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Korean Strategy for Low-Carbon Green City

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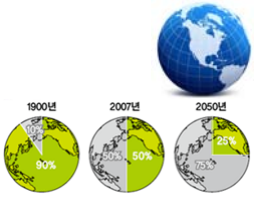
I Overview : Low-Carbon Green City

Background

Need to reduce carbon in cities

- **Portion occupied by cities in the world**
  - 1% of the Earth's surface
- **About 50% of the world population reside in cities**
  - 75% will reside in 2050
- **Cities use 75% of the world's electric power production**
- **Cities discharge 75% of the total CO2 emissions**



[EU]
- Emphasize the role of cities to reduce 30% of GHG emissions by 2020

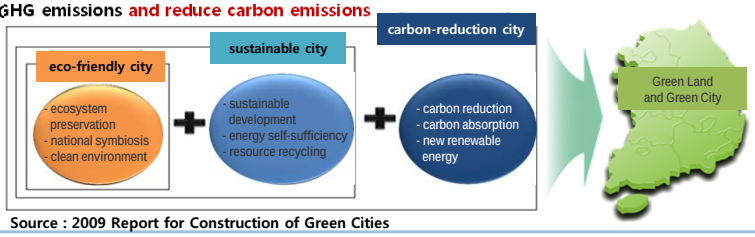
[KOREA]
- Realize 30% reduction by 2020 compared to the BAU of GHG emissions
- Build inventory local governments set GHG emissions targets

※ Source : Green KOREA 2011

Concept

Korean Definition of Low-Carbon Green City

- **Low-Carbon Green City : A city designed to reduce potential carbon emissions and absorb emitted carbon to actively respond to climate change issues**
  - Compression-type urban spatial structure, Mixed use of land, Public transit-oriented transportation system for conserving transportation energy.
  - Use more new and renewable energy sources in buildings and daily life
  - Secure green space to play a role of carbon absorption and improve people's quality of life
  - Establish a virtuous cycle of water and resources
  - A city with factors for low-carbon green growth to minimize environmental degradation and GHG emissions and reduce carbon emissions



Source : 2009 Report for Construction of Green Cities

Concept

Structure of Urban CO_2 Emissions

CO_2 emissions	=	Activity	×	Energy consumption unit	×	CO_2 Emission Factor
Transportation		Number of passage Distance of passage		Fuel efficiency of vehicles		Factor by types of fuel
Buildings		Building Floor Area		Energy consumption unit		Fuel emission factor
Green fields		Absorb CO_2		Protect Heat island		Supply biomass

Organize interconnected responses

Urban planning tools to reduce GHG emissions

Density | Arrangement of functions | Urban facilities, Infrastructure

Concept

Urban Planning Methods for CO_2 Reduction

Planning	Emissions structure	Transportation (Traffic)	Building	Green fields
Density management	Activity	Average trip distance ▼ ⇒ emissions ▼	-	Urban intensive development ⇒ Securing surrounding Green fields ⇒ a source of absorption ⇒ emissions ▼
	Basic unit	Traffic congestion ▲ ⇒ emissions ▲	The rate of use of elevators ▲ ⇒ emissions ▲ apartment housing ▲ Large heat source system ⇒ emissions ▼	
	Emission factor	-	-	
Arrangement of Functions	Activity	Mixed use ▲ ⇒ emissions ▽	-	Green fields ⇒ easing urban climate ⇒ Cooling and heating energy ▼ ⇒ emissions ▼
	Basic unit	Public transit rate ▲ ⇒ emissions ▼	Mix energy demand ⇒ emissions ▼	
	Emission factor	-	Use untapped heat sources ▲ ⇒ emissions ▼	
Urban Facilities	Activity	-	-	Cells including streetlights ⇒ turn to biomass ⇒ emissions ▼
	Basic unit	Pedestrian space/Road maintenance /Public transit adjustment ⇒ emissions ▼	Heat pipe repair ▲ ⇒ emissions ▼	
	Emission factor	Biomass ▲ ⇒ emissions ▼	Energy network ⇒ emissions ▼	

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Concept

Planning Elements of Low-Carbon Green City

Category	Low-Carbon Green City Planning Elements	
Environment-Friendly Urban Planning	• Wind Path • Journey-to-Work Distance • Buildings Facing South	• Public Transportation Oriented Development • Compact City • Mixed Use Development
Green Transportation	• Bicycle Lanes • Rapid Bicycle Lanes	• Tram • Bio-Diesel Bus
Ecological Green Space	• Green Space and Parks • Ecological Spaces	• Restoration of Ecological System • Green Roof and Wall
Resource Recycling	• Group Energy Facilities • Gray water Facilities • Waste Incineration	• Sewage Energy • MBT • RDF Facilities
Energy Efficiency	• Wind Path • Passive House	• High Efficiency Material • LED Lights
Renewable Energy	• Solar Energy, Solar Light • Wind Power, Soil Power	• Fuel Cell • Bio-mass
Green IT	• U-city	• U-Eco city • Smart Grid

