

Energy Efficiency in China: Glorious History, Uncertain Future

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Part I: Glorious History

In three Acts

Part II: Energy Crisis in China: 2001 to present

repeat of much earlier “inglorious history”??

Part III: The Future:

What might happen? What is to be done to end the crisis?



Executive Summary (Part I)

- Things were bad in energy (for 3 decades)
- Deng Xiaoping came to power
 - A group of academics suggested a new approach to energy
 - Deng listened!
- Things were much better (for 2 decades)
- The market became king
 - Energy went off track again
- There are solutions
 - The Chinese government and Communist party are responding, somewhat in the manner of Deng

Part I: China's Energy History in Three Acts

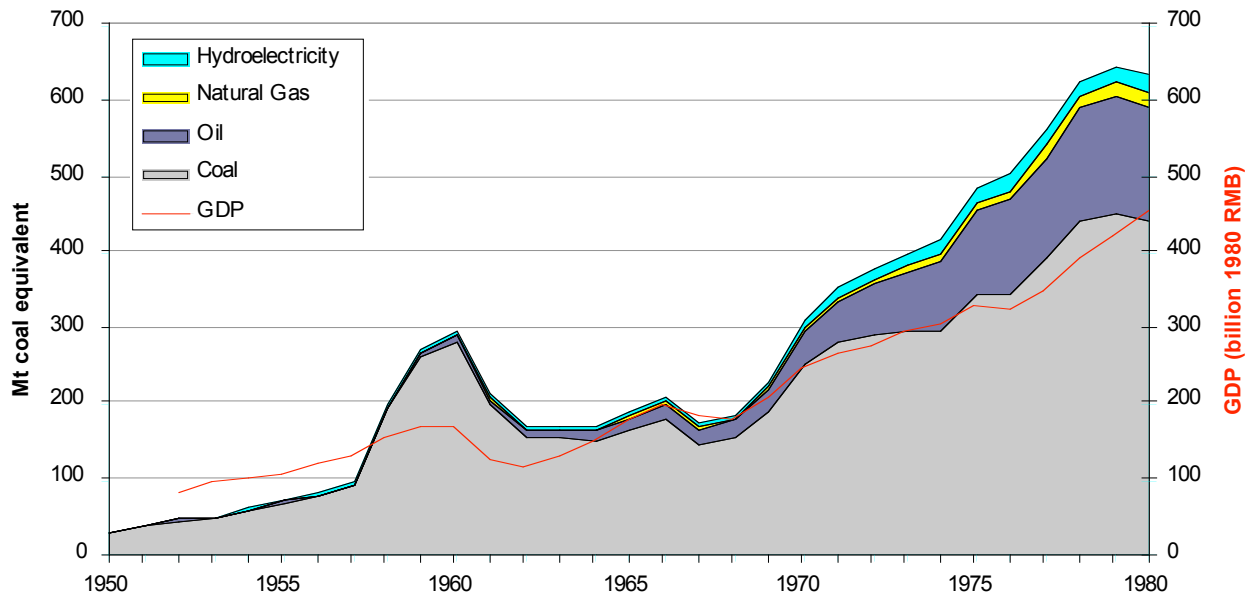
“Soviet Style” Energy Policy (1949-1980)

Deng's Initial Reforms (1981-1992)

Transition Period (1993 to 2001)

“Soviet Style” Energy Policy (1949-1979)

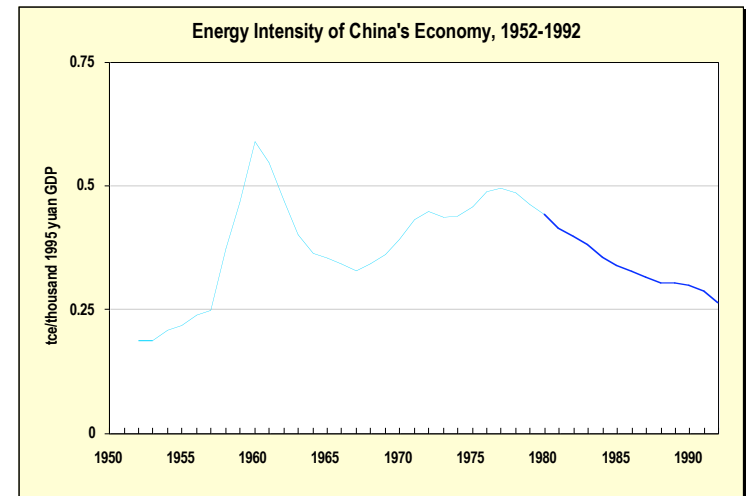
- Single objective was rapid energy supply growth
- Energy prices greatly subsidized
- Central allocation system provided energy primarily to heavy industry
- No attention to environment
- **Result:** one of the world’s least efficient (and fastest growing) energy systems



Energy Output and GDP, 1950-1980

Deng's Initial Reforms (1980-1992)

- Key meetings among more than 100 academic energy experts in 1979 and 1980 stated:
 - China energy policy in crisis
 - need for radical reform
 - major changes identified:
 - (1) energy price reform, and
 - (2) serious attention to energy efficiency
- Government quickly implemented reforms in Sixth Five-Year Plan (1981-1985)

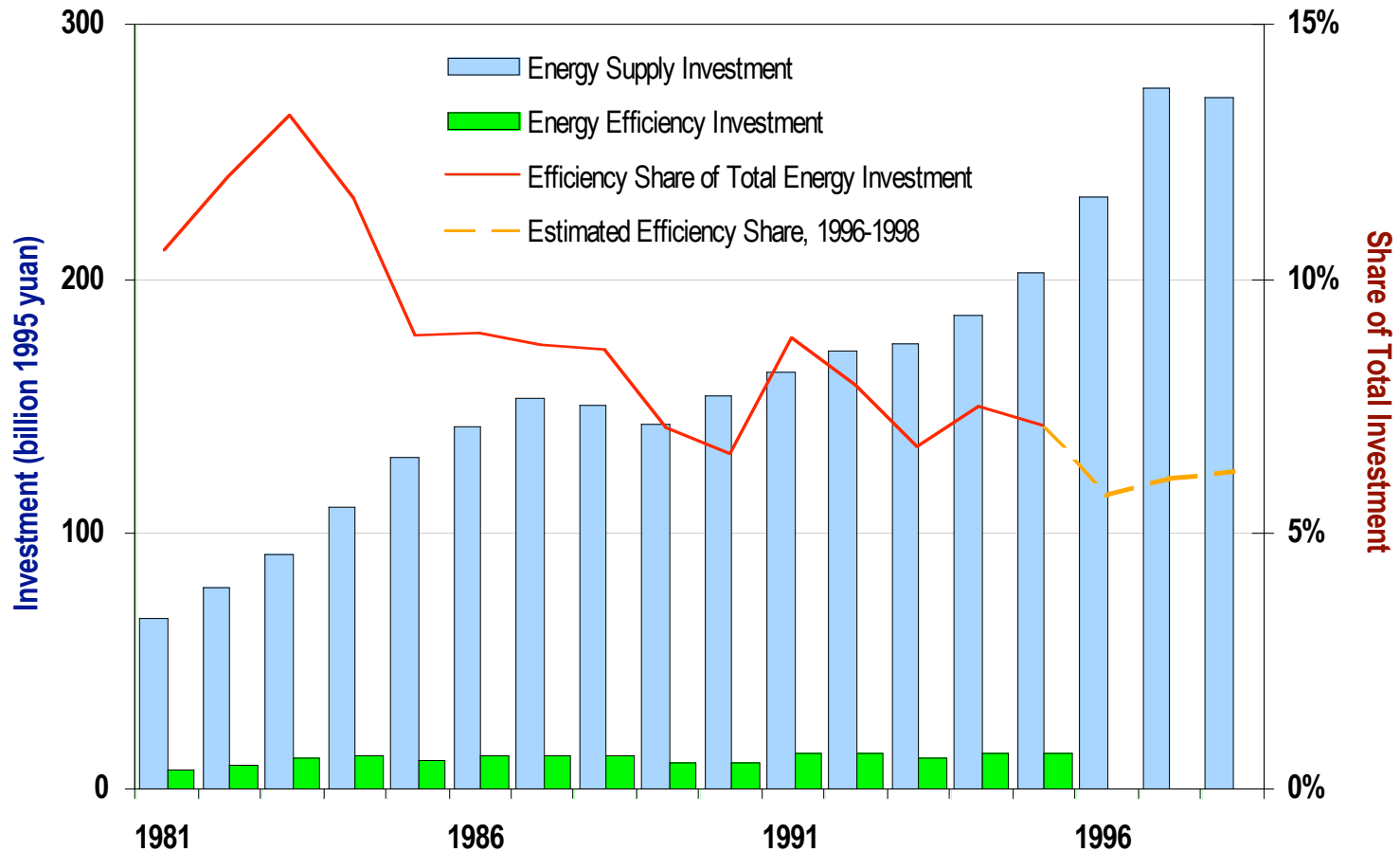


Energy-conservation policies & measures in Phase II

- **Energy Management**
 - factory energy consumption quotas
 - factory energy conservation monitoring
 - efficient technology promotion
 - close inefficient facilities
 - controls on oil use
- **Financial Incentives**
 - low interest rates for efficiency project loans
 - reduced taxes on efficient product purchases
 - incentives to develop new efficient products
 - monetary awards to efficient enterprises
- **R D & D**
 - funded strategic technology development
 - funded demonstration projects
- **Information Services**
 - national information network
 - national, local, and sectoral efficiency technical service centers
- **Education & Training**
 - national, local, and sectoral efficiency training centers
 - Energy Conservation Week
 - school curricula

