Towards Low-Carbon Society in Asia

Progress of the “Research Project to Establish a Methodology to Evaluate Mid to Long Term Environmental Policy Options toward Asian Low-Carbon Societies” (S-6 research project) supported by Environment Research and Technology Development Fund of the Ministry of Environment, Japan (MOEJ),

“Asia LCS scenarios and **actions** to reduce GHG emissions by half by 2050: A proposal from the Asia low carbon project

Mikiko Kainuma

National Institute for Environmental Studies

International Conference Hall, JICA Research Institute, Tokyo
22 Feburuary 2011

Framework of Asia LCS Project

Sustainable development through LCS

Future trends on socio-economic conditions, energy, resources, regional diversity, culture, lifestyle, etc.

Institutional design for international cooperation

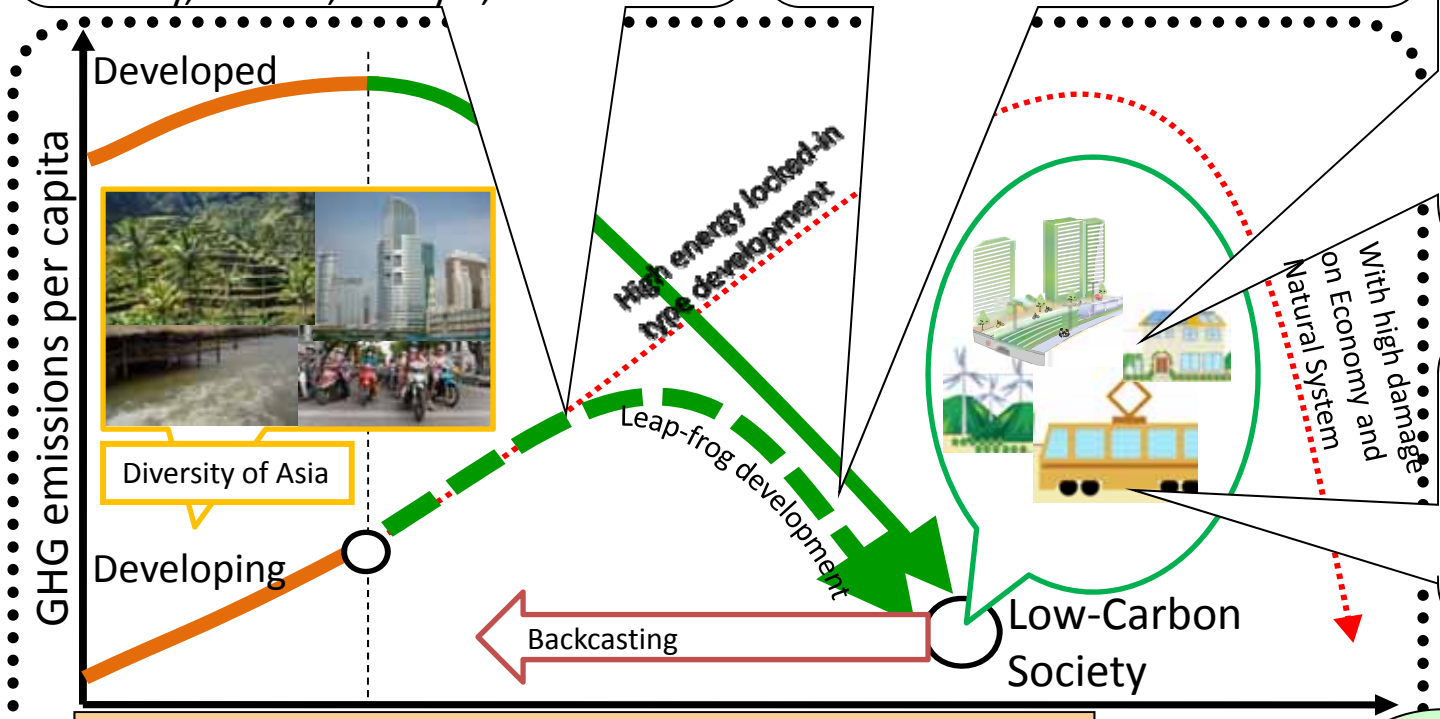
Institutional design for international and regional cooperation regime

Sustainable resource management

- Constructing material accounts
- Low-carbonization through improvement in resource productivity and material recycle

Low Carbon Transportation

- Low-Carbon City with LC transport system
- Design for future transport system



Development of Asia LCS Scenarios

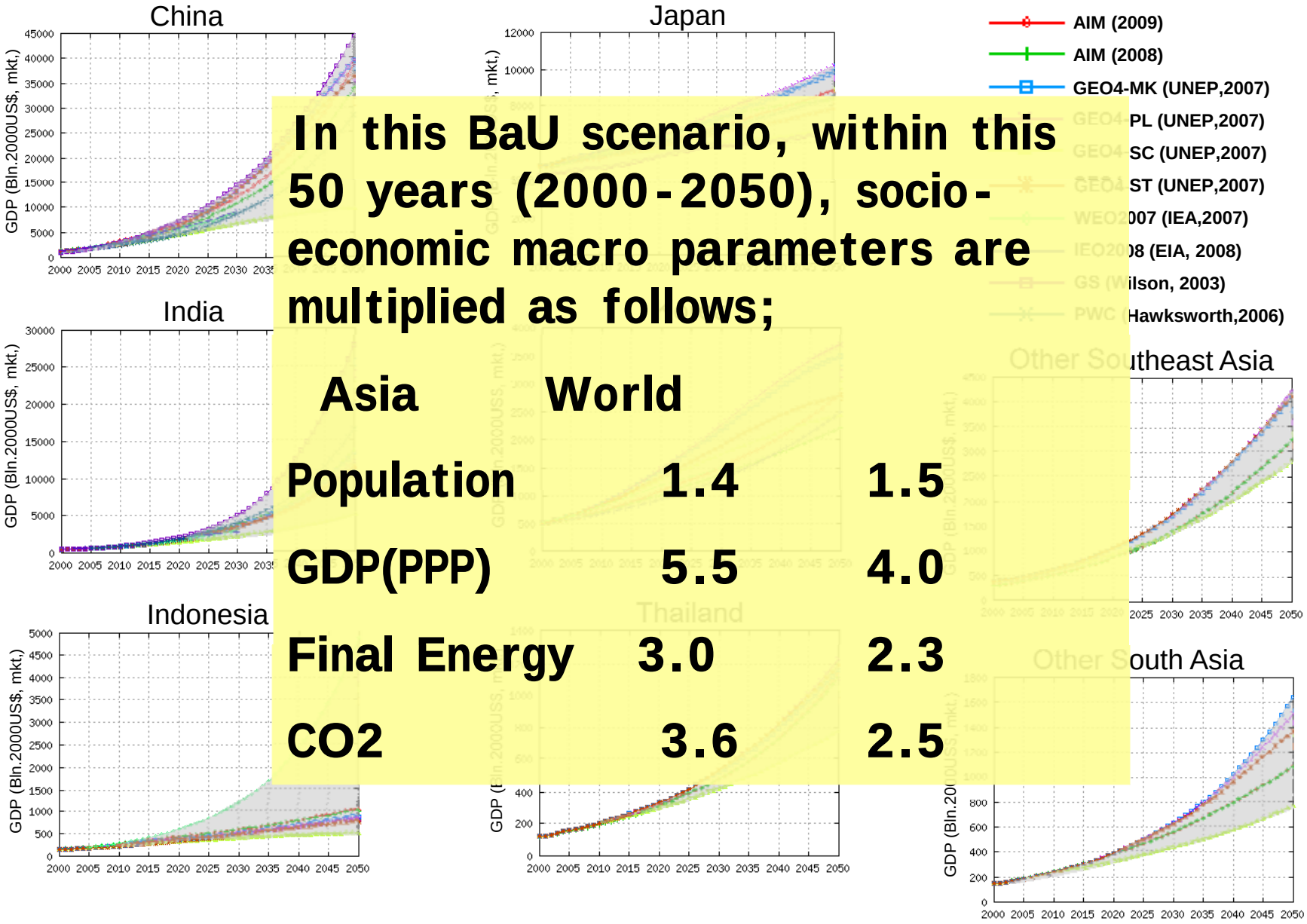
(1) Depicting narrative scenarios for LCS
(2) Quantifying future LCS visions
(3) Developing robust roadmaps by backcasting

Policy Packages for Asia LCS

- Encouraging the framing for LCS policy in each Asian country
- Assistance for international negotiations with scientific basis
- Networking among LCS research in Asia

