Energy Forecasting and Korean Climate Modeling Perspective

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Contents

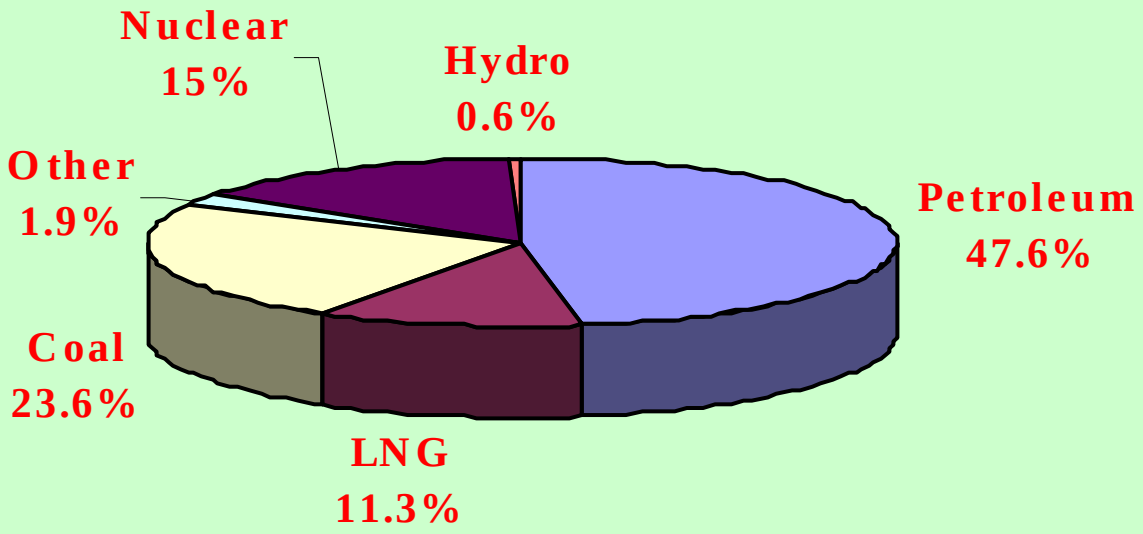
- Energy Consumption in Korea
- Energy Outlook in Korea
- Modeling Application at KEEI
- Introduction of Two Presentations from KEEI

Energy Consumption in Korea

Major Energy/Economic Indicators

	1981	1990	1995	2002	2003(p)	AAGR(%) '81 - '90	AAGR(%) '90 - '03
Energy Consumption (million toe)	45.7	93.2	150.4	209.1	215.1	8.2	6.6
Energy/GDP Ratio (toe/trillion won)	0.37	0.35	0.40	0.40	0.39	-0.6	0.8
Per Capita Energy Consumption (toe)	1.18	2.17	3.34	4.21	4.44	7.0	5.7
GDP (trillion won)	122.4	263.4	377.4	524.7	538.3	8.9	5.7
Population (million)	38.7	42.9	45.1	47.3	48.4	1.2	0.9

Consumption of Energy by Source(2003p)



	Petroleum	Coal	Nuclear	LNG	Hydro
1990	53.8%	26.1%	14.2%	3.2%	1.7%

Energy Outlook in Korea

Factors Affecting Energy Demand in Korea

■Economic Growth & Industry Structure

-Economic growth rate will slow down over time.

-GDP share of energy intensive industries will be lower.

-GDP share of service sector will be higher

■Energy Market and Policies

- Policies push toward more competitive energy market

- Privatization of public energy companies (electricity and natural gas)

■External Factors

- Implementing Climate Change Treaty of UNFCCC affects
  - The environment regulations and energy prices & tax
  - Investment on energy efficiency improvement and renewable energy technology
  - Environmental awareness of private sector

Projection of Major Energy Indicator

	2001	2005	2010	2015	2020	AAGR(%)		
						'01-'10	'10-'20	'01-'20
GDP (T. Won)	493.0	614.8	786.9	980.7	1,193	5.3	4.2	4.8
Primary Energy (MTOE)	198.4	231.1	276.9	310.9	345.4	3.8	2.2	3.0
Per Capita Energy (TOE)	4.19	4.77	5.58	6.18	6.82	3.2	2.0	2.6
Energy / GDP (TOE / M Won)	0.4	0.38	0.36	0.32	0.29	-1.2	-2.1	-1.7

