국외출장 보고서

The 21st AIM International Workshop

- AIM 워크샵 참가 및 결과 발표 -

2015. 11.

1. 출장 개요

□ **출장명** : The 21st AIM International Workshop

□ **출장 목적**

❍ 아시아지역 미래 기후변화 시나리오 작성을 위한 사회·경제 모형 (AIM/Enduse) 참가 및 주제 발표

❍ 이에, 본 국외 출장을 통해 미래 기후변화 배출량 시나리오 도출을 위한 사회·경제 전망 자료와 기술을 상호 교류하고자 함

- 발표 주제 : SSP 시나리오를 적용한 미래 동아시아의 온실가스 및 대기오염물질 배출량 산정(구두발표), 2010-2100년 한국의 온실가스 및 대기오염물질 배출량 -산업부문을 중심으로-(포스터발표)

□ **출장 개요**

❍ **출 장 지** : 일본 (츠쿠바)

❍ **출장기간** : 2015년 11월 12일 ~ 2015년 11월 15일(3박 4일간)

❍ **출 장 자**

구 분	출 장 자	주요 임무
국토연구원	박찬	AIM 워크샵 참가 및 발표

□ 출장 일정

월일(요일)	출발지	도착지	방문기관	업무수행내용	접촉예정인물
11.12(목)	한국 (서울)	일본 (도쿄)		❍ 출국(한국 서울 ⇒ 일본 도쿄) - 도쿄 ⇒ 츠쿠바 이동	
11.13(금) ~11.14(토)			NIES AIM International Workshop 참석	❍ (11.13) AIM International Workshop 등록 및 참석 - AIM project 및 산업부분 저감 연구결과 발표 ❍ (11.14) AIM International Workshop 참석 - 시나리오에 따른 동아시아 지역의 배출량 연구결과 발표	o T. Masui o T. Hanaoka o J. A. Edmonds o H. Dai o H. Shiraki o K. Takahashi etc.
11.15(일)	일본 (도쿄)	한국 (서울)		❍ 귀국(일본 도쿄 ⇒ 한국 서울)	

□ 참가국 및 참가자수

❍ 참가국 : 10개국 (한국, 미국, 중국, 일본, 인도, 인도네시아, 네팔, 말레이시아, 대만, 태국 등)

❍ 참가자수 : 79명

2. 세부내용

□ The 21st AIM International Workshop 발표

❍ **일시/장소**: 2015. 11. 13~14, NIES, 츠쿠바

❍ **주 제 1** : SSP 시나리오를 적용한 미래 동아시아의 온실가스 및 대기오염물질 배출량 산정 (Future GHG and Air-pollutant emission range consistent with the SSP in East Asia

region)

❍ **발 표 자** : 박찬 외

- 주요 내용 : 2010년 배출량을 기준으로 2100년 까지 동아시아의 온실가스 물질 및 대기오염물질의 배출량을 BAU 시나리오, 고성장 시나리오, 저성장 시나리오 등 3개의 시나리오에 대해 예측함.

❍ **주제 발표 내용**

21th AIM International Workshop, NIES

Future GHG and Air-pollutant emission range consistent with the SSP in East Asia region

Chan Park, Dong Kun Lee, Jin Han Park,
Mi Jin Lee, Tae Yong Jung, Yongwon Mo, Junghyun Woo

24th January, 2015

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1. Project Overview
2. Scope of Presentation
3. Methods
4. Results
5. Summary

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01 Project Overview

Background

▪ Hot-spot area of climate change

Category	Area	Current (1986–2005)	Mid term (2046–2065)		Long term (2081–2100)	
Average temperature (℃)	Korea peninsula	11.3	+2.3	(+3.3)	+3.0	(+5.9)
	East Asia	–	+1.9	–	+2.4	–
	Global	–	+1.4	(+2.0)	+1.8	(+3.7)
Precipitation	Korea peninsula	1144.5	+13%	+21%	+20%	(+18%)
	East Asia				+7%	

Source: CMIP5 results based on RCP4.5
( ) means RCP8.5 result

▪ South Korea's climate change laws
- Framework Act on Low Carbon Green Growth / 2010
- Act on the allocation and trade of greenhouse gas emissions rights / 2012
- Act on the Creation and Facilitation of Use of Smart Grids / 2011

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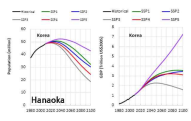
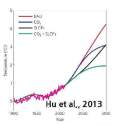
01 Project Overview

