AIM modeling 2010

~ Designing Asian scenarios towards Low Carbon Societies ~

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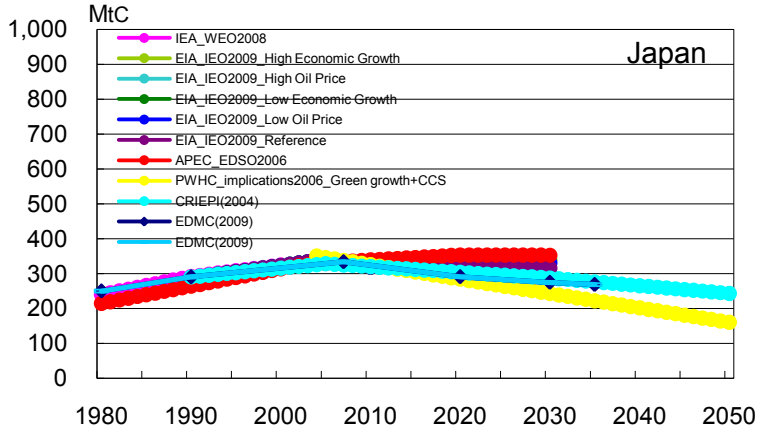
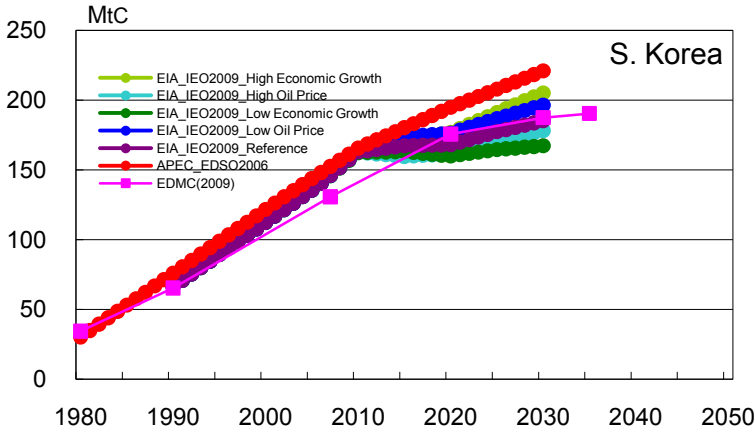
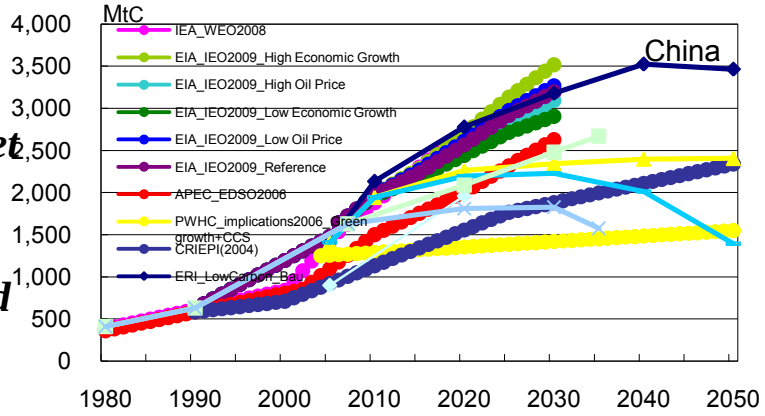
From the point of realizing global LCS, Asia is the most important region of the world.

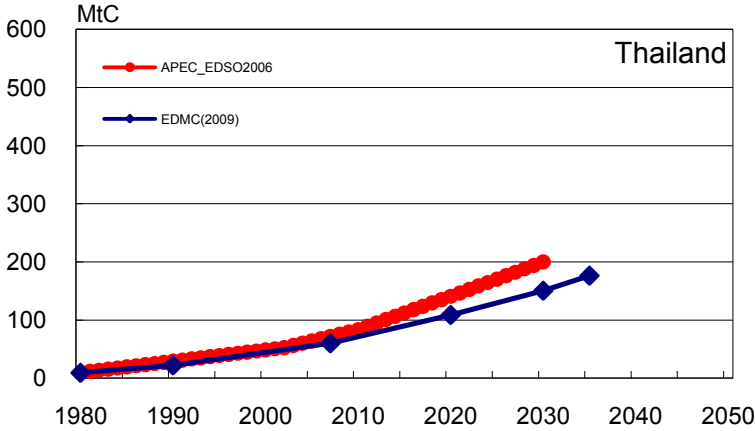
Some groups already projected the future GHG emissions in this region, however, consistent and target oriented studies towards LCS are desperately required to realize actually Asian wise LCS.

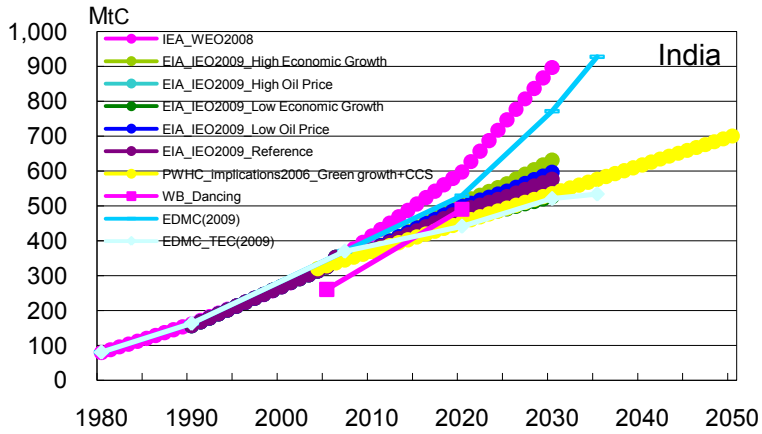
Sorry, AIM members results are not included in this figures.











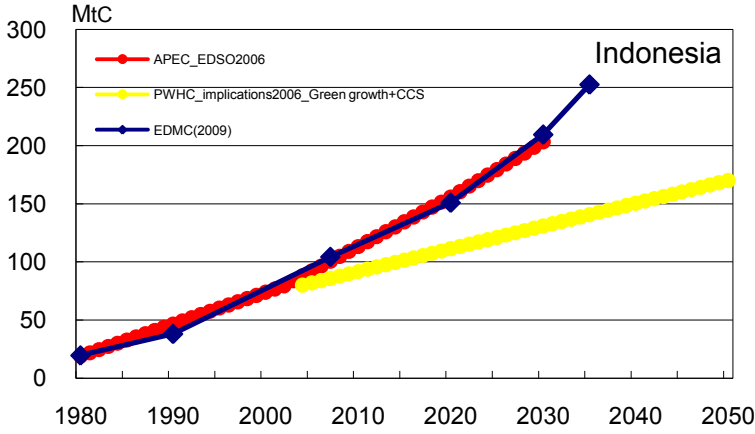


Table of Contents

1. Objective of the model development

In order to realize Asian Low Carbon Societies, ...

1. We focus on domestic and international factors which control the realization of LCS,
2. Describe the development, accumulation, and deepening of factors which control the realization of LCS with multi-layered, spatial, and integrated quantification models/tools,
3. Apply quantification models/tools to whole Asian area and various regions in the Asia,
4. Taking account of regional distinctive diversified characteristics,
5. Design positive Asian low carbon societies and roadmaps towards the LC societies, in each country with a back-casting methodology.

