Argonne NATIONAL LABORATORY

... for a brighter future

Challenges of Chinese Motor Vehicle Growth and Fuel Supply

Michael Wang

Center for Transportation Research

Argonne National Laboratory

TRB Climate Change Workshop

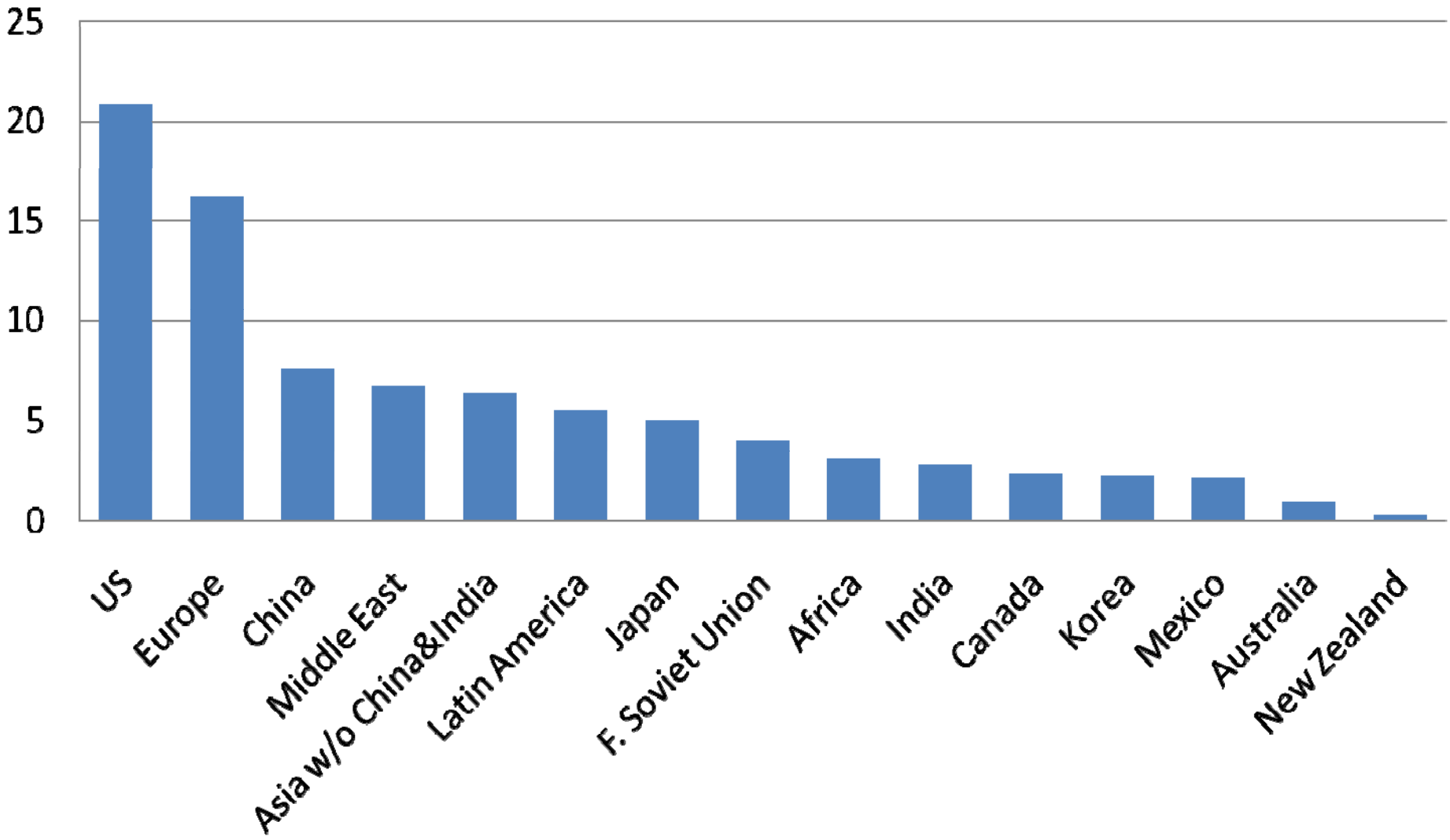
Washington, DC, Jan. 13, 2008

