Recent MARKAL related modelling activities

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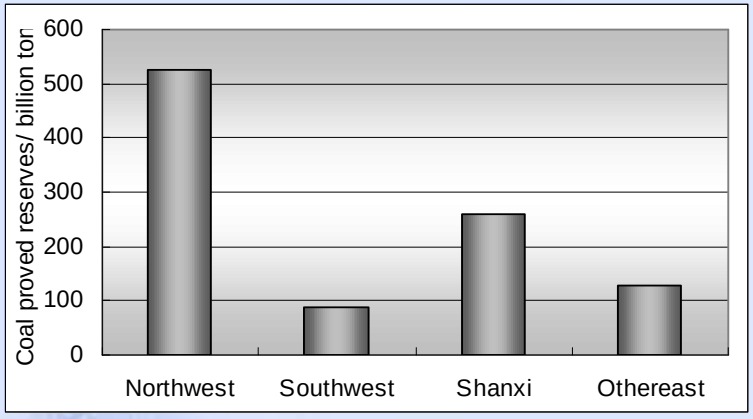
Outline

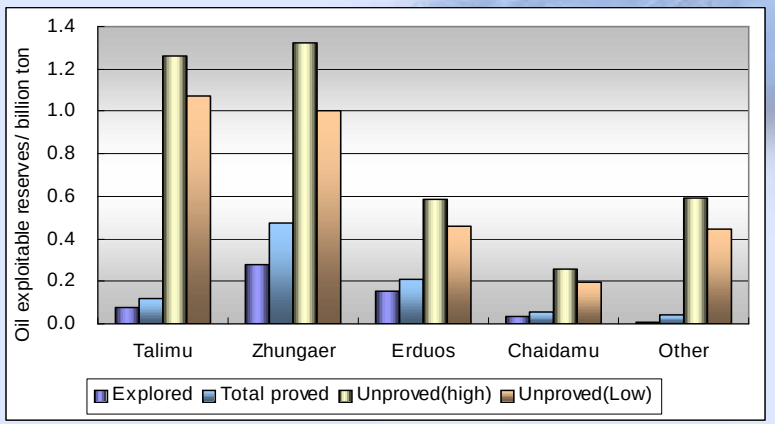
- **Sustainable Energy Development Model for West China (W-SED)**
- **4-region China MARKAL**
- **Beijing MARKAL**
- **China MARKAL**
- **Development of models for climate change mitigation assessment**

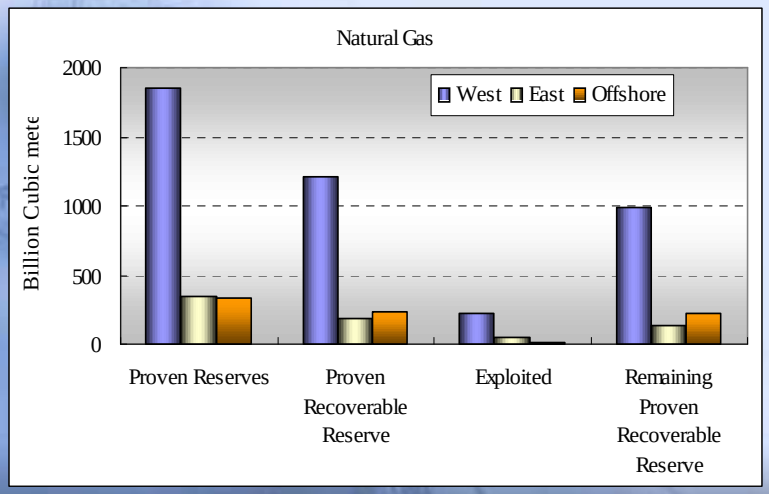
Sustainable Energy Development Model for West China (W-SED)

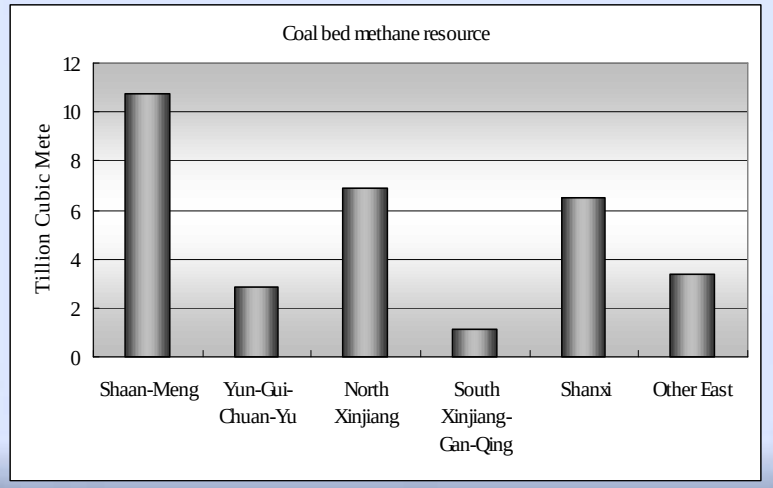
Supported by Nature Science Fund of China

Fossil fuel energy resources in West China

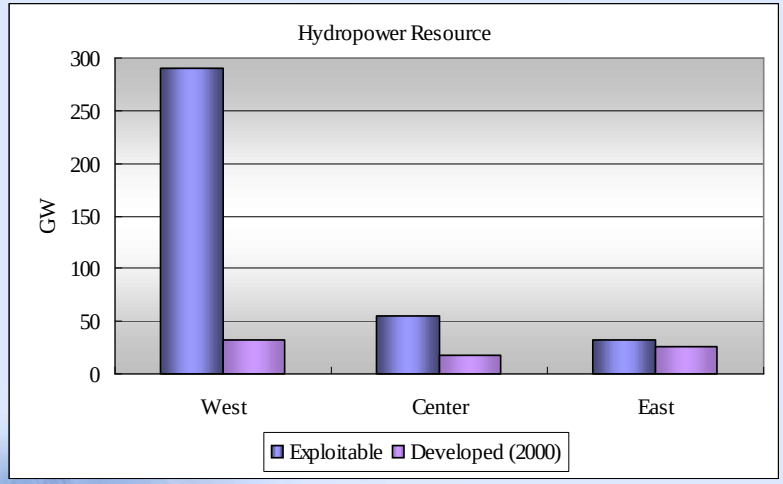


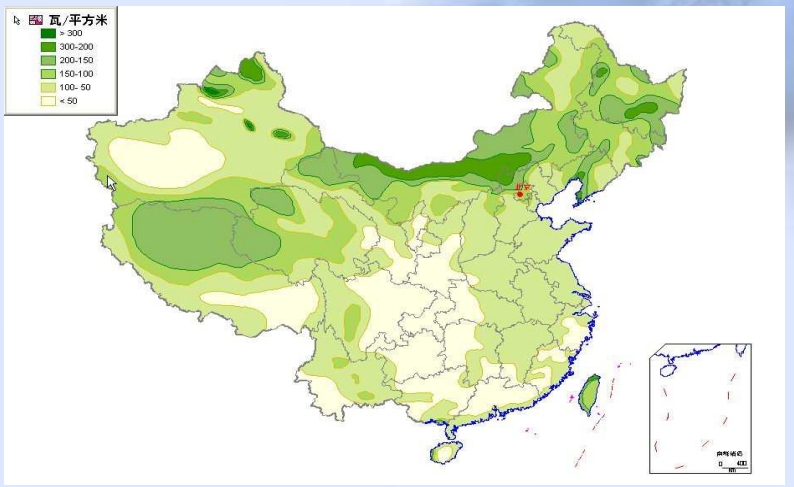


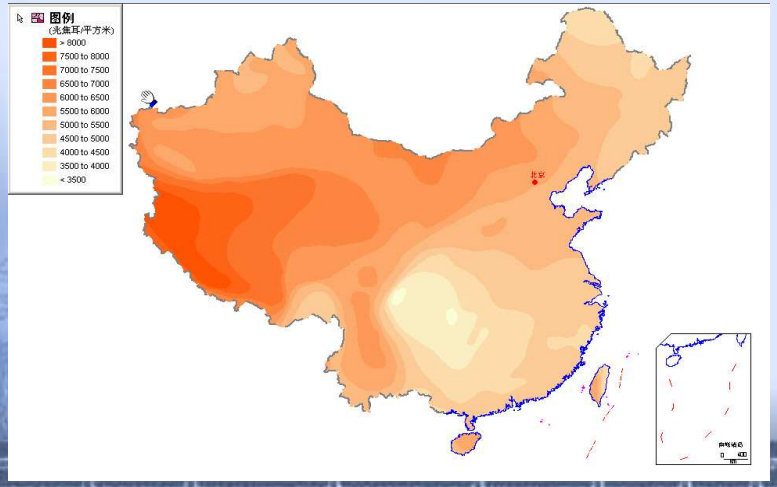




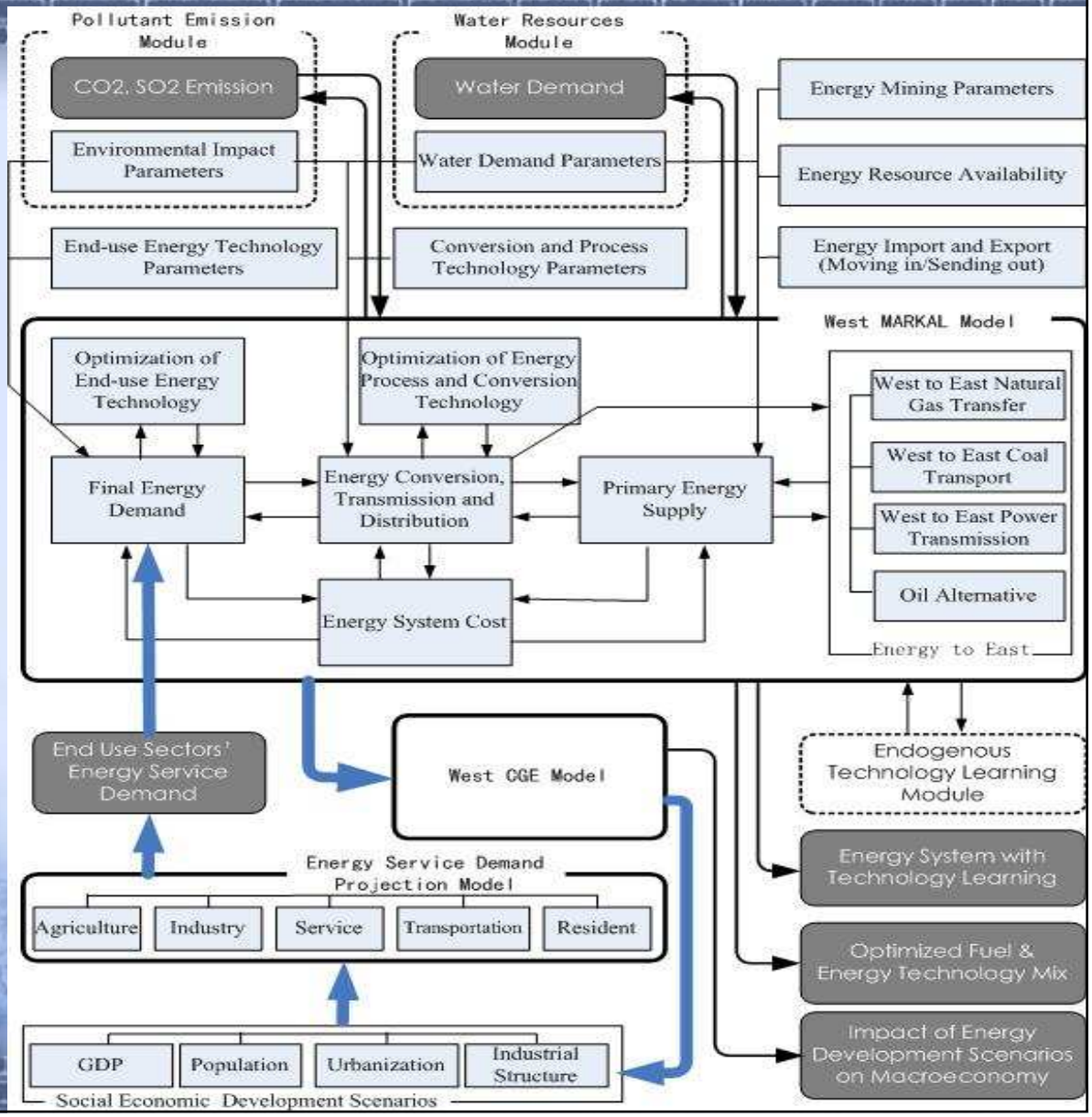
Renewable energy resources in West China





