Thoughts on the Green Building Development Target and Roadmap

Ministry of Housing and Urban-Rural Development of the People's Republic of China

Department of Building Energy Saving and Technology

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Urgent Need for Green Building Development

Green building is essential for China's urbanization and transformation of the building industry.

1. Position of Green Building Development
2. Roadmap of Green Building Development
3. Scenarios and Target Selection of Green Building Development
4. Path Selection of Green Building Development

1. Position of Green Building Development

Thought:

Should we develop green building based on single building units, or on both single building units and regions?

1. Position of Green Building Development

The position of green building development must comply with China's actual situation and meet the requirements of scientific development and harmonious coexistence.

At present, China's urbanization development pattern is promoted by region, rather than by single building units. Regional planning of eco-cities should be consistent with the pattern of urbanization.

Only emphasizing green development in single building units misses the opportunity to develop overall green regions.

Regional development will make single building units more efficient. According to the "top-down" principle, we should promote green regional development first and then construct single unit green buildings.

1. Position of Green Building Development

A region is a complicated system and its development is influenced by different factors within it. The relationship between subsystems, such as buildings, transportation, water supply and drainage, waste disposal, sewage treatment, and the whole system are mutually reinforcing and restricting.

Principles of System Engineering

Integrity principle	**The overall effect is greater than the simple sum**
Orderly relevance principle	**The system will be better if each part is in order**
Dynamics principle	**The implementation process is dynamic**
Target optimization principle	**Systemic performance is optimal**
Feasibility principle	**The optimal plan is among the feasible plans**

The optimization of the whole system can promote single system optimization

Case：Qianhai Low-carbon Ecocity Construction

Position

Qianhai：A national seashore innovative low-carbon planning model

One target：Carbon emissions will be reduced by **30%** based on 2010 energy efficiency standards.

Three innovations for low-carbon eco-planning：

- For the first time use multi-constraint simulation tools to guide spatial planning
- For the first time put forward a per unit land carrying capacity index
- Innovatively put forward a ecological control system planning guideline methodology

Two Concepts

- Coexistence with Efficiency
- Coexistence with Nature

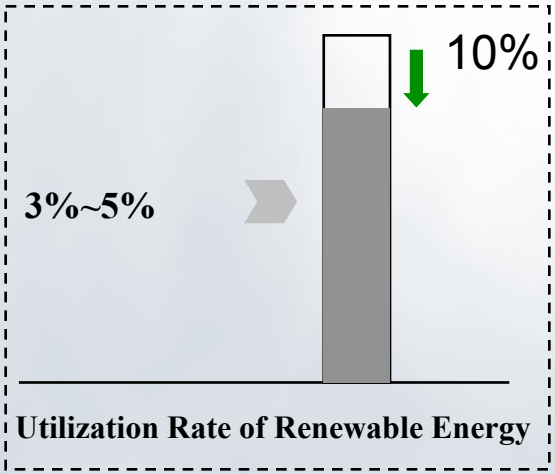
Nine Contents

- Efficient City
- Convenient City
- Energy Saving City
- Comfortable City
- Garden City
- Quiet City
- Soft City
- Cool City
- Clean City

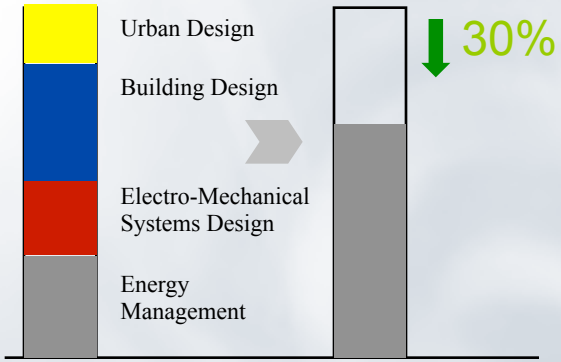



Case： Qianhai Low-carbon Ecocity Construction

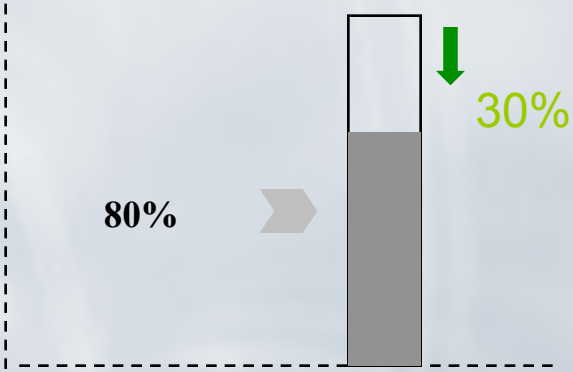
Carbon emissions will be reduced by 30% based on 2010 energy efficiency standards



