IAM COMPACT

Expanding Integrated Assessment Modelling:
Comprehensive and Comprehensible Science
for Sustainable, Co-Created Climate Action

IAM COMPACT Modelling Seminars

Model Presentation: IMACLIM-China & China-MORE

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The IAM COMPACT project has received funding from the European Union's Horizon Europe Research and Innovation Programme under grant agreement No 101056306.

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Top-Down (TD) model: IMACLIM-China:

- General equilibrium, input-out relationship representing
- Substitution based on elasticity. May not achievable in actual word
- non-CO_2 GHG emissions are characterised based on values of sectors: low accuracy.

Bottom-Up (BU) model: China-MORE:

- Technology-rich, high reliability of technical substitution
- Exogenous demand, lack reflecting the socio-economic structure.
- Partial equilibrium, ignoring the rebound effect, ignoring influence between sectors.

Linking IMACLIM-China model and China-MORE model

- Combining the advantages of TD model and BU model.

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IMACLIM-China model

- A global dynamic recursive CGE model based on the MPSGE language in GAMS.
- Based on energy balance sheet and input-output table data, China's economy is divided into 18 sectors.

Code	Energy Sectors	Code	Non-Energy Sectors
COA	Coal mining and cleaning	AGR	Agriculture, forestry and fishery
OIL	Oil mining	MIN	Mining industry
GAS	Natural gas extraction and gas transmission	FOOD	Food, beverage, and tobacco processing
REF	Petroleum refining	CHM	Chemical industry
COKE	Coking	STE	Iron and steel
ELE	Electricity and heat supply	NFM	Non-ferrous metals
		NMM	Non-metal
		EQUT	Equipment manufacturing
		OTHIND	Other industries
		CON	Construction
		SERV	Service industry
		TRAN	Transportation

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Hybrid dataset

- We build the hybrid energy/economy dataset based on China's input-output table 2015, energy balance table 2015, and market price investigation.

1) aggregate the IO table to 18 sectors.

2) aggregate the energy balance table to 18 sectors.

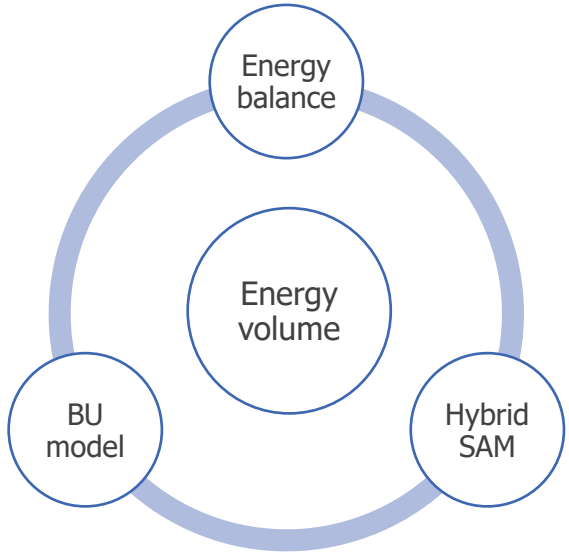
3) get the original price matrix through dividing the value matrix by the volume matrix.

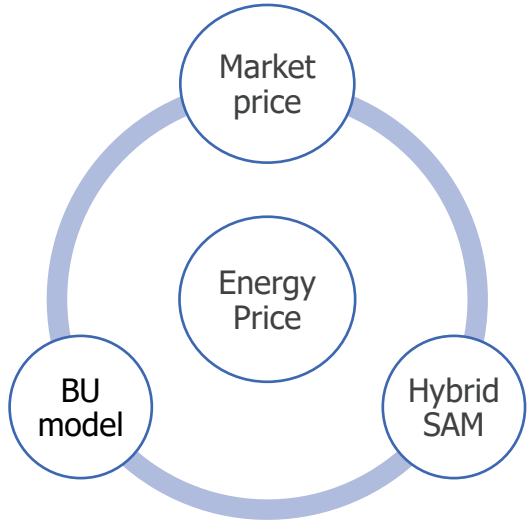
4) adjusting the original price matrix with the market price information.

5) get a new energy value matrix using the adjusted price times the volume.

6) replace the matrix with adjusted energy value matrix and rebalance it.

Adjusting the energy costs and energy volume in BU model, according to the dataset.