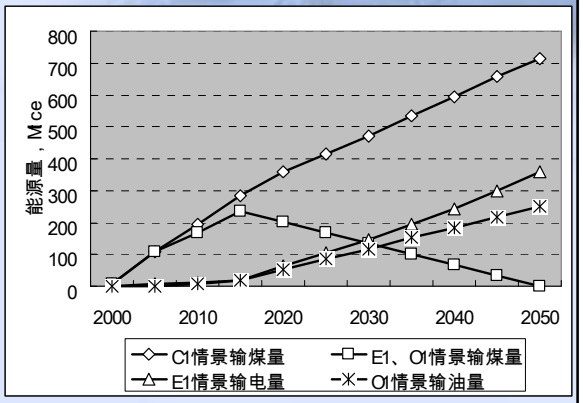


Structure of W-SED

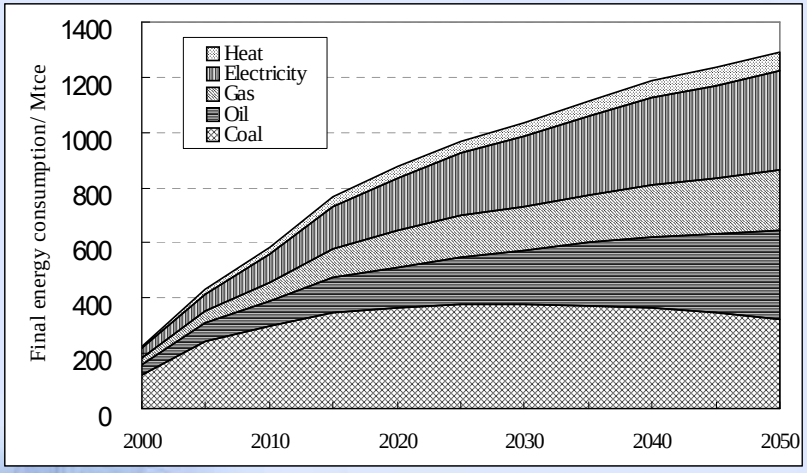


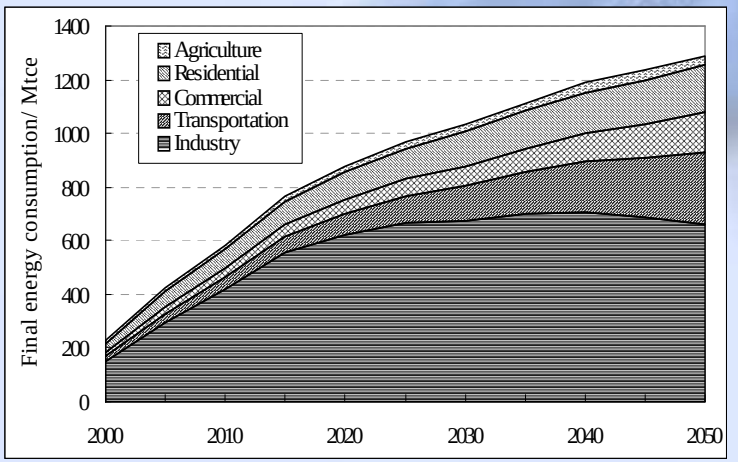
Scenarios designed

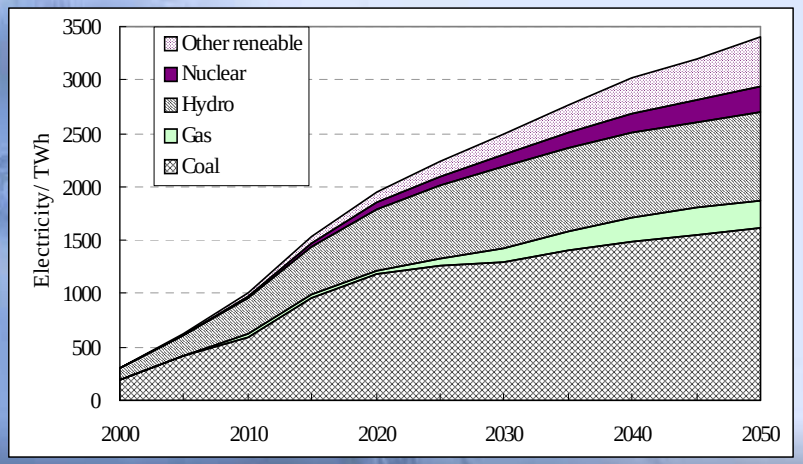
- Base
- C1,E1,O1
- WC,ETL
- C1+WC, E1+WC, O1+WC
- C1+WC+ETL, E1+WC+ETL, O1+WC+ETL

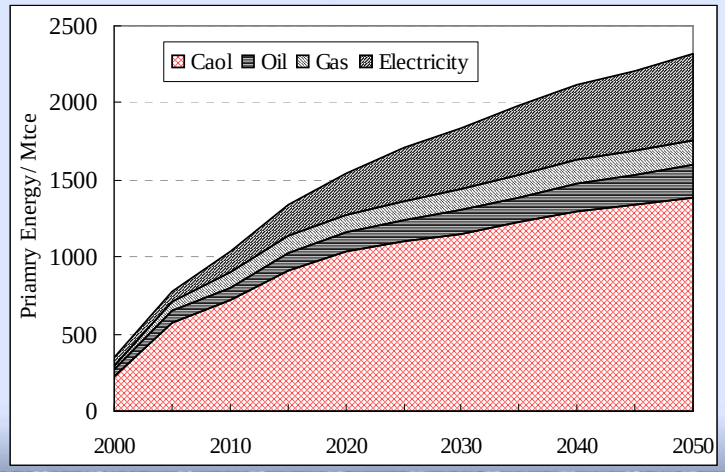


Modeling results (Base)

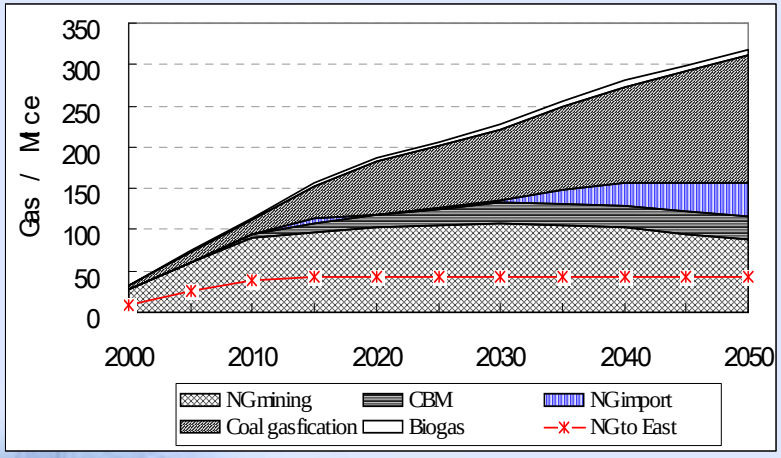


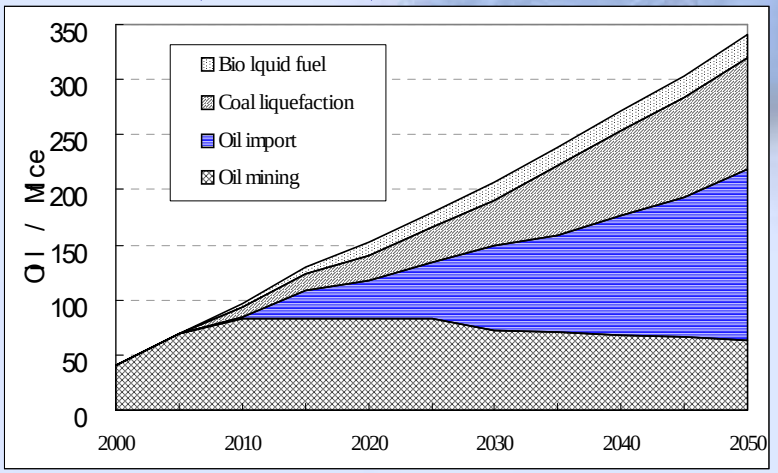


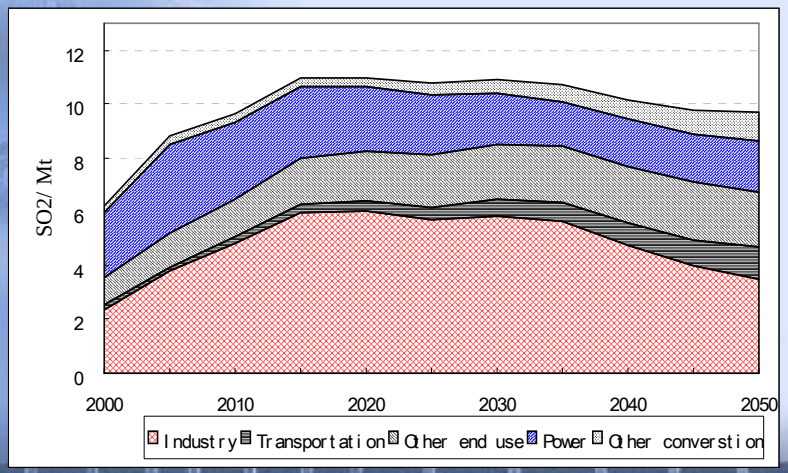


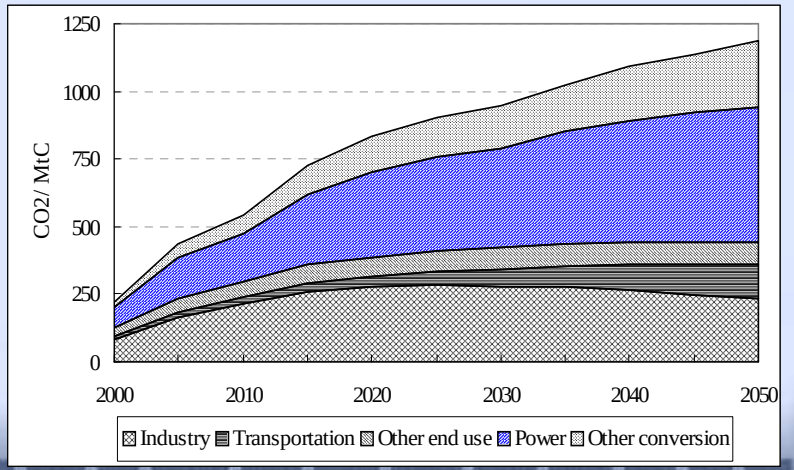


Modeling results (Base)

