

# China: Peak Energy and the Limits to Economic Growth

Dr. Minqi Li, Associate Professor

Department of Economics, University of Utah

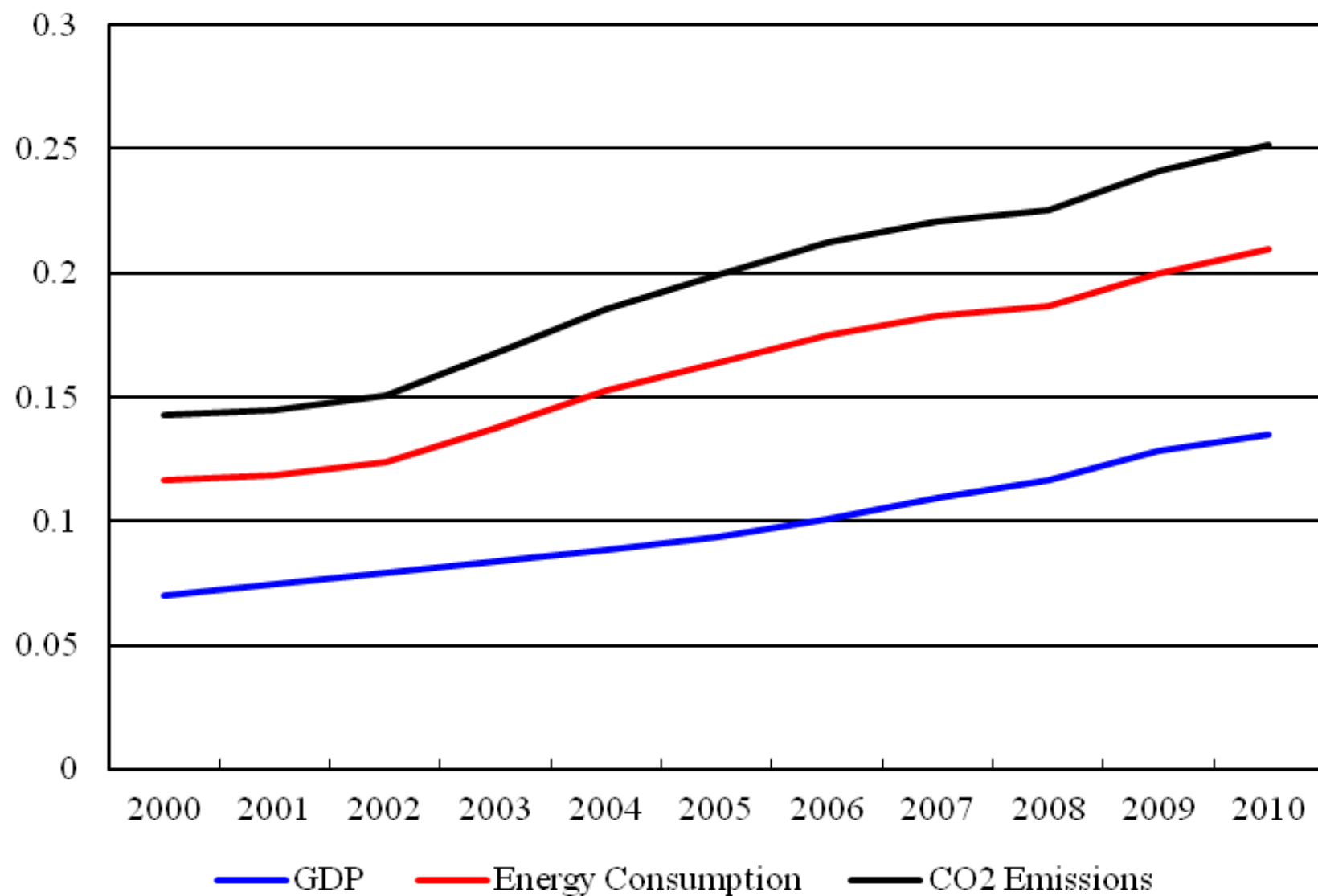
E-mail: [minqi.li@economics.utah.edu](mailto:minqi.li@economics.utah.edu)

Webpage: [www.econ.utah.edu/~mli](http://www.econ.utah.edu/~mli)

