Thailand CGE Model
AIM/Material

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Outline

- Thailand CGE model;
  - → Thailand: At-a-glance
  - → Model characteristics in Static and dynamic model
  - → Data input and definition
  - → Policy simulation
- Results and Policy implications
- Modeling experiences
- Proposed Activities
- Conclusions

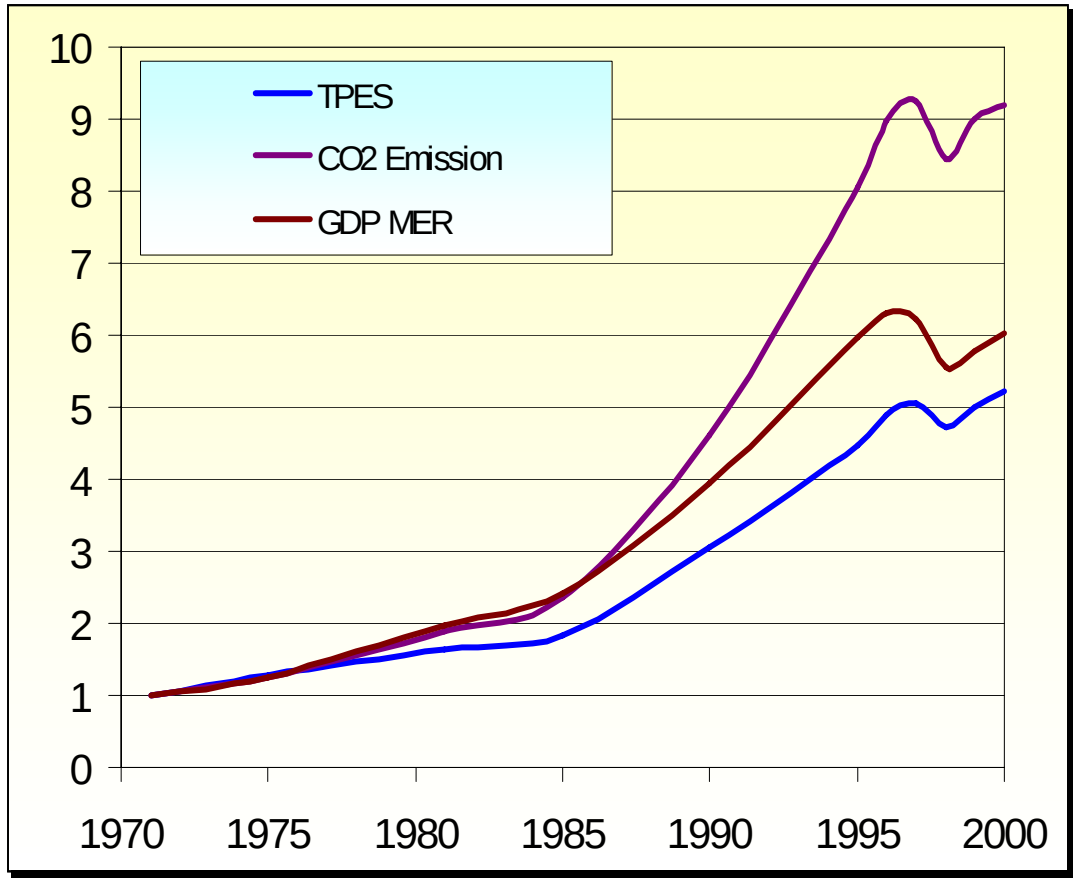
Thailand: At a Glance [End of 2003]

- **Population:** 63.0 Millions
- **GDP:** 140.1 Billion US$; 8.9% growth → 10.4%@2004$_{q1-2}$
- **Status on KP:** Non-Annex I (Ratified: August 28, 2002)
- **Final Energy Consumption:** 56,289 kTOE
- **Energy-Related Carbon Emissions:** 48.5 million metric tons of carbon (0.7% of world)
- **Energy Intensity:** 8,126 Btu/US$$_{1995}$$
- **Carbon Intensity:** 0.14 metric tons /thousand US$$_{1995}$$

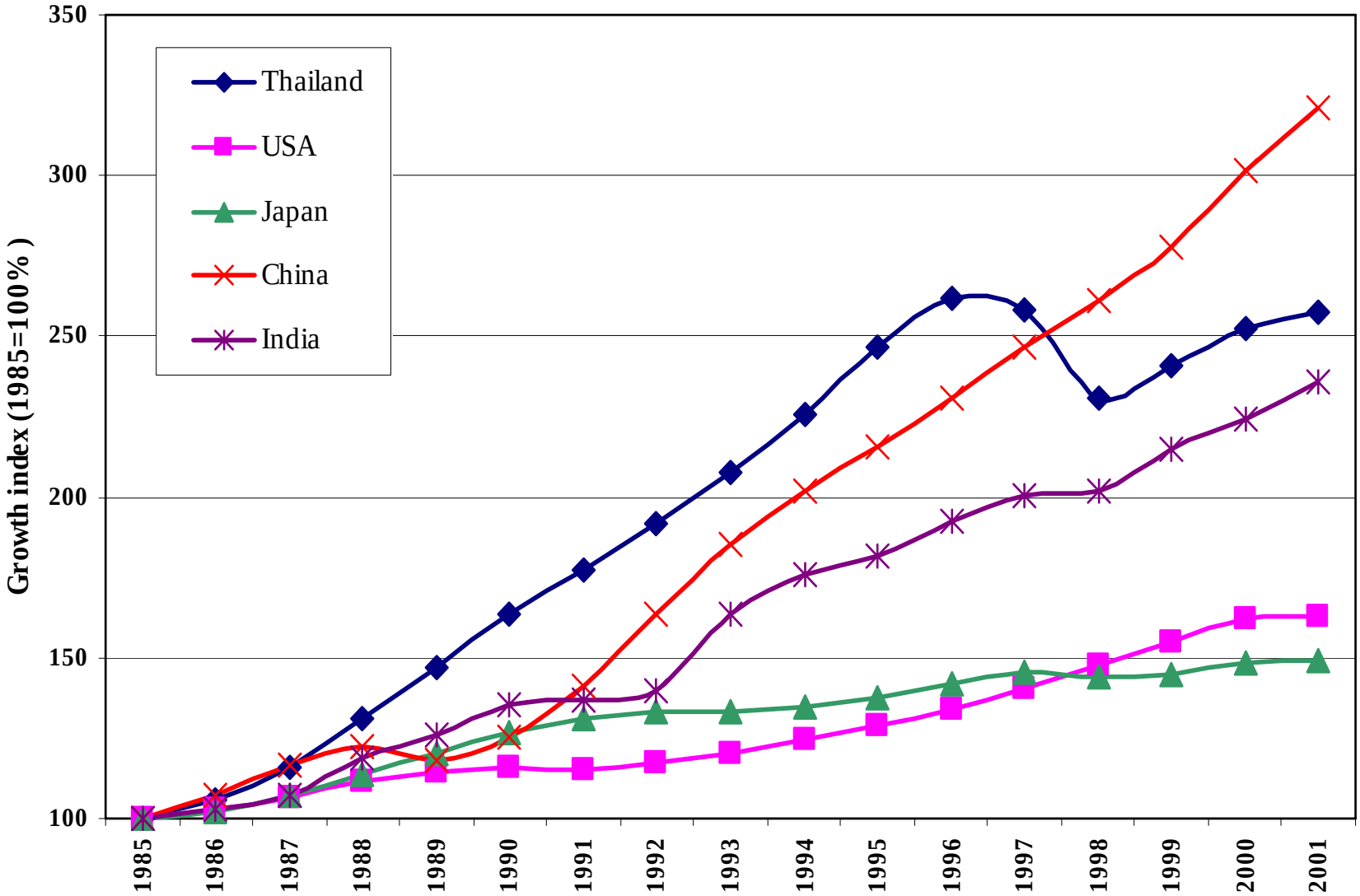
Economic Growth, Energy Use & CO_2 Emission