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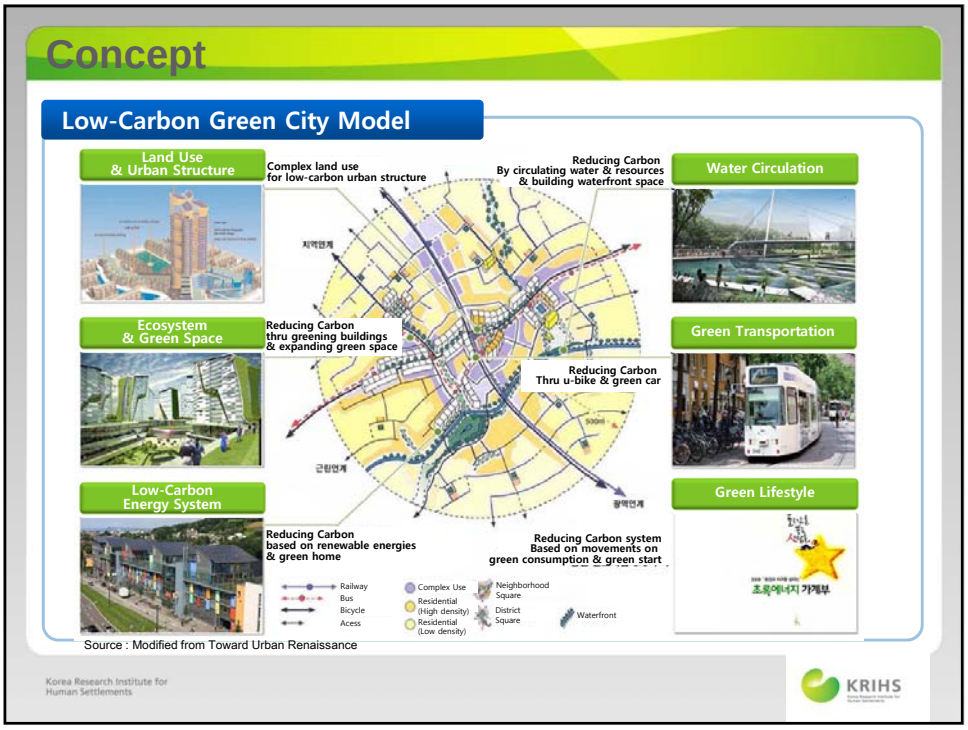
Concept
Low-Carbon Green City Model
Land Use & Urban Structure
Complex land use for low-carbon urban structure
Reducing Carbon By circulating water & resources & building waterfront space
Water Circulation
Ecosystem & Green Space
Reducing Carbon thru greening buildings & expanding green space
Green Transportation
Reducing Carbon Thru u-bike & green car
Low-Carbon Energy System
Reducing Carbon based on renewable energies & green home
Reducing Carbon system Based on movements on green consumption & green start
Green Lifestyle
Railway
Bus
Bicycle
Acess
Complex Use
Residential (High density)
Residential (Low density)
Neighborhood Square
District Square
Waterfront
Source : Modified from Toward Urban Renaissance
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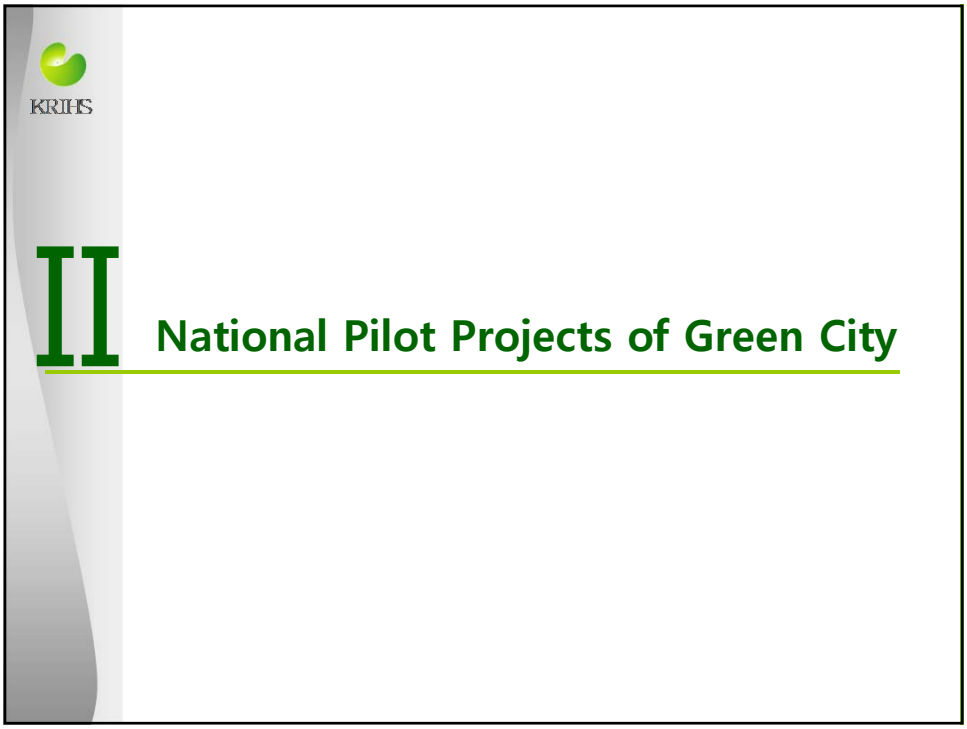
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National Pilot Projects of Green City