2. What are the Asian Low Carbon Societies we study ?

By the middle of this century (2050), the target societies will satisfy the followings;

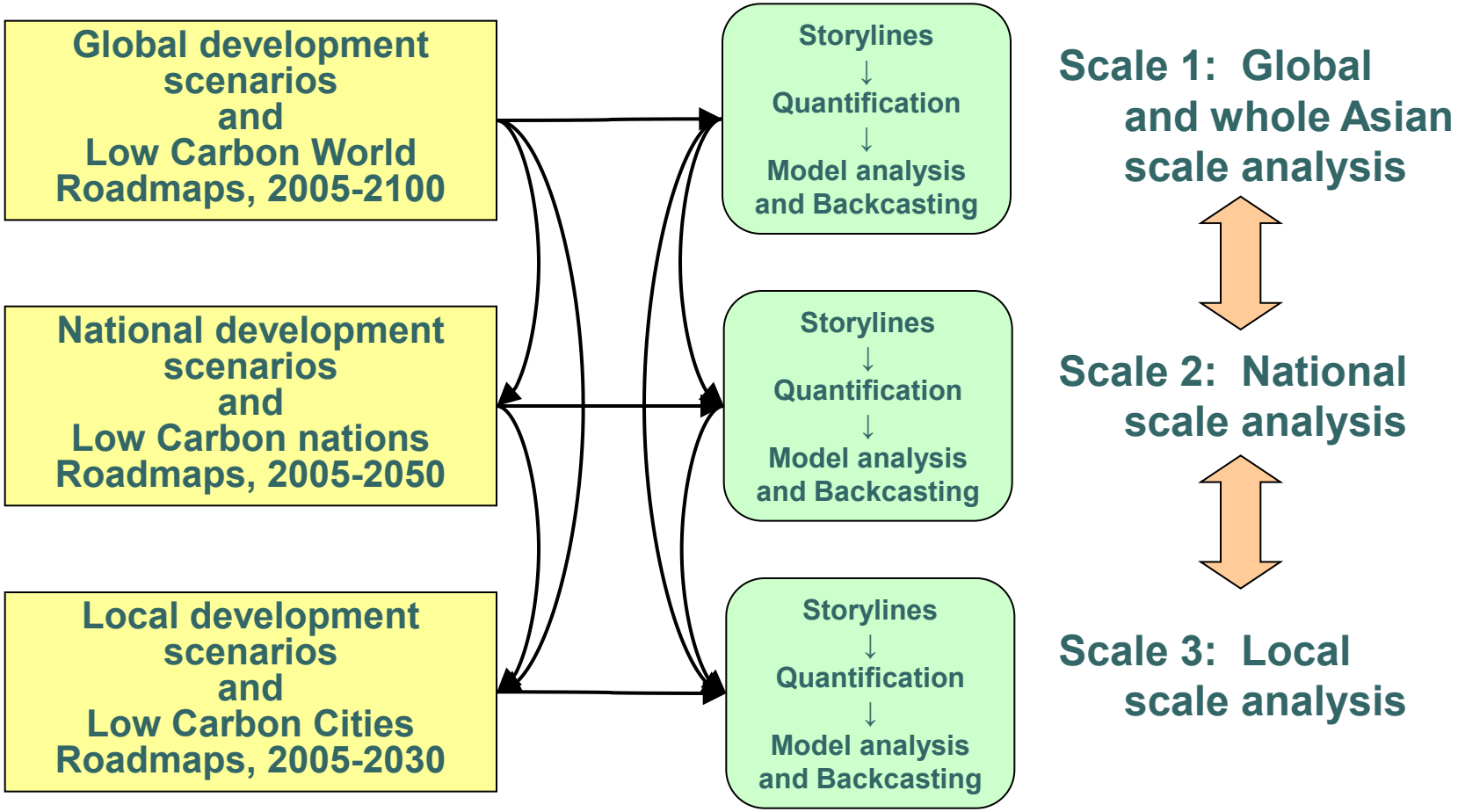
1. Harmonized with drastically changing future Asian society and economy,
2. Complying with each country's national reduction target that consists with the global low carbon target, under the global, national and regional constraints on fossil and renewal energy resources, and land resource,
3. Developing/devising/promoting LCS policies based on each region’s characteristics ,
4. Also utilizing effectively co-benefits of LCS policies and neighboring policies.

2. (continued): Complying with each country's national reduction targets which consists with the global low carbon target, global, national and regional constraints on fossil and renewal energy resources, and land resource

1. We consider two types of national targets;
   1) Targets determined with some normative principle by using long-term dynamic CGE model coupled with a global climate module.
   2) Targets determined by political, economical and engineering arbitrament, considering reduction potentials, marginal costs, institutional inertia etc.
2. Depletion of fossil resource, domestic and international commercial biomass, competition with agricultural production…, major elements which influence the realization of Asian low carbon societies should be considered.
3. Other important issues which suffer the 21st century's Asia, such as improvement of social/human security etc. should be taken account.

3. Three regional/time scales we are concerning

To all scales, our methodology has been applied, and they are inter-connected each other.



4. Two approaches we adopted

In order to take account of multilayered characteristics of Asian region, and not to loose perspective and reality of LCSs

1. Region specific study : Country/region specific approach collaborating with domestic research institutions, and putting more focus on regional initiative and acceptability

2. Pan Asian-Pacific approach : Put more emphasis on comprehensiveness and compatibility among global and pan Asian-Pacific regions

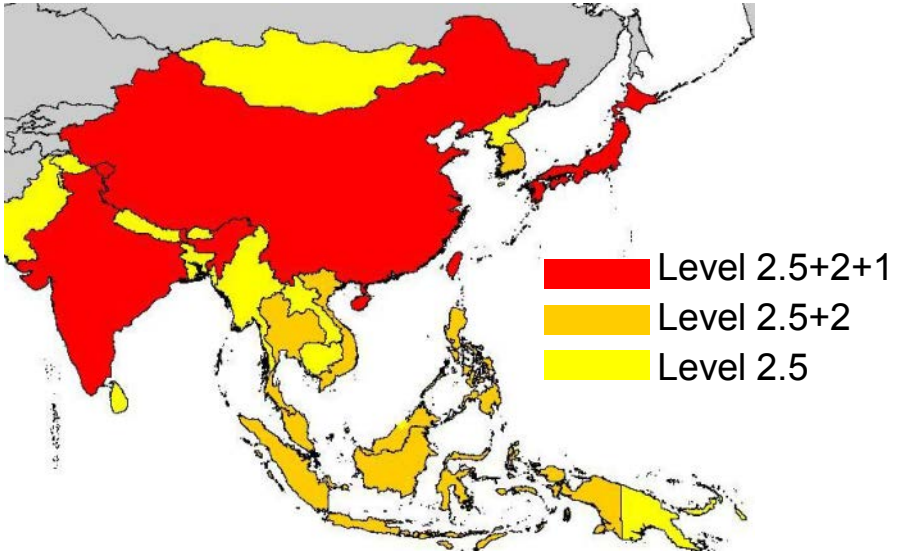
5. Coupling the three scales and the two approaches

