

Asia Low Carbon Society Scenario Development

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Challenges to Low Carbon Asia

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Introduction

- As the countries of Asia differ in terms of their stage of economic development and have diverse climatic conditions, cultures, societies and present circumstances, the climate change mitigation policies that will be introduced in each country are expected to differ. This scenario shows as a whole scenario for Asia.
- In Low Carbon Society (LCS), the target of the global GHG emissions in 2050 is set to be half compared with those in 1990.
 - This presentation is “Top-down” type approach. “Bottom-up” type approach will be explained by Prof. Matsuoka.
 - Countermeasures related to Transportation (Actions 1&2), Industry (Action 3) and Governance & Institution (Actions 9&19) are assessed based on the results from Prof. Hayashi, Prof. Moriguchi and Prof. Kanie’s team, respectively.

GHG emission reduction target in Asian countries

- Japan:
 - In Action program to develop low carbon society (2008), 60-80 % reduction compared to the present level as a long term target, year 2050.
 - In 2009, Prime Minister at that time, Mr. Hatoyama, showed 25% reduction compared to the 1990 level, which is premised on the establishment of a fair and effective international framework in which all major economics participate and on agreement by those economies on ambitious targets.
 - In 2013, present Prime Minister, Mr. Abe, indicated that the mitigation target would be readjusted, and the new target would be decided by the COP19. However, the new target has not yet been drawn up.
- China:
 - Lower CO2 emissions per unit of GDP by 40-45% by 2020 compared to the 2005 level
- India:
 - Reduce emission intensity of GDP by 20 to 25% by 2020 in comparison to the 2005 level
- Indonesia:
 - Reduce emissions by 26% on BaU by 2020
- Korea:
 - Reduce emissions by 30% below BaU by 2020
- Papua New Guinea :
 - Reduce emissions by at least 50% below BaU by 2030

Ten Actions for Realizing a Low Carbon Asia



Action 1 Urban Transport
Hierarchically Connected
Compact Cities



Action 2 Interregional Transport
Mainstreaming Rail and Water in
Interregional Transport



Action 3 Resources & Materials
Smart Ways to Use Materials that
Realize the Full Potential of Resources



Action 4 Buildings
Energy-Saving Spaces Utilizing
Sunlight and Wind



Action 5 Biomass
Local Production and
Local Consumption of Biomass



Action 6 Energy System
Low Carbon Energy System
Using Local Resources



Action 7 Agriculture & Livestock
Low Emission Agricultural
Technologies



Action 8 Forestry & Land Use
Sustainable Forestry Management



Action 9 Technology & Finance
Technology and Finance to
Facilitate Achievement of LCS



Action 10 Governance
Transparent and Fair Governance
that Supports Low Carbon Asia

Qualitative storylines are quantified.

Two future scenarios in this project

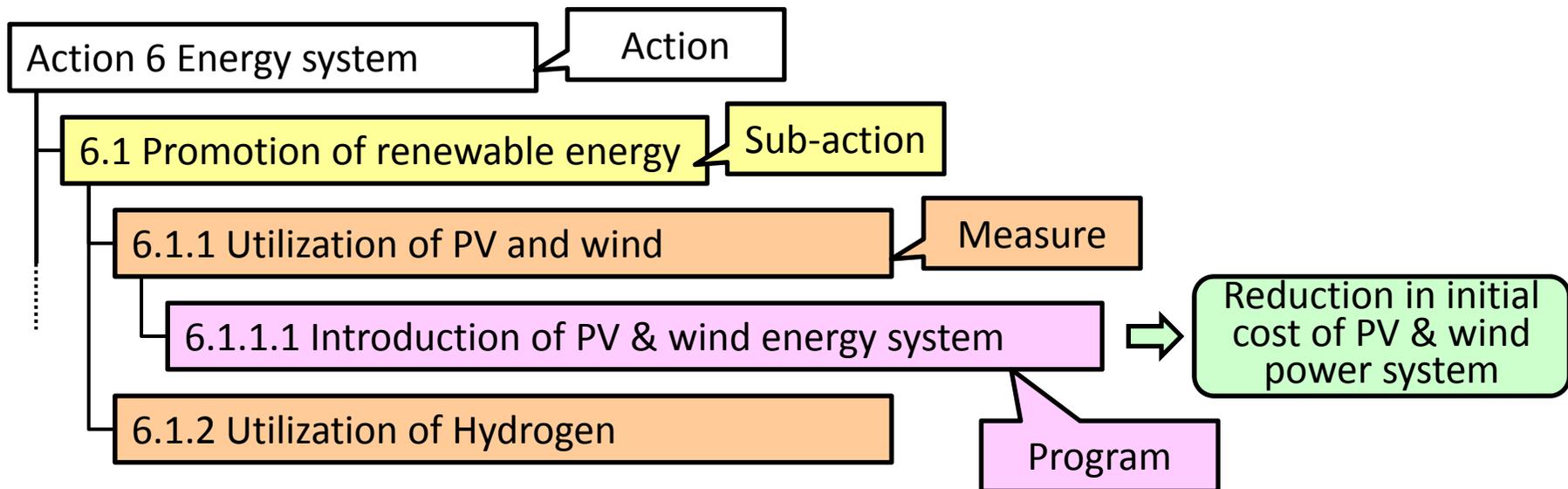
	Advanced Society Scenario	Conventional Society Scenario
Overall Features	Society that is highly motivated and actively working to achieve a transition to next-generation social systems, programs, technologies etc.	Society that is cautious about making changes to social systems, programs, technologies and so on and that is concerned about the transition costs of social change.
Economy	Average annual growth rate: 3.27%/year (global) 4.16%/year (Asia)	Average annual growth rate: 2.24%/year (global) 2.98%/year (Asia)
Population	Total population in 2050: 6.9 billion (global) and 4.6 billion (Asia)	Total population in 2050: 6.9 billion (global) and 4.6 billion (Asia)
Education	Active efforts to improve education Average number of years of schooling: 4 - 12 years (2005) → 11 - 14 years (2050)	Standard improvements to educational policy Average number of years of schooling: 4 - 12 years (2005) → 8 - 13 years (2050)
Use of Time	Diverse mix of lifestyles, but a comparatively long period of time spent on work and career advancement	Diverse mix of lifestyles, but a comparatively long period of time spent on time with family and friends
Work	Unemployment rate of 0% achieved by 2075	Fixed at 2009 level
Government Efficiency	Improved from a comparatively early stage	Improved gradually at a slow pace
International Cooperation	Lower trade barriers and reduced foreign direct investment risk	Gradual progress in establishing cooperative relationships among countries in Asia
Technical Innovation	High rate of advancement	Gradual advancement
Transportation	Increased demand resulting from high economic growth rate	Gradual increase in demand
Land Use	Speedy and efficient land improvement	Gradual and cautious land improvement

How to estimate future?

In global computable general equilibrium (CGE) model, the individual programs in actions are reflected, and the GHG emissions are simulated.