Energy efficiency investment is stable, but declining as share of total investment

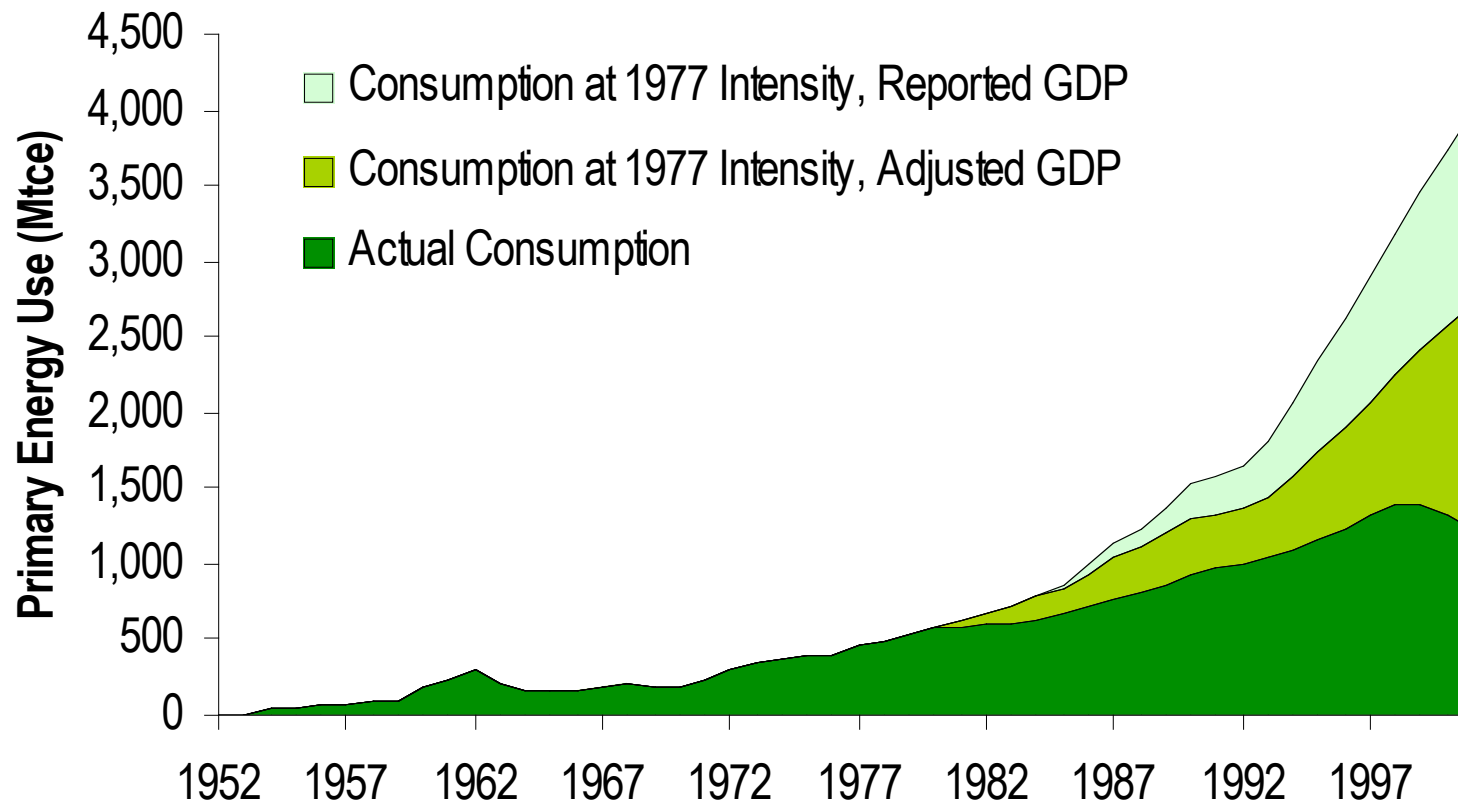
Energy Supply and Energy Efficiency Investment, 1981-1998



N.B. Only partial data on energy efficiency investments after 1995 are available. These partial data informed the estimates presented here of efficiency's shares of total energy sector investment for 1996-1998. All investment data are for state-owned units only.



Investment in energy efficiency and other policies greatly reduced China's energy intensity (1980-2000)



Energy Use, Actual and Projected at 1977 Intensity, 1952-1999

Transition Period (1993 to 2001) and After

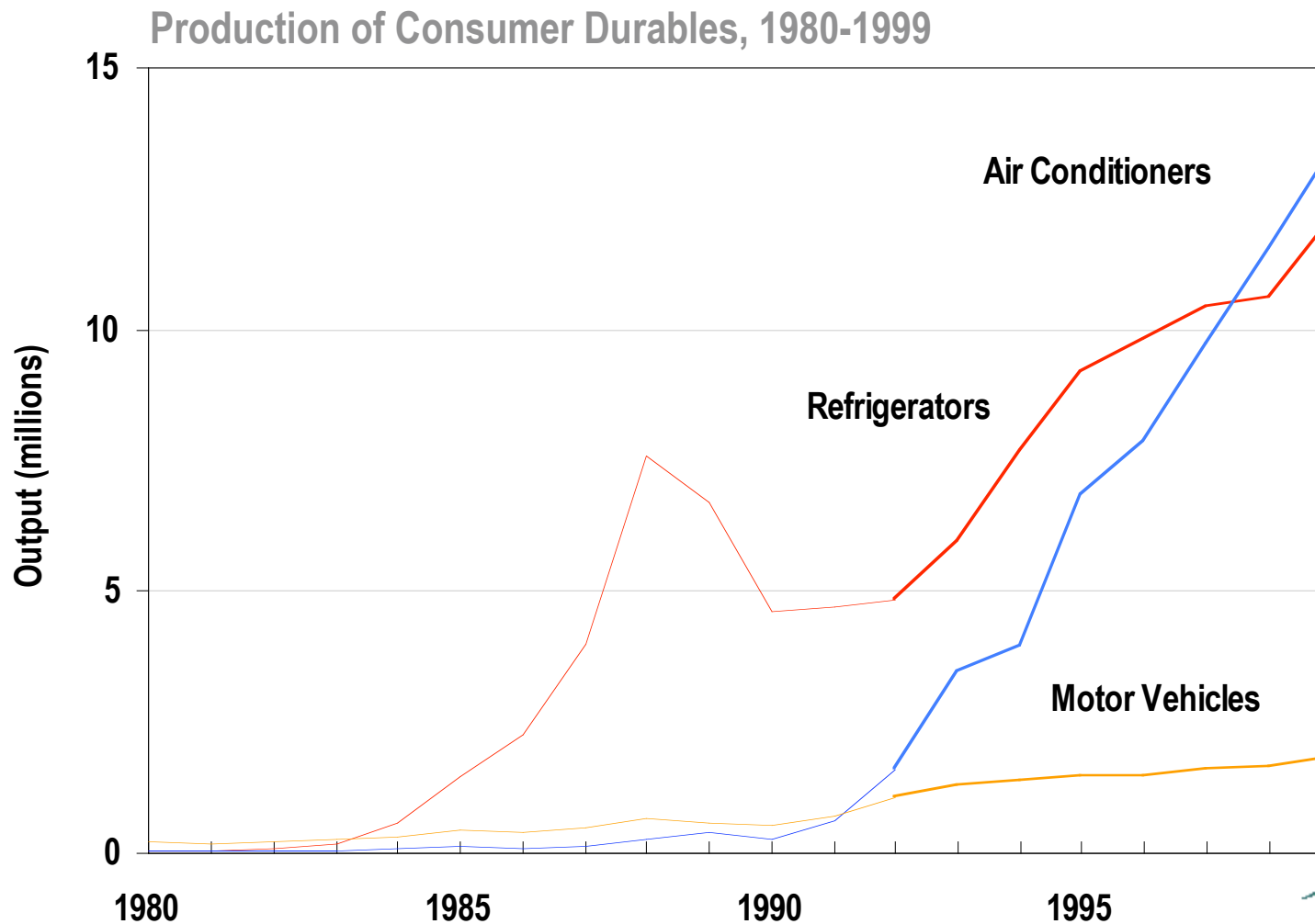
Rapid movement towards market-based system...

- Dramatic energy price reforms (raised all energy prices to consumers)
- Enterprise reforms increased price sensitivity

...but past successes in improving energy efficiency were based on mechanisms that were disappearing...