Background

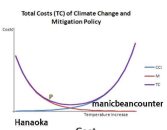
▪ "No Regrets" Approach to Decision-Making against climate change
- Characterizing Uncertainty in Regional Climate Change and impact
- Integrated assessment modelling coupled with Regional characteristic



Socio-economic scenario



Modelling (LLGHG, SLCP)



Cost

Goal

▪ To develop an integrated evaluation system for climate policy by intercoonecting emission inventory, integrated assessment models (emission and impact), and climate models

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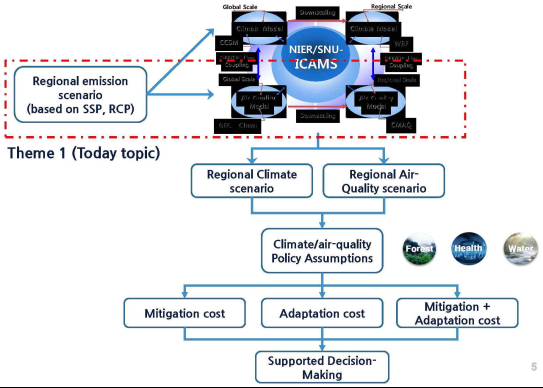
01 Project Overview



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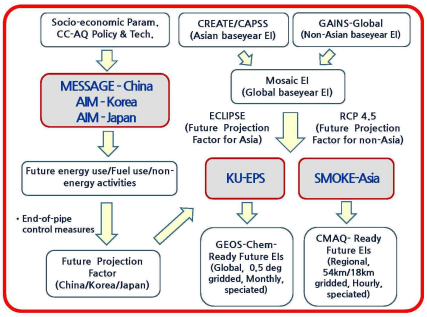
02 Scope

- To Present emission scenarios of Long-lived GHG(LLGHG) and Short lived Climate Pollutant (SLCP) (East Asia region) for climate modeling



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03 Method

Emission modeling

- Time
  - 2010 - 2100
    - Base Year : 2010, Target Year : 2030, 2050, 2100
- Sectors
  - Fuel combustion (Residential sector, Commercial sector, Transport sector, Industry sector (Steel, Cement, Other industries))
  - Industrial process, Agriculture, Waste (Residential sector, Commercial sector, Industry sector), Fuel mining, Ohters
- Data
  - Population, GDP : OECD, IIASA, National Statistics
  - Mitigation policy : National policy, Suggested policy from research
  - Technology : AIM Enduse, GAINS-China
  - Discount rate: 5%
  - Energy price: World Energy Outlook
  - Emission factor: IPCC guideline
  - Climate scenario : RCP8.5

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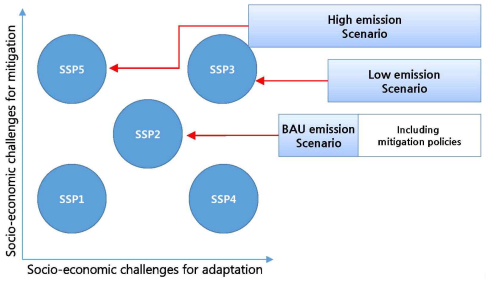
03 Method

Social economic scenario setting



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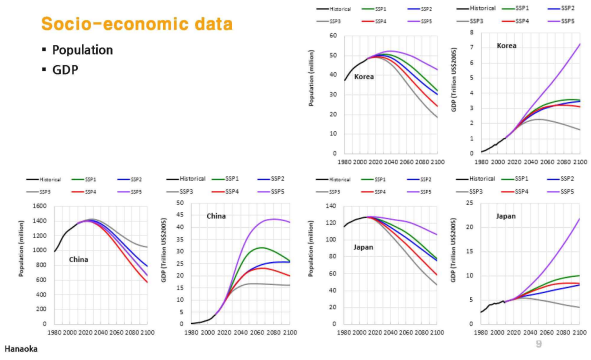
03 Method

Socio-economic data

- Population
- GDP



Hanaoka

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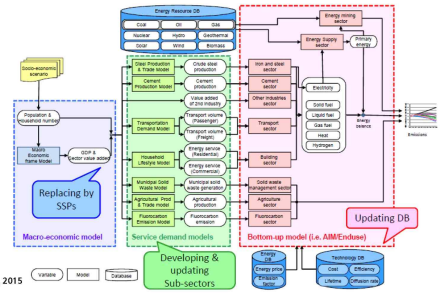
03 Method

Emission modeling (Korea, Japan)