U.S. Department of Energy

UChicago Argonne LLC

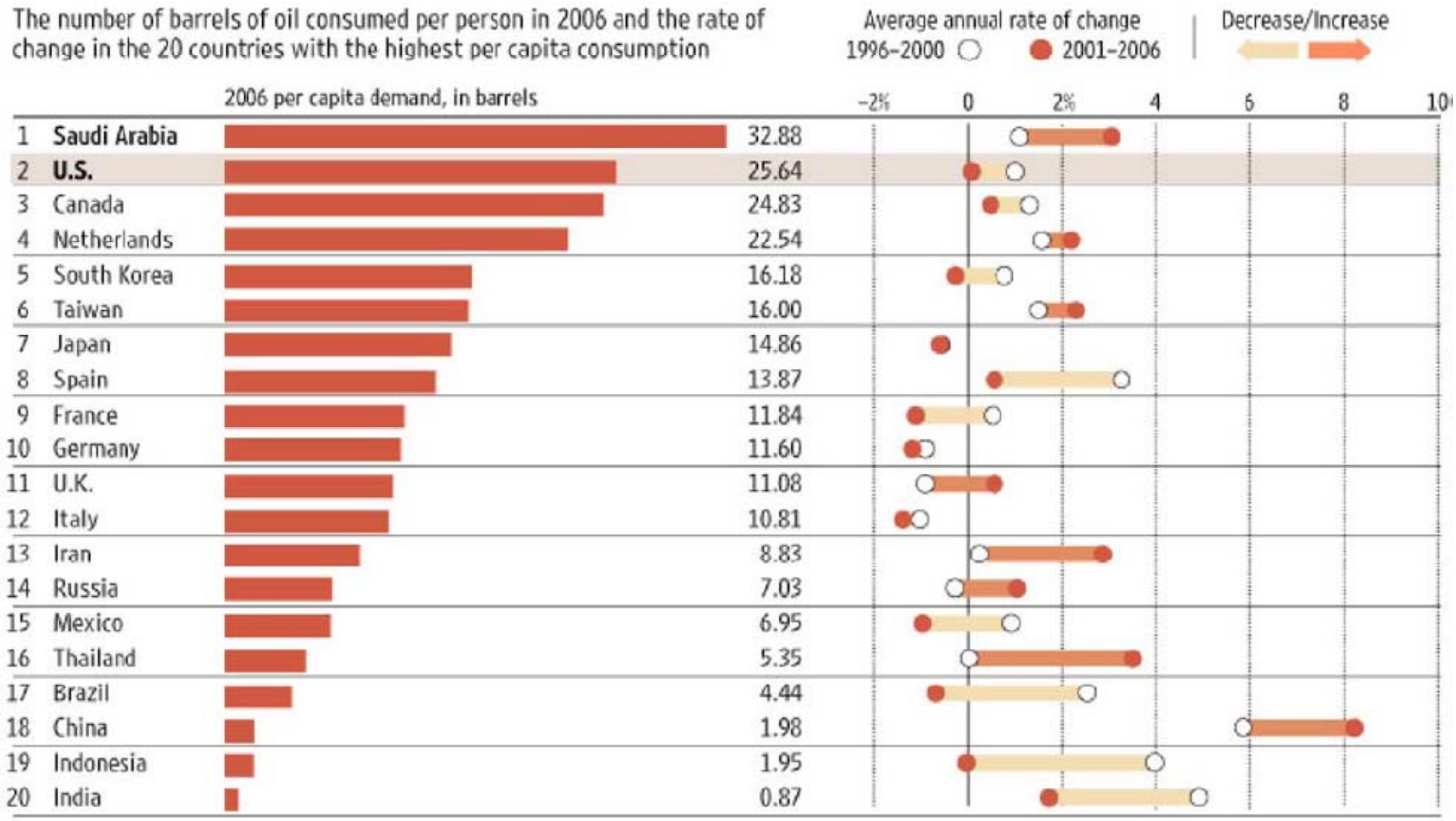
A U.S. Department of Energy laboratory managed by UChicago Argonne, LLC

Oil Consumption by Region in 2007 (MMBBL/D)



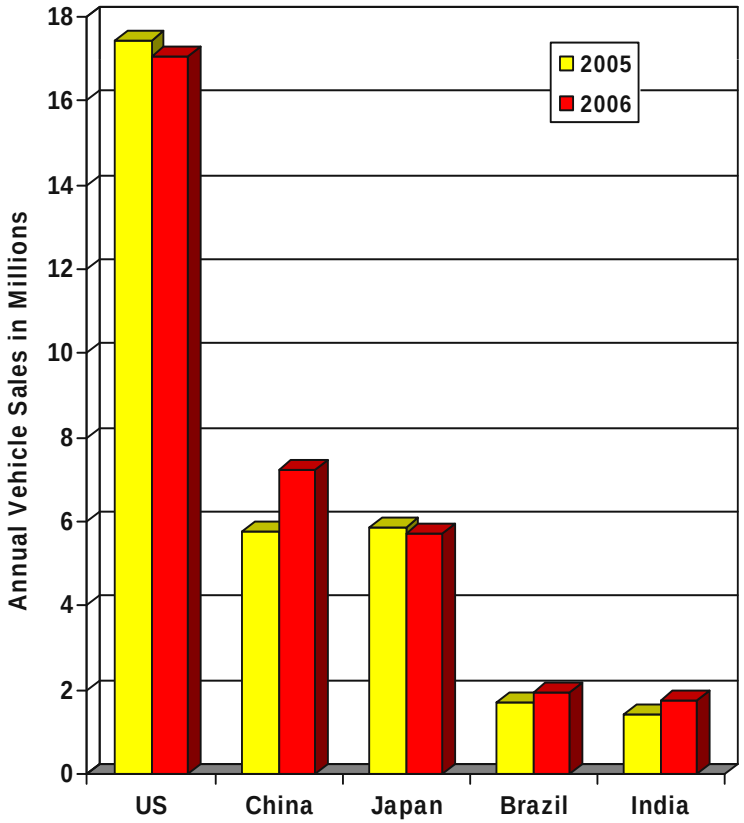
Based on data in The Wall Street Journal, Jan. 3, 2008.

