2012 AIM International Workshop

How to Develop National Low-Carbon Scenarios with AIM/CGE Basic Country Model

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Background and Outline of study

- Greenhouse gas (GHG) emissions reduction = global challenge
- World target: 50% reduction of GHG emissions by 2050
- → Individual targets and actions for every countries, especially Asian countries with rapid economic growth
- → feasibility of the targets and actions
- → economic effects from the targets and actions

The target of this study

Provide a platform where national and international researchers are able to develop scenarios toward Low Carbon Society interactively.

- Target regions: Asian 15 regions
- Model : AIM/CGE Basic Country model
- Reflecting scenarios and information from national level

Region	Detail
China	China
India	India
Indonesia	Indonesia
Japan	Japan
Korea	Korea
Malaysia	Malaysia
Taiwan	Taiwan
Thailand	Thailand
Vietnam	Vietnam
Singapore	Singapore
Philippines	Philippines
Other East Asia	North Korea, Mongolia
Other South Asia	Bangladesh, Sri Lanka, Pakistan, Bhutan, Maldives, Nepal
Other South East Asia	Brunei Darussalam, Timor-Leste, Cambodia, Laos, Myanmar
Oceania	Fiji, Papua New Guinea, Solomon Islands, Vanuatu, Kiribati, Nauru, Tonga, Tuvalu, Samoa, FS Micronesia, Marshall Islands, Palau

