New Activities of CGE Model Development

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Presentation outline

- Current issues in CGE modeling activities
  - Original data issues
  - Model structures

- Identification of the issues

- Proposition of solutions to those issues

Climate change and CGE model

- CGE model simulation contributed to the climate change issue
  - GHG, Mitigation cost and Economic impact

- A lot types of / similar models have been developed
  - AIM/CGE, SGM ….

Model	Model Type
AIM	Multi-Sector General Equilibrium
AMIGA	Multi-Sector General Equilibrium
GTEM	Multi-Sector General Equilibrium
GEMINI-E3	Multi-Sector General Equilibrium
EU-PACE	Multi-Sector General Equilibrium
EDGE	Multi-Sector General Equilibrium
EPPA	Multi-Sector General Equilibrium
IPAC	Multi-Sector General Equilibrium
SGM	Multi-Sector General Equilibrium
WIAGEM	Multi-Sector General Equilibrium

Purpose of this presentation
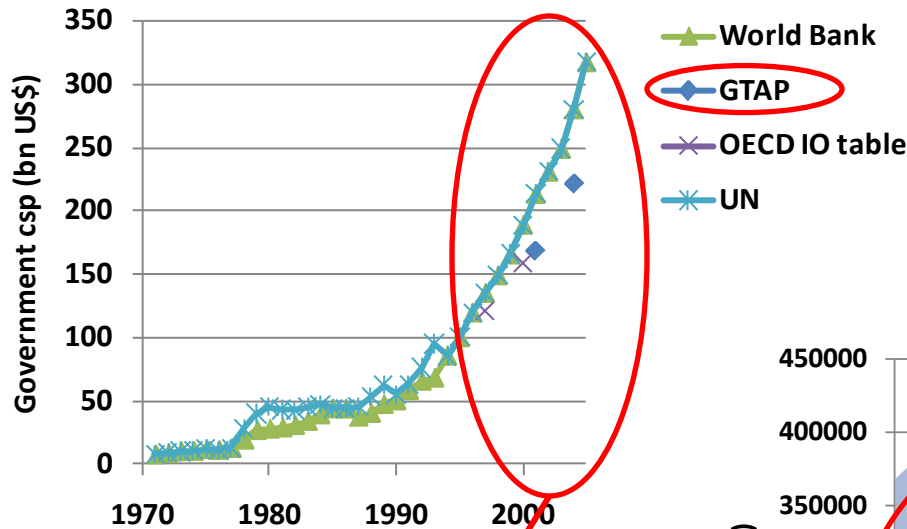
- Answer to those questions

  - What is needed to the CGE modeling activities?
    - Original data issues
    - Model structures

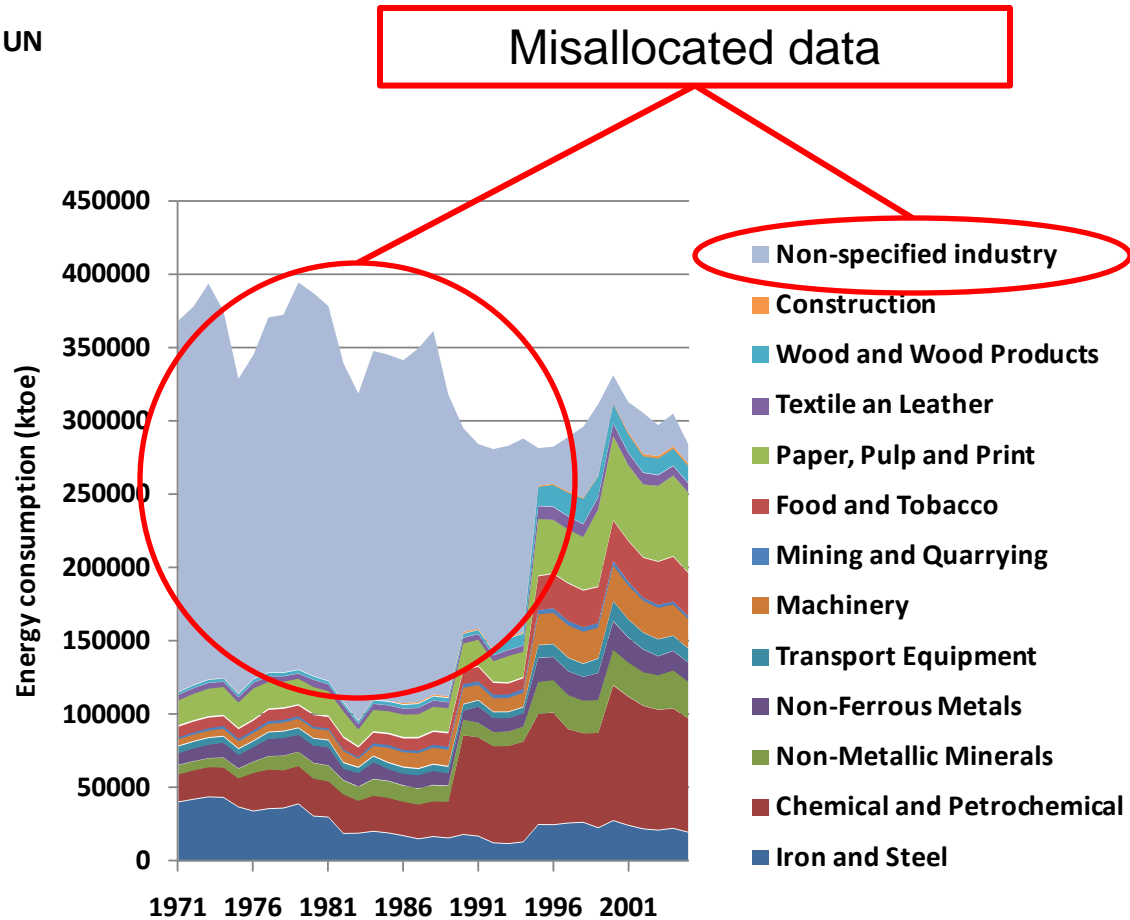 Validate the results with the historical statistics

  - How can we overcome the issues?

Original data issues

China's government consumption

GTAP is not consistent with original statistics

Misallocated data

US industry energy consumption (IEA Energy balance)

Purpose of this presentation

- Answer to those questions

  – What is needed to the CGE modeling activities?
   - Original data issues
    - Model structures

    Validate
   CGE simulation results
    historical statistics

  – How can we overcome the issues?