Style	Scale/level	Spatial resolution	Time horizon	Contents	Tools
Pan Asian-Pacific approach	Level 1	JPN, CHN, IND, ASA, USA, EU, CANZ, RUS, LAM,AFR, MID	～2100	Analyse dynamicaly optimized economic growth and emission paths	*AIM/Impact[Policy]*
	Level 2	World 35 regions	～2100	Global LCS scenario making , especially on energy demand /supply, economic and trade changes	*AIM/CGE[Global]* *AIM/enduse[Global]*
		Asia 15 regions	1950～2050	National LCS scenarios and roadmap developments	*AIM/CGE[Country]* *AIM/enduse[Country]* *Element models* *BCM (Backcast model for dynamicaly optimized mitigation policies)*
	Level 2.5	Asia 28 regions	～2030	Disaggregation and localization of LCS and Roadmap designs of level 2, considering regional characteristics and development paths	*ExSS (Extended snapshot model)* *BCT (Backcast tool for managing mitigation policies)*
Region specific study	Country、city, local level (Level 3)	Iskandar, Ahmadabad, Guangzhou, Kyoto, Shiga pref., Hanoi ….	～2030	On-site localized studies collaborated with domestic research institutions. Design of qualitative, quantitative LCS scenarios and their roadmaps.	*Element models* *AIM/enduse[local]* *ExSS (Extended snapshot model)* *BCT (Backcast tool for managing mitigation policies)*

5.2. Regionalization for Pan Asian-Pacific approach

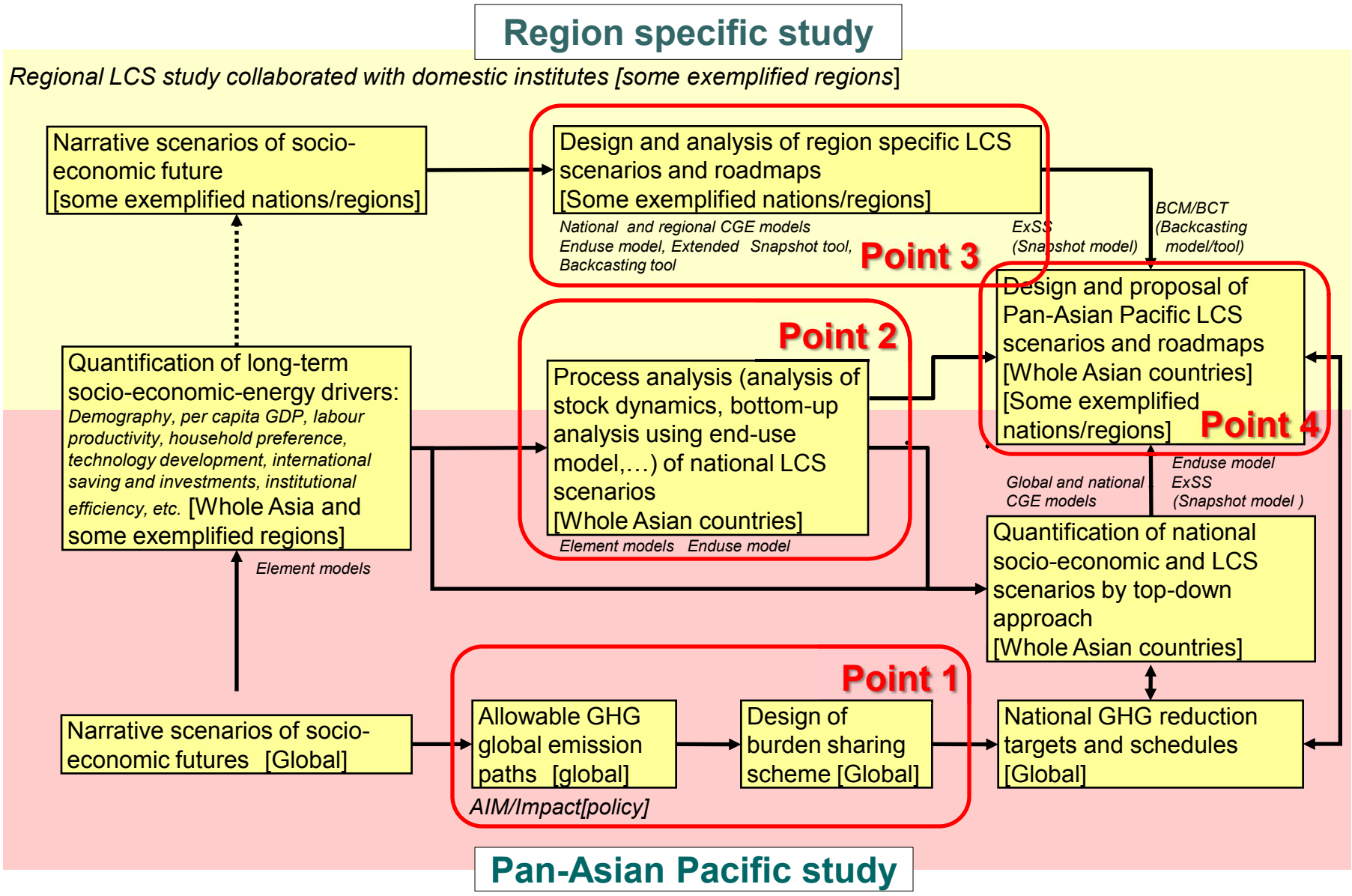
Country/Region	Level 2.5 (28 regions)	Level2 (15 regions)	Level 1 (4 regions)
Japan	JPN	JPN	JPN
China	CHN	CHN	CHN
Taiwan	TWN	TWN	
India	IND	IND	IND
Indonesia	IDN	IDN	ASIA
Malaysia	MYS	MYS	
Philippines	PHL	PHL	
Korea, Republic of	KOR	KOR	
Singapore	SGP	SGP	
Thailand	THA	THA	
Viet Nam	VNM	VNM	
Korea, DPR	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	XOC	
Papua New Guinea	PNG		
Marshall Islands	MCR		
Micronesia			
Palau			
Kiribati	XOC		
Nauru			
Samoa			
Solomon Islands			
Tonga			
Tuvalu			
Vanuatu			

- East, South, Southeast Asia, Melanesia, Micronesia, and Polynesia, Based on major international statistics.
- Four regions in level 1, *i.e.* China, India, Japan and Rest of Asia
- Fifteen regions in level 2. Aggregation of small countries less than one million population and so on.
- 28 regions in level 2.5. Aggregation of small island states in Oceania region



5.3. Flow diagram of the study

How these approaches are integrated towards Asian LCS study?



6. Modeling

Development, maintenance and application of multi-layered modeling system

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Two groups of models and tools have been and are being developed.

(1) Quantification tools encompassing various spatial scales and disciplines, operated complementary, such as global, country, and local (city) scales, energy, economical, demographical, industrial, building, transportation systems, etc.
i.e. Element models, AIM/impact, …..

