



U.S. DEPARTMENT OF
ENERGY

PNNL-18906

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

A Glance at China's Household Consumption

B Shui

October 2009



Pacific Northwest
NATIONAL LABORATORY

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Printed in the United States of America

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Acknowledgement

This report owes its existence to Techosocial Predicative Analytics Initiative (TPAI) at Pacific Northwest National Laboratory (PNNL). I am particularly grateful to the TPAI team, led by Dr. Antonio Sanfilippo, for their leadership and financial support of this work.

I am indebted to Hugh Pitcher for taking the time to review this report. Alison Delgado and Becky Schaaf kindly provided editorial assistance. I would also like to express my gratitude to several other individuals for their advice and input, including Stanley Fran and Tom Sanquist (PNNL), YU Cong and ZHU Yuezhong (Energy Research Institute, National Development and Reform Commission), GE Quanshen (Institute of Geographic Sciences and Natural Resources Research, China Science of Academy), FANG Xiuqi (Beijing Normal University), ZHAO Hui and WEI Qingpeng (Tsinghua University).

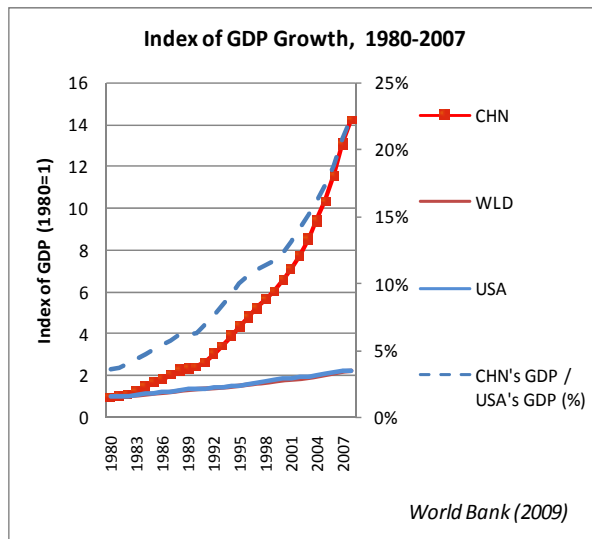
Abstract

Known for its scale, China is the most populous country with the world's third largest economy. In the context of rising living standards, a relatively lower share of household consumption in its GDP, a strong domestic market and globalization, China is witnessing an unavoidable increase in household consumption, related energy consumption and carbon emissions. Chinese policy decision makers and researchers are well aware of these challenges and keen to promote green lifestyles. China has developed a series of energy policies and programs, and launched a wide-range social marketing activities to promote energy conservation.

1. Introduction

Known for its scale, China is the most populous country with the world's third largest economy: the number one producer of crude steel, coal, cement, cereals, meat, tea, and carbon emissions; and the number two producer of primary energy and electricity (China National Bureau of Statistics 2009). China also has been admired for maintaining fast economic growth over three decades—its gross domestic product (GDP) has nearly quadrupled since 1978 (Box 1).

Box 1 China's GDP soared four-fold in three decades



China's GDP was US\$0.18 trillion* in 1980 and climbed to US\$2.60 trillion in 2007, with an annual growth rate of 10.4 percent. Over the same period, U.S. GDP rose from US\$5.13 trillion to US\$11.62 trillion, with an annual growth rate of 3.1 percent (World Bank 2009).

The U.S. GDP growth rate has kept pace with the world average (see the blue and red lines on the left figure).

Although China's GDP is still far lower than that of the U.S., it has increased from 4 percent of the size of U.S. GDP in 1980 to 22 percent in 2007 (see the dashed line).

* All monetary estimates in this box are in constant 2000 US\$.

The growth of China's GDP is driven by its final consumption expenditure (the red line in Figure 1), gross capital formation (the green line), and external trade balance on goods and services (the blue line). For instance, the share of final consumption expenditure in GDP declined from approximately 65 percent in the early 1980s to below 60 percent by the early 2000s, except for a bump between 1996 and 2002 when its share rose above 60 percent. By 2007, the share of final consumption in China's GDP slipped to 47 percent. The values are much lower than other countries. For example, the share of final consumption in GDP was 77 percent for the world average in 2000, while the U.S.'s value reached 83 percent that year (World Bank 2009).