GDP is growing in Asia

Various socio-economic scenarios have beeb studied

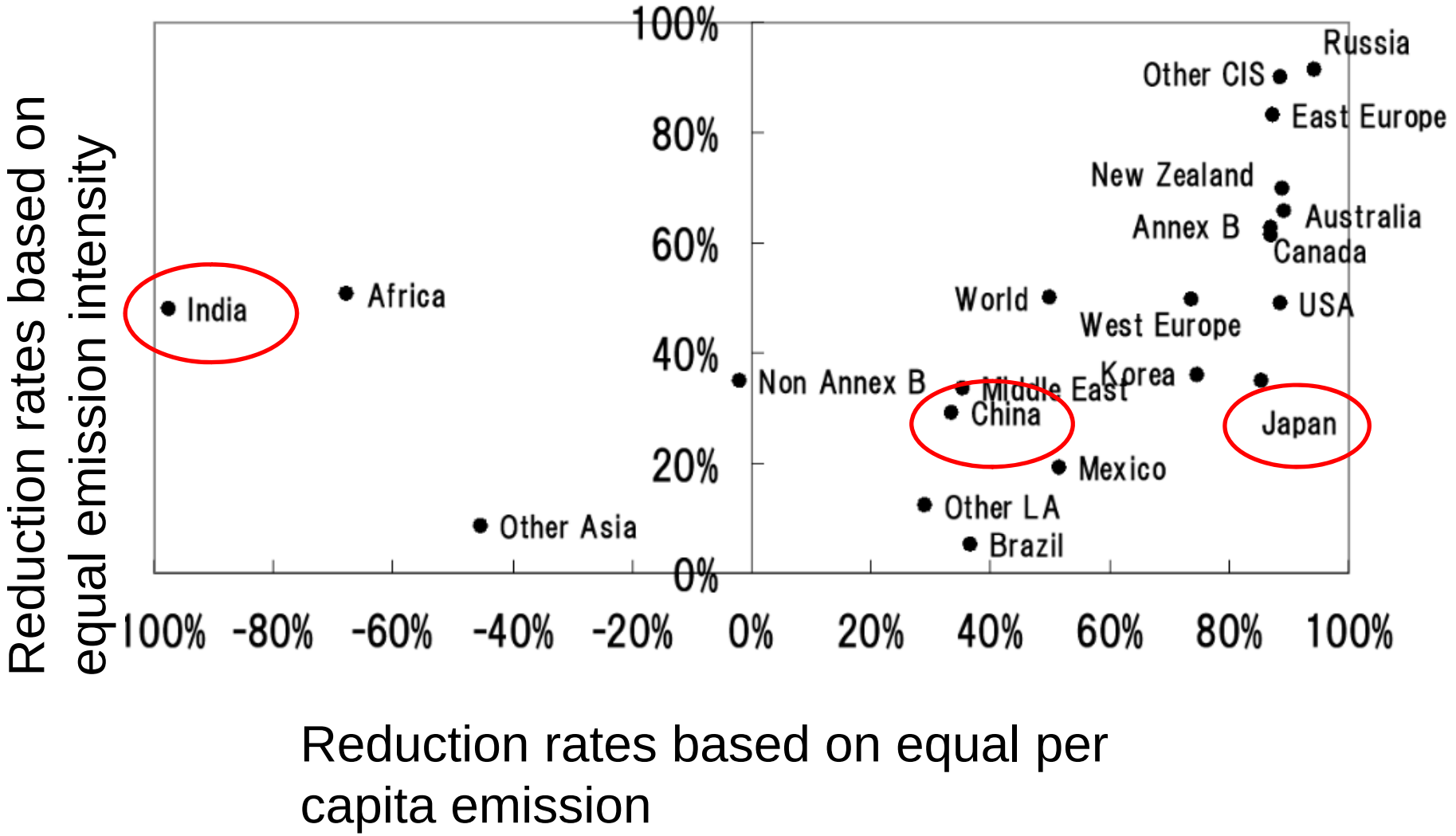


In this BaU scenario, within this 50 years (2000-2050), socio-economic macro parameters are multiplied as follows;

	Asia	World
Population	1.4	1.5
GDP(PPP)	5.5	4.0
Final Energy	3.0	2.3
CO2	3.6	2.5

How much GHG emissions should be reduced by 2050 compared to 1990 to reduce global GHG emissions by half?

Different index shows different reduction rate.



Low carbon Asia project

Issues to be tackled in Asia region:
Economic development, resources, energy security, poverty reduction, improve environmental quality, etc..

Low carbon development in Asia

Research themes:
- Leap- frog toward low carbon development
- Biomass production for food or energy
- Social infrastructure and less material use
- Diversity in Asia in lifestyle
- Institution and governance to realize low carbon society
- Low carbon sustainable transportation and urban city

Backcasting from future vision and roadmaps

Realization of a low carbon society with high quality of life
Society that that each country of Asia has to low carbon society

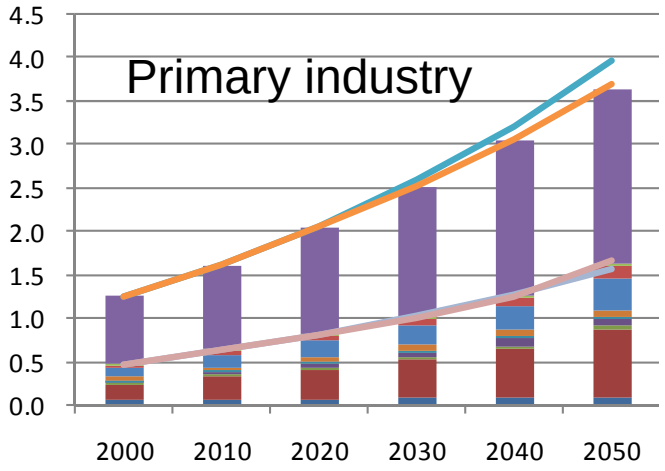
Narrative storyline and evaluation by qualitative modeling
Options by roadmaps
Capacity building and release of innovative strategy from Asia
Encouraging the framing for LCS policy in each Asian country

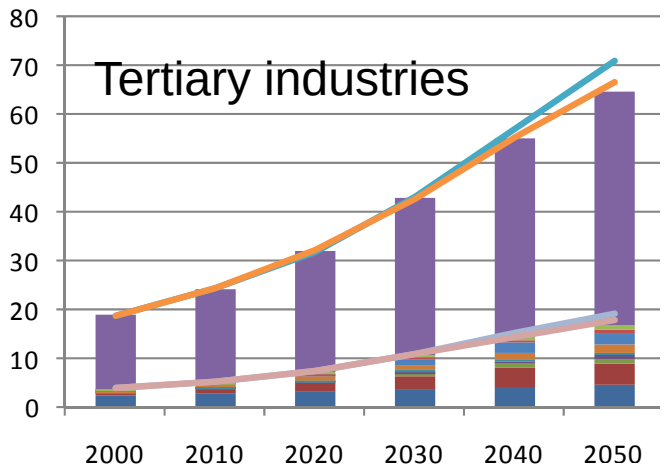
Factors in Scenario/Roadmap

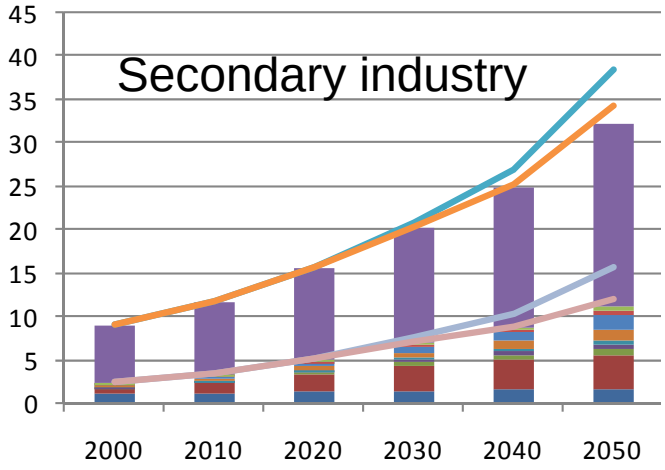
Domestic | International

- Energy production: Resource & technology
- Social infrastructure
- Trade
- Social resource: Tradition & regulation
- Other environmental problems
- Human resource
- Institution
- International policy