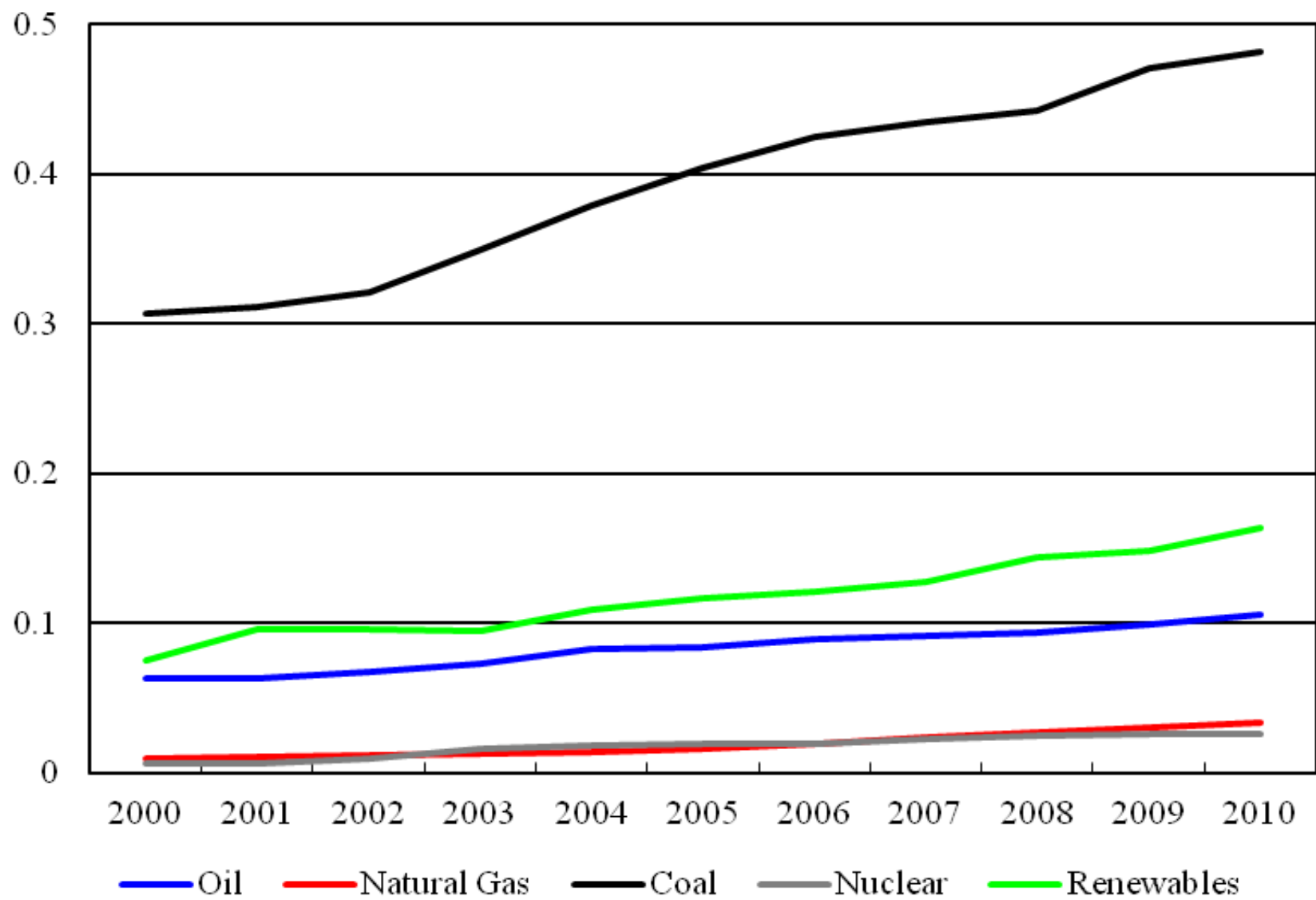
November 2011

Presentation at the ASPO 2011 Conference, Washington, D.C.

The Rise of China?  
(China as Share of World Total, 2000-2010)



China's Energy Consumption  
(China as Share of World Total, 2000-2010)



# **World Energy Consumption, 2010**

(Nuclear and Renewable Electricity Measured by Their Electric Energy Content)

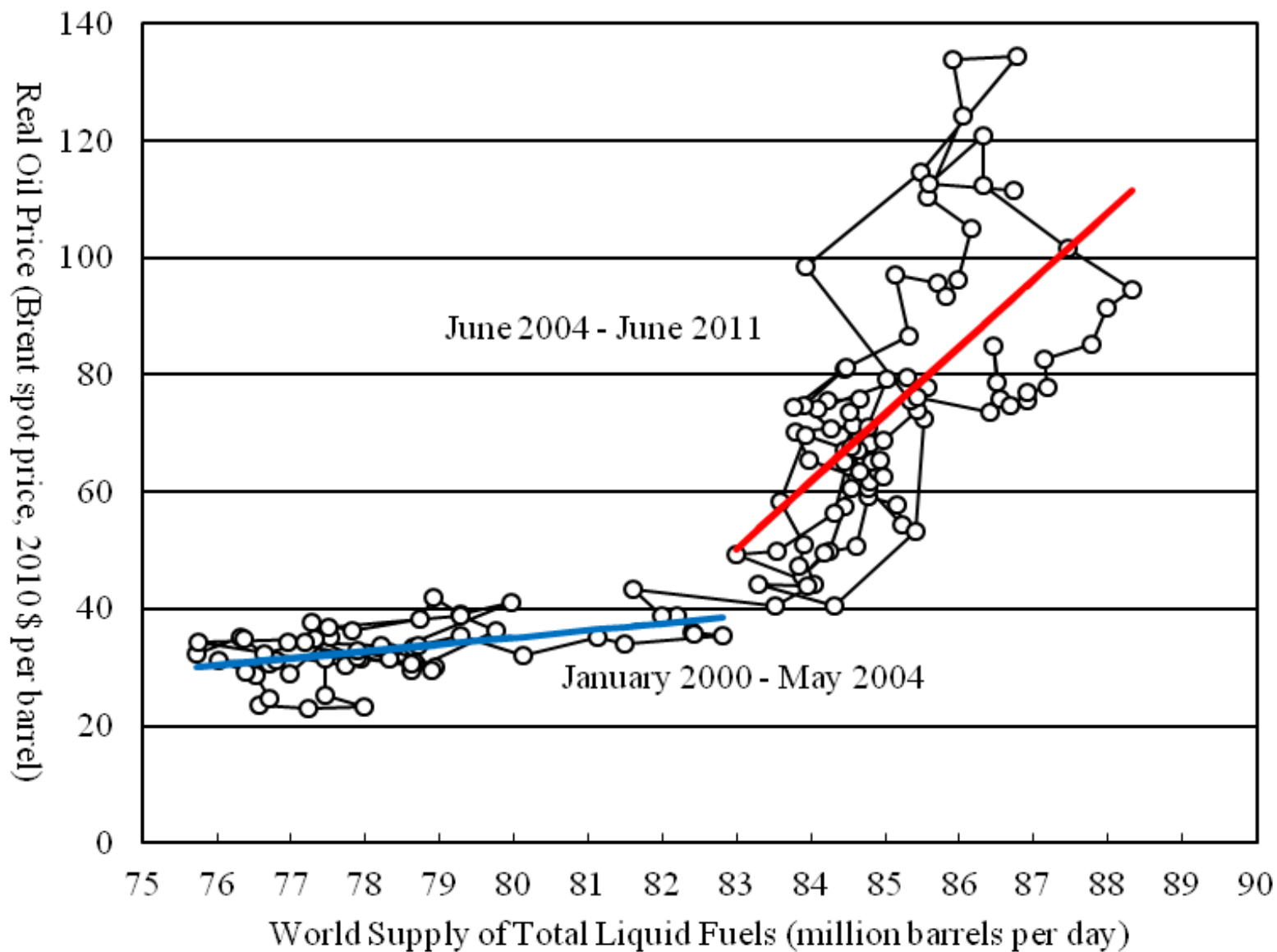
- Share of World Energy Consumption, 2010: Oil 37%; Natural Gas 26%; Coal 32%; Nuclear 2%; Renewables 4%.
- Growth by Volume (million tons of oil equivalent, 2000-2010): Oil, 460 Mtoe; Natural Gas, 680 Mtoe; Coal, 1,160 Mtoe; Nuclear, 20 Mtoe; Renewables, 160 Mtoe