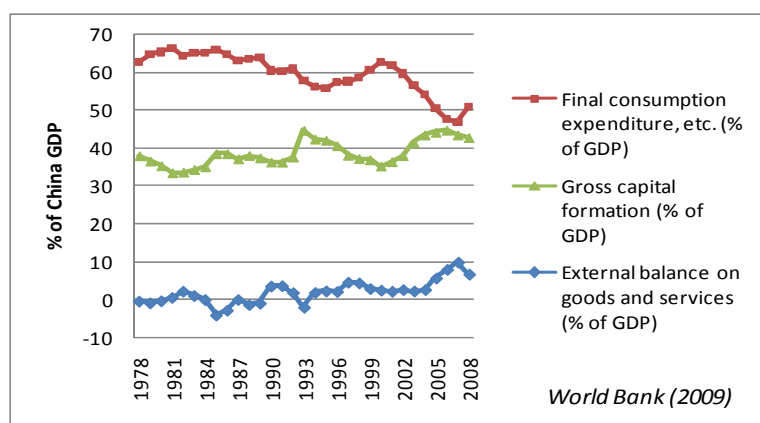


Figure 1 The contribution share of GDP, 1978-2008

In the midst of the global financial meltdown in 2008, China still sustained its robust economic growth. China's industrial production rose 8.9 percent in May compared to one year earlier (Xinhua 2009). The government held moderate optimism that China could achieve an 8 percent economic growth rate in 2009.

In order to weather the negative impacts of the worldwide economic depression on China's exports (the blue line in 2008, Figure 1), the Chinese government has been reorienting its economy toward domestic consumption. Final consumption expenditure rose for the first time in the past eight years in 2008, with a 50.8 percent share of GDP (the red line in 2008, Figure 1).

China's household consumption expenditure (the red line in Figure 2), the major component of final consumption expenditure (the red line in Figure 1), has followed a similar growth path. In 2008, it rose for the first time in the last nine years, achieving a GDP share of 38.2 percent. Notice that China's share of household consumption in GDP is also much lower than the world average. The share of household consumption in GDP globally was 61 percent in 2000, while the U.S. value was 69 percent that year (World Bank 2009)

Another noticeable change in 2008 is that both exports (the blue line in Figure 2) and imports (the green line in Figure 2) dropped for the first time since the 1997 Asian financial crisis.