Asia leads the world economy



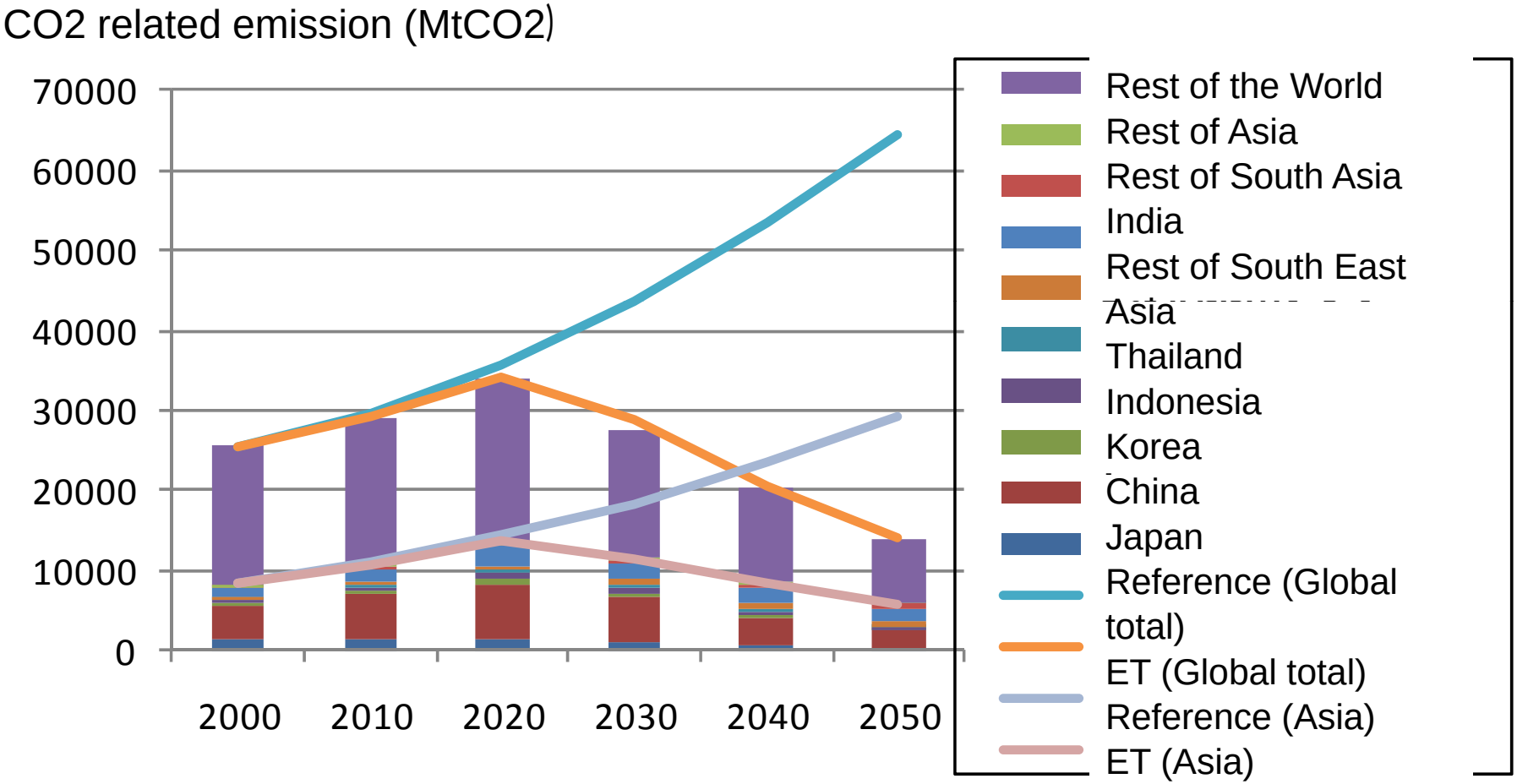




Sector GDP (2000price trillion US$)

Scenario Team

Reduction in Asia is a key to reduce global GHG emissions



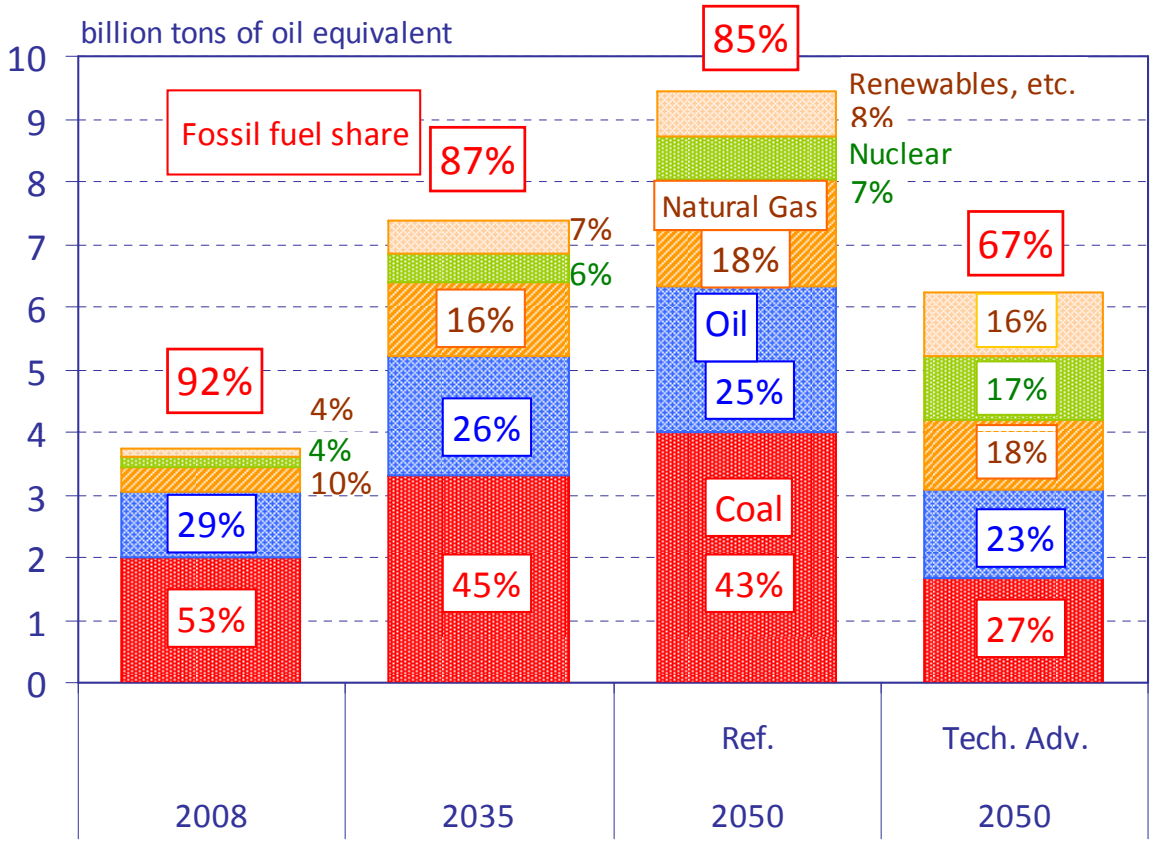
Emission target in Japan in 2050 is 220MtCO2 in case of equal per capita allocation

In case of ET, it will be 860MtCO2

Scenario Team

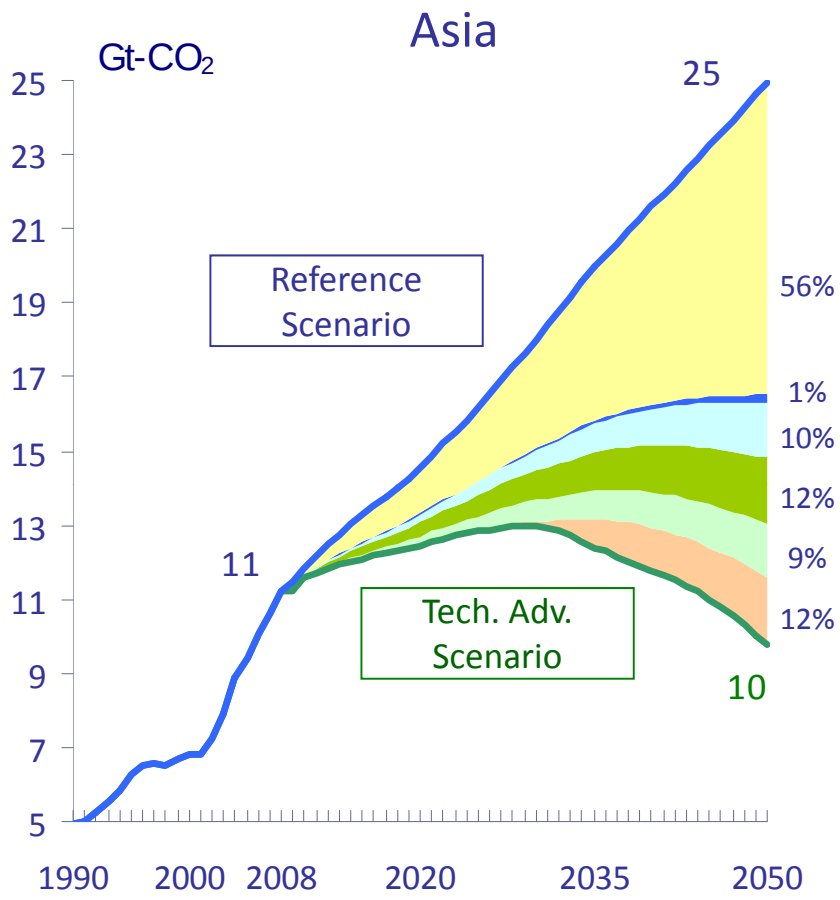
How about energy scenario?