Frameworks and key assumption

- Regions; 3 (OECD, BRICs, non-OECD)
- Period; 2005 → 1971 (1 year step)
- Exogenous parameters
  - GDP
  - Saving propensity
  - Government consumption
  - OECD's CPI
  - Differences of factor prices among sectors (agr, fossil fuel mining, industry, service sectors)
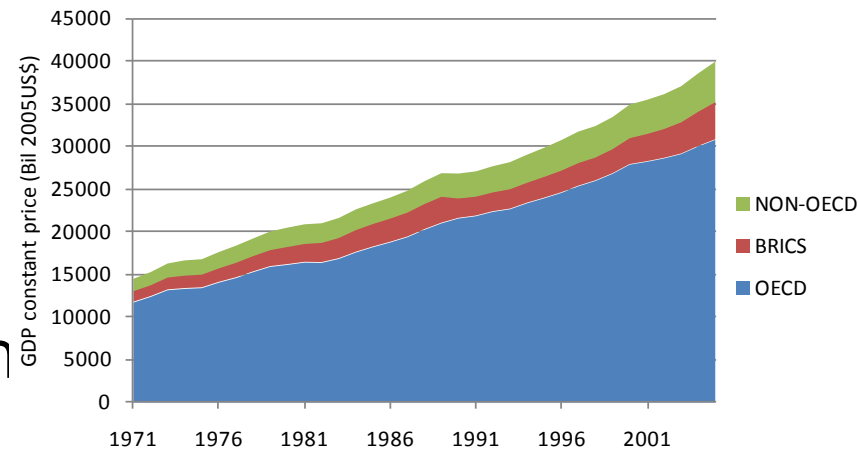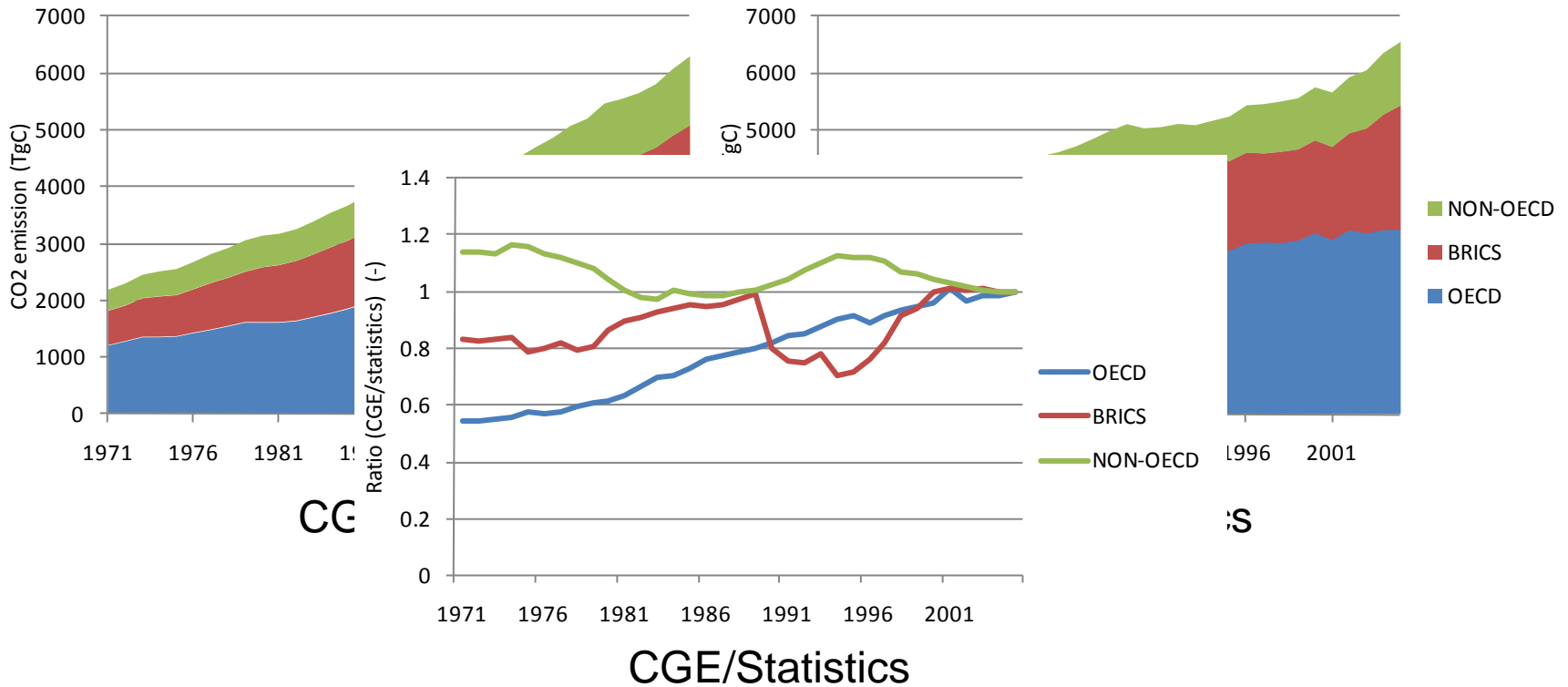
Industrial structure in OECD
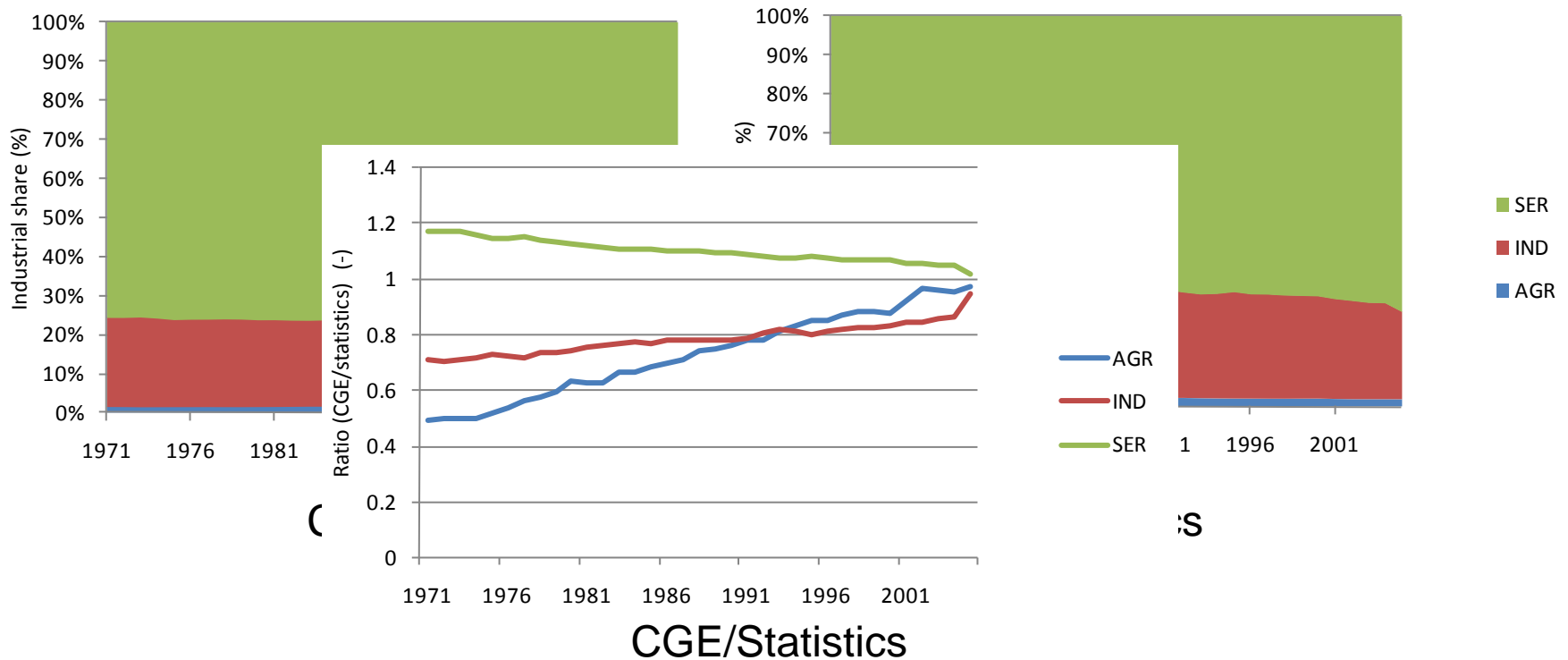
- CGE : non-change industrial structure
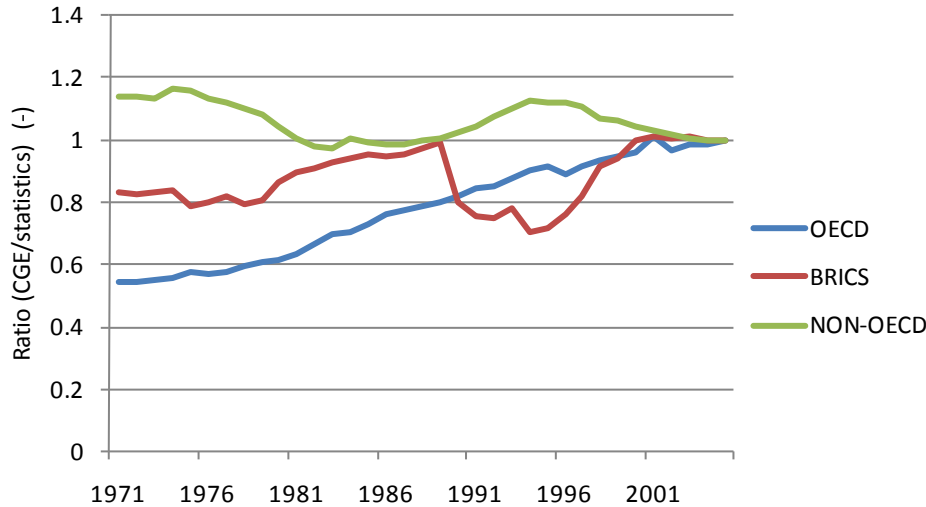- Statistics : change industrial structure
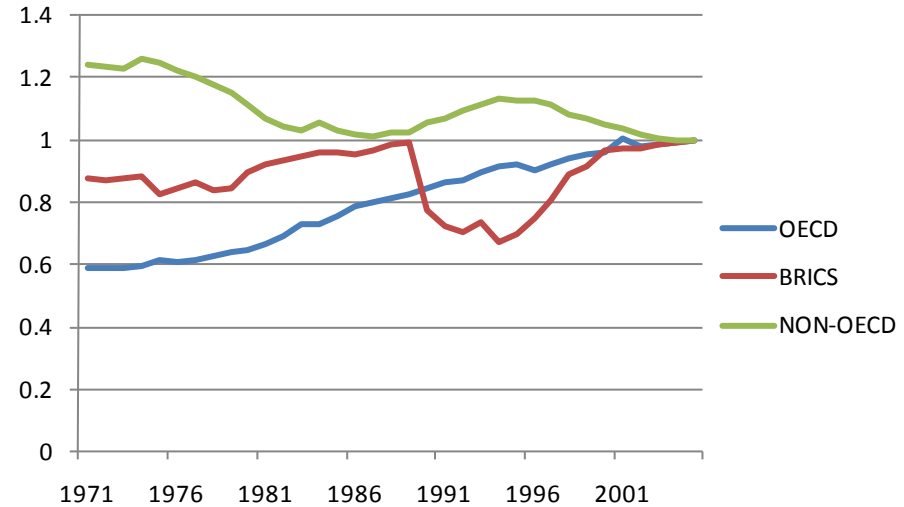
Results(1)
CO2 emissions

- CGE < Statistics
- OECD is the most different

CO2 emissions and energy consumption

CO2 emission

Energy consumption

- Energy consumption and CO2 emissions show similar trajectories
- Energy consumption is the key issue

Discussions

- What makes the difference between statistics and CGE?