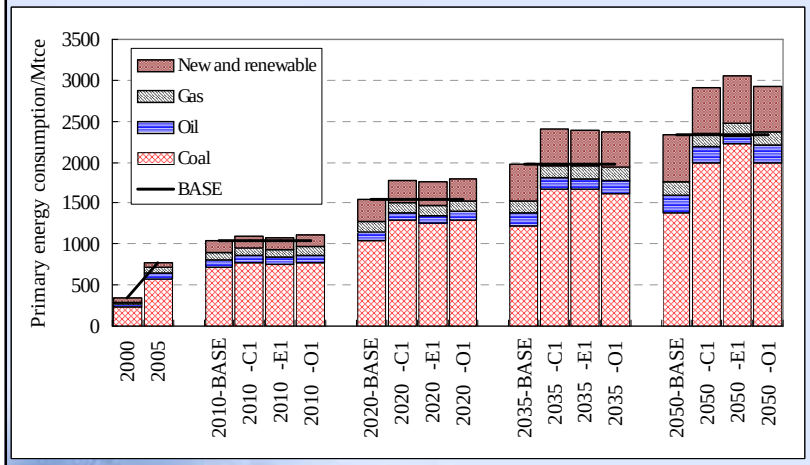


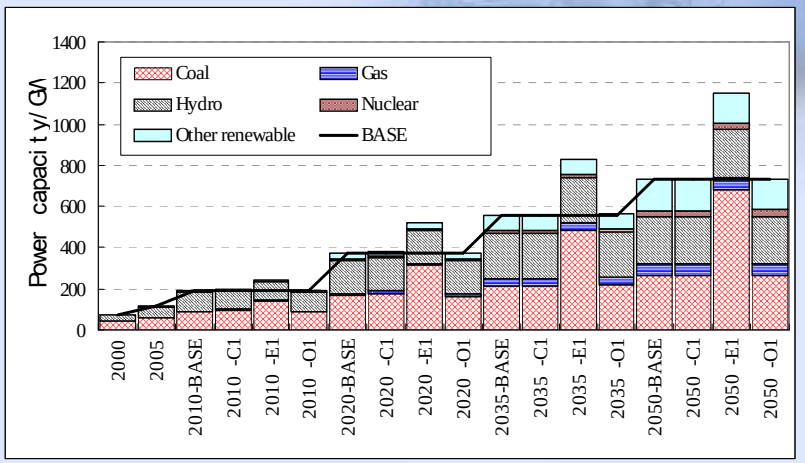


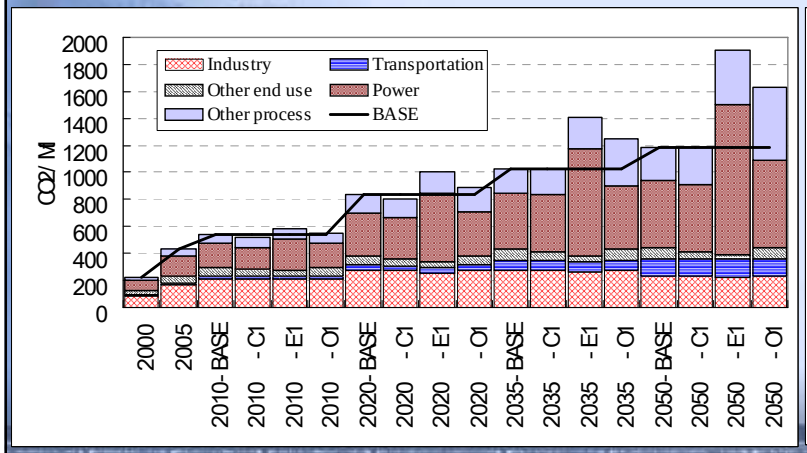


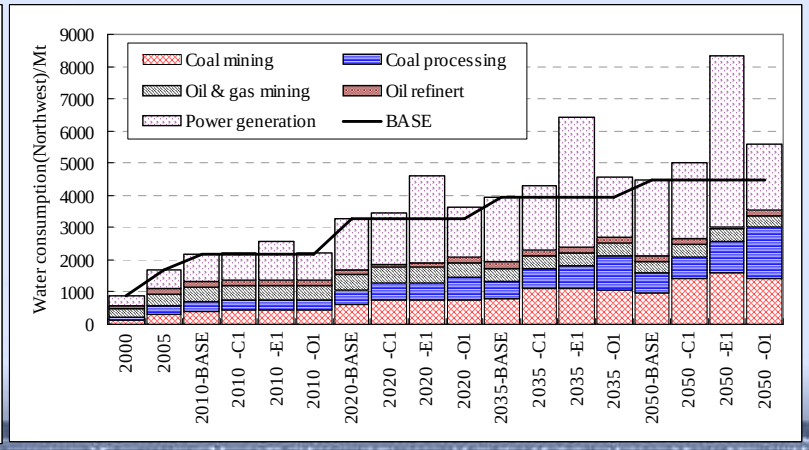


Modeling results (west energy to east)

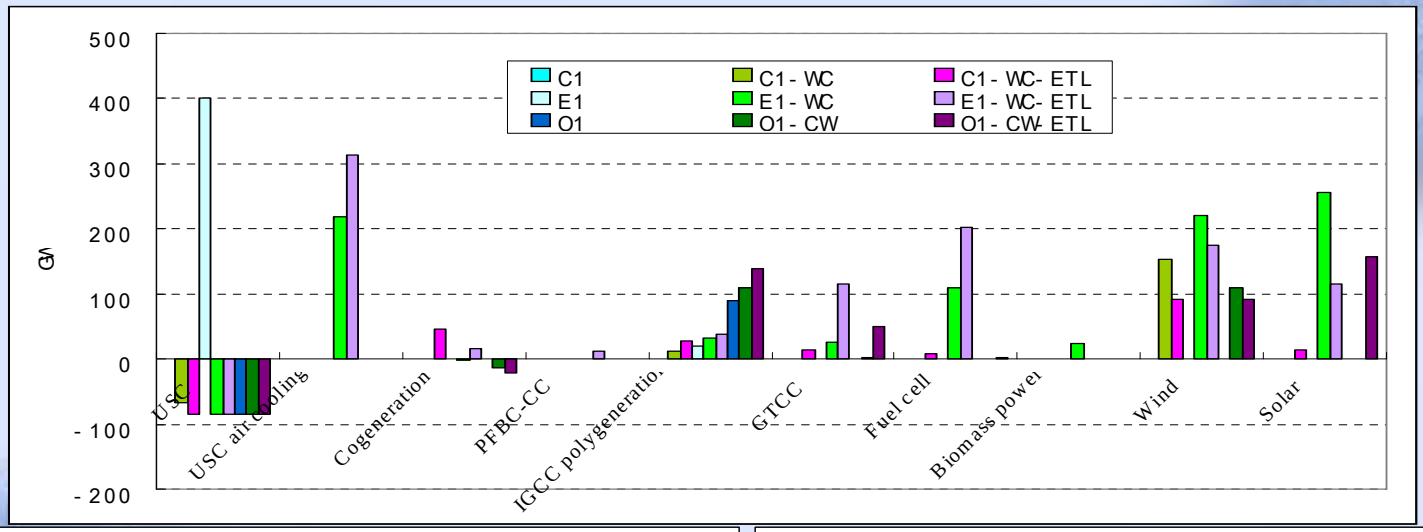


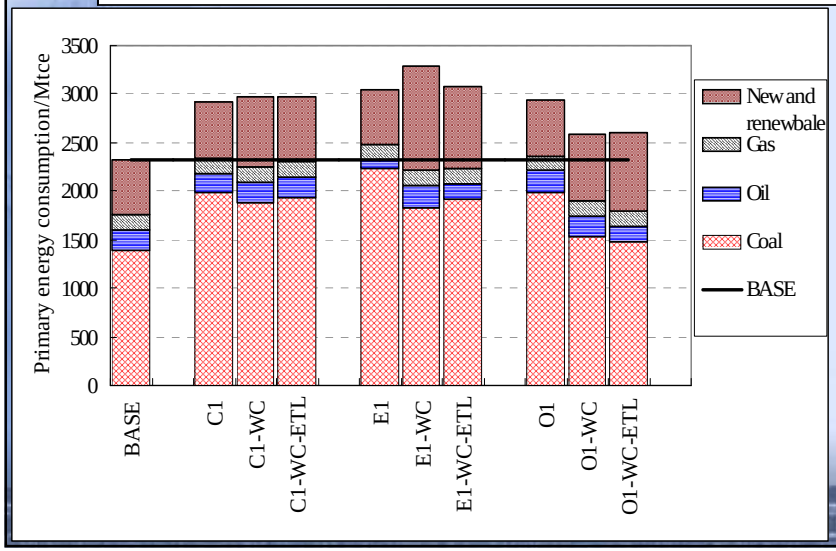


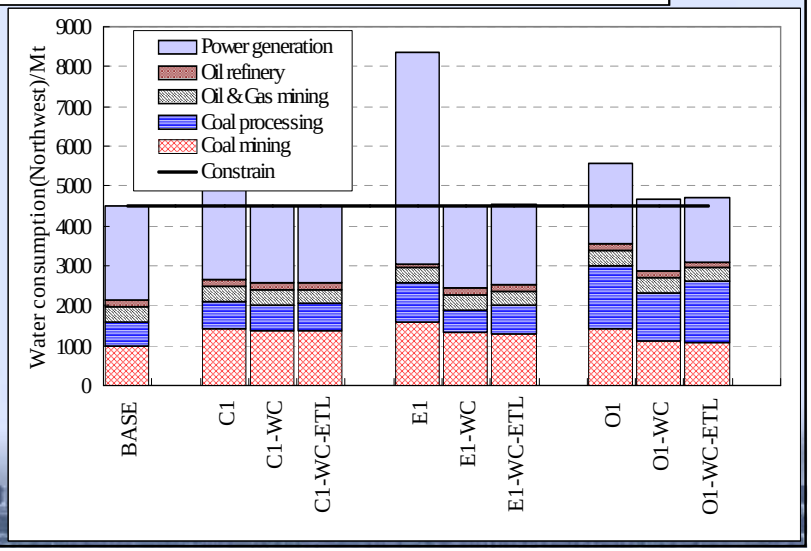




Modeling results (west energy to east)







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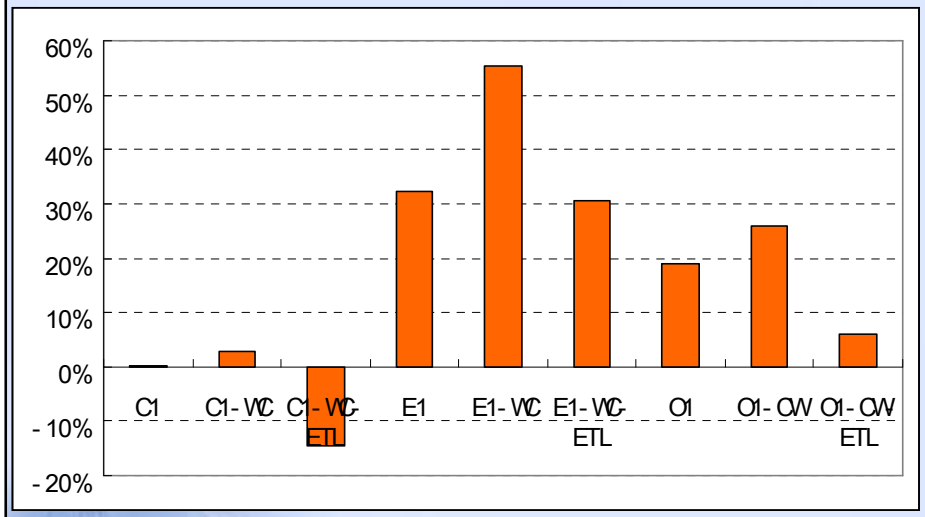
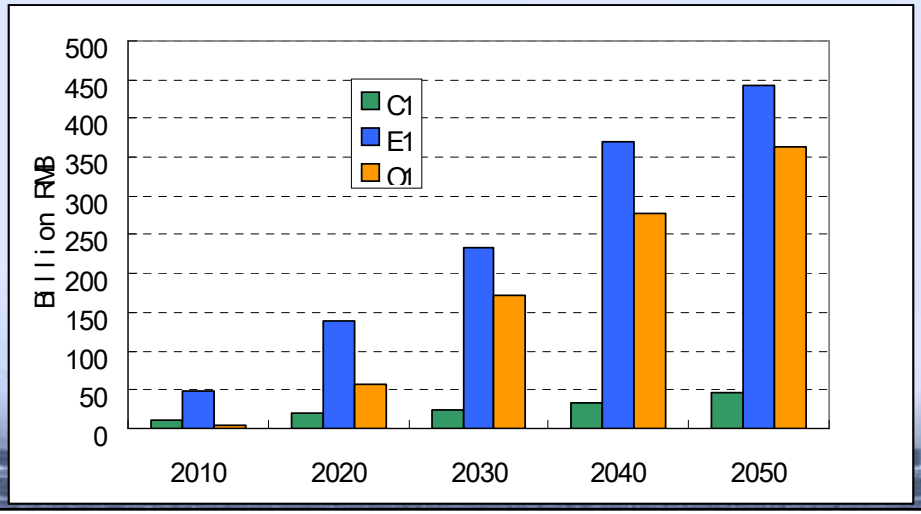


