

The Action Plan for Clean and Green Wonju

(Plans of implementation for GHG emissions reduction and adaptation in Wonju City)

December, 2009



Wonju City

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Plans for GHG emissions reduction and adaptation

1. INTRODUCTION

- . To respond to climate change and contribute to "low carbon, green growth" for the nation, Wonju city establishes the comprehensive plan for reduction of GHG emissions and adaptation for climate change and will reduce GHG emissions in 2020 by 7% below 2005 levels.

2. STATUS OF GHG EMISSION SOURCES BY SECTOR

- . To research status of GHG emissions, investigate status of GHG emission sources in Wonju city by Sector during 2000~2007.

2.1 Energy Sector

- . The amounts of electricity and gas consumptions are increasing gradually, but oil consumptions are decreasing.

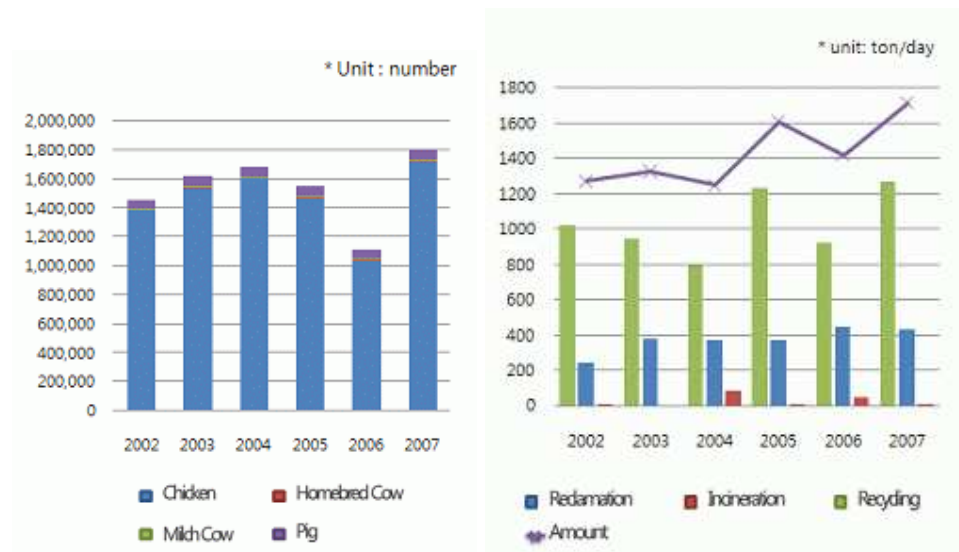


<Figure 2.1> Energy and Industry Sector

2.2 Industry Sector

- . The total number of companies Wonju city is 22,374 and occupies 19.1% of that of Gangwon Province.
- . In the case of Industrial structure, primary industry occupies 0.1%, secondary industry 9.5%, third industry 94.5% mostly.

- . In the case of the total number of business employees, primary industry occupies 0.1%, secondary industry 22.4%, third industry 77.5% mostly.



<Figure 2.2> Industry and Agriculture Sector

2.3 Agriculture Sector

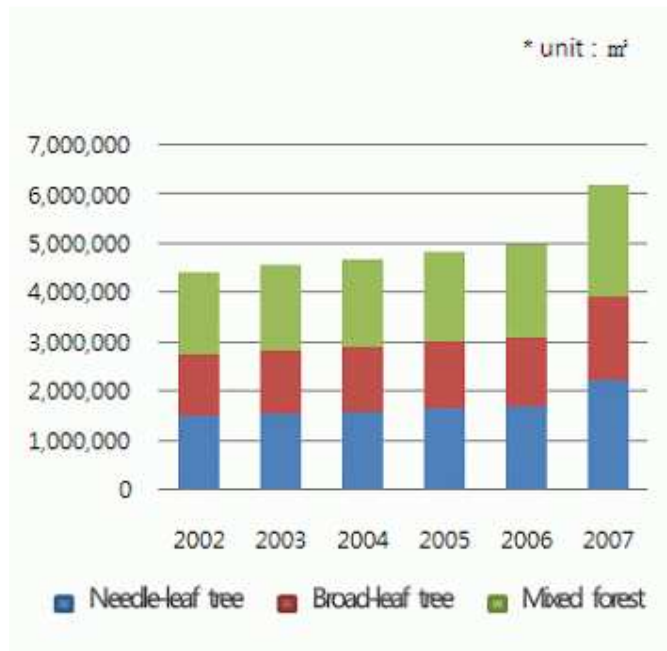
- . The total area of arable lands has gradually decreased from 9,985ha in 2000 to 9,653ha in 2007.
- . The total number of homebred cattle is increasing, but the number of milch cows is decreasing.