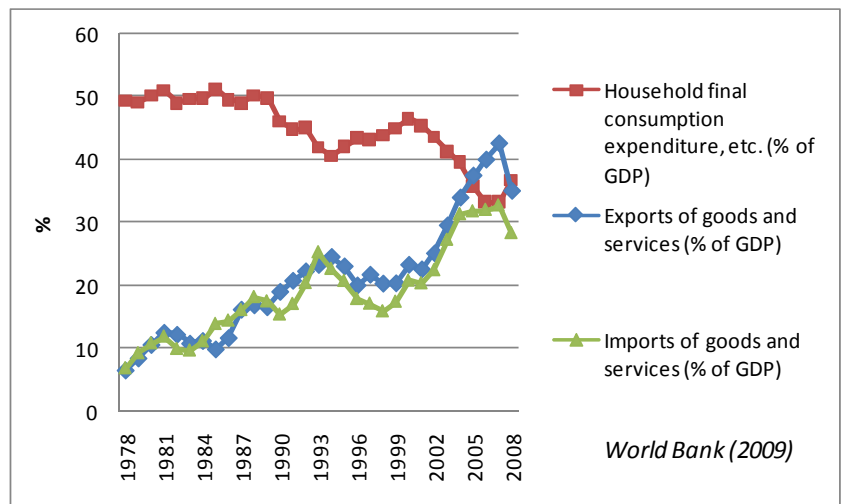


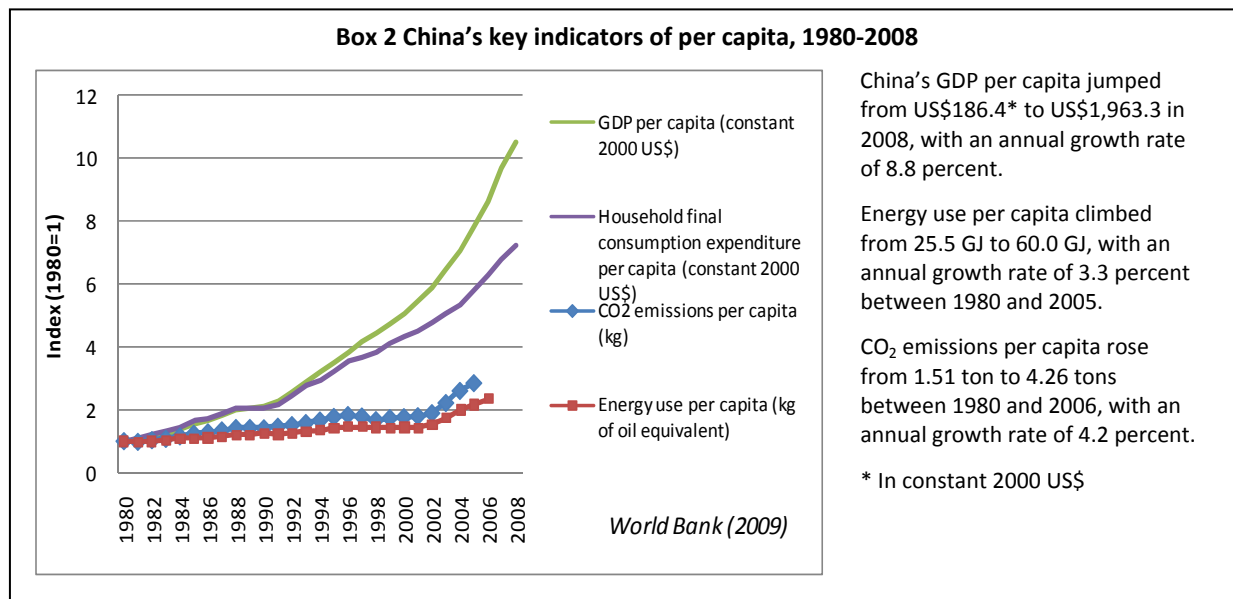
Figure 2 The share of household final consumption in GDP, 1978-2008

China's consumption is taking off in the context of rising living standards, a relatively lower share of household consumption in its GDP, a strong domestic market and globalization. There is little doubt that China's domestic consumption will soon be a subject of climate change negotiation as well as a policy and research target in the areas of global and national energy security.

This report offers a snapshot of China's household consumption (Section 2), a brief review of China's current policies, studies and views held by China's senior researchers (Section 3). Due to time limitations, the report will not extend to comprehensive data analyses and a wider range of discussions.

2. A Glance at Household Consumption

China made a bold move in 1978 by encouraging the growth of private and semi-private enterprises. With fast growing economic development and living standards, China's annual household expenditure per capita leaped from US\$101.8 (constant 2000 US\$) in 1980 to US\$734.1 in 2008 (the purple line in Figure 3), with an annual growth rate of 7.3 percent (World Bank 2009). This rate is lower than that of the GDP per capita over the same period, 8.8 percent, but higher than both annual growth rates of CO₂ emissions per capita (3.3 percent over 1980 to 2005) and energy use per capita (4.2 percent over 1980 to 2006).



2.1 Urban and Rural Living Expense, and Their Regional Differences

The pattern of household living expense displayed huge differences between urban and rural areas as well as among regions in China.

For example, the living expense in urban areas (the blue line in Figure 3) is much higher than that in rural areas (the red line in Figure 3) at US\$1,287 vs. US\$442 in 2007 (in 2007 US\$). Eastern China, which houses many of China's booming export manufactures, is the most expensive region for urban and rural residents. The Northeastern region, in which most of China's heavy industries are clustered, ranked the second most expensive region with a high urban and rural living expense. The expense of urban living in Central China and rural living in Western China are among the lowest in the four regions.