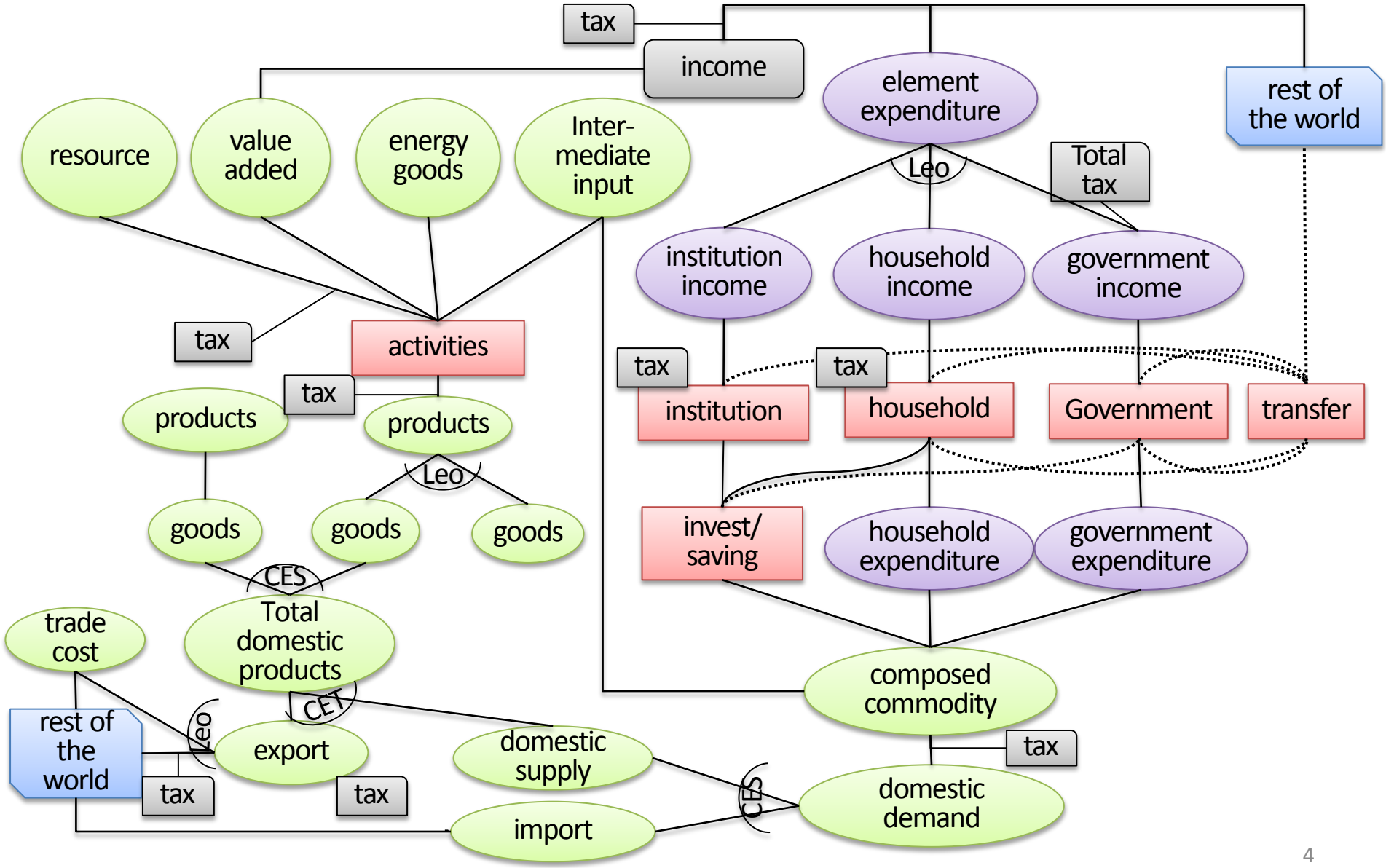
AIM/CGE Basic Country Model

- **CGE (Computable General Equilibrium) model**
  - Economic model
  - Fundamental idea: supply = demand, balanced by price mechanism
  - Maximization problem:
    household = utility maximization, enterprise = profit maximization
  - Whole social structure is described with consistence

- **AIM/CGE Basic Country Model**
  - A model developed by Dr. Fujimori based on Standard CGE model (IFPRI)
  - Recursive dynamic (one year step), and one region (country) model
  - 36 industrial sectors, and 23 commodities
    - Detailed power generation sectors:

    Coal fire, Gas fire, Oil fire, Hydro, Nuclear, Wind, Solar, Biomass
