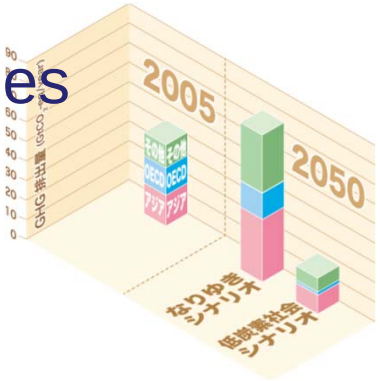
Pathways toward low carbon societies in Asia by 2050 and contributions of Japan to their realization

－Quantitative and qualitative assessment of LCS using Asia-Pacific Integrated Model (AIM)－

Methodologies to Estimate Pathways

Mikiko Kainuma
National Institute for Environmental Studies



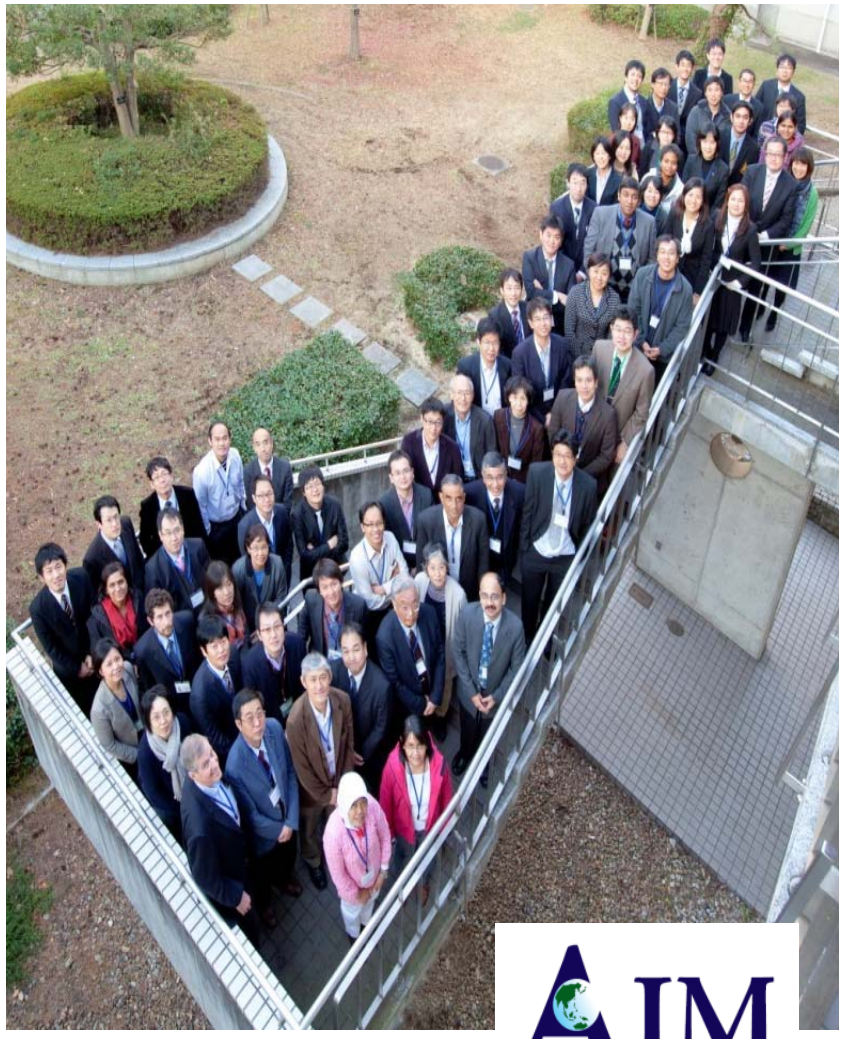
COP19 Side Event at Japan Pavilion

13 November 2013

http://2050.nies.go.jp/COP/COP19

AIM (Asia-Pacific Integrated Model): A model for quantified LCS assessment

- AIM is an integrated assessment model to assess mitigation options to reduce GHG emissions and impact/adaptation to avoid severe climate change damages
- Developed since 1990
- First set of models focusing on Asia-Pacific region to assess the strategies of low carbon development plan quantitatively