Investment cost

GDP



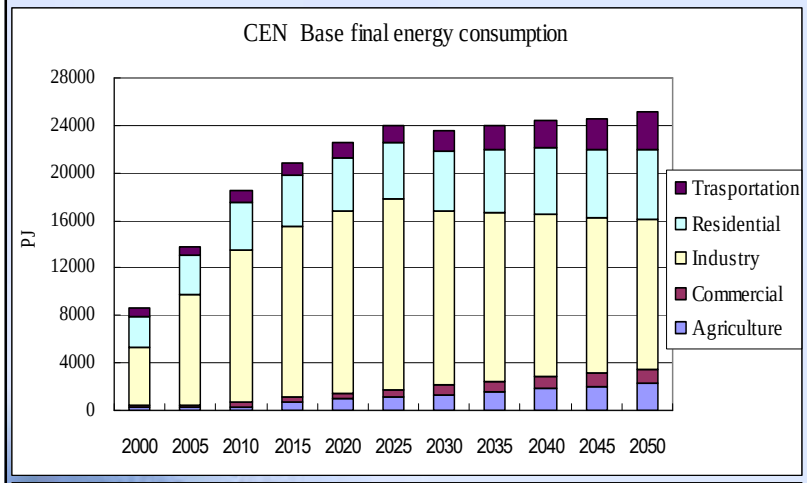
Four region China MARKAL model

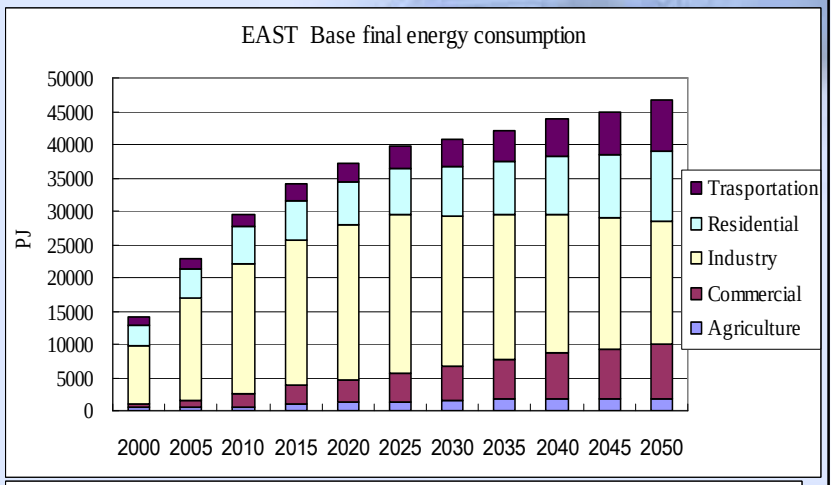
Supported by IEA

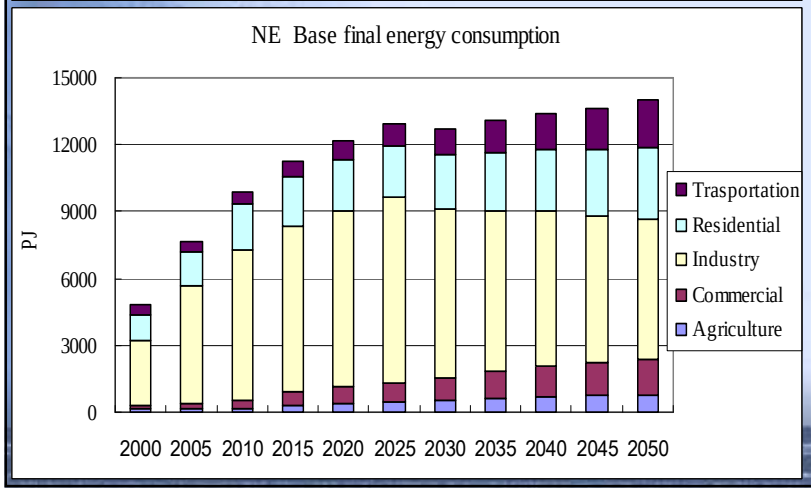
Scenarios

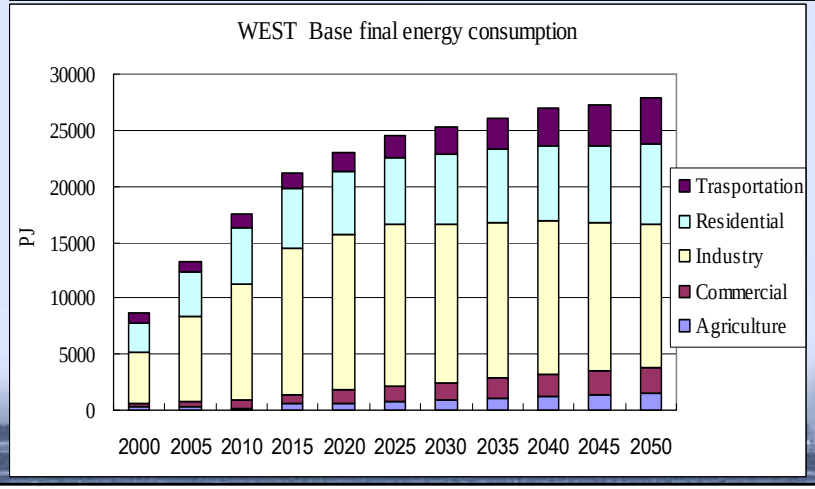
- **Base**
- **CTAX50**
- **CTAX200**

Final energy consumption (BASE)

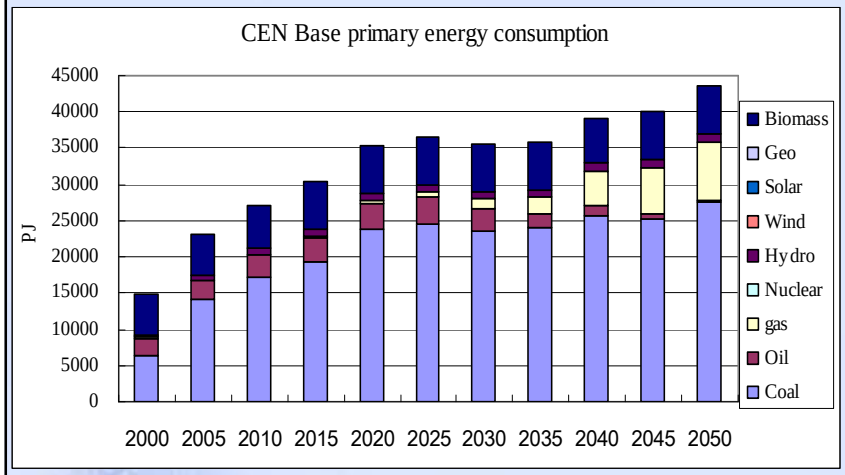


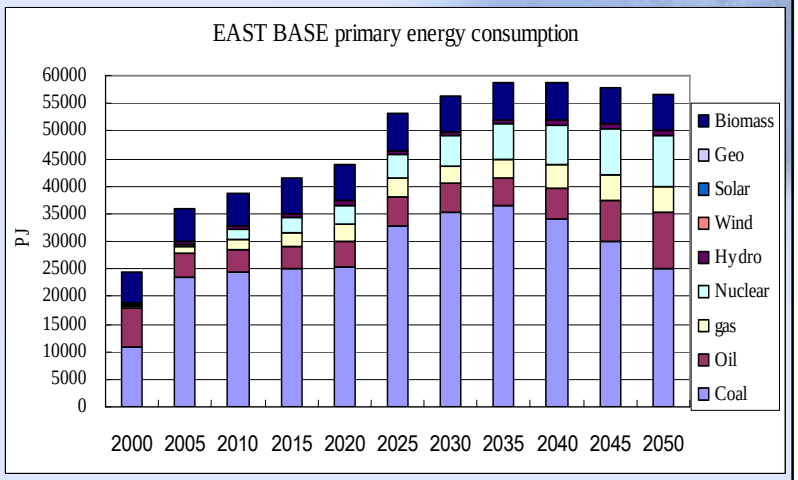


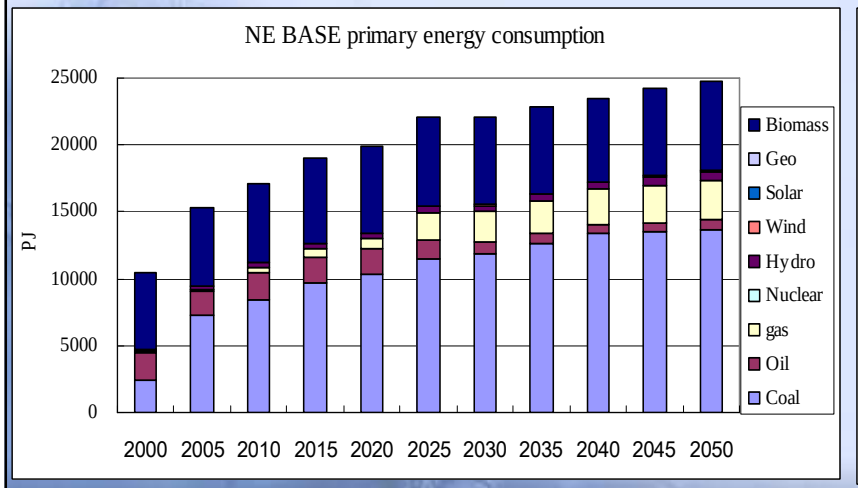


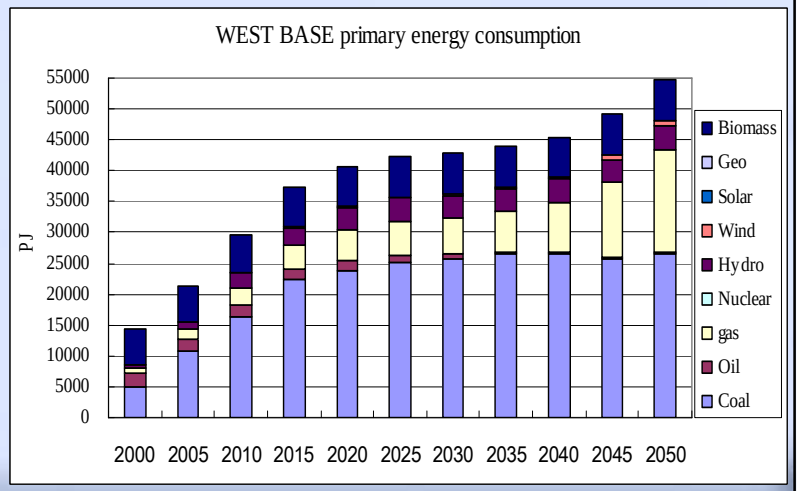


Primary energy consumption (BASE)