- Model: AIM Enduse Global



Hanaoka., 2015

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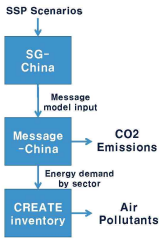
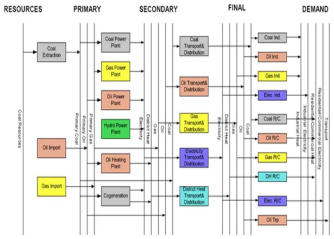
03 Method

Emission modeling (China)

- **Model: MESSAGE-China**





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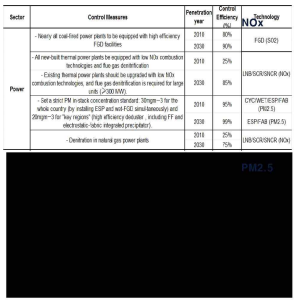
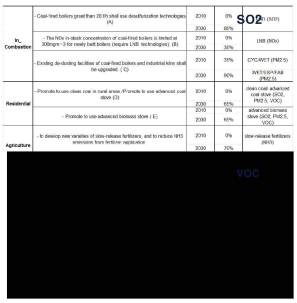
03 Method

Implementation of Control technology (China case)

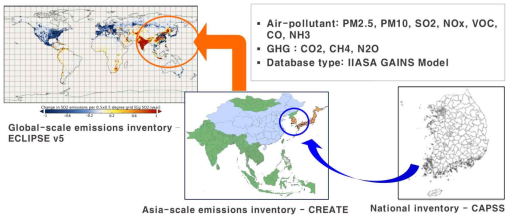




03 Method

Grid Emission Inventory

- Global : ECLIPSE version 5
- Regional : CREATE (NIER-KU)
- Korea : CAPSS (NIER)



- Air-pollutant: PM2.5, PM10, SO2, NOx, VOC, CO, NH3
- GHG : CO2, CH4, N2O
- Database type: IIASA GAINS Model

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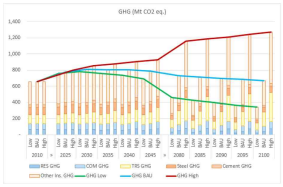
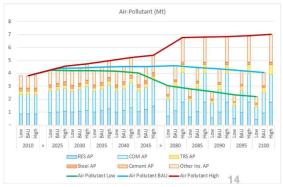
04 Results

Emission in Korea

- Emission inventory : GHG(CO2, CH4, N2O), Air-pollutant (SO2, NOx, PM10, CO, BC, TSP, VOC, NH3)
- Sector's Contribution to GHG :
  (2010) Building 21%, Transport16%, Industry 63%
  (2100) Building (13-18)%, Transport (26-28)%, Industry (56-59)%
- Sector's Contribution to Air-pollutant :
  (2010) Building 6%, Transport 63%, Industry 31%
  (2100) Building (8-11)%, Transport (55-66)%, Industry (26-33)%





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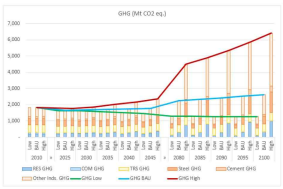
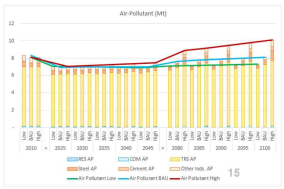
04 Results

Emission in Japan

- Emission inventory : GHG(CO2, CH4, N2O), Air-pollutant (SO2, NOx, BC)
- Sector's Contribution to GHG :
  (2010) Building 20%, Transport 24%, Industry 56%
  (2100) Building (17-25)%, Transport (7-32)%, Industry (51-68)%
- Sector's Contribution to Air-pollutant :
  (2010) Building 2%, Transport 82%, Industry 31%
  (2100) Building (1-2)%, Transport (74-93)%, Industry (6-23)%





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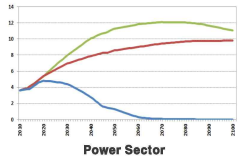
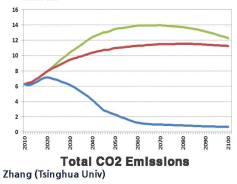
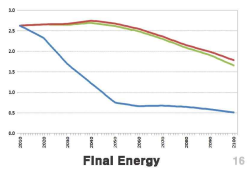
04 Results

Emission in China (air-pollutant)

- Emission inventory :
  GHG(CO2, CH4),
  Air-pollutant (SO2, NOx, PM2.5, CO, BC)







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Qiang Zhang (Tsinghua Univ)

❍ 주 제 2 : 2010-2100년 한국의 온실가스 및 대기오염물질 배출량 -산업부문을 중심으로- (GHG and air pollution emissions in Korea, 2010-2100 -Focused on Industrial Sector-)

❍ **발 표 자** : 박진한 외

- 주요 내용 : 산업부문을 중심으로 2010년 배출량을 기준으로 2100년 까지 CO_2 및 대기오염물질에 대한 배출량을 BAU 시나리오, 고성장 시나리오, 저성장 시나리오 등 3개의 시나리오에 대해 예측함.

