

Joint Research Centre (JRC)

The POLES and GEM-E3 models



Peter Russ

IPTS - Institute for Prospective Technological Studies
Economics of Climate Change, Energy and Transport

Seville - Spain

<http://www.jrc.ec.europa.eu/>

Key Design Characteristics

- ▶ ***Participating Model:*** POLES

Prospective Outlook on the Long-term Energy System

- ▶ ***Model Type:*** Energy Model (simulation)

Participating Modelers: Peter Russ, Burkhard Schade, Laszlo Szabo, ...

- ▶ ***Time Step:*** 1 year

- ▶ ***Time Frame:*** 2000 to 2050 (optional 2100)

- ▶ ***Solution Type:*** Dynamic Recursive

Equilibrium Type: Partial Equilibrium

Computing Framework: VENSIM, C++

Inputs and Outputs

► Key inputs

- **Demographics:** Population by region
- **Economic:** GDP
- **Technology:** Technological data
- **Resources:** Depletable resources (e.g. fossil fuels and uranium); renewable resources (e.g. wind, solar).

Key outputs

- **Economic:** energy prices
- **Energy:** Energy consumption by sector
- **Emissions:** CO₂ emissions by source, non-CO₂ emissions (Kyoto gases), local pollutants (SO₂, Nox,..) only by coupling with EDGAR, carbon prices

Regional Scope & Other Detail

▶ Regional Details:

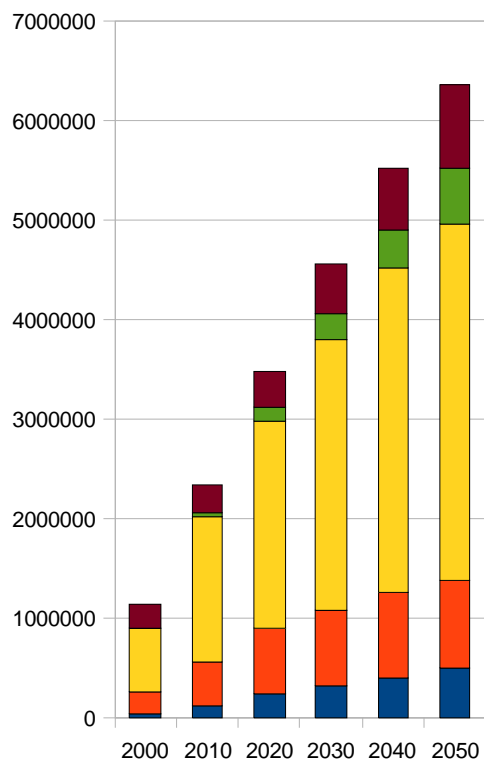
- **Regional Scope:** Global
- **Number of Sub-Regions:** 47 (58) / 71 oil and gas producers
- **Asian Regions:** China, India, Japan, South Korea, Southeast Asia, Rest of Asia, (Indonesia)

▶ Other Details:

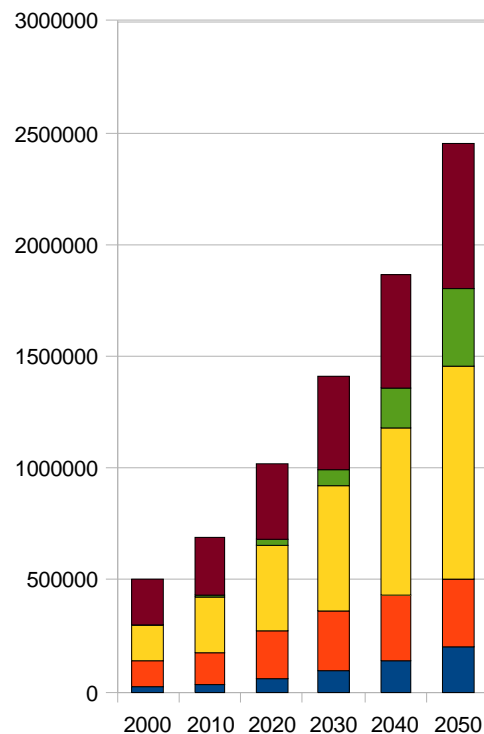
- **Energy Demand Sectors:**
 - **Industry:** energy intensive sectors (iron and steel, aluminium, cement), other industrial sectors
 - **Transport :** domestic, international maritime and air transport
 - **Services**
 - **Households**
- **Energy Supply Sectors (4):** solid fuels, crude oil & refined oil products, gas, and electric power, hydrogen