AIM
ASIA-PACIFIC INTEGRATED MODEL

Examples of Brochures introducing Asian Low Carbon Scenarios

Communication and feedbacks of LCS study to real world

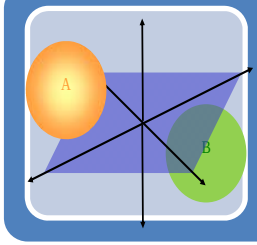
http://2050.nies.go.jp/LCS/

Methodology for LCS Action Plan

Process

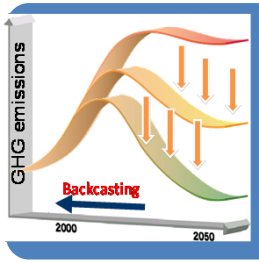
Information and Data Collection

- Identification of data sources
- preliminary data formation



Synthesis and Preliminary Analysis

- Information collection for present practices and policies
- Data compilation



Modeling and Analysis

- Development of storylines
- Quantification scenarios

Developing LCS Action Plan

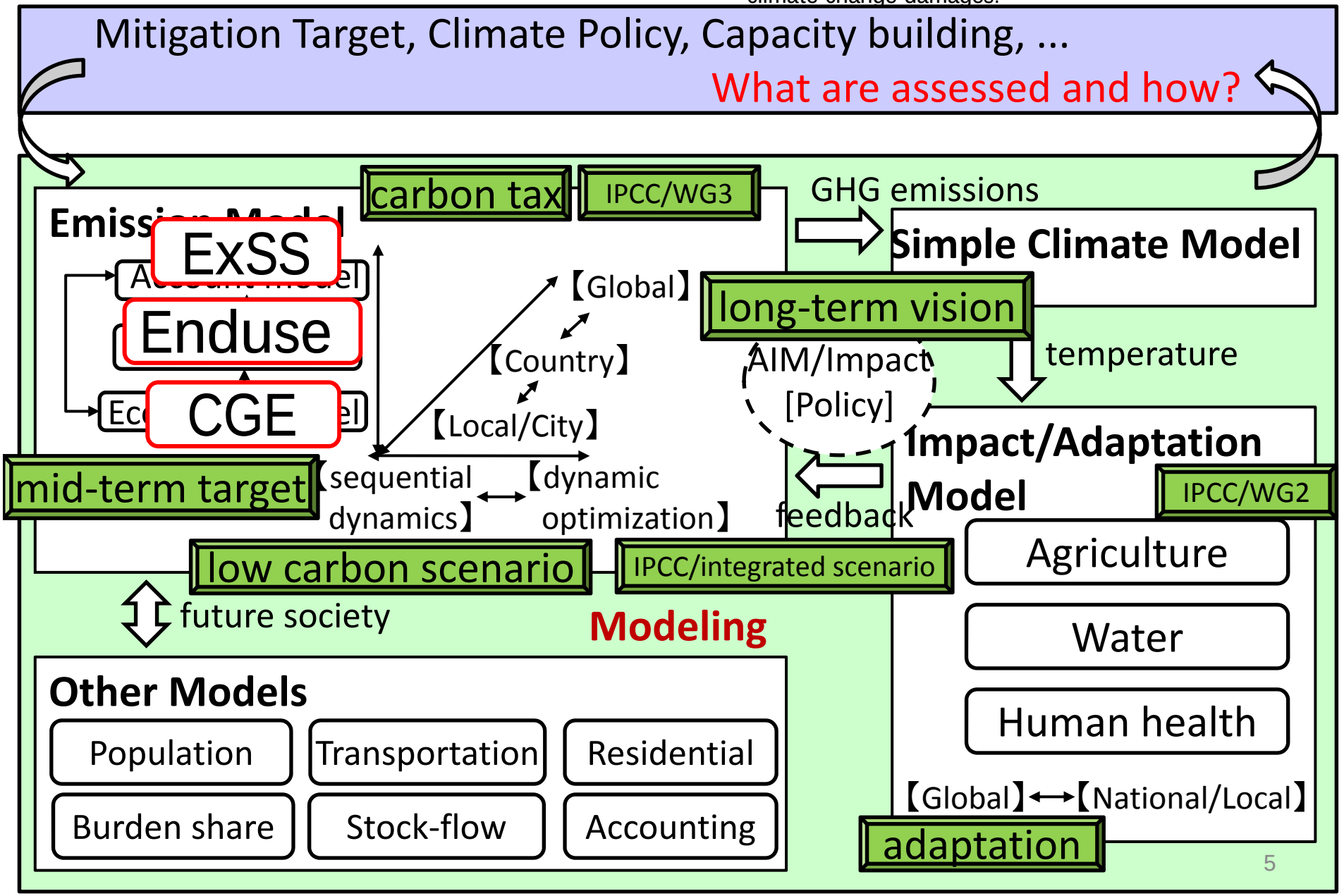
- Quantification of LCS action plans
- Development of roadmaps

Objectives / Outputs

- Identify emission reduction potentials and its co-benefit
- Estimate the cost of policy measures
- Provide incentives for use of innovative technologies
- Prioritize investments
- Promote behavioral and lifestyle changes
- Monitor performance

Structure of AIM model

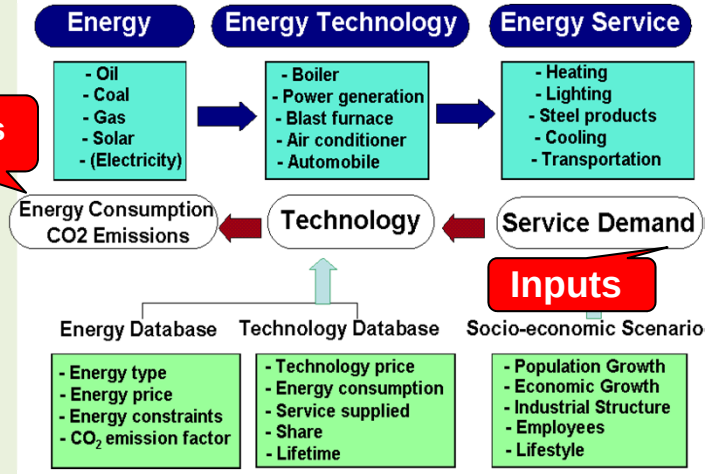
AIM (Asia-Pacific Integrated Model) is an integrated assessment model to assess mitigation options to reduce GHG emissions and impact/adaptation to avoid severe climate change damages.



Characteristics of Bottom-up (sector optimization) models

e.g. AIM/Enduse, AIM/AFOLU

Key Features and Assumptions	Strengths	Weaknesses
▪ Choice of the most efficient mix of technologies to deliver services	▪ In case of energy sector, provide a comprehensive, coherent picture of the energy system (from primary energy to final energy and energy services use)	▪ Neglect feedback effects of emission reduction policies on the rest of the economy
▪ Rich collection of related data, abundant in detail on various technologies and countermeasures	▪ Useful for assessing and identifying mitigation and efficiency potentials	▪ Do not capture demand-price interactions ▪ Undervalue the transaction costs of mitigation policies
▪ Perfect foresight· simulates perfect competition among technologies and energies	▪ Enable assessment of supply and demand-oriented policies to curb GHG emissions	▪ Assume that markets react perfectly to price signals