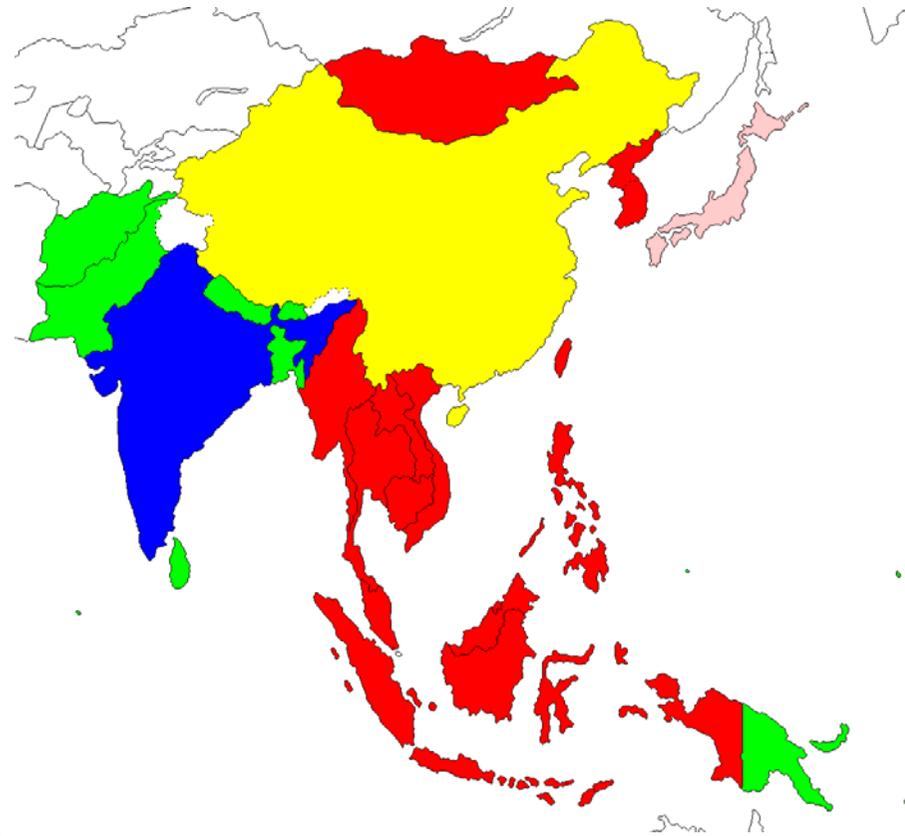
CGE model: Price mechanism to balance supply and demand of all goods and production factors.

See Fujimori et al.(2012) AIM/CGE [basic] manual, Discussion Paper Series, Center for Social and Environmental Systems Research, NIES, 2012-01, <http://www.nies.go.jp/social/dp/pdf/2012-01.pdf>



Regional disaggregation

Japan		JPN
China		CHN
India		IND
Indonesia	South East Asia + Rest of East Asia	XSE
Malaysia		
Phillipines		
Thailand		
Singapore		
Vietnum		
Lao		
Myanmar		
Brunei		
Cambodia		
East Timor		
Republic of Korea		
DPRK		
Mongolia		
Taiwan		
Bangladesh	Rest of Asia	XSA
Bhutan		
Nepal		
Pakistan		
Maldives		
Sri Lanka		
Afghanistan		
Fiji		
Papua New Guinea		
Marshall		
Micronesia		
Palau		
Kiribati		
Nauru		
Samoa		
Solomon Islands		
Tonga		
Tuvalu		
Vanuatu		



Japan	EU25	Brazil
China	Rest of Europe	Rest of Latin America
India	CIS	Middle East
South East Asia + Rest of East Asia	Turkey	North Africa
Rest of Asia	Canada	Rest of Africa
Oceania	USA	

Sectors and technologies in the CGE model

Rice	Non ruminant livestock, other livestock & fishery	Wood products	Other Manufacturing
Wheat	Forestry	Paper, Paper products & Pulp [#]	Electricity*
Other grains	Coal mining	Chemical, Plastic and Rubber products [#]	Gas manufacture distribution
Oil seed crops	Oil mining	Petroleum refinery [#]	Construction
Sugar crops	Gas mining	Coal transformation	Transport & communications
Vegetable, Fruits & Nuts, Fiber crops, Other crops	Mineral mining & Other quarrying	Mineral products nec [#]	Other service sectors
Ruminant livestock	Food products	Iron & Steel [#]	Biomass transformation ⁺
Raw milk	Textiles, Apparel & Leather	Non Ferrous products	

* Electricity includes following technologies;

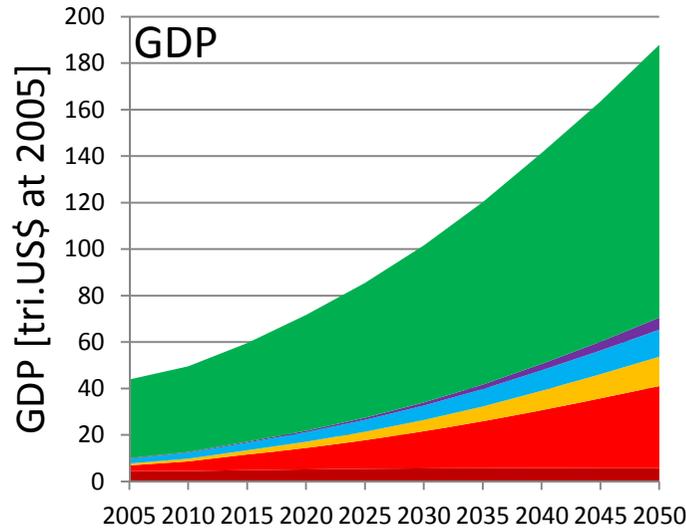
Coal-fired [#]	Gas-fired [#]	Hydro	Solar	Waste biomass ⁺
Oil-fired [#]	Nuclear	Geothermal	Wind	Other renewables

+ “Biomass” includes following types;

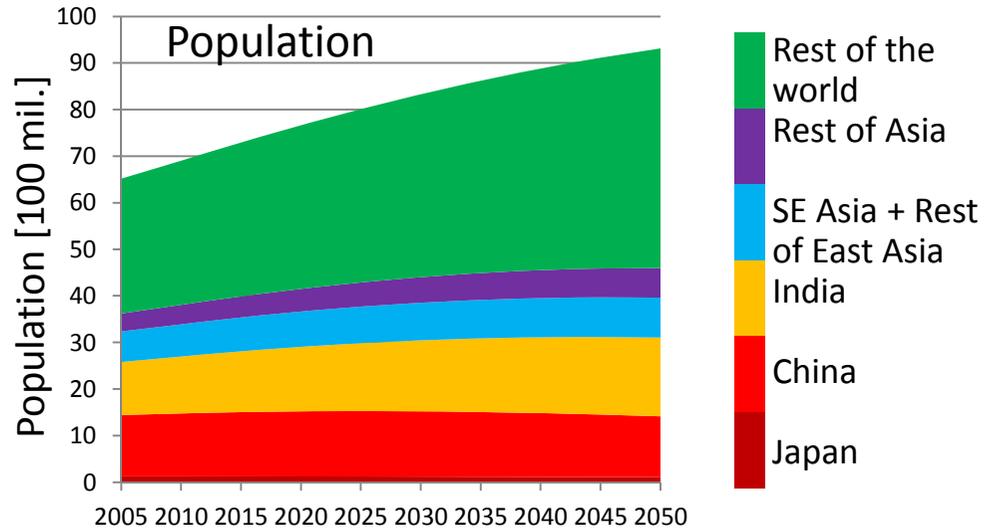
1st generation, 2nd generation with energy crop, and 2nd generation with residue

These sectors including power sub sectors indicate the sectors in which CCS will be able to be installed.

