1st Symposium on Green Infrastructure for Future City

4nd International Symposium ZEBISTIS Zero Emission Building
-Integrating Sustainable Technologies and Infrastructure Systems

Green Infrastructure and Low Impact Development for future city in Korea

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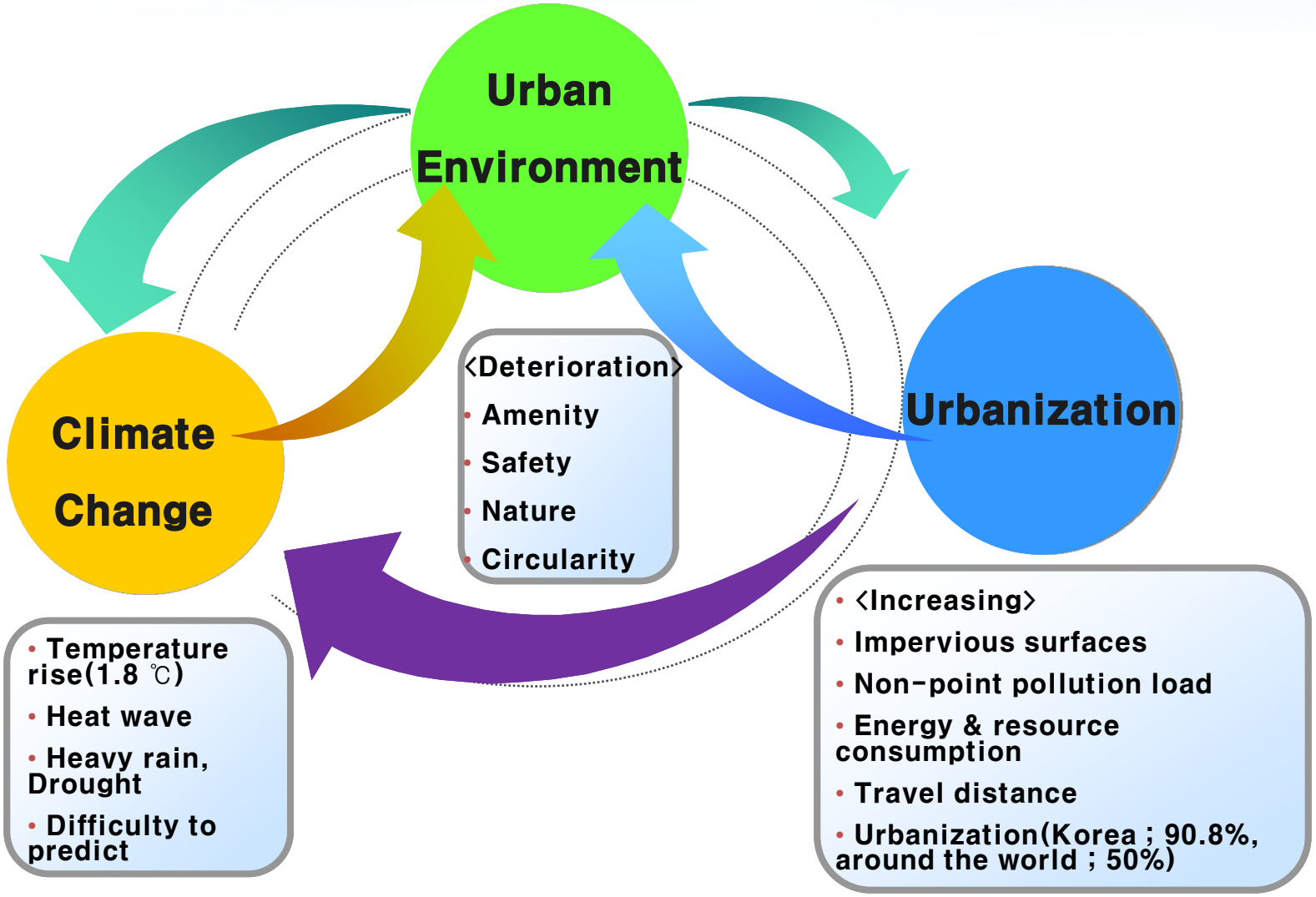
LH Land & Housing Institute