Production function

- How can production functions be modified?

Productivity, Energy efficiency

- Does it make any improvements to the forecasting simulation?

Empirical evidences for changing the model assumptions

- Are there any other functions need to be modified?

Trade and consumption function

Purpose of this presentation

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  - How can we overcome the issues?

# Overview of the model development
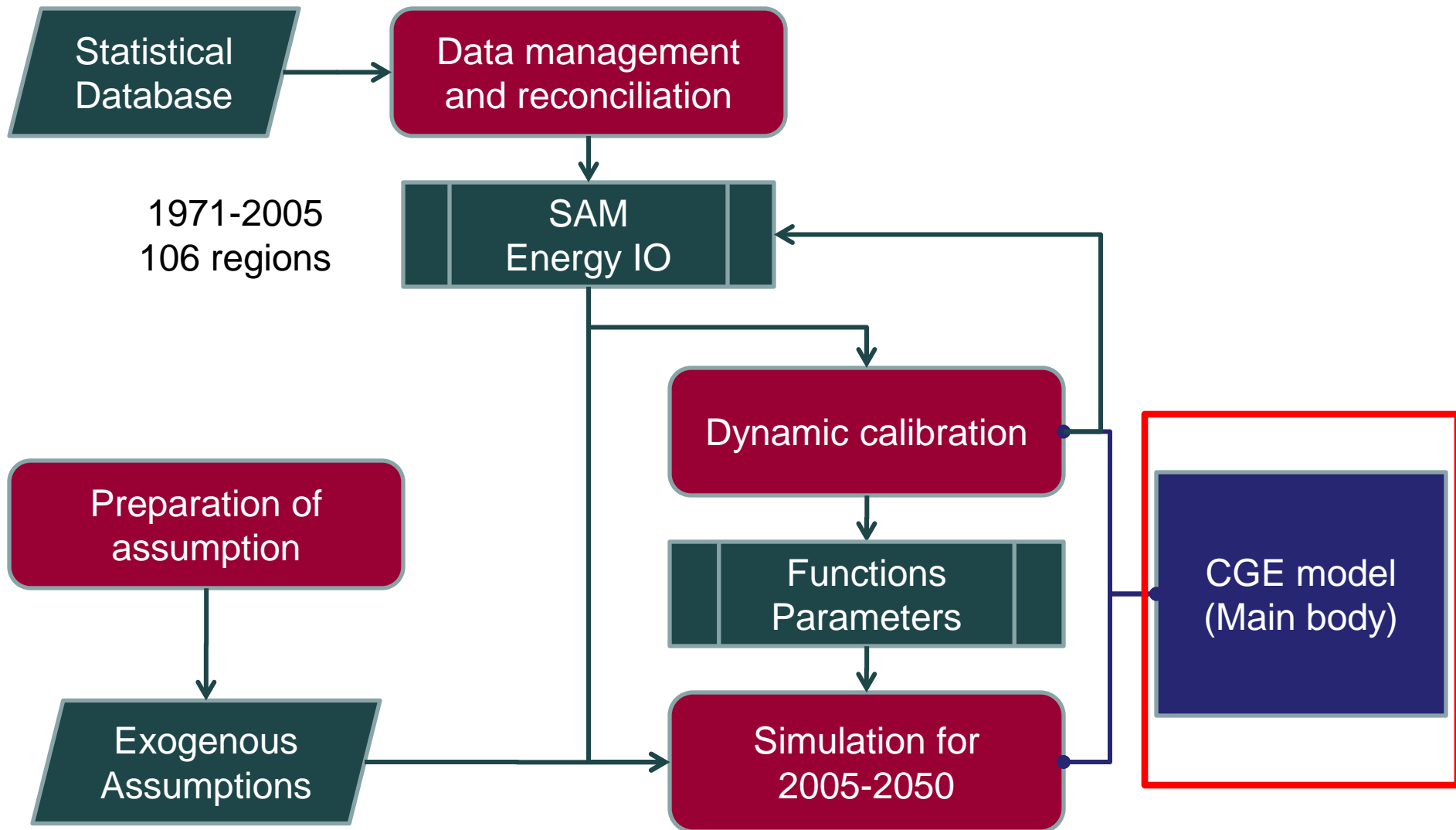
Model characteristics

- Based on IFPRI's model (Lofgren, 2002)
- Expansion
  - Regions; [World (30-40 regions)] / [Country]
  - Period; 1971-2050
  - Productive activities; 25-30 (multi-power sectors)
  - Institutional sectors; Household, Government, Enterprise
 - Dynamic Recursive
  - World market for each goods

Overview of the model development

Statistical Database

Data management and reconciliation

1971-2005
106 regions

SAM
Energy IO

Preparation of assumption

Dynamic calibration

Functions Parameters

CGE model (Main body)