- **AAGR:**
  - TPES: 5.9%
  - GDP: 6.4 %
  - CO_2 emission: 8.0 %

- CO_2 emission from energy use accounts for more than 70% of the total CO_2 emission.

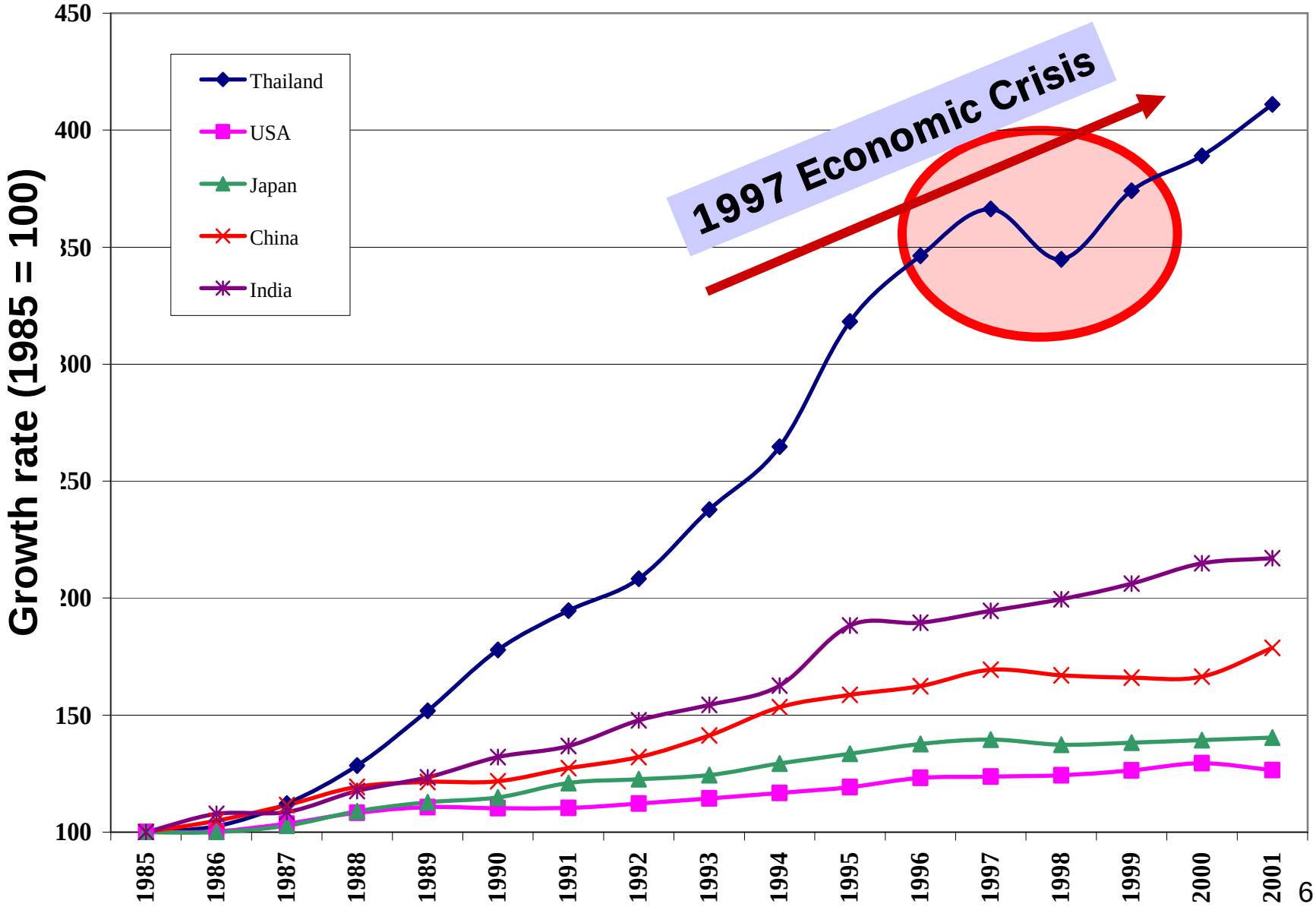


Economic growth of Thailand and other countries



GDP$_{PPP}$ at 1995 prices; from ADB, NESDB, OECD

Primary Energy Consumption (1985=100)



Model Characteristics

Static and Dynamic CGE model with nested C-D functions of production and consumer structures,

27*27 sectors/commodities with 8 energy-related sectors (Coal, Crude oil and natural gas, petroleum (4), Electricity, Gas distribution) from 61 sectors of 1998 SAM for Thailand,

Sector Classifications

27 Sectors/commodities with 19 Non-Energy sectors

1	Agriculture, livestock, forestry, fishery	23	Construction
4	Other non-energy mining	24	Trade
5	Food, beverage and tobacco	25	Hotels & Restaurants
6	Textile, leather, and the products	26	Transport & Communications
7	Timber and wooden products	27	Services
8	Pulp, paper and printing		8 Energy sectors
9	Chemical products		Coal and lignite
14	Plastic and rubber products	3	Crude petrol and natural gas
15	Non-metallic mineral products	10	Gasoline
16	Metal products	11	Diesel
17	Machinery	12	Aviation fuel
18	Transport equipment	13	Fuel oil
19	Other manufacturing products	20	Electricity
22	Water	21	Gas distribution

e.g. Ceramics

e.g.Cement

Production

Natural gas Distribution

Model Characteristics

Main data input:

- Base year 1998 → forecast to 2030
- U- and V-Matrix data are disaggregated from 1998 SAM for Thailand by IFPRI,
- Population data are taken from national forecast from 2001 to 2030,
- From 2000 to 2016, GDP growth rate are taken from national GDP forecast data (current prices), by sector. After 2016 to 2030, 5% GDP growth rate in all sectors was assumed,

Model Characteristics

Main data input:

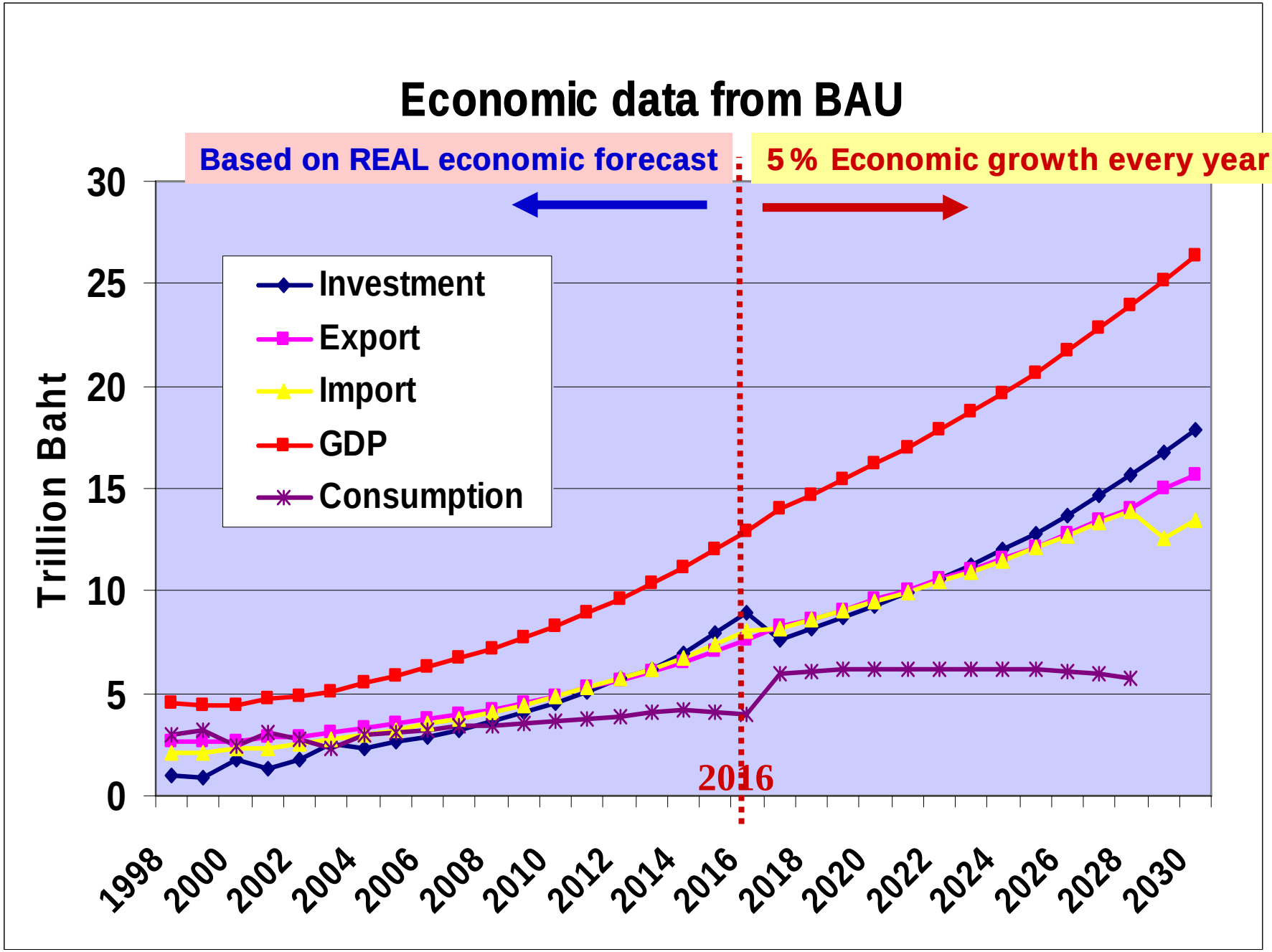
- Fixed Capital Formation data are estimated from the proportion of Capital data in U-Matrix,
- All Energy data, in both consumption and prices, are taken from 1999 MoE data,
- Based on I-O table, crude oil and Natural gas production are aggregated into only one sector,

Scenarios Simulations

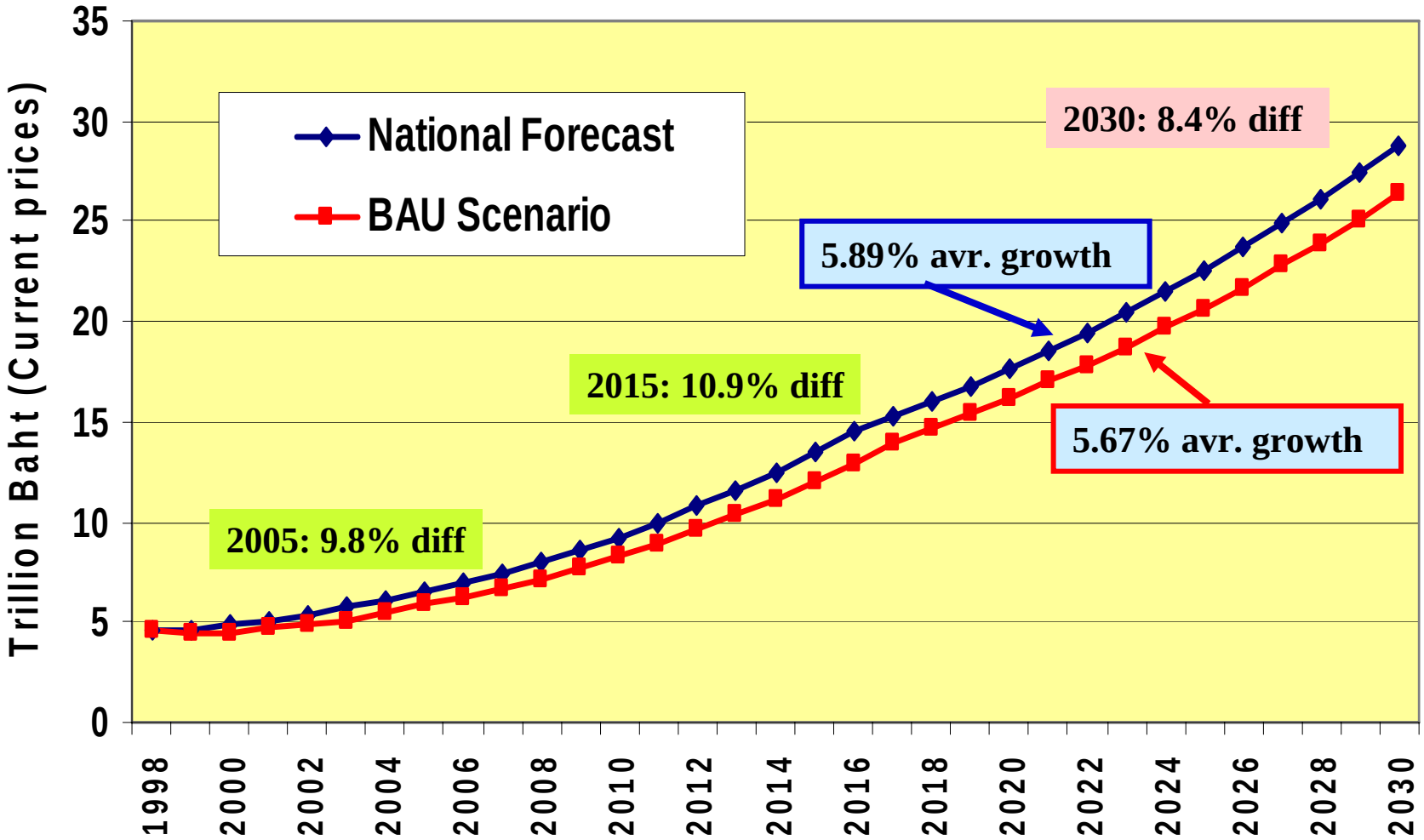
1. **Reference or BAU Scenario**
   - → Based on 5% CO_2 increase per year
   - → Economic and population based on country data
2. **Energy Efficiency (EE) Scenario**
   - → Assume 10% increase in EE investment in energy-intensive manufacturing sectors (Cement, Basic metal, Paper sector)
3. **Tax Scenario**
   - → Based on 4 types of taxes (K, L, C, and I)
   - → Results from the tax are limited to the year 2016 due to the data problem