- Elimination of energy quotas
- Low incentives for monitoring in industry
- Difficulty in continuing energy efficiency loan subsidies
- New tax code (1994) eliminated tax breaks for efficiency

Take-off of consumer goods highlights the need for efficiency standards



Source: NBS

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Part II: Energy Crisis in China: 2001 to present

repeat of much earlier “inglorious
history”??



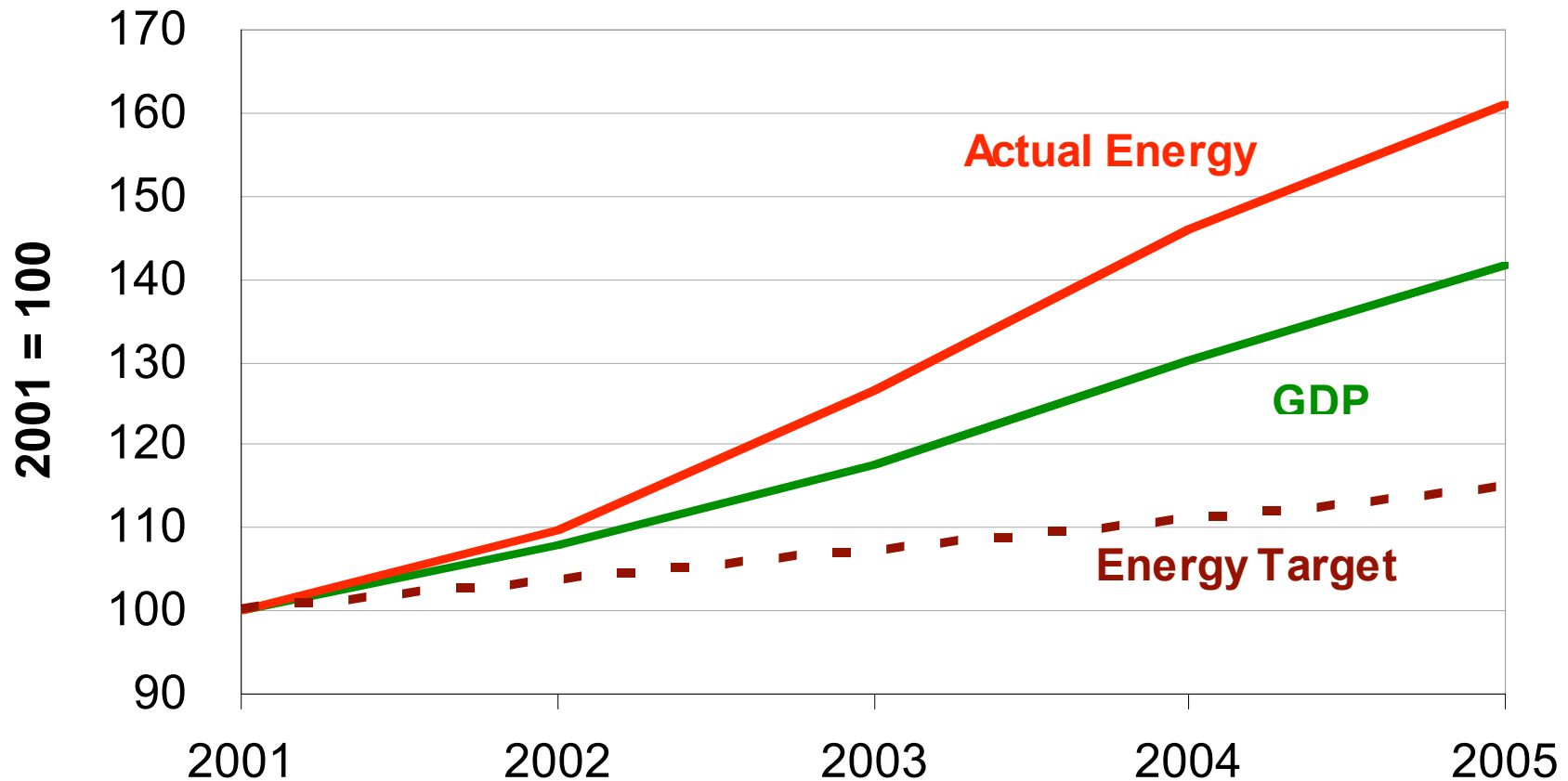
Executive Summary (Part II)

- China faces a serious **new energy crisis**
 - Most Chinese see the **energy shortage** as the crisis
 - The real crisis is in **energy policy** (just as in 1979)
- A key issue: how can **investment** be attracted to energy efficiency and how can **government policy** spur such investment?
- A failure to rein in energy demand growth will have serious impacts
 - The **environmental consequences** of energy policy failure are truly frightening
 - Rapid energy growth portends **economic consequences** of equal concern

Current Energy Crisis

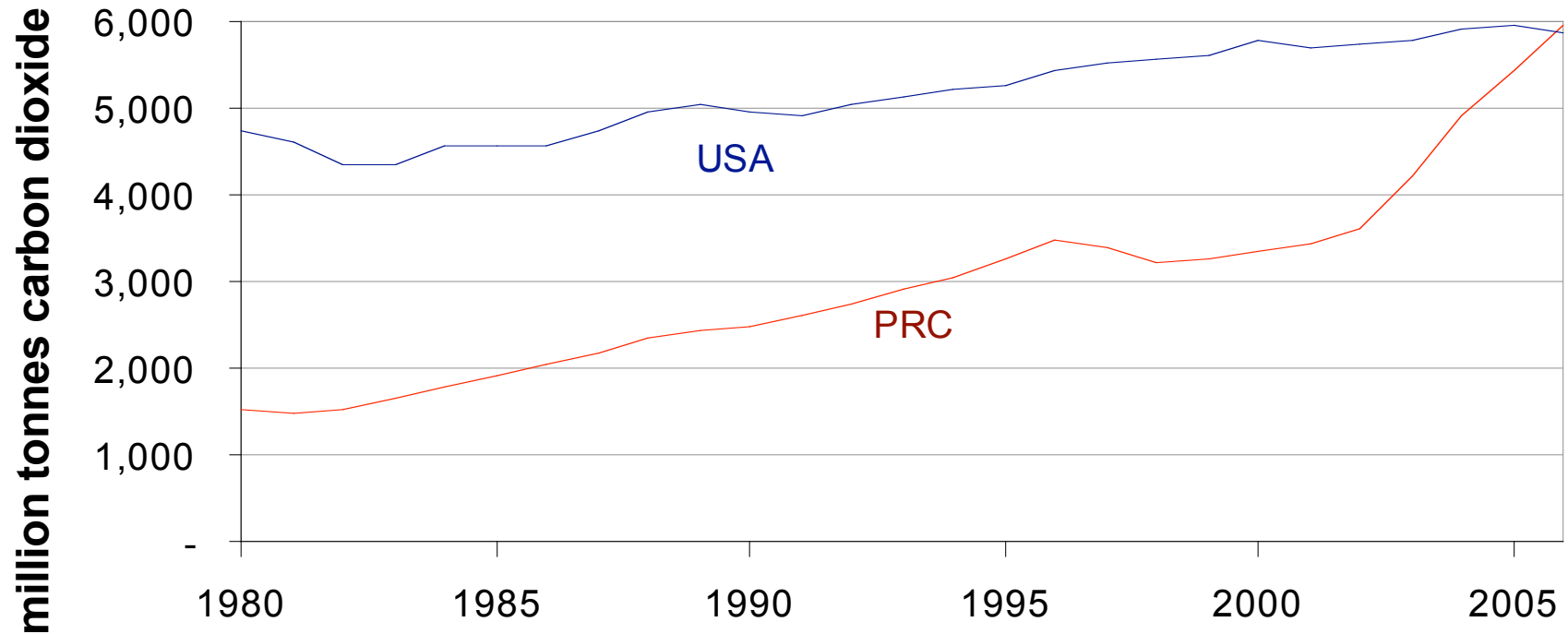
- **Energy demand growing very, very fast**
- **In 2004, widespread power shortage (24 of 31 provinces)**
- **Soaring coal prices**
- **Transportation bottlenecks for coal**
- **Significant economic losses**
- **“Surge” in oil imports especially as oil is used in place of coal**

Since 2001, energy use has grown much faster than GDP, reversing patterns from 1980 to 2000



Source: NBS, China Statistical Yearbook, various years; China Statistical Abstract 2005; growth estimates extrapolated from mid-year production data for 2005.