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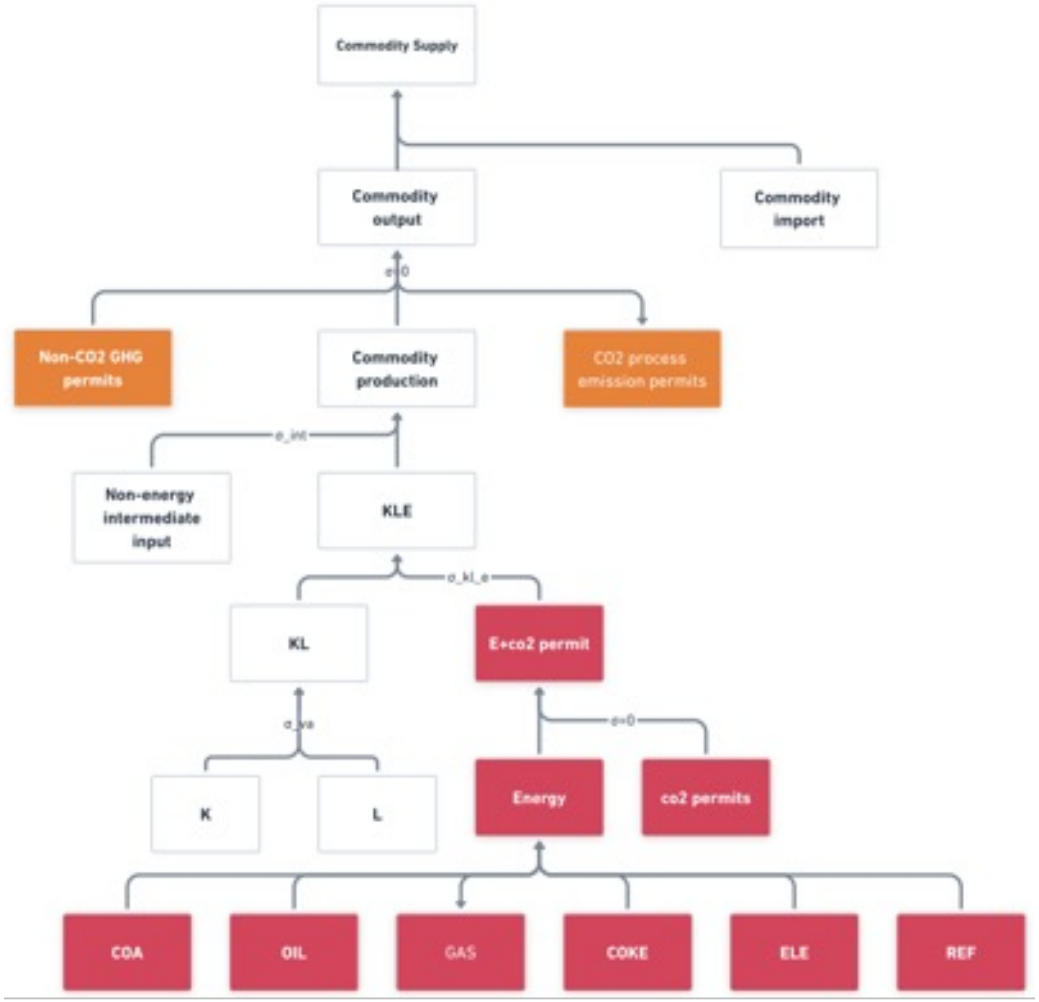
- Non-energy Sectors

- The classical KLE structure is used to construct the production function for the non-energy sector.

- Direct carbon emission rights are tied to energy inputs.

- Industrial process carbon emissions and non-CO_2 GHG emission rights are tied to product outputs.