Results from the model

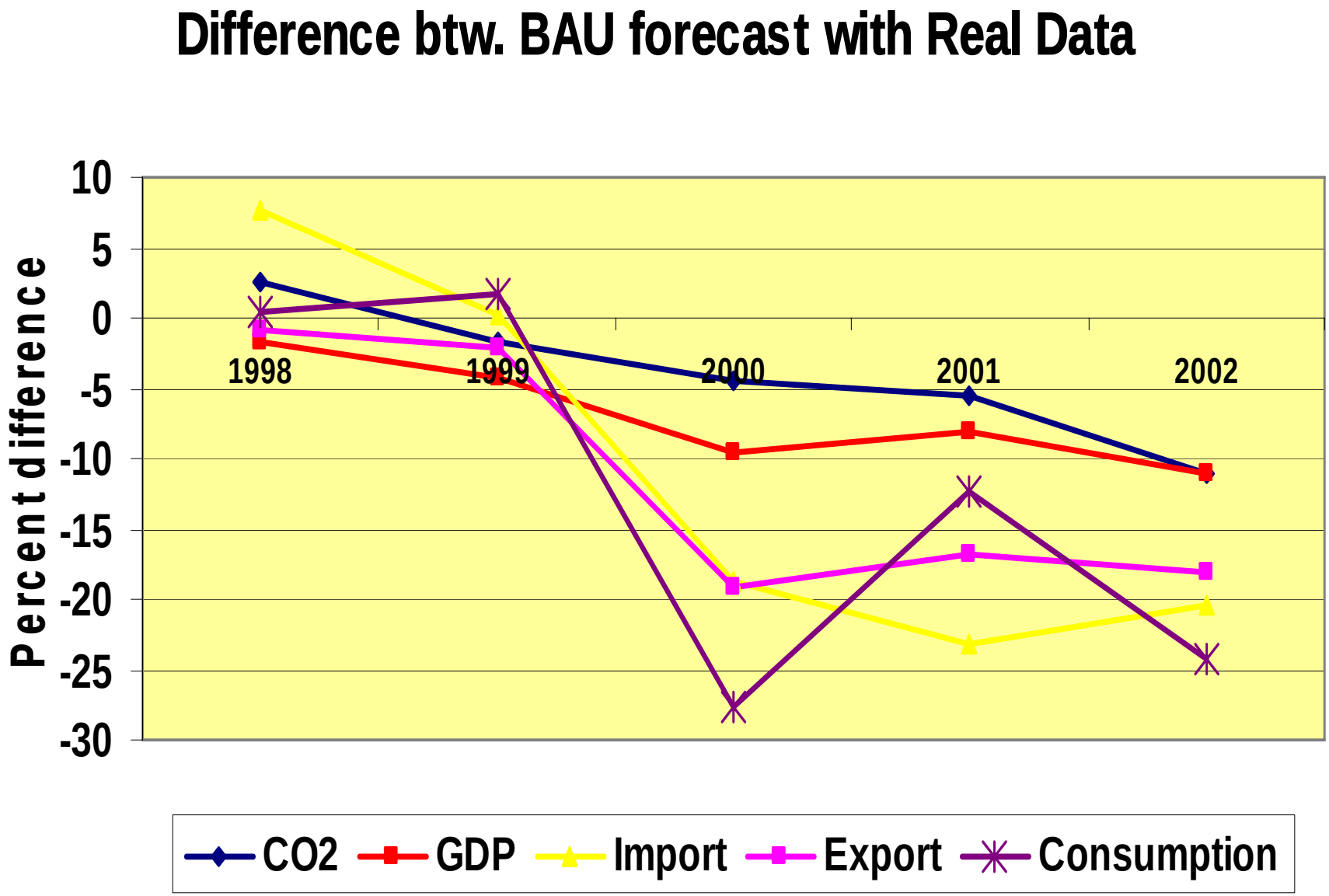
BAU Scenario


Economic data from BAU
Based on REAL economic forecast
5% Economic growth every year
Trillion Baht
30
25
20
15
10
5
0
Investment
Export
Import
GDP
Consumption
2016
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030

GDP Forecast



Sensitivity Analysis



BAU Scenario

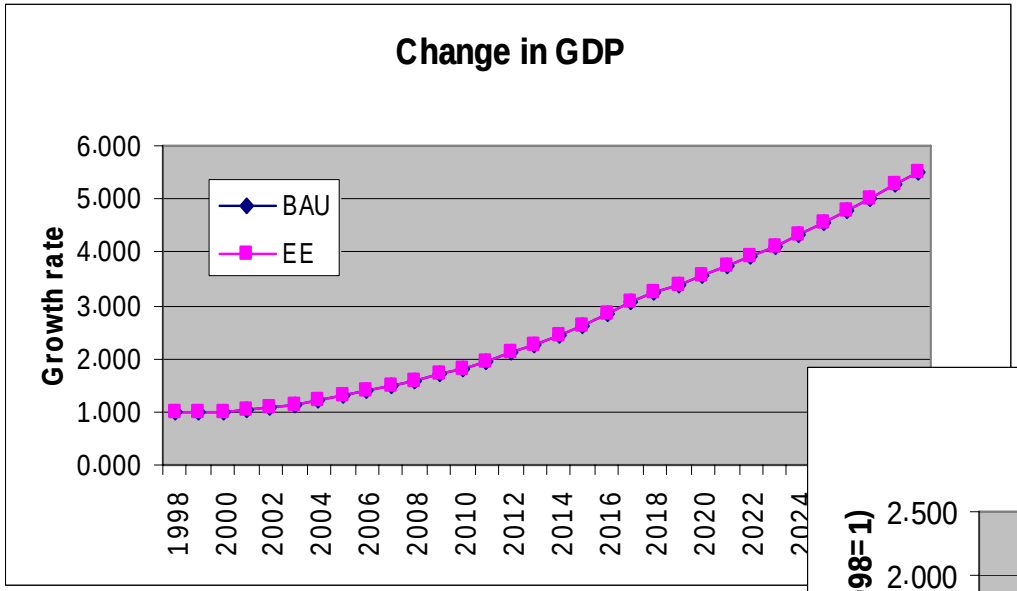
Compared with the real data, CO_2 emission and GDP during 1999 to 2001 is less than 5% error, while import and export data is ~10% error,

