The integrated assessment of Korea's response to climate change

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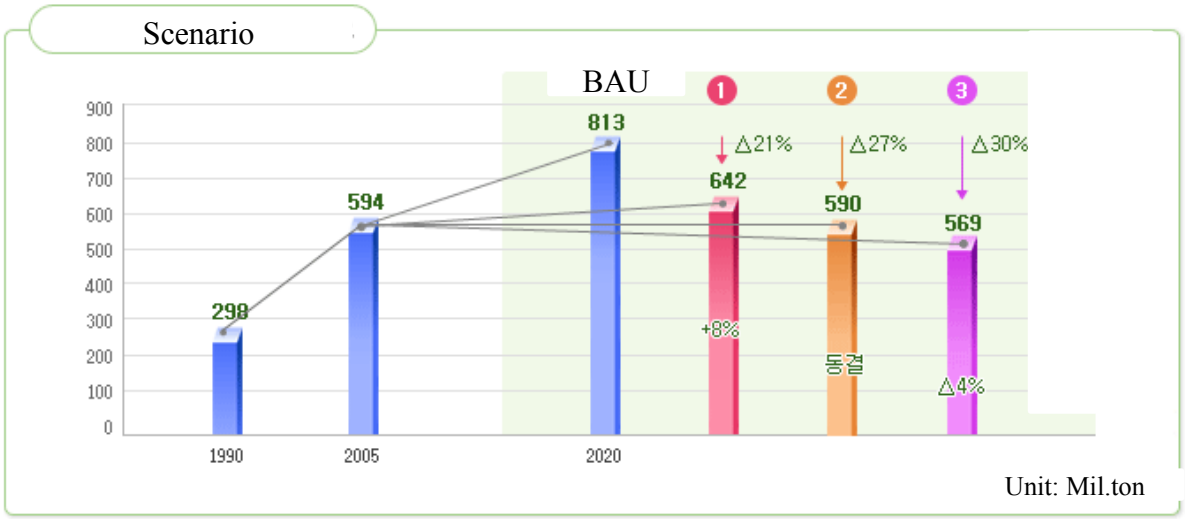
Trends in Korea

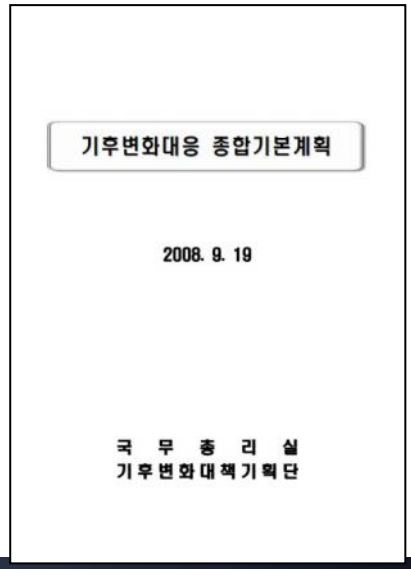
Trends in Korea

Government policy

- Succeeding the enactment of low- carbon green growth in November 09, a goal was set for the country to reduce its greenhouse gas emissions via the vote of the State Council, in comparison to BAU(Business as Usual, under BAU) by 30% by 2020.
- Beginning from 2009, the mitigation of climate change and its adaption methods of the reduction of greenhouse gases data will be established with 16 metropolitan cities in a comprehensive climate change adaptation plan.



Source : Presidential Committee on Green Growth, 2009

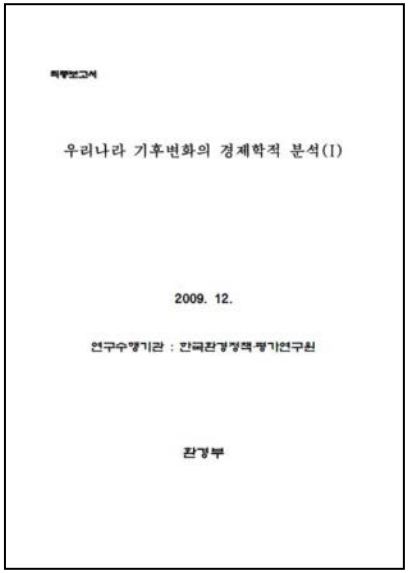


Trends in Korea

Research trends

- By developing a domestic/international model, the quantitative prediction of national greenhouse gas emissions and its reduction goal are achieved.

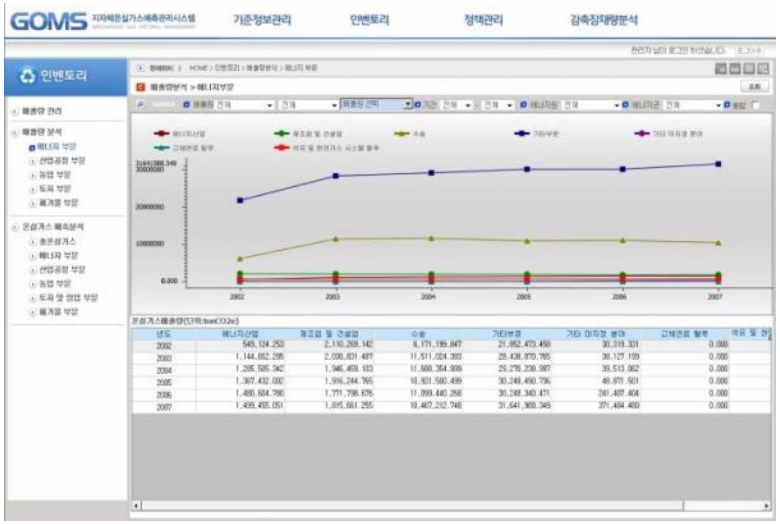
- The comprehensive economic analysis will be done according to the impacts of climate change and reductions.



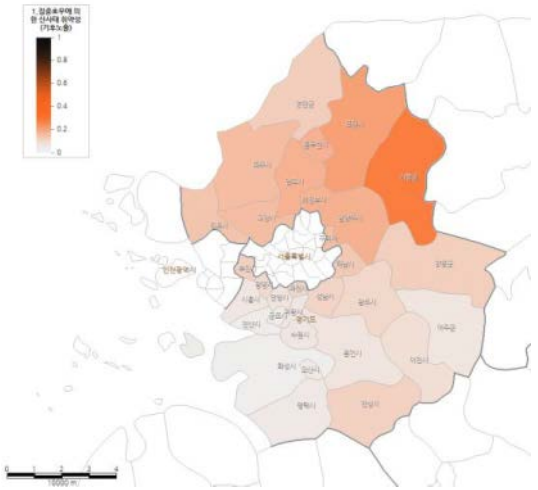
Trends in Korea

Research trends

- The development of an impact prediction model, vulnerability assessment model and an emissions prediction model for the establishment of climate change adaption strategies is carried out at a local level.



Local Government Greenhouse Gas Emissions Prediction Model



Vulnerability assessment of climate change

Korea's attempt in integrated assessment and its significance

Outline

- Using the developed domestic and foreign-based greenhouse gas emissions prediction, climate change impacts, adaption methods (model) and more the analysis is being carried out.
- Utilizing a variety of models, integrated assessments are being initiated, however, rather than embodiment in an integrated assessment model, individual models are being developed instead at the current state.
- In national studies, meaningful results are drawn, but a substantial amount of research of transitional climate change adaption plans at the local government is still insufficient.
- For the concrete mitigation & adaption plans of climate change, each local government has its research in progress.

