with existing use of agricultural waste

Production from biomass sources = 100 000 inhabitants CH4 (37 MJ/ m3)

	Qty (tons/yr)	*Total Solids*	Dry qty (tons)	*Equiv (t-> CH4 in m3)*	CH4 produced (m3)	*Energy containt in CH4 (MWh)*	Electricty produced (MWh)	*Heat produced (MWh)*
sludge	14600	30%	4380	150	591300	3666,06	1283,121	1466,424
Houshold waste (organic on only)	21900	40%	8760	450	2759400	17108,28	5987,898	6843,312
TOTAL			13140,00		3350700		**7,3E+03**	**8,3E+03**

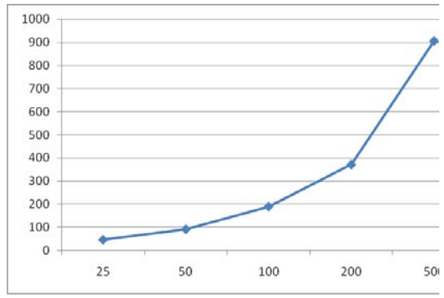
A biogas plant generate CH4 and CO2. CO2 can be used to feed micro-algae for photosynthesis. Even experimental, this scheme can be further developed in the future. Algae can be used to create biogas or biodiesel in the future Huludao biofuel plant. Both can be used to run the city buses. This link

human manure to transportation : Sewage > Biogas > CO2 > Algae > Biogas/Biodiesel and is thus a very good and steady source of energy.

As for wind energy, the site configuration makes it hard to assess real potential without a field study. However, our goal does of 10% of wind energy is not unrealistic, as we estimated that it represents **6 GE "Artic" wind mills of 1,5MW** (the most used in the world) with the Betz limit and around 3000h of wind potential hours. Of course more spots may be found in the area, thus. **This is a conservative assumption**. Off shore was not considered because of its price and interference with military activities in the area.

Urban solar and wind energy for CDB buildings can help reduce the amount of energy needed. We do not us this as a core component of our energy strategy. However, pillars built underground to build the CDB towers are a good opportunity to go deeper and use geothermal energy for those buimding. For other low rise buildings, it is not worth the investment and we prefer a heat network from the biogas plant. However we did not investigate this project further. Thus no reduction for heat network is included in the footprint reduction. Feel free to propose one.

Capacity (ML/day)	GWh/yr	Demand MW
2,5	4,55	0,55
25	45,5	5,5
50	91	11
100	189	23
200	371	45
500	906	110



We can compare this amount with the one produced by the biogas plant. This means that all our needs for water desalination are covered with renewable energy derived from sewage.

Needs :

Given a 2 000 000 m² of residential space : today's needs are **220KWh/m²/yr**, which we want to bring down to Minergie standard (**35KWh/m²/yr**) for heating, and to passivhaus for other electric expenses. (namely **35KWh/m²/yr**). This difference assuming a **90m² flat per household** gives the 25.5% reduction in footprint by **energy efficiency.**

Given a 1 000 000 m² of residential space : the use of cooling units is expanding in China and some ldings in Shanghai today need **194 KWh/m²/yr** (published in *The reality and future scenarios of commercial building energy, Energy and Buildings 40 (2008) 2121–2127*). Our goal is to **divide by 2** this amount through building conception, and to **cover 70%** of those needs through urban solar, wind, and geothermal for eating/cooling.

Water desalination :

Compared to ordinary water supply, we decide to find a continuous supply of water. For our calculations, we used an ordinary but quite energy consuming process, which is reverse osmosis to process seawater. According to Sutherland Shire Council for the Sydney Water Wesite (http://www.sutherland.nsw.gov.au/ssc/rwpattach.nsf/viewasattachmentPersonal/TRENT+FAIRWEATHER~SSC~Desalination+planning+study.pdf/$file/Desalination+planning+study.pdf) here are for this process the capacities and needs. For 25L/cap and 100 000 people, we can extrapolate the capacity for a small plant.

This document may contain some errors (calculation, concept). Feel free to add your contribution and share your knowledge. For any comment or remark after this workshop, please email thomas.vandenbogaerde@gmail.com

TEAM B – Energy and Environment

ENERGY

Comparison our objectives in terms of energy consumption and BAU (Business as usual):

Situation actuelle			
hab huludao	600 000		
hab 10*20 (2020)	2 700 000		
Water		Electricity+Heating	
NOW		**NOW**	
need(L/capita/day)	240	housing kWh/m2/y	220
Total need (10^6*L)	52 560	Total need housing MW	15,07
In 2020 BAU		**In 2020 BAU**	
need(L/capita/day)	240	housing kWh/m2/y	220
Total need (10^6*L)	236 520	Total need housing MW	67,81

Hypothesis:

Offices m²	600 000
Housing	1 200 000
Hotel	300 000
University	100 000
Congress	100 000
Facilities	100 000
Commercial	200 000
Science+Planet	100 000
TOTAL m²	2 700 000

Space HEAT kWh/m2/y	**15**
HotWater+Elec	27
HOTELS	
People per room	1
chambre m²	10
Accom. Capacity	30 000
People/family	3,1
Inhabitants	40000
Average floors	6

Heating and Energy Needs:

HEATING		ELEC	
Offices MWh/y	9 000	Offices MWh/y	32 400
Housing	18 000	Housing	8 100
Hotel	9 000	Hotel	5 400
University	1 500	University	2 700
Congress	3 000	Congress	5 400
Facilities	1 500	Facilities	5 400
Commercial	3 000	Commercial	5 400
Science+Planet	1 500	Science+Planet	2 700
TOTAL MWh/y	46 500	TOTAL MWh/y	67 500
TOTAL HEAT MW	5,3	TOTAL HW+ELEC MW	7,7

TOT HotWater	**21 048**	**TOT elec**	**46 452**
TOT HotWater MW	2,4	TOT elec MW	5,3

Calculations for several energy sources:

SOLAR HEATING

panel/familly m²	2	pot prod kWh/m²/y	1450	total population	45000	Surface panels Number of 2m² panels	29 032
		efficiency	0,5	Total Prod GWh/y	21,0		14 516
		prod kWh/m2/y	725				
Roof capacity							
Surface of roofs m²	450 000	space for 1 panel m²	10	space for al panels	129 032	CONCLUSION	
Surface roofs housing	200 000	number panels need	12 903			RELATIVE AUTONOMY	

SOLAR ELECTRICITY

Less cold month Summer (kWh/m2/day)	3,514	Panel Area	18 000
Less cold month Winter (kWh/m2/day)	2,2638	PR factor	0,75
Average on 12 months (kWh/m2/day)	3,433367671	inclination factor	1
		Installed area (ha)	**6,00**

	Efficiency	**winter**	**summer**	**total day MWh**	**total year GWh**
Multichristalline	15%	6 112	9 488	9	3,4
Thin film	9%	3 667	5 693	6	2,0
Monochristalline	18%	7 335	11 385	11	4,1

There will be a solar farm and a village, upstream the moon river with all the roofs with solar panels “solar village”.

METHANE

pop	100 000	huluadao pop	400 000	prod agriculture	20000t		
Elec pr. GWh/y	5,6	Elec GWh/y	22,3	agri elec	17,5	total elec	39,8
	6,4	Heat GWh/y	25,4	agri heat	19,9	total heat	45,3

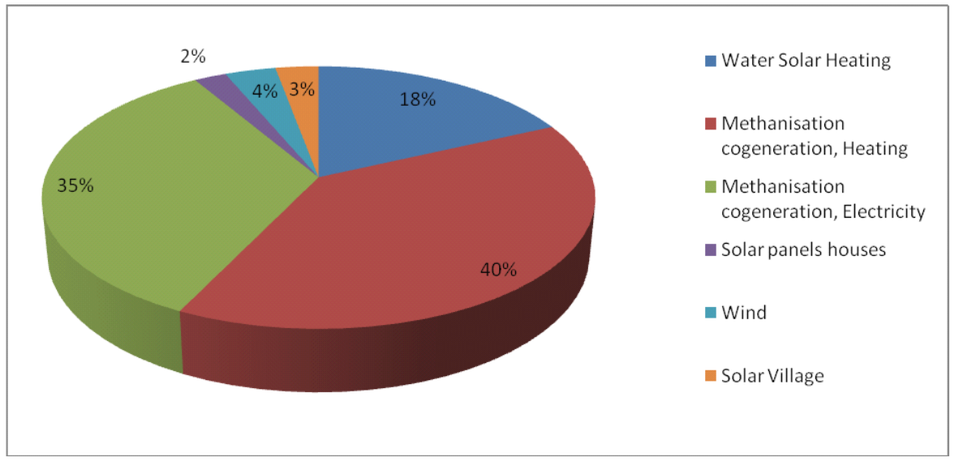
Calculation table from « Les Mines » with the preceding hypothesis.

Production form biomass sources (basse) + 50 000 inhabitants + 50 000 tourists							CH4 (37 MJ/ m3)			
	quantity (tons)	*Total Solids*	dry matter quantity (ton	*Volatil Solids*	Volatil matter (in ton	*equivalent (t-> CH4 in m3)*	CH4 produced (m3)	*energy contains in CH4 (MWh)*	Electricty produced (MWh)	*Heat produced (MWh)*
biomass	*1 ton/an*	*x%*	*1*x%*	*y%*	*1*x*y*	*z*	*1*x*y*z*	*(6,5*1*x*y*z)/1000*	*35%*	*40%*
sludge	6570	4%	262,8	90%	236,52	150	35478	219,9636	76,98726	87,98544
Houshold waste (orgar	20075	40%	8030	70%	5621	450	2529450	15682,59	5,E+03	6,E+03
"dechet verts"		40,00%	0	95%	0	500	0	0	0	0
Fruits and vegetables		15,00%	0	80%	0	600	0	0	0	0
Corn, Maize silage	20000,00	86,00%	17200	72%	12384	650	8049600	49907,52	17467,632	19963,008
Cow manure		8,50%	0	76,00%	0	230,00	0	0	0	0
TOTAL	46645,00		25492,80				10614528	65810,0736	2,30E+04	2,63E+04
										4,94E+04

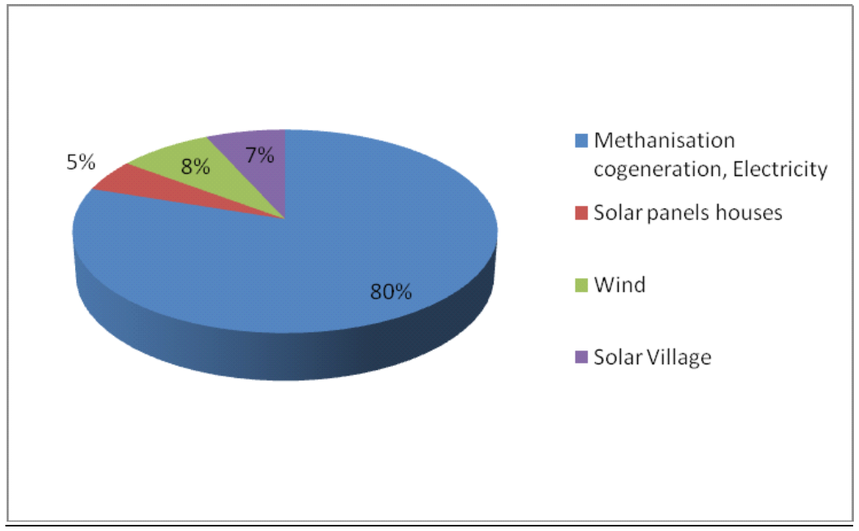
Energy mix:

Based on existence of urban heating system.

type of energy	Energy for :	Electricity	Elec+Heating
Water Solar Heating	21		18%
Methanisation cogeneration, Heating	45		40%
Methanisation cogeneration, Electricity	40	80%	35%
Solar panels houses	3	5%	2%
Wind	4	8%	4%
Solar Village	3,4	7%	3%



Energy Mix (Heating+Electricity)



In the region, there is a real possibility for geothermal activity. Some heating from methanisation cogeneration could be replaced by geothermal at a district level.

WATER

Hypothesis:

hab	50 000
Inhab/house	3,1
logement	16 129
m2/logement	80
m2 total	1 290 323
reduction efficient tap	30%
Needs :	
URBAN	
Potable water	
Housing	
need(L/capita/day)	35
Need(L/capita/year)	12 775
Total need (10^6*L/year)	639
Other activities	
need(L/capita/day)	50
Need(L/capita/year)	18250
Total need (10^6*L/year)	913
FARMING/INDUSTRY	
need(L/capita/day)	140
Need(L/capita/year)	51100
Total need (10^6*L/year)	2 555
TOTAL WATER NEED	4 106

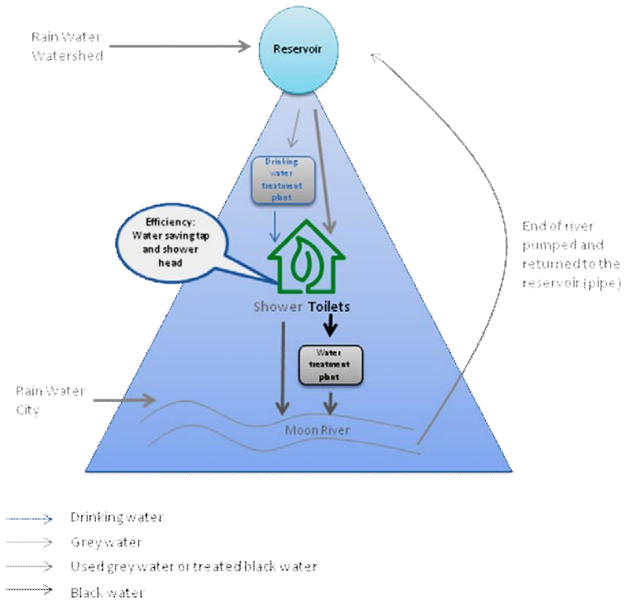
Diagram of the grey water recycling system:

The moon river has only a little flow going to the sea to allow sediments to be brought into the sea and bring necessary nutrients for aquatic life.