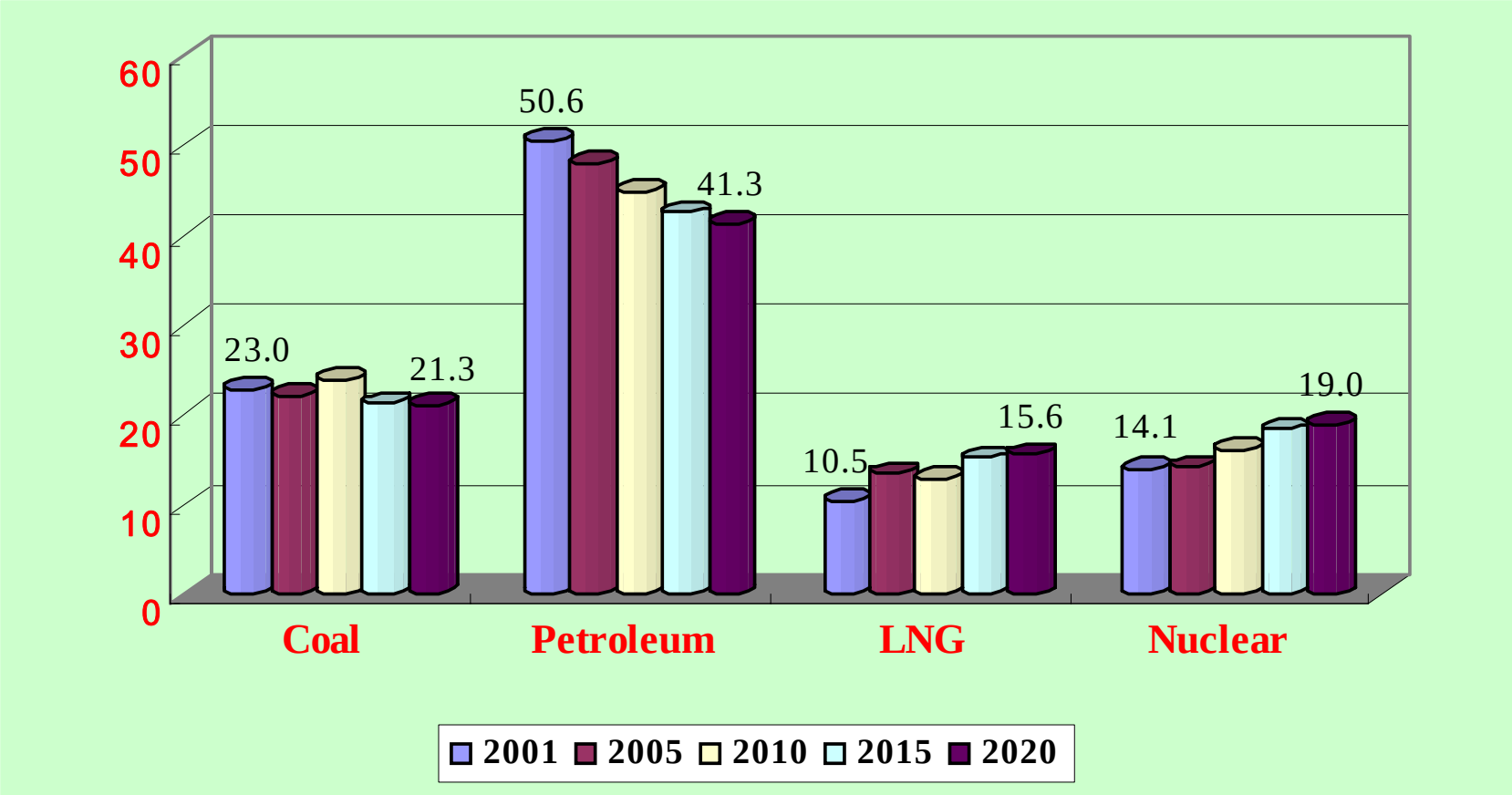
- Energy demand will grow steadily, but at a slower pace
  - Moderate economic growth
  - Improving energy efficiency
  - Economic growth by less energy-intensive industry