  - Base year = 2005, Social accounting matrix + energy balance table
  - GHG emissions (CO_2, CH_4, N_2O), GHG constraint
  - Reduction measures: Carbon tax, CO_2 capture and storage (CCS) technology, Renewable energy, Emission trading etc…

AIM/CGE Basic Country Model



GHG Emissions Reduction Targets

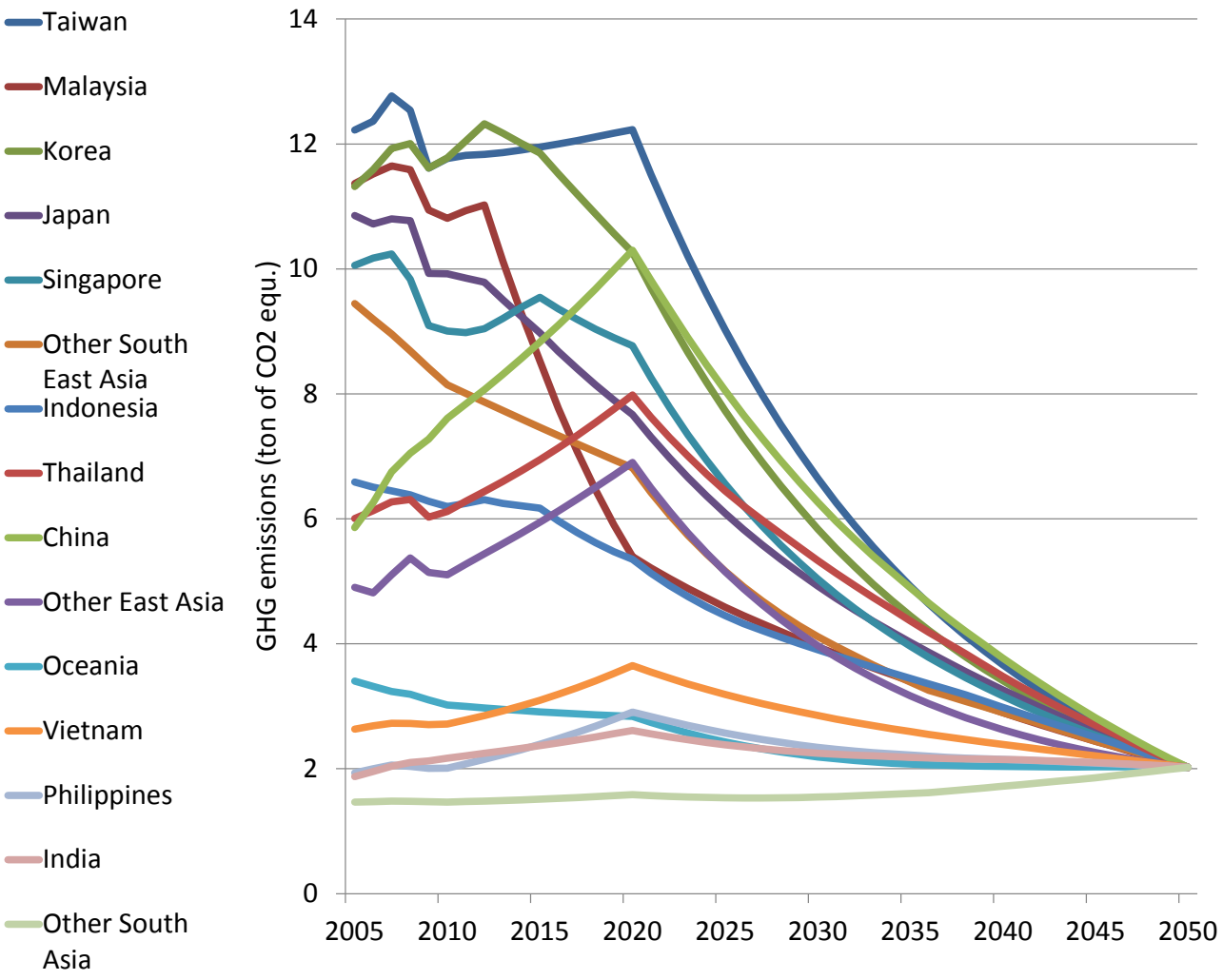
- World GHG Reduction Target
  - 50% reduction of GHG emission in 2050 from 1990 levels
- How to distribute the target? (Burden sharing)
  - Emissions per capita is equal all over the world
  - Emissions per GDP is equal all over the world
  - And so on..
- Some countries have national reduction targets
  - E.g.) Japan: 25% reduction by 2020 from 1990 levels… might be changed because of the earthquake