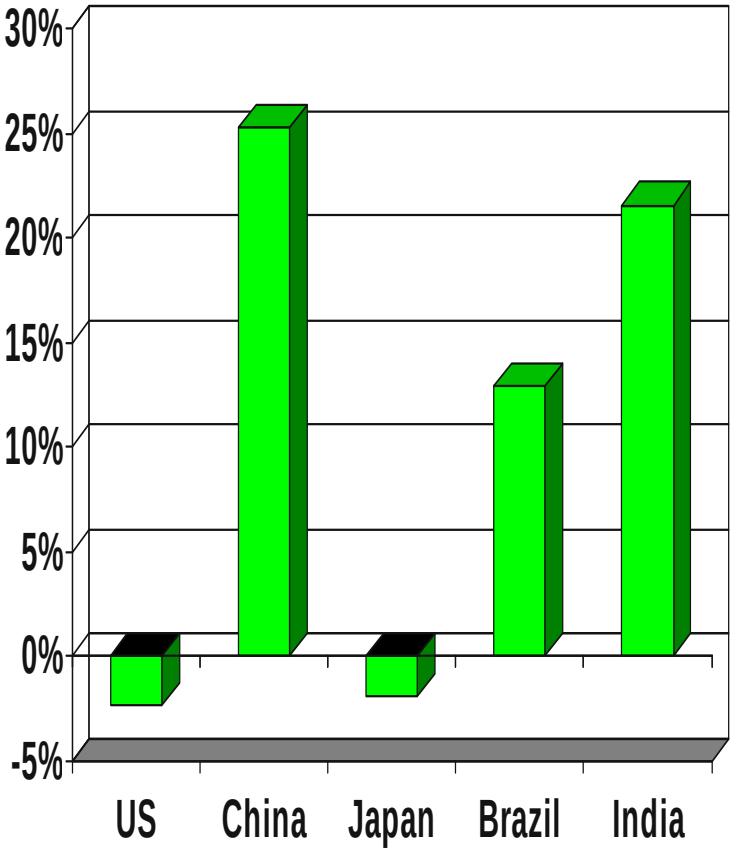
Per-Capita Oil Use Among Countries



Source: The Wall Street Journal, Jan. 3, 2008.

