Improvements on local government's greenhouse gas emission prediction methodology in Korea
- Focused on residential sector, commercial and public sector and transport sector -

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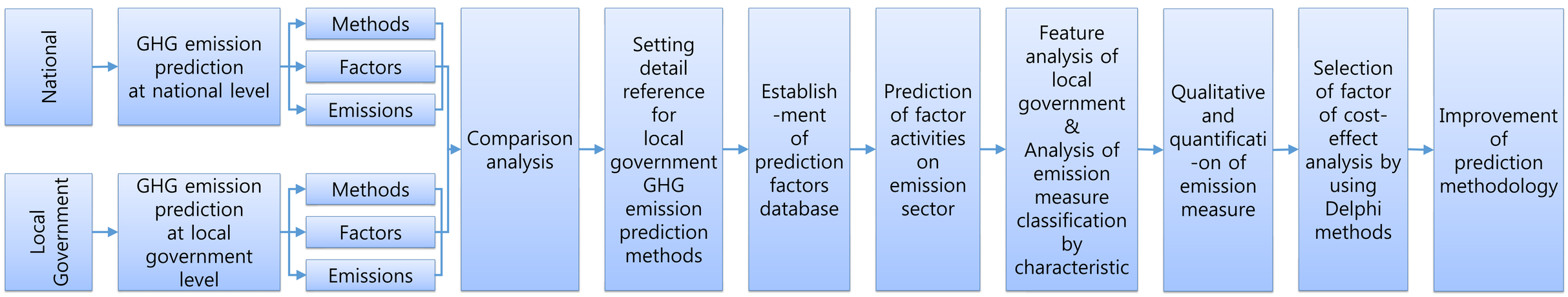
Introduction

The need for climate change mitigation has been increasing at the international level. Therefore, Korea government set up greenhouse gas reduction target by 30% ratio of BAU until 2020 by green growth plan. As following, local governments are trying to make mitigation plan and greenhouse gas inventory. However, local governments do not have specific emission factor and methodology for themselves. Thus, this study proposed greenhouse gas emission prediction methods and emission factors for local governments which reflect each local government's characteristics.

- Advanced local government GHG emission prediction
- Suggest advanced reduction measures
- Analysis of effect of reduction measures
- Constructed reduction roadmap and scenarios

→ Making Advanced System → Building a GHG management system

Methods



Results

Residential / Commercial and Public Sector

● Energy division

	Coal	Oil	Gas	Electricity
Heating	65.0%	57.4%	55.7%	-
Hot-water	35.0%	30.9%	30.0%	-
Cooking	-	11.7%	14.3%	-
Lighting	-	-	-	7.6%
Electronic instrument	-	-	-	92.4%
Total	100%	100%	100%	100%

● Prediction equation of energy consumption

	Prediction equation
Heat Lighting	population(TY) X average floor area(TY) X (energy consumption(SY) / pop(SY) X floor are(SY))
Hot-water Cooking	population(TY) X households number(TY) X (energy consumption(SY) / pop(SY) X households(SY))
Electronic instrument	population(TY) X distribution rate(TY) X (energy consumption(SY) / pop(SY) X distribution rate (SY))

* TY: target year, SY: standard year

● Prediction of emission factor

- Using the possible local government data
- Making the regression curve of distribution rate of electronic instrument (TV, refrigerator, kimchi fridge, washing machine, fan, air conditioner, computer, laptop) by using past data
- For example about TV

Division		Function type	Equation of regression (x:target year, y: distribution rate)	R^2
TV	Metro politan city	exponential	$y = 1.3676e^{0.0119x}$	0.2373
		linear	$y = 0.0165x + 1.3719$	0.2360
		log	$y = 0.0627\ln(x) + 1.3653$	0.2349
		polynomial	$y = -0.0049x^2 + 0.0657x + 1.2817$	0.3439

Transport Sector

● Energy division (example)

- Classification of car type and size: sedan, taxi, van, bus, truck, special car, RV / compact, small size, midsize, full-size etc.
- Classification of fuel type of each car: gasoline, diesel, LPG, CNG(bus) etc.

● Prediction of emission factor

- Using the possible local government data
- Number of registered car: direct use of local government data

① Prediction equation of target year energy consumption

- VKT = number of registered car X distance of car
- Emission = energy consumption X emission coefficient

(number of registered car (TY) X distance of car(TY)) / (fuel efficiency of each fuel)

* TY: target year

② Prediction equation of average distance per day

$$average\ distance\ per\ day = \frac{total\ distance}{total\ drive\ day} = \frac{dis_2 - dis_1}{365 \times (y_2 - y_1) + \frac{365}{12} \times (m_2 - m_1) + (d_2 - d_1)}$$

moving distance(TY)=moving distance(SY) X (1+x)

③ Prediction equation of the number of registered cars

number of car(TY) = pop(TY) x (number of car(SY)/pop(SY))
- Case of sedan, taxi, bus, RV

number of car(TY) = GDP(TY) x (number of car(SY)/GDP(SY))
- Case of truck and special cars

④ Using data of fuel efficiency prediction

Fuel efficiency	2008	2012	2015	2020	2030
LPG (km/l)	7.65	8.06	8.64	10.10	13.58
Gasoline (km/l)	10.84	11.43	12.25	14.33	19.26
Diesel sedan (km/l)	10.88	11.47	12.29	14.38	19.32
Diesel heavy (km/l)	2.63	2.77	2.97	3.47	4.67

- Making the regression curve of fuel efficiency

Emission measure and effect analysis

● City classification by emission character

Commercial city: 23 cities	Industrial city: 47 cities
Residential city + Commercial city: 37 cities	Complex city: 41 cities
Residential city: 27 cities	Agriculture and fishery city: 73 cities

● Emission policy classification and analysis (example)

Category		Sub-category	Detailed feature
High efficiency instrument	using high efficiency instrument	Supply and expansion of high efficiency instrument	Supply of high efficiency electronic instrument
Green building Green city	Green building	Supply and expansion of green home	Change the insulation window

● Effect analysis of emission policy

- Selection emission policy and definition of effect analysis terms by using expert Delphi methods
- Residential: 3 policies, Commercial & Public: 3 policies, Common: 6 polices, transport: 9 polices

● Results of effect analysis (example)

category		sub-category	Detail measure
high efficiency instrument		supply and distribute of high efficiency instrument	distribute of high efficiency instrument
Life expectancy	5~6 Years	supply time	present
necessary expenses	initial introduction cost	purchasing cost	
		refrigerator	1,400 won/L
		wash machine	- 27,895 won/kg
		cooker	3,175 won/person
	maintenance cost	energy consumption	
		-	
effect	emission unit	refrigerator	69.6 kg/yr · unit
		wash machine	0.8 kg/yr · unit
		cooker	15.2 kg/yr · unit
	emission equation	emission unit(kg/yr · unit) × number of households × distribution rate(%)	
GHG emission per unit price		refrigerator(650L)	76.48 kg/million won · yr
		wash machine(10kg)	-
		cooker (10 person)	478.74 kg/million won · yr

Conclusion

In this study, we analyzed prediction elements for national greenhouse gas emission. Then, we suggested local government's greenhouse gas emission prediction in accordance with the characteristics of the each local government in three sector such as residential, commercial & public and transportation sector. Also we were able to predict greenhouse gas emission which has considered government's characteristics. As a result of this study, local governments could propose potential greenhouse gas emission through the comparison with the national greenhouse gas emission.

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