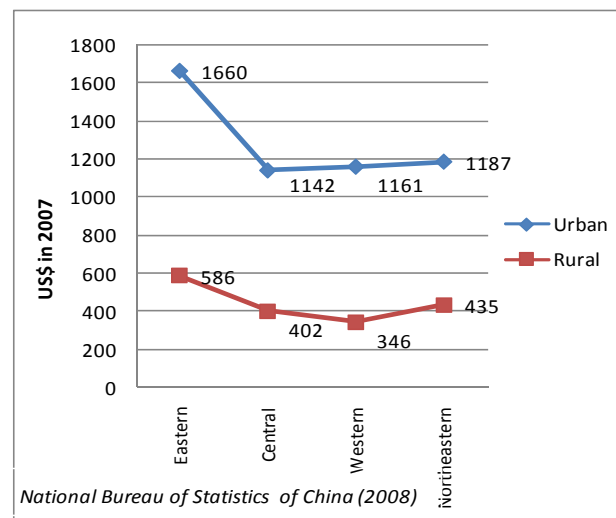


Figure 3 Urban and rural living expense per capita, 2007

Among a variety of expenditure categories, food consumption comprises the largest share of Chinese household expenditure across all settings, representing as much as 39 percent of urban expenditure and a 47 percent share of rural living expense in Western China (the red lines in Figures 4A and 4B).

The second largest expenditure categories varied by setting. In urban areas, transportation and communications was the second largest expense in Eastern China, with 16 percent in 2007. Education and recreation ranked second for urban areas in both Central and Western China, with 13 and 12 percent, respectively. In Northeastern China, clothing was the second largest expense category, with 12.1 percent, and is closely followed by education and recreation with 11.6 percent (Figure 4A).

In rural areas, housing expenses ('residence') was the second largest expense across all regions. Health care or transportation and communication ranked third or fourth in all four regions (Figure 4B).

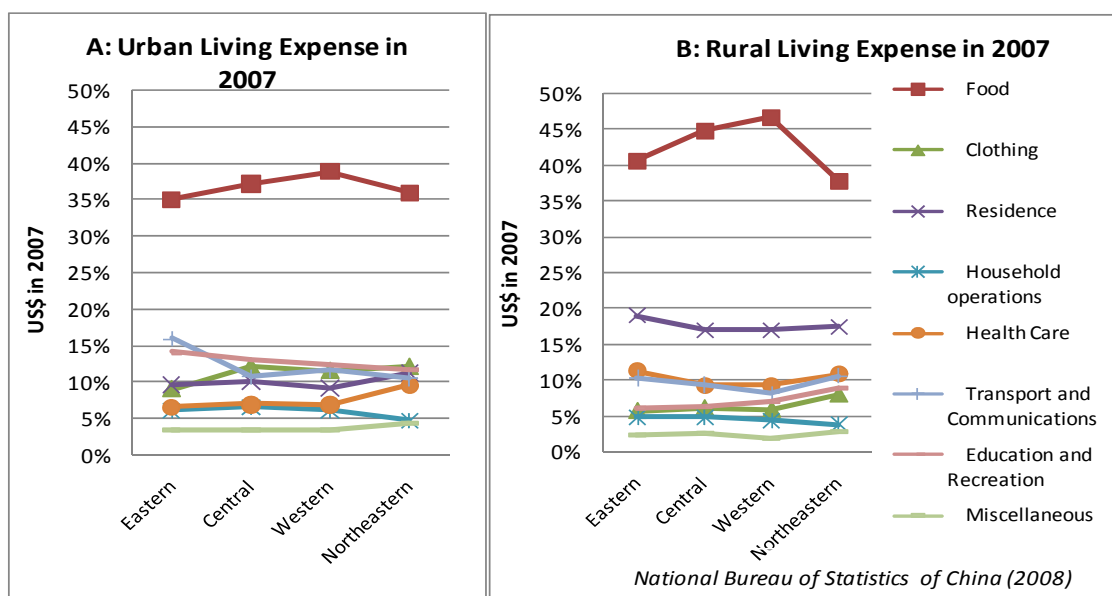


Figure 4 Urban vs. rural living expense per capita in China, 2007

2.2 Household Energy Consumption

China's household energy consumption jumped from 2.69 EJ in 1980 to 7.49 EJ in 2006, with an annual growth rate of 4.0 percent, far less than an 8.5 percent of annual growth rate of household final expenditure over the same period.

In regards to household energy consumption, the use of electricity (the red lines in Figure 5) soared from 0.13 EJ in 1980 to 3.85 EJ in 2006, with an annual growth rate of 14.1 percent. The share of electricity of household energy consumption rose from 4.7 percent in 1980 to 52.6 percent in 2006, which has surpassed coal as the most popular fuel type at home since 2000.