In this study..

- Emissions per capita is equal all over the world in 2050
- Regions with individual target in 2020 will achieve their targets
- All regions start reducing emissions from 2020 toward world halving target

GHG constraint

GHG emission reduction target
(GHG emissions per capita)



Total GHG Emissions
Change (2050/2005, %)

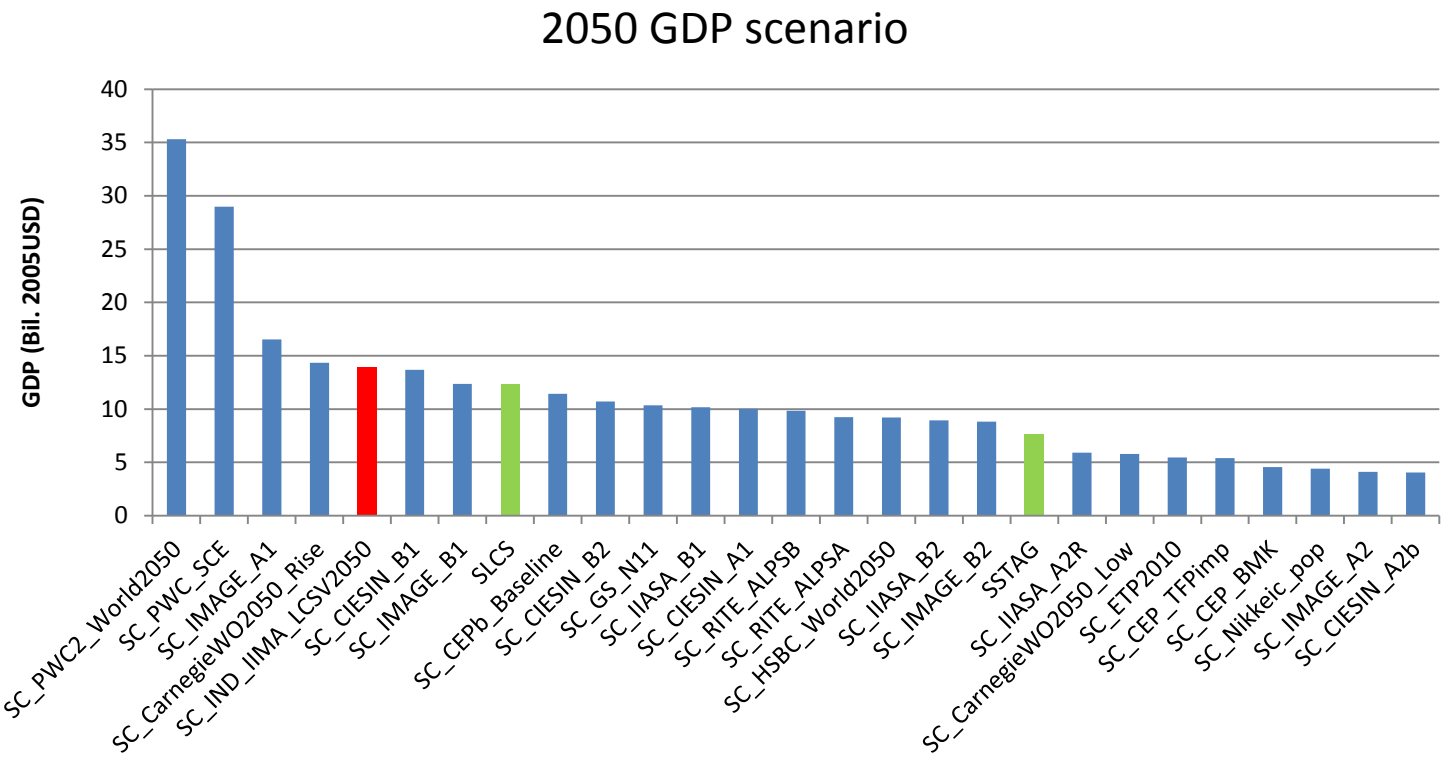
China	▲ 66
Indonesia	▲ 60
India	60
Japan	▲ 84
Korea	▲ 82
Malaysia	▲ 70
Philippines	89
Singapore	▲ 71
Thailand	▲ 64
Vietnam	▲ 4
Tiwan	▲ 85
Other East Asia	▲ 52
Oceania	20
Other South Asia	127
Other South East Asia	▲ 72

