Case Studies on Gwangju’s Low Carbon Development and Policies

Kim, Tae Ho
Chief, Planning and Cooperation Office
International Climate and Environment Center

“International Consultation Workshop on Gwangju’s Low Carbon Development”
Oct. 22. 2019
1. Current Status on Climate Change Response in Korea and around the Globe

2. Emissions in Gwangju and Policies to Reduce GHG

3. Best Practices of Gwangju for Climate Change Response
About International Climate and Environment Center

- **Purpose**: To research and develop policies on climate change response, support green lives of citizens, and create a low-carbon green city (Form of structure: Foundation)

- **Structural Basis**: Gwangju Ordinance on Climate Change Response, Article 18
  - R&D and education/training on climate change and other environmental issues
  - Develop and implement programs for low-carbon green lifestyles
  - Exchange and cooperation on climate change between cities and organizations

*ICEC also runs 'Fine dust office for safety of citizens' since Nov. 2018.*
1. Current Status on Climate Change Response
Current Status on Climate Change Response

Trend in Korea

Key plans of Korean National Government

<table>
<thead>
<tr>
<th>Status</th>
<th>Green Growth 5-Year Plan</th>
<th>Energy Basic Plan</th>
<th>Emission Trade Scheme Basic Plan</th>
<th>Climate Change Adaptation Plan</th>
<th>Climate Change Response Basic Plan</th>
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</thead>
<tbody>
<tr>
<td>Phase 3 (’19.5)</td>
<td>Phase 3 (’19~’23)</td>
<td>Phase 2 (’14.1)</td>
<td>Phase 1 (’14.1)</td>
<td>Phase 2 (’15.12)</td>
<td>Phase 1 (’16.12)</td>
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<td>’14~’35</td>
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<td>: ’15~’24</td>
<td>: ’16~’20</td>
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<td>Phase 2 (’15.12)</td>
<td>Phase 1 (’16.12)</td>
<td>Phase 1 (’16.12)</td>
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<td>Planning Period</td>
<td>Every 5 years by 2050</td>
<td>Every 5 years</td>
<td>Every 5 years, by decade</td>
<td>Every 5 years</td>
<td>Every 5 years</td>
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<td></td>
<td>for 20 years</td>
<td>for 20 years</td>
<td>by decade</td>
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<td>for 20 years</td>
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Green Growth 5-Year Plan : Phase 3

- Vision: Realize Inclusive Green Nation
  (economy and environment in harmony → fortify inclusiveness of green growth)

- Strategies
  - Responsible GHG reduction and sustainable energy transition
  - Innovative green technology/industry and fair green economy
  - Realize green society together and fortify global green cooperation

- Characteristic: Policy Agenda and build system

- Focusing on actual/practical action plans
Current Status on Climate Change Response

Trend in Korean Municipalities

- Highlighted roles of municipalities (local governments)
  - Cities are ‘Culprits and also Victims’ to the climate change
  - Climate change response may be local, but its impact is global → Local administration is important
  - Cities’ voluntary efforts and inter-cities collaboration in the international society (playing active roles)

- Plans for local governments’ climate change response
  - Paris Agreement highlights roles of not only national government but also local ones

<table>
<thead>
<tr>
<th>Contents</th>
<th>Local Green Growth Plan</th>
<th>Local Energy Plan</th>
<th>Local Climate Change Response Plan</th>
<th>Local Climate Change response Comprehensive Plan</th>
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</thead>
<tbody>
<tr>
<td>GHG reduction/ green industry</td>
<td>energy efficiency/demand/ renewable energy</td>
<td>impact and vulnerability assessment</td>
<td>GHG reduction / adaptation</td>
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<tr>
<td>Period</td>
<td>5 years per phase</td>
<td>5 years per phase</td>
<td>5 years per phase</td>
<td>5 years per phase</td>
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<tr>
<td>Related national plans</td>
<td>green growth plan</td>
<td>energy basic plan</td>
<td>climate change adaptation plan</td>
<td>climate change response basic plan</td>
</tr>
</tbody>
</table>