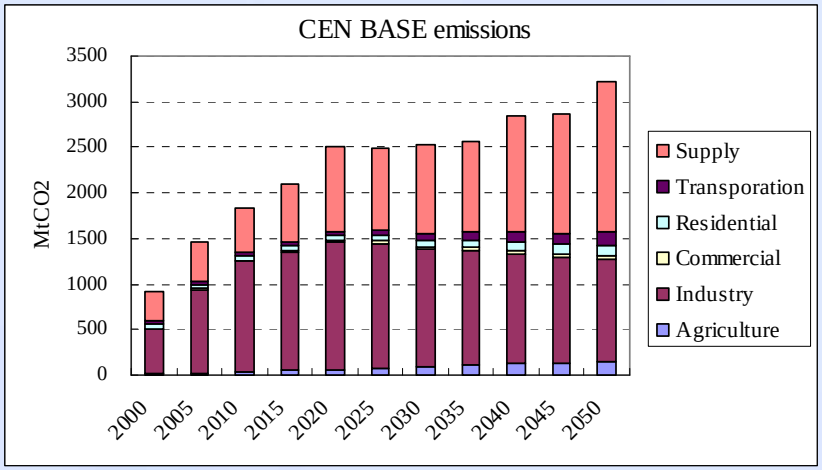


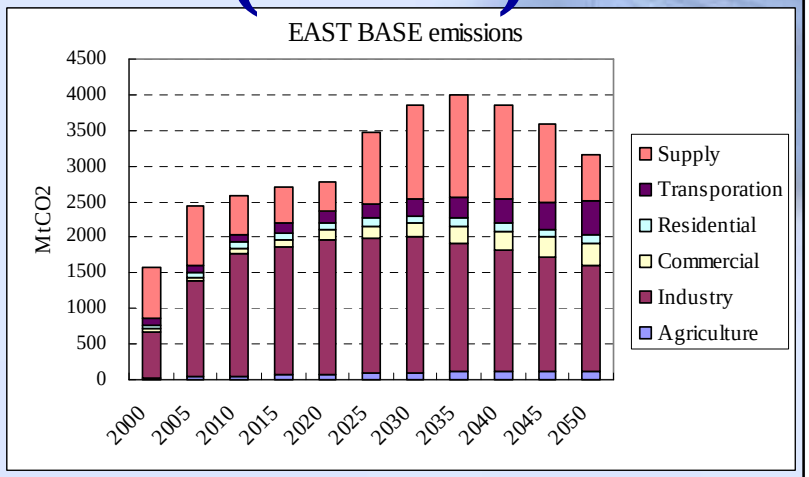


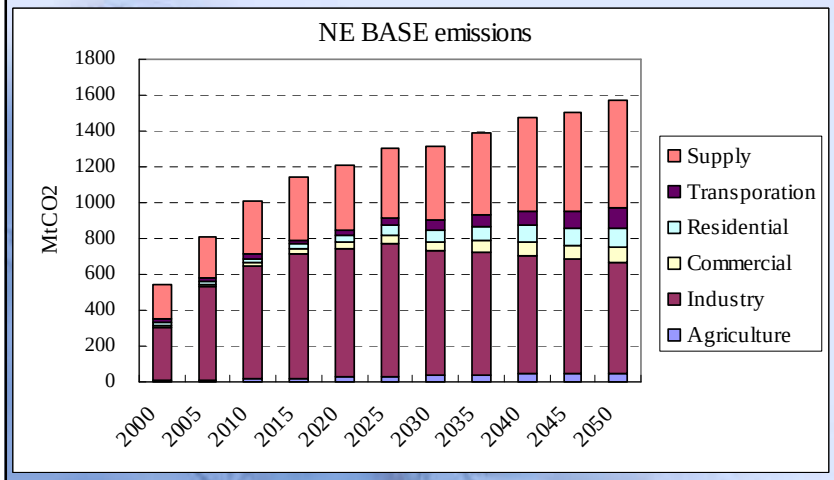


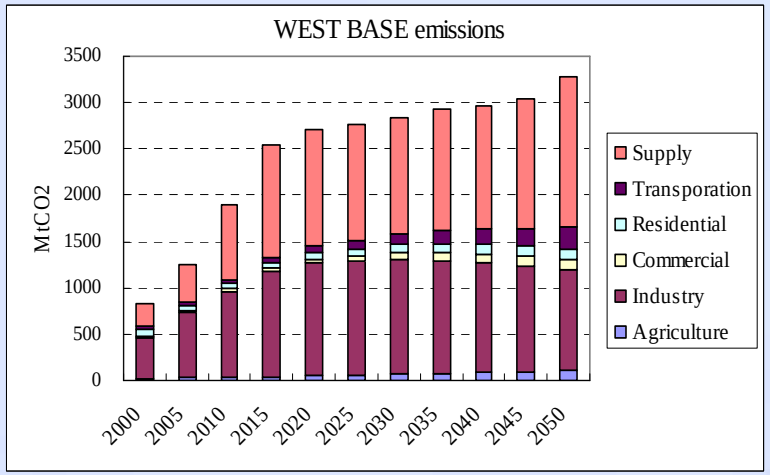


Carbon emission (BASE)

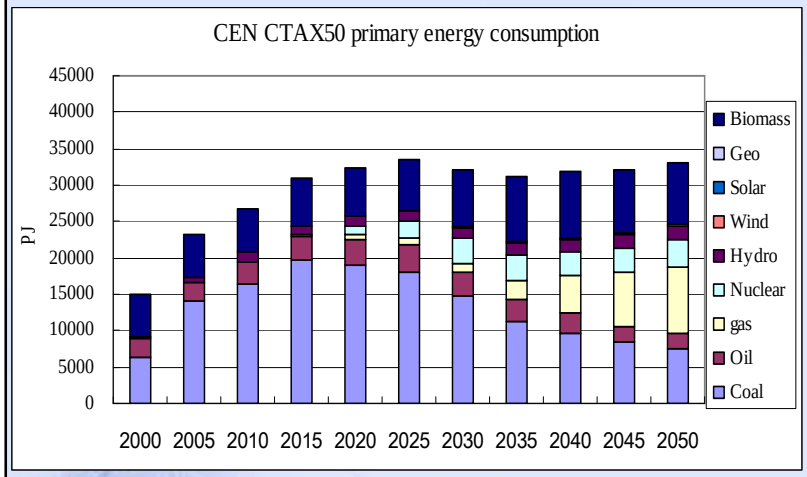


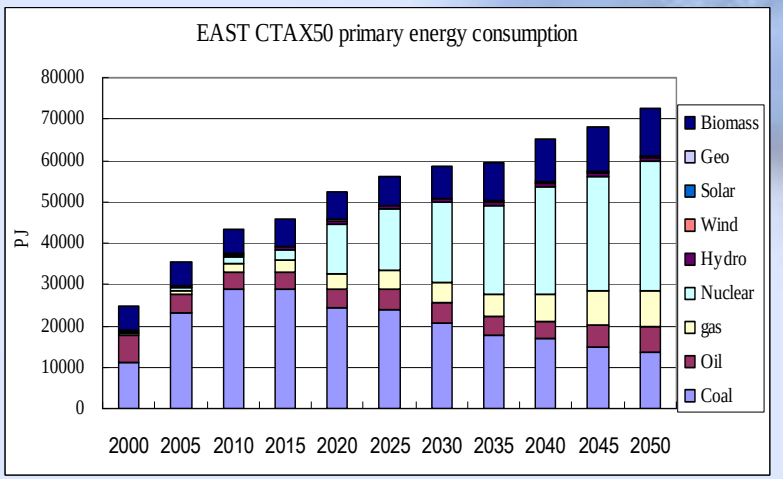


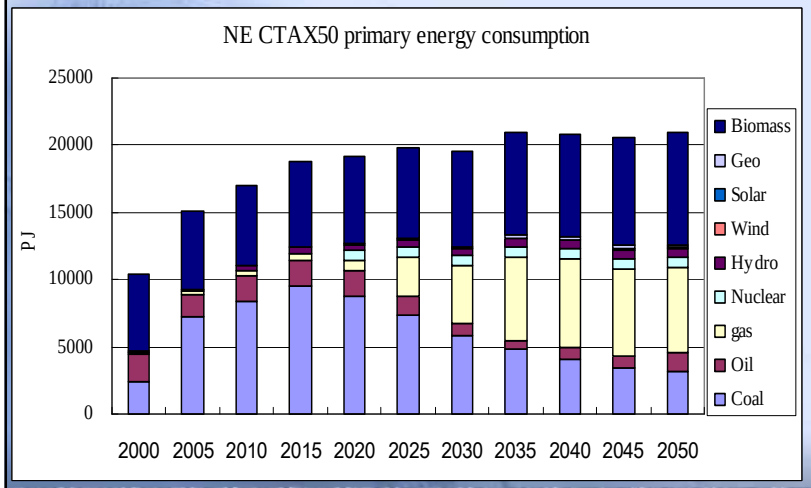


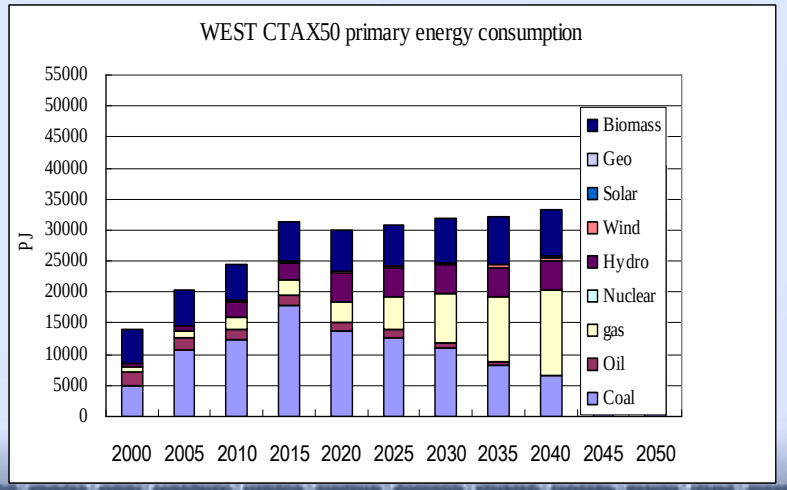


Primary energy consumption (CTAX50)