Hyun, Kyoung-hak
khhyun@lh.or.kr

1. Status & Problems

Energy, resource-consuming cities



1. Status & Problems

Energy, resource-consuming cities

- **Urban infrastructure such as building, transportation**
  ⇒ **High level of dependence on fossil energy**

- **2/3 of energy and 60% of the drinking water have been consumed in cities around the world**

- **Increasing in impervious surfaces**

  ⇒ **Lack of soil moisture, decrease of evapotranspiration rate, increase of heat island**

  ⇒ **Reduced time of travel of stormwater increases flooding and safety issues**

  ⇒ **Problems of river ecosystem disturbances and water quality safety due to increases in inflow of viruses, bacteria and xenobiotic**

1. Status & Problems

Energy, resource-consuming cities

➢ Impacts of climate change of Korea

⇒ Rainfall has been increased by 17% over the past 100 years

⇒ But, 18% reduction in number of rainy days

⇒ Heavy rain days of more than 80mm have doubled in the 1970s

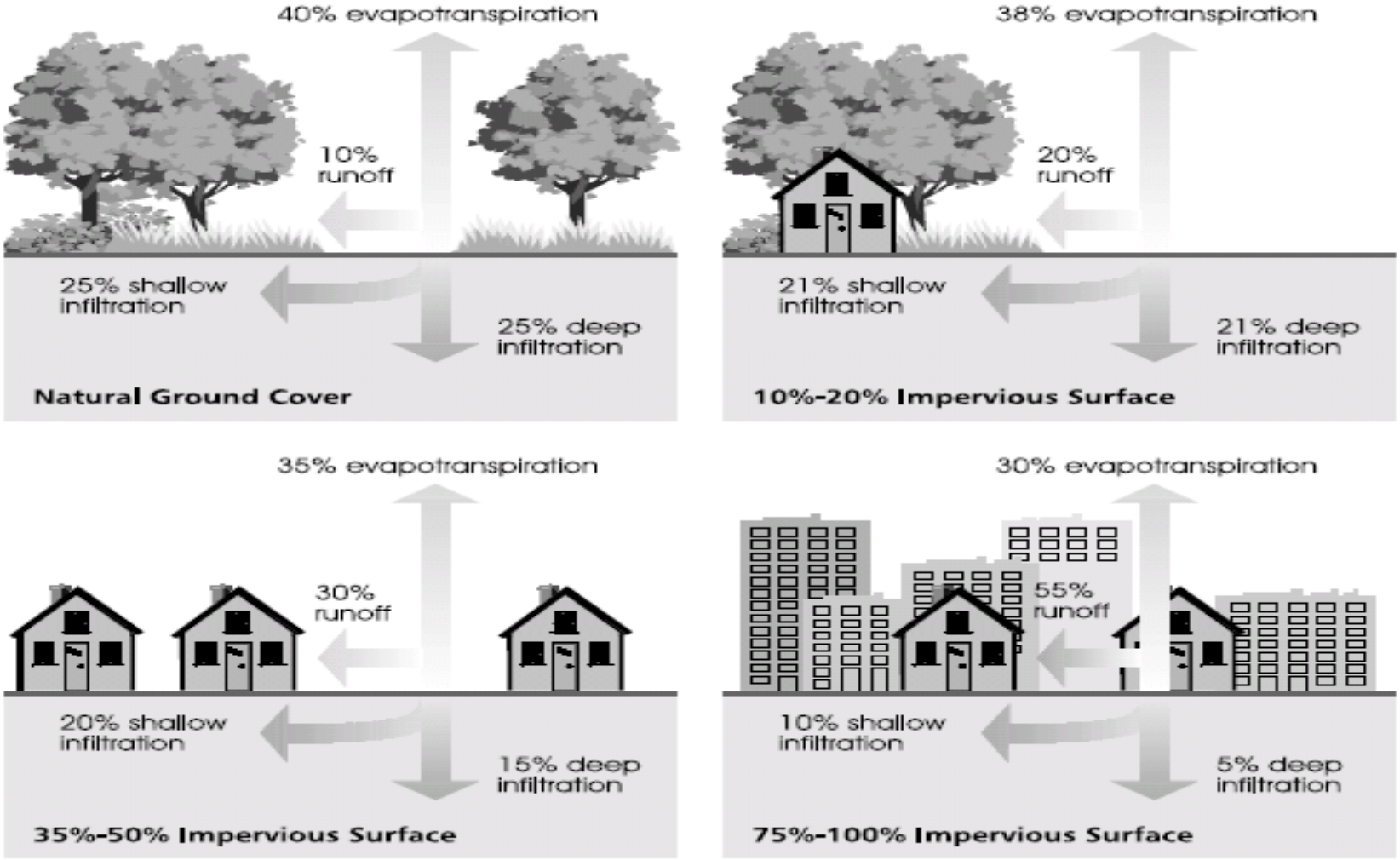
⇒ Increase of 1.8 ℃ in Korean cities (Seoul, Gangneung, Incheon, Daegu, Mokpo, Busan) from 1911 to 2010. But, average of 0.75 ℃ rise in global temperature over the past 100 years