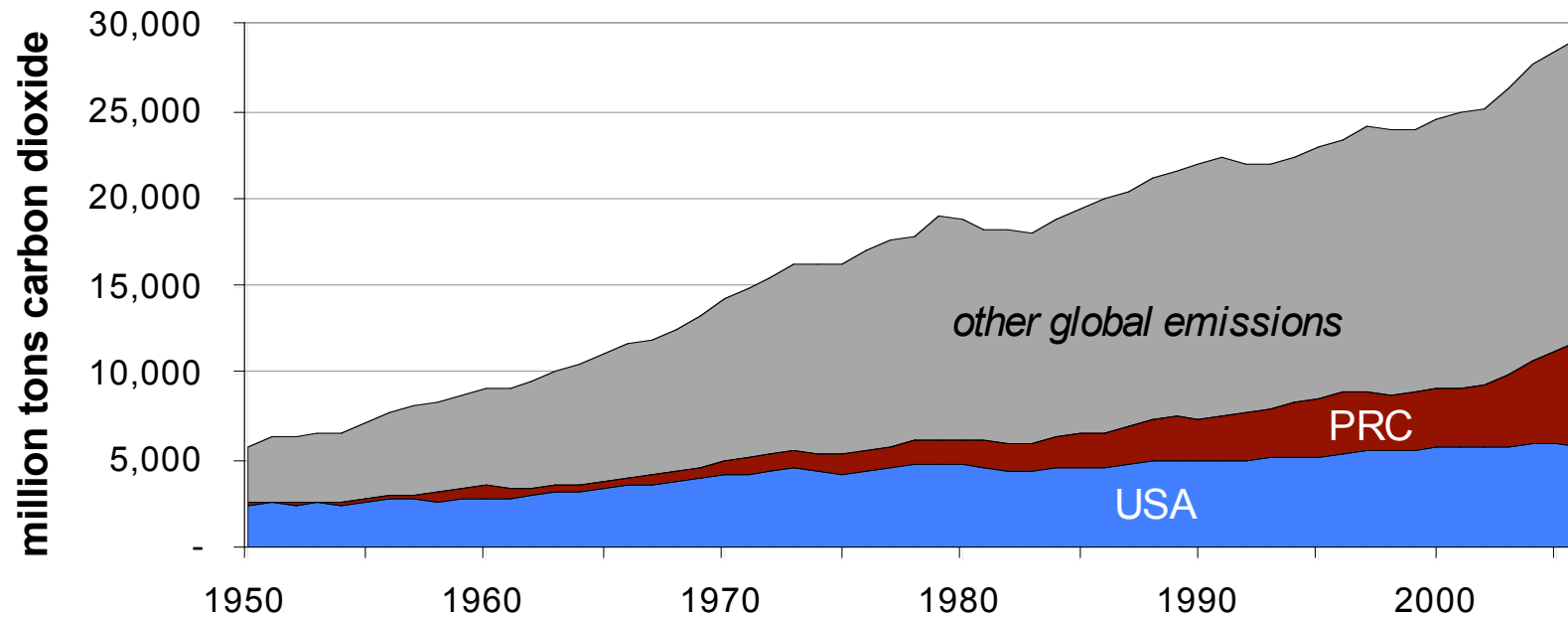
Annual energy-related carbon dioxide emissions, 1980-2006



Source: US annual emissions amounts reported by US EIA in the 2006 Annual Energy Review and 2007 Flash Estimate; China emissions are derived from revised total energy consumption data published in the 2007 China Statistical Yearbook using revised 1996 IPCC carbon emission coefficients by LBNL.



Annual energy-related carbon emissions, 1950-2006



Source: Historical 1950-2003 US and global emissions data from Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center; 2004-2006 US data from BP via Global Carbon Project. China 1950-2006 emissions data are derived from revised total energy consumption data published in the 2007 China Statistical Yearbook using revised 1996 IPCC carbon coefficients by LBNL.