The rest of the flow will be pumped and brought to the clean grey water reservoir upstream. In this reservoir the rainwater from the water shed will be collected.

The reuse of the water through the system of “close” loop will allow large water savings.

The waste water treatment plant will be buried under the congress center, in the middle of the city.



Appendix Team C
Sustainable urban design –Urban metabolism

The analysis of Ecostal's metabolism recalls the theoretical concept of embedded ecosystems with a hierarchic scheme of relationships through material and energy flows. The river is the dorsal spine that harmonizes the system relating it to its environs.

Design turns Ecostal into a balanced ecosystem: secure, self-sufficient, healthy and clean:

> Secure and self-sufficient as it assures minimum amounts of:
- food: 70% of urban needs through bio-intensive agriculture that maximize water and land uses, regenerating the soil
- water: 80% of fresh water, 92% of water recycled.
- energy: 90% of city needs –reduced through the urban morphology.
- fertilizer enough for 1840ha.

The regeneration capacity and ordered conception guarantee an ecological footprint "ecological" in fact.

> Clean and healthy: the water and solid waste treatments are linked to the energy production –that is completed with solar and wind- reducing CO_2 and S emissions, ensuring air and water quality and healthy soils. The urban landscape allows to restoring the land contributing to the harmonic look of the system.

Such a system is naturally oriented to interact with its envelope in order to achieve the sustainable development of the whole territory integrating a global economy and supported by the natural richness of the milieu and its capacity for regenerating: exporting silk produced in the green belt around the river, sending wastes from soil restoration to local cement industry, exporting the biomass from forest harvesting, eco-tourism, research centers in soil restoration, advanced centre of intelligent design, coordination for a regional facility for e-waste treatment, a regional centre of observation and control of GHG emissions and a chamber of commerce of clean economy.

Ecostal emerges as a model to be adapted and a sustainable business opportunity.

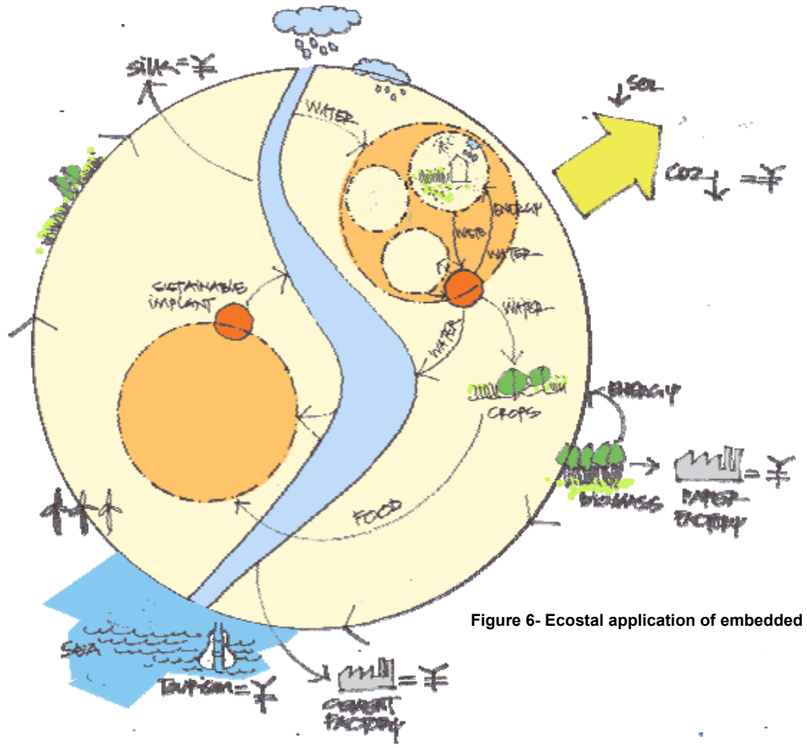


Figure 6- Ecostal application of embedded ecosystems.

Sustainable urban design -Life supporting systems

How are the interactions defining the metabolism that supports the city?

The main flows are identified and quantified separately strengthening their linkages: the mechanisms of water, waste and energy –including food production- show the hierarchy of the urban ecosystem where building, district and city coordinate their performances.

The "sustaining implants" are critical to assure such interaction and the ecosystem's organic balance.

Each of those implants spreads over 1ha including:

- A 3.700m^2 biological filter with capacity to daily treat 1.000m^3 of water –including 8.500 people equivalent, the sludge outcome of anaerobic digestion and the flow from public spaces- consuming 1'320MWh.

- An anaerobic digestion plant coupled with a heat and power co-generation facility and a composting unit for the organic wastes, in order to treat up to 77tn of waste daily outputting 11'24MWh of electric energy -48% of district needs including household consumption, water treatment and energy production-, and 12'84MWh of heat and annual fertilizer for 201ha. Indeed 80'7tn of sludge are daily sent to the bio-filter and added to the urban water cycle.

- Store capacity for inorganic wastes that are collected and sorted at the block level.

This design decentralizes city's conception and moves the neighborhood towards energy self-sufficiency. Comparing to traditional water and waste urban treatments:

- It reduces the investments for infrastructures and maintenance costs
- It reduces pumping, sorting and transportation of wastes therefore reducing CO_2 emissions and energy consumption.

Water cycle

Scarcity and perspectives of future drought both at local and regional level are leading the project to propose a balanced development that takes up restoring and protecting the land and watersheds to ensuring access to water. The river is the natural vessel supporting Ecostal's water strategy. A 20ha reservoir with capacity to store 5 million m^3 of rainfall makes the water management and supply system flexible and secure.

The project identifies other strategic areas in the site dedicated to protecting and ensuring the access to water for a total of 61ha for sustainable urban agriculture. Those restoration areas alongside a 35ha green belt around the river reassure the identity of the site and allow catching yearly about 115.200m^3 of rainfall.

A treatment center in the middle of the reservoir with daily capacity for 15.600m^3 guarantees water supply for more than 100.000 people according to the current standards of consumption -150 liters per day per person.

Dry-toilets that separate the flows of urine and feces economize up to 40% of standard water consumption; the mechanism stores the waste in a system of tanks with in the basement –their total capacity is de 40m^3 for the feces and 230m^3 for the urine. Urine has a high nutritive value and soil restructuring potential and can be straight disposed over 1ha of land. Feces are composted in a natural process that can be speeded up with a reduced amount of heat producing per district soil enrichment enough for 0'22ha -3kg of compost per m^2.

Keeping in mind the strategy of protecting and giving access to water, each block has tanks with total capacity for storing 650m^3 yearly. This water is caught through the roofs:

- 10% of each building roof is dedicated to catching directly rainfall,
- the roof gardens on 80% of the surface retain 20% of the rainfall –average
- the remaining 10% of the surface is cover by solar panels for local energy production and allow recovering 80% of the rainfall.

Two additional independent networks supply drinking water straight from the reservoir's treatment center and discharge the black water from the kitchen direct into the implant.

Each implant can supply water either to the domestic network or for public irrigation and is also connected to the river being able to control the water flow in both senses hence granting flexibility to the urban cycle.

The 1.300m^2 courtyard gardens per block are dedicated for bio-intensive agriculture. The 40$m^3$of water yearly needed is collected from the rainfall over a central 66m^2 circular surface. 450m^3 of water are yearly collected per block:
- 80% of the rainfall on the asphalted 600m^2 of the courtyard,
- 20% of the rainfall over the courtyard,
- a total of 160.000m^3 in addition to the 14.400m^3 of the circular tanks, are collected in the blocks across the city.

1.500.000m^3 of rainfall water are yearly collected and conducted towards the river.

Two additional resources feed the urban cycle:
- 28.177m^3 of water are recovered from the sludge output of the anaerobic digestion in each implant –197.000m^3 in the whole city.
-
- saltwater green houses in the sea districts not only secure urban food production but also provide the city with fresh water. The irrigation of 10.000 m^2 requires 12m^3 of water daily -1'2 liters per m^2. 7200m^2 of solar panels would daily produce 32MWh enough for 300m^3 of fresh water and an annual extra of 105.000m^3.

The annual domestic consumption of 140.000 inhabitants would rise up to 4.559.000m^3 –dry toilets reduce standard to 80 liters per day. 3.066.000m^3 are gray waters.

Bio-intensive agriculture techniques and adequate irrigation systems reduce annual needs for farming and watering green spaces to 66.000m^3 -44.000m^3 for urban gardens and 20.000m^3 for the 61ha green belt.

The gray water cycle based on rainfall and integrated by buildings, public and green spaces, the sustaining implants and closed by the river is not enough to secure its demand of 3.130.000m^3 –the isolated flow considering water recovered form anaerobic digestion and sea water green houses rise up to 1.802.000m^3.

An annual black water volume of 1.450.000m^3 –drinking water supplied to the kitchen and not drunk- feeding the urban system from the river's reservoir creates and excess of water that can be discharged into the sea so that the global cycle –city, river, sea- is virtually balanced –the upstream reservoir makes the water system flexible –and able to cope with evapo-transpiration.

Sustainable fishing and tourism fit naturally within the sea.

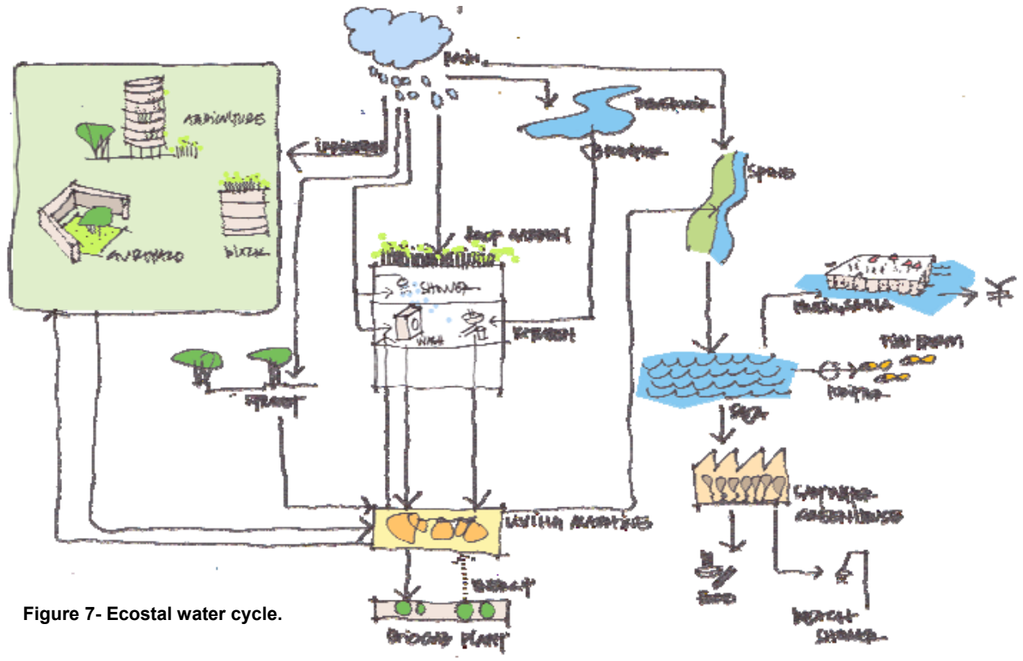


Figure 7- Ecostal water cycle.

Food

Seasonal fishing is one of the intrinsic features of the site's idiosyncrasy.

It provides 247.000tn of food per year. The design must recognize the richness, knowledge and traditional balance between human and sea in order to integrating it into the new development.

Fish and farming are part of an urban landscape that is both dynamic and productive at once while gradually restoring and regenerating the soil.

In the buildings, a basic annual amount of 25'6tn of vegetables are produced per block in the 2560m^2 of roof garden -10kg/m^2/year; 9216tn in 92'16ha across the city.

The bio-intensive farming in courtyards and the green belt undertakes the principles of traditional Chinese agriculture and rises up to 6 times the productivity rate of fertile soils with a more efficient water supply –up to 8 times- and an appropriate rotation of the crops -60% corn and 40% vegetables- for regenerating the soils:
- In the district: 2'86tn of corn and 1'9tn of vegetables are produced in each 1.300 courtyard garden -22kg of corn per 10m^2 bed; 1.030tn of corn and 686tn of veggies in 46'8ha across the city.
- The green belt 61ha produces 1.342tn of corn and 207th of orchards –8'5tn/ha of apple.
- 300tn of corn and 200tn of vegetables are produced in the 10.000m^2 of seawater green houses by bio-intensive farming and crops rotation –factor 3 of productivity, i.e. 30kg/m^2/year.

The total urban food production in 210ha of soils rises up to 57.000tn of fish –prorating production with populations of Huludao and Ecostal-, 2.672tn of corn, 10.102tn of vegetables and 207tn of fruits for a total of 70.000tn of food –13.000tn of cereals and vegetables aprox..

Considering that the annual basic needs in Huludao are 0'4tn food per capita -0,065ha per person- the urban system could supply between 25% of population needs -0,1tn crops and 0'0015ha per capita- and 100%, depending on the local fish consumption. Assuming the same seasonality in the fish consumption than for fishing –6 months per year, i.e. 28.500tn fish, half of the production for local consumption- 0'3tn food per capita are locally produced in Ecostal, equal to 75% of its annual needs.

Waste

Farming waste represents one of the most important contributions to the urban flow.