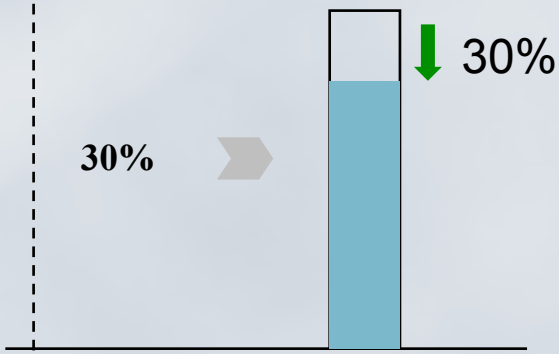
Utilization Rate of Renewable Energy



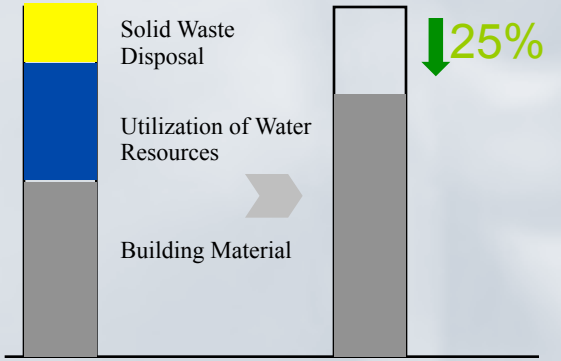
Building Energy Saving



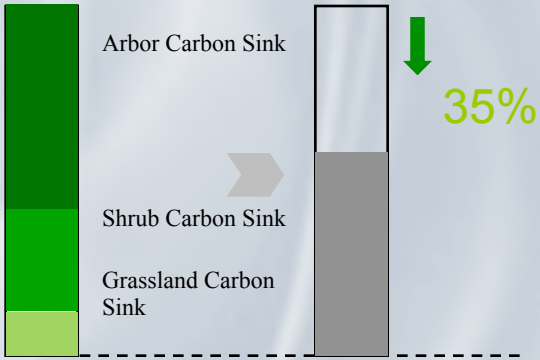
Bus Sharing Rate



Utilization Rate of Non-traditional Water sources

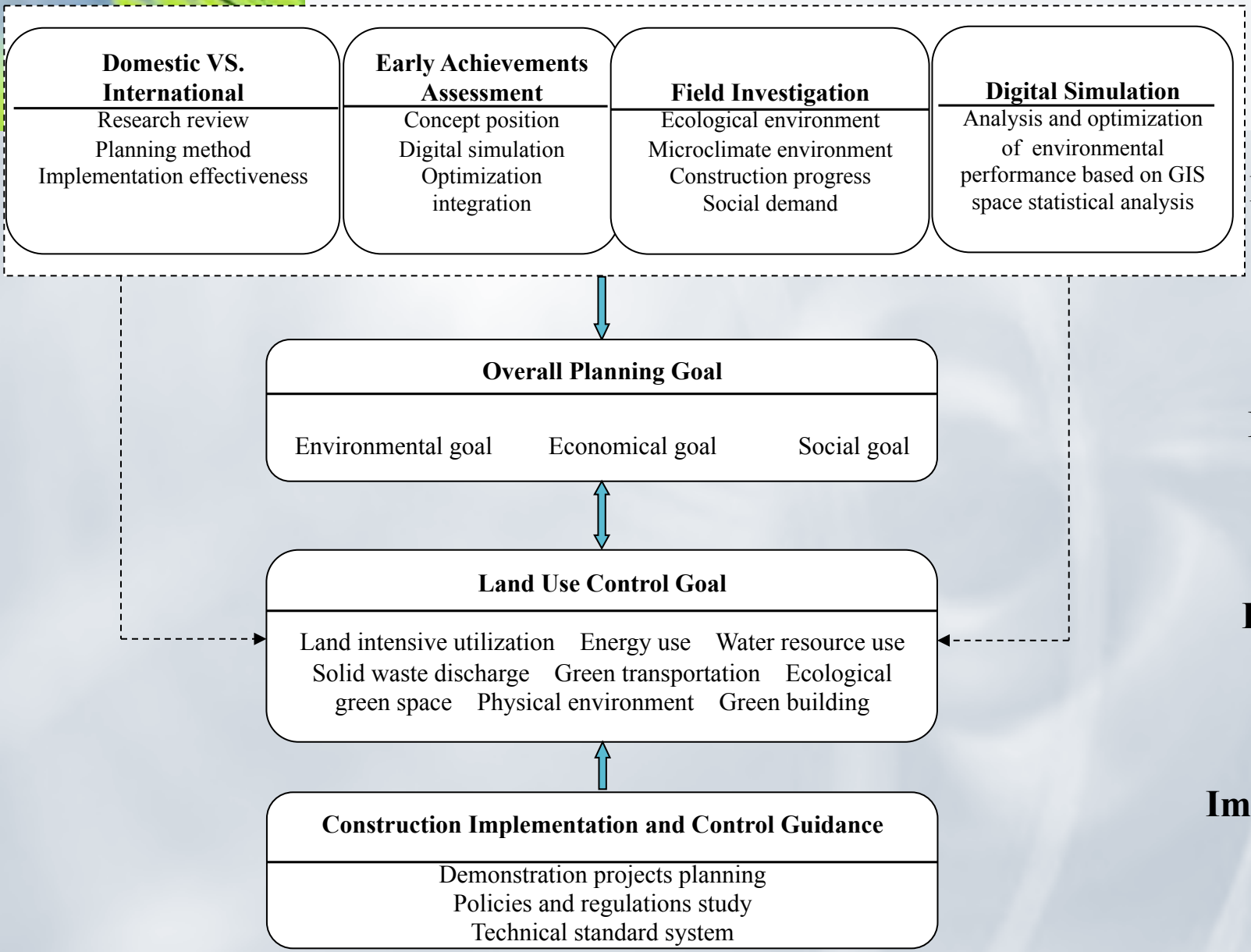


Resource Utilization



Vegetation Carbon Sequestration

Case：Qianhai Low-carbon Ecocity Construction



Case：Qianhai Low-carbon Ecocity Construction

Spatial Medium

- **Planning Principle**
- **Design Guidance**
- **Ecological Control Index**

Plan and Construction:

- The proportion of underground space development
- Compliance rate of daily waste separation facilities
- Utilization rate of renewable energy
- Utilization rate of non-traditional water sources
- The proportion of green building
- Density of road network

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- Coverage rate of non-motorized vehicles
- Coverage rate of community facilities
- Accessibility of public green space

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Block-level

- Underground space control index
- Green capacity rate
- Green roof area rate

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Land Parcel level

Non-spatial Medium

Statistics

Environmental Protection

System-level

- **Ecological Services**
- **Planning Strategies**
- **Technology roadmap**

Supplement of Index System

Case：Qianhai Low-carbon Ecocity Construction

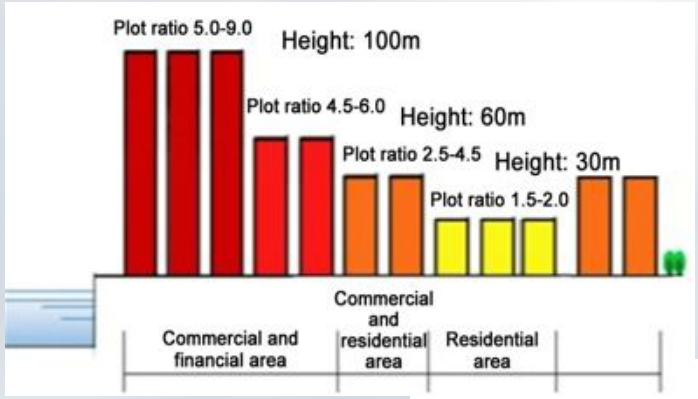
1. Intensive Land Utilization

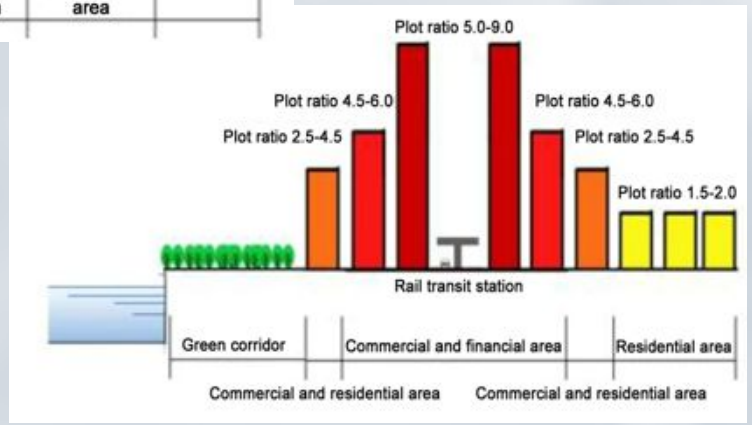
- **Land Development**

►Control building height down to the seaside based on comprehensive volume rate index

►Reserve green belt along the coast to protect ecological sensitivity of land and create coastal landscape

►Determine altitude of outside buildings and development intensity according to the distance between the rail stations transportation stations