Figure 6: Historical and Forecast China Carbon Emissions (WEO), 1990-2030

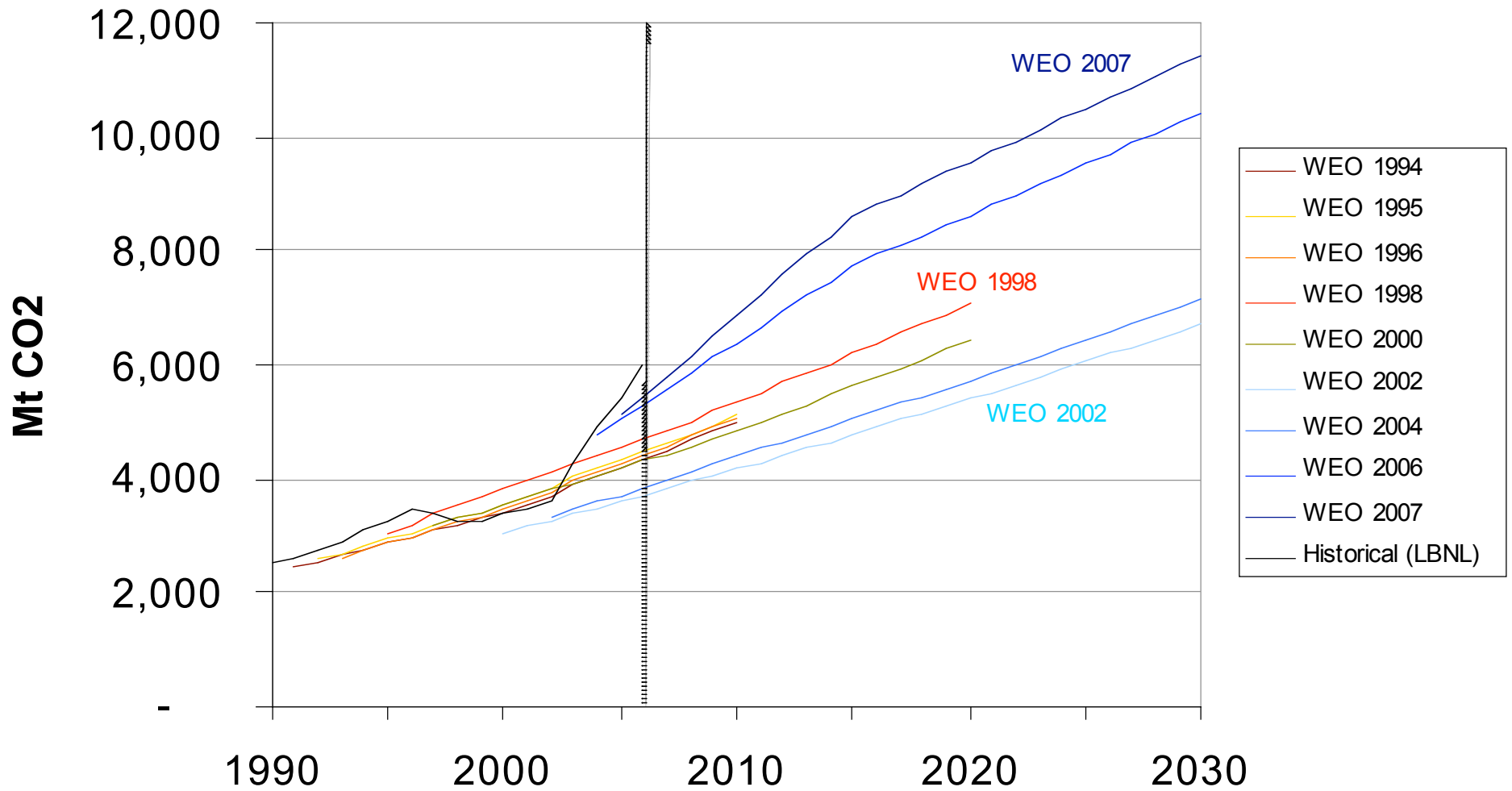


Figure 8: Historical and Forecast China Carbon Emissions (8, 9, 10), 1990-2030

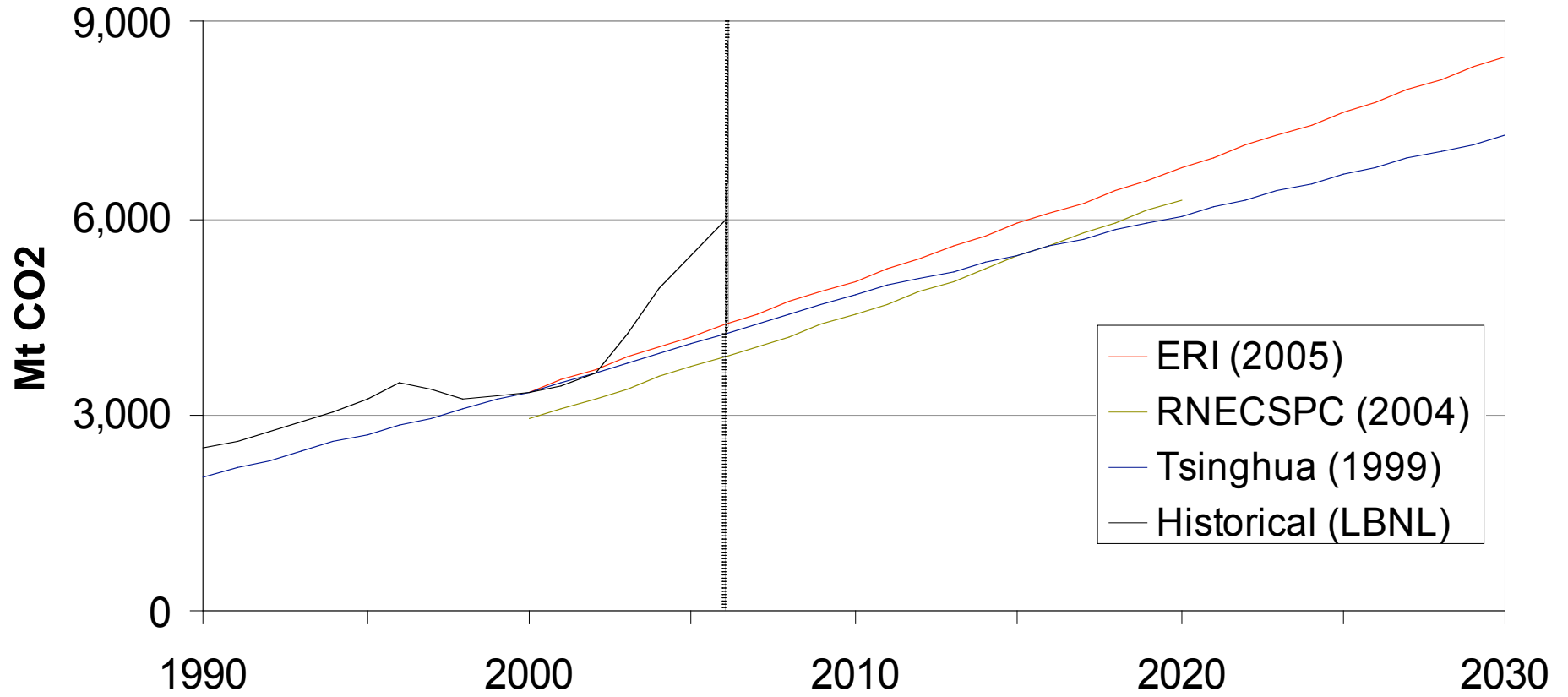
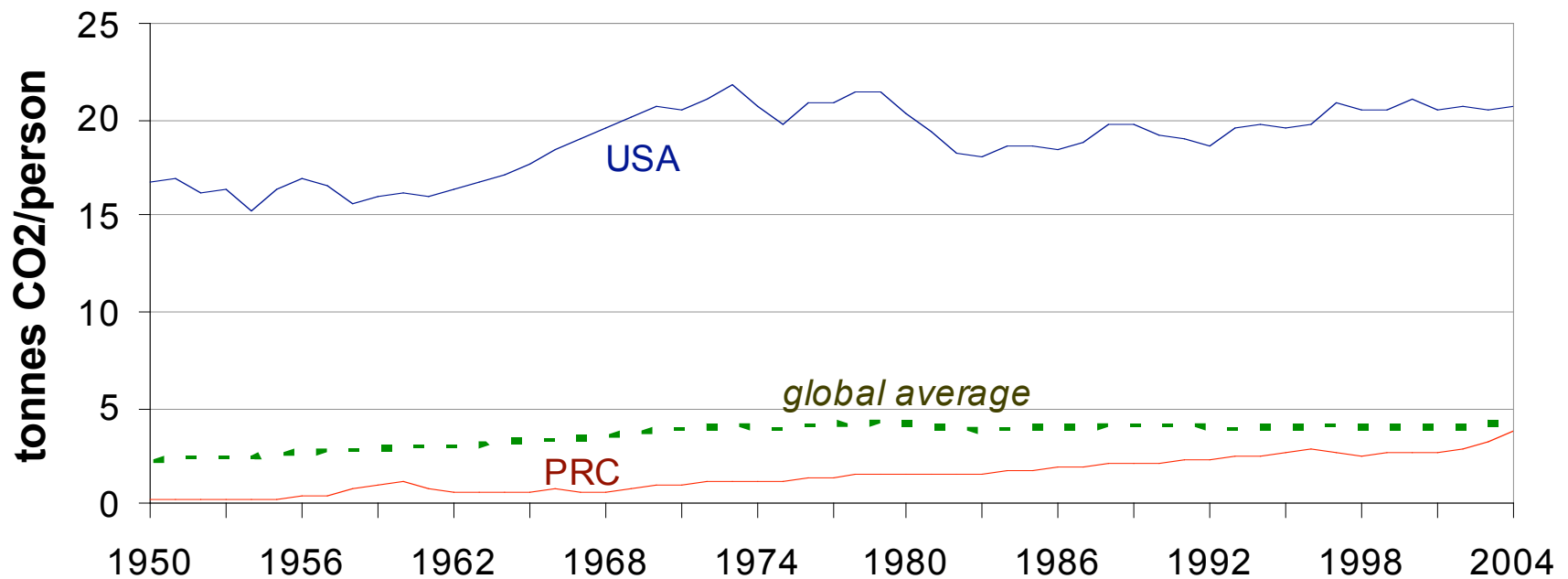


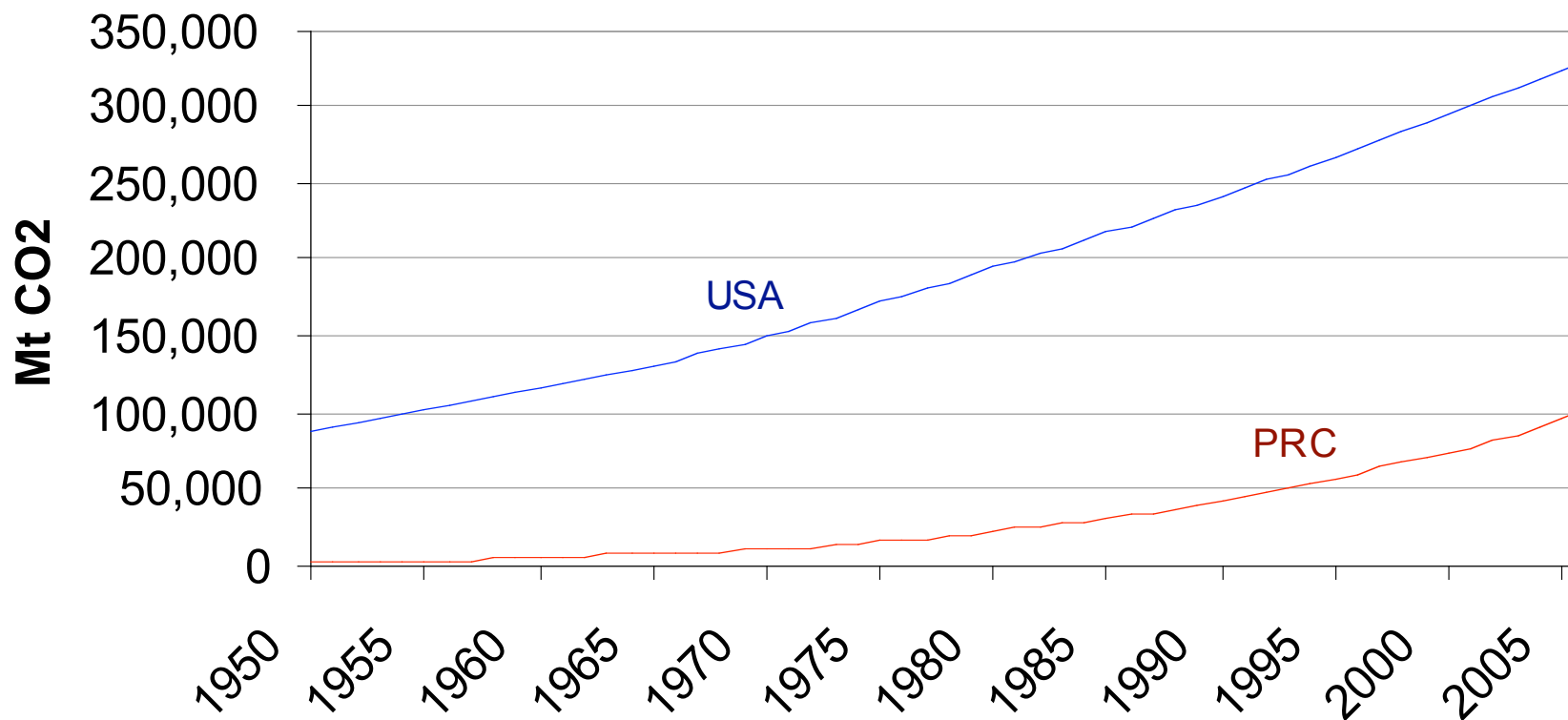
Figure 3: Global, Chinese, and American Per-capita Energy-Related CO₂ Emissions, 1950-2004



Source: China emissions are derived from revised total energy consumption data published in the 2007 China Statistical Yearbook using revised 1996 IPCC carbon emission coefficients by LBNL; China population data from NBS and US Census (for 1950-51); global and American emissions data from Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center; global and American population data from US Census.