⇒ Tropical night (70's 4.3 days -> 00's 7.8 days, Seoul),

⇒ Impervious surface in urban area (48%; 2005), non-point loads (72%, 2020)

⇒ 90% of the damage from the storm and flood occurred in the city

Energy, resource-consuming cities, Urbanization & Climate change



<Federal Interagency Stream Restoration Working Group, 1998>

1. Status & Problems

Energy, resource-consuming cities

<Rainfall of 12mm isolated citizens in Cheonggye Stream ; safety issues are becoming more and more common(11 Oct. 2012, JoongAng Daily)>

❖ We need to find new roles and functions of Infrastructure (urban infrastructure)

2. Pending issues and challenges of infra

Infrastructure

➢ **Issues**

- A city is an organism
- But, lack of organic approach and interconnectedness of infrastructures

➢ **Challenges**

- **Fusion and link of urban infrastructure and urban planning & design**

  water and sewage, municipal water, drought, non-point pollution, flooding, urban river, urban flooding inundation, food waste, water temperature difference energy and bio-energy, parks and green area and heat waves

- Grey infra(existing) -> Green infra

2. Pending issues and challenges of infra

Infrastructure - issues

- **Water and wastewater infra ; supply and consumption of long-distance**

- **Reproduction and reuse of municipal water in urban area**
  - **Source treatment and use of rainwater**
  - **Greywater separation and reuse in apartment complexes, new town, urban regeneration**
  - **Ecosan ; constructed wetland, ecological engineering**
  - **Water Quarter City ;** About 150−250L/Household (Grey water)

- **Water quality management ; dependence on facilities, equipments and mechanical treatment**
  - **Source control, small-sized natural control, decentralized rainwater management(DRM), Zero City of non-point pollution loads**

  - **DRM and LID(low impact development) for reducing flood and non-point pollutant, and restoring the water cycle**

2. Pending issues and challenges of infra

Infrastructure - issues

- **Experimental evaluation ; Greywater separation and treatment using constructed wetland in basement of apartment building**

2. Pending issues and challenges of infra

Infrastructure - issues

- **Utilization of water temperature difference energy in urban**

  - linkage between water & wastewater planning and district unit planning

  - self-supporting energy city

- **Wastewater treatment and energy harvesting in sewage treatment plant**

  - water temperature difference energy, bio-cell, small hydro power

  ; self-supporting energy plant

  - goal ; energy self-sufficiency rate of 50% in 2030 (Ministry of Environment, Korea)