How to Develop National Low-Carbon Scenarios with AIM/CGE Basic Country Model

Trial Application for India and China

India <situation>

- India's GHG emissions reduction targets:
  - 20-25% reduction of CO_2 Intensity (CO_2/GDP) in 2020 from 2005 levels
  - Calculated GHG emissions reduction target in 2050: 60% increase from 2005 levels
- Socio-economic projections have a wide range among scenarios

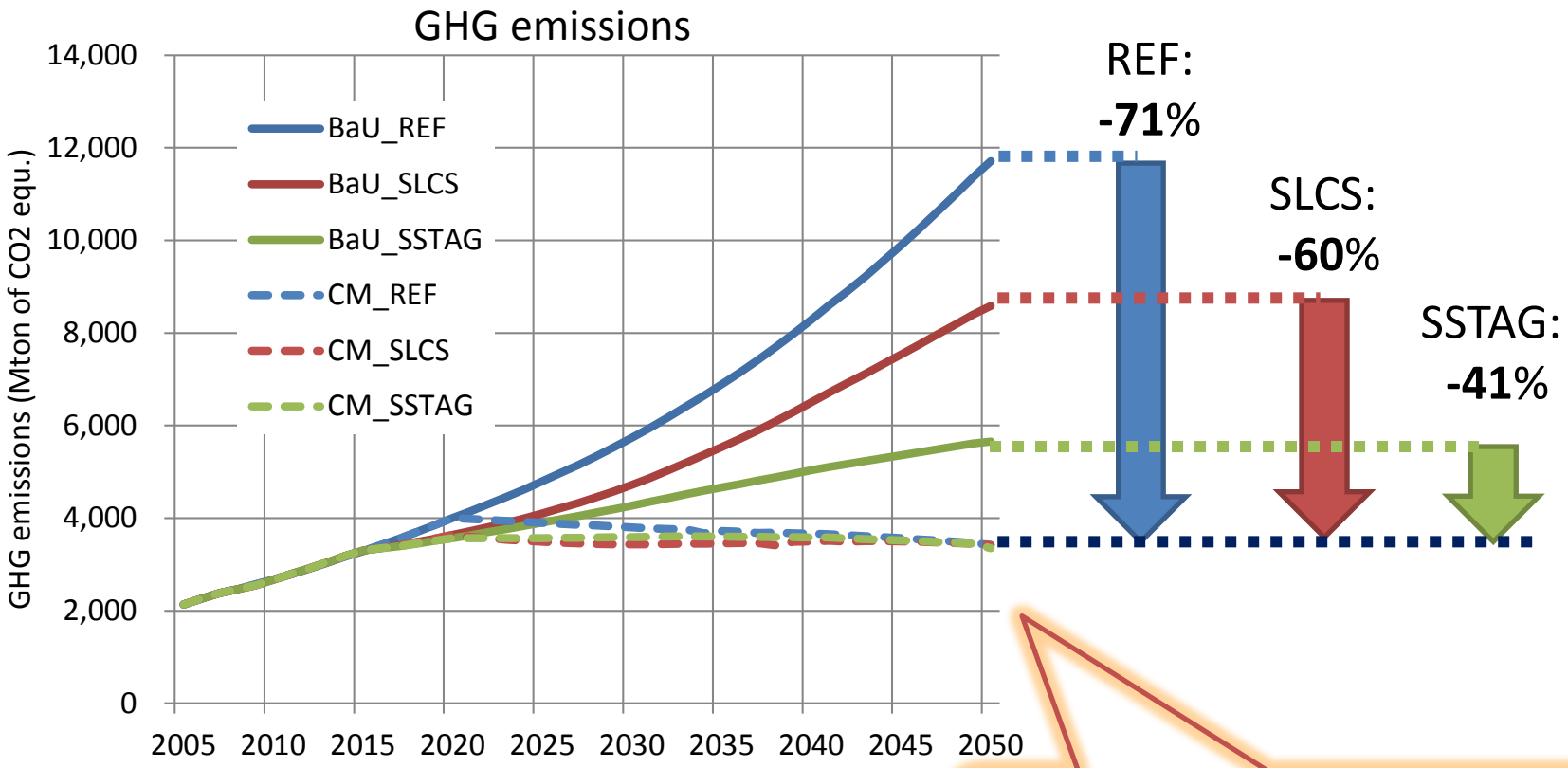


India <scenario setting>

	SLCS scenario	SSTAG scenario	Reference scenario
population	UN population prospect 2010		
Target GDP	Modest GDP growth (6.5%/yr)	Lower GDP growth (5.5%/yr)	Rapid GDP growth (7-8%/yr)
Target GDP share (in 2050)	Primary: 10%, Secondary: 20%, Tertiary: 70%		Primary: 5%, Secondary: 45%, Tertiary: 55%
GHG reduction target	2020 target: reduction of GHG intensity by 23% from 2005 levels 2050 target: reduction of GHG emission by 50% from 1990 levels		
GHG reduction measure	CCS technology is available from 2020. Renewable energy cost decrease.		
Energy	Autonomous Energy Efficiency Improvement; Coal 3%/year, Oil 2%/year, Gas 1%/year, Electricity 1%/year		

*More detailed information of this setting is available in individual meeting

India <results>



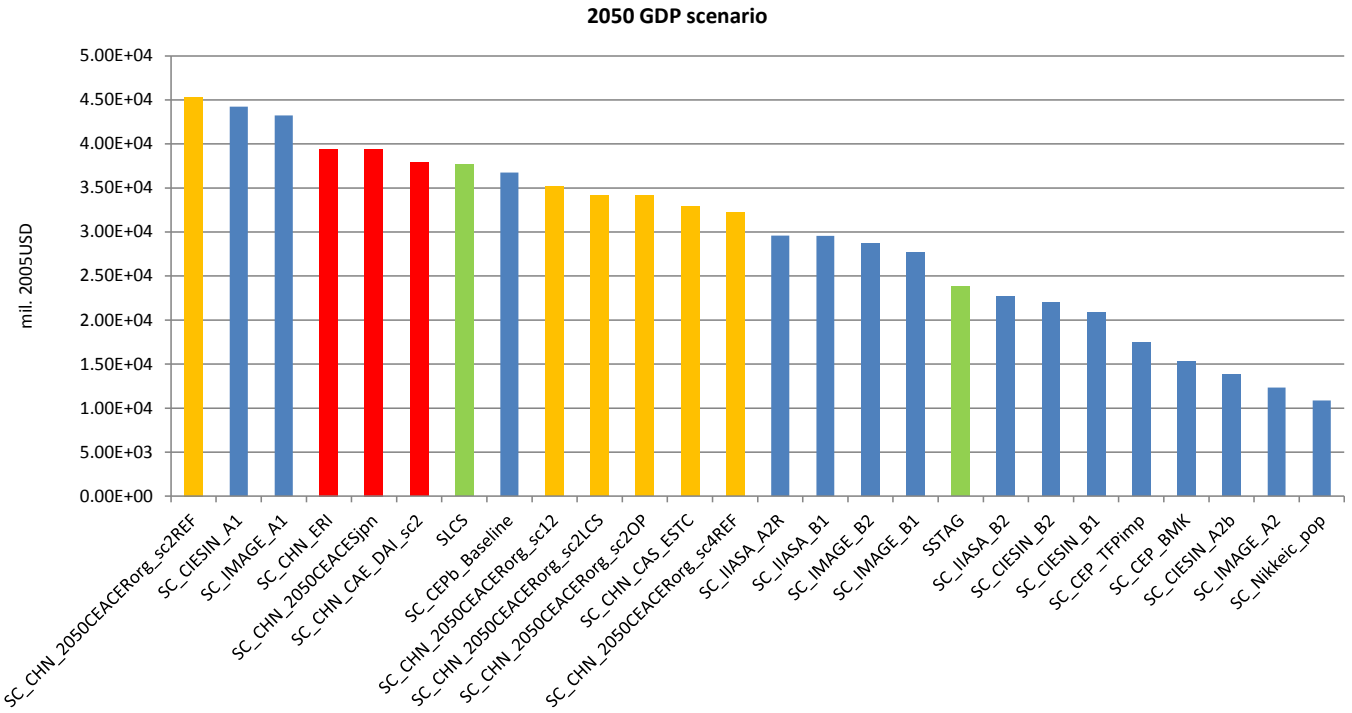
	Carbon Price in 2050 (2005USD/ton of CO_2 eq.)	GDP Loss in 2050 (%)
SLCS	91	2.12
SSTAG	67	1.60
REF	164	2.73