Cumulative Energy-Related CO₂ Emissions, 1950-2006



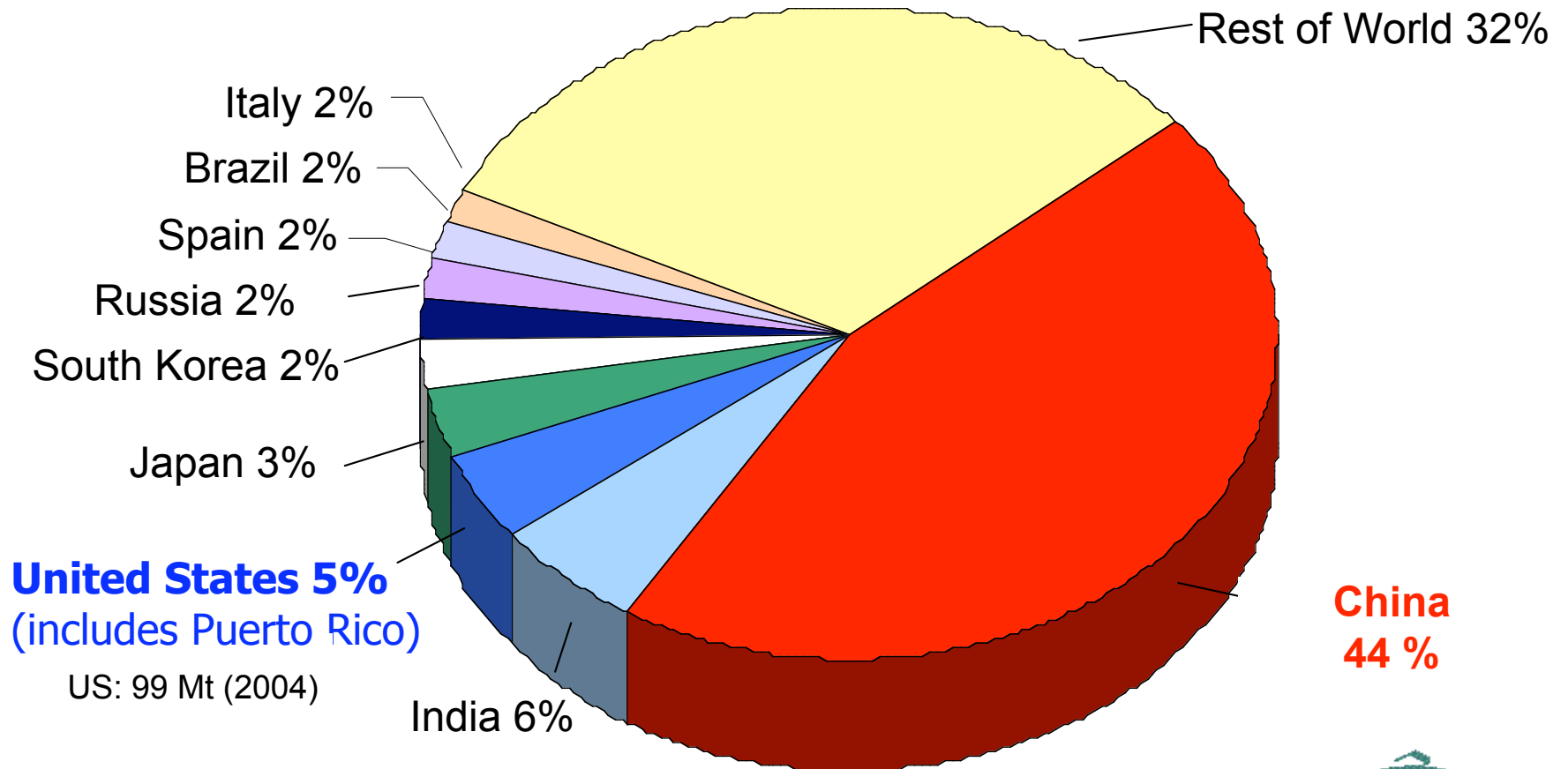
Source: Historical 1800-1980 US emissions data from Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center; 1980-2006 US data from US EIA 2006 AER. China 1902-1949 emissions data from Oak Ridge National Laboratory, Carbon Dioxide Information Analysis Center; 1950-2006 emissions data are derived from revised total energy consumption data published in the 2007 China Statistical Yearbook using revised 1996 IPCC carbon coefficients by LBNL. Pre-1902 China emissions data unavailable, but generally considered to be negligible.



Growth in heavy industry has been extraordinary in past five years: industrial efficiency especially critical

- **Consumes >60% of energy**
- **Technical complexity: many different types of processes**
- **Extraordinary growth in past five years**
- **Existence of many old, legacy industrial facilities**

Cement Production Worldwide: 2004

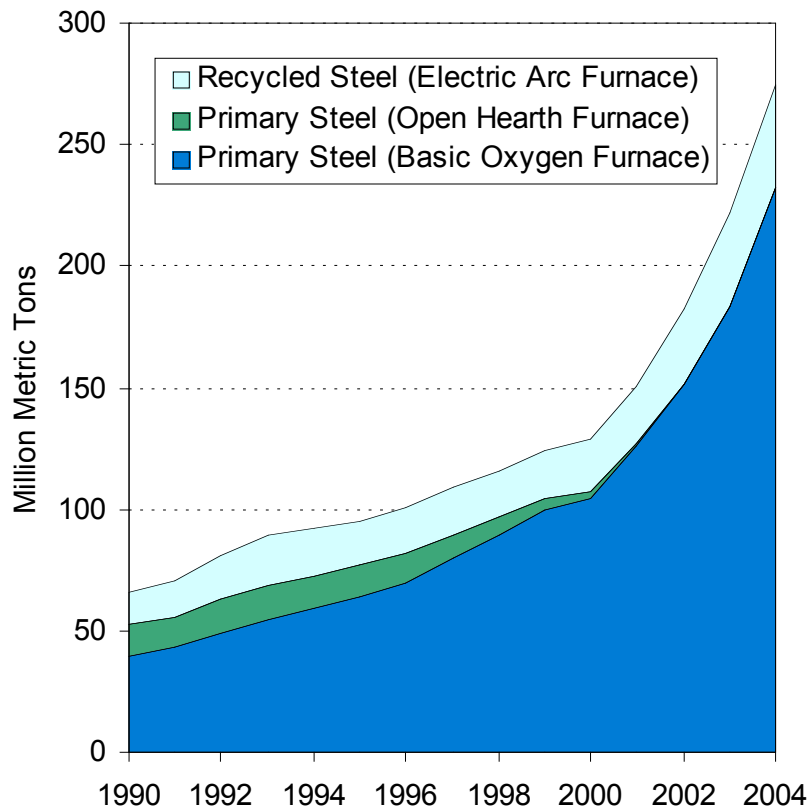


Sources: U.S. Geological Survey, 2005. Mineral Commodity Summaries: Cement; Cui, Y., 2006