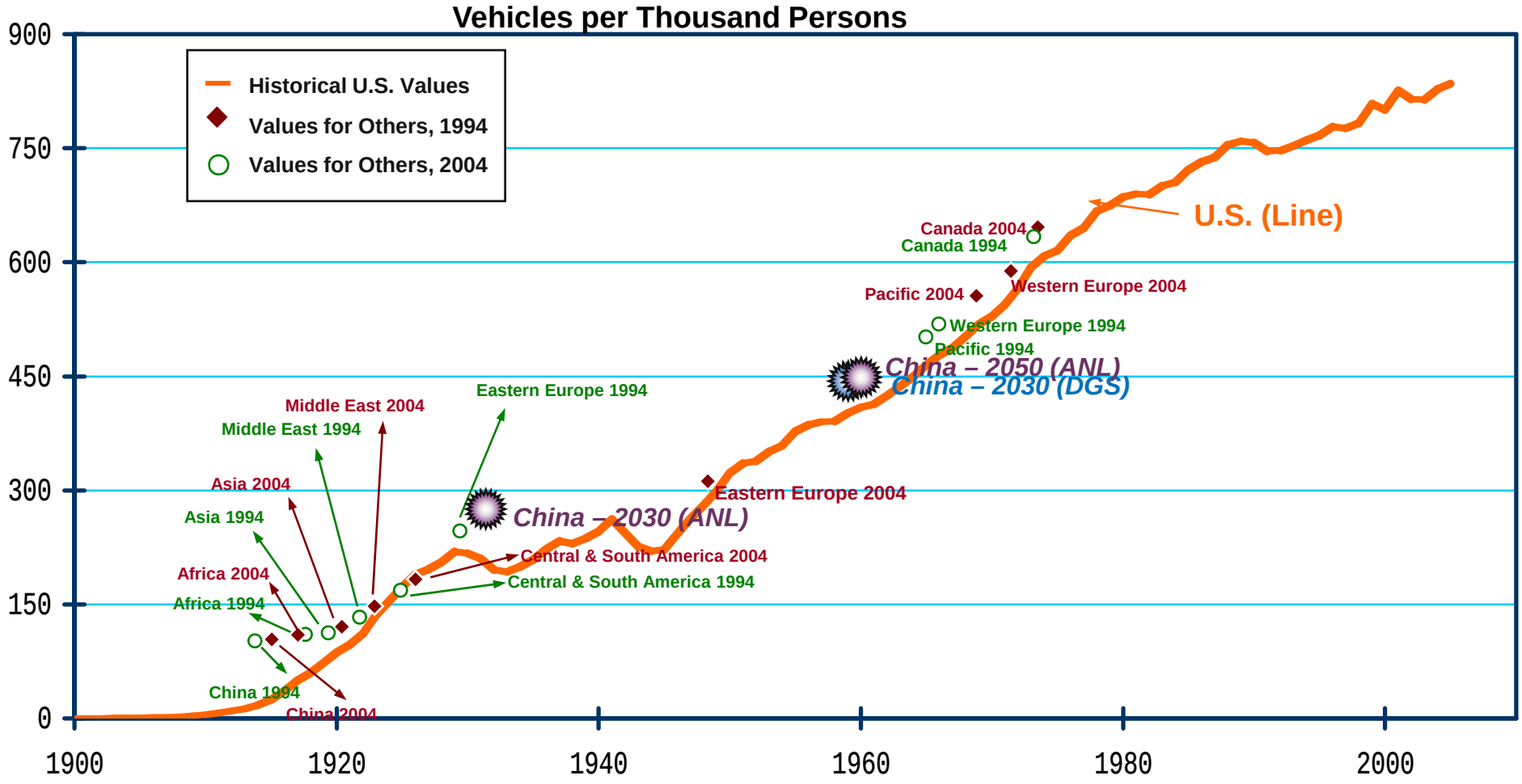
Annual Vehicle Sales in Five Countries





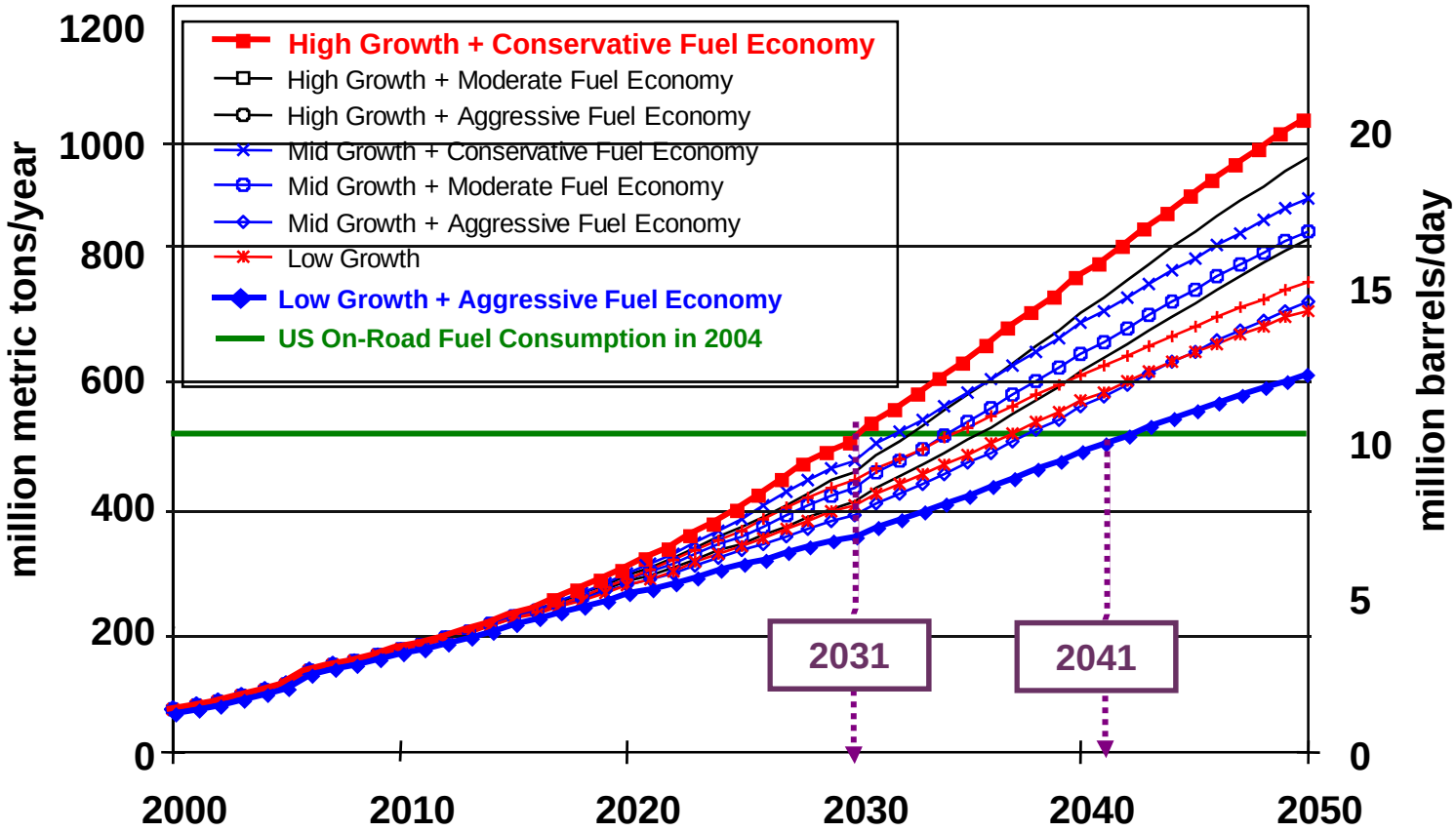
Source: Fact #500 of DOE/EERE, January 7, 2008.