BaU: without GHG reduction targets
CM: With GHG reduction targets

$$\frac{\left(GDP_{BaU,2050} - GDP_{CM,2050}\right)}{GDP_{BaU,2050}} \times 100$$

China <situation>

- China's GHG emissions reduction targets:
  - 40-45% reduction of Intensity (CO_2 emissions/GDP) in 2020 from 2005 levels
  - Calculated GHG emissions reduction target in 2050: 66% reduction from 2005 levels
- A number of socio-economic scenarios from international and domestic organizations



Yellow: scenarios from domestic institutions, Blue: scenarios from international institutions

China <scenario setting>

	SLCS scenario	SSTAG scenario	REF scenario
Population	UN population prospects 2010		
Total GDP	6.3%/year	5.0% /year	6.7%/year
GDP structure	Similar to current developed country. Tertiary industry is the main industry.	While tertiary industry increases the share, still secondary industry plays an important role.	Similar to current developed country. Tertiary industry is the main industry.
Energy	Coal: 4%/year, Oil: 3%/year, Gas: 2%/year, Electricity: 3%/year	Coal: 2%/year, Oil: 1%/year, Gas: 0%/year, Electricity: 1%/year	Coal: 5%/year, Oil: 4%/year, Gas: 1%/year, Electricity: 5%/year
Renewable Cost Decrease	Wind, photovoltaic, geothermal, biomass power cost decrease		
GHG constraint	43% reduction of GHG intensity from 2005 levels by 2020 66% reduction of GHG emissions from 2005 levels by 2050		