2.4 Waste Sector

- . The total amounts of wastes generated in 2006 decreased for a moment but since 2006, they began to increase again.
- . Wastes are treated in the following order : 1st recycling, 2nd reclamation, 3rd incineration. so, wastes in Wonju city are mainly recycled.

2.5 Forest Sector

- . The forest area in Wonju city occupies 4.5% of Gangwon Province and the cumulative dose of forest trees in Wonju city does 4% of Gangwon Province.
- . Since 2003, the forest area in Wonju city has been kept in the similar level and the cumulative dose of forest trees has been increasing gradually.



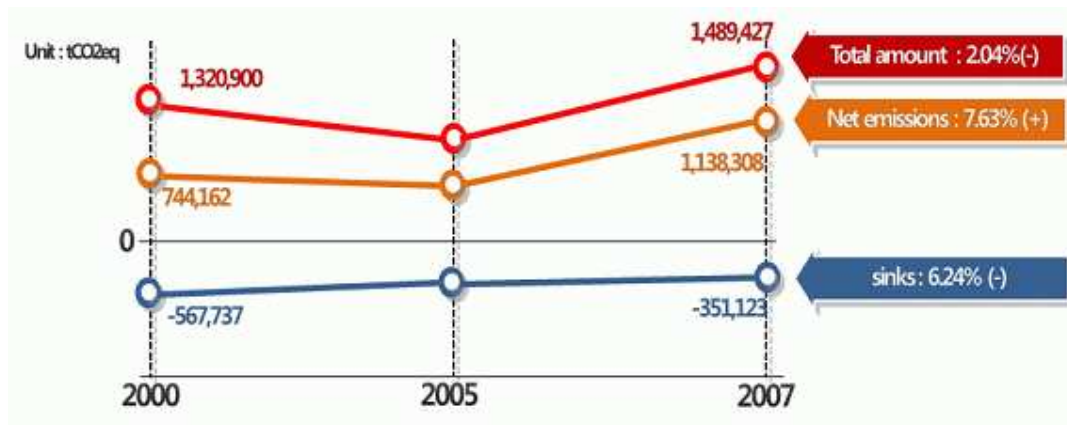
<Figure 2.3> Forest Sector

3. GHG EMISSIONS STATUS

- . The amount of GHG emissions in Wonju city is calculated through IPCC 2006 Guideline during 2000-2007.

3.1 GHG emissions

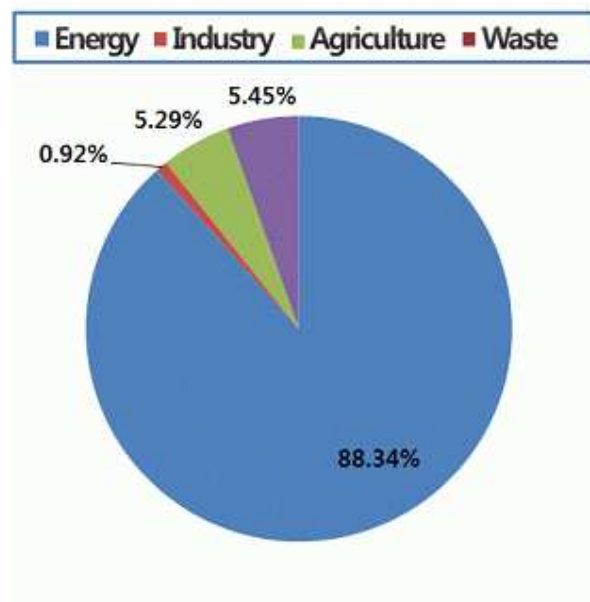
- . The total amount of GHG emissions in 2007 was 1,489,427ton.CO₂eq and increased by 2.42% compared with 1,320,900ton.CO₂eq in 2000.
- . The total sinks of GHG in 2007 was 351,123ton.CO₂eq and decreased by 6.24% compared with 744,162ton.CO₂eq in 2000.
- . The net amount of GHG in 2007 was 1,138,308ton.CO₂eq and increased by 7.63% compared with 744,162ton.CO₂eq in 2000.