The story for coal use is the opposite. Coal (the blue line in Figure 5) dropped from 2.42 EJ in 1980 to 1.75 EJ in 2006. The share of coal of total household energy consumption fell from 90.9 percent in 1980 to 24.0 percent in 2006 (LBNL 2008).

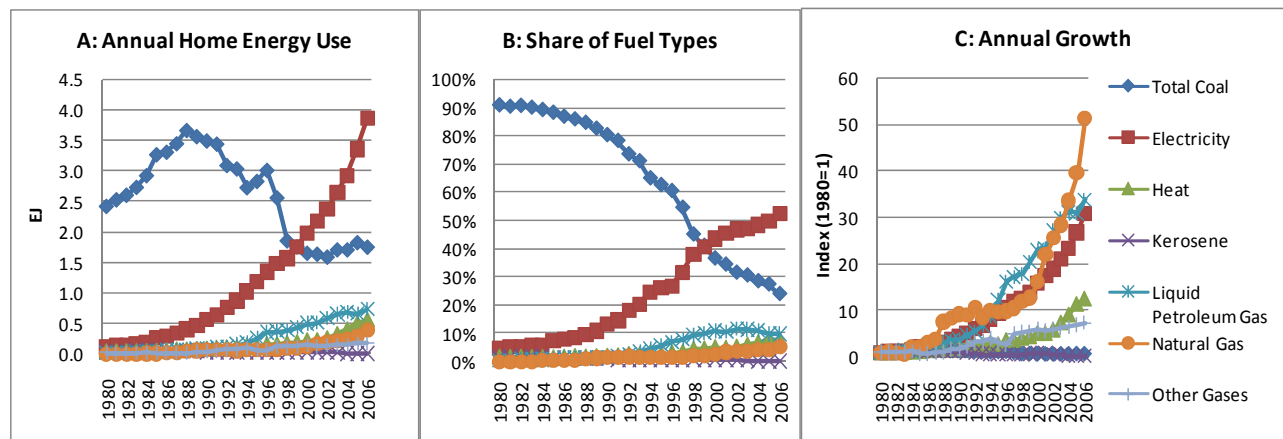


Figure 5 Household energy consumption by fuel types, 1980-2006

LBNL (2008)

Natural gas (the orange line in Figure 5) held the fastest annual growth rate, 16.4 percent, over 1980 to 2006. Its share of the total household energy use has been stepping from 0.3 percent of the total in 1980 to 5.5 percent in 2006. Both liquid petroleum gas (LPG, the light blue line) and heat (the green line) are another two fuels with faster annual growth rates, 14.5 percent and 10.2 percent, respectively. In 2006, LPG and heat ranked third and fourth popular fuel types at home, after electricity and coal.

Notice that the household energy consumption patterns are varied by urban and rural areas, by geographic and climate conditions, as well as income groups. The analysis on this issue is beyond the scope of this paper.

2.3 Transportation

In 1990, vehicle ownership in China included 0.24 million passenger vehicles, 0.57 million private trucks and 0.21 million private motor vessels. The number of passenger vehicles rocketed to 23.17 million in 2007 (the blue line in Figure 5), with an annual growth rate of 31 percent. Private trucks soared to 5.39 million in 2007, with an annual growth rate of 14 percent (the red line in Figure 6). The number of private motor vessels has dropped over years, from 206 thousand in 1990 to 62 thousand in 2007.

Notice that the vehicle ownership figures above include both passenger and private business vehicles. The current Chinese statistics

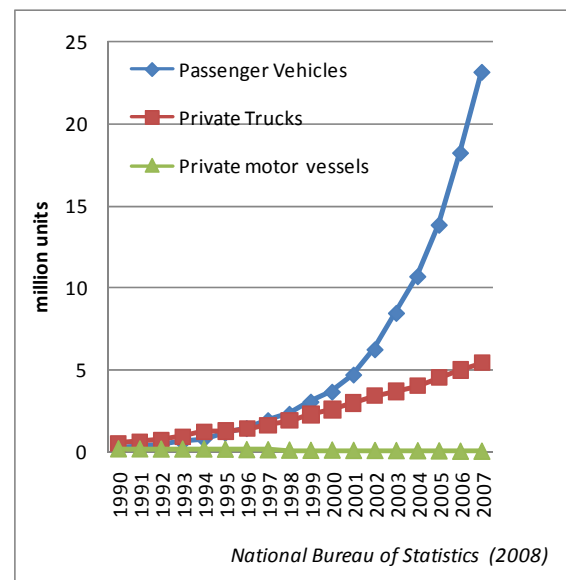


Figure 6 Ownership of private vehicles, 1990 - 2007

do not provide details on how the vehicles are used.