# China's Energy Consumption, 2010

(Nuclear and Renewable Electricity Measured by Their Electric Energy Content)

- Share of China's Energy Consumption, 2010: Oil 19%; Natural Gas 4%; Coal 74%; Nuclear 0.3%; Renewables 3%.
- Growth by Volume (million tons of oil equivalent, 2000-2010): Oil, 200 Mtoe; Natural Gas, 80 Mtoe; Coal, 980 Mtoe; Nuclear, 5 Mtoe; Renewables, 50 Mtoe

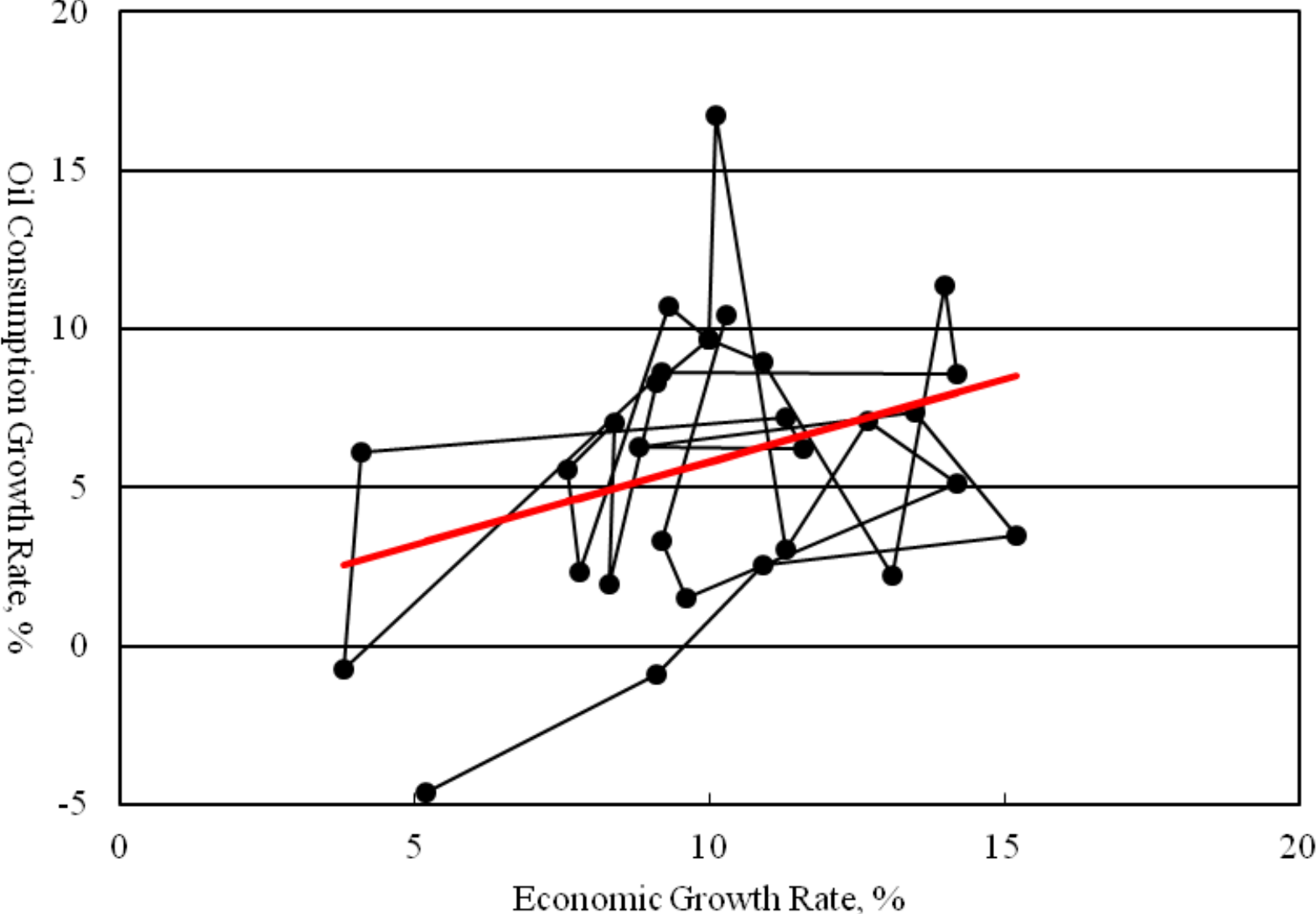
# World Oil Production and Prices, 2000-2011