* Local governments are developing local energy plans with citizen participation in accordance with national’s ‘renewable energy 3020’ implementation plan
## Case Studies of 3 cities in Korea

### Analysis of 3 cities: Jeju, Gwangju, Suwon

<table>
<thead>
<tr>
<th>Basis</th>
<th>Jeju</th>
<th>Gwangju</th>
<th>Suwon</th>
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</thead>
<tbody>
<tr>
<td>Basis</td>
<td>Connected to green growth basic plan</td>
<td>Local ordinance</td>
<td>Local ordinance</td>
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<tr>
<td>Name of Plan</td>
<td>2020 Jeju WEH basic plan, 2030 CFI Jeju</td>
<td>Carbon neutral city2050, General plan for climate change</td>
<td>General plan for environment capital, general plan for climate change response</td>
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<tr>
<td>Review Committee</td>
<td>WEH organizing committee</td>
<td>Gwangju climate change citizen committee</td>
<td>Suwon climate energy committee</td>
</tr>
<tr>
<td>Inventory</td>
<td>Made during planning</td>
<td>Analyze/announce annually</td>
<td>Register cCR and analyze annually</td>
</tr>
<tr>
<td>Assessment</td>
<td>Annually</td>
<td>Annually</td>
<td>Annually</td>
</tr>
<tr>
<td>Type</td>
<td>Led by Municipality</td>
<td>Led together by municipality specialized organization</td>
<td>Led by municipality, also with citizen participation</td>
</tr>
<tr>
<td>Responsibility</td>
<td>Make announcement (connected to national govt.)</td>
<td>Make announcements (connected to local govt.)</td>
<td>Join international program(cCR)</td>
</tr>
<tr>
<td>Additional Policies</td>
<td>in addition to national policies</td>
<td>in addition to national policies</td>
<td>in addition to national policies</td>
</tr>
<tr>
<td>Focus</td>
<td>Integration(Economy, Society, Environment)</td>
<td>Consider during planning</td>
<td>Consider when making some related policies</td>
</tr>
</tbody>
</table>
2. Emissions in Gwangju and Policies to Reduce GHG
Emissions and Policies in Gwangju

Current status of GHG emissions in Gwangju

Increased by 20.7% compared to 2005, and 0.6% by 2015
Average increase in energy sector between 2005~2016 : 1.8%

9.25 million tCO₂eq

GHG emissions in 2016 by sector

GHG emissions in energy sector in 2016

Energy | Industrial Process | AFOLU | Waste
---|---|---|---

Transport Household Commercial Industry Public Other

2,795 1,765 1,856 1,691 271 86
Emissions and Policies in Gwangju

Current status

- Emissions per GRDP
  - Average GRDP per last 11 years: 6.9%
  - Carbon concentration: -2.9%
  - Carbon concentration drops, but not low enough to reduce emissions.
  - Actual average emissions increase by 1.9% - increase not fast enough compared to economy growth.

- Emissions Increase/Decrease
  - Progressive increase: 2000~2004
  - Big leap in every 3 years since 2005
  - Progressive decrease since 2014, getting stable
### Emissions and Policies in Gwangju

**Emissions based on reduction inventory**

- **Emission per capita**: increase → decrease
- **Emission per GRDP**: decrease → decoupled

<table>
<thead>
<tr>
<th>Year</th>
<th>Reduction Inventory(Kton)</th>
<th>Population(Thousand)</th>
<th>Emission per capita, Gwangju (ton/Capita)</th>
<th>Emission per capita, national (ton/Capita)</th>
<th>GRDP(billion KRW)</th>
<th>Emission per GRDP (ton/billion KRW)</th>
<th>National Average</th>
</tr>
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<tbody>
<tr>
<td>2005</td>
<td>5,710</td>
<td>1,408</td>
<td>4.1</td>
<td>11.6</td>
<td>23,834</td>
<td>257</td>
<td>503</td>
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<tr>
<td>2010</td>
<td>6,399</td>
<td>1,468</td>
<td>4.4</td>
<td>13.2</td>
<td>26,401</td>
<td>242</td>
<td>520</td>
</tr>
<tr>
<td>2015</td>
<td>6,949</td>
<td>1,491</td>
<td>4.7</td>
<td>13.5</td>
<td>27,789</td>
<td>229</td>
<td>521</td>
</tr>
</tbody>
</table>