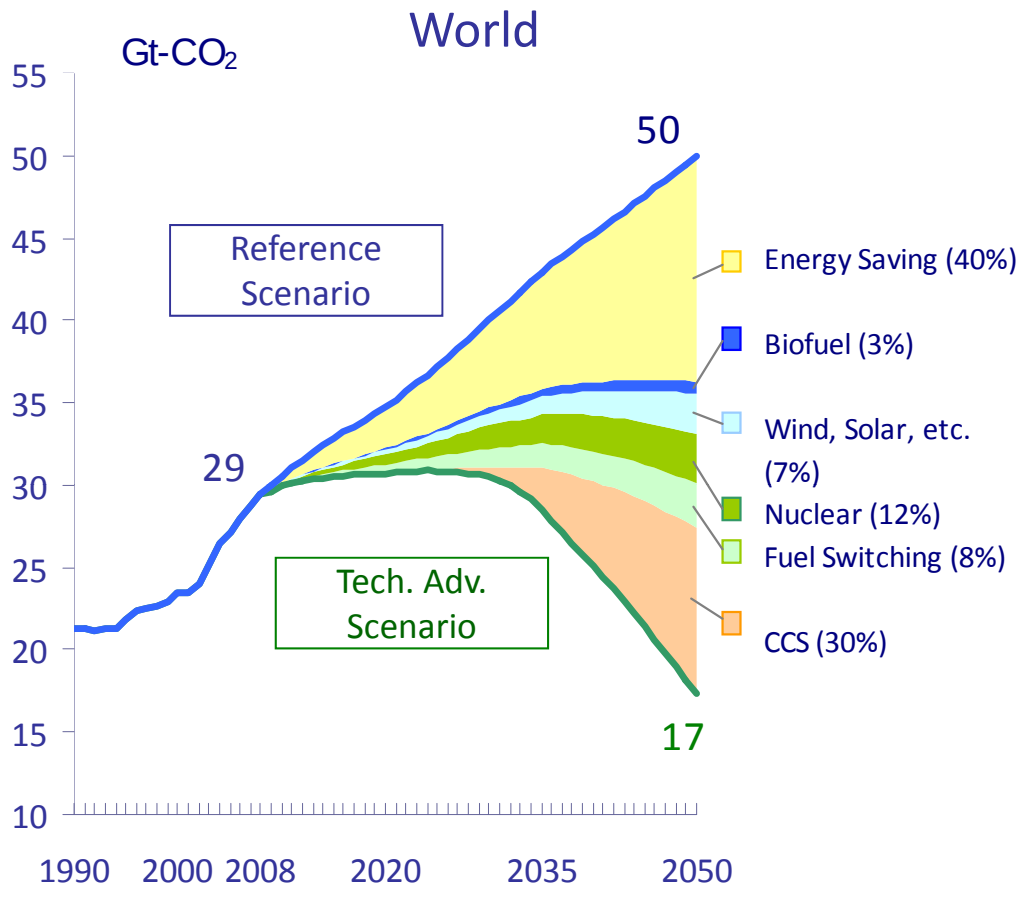
Primary Energy Consumption in Asia



- In the Reference Scenario, total primary energy consumption in Asia will grow from 3,700 Mtoe in 2008 to 9,400 in 2050, showing a 2.5-fold increase. Coal consumption, which will grow especially in the power generation sector in developing countries, will maintain the dominant share up to 2050.
- In the Technologically Advanced Scenario, where advanced low-carbon technologies become widely deployed through cooperation and technology transfer from developed to developing countries, total primary energy consumption in 2050 will be reduced by 34% from the Reference Scenario. The share of fossil fuel in the primary energy mix will decrease to 67%.

CO_2 Emissions





-In the Reference Scenario, energy-related CO_2 emission will increase 2.2-fold from 2008 to 2050 in Asia, and 1.7-fold in the world.
- In the Technologically Advanced Scenario, CO_2 emission will be reduced by 15 Gt from the Reference Scenario (13% from 2008) in Asia, and by 33 Gt from Reference (41% from 2008) in the world.
- In order to halve CO_2 emission by 2050, further efforts are needed to develop and deploy innovative technologies through 2050.

Only by energy supply side management is not enough to reach the target

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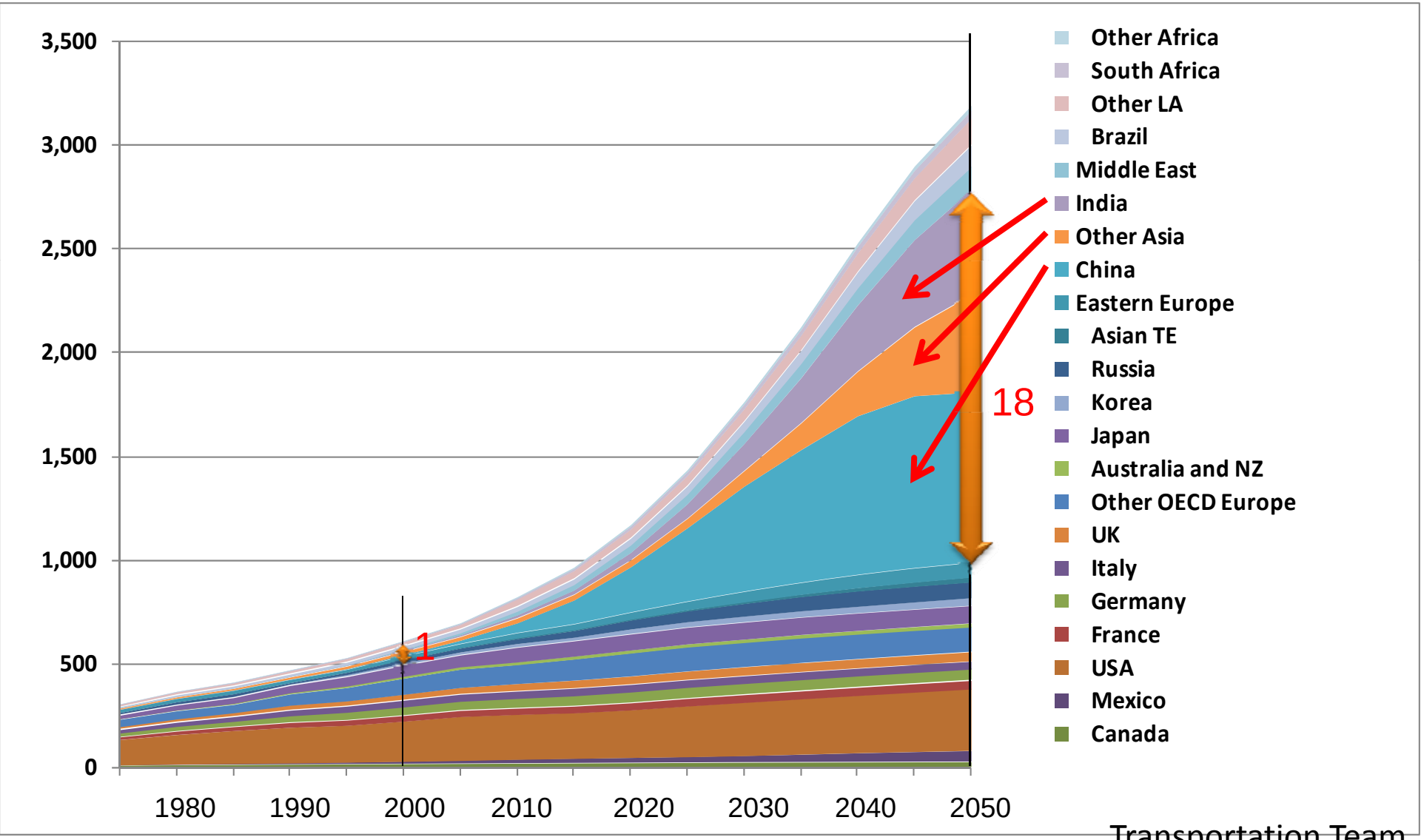
Demand side management is important

Key policies and countermeasures from the demand side

- Low carbon transportation system
- Recycled use of resources

Number of cars are growing rapidly in Asia

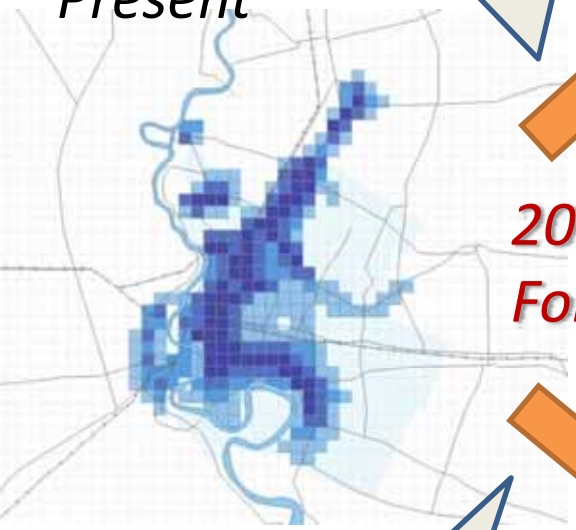


Transportation Team

Relationship between urban spatial structure & transport network

- Population
- Aging
- Life & industry style

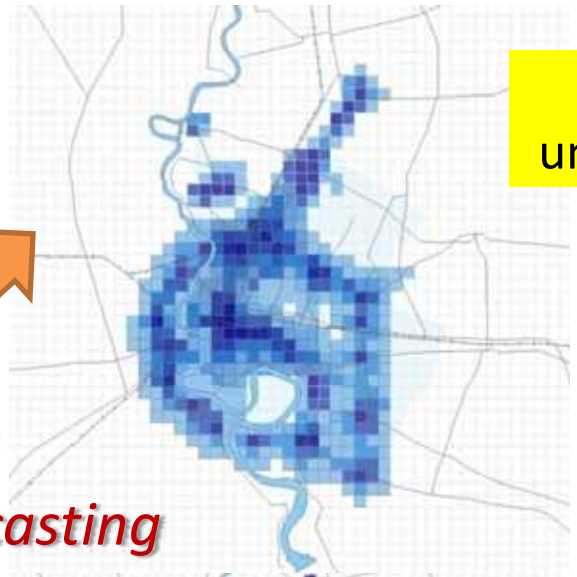
Present

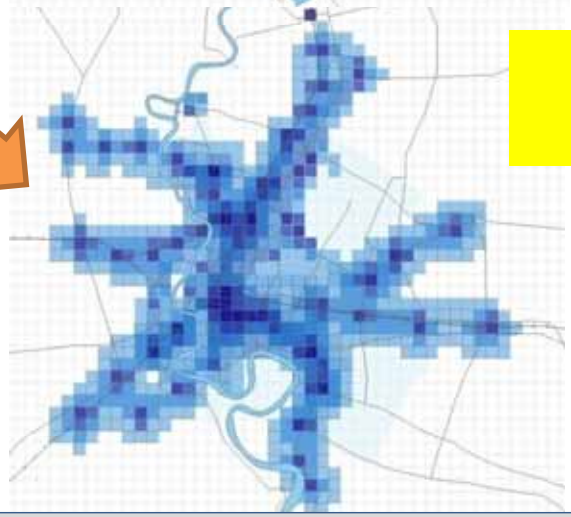


2050 Forecasting

Without railway provision & uncontrolled land development

- Car-oriented
- Higher CO_2
- Higher cost & disaster risk
- Lower QOL





Improving radial railways & developing around stations

- Railway-oriented
- Lower CO_2
- Lower cost & disaster risk
- Higher QOL

- Motorization
- Transport network improvement
- Urban planning (also controlled)