National Pilot Projects

Green City Pilot Projects

Green City Projects in Korea commissioned by central government and conducted by municipal governments are 9 projects in total

- Government-led initiatives including Eco Rich City, Pilot City Development for Climate Change, Low-Carbon Green Community and Sustainable Newtown Planning
- Carried out to achieve goals similar to that of low-carbon green city project
- Categorized into three types by their nature; urban planning, guideline and others
  ** The urban planning projects are subdivided by the target area; city-level and community-level.*

Green City Projects can also be categorized by the commissioner;

- Ministry of Environment (3 projects; Pilot City for Climate Change, Green City, Eco City),
- Ministry of Land, Transportation and Maritime Affairs (4 projects; Eco Rich City, Low-Carbon Green City Guideline, Sustainable New Town Planning Guideline, Innovative City),
- Joint Project by 7 Ministries (1 project; Low-Carbon Green Community)
- LH Corporation (1 project; Environment-Ecology Planning)

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National Pilot Projects

Green City Pilot Projects

Category		Project Title	Goal	Key Directions	Authority
URBAN PLANNING	CITY LEVEL	Eco Rich City	Establish and promote Low-Carbon Green Growth Model City where environment and economy coexist and cooperate.	7 key consideration factors; Energy, Commuting, Oasis, Recycle, Industry, Corridor, & Humanism.	Presidential Committee on Green Growth
		Pilot City Development for Climate Change	Encourage awareness of and participation in measures to cope with climate change and reduce GHG emission.	GHG BAU, main themes and joint projects with central government by each municipality are selected.	Dept. of Climate Change in Ministry of Environment
		Green City	Reinforce environment management capability of municipalities and decentralized administration.	Provides incentives for municipalities selected as green city (prize money, environmental budget).	Dept. of Participatory Cooperation in Ministry of Environment
		Eco City	Promoting regional development focusing on backward areas while maintaining environmental preservation policies.	Target backward areas (in mountainous, hillside, coastal region) with high interest in eco city projects or participatory intention among residents.	Dept. of Natural Policy in the Ministry of Environment

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National Pilot Projects

Green City Pilot Projects

Category	Project Title	Goal	Key Directions	Authority
Community	Low-Carbon Green Community	Achieve new/recyclable energy supply target using wasted resources and biomass, while fostering Green New Deal projects and new growth dynamic projects	Select target communities for pilot projects taking the municipalities' demand, locality, waste resources and available biomass energy into account, and prepare plans for effective operation and nation-wide expansion.	MPAS/ MEST/MKE/MARA/ME/Korea Forest Service/MLTM
Guideline	Low-Carbon Green City Guideline	Overcome risks of resources and environment challenged by climate change and create low-carbon green growth urban spaces	Utilize as basic information for status quo investigation and forecast on GHG emission, and reduction target	Dept. of Urban Policy, MLTM
	Sustainable New Town Planning Guideline	Create healthy environment and beautiful landscape in harmony with economic and social developments to achieve sustainable green growth	Create healthy environment and beautiful landscape with harmonized economic and social development to achieve sustainable green growth	Dept. of Urban Development, MLTM
	Environment-Ecology Planning	Secure best-of-breed low-carbon green growth research capabilities and measures and capabilities to cope with global warming	Categorized into regional environment-ecosystem planning and urban environment-ecosystem planning, which are prepared before land use planning.	Green Landscape Service in LH Corporation
Other	Innovative City	Realize low-carbon green city through eco-friendly construction and green infra	Prepare growth plans to develop the 10 innovative cities as green growth hubs through localized specialization strategies including new/recyclable energy	Dept. of Urban Development, MLTM

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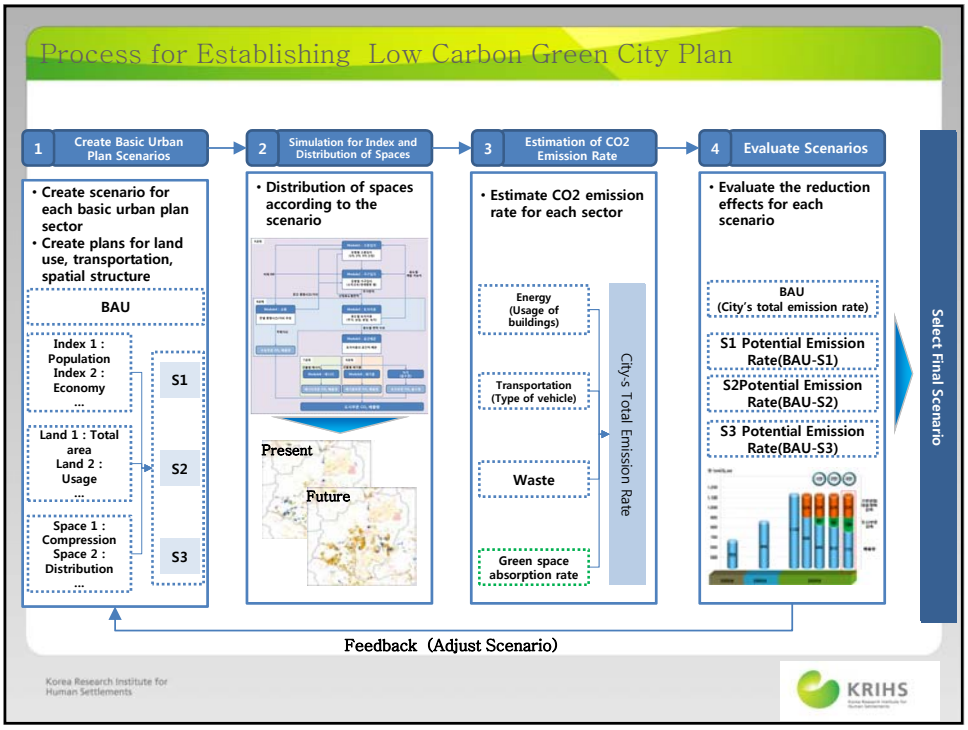
III