- Imports and domestic supply are based on the Armington assumption



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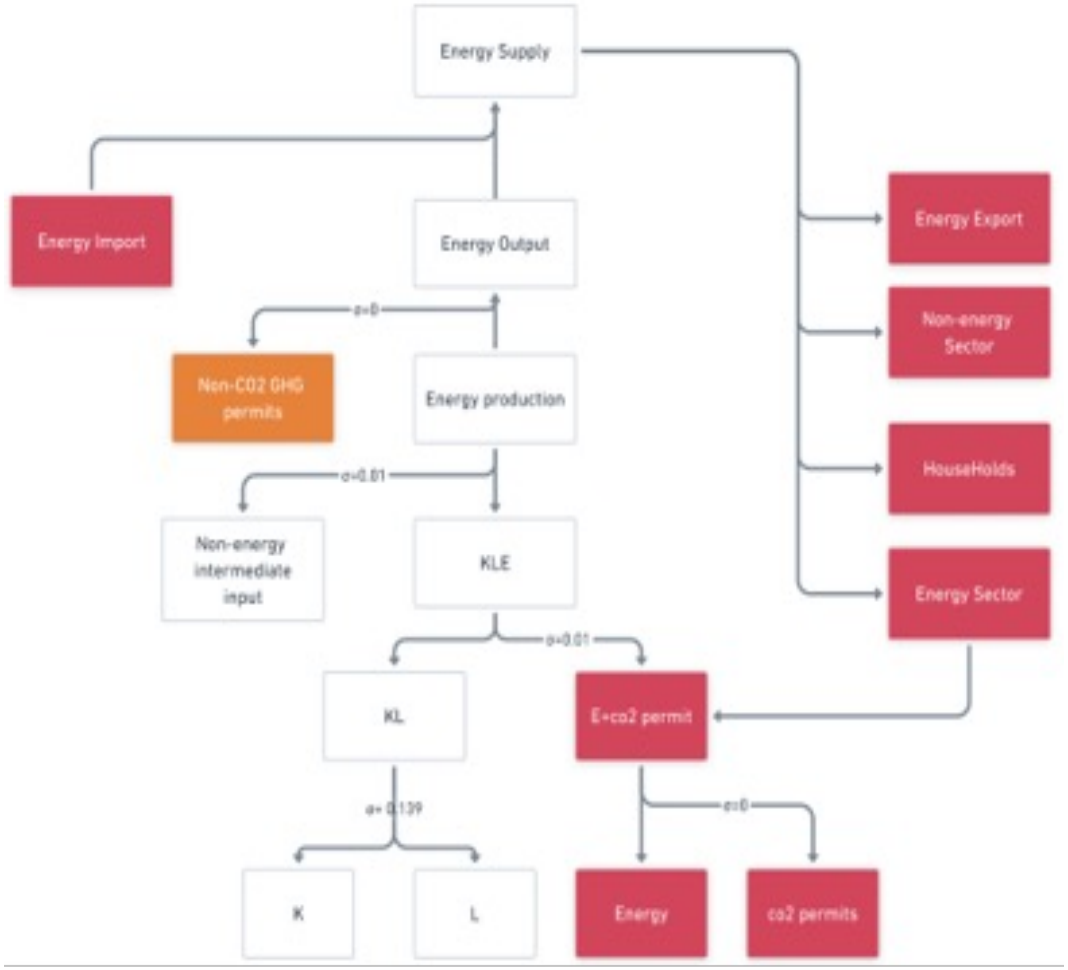
- Energy Sectors

- The production function for the energy sector also uses the KLE structure.

- CO_2 emission rights are tied to energy inputs.

- Non-CO_2 emissions are tied to energy outputs.



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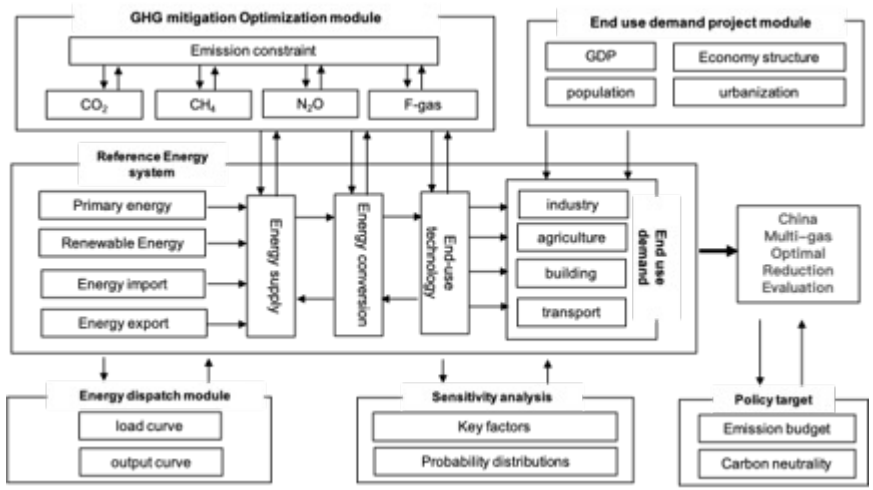
China-MORE model

- Bottom-up China Multi-gas Optimal Reduction Evaluation model Based on TIMES veda 2.0 software.
- CO_2, N_2O, CH_4, F-gases emissions and mitigate technologies are detailly modeled.
- The electricity dispatch module represents the challenges for variable renewable energy deployment.



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- Building sector modeling in the China-MORE model
- Three subsectors are constructed: rural, urban, and public buildings.
- Six major energy service demands such as heating, cooling, cooking, lighting, and hot water appliances are carved under each sub-sector.
- Transportation Sector Modeling
- Map the passenger and freight transportation needs of railroads, roads, waterways and airlines and the related transportation technologies.
- Map the future availability and cost of zero-carbon technologies such as BEVs, PHEVs, FCEVs, hydrogen powered aircraft, hydrogen powered ships, etc.
- Industrial Sector Modeling
- Steel, Non-Ferrous, Non-metallic, Chemical, Food, Paper, Textile, Rubber and plastic, Equipment manufacturing.

