

# **AIM modeling activity FY2011-FY2012**



**The 17<sup>th</sup> AIM International Workshop  
February 17, 2012  
NIES, Tsukuba, Japan**

**Yuzuru Matsuoka**

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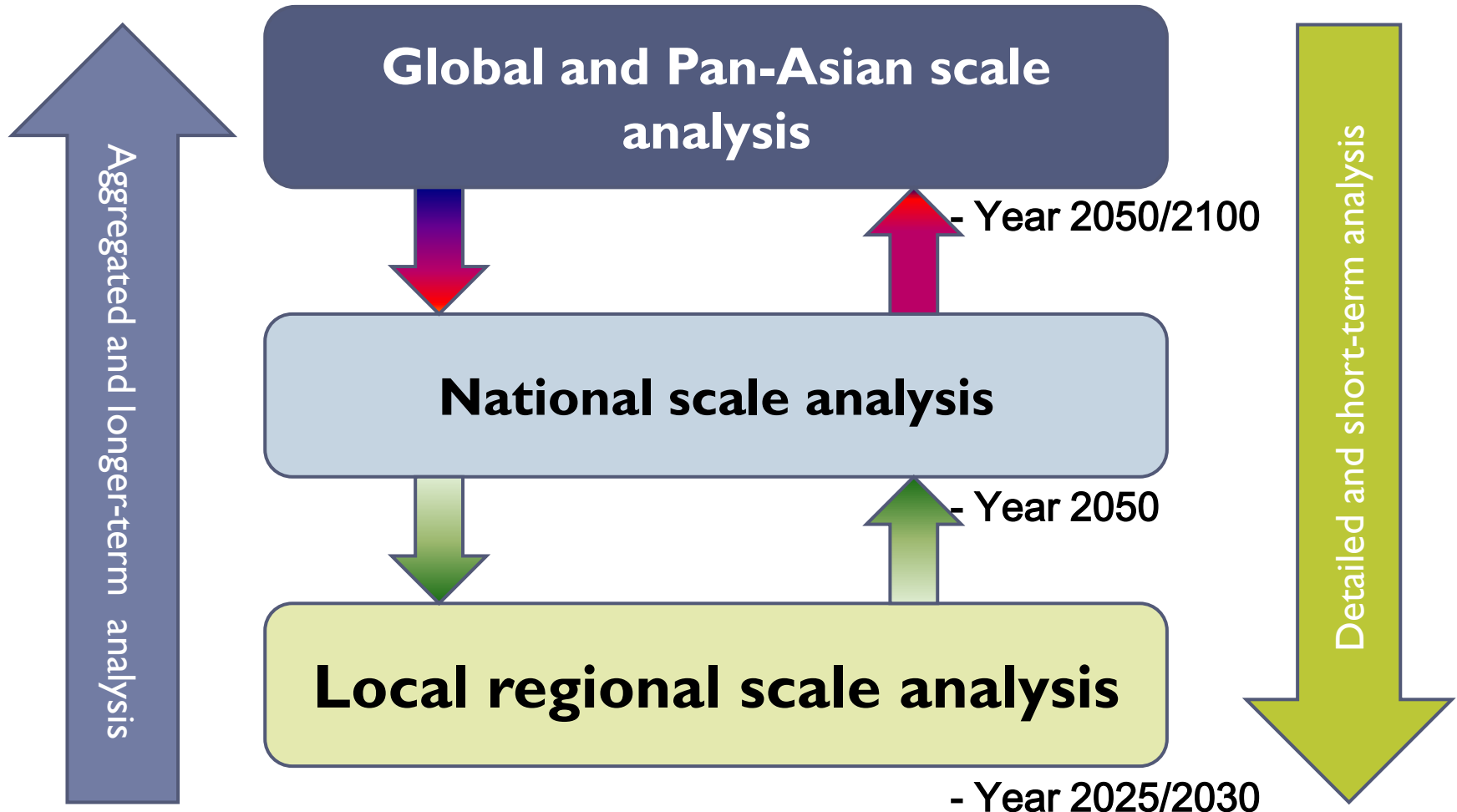
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# Models in AIM family

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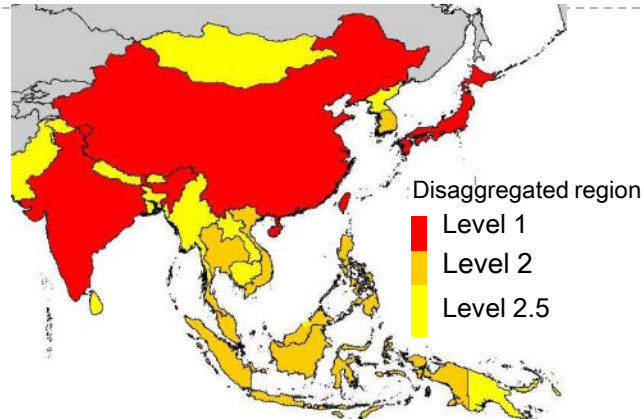
- **AIM/CGE(Global/National):** One/multi-regional CGE model. Integration platform of element models. They are soft-linked according to analytical objects. Global and National scales.
- **AIM/Enduse(Global/National):** One or multi-regional, multi-sectoral bottom-up type energy end-use model. Integration platform of energy service's generation processes, energy technology development, and LCS policies. Global, national, and local scales.
- **Extended snapshot tool (ExSS):** One or multi-regional model, based on input and output analysis. It integrates future economic, industrial, social and energy policies, using social accounting matrices, trade matrices, energy balance tables, energy technologies, regional energy resources information.
- **Back-casting model/Tool (BCM/BCT):** A model for designing roadmaps towards low carbon societies. Dynamic optimization type model.
- **Element models:** Models of specific mechanisms of social-economic processes and energy service demands, such as macro-economy (MEM), dynamic demography (PHM), building dynamics (BDM), traffic demand (TDM), material stocks and flow (MSFM), agriculture forestry and land-use activity (AFOLU).

Using these models, we are conducting multi-scale and interactive analysis for developing Asian LCS scenarios



# Target regions of AIM study

Country/Region	Level 2.5 (28 regions)	Level2 (15 regions)	Level 1 (4 regions)
Japan	JPN	JPN	JPN
China	CHN	CHN	CHN
Taiwan	TWN	TWN	
India	IND	IND	IND
Indonesia	IDN	IDN	ASIA
Malaysia	MYS	MYS	
Philippines	PHL	PHL	
Korea, Republic of	KOR	KOR	
Singapore	SGP	SGP	
Thailand	THA	THA	
Viet Nam	VNM	VNM	
Korea, DPR	PRK	XEA	
Mongolia	MNG		
Lao PDR	LAO	XSE	
Myanmar	MMR		
Brunei	BRN		
Cambodia	KHM		
Timor-Leste	TLS		
Bangladesh	BGD	XSA	
Bhutan	BTN		
Nepal	NPL		
Pakistan	PAK		
Maldives	MDV		
Sri Lanka	LKA		
Afghanistan	AFG		
Fiji	FJI		
Papua New Guinea	PNG		
Marshall Islands	MCR		
Micronesia			
Palau			
Kiribati	XOC		
Nauru			
Samoa			
Solomon Islands			
Tonga			
Tuvalu			
Vanuatu			