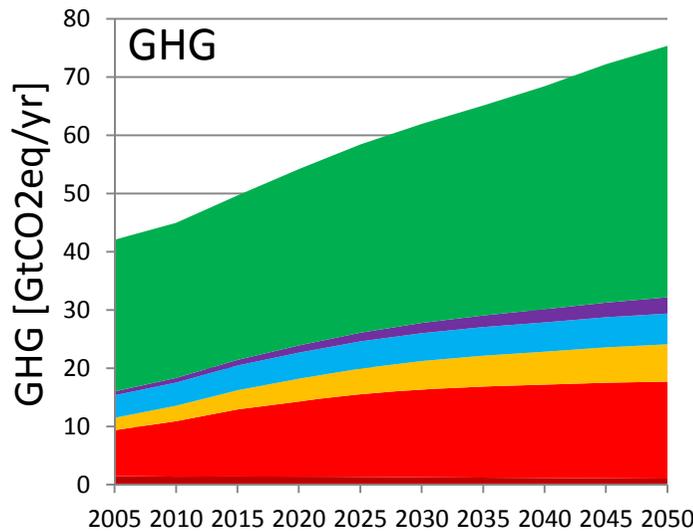
Asia in BaU scenario



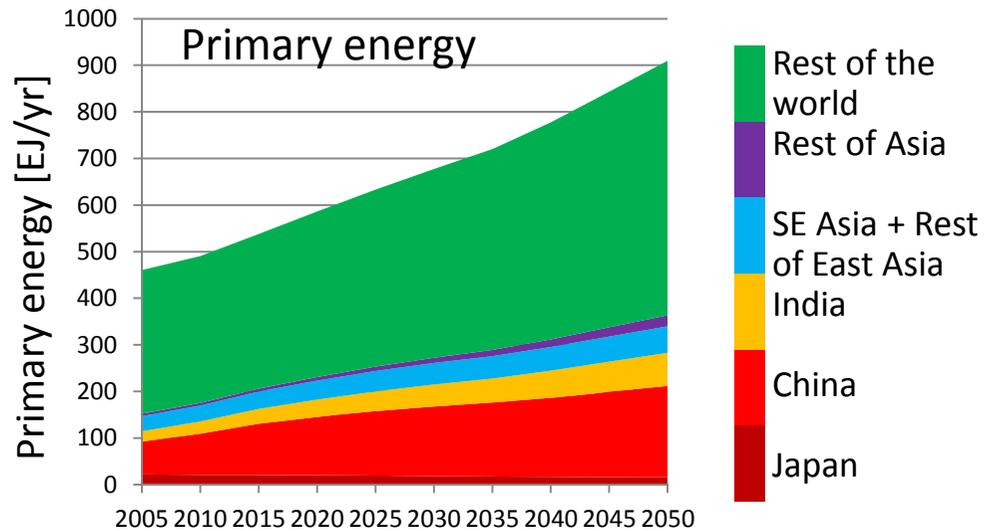
Share of Asia: 27% in 2005 to 37% in 2050