Structure of the AIM/End-Use Model

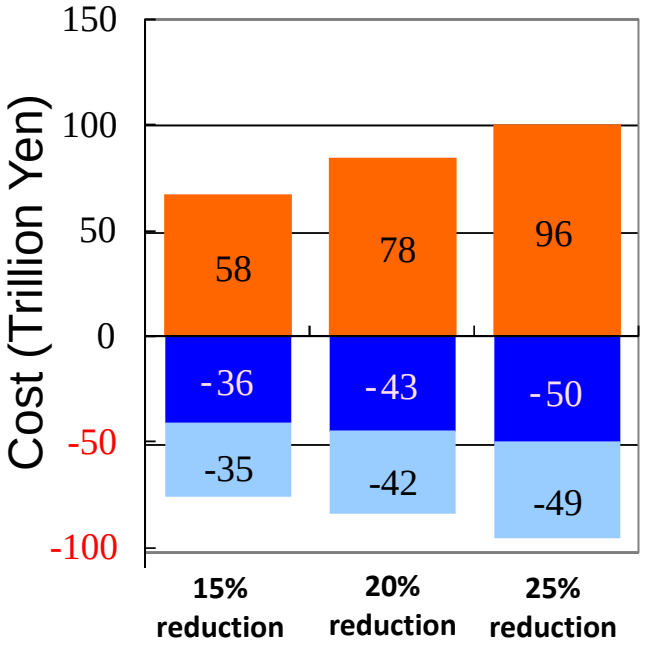
- ***"Energy technology" refers to a device that provides a useful service by consuming energy***
- ***"Energy service" refers to a measurable need that must be satisfied.***

From 1995, Japan Ministry of Environment used this model almost all times to evaluate the national reduction targets of Japan. Also, the case of China study conducted by Energy Research Institute, NDRC, PRC, and the National Thailand study by Thammasat University, Thailand caused hot, but positive discussions on Low Carbon Development within the nations.

Japanese Case Study
Relationship between low-carbon investment and energy reduction expense

- As for the investment amount for global warming, half of the overall investment amount will be collected by 2020 and an amount equal to the investment amount will be collected by 2030 based on energy expenses that can be saved through technologies introduced.

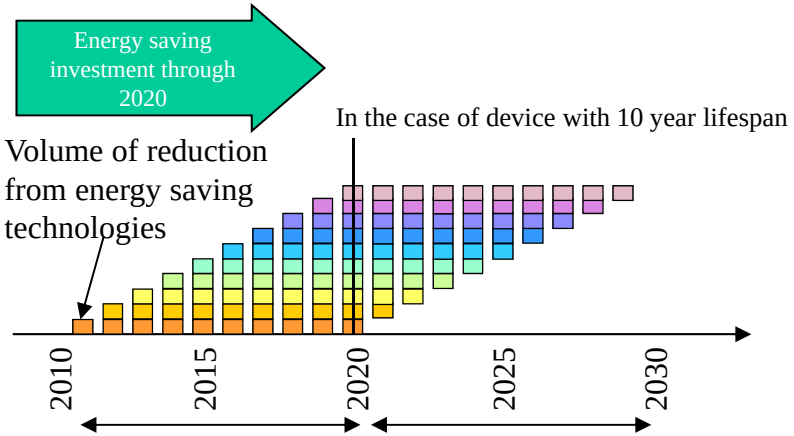
<Low-carbon investment amount and energy reduction expense>



Additional investment ('11 – '20 total)

Energy reduction expense ('11 – '20 total)

Energy reduction expense ('21 – '30 total)

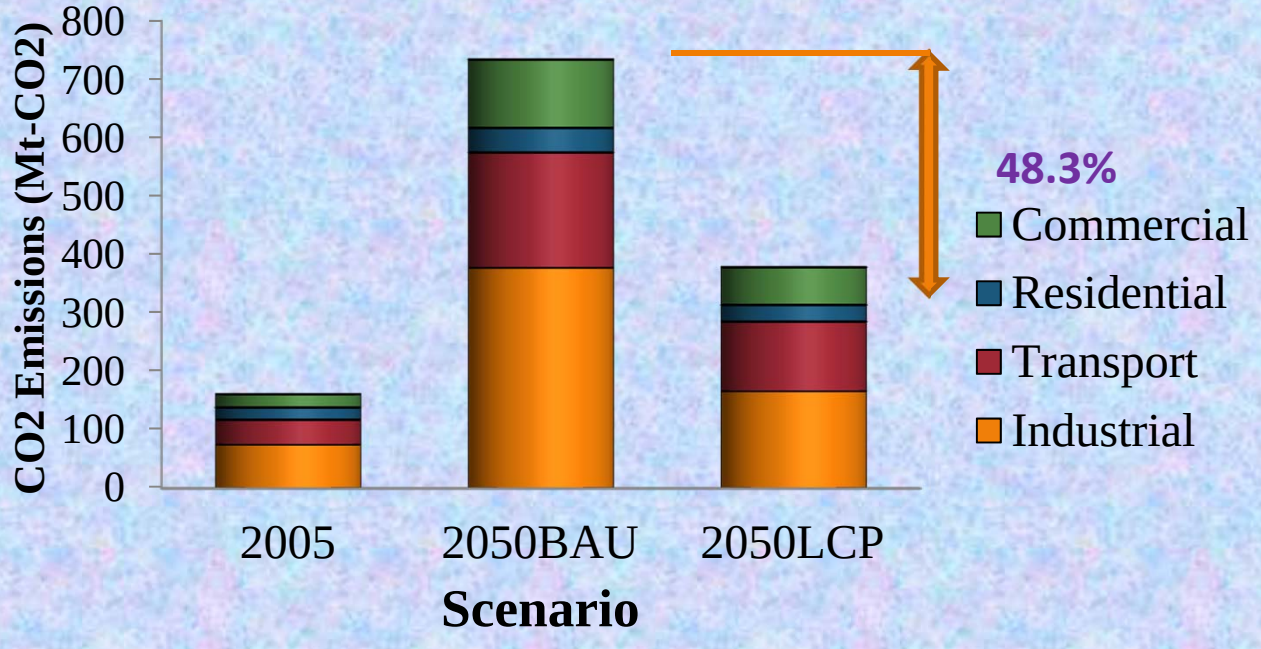


Energy reduction expense from energy saving investment = approx. 50 trillion yen (25% reduction)