Backcasting *Evaluating & Targeting*

交通チーム

Changes in Passenger Transport Demand

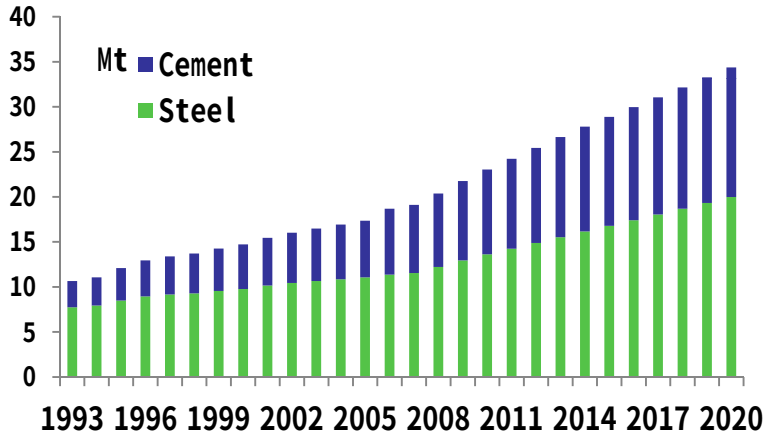
Type	Mode	End of the 20th Century	Beginning of the 21st Century	Coming Future
Private Travel	Motorcycle	Growth & popular	Slightly declining	Electric motorcycles
	Car	Significant growth	Continuing growth	Low Emission Vehicles Changes in usage
Taxi-type Road Public Transport	SOI Motorcycle	Growth	Feeder transit for urban rail transit	Electric feeder transit
	Tuk –tuk	Popular for tourists	Used for local home-based travel	Electric Tuk-tuk for tourists & residents
	Taxi	Popular for middle-income people	Replaced more by urban rail transit	Less supply
Shared Road Public Transport	Silhorlek	Locally organized	Locally stable services	Locally electric Silhorlek
	Songtaew	Complementary bus services	Complementary bus services	Remaining
	Bus	Services for low-income people	Little improvement	Network improvement (Curitiba)
Rail-type Public Transport	BRT	×	Opening the 1st line	Opening more lines
	Urban Rail Transit	×	Opening new lines	Larger-scale network
	Traditional Railway	Services for low-income people	Little improvement	Long-distance transit only

Transportation Team

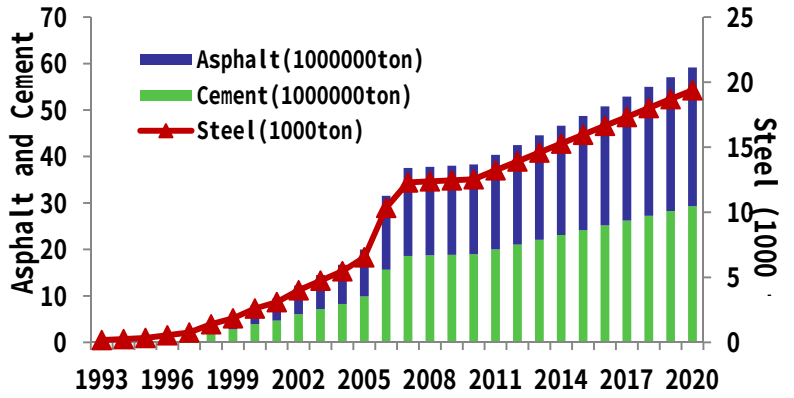
Estimate of Demand for Construction Materials

- Estimate based on China's plan for construction of transportation network
- Current construction speed is faster than the plan
- Infrastructure per capita or per area in China is not still enough

Railway



Highway



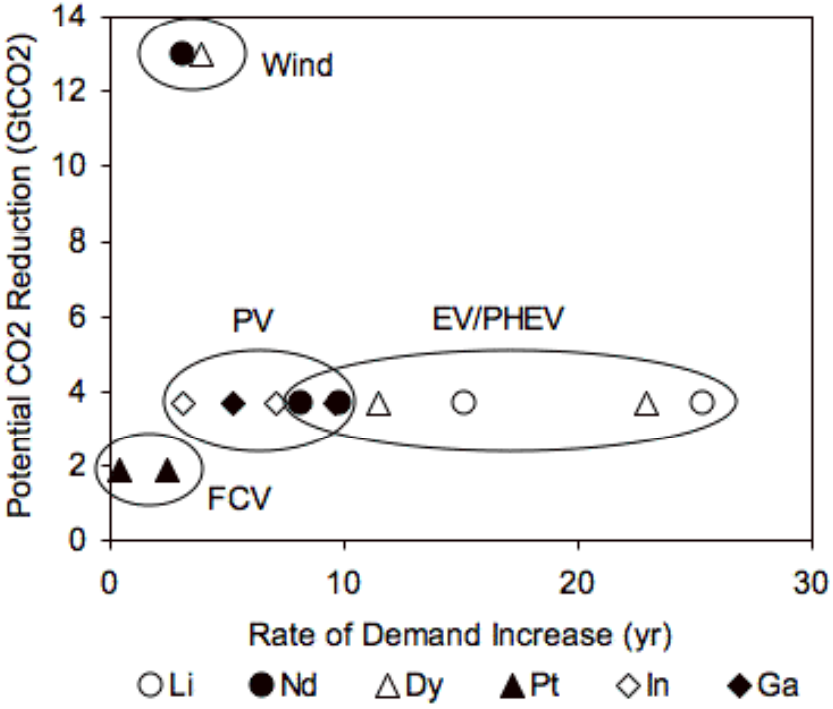
	Unit	USA	China	India	German	France	Brazil	Japan	Italy	UK
Railway length	10000 km	22.67	7.8	6.33	3.39	2.95	2.95	2.01	1.67	1.62
Railway density	Km/km^2	0.025	0.008	0.019	0.095	0.054	0.003	0.053	0.055	0.066
	Km/10000 persons	7.54	0.59	0.58	4.11	4.84	1.56	1.57	2.87	2.67
Road length	10000 km	646.58	193.05	331.65	64.45	95.15	175.19	119.70	48.77	39.83
Road density	Km/km^2	0.724	0.201	1.009	1.805	1.739	0.206	3.168	1.619	1.627
	Km/10000 persons	215.02	14.60	30.28	78.17	156.29	93.14	93.79	83.90	65.74

Resource Management Team

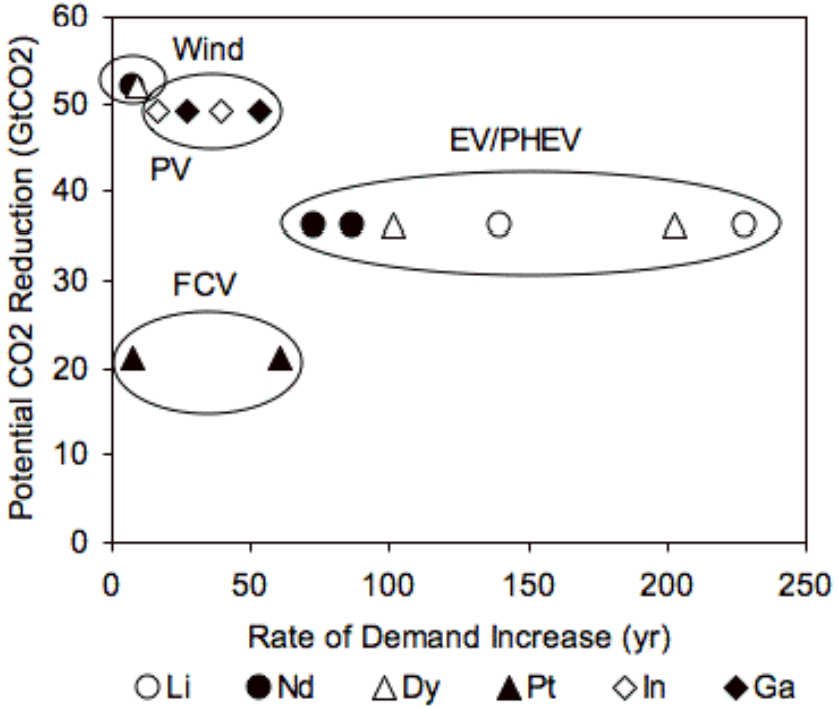
Criticality of metals associated with mitigation technologies

- Metals required for EV/PHEV are critical, according to the evaluation based on the rate of demand increase (accumulated metals demand/current metals production) and potential CO_2 reduction (accumulated CO_2 reduction)