Share of Asia: 56% in 2005 to 49% in 2050

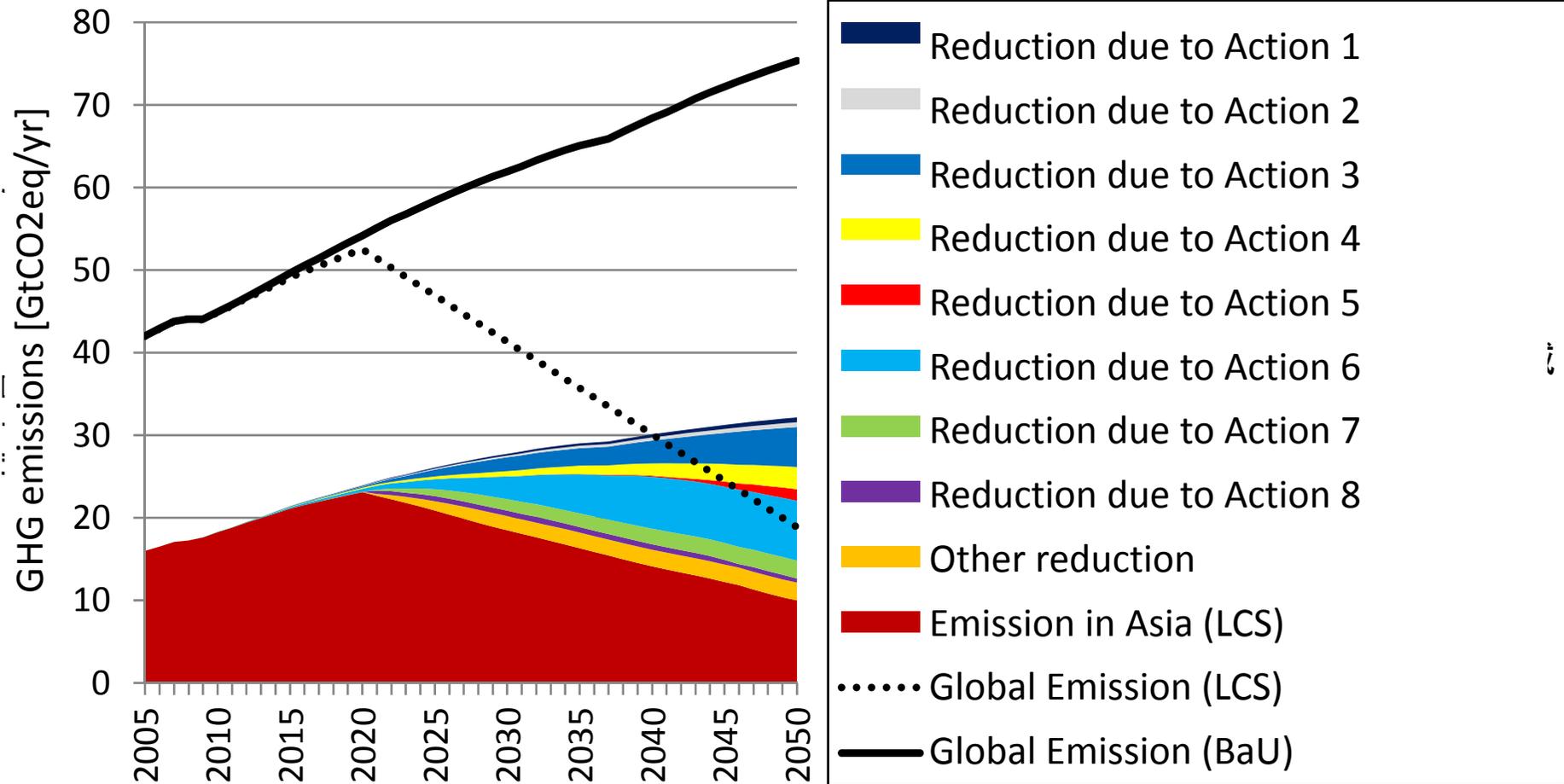


Share of Asia: 38% in 2005 to 43% in 2050

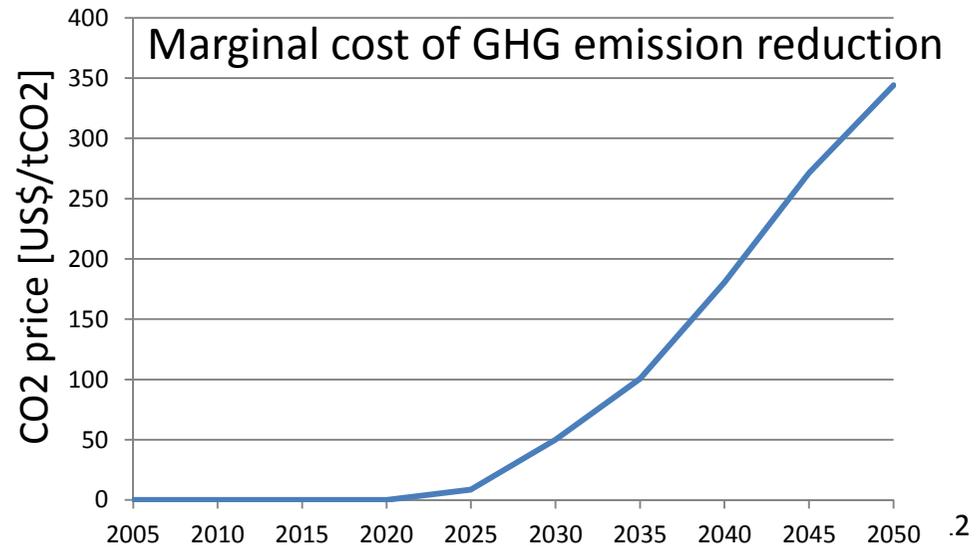
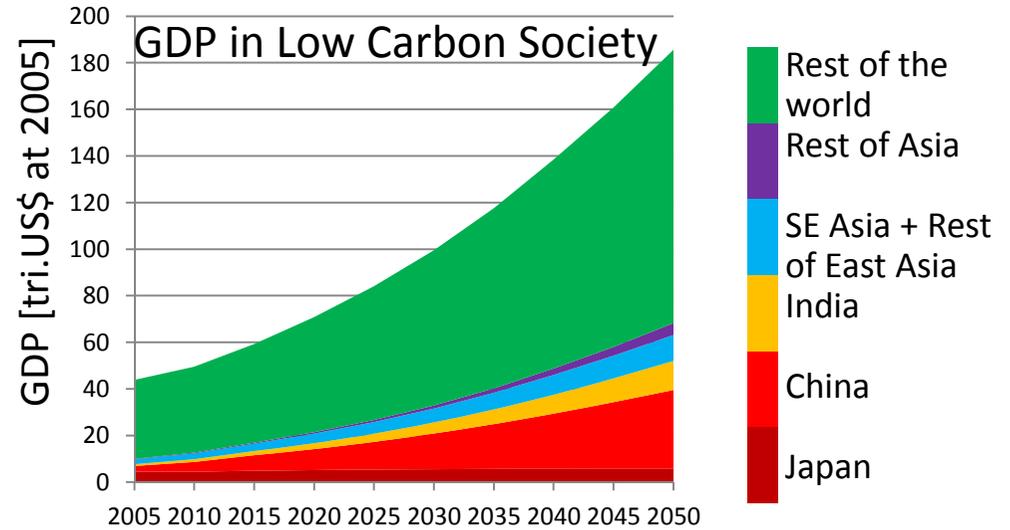
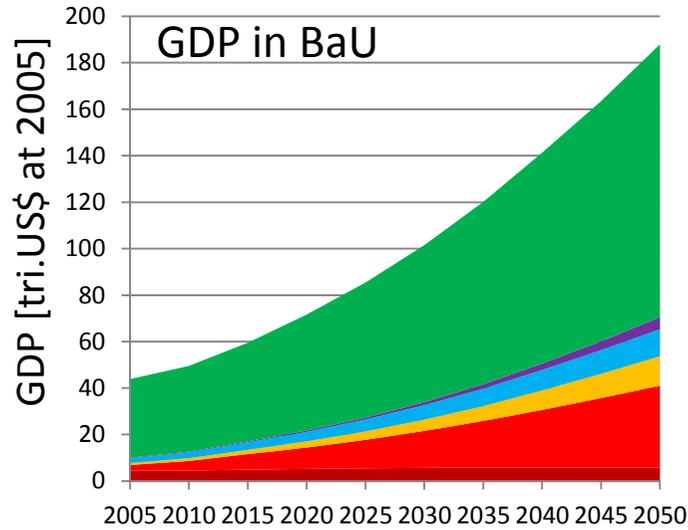


Share of Asia: 33% in 2005 to 40% in 2050

GHG Emissions in Asia



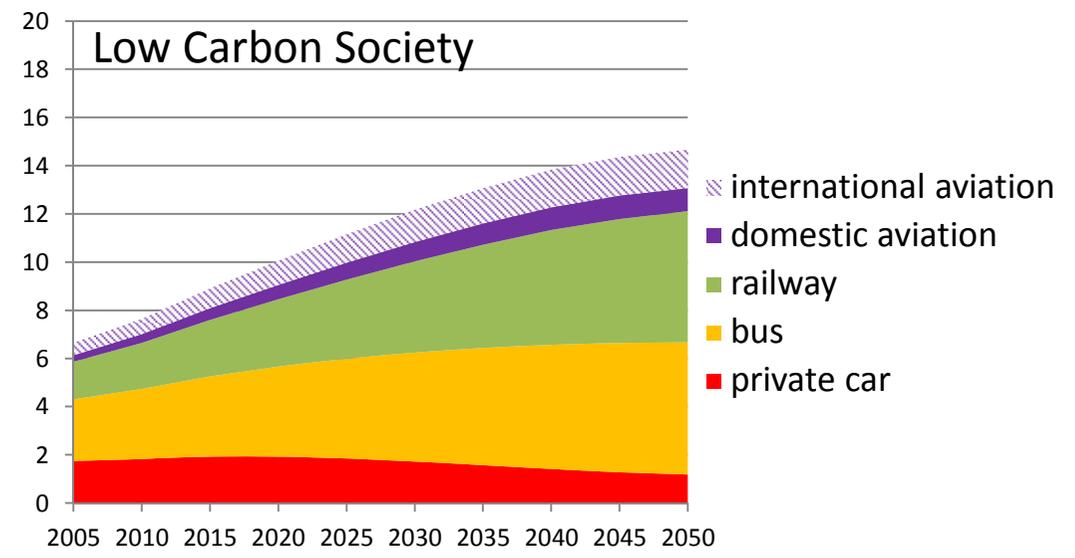
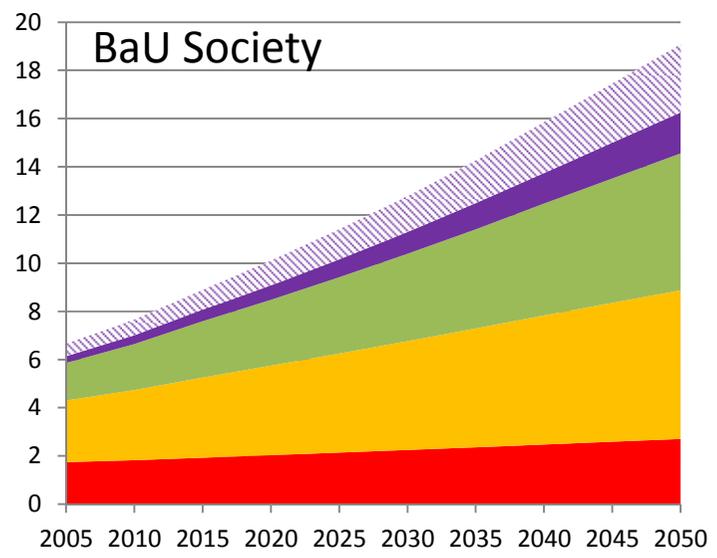
Asia in Low carbon society