Korea's attempt in integrated assessment and the results

The top-down integration model development and low carbon policy analysis

Noh et al., 2010

- By incorporating the bottom-up model of MARKAL and the top-down model of CGE, the potential greenhouse gas emissions and the cost reduction will be analyzed and the reduction target will be achieved in order for the policy measures to be evaluated.
- The possible achievable reduction of international carbon price of 19dollars per CO2 ton is analyzed according to carbon emissions of 16.4%, which is equivalent to 102,505 thousand CO2 ton.

Economic impact analysis according to climate change

Kim et al., 2010

- Using the CGE and PAGE models, the damages of climate change and its reduction cost are analyzed.
- Using the CGE model, the analyzed results of the real GDP reduction (in comparison to BAU) in 2020 is estimated to be around 0.01%~0.15% and 0.03%~0.75% in 2030.

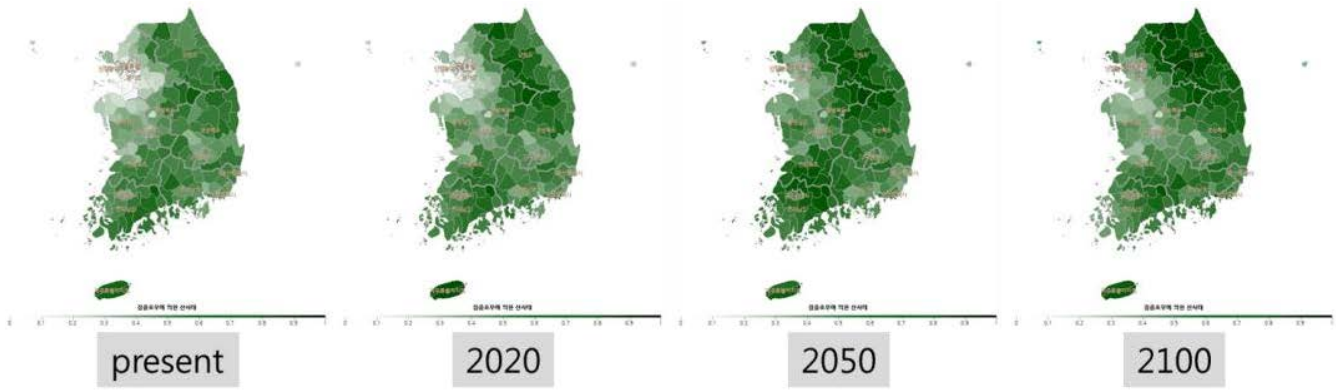
Korea's attempt in integrated assessment and the results

The Vulnerability Assessment for Local government in Korea

Lee et al., 2011

- Using the CCGIS from the National Institute of Environmental Research center, the local government vulnerability assessment implemented according to future climate change, climate sensitivity and the ability to adapt.
- The study results show the policy and support funds that are selected for utilization of the importance of local needs for the response to climate change in each local government.
- The evaluation of vulnerable areas are done by individually in each local government, which is then used in the establishment of measures.

Results of vulnerability assessment



(NIER, National Institute of Environmental Research, 2011)

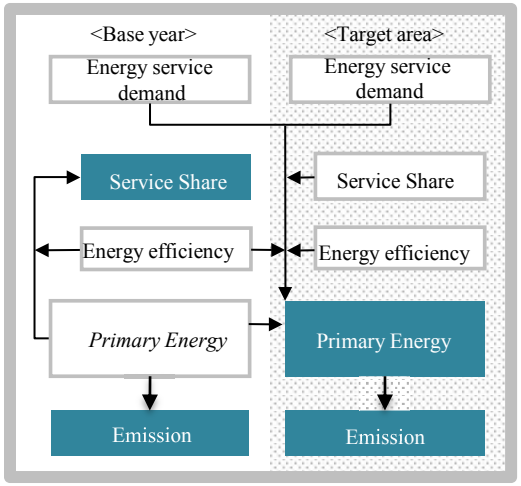
The development of Local government-oriented model and its application

1. Greenhouse gas emissions management model
2. Implementation of vulnerability model and its assessment (case study in Gyeonggi-do Province)
3. Response to climate change with the adaption and management model of an urban ecosystem supporting the security of biodiversity.
4. Future Challenges
5. Greenhouse gas mitigation analysis model (case study in Gyeonggi-do Province)

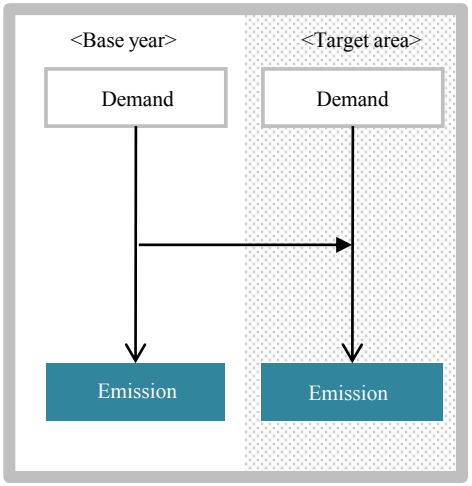
The development of Local government-oriented model and its application

Greenhouse gas emissions management model for each local government

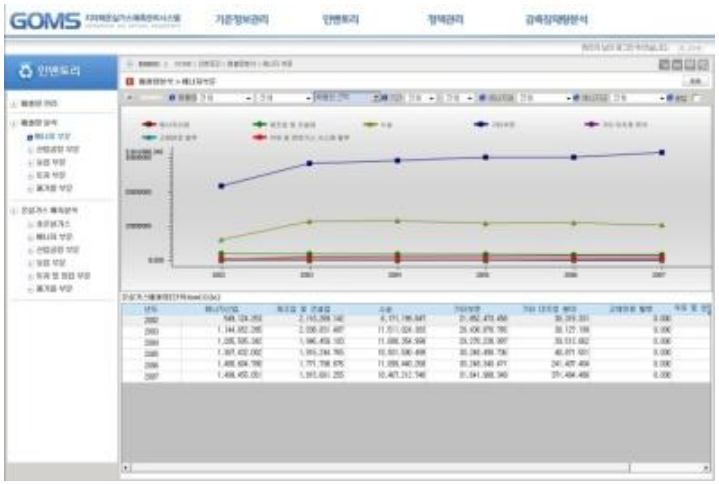
- The greenhouse gas emissions for each local government are categorized and managed according to energy, industrial processes, agriculture, land use change and forestry and waste materials.
- Using the concept of energy services, the future greenhouse gas emission calculations and application of reduction policy results are derived from the AIM model.
- The energy service demand is forecasted through past greenhouse emission data and regression analysis (which are derived initially from socio-economic variables).
- The organization of the reduction policy is done according to priority and its performance evaluation is implemented.