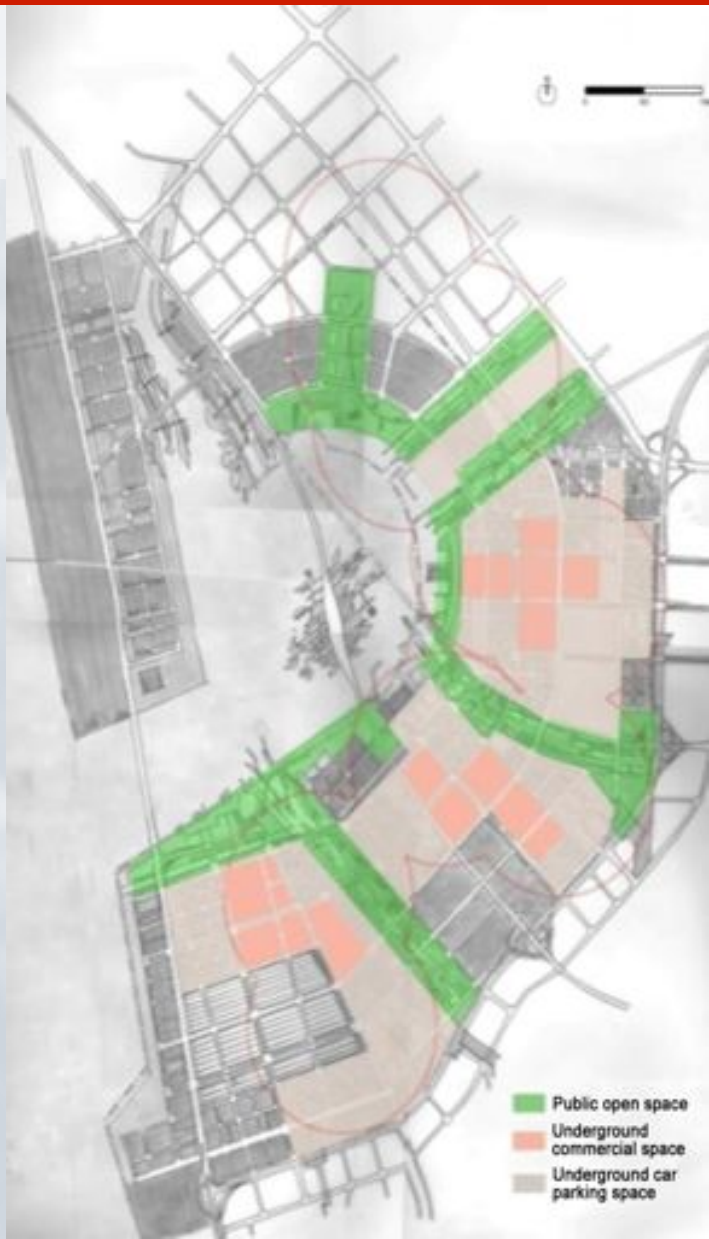




Case：Qianhai Low-carbon Ecocity Construction

1. Intensive Land Use

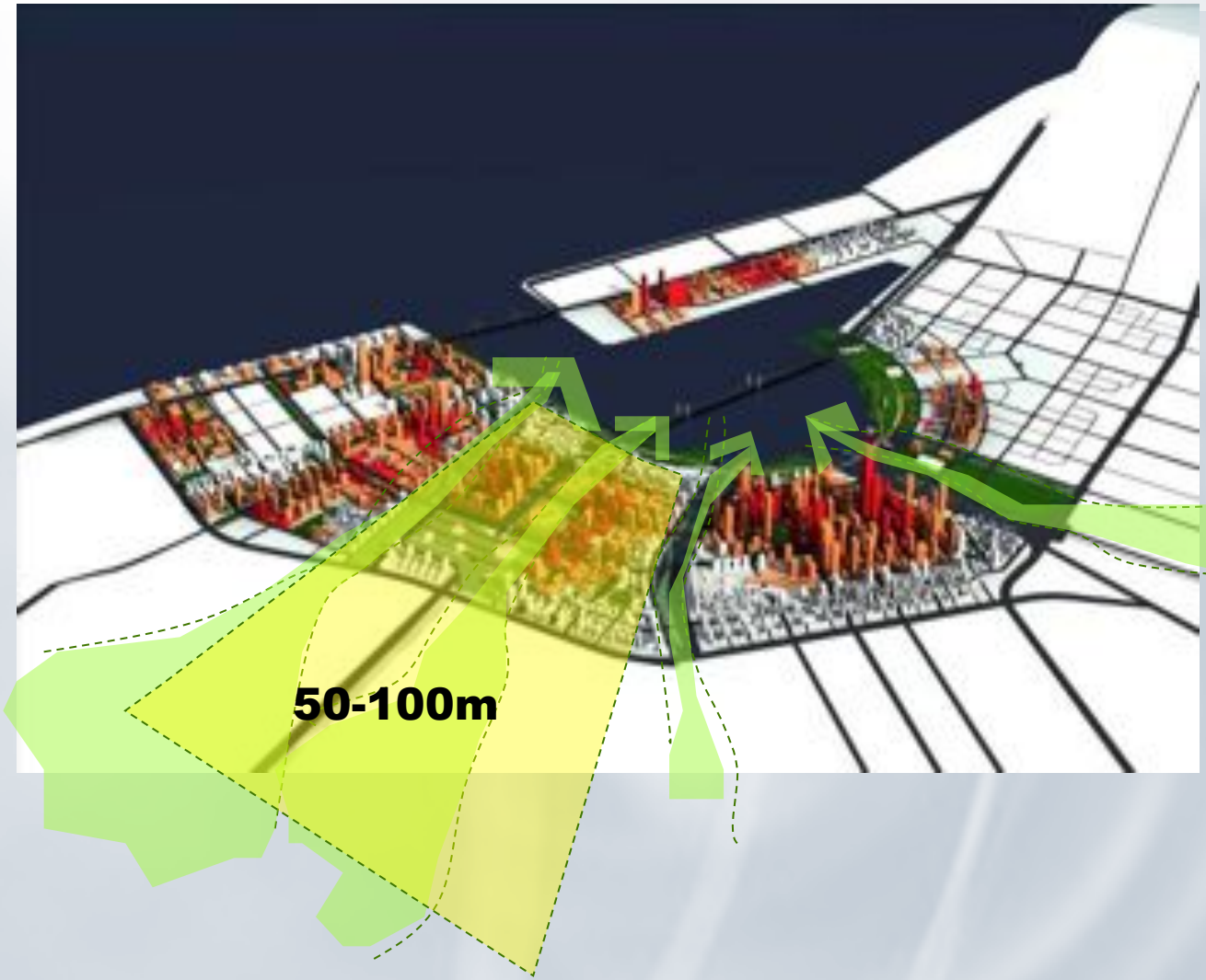
- **Underground space development**
  - ►The main way to save land resources in the central business center. **The underground space development proportion index is used** to control underground space development.
  - ►Develop and use underground space around **railway stations, large public buildings, squares and major public green space** to beautify the environment, improve transportation and save land.
  - ►Improve the **regional business and transportation systems** within **underground spaces** to enhance the vitality of urban public nodes and services, while also enabling intensive use of land.



Case：Qianhai
Low-carbon Ecocity Construction

2. Develop Land via TOD Mode

- Develop land via TOD (Transit-Oriented Development)
- Building height and density of transport nodes are significantly increased and the intensity decreased from the site to surrounding areas
- Consider the influence of the ventilation corridor
- Sight：Mountain and sea views not blocked by buildings
- Building height in integrated development regions is affected (most buildings between 50-100 meters. Other regions' building height is only constrained by the airport space.



Case：Qianhai Low-carbon Ecocity Construction

3. Large-Scale Application of Renewable Energy

- ▶Residential solar-thermal large scale application
- ▶Regional central cooling application
- ▶Regional polluted water source heat pump application
- ▶Regional sea water source heat pump application

Conduct renewable energy pilot demonstration projects according to local conditions:

- **Use centralized cooling technologies in high-density and high development intensity regions;**
- **Set up sewage-source heat pump integrated with the sewage treatment plant;**
- **Develop seawater source heat pump projects after treatment of marine environment**

Control Index

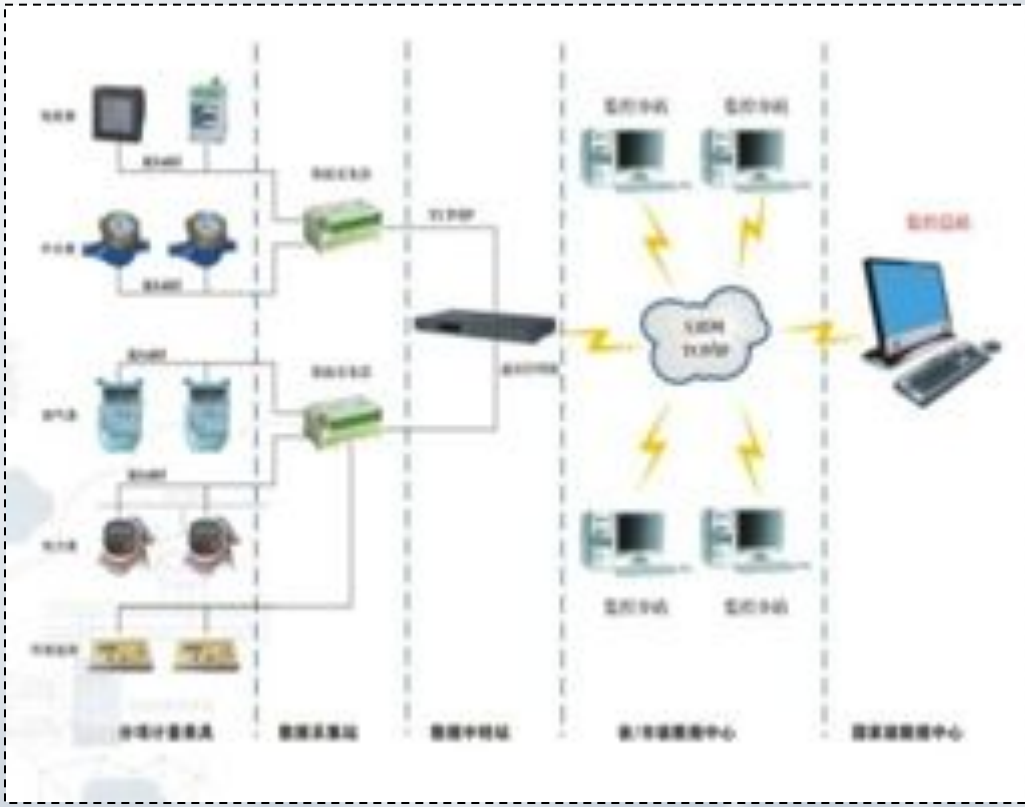
- Index of land energy consumption per unit
- Utilization rate of renewable energy
- Coverage rate of energy consumption monitoring

Distribution of solar and photoelectric resources in Qianhai

Case：Qianhai Low-carbon Ecocity Construction

4. Innovative Energy Management

- Establish **on-line monitoring system** for renewable energy and conventional energy supply
- Establish **subsidy system** for renewable energy production and **energy consumption cap system**
- Determine energy consumption cap per unit of land area and per unit of building area

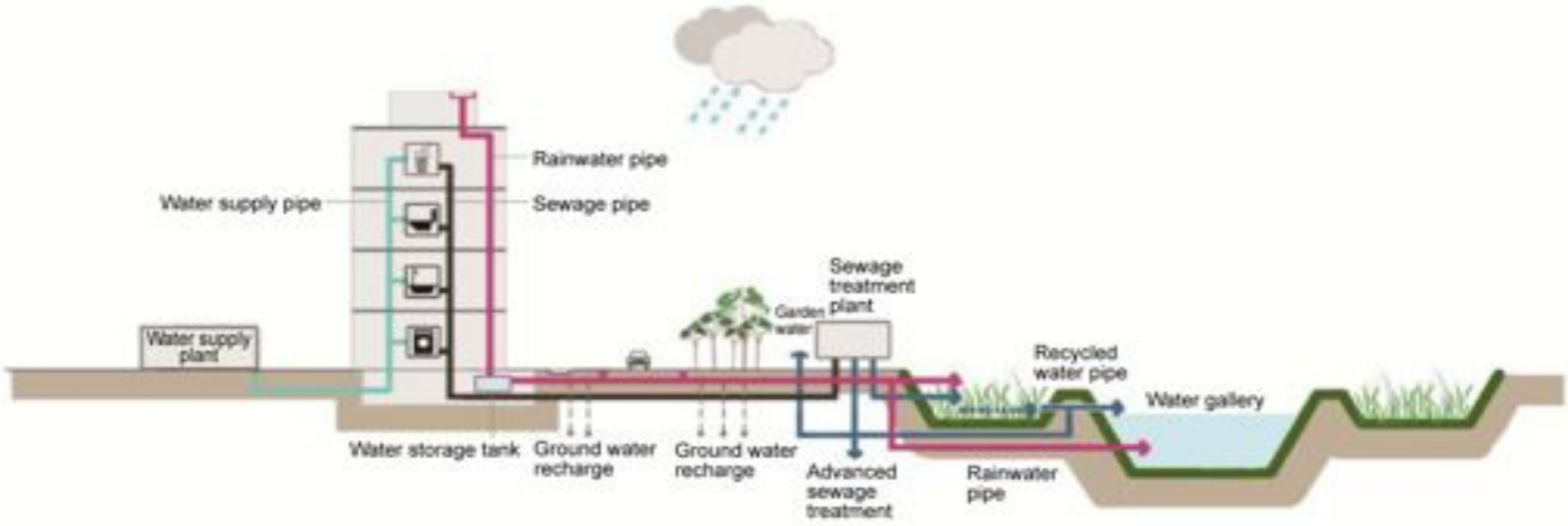


On-line monitoring system

Case：Qianhai Low-carbon Ecocity Construction

5. Scientific Utilization of Water Resources

- Low-impact development model is used to protect existing water bodies, wetlands and control field comprehensive runoff coefficient
- Establish water drains with the original wetlands as well as treated waste water as the main recycled water recharge in non-rainy season. Bio-purifying treatment of water drains can further produce reclaimed water
- Formulate water consumption cap per land unit through the non-traditional water resource use index