Even by 2030-2050, Chinese Vehicle Ownership Will Be Still Far Below the Current U.S. Level



Source: Transportation Data Book, Vol. 25, ORNL, 2006 and Wang et al., 2006

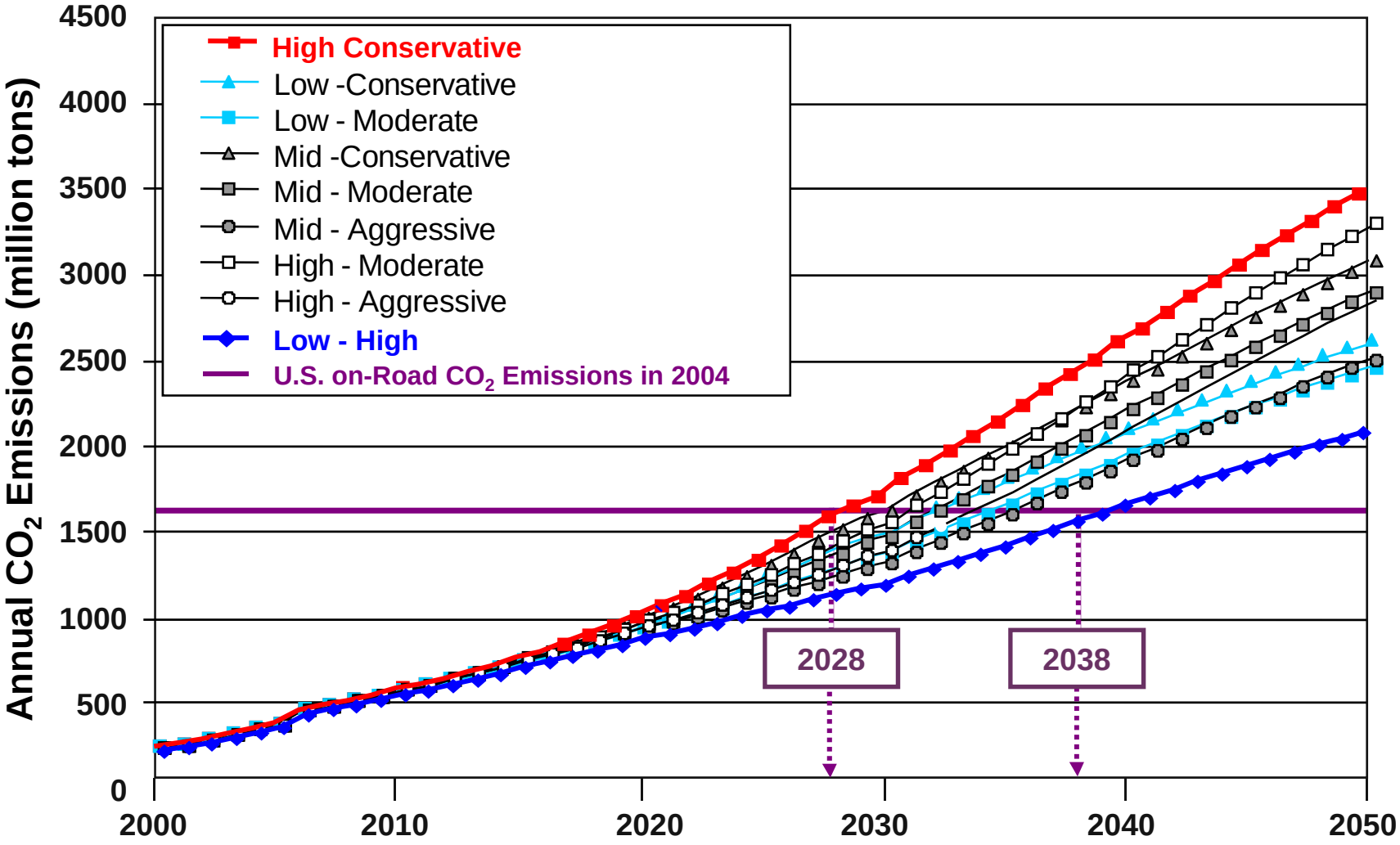
Oil Demand by Chinese Motor Vehicles Could Reach the Current U.S. Level by 2030-2040