There are two types of urban wastes –inorganic and organic. The principle "waste equals food" must guide both product conception and material flows management in the urban system. in order to create goods and services that flow effectively within interconnected closed-loop systems, providing after each useful life either nourishment for nature or high quality materials for new product.

The generation points for both inorganic and organic flows are identified as spots in which the urban design can induce their transformation and revalorization:
- Public and domestic inorganic wastes –plastic, glass, paper- are sorted in the collecting points as it is customary practice. Afterwards the flow in each district is guided towards the "sustaining" implant where it is stocked as a previous stage to facilitate its externalization for recycling.
- E-wastes are a particular case in China to be considered. That could involve the collection and storage of e-wastes in the sustainable implants before externalization to that plant.
- There are 5 main sources of organic waste:
  - Green wastes from soil recovering, rich in heavy metals and valuable for metal or cement industry.
  - 2 flows at domestic level:
    - physiological wastes -232'5tn of urine and 6'7tn of dry feces per block- transformed at the block scale in compost for soil use -0'22ha with feces compost (3kg compost/m^2) and 1'1ha with urine (450m^3/ha per 6months).
    - farming wastes from private gardens and domestic consumption that are collected –as inorganic wastes- at every block and sent to the district implant where they are transformed into energy, fertilizer and water.

- Food production wastes –fishing, farming-, green industries waste –silk-, waste from public green spaces and public wastes from human consumption –including restaurants- are added to the domestic flow entering the implant.
- Solid wastes from the bio-filter water treatment in the implant.

The organic wastes annual distribution treated in the implant of an average district are:
- 4.900tn of domestic wastes -98tn per block, i.e. 200kg per inhabitant
- 10.000tn of green wastes –from harvesting 41ha of silk trees by the river assuming that waste weights 1/6 of total trees weight.
- 377'6tn of farming waste –corn.
- 245'5tn of fruits and vegetables wastes –assuming 1/6 of production weight
- 8.821tn of fishing waste -1/4 of fishes weight; average contribution per district
- 6.228tn of solid wastes from water treatment –dry waste from kitchen's black waters assuming dry content 1/10 of traditional systems.

30.570tn is the pro rata of wastes treated per year in each of the seven district implants in the city assuring 100% of organic waste valorization. The outputs are:
- 28.100m^3 of sludge from the anaerobic digestion to be treated in the implant's advanced bio-filter and eventually added to the urban water cycle.
- 6.000tn of soil enrichment enough to fertilize 201ha -3kg/m^2.
- 3.000.000m^3 aprox. of methane through a thermophilic process of anaerobic digestion; this methane is used as bio-fuel for the co-generation of 4'1GWh of electric power and 4'7GWh of heat.

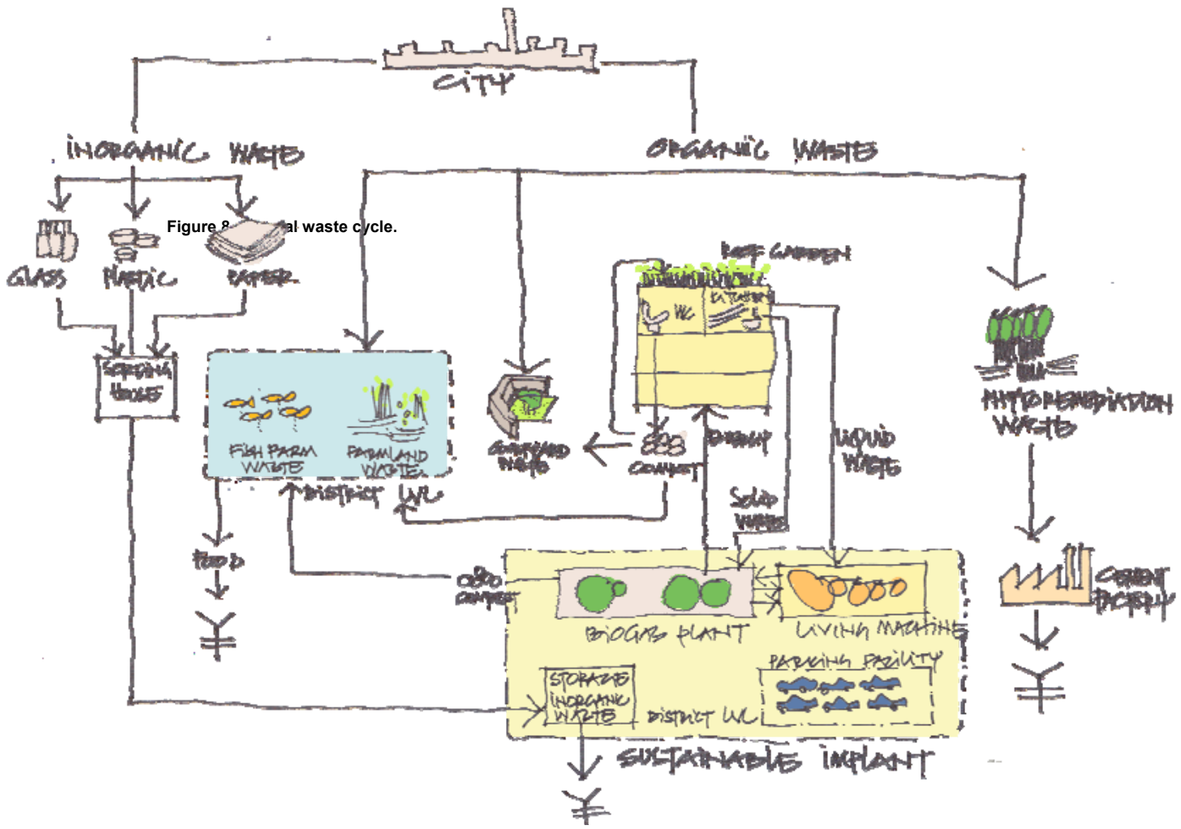


Figure 8 [illegible]al waste cycle.

Energy

Today's energetic conjuncture announces dramatic perspectives for the region:
- high domestic consumption due to a inefficient design –225kWh electricity per day and 257kWh heat,
- dependence in a cheap energy –coal- with very low efficiency, highly pollutant –sulfur, acid rain-, and scarce in a medium term.

Urban morphology conception from the building to the city level aims energy conservation and a reduction in consumption through the design: domestic standards for electricity and heat will not surpass 50kWh/m^2 -57GWh in all the buildings in Ecostal.

The supply strategy relies on local nature's potential –sun, wind, geothermal- and on the urban metabolism itself –biogas obtained from organic wastes- as sources of renewable energy. Self-sufficiency prevails to centralized generation.

Sun's energy is used:
- in each block: 10% of roof covered by solar panels, i.e. 115.200m^2 generating 18'4GWh –32% of total domestic consumption,
- in the building and the district: for food production,
- in the district: for public lighting,
- in the sea: food and fresh water production in seawater green houses -11'68GWh generated by 7.200m^2 of solar panels, i.e. 6% of roof solar surface for buildings,
- in the sea: all year sauna in out to sea resorts – same principle than green houses.

At the district level, the energy supplied by the sustaining implants secures 48% of domestic consumption of electric power and 58% of heat, as well as the full needs of water and waste treatments –including energy generation.

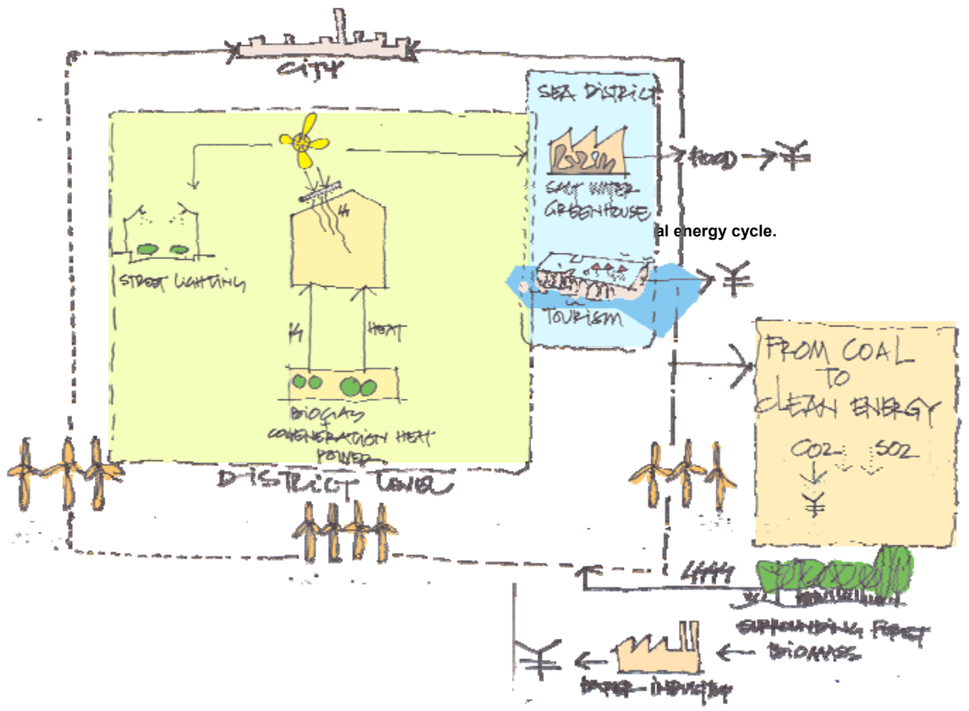
13 windmills across the city supply 2GWh per year -3% of domestic total consumption.

Such configuration provides the city with 80% of the electric needs and 60% of heat needs for the projected design.

Doubling the roof surface for solar panels and using geothermal energy for heating the water tanks in the buildings 100% of the domestic demand could be supplied.

Harvesting the local forest is a potential source of energy, supplying biomass as bio-fuel.

Ecostal's strategy turns the dangerous dependence on a scarce and polluting source into the security and quality offered by a healthy and endless energy.



[illegible]al energy cycle.

Closing the loop: socio-economic cycle and land uses

A first approach to the human capital required to sustain these flows of water, wastes and energy –including agriculture and fishing- that support the urban metabolism accounts for 15.000 people –according to Chinese context. That represents 20% of working population and 10% of the city crowd.
The transport proposal throws the human flow into the analysis and hence deepens into the proposed strategy for the sustainable development of the city. Access to schools and to education is another pillar of the strategy. The jobs generated by those activities –2.000 teachers, 1.500 transport- would rise up to 25-30% of working population –i.e. half of city's- the amount of people dedicated to secure the urban metabolism which generates several inputs of money in the economic flow of the city. The other two tiers of the working population must ensure:

- services –such us tourism, commerce, catering, leisure…- that increase the external inputs of money in the urban flow,
- CBD's business that multiply the monetary inputs,

Those inputs complete a balanced cycle in which money flows thorough all the sectors hence physically and economically interconnected.
Land use distribution in the project comprehensibly supports such interactions showing how Ecostal pursuits from the very design the long-term freshness of the ecosystem. Balance and harmony are at hand by closing the loop.

Annexes

Biogas production and energy co-generation – table including primary calculations:

Production from biomass sources (base) = 1 district= 490*50 inhabitants 0 tourists (7 districts)										
	Tn	Total Solid	dry mat – Tn	Volat solid	Volat mat – Tn	t_{equi}-CH_4 – m^3	CH_4 –m^3	Energy cont MWh	Electr MWh	Heat MWh
Biomass	Tn/an	x%	1*x%	y%	1*x*y	z	1*x*y*z	(6,5*1*x*y*z)/1 000	0,35	0,4
Sludge	6228	0,30	1868,4	0,90	1681,6	150	252237	1563,87	547,35	625,55
Household waste	4900	0,40	1960,0	0,70	1372,0	450	617400	3827,88	1339,8	1531,15
Green wastes	10000	0,40	4000,0	0,95	3800,0	500	1900000	11780,00	4123,0	4712,00
Fruits & vegetables	245,4	0,15	36,82	0,80	29,45	600	17672,5	109,57	38,35	43,83
Corn	377,6	0,86	324,71	0,72	233,79	650	151965	942,18	329,76	376,87
Fishes	8821	0,20	1764,3	0,75	1323,2	500	661607	4101,96	1435,7	1640,79
TOTAL	30572		8189,9		8440,0		2939275	18223,50	7816,1	8930,88

The combination of fat waste –45%, richer in C- and green wastes –35% and richer in N- assures a suitable ratio C:N –close to optimal, 20-30:1- for the anaerobic digestion process and the fertilizer value of the final compost as far as, cellulose contents –that might slow down the process-, and woody molecules such us lignin –that could stop it as they are not digested-, remain under control. The blend with green and sludge contributes to get right moisture to use less energetic conventional pumps to mix it.
Finally an effective colleting and sorting process at the source will guarantee a smooth, continuous process of the non-polluted biomass –no plastic, glass or metals.