❍ **주제 발표 내용**

GHG and air pollution emissions in Korea, 2010~2100

- Focused on Industrial Sector -

Jin Han Park[1], Dong Kun Lee[1], Mi Jin Lee[1], Chan Park[2], Yong Won Mo[1], Tae Yong Jung[3]

[1]Seoul National University, [2]Korea Research Institute for Human Settlements, [3]Yonsei University

Today, the negative impact of global climate change is widely observed and Korea also been a big influence. To reduce the risks of climate change, global GHG and air pollution emissions and the impact is investigated the relationship of research being performed. In this study, socio-economic scenarios were made for the situation in Korea. The inventory of GHG sources are divided in residential, commercial, transportation, power generation, industry sector. Structured data were entered in the AIM/Enduse models to estimate future energy use based on the technology of choice over time to estimate GHG emissions. In this study, I will estimate GHG and air pollution emissions in the industrial sector.

Service demands of steel and cement appears similar. Because population data was used to calculate service demand as the primary data. The trend is increasingly reduced after 2030. Demand of the other industries are look like GDP trend.

In steel industry, almost emissions are continually reduce in all scenarios. Greenhouse gas will be decrease from 92Mt to 34~77Mt and air pollutants will be reduce from 0.24Mt to 0.08~0.19Mt. In cement industry, almost emissions are continually reduce in all scenarios. Greenhouse gas will be decrease from 36Mt to 15~35Mt and air pollutants will be reduce from 0.03Mt to 0.01~0.03Mt. In other industry, emissions appear differently depending on the scenario. Greenhouse gas will be decrease or increase from 287Mt to 143~638Mt and air pollutants will be also reduce or increase from 0.93Mt to 0.48~2.12Mt.

In the BAU scenario including the emissions reduction policy of the government has increased both the energy consumption and GHG and air pollution emissions of industrial sector increased until 2030, and decreased until 2100. Energy consumption decreased until 2030, because it was influenced by emissions reduction policy and population, input data. Therefore, GHG and air pollution emissions had same tendency with energy consumption, and it will decrease gradually until 2100, target year. In the low emission scenario, energy consumption and GHG and air pollution emissions decreased greatly, but it is expected to be impossible in reality. However, what is the difference between the emissions in scenarios appears largely means the reduction potential is large. To meet the emission reduction scenarios, it is not only important to carry out a policy of the government and but also developed technology.

GHG and air pollution emissions in Korea, 2010~2100 - Focused on Industrial Sector -

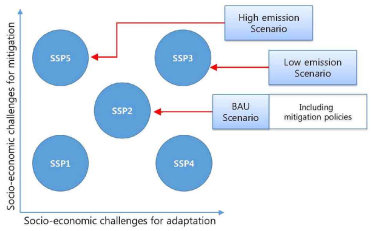
Jin Han Park[1], Dong Kun Lee[1], Mi Jin Lee[1], Chan Park[2], Yong Won Mo[1], Tae Yong Jung[3]

[1]Seoul National University, [2]Korea Research Institute for Human Settlements, [3]Yonsei University

Introduction

Today, the negative impact of global climate change is widely observed and Korea also been a big influence. In the future, the negative impact is expected to further increase due to climate change and cause of climate change is greenhouse gas (GHG). To reduce the risks of climate change, global GHG and air pollution emissions and the impact is investigated the relationship of research being performed. GHG and air pollution emissions are related to changing of the atmosphere and environment, and there is a need to progress the study of GHG and to estimate the GHG and air pollution emissions. In this study, socio-economic scenarios were made for the situation in Korea. The inventory of GHG sources are divided in residential, commercial, transportation, power generation, industry sector. Structured data were entered in the AIM/Enduse models to estimate future energy use based on the technology of choice over time to estimate GHG emissions. In this study, I will estimate GHG and air pollution emissions in the industrial sector.