The difference among the scenarios could be as high as 65%, indicating a great potential for reducing oil demand by both containing vehicle population growth and improving vehicle fuel economy

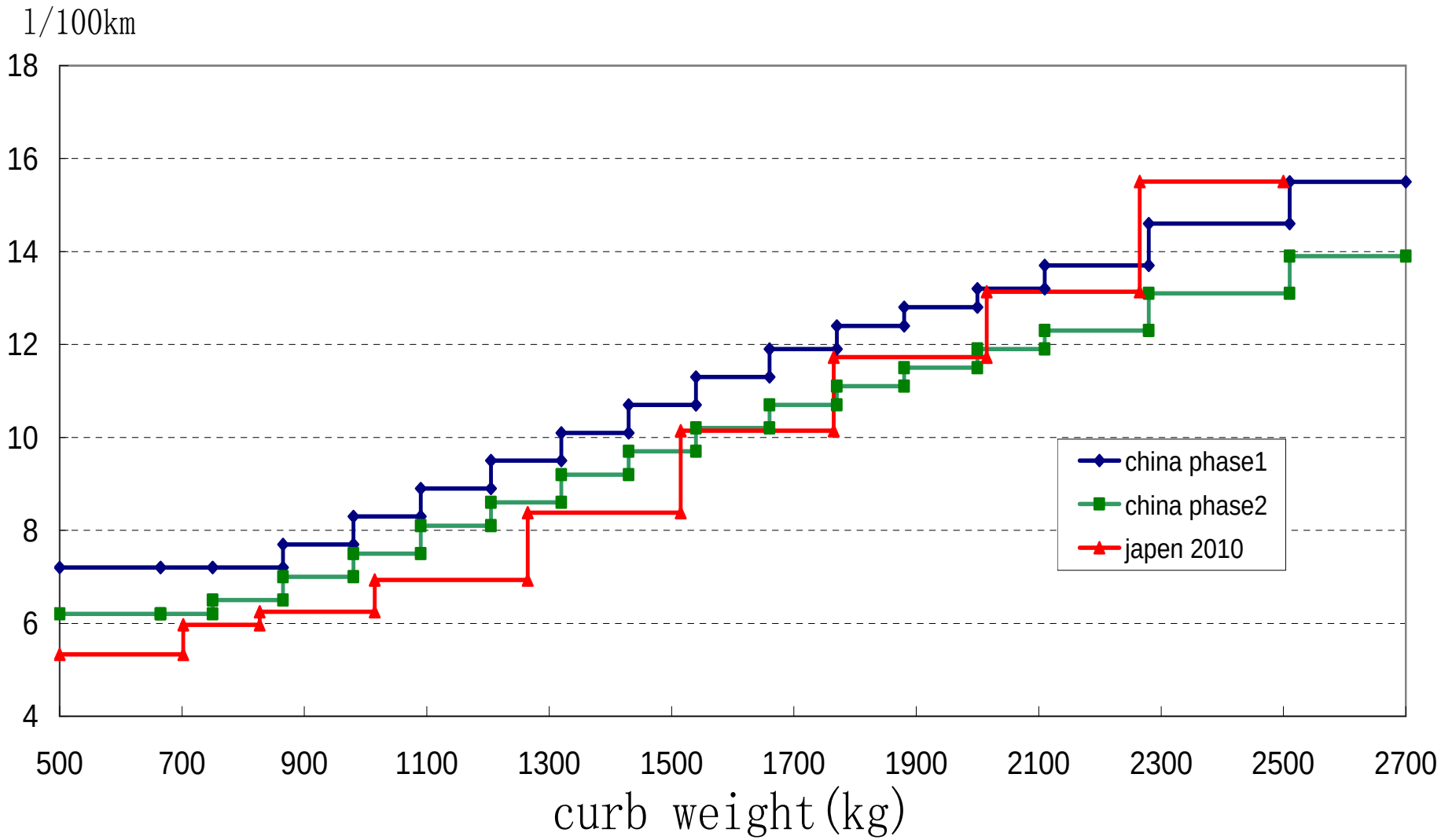
Source: Wang et al., 2006

CO_2 Emissions from Chinese Motor Vehicles Could Equal the Current U.S. Level by 2030s