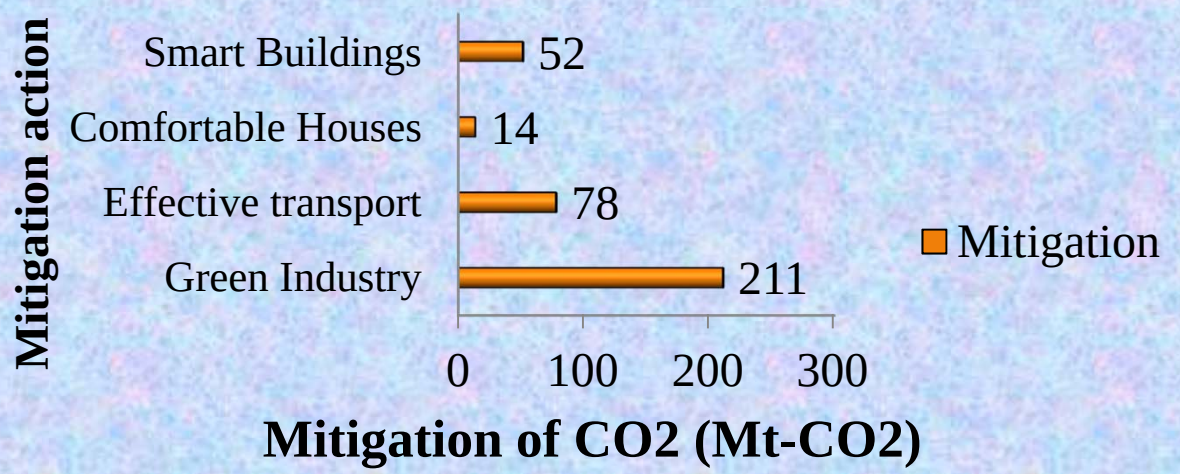
Energy reduction expense from energy saving investment = approx. 49 trillion yen (25% reduction)

Thailand Case Study

GHG Emissions in 2050 (Peak CO_2)



GHG Mitigation by 2050 (Peak CO_2)



Source: Bundit Limmeechokchai et al., 2013

Indonesia Case Study

SECTORS AND MODELS

- **The covered sectors of the analysis are: Energy, AFOLU, Industrial and waste sectors.**

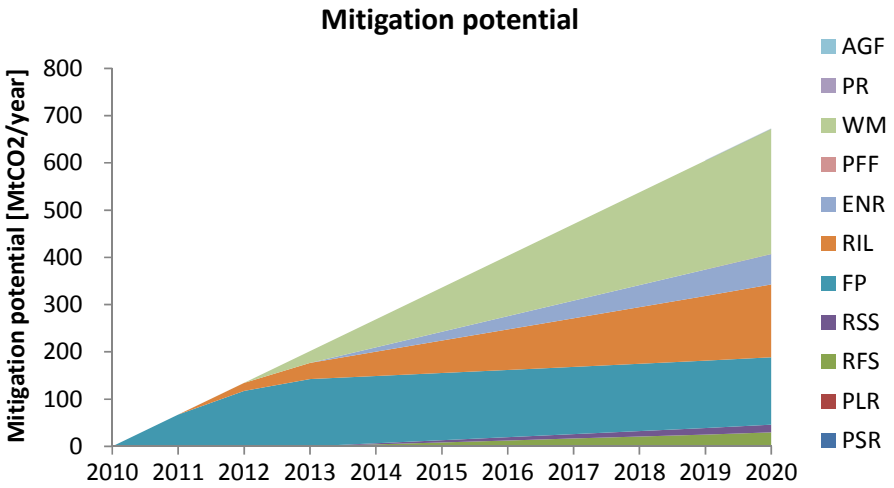
- **Three national level quantification models/tools are expected to use. They are:**

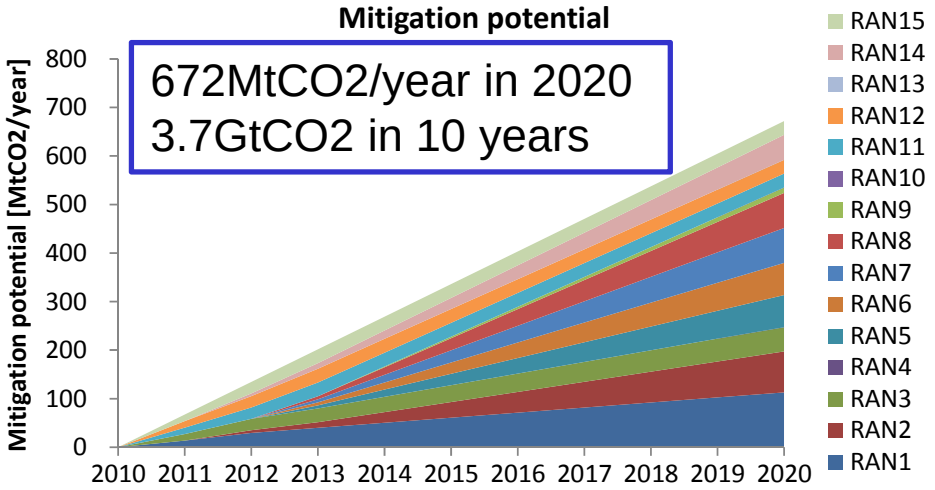
- **Extended Snapshot model (ExSS) and AFOLU-A: To design LCS vision and quantify the GHG reduction potentials;**
- ***Bottom-up type end-use model (AIM/enduse, AFOLU-B): To identify effective technologies and necessary financial policies for Low Carbon Growth;***
- **CGE model (AIM/CGE[basic]): To assess the macroeconomic impacts of Low Carbon Growth policies**