Best Practice Cases

III-1. Wonju City
III-2. Gangneung City
III-3. Geomdan New Town
III-4. Mongolia
III-5. Vietnam


Process for Establishing Low Carbon Green City Plan
1 Create Basic Urban Plan Scenarios
• Create scenario for each basic urban plan sector
• Create plans for land use, transportation, spatial structure
BAU
Index 1 : Population Index 2 : Economy ...
Land 1 : Total area Land 2 : Usage ...
Space 1 : Compression Space 2 : Distribution ...
S1
S2
S3
2 Simulation for Index and Distribution of Spaces
• Distribution of spaces according to the scenario
Present
Future
3 Estimation of CO2 Emission Rate
• Estimate CO2 emission rate for each sector
Energy (Usage of buildings)
Transportation (Type of vehicle)
Waste
Green space absorption rate
City's Total Emission Rate
4 Evaluate Scenarios
• Evaluate the reduction effects for each scenario
BAU (City's total emission rate)
S1 Potential Emission Rate(BAU-S1)
S2Potential Emission Rate(BAU-S2)
S3 Potential Emission Rate(BAU-S3)
Select Final Scenario
Feedback (Adjust Scenario)
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III-1. 2030 City Master Plan : Wonju City
Demands on New Green City Development as Low-Carbon Green Growth era has come
- 2030 Wonju master plan has been established as low-carbon green city plan reflecting the local characteristics
Consistency with Upper and Related Plans
• The 4th Revision for National Comprehensive Planning (2012~2020), 5 Year Regional Development Plan, Ganwon Province Comprehensive Plan (2012~2020), The 5th Tourism Development Plan for Ganwon Province
Demands on New Green City Development
• Established legal framework such as Framework Act on Low Carbon, Green Growth, Low-Carbon Green City Planning Guideline
Accepting Changes in Demography, Economy and Social Growth
• Long-term plan representing future of Wonju city over the next 20 years
Adapting to Climate Change & Overcoming Resource/Environmental Risks
• Deliberate/reasonable comprehensive plan suggesting environmentally sustainable urban structure
2030 Wonju Master Plan
Low-Carbon Green City Plan
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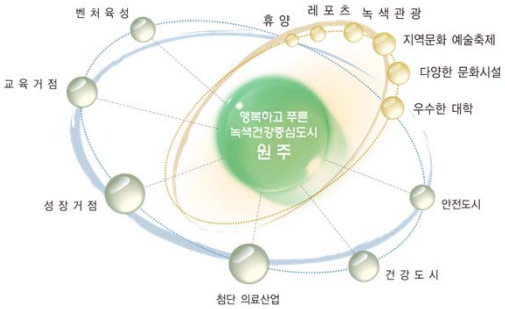
III-1. 2030 City Master Plan : Wonju City

Setting up the Future Image in 2030

- Happy, livable, green healthy city (G-Healthy City Wonju)



Happy	• Respecting diversity of individuals • Ensuring best quality of living • Participatory urban development
Green	• Minimizing GHG and pollution • Low-Carbon Green Growth • Clean and green city
Green Healthy City	• An urban-rural complex city with improved physical, social environment • Caring about physical, mental health of citizens • Fostering advanced medical and healthcare industries • Branding the image of the city as a healthy city

Future Image

Happy Livable Green Healthy City
(G-Healthy City Wonju)

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III-1.2030 City Master Plan : Wonju City

Suggested urban planning strategies to establish low-carbon green city plan

Urban Planning Aspects

- Encourage concentrated public facility and services
- Normalize the energy demands by mixed-use
- Adopt use of unused/recyclable/new energy thru urban development
- Preserve and create green spaces

Category	Strategies
Spatial Structure	• Mononuclear concentrated spatial structure inter-linked to living zones • Low-carbon development axis connecting existing nuclear and transportation axes • Prioritize and reinforce preservation and green axis
Land Use	• Compact, mixed land use for reduced GHG emission and reasonable distribution of land • Develop unused/underused lands within existing established lands rather than developing new lands • TOD-oriented transportation plan • Reduce GHG emission and minimize impact of developments on environment
Transportation	• Energy-saving transportation system • Expanding the green transportation - promoting bicycle use • Transportation system with less GHG emission - activating public transportation
Urban Center/ Residential Environment	• Reinforce energy standards on new buildings • Improve energy efficiency of existing buildings • Improve energy efficiency of public buildings • Develop green construction technology and infra
Parks and Green Spaces	• Expanding rest areas within the city (parks, green paths, forests) • Build green networks for efficient urban greening • Carbon-absorbing facilities