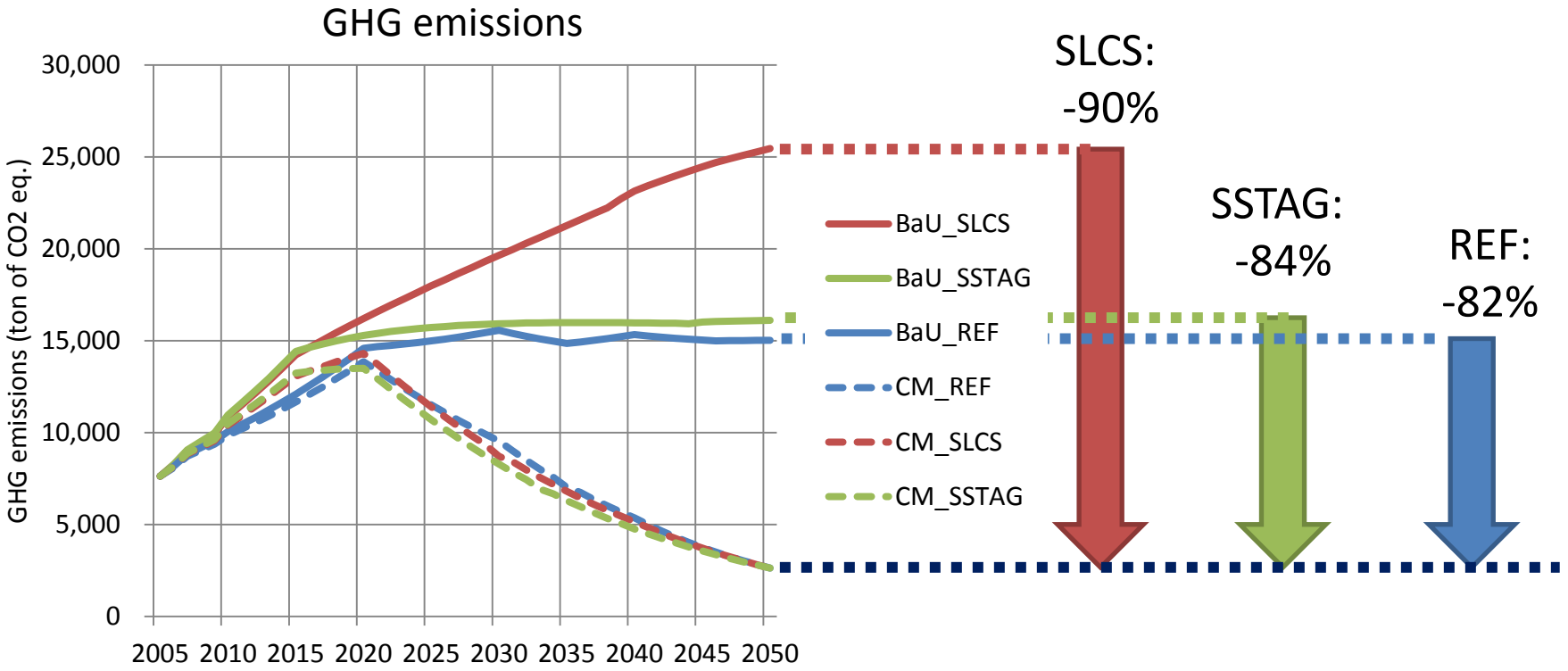
*More detailed information of this setting is available in individual meeting

China <LCS action>

	LCS action
Transport	Increase of public transport share, transport energy efficiency improvement, transport efficiency improvement
Renewable Power	Additional cost decrease of renewable energy (1.1% additional decrease of solar photovoltaic cost, 0.7% additional decrease of solar photovoltaic cost)
Energy Intensive Industry	Less output of energy intensive products resulted from dematerialization, efficiency improvement (Iron and steel, cement, paper and pulp etc..)
Energy	Additional Energy Efficiency Improvement (1%/year additional energy efficiency improvement for Coal, Oil, Gas, Electricity)
CCS	CCS technology is available from 2020

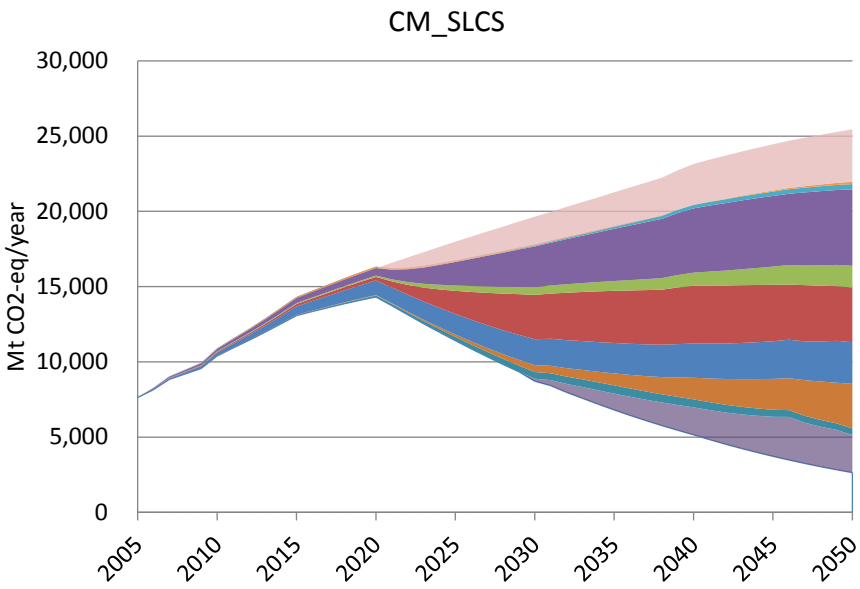
*More detailed information of this setting is available in individual meeting