- **Reduction Inventory**: inventory in responsibility of Gwangju municipality (71% of entire emission : 29% are out of Gwangju’s responsibility)
- **Emission per GRDP**: decrease → decoupled

- **National Average**
  - 2009: 503
  - 2010: 520
  - 2011: 521
  - 2012: 512
  - 2013: 505
  - 2014: 484
  - 2015: 472
Emissions and Policies in Gwangju

Gwangju’s Efforts for Climate Change Response

- Agreement with MoE on the model city of climate change
- Organized climate change response department
- Set up overall plan for climate change response
- Carbon Bank

- UEA Summit (Gwangju)
  - UNEP GEO-5
  - Green Growth Forum
  - Designated as a leading city for electric vehicles

- UEA Summit (San Antonio, Texas)
  - Gwangju climate carbon map
  - Proposed special law on carbon neutral city
  - Joined Carbon Disclosure Project (CDP)

- UEA Summit (Iloilo, Philippines)
  - City Carbon Management System, first in Korea
  - 2nd General plan for Climate Change
  - Gwangju GHG Inventory Report 2015

- UEA Summit (Melaka, Malaysia)
  - Gwangju Climate Action Plan
  - City heat environment map
  - Expanded Low-Carbon Green Apartments
  - 2nd Infrastructure Improvement Project in Non-industry Sector
  - Gwangju GHG Inventory Report 2017

- Won Climate Change Green Award (Leading Municipality)
- Proposed special law on carbon neutral city
- GHG inventory report 2018

- 1st general plan for climate change response
- Low-Carbon Green Apartments
- Established low carbon green development ordinance

- 1st climate change adaptation plan
- Established Gwangju Climate Change Response Center
- Established UEA Secretariat
- Carbon-neutral Gwangju 2050

- 2nd climate change adaptation plan
- 1st Infrastructure Improvement Project in Non-industry Sector
- Household power plant project
- Household powerplant project
- Foodwaste output map
- Gwangju GHG Inventory Report 2016
- Cluster of eco-vehicle parts

- 2030 GHG reduction roadmap
- Implementation plan for climate change response in waterworks sector
- Guideline for energy transition village
- Research on Redox flow battery
- Research on Energy Prosumer
- Certification of value assessment for waste
- Electric/Hydrogen vehicles
- Environment preservation plan
- Planting 30 million trees
- Inventory report 2018
Emissions and Policies in Gwangju

Summary on Gwangju’s Climate Change Response

- **Vision and Strategy:** Carbon Free by 2050
  - **Goal:** Reduce 30% by 2020, 40% by 2030, and Carbon Free by 2050 (BAU Scenario)
  - **Strategies:** 69 Initiatives in 4 Sectors
    - GHG Reduction (48): Carbon Bank, Centralized Energy Supply, etc.
    - GHG Offset (7): Carbon Neutral Program in Environment Infrastructure, etc.
    - Climate Change Adaptation (4): Vulnerability Analysis in Forest, Monitoring Disease Information, etc.
    - Green Lives (10): Green Start Network, Local Food, etc.
  - **Duration:** 5 Years (2016~2020)
  - **Legal basis:** Gwangju climate change response ordinance
  - **Emission Trend/Projection:** 9.25mil. tCO₂eq (1.3% of entire nation) in 2016 / 11.58mil. tCO₂eq by 2030 (25.8% increased compared by ‘2015)

Key Characteristics

- Lead policies higher than legally, administratively required
- Yearly assessment on systematic implementation of policies
- GIS-Based Urban Carbon Management/Monitoring System
- Systematic education and training led by citizens
- Operate special organization for expertise and sustainability
Emissions and Policies in Gwangju