Primary Energy demand by Fuel (Unit: MTOE)

	2001	2005	2010	2015	2020	AAGR(%)		
						'01-'10	'10-'20	'01-'20
Coal	45.7	51.6	66.1	66.3	73.4	4.2	1.1	2.5
Petroleum	100.4	111.4	124.2	132.4	142.7	2.4	1.4	1.9
LNG	20.8	31.1	35.7	47.1	53.9	6.2	4.2	5.1
Hydro	1.0	1.1	1.3	1.4	1.5	3.0	1.4	2.2
Nuclear	28.0	32.7	44.4	57.0	65.5	5.3	3.9	4.6
Total	198.4	231.1	276.9	310.9	345.4	3.8	2.2	2.9

- Oil dependency lessens, but oil will remain as the most important fuel
- LNG's demand is projected to grow by 5.1% per year, which is the highest
- Coal and nuclear is projected to grow steadily with electricity demand growth

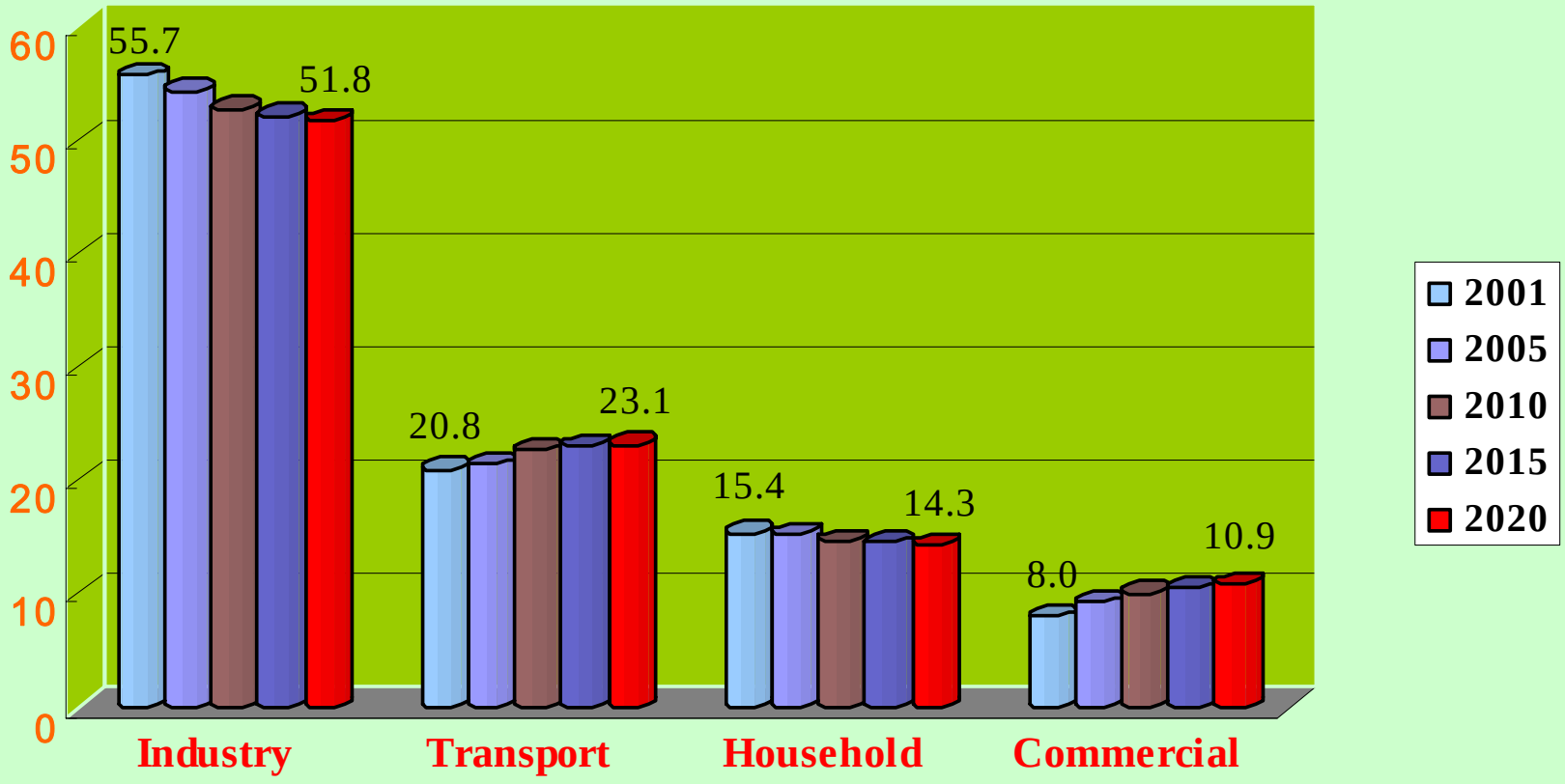
Primary Energy Demand by Fuel (Share)