(2) Integration tools which link the above models to low carbon society visions and roadmaps.
i.e. AIM/CGE, AIM/enduse, ExSS (Extended snapshot model), BCM (Backcasting model), ……

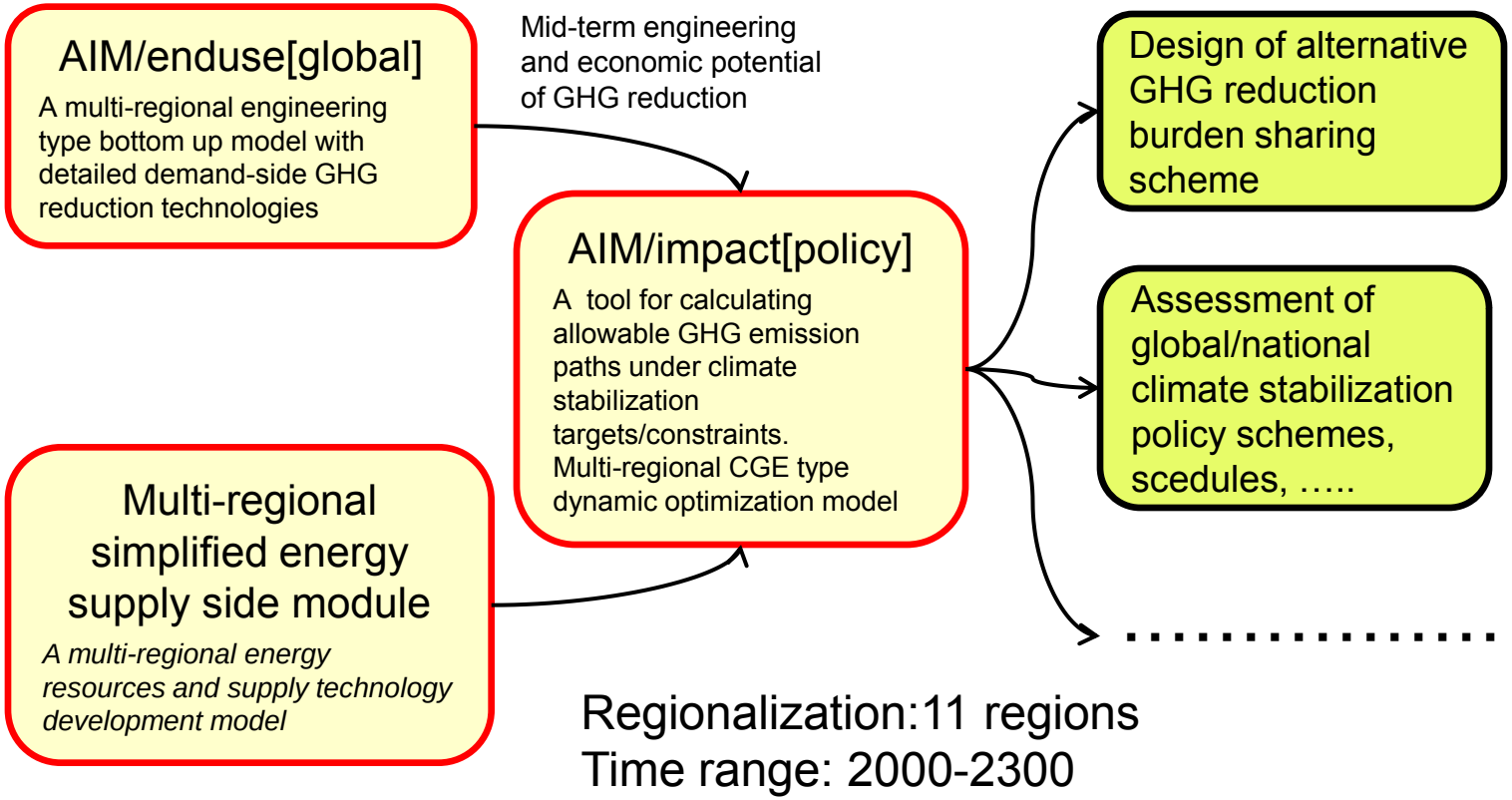
6.2. Element models

- ***Macro-economy model (EME):*** Supply-side type mid-term econometric model
- ***Population/Household dynamics model (PHM):*** to describe each country's demographic dynamics
- ***House and building dynamics model (BDM):*** to describe transition and renovation dynamics towards modern and highly insulated buildings.
- ***Traffic demand model (TDM):*** to describe passenger and freight transports coupled with economic activity and urban structure
- ***Material stocks and flow model (MSFM):*** to describe material metabolism towards low material societies
- ***Energy supply model (ESM):*** to describe scenarios of biomass production, power infrastructure development
- ***Household production and lifestyle model (HPLM):*** to describe the transition of household consumption, lifestyle etc.
- ***AIM/enduse[air]:*** an atmospheric environment model to estimate co-benefits caused by low carbon policies.

6.3. Integration tools

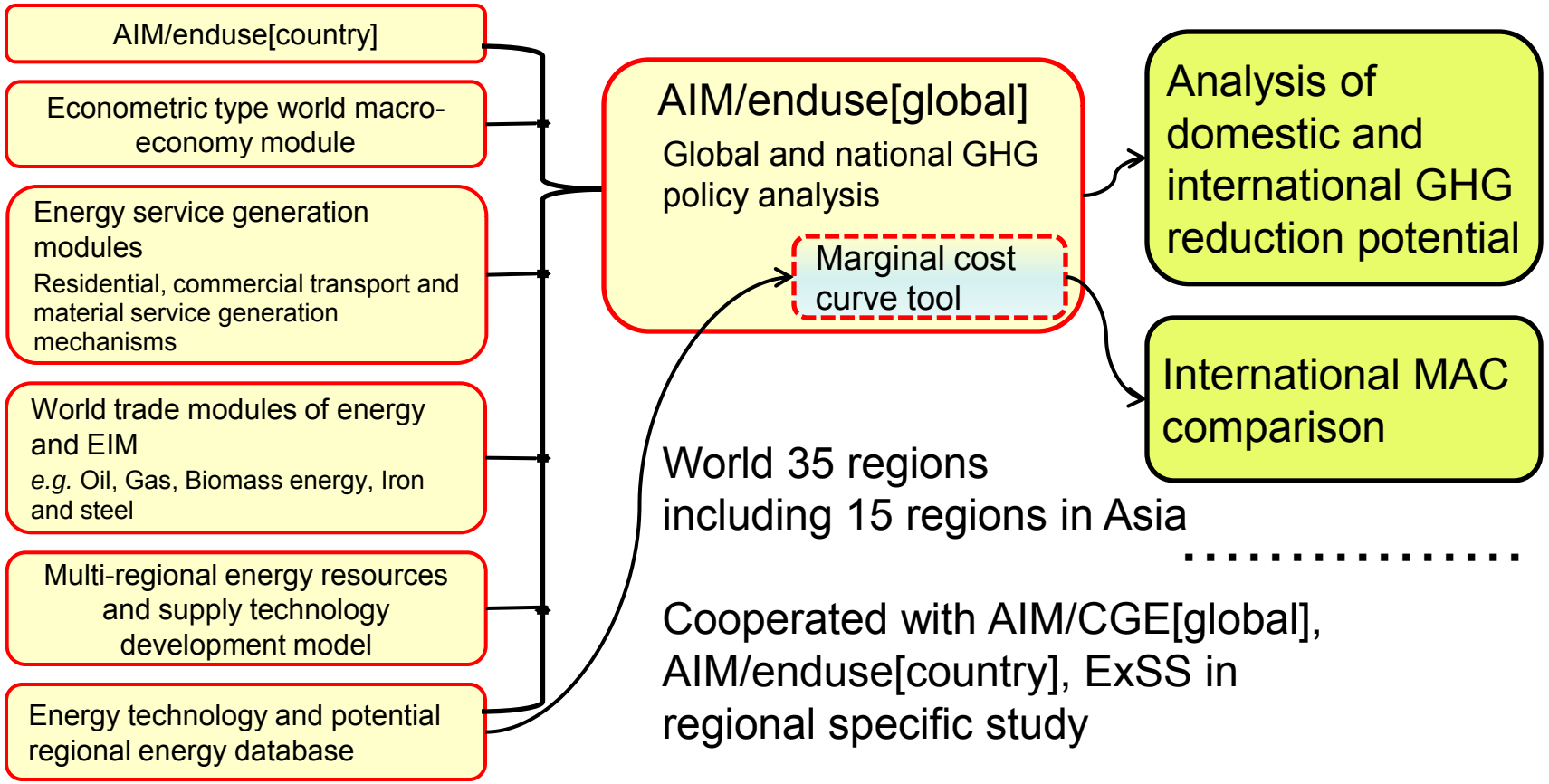
- ***AIM/CGE:*** One/multi-regional CGE model. Integration platform with which element models are soft-linked according to analytical objects. Global and National scales.
- ***AIM/enduse:*** One/multi-regional multi-sectoral bottom-up type energy enduse model. Integration platform of energy service's generation processes, energy technology development, and LCS policies. Global, national, and local scales.
- ***Extended snapshot tool (ExSS):*** A tool for integrating future economic, industrial, social and energy policies, using social accounting matrices, trade matrices, energy balance tables, energy technologies/regional energy resources information. One/multi-regional accounting type tool Multi-regional static model.
- ***Back-casting model /Tool (BCM/BCT):*** A model for designing roadmaps towards low carbon societies. Dynamic optimization model.