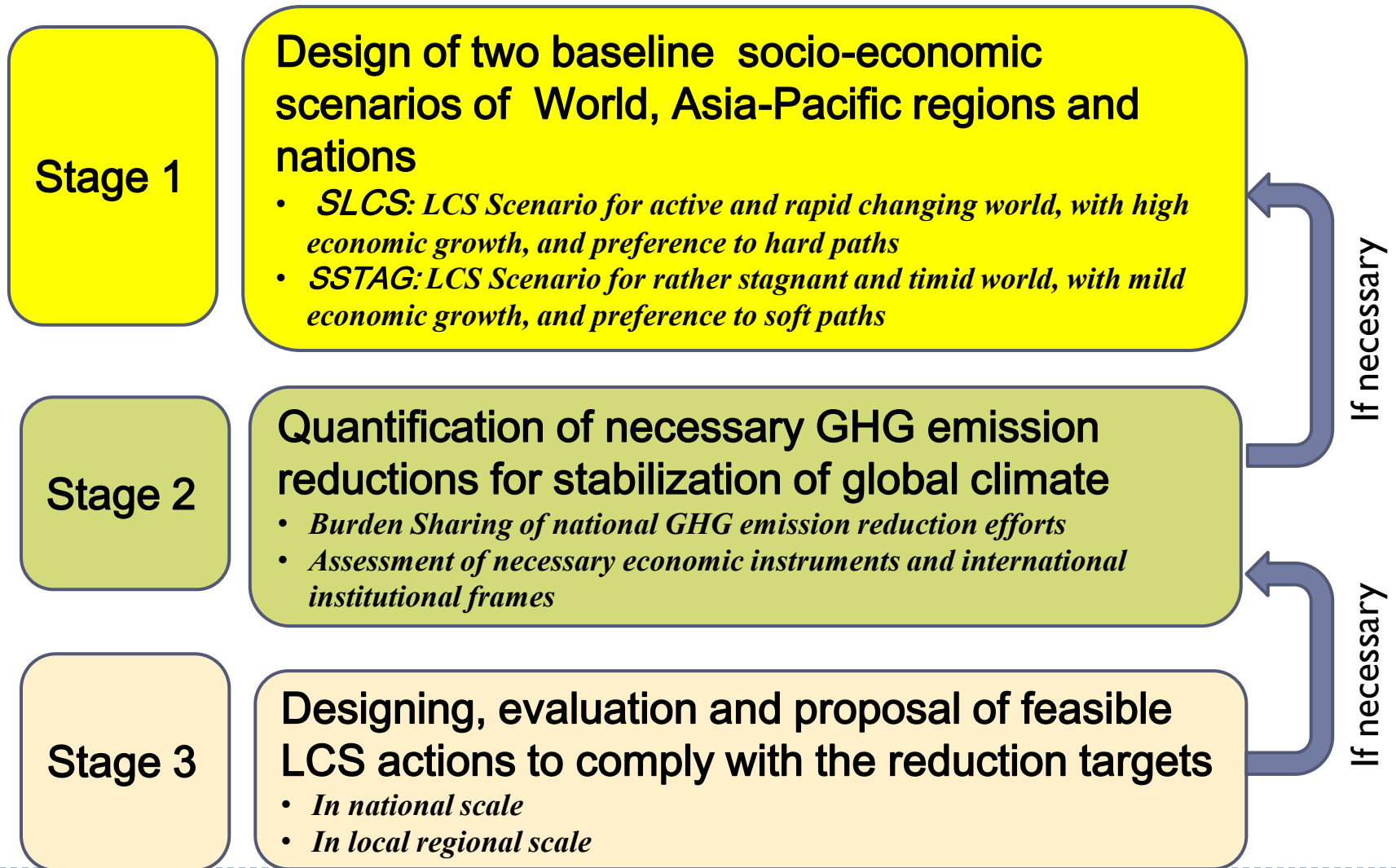


- Covered East, South, Southeast Asia, Melanesia, Micronesia, and Polynesia
- Level 1: Four regions, *i.e.* China, India, Japan and Rest of Asia
- Level 2 : Fifteen regions, aggregation of small countries less than one million population.
- Level 2.5 :28 regions, aggregation of small island states in Oceania region

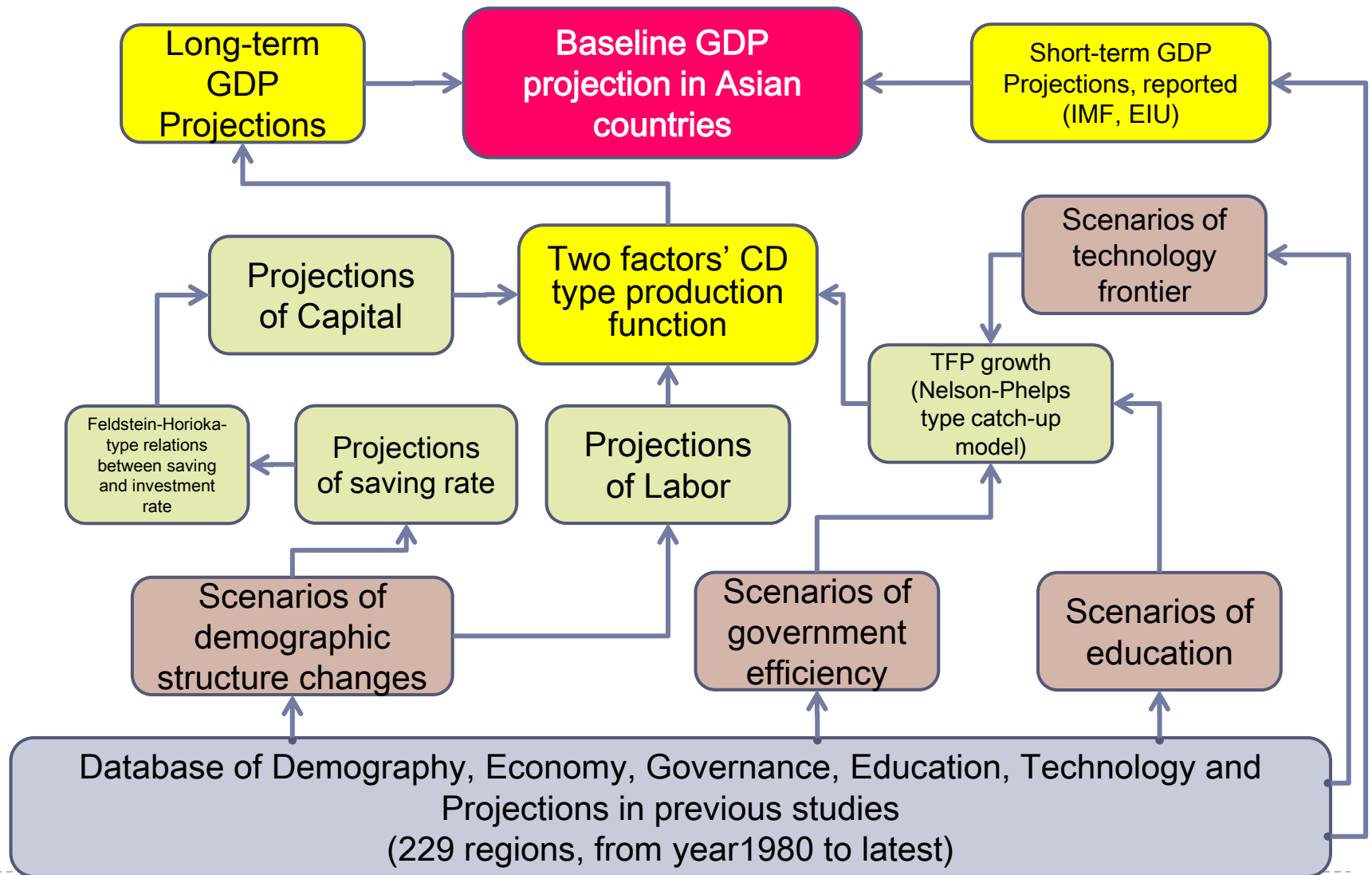
Central Asia	XCS
Middle East	XME
Other Latin America	XLM
Canada	CAN
USA	USA
EU-15	XE15
EU-10	XE10
EU-2	XE2
Turkey	TUR
Other Europe	XENI
Other Western Europe in Annex I	XEWI
Other Eastern Europe in Annex I	XEEI
South Africa	ZAF
Other Africa	XAF
Russia	RUS
Mexico	MEX
Argentina	ARG
Brazil	BRA
Australia	AUS
New Zealand	NZL

- Rest of the world : 20 regional disaggregation, corresponding to Level 2. So the world total is 35 regionalization.