## To Replace One Million Barrels of Oil A Day ...

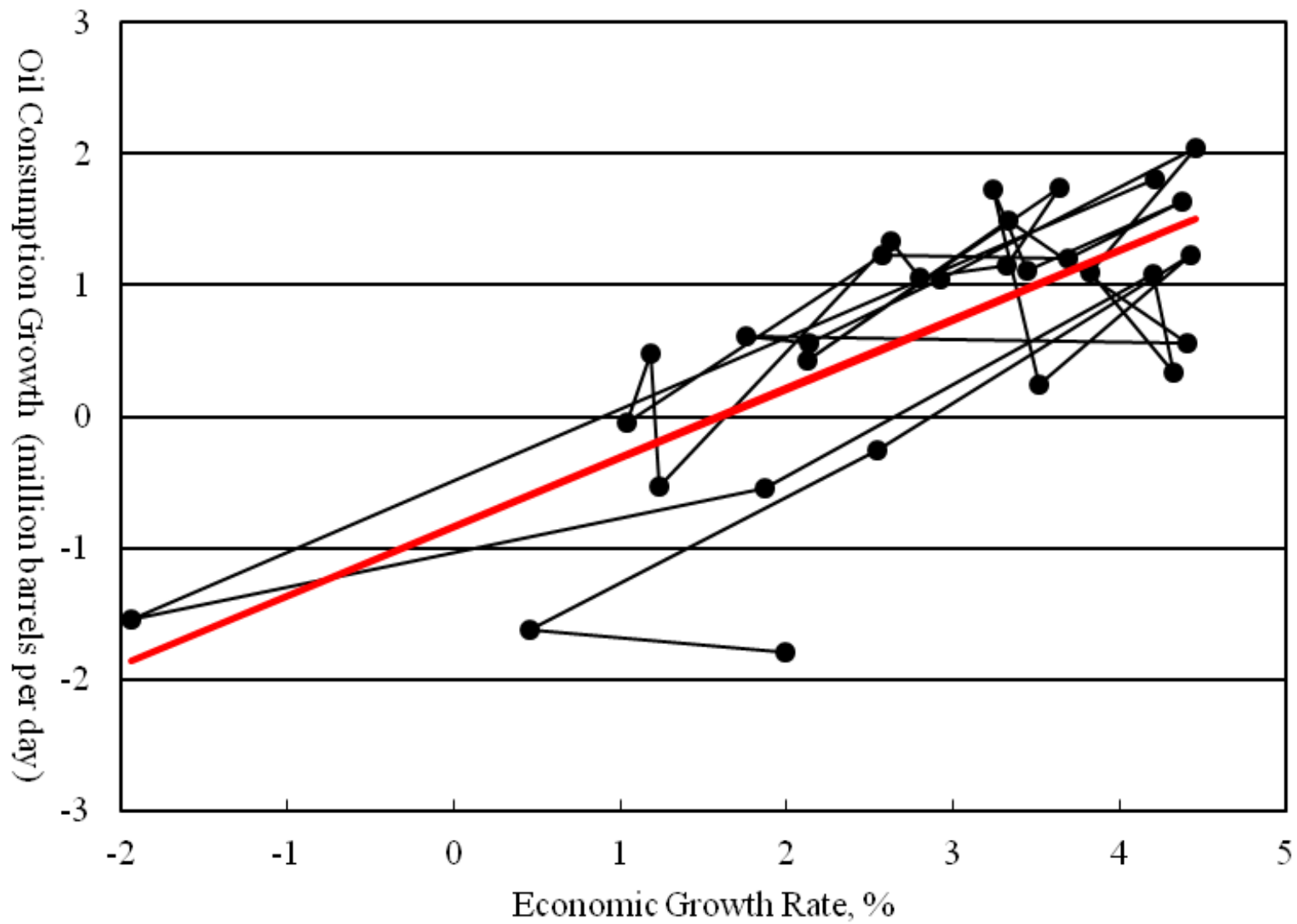
- Coal-to-Liquids: 200 million tons of coal or 2.7% of world coal production
- Natural Gas: 50 million tons of oil equivalent or 1.7% of world natural gas production + *massive infrastructure transformation*
- Biofuels: 1.6 million barrels a day or 220 million tons of grains or 9.7% of world grain production
- Electricity (thermal equivalent): 220 terawatt-hours or 1.0% of world electricity generation + *massive infrastructure transformation*
- Wind Electricity: 100 giga-watts or 50% of world total installation of wind power + *massive infrastructure transformation*

China: Oil Consumption and Economic Growth  
(Annual rates of change, 1981-2010)