Action 1: Hierarchically Connected Compact Cities (Urban Transport)

1.1 Compact cities with well-connected hierarchical urban centers (AVOID)	1.1.1 Development of employment cores in urban transit corridors
	1.1.2 Exclusion of private cars from inner city areas
1.2 A seamless and hierarchical transport system (SHIFT)	1.2.1 Early development of urban public transport networks
	1.2.2 Improvement of feeder transport systems
	1.2.3 Integrated management of public transport systems
1.3 Low carbon vehicles with efficient road-traffic systems (IMPROVE)	1.3.1 Vehicle technology development
	1.3.2 Promotion of alternative fuels
	1.3.3 Development of integrated freight transport systems

- Reduction in unit traffic volume
- Energy efficiency improvement
- Modal shift

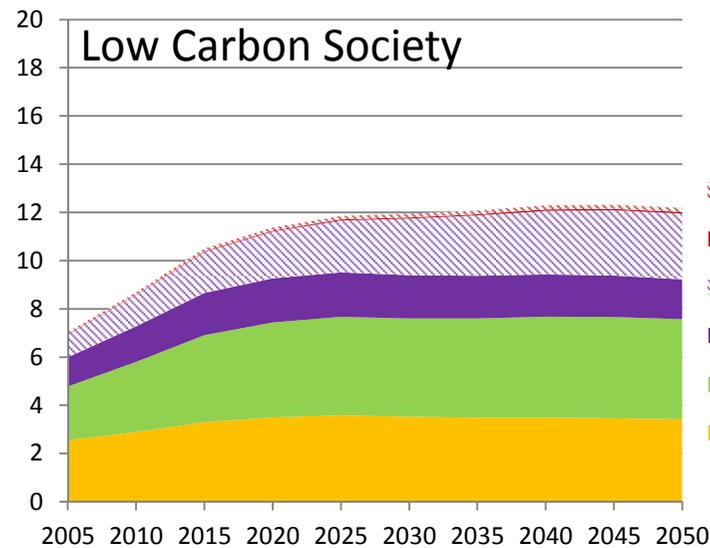
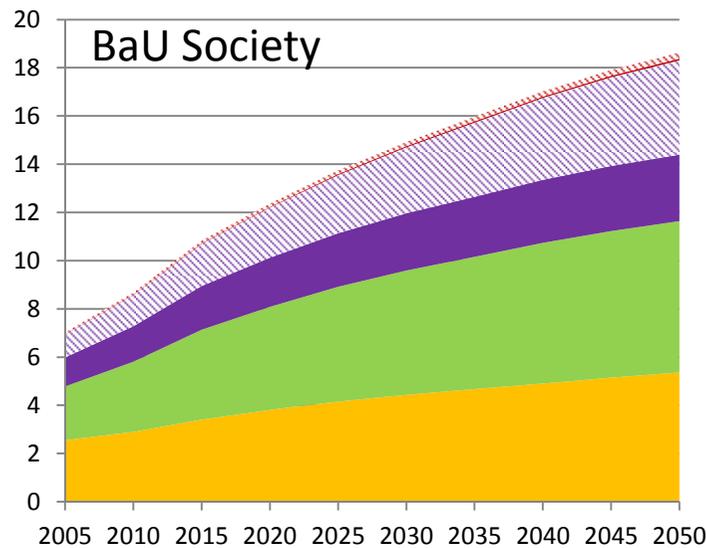


Passengers traffic in Asia [unit: tri. person km/year]

Action 2: Mainstreaming Rail and Water in Interregional Transport (Interregional Transport)

2.1 Formation of industrial corridors using a low carbon transport system (AVOID)	2.1.1 Creation of arterial corridors for high-speed freight rail
	2.1.2 Clustering of industries around the arterial and terminal connection hubs of high-speed freight rail
	2.1.3 Creation of institutions and systems to suppress transport demand
2.2 Establishment of an intermodal transport system incorporating rail and water (SHIFT)	2.2.1 Dev of base ports to support international maritime transport
	2.2.2 Creation of infrastructures for inland high-speed rail
	2.2.3 Establishment of institutions to promote the use of low carbon transport modes
2.3 Reduction of CO2 emissions from vehicles and aircraft (IMPROVE)	2.3.1 Technological improvements to transport modes
	2.3.2 Development of biofuels and promotion of their use
	2.3.3 Optimization of the speed of maritime vessels

- Reduction in unit traffic volume
- Energy efficiency improvement
- Modal shift
- Bio-fuels

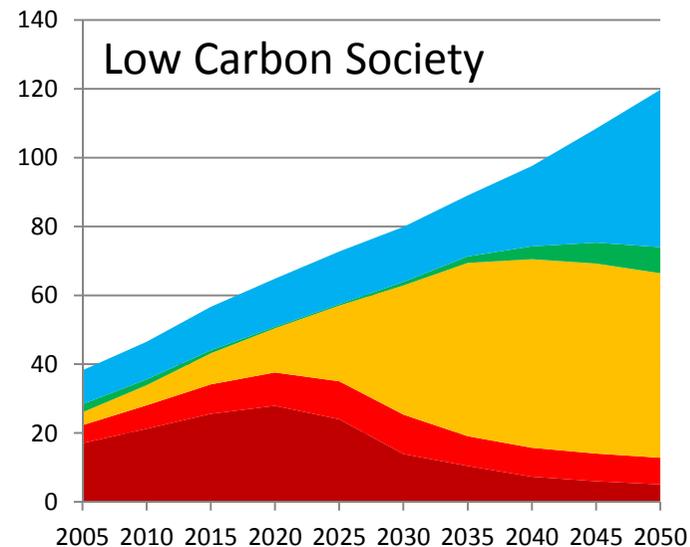
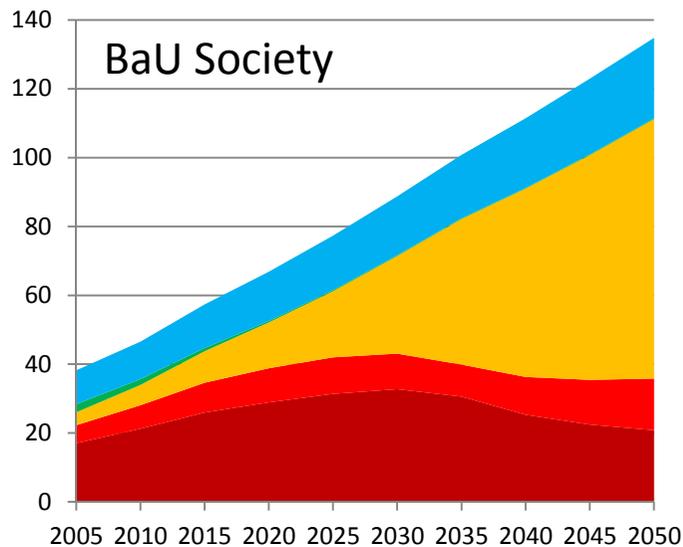