<Figure 3.1> GHG emissions diagram

3.2 Ratio of GHG emissions

- Yielding average of GHG emissions during 2000~2007, ratio of GHG emissions by sector is calculated.
- Contribution of GHG emissions by sector is illustrated at figure 3.2 and energy sector occupies 88.34% of the total amount of GHG emissions in Wonju city.
- 1st : Energy (88.34%)
- 2nd : Waste (5.29%)
- 3rd : Agriculture (5.45%)
- 4th : Industry (0.92%)



<Figure 3.2> Ratio of GHG emissions

4. GHG EMISSIONS ESTIMATE AND REDUCTION GOAL ESTABLISHMENT

- . The amount of GHG emissions in Wonju city is estimated through IPCC 2006 Guideline.

4.1. Estimate methods

- 1) Estimate by energy consumption
 - . As Energy consumptions increase with growth of city and GHG emissions are expected to increase with energy consumptions, GHG emissions are estimated by the rate of energy consumptions.
- 2) Estimate by linear regression equation
 - . GHG emissions are estimated by consumption amount during 2000 ~ 2007 in the local energy statistics annual report and linear regression equation.
- 3) Estimate by scenario
 - . GHG emissions are estimated by the scenario modified from BAU for GHG emissions estimate in Gangwon province by Gangwon Development Research.

4.2 Estimate of GHG emissions(2005~2020)

- . Table 4-1 shows the estimate of emissions by year.
- . The estimate by scenario is higher than those by other methods and is excluded for the average of estimates in 2020.
- . The average of estimates in 2020 is 1,644,079 t.co₂eq.

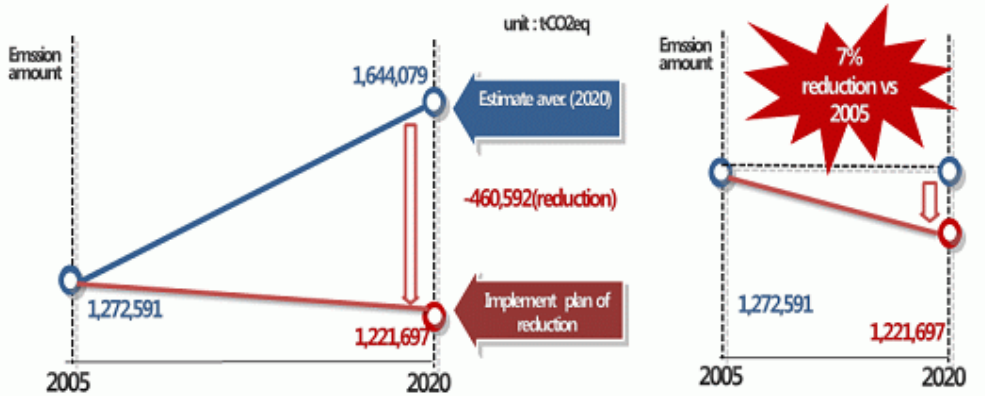
(Unit: tCO ₂ eq)					
	Estimation method	Calculation	Estimation		
		2005	2010	2015	2020
Total amount	Energy consumption	1,272,591	1,517,926	1,574,653	1,633,144
	Linear regression equation	1,272,591	1,530,870	1,591,983	1,655,015
	Scenario by Gangwon Development Research	1,272,591	1,599,544	1,916,241	2,314,012

<Table 4.1> Estimate of emissions by year

4.3 GHG emissions reduction target

- . GHG emissions reduction target in 2020 is 7% minus compared with 2005.
- . So, Wonju city will reduce 460,592t.co₂eq by 2020.

- . To accomplish reduction target, plans for reduction in GHG emissions are established and implemented positively and aggressively step by step.



<Figure 4.1> GHG emissions reduction target

5. PLANS OF IMPLEMENTATION FOR GHG EMISSIONS REDUCTION

- . Plans to reduce GHG emissions by sector in Wonju are below.