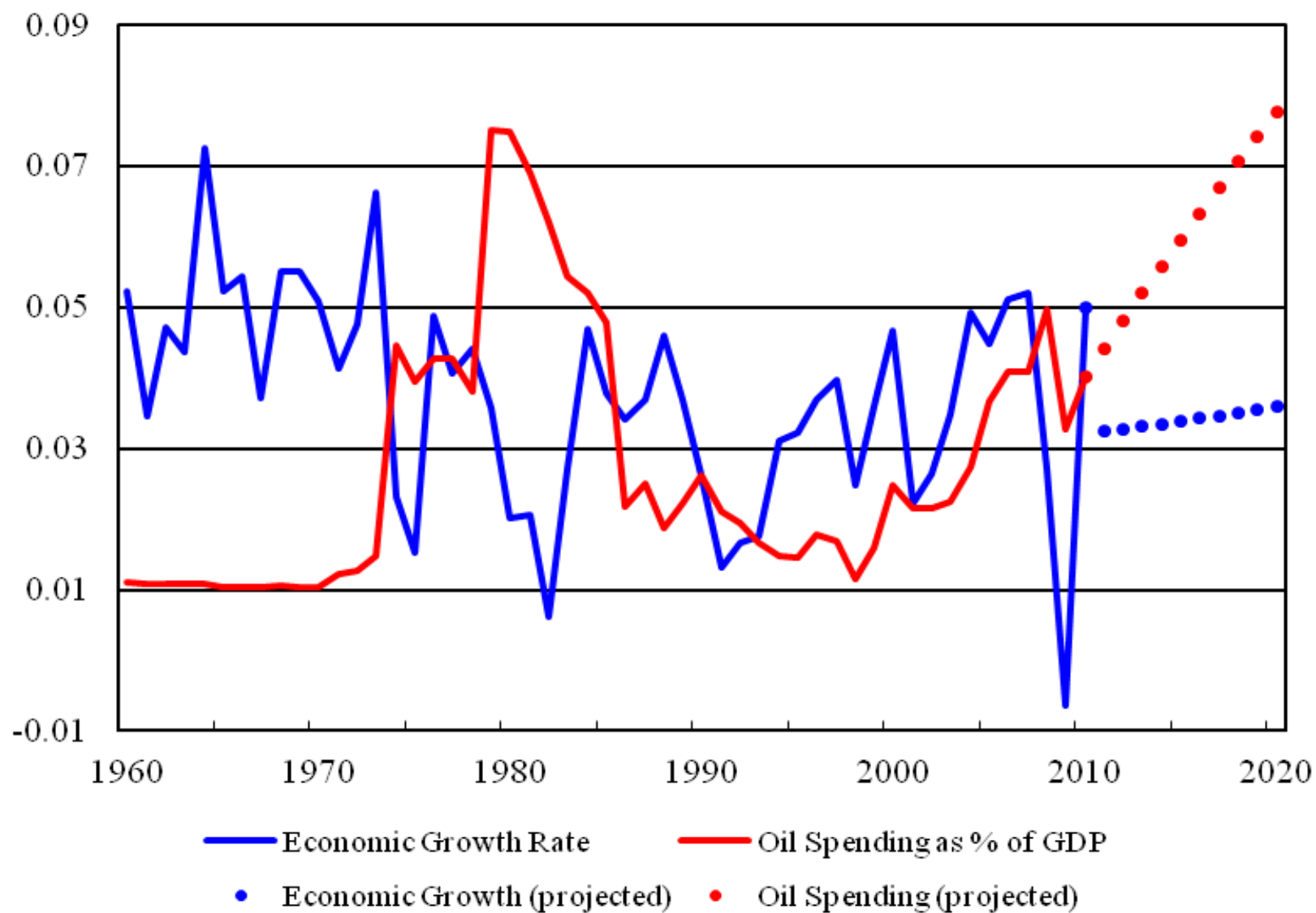




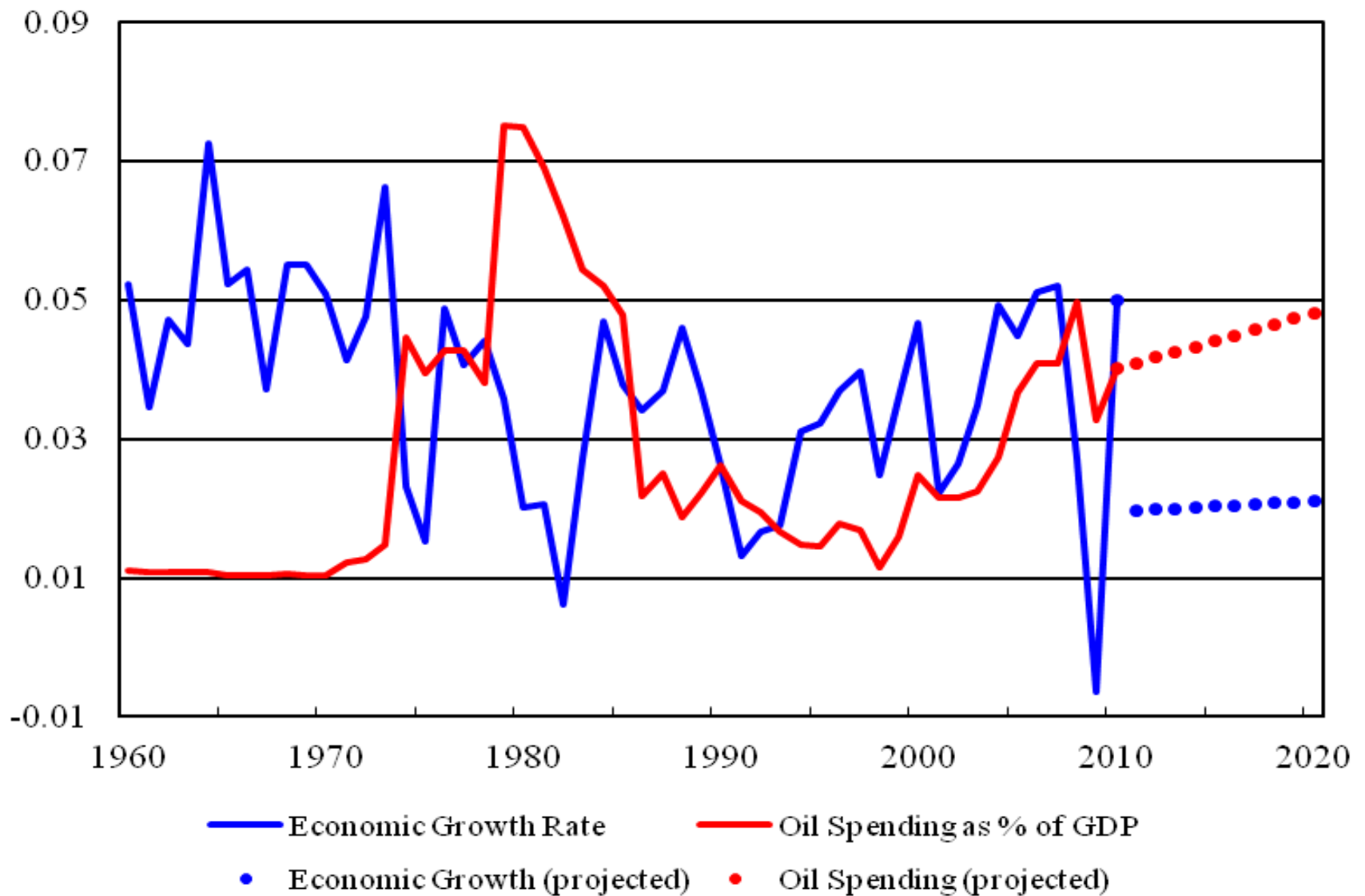
# World (ex. China): Oil Consumption and Economic Growth (1981-2010)



World Economic Growth and Oil Spending  
(Historical and Projected, 1960-2020, Scenario 1)