Final Energy demand by Sector (Unit: MTOE)

	2001	2005	2010	2015	2020	AAGR(%)		
						'01-'10	'10-'20	'01-'20
Industry	85.2	96.4	109.9	120.6	131.8	2.9	1.8	2.3
Transport	31.9	37.9	46.9	53.3	58.7	4.4	2.3	3.3
Household	23.6	27	30.4	33.5	36.3	2.9	1.8	2.3
Commercial	12.3	16.3	20.8	24.3	27.8	6.0	2.9	4.4
Total	153.0	177.6	208.0	231.7	254.6	3.5	2.0	2.7

Final Energy demand by Sector (Share)



Model Applications
at KEEI
Using CGE Model

Model Application at KEEI Using CGE Model

- Global Model & One-Country Model
- Global Model
  - Economic analysis on UNFCCC negotiation steps
  - Scenario analysis on post Kyoto commitment by Non-Annex I
  - Economic and environmental impacts of various Climate Issues
  - Kyoto Mechanism: CDM, IET
- National CGE Model
  - Design of domestic policy portfolio for GHG reduction
  - Economic and environmental impacts of domestic P&Ms
  - Domestic emissions trading, carbon tax, etc

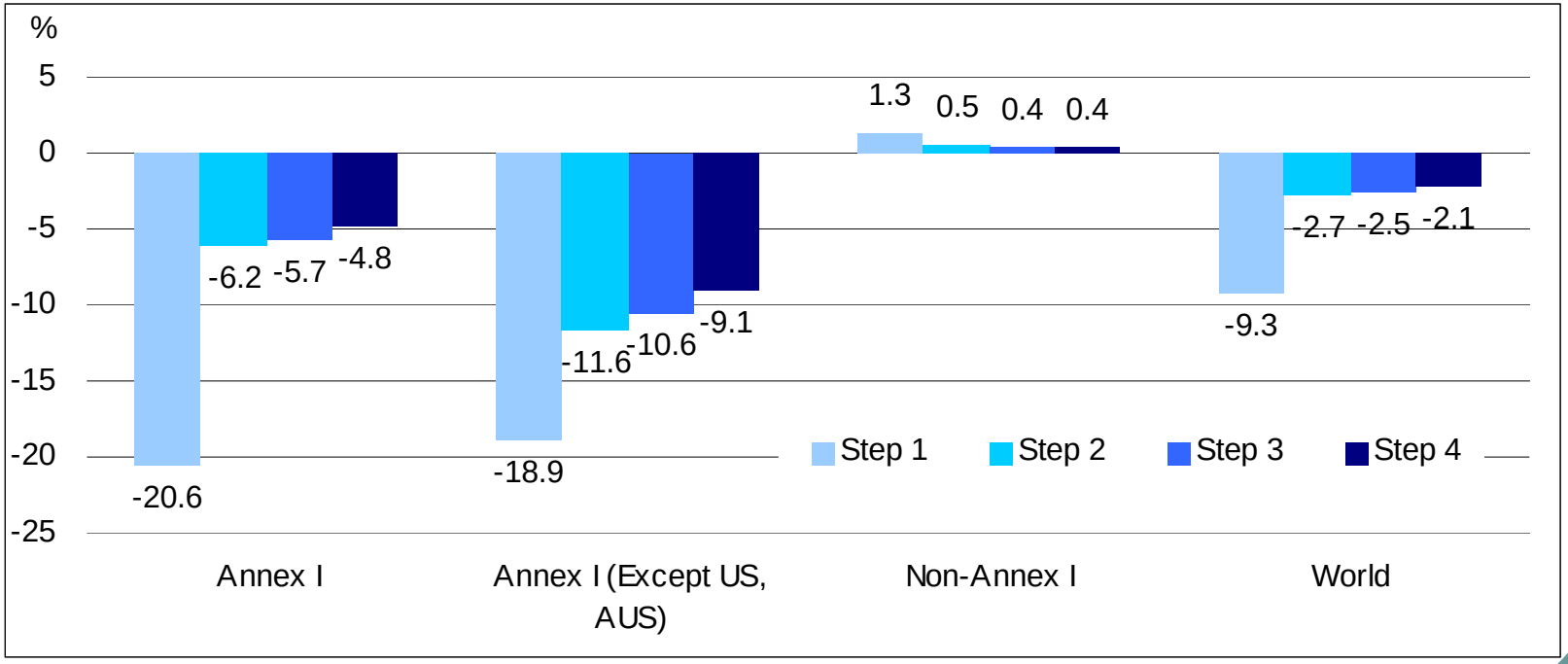
Global CGE Model Application
- Negotiation and Impacts -

- Economic and Environmental Impact Analysis on Negotiation Steps

	Participation of US and Australia	IET	Forest Management	Permit Banking
Step 1	○	○	×	×
Step 2	×	○	×	×
Step 3	×	○	○	×
Step 4	×	○	○	○

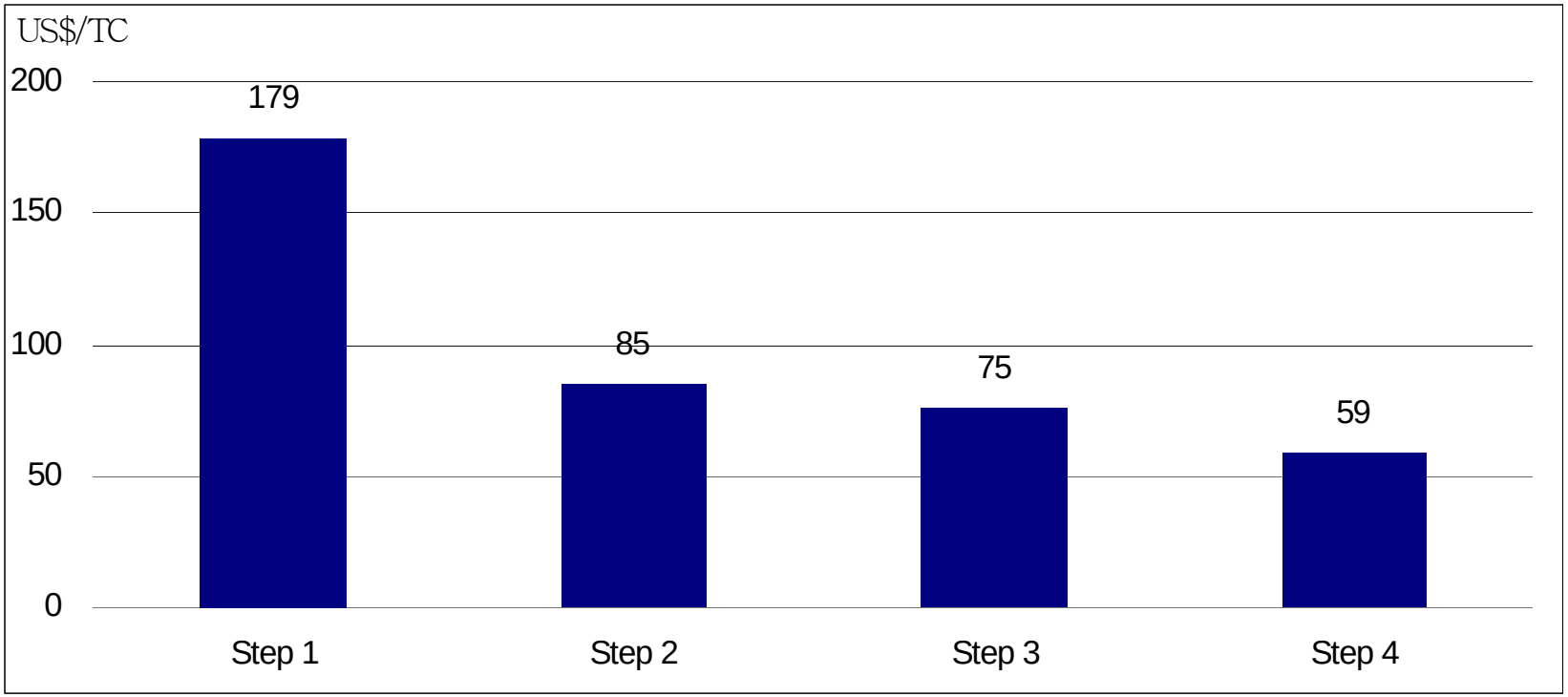
Global CGE Model Application
- Negotiation and Impacts -