Energy sector



Non energy sector



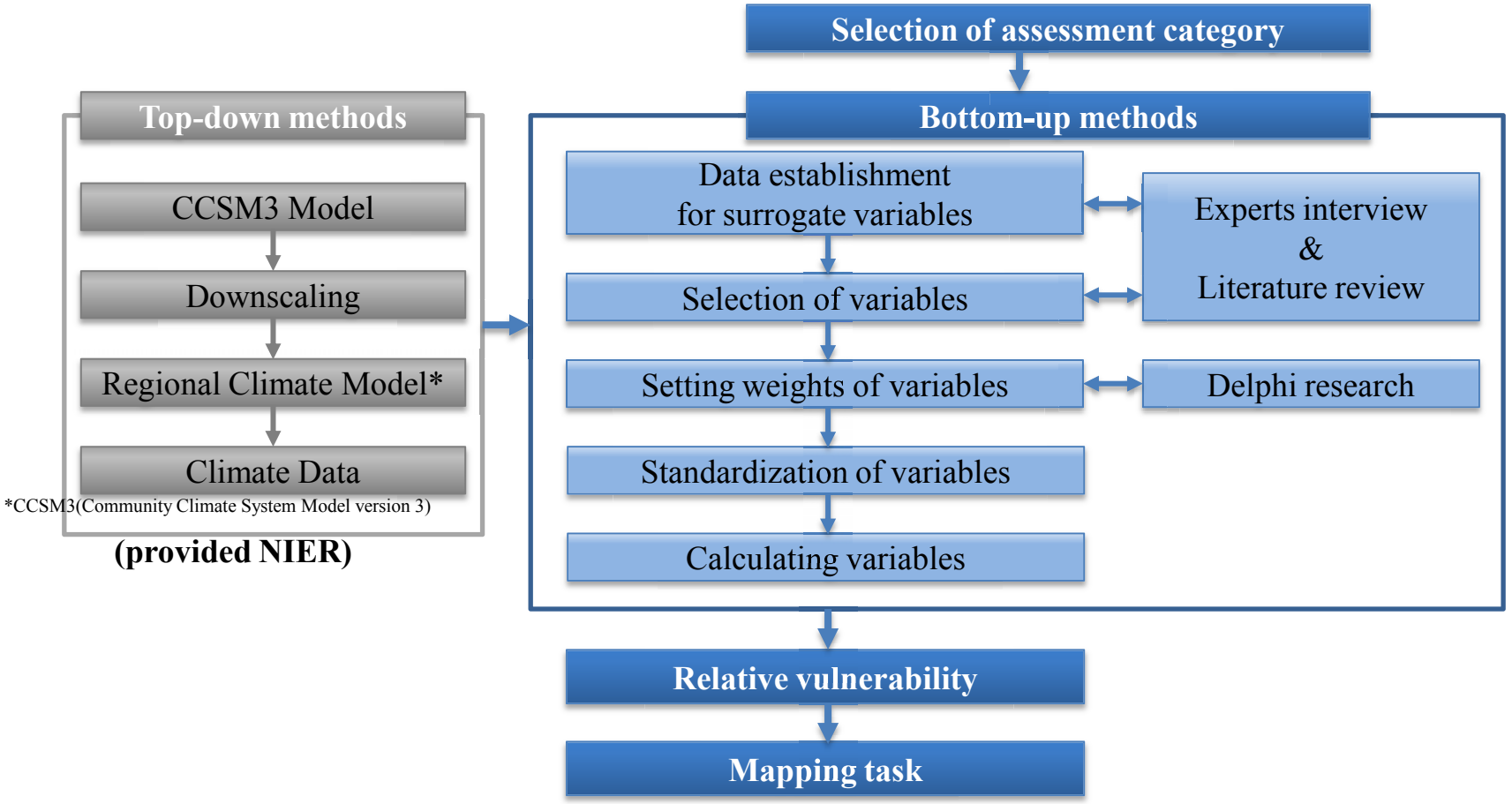
(NIER, National Institute of Environmental Research, 2011)

The development of Local government-oriented model and its application

Vulnerability model and the evaluation

Method

- The assessment of vulnerability is carried out using the bottom-up and top-down methods.

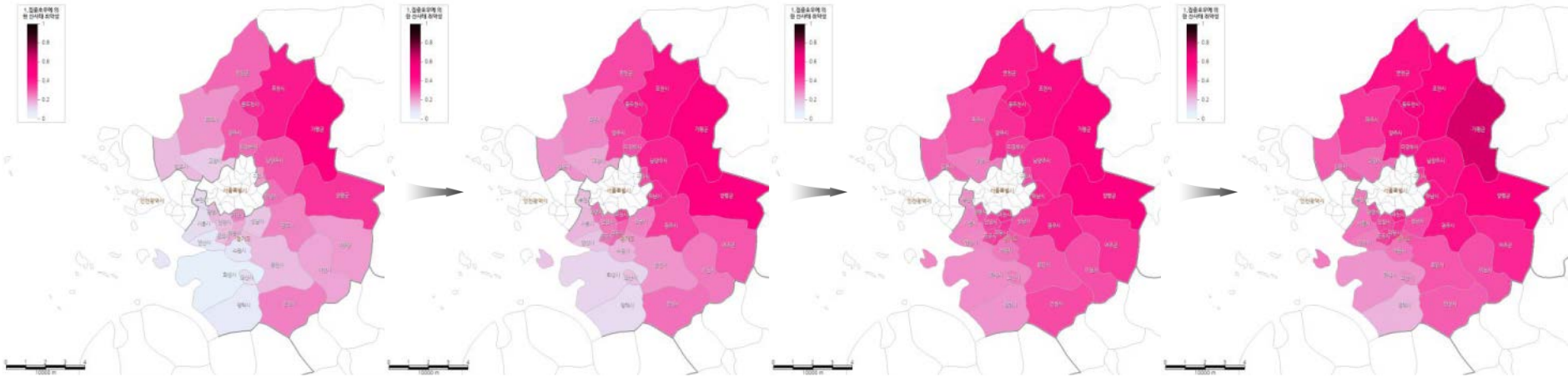


The development of Local government-oriented model and its application

Vulnerability model and the evaluation

Main results

- The vulnerability of landslides caused by torrential rains
  - The vulnerability of landslides caused by torrential rain in the Province of Gyeonggi-do will show a continuous increasing pattern from the year 2000 to 2050.
  - In the year 2100, the northeastern region indicates a relative increase in vulnerability.

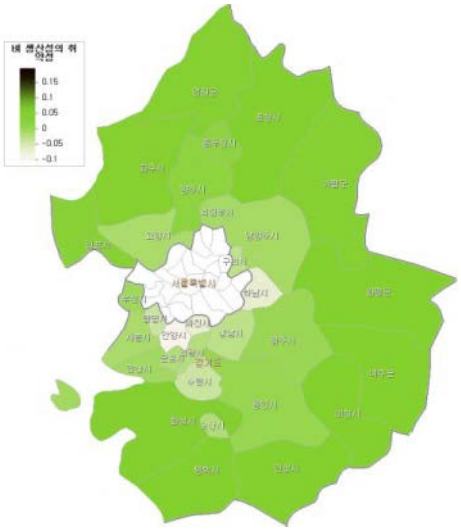


Lee et al., 2011

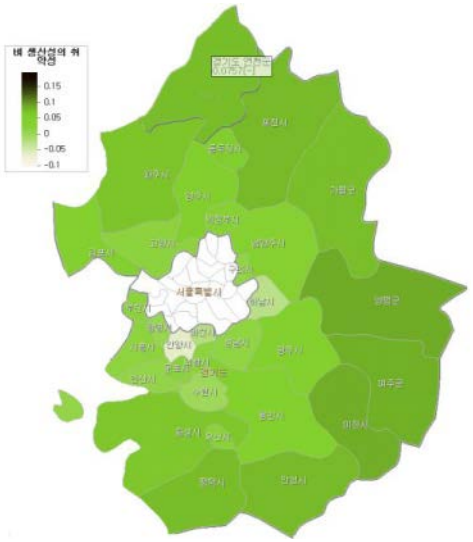
Vulnerability model and the evaluation

Main results

- Vulnerability of rice production in Gyeonggi-province
  - Due to climate change, rice productivity falls
  - Rice production according to changes in temperature at the present state (100%) → 2℃ Rise (96.3%) → 3℃ Rise(92.3%) → 4℃ Rise(90.4%) → 5℃ Rise(86.5%) is shown.