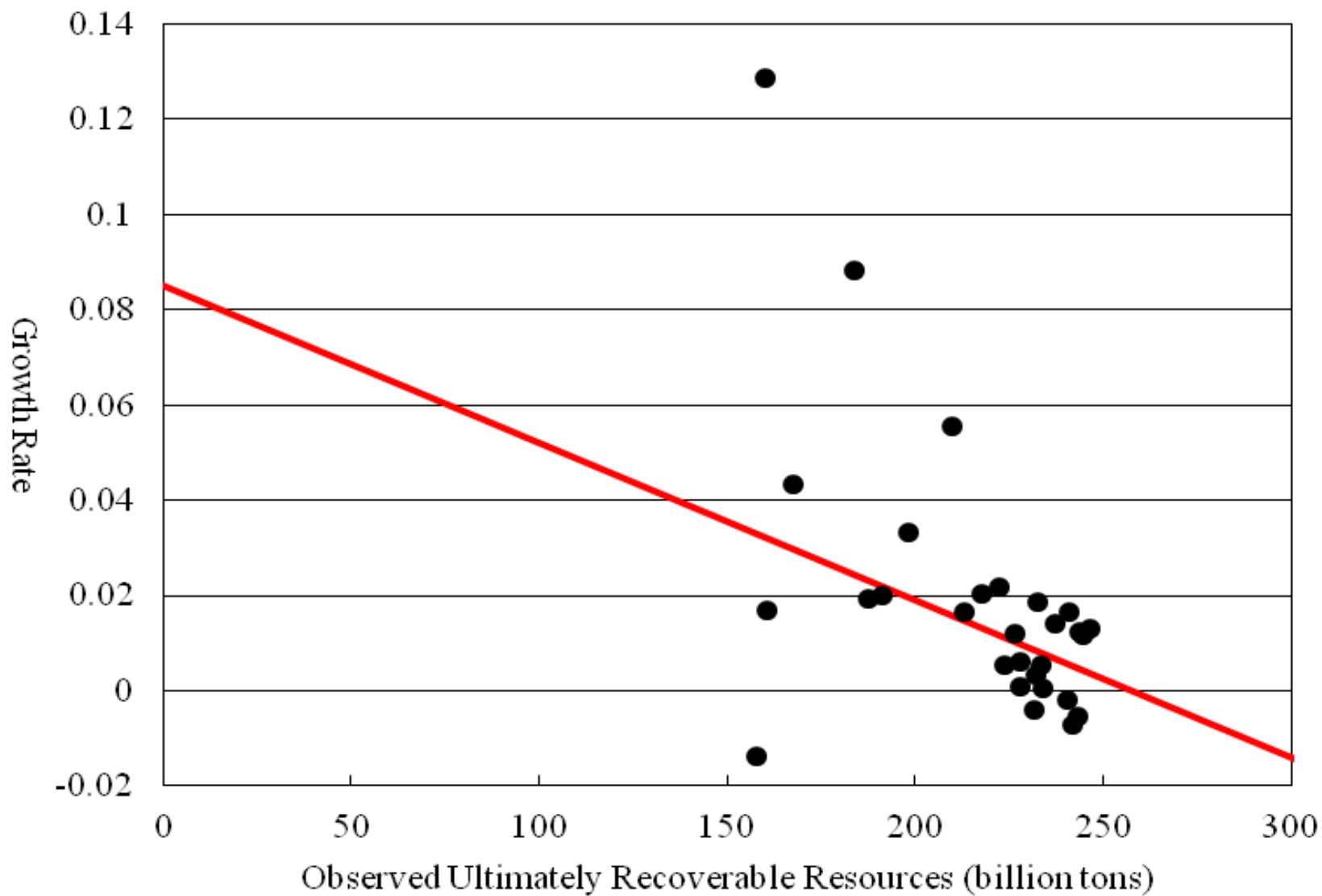
World Economic Growth and Oil Spending  
(Historical and Projected, 1960-2020, Scenario 2)



# China: Coal Resources and Reserves

- Identified and Prospective Resources: 5.6 trillion tons (1992-1997 survey)
- Identified Resources: 1.3 trillion tons (2009)
- Reserve Base: 319 billion tons (2009); has been annually published
- Reserve: 183 billion tons (2006)