5.1 Promotion directions

- . Realize below through implementing concrete plans for reducing GHG emissions:
 - Introduction of social system for low carbon
 - **Renewable energy extend supply and energy-efficiency improvements**
 - Introduction of low carbon vehicles and operating systems
 - Waste reduction & Making Waste into energy
 - Creating a low carbon eco-friendly living spaces
 - **Settlement of civic low carbon practice campaigns and building capacity responding climate change**

5.2 Plans of implementation for reduction

● Introduction of social system for low carbon

- 1) Establish "the 2025 green city comprehensive plan"
 - . To convert urban structure of Wonju city to low-carbon structure, establish "the 2025 green city comprehensive plan".
- 2) Extend voluntary agreements of large energy consuming companies.
 - . To encourage energy conservations in industry, extend voluntary agreements of large energy consuming companies.
- 3) Introduce system of the total amount of public institution energy consumption
 - . To reduce public energy consumptions by 5%, Introduce system of the total amount of public institution.

- 4) Supply electricity smart measuring meters
 - . For citizens to save energy, supply electricity smart measuring meters 100% of homes by 2020.

- Renewable energy extend supply and energy-efficiency improvement

- 1) Implement pilot projects
 - . Implement pilot projects such as solar photovoltaic power generation installments at the city hall and the sewage treatment plant.
- 2) Supply Renewable energies
 - . After analyzing outcomes of pilot projects, supply 10,000 homes utilizing solar photovoltaic power generation and solar thermal power generation.
- 3) Improve energy-efficiency of buildings
 - . Raise fund of 5 billion won every year and subsidize citizens who want to improve energy-efficiency of their buildings.
- 4) Extend supply low-carbon energy such as LNG
 - . Improve household penetrations of LNG up to 80%.
- 5) Extend supply district cooling/heating systems and CES
 - . To improve efficiency of energy supply to the homes and buildings, extend supply district cooling/heating system and CES by up to 20% of the homes and buildings in Wonju city.

- Introduction of low carbon vehicles and operating systems

- 1) Build the low-carbon transportation control center
 - . To control petroleum-based vehicles on the roads efficiently, build the low-carbon transportation control center.
- 2) Replace traffic control signals and street lamps with LEDs
 - . To construct low energy traffic systems, Replace all of the traffic control signals and street lamps with LEDs.
- 3) Extend supply eco-friendly vehicles
 - . To encourage citizens eco-friendly vehicles such as bike, Introduce 2000 units of public bikes, repair roads for bike and build new tracking courses around the Mt. Chiak.
 - . To supply low-energy consuming vehicles, introduce biomodal traps driven by electricity.
- 4) Improve energy efficiency of vehicles
 - . Replace petroleum-based buses with 150 units of CNG buses.
 - . Support modification expenses of 1.5M won per person who want to replace car's engine with CNG type.

- Waste reduction & Making waste into energy

- 1) Build the environmental energy complex town
 - . To make wastes into energies such as fuel, biogas and electricity, build the environmental energy complex town which consists of RDF manufacturing facility(160ton/day), food waste treating facility(90ton/day) and LFG generation plant(2.3MW).
- 2) Introduce systems to reduce waste-generation
 - . To reduce waste generation fundamentally, introduce systems of the total amount of food wastes and voluntary agreements to reduce food wastes at the restaurants.
- 3) Install sewage sludge treatment facility
 - . To reduce GHG generated from sludges, install sewage sludge treatment facility at the sewage treatment plant.

● Creating a low carbon eco-friendly living space

- 1) Extend supply sources for sinks of GHGs
 - . To pursue forestation and greenway of buildings in the city, build the arboretum of Wonju city, the street for sinking carbon and open the campaign "planting 1000M trees".
 - . Promote projects such as rooftop garden(100EA) and school forest(50EA).
- 2) Make eco-friendly environments for citizens
 - . To Make eco-friendly environments, develop new five urban parks, artificial eco-wetlands by the WonJu River and small parks in the lots around the center of the city.