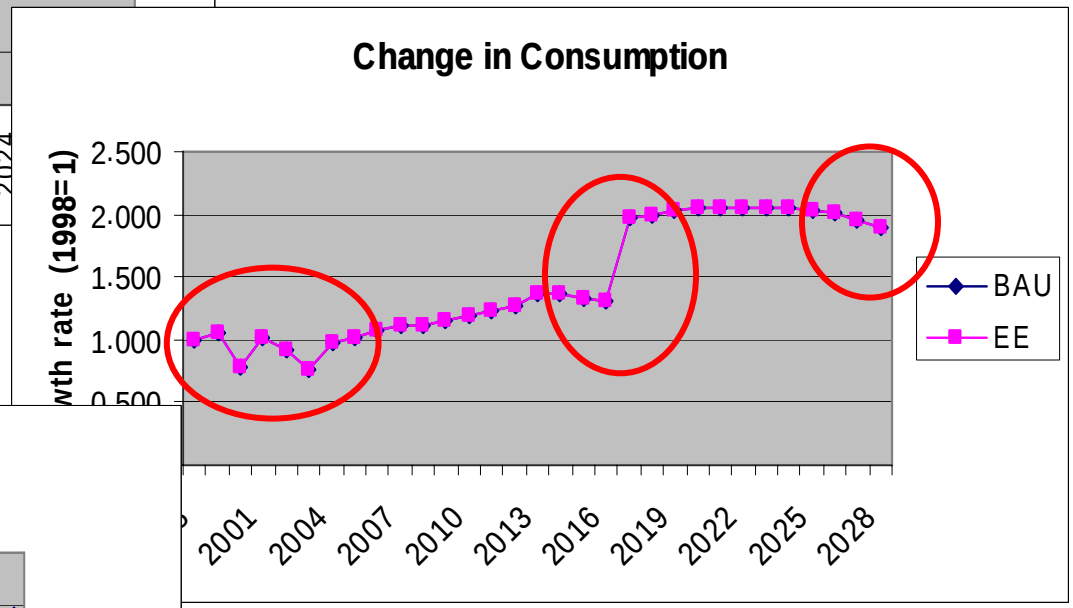
Note; During 2029-2030, the GDP decreases while consumption is equal to zero.