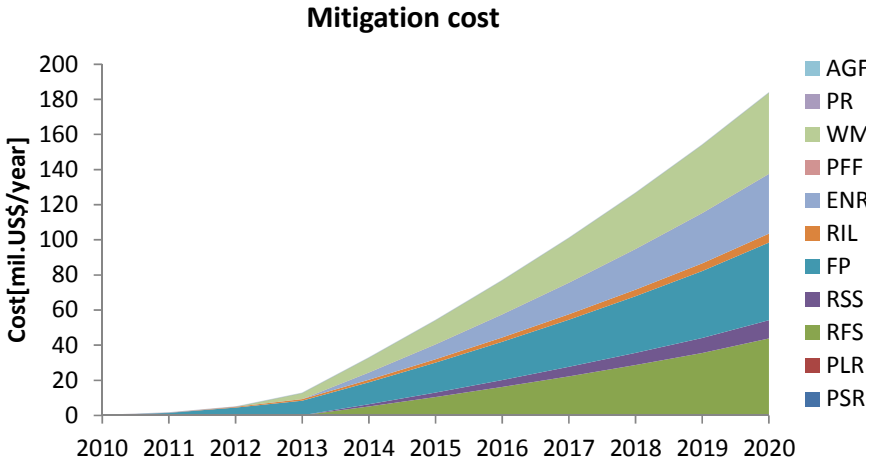
Source: Rizaldi Boer, 2013

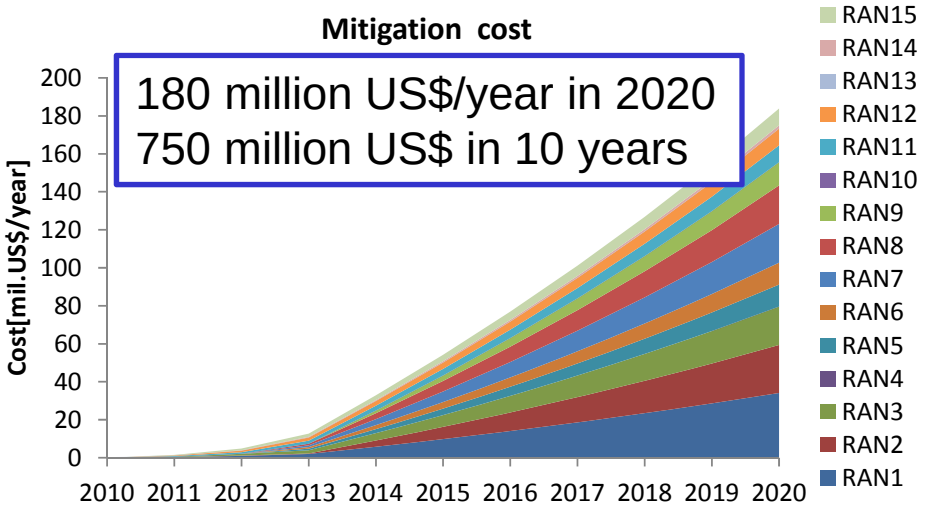
Indonesia Case Study

Mitigation potential & cost land use change





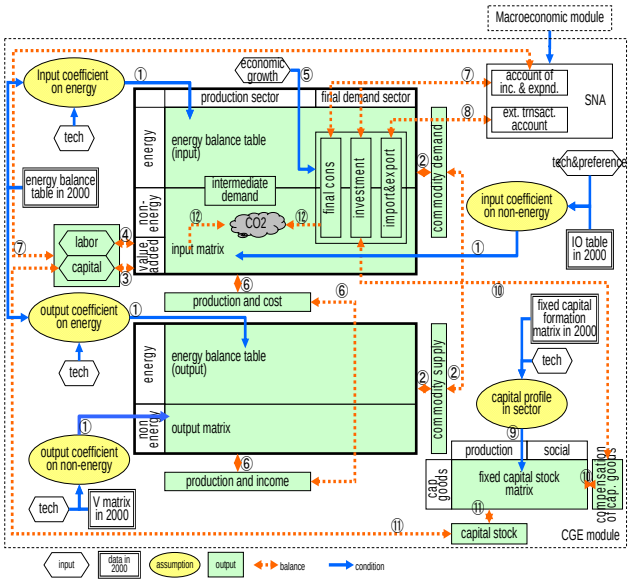




Source: Rizaldi Boer, 2013

Characteristics of Top-down (Computable General Equilibrium) models
AIM/CGE

Key Features and Assumptions	Strengths	Weaknesses
▪ Markets and the economy, as a whole, reach equilibrium, through price adjustments	▪ Able to estimate economy-wide costs of reduction policies, including trade effects	▪ Poor description of energy end uses and technologies ▪ Assume markets always work efficiently
▪ Markets work efficiently (no market barriers, hidden costs or information barriers)	▪ Describes the details of economic interactions among sectors	▪ Cannot well reflect short-run economic adjustment costs
▪ Able to analyze long-term resource allocation	▪ Able to assess long-term effects of GHG abatement policies on structural change in a coherent macro-setting	▪ Have a weak statistical basis (usually models are calibrated on a single-year basis)