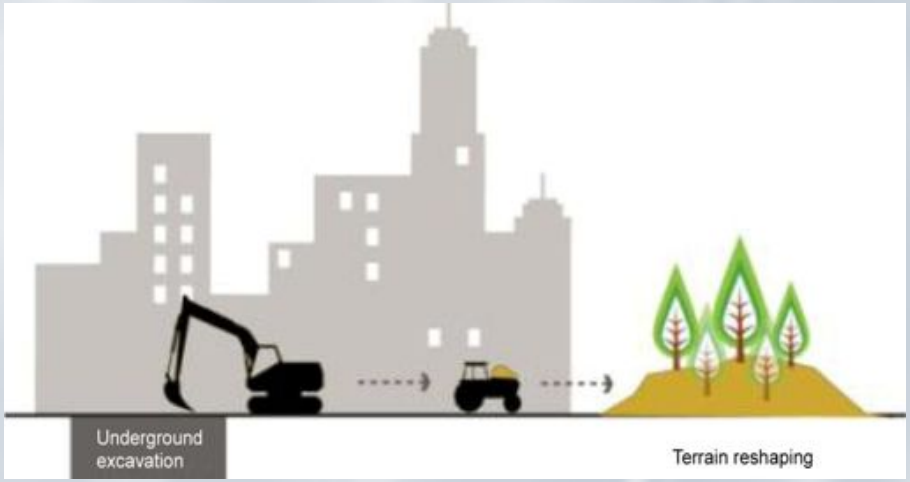


Case：Qianhai Low-carbon Ecocity Construction

6. The Utilization of Solid Waste

- According to the principles of unified planning, centralized discharge, integrated utilization and harmless treatment, promote recycling, and build eco-cities with reduced, recycled and harmless solid waste

Automatic solid collection system



Balanced earthwork

Case： Qianhai Low-carbon Ecocity Construction

7. Green Transportation

- Construct rail transportation, clean energy public transit and high-density homogeneous network to encourage green travel. Public transportation with open space and service facilities can be accessed by walking. Achieve 100% coverage rate of public transportation stations and 80% of public transport share rate within 500 meters.

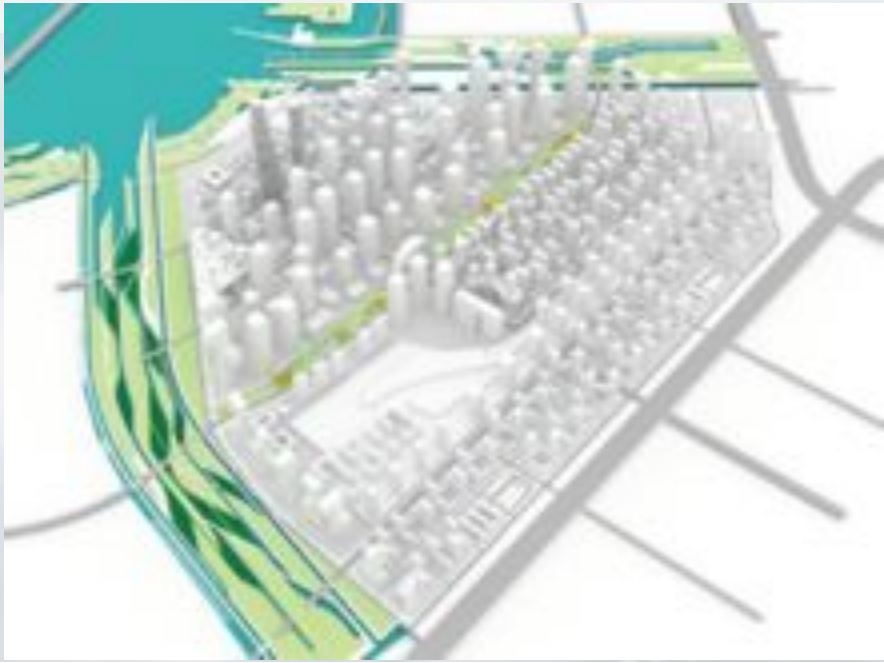
Control Index

- Bus sharing rate
- Coverage rate of public transit stations
- Coverage rate of slow system

Case：Qianhai Low-carbon Ecocity Construction

8. 100% Green Building

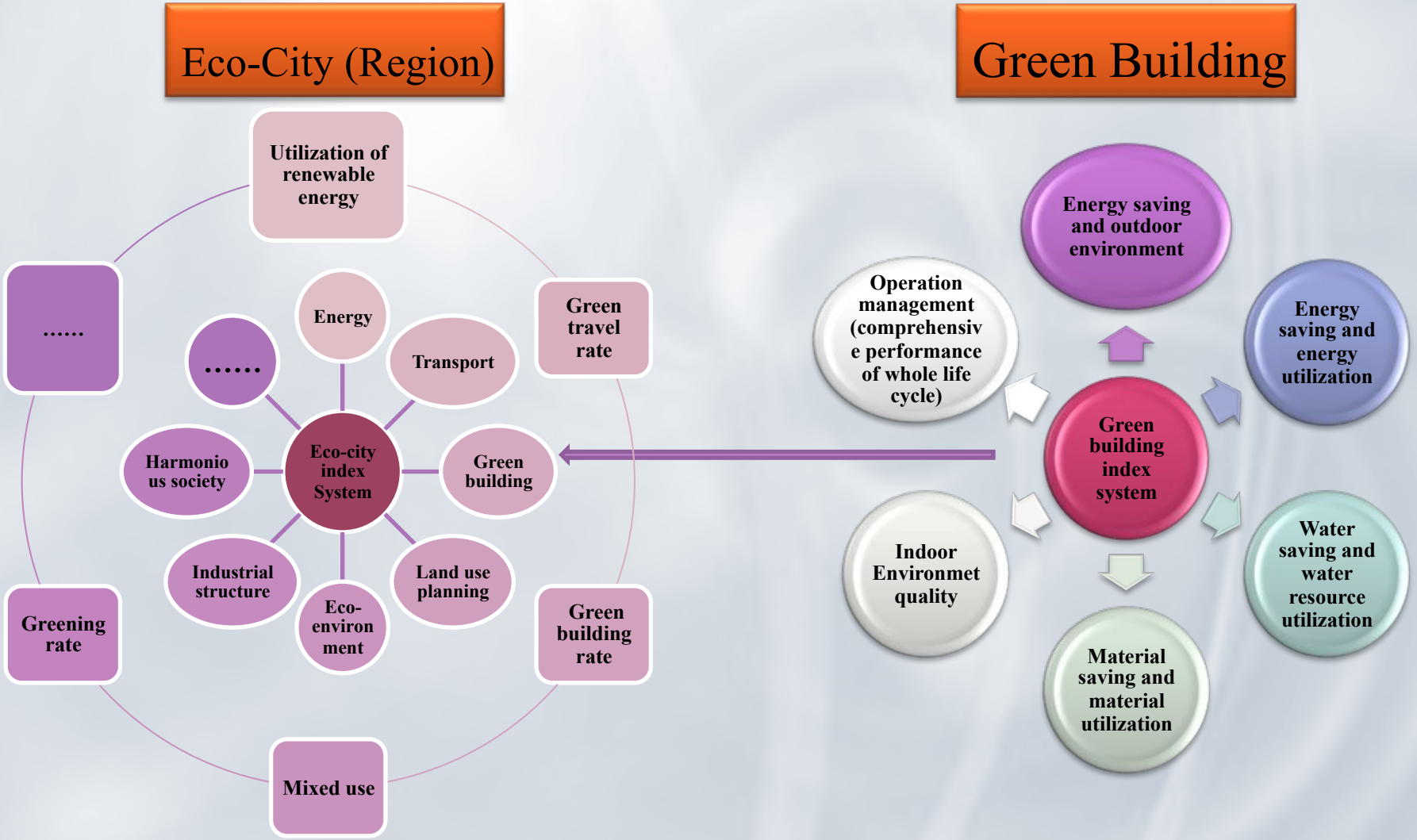
- Achieve 100% coverage rate of green building
- Landmark green buildings are set in each space district as eye-catching highlight of Qianhai coastal skyline.



Spatial simulation of the core district

2. Roadmap of Green Building Development

The Qianhai case shows that green buildings' large-scale development must start with regional green planning to create a reasonable targets and index system and guide the harmonious development of land, energy, infrastructure, buildings, environment and society.