2010年~2030年

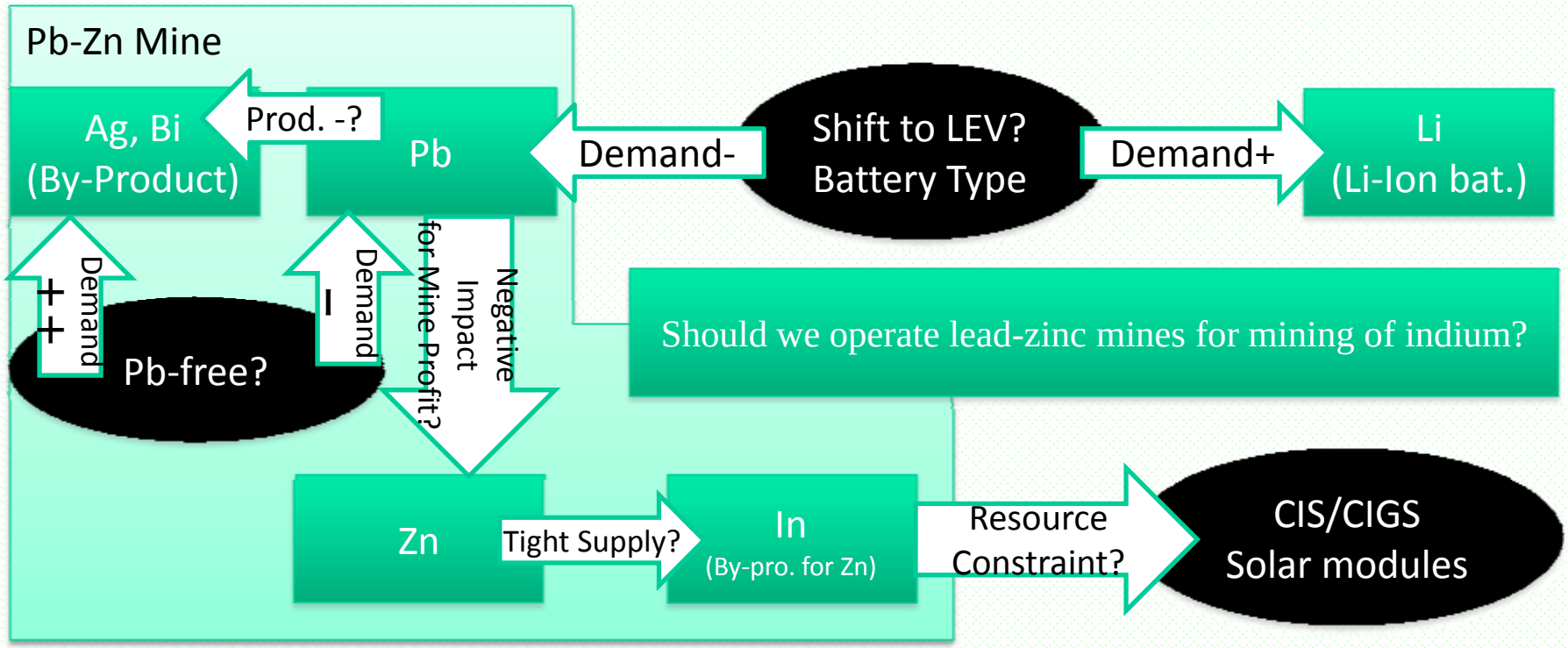


2010年~2050年



Demand Balance between Co-products and By-products in mines

- Among the common non-ferrous metals, copper and zinc draw a lot of attentions due to their relatively instable supply
- As for zinc, which is usually produced in lead-zinc mine, we expect the decreasing demand for its main co-product, lead, while also expect rapid demand increase for their by-product, indium, silver, bismuth and so on.



How to deploy our study to real world

Policy makers
Central/regional government administration
Development Agencies
NGOs

Collaboration for LCS scenario development and building roadmaps

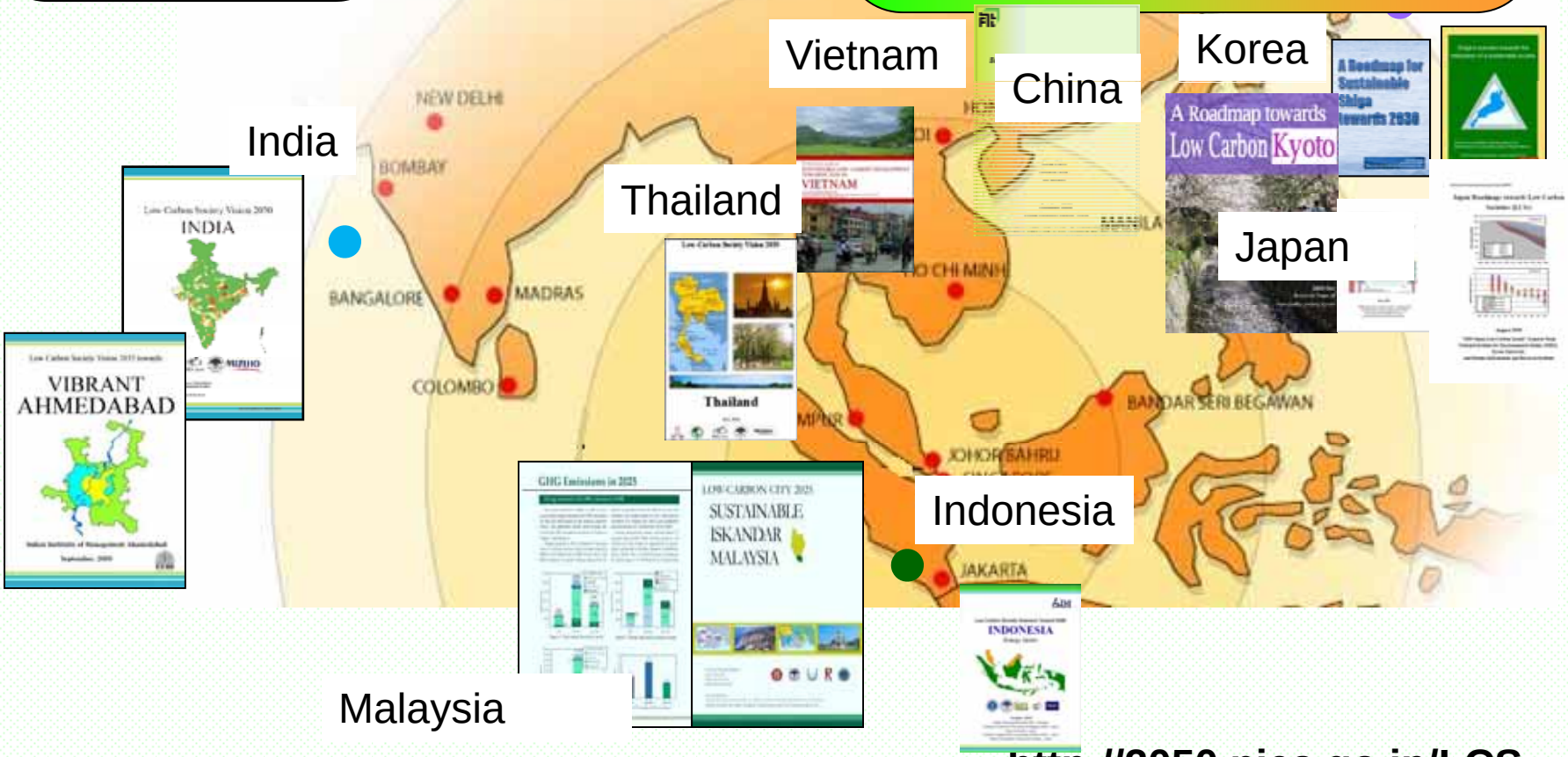
Request of more practical, realistic roadmaps and also tractable tools for real world

Each country's domestic/ local research institute

Core research members

Application and development to actual LCS processes

Development and maintenance of study tools/models



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

Scenario Development in Iskandar Malyais

To SATREPS project for implimentation

Low Carbon Cities: Sustainable Iskandar Malaysia

Establishment of a sustainable low‐carbon society in Iskandar Malaysia
Create awareness among local authorities, the State government, stakeholders and the community urgent and decisive actions to be taken to realize a robust growth and low‐carbon Malaysia