Outcomes in 2018, and Planning in 2019

- Outcomes in 2018 (except adaptation)
  - Practical mitigation policy: Citizen’s Practice Committee on Fine Dust
  - Join Carbon Points: 351 thousands households (59%), highest rate among metropolitan cities
  - Low Carbon Green Apartment (40 apartment buildings)
  - Eco-vehicles (824 EV, 166 hydrogen vehicles and 1 hydrogen station)
  - Support lowering vehicles’ emissions (3,661), LNG hybrid bus (20)
  - Planting 30 million trees initiative to respond to heat wave and heat island
  - Climate Change Response Education (840 times for citizens, 93 eco-instructors, 940 exhibition halls)
  - Environmental Education in schools (develop textbooks for 3~4 grade, green curtains in 10 schools, 10 schools for education, 5 schools for outstanding school award)

- Revenue in 2019: 171 billion Korean Won (37.6 from national, 117.9 from municipal, 15.5 from private)
  - 118.8 bil. KRW for Mitigation, 5.8 bil. KRW for Offset, 23.7 bil. KRW for adaptation, 22.7 bil. KRW for Practice

<table>
<thead>
<tr>
<th>Year</th>
<th>Emissions (A)</th>
<th>Reduction Plan (B)</th>
<th>Reduction Outcomes</th>
<th>Compared to B (%)</th>
<th>Compared to A (%)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>9,251</td>
<td>689</td>
<td>617</td>
<td>89.6</td>
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<tr>
<td>2017</td>
<td>9,311</td>
<td>568</td>
<td>521</td>
<td>91.7</td>
<td>5.6</td>
<td></td>
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<tr>
<td>2018</td>
<td>9,621</td>
<td>506</td>
<td>457</td>
<td>90.3</td>
<td>4.8</td>
<td></td>
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<tr>
<td>2019</td>
<td>9,771</td>
<td>486</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2017~2019: Projected Figures</td>
</tr>
</tbody>
</table>
Gwangju GHG reduction roadmap
2030

- **Vision**: Gwangju, a green city leading low-carbon development
- **Target**: 30.3% of reduction by 2030 compared to BAU scenario
  (*as recommended national government*)

**Key Strategies**
- **Environment**: Green space → lower temperature and secure green area safe from fine dust, boost carbon absorption
- **Economy**: new energy economy → foster new economy and job opportunities, also reduce GHG
- **Society**: Low carbon society → low-carbon lives with citizens and communities through green lives

**Graph**
- **Reaching target**: 82% compared to 2005
- **Achieving scenario**: 53% compared to 2005
Emissions and Policies in Gwangju

Implementation and assessment of reduction roadmap

Assessment of reduction roadmap

Set target by projects
- Implementation checkup
- Index Assessment
  - Account and analyze entire reduction (2)
  - Comprehensive Checkup
  - If failed to reach target
  - Report and announce reduction
- Reduction checkup
  - Quantitative Assessment

Achievement Assessment
- Develop/verify reduction inventory
- Analyze possibility to achieve
  - If achieved (target >= reduction)
  - If failed (target < reduction)
  - Account actual emission (considering offset e.g. renewable energy)
  - If achieved
    - Reach target
  - If failed
    - Failed to reach target

Add unreached target

Develop New Project

Causality Analysis

Ministry of Environment

International Climate and Env. Ctr.

Implementation Group

Committee
3. Best Practices of Gwangju for Climate Change Response
“Characteristics of mitigation and adaptation for climate change response are convergence (or complimentary).” Actions such as planning, policies, ECO\textsuperscript{2}, technologies, and governance based on convergence can maximize its impact.

※ ECO\textsuperscript{2} : ‘Ecological Cities as Economic Cities’, similar with Greenomics. It aims to create synergy by seeking both ecological and economic sustainability.
Best Practice of Gwangju

Set up infrastructure and system for implantation of policies

“Collaboration for climate change response needs to be done at a high level in legislative and deliberative manners.”