  0.8% in 2007

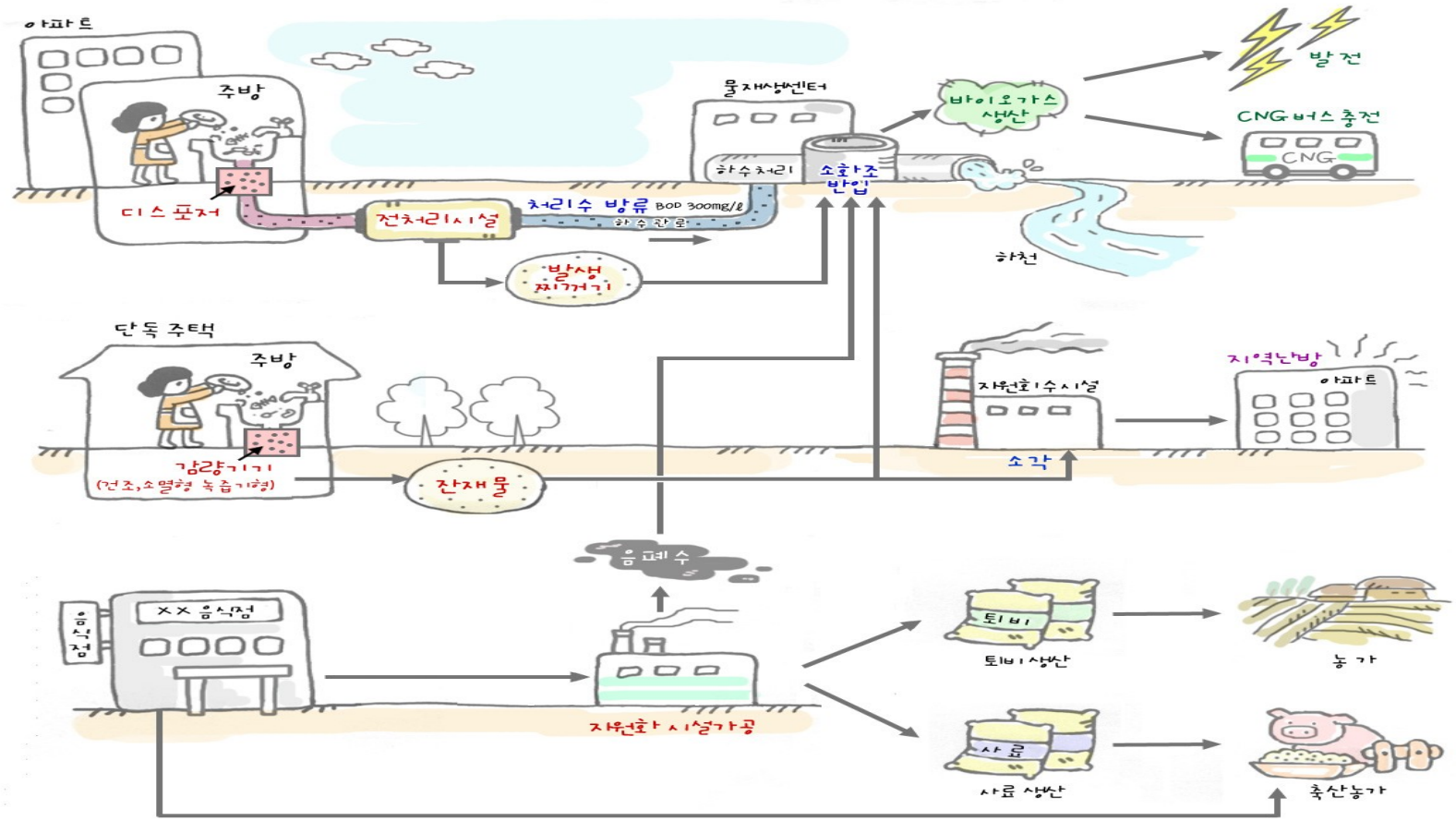
2. Pending issues and challenges of infra

Infrastructure - issues

- Food waste treatment using disposer and sewer
  - Now, prohibition of use of disposer; except for study
  - partial permission in 2016
    ; district of separated sewer system and advanced sewage treatment facility
- Multi-functional park and green area
  - reduction of flooding and non-pint source pollutant
  - microclimate control, absorption of carbon dioxide, healing
- Reduction of impervious surface ; one of LID methods
  - Impervious surface rate of 48% in 2005 -> 40% in 2020
    (Ministry of Land, Infrastructure and Transport, Korea)
  - Reduction of 10% impervious surface rate from 2010 to 2030 for water quality protection and flooding control by achieving zero emission of rainfall of 25.4mm

Infrastructure - issues

Diverse methods of food waste treatment – demonstration of disposer, Seoul, 2009



Green Infrastructure - LID

➢ Definition of Green infrastructure

- landscape architecture ; green infra focusing on park, green area system

- WEF stromwater report(September 11, 2012) ; focused on LID
  municipal stormwater infrastructure : Going From Grey to Green for water quality control
  small-sized, decentralized, planted stormwater management with non-structured methods ; LID

- WEF stromwater report(April 2, 2014) ; reducing stormwater management costs and providing parks and green space in cities