- international aviation
- domestic aviation
- International navigation
- domestic navigation
- railway
- truck

Action 3: Smart Ways to Use Materials that Realize the Full Potential of Resources (Resources & Materials)

3.1 Production that dramatically reduces the use of resources	3.1.1 Development and active employment of technologies for weight reduction and raw material substitution
	3.1.2 Creation of materially simple lifestyles while still enjoying richness
3.2 Use of products in ways that extend their lifespan	3.2.1 Development and active employment of product life-extension technologies and maintenance systems
	3.2.2 Development of cities and national land from a long-term perspective
	3.2.3 Construction of long-lasting housing and replacement of housing
	3.2.4 Selection of less resource consuming, long-lasting, recyclable, and reusable products
3.3 Development of systems for the reuse of resources	3.3.1 Development and active employment of recycling and reuse technologies
	3.3.2 Establishment of recycling and reuse systems for various goods
	3.3.3(3.2.4) Selection of less resource consuming, long-lasting, recyclable, and reusable products

- Energy efficiency improvement
- Reduction in material inputs
- Preference change



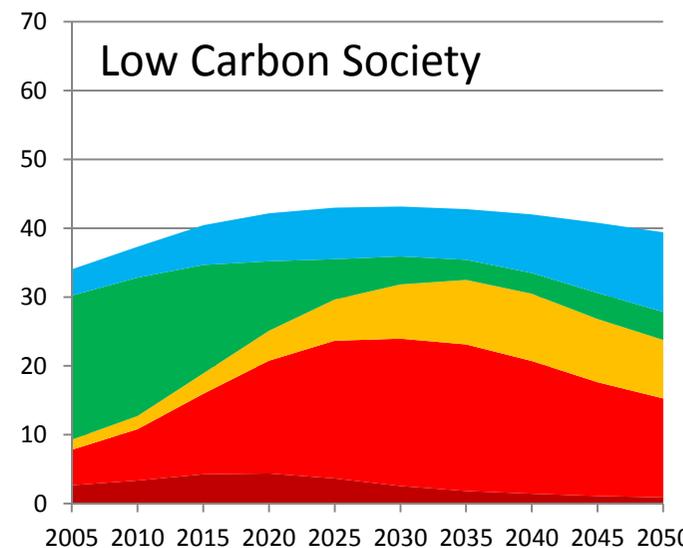
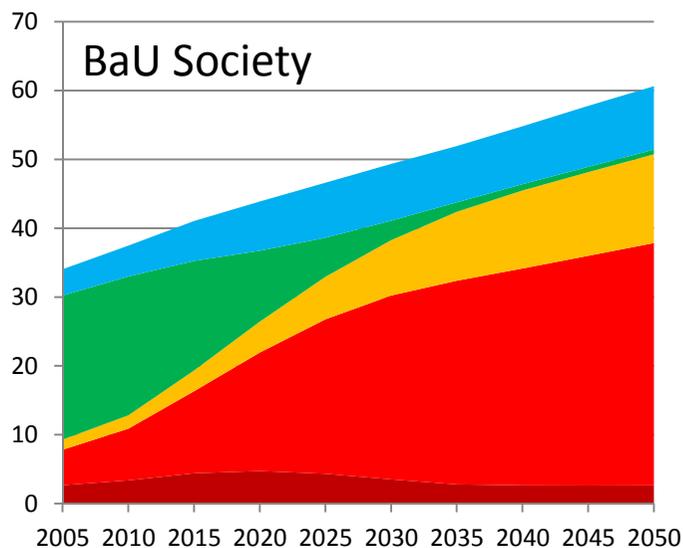
Final energy demand in industry in Asia [unit: EJ/year]

Action 4: Energy-Saving Spaces Utilizing Sunlight and Wind (Buildings)

4.1 Improvement of the energy-efficiency performance of buildings	4.1.1 Mandatory energy-efficiency standards for new and renovated buildings
	4.1.2 Creation of comfortable environments through max use of renewable energy
	4.1.3 Development of a financial support scheme for improvement of building energy performance
4.2 Application of high-efficiency equipment to buildings	4.2.1 Promotion of energy-efficiency improvement of equipment
	4.2.2 Development and deployment of comprehensive evaluation systems for energy-efficient equipment
	4.2.3 Provision of financial support for energy-efficient equipment
4.3 Visualization of energy-saving efforts	4.3.1 Development and management of evaluation systems for energy-saving actions
	4.3.2 Development of incentive schemes in line with energy-saving efforts
	4.3.3 Education on energy-saving actions & promotion of knowledge sharing

Energy efficiency improvement

Reduction in cooling & heating demand



■ electricity
 ■ biomass
 ■ gas
 ■ oil
 ■ coal

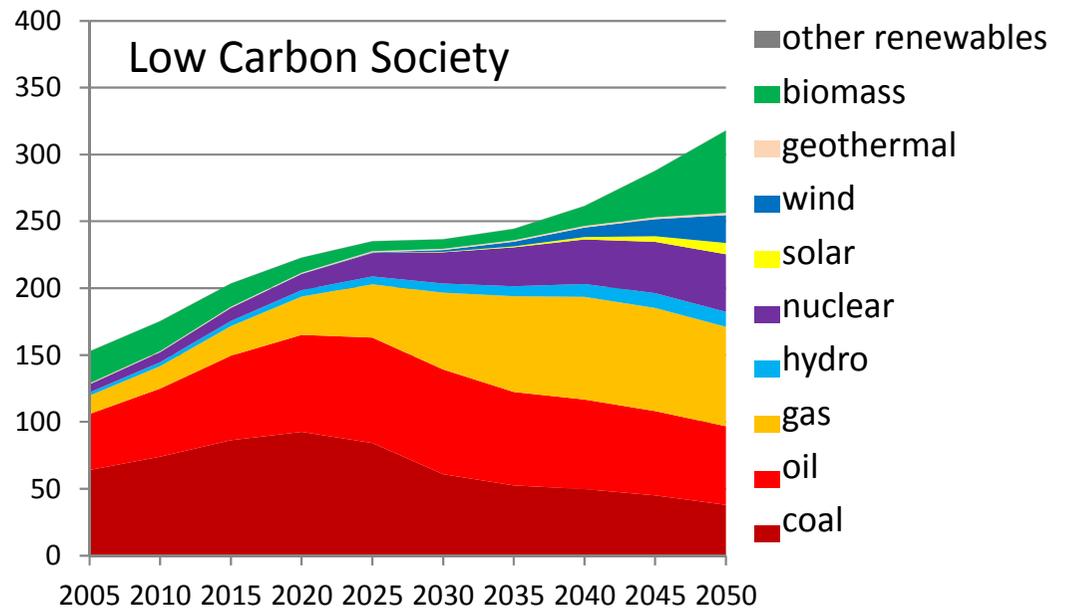
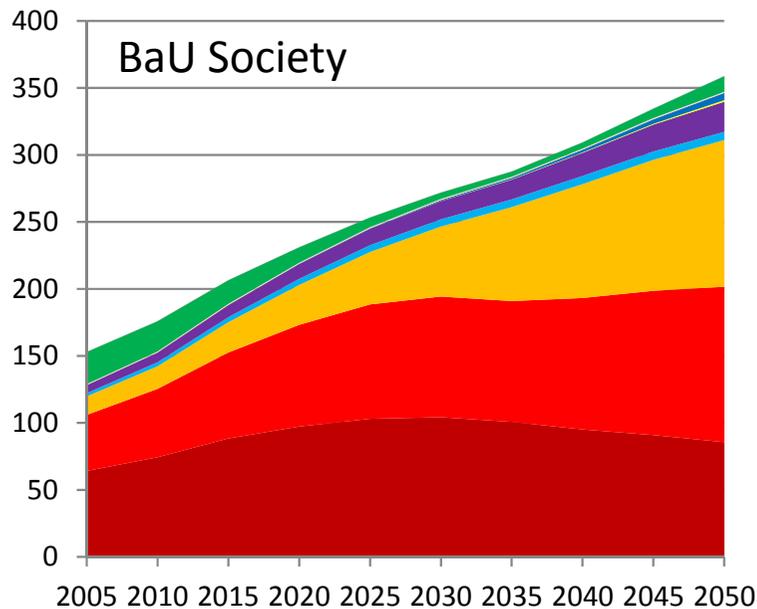
Final energy demand in residential and commercial sector in Asia [unit: EJ/year]