Exogenous Assumptions

Simulation for 2005-2050

Data management and reconciliation

- Main purposes
  - Supplement missing data
  - Reconcile the inconsistent data

- Data management platform
  - GAMS code
  - EXCEL and GDX file

Almost finished

- Using Historical statistics
  - International and country statistics

- Easy to control sector and region classifications
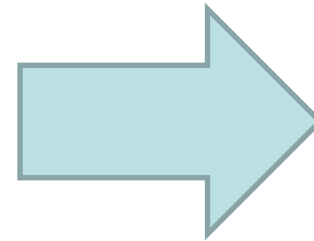
Reconciliation results
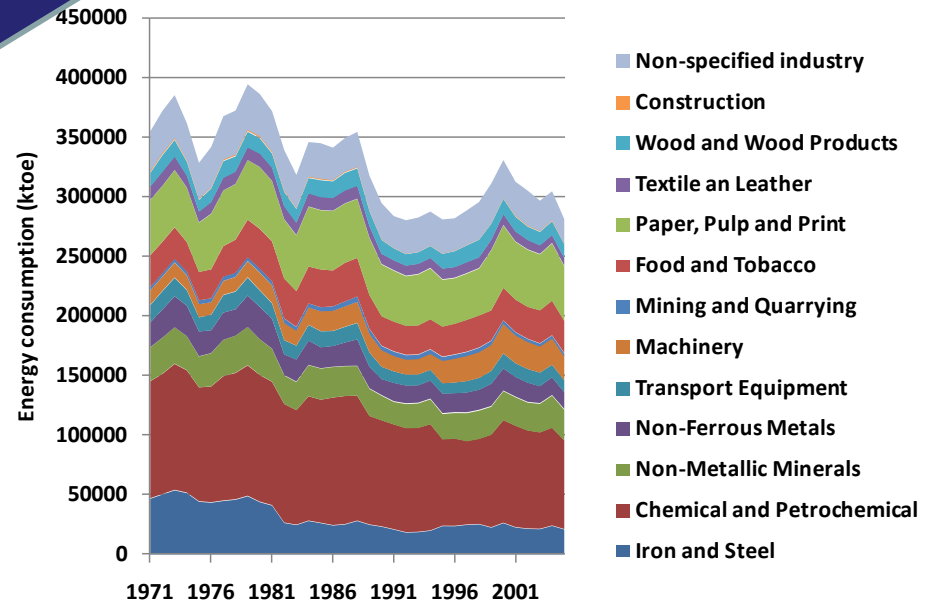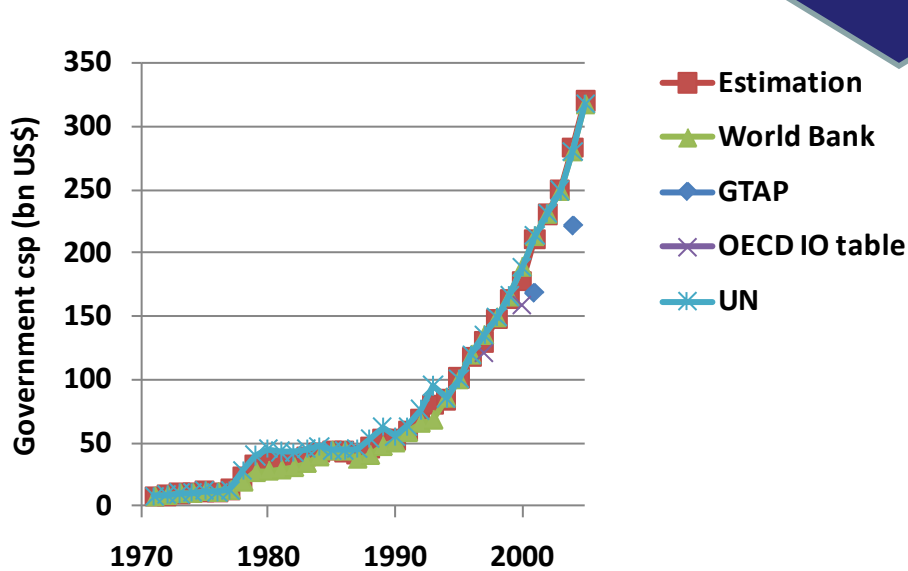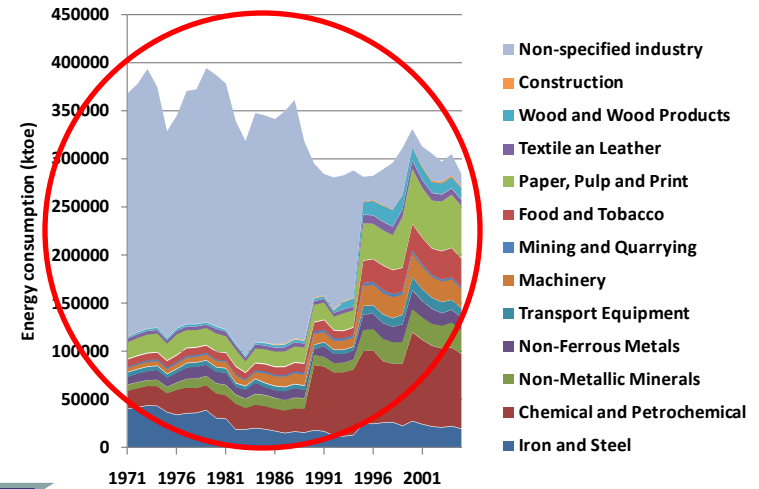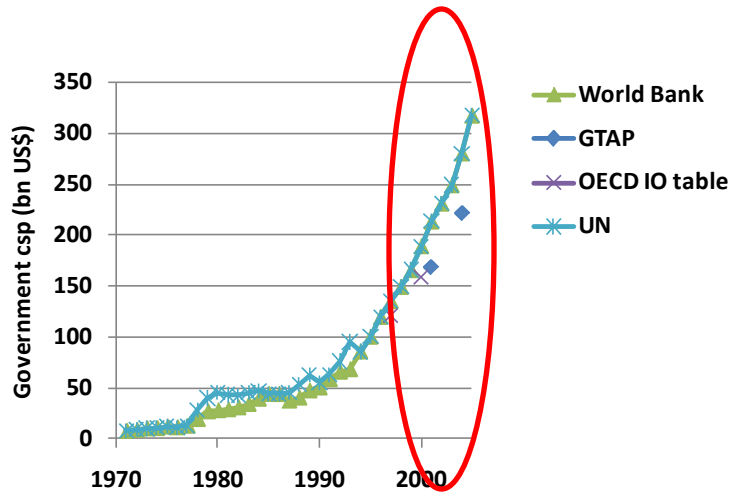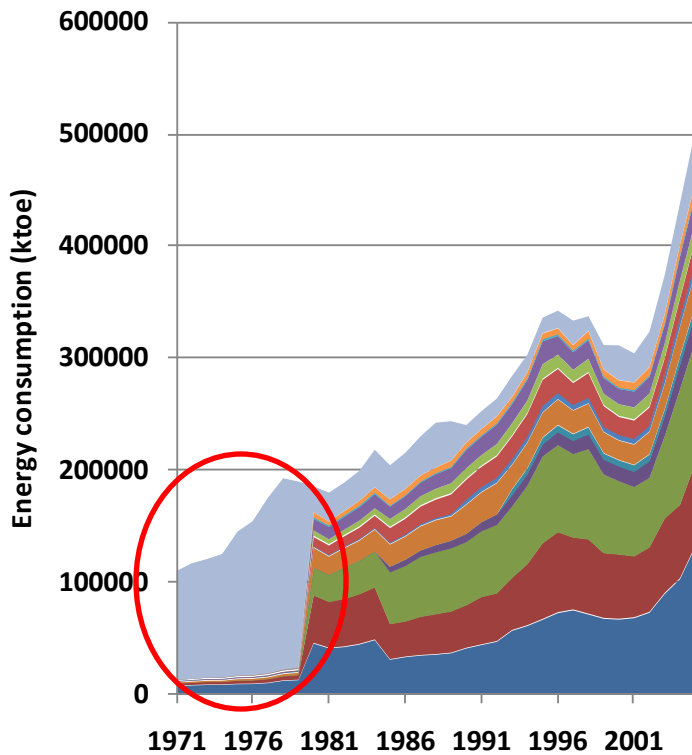
Japan
Industrial energy consumption

Legend (right):
- Non-specified industry
- Construction
- Wood and Wood Products
- Textile an Leather
- Paper, Pulp and Print
- Food and Tobacco
- Mining and Quarrying
- Machinery
- Transport Equipment
- Non-Ferrous Metals
- Non-Metallic Minerals
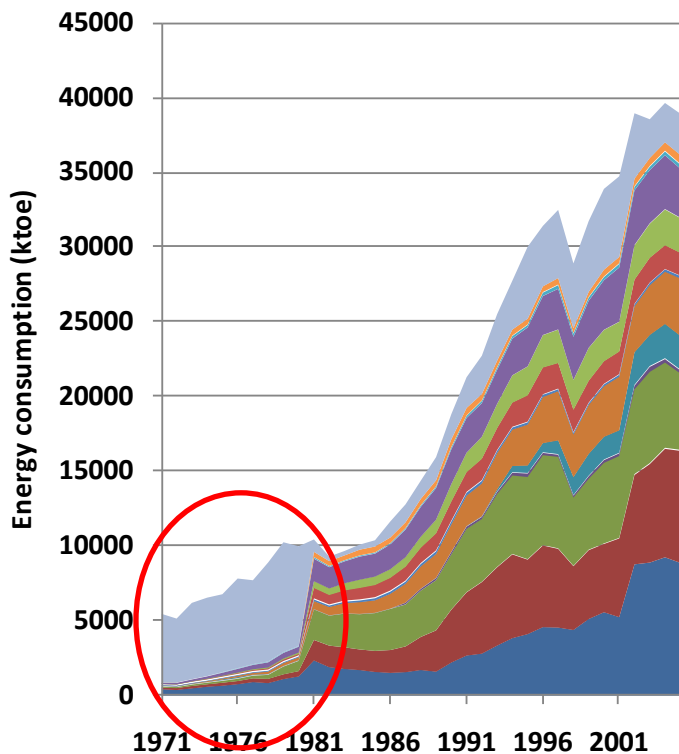- Chemical and Petrochemical
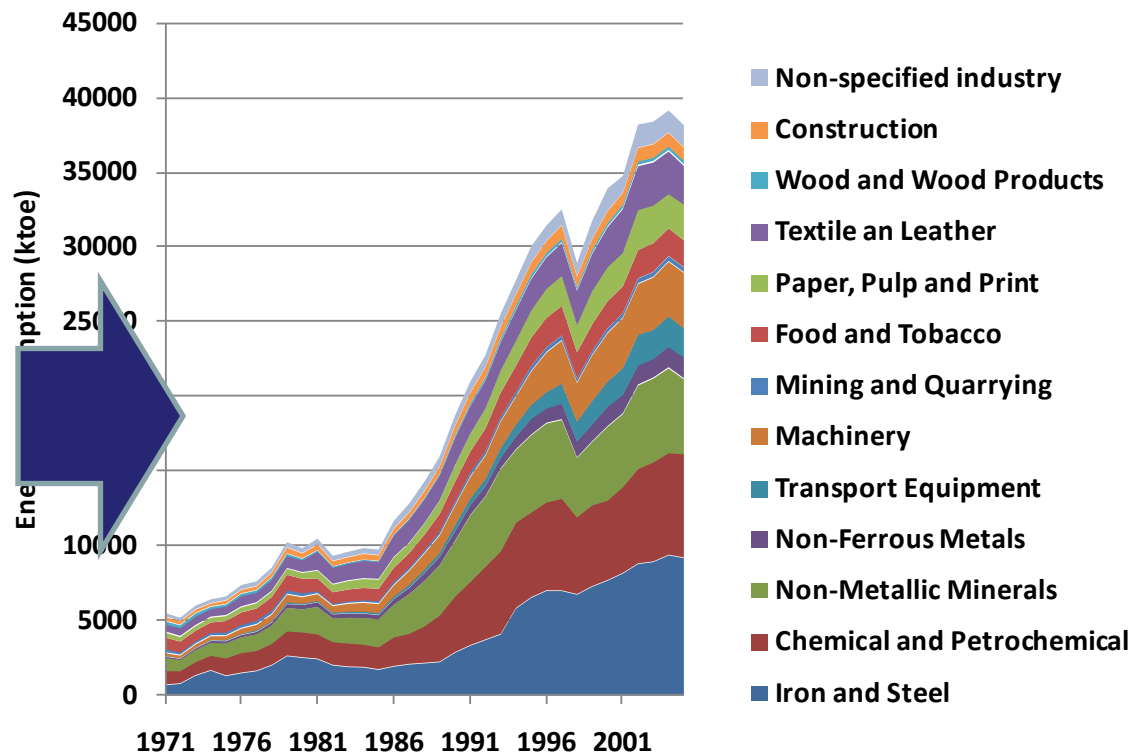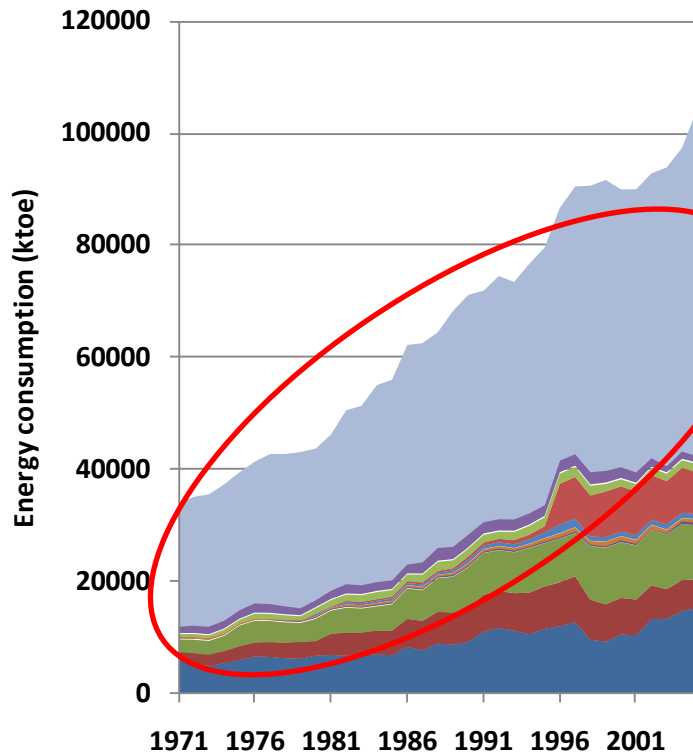- Iron and Steel