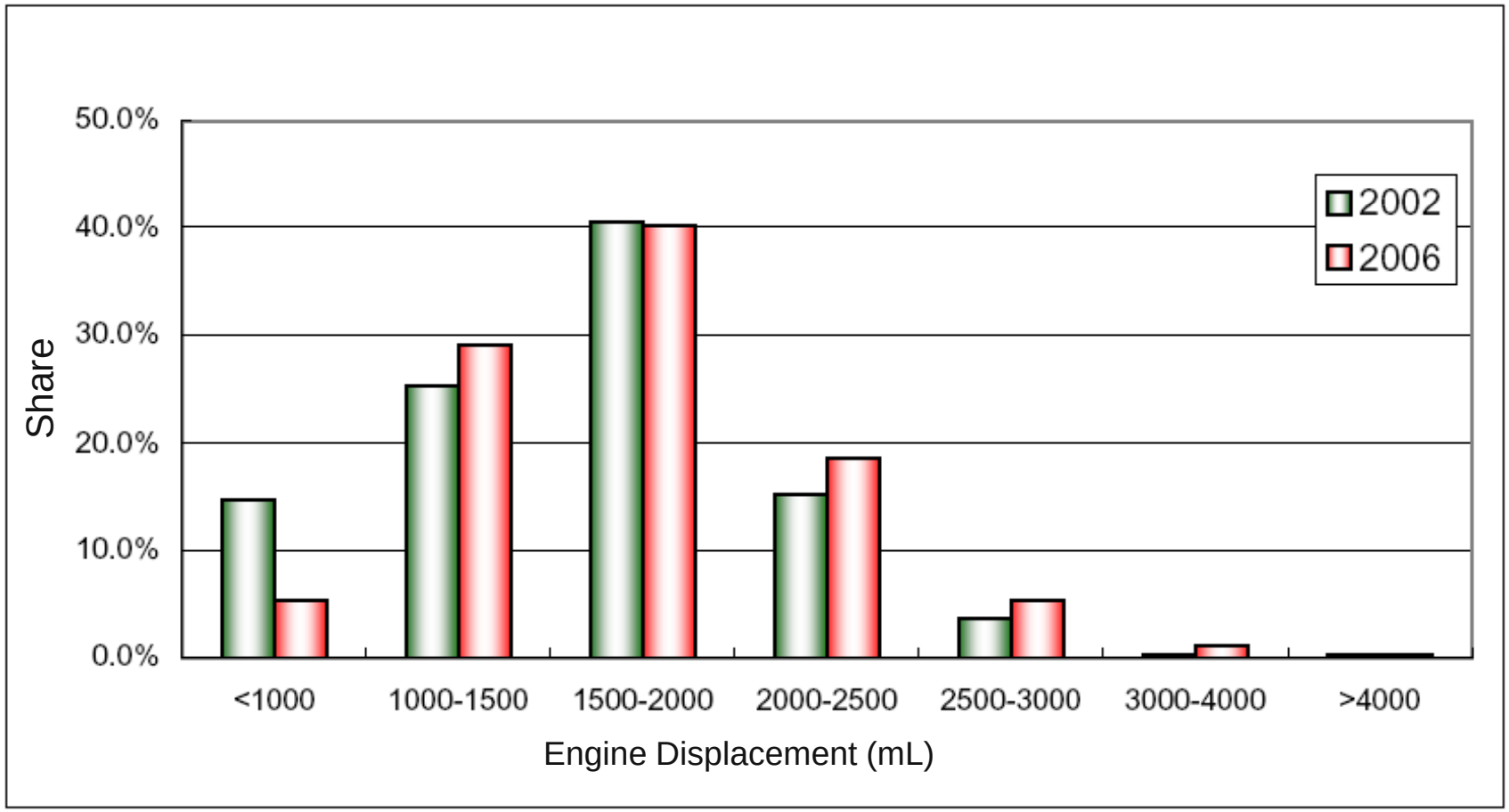


Source: Wang et al., 2006

China Has Established Class-Based Vehicle Fuel Consumption Standards



Chinese Vehicle Purchase Shows a Discouraging Trend to Larger Cars, Even With Governmental Fiscal Policy To Discourage Such Trend