2.4 Communications

China is not only the most populous country on earth, but also the country with the most internet and mobile phone users.

By the end of 2008, when global internet users first reached to 1 billion, China contributed the most users with 180 million, followed by the U.S. with 163 million (comScore 2009) (Figure 7).

A new report, released by China Internet Network Information Center, indicates a much higher number: Chinese internet users reached to 338 million by June 30, 2009. The number of broadband users rose to 320 million, about 94.3 percent of total internet users (China Internet Network Information Center 2009).

By the end of July 2009, China reached 703 million mobile users, which is double the population of the U.S., the second largest user. China added 61.4 million new handset users in the first seven months of 2009 (China.org.cn 2009).

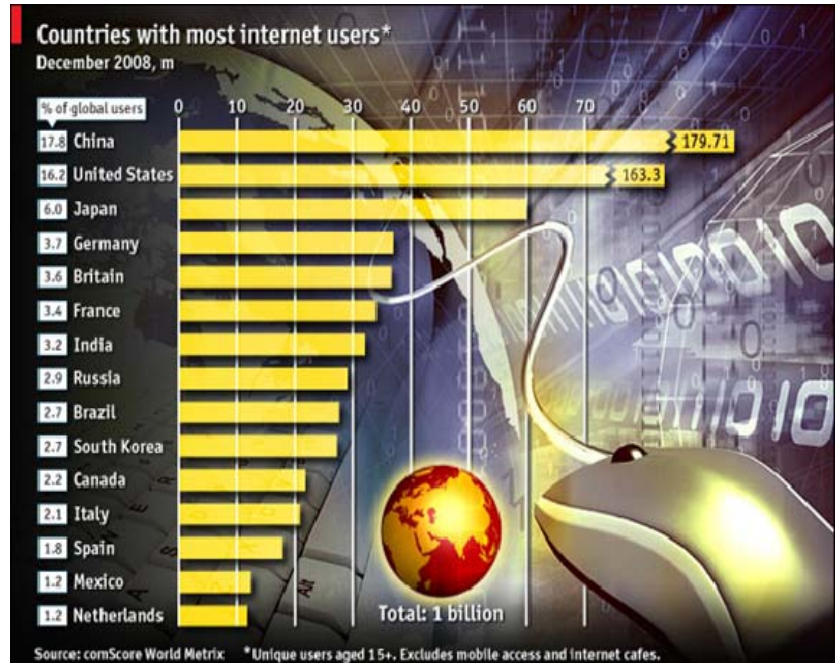


Figure 7 Countries with most internet users in 2008 (from comScore)

3. What is happening in China

3.1 *Governmental Policies and Programs*

3.1.1 China Energy Conservation Law (1997, 2007)

China issued its first Energy Conservation Law in 1997, which was intended to build strong legislative support for energy conservation across the country. The release of Energy Conservation Law proved to be a watershed in the development of China's energy policies.

The 1997 Energy Conservation Law addresses the education of the public on "the importance of energy conservation," in order to "enhance their awareness of the need," (Article 6). Furthermore, the Law declares that "All organizations and individuals shall fulfill their obligation to conserve energy and have the right to report against any waste of energy" (Article 7).

China amended the 1997 Law in 2007, and enacted it in 2008. The amended version aims to "promote energy conservation in the whole society," (Article 1). The Law states that "The State carries out publicity and education of energy conservation, incorporates energy conservation knowledge into national education and training systems, popularizes scientific knowledge about energy conservation, enhances the awareness of the whole population in energy conservation, and advocates energy-saving consumption patterns," (Article 8).