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- Power sector modeling in the China-MORE model
- Describe the size, technology type, installed capacity, plant construction time, generation efficiency, utilisation hours, investment cost, fixed cost, and variable cost of coal power units in China in a detailed way.
- Careful portrayal of renewable energy output curve, electricity load curve and energy storage technology.
- Non-CO_2 GHG emissions projection module
- Update the survival curves for air conditioning and commercial refrigeration equipment.
- Update dynamic non-CO_2 emissions factors related to air conditioning, landfill, and refrigeration equipment.
- Expand the CH_4 and N_2O emission reduction technologies based on the latest literature.

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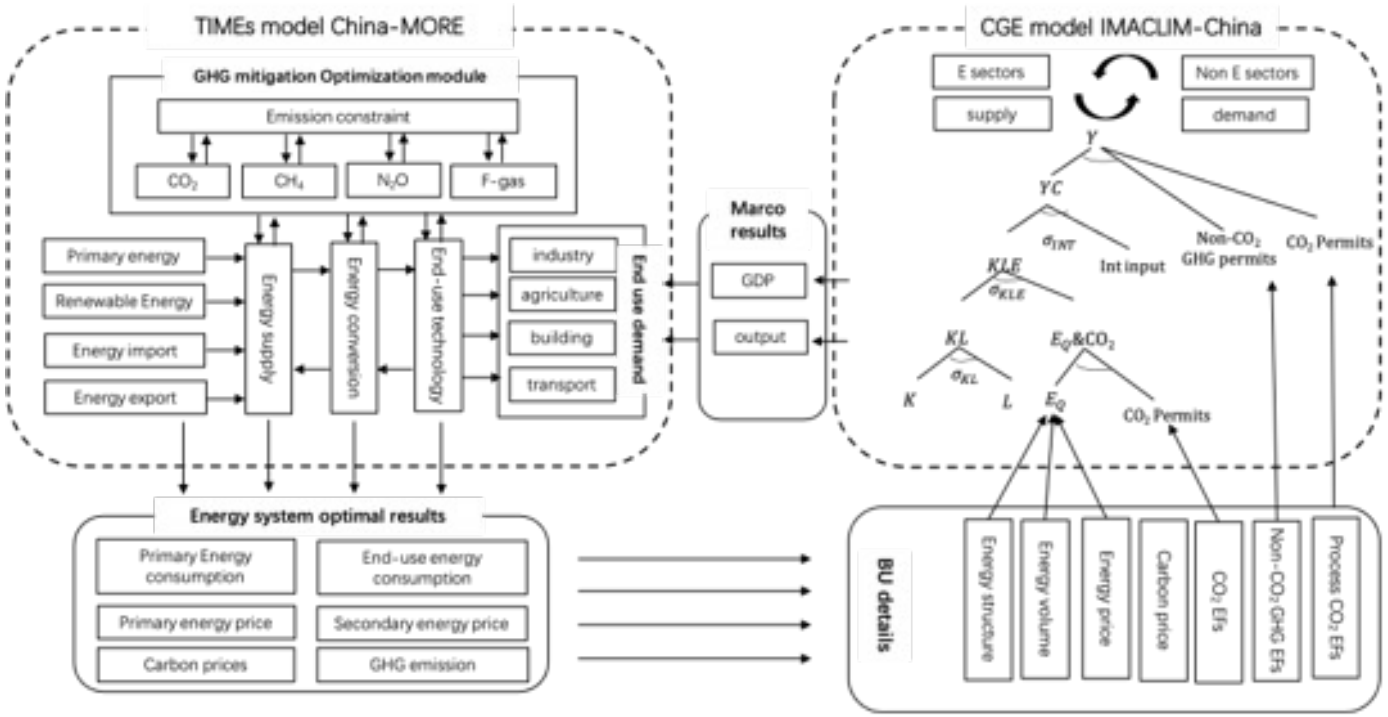
Hard linking IMACLIM-China model and China-MORE model

Model Hard link

- TD to BU: macro results
- BU to TD: energy flows volumes, prices, emission factors, carbon price.



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What the models can do:

- Simulating China's energy and economic transition pathways for specific emissions targets.
- Assessing the economic cost of achieving climate goals.
- Evaluating the impacts of key factors such as renewable energy costs, and negative emissions technologies on the achievement of climate targets.

What the models can not do:

- Global analysis.
- Cost-benefit analysis of climate policies.

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Thank you!

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