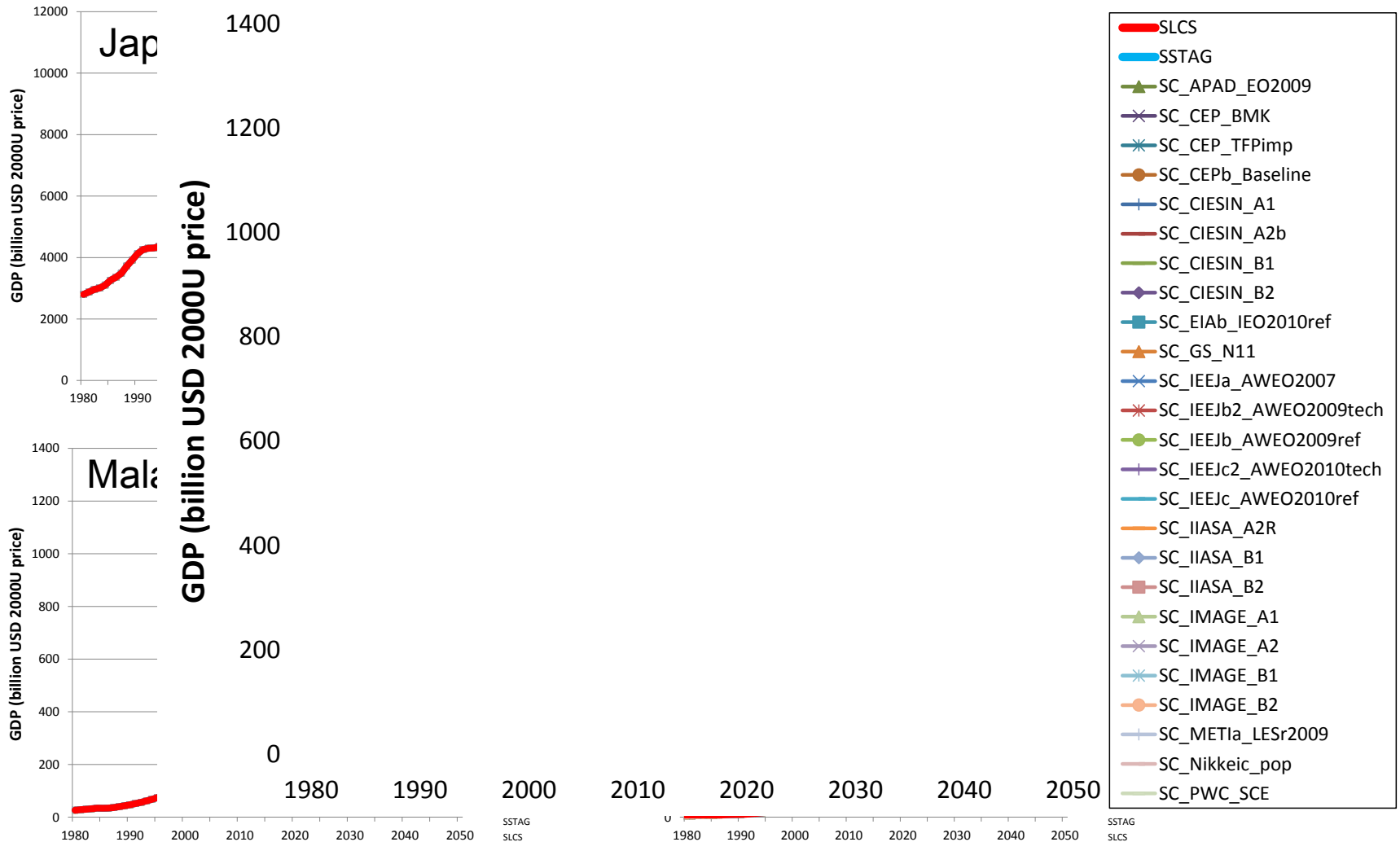
# Three stage's approach for Pan-Asian and national LCS studies



# Quantification methodology of national baseline GDP in Stage 1



# Examples of national baseline GDP in SLCS and SSTAG scenarios



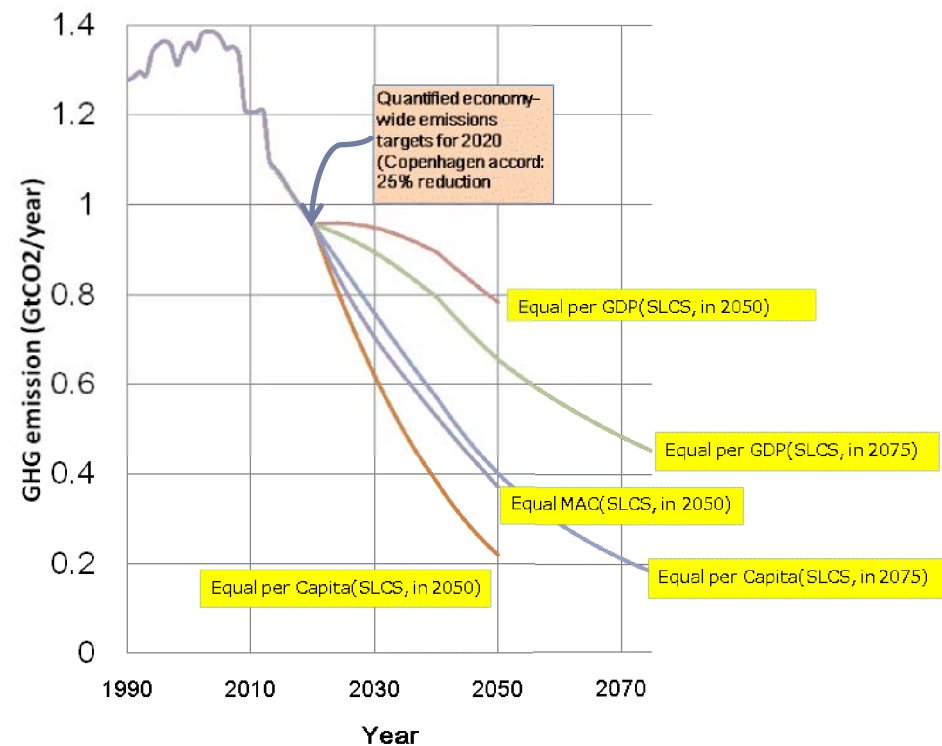


# Stage 2: Quantification of necessary GHG emission reductions for stabilization of global climate under alternative burden schemes

- Scheme 1: Equal per capita emission in year 2050 or 2075
- Scheme 2: Equal per GDP emission in year 2050 or 2075
- Scheme 3: Equal marginal reduction cost in year 2050 or 2075
- Scheme 4: Equal cumulative GHG emission from year 1990 to year 2050 or 2075

- Under constraints of
1. In year 2050 or 2075, world total emission reduces to half of year 1990
  2. In year 2020, each region follows the Copenhagen accord