Change of GHG Emissions relative to BaU, 2010



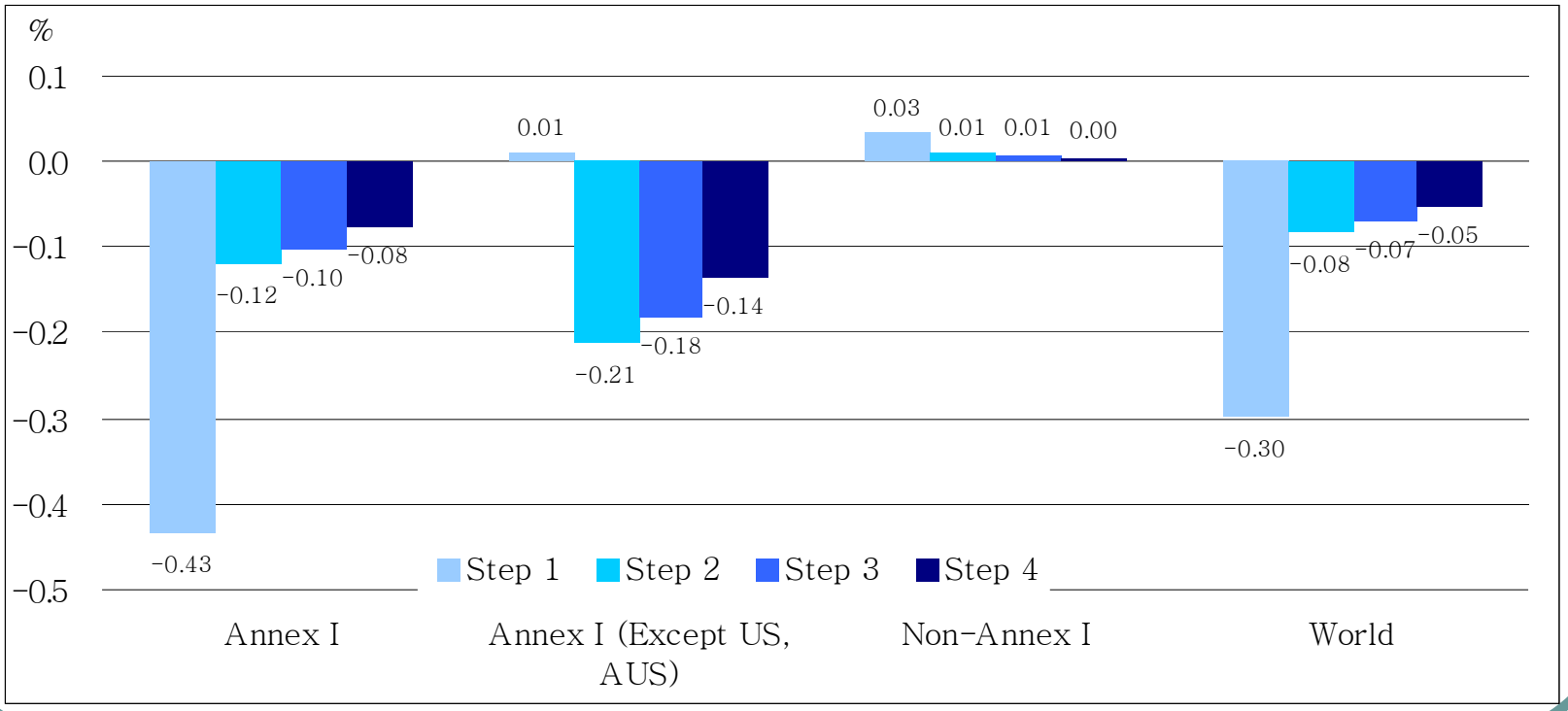
Global CGE Model Application
- Negotiation and Impacts -