IEA Energy balances

Reconciliation results

China
Industrial energy consumption
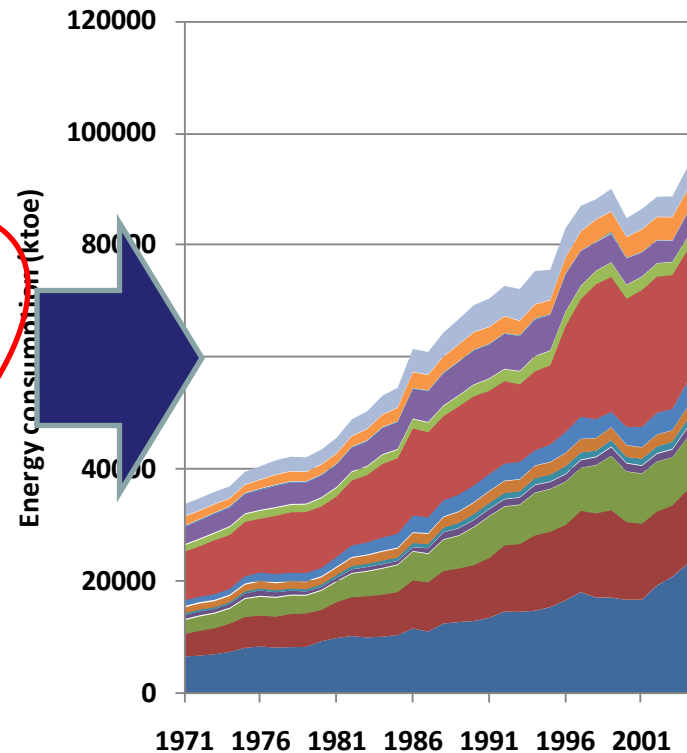

IEA Energy balances
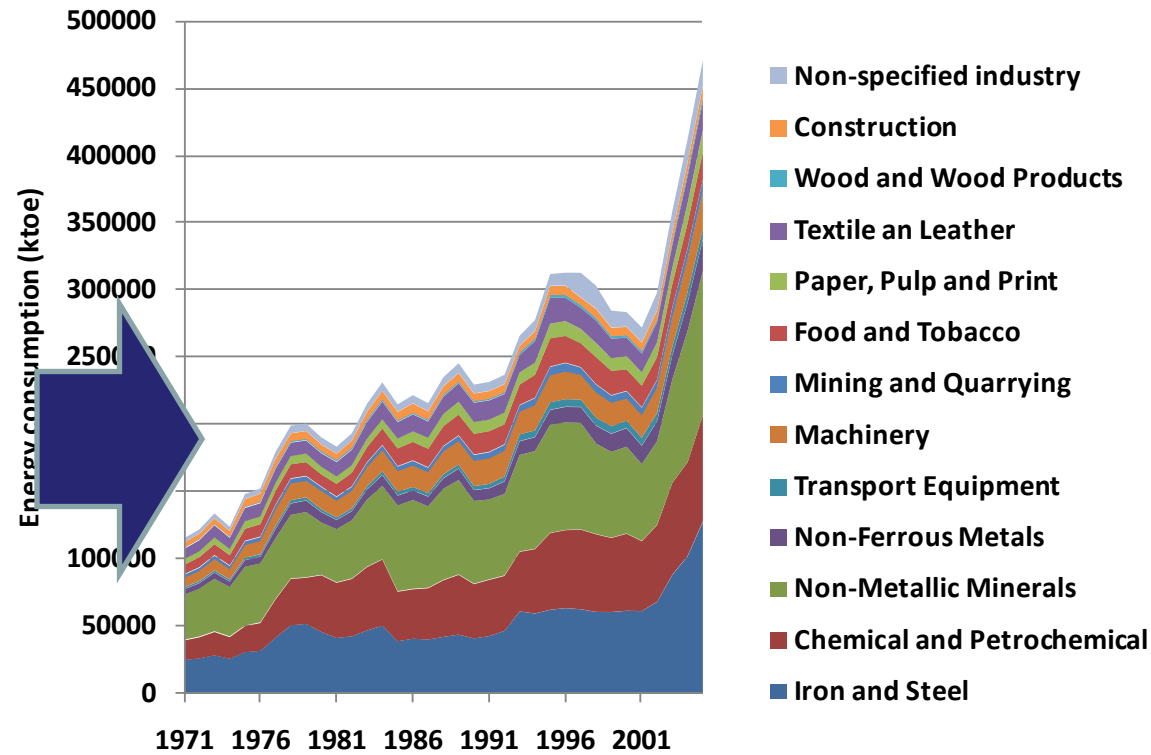
Reconciliation results