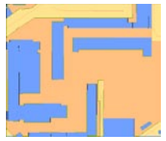
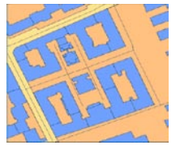
Sources –Living support systems

Advanced water bio-filter systems – http://www.livingmachines.com/
http://www.organica.hu/download/Organica_References_EN.pdf
Combined water-waste treatment in the Netherlands –
http://www.enhr2007rotterdam.nl/documents/W19_paper_Timmeren_Kaptein_Sidler.pdf
Bio-intensive agriculture – http://en.wikipedia.org/wiki/Biointensive
Seawater greenhouse – http://www.seawatergreenhouse.com
Dry toilets – http://www.gtz.de/en/themen/umwelt-infrastruktur/wasser/9397.htm

Urban Morphologies: First Results

Urban Morphology & Energy consumption

Study of Paris

	18-19th C Ancient fabric	1918-1980 Modernist fabric	1980-2000 Contemporary fabric
	•Very high building density •High FAR and high block density •Good ratio Vp/Vt •Bad solar admittance	•High solar admittance, useful compacity and ratio Passive Volume/total Volume (Vp/Vt) •Very low building density, FAR and block density	•Very low building density •Low block density and ratio Passive Volume/Total Volume •Average for the rest
Heating Energy density due to factors of urban morphology (GJ / year / m ²)			
	0,21 GJ/year/m²	0,36 GJ/year/m²	0,20 GJ/year/m²

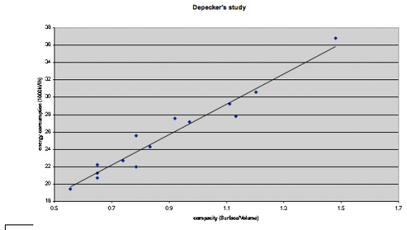
→ Due to urban morphology, the modernist texture consumes **1.7 times** more energy for heating than contemporary Paris!

Effect of Compacity

Related to the transmission surface of the walls with the outdoor environment.

$$C = \sum_{buildings} \frac{A_{ext}}{V^{2/3}} [/]$$

Depecker's curve shows that the greater the compacity, the more energy is used.



New high-rise developments

C ~ 8

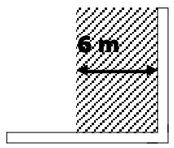
HK — Guangzhou — Shanghai

Historic urban fabric

C ~ 5 — C ~ 3

Old parts of Guangzou and Shanghai — *Old Paris*

Effect of Passive Volume



Passive volume

Built volume

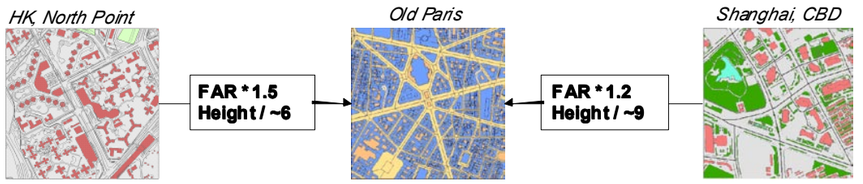
$$Ratio = \frac{\sum_{buildings} PassiveVolume}{\sum_{buildings} BuiltVolume}$$

Urban Texture and Energy Consumption, Ratti, Baker, Steemer, 2005

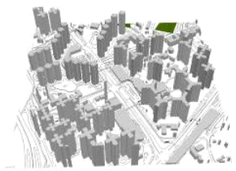
Shanghai, Lujiazui (CBD)	Guangzhou, Tianhe	Hong Kong, North Point (residential)	Shanghai, Hongkou (lilongs)	Paris, 19th century
Ratio = 43 %	Ratio =66 %			

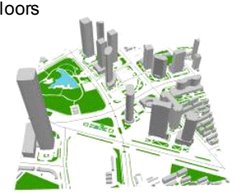
Ratio ~ 80%

Old Paris vs Modern Asian Cities



Built-up area density = 19%	Built-up area density = 61%	Built-up area density = 11%
FAR = 3.1	FAR = 4.5	FAR = 3.7
Buildings height = mainly above 30 – 40 floors	Buildings height = about 6 - 7 floors high	Buildings height = mainly above 45 floors

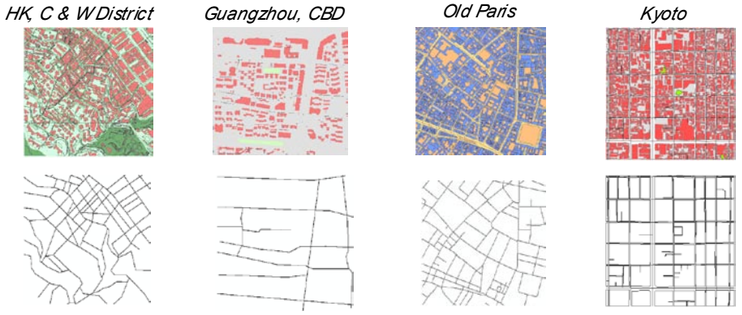




Dense low-rise vs. high rise

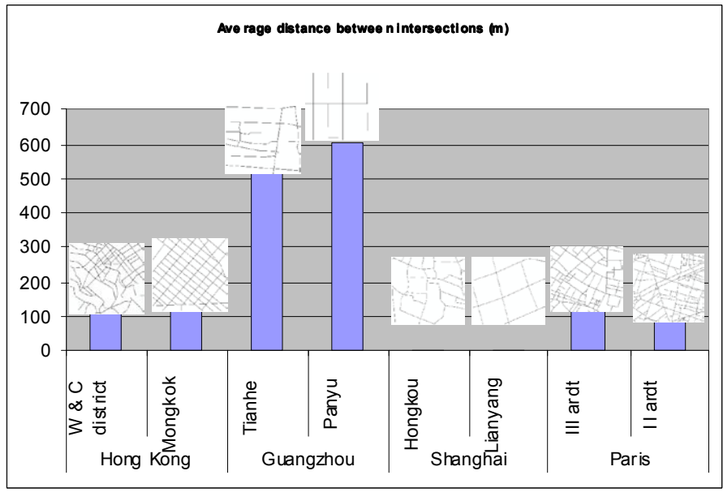
Street Network & Connectivity

Comparative analysis of Street Networks in our various studied cities have shown a number of conclusions thus far regarding connectivi ty: greater cyclomatic number (average # connections between 2 points); smaller distances between intersections; and greater density of intersections, generally indicate a more connected, accessible c ity fabric



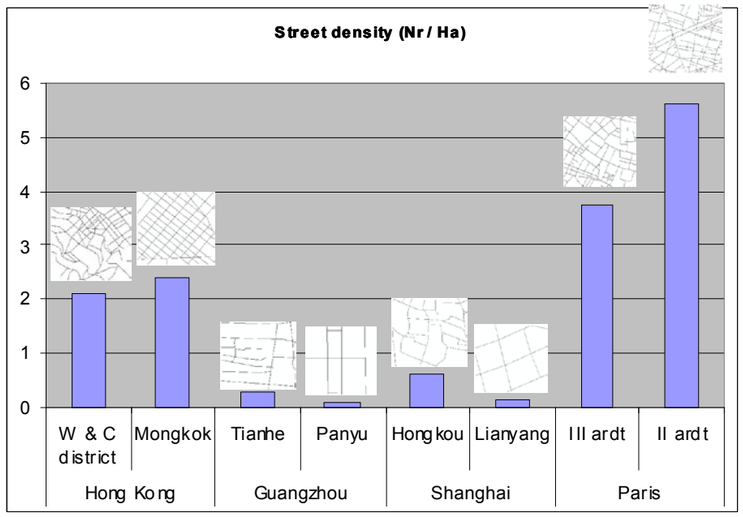
Cyclomatic number	51	6	88	83
Average distance btw intersections	157	518	153	52
Intersection density	6.38	1.93	6.5	19.24

Effect Of Street Network: Distance between intersections



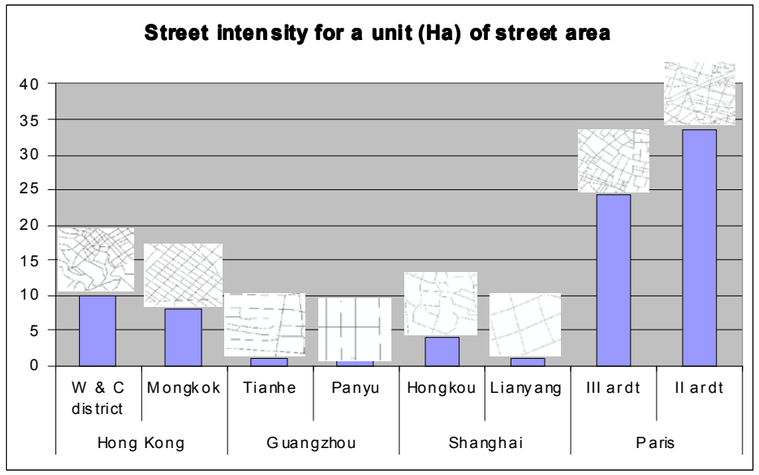
Smaller distances between intersections indicate a more connected city fabric

Effect Of Street Network: Street Density



Greater density of intersections indicates a more connected city fabric

Street Intensity (Nr of streets by Ha of street area)



Building Height & Density

- Land management plays a major role.
- A dense area is not synonymous with high rise constructions
- Some high-rise (40+ floor) districts in HK have similar FAR to 4-6 storey Paris!

Paris: 40 % of Paris reaches a density superior to 40000 hab/ km2, without resorting to high-rise constructions. Current average living space in Paris: 32 m2/hab

Hong Kong: population density reaches an average of 40000 hab/ km2 in most places . Very high-rise buildings and average living space only 12 m2...!

Building Mass Organisation: FAR & Building Height

Ancient morphologies in Shanghai can reach FAR similar or superior to the new development, but with low-rise construction, due to an efficient use of land.

FAR = 1.9

FAR = 1.2

FAR = 1.2

Ancient morphologies (lilongs)

New development

Building Mass Organisation: Comparison at larger scale

*800 *800 meters urban sites*

SHANGHAI (Lianyang)

FAR * 5
Height * ~1.5

HONG KONG (Central district)

FAR * 1.5
Height * ~1.5

GUANGZHOU (Tianhe)

Built-up area density = 14%

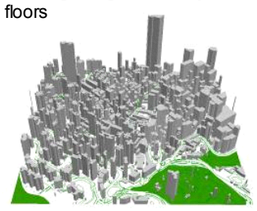
FAR = 1.2

Buildings height = 1 to 30 floors

Built-up area density = 35%

FAR = 6

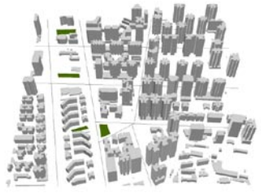
Buildings height = mainly over 20 floors



Built-up area density = 26%

FAR = 4.1

Mean height = partly over 25 floors, some very low



Building Mass Organisation: Comparison at smaller scale

*200*200 meters urban sites*

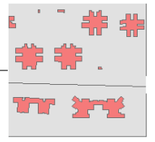
Shanghai

FAR * 5
Height * ~1.8

Hong Kong

FAR *2.3
more or less
similar
heights

Guangzhou



Built-up area density = 14%

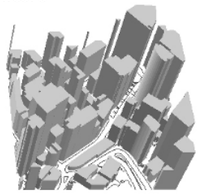
FAR = 2.2

Buildings height = mainly 10 to 25 floors

Built-up area density = 54%

FAR = 11.8

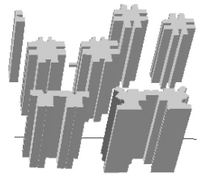
Buildings height = mainly 20 to 50 floors



Built-up area density = 15%

FAR = 5

Buildings height = mainly 30 floors



Presentations of Techniques

By French Industrials

PARTICIPANTS :_Industrials & Consulting firms:

- Serge NEUMAN (SOMFY)
- Jason YIN (SOMFY)
- Eric DUAN (SOMFY)
- Delphine YANG (AERECO)
- Jun ZHANG (ALDES)
- Laure LE GREVES (LEGRAND)
- David SHAN (CIAT)
- Suzanne OTTO (IOSIS)
- Nicolas SAMSOEN (AREP)

CONTEXT

March 16th and 17th have been two introductive days to the urban design Huludao workshop which aimed at providing ecocities prototypes adaptable to whole China, based on the specific Huludao case.

On March 16th, there have been interventions by Tongji university experts, Serge Salat from ;CSTB, Ying Hua from Cornell University and SOMFY representant, Serge Neuman, who delivered a lecture on the influence of the building in the city energy consumption.

March 17th was devoted to the intervention of other industrials who specifically proposed their innovative technologies in terms of energy economy and CO2 emissions to all participants, architects, urban designers, but especially to the engineers whose specific task was to integrate these technologies in their final proposal to manage environment and energy.

As far as the consulting firms are concerned, they focuses more on the broad principles of their company strategies to achieve a sustainable urban development (compacity, « soft » transport…etc) and some overall technologies they use to lower energy consumption and preserve the environment.