Marginal Abatement Cost, 2010



Global CGE Model Application
- Negotiation and Impacts -

Change of Real GNP relative to BaU, 2010



Global CGE Model Application
- Scenario Analysis of Post Kyoto Commitments -

- Objective
  - Scenario Analysis of Economic and Environmental Impact of Future Commitment by Developing Countries
- Assumption
  - Developing countries : abatement commitment with developed countries (including US) from the 2nd commitment period
  - 5% reduction of GHG from emission in the 1st commitment period
  - international emission trading
- Developing countries : three groups
  - based on analysis and literature review on the issue of burden sharing
  - Group 1 : Korea, Mexico, Argentina, Indonesia, Brazil, Colombia, Rest of ASEAN
  - Group 2 : China (including Chinese Taipei), India, Middle East, Venezuela
  - Group 3 : other developing countries

Global CGE Model Application
- Post Kyoto Commitments -

scenario	1st commitment period	2nd commitment period
1	No U.S. participation (own strategy)	Annex I , group 1
2		Annex I , group 1 & 2
3	U.S. participation	Annex I , group 1
4		Annex I , group 1 & 2

National CGE Model Application
- Design of Domestic Policy Portfolio -

- Impact Analysis on domestic policy portfolio

	Early Stage (2005~2010)		Matured Stage(2011~2020)	
	Emission Trading	Carbon Tax	Emission Trading	Carbon Tax
Scenario 1	-	All downstream sectors	-	All downstream sectors
Scenario 2	Grandfathering, Sectors in VA (44 sectors)	Household, Transport, Other downstream sectors	Grandfathering, Sectors in VA (44 sectors)	Household, Transport, Other downstream sectors
Scenario 3	Grandfathering, Sectors in VA (44 sectors)	Household, Transport, Other downstream sectors	Grandfathering, (44 sectors) + (20 emission intensive sectors)	Household, Transport, Other downstream sectors
Scenario 4	Grandfathering, All downstream sectors	-	Grandfathering, All downstream sectors	-

Presentations from KEEI

"Energy Mix Transition Model: Vintage Model and Renewable Energy"

by Moon, Young-seok

- To examine the transition of fuel use from coal through petroleum and natural gas to renewables in world Economy
- To analyze the impact on the transition process of the environmental policies including Climate Change Policy
- Some Features of Theoretical Model
  - Dynamic Model
  - Imperfect Competition in Energy Supply Sector

"Strategies of Coalition Formation Under Kyoto Protocol"

by Cho, Gyeong-Lyeob

- To compare the GHG's abatement costs of 3 types of the coalitions among nations under the game theoretic environment.
- To investigate the payoffs of coalitions and optimality of outcomes and stability of the coalitions
- Some Features of Theoretical Model
  - Open Membership Model
  - Simultaneous Movement
  - Cooperative vs. Non-cooperative

Thank You !

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