Baselines

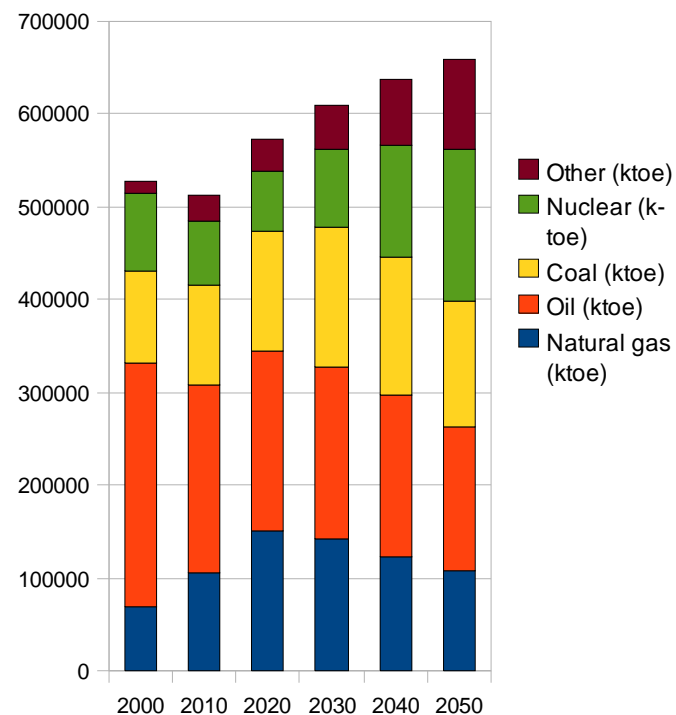
China



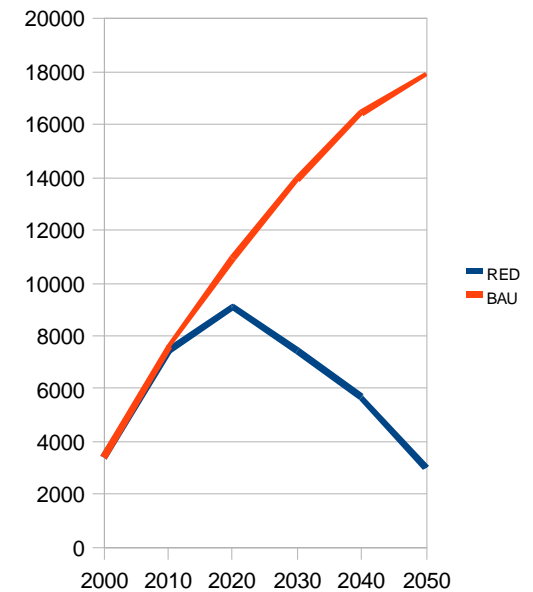
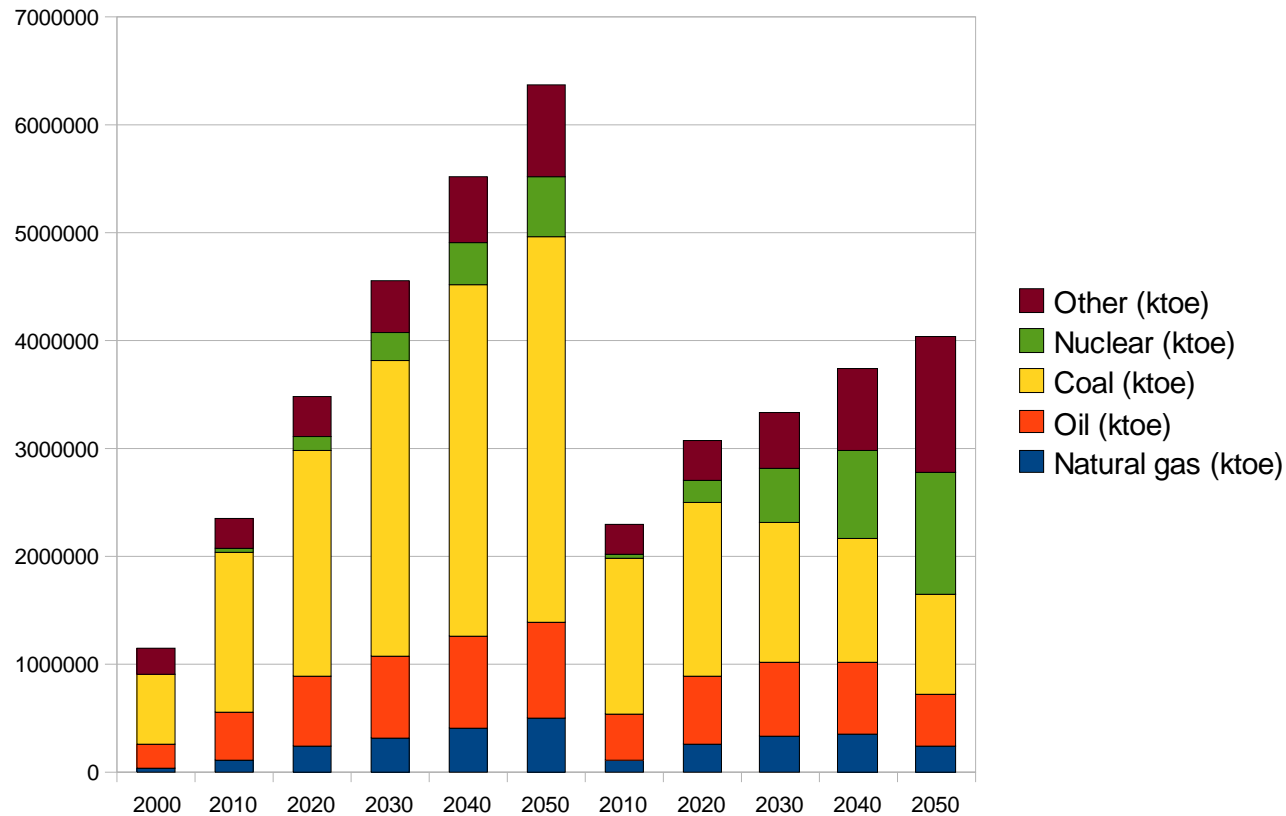
India