Point 1: Coupling of allowable GHG global emission paths with details of reduction technologies



Regionalization:11 regions
Time range: 2000-2300

Point 2: Extension/reinforcement of AIM/enduse for Global/Asian LCS scenario study

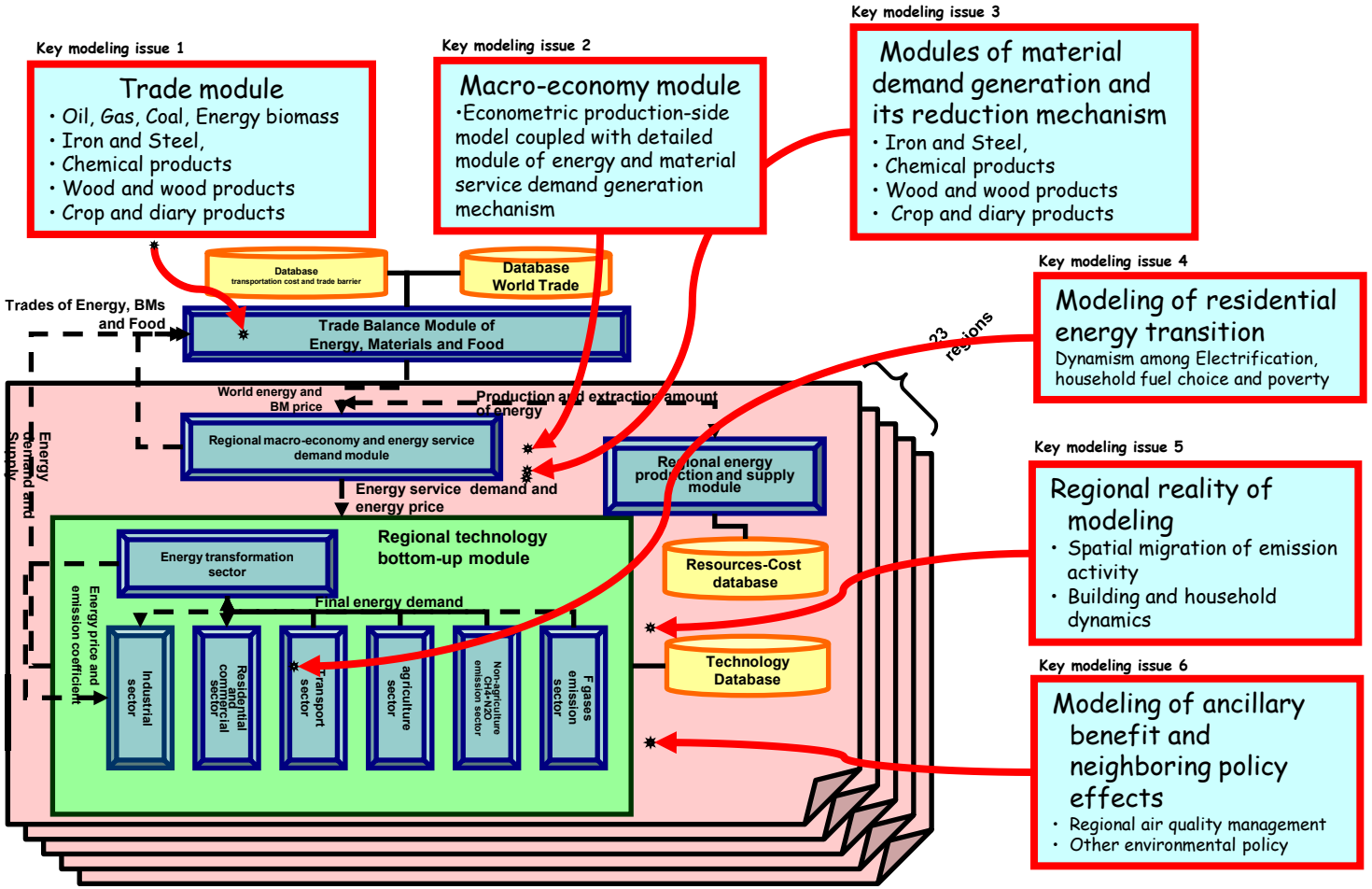


6.4 Focusing points

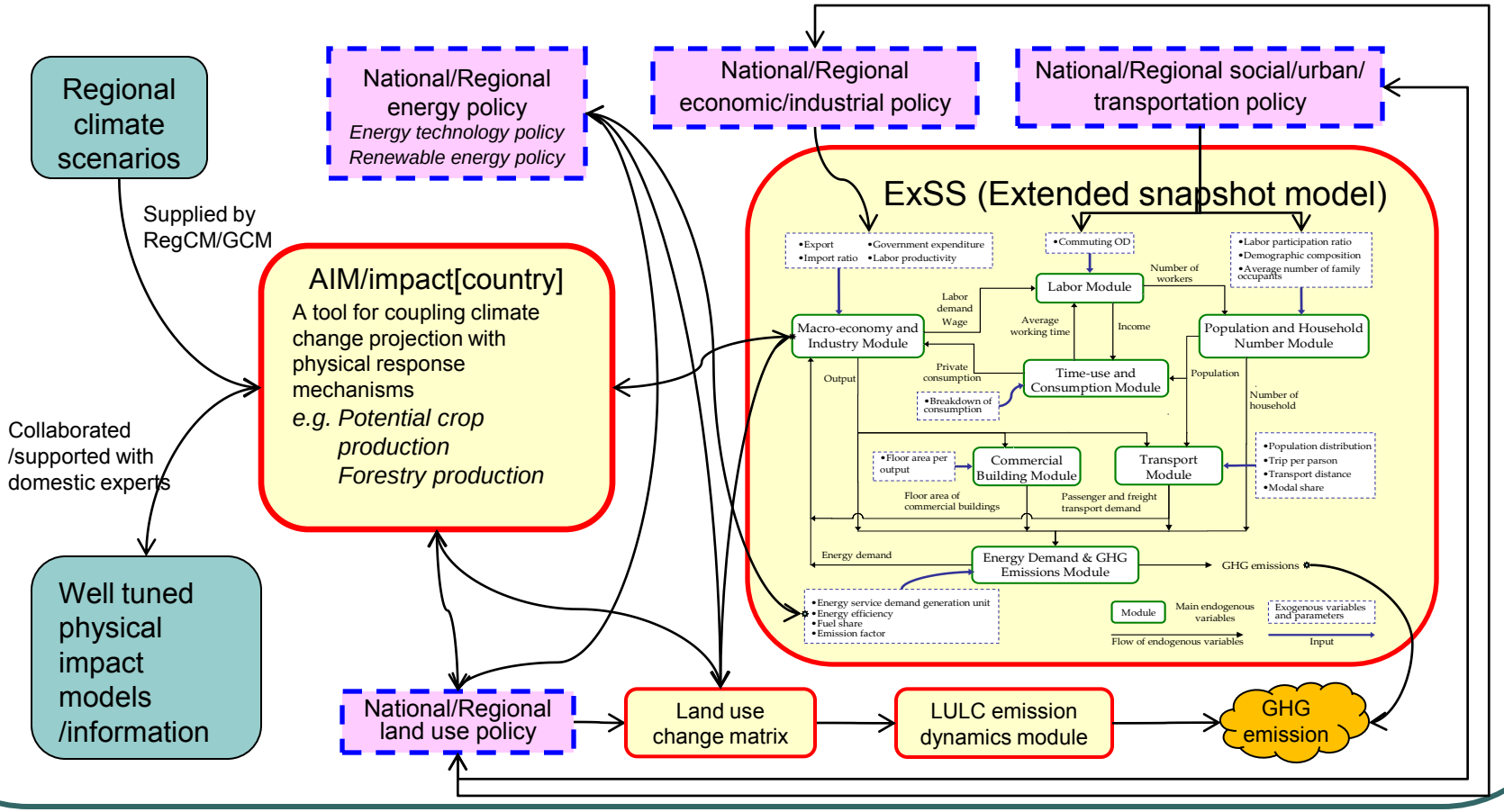
Frame of AIM/enduse[Global] (from 2004 AIM workshop)

