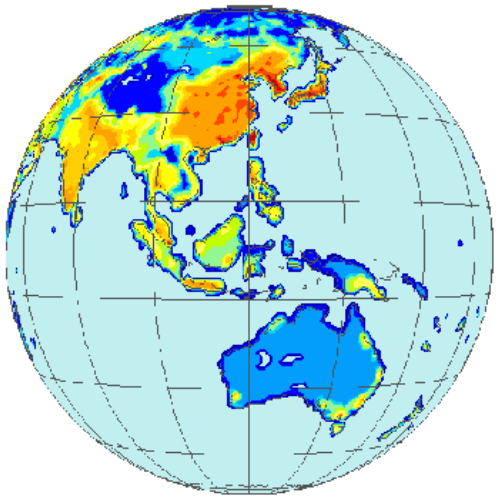
Models developed by Asia LCS project and scenarios



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Coupling the three scales and the two approaches

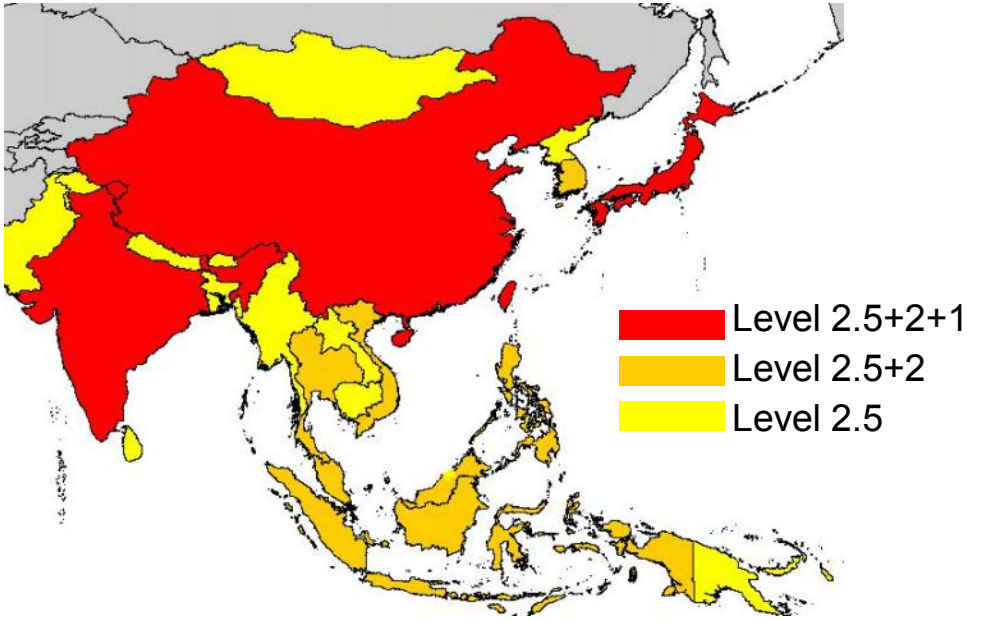
Style	Scale/ level	Spatial resolution	Time horizon	Contents	Tools
Pan Asian-Pacific approach	Level 1	JPN, CHN, IND, ASA, USA, EU, CANZ, RUS, LAM,AFR, MID	～2100	Analyse dynamicaly optimized economic growth and emission paths	*AIM/Impact[Policy]*
	Level 2	World 35 regions	～2100	Global LCS scenario making , 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)*

source: Matsuoka (2010)