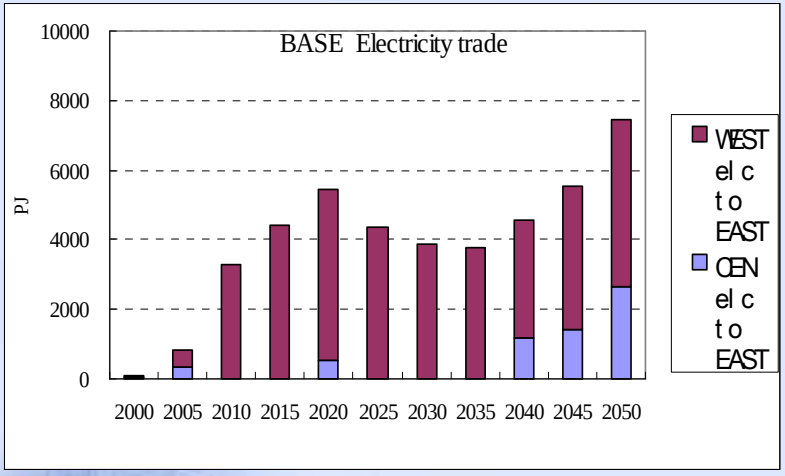


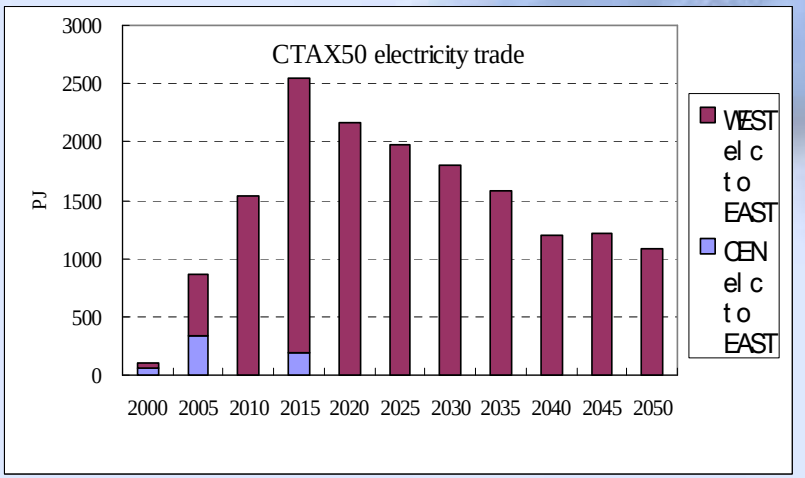


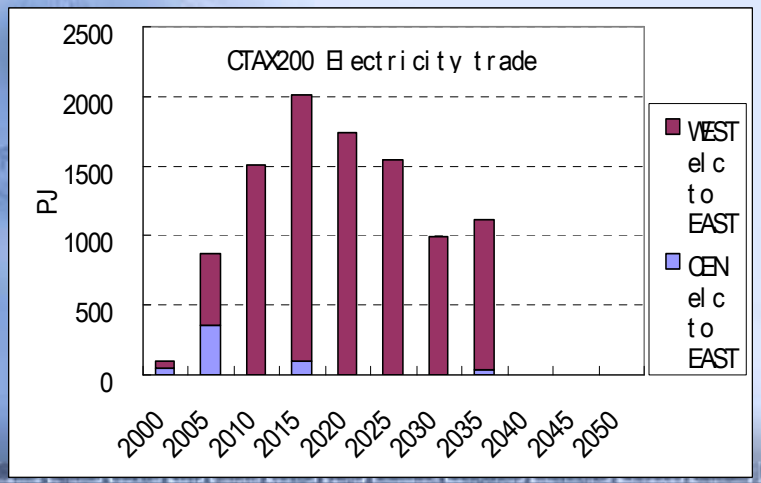


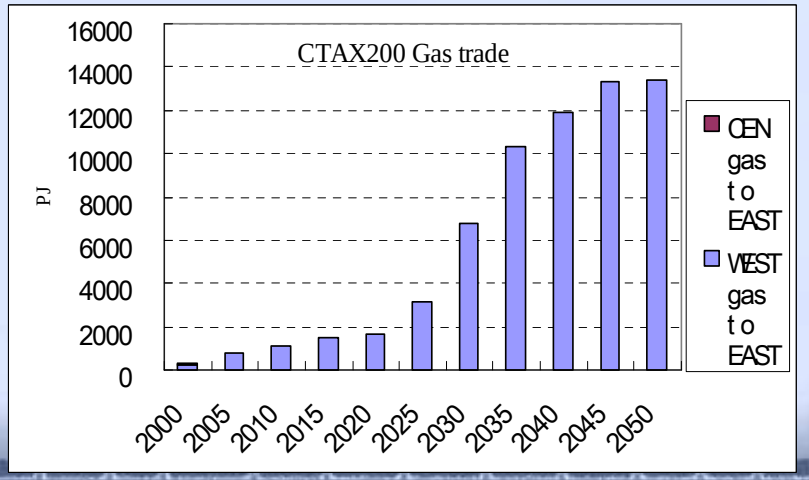


Energy trade









4-region vs. single region model

- **The 4-region model did provide some valuable results which the single region is not able to provide.**
  - **First is the regional picture of energy production and consumption, emission and etc.**
  - **Second is the energy trade among regions. The model shows energy trade among regions will change greatly under different scenarios. For example, coal trade among regions will significantly decrease while gas trade will have to increase dramatically in the carbon constrain scenarios compared with BASE, and electricity trade will also decrease in the carbon constrain scenarios compared with BASE since nuclear power will play important role to supply electricity for EAST when carbon is taxed.**

Beijing MARKAL model

Supported by Stanford Univ.

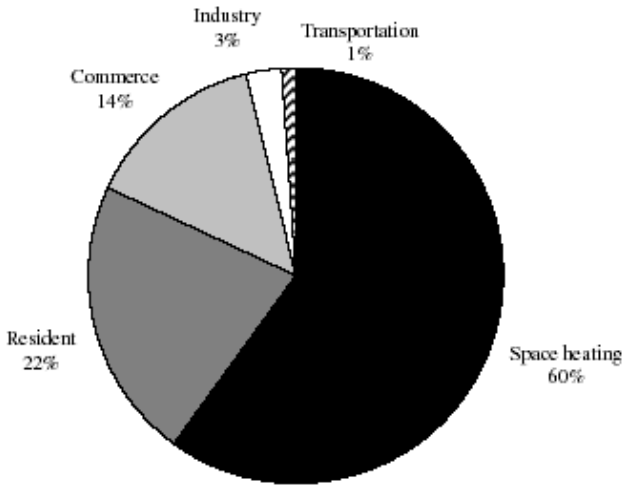


Fig. 6. Beijing natural gas demand in 2003. (*Source*: Beijing Statistic Bureau, 2004).

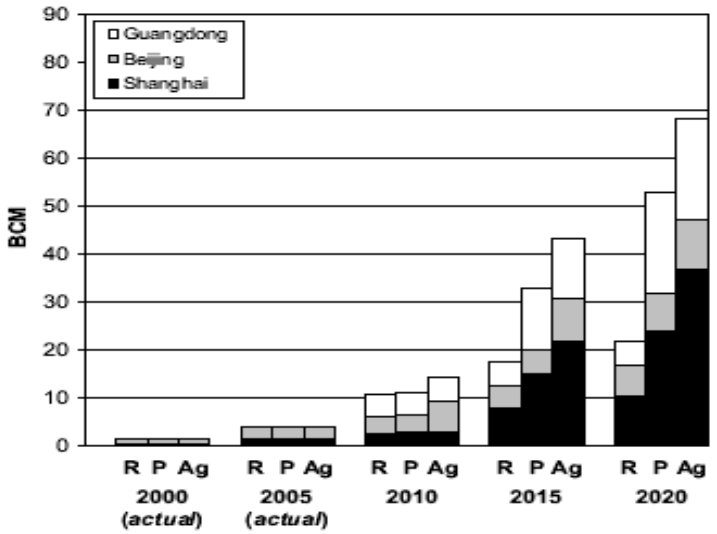


Fig. 5. Natural gas consumption for all study areas: comparison of results for reference and SO_2 constrained scenarios.

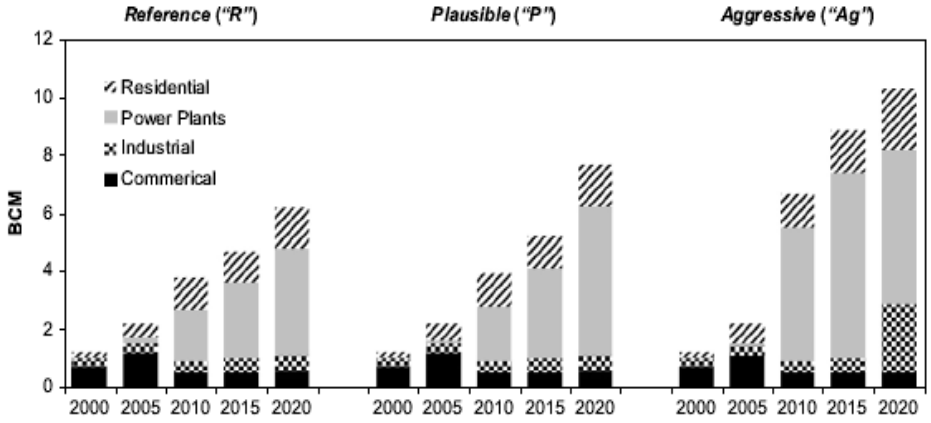
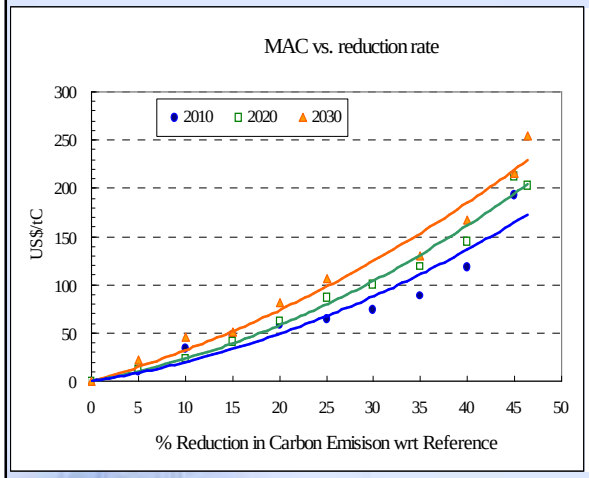
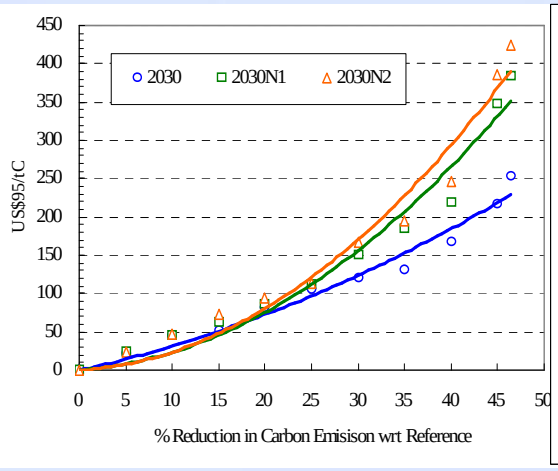


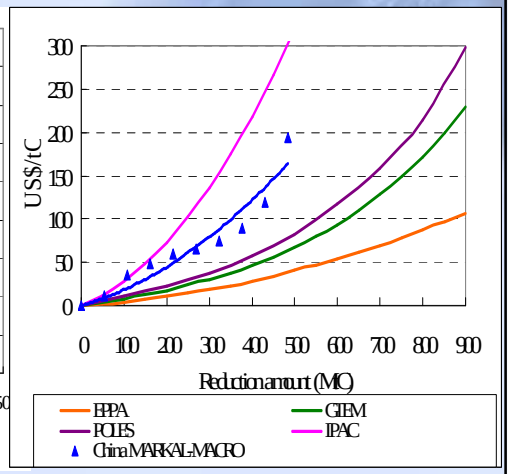
Fig. 7. Natural gas consumption in Beijing for reference, plausible, and aggressive SO_2 constraint scenarios.