I have to admit, this Point 2 was what we have finished several years ago.

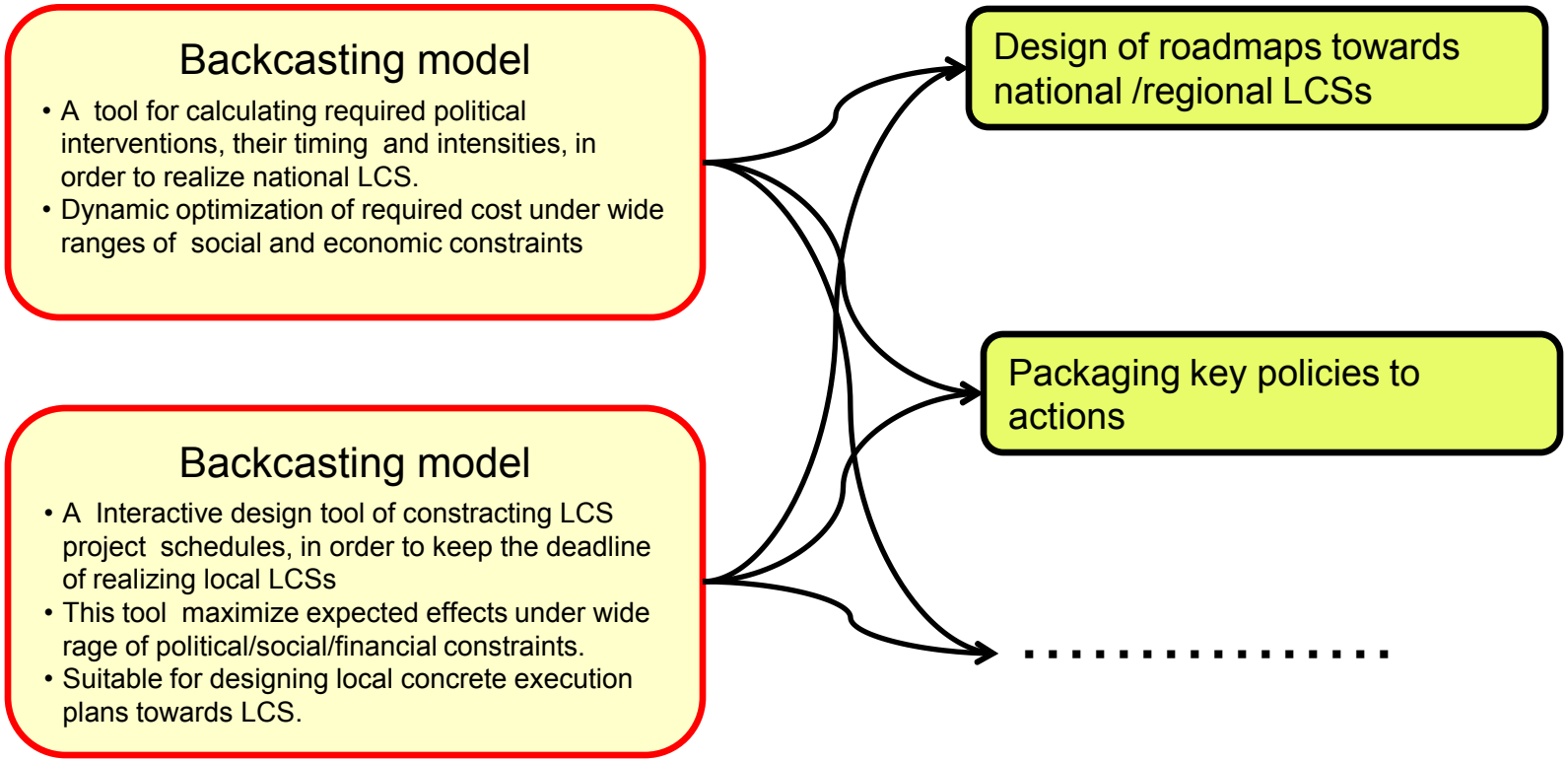
We must catch up on the delay as soon as possible, not to loose the timing



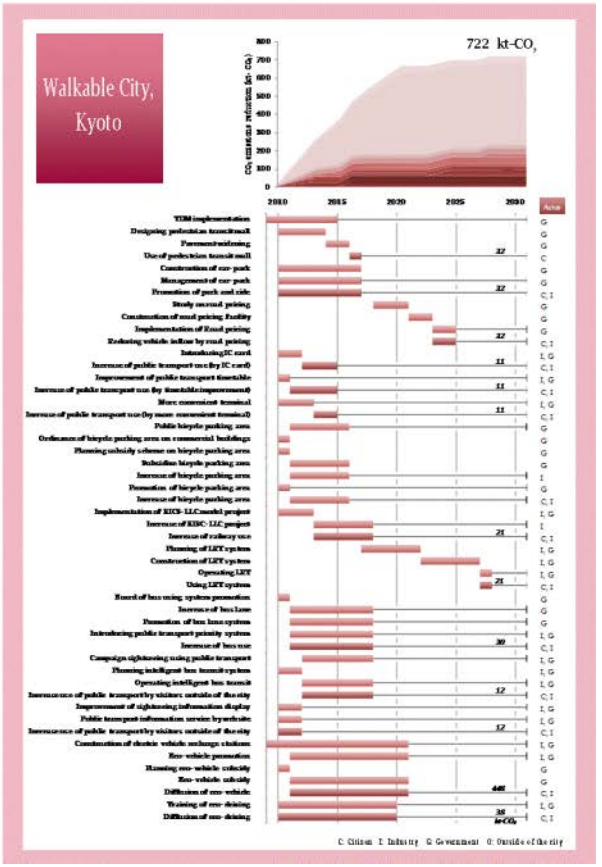
Point 3: Coupling of Extended Snapshot Tool (ExSS) with other important mechanisms relating with LCS, such as land use dynamics, climate impacts/adptation, etc.