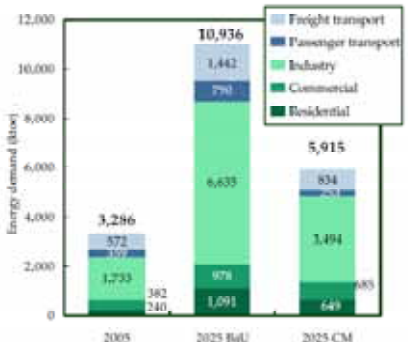


Figure 6. Final energy demand by sector

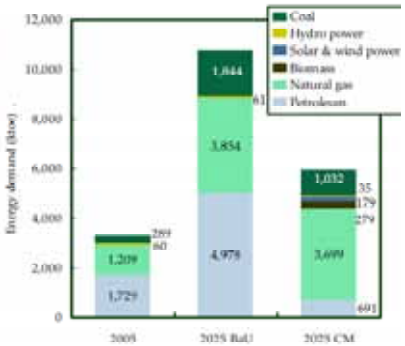


Figure 7. Energy demand by primary energy

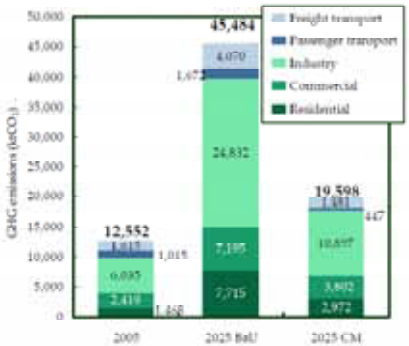


Figure 8. GHG emissions by sector

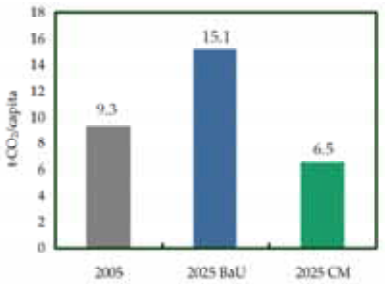
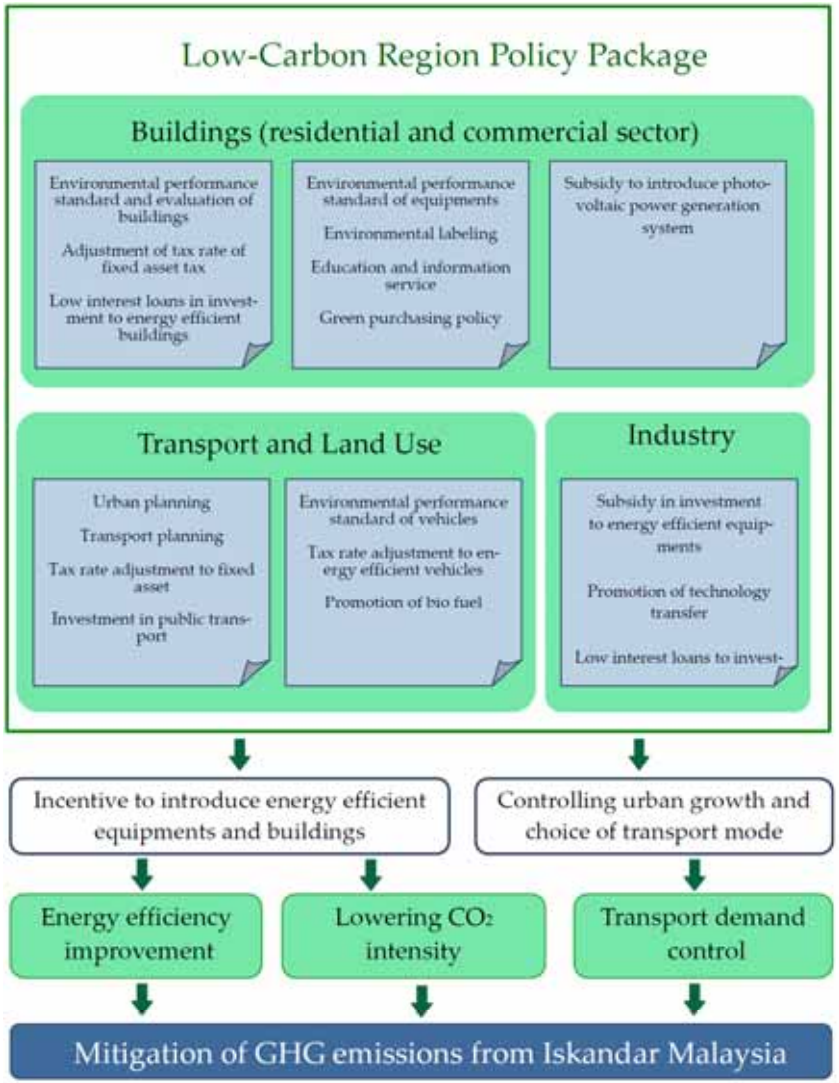
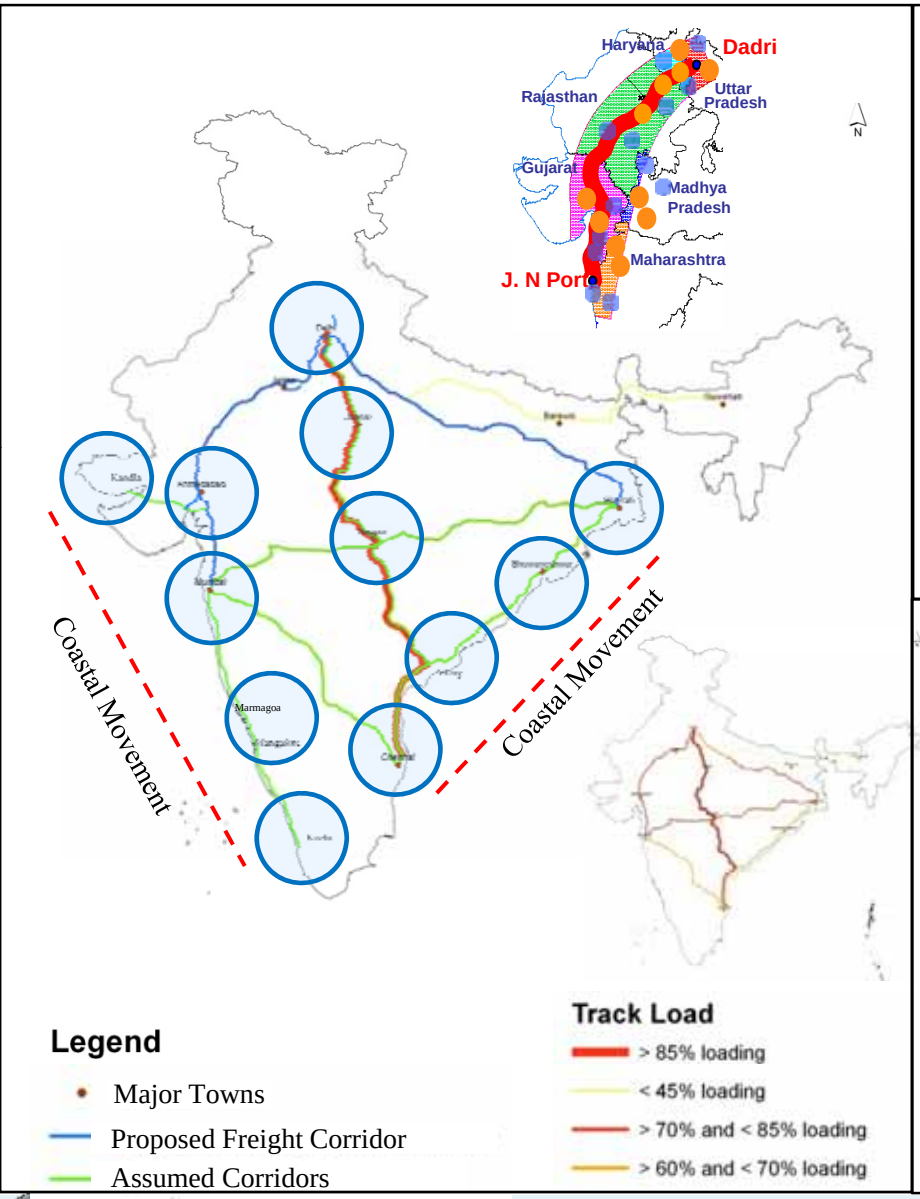


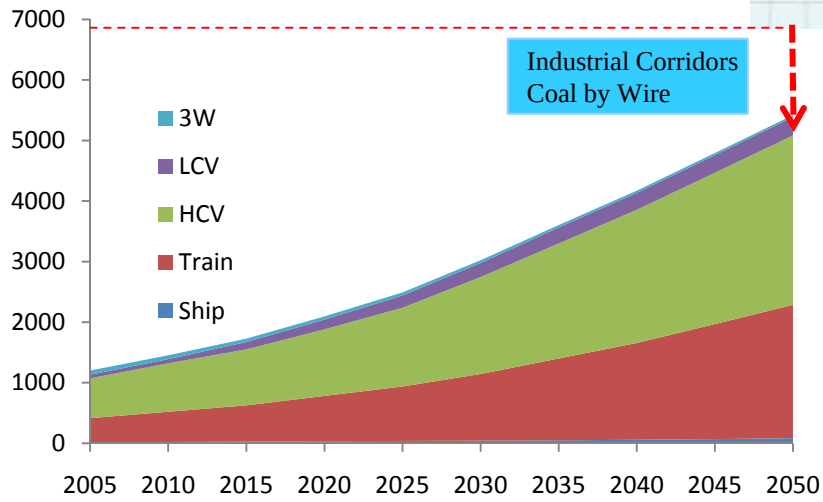
Figure 9. Per capita GHG emissions



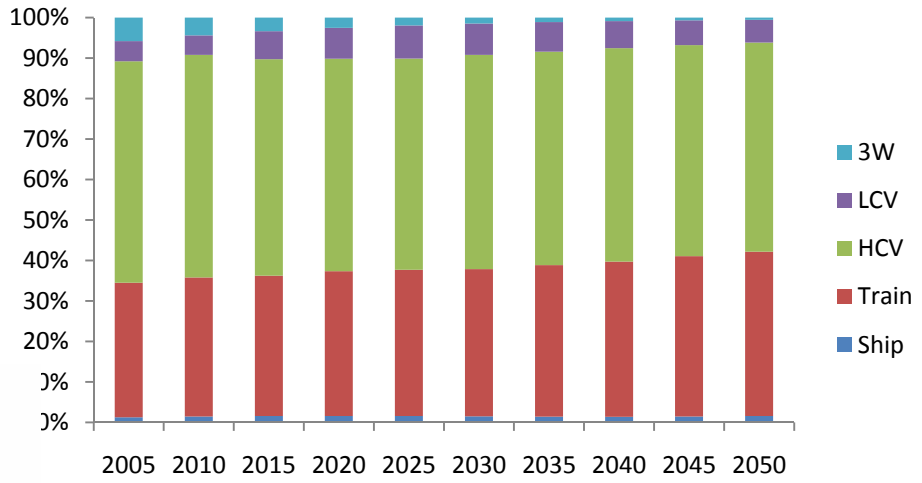
AIM ASIA-PACIFIC INTEGRATED MODEL
NIES JAPAN
KYOTO UNIVERSITY FOUNDED 1897
UTM

Freight Transport Infrastructure





Freight movement by transport infrastructure type (Bn Tkm)



Sectoral shares in freight transport infrastructure (%)