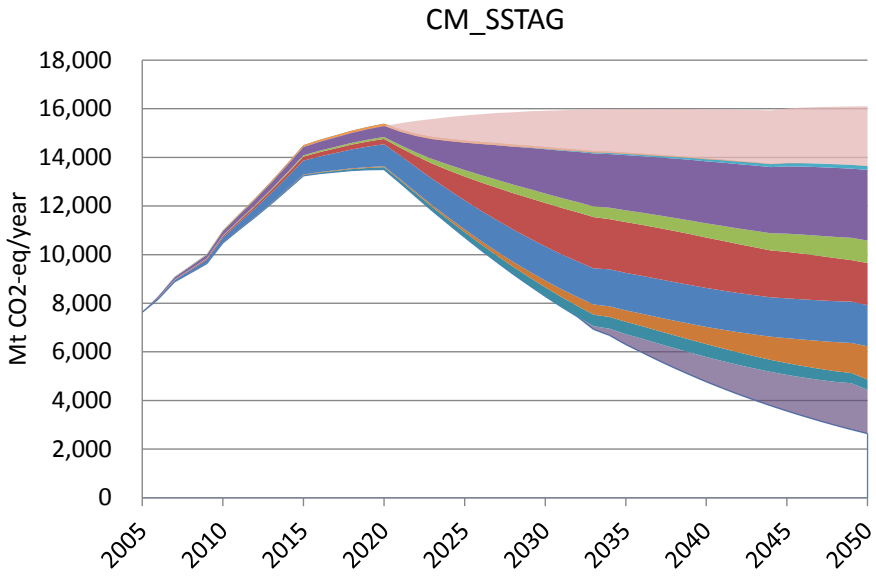
China <results>

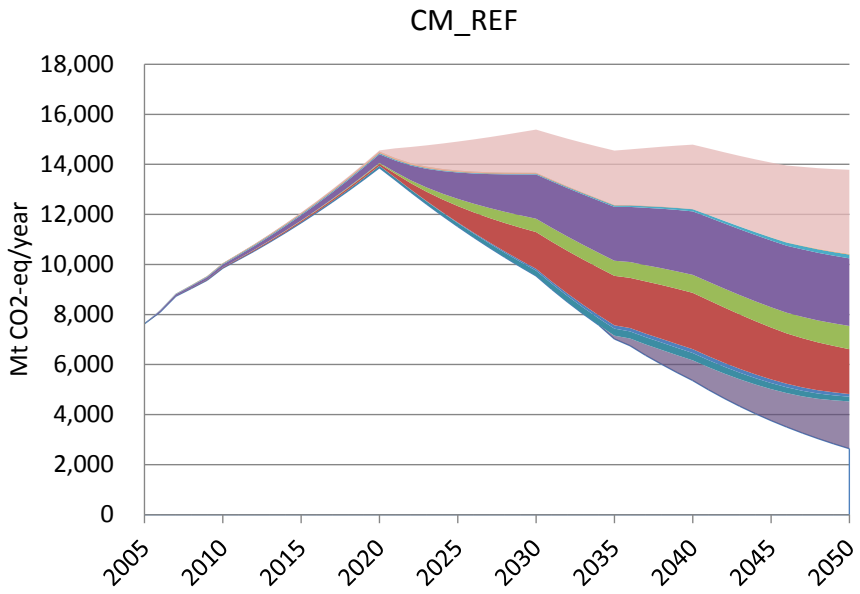


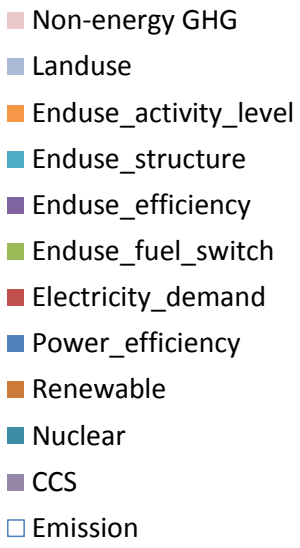
	SLCS		SSTAG		REF	
	without LCS action	with LCS action	without LCS action	with LCS action	without LCS action	with LCS action
Carbon Price in 2050 (2005USD/ton of CO_2 eq.)	1053	628	535	297	745	466
GDP Loss (%) in 2050	17.87	3.30	8.74	-1.10	10.46	2.01

China <GHG reduction measure>









For further study

- This study is underway
- Application to China, India and Japan has started, and application to the other regions will coming soon
- We would like to get some comments and advice from professionals in target countries/regions

The target of this study

Provide a platform where national and international researchers are able to develop scenarios toward Low Carbon Society interactively.

Thank you for your attention!

If you have any questions, please contact me

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