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III-1. 2030 City Master Plan : Wonju City

Suggested urban planning strategies to establish low-carbon green city plan

Other Aspects

- Maximize use of water resources and waste recycling
- Establish plans for interoperability with industrial development plans
- Expand the use of unused/new/recyclable energy
- Restore intercity streams to mitigate heat island effects

Category	Strategies
Water Resource	• Energy saving and GHG reduction through managing water environment and wastes • Waterfront spaces and eco-streams to mitigate island heat effects • Water circulation system (storm sewers, detention ponds, sewage treatment facilities) and recycling of water resources
Waste Treatment	• Waste recycling and fuelization to create waste recycling circumstances and industries • Create new energy using incineration heats and promote the utilization
Agricultural Development	• Agricultural science to deal with the effects of climate change • Efficient use of energy in agricultural facilities
Industrial Development	• Promote conversion from traditional to low-carbon industry • Establish green industrial complex • Eco-friendly industrial complex through improving structure of existing industrial complexes

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III-2 Gangneung Low-Carbon Green City Pilot Project

- **ME has launched (15, Jul, '09) the first pilot project for Low-Carbon Green City in Gangneung city** (18,326km²)
  - The project aims to create a globalized city to lead low-carbon green growth
  - Until 2020, 29 sub-projects are carried out based on 1 trillion Won budget
    - Utility project including infra construction is carried out by national fund, green technology and industry test bed project is carried out using private fund
    - The project is led by the municipality (Gangneung city government), funded by central government and jointly governed by ME and MLTM and MPAS, MKE and Forest Service are also participated.
    - Project Phase:

Phase 1 (~2012)	▪ Green Renaissance Landmark Project, Gyeongpo Lake Wetland Restoration Project, Green Path Project, Project for 10 Bicycle Cities
Phase 2 (~2016)	▪ Home Stream Project for Gyeongpo Stream, Healing Forest Project, Green Forest Path, LED Security Lighting Project, Green City New/Recyclable Energy Project, ZED Village Project
Phase 3 (~2020)	▪ Green Technology Theme Park Development, Smart Green City and U-City, Energy Generation Facility using Waste Resources

- **Based on these experiences, Korea is planning to rearrange the institutions and policies and expand the initiatives to other 16 cities or provinces**

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III-2 Gangneung Low-Carbon Green City Pilot Project

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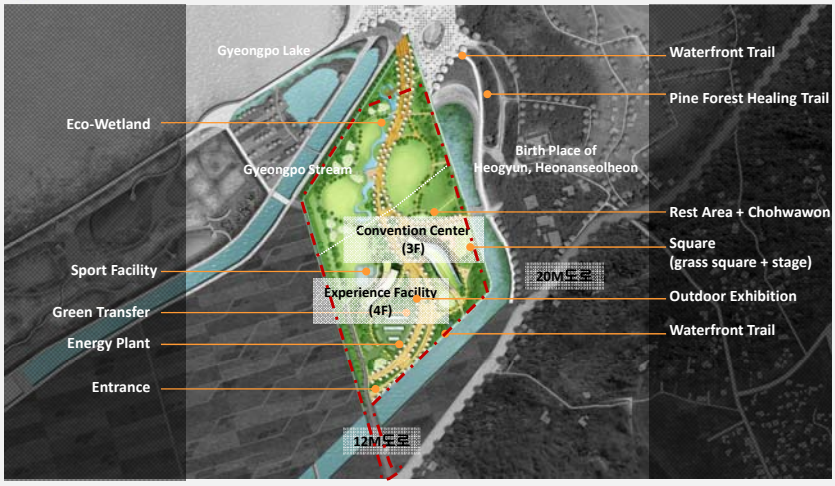
III-2 Gangneung Low-Carbon Green City Pilot Project

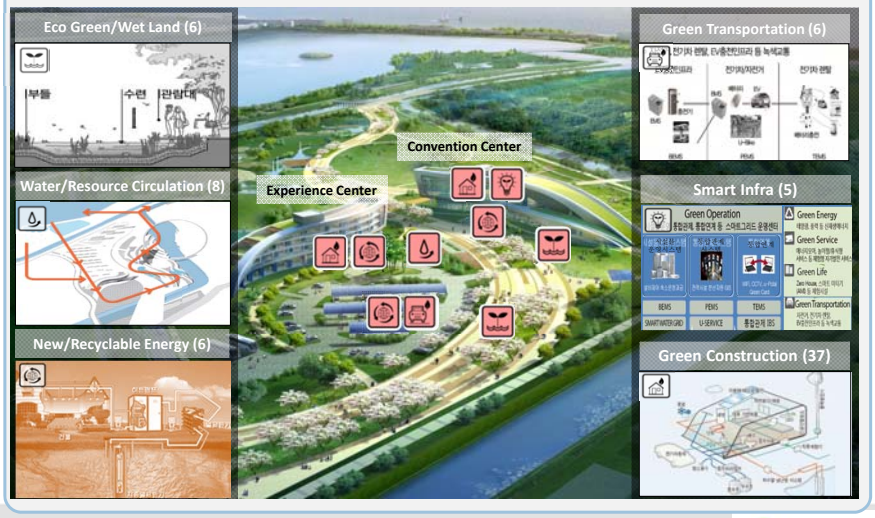
Green City Landmark Project

- **Ranges over Chodang-dong, Gangneung city**
- **Area** : 97,984㎡ (29,640 pyeong)