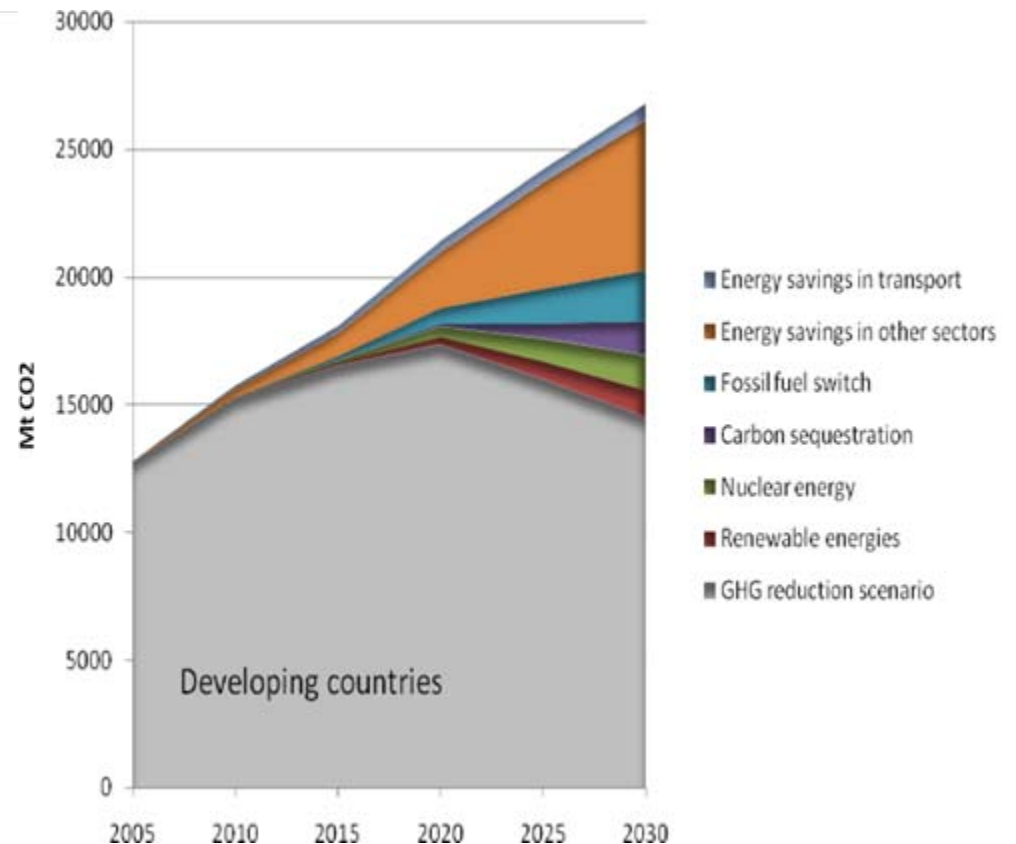
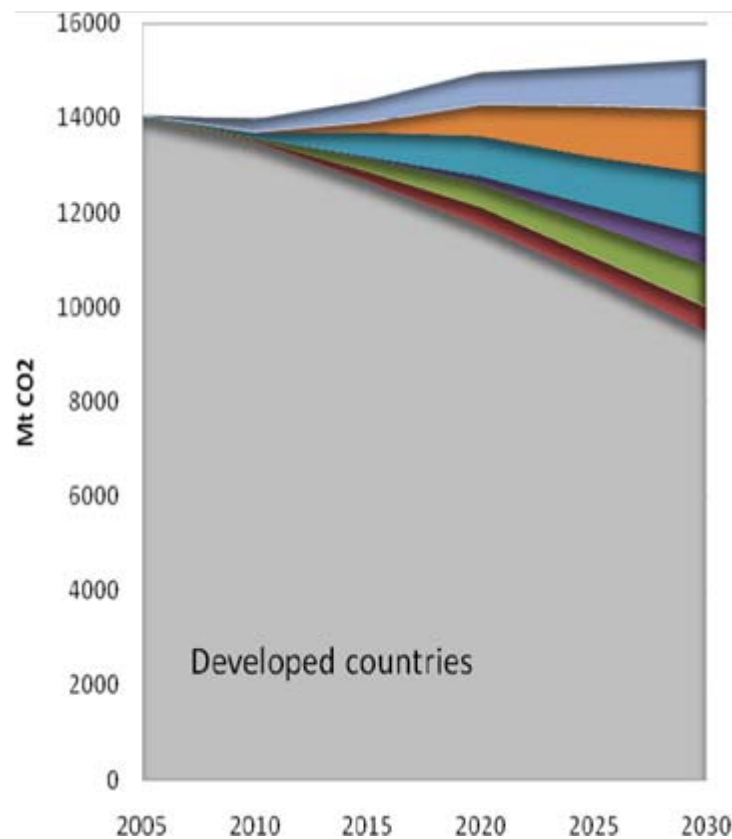
Japan