Japan's reduction pathway under alternative reduction burden schemes



Japan's GHG reduction paths calculated with each BS scheme

# Quantification of necessary GHG emission reductions

## 50% reduction of global GHG emission in 2050/2075 compared with 1990

	Target year	Reduction rate in year 2050 compare with 2005									
		World	Asia	China	India	Indonesia	Japan	Korea	Malaysia	Thailand	Vietnam
Equal per capita emission	2050	58	43	66	-60	60	84	82	70	64	4
	2075	19	-11	7	-163	32	71	61	46	13	-55
Equal per GDP emission	2050	58	56	60	84	35	43	65	62	56	56
	2075	15	-7	-11	55	-89	52	55	37	-8	-27
Equal MAC reduction	2050	58	35	28	6	51	75	78	47	38	-12
	2075	23	-14	-34	-42	8	54	60	-3	-44	-101
Equal per capita cumulative emission	2050	58	48	53	56	7	70	68	64	56	37
	2075	19	-1	10	15	-86	43	39	30	15	-27

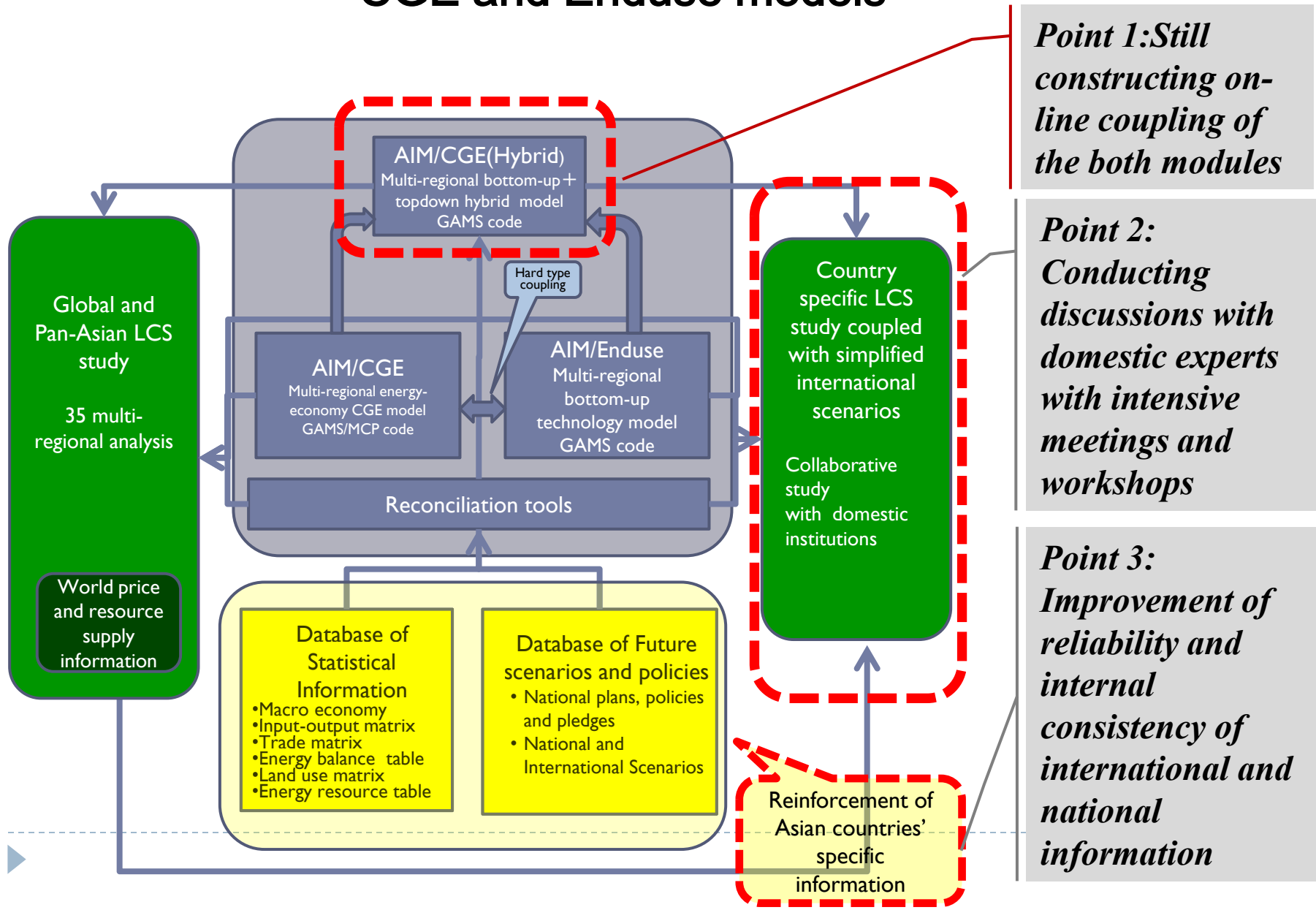
# Influence of GHG emission trades under 50% world emission reduction in year 2050

Comparison of with/without free trading of emission allowance

Scenario: SLCS, year 2050	Per capita emission without reduction effort (tCO2/capita)	with national target and free GHG emission trade		
		per capita emission (tCO2/capita)	% of imported allowance to actual emission	
Taiwan	21.27	2.61	21.11	Importer of carbon credit
Thailand	19.52	3.48	40.85	
China	17.43	4.26	51.72	
Malaysia	17.19	3.60	42.95	
Singapore	16.90	5.70	63.95	
Japan	12.67	3.15	34.71	
Indonesia	12.50	2.50	17.63	
Korea	11.57	2.49	17.53	
Viet Nam	9.04	2.36	12.79	
Other Southeast Asia	7.46	2.08	1.12	
India	5.64	1.18	-73.78	Exporter of carbon credit
Other East Asia	4.86	1.40	-46.63	
Philippines	3.82	1.20	-71.78	
Other South Asia	2.97	1.01	-103.23	
Other oceania	2.94	0.96	-113.88	
Asia	12.88	3.03	32.20	
World	9.53	2.06	0.00	Asia is a net importer