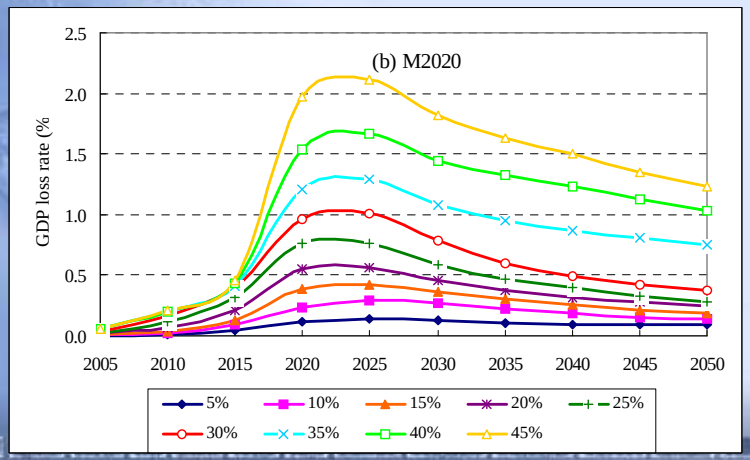
China MARKAL modeling

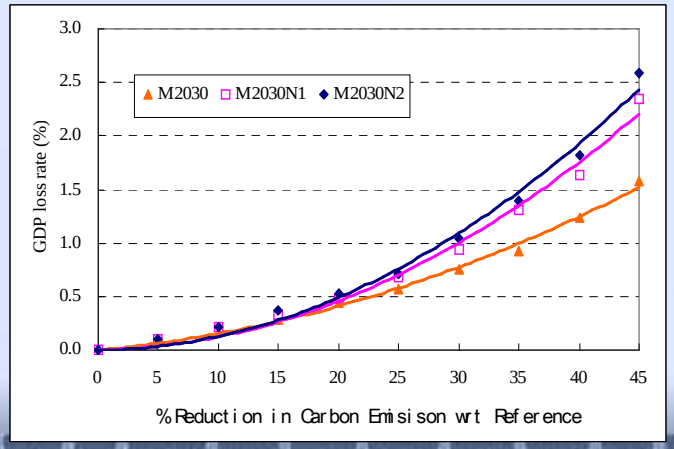
Former results from China MARKAL



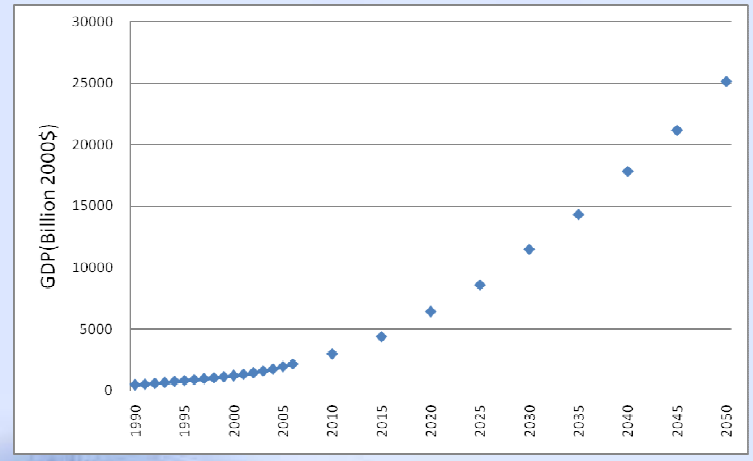


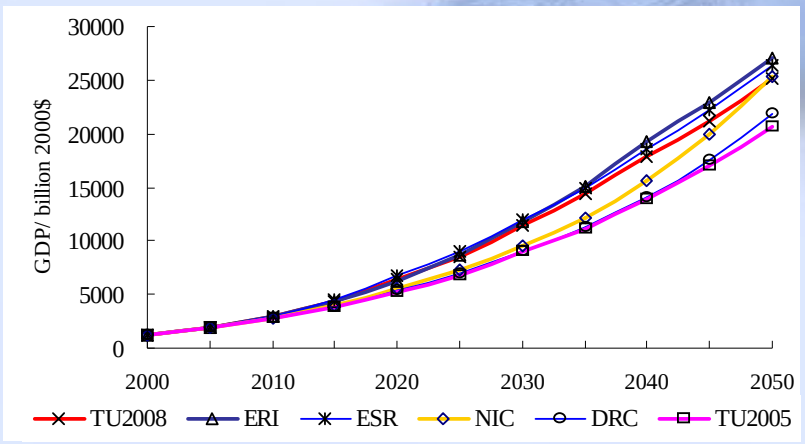


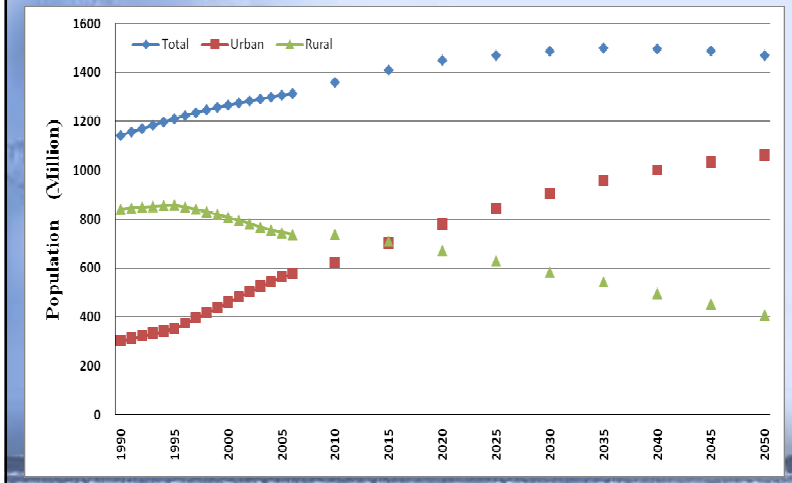


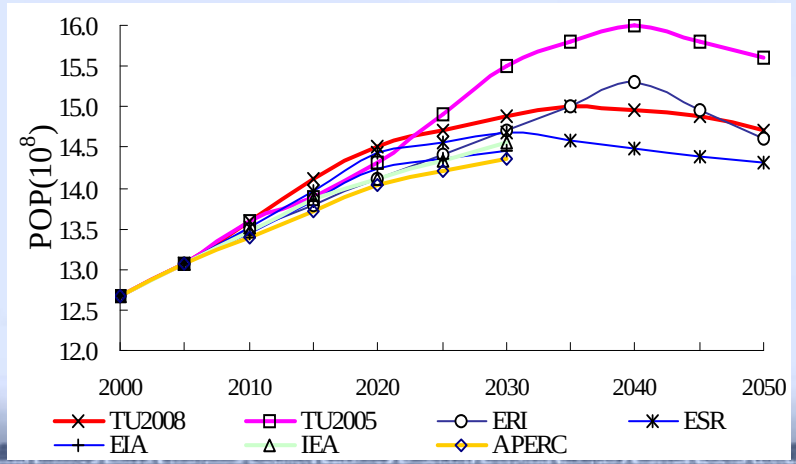


New assumptions

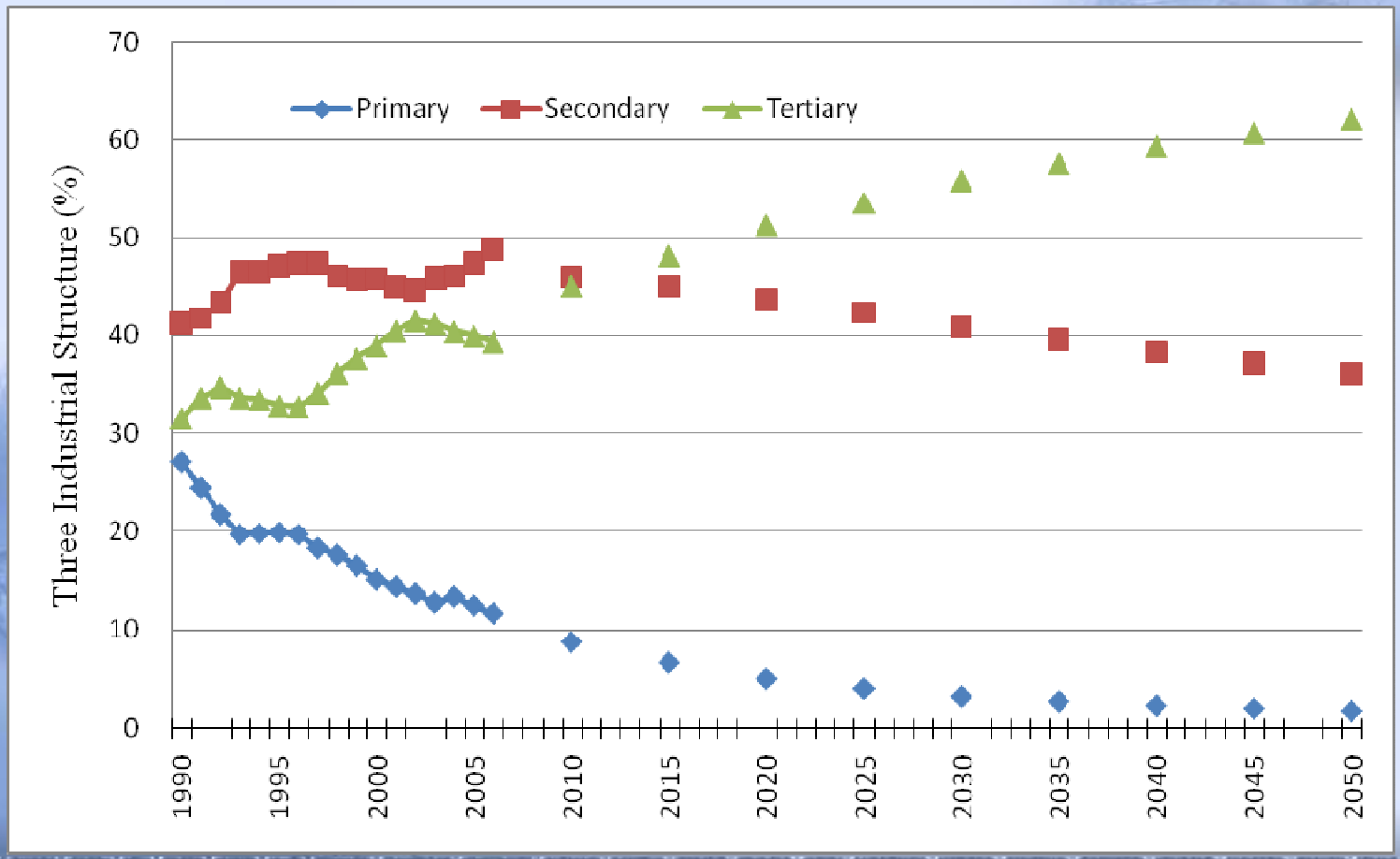




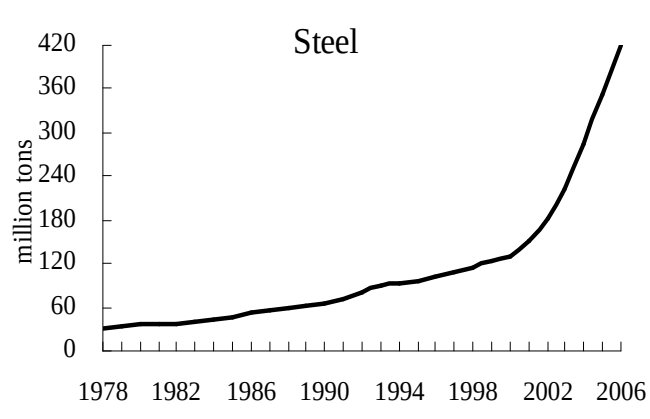


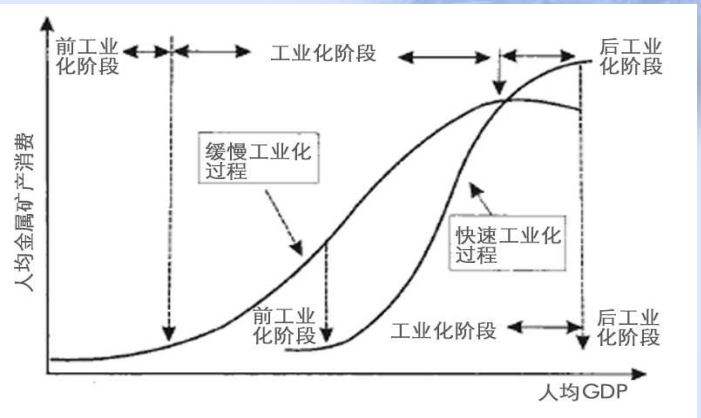


New assumptions

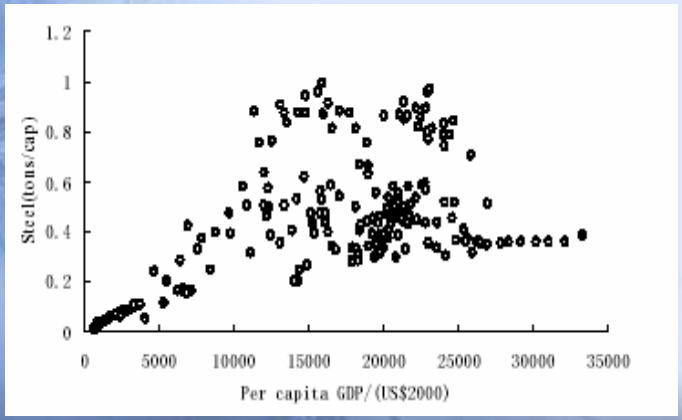


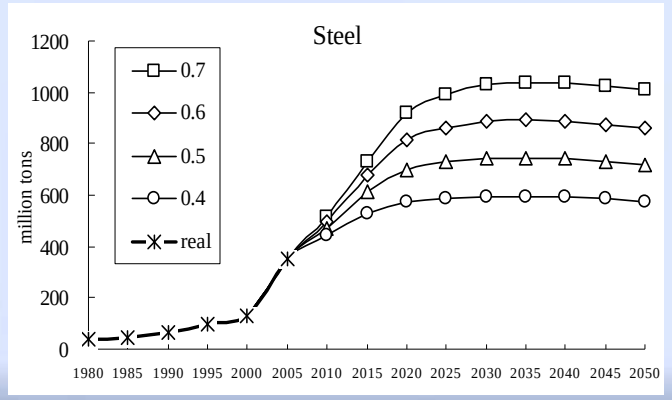
ESD input to China MARKAL



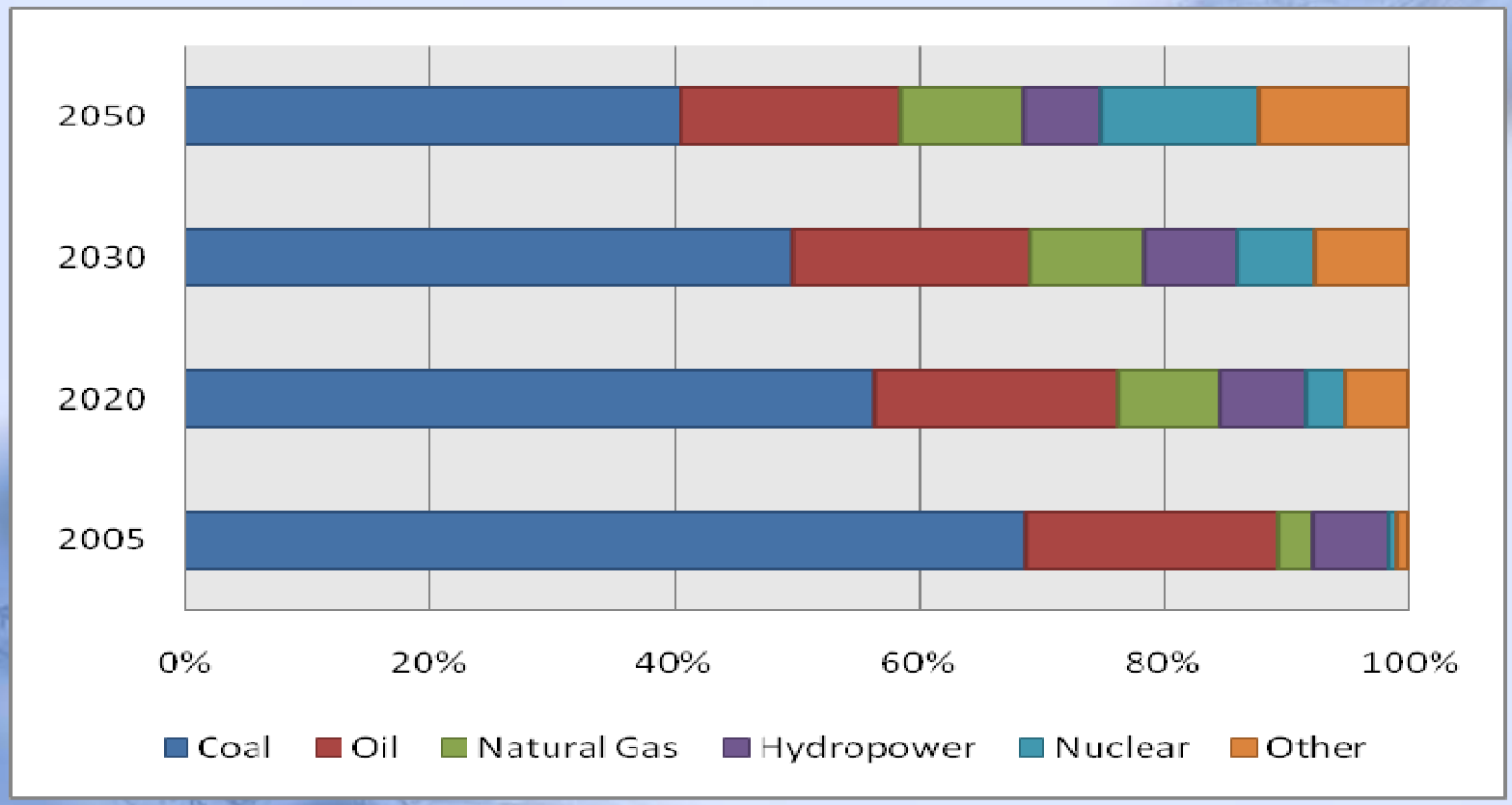


$$I = S \cdot e^{\alpha \cdot e^{\beta \cdot PGDP}}$$