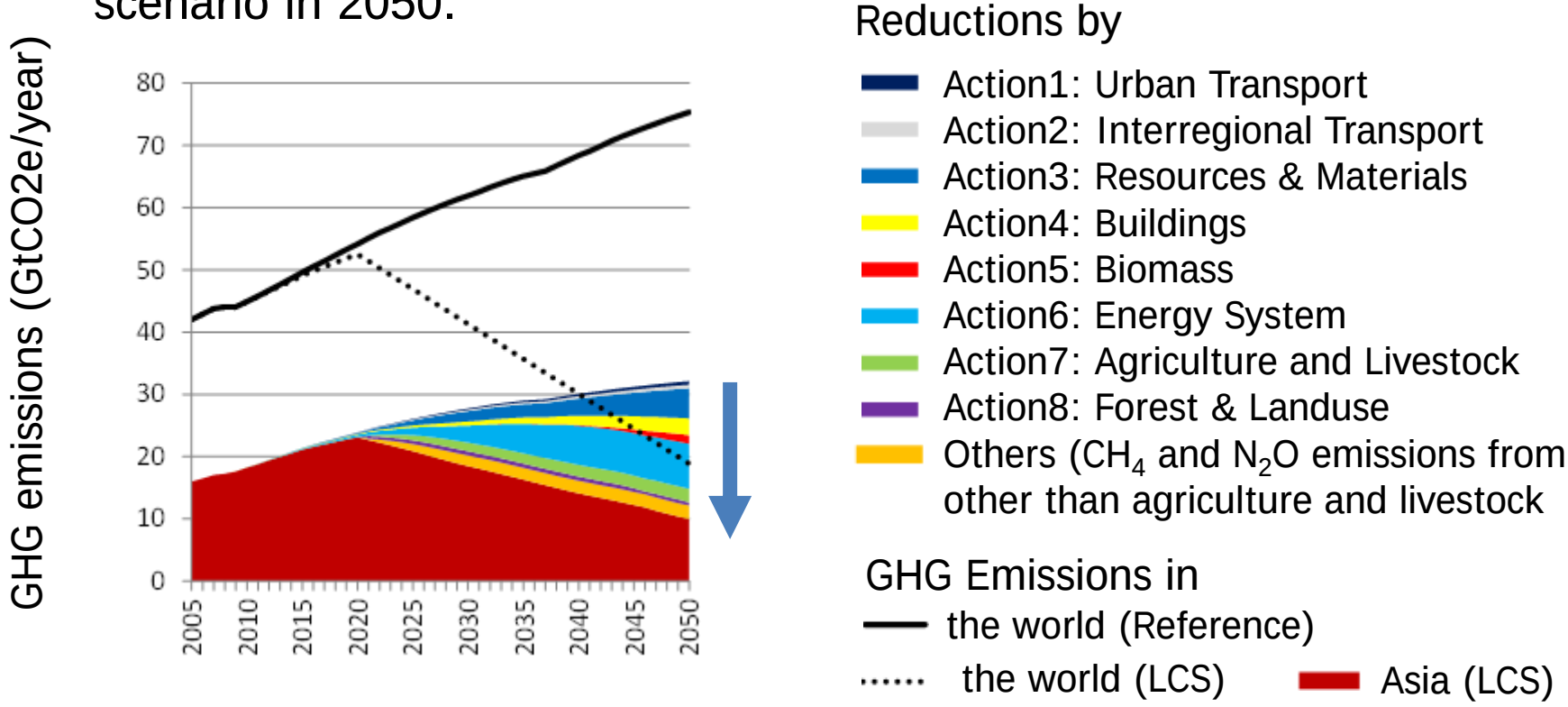
① production function
② commodity market
③ capital market
④ labor market
⑤ calculation of GDE
⑥ expenditure and income in production sector
⑦ expenditure and income in household and government
⑧ assumption of import and export
⑨ fixed capital stock matrix
⑩ investment goods market
⑪ capital stock
⑫ CO_2 emissions

Framework of AIM/CGE

Applied very often to evaluate national macro-economic impacts by GHG reduction targets of Japan. Also, we applied this model to many Asian countries, such as China, India, Indonesia, Thailand, Malaysia, Philippine, Vietnam, Taiwan and Korea.

There is potential to reduce GHG emissions by 69% compared to the reference case in Asia

- The global emissions will become 1.8 times larger compared to the 2005 level and emissions in Asia will be doubled under the reference scenario.
- It is feasible to reduce GHG emissions in Asia by 69% by introducing ten actions and Others (CH_4 and N_2O emissions from other than agriculture and livestock) appropriately compared to the reference scenario in 2050.



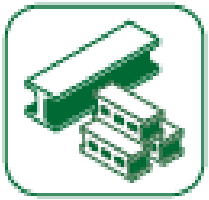
Ten Actions toward Low Carbon Asia are examined