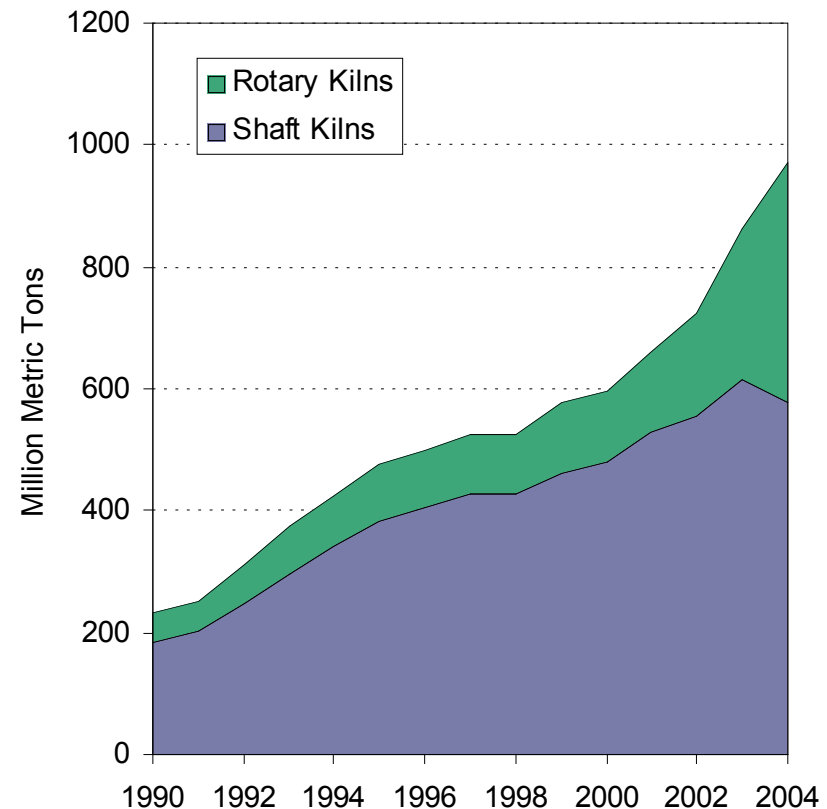


China is the world leader in the production of many industrial commodities

**China's Crude Steel Production
1990-2004**



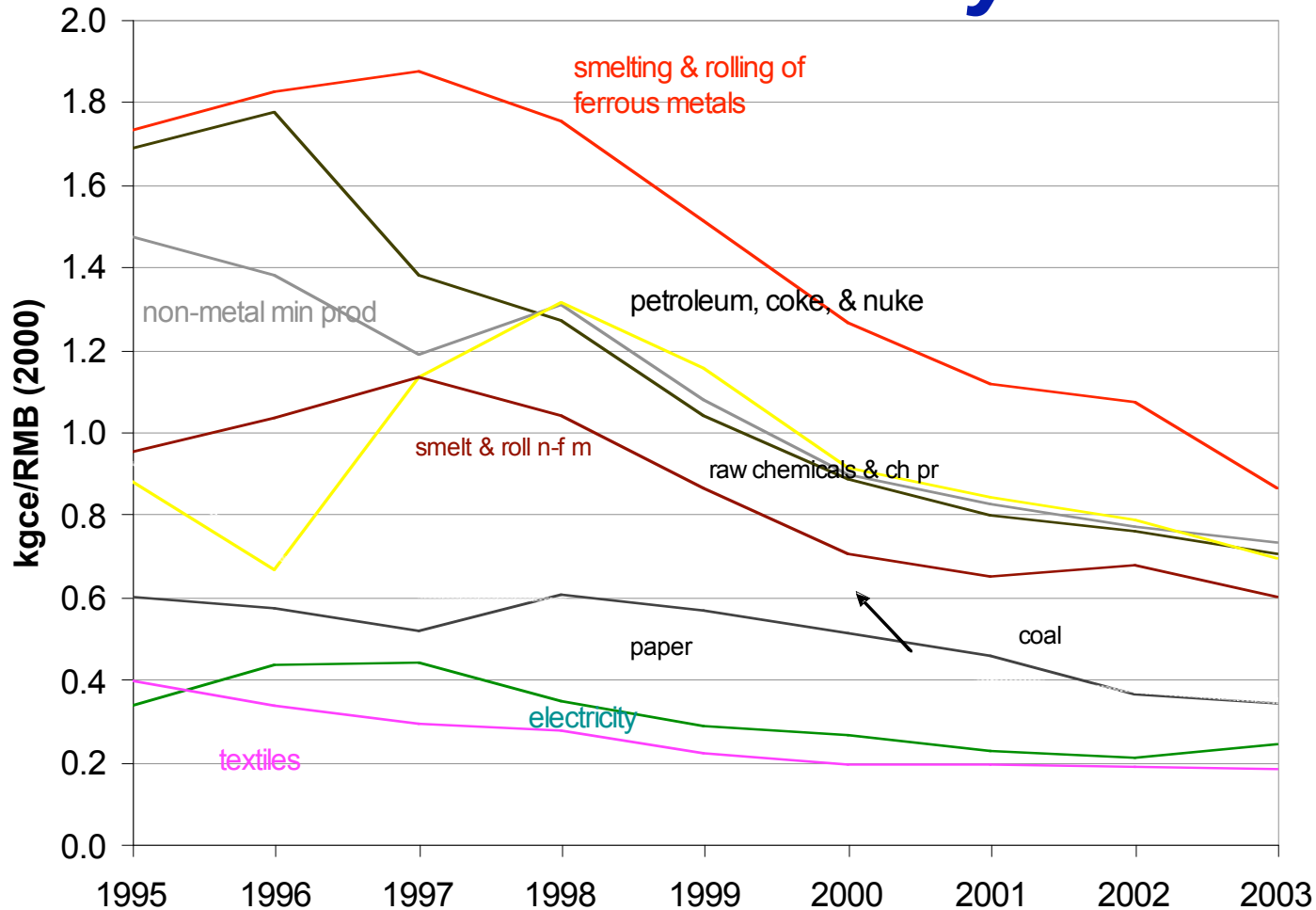
**China's Cement Production
1990-2004**



Industry Major Drivers

Industry Production Revision (million ton)	2000	2005	2010
Glass previous	9.1	9.6	10.1
Glass revised	9.1	17.5	27.5
Ethylene previous	4.7	7.7	12.0
Ethylene revised	4.7	7.6	13.0
Ammonia previous	33.6	36.0	38.0
Ammonia revised	33.6	46.0	38.0
Paper previous	30.5	40.0	50.0
Paper revised	30.5	52.6	68.0
Cement previous	597.0	680.0	790.7
Cement revised	597.0	1050.0	1310.0
Aluminium previous	3.0	4.0	4.6
Aluminium revised	3.0	7.7	11.2
Iron and Steel previous	128.5	250.0	300.0
Iron and Steel revised	128.5	349.4	440.0

Energy intensities within industrial sub-sectors are actually declining



Part III: The Future

What might happen? What is to be done
to end the crisis?



Executive Summary (Part III)

- **Things could get worse**
 - Very unlikely, but they could continue on the present path for some time
- **Things could get better**
 - There is some chance!!

China's National Energy Strategy

“Energy development and efficiency have equal role (emphasis on efficiency)”

- But supply investment at *RMB 424 billion* (\$ 50B) while energy conservation investment at *RMB 23 billion* (\$3B) in 2003 !!

Energy Investment

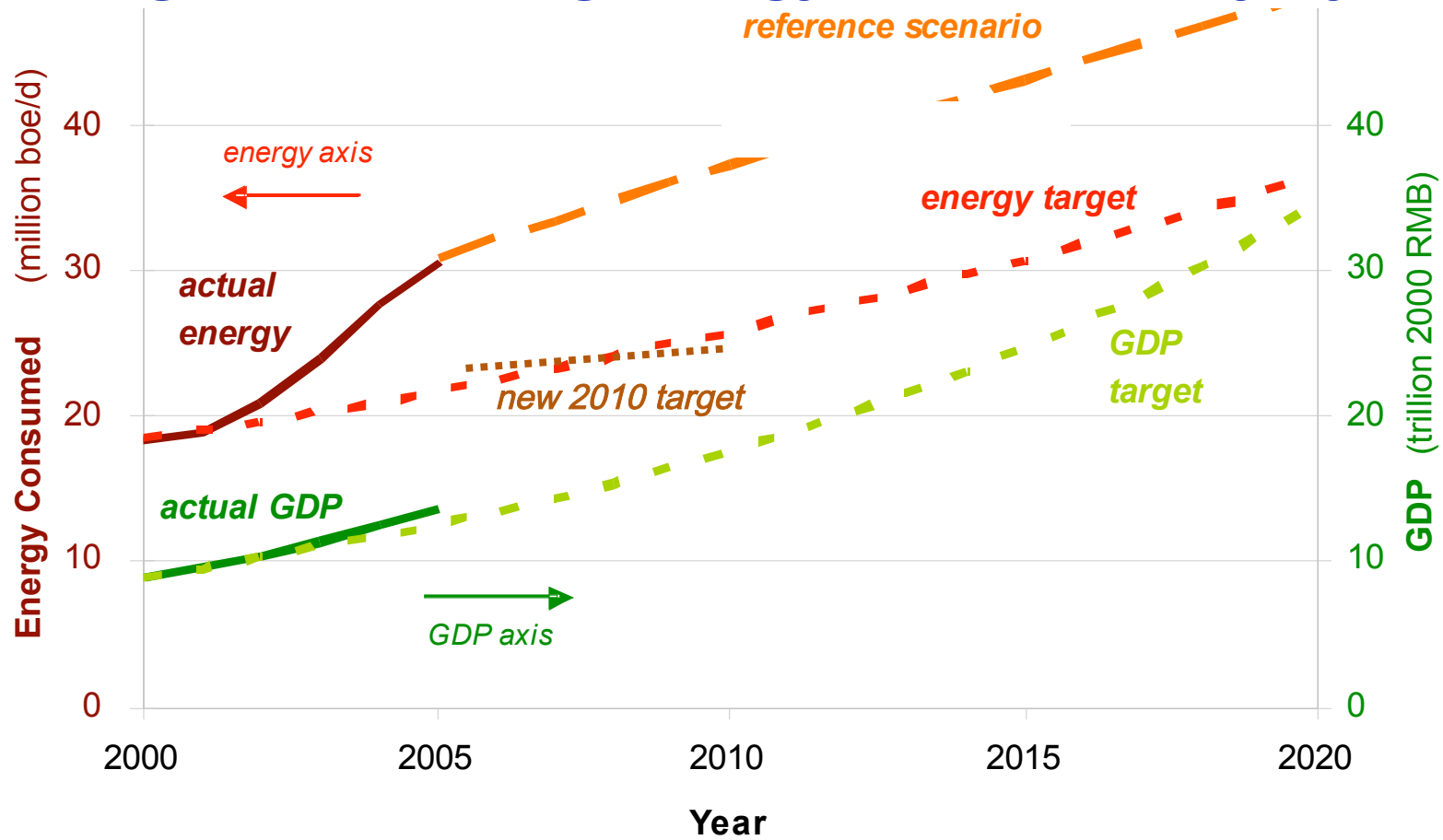
- **Energy supply investment is ~18 times energy efficiency investment**
- **Energy efficiency investment needs to increase from \$3B to \$25B per year (avg over next decade)**