3.1.2 Building Energy Codes and Other Programs

China has issued a series of national and local building energy codes for energy efficiency, including three design standards for residential buildings in China's three climate zones (published in 1995, 2001, and 2003, respectively) and one design standard for public buildings (2005).

In its Medium and Long Term Energy Conservation Plan released in 2004, the Chinese government revealed its ambitious energy conservation targets for buildings: "During the Eleventh Five-year Plan period, new buildings should be strictly subject to the design standard of 50 percent energy conservation. Several major cities such as Beijing and Tianjin shall take a lead in implementing the 65 percent energy-saving standard."

Since 2004, the Ministry of Housing and Urban-Rural Development has issued a series of regulations, policies and programs to promote building energy efficiency, including: National Green Building Innovation Awards (2004, 2005, 2006, 2007), Notice on Enforcement of Building Energy Standards for New Residential Buildings, Notice on Conducting Building Energy Conservation Inspections (2005, 2006), Management of Energy Conservation in Civic Buildings (2005), Notice on Central Governmental Activities in the Energy Conservation Week (2006), Civic Building Energy Consumption Statistics Reporting (trial) (2007), Green Building Evaluation Labeling (2008), and Management and Technical Guidance for Energy-efficient Campuses in Universities and Colleges (2008) (Shui, Evans et al. 2009).

3.1.3 Residential Appliance Standards and Programs

The Chinese government set a goal to promote energy efficient appliances standards in the early 1990s. Since 1990, China has developed and updated more than two dozen mandatory energy efficiency equipment standards, including refrigerators/freezers, room air conditioners, clothes washers, televisions, and fluorescent lamp ballasts. Launched in 1999, China's energy labeling program (Figure 8) has covered more than forty products, such as energy labeling for refrigerators/freezers (issued in 1999 and 2003) and televisions (in 2002 and 2006) (Zhou 2007).

Take a refrigerator with 170 liters as an example, the minimum energy performance standards (MEPS) of a refrigerator in 2007, or 336 kWh/year, is 31 percent more efficient than its 1999 level. The energy consumption of a labeled refrigerator of the same volume in 1999, which is 367 kWh/year, is 25 percent more efficient than the MEPS unit at the same year. The energy consumption of a labeled refrigerator in 2007, 218 kWh/year, is 35 percent more efficient than the MEPS unit at the same year. The energy consumption of a labeled refrigerator in 2007, 218 kWh/year, is 35 percent more efficient than the MEPS unit of the same year, and 41 percent than its labeled unit in 1999 (Figure 9) (Fridley, Aden et al. 2007).



Figure 8 China energy labeling

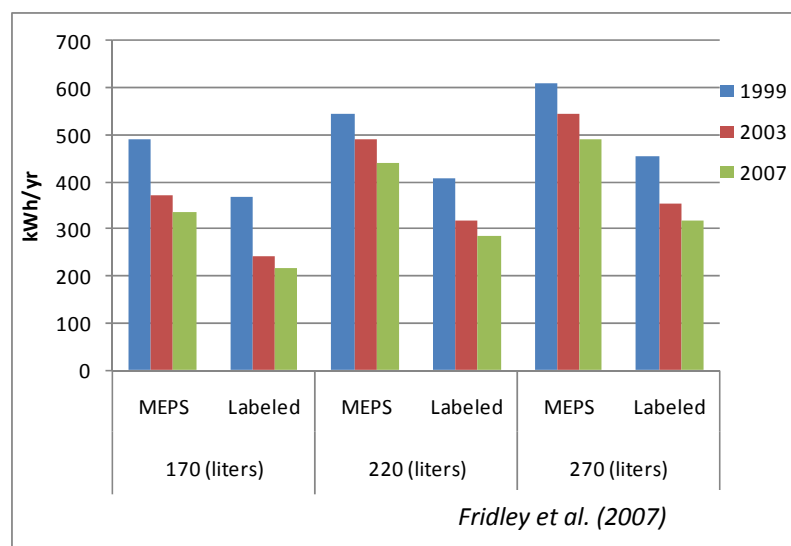


Figure 9 Energy efficiency of model refrigerator

3.1.4 Social Marketing

With the purpose of fostering a social atmosphere to build a resources-conserving and environmentally-friendly society, China has been conducting intensive social marketing to raise public awareness on energy conservation and climate change. For example, China has held eighteen National Energy Conservation Weeks since 1992 (Figure 10).