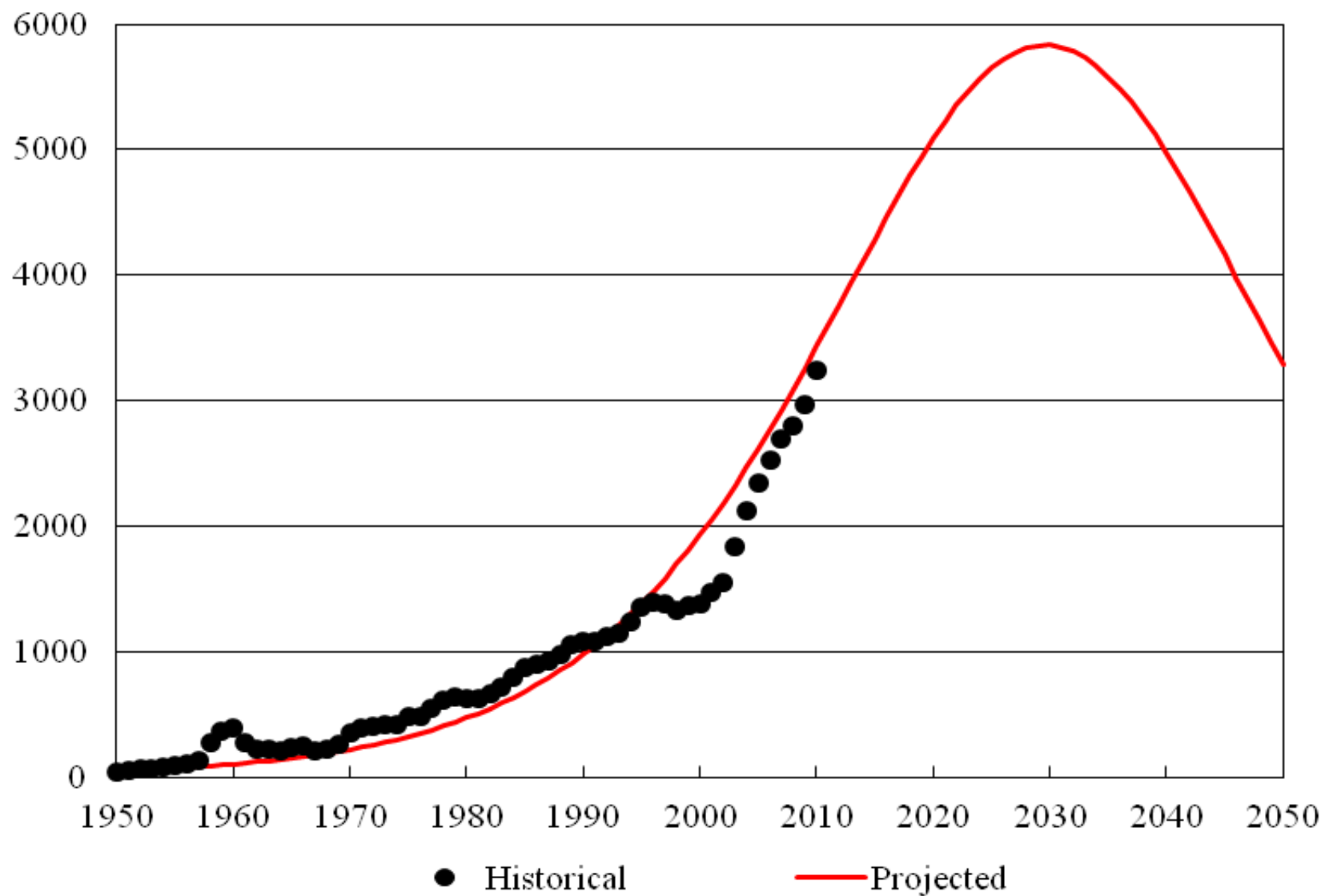
# China's Observed Ultimately Recoverable Coal Resources (Growth Rates)



# China: Coal Production

- 2010: national production 3.2 billion tons; Inner Mongolia 780 million tons
- 2001-2010 (annual average growth rate): national production 8.9%; Inner Mongolia 26.9%
- January-August 2011: national production 2.5 billion tons (an increase by 14.3%); Inner Mongolia 625 million tons (an increase by 31.6%)

China's Coal Production  
(Historical and Projected, million tons)

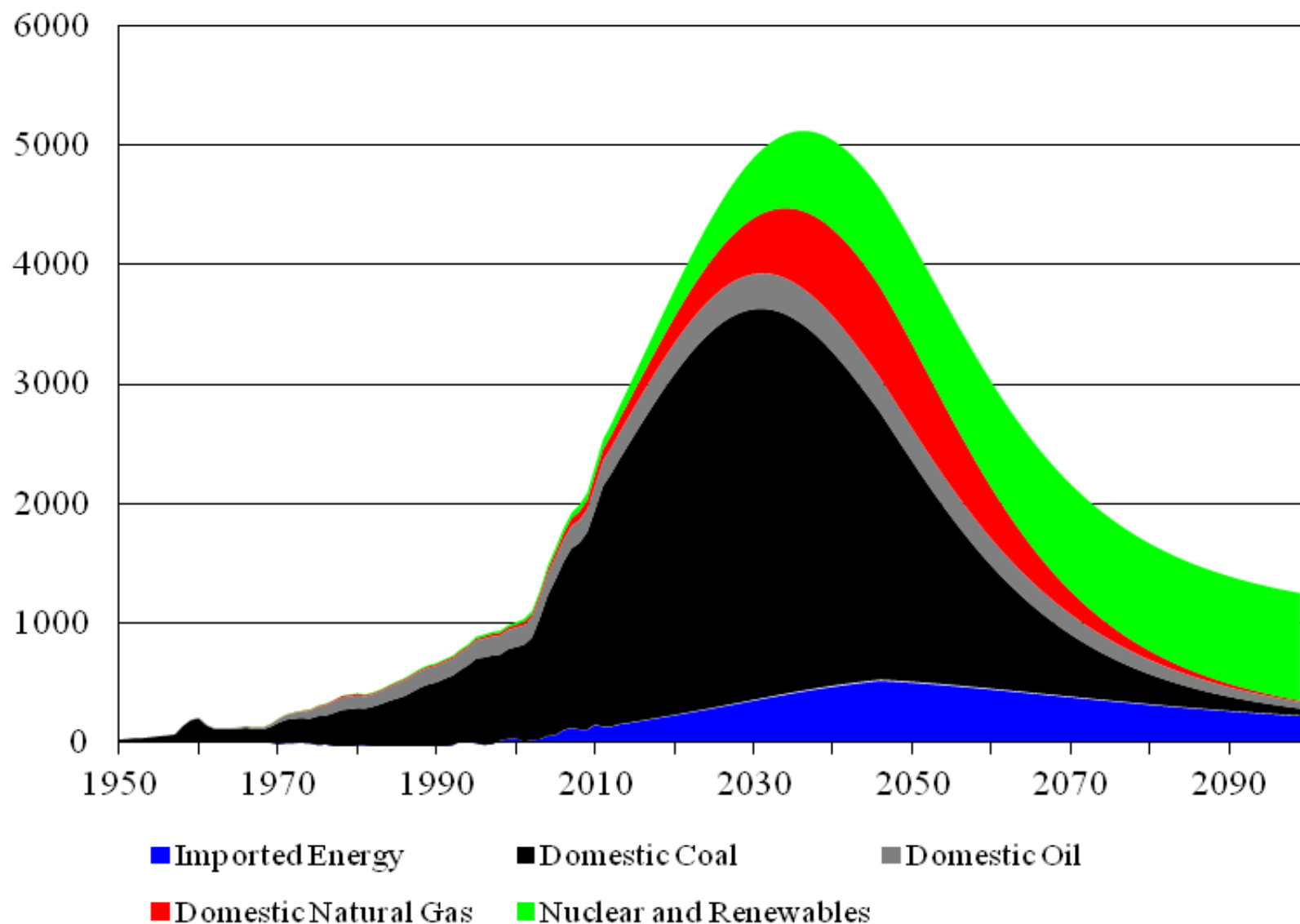


# Projecting China's Energy Future

- Ultimate Recoverable Resources: Coal, 300 billion tons; Oil, 25 billion tons; Natural Gas, 30 billion toes
- Nuclear Electricity: 200 GW
- Renewables: Hydro Electricity, 500 GW; Wind Electricity, 1000 GW; Solar, 2500 GW; Biofuels, 130 Mtoe
- Imported Energy: China's imports as % of world tradable energy supply is assumed to rise from 1.5% to 5%; rest of the world biofuels production is assumed to rise to 1,800 Mtoe