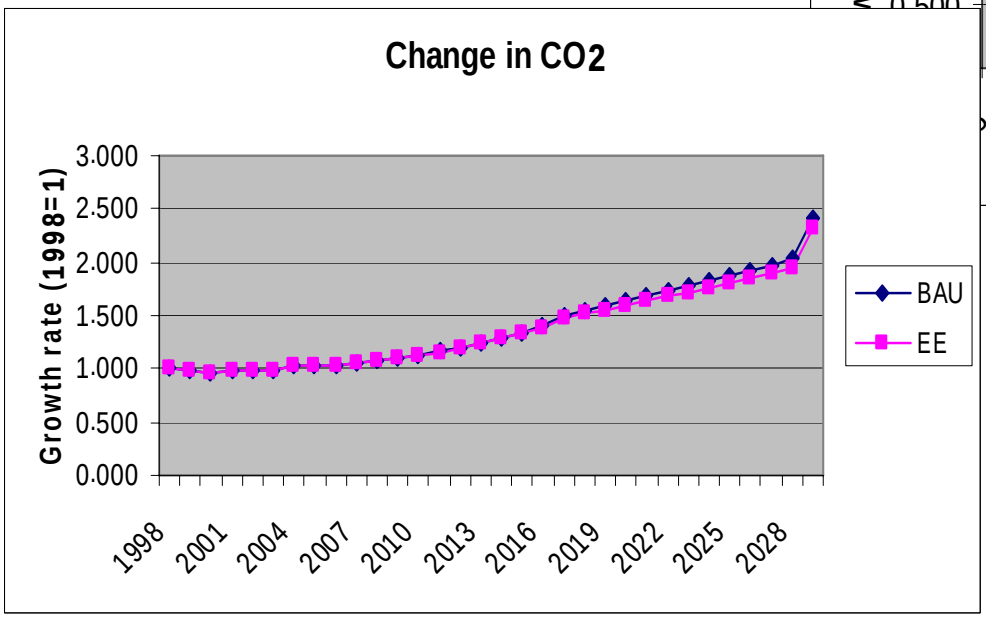
Results from the model

BAU compare with Energy Efficency and Tax Scenario

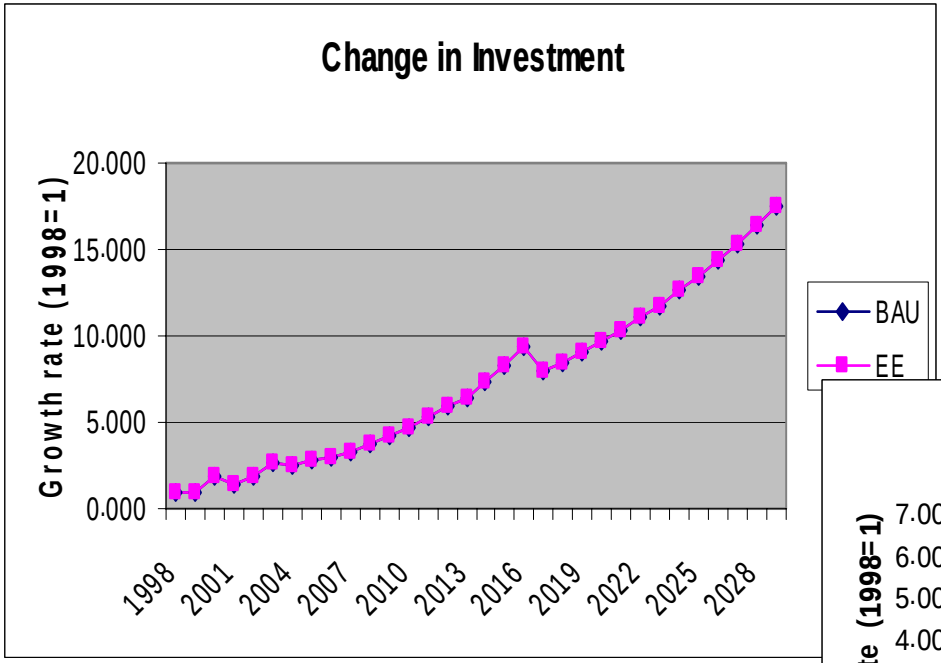
BAU and EE Results

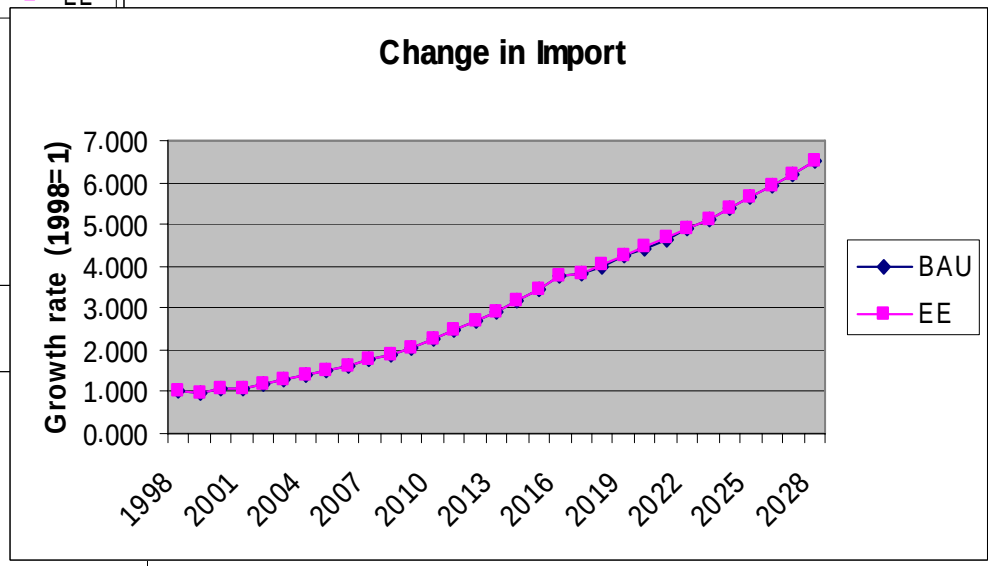


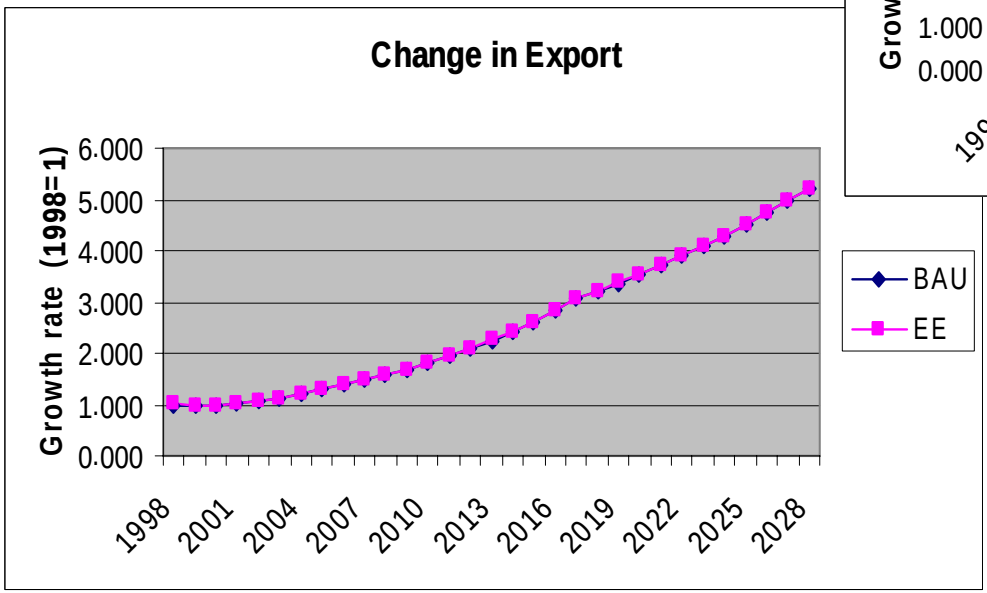




BAU and EE Results







Result

EE Scenario

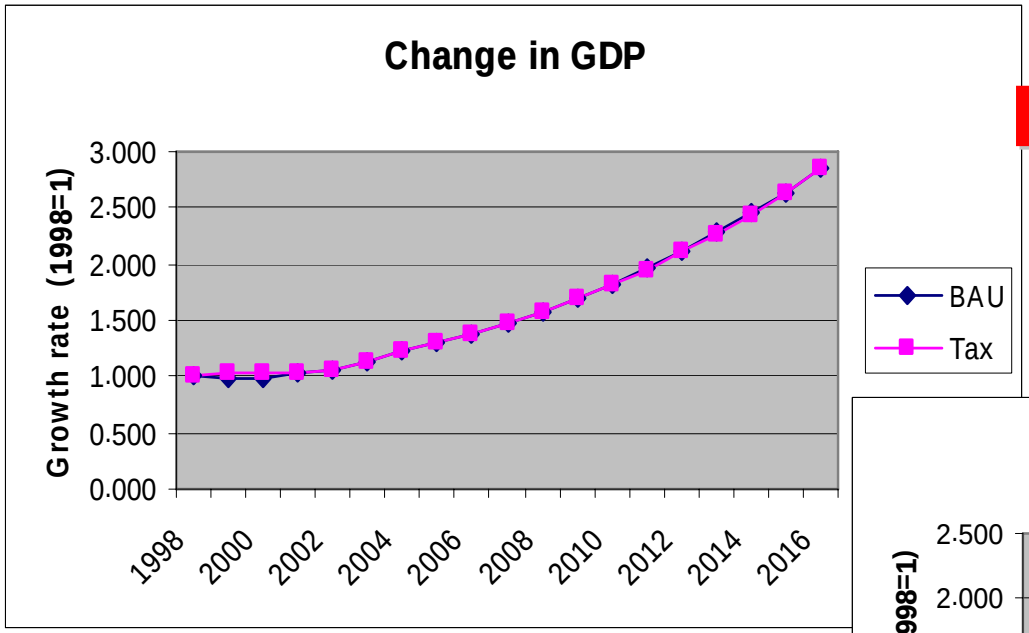
Results under BAU and EE scenarios are almost similar

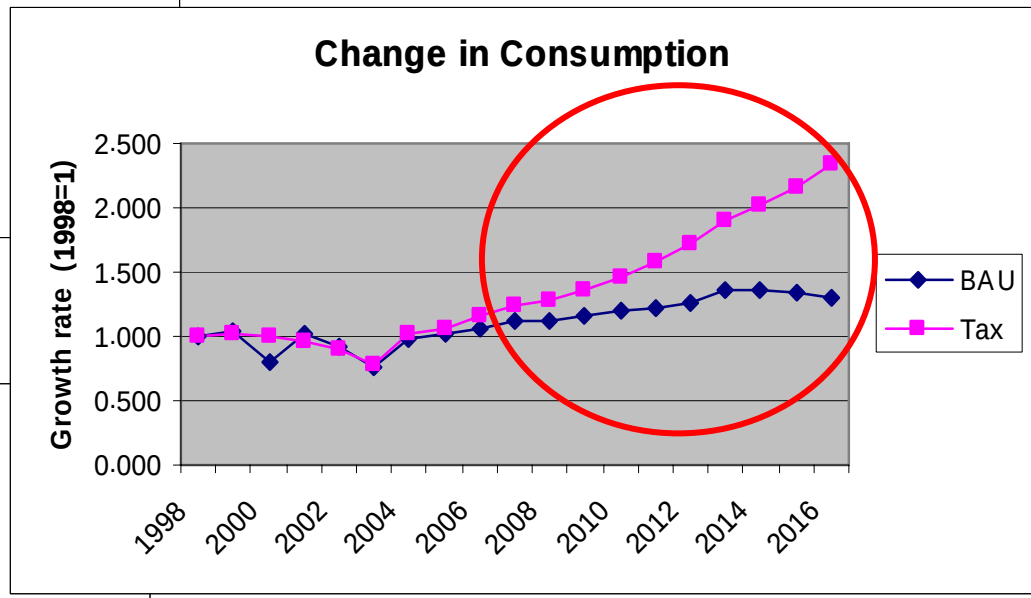
The model results for consumption seems to have a problem while the other variables (GDP, import, export, investment, and CO_2) have the similar trends,