深圳市绿色保障性住房

《深圳市保障性住房建设标准（试行）》

基本规定

- 保障房整体性能应达到《深圳市绿色建筑评价规范》SZJG 30的**铜级**要求**或**国家标准《绿色建筑评价标准》GB/T 50378的**一星级**要求
- 保障性住房宜推行**工业化**建造模式，选择产业化的住宅部品件
- 保障性住房应按照本标准附录B规定的保障性住房装修标准**一次装修**到位
- 保障性住房建设选用的水、电、气、通风与空调等部品、器件和产品，应优先采用本地和**高性能**的产品。

深圳市绿色保障性住房

《深圳市保障性住房建设标准（试行）》

建设指标

指标项	指标值
容积率	≥3.0
绿地率	≥30%,（旧城改造和零散用地≥25%）
可再生能源利用率	≥5%
非传统水源利用率	≥5%
节能灯具安装率	100%
工业化产品总量占比	≥25%
绿色再生建材产品利用率	≥50%
建筑废弃物回收率	≥30%
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深圳市绿色保障性住房

《深圳市保障性住房建设标准（试行）》

总图

- 建筑物的主立面与夏季主导风向宜成40°～65°夹角
- 人行道树或具有遮阳设施的遮荫面积应覆盖人行道50%的面积

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户型

- 保障性住房层高不应超过2.8米
- 除安居性商品房外，其余保障性住房单套建筑面积应控制在65平米以内
- 新建保障性住房标准户型的选用率不应少于80%

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一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

《深圳市保障性住房建设标准（试行）》

设施

- 休闲广场应保证30％以上广场面积有遮荫
- 景观补水、绿化浇洒、道路冲洗及公共建筑的卫生间冲厕等应利用再生水、雨水等**非传统水源**，不得使用生活饮用水
- 保障性住房应考虑**雨水的利用**，雨水利用的方式可采用雨水入渗系统、收集回用系统、调蓄排放系统之一或组合系统
- 卫生器具、水嘴、淋浴器等应符合《节水型生活用水器具》CJ164的要求，坐式大便器应采用设有大小便**分档**冲洗水箱，不得使用一次冲洗水量大于**6L**的坐便器
- 保障性住房热水系统的热源，应优先选用**太阳能等可再生能源**

深圳市绿色保障性住房

《深圳市保障性住房建设标准（试行）》

建造

- 新建、扩建保障性住房的结构设计使用年限不低于**50年**
- 保障性住房建设应编制绿色施工组织方案，方案应采用绿色施工技术与手段
- 保障性住房应采用成熟的工业化产品
- 碎石、土石方类建筑废弃物，可采用地基填埋、铺路等方式提高再利用率，再利用率宜大于等于**50%**
- 保障性住房装修造价不应超过当年度深圳市发布的不同类型保障性住房装修标准

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一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

2、建设目标

标准（试行）》中要求：

（1）绿色建筑等级

- 约10%建筑面积应达到铂金级标准
- 其余建筑面积达铜级和国家一星标准

满足 → 整体性能达到《绿色建筑评价标准》的一星级

（2）住宅产业化

- 住宅全部为精装修交楼
- 采用工业化预制装配式结构体系
- 降低施工污染和建筑施工能耗
- 减少水、木材消耗，减少建筑垃圾

满足 → 保障性住房宜推行工业化建造模式，选择产业化的住宅部品件

一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

《[illegible]标准（试行）》中要求：

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一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

（3）可再生能源应用

- 太阳能应用
- 雨水、中水回收利用
- 种植屋面

（4）建筑废弃物再生建材应用

- 路基、管井、管沟、围墙、园建铺贴、路面等工程部位使用建筑废弃物再生建材产品

《[illegible]标准（试行）》中要求：

满足 →

（1）保障性住房热水系统的热源，应优先选用太阳能等可再生能源

（2）保障性住房应考虑雨水的利用

满足 →

碎石、土石方类建筑废弃物，可采用地基填埋、铺路等方式提高再利用率，再利用率宜大于等于50%

一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

3、建设模式——代建总承包模式

（1）建设模式特征：由代建总承包单位履行建设单位职能，承担建设单位法定责任，并负责项目总承包，对项目总投资承担责任

（2）发包人角色：项目业主

（3）承包人角色：建设单位、项目总承包单位

（4）监理、设计、施工总承包单位选择：代建单位

（5）合同总价款与投资风险承担：代建管理费、勘察、 设计、施工总承包等工程投资总费用；承包人承担投资风险

（6）投标人资格：大型专业房地产开发企业

一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

3、建设模式——代建总承包模式

（7）后续招标内容：无后续招标内容

（8）需发包人审批的设计变更：涉及初步设计的修改，涉及规模、功能、标准的主要变更

（9）对承包人的激励机制：强

（10）招标方式：公开招标，资格预审

（11）付款方式：按节点工期支付进度

（12）合同履行过程中的审批程序：社会工程的审批程序

（13）政府对市场活动的参与度和责任承担：小

一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

3、建设模式——代建总承包模式

序号	对比内容	代建总承包模式	典型企业代建制模式	BT模式
1	建设模式特征	代建总承包单位履行建设单位职能，承担建设单位法定责任，并负责项目总承包，对项目总投资承担责任	代建单位提供项目管理服务，履行建设单位职能，承担建设单位法定责任，收取代建管理费，对工程总投资不承担责任	承包人(BT承办人)履行项目投融资、设计—施工总承包职责，对工程总投资承担责任，不承担建设单位责任
2	发包人角色	项目业主	项目业主	建设单位+项目业主
3	承包人角色	建设单位、项目总承包单位	建设单位	投融资、设计—施工总承包单位
4	监理、设计、施工总承包单位选择	代建单位	代建单位	BT发起人（建设单位）
5	合同总价款与投资风险承担	代建管理费、勘察、设计、施工总承包等工程投资总费用； 承包人承担投资风险	代建管理费（按总投资的固定费率1%-3%计取+或投资节约激励费用）； 发包人承担投资风险	项目投融资、设计—施工总承包的费用（含4%的风险包干费和按事定价的部分建设管理费）； 承包人承担投资风险

一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

序号	对比内容	代建总承包模式	典型企业代建制模式	BT模式
6	投标人资格	大型专业房地产开发企业（对拟承接勘察、设计、施工、监理任务的企业有最低资质要求）	有项目管理能力的设计、咨询、监理、施工、工程造价、项目管理、房地产开发企业等其他企业	有投融资能力，并具备的设计、施工资质的企业
7	后续招标内容	无后续招标	勘察、设计、施工、监理、货物、服务等均需由代建单位另行招标	非BT合同范围内的监理、货物、服务等由BT发起人另行招标
8	需发包人审批的设计变更	涉及初步设计的修改，涉及规模、功能、标准的主要变更	全部设计变更	涉及初步设计的修改，涉及规模、功能、标准的主要变更
9	对承包人的激励机制	强	弱	强
10	招标方式	公开招标，资格预审	招标或委托	邀请招标
11	付款方式	按节点工期支付进度款	按月支付进度款	工程竣工后分期支付回购款
12	合同履行过程中的审批程序	社会工程的审批程序（除初步设计和概算审批外）	社会工程的审批程序	政府投资项目的审批程序
13	政府对市场活动的参与度和责任承担	小	小	大

一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

4、建设概况

- **项目性质：**住宅产业化示范项目
- **用地面积：**50134.3㎡
- **容　积　率：**3.5
- **建筑面积：**21.5万㎡
- **建筑栋数：**6栋
- **建筑层数：**28层
- **建筑特点：**每栋几乎完全相同，单栋呈U形状，全部由35、50、70平米小户型组成