For many urban residents the term infrastructure brings to mind roads, pipes, and power lines. Green infrastructure systems, however, are practical integrations of built and ecological systems that incorporate all natural, semi-natural and constructed green spaces within, around, and between built areas, to replace or augment more traditional gray infrastructure(Kathleen L. Wolf)

⇒ Multitasking nature and co-benefits, health and wellness benefits

Green Infrastructure - LID

➢ **Definition of Green infrastructure**

- Green Infrastructure of new paradigm

Infrastructure for circulating metabolism based on fusion of water, food, energy, ecosystem and urban planning including restoring hydrological water cycle system, park and green area system

3. Green infrastructure of new paradigm

Green Infrastructure : paradigm shift

Grey Infra

Existing

- individual operation of road, water and wastewater, river, building

Characteristic

- large scale, long-distance
- high speed, energy consumption
- lack of interconnectedness between infra

Construction & management

- individual criteria of management
- non-multi functional Infra

Green Infra

New

- LID, energy harvesting, decentralized water management, greywater separation and reuse

Characteristic

- decentralized, small scale, circular
- source control, natural treatment
- link of park, rainwater and heat island management
- new job

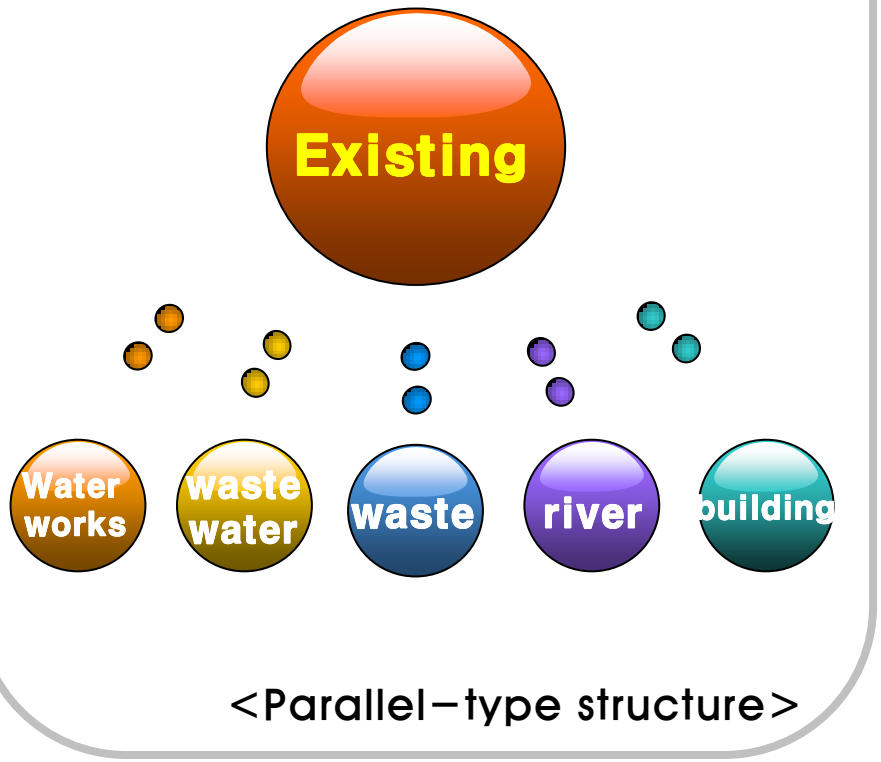
Construction & management

- Fusion of water, energy, land use
- Multi functional Infra
- low energy & maintanance cost
- integrated management