背景

3 月 16、17 日是葫芦岛城市设计项目的启动阶段，该项目旨在从葫芦岛的特定情况出发，提供适用于整个中国的生态城市的样本。

3 月 16 日，与会者有同济大学的专家、来自法国建筑科学技术中心的薛杰（Serge Salat）先生和康奈尔大学的嬴华 以及 SOMFY 尚飞的代表 Serge Neuman 先生, Neuman 先生并作了有关建筑对城市能耗影响的演讲。

3 月 17 日，其他企业的代表聚集一堂，向与会的嘉宾、建筑师、城市设计者、特别是那些需要在最终方案中采取措施来解决环境和能源问题的工程师们，着重介绍了他们在节能和二氧化碳排放方面的先进技术。

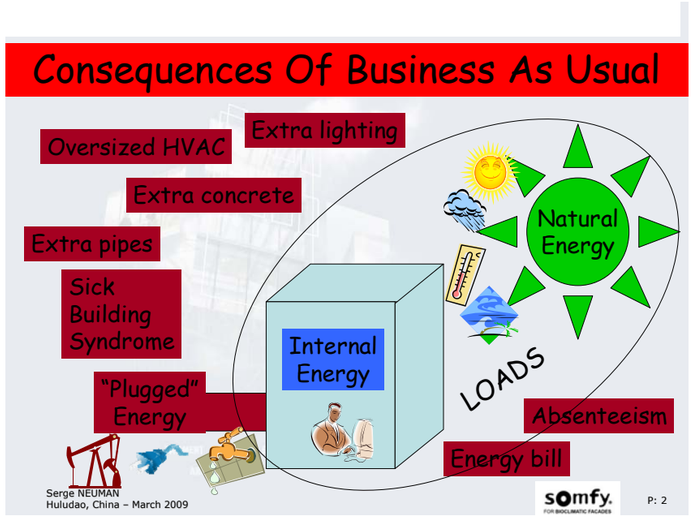
这些顾问公司着重强调了他们为达到可持续发展的目标（密集度“软”交通等等）而制定的战略原则和一些能降低能耗、保护环境的整体措施。

1-SOMFY

somfy
FOR BIOCLIMATIC FACADES

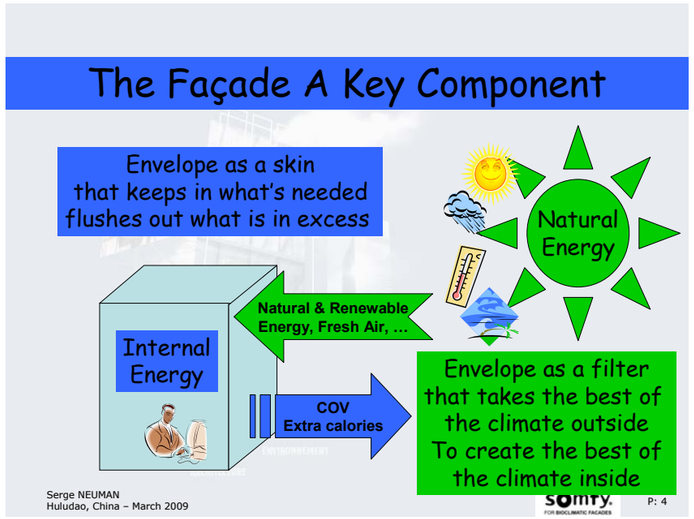
Serge Neuman's lecture consisted in a review of the several energy, environment and human issues linked to building design.
Serge Neuman 的介 探 了与建筑 有 的能源、 境和人文

He first makes a review of the energy sources of the building and the advantages of a smart management of energy:
他首先 了建筑能量来源以及智能化能量管理的优点



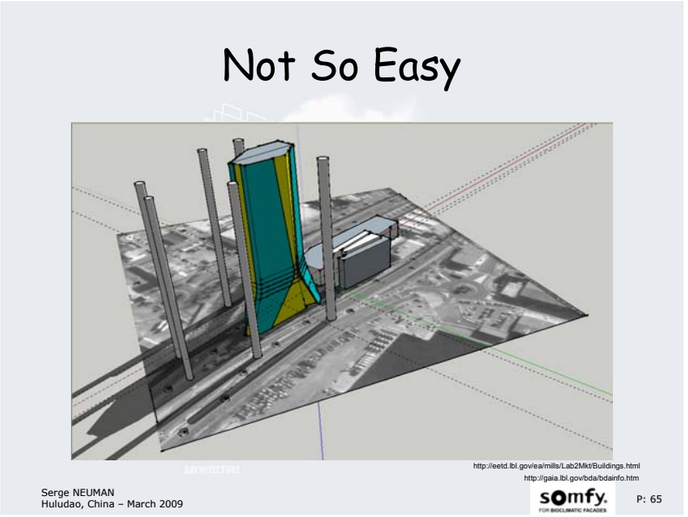
Then he points out the importance of the façade to soak up solar energy:

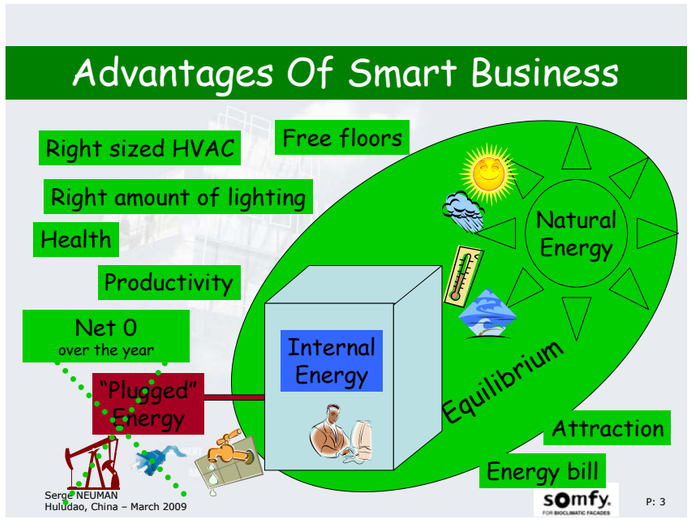
然后他指出了能吸收太阳能的建筑外表面的重要性

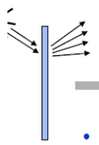


The parameters that need to be taken into account in the building design : wind, rain, shadow, luminance:

需要在建筑设计中加以考虑的因素：风，雨，影，光线

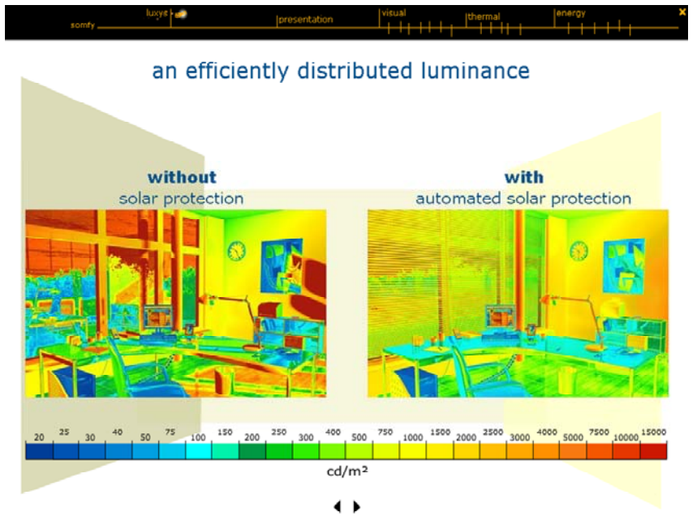






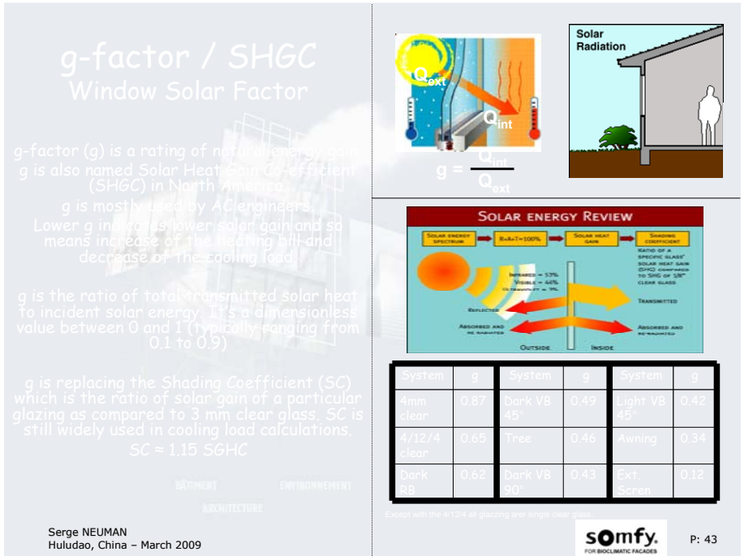
Directional Light Control

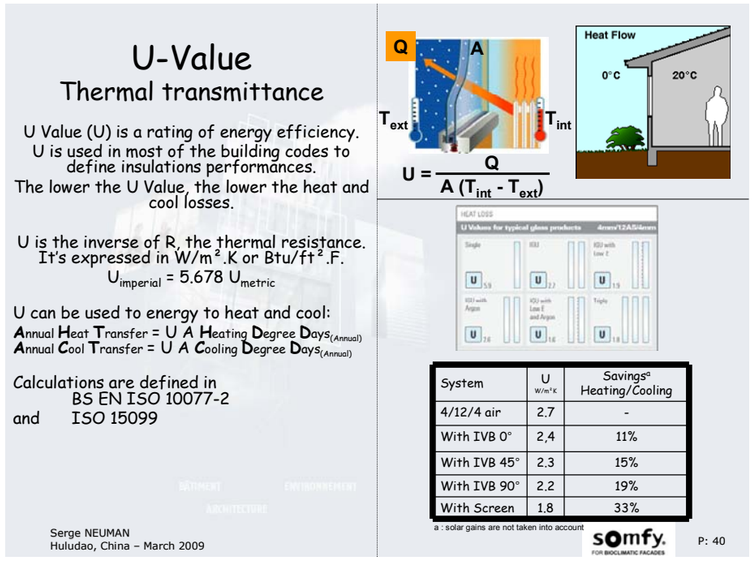
- **Conventional control of direction of light**
  - Glass block
  - Fritted glass
  - Shading systems
  - Light shelves
- **New Options**
  - Prismatic glazings
  - Holographic materials
  - Laser cut panels
  - Light pipes
  - Fiber optics

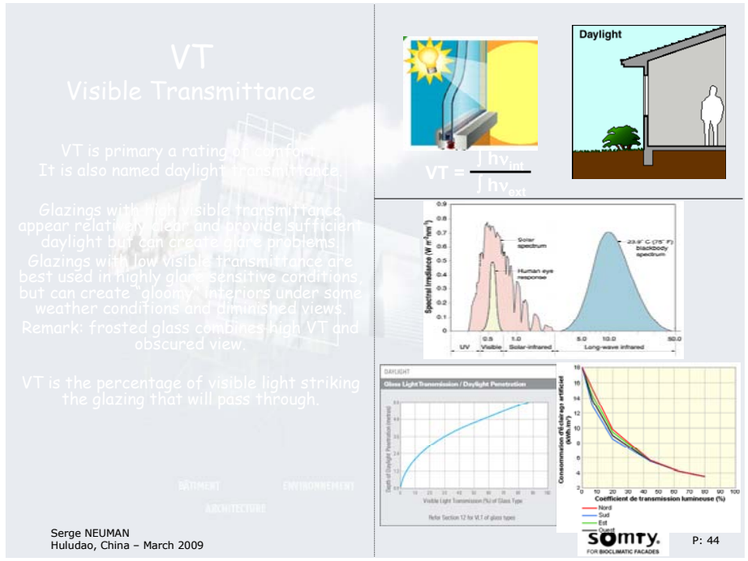


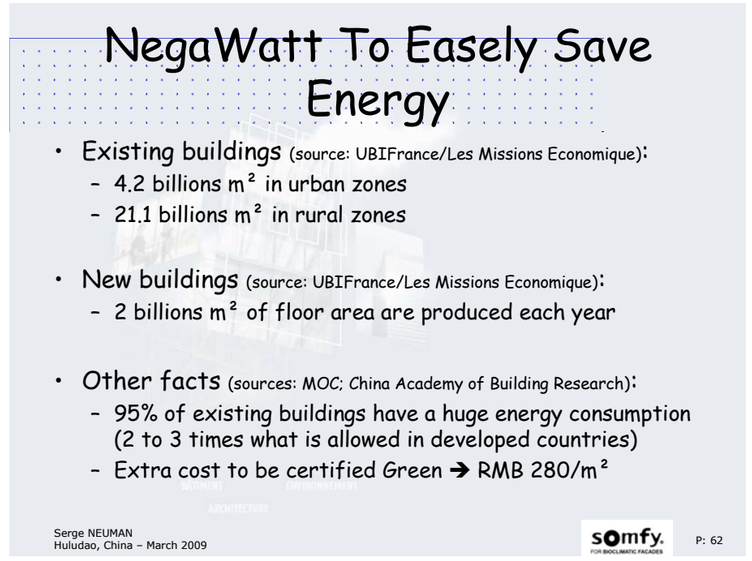
Serge Neuman shows next how the bioclimatic façade takes into account all these parameters and optimise them using a **dynamic process** (vs.fixed solution):

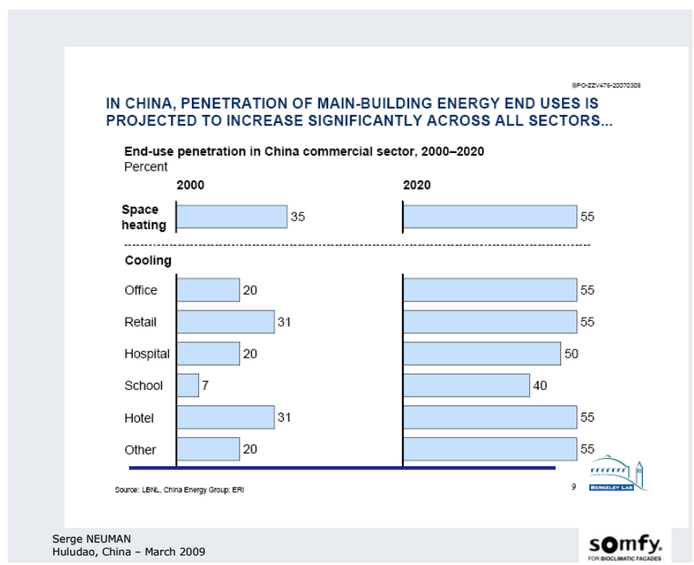
Serge Neuman 接着展示了生物气候表面如何综合考虑了所有这些因素，并用一种动态过程（复合方法）将它们进行优化











somfy FOR BIOCLIMATIC FACADES

The particular Chinese context

中国的特殊情况

2- AERECO

AERECO S.A, inventor of the first Demand Controlled Ventilation system, is located in Paris, France.