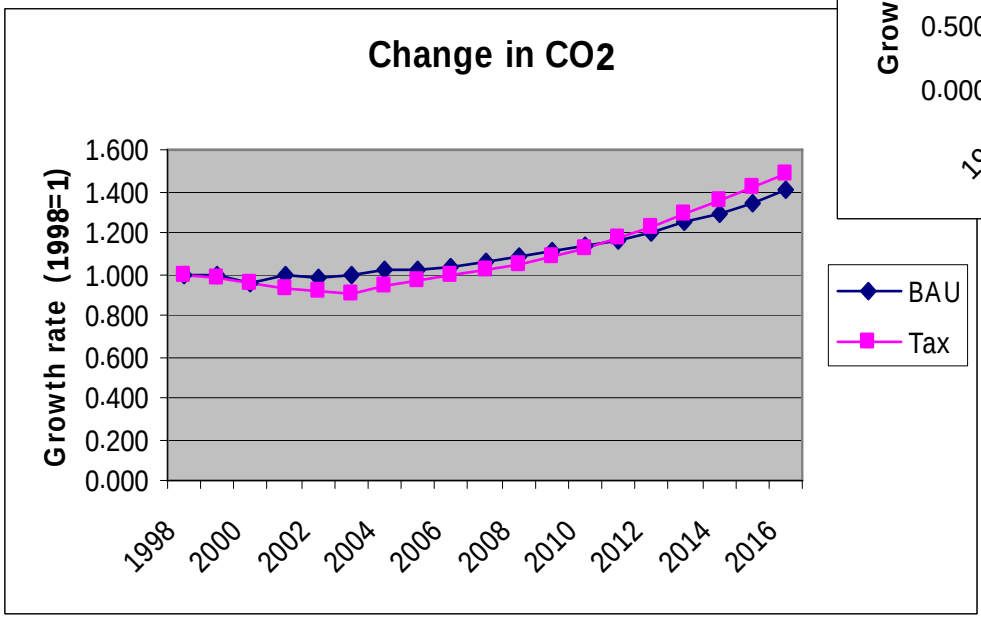
The reasons behind this may be :

- **the restricted flexibility of elasticity of substitution in the model, and**
- **The limited impacts from selected three manufacturing sectors**
- **the labor is assumed as exogenous in the model while capital is assumed as endogenous**