项目具体进展情况

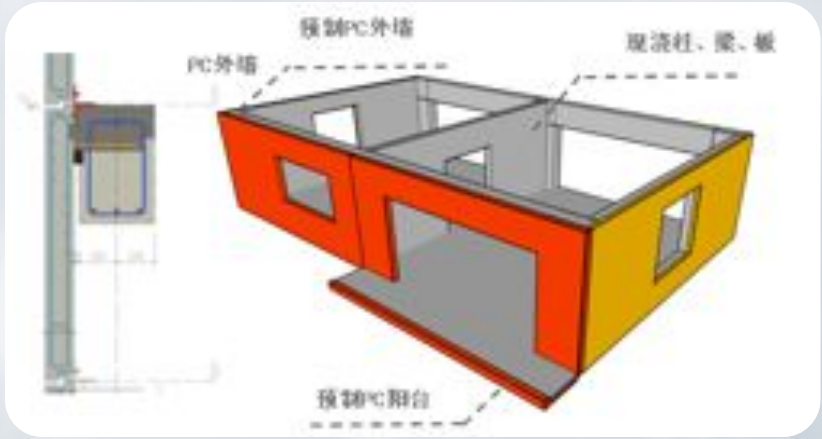
一星级绿色建筑（住宅）

深圳市龙华扩展区0008地块保障性住房项目

- **5、住宅产业化介绍**

工业化预制装配式工业化体系

按统一模数预制外墙、楼梯、阳台 → 现场吊装



与传统施工方式相比优势：

- 能源利用效率
- 建筑隔声效果
- 建筑保温性能
- 建筑防火性能
- 建筑外观品质
- 安全文明施工

升

- 建筑垃圾的产生
- 建筑污水的排放
- 建筑噪音的干扰
- 有害气体的排放
- 建筑粉尘的产生
- 建筑施工的工期

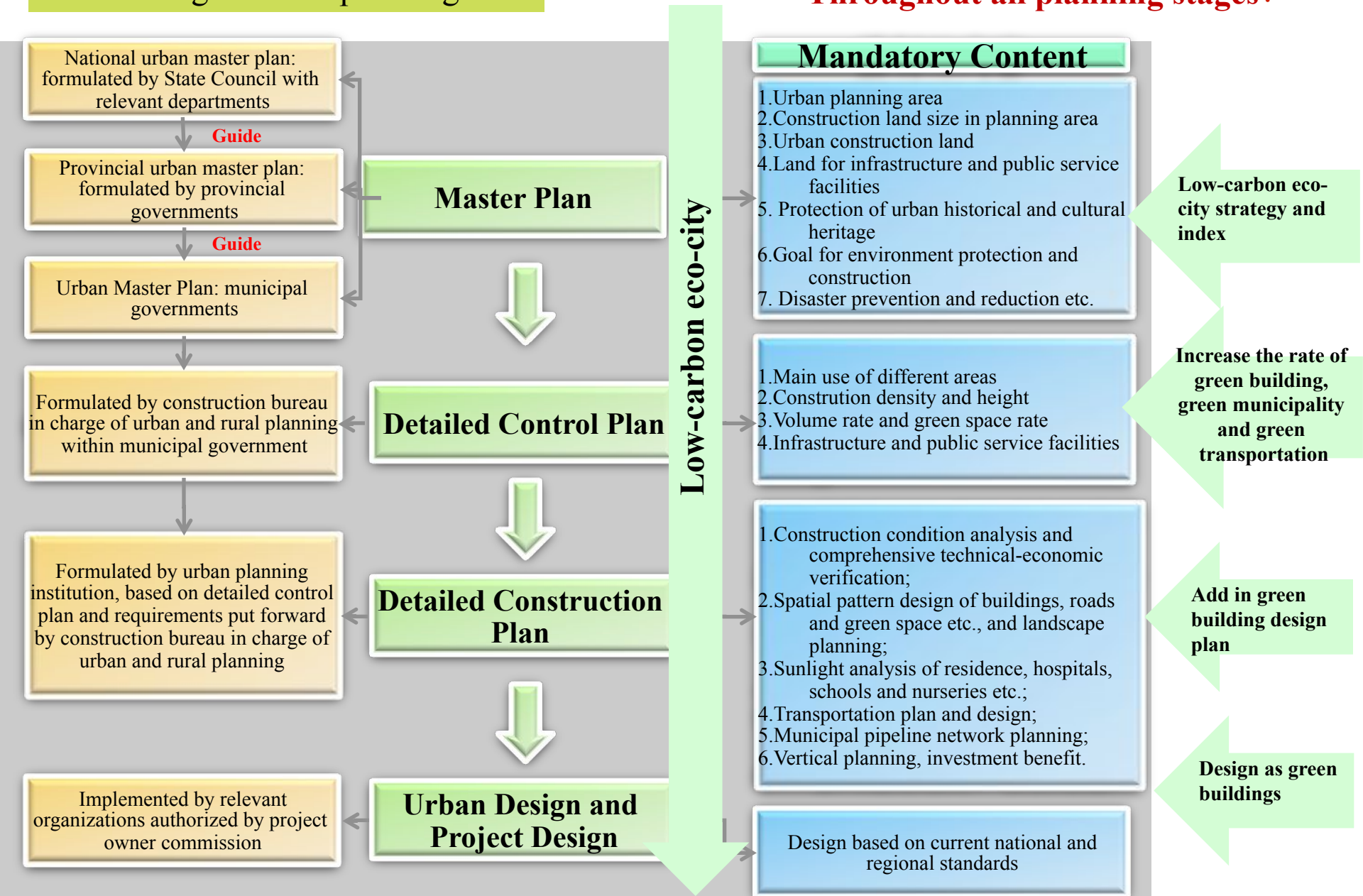
降

2. Roadmap of Green Building Development

1. Greening of the urban master plan
2. Greening of the urban infrastructure
3. Greening of the single building

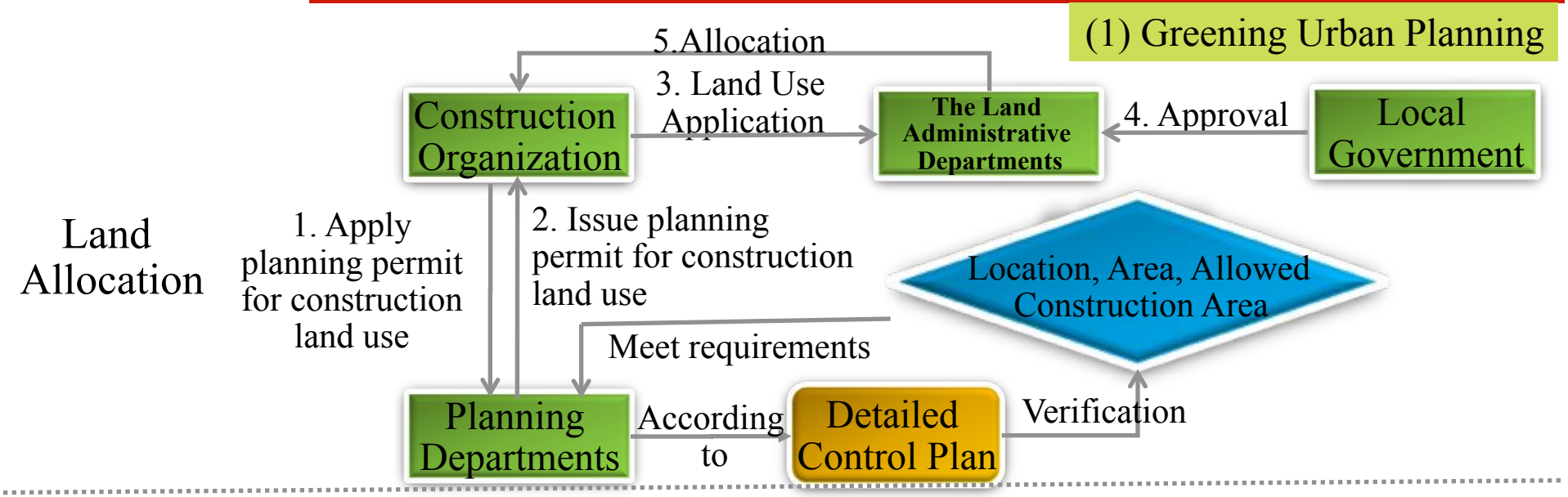
2. Roadmap of Green Building Development: Planning Pilot