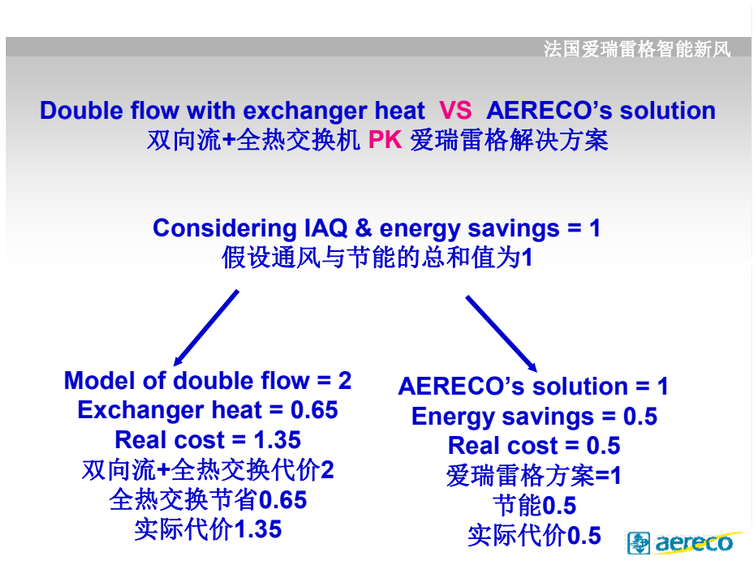
发明了第一个湿感通风系统的法国爱瑞雷格（AERECO S.A）湿感技术公司坐落于法国巴黎。

The AERECO company is dedicated to the innovation of energy saving oriented ventilation system. Such as: humidity sensitive ventilation system in 1984; Ventilation with Presence detection in 1988; Ventilation with counting device by motion detection in 1991; New concept of hybrid ventilation in 2002;

爱瑞雷格公司致力于节能通风系统的创新改进，例如：1984 年成功研制了无源湿感通风系统，1988 年的自动识别人员通风系统，1991 年的运动感应控制通风系统，2002 年的智能湿感通风新概念。

AERECO has 10 subsidiaries and offices worldwide in order to meet the needs where they grow. AERECO (Beijing) Trading Co. Ltd and AERECO China Representative Office are at Chinese client's disposal for any further information about AERECO Intelligent Ventilation System: www.aereco.com.cn.

爱瑞雷格在世界范围内有 10 个子公司以满足各地的市场需求。爱瑞雷格北京贸易有限公司和爱瑞雷格中国代表处愿意为中国客户提供更多有关 AERECO 智能通风系统的资讯：www.aereco.com.cn.



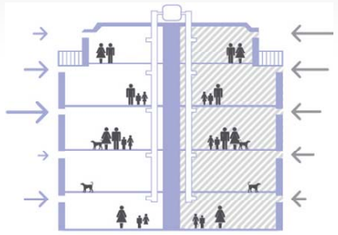
Mrs Yang presented AERECO's ventilation technologies that allow to conciliate indoor air quality and energy savings, pointing out the drawbacks of « double flow exchanger heat » technology (instable performance and large space needed for installation).

爱瑞雷格公司代表杨女士介绍了 AERECO 的有利于室内空气质量和节能的通风技术，并指出了《双流换热》技术的缺陷（性能不稳定并且设备需要较大空间）

法国爱瑞雷格智能新风

AERECO'S SOLUTION 爱瑞雷格解决方案

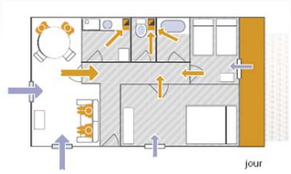
Adapts the airflow according to the needs between the different dwellings 风随人走，变量节能



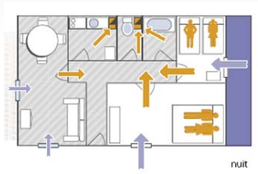
AERECO 智能、变量新风 | **Fix ventilation** 恒量新风

法国爱瑞雷格智能新风

AERECO'S SOLUTION 爱瑞雷格解决方案



Occupation DAY
白天,新风集中在人活动的客厅



Occupation NIGHT
夜晚，卧室新风量加大

法国爱瑞雷格智能新风

AERECO'S SOLUTION 爱瑞雷格解决方案
Conclution结论

Humidity is a good indicator of the indoor pollution
Its integration for the air renewal allows also a better regulation of the humidity level in the dwelling (which is not possible with the systems which only detect CO2)

由人员活动导致室内相对湿度波动, 与室内污染度的变化紧密相关, 成为测试室内污染度的极具真实性的指标. 同时揭示出室内二氧化碳的波动, 不够活跃, 无法相提并论

法国爱瑞雷格智能新风

AERECO'S SOLUTION 爱瑞雷格解决方案

Energy impact 节能效率

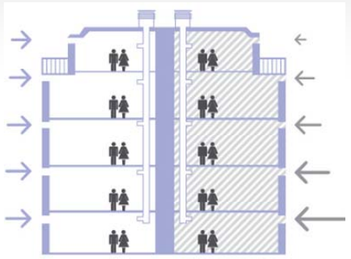
- Up to 40 - 50% energy savings*

* Average with equal air quality obtained with « standard » fix airflow

法国爱瑞雷格智能新风

AERECO'S SOLUTION 爱瑞雷格解决方案

Balances the airflows on the duct column
智能新风巧妙解决楼层间流量平衡



AERECO智能、变量新风　Fix ventilation恒量新风

3- ALDES

ALDES group was established in Lyon in 1925. In the past 80 years, ALDES international group has grown up to the biggest company in ventilation system (VMC), centralized Vacuum cleaning system (CVC), fire protection, air distribution and acoustic. Le group has done a lot of projects on over the world. Most of committees and testing organizations of different countries have integrated ALDES concept into their regulations and standards. ALDES has opened its 40 branches in more than 35 countries all over the world such USA, UK, Italy, Belgium and China.

Today, leader in ventilation and air quality, ALDES manufactures MVSs forIndividual and Collective housing, and for Commercial premises. These systems provide solutions to universal concerns – air quality and energy savings. ALDES offers several ventilation solutions :

- Exhaust constant airflow mechanical ventilation with or without heat recovery.
- Humidity-controlled exhaust ventilation.
- Exhaust mechanical ventilation with or without heat recovery with modulated airflow.
- Ventilation for renovation.

With the idea of imrpoving air quality inside buildings, in 1991 ALDES ventured into the development of centralised vacuum cleaning systems.Today, ALDES is the European leader in centralised vacuum cleaning. Range from the single user vacuum cleaning system for individual and collective housing to the multi-user cleaning system for commercial premises, ALDES offers a complete range, from the central unit to the accessories.

ALDES(Shanghai) Indoor Air Technology Co., Ltd. was established in 1998, it is a unique foreign investment company in China on the VMC and CVC fields. Shanghai ALDES has created the VMC market with “house breathing concept”. ALDES product has passed CE/NF, CCC certification, and has been honored by Chinese Ministry of Construction as “product recommended”. It has also won Beijing Olympic games 2008. It participates on the Chinese regulation draft on ventilation.

爱迪士 ALDES 集团在 1925 年成立于里昂。在过去的 80 多年里，ALDES 国际集团成长为设计制造中央机械式通风系统（VMC）、中央真空式吸尘系统（CVC）、防火产品、散流器和降噪产品的最大专业公司。不同国家的大部分行业协会和质检机构都将 ALDES 的产品和设计原则作为他们的规范和标准。爱迪士 ALDES 在美国、英国、意大利、比利时和中国等 35 个国家设立了 40 个分支机构，业务遍布全球。

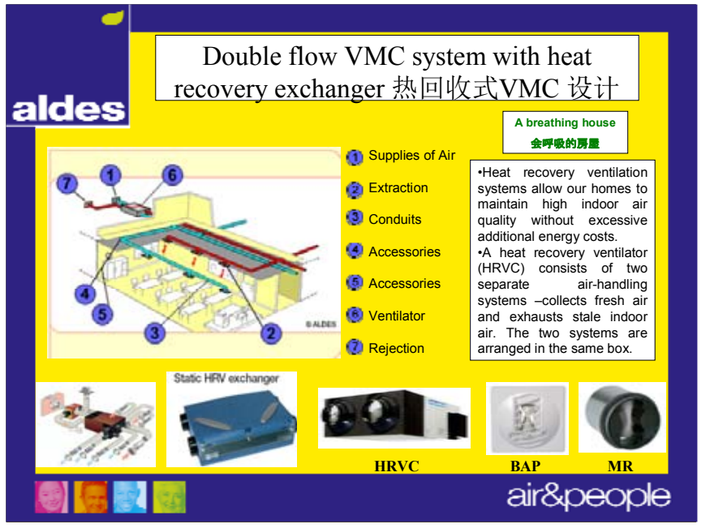
今天，作为通风和空气质量领域的领导者，爱迪士 ALDES 为独立住宅和集合住宅以及商业建筑制造机械通风系统（MVS）。这些通风系统为广泛关注的空气质量和节能问题提供了解决办法。爱迪士 ALDES 提供的通风方案有：

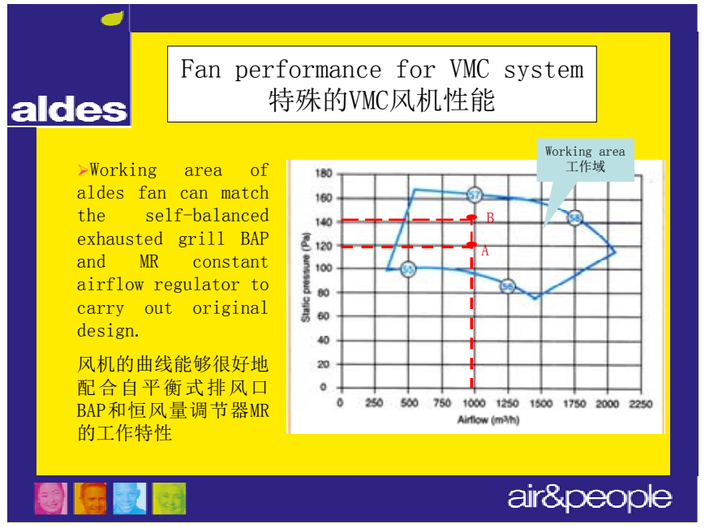
－带热回收或不带热回收的机械持续排风的通风系统
－湿控式排风通风系统
－带热回收或不带热回收的机械排风自平衡通风系统
－新风系统

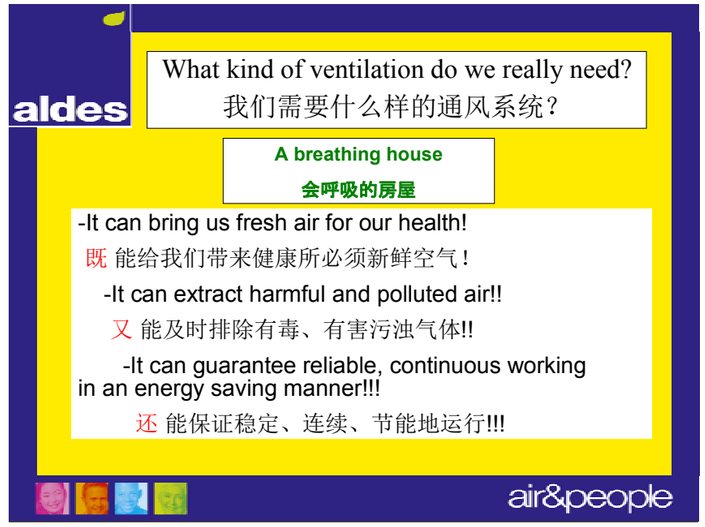
为了提高住宅内部的空气质量，1991 年爱迪士勇于尝试了研发中央真空式吸尘系统。今天，爱迪士已经是这个领域的欧洲领导者。从独立或集合住宅的个人用户到商业建筑的多用户，爱迪士提供了真空吸尘系统从主机到配件的整套解决方案。

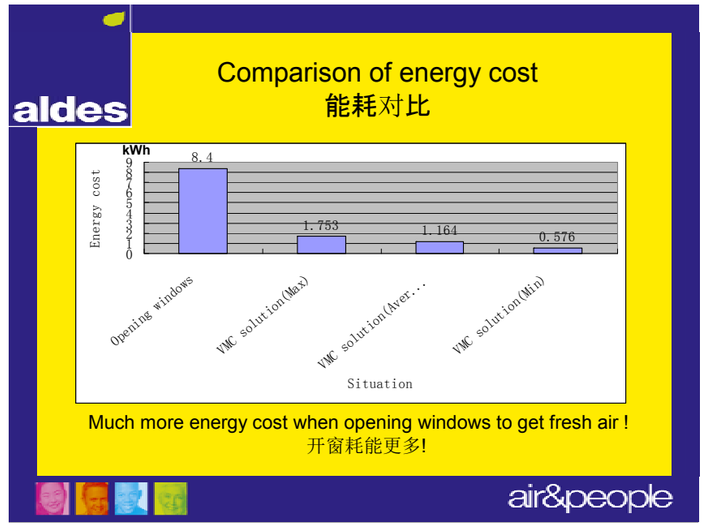
Mr Jun ZHANG rappelle d'abord les risques liés à une mauvaise ventilation (condensation, dégradation des matériaux, moisissure) et les principes de la technologie CMEV (air flow path, minimum air supply, continuously), pour enfin exposer les différentes solutions proposées par ALDES.