Reference scenario



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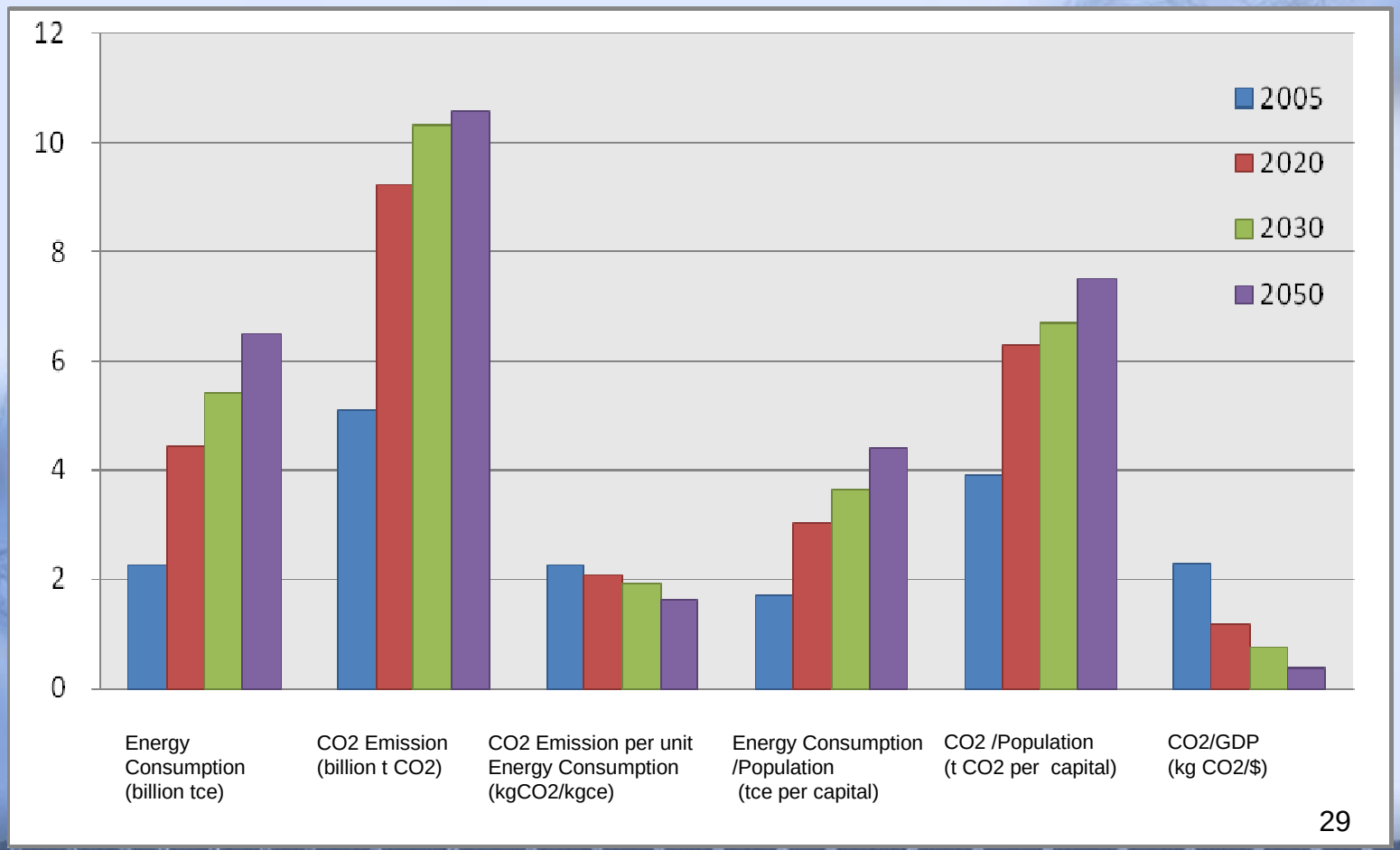
Reference scenario



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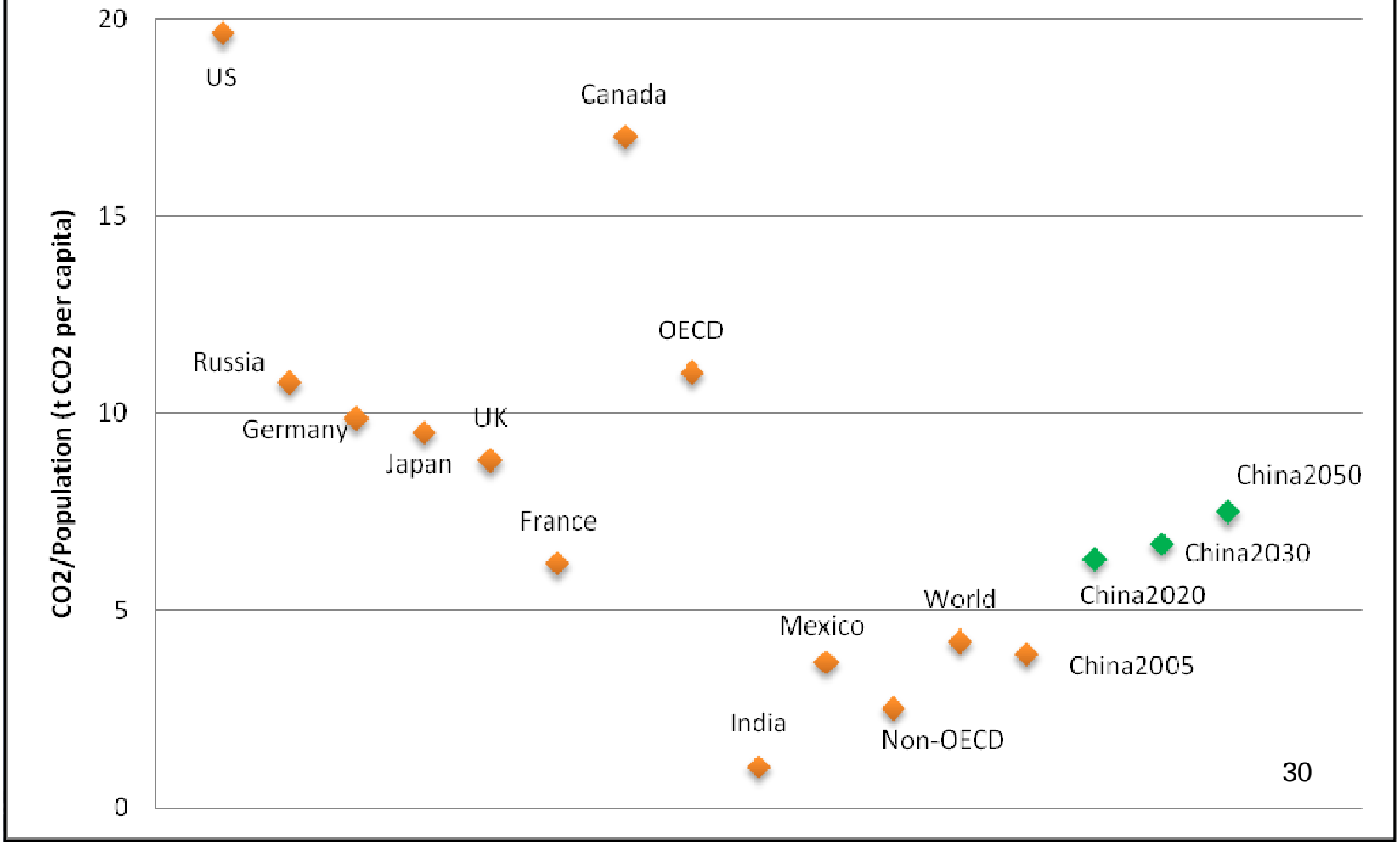
Comparison of carbon emission per capital



Further work

- **Further update Base scenario**
- **Simulate carbon constrain scenarios**
- **Assess CCS role**

Models Development and application for climate change mitigation assessment

Models

- National models
  - China MARKAL
  - China CGE
- Global models
  - Global technology optimization model (based on ETSAP-TIAM?)
  - Global CGE model (based on GTAP)

Thank you for your attention