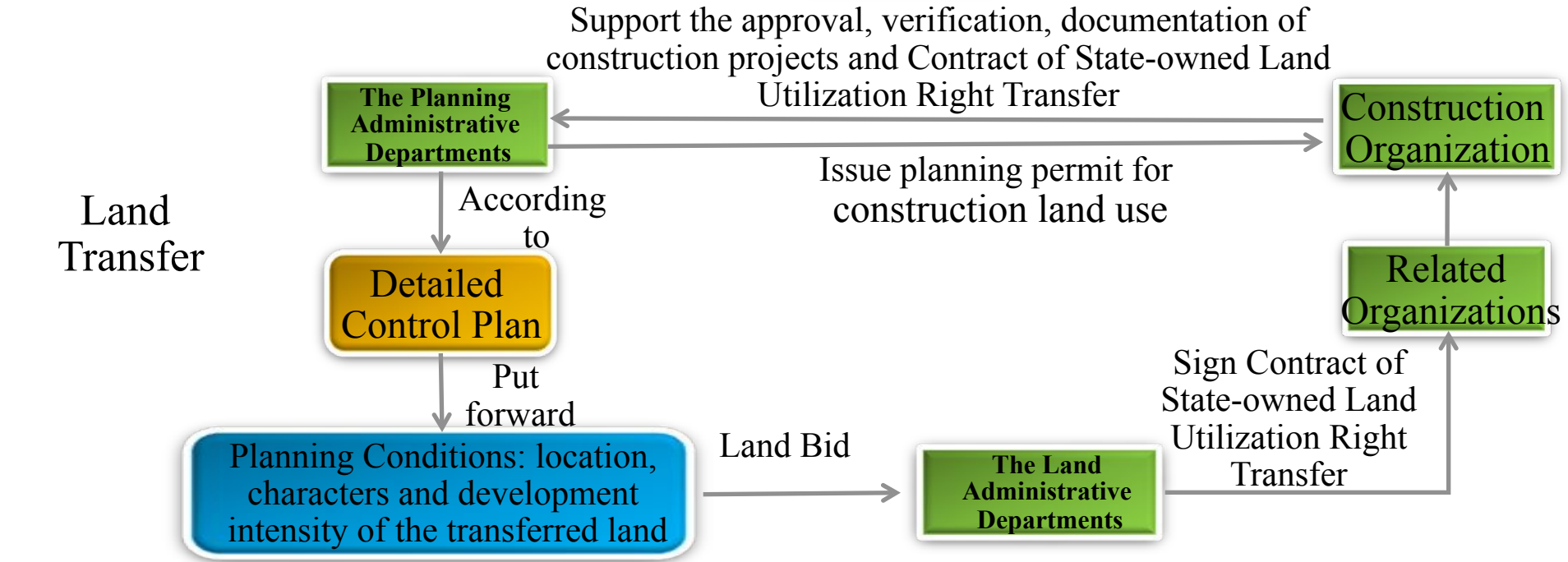
1. Greening of urban planning



2. Roadmap of Green Building Development: Scientific Land Transfer

(1) Greening Urban Planning





2. Roadmap of Green Building Development

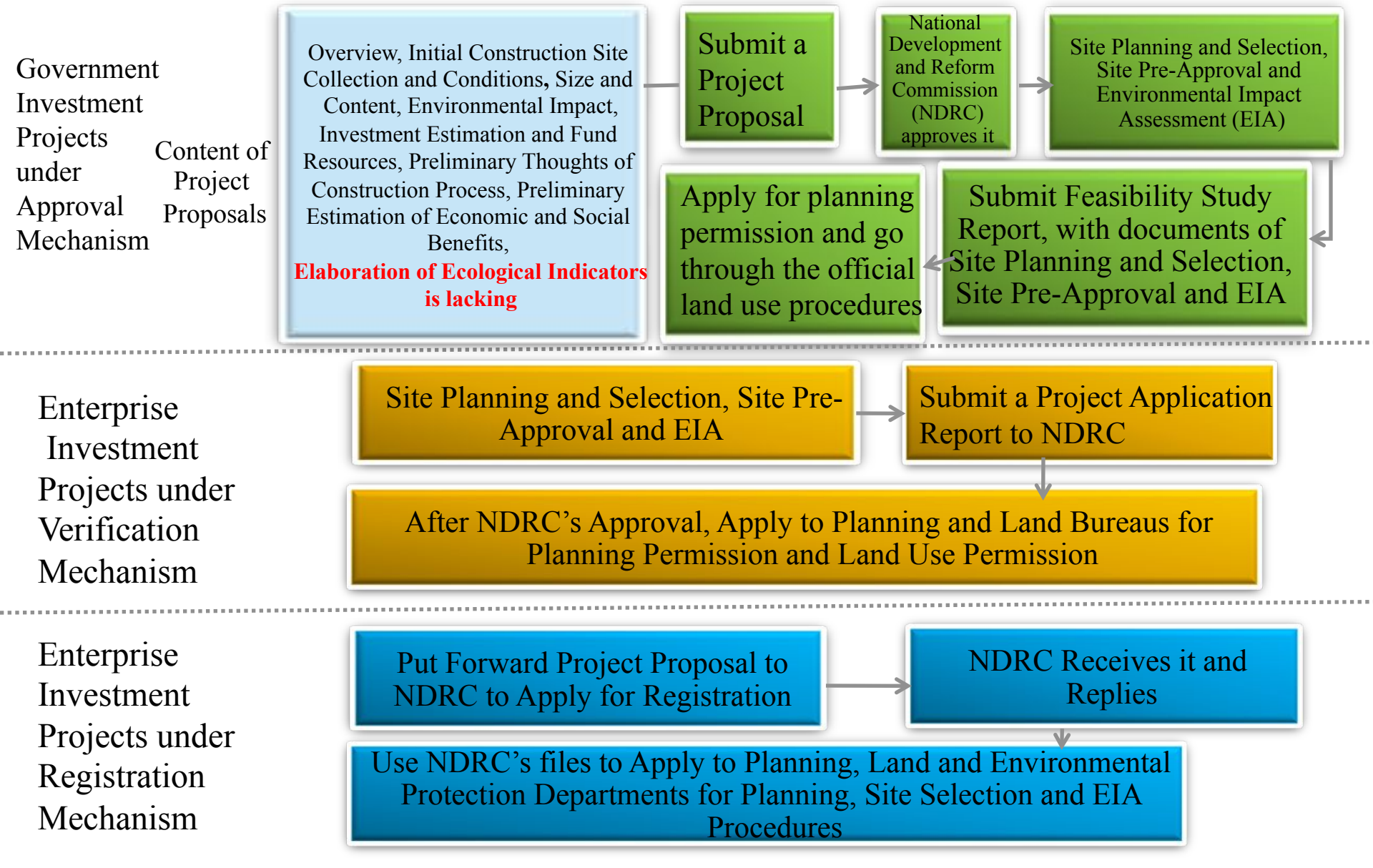
(2) Greening of Urban infrastructure

Establish scientific planning index system：

Category	Index	Sino-Singapore Tianjin Eco-City	Sin-SwdenWuxi Eco-City	Wuhan green CBD Demonstration Area	Average City
Green building	Rate of green building	100%	100%	70%	no requirement
Energy sustainable utilization	Rate of sustainable energy utilization	≥20%	≥8%	2%	no requirement
Infrastructure	Coverage rate of municipal pipeline network	100%	100%	—	70%
Water resource sustainable utilization	Utilization rate of non-traditional water resource	≥50%	50%	5%	no requirement
	Per capital water use quota (Liter / person · day)	≤120	—	≤200	no requirement
	urban sewage treatment rate	—	100%	100%	100%
Material resource sustainable use and solid disposal	Household solid waste separation and collection rate	—	100%	100%	no requirement
	Garbage recycling and utilization Rate	≥60%	≥95%	—	no requirement
	Fine decoration rate	—	100%	40%	no requirement
Livable Environment	Per capita public green area (m2 / person)	≥12	—	—	6/7/8
	Green space rate	—	—	≥38%	35
	Native plant index	≥0.7	≥0.8	—	
	Compliance rate of surface water quality	IV	—	IV	—
Green transportation	Green travel rate	≥30%	≥80%	55%	no requirement
Green construction	green construction rate	100%	—	100%	no requirement

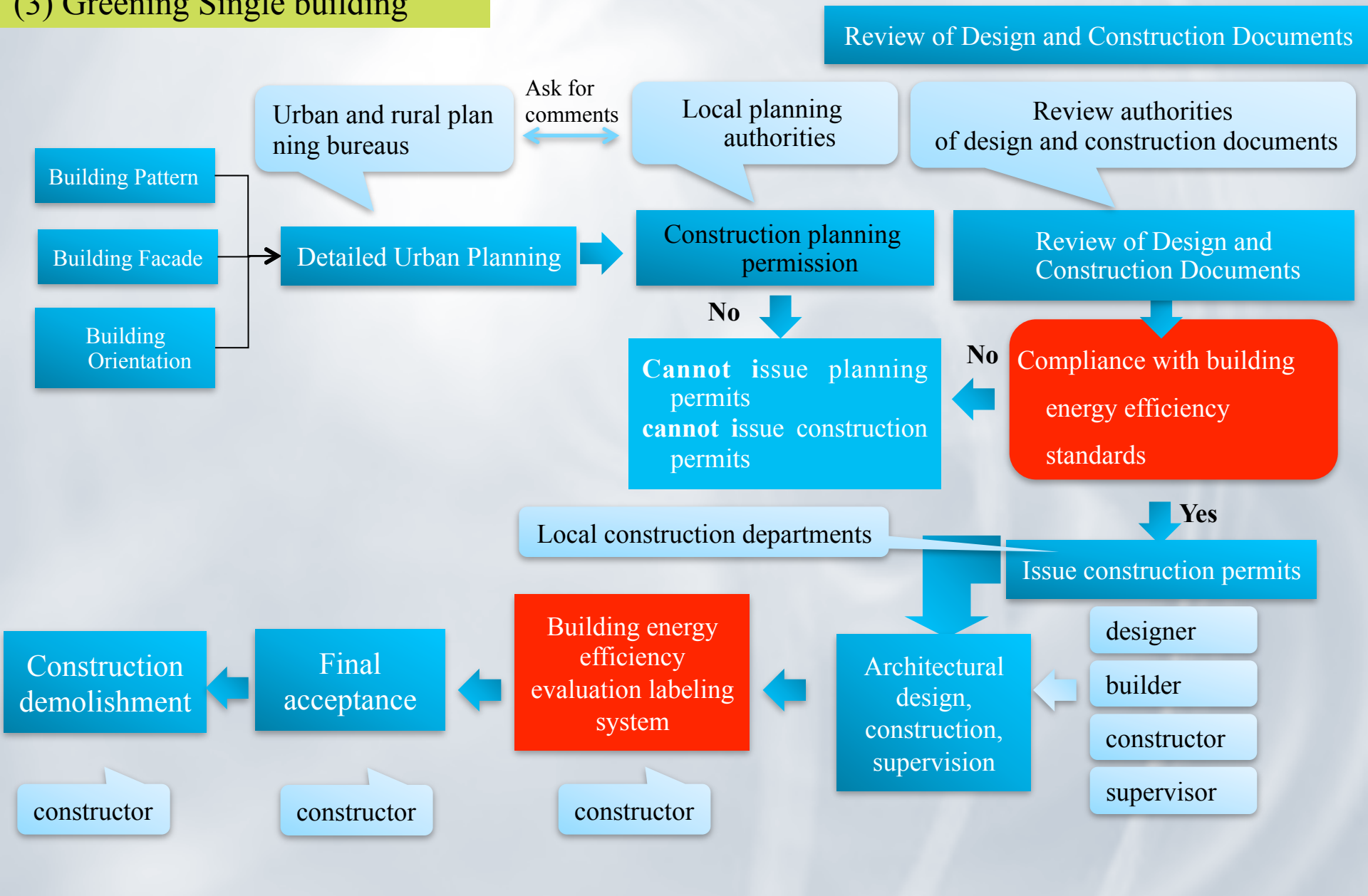
2. Roadmap of Green Building Development Path: Approval Process of Green Projects