Action 5: Local Production and Local Consumption of Biomass (Biomass)

5.1 Sustainable utilization of biomass with sustainable food production	5.1.1 Improved biomass production technologies
	5.1.2 Land use for sustainable biomass production
	5.1.3 Development and implementation of biomass CCS technologies
5.2 Low carbon energy systems using local biomass resources in rural areas	5.2.1 Design and implementation of energy systems using biomass
	5.2.2 Visualization of the benefits of independent energy-supply systems
5.3 Improvement of living environments with intensive biomass utilization	5.3.1 Widespread adoption of high-efficiency furnaces in homes
	5.3.2 Widespread adoption of new biomass technologies

Biomass energy

CCS



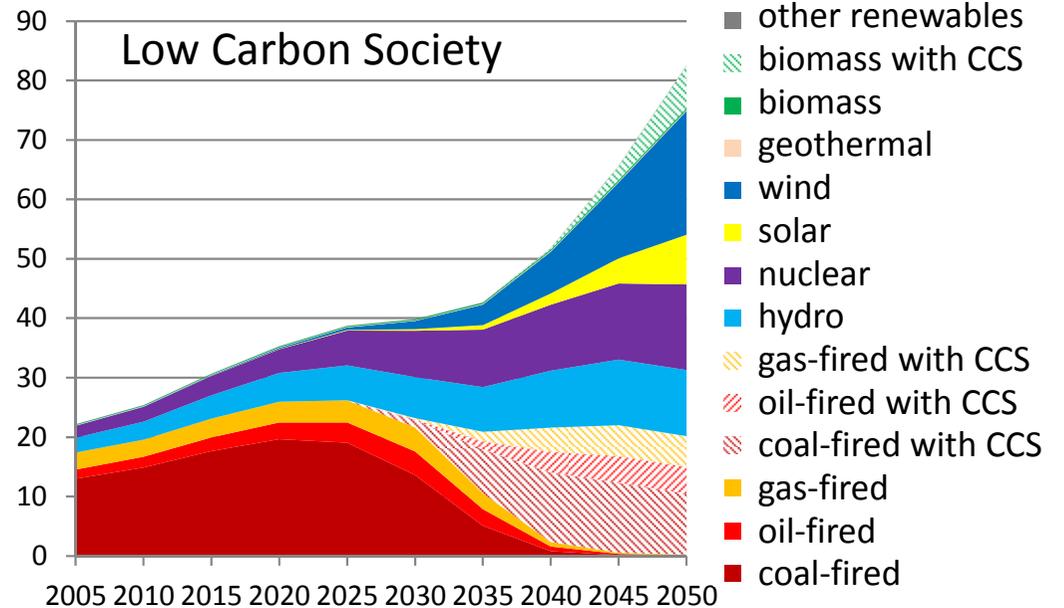
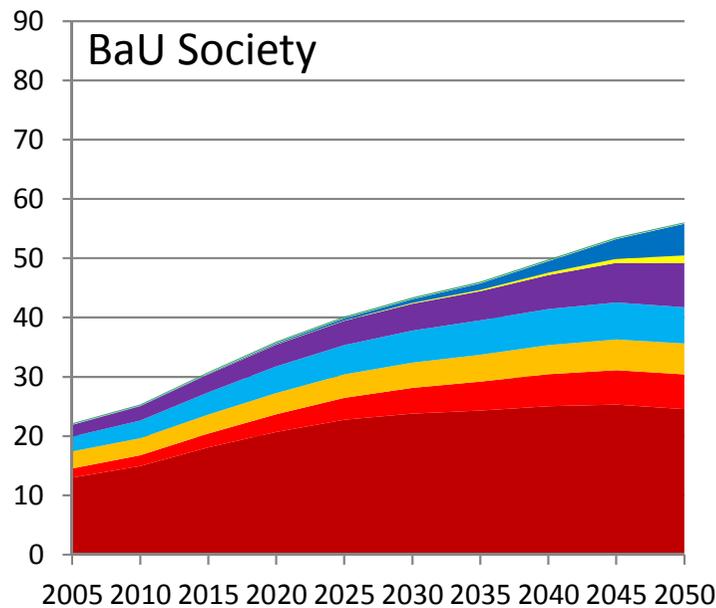
Primary energy supply in Asia [unit: EJ/year]

Action 6: Low Carbon Energy System Using Local Resources (Energy System)

6.1 Promotion of sustainable local energy systems with renewables	6.1.1 Use of solar and wind power energy
	6.1.2 Use of hydrogen energy
	6.1.3 Incentives for introducing renewable energy
6.2 Creation of smart energy supply and demand systems	6.2.1 Introduction of smart energy systems
	6.2.2 Introduction of demand response systems
	6.2.3 Introduction of power management systems
	6.2.4 Introduction of incentives for managing demand
6.3 Enhanced energy security with collaboration between low carbon energy sources and fossil fuels	6.3.1 Enhancement of the efficiency of power-supply equipment
	6.3.2 Use of carbon capture and storage (CCS) equipment
	6.3.3 Promotion of international cooperation

Reduction in initial cost of renewable energy

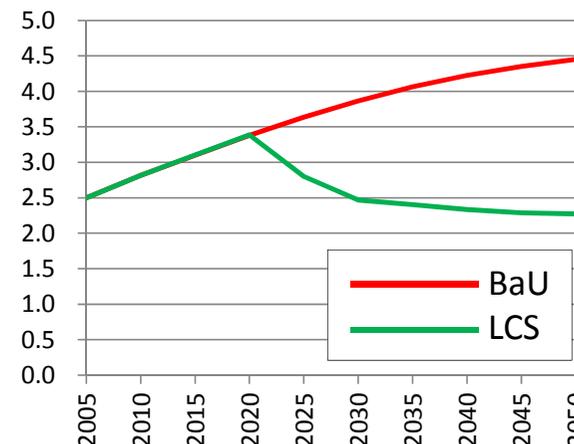
CCS



Action 7: Low Emission Agricultural Technologies (Agriculture & Livestock)