- **Legal basis**: Gwangju climate change response ordinance, Basic ordinance for low-carbon green growth and sustainable development

- **Related Plans**
  - National: Green Growth 5-year plan, Environment preservation plan, Climate change adaptation plan
  - Gwangju: Implementation plan for sustainable development, General plan for climate change response
  - Non-legal: Gwangju carbon-neutral 2050, Gwangju 1°C cooler project, Gwangju climate action plan (2018-2030), Gwangju GHG reduction roadmap 2030
  - Review: Gwangju civil committee for climate change response
  - Department: Climate and air department (Environment Ecology Bureau)
  - Specialized Organization: International Climate and Environment Center

- **Assessment Structure**
  - Submit implementation plans by each organization, aiming to develop 5-year plans
  - 4 types of projects: reduction, offset, adaptation, green lives
  - Project assessment (2 times a year) → achievement analysis (compared to target)
  - Emission accounting and analysis: GHG inventory report, emission information, etc.
Best Practice of Gwangju

Carbon management and monitoring in the city

- GHG Projection & GHG Information in my town
- Food waste Map (Multi residence Units)
- Thermal Environment Analysis
- Daytime: artificial heat controlled (reduced)
- Nighttime: artificial heat controlled (reduced)

Urban Carbon Management System

Inventory Analysis (every year)

Environment and Carbon Management based on Database

Vulnerability Assessment (every 5 years)

Average daily temperature
**Best Practice of Gwangju**

Gwangju-style climate change platform (heat waves, fine dust) / under development

- **Data Input**
  - Analyze Comprehensive D/B
  - Satellite and GIS data

- **Assess and Analysis**
  - Assess data model and outcomes
  - Impact analysis in vulnerable area

- **Take Measure**
  - Risk information for citizens
  - Immediate measurement

### Comprehensive D/B System

- Satellite-based GIS modelling

### Gwangju’s land use

### Gwangju’s temperature(satellite)

### Analysis and vulnerability grade (1~5)

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<th>발생</th>
<th>희생률</th>
<th>홍역가해력</th>
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<tbody>
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<td>5등급</td>
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- Restricted transport
- Heat shield
- Smart clean road/clean fog
- Shelter from heat
**Best Practice of Gwangju**

**Policies on climate change response with citizen participation**

- **Gwangju 1℃ Cooler Project**
  - Cool and Green City with Citizens
  - Solve environment issues led by citizens

- **Carbon Bank**
  - Reduced 85ktCO₂eq in 2018

- **Low-Carbon Green Apartment**
  - Reduced 10,909tCO₂eq in 2010~2018

- **Together Green Village**
  - 1,284(~2018), 944tCO₂eq reduced

- **Electric Vehicle City Project**
  - 467ktCO₂eq by 2030(BAU 5.7%)

- **Energy transition up to 20%**

**Specialized Organization**
- (재) 국제기후환경센터

**[Governance]**
- Gwangju Council for Sustainable Development
Best Practice of Gwangju

Virtuous Circle: Education-Public Awareness-Citizens’ Action

**Education**
- Education for instructors
- Green jobs (train instructors and consultants)
- Education contents (on/offline)

**Public Awareness**
- Education for the vulnerable (elder citizens living alone, etc.)
- GHG consulting (household, commercial, school)
- Education targeting to citizens

**Citizen’s Action**
- Capacity building for the vulnerable
- Citizen-led program (low-carbon green apartment)
- Citizen-led green lives (green leaders)

- Using public transportation
- Sharing books, urban farming
- Planting trees
- GHG emission reduction
Best Practice of Gwangju

City-wide international collaboration under UEA network

- UEA (Urban Environmental Accords) : a collective of 156 cities (in 52 countries) committed to environment and climate actions
  - Organize UEA Summit (biannual event), share best practices, run training programs, etc.
  - ‘UEA City Award’ based on the urban environment evaluation index
  - Share Gwangju’s policies and best practices and develop knowledge sharing program

UEA was founded in San Francisco (California) in 2005, and UEA Secretariat was established in Gwangju in 2012.
Thank you for your attention!

solar@icecgj.or.kr