● Settlement of civic low carbon practice campaigns and building capacity responding climate change

- 1) Introduce "carbon footprint" to specialties of Wonju city
 - . To promote sales of low carbon specialties of Wonju city, apply carbon footprint to them.
- 2) Spread low energy-consuming lifestyle in to citizens
 - . Open "GREENSTART" campaign, civic engagement events and practice exercises for reducing CO₂ in the living .
 - . Increase the participation rate of homes in "carbon point" to 100% by 2020.
- 3) Enhance capacities for R&D and foster specialists for climate change
 - . To enhance capacities for R&D and foster specialists in areas such as climate change and environmental consulting, establish the Education and research center for Climate change and attract specialized graduates for climate change and waste-energy.

6. PREDICTIONS ON IMPACTS OF CLIMATE CHANGE

- . Predict impacts of climate change by sector.

6.1 Impacts on agriculture sector

- . Wonju city belongs to 'central inland areas' on the distribution of rice cultivation areas and the quantity of rice cultivation is expected to decrease due to climate change.
- . Pests occur more frequently due to temperature rise from climate change and On the other hand, Warm temperate crops are expected to be cultivated due to changes in vegetation.
- . Crop growth is reduced and quality of crops is bad due to temperature rise and damages to crops under structure are expected to occur due to disasters resulting from climate change.

6.2 Impacts on forest sector

- . Forest pests occurrence, ecosystem disturbance and biodiversity loss and so on are expected due to temperature rise resulting from climate change.
- . Forest fires and landslides are expected to increase due to climate change.
- . Needle-leaf trees which are consisted most of forest in Wonju city are expected to decrease and broad-leaf trees are prevailing due to temperature rise.

6.3 Impacts on disaster sector

- . As heavy rains and torrential rains are increasing due to climate change. landslides and floods also are expected to increase.
- . As occurrence frequency of typhoons is decreased by 30% but the intensity of them is more destructive until the end of the 21st century, they are expected to cause damages much more than ever.

6.4 Impacts on health sector

- . Ongoing heat wave is expected due to climate change
- . Heart disease. diabetes, hypertension, respiratory diseases and etc. are expected to increase relatively.

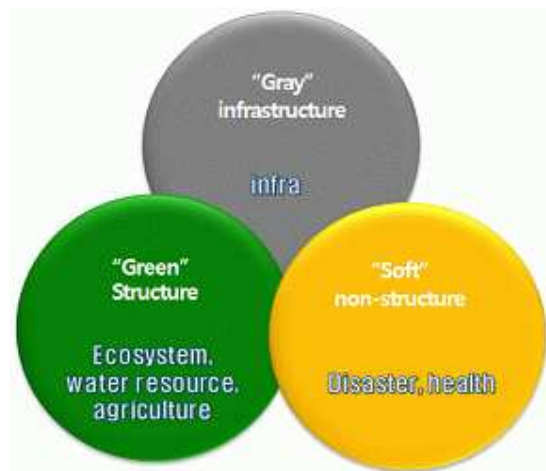
7. PLANS FOR CLIMATE CHANGE ADAPTATION

- . Investigate overseas adaptation policies and modify them appropriate for Wonju city.
- . List existing policies of Wonju city related to climate change and establish strategies to adapt them to plans of adaptation.

- . Establish strategies of adaptation for vulnerable areas according to the vulnerability assessments.

7.1 Promotion directions

- . Plans of adaptation are classified into three areas configuring "Grey" infrastructure, "Green" structure and "Soft" non-structure.
- 1) "Grey" infrastructure
 - . "Grey" Infrastructure is the technical means to adapt buildings and infrastructure facilities essential for social and economic welfare to climate change.
 - . The corresponding areas of adaptation is infrastructure.
 - 2) "Green" structure
 - . "Green" structure contributes to increase the ability to adapt to ecosystem, prevent biodiversity loss and ecosystem destruction, recover circulation of water resources.
 - . The corresponding areas of adaptation is ecosystem, water, agriculture.
 - 3) "Soft" non-structure
 - . "Soft" non-structure controls land use to reduce disaster vulnerability and prevent disasters and provides incentives.
 - . The corresponding areas of adaptation is disaster and health.



<Figure 7.1> classification of adaptation plans

7.2 Plans of implementation by sector

● Adaptation infrastructure for climate change

- 1) Plan Urban renewal
 - . Plan improvements of existing urban environments and housing, renewal of waterfront and adding culture space to the city.