# Improvements of models and tools (1)

## CGE and Enduse models



# Improvements of models and tools (2)

## Extended Snapshot Tool

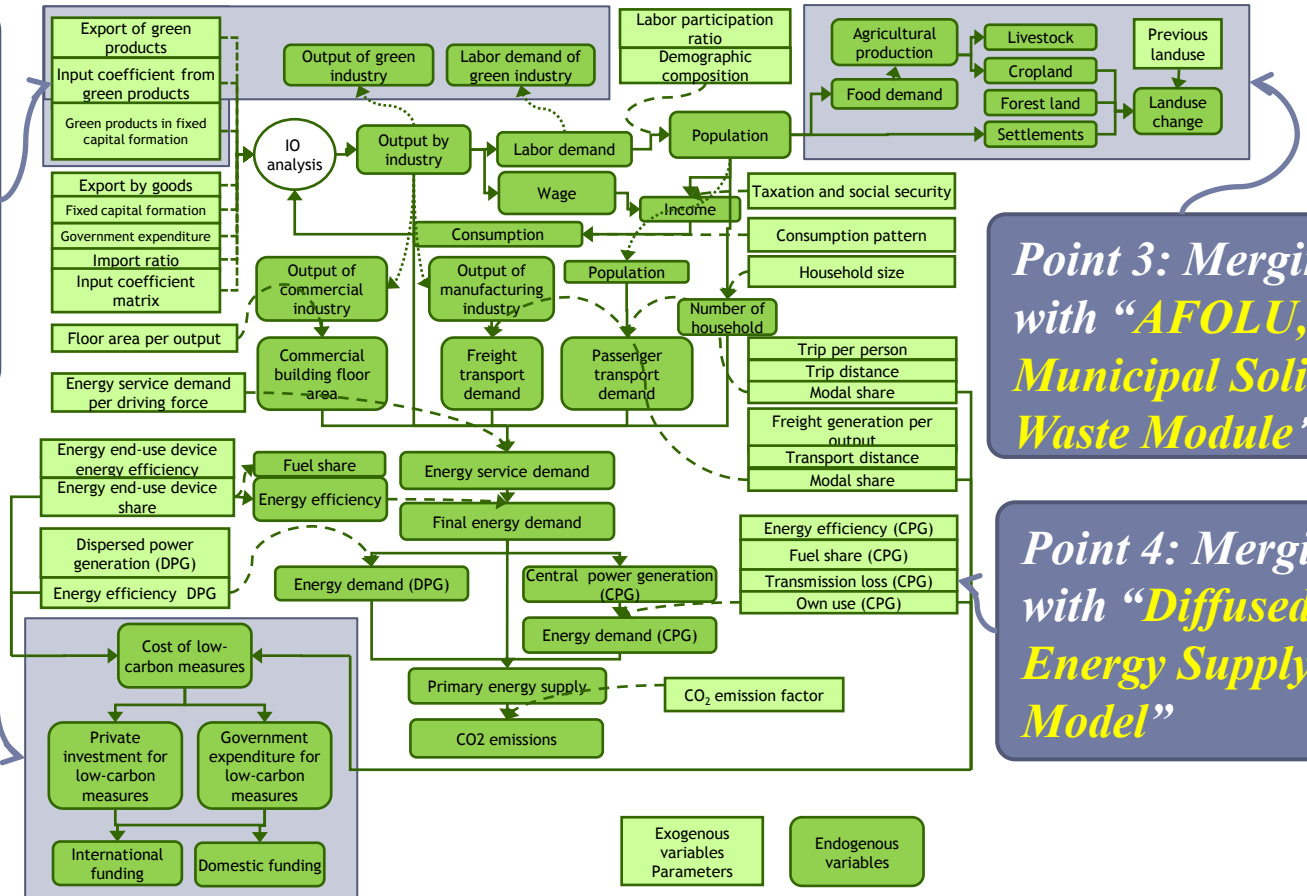
- ▶ Extension of ExSS to cover whole related sectors

*Point 1: Detailed disaggregation of “Green Industry” sectors*

*Assessment of regional economy stimulation with green policies*

*Point 2: Modeling of financial aspects of Low carbon society policies*

*Accounting of monetary flows caused by LCS policies*



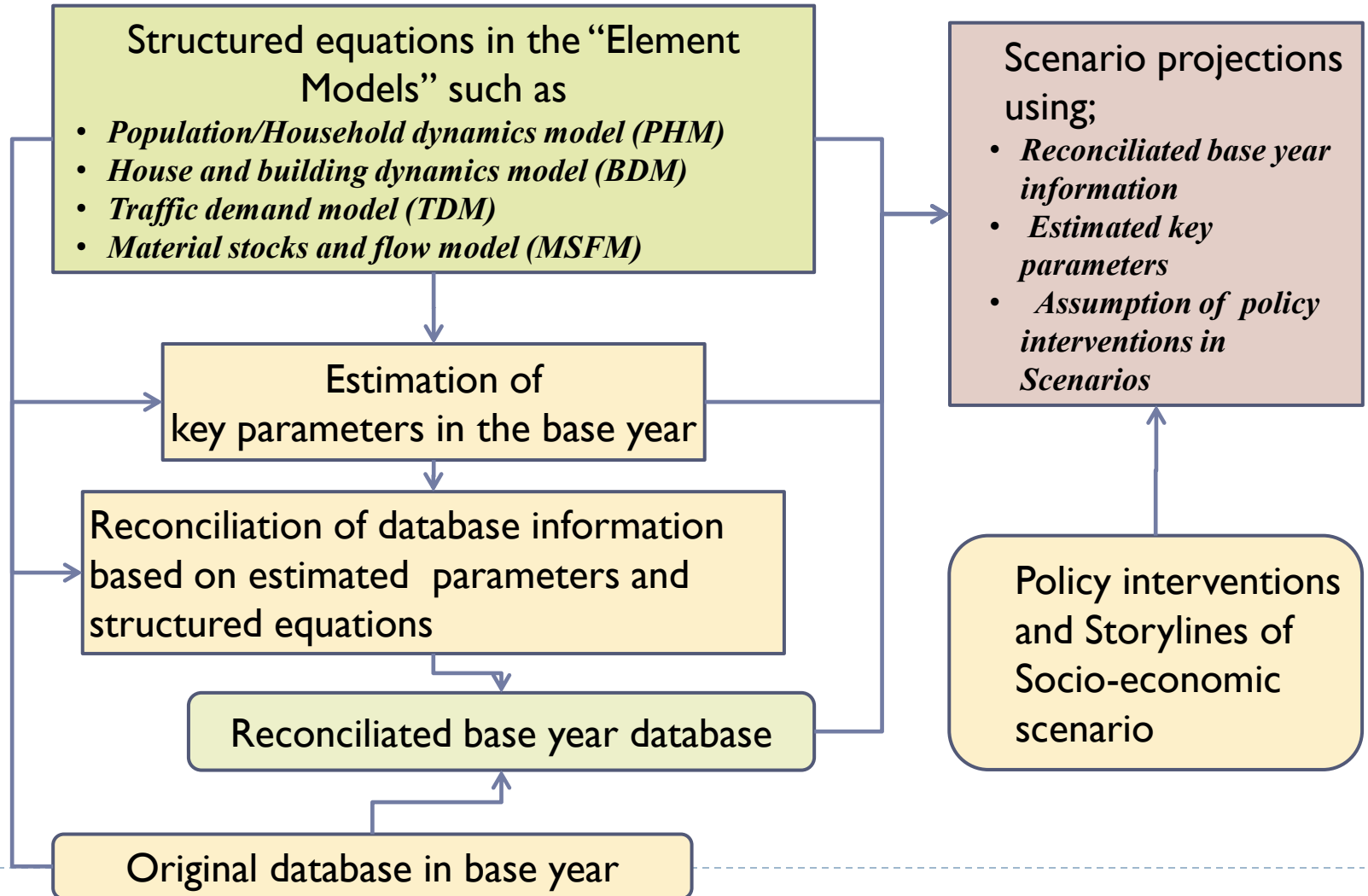
*Point 3: Merging with “AFOLU, Municipal Solid Waste Module”*