China's government now recognizes the urgency of energy efficiency

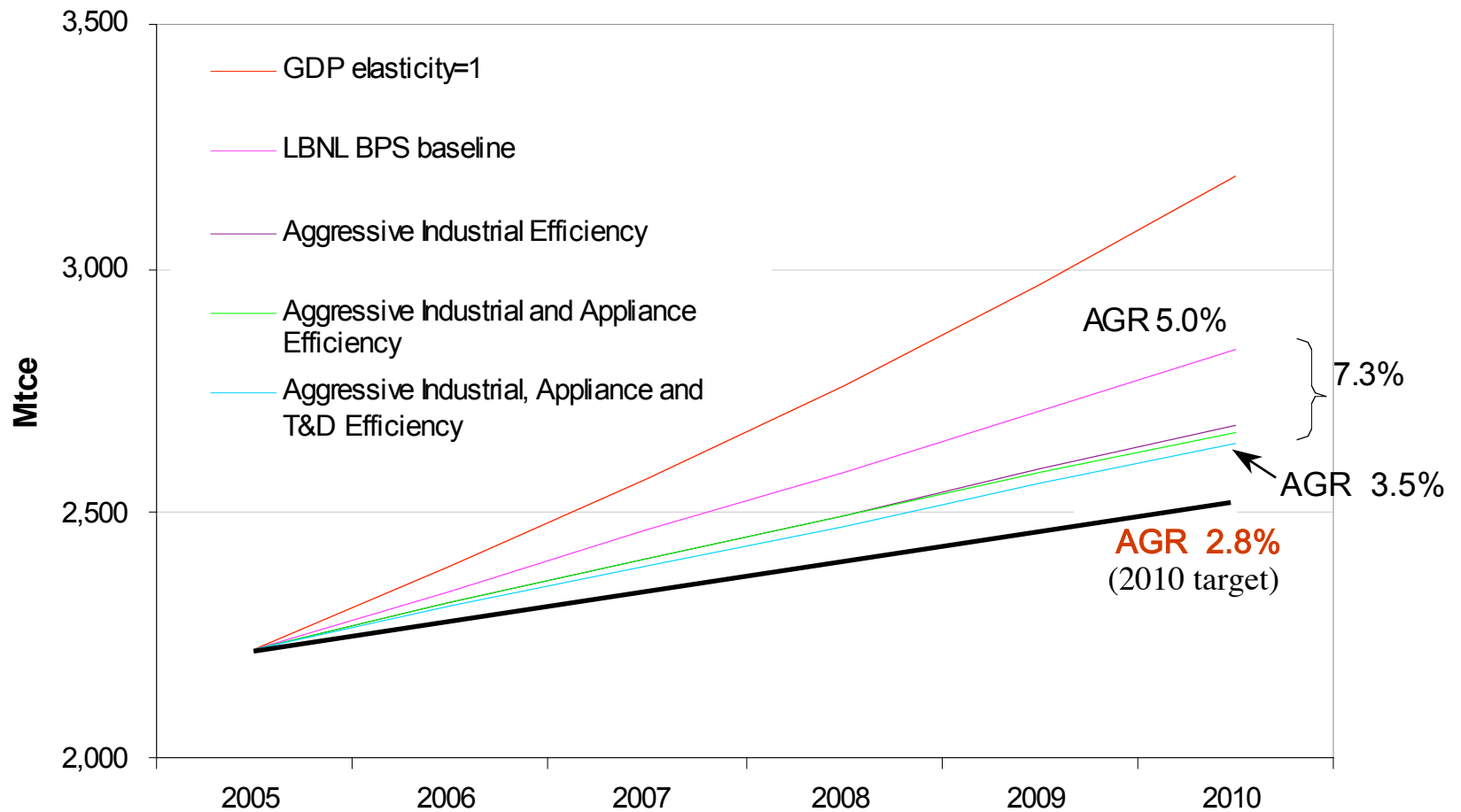
- The reform period (1980-2000) showed that energy efficiency was essential to achieve economic goals (*Deng Xiaoping*)
- The current leadership recognizes the same imperative (*Plenary of the Communist Party, Nov, 2005*)—Premier *Wen Jiabao*:
“Energy use per unit of GDP must be reduced by 20% from 2005 to 2010”
- Statement reiterated by the National Peoples Congress (March 2006)
- National Development and Reform Commission creating and re-creating aggressive energy efficiency policies and programs



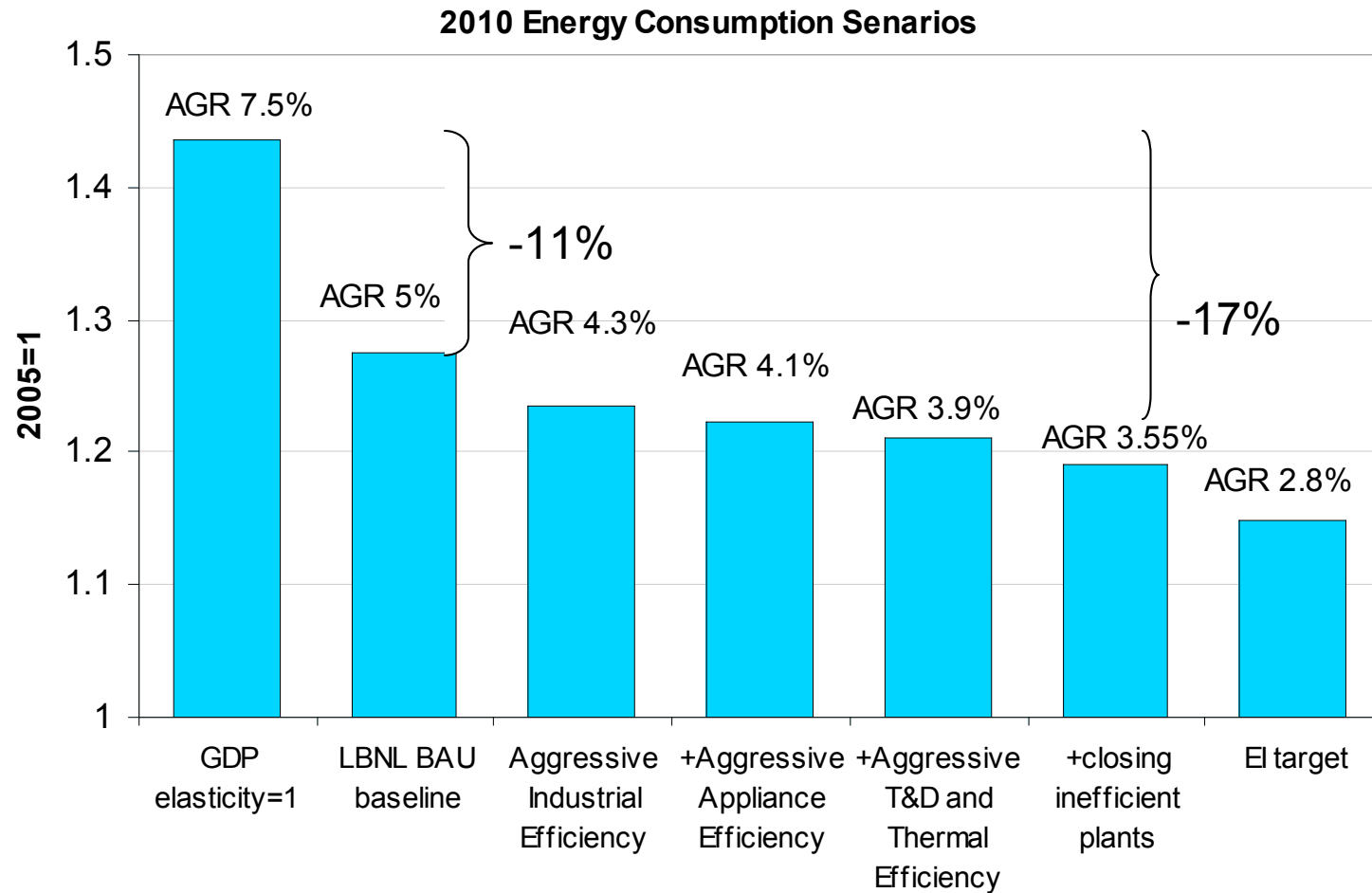
The loss of control led to imposition of new 2010 target of reducing energy/GDP intensity by 20%



Is the 20% intensity reduction possible?



Is 20% energy intensity reduction by 2010 possible?



Policies

- **Microeconomic policies (targeting energy efficiency)**
 - targets for energy efficiency for industries, with strong incentives (carrots) and penalties (sticks)
 - Key supporting policies: information and technical guidance; strengthening local energy conservation service provider network; and subsidies directly connected to achieving industrial targets
 - enhanced enforcement of tighter building energy standards,
 - tighten and assure compliance with appliance efficiency standards,
 - strict enforcement and strengthening of auto fuel economy standards,
 - initiation of demand-side management programs of scale in several electric utilities, and
 - investment in mass transit alternatives.

Policies (cont)

- **Macroeconomic Policies**

- Revisiting of energy prices to better reflect costs and taxes to better achieve social/ political objectives
- Re-creation of successful approach (during 1980s and part of 1990s) of subsidizing investments in energy efficiency
- Policies that result in additional closings of energy inefficient factories
- We also recommend exploration of ways in which macroeconomic policies can lead to structural changes favoring lower energy use.

THE END