Figure 10 Posters in energy conservation week

In addition, the Government issued the Public Action Plan on Energy Conservation and Emission Reduction, and commended relevant national and local activities with communities, enterprises, schools, governmental agencies, and the mass media. The Chinese Government requires governmental agencies to take leadership to reduce their own energy consumption in buildings and transportation. The Chinese Government also encourages citizens to change their lifestyles and consumption patterns for energy conservation and emission reduction.

3.2 Views of Chinese Researchers

3.2.1 Literature Review

Studies of China's household consumption have flourished in the past three years. Wei and his co-authors employed the Consumer Lifestyles Approach (Shui and Dowlatabadi 2005) to study the impact of lifestyle on China's energy use and CO₂ emission and concluded that "approximately 26 per cent of total energy consumption and 30 per cent of CO₂ emission every year are a consequence of residents' lifestyles, and the economic activities to support these demands" (Wei, Liu et al. 2007). B. Chen and his colleagues studied the ecological footprint (EF) for energy and resource use in China, and suggested that the EF per capita always exceeded the biocapacity, and that the EF intensity increased steadily over the study period from 1981 to 2001 (Chen, Chen et al. 2007).

Guan *et al.* studied the drivers of Chinese CO₂ emissions from 1980 to 2030 by using the IO-IPAT approach to develop a baseline and conduct scenario analyses; they stated that "Household

consumption, capital investment and growth in exports will largely drive the increase in CO₂ emissions.”(Guan, Hubacek et al. 2008) Feng and his co-authors employed the IPAT model to analyze how these main drivers contributed to the growth of CO₂ emissions in the past fifty years. The authors found that “household consumption across the five regions follows similar trajectories, driven by changes in income and the increasing availability of goods and services, although significant differences still exist between and within regions due to differential policies in China and different possibilities for social mobility”(Feng, Hubacek *et al.* 2009).

S. Chen *et al.* conducted a comparative analysis on annual energy consumption in new and old residential buildings in Shanghai, which revealed that “compared with other developed countries, the ratio of space heating and cooling to total residential energy use is much smaller in Shanghai, and the indoor thermal environment is very poor as well. This is because many Chinese families would like to save the energy expenditure at the cost of sacrificing the indoor thermal environment.”(Chen, Yoshino et al. 2009). A study conducted by S. Chen and her colleagues on biomass energy utilization in Hunan province suggested that a variety of consumption patterns and fuel structures exist in China’s rural areas too (Chen, Li et al. 2009).

Other interesting studies include but are not limited to the following: studies on appliances such as clothes washers (Lin and Iyer 2007) and household refrigerators (Lu 2006) and research on residents’ behavior (Ouyang and Hokao 2009). Du and his co-authors suggested that rapid income growth has had a larger impact on the diet quality of the Chinese poor than on other income groups (Du, Mroz *et al.* 2004).

3.2.2 Discussions with Chinese Researchers

The author had several discussions with China’s senior energy researchers and became aware of several standpoints. First, they all agreed that China’s household consumption will keep on growing, considering the relative lower consumption level than high-income and middle-income countries. Secondly, they firmly believe that China cannot afford the American energy-intensive lifestyle, which is not feasible in China given resource constraints. Thirdly, they would like to seek a different consumption pattern which is more suitable for China and that will moderate the growth rate of China’s household consumption. Some of them admitted that a very few studies exist on the subject currently carried out by Chinese researchers.

Chinese researchers also showed openness to learning about and applying some of the research methodologies, policies and programs currently conducted in western countries.

4. Conclusions

China is witnessing its unavoidable increase in household consumption. It is foreseeable that energy use and the related carbon emissions will continue to grow in the near future. Chinese policy decision makers and researchers are well aware of these challenges, and are keen to promote green lifestyles in the context of pursuing low-carbon economic development.

Seemingly taking seat in the front row in promoting sustainable lifestyles, China has developed a series of effective policies and programs, and launched a wide-range of social marketing activities to concrete its efforts on energy conservation and carbon mitigation.

A future comparison study on China and U.S.’s household consumption would encourage more debates on the issue of green lifestyles, personal choices and responsibilities not only within these two countries, but also spur relevant discussions between other developed and developing countries.

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