Scenarios



Scenarios



Key Design Characteristics

- ▶ ***Participating Model:*** GEM-E3
General Equilibrium Model for Energy-Economy-Environment
- ▶ ***Model Type:*** Economic CGE Model
- ▶ ***Participating Modelers:*** Denise Van Regemorter, Bert Saveyn, Juan-Carlos Ciscar, Laszlo Szabo
- ▶ ***Time Step:*** 5 year
- ▶ ***Time Frame:*** 2000 to 2050 (optional 2100)
- ▶ ***Solution Type:*** Dynamic Recursive
- ▶ ***Equilibrium Type:*** General Equilibrium
- ▶ ***Underlying Computing Framework:*** GAMS

Inputs and Outputs

► Key inputs

- **Demographics:** Population by region
- **Economic:** GTAP data base with bilateral trade information, transport and protection linkages among 113 regions for all 57 commodities for single calibration year
- **Technology:** Technological progress, abatement technology, substitution among inputs, intermediates and final products.

► Key outputs

- **Economic:** GDP, employment, private consumption, investment, domestic production, trade, carbon market, tax revenues,
- **Energy:** Energy consumption by sector
- **Emissions:** CO₂ emissions by source, non-CO₂ emissions (Kyoto gases), local pollutants (SO₂, NO_x, VOC, PM)

Regional Scope & Other Detail

▶ Regional Details:

- **Regional Scope:** Global

**GEM-E3 Europe models 27 EU member states

- **Number of Sub-Regions:** 18

- **Asian Regions:** China, India, Japan, Southeast Asia, Rest of Asia, Former Soviet Union

▶ Other Details:

- **Energy Demand Sectors:**

- **Industry:** energy intensive sectors (ferrous and non ferrous ore/metals, chemical products, other energy intensive goods), other industrial sectors (electric goods, transport equipment, other equipment goods, consumer goods, building and construction)
- **Transport service** sector
- **Other service** sectors (services telecommunications, credit and insurance, other market services, non market services)
- **Household:** heating and transport demand

- **Energy Supply Sectors (4):** solid fuels, crude oil & refined oil products, gas, and electric power