The New Urban Design Control Strategy of Kaohsiung City based on Micro-Climatic Map in Taiwan

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Situations of Taiwan Environment In Sustainability

1. High diversities of climate, ecology and society
2. The high density urban belt development
3. Everyplace facing more than three kinds of disasters (The highest risk country in the world)
4. Last three water shortage country in the world
5. 97% Energy resource is Imported
Taiwan: Line with most deserts located
TAIWAN

36,188 km²
71% mountains and hills
23,170,321 population
Taipei  5,542,956  (9,710 p/km²)
Taichung 2,658,735
Kaohsiung  2,772,838
Tainan 1,875,637
CULTURE
Diasters

2006.07.11 Taipei Flooding

2009.08.07 MORAKO Typhoon

1999.09.21 Earthquake 921

2010.08.07 FANAP typhoon
(Over 200 frequency risk)
Land, Region, Urban, Building

Action Plan of Kaohsiung Ecocity and Green Building

1. Land Sustainability and Mitigation
2. Urban / Rural Development
3. Urban Plan & Design Guideline with Sustainability
4. Regional community evaluation
5. Green Building (Evaluation & Labeling)
6. Sustainable Campus
Investigations and Establish Taiwan Base Map in GIS

YY Li, CY Yu, CM Chiang, ARCHILIFE RESEARCH FOUNDATION, 2000, 2011

Green Map

Green Infrastructure Map

Atmosphere and Air Shed Map

Geographic Info Map

Urban/Rural Map

Disaster Risk Map

Safety Region
Kaohsiung City: Environmental database for micro-climate map

Total 2586 sampling position in the Kaohsiung.

The SOP set as the guideline for the next step.

Temperature, RH, Velocity, Wind direction, Heat situation, Infrared thermal camera, for each spot.
The Integrated Planning and Innovation Practice Processes

1. Need to respond to the earth and the climate

Field Monitoring and Measurement Results to Establish Micro-Climatic Map in Kaohsiung City

YY Li, CM Chiang, Kaohsiung Ecocity Program, 2009

Urban Thermal Situation (DBT): Summer Daytime 12:00-14:00

Urban Thermal Situation (DBT): Summer Nighttime 20:00-22:00
1. Need to response to the earth and the climate

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Urban Thermal Situation (RH): Summer Daytime 12:00-14:00

Urban Thermal Situation (RH): Summer Nighttime 20:00-22:00
1. Need to response to the earth and the climate

Field Monitoring and Measurement Results to Establish Micro-Climatic Map in Kaohsiung City

Urban Thermal Situation (WS):
Summer Daytime 12:00-14:00

Urban Thermal Situation (WS):
Summer Nighttime 20:00-22:00

YY Li, CM Chiang, Kaohsiung Ecocity Program, 2009
The Integrated Planning and Innovation Practice Processes

1. Need to response to the earth and the climate

CFD Analysis

Urban Thermal Situation:
Winter Daytime CFD Analysis

Urban Thermal Situation:
Summer Daytime CFD Analysis
1. Need to respond to the earth and the climate

Mapping SWOT Analysis to determine the climatic area for the urban design guideline
Thermo Camera Identification Process

YY Li, CM Chiang, Kaohsiung Ecocity Program, 2009
2. Need to construct the typical material space system

The material space system is the platform of city running, typical city function need typical material space system to run.

- The infrastructure should consider as the eco-socio-balance system.
- The harmony relationship in-between artificial and natural systems
- Ecocity needs the “Function Platform” to make the material space system running in a balance and presented as landscape system.
Eco-Design _ Purposes and Terms

Urban & rural Scale

Land use
- Efficiency
- Conservation
- Less Pollutants
- Reuse/Re-life

Green
- Carbon Neutral
- Continuity
- Cooling
- Biodiversity

Water
- Preservation
- Cleanliness
- Cooling
- Reuse

Energy
- Renewable Energy
- Recovery
- Saving

Bio-climate
- Introducing
- Cooling
- Cleanliness

Mobility
- Saving
- Reduction
- Safety
- Convenience
- Efficiency

YY Li, EDS Group, Tainan Ecocity Program, 2006
NDVI for Surface Covering

Surface Temperature

1990 YY Li, JY Tsou, Integrated Processes to analyze urban climatic solutions, Collaboration between ShuTe University and CUHK
Setting different scale for Eco-city Planning and Design Practice and Policy

Symbio-Map ➔ Growth Management ➔ Guidelines ➔ Self-Practice ➔ Carbon Neutral

**Regional Scale**
- National Land Program
  100,000 : 1
- Land Use Grades

**City scale**
- Urban Major Program
  10,000 : 1
- Land Use Regional control
- Urban Design Guideline Control

**Community/Building Scale**
- Urban Detail Program
  1,000 : 1
- Urban Design Detail Control
- Eco-Green Building Control
Transport system
+ Land Use Area
+ Public Infrastructure

Eco-Infrastructure
- Land Use
- Bio-Climate
- Water Cycle
- Shed Management
- Green Quality
- Renewable Energy
- Resource Cycle
- Green Transport
- Pollution control
- Short-distance Agriculture

Sustainable Lifestyle
+ Eco-Green Building system
GIS database: The Base Map is Natural Map
Geographic and limitation data without the boundary estimate
The new 9 landuse definition were set to the regional development with the concept of Eco-Development Map.
1. Urban-Strategy of Heat Island Effect Reduction

- The seashore and east side of Lover River to identify as wind introducing zone
  - Prevent the Landuse for pollutants
  - Identify the main introducing break
  - FAR control for the wind entrance
1. Urban-Strategy of Heat Island Effect Reduction

- Establishment of the wind introducing streets of Kaohsiung

- Let the wind go down
- Decrease the influence of the boundary roughness
- Decrease the speed and pollution from vehicles
1. Urban-Strategy of Heat Island Effect Reduction

- Establishment of the cooling streets of Kaohsiung
- Increasing the overheat area shading
- Height Control for the wind
- Clean zoning for bioclimate control
2. Strategy of the City Block Cooling System in Heat Island Area

- Regional Refurbishment Potential area
- Search for the renew neighborhood
- Good Connection to Natural Boundary
- Demonstration sites and pilot buildings
2. Strategy of the City Block Cooling System in Heat Island Area

- Establishment of natural ventilation lanes in city block
- Block site renew integrated development
2. Strategy of the City Block Cooling System in Heat Island Area

- Following the green community and green building concept
Based on the Field of “Ecology and Environment” – Unique for Kaohsiung

- 10 Main Terms
- 2 Negative Terms
- 37 indicators, all can be calculated and quantified
What we are doing now is not for us, is for the future.

Thank You!

Joseph Yenyi Li, 李彥頤 教授
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