Point 4: Establish designing methodology of LCS roadmaps; Back-Casting approach



Example of concrete execution plan towards Local LCS
- Roadmap towards Low Carbon Kyoto study -



Example of Packaging key policies to actions - Roadmap towards Low Carbon Kyoto study -

Action 1 Walkable City, Kyoto

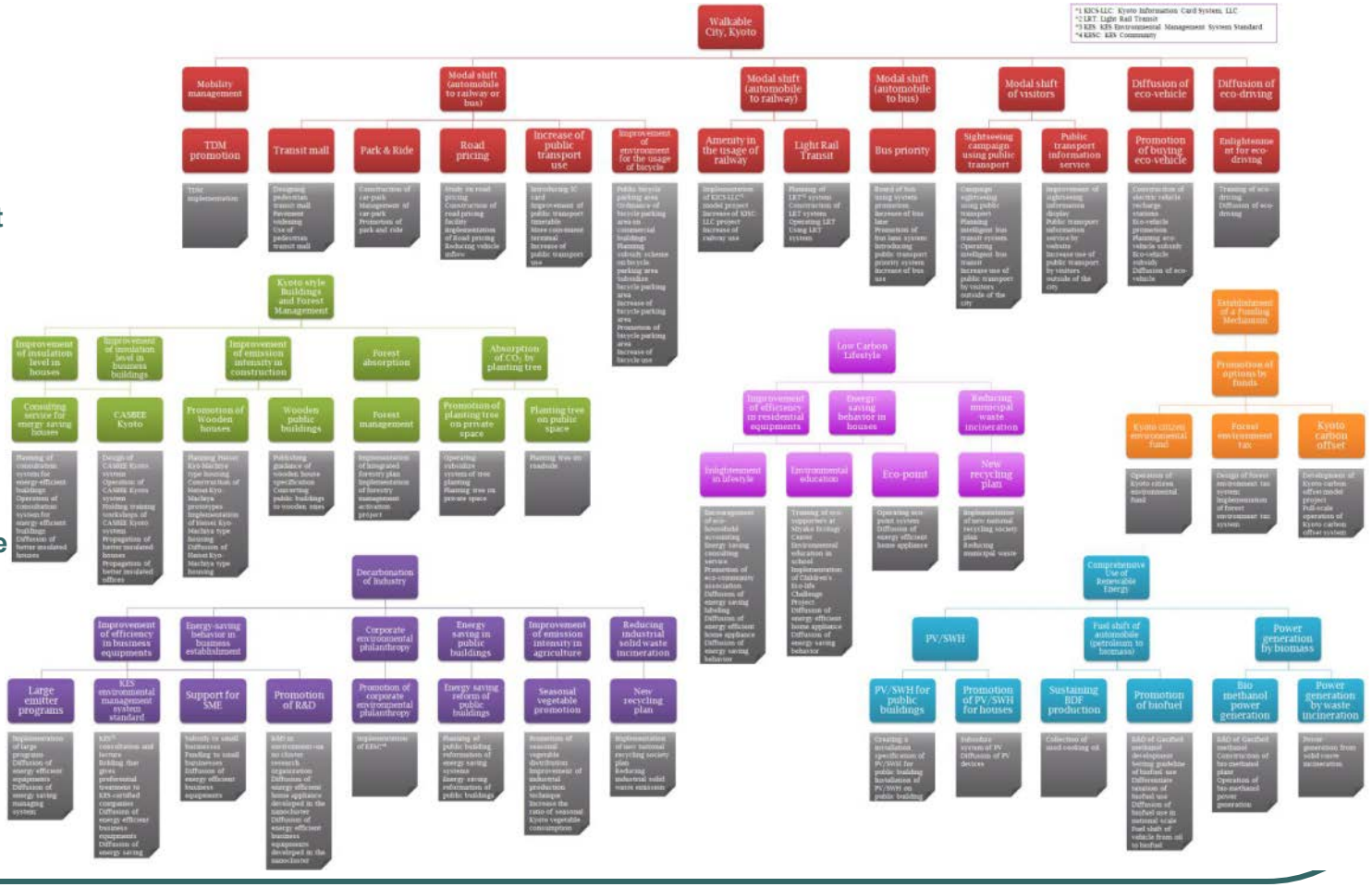
Action 2 Kyoto-style Buildings and Forest Management