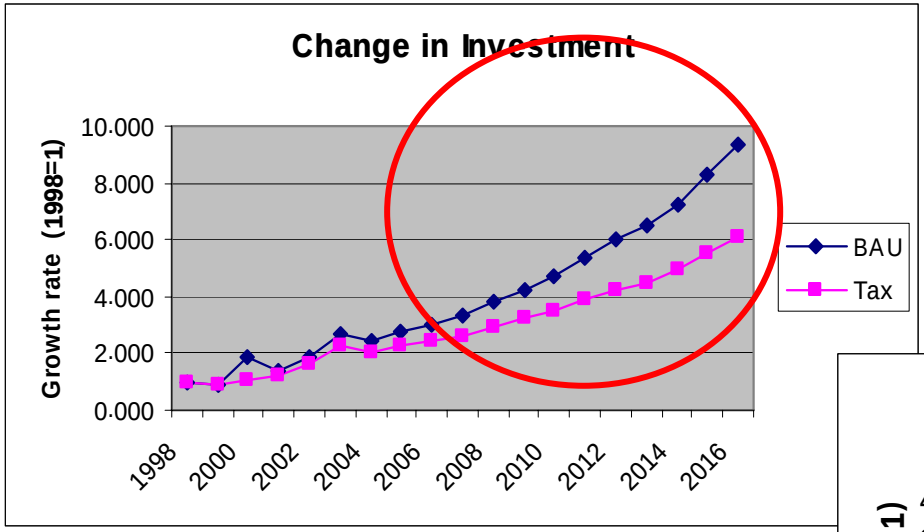
BAU and Tax results

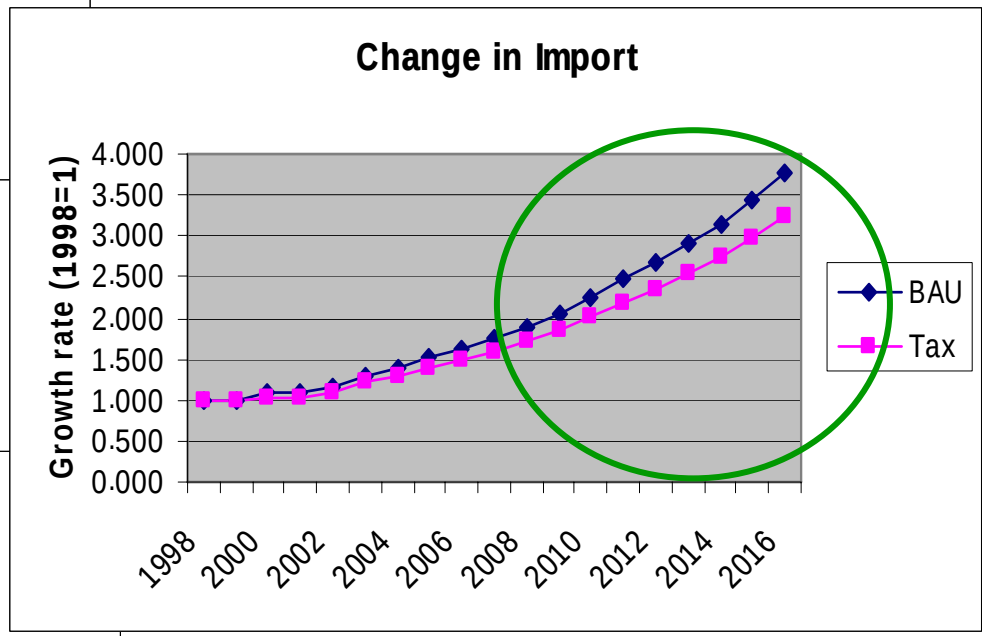


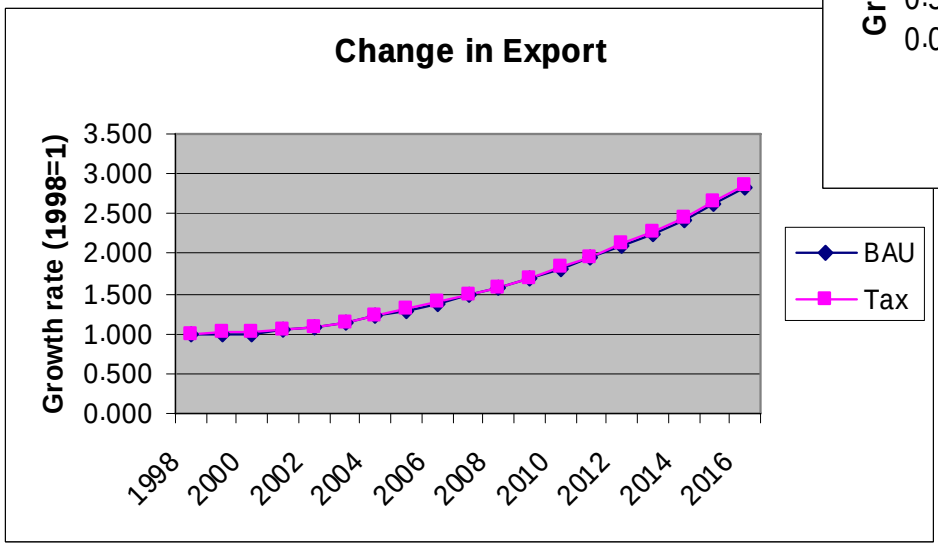




BAU and Tax results







Result

Tax Scenario

Results from the tax are limited to the year 2016 due to the data problem,

The values of import is lower due to the import tax (which is 1/4 of the total tax),

The values of investment is lower due to the labor tax (which is more than 1/4 of the total tax),

For the case of consumption, the results seems to be against the economic theory ???
(Consumption should decrease when tax is imposed…)

Modeling Experiences

Data Limitations

- Fixed capital formation and labor tax data,
- Oil and gas production data from I-O are presented in the same sector,
- All energy related conversion data (CO_2/ktoe, extraction cost, etc.) are taken from Japan database,

- Limited exposure to MPSGE
- SAM to V- and U-Matrix concept

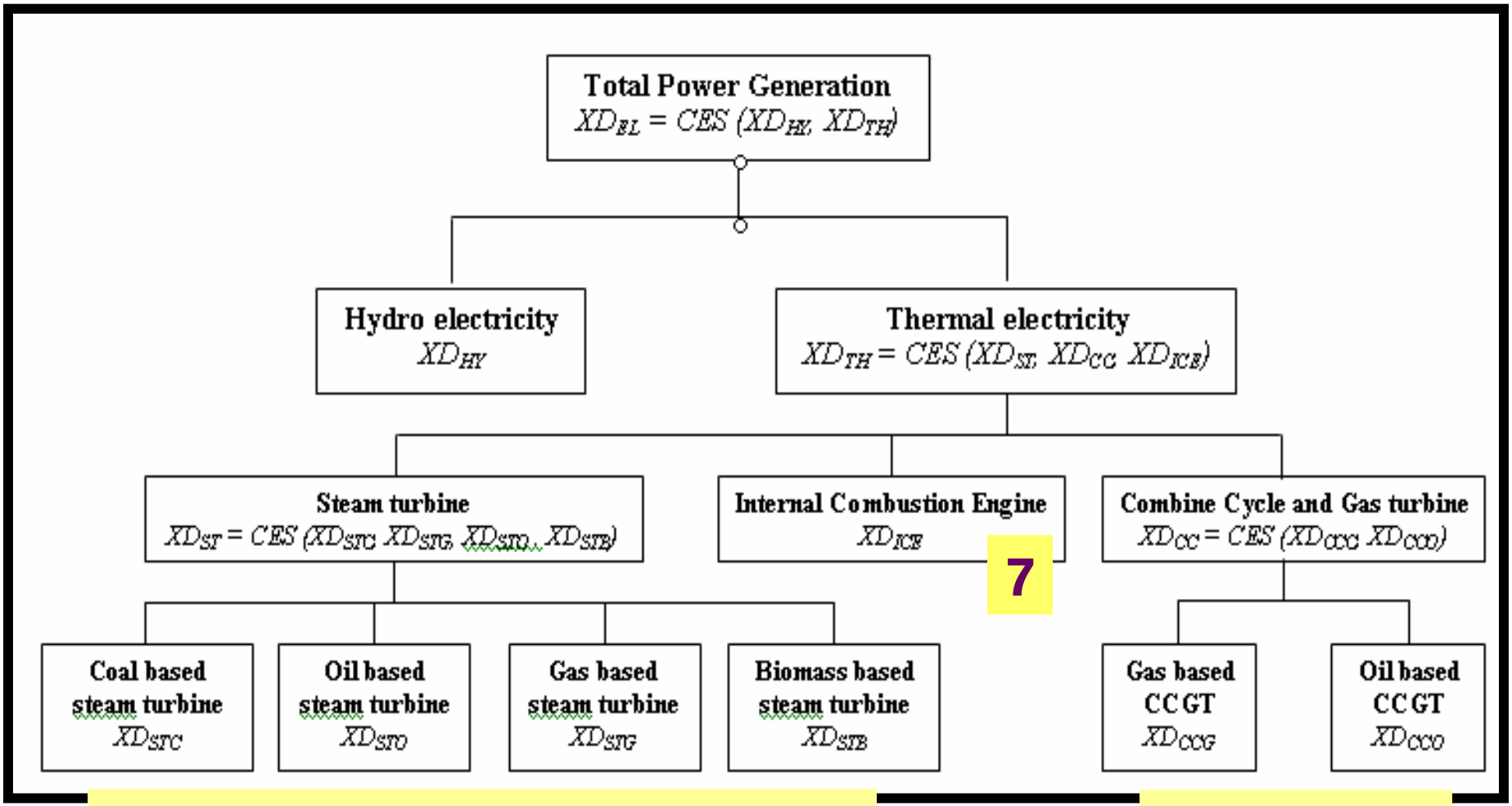
Proposed Activities

(1) Disaggregate the Electricity sector into 7 sub-sectors particularly for energy related environmental issues ;

→ Increase the share of biomass power plant to 5% by 2010 (RPS) → Thai policy

→ Natural gas import and infrastructure ?

Special treatment: Electricity Generation



Proposed Activities

(2) Extend the energy efficiency issues to measure the Rebound effect from the National Energy Conservation Promotion Act;

(3) Carbon reduction policy

- Carbon tax (distributional effects)
- Energy tax (Btu)
- Tax revenue recycling schemes

(4) Reduce energy consumption by 10%→Thai policy

- Through energy efficiency improvement
- Through innovative technologies (SDB)

Looking Forward

- Understanding the linkage of top down and bottom up models within AIM models family
- Additional works need to be carried out particularly on Database for Thailand
- The policy options (energy security, CDM) should be coherent with national policies
- In Thailand, local & regional pollutants are important as well (AIM/air??)
- Working towards IPCC Scenarios in modeling
- Linking information from SDB as a future policy that can be used in AIM family of models

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- ENERGY

Areas of Specialization

- Electric Power System Management
- Energy Economics and Planning
- Energy Management (New)
- Energy Technology
- Gas-Fired Power Plant Technology (New)

Interdisciplinary

- Cleaner Production


Thanks you