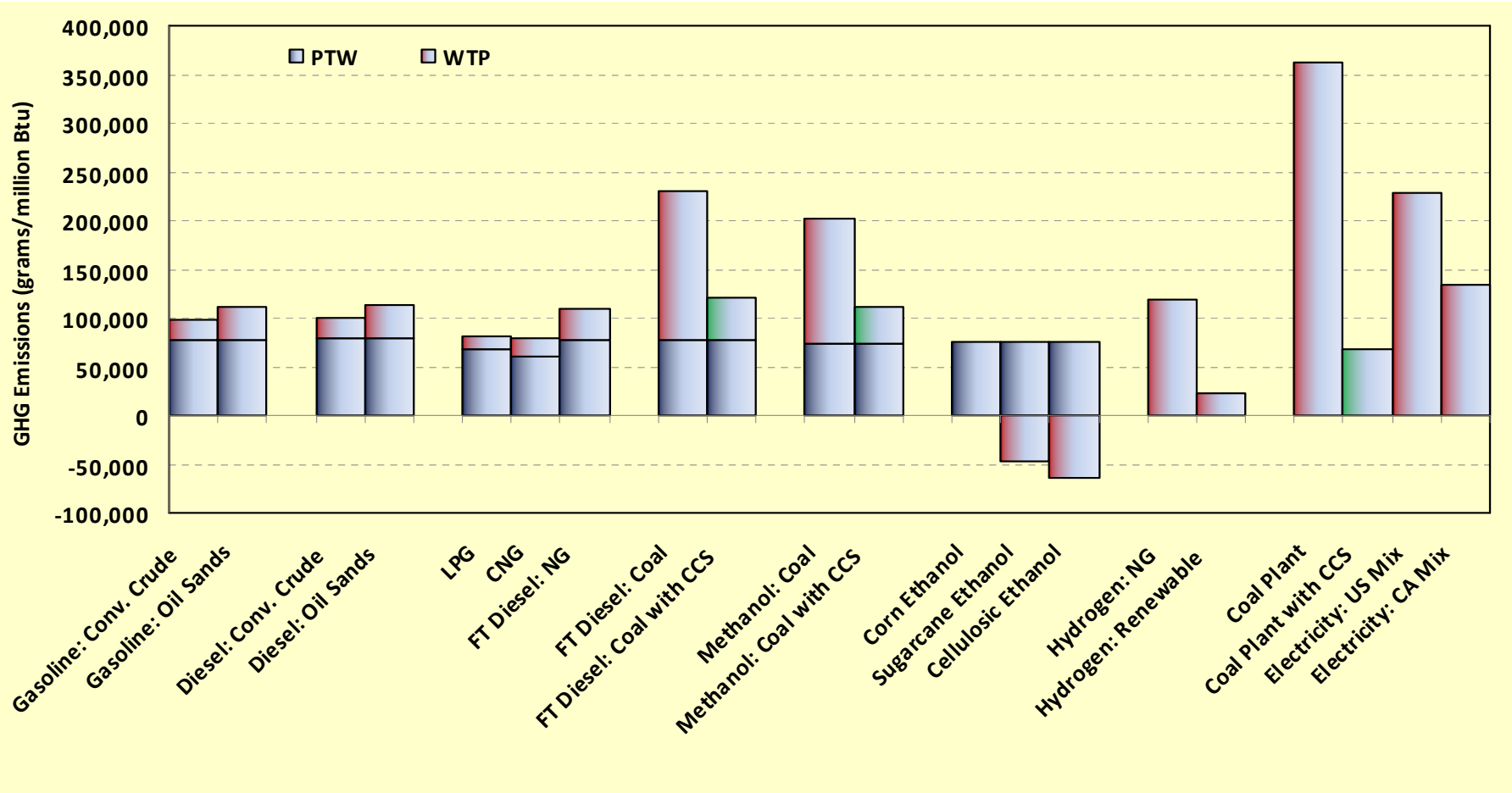
Chinese Vehicle Excise Tax Effective of April 1, 2006

Engine Displacement (mL)	<=1500	1500-2000	2000-2500	2500-3000	3000-4000	=>4000
Vehicle Excise tax	3%	5%	8%	11%	14%	20%

China Is Pursuing Alternative Transportation Fuels Primarily for Reduction in Its Oil Import

- The Clean Vehicle Action with 20 Chinese cities to deploy alternative-fuel vehicles
- A large number of CNG or LPG taxi and bus fleets in several cities
- 440 million gallons of corn-ethanol was used in 2006
  - U.S. used 4.9 billion gallons
  - Brazil used 4.5 billion gallons
  - China has cellulosic ethanol R&D program in its 11th 5-Year Plan
- Coal-based fuels have been pursued
  - *Coal-based methanol is blended with gasoline up to 15% in several provinces*
  - *A direct liquefaction plant will come online in 2008*
  - *FT diesel plants is under consideration*
  - *Demonstration of 1,000 DME buses in Shanghai by 2010*
  - *Coal-based fuels will cause carbon intensification of Chinese transportation fuel supply pool*

Well-to-Wheels GHG Emissions Vary Considerably Among Transportation Fuel Options



Feedstock recovery → Feedstock Transportation → Fuel Production → Fuel Transportation → Fuel Utilization

Carbon capture and storage (CCS) is applicable to the fuel production stage; decarbonization of fuels themselves offers additional GHG reduction potentials.

Summary and Research Needs

- Growth in vehicle population in China will drive demand for petroleum and cause CO2 emissions in the Chinese transportation sector
  - The transportation community needs to convey social costs (and benefits) of personal vehicles to China so that it can strike a balanced personal vehicle growth
- Vehicle efficiency improvement measures will slow down the growth but may not reverse it
  - The newly adopted fuel economy standards in the U.S. may help US, China, and other countries work together to further pursue vehicle efficiencies
  - Internationally coordinated demonstration of high-risk (and potentially high-reward) vehicle technologies may help promotion and advance vehicle technologies globally
- If China is going to tap into coal for liquid fuel production, it will face carbon intensification of its transportation fuels
  - Urban air pollution is a major concern in China now, thus better-quality fuels such as low-sulfur fuels are presently top priority
  - China needs to realize social and economic risks of climate change to itself and thus to treat GHG emissions as a top priority
  - Biofuel potential in China lie in non-grain, non-food based biofuels, but commercialable technologies are needed
  - Carbon capture and storage will need to be advanced and play an important role in coal-based liquid fuel production