7.1 Water management in rice paddies	7.1.1 Construction of infrastructure
	7.1.2 Development of water management technologies
7.2 Highly efficient fertilizer application and residue management	7.2.1 Development and diffusion of fertilizer management techniques
	7.2.2 Improvement of tillage and residue usage
7.3 Recovery and use of methane gas from livestock manure	7.3.1 Installation of manure management systems
	7.3.2 Establishment of regulations and provision of financial support for manure management

Reduction in mitigation costs

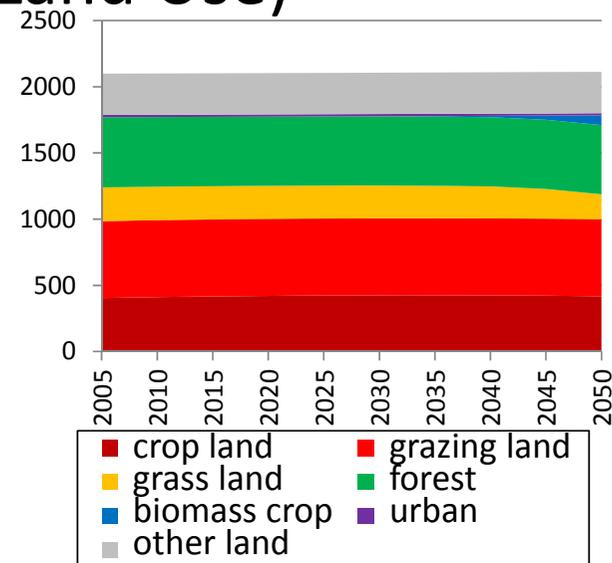


GHG emissions from agriculture [GtO2eq/yr]

Action 8: Sustainable Forestry and Land Use Management (Forestry & Land Use)

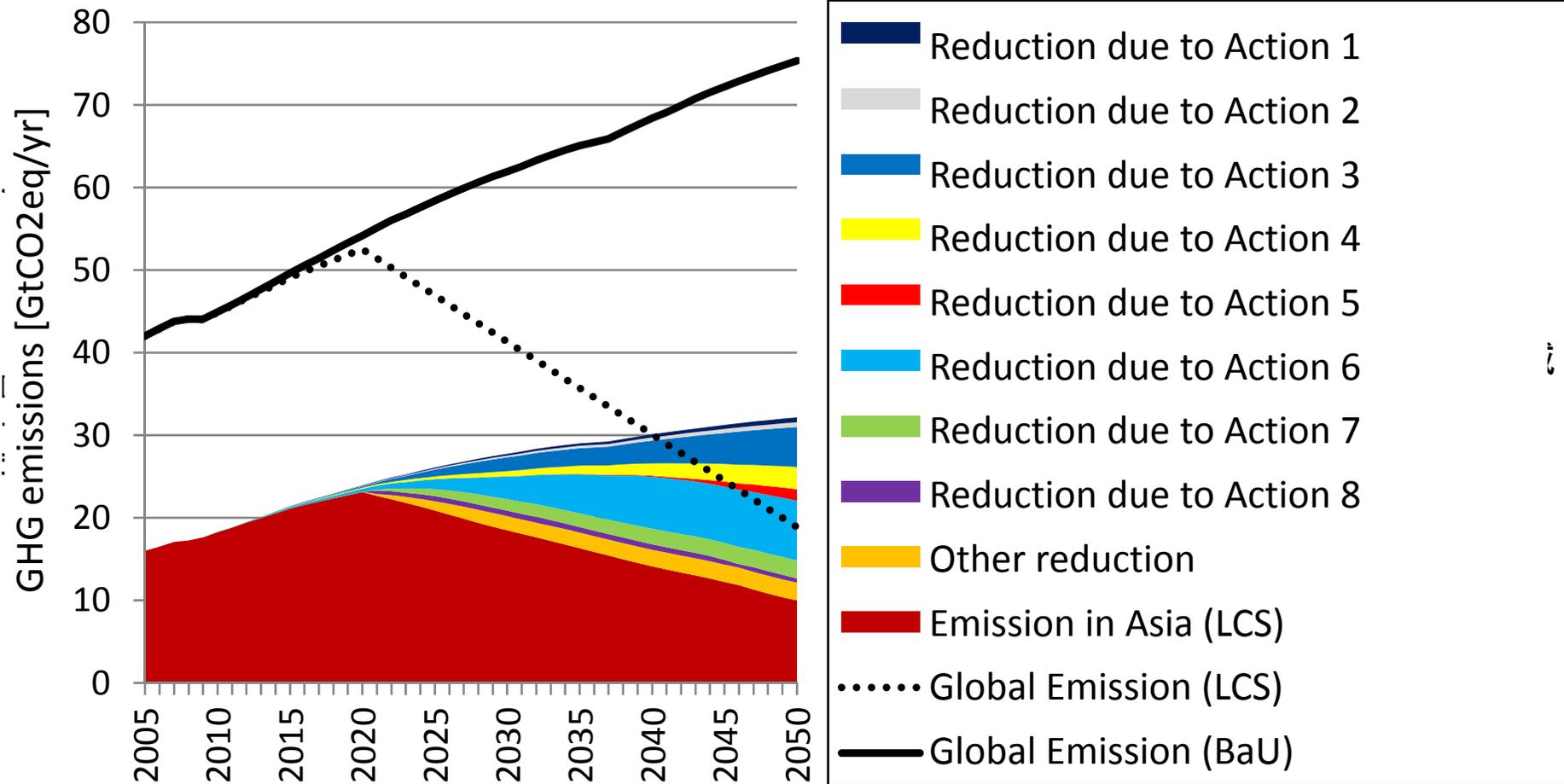
8.1 Sustainable forest management	8.1.1 Reduction of unplanned deforestation
	8.1.2 Reduction of planned deforestation
	8.1.3 Reduction of forest degradation in production forest
	8.1.4 Enhancement of forest carbon stock
8.2 Sustainable peat land management	8.2.1 Improvement of peat land management practices
	8.2.2 Peat land rehabilitation
8.3 Monitoring and management of forest fire	8.3.1 Stop lighting to land clearance
	8.3.2 Preventing uncontrolled fire

Reduction in mitigation costs



Land use change in LCS Asia [Mha]

GHG Emissions in Asia



Findings

- We simulate effectiveness of “Ten Actions” using CGE model.
- GHG emission in Asia in 2050: Emission in LCS is lower than that in BaU by 69%. Compared with emission in 2005, 38% reduction is achieved.
- Among “Ten Actions,” Action 6: energy system, Action 3: options in industry, and Action 4: options in building sector are effective.
- Not only energy efficiency improvement but also other activities including reductions in traffic volumes and material inputs will lead the halved GHG emissions in the world in 2050.
- In this simulation, marginal abatement cost of GHG emission reduction in 2050 is 344 US\$/tCO₂eq.

How to realize Low Carbon Asia?

- How to implement each action/program?
- In Asian countries, the some activities have already been implemented toward the LCS at their own initiatives. The role of Japan to support them is important in order to achieve “Leap-flog development” in Asia.

Training workshop on model at NIES (2013.6.10)



Policy dialogue on mitigation target in Indonesia (2013.10.9)



Researchers introducing their countries' activities at ISAP (2013.7.24)