2000s



2020

The development of Local government-oriented model and its application

Response to climate change with the adaption and management model of an urban ecosystem supporting the security of biodiversity

Concept

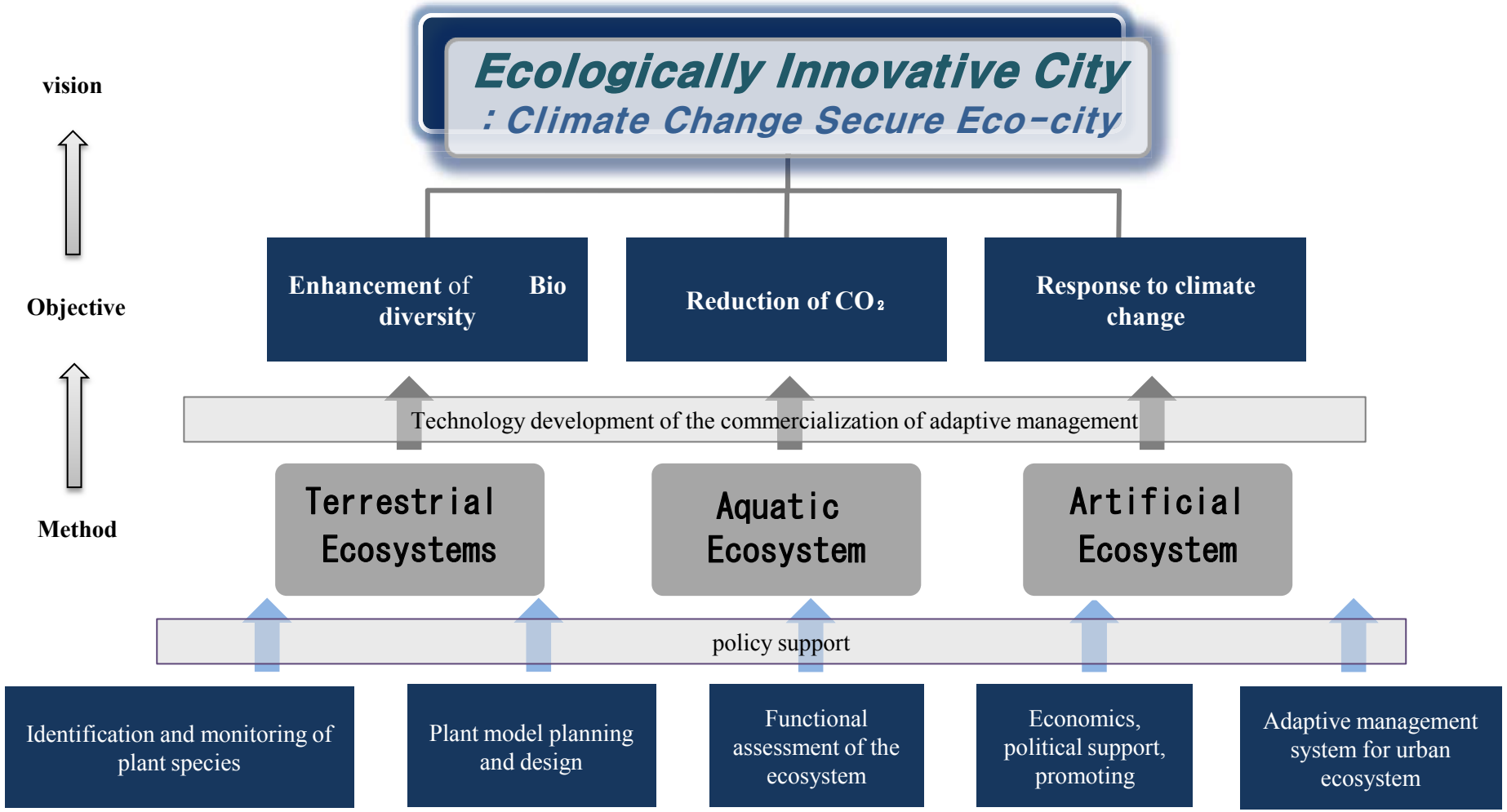
Sustainable use of ecosystem services

Ecologically Innovative City : Climate Change Secure Eco-city

The development of Local government-oriented model and its application

Response to climate change with the adaption and management model of an urban ecosystem supporting the security of biodiversity

Model structure



The development of Local government-oriented model and its application

Future Challenges

- The mitigation of climate change and the response needed for an integrated assessment model is being developed, however a direct link fails to be met at the moment.
- In order to apply the integrated model, the scenario from the local government needs to be developed.
- Overall emission calculation model should be set up, which includes the data of the actual spatial plan and land use.
- Due to the importance of biodiversity worldwide, technology development and management strategies for climate change response is required.

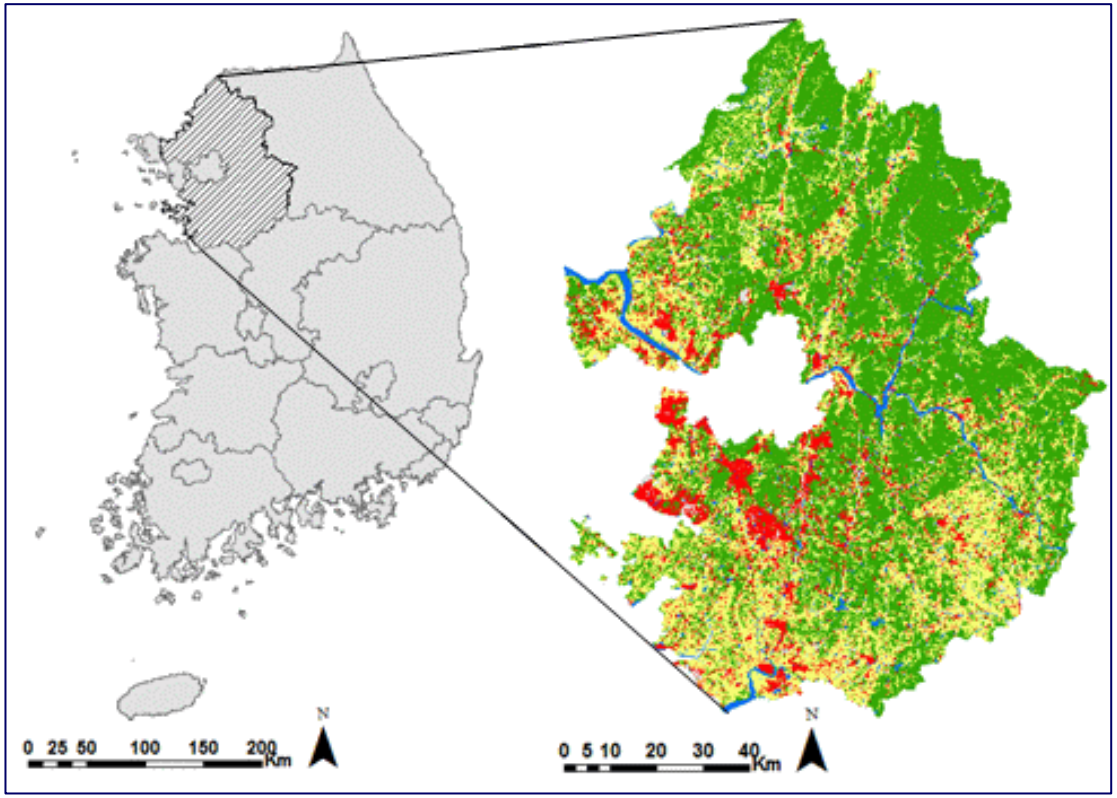
Feel free to share your ideas on the expansion of biodiversity and climate change mitigation & adaption