张军 先生首先提醒我们不良通风系统会带来的危险（冷凝，材料老化，长霉）和 CMEV 技术的原则（气流通道，最少空气供给，持续性），最后他介绍了 ALDES 提供的解决方案。





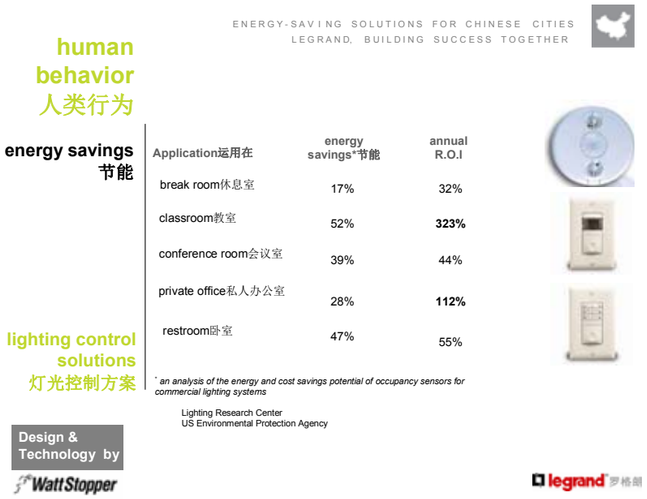




4- LEGRAND

Legrand Group is one of the worldwide leaders in products and systems for electrical installations and data networks, for any kind of building. Twenty years after its entrance in China, Legrand has developed a strong sales force/distributors' network and is running one headquarters in Shanghai, seven subsidiaries and eight factories all over the country. In 2009, Legrand China enables additional energy savings in buildings through a large offer of energy efficient products. For instance, automation systems can help inhabitants of residential buildings to reduce their energy consumption, thanks to a system of scenarios controlling lighting, HVAC, shutters etc.. For commercial buildings, Legrand occupancy sensors related to the lighting systems enable to turn automatically the light off when a room is vacant. Money and energy are then saved.

罗格朗集团是世界范围内能为各种建筑类型提供电气设备、数字网络的产品和系统的行业领导者之一。进入中国 20 年之后，罗格朗已经发展了强大的营销网络，在上海设立总部，并在全国有 7 个分公司和 8 个工厂。2009 年，罗格朗中国通过大量提供高能源效率产品实现了额外的建筑节能。例如，通过能控制照明、暖通设备、百叶窗等的自动系统帮助居民减少能耗。对于商业建筑，与照明相联的罗格朗感应器能在某个房间无人时自动关灯，因而大大节省了资金和能源。



Among the 3 levels of sustainability – urban planning, building design, human behaviour -LEGRAND's fields of intervention cover the two last ones.

在可持续性三个层面上——城市规划，建筑设计，人类行为——罗格朗的产品覆盖了后两者。

legrand 罗格朗

ENERGY-SAVING SOLUTIONS FOR CHINESE CITIES
LEGRAND, BUILDING SUCCESS TOGETHER

human behavior 人类行为

smart home technology
家居科技

in one by legrand

my home by bticino

MY HOME

ENERGY-SAVING SOLUTIONS FOR CHINESE CITIES
LEGRAND, BUILDING SUCCESS TOGETHER

human behavior 人类行为

■ **scenario switch 场景开关**

energy savings 节能

Energy management: heating, lighting, domestic hot water, shutters under control能源管理：供热，灯光，家用热水，百叶窗，地下控制

in one by legrand

■ 6 to 10% of energy saving 能节约6-10%的能源

my home by bticino

■ 400 000 houses 400000个房屋
850 Kwh/year/house 850度/年/户
8 TWh

*

Prix Entreprises & Environnement

legrand 罗格朗

* in one under celiane design in europe and new mosaic design in asia

ENERGY-SAVING SOLUTIONS FOR CHINESE CITIES
LEGRAND, BUILDING SUCCESS TOGETHER

human behavior 人类行为

smart home technology
家居科技

technological functions
科技的运用

in one by legrand

my home by bticino

MY HOME

legrand 罗格朗

ENERGY-SAVING SOLUTIONS FOR CHINESE CITIES
LEGRAND, BUILDING SUCCESS TOGETHER

human behavior 人类行为

■ **temperature management 温度管理**

energy savings 节能

in one by legrand

my home by bticino

control with thermostat 用调温器控制	up to 10%
control with outdoor sensor 用户外传感器控制	up to 4%
single-or multizone time switches 一个或多个时间开关	up to 12%
centralized shutter control 中央化百叶窗控制	up to 8%
shutter control with time switches 用时间开关控制百叶窗	up to 11%

■ **lighting management 灯光管理**

movement detector	
occupancy sensor	up to 55%/room
programmable time switches (outdoor) 可编写程序的时间开关（户外）	up to 35%

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5- CIAT

CIAT Group has been recognized for 70 years for its expertise in the field of Heating, Refrigeration, Ventilation, Air Handling and Heat Exchange. CIAT is also a European leader in HVAC for Residential, Office buildings, Health Care and Industry.

Today, CIAT is an equipment manufacturer with industrial operations in France, Italy, Spain, China and India, selling Products, Systems and Services. Committed to sustainable development, CIAT develops air conditioning and heating equipment in line with the ecological stakes. These equipments follow the future European thermal regulation requirements and preserve our environment for generations to come.

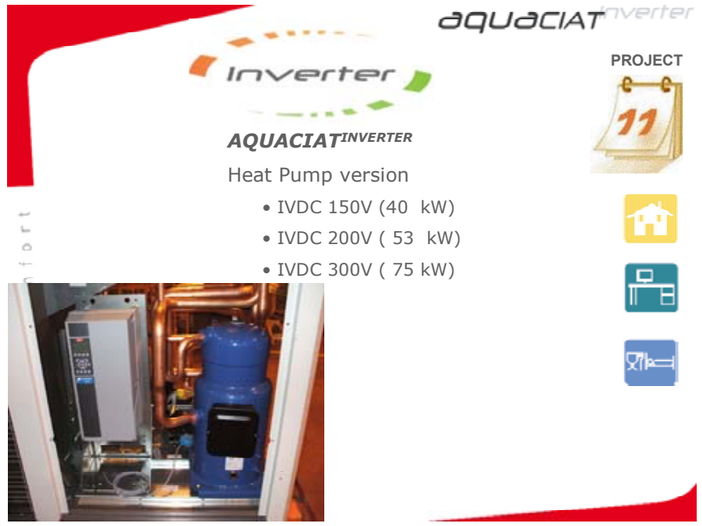
CIAT is an expert in energetic systems at the level of energy production (chillers, heat pumps), air treatment (air handling units) and final treatment and distribution to living spaces (fan coil units). These expertises allow CIAT to be present in several markets : hotels, residential.

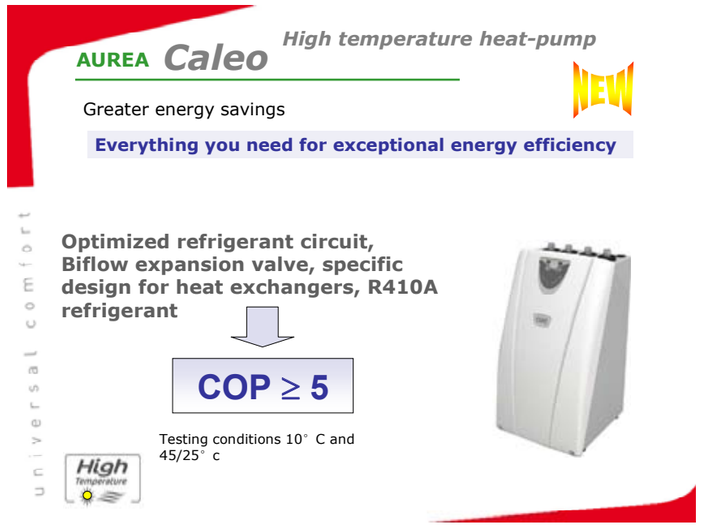
西亚特 CIAT 集团在供暖、制冷、通风、空气处理和热交换领域的专业经验已享誉 70 年。他也是住宅、办公建筑、医疗和工业建筑暖通系统这一领域的欧洲领导者。

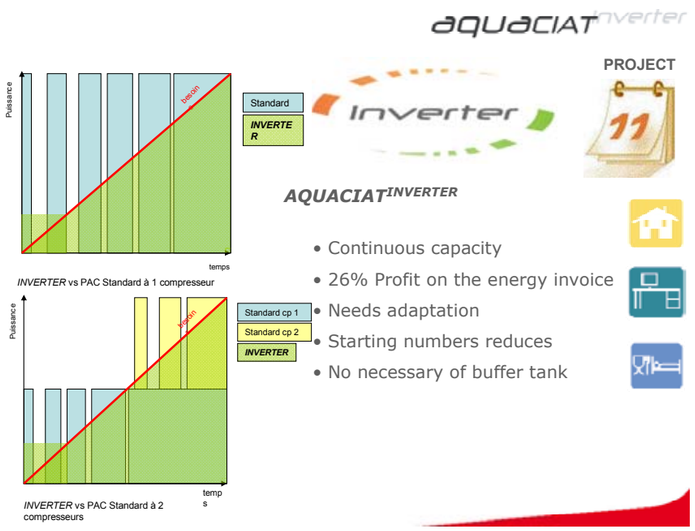
今天，西亚特的工程项目遍布法国、意大利、西班牙、中国和印度，在这些国家生产设备并销售产品、系统和服务。为实现可持续发展，西亚特研发了生态环保的空调和取暖设备。这些设备符合欧洲未来实行的热规范要求并为后代人保护环境。

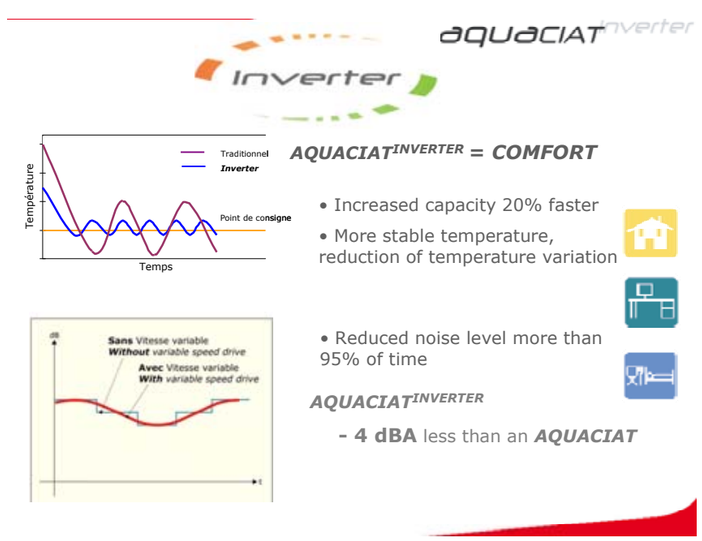
西亚特的主要任务和目标是在提高室内空气质量和舒适度的同时优化能耗。

西亚特是产能（冷凝器，热泵）、空气处理（空气处理机组）和输送分配（风机盘管）等方面的专家。这些专业技术使得西亚特能在酒店和住宅等领域赢得市场。

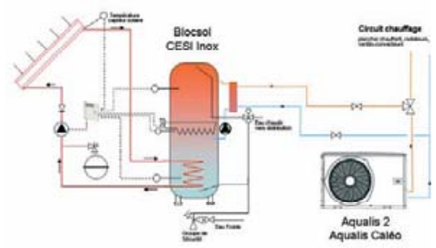








PACSOL-SYSTEM



Mr.David SHAN

CIAT GROUP

NEW ecobox

Status :
- Indoor air quality is more and more important
- Fresh air introduction is most of the time an obligation
- Then exhaust air is necessary

Exhaust air heat recovery
Domestic Hot Water preparation

NEW ECOBOX

Exhaust air heat recovery
Sanitary Hot Water preparation

For all Markets segments :
- Where exhaust air is mandatory
- Where Domestic Hot Water consumption is important

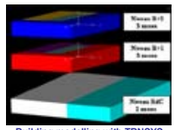
Domestic hot water will be main energetic needs of tomorrow building, it will be better to recover energy on domestic hot water than in introduce air :
- Air recovery systems, wheels …have a low efficiency (<1)
- Ecobox thermodynamic recovery guaranty **an efficiency > 3,5**

HVAC SYSTEMS APPROACH

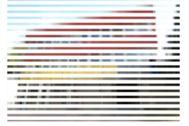
GENHEPI Project – This demonstration project is the occasion to apply a global approach when sizing an HVAC system by finding an economic optimum (lowest pay back time) between the investment cost of heat pump and fan coil unit and the operation cost. The choice of water regime (for cooling and heating) different from the traditional ones leads to energy efficient HVAC systems with low pay back time of 2 years.

The monitoring phase has started in autumn 2007

Office building in Lyon (F) before renovation



Building modelling with TRNSYS



Office building under renovation

Heat pump on the roof of the building

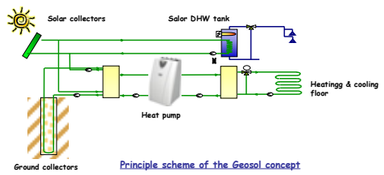
HVAC SYSTEMS APPROACH
Coupling to Renewable Energy Sources

GEOSOL – The aim of the project was to couple a geothermal heat pump to vertical ground collectors and solar collectors in order to improve the overall and seasonal efficiency of the all system. For vertical collectors, the ground thermal depletion has been identified as a possible source of efficiency decrease.

In parallel with the installation of the Geosol system in a single family house in Chambéry (F), a modelling was realized by a PhD student and tuned with monitoring results.

It was then possible to make some simulation for a long term period.

The simulation results have shown that for a single family house, the ground thermal depletion was not a major problem and that the Geosol system did not bring an important increase of energy efficiency. For collective houses, the thermal ground depletion is more critical and Geosol becomes really interesting.