(3) Greening single building

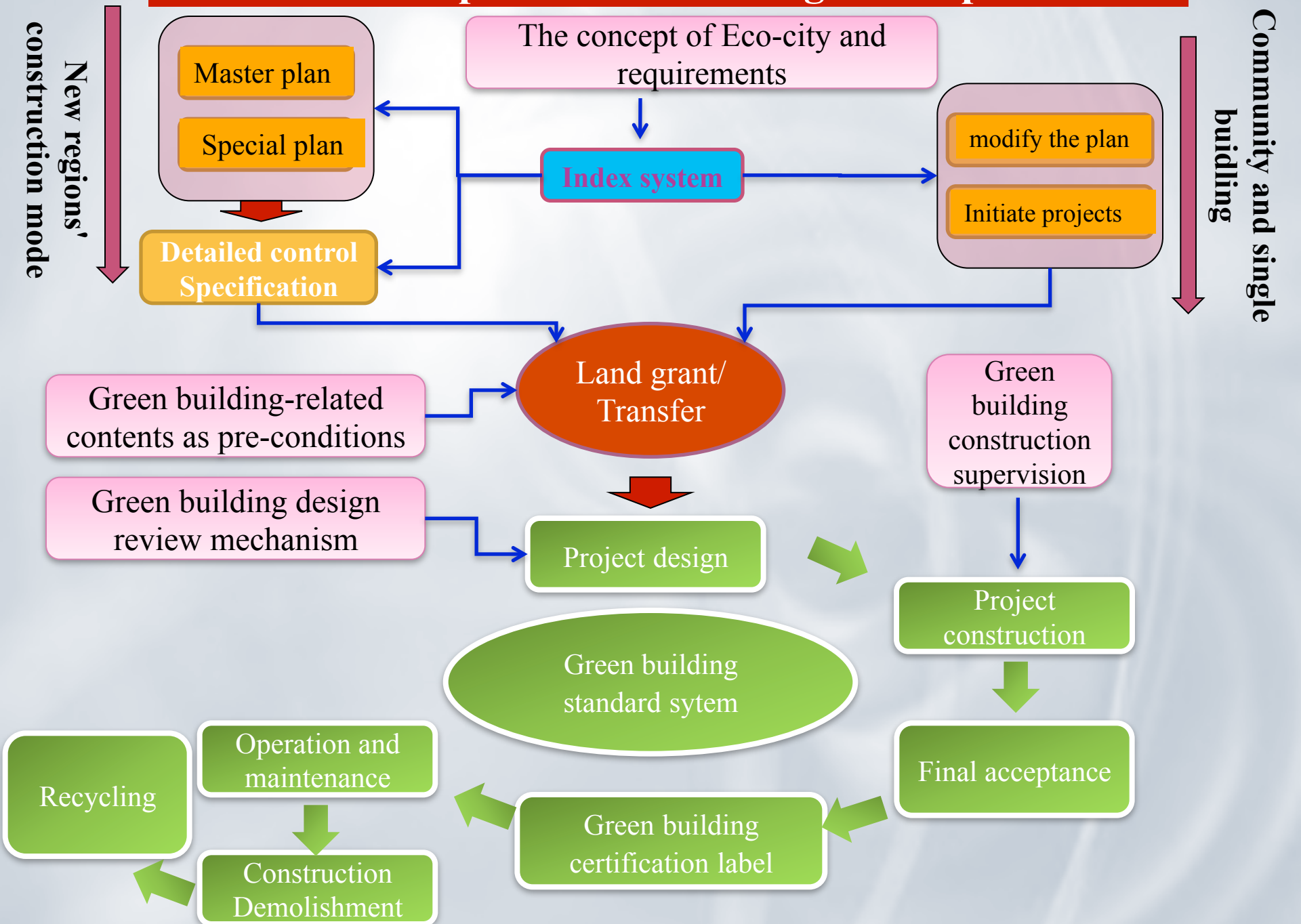


2. Roadmap of Green Building Development： Green Project Implementation

(3) Greening Single building



2. Roadmap of Green Building Development



Case： Sino-Singapore Tianjin Eco-city

Relavant requirements for green buildings and eco-cities

Index system → Master planning → detailed control Specification

Specific green building index

Land grant and transfer

Project design

Project Implementation

Final acceptance

Green buidling evaluation

Construction principles:

- Insist on principle of ecology priority, and build safe and healthy natural ecosystems
- Insist on principle of resource conservation, and establish a resource intensive sustainable utilization system
- Insist on people-oriented principle, and build livable and friendly living environment system
- Insist on approach shifting principle, and build circulated and efficient supporting system to optimize industrial structure
- Insist on the advanced direction, and build a harmonious ecological civilization
- Insist on reform and innovation, and build an open and fair operating management system

Case：Taihu New Town in Wuxi

Ecological Strategy → **Index System**

- Resource recycling strategy
- Eco-construction strategy
- Low-carbon economy strategy
- Green transportation Strategy

Characteristics

Coordinated by organizations and promoted by legislation

Technologies integrated according to local conditions

one-star labeling for all buildings; government invests in public buildings to encourage higher level performance.

3. Scenarios and Target Selection of Green Building Development

Natural conditions vary across the country, and economic and social development is imbalanced, so it is difficult to unify the development strategy. At different stages, different strategies are encouraged to promote green building's scientific development.

Low- scenario

Voluntary and encouraging development mode

- **Maintain current green building codes, standards and other incentive policies unchanged. Promote the development of green buildings through the voluntary labeling system; the number of green buildings is expected increase by 100 per year.**
- **Can not scale up the promotion of green building**

Midddle scenario

Voluntary and mandatory development mode

- **The first phase of 2011-2013 to adopt the voluntary plus mandatory method to promote the popularization of green building.**
- **The second phase of 2014-2015 to adopt the mandatory plus voluntary method**
- **The third stage of 2016-2020 to promote two-star and above green buildings, improving green building's performance.**
- **Positively promotes the development of green buildings**

High- scenario

Mandatory development Mode

- **Since 2011, new buildings compliance with green building one-star standard is mandatory, and qualified regions are encouraged to implement green building two-star or three-star standards.**
- **Not suitable for China's current situation**

3. Scenarios and Target Selection of Green Building Development

- **Middle scenario projected targets**

12th FYP	Voluntary + Mandatory	Popularize green buildings
13th FYP	Mandatory + Voluntary	Make green building achieve high level performance

3. Scenarios and Target Selection of Green Building Development

●Middle scenario Projected Targets

By 2015

- The area of newly built green buildings is 2.4 billion square meters
- Build a number of eco-cities(regions) and green farm houses

By 2020

- All newly built buildings must comply with green building standards
- New regions should be constructed and planned based on low-carbon eco-city requirements.

3. Scenarios and Target Selection of Green Building Development

- **Middle scenario projected targets in12th FYP**

Form five major systems that are beneficial to green building development:

- Policy and regulations system
- Technology and standard system
- Industry and products system
- Capacity building system
- Application model system

3. Scenarios and Target Selection of Green Building Development

●Middle scenario projected targets in 12th FYP

1.The proportion of newly built buildings mandatorily complying with green building design standards is 70% in pilot urban regions

2 Non-Pilot Area

The proportion of newly built park type buildings (schools, hospitals, cultural and other park buildings) complying with green building design standards is 70%

The proportion of newly built government office buildings and large public buildings complying with green building design standards is 70%

The proportion, complying with green building design standards, of affordable housing that is invested in by provincial capital cities and separately listed municipal governments in plan is 80%

Carry out pilot demonstration of green rural housing construction

3. Implement 100 green eco-cites (regions) pilot demonstrations

4. Conduct existing residential building heat metering and energy efficiency retrofits by 400 million square meters

5. Implement energy efficiency retrofits of high energy consumption public buildings by 600 billion square meters

6. Implement residential building energy efficiency retrofits in hot summer and cold winter zones as well as hot summer and warm winter zones by 50 million square meters

7. Promote the development of green building materials and construction waste integrated utilization

4. Path Selection of Green Building Development

With reasonable anticipation of future development, based on the correct orientation, appropriate promotion steps should be proposed with a perfect supporting system.

Conceptual Orientation

1. Nature Concept
2. Regeneration Concept
3. Reasonability Concept
4. High efficiency Concept
5. Innovation Concept

Promotion steps

1. First control incremental quantity and then control stock
2. First led by governments and then promoted by market
3. First guarantee low-income groups and then others
4. First carry out region plans and then design buildings

Supporting system

1. Formulate policy standards and promote processes simultaneously
2. Promote technology advancement and industrial development simultaneously
3. Build capacity and improve organizational development simultaneously

4. Path Selection of Green Building Development

Scientific promotion is an important pre-condition for green building development.

- Promote green building by steps
- Promote green building by harmonious urban and rural master plan
- Promote green building considering both newly built and existing buildings
- Promote green building by industries
- Promote green building by regions
- Promote green building by market

4. Path Selection of Green Building Development

Solve the problem of the lack of supporting systems; improve policies and institutions; and establish five major systems of policies and regulations, technical standards, industrial support, capacity building as well as supervision and management.

1. Improve understanding and strengthen leadership
2. According to the laws and regulations, actively promote green building
3. Improve standards and establish technical standards and supporting systems
4. Innovate the system to establish life cycle supervision systems
5. Active R & D to strengthen technical support
6. Increase investment and improve economic incentive policies
7. Provide whole process services to enhance capacity building of green buildings' up and downstream industries
8. Improve policies to actively foster green industries
9. Via publicity and training, establish green building and green living concepts

Thank You !