Korea
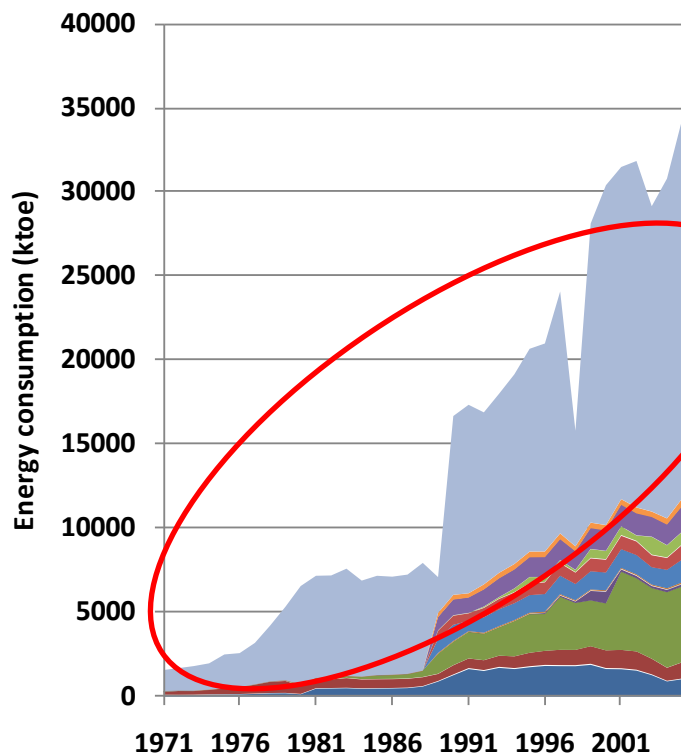# Industrial energy consumption
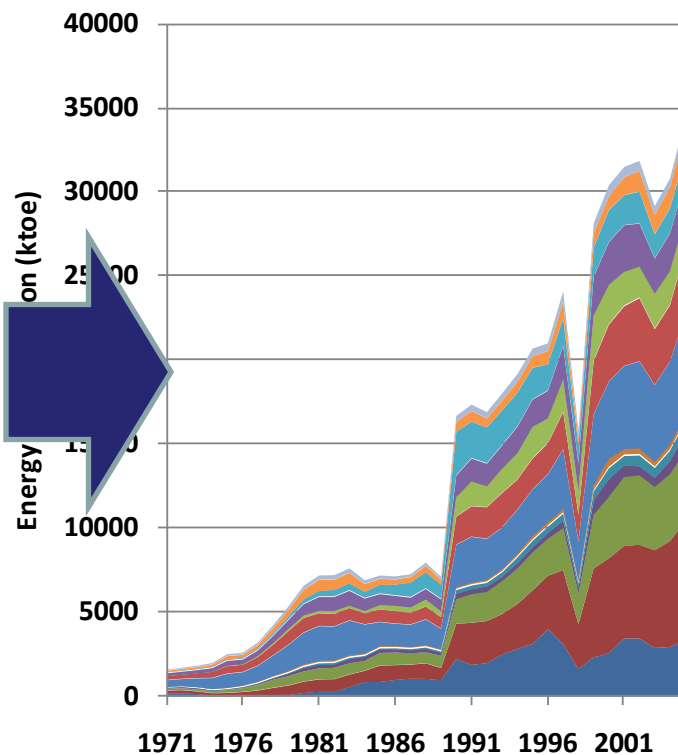

IEA Energy balances

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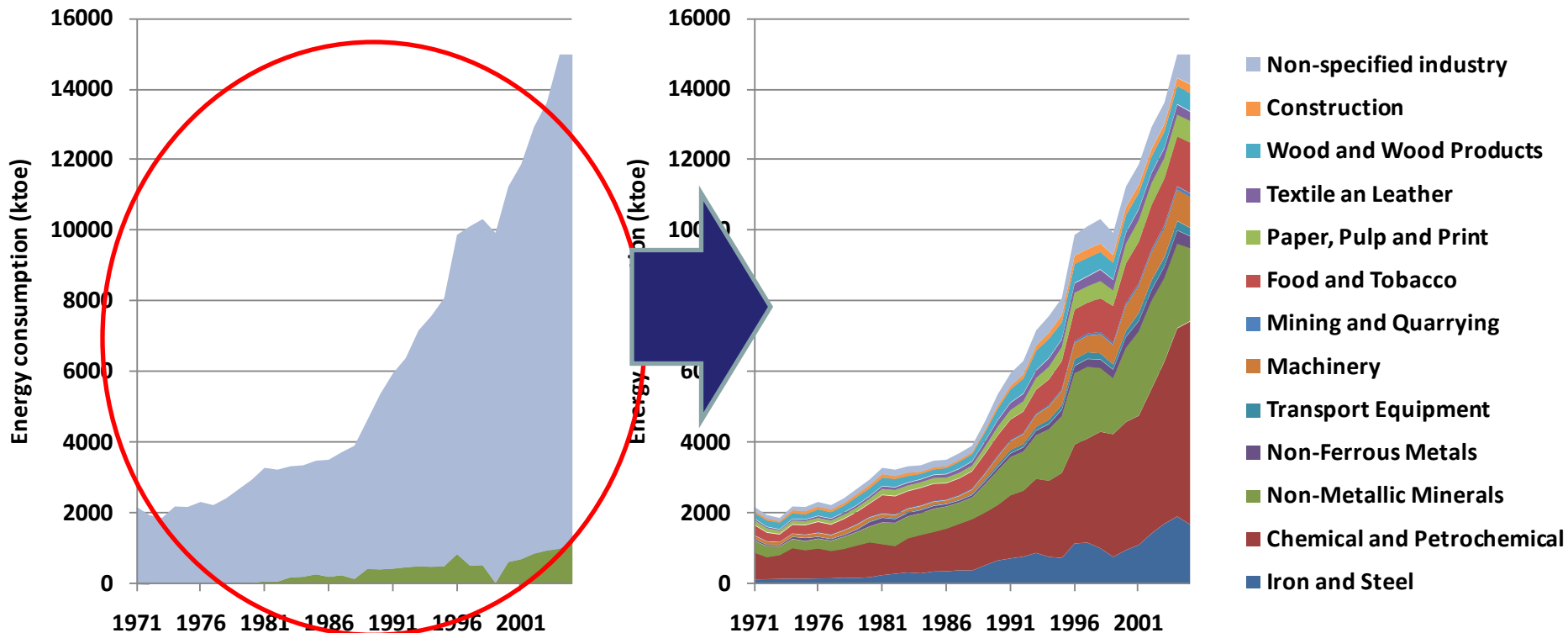# India
Industrial energy consumption

IEA Energy balances

Reconciliation results

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Indonesia
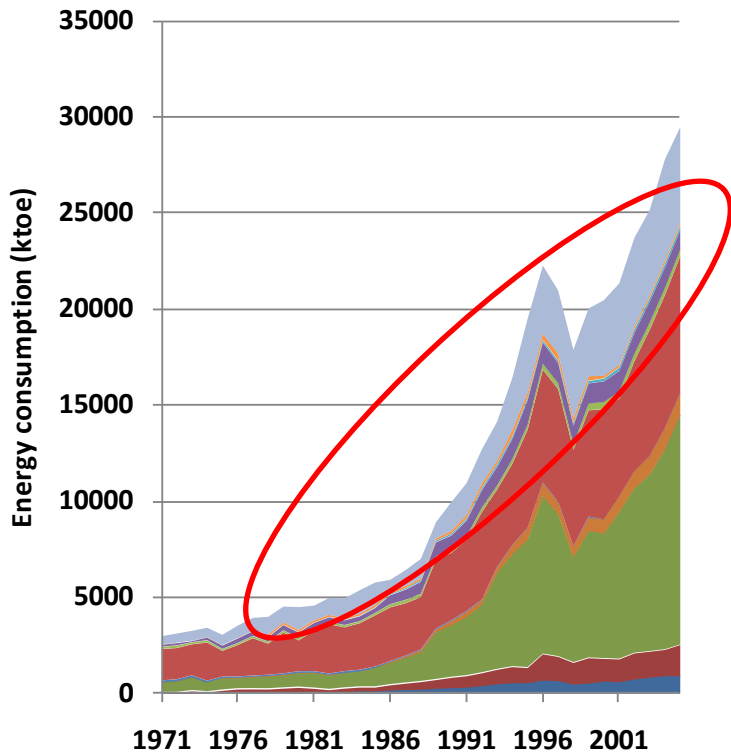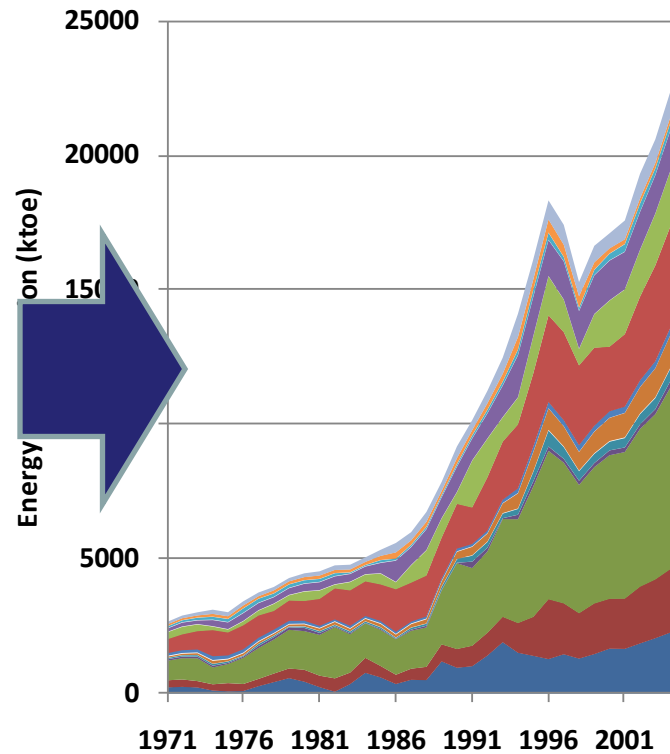# Industrial energy consumption