Regionalization for Pan Asian-Pacific approach

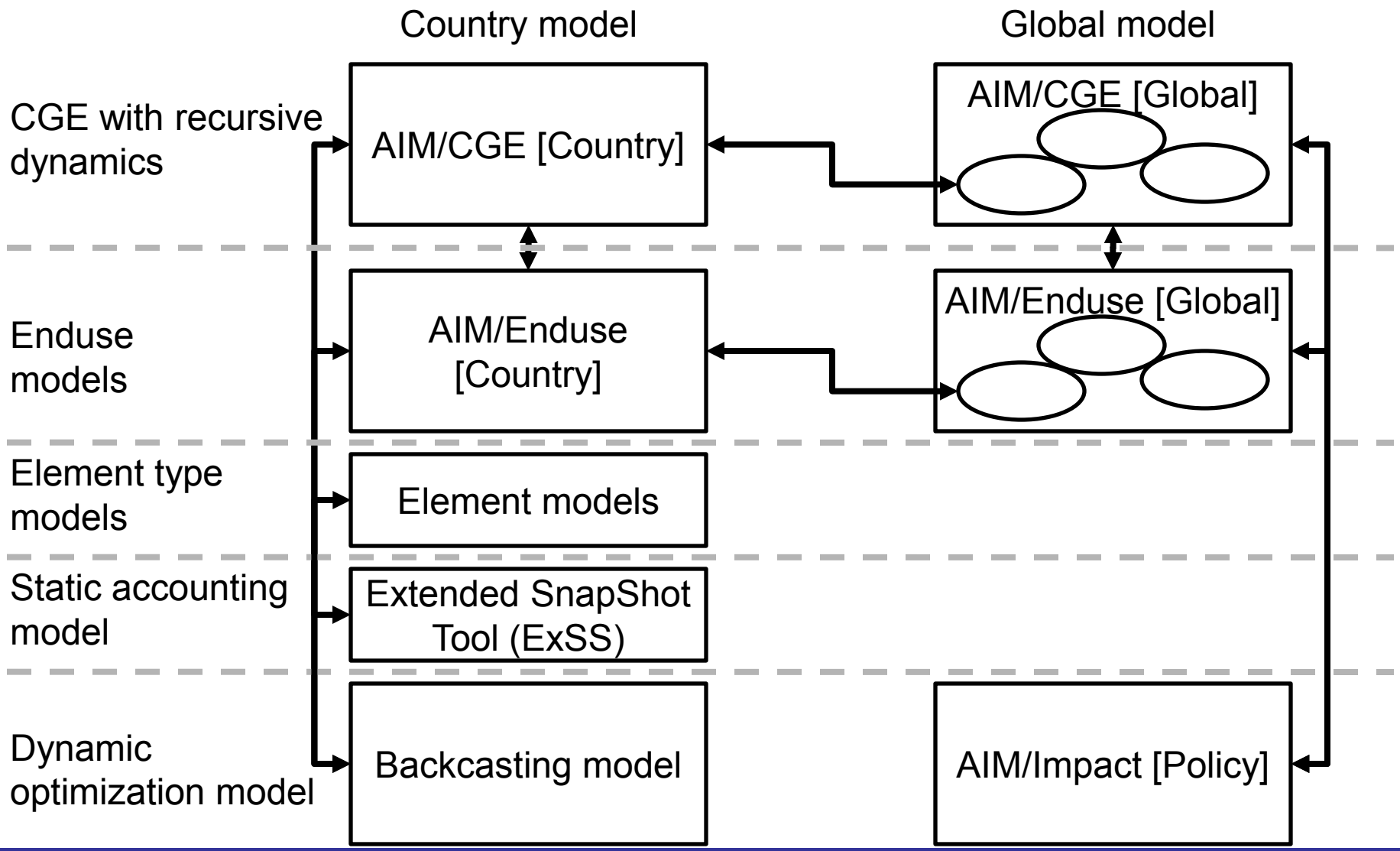
Country/Region	Level 2.5 (28 regions)	Level2 (15 regions)	Level 1 (4 regions)
Japan	JPN	JPN	JPN
China	CHN	CHN	CHN
Taiwan	TWN	TWN	
India	IND	IND	IND
Indonesia	IDN	IDN	ASIA
Malaysia	MYS	MYS	
Philippines	PHL	PHL	
Korea, Republic of	KOR	KOR	
Singapore	SGP	SGP	
Thailand	THA	THA	
Viet Nam	VNM	VNM	
Korea, DPR	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



source: Matsuoka (2010)

Models for LCS study



Modeling of LCS

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), ……

source: Matsuoka (2010)

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.