China: Primary Energy Consumption  
(Million Tons of Oil Equivalent, 1950-2100)



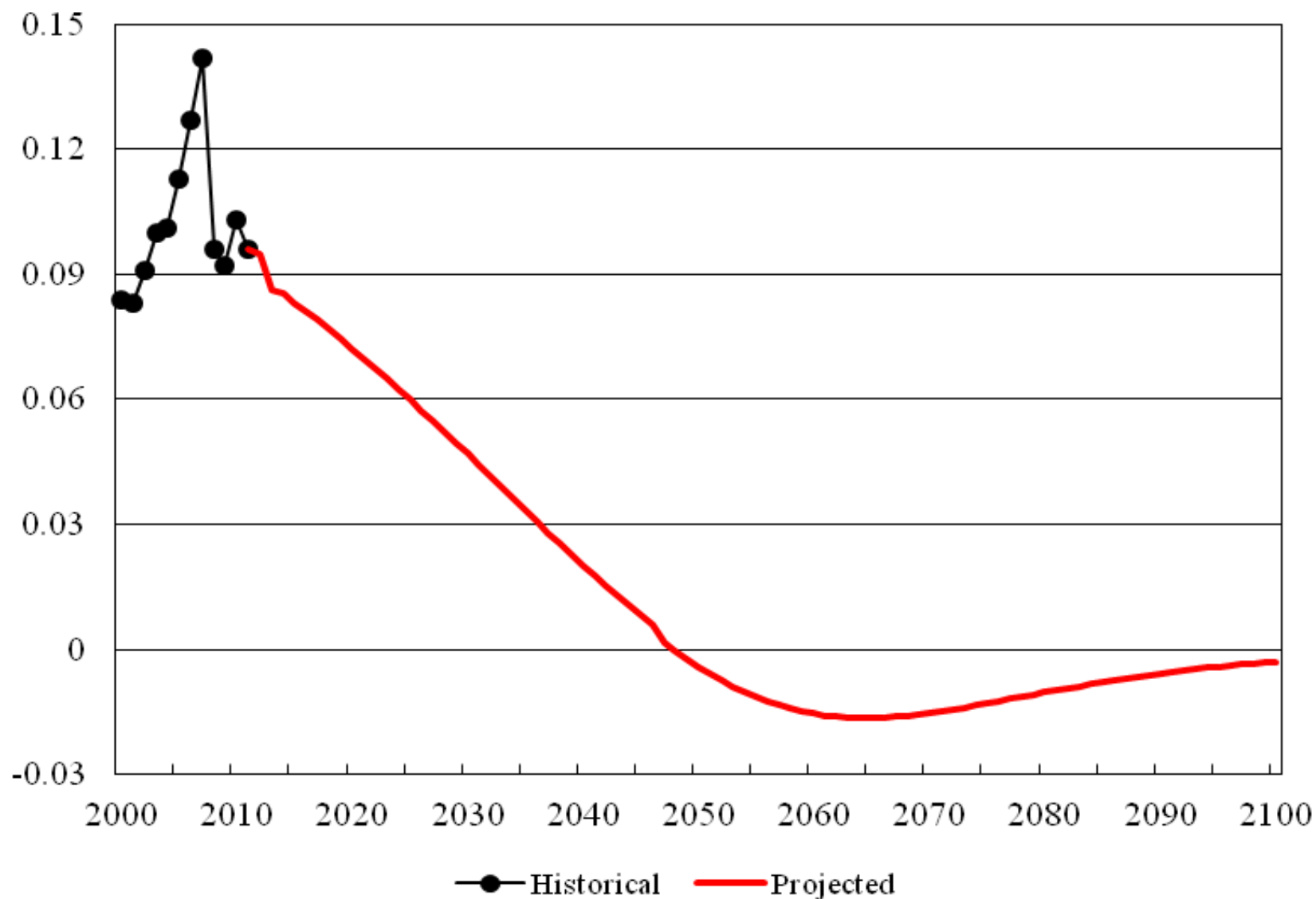
# Implications for Climate Change

- Cumulative Consumption: Domestic Coal, 150 billion toes; Domestic Oil, 20 billion toes; Domestic Natural Gas, 30 billion toes; Imported Energy, 32 billion toes
- Cumulative Carbon Dioxide Emissions over the 21st Century: 820 billion tons
- Implied Global Cumulative Emissions: 4.1 trillion tons (assume China's share = 20%)
- Implied Long-Term Global Warming: 5°C

# Projecting Energy Efficiency

- Energy Efficiency (China, 2010): \$3,900/toe
- Energy Efficiency (world, 2010): \$6,100/toe
- Energy Efficiency (long-term potential): \$30,000/toe

China: Economic Growth Rates  
(Historical and Projected, 2000-2100)



# China: Energy and Economic Growth, 2000-2050

(Average annual rates of growth)

---

	Energy Consumption	Energy Efficiency	Economic Growth
Historical:			
2000-2010	8.7%	1.6%	10.5%
Projected:			
2010-2020	5.0%	3.2%	8.3%
2020-2030	2.6%	3.2%	5.9%
2030-2040	0.3%	2.9%	3.2%
2040-2050	-1.8%	2.5%	0.7%

---