Action 1 **Urban Transport**

Structured Compact City

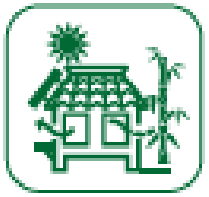
Action 2 **Interregional Transport**

Mainstreaming trains and water transportation



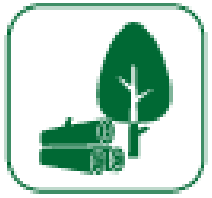
Action 3 **Resources & Materials**

Smart material use that realizes the full potential of resources



Action 4 **Buildings**

Smart buildings that utilize natural systems



Action 5 **Biomass**

Local production and local consumption of biomass

Action 6 **Energy System**

Low carbon energy system with local resources

Action 7 **Agriculture & Livestock**

Spread of high yields and low emission agricultural technologies

Action 8 **Forest & Landuse**

Sustainable forest management

Action 9 **Technology & Finance**

Technology and finance to facilitate achievement of LCS

Action 10 **Governance**

Transparent and Fair Governance that Supports LCS Asia

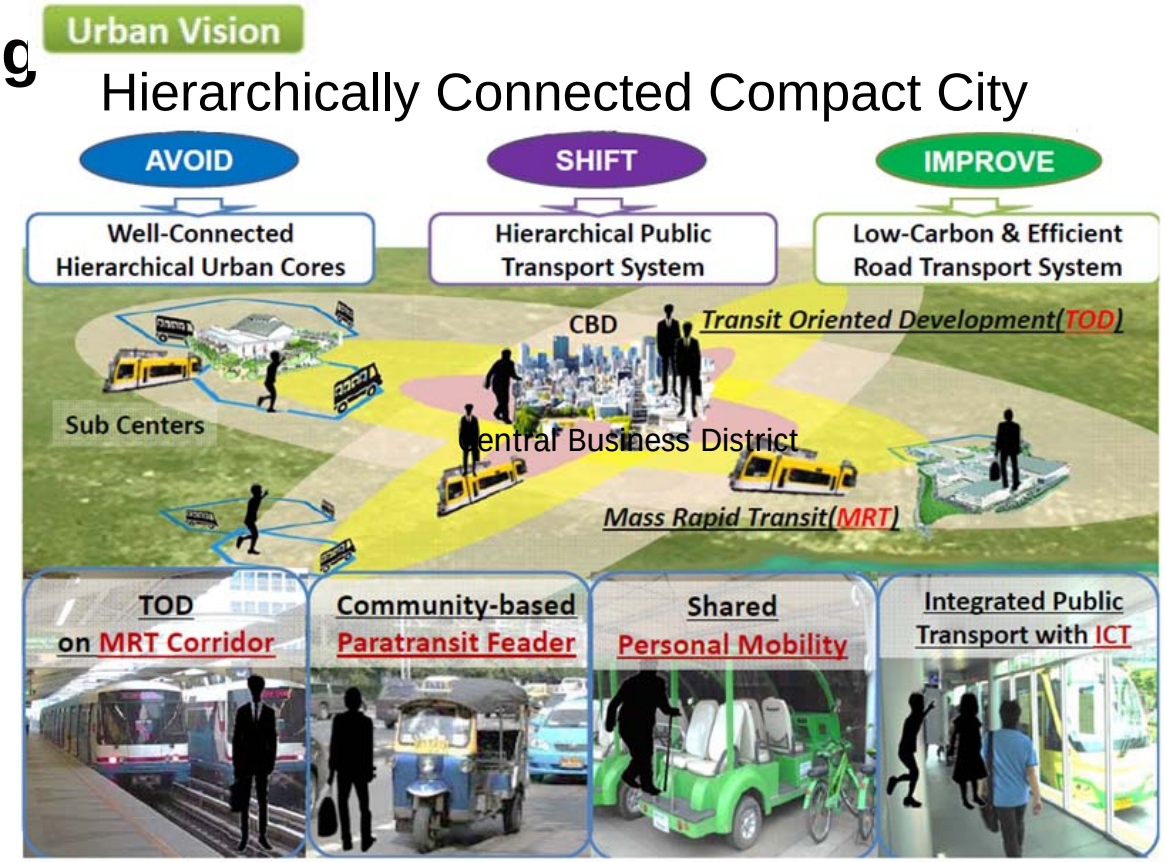
Actions 1 & 2: Transport

Action 1: Hierarchically Connected Compact Cities

- Compact cities with well-connected hierarchical urban centers
- A seamless and hierarchical transport system
- Low carbon vehicles with efficient road-traffic systems

Action 2: Mainstreaming Rail and Water in Interregional Transport

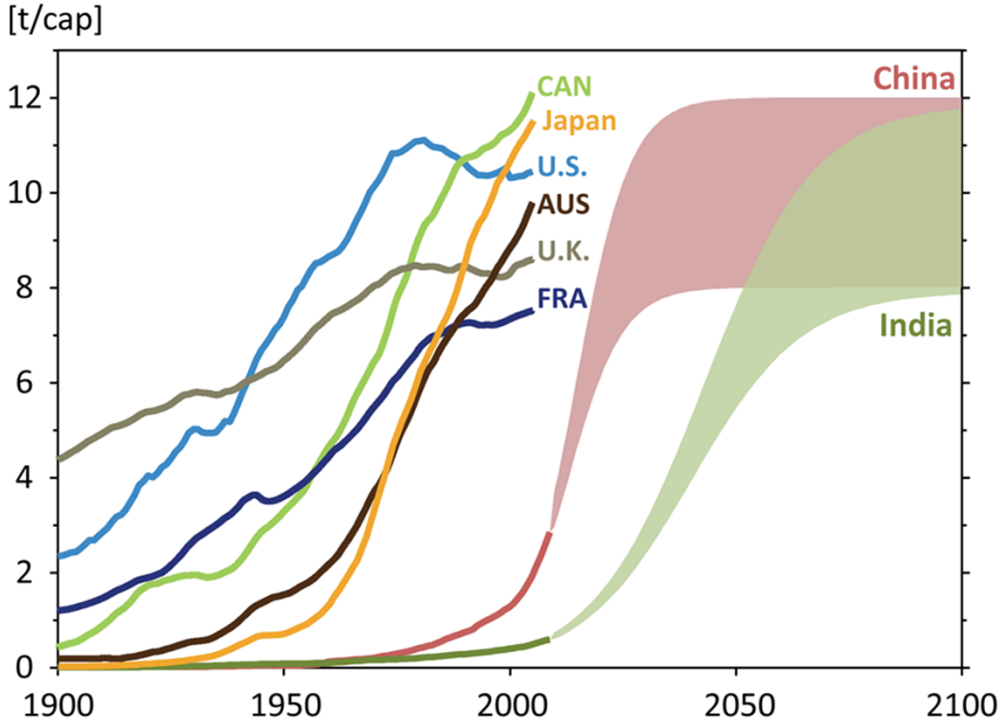
- Formulation of industrial corridors using a low carbon transport system
- Establishment tof an intermodal transport system incorporating rail and water
- Reduction of CO2 emissions from vehicles and aircraft



Action 3:Smart Ways to Use Material that Realize the Full Potential of Resources

- Production that dramatically reduces the use of resources
- Use of products in ways that extend their lifespan
- Development of systems for the reuse of resources

Lower per capita stock (8 t/cap), the saturation level of France and the UK, would decrease the steel demand in China significantly to the lower level of 0.3 Gt in 2050