*Point 4: Merging with “Diffused Energy Supply Model”*

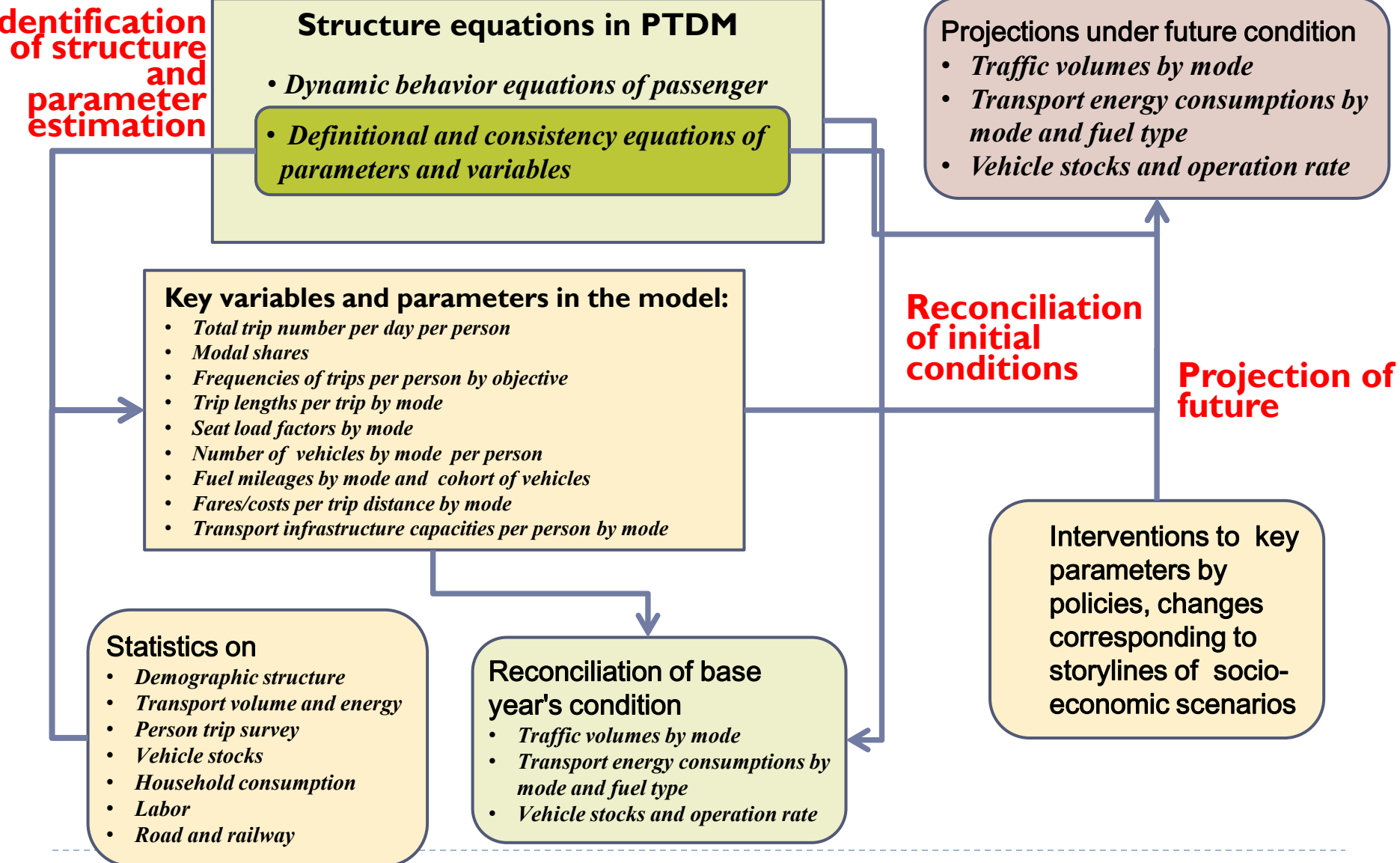


# Improvements of models and tools (3): Element models

## *Consolidation of reconciliation process and projection tools*




# For example, in case of “Passenger Traffic Demand Model (PTDM)”



# Pan-Asian LCS study now going on

## Pan-Asian Study

	Expected progress in FY2011	Progress up to now	Collaborating Research Institutes
Pan-Asian Study	<p>1. Hard coupling of AIM/CGE, AIM/enduse and some element models to AIM/CGE(Hybrid)</p> <p>2. Preparing world and Pan-Asian reference scenarios as references of national LCS development</p> <p>3. Integrating with national scenarios, and analyzing gaps of international and local GHG reduction policies</p>	<p>1. Tuning the behavior of the consolidated model and comparing the results</p> <p>2. Final stage of tuning two scenarios, SLCS and SSTAG</p> <p>3. Established a methodology from global results to each national scenario (boundary conditions) Still integrating national informations towards pan-Asian consolidated information database</p>	<p>S6 teams in Japanese institutions</p> 



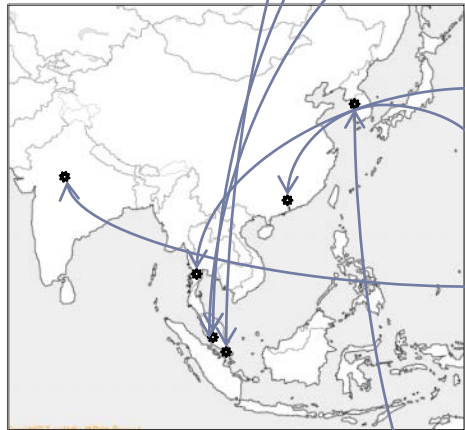
# National LCS studies now going on

	Expected progress in FY2011	Progress up to now	Collaborating Research Institutes
China	Coupling with ERI's national study with AIM/CGE	Tuning the calculated results and comparing the scenarios/assumptions/results with ERI's and other projections	China Energy Research Institute
India	Following up of IIM's 2C "Conventional Mitigation" and "Sustainable" scenarios with AIM/CGE	Tuning the calculated results and analysing the results/feasibilities of the scenarios	IIM Ahmedabad
Thailand	National LCS study using coupled CGE and enduse model	On going	Thammasat University
Indonesia	National LCS study using coupled ExSS, enduse model and AFOLU model	Preliminary projections with energy ExSS and AFOLU modules	Institut Teknologi Bandung
Vietnam	National LCS study covered all sectors	Preliminary projections with energy ExSS and AFOLU modules	Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE)
Bangladesh	Preliminary analysis of Bangladesh LCS with ExSS, covering all sectors	Preliminary analysis of Bangladesh LCS with energy ExSS	
Malaysia	National LCS study covering all sectors	Following up the result of the second national communication with ExSS and AFOLU models	Universiti Teknologi Malaysia

# Local regional LCS studies now going on

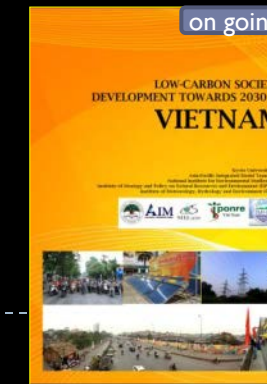
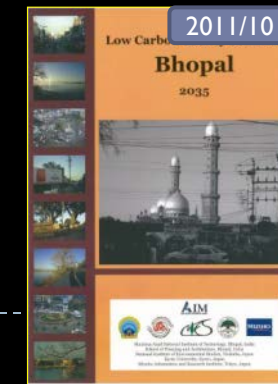
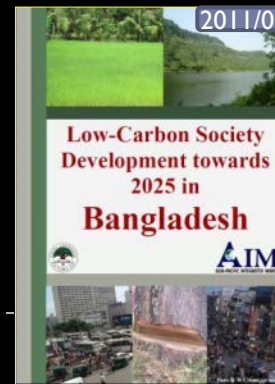
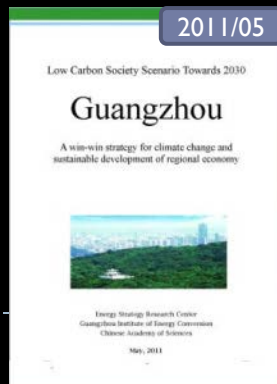
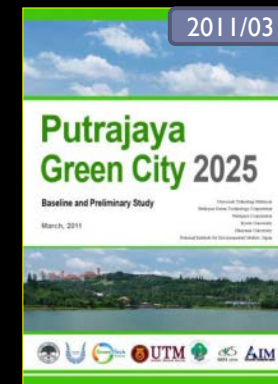
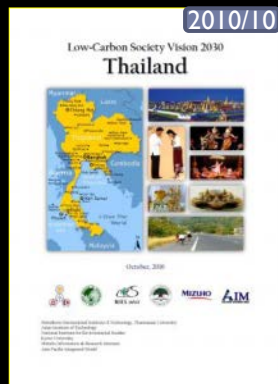
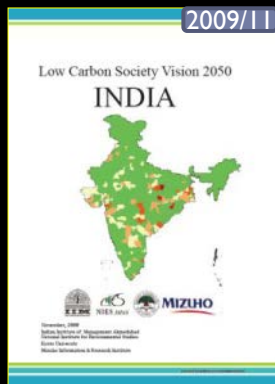
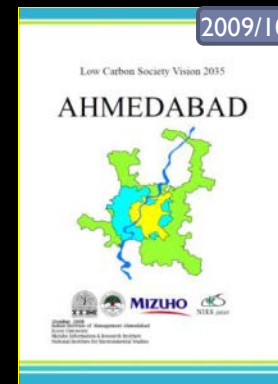
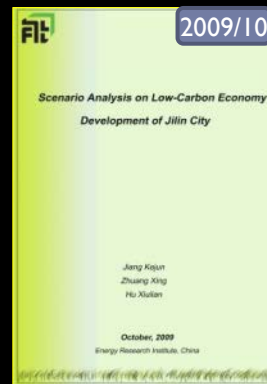
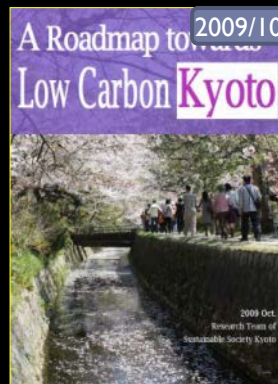
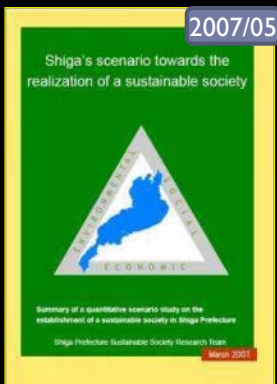
## Local region studies