IEA Energy balances

Reconciliation results

Malaysia
Industrial energy consumption

IEA Energy balances

Reconciliation results

Thailand
Industrial energy consumption

IEA Energy balances

Reconciliation results

Viet Nam
Industrial energy consumption

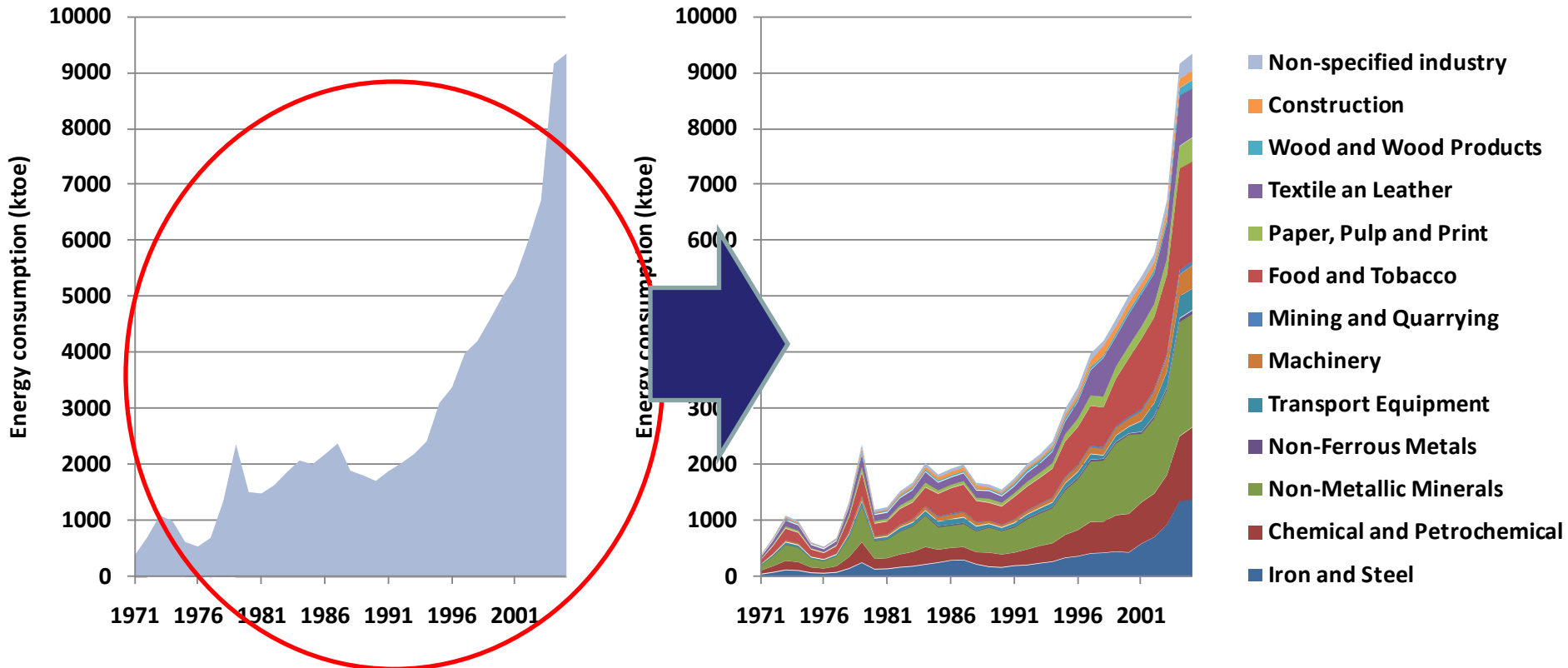IEA Energy balances

Reconciliation results

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Brazil
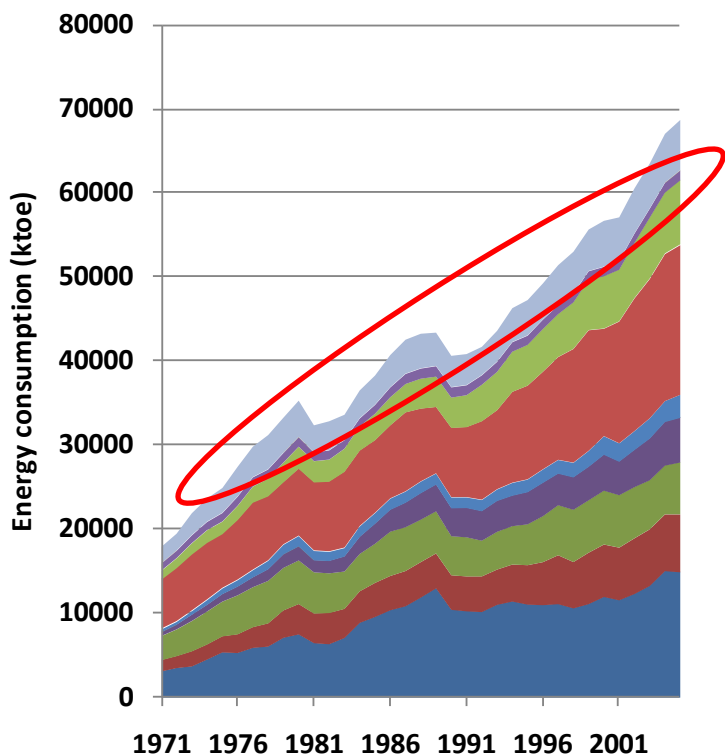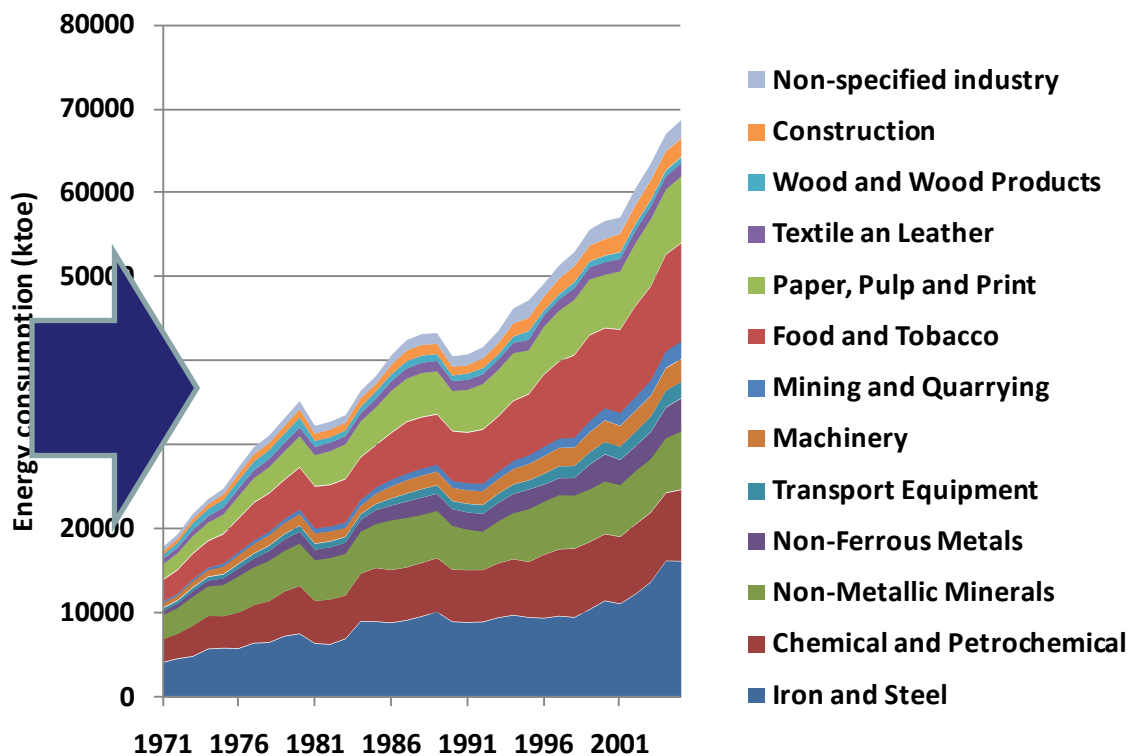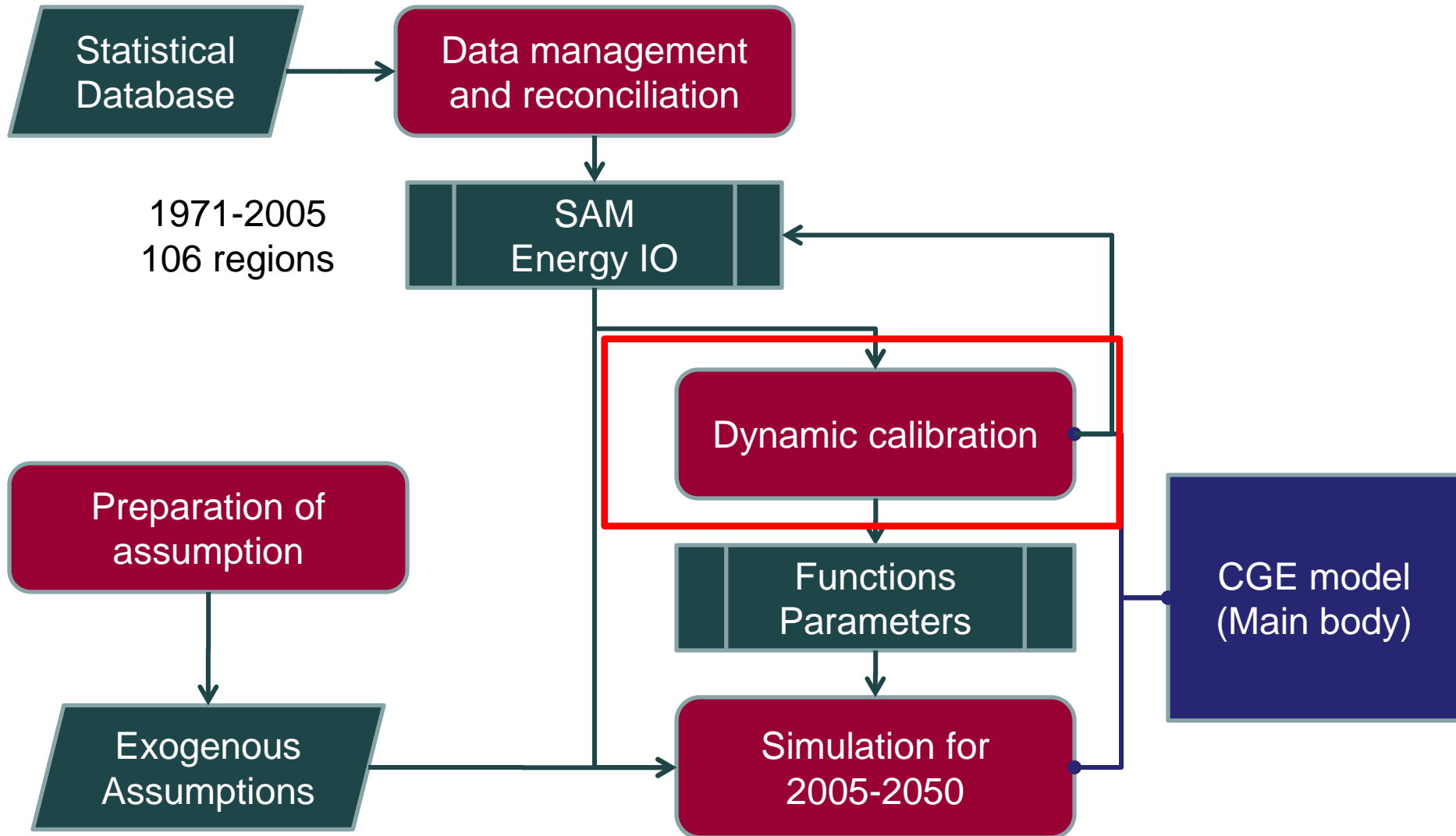# Industrial energy consumption