III-2 Gangneung Low-Carbon Green City Pilot Project

- **Plans to Apply Green Technology** (6 green technologies & 68 factors)



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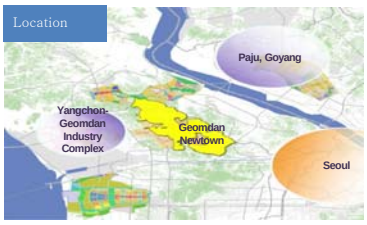
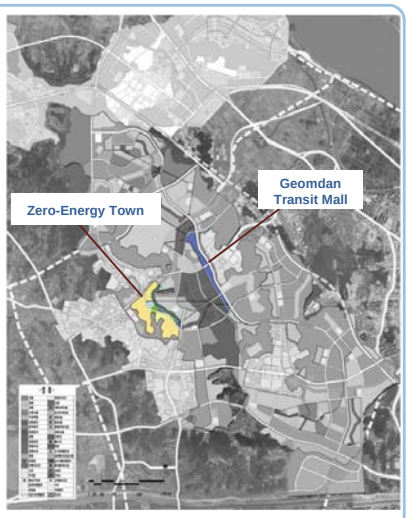
III-3 Geomdan New Town (Incheon Metropolitan City)

- **Ranges over Dangha, Majeon, Bullo and Wondang - dong, Incheon Metropolitan City**
- **Area:** Approx. 18.1 km^2 (5.5M Pyeong)
- **Population:** 230,000 (92,000 households / 127 persons per ha)
- **Project Duration:** Feb. 2009 ~ Dec. 2014
- **Promoter:** Incheon City Government, Incheon Urban Development Corporation, Korea Land & Housing Corporation
- **Projected Cost:** Approx. 16 trillion Won (14 billion USD)





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III-3 Geomdan New Town (Incheon Metropolitan City)

Energy-Saving Planning

- 10 minute distance from subway station to transportation centers
- Pedestrian network for reducing energy consumption

Categories	Methods	Techniques	Adopted Techniques
Urban Structure	Formation	Compact City Public Transportation	Station-centric allocation (TOD, BOD, POD)
Site Planning	Pedestrian-centric Environment	Pedestrian Network Spatially Separated Road Traffic Calming	In-site pedestrian/bike road network Parking lots on site fringes Traffic Calming
	Building Allocation	Planning facing directions & wind paths	Construction considering buildings' facing directions
	Microclimate	Green spaces & water places	Green space & water place
Buildings & Facilities	Renewable Energy Use	Buildings with renewable energy system	Zero-energy town Transit malls
	Water & Ventilation	Gray water & ventilation	Building system recycling gray water &ventilation

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III-3 Geomdan New Town (Incheon Metropolitan City)

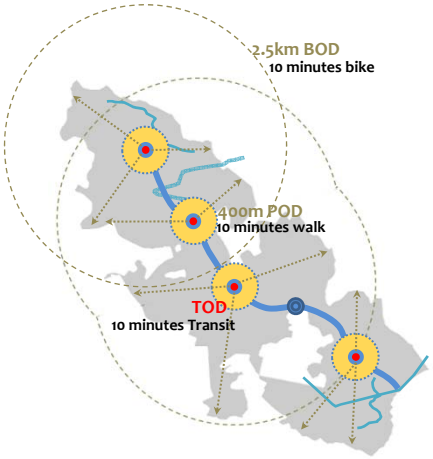
Urban Structure #2

Station-Centric Allocation

- 3 areas centered around subway station
- Compact development on pedestrian network centered on subway station

Transportation Networks

- 10 minute distance to subway station on foot (POD) or by bicycle (BOD)
- Circular pedestrian/bicycle network for interconnecting areas



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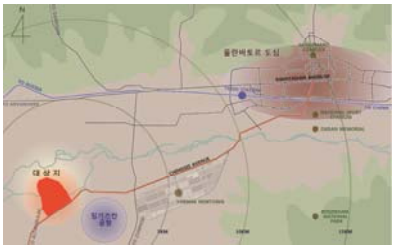
III-4 Mongolia – Green City for Ulaanbaatar

Background

- **Background**
  - In respect of East Asia Climate Partnership (EACP), performed research on "Application Possibility of Low-Carbon Green City in East Asia Countries"
  - Construction of low-carbon green city development model in Ulaanbaatar
- **Development Condition**
  - Location : 15km South-West from the center of Ulaanbaatar.
    Chinggis Khan International Airport is located 3km South of the area and Tuul river flows through the center and Northern side of this area
  - Plan for the concept of multi-purpose new town is possible because traditional style of residential area is located on both sides of the selected area