The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Target area

- In comparison to other Metropolitan Local Governments in Korea, Gyeonggi-do province is adjacent to Seoul and has a sustainable high growth potential, which results in potential diverse changes.

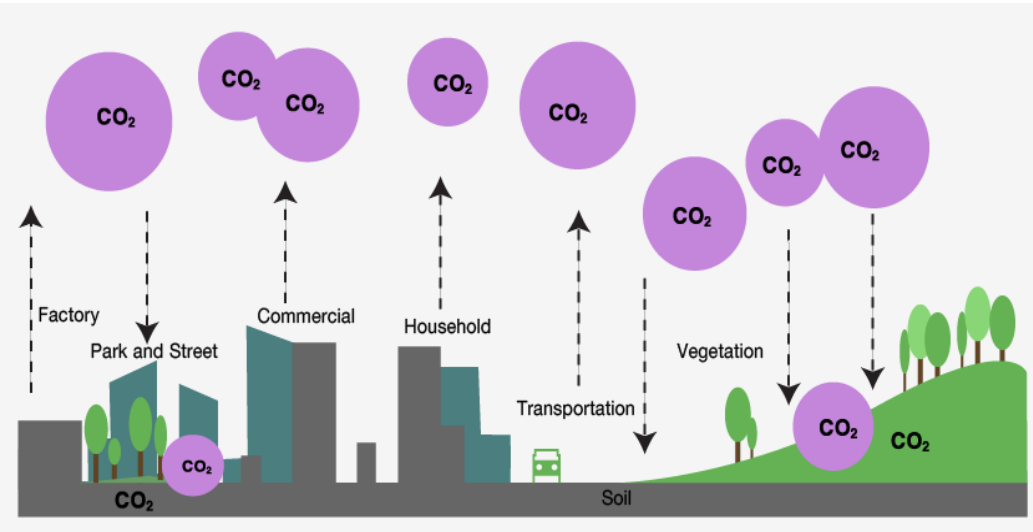


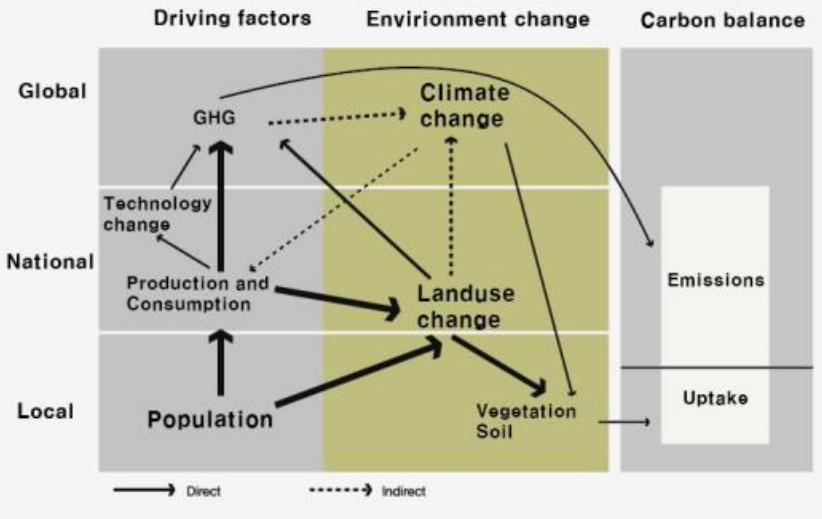
The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Scope

- Base year: 2005
- Target year:2030
- GHG : carbon dioxide
- Emissions, Carbon sequestration through the soil and vegetation



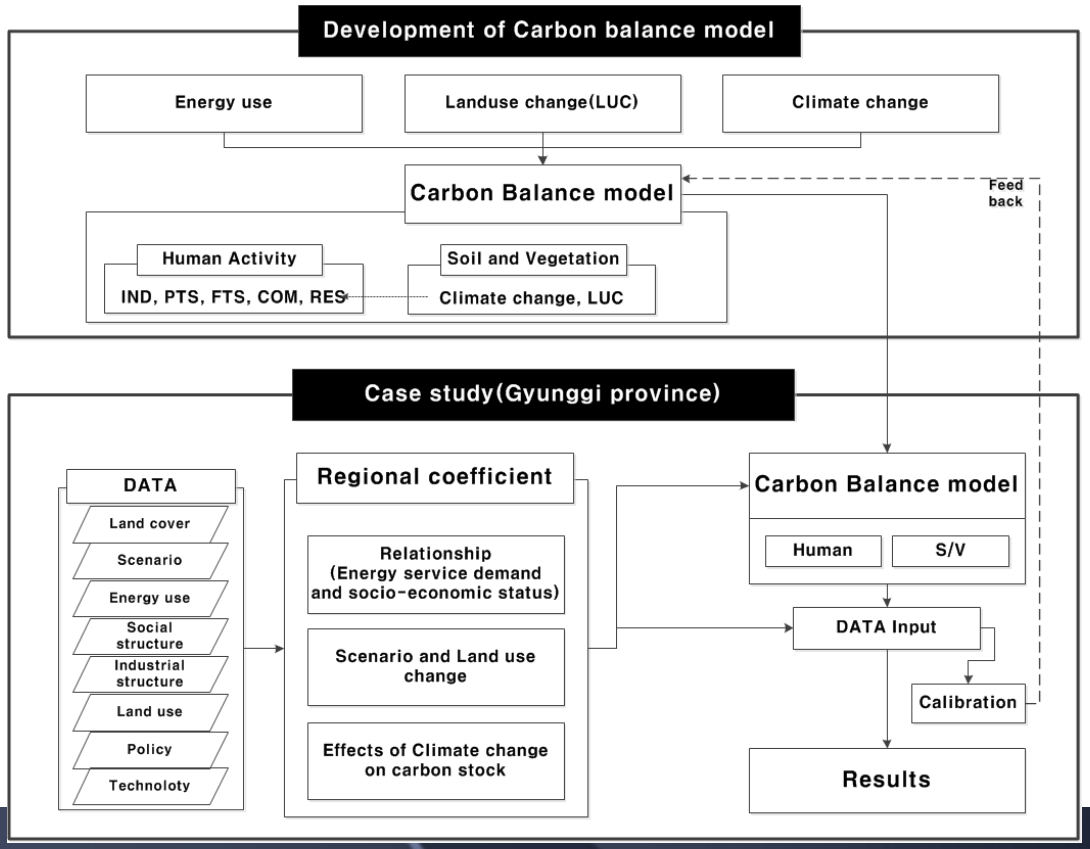


The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Methods

- Using the ExSS model, land use change model, and vegetation carbon and soil carbon calculation model, the quantitative analysis of greenhouse gas emissions, its absorption amount and measures for future climate change, are performed.