	Activity in FY2011	Collaborating Research Institutes
*Iskandar, Malaysia	Start full scale interaction with on site governmental institutions Preparing a draft of "Blueprint to Low Carbon Iskandar" including 12 actions Start assessment study on co-benefits by 3R policies and Air quality management Developing Regional Diffused Energy Supply System Model Developing a systematic methodology of Consensus Building towards LCS	Universiti Teknologi Malaysia (UTM) Iskandar Regional Development Authority (IRDA) Federal Department of Town and Country Planning Malaysia (JPBD) Malaysian Green Technology Corporation (MGTC)
*Putrajaya, Malaysia	Finished preliminary design of "Actions towards Putrajaya Green City 2025". Conducted "Focus Group Meeting" with regional stakeholders	Universiti Teknologi Malaysia (UTM) Putrajaya Corporation Malaysian Green Technology Corporation (MGTC)
*Cyberjaya, Malaysia	Start "Cyberjaya Digital Green City 2025 (Cyber DGC 2025) project with four pillars; "Low-carbon Cyberjaya" for climate change mitigation, "Smart 3R Cyberjaya" for solid waste management, "Livable & Vibrant City" for a good living environment, "Smart Digital Network City" for an ICT-based society.	Universiti Teknologi Malaysia (UTM) Multimedia Development Corporation Sdn. Bhd ((MDeC) Cyberview Sdn. Bhd
*Ratchaburi, Thailand	On going	King Mongkut's University of Technology
*Guangzhou, China	Finished preliminary design of "4. Actions for Guangzhou Low-carbon Social development" including 5 actions; Action 1: Convenient transport, Action 2: Green Building, Action 3: Decarbonation of Industry, Action 4: Fuel Switch, Action 5: Low-carbon Electricity	Guangzhou Institute of Energy Conversion
*Bhopal, India	Finish the 1st phase study on "Low Carbon Society Scenario Bhopal, 2035" with 7 actions; Action 1:GREEN GOVERNANCE: Government Initiatives Towards LCS Action 2:HOLISTIC HABITAT: Energy Efficiency in Buildings Action 3:SUSTAINABLE STYLE: Low Carbon Lifestyle Action 4:CELLULAR CITY: Multi Nuclei Land Use Planning Action 5:FORM AND FLOW: Integrating Transport with City Structure Action 6:NURTURING NATURE: Leveraging on the Natural and Historic Assets Action 7:RURAL RICHES: Promoting a Better Lifestyle in the Rural Areas Had a symposium with regional policy makers and stakeholders to stimulate Actions, on Sept. 2011	Maulana Azad National Institute of Technology, Bhopal School of Planning and Architecture, Bhopal
*Kyonggi Province, Korea	Preliminary analysis of energy related part are conducting with ExSS	Seoul National University



# Brochures introducing our country and region LCS studies

## Communication and feedbacks of LCS study to real world



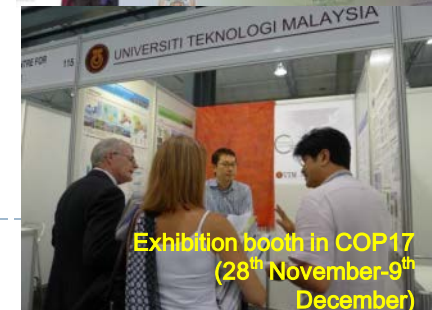
# An example of Local regional LCS study: Project for Development of Low Carbon Society Scenarios for Asian Regions (SATREPS-LCS)



- **Establish a methodology to create LCS scenarios which is appropriate for Malaysia through a case study of LCS development in Iskandar Malaysia. Also, the overall aim will result in and benefit not only the specific region but also the whole Malaysia as well as the other Asian regions by providing the LCS scenario development methodology for Asian regions.**
- **Now on the later stage of data collection for improvement of LCS scenario in Iskandar Malaysia, while carrying out capacity development of Malaysian researchers and policy.**
- **As an output in the first phase, the project will propose “a dozen actions towards low carbon society in Iskandar Malaysia” by March 2011, which will be incorporated into “Blue Print on Low Carbon Society” to be newly issued by IRDA.**

# Major events under SATREPS-LCS project in FY2011

- 2<sup>nd</sup> June, 2011
  - Signing of Record of Discussions between Malaysian government and JICA
- 4<sup>th</sup> & 5<sup>th</sup> July, 2011
  - 1<sup>st</sup> Symposium on Low Carbon Asia Project (Approx. 120 participants)
  - 1<sup>st</sup> International Training Workshop (Approx. 70 attendees)
- 2<sup>nd</sup> -9<sup>th</sup> October, 2011
  - Training on Consensus Building towards LCS
- 31<sup>st</sup> October, 2011
  - 2<sup>nd</sup> Symposium on Low Carbon Asia Project (Approx. 100 participants)
- 1<sup>st</sup> November, 2011
  - 2<sup>nd</sup> International Training Workshop (Approx. 60 participants)
- 28<sup>th</sup> November – 9<sup>th</sup> December, 2011
  - Exhibition & Side Event at COP17 in Durban, South Africa



# News on SATREPS-LCS in FY2011 by the press

**1** Utusan Online \*Online news of Malaysia, one of major newspapers in Malaysia On 6th July 2011  
[http://www.utusan.com.my/utusan/info.asp?y=2011&dt=0706&pu=Utusan\\_Malaysia&sec=Johor&pcw=01.htm](http://www.utusan.com.my/utusan/info.asp?y=2011&dt=0706&pu=Utusan_Malaysia&sec=Johor&pcw=01.htm)

**3** The Star Online \*Online news of The Star, the biggest issuer in Malaysia On 8th July 2011

**5** Daily Asia INFO \*Reporting industrial news of Malaysia

**6** China Press - Regional On 6th July 2011

**China Press - Regional**  
 06-Jul-2011  
 Page: 11  
 Regional Changes - South  
 Market: KL  
 Type: Malaysia - Chinese Newspapers  
 Size: 379.74 Kbytes  
 Frequency: Daily