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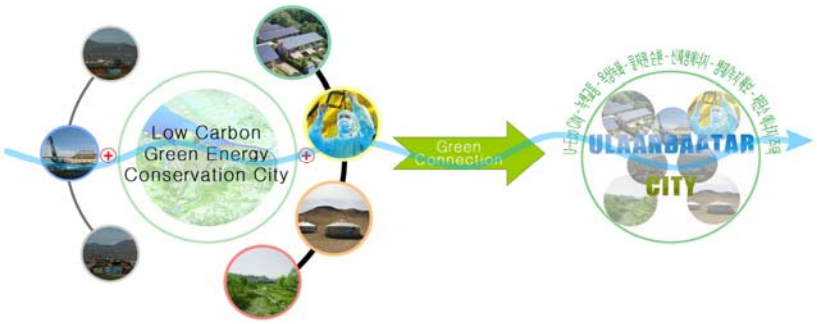
III-4 Mongolia – Green City for Ulaanbaatar

Development Concept

- **Low- Carbon Green Energy Conservation City that links the airport, commercial, and Ulaanbaatar City together**



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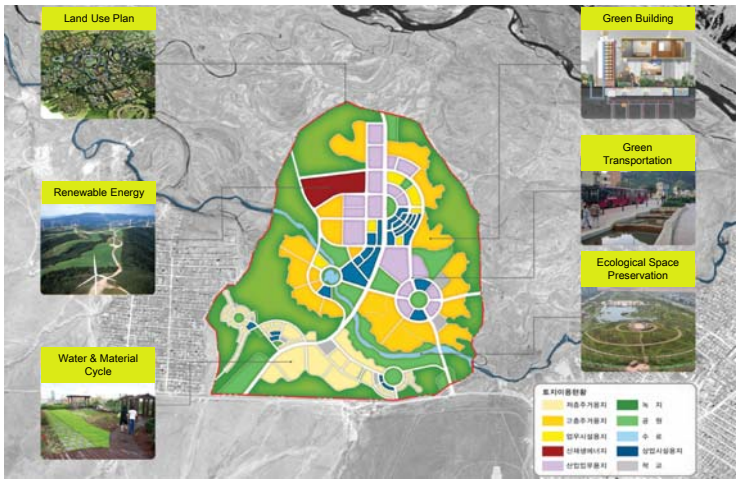
III-4 Mongolia – Green City for Ulaanbaatar

Concept Master Plan



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III-4 Mongolia – NUBIA City

Vision

- **Sustainable City**
  : Goal of Reducing Impacts to the Environment
  - Minimum input – water/energy
  - Minimum output – waste/pollution
  - Renewable resources
  - Local resources – energy/food

- **Livable City**
  : Qualities of Urban Environment
  – Physical, Social, and Mental Well-being
  - Balance of jobs and housing
  - Safe and secure environment
  - Availability of public transit
  - Healthcare facilities

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III-4 Mongolia – NUBIA City

Success Factors for Nubia City

Job Creation

New Airport is not able to bring enough population for a new city
-Expected traffic, NUBIA : 1 mil people/ yr ⇒ Job Creation 3,000

Co-Work

Co-planning with private and government sector incorporate various interest and enhance efficiency

Urban Hub

Population Inducement

Urban Hub as population inducement factors required
- Industry rearing to create jobs (Fashion-Cashmere /Tourism)
- Transportation and Logisticss
- Major government office relocation
- National education institute relocation

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III-4 Mongolia – NUBIA City

Co-Work : Approach

- **Co-Planning**
  - Working with Mongolia Government to create a practical plan
  - Establish a task force team with Mongolia Government
  - Collaborating with Korean players such as KRIHS and LH
  - Seeking additional fund for planning
  - Creating business plan including financing, marketing and master plan
- **Co-Marketing**
  - Working with Mongolia Government to identify potential tenants/inventors
  - Negotiate with tenants/investors
- **Co-Development**
  - Identify co-development project
  - Set up special purpose company

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III-4 Mongolia – NUBIA City

Co-Work : Suggested Process for Development

To set up strategy plan as initial step of urban planning

- Provide basic direction in urban development planning
- Guideline plan for the following development and execution plans

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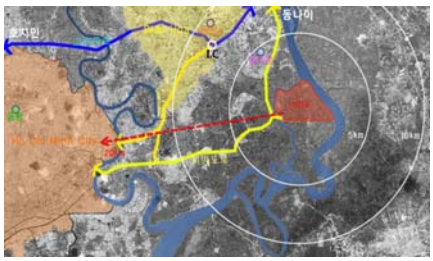
III-5 Vietnam – Ho Chi Minh City

Background

- **Background**
  - In respect of East Asia Climate Partnership (EACP), performed research on "Application Possibility of Low-Carbon Green City in East Asia Countries"
  - Construction of low-carbon green city development model in Ho Chi Minh City
- **Development Condition**
  - Location : Phuoc Long Village – boundary of Ho Chi Minh City and Dong Nai Province
  - This is the area with potential for developing into green city since it is a clean zone with good ecological condition where river flows on both sides of the area



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III-5 Vietnam - Ho Chi Minh City

Development Concept

- Construct as multi-purpose green city test-bed in order to implement the image of green city
  - Mix commercial use with residential use to induce development that possess green functions
- Promote multi-purpose low-carbon green city with the concept of energy circulation which consists Vietnamese culture

Urban Circulation

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III-5 Vietnam - Ho Chi Minh City