Principle scheme of the Geosol concept

Single Family House equipped with Geosol

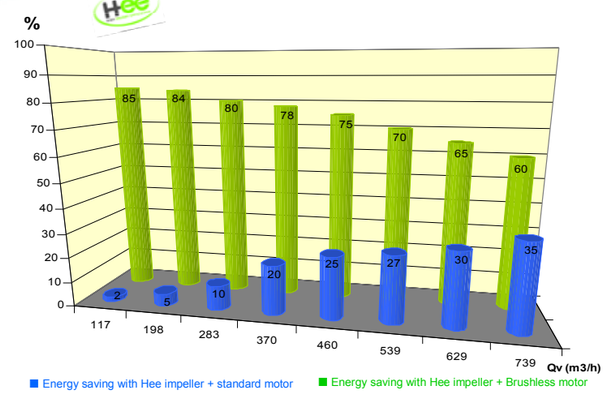
CIAT Hee OFFER

HIGH ENERGY EFFICIENCY.
This logo is including 2 CIAT solutions for energy saving :

❑ Hee Motor : Brushless motor
Result of a common development with our motor supplier

❑ Fan
3 new high efficiency fan impellers developed by CIAT and covering almost all our FCU offer (except Mélody and UTA).

Brushless motor: Energy saving



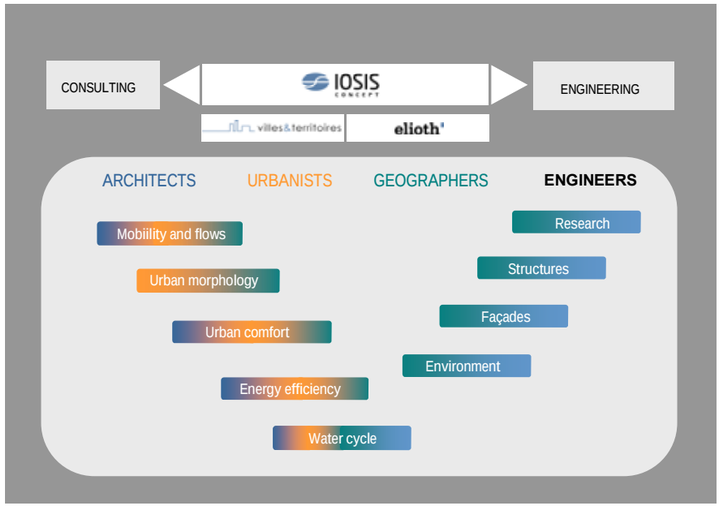
6- IOSIS

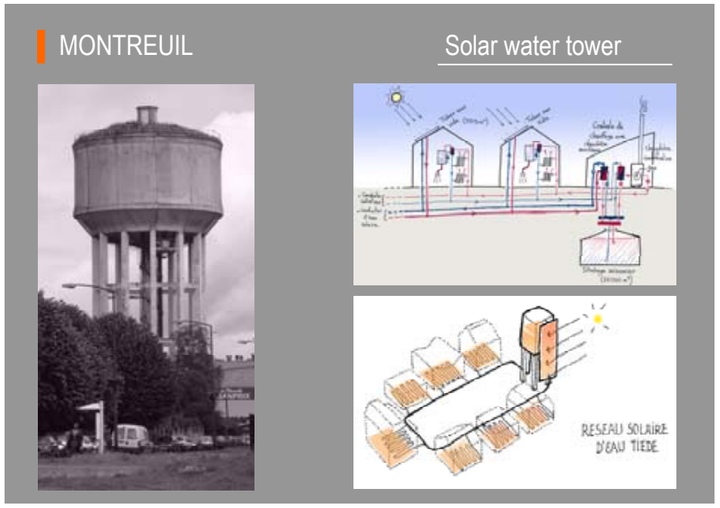
IOSIS was created in January 2007 following a merger of OTH and Séchaud. It groups together under the same “roof”, building consultancy, management and engineering expertise in the sectors of building, infrastructure, civil engineering, energy and industry.

As an urban design consulting firm, IOSIS presented some case studies the firm dealt with proposing several technologies (solar water tower, integrated wind turbines…etc) to cope with sustainable urban issues.

OSIS 公司是在 OTH 和 Séchaud 合并后创立于 2007 年 1 月。在同一个公司平台下，它集合了在建筑、设备、土木工程、能源和工业领域的建筑咨询、管理和施工的专业经验。

作为一个城市设计顾问公司，IOSIS 介绍了一些可持续发展方面的工程实例，并提供了相关的技术措施（太阳能水塔，整体风机涡轮等等）



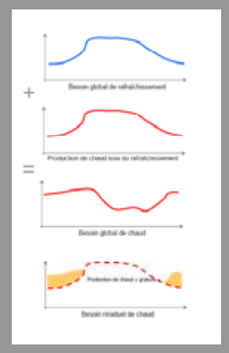


WIND IT

Integrated Wind Turbines

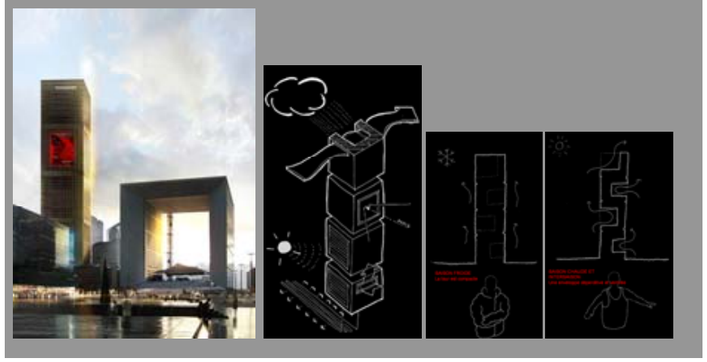
PARIS AUSTERLITZ

The Parisian Climat Plan



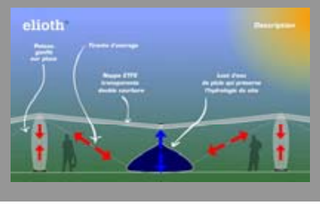
TOUR SIGNAL

The vertical City



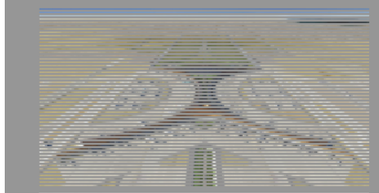
Solar Montains

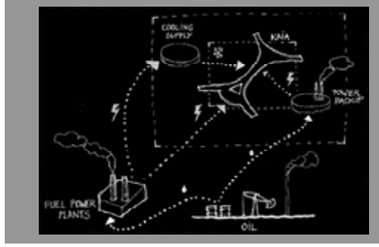
Solar energy plant

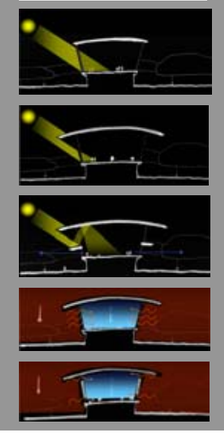


JEDDAH AIRPORT

Leed approach







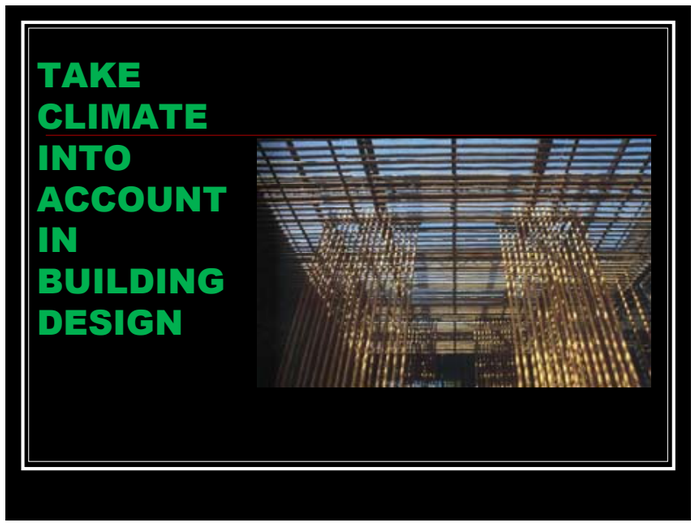
7- AREP

AREP group is a subsidiary of the French SNCF and was created in 1997.
Its business activities are handled by three separate companies: AREP, AREP ville and AREP architecture, each one handling a different scale of urban planning and design.

AREP's fields of expertise are: architectural programming, spatial organisation, structural design for large spaces, interior design, furniture and equipment design, construction financial management, climatic comfort, acoustics and sound-proofing, lighting, electromechanical engineering, fire safety and security measures, construction management and on-site coordination.

AREP 是法国 SNCF 的子公司，创立于 1997 年。
其业务由三个独立公司来运作：AREP，AREP 城市和 AREP 建筑，每个都有其不同的城市规划和设计的领域

AREP 的专业领域包括：建筑设计，空间组织，大空间结构设计，室内设计，设备设计，建设财务管理，气候舒适，声学，隔音，照明，电机工程，防火，安全措施，施工管理和现场协调。



COMPACITY

In Tianjin, mixity in the new CBD

AREP Groupe

Nicolas SAMSOEN focused on presenting the broad land-management and urban design principles on which rely AREP's strategy:
Nicolas SAMSOEN 强调介绍了 AREP 在土地管理和城市设计原则的战略重点

USE RENEWABLE ENERGY

In Beijing, in Xizhimen station, retail & offices in a compact program

In Beijing, a study on the main axis underlines the necessary reorganization of public transport

In Torino, Italy, the new station is covered with photovoltaic panels

In Besançon,

the new station is integrated in the forest

In Tolosa, the retail park is refreshed through natural ventilation

Facebook

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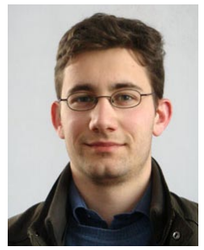

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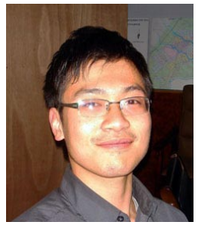

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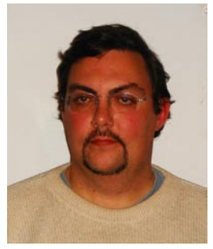

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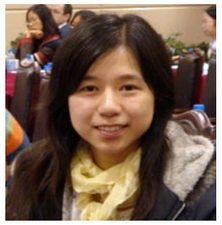

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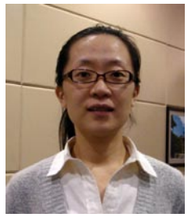

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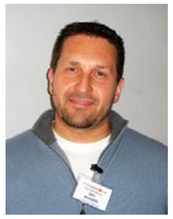

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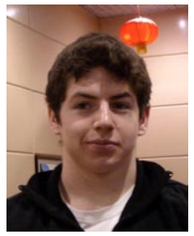

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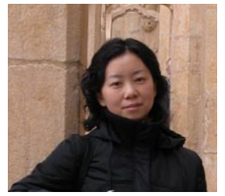

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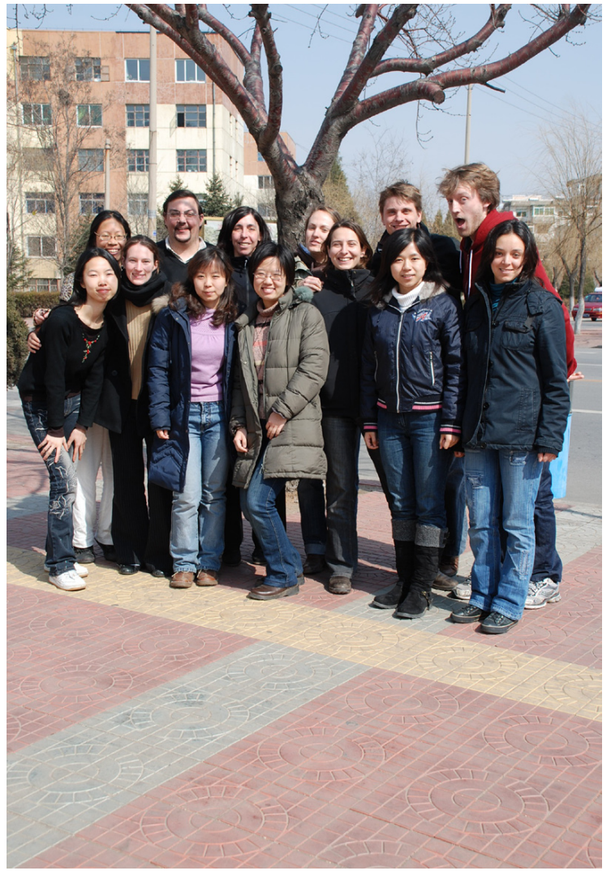


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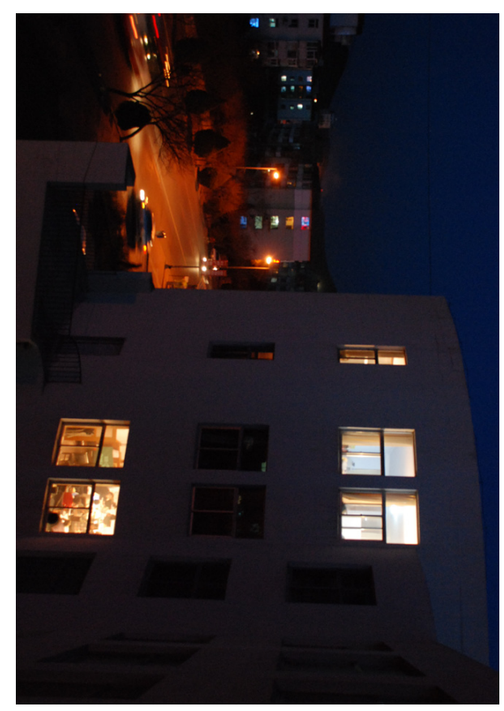






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