**2** Berita Harian \*One of major newspapers in Malaysia On 6th July 2011

**4** NNA.ASIA \*Reporting economic business information of Malaysia <http://nna.jp/free/news/20110705myr002A.html>

**4** NNA.ASIA \*Reporting economic business information of Malaysia <http://nna.jp/free/news/20110705myr002A.html>

**8** Sin Chew Jit Poh On 5th July 2011

**China Press - Regional**  
 06-Jul-2011  
 Page: 11  
 Regional Changes - South  
 Market: KL  
 Type: Malaysia - Chinese Newspapers  
 Size: 379.74 Kbytes  
 Frequency: Daily

**7** Nanyang Siang Pau - Regional On 5th July 2011

**9** 2011年10月6日中新网

**9** 2011年10月6日中新网

**8** Sin Chew Jit Poh On 5th July 2011

**China Press - Regional**  
 06-Jul-2011  
 Page: 11  
 Regional Changes - South  
 Market: KL  
 Type: Malaysia - Chinese Newspapers  
 Size: 379.74 Kbytes  
 Frequency: Daily

22 2011/12/22

# Bhopal LCS study was also introduced in a newspaper

## Bhopal fast on way to fuelling global warming

**REPORT** But effective steps can reduce greenhouse gas emissions by 40%

**sunday special**

Sravani Sarkar  
#sarkar@hindustantimes.com

**BHOPAL:** If things remain unchecked, Bhopal is likely to emerge as six-fold bigger contributor to global warming and climate change by way of increased greenhouse gas (GHG) emissions in another 25 years. However, sustained energy-efficient efforts could ensure that Bhopal cuts down on this projected increase of emission levels by at least 40%.

A study on Bhopal with emphasis on low carbon scenario in future, says that if things were left unchecked, the greenhouse gas (GHG) emissions in the city would rise by six times to 14.2 million tonnes of carbon dioxide (CO<sub>2</sub>) annually by 2035 from the current emissions of 2.5 million tonnes of CO<sub>2</sub> (data of base year 2005) – an increase of about six times. However, if corrective steps were taken, this increase could be cut down by as much as 40%, the report concludes.

A report, prepared after a 1.5 year study by two Bhopal-based and three Japan-based organisations, also proposes a seven-point action plan for achieving this potential reduction of GHG



■ Vehicular emissions are one of the major contributions to rising greenhouse gas levels in the city. MUJEEB FARUQUI/HT PHOTO

emissions. It says that transport (39%) and residential (36%) sectors that are presently the main contributors to the emissions have to be targeted for achieving the best results.

The report – ‘Low Carbon Society Scenario Bhopal 2035’ – was released on Saturday at a programme hosted by School of Planning and Architecture (SPA), Bhopal.

The study assesses that of the total emission reduction potential, 50% would be due to fuel switch that is prominent in residential, commercial and industrial sectors; about 40% would be due to energy efficient improvements in residential, commercial and transport sectors while 10%

would be in the form of reduction in energy service demand in residential and transport sectors.

“We have suggested seven actions, most of which would have impact in reducing the emissions from residential and commercial sectors,” Sheuli Mitra of SPA, one of the authors of the report said while talking to Hindustan Times.

The seven actions include green governance, developing holistic habitat, promoting sustainable style, developing cellular city, emphasising on form and flow (of transport), nurturing nature and promoting rural riches.

The report suggests with these actions, Bhopal would take prominent steps towards Low Carbon

### GREENHOUSE GASES

Greenhouse gases are those gases that trap heat in the atmosphere and proper amount of these gases are required to ensure that warmth is maintained in atmosphere. However, excess of these gases could lead to global warming and consequent climate change that could lead to dangerous consequences like coastal flooding, melting of glaciers and others. The most abundant greenhouse gases in the earth’s atmosphere are: ■ Water vapour ■ Carbon dioxide ■ Methane ■ Nitrous oxide ■ Ozone

Society concept, which emphasises same level of attention to environmental protection as other socioeconomic development issues.

The study has been conducted by the Maulana Azad National Institute of Technology, Bhopal, SPA, Bhopal, National Institute of Environmental Studies, Tsukuba, Japan, Kyoto University, Japan and Mizuho Information and Research Institute, Tokyo, Japan.

The team of Aashish Deshpande, Manmohan Kapshe, Sheuli Mitra and Kshama Puntambekar conducted the study and compiled the report.

CONTINUED ON PAGE 7

**SUNDAY** hindustantimes.com  
**hindustantimes**  
 SEPTEMBER 25, 2011  
 Bhopal, 16700 • 908 8000 • 7430  
**Magazine** **HT CITY** **think!**  
 FOR BEST GAMES **PARIS COMES TO MUMBAI** **BRETFRIENDING CHINA**  
 Don't miss the new season with the best tracks in India and abroad  
 Hilton gets mobbed on her first visit to the country  
 Despite geopolitical differences, the first Indo-China strategic economic dialogue can boost bilateral ties. THE BEE STORY Pg. 2002. See that show. ©GLOBAL, PH

## Bhopal's contribution to global...

CONTINUED FROM PAGE 1

### Suggested actions WHAT THE GOVERNMENT CAN DO:

- Give incentives and subsidy on the use of green technology like solar power (including cookers and heaters), alternative fuels
- Providing loans for switching to alternative energy
- Enforcing sustainable methods of development like rainwater harvesting, zero discharge and recycling of wastewater, optimal energy usage in buildings
- Ensuring energy efficiency in all buildings through environment impact assessment, ensuring minimum emissions in the process of production and transportation of construction materials and use of locally available materials and technology for construction
- Developing number of mixed land use compact zones that are self-sustaining to reduce long distance travel

- Integrating transport with city structure by developing efficient public transit system and having good connectivity as well as reduced road lengths. Also, designing pedestrian friendly roads and walkways to promote walking and cycling
- Leveraging on natural and historic assets through lake conservation and water management, rainwater harvesting, social and urban forestry and promoting eco-tourism and heritage tourism
- Promoting a better lifestyle in rural areas by developing rural fringes as city's food reserve, preventing conversion of rural land to urban housing sprawl and providing incentives for developing rural housing typologies with energy efficient interventions

### WHAT WE CAN DO:

- Incorporating energy saving techniques in day-to-day operations by switching off gadgets when not used and not wasting water
- Reducing dependence on energy driven gadgets like air conditioners,

- high-grade refrigerators, microwave ovens
  - Reducing dependence on automated transport mainly four wheelers and switching to public transport, pooled transport or taking up cycling or walking
  - Using alternative energy source gadgets like solar cooker, solar heater, solar power
  - Ensure naturally lit and ventilated living conditions to minimize use of energy
  - Value education to children to internalise the concept of sustainable living (like above) in them
  - Taking up rainwater harvesting and ensuring zero discharge of gray water by recycling and reuse
  - Sticking to concept of reduce, reuse and recycle in all possible facets of living
  - Creating awareness among people around us for sustainable living
- (Note: The above is simplified gist of the suggested actions for low carbon society scenario divided into seven technical heads in the report)

# Interview on SATREPS-LCS Project at COP17

2<sup>nd</sup> December, 2011  
Durban Exhibition Center, South Africa  
by “Climate Change Studio”



**Prof. Ho Chin Siong**  
Universiti Teknologi  
Malaysia (UTM), Malaysia



**Dr. Juinichi Fujino**  
National Institute for Environmental  
Studies (NIES), Japan



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