- 2) Build climates playgrounds
 - . Install climate playgrounds at parks, children's playground, theater and so on where citizens produce electrical energy through self-development exercise equipments.
- 3) Install vending machines for recycling
 - . Install vending machines at the markets over a certain size to collect bottles and packaging for recycling.
- 4) Enact the ordinance "limited resource building"
 - . Enact the ordinance "limited resource building" to minimize resources used during from architectural design to operation.
- 5) Install a sculpture about climate change
 - . Install a sculpture at the entrance of the city hall to remind citizens of seriousness of climate change.
- 6) Publish "civil adaptation action"
 - . Issue the publishing committee consisting of officials, civic groups and professionals.
 - . Publish practice guides for individual or family about climate change adaptation.
- 7) Install white roofs
 - . Install white roofs to reduce urban heat-island effects and microclimates.
- 8) Raise "Green Donation"
 - . Charge companies with a certain amount of expenses for GHG sinks destroyed by developments.
 - . Raise fund to write MOUs with companies emitting GHG.
- 9) Mandate low-carbon green events
 - . Being obligated to organize all the meetings, performances, ceremonies and festivals in low-carbon green events.
- 10) Operate the climate academy
 - . Organize members of the climate academy consisting of civic groups, governments and businesses and conduct education and training on climate change for citizens.
- 11) Operate the system "energy mentor"
 - . Operate the system "energy mentor" which consultants visit homes and buildings to diagnose energy use and advice energy-savings.
- Enhancing ability of eco-system to adapt and recovering water resources
 - 1) Plan "maintenance of irrigation facilities for agriculture"
 - . Agriculture water will be acquired by construction of reservoirs and embankments in the comprehensive plan.
 - 2) Issue the agriculture guideline for climate change

- . Issue the comprehensive guideline to respond to the changing circumstances of agriculture by climate change.
- 3) Build artificial streams
 - . Build small artificial streams to control microclimates in the city.
- 4) Plan monitoring climate change and ecological environment
 - . By selecting regional representative species, plan monitoring climate change and ecological environments.
- 5) Build carbon-cycling towns
 - . Build carbon-cycling towns to utilize forest biomass as a source of low-carbon energy.
- 6) Mandatory rainwater reuse of buildings
 - . By installing rainwater storages, recycle rainwater as water for agriculture and industry and minimize dry of stream flow, decrease of underground water levels and so on.
- 7) Mandatory water reuse of buildings
 - . To encourage water conservation, reuse water from buildings.
- 8) Replace the aging sewer pipes
 - . To reduce leakage in pipes, replace aging water pipes with new ones.
- 9) Enhance the forest monitoring panel
 - . To prepare for occurrences of insects and wildfires by climate change, enhance actions of the forest monitoring panel.
- 10) Forest at limited farmlands
 - . Forest at the remaining space of the city for sinks of GHG.
- Establish system for risks from climate change
 - 1) Build the monitoring system of health impacts from climate change
 - . To acquire statistics of the disease from climate change, build the systems of long-term monitoring impacts on health and infectious disease surveillance.
 - 2) Install automatic climate measuring meters
 - . To collect data about temperature, humidity, rainfall and so on at the representative regions in Wonju city, Install automatic climate measuring meters.
 - 3) Maintain Wonju River
 - . Plan maintenance of Wonju River utilizing eco-friendly materials and acquire green spaces and waterfronts for flood prevention.
 - 4) Build Early warning system
 - . To minimize the impacts of climate change on citizens, Build early warning systems to provide accurate information quickly.
 - 5) Public promotion and education about responding tips

- . Conduct preventive education for citizens and special intensive training for the vulnerable.
- 6) Enhance emergency medical services
 - . Build systems of rapid first aid and emergency medical evacuation for patients related to disasters from climate change.

8. CONCLUSIONS

- . Wonju city is going to cut 5%¹ of GHG emitted in 2005 by year 2020 by establishing and implementing plans for GHG emissions reduction.
- . Also, Wonju city will adapt to climate change through establishing the comprehensive and systematic plans for climate change.
- . So, Wonju city will lead the world in responding to climate change and green growth.

¹ The objective of the national government is 4%.