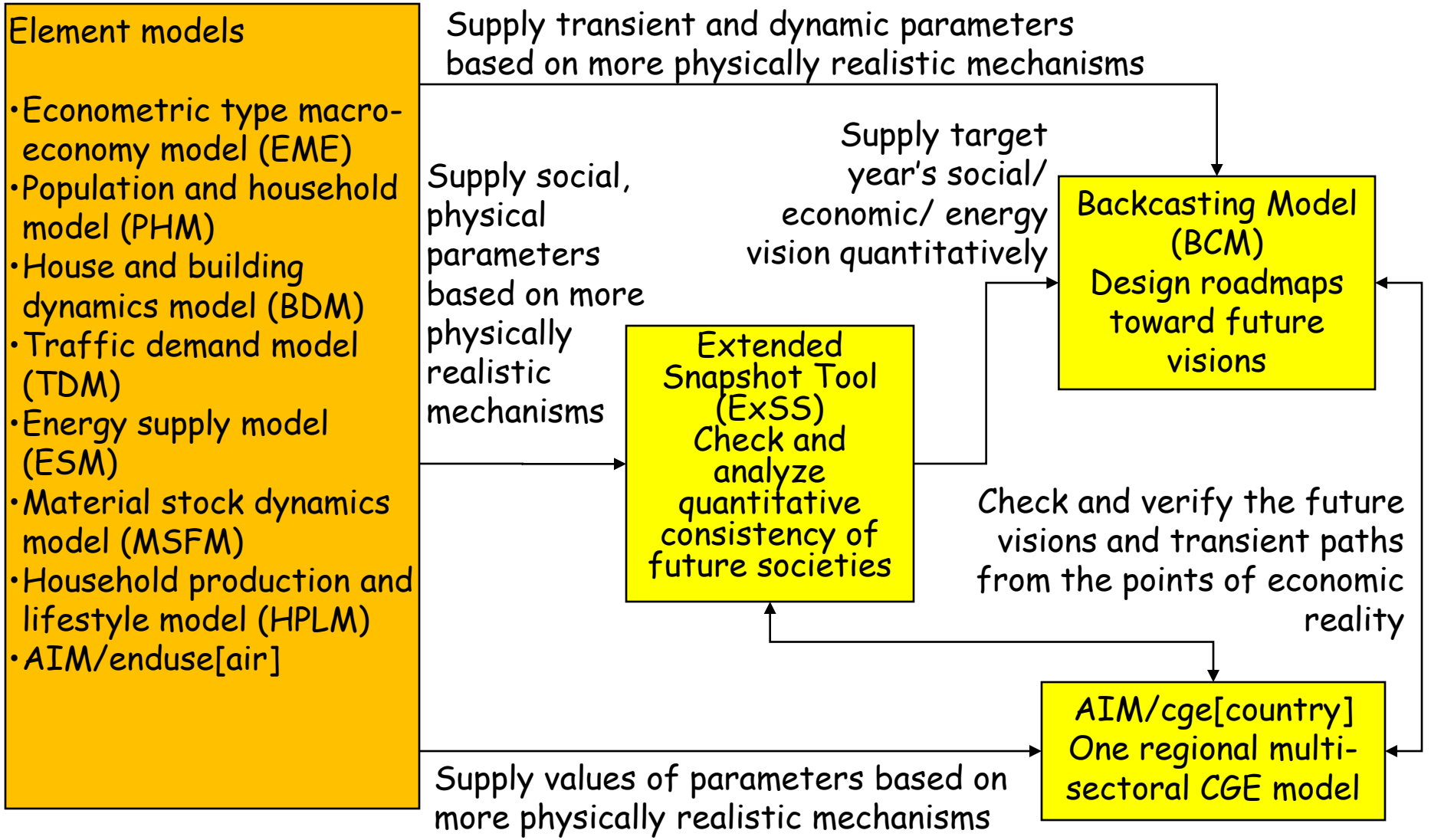
source: Matsuoka (2010)

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.

source: Matsuoka (2010)

How to integrate various models with consistency



source: Matsuoka (2009)

Global CGE vs Country CGE

- Purpose
  - Country model: Quantification of National LCS
  - Global model: Quantification of Global/National LCS
    - Asian countries are components of Global model.
    - Asian countries in Global model should be consistent with Country model, but actually these models will be operated in parallel.
- GHG emission target
  - Country model: following each national target

    e.g. China: 40-45% reduction of carbon intensity by 2020 as compared to 2005 levels
  - Global model: following common burden sharing schemes

    e.g. emission per capita
- Classification of Sector/Commodity
  - Country model: following each team's interests
  - Global model: following common definition

Global CGE model

- Base model: AIM/CGE [Global]
- Linkage to AIM/CGE [Country] and AIM/Enduse [Global]
- Following parts will be updated
  - Classification of region: 24 -> 35 regions

    15 countries of Level 2 will be treated independently.
  - Classification of sector:

    Key materials such as steel and cement will be treated.
- Scenarios: Asian future perspectives will be introduced.
  - Policy
  - Resource (human resource, potential economic growth, ...)
  - Efficiency

Present AIM/CGE [Global]

- Base data: GTAP6 (Benchmark year: 2001)
- Recursive dynamics up to 2100 (2001, 2005, 2010, 2020, ..)
- Production factors: capital, labor, land, resource
  - New capital and old (existing) capital are distinguished
    - Old (existing) capital stocks are immobile among sectors.
    - New capital is installed to maximize profit.
- Emissions: CO2, CH4, N2O, SO2, NOx, CO, NMVOC, BC, OC, NH3, HFCs, PFCs, CFCs, SF6

Present AIM/CGE [Global]

Region

Japan	USA
China	EU-15 in Western Europe
Korea	EU-10 in Eastern Europe
Indonesia	Russia
India	Rest of Europe
Thailand	Brazil
Other South-east Asia	Mexico
Other South Asia	Argentine
Australia	Other Latin America
New Zealand	Middle East
Rest of Asia-Pacific	South Africa
Canada	Other Africa

Present AIM/CGE [Global]

Sectors/Commodity

agriculture	construction
livestock	transport
forestry	communication
fishing	public service
mining (except fossil fuels)	other service
energy intensive products	coal
metal and machinery	crude oil
foods	petroleum products
other manufactures	gas
water	gas manufacture distribution
	electricity

Power plant

coal fire	waste
oil fire	geothermal
gas fire	solar
nuclear	wind
hydro	other
biomass	

Requests!

- Global/Country CGE model is a platform when we discuss Low Carbon Scenario/Vision at global level and national level.

- Any comments and suggestions on CGE model (both global model and country model) are welcome in order to sophisticate models and scenarios.