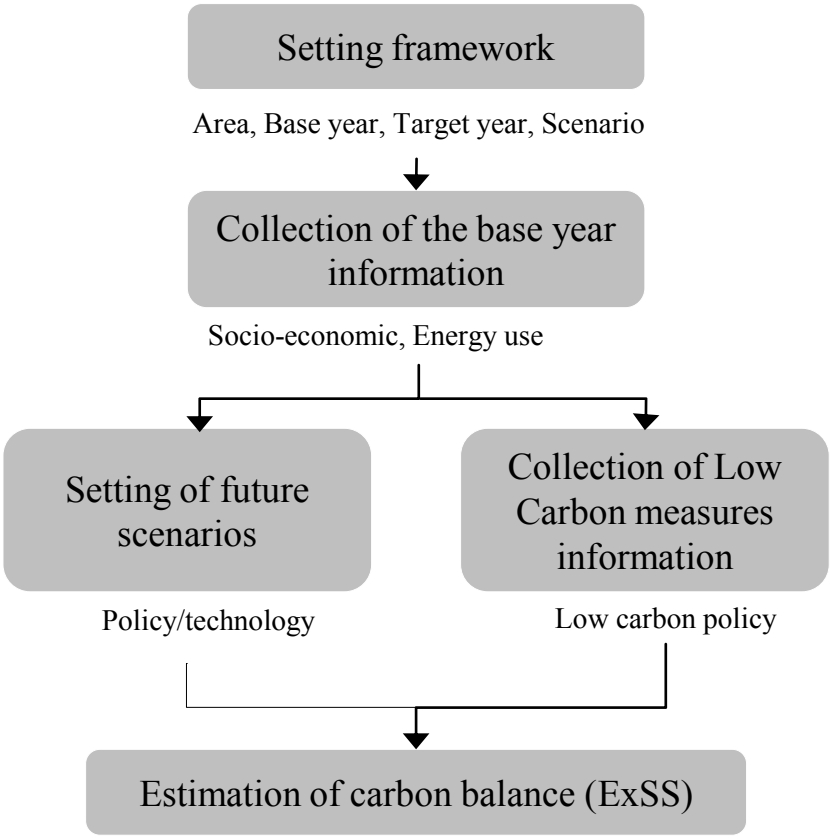
The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

The energy sector

- The energy sector is categorized into industrial, household, commercial, public and transportation.

- Energy usage due to changes in energy service demand utilizes both classified data and the energy use census data report from the National Institute of Environmental Research.

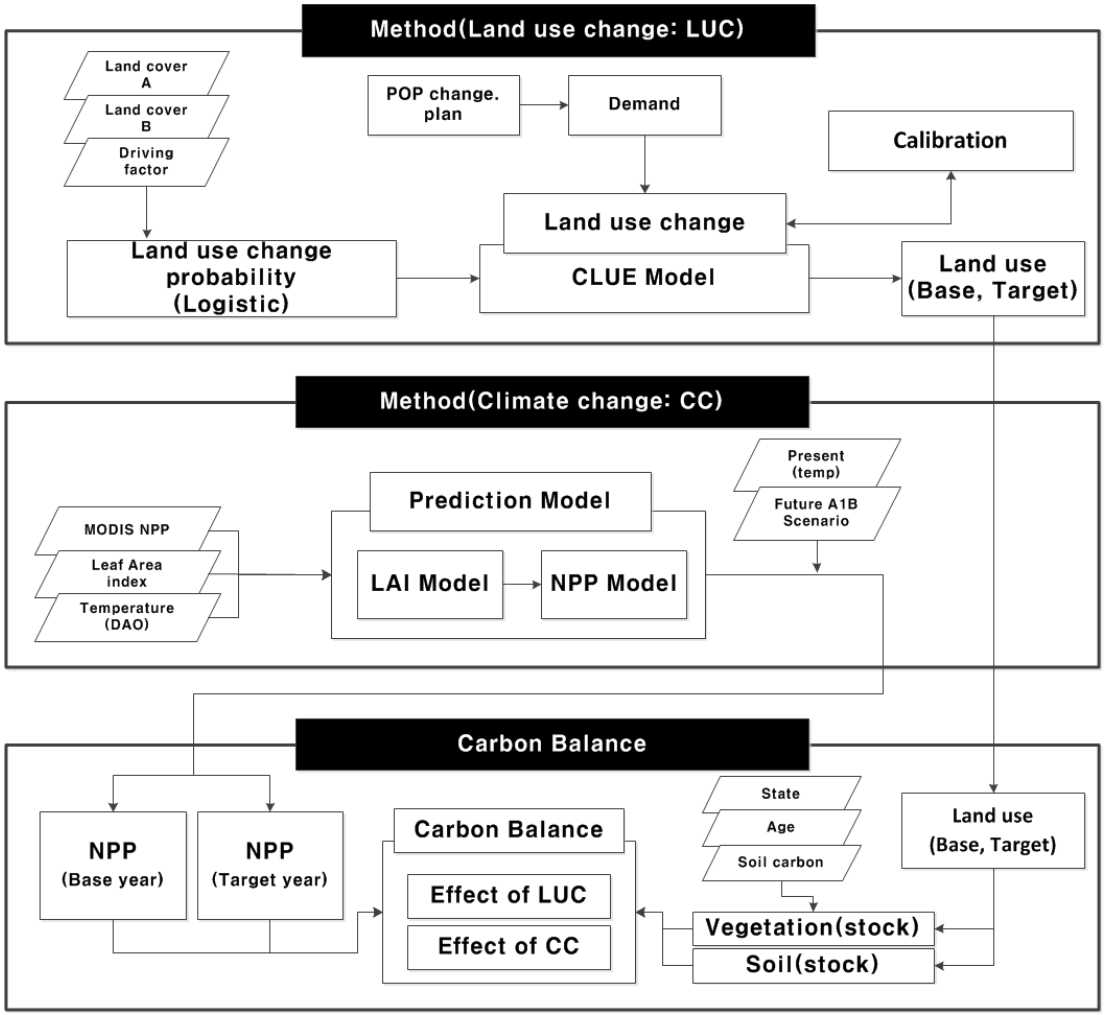


The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Vegetation and soil Sector

- For the land use change simulation, the CLUE model will be implemented.
- Impacts due to climate change will draw regression equation that measures for temperature, LAI, and NPP.
- The changes in the reduction/emission of greenhouse gases due to land use and climate change will be classified to attain the data.