Action 3 Low Carbon Lifestyle

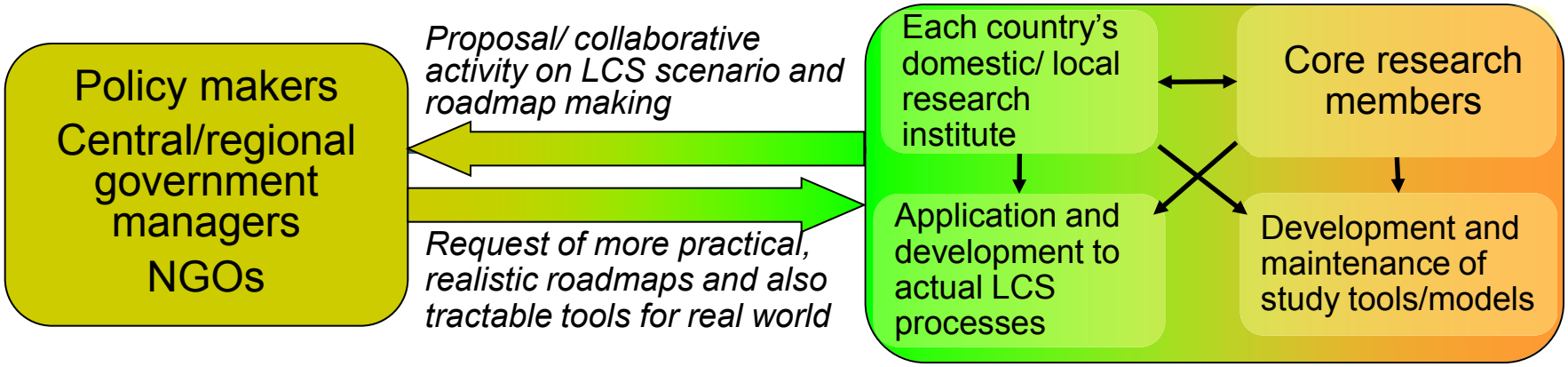
Action 4 Decarbonation of Industry

Action 5 Comprehensive Use of Renewable Energy

Action 6 Establishment of a Funding Mechanism



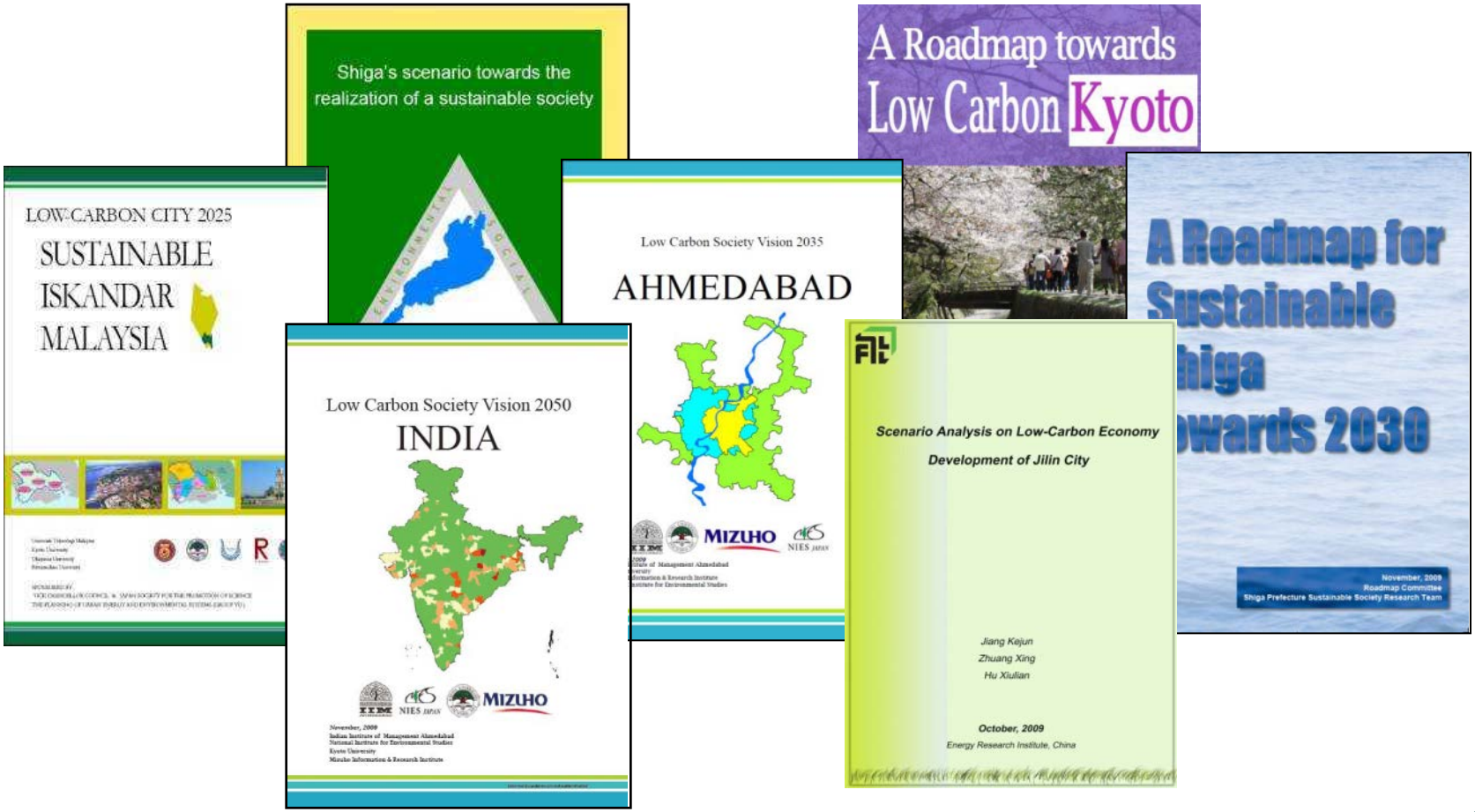
7. Region specific studies now we are going on



Region	Country	Domestic counterpart institutions	Stage
Japan	Japan	NIES, Kyoto Univ. and 23 institutions in Japan	Preliminary stage finished and implementing to policy making stage
Iskandar development region	Malaysia	University Technology Malaysia, Iskandar Regional Development Authority, Federal Department of Town and Country Planning Malaysia, Malaysia Energy Centre	Preliminary stage finished
India	India	Indian Institute of Management, Ahmedabad	Preliminary stage finished
Ahmedabad city	India	Indian Institute of Management, Ahmedabad	Preliminary stage finished
Guangzhou city	China	Guangzhou Institute of Energy Conversion, CAS	Just started
Shiga prefecture	Japan	Lake Biwa Environmental Research Institute	Implementation stage
Kyoto city	Japan	Kyoto city government	Preliminary stage finished
Kyoto prefecture	Japan	Kyoto prefectural government	Just started

7. Region specific studies now we started collaborated with Asian colleagues

Communication and feedbacks of LCS study to real world



8. Final remarks

AIM model family introduced in 2008 AIM/WS is not still obsolete.

We will continue enforcing the AIM model family and intensify internal collaborations among them.

Especially, we must devote urgent and most efforts to the red parts …… in order not being left behind ……

From 2008 AIM/Workshop AIM model family

Category	Name	Category	Objective	Model type
Top-down models	Ecosystem	Conservation of ecosystem/ water stress/ landuse/ pollution in developing countries	Modeling of relationship among economic activities, land use and ecosystem	Multi-regional CGE + various environmental process models
	Global/CGE	Energy, GHG Control	Projection of long-term GHGs emission	Multi-regional CGE model
	Material	CO2 reduction, energy consumption, waste management. environmental industry	Economic and material flow impact by climate and other environmental policy	One regional national CGE model
	Econometric	Forecasting macro-economic frame	Quantification and analysis of macroeconomic and energy variables	Country-level econometric model
	Backcasting	GHG, Energy, Low carbon society	Establishing scenarios toward saustainable society from view points of environment and economy	Country-level dynamic optimization model
Models /Tools for scenario making	Population/Household	Population, household	Establishing scenarios toward saustainable society from view points of environment and economy	Cohort-component model, houshold transition matrix model
	Building	Residential, non-residential building	Estimation of building demands related to houshold change, economic change and so on	Stock dynamics model
	Transport	Passenger and Freight transport demand	Estimation of transport demand related to national/regional/urban land planning	Trip generation, modal share modeling
	Stocks	Infrastracture, capital, buildings	Estimation of raw material needs, waste generation related to recycling and economic activity	Stock dynamics model
	Extended Snapshot	Integrating tool of element models	Comprehension of economic activity and environmental loadings with Social Accounting Matrix and energy balancing approach	Accounting tool
End-use, Energy, Technology Bottom-up	Energy supply and demand regulation	Temporal and spatial regulation of electlicity, heat and hydrogen	Adjustment among temporal and spatial fluctuation of energy demand and supply	Simulation and optimization type model
	Enduse[global]	GHG,SO2,NOX,PM abatement technology	Technology selection for global warming, regional air pollution	Country-level or regional-level bottom-up model
	Enduse[country]	GHG,SO_2,NO_X,PM abatement technology	Technology selection for global warming, regional air pollution	Country-level or regional-level bottom-up model
	Enduse[local]	GHG,SO_2,NO_X,PM abatement technology	Technology selection for global warming, regional air pollution	Country-level or regional-level bottom-up model
Impact Assessment	Impact	Impact assessment of climate change	Impact assessment at global scale	Process model based on raster GIS data
	Impact[Country]	Impact assessment of climate change	Impact assessment at country scale	Process model based on raster GIS data
	Impact[policy]	Integration of mitigation policy evaluation and impact assessment	Investigation of stabilization level and mitigation policy with considering consequent impacts	Calculating global GHGs paths