Scenarios and Method



<Basic setting>

- Target: South Korea
- Sector: Industrial Sector
  - Iron industry
  - Cement industry
  - Other industry
- Base year: 2010
- Target year: 2100
- Scenarios: SSP2(BAU) scenario
  SSP5(High emission) scenario
  SSP3(Low emission) scenario

<Equation for service demand>

- Steel industry

$$\ln(SD_{i,t}) = \frac{cnspa_i}{1+\exp(-cnspc \times (\overline{GDPP_{i,t}} - cnspb_i))}$$

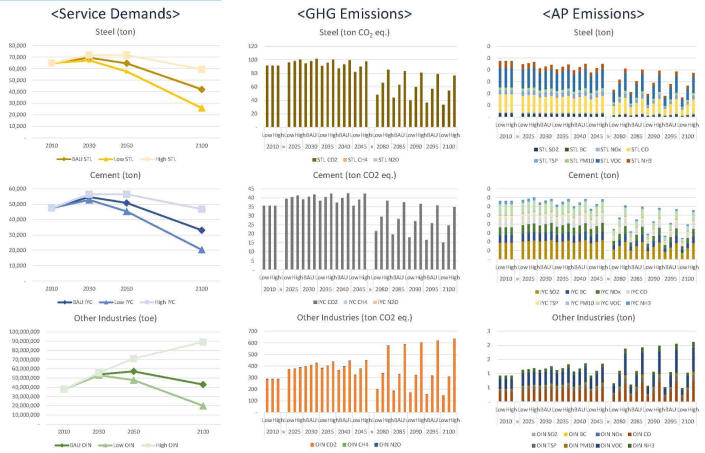
- Cement industry

$$\ln(SD_{i,t}) = \frac{prdpa_i}{1+\exp(-prdpc \times (\overline{GDPP_{i,t}} - prdpb_i))}$$

- Other industry

$$SD = SD_{baseyear} \times \overline{GDPP_{i,t}}$$

Result and Discussion



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Conclusion

In the BAU scenario including the emissions reduction policy of the government has increased both the energy consumption and GHG and air pollution emissions of industrial sector increased until 2030, and decreased until 2100. Energy consumption decreased until 2030, because it was influenced by emissions reduction policy and population, input data. Therefore, GHG and air pollution emissions had same tendency with energy consumption, and it will decrease gradually until 2100, target year. In the low emission scenario, energy consumption and GHG and air pollution emissions decreased greatly, but it is expected to be impossible in reality. However, what is the difference between the emissions in scenarios appears largely means the reduction potential is large. To meet the emission reduction scenarios, it is not only important to carry out a policy of the government and but also developed technology.

Acknowledgement

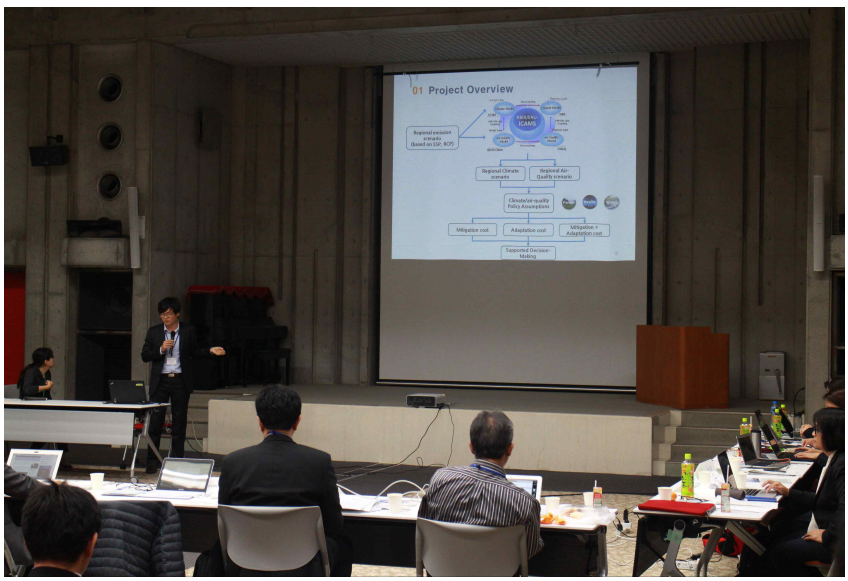
This work was supported by the BK 21 Plus Project in 2015 (Seoul National University Interdisciplinary Program in Landscape Architecture, Global leadership program toward innovative green infrastructure), Development of LLCPs/SLCPs emissions scenarios based on future socio-economic change of East Asia and research of National Institute of Environmental Research, Korea Ministry of Environment (Project number: 2015-02-02-040).

3. 종합 의견

❍ 사회·경제 시나리오를 고려한 동아시아 지역의 미래 배출량 산정 논리 및 결과에는 큰 문제가 없는 것으로 판단됨

4. 사진 자료 등

❍ 발표 사진 등



<사진> 구두발표 및 포스터발표 사진과 워크샵 전경 및 참가자 단체 사진