NPP : Net Primary Production

CLUE : Conversion of Land Use Change and its Effects

The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Socio-economic scenarios

		2005	2030	ratio
Population		10,612,455	14,074,523	1.3
Household		3,329,177	5,814,153	1.7
GRDP(10bill.KRW)		169,315	424,246	2.5
Industry production structure ratio	Primary industry	2.4	2.1	
	Secondary industries	63.3	55.9	
	tertiary industries	34.3	42.0	
Area of commercial areas(㎢)		212,197,102	539,722,821	2.5
Passenger transport demand(M.P.km)		119,347	147,272	1.2
Freight transport demand(M.t.km)		3,393	7,598	2.2

The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Measures

- The reduction of energy efficiency, transportation structures, use of renewable energy and energy conservation for each household.

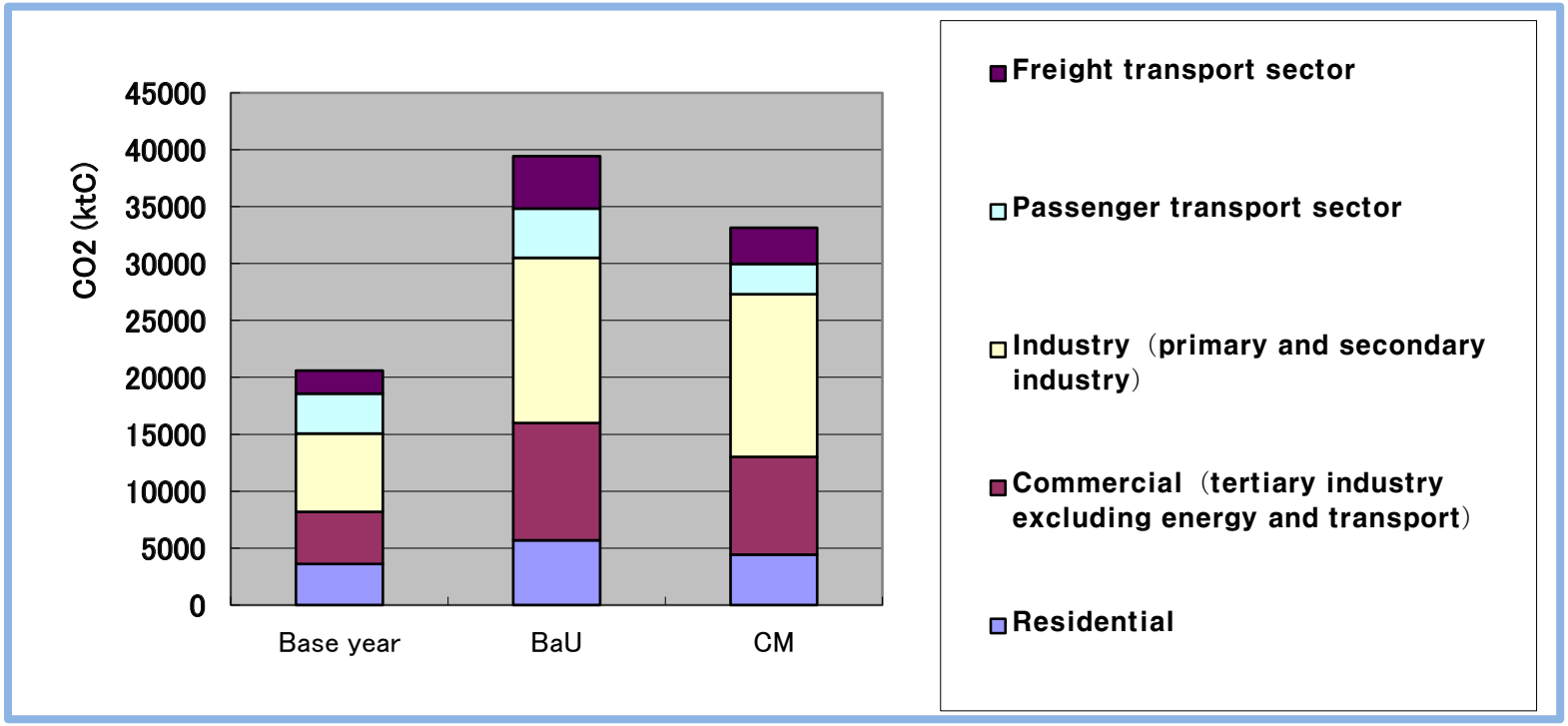
Measures		Element	Quantification	Remarks
Energy-efficient appliances		Increased equipment efficiency		
Building insulation		Reduction in heating energy demand	5%	
Power generation		Fuel composition		The National Energy Plan
Renewable energy	Geothermal	Changes in heating fuel configuration	1%	
	Photovoltaic, Wind	Changes in heating fuel configuration	5%	
Passenger transportation structure	Reduction in demand to move	Reduction in traffic for one day	10%	
	Expansion in public transportation	Changes in transportation	10%	Public transportation policy
	Compact city	Decreased mobility	5%	
Freight transportation structure	Usage of freight trains	Changes in transportation	10%	
Energy saving actions	Household	Reduction in energy service demand	10%	Heating, cooling, and other devices.
	Commerce	Reduction in energy service demand	7%	Heating, cooling, lighting

The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Main results

- According to BAU(Business as usual) emissions analysis, indicates 80% increase in comparison to 2005.
- Via improvement in efficiency and lifestyle changes (which reduces demand for energy services) a 16% reduction is shown in comparison to BAU.