Concept Master Plan

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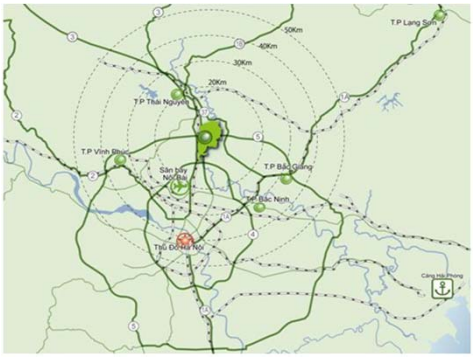
III-5 Vietnam – Smart & Green City in Thai Nguyen Province

Project Information

- **Project Name : Technical Assistance for the Master Plan of Smart City in "The Bright City"**
- **Donor : Government of South Korea via the Korea International Cooperation Agency (KOICA)**
- **Period : Approximately 1.6 years (2014~2015)**
- **Location : Pho Yen and Binh districts of Thai Nguyen Province – Yen Binh "The Bright City"**
- **Total Fund : USD 3,500,000**



Strategic Location of Yen Binh Project

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III-5 Vietnam – Smart & Green City in Thai Nguyen Province

Basic Concept

- The "Bright City" project is one of the important large-scale development projects which can largely contribute to the development of Thai Nguyen Province
- The city is located 36 kilometers North of Hanoi, 15 kilometers South-West of Hanoi Nội bài airport, and 20 kilometers away from Thai Nguyen
- It is surrounded by five metropolitan cities Hanoi, Bac Ninh, Bac Giang, Vinh Phuc and Thai Nguyen, all of which are found within 30 kilometers radius of the city center
- The "Bright City" project aims to create a community which pursues eco-friendly and systematic development where modern civilization, knowledge and technologies are harmoniously combined and inter-operated
- The city also aims to achieve what the central government requires to meet the public interest; provision of job opportunities and livability, good use of leisure, and domestic and foreign investments.
- As a systematically planned urban area, it will be a smart city which satisfies the general components of a smart city including smart economy, smart transportation, smart environment, smart communities, smart living, smart urban management.

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III-5 Vietnam – Smart & Green City in Thai Nguyen Province

Structure Plan

"Smart City" Location in Yen Binh Project(1/2000)

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Project Plans

- **The Smart Green Urban Planning project will produce the followings as the end products**

1) Urban planning support systems for Smart Green City

① Decision-making support system for low-carbon city planning
② Decision-making support system for energy planning
③ Urban management systems for Smart Green City

2) Urban planning for Smart Green City

① Urban planning for Smart Green City
② Guidelines for Smart City urban planning
③ Guidelines for Green City urban planning
④ Promotional movies for urban planning for Smart Green City

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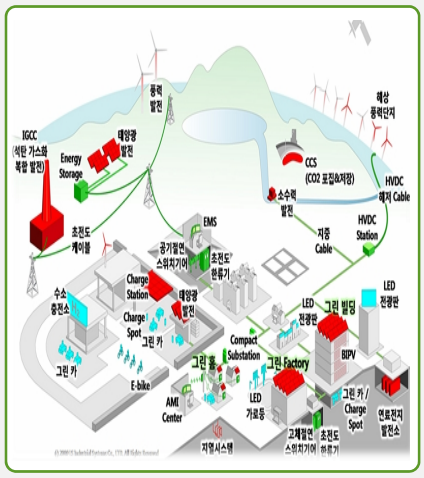
IV Strategies for Developing Low Carbon Green City

Process for Low Carbon Green City Development

1) Review of Low-Carbon Green City with City Characteristics



Green Smart Town

Environmental Agriculture

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Process for Low Carbon Green City Development
2) Establishing Low-Carbon Green City Model for your city
Eco-Friendly City with Site-Level Energy System and Less CO2 Emission through Convergence of Technologies of Renewable Energy, Energy Efficiency and Building Energy System
Construction
Bridging
Energy Efficiency
Renewable Energy
5. Comprehensive Design
Technology for comprehensive renewable energy generation/consumption for buildings (BIPV, BiWP, BiST, etc.)
1. 100% Zero Energy House
Houses running on natural energy not fossil fuel (Renewable system + building energy saving techs, waste heat recovery, solar power, backup system)
7. Building Energy Saving Technologies
(adiabatic vacuum panel, vacuum window, LED lighting, waste heat recovery, etc.)
2. Zero Energy Community (Town)
A housing site consisting of a series of zero energy houses (Renewable energy supply for electricity/heating, group energy supply system)
6. Integration of Green Buildings
Encourage to use solar heat collector, sunlight modules as claddings on buildings for efficient energy generation
4. Centralized Group Energy Supply System for Renewable Thermal Sources
(Solar heat, bio, cogeneration, local heating, geothermal...)
3. Micro CHP
Small cogeneration system connected to renewable energy systems for building/site

Process for Low Carbon Green City Development
3) Link with City Growth Potentality (Culture, Tourism, Sports, etc...)
Eco-Friendly Olympic Park
- Urban regeneration through development of the Olympics Park and surrounding areas.
Cultural Industry
- Multi-functional space (exhibitions, concert, sports games, convention, business and cultural purposes)
Tourism/Sports Industry
- Tourism industry based on the local natural resources and new sports facilities development
- Sports facility and Convention center can be used as ; community service facility or for regional healthcare and recreational purposes; or international training facility to accommodate athletes from surrounding countries for foreign training.
Contribute to Regional Development
Olympics Park
Multi-Purpose Sports Facility
Convention Center
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THANK YOU!

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