Consumption of Iron and steel

Source: Mûller and Wang, 2009

Key Messages

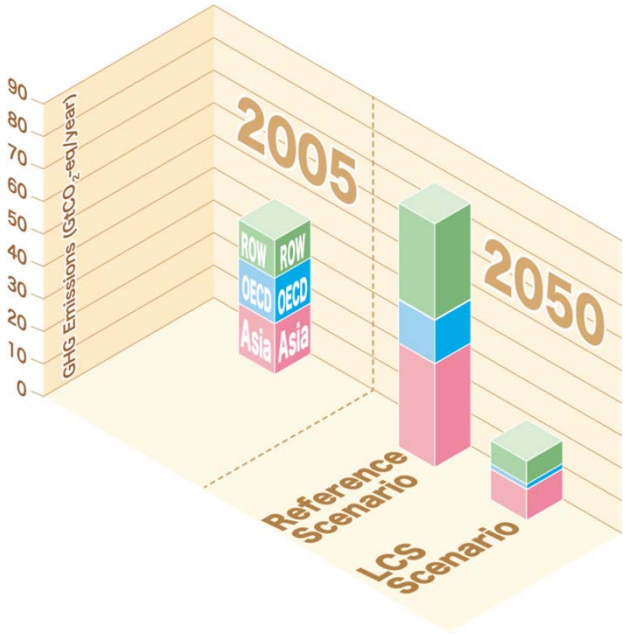
Achieving 2°C target is feasible

If all the actions proposed here are applied appropriately, 69% of the emissions in the Reference scenario can be reduced in Asia in 2050. This is in line with a global pathway with the 2oC target.

Early actions are needed

Whatever pathways are followed, GHG emissions should be reduced to zero in the long run to keep the climate at the corresponding level. More the actions are delayed, larger the reduction rates become and higher the stabilization level will be.
GHG emissions need to be below zero to lower temperature. To realize negative emissions is very tough.

There is a danger that socio-ecosystem will not be recovered even if GHG concentrations are returned to the lower level.

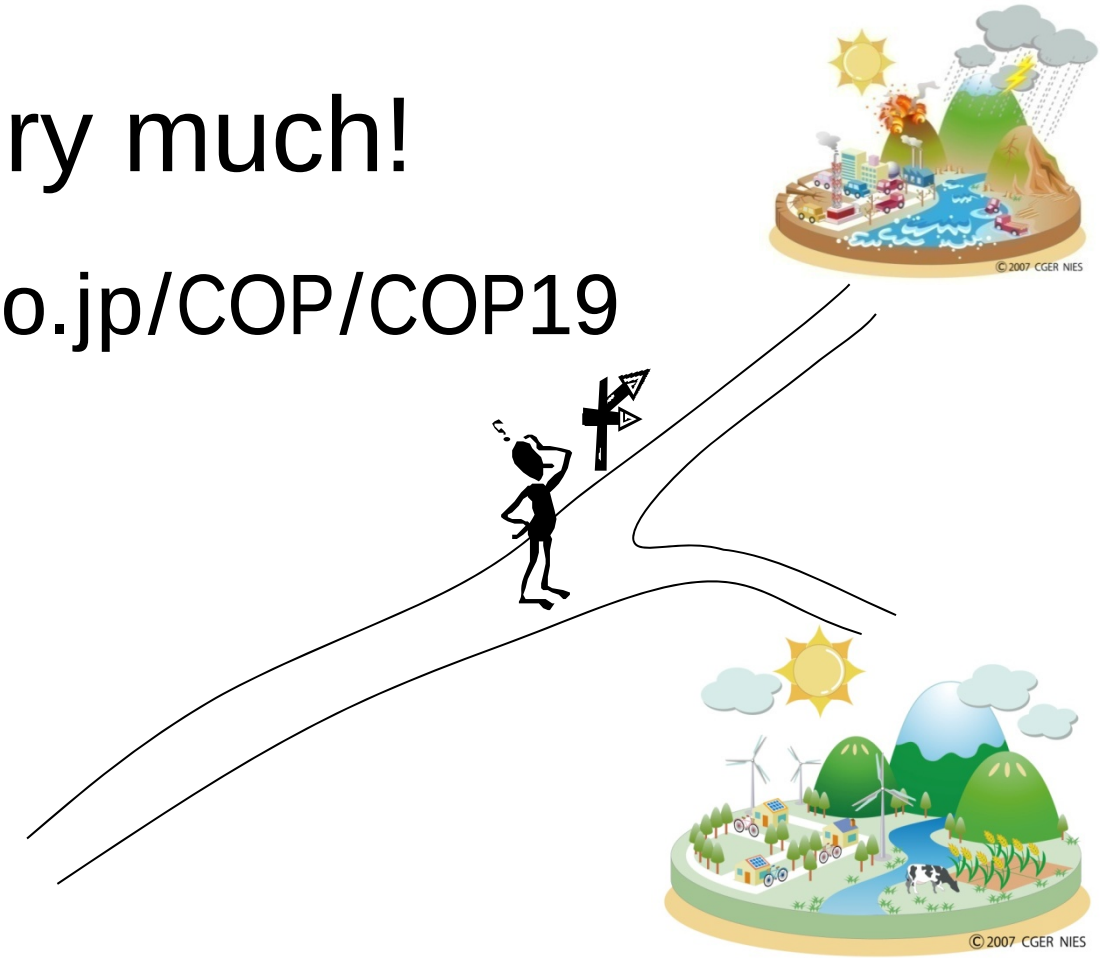


Leapfrogging development in Asia leads to a Low Carbon Society

Transition to low carbon emissions and low-resource consumption societies, while simultaneously improving the economic standards of living is vital for sustainable development. Asia has many opportunities to realize an LCS by leapfrogging.

Thank you very much!

http://2050.nies.go.jp/COP/COP19



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