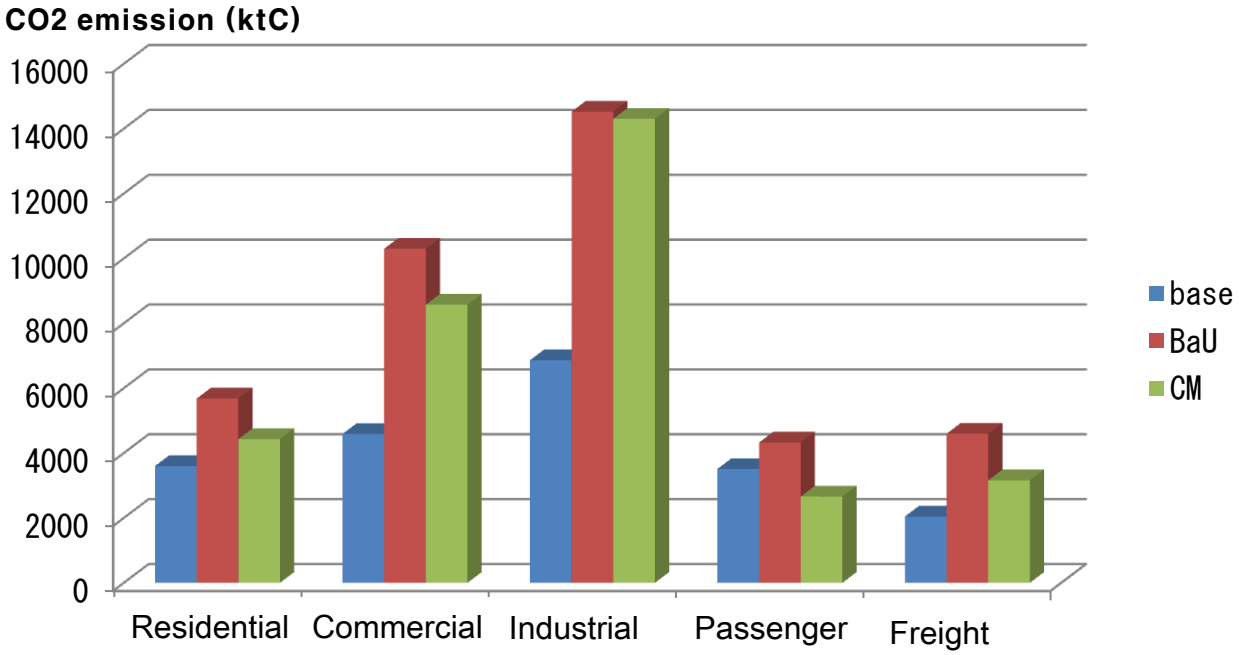


The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Main results

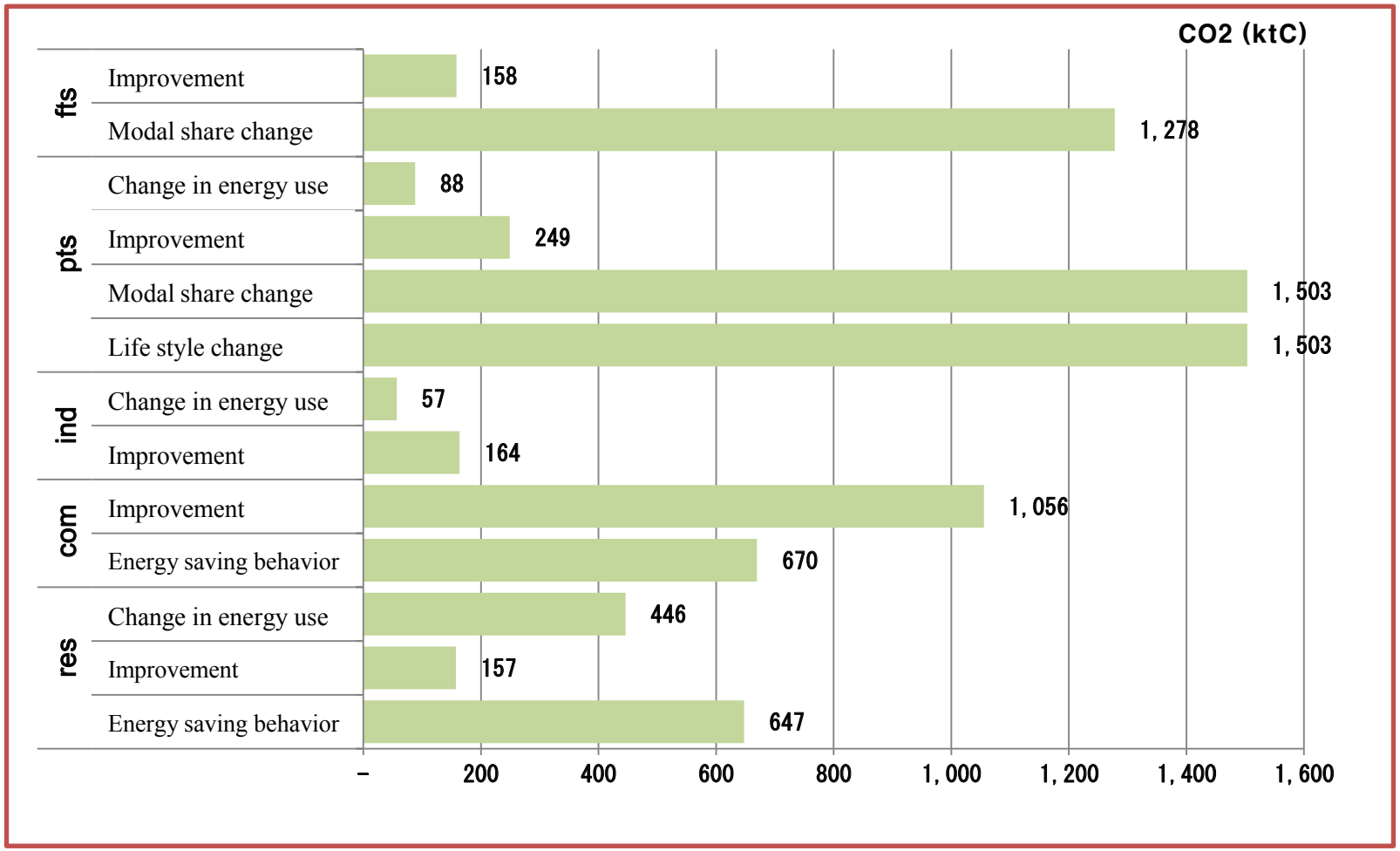
- The passenger transportation sector displays a 40% reduction in 2030 compared to BAU.
- Freight transportation displays a 30% reduction in 2030 compared to BAU.
- The residential sector displays a 20% reduction in 2030 compared to BAU.
- The commercial sector displays a 17% reduction in 2030 compared to BAU.



The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Main results



The development of Local government-oriented model and its application

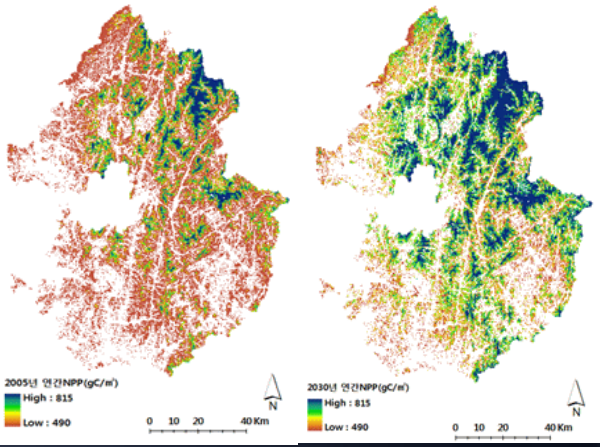
Greenhouse gas mitigation analysis model

Main results

- In 2030, the alternative of energy sector accounts for 16%, vegetation and land use change account for 7.1% in comparison to BAU.
- Through the land use change in 2030 the level of soil inorganic carbon is reduced compared to 2005, and 1,485KtC of greenhouse gases are being emitted into the atmosphere.
- If land use changes can progressively occur, the accumulated carbon in the vegetation will be emitted into the air, 674KtC to be exact.
- Due to the climate change, there will be an increasing rate of carbon sequestration by plants.

CO2 (ktC)

	Driving factors	Elements	2005	2030
Soil and vegetation	Land use change	Soil carbon stock changes	-	59
		Deforestation	-	23
	Climate change	Stem volume increment (Forest)	-2,872	-2,916
		Stem volume increment (Park and Grass)	-97	-107
total			-2,969	-2,941



The development of Local government-oriented model and its application

Greenhouse gas mitigation analysis model

Summary

- In 2030, the alternative of energy sector accounts for 16%, vegetation and land use change account for 7.1% in comparison to BAU.

- The carbon intake by vegetation ratio in 2005 is 13.9% compared to the energy sector emissions. This percentage will decrease to 7.1% compared to BAU.

- As the rate of vegetation reducing carbon increases, the need for policies increases.

Thank you for your attention!