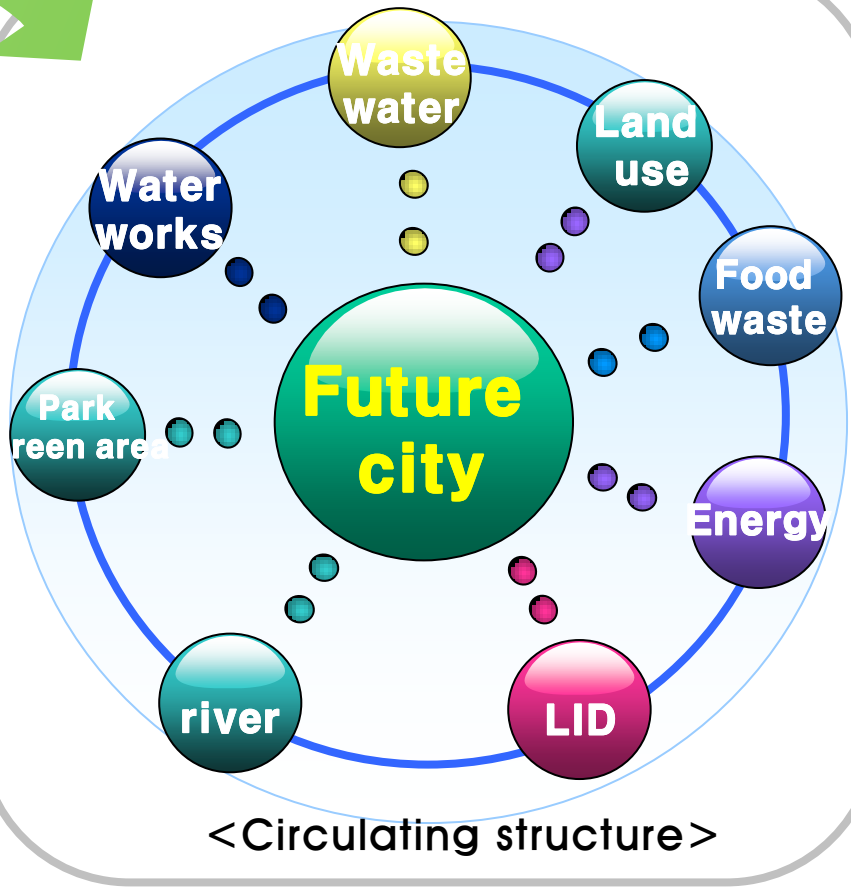
3. Green infrastructure of new paradigm

Green Infrastructure : paradigm shift

paradigm shift of infra



<Parallel-type structure>



<Circulating structure>

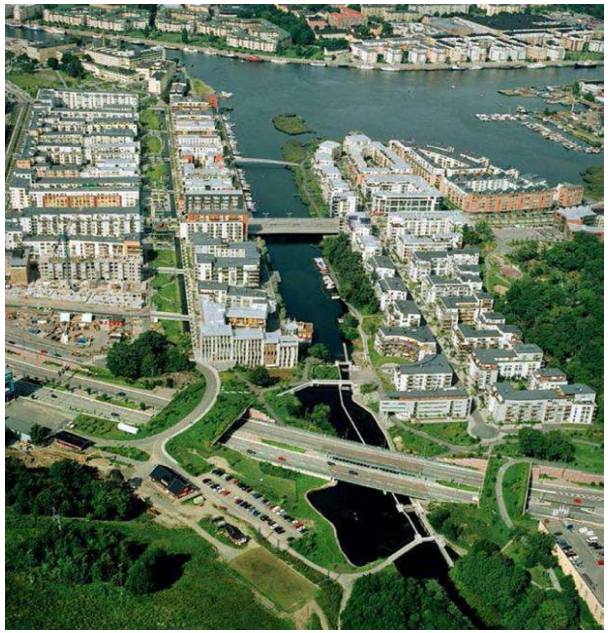
4. Model of future city

Hammarby(Sweden)

<Hammarby Sjostad Case Study | CP 249 Urban Design in Planning 2007>

- **area : 200 ha**
- **population : 25,000 people**
- **goal of construction**

  integrated management of water, energy and waste
  sustainable urban development by creation of waterfront
  50% reduction of water supply in existing usage
  50% reduction of heating and cooling energy
  rainwater management: water cycle using LID



Stormwater drainage

Separation of rainwater and sewage

The Hammarby model – a unique eco-cycle

The integrated environmental solutions can be followed through an eco-cycle that has become known as the Hammarby model. The eco-cycle handles energy, waste, water and sewage for housing, offices and other commercial activities in Hammarby Sjöstad. The eco-cycle is also designed to act as a role model for the development of equivalent technological systems in big cities. The Hammarby model is shown on the inside of the front cover, along with explanatory texts, and the various sections of the cycle – namely energy, water & sewage, and waste – are presented on the following pages.