Asia LCS scenarios and actions: How to achieve sustainable low-carbon society

Dissemination & ExSS Workshop in Thailand

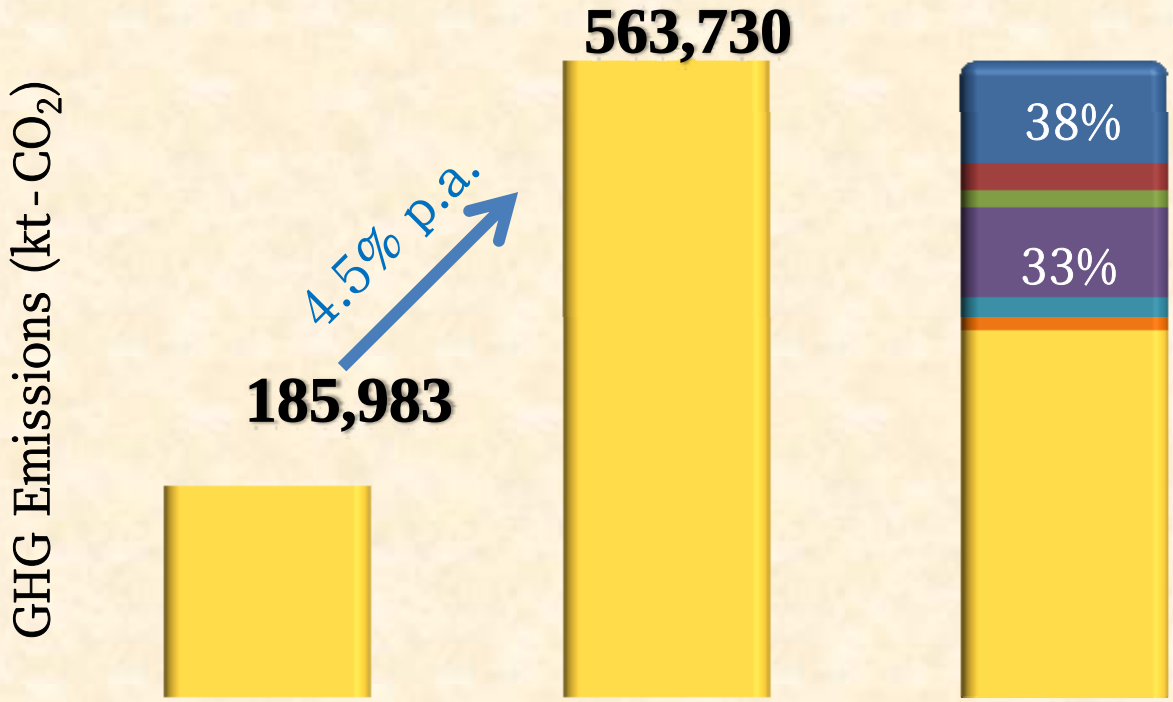
Low-carbon society model capacity building workshop

Bridge simulation scenarios and sustainable LCS policy implementation using AIM (Asia-Pacific Integrated Model)

Organized by TGO, SIIT-TU, JGSEE, NIES

November 19, 2010. Pullman King Power Hotel, Bangkok

GHG EMISSIONS/REDUCTIONS



Power: 91,615 kt-CO_2
Freight: 23,118 kt-CO_2
Passenger: 15,159 kt-CO_2
Industry: 79,984 kt-CO_2
Commercial: 18,734 kt-CO_2
Residential: 10,950 kt-CO_2

Remarks: BAU is Business as Usual
CM is Countermeasure

Thailand's LCS brochures had been distributed and disseminated in Thailand.

1. Thailand Greenhouse gas management Organization (TGO).
2. Climate change focal point of Thailand: ONEP.
3. Bangkok Metropolitan Administration (BMA).
4. Energy Planning and Policy Office (EPPO), MOEN.
5. Department of Alternetive Energy Development and Efficiency (DEDE), MOEN.
6. Research Institutes & Universities.
7. NGOs.
8. Privates/Business.

Note: TGO & MOEN are looking towards 2030, instead of 2022.

$kt\text{-}CO_2$
8 $kt\text{-}CO_2$
159 $kt\text{-}CO_2$
84 $kt\text{-}CO_2$
8,734 $kt\text{-}CO_2$
,950 $kt\text{-}CO_2$

Architecture for Low Carbon Technology

1) International Institution

Governance Architecture for Low Carbon Technol

2) Case Studies in Asia
(Reality, Obstacles, Possibilities in Tech Transfer)

A) Economics (Negative impact of regulations)
- **International Competitiveness (trade)**
- **Elasticity**
- **Carbon Leakage, etc.**

B) Technology (transition theory)
- **RD&D/Demonstration**
- **Deployment**
- **Diffusion**
- **Commercialization**

C) Institution
- **Domestic Institution (Home country factor)**
- **Converging Factor (Globalization, etc.)**

Institution Team

Leap-frogging and political/economical diversity potential and obstacles

- **Technological leap-frogging**

  Potential：CCS, Renewable, Nuclear, DSM

  Obstacle：1) Under development even in the developed countries, 2) High cost, 3) Shut-down of the small/inefficient facilities and reduction of the demand are un-avoidable

- **Political/Economical Diversity**

  Potential：Un-democratic top-down measures (esp. in China), Bottom-up efforts by the local community for low-carbon (Thailand, Philippines)

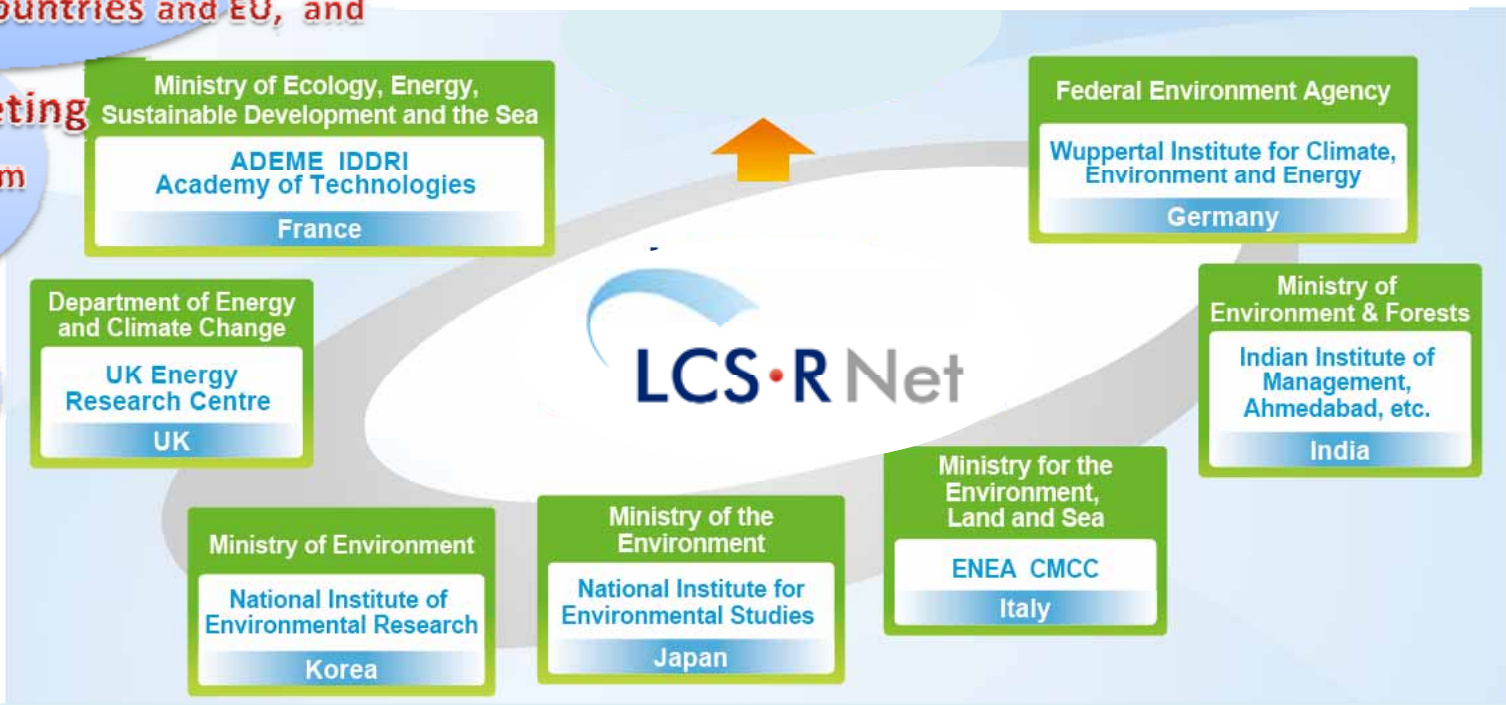
  Obstacles：1) Top-down: Social insecurity, Human rights for the development, 2) Bottom-up: Lack of finance, small emission reduction amount

Integrating research into policy-making process

2nd Annual Meeting
88 participants from
57 institutions
from 23 countries and EU, and
2 IGOs

1st Annual Meeting
56 participants from
17 countries,
2 IGOs

Researchers Meeting



- Supported its foundation by G8 Environment Ministers Meeting.
- 7 countries and 15 research institutes (currently)
- Willing to Expand to G20 countries under French G8/G20 presidency in 2011

*What makes LCS-RNet "**Unique**";*

- Strong connection with G8 EMM process
- Targets on new research for LCS to fill the knowledge gap
- Involve other research areas

Final Remarks

1. GHG emission paths for LCS will be quantified to propose effective policies and countermeasures.
2. Link GHG stabilization studies with other important issues such as energy-food-water security for achieving LCS.
3. Issues arising in the transition process to LCS will be identified and studied.
4. Develop country/region/city scenarios in Asia with researches in each country by supporting model building.
5. Analyze fund mechanism for technology transfer
6. Enhance LCS studies by tying with SATREPS and Low Carbon Research Network (LCS-RNet)

Thank you for your attention!