IEA Energy balances

Reconciliation results

Overview of the model development

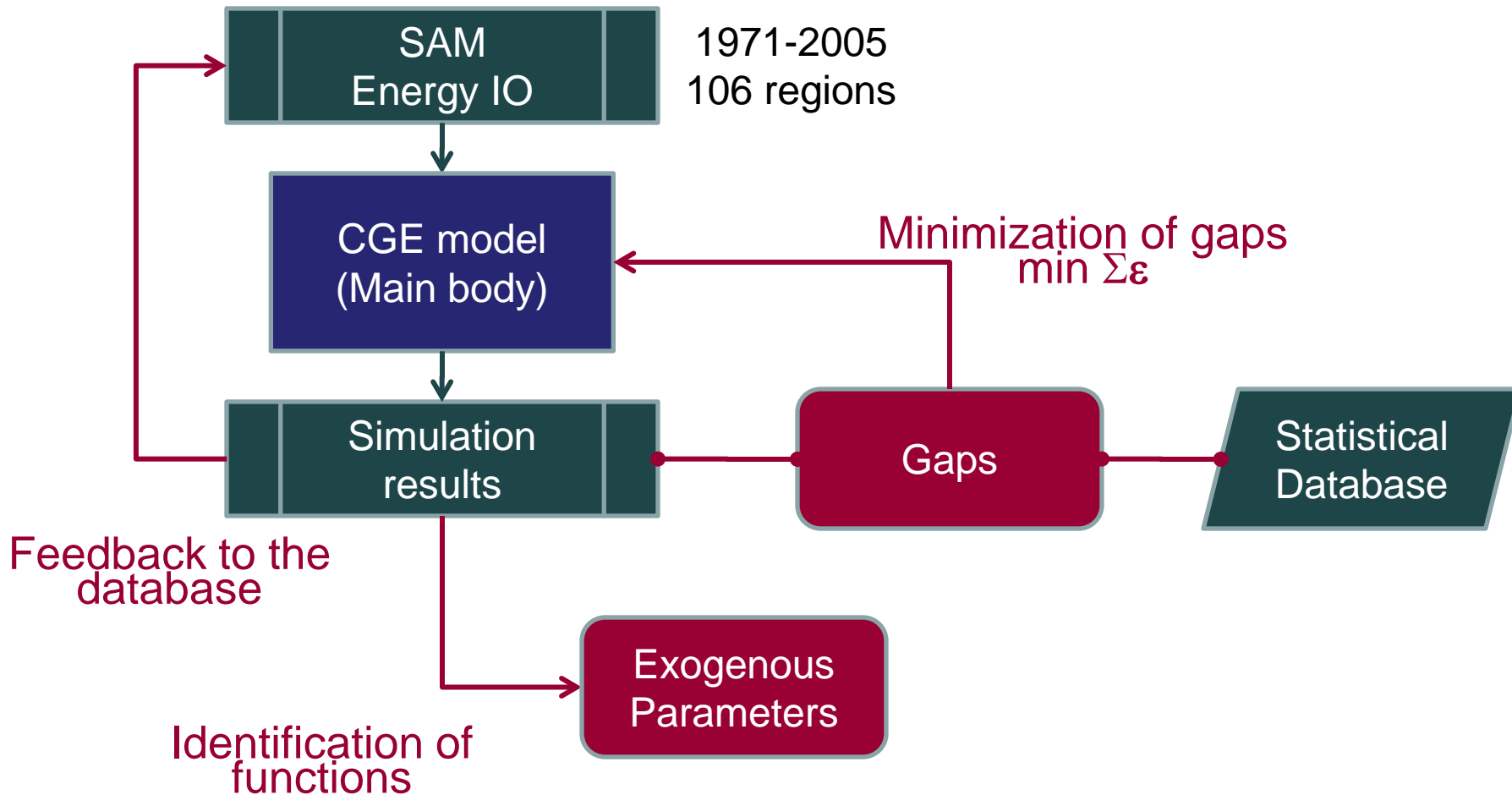# Dynamic calibration (1)

- CGE model - Backward running

1970   1980   1990   2000   2005
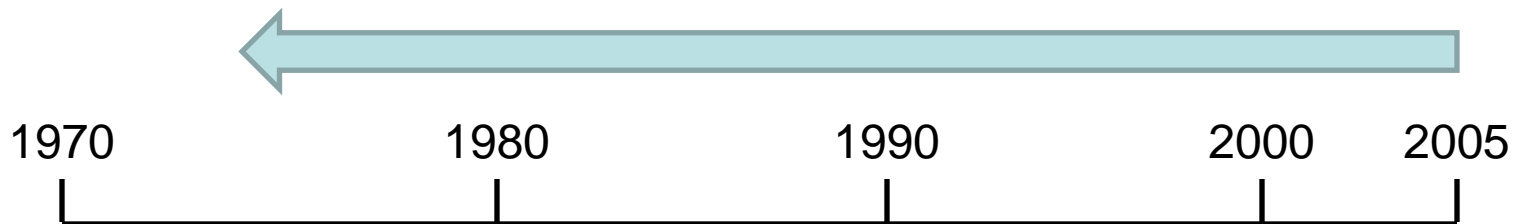
- Two main objectives
  - Identify the functions and parameters in CGE
  - Assist historical data reconciliation

Dynamic calibration (2)

Final remarks

- Current issues in CGE modeling activities and the identification of them
  - Original data issues
  - Model structures

- 2 key solutions to those issues
  - Data management and reconciliation system
  - Dynamic calibration system