Published paper
Hubacek, K., Guan, D. and Barua, A. (2007) *Changing lifestyles and consumption patterns in developing countries: A scenario analysis for China and India,* Futures, Volume 39 (9), 1084-1096.

Changing lifestyles and consumption patterns in developing countries:
A scenario analysis for China and India

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Abstract

China and India are the world's largest developing economies and also two of the most populous countries. China, which now has more than 1.3 billion people, is expected to grow to more than 1.4 billion by 2050, and India with a population of 1 billion will overtake China to be the most populous countries with about a 1.6 billion population. These population giants are home to 37 percent of the world's population today. In addition, China and India have achieved notable success in their economic development characterized by a high rate of GDP growth in the last two decades. Together the two countries account already for almost a fifth of world GDP.

The most direct and significant result of economic growth in India and China is the amazing improvement in quality of life (or at least spending power) for an increasing share of the population. The population of both the countries have experienced a transition from 'poverty' to 'adequate food and clothing'; today growing parts of the population are getting closer to 'well to do lifestyles'. These segments of the society are not satisfied any more with enough food and clothes, but are also eager to obtain a quality life of high nutrient food, comfortable livings, health care and other quality services.

The theme of this paper is to analyze how the major drivers did contribute to the environmental consequences in the past, and take a forward look to the environmental impacts based on the changes of these driving forces in China and India. The paper identifies population, affluence and technology to be the major driving forces in environmental pollution for the two most populous countries in the world; then applies a simple equation of *Impact= Population x Affluence x Technology*, or *I=PAT* to evaluate the effects of changes in these drivers on CO_2 emissions.

Keywords:
China, India, CO2, Sustainable Consumption, I=PAT, Population Growth, Technical Change, Scenario Analysis.

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1 Catching up with the 'North'

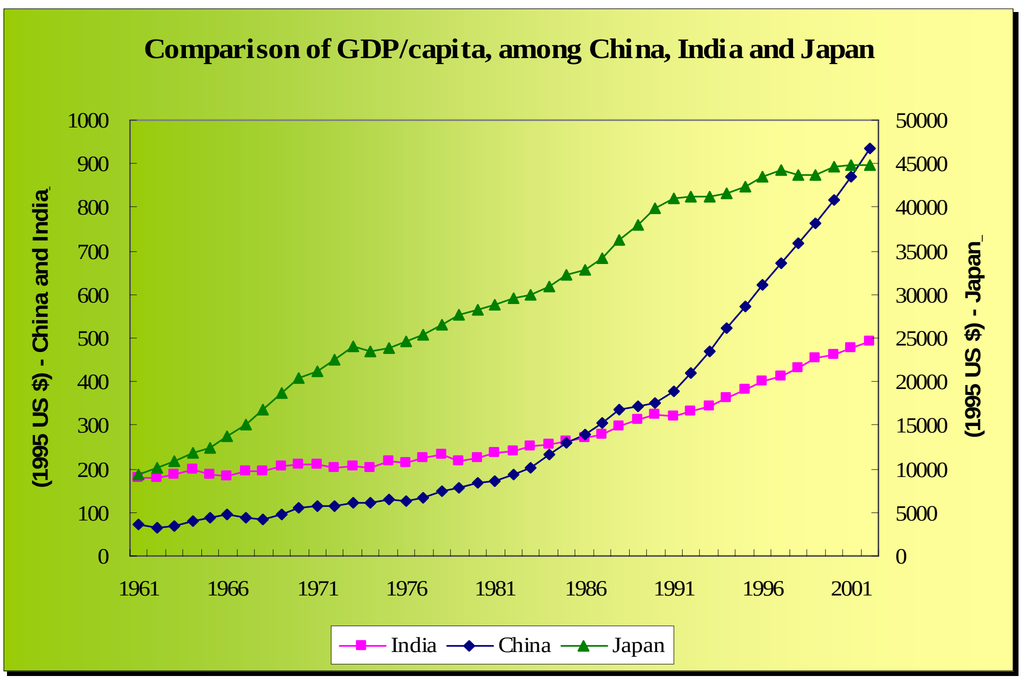
Ever increasing consumption is putting a strain on the environment, polluting the Earth and destroying ecosystems [1]. Large-scale economic development in the North occurring in the first half of last century has left deep marks on natural resources availability and quality. These are dangerous side-effect of the development model the North follows and the South emulates. Changing lifestyles and consumption patterns has been a common feature of most developing Asian nations, in recent decades. Increasing income provides their citizens with more options in how they use it; and people's choices will largely determine what impact their economic growth will have on the environment. As nations develop and their economies grow, so too does the consumption of resources. Developing Asian nations have shown a steady growth in both population and in economic activity. In addition, over-consumption may not only be the result of too many humans competing over a limited resource base but also economic elites using that resource base excessively and abusively to the detriment of other sectors of society, poorer nations, future generations and other species [1].

While attempting to raise awareness regarding the changing lifestyles in almost all of the developing countries in East and Southeast Asia and its potential environmental implications, the paper will focus on the two largest nations in this group, China and India and compare them to Japan, a highly industrialised nation used here as a benchmark. Japan has been chosen for this comparison due to its cultural and geographic proximity and at the same time being representative of consumption patterns within OECD countries. Japan will serve as an example of how consumption patterns in India and China might change in the not so near future.

India and China have teeming populations topping the one-billion mark; both experienced the transition from a closed economy to a more market–oriented engagement with the outside world in trade and investment; and both to date are in the processes of industrialization and modernization accompanied by significant rates of economic growth. In comparison, Japan as a highly developed nation in South-east Asia will be used to show where China and India are situated in terms of economic growth, people's consumption patterns and environmental pollution, in this example, CO_2 emissions. We have specifically limited ourselves to the time period until 2050 because of our focus on the important greenhouse gas $C0_2$. There is widespread agreement amongst climate researchers that the next couple of decades will be crucial in terms of human induced climate change and thus deduce a certain urgency of immediate policy action.

Figure 1 shows the three countries in terms of their economic conditions, represented by Gross Domestic Product (GDP) per capita, over a time period of more than 40 years. In the 1960s, Japan's GDP per capita was a factor 50 higher than India's and about a factor 100 in relation to China's. Since then, both China and India's GDP per capita is still far behind Japan's but the relative position of China and India has changed in the middle of the 1980s due to the success of the implementation of the 'Open Door' policy in China. India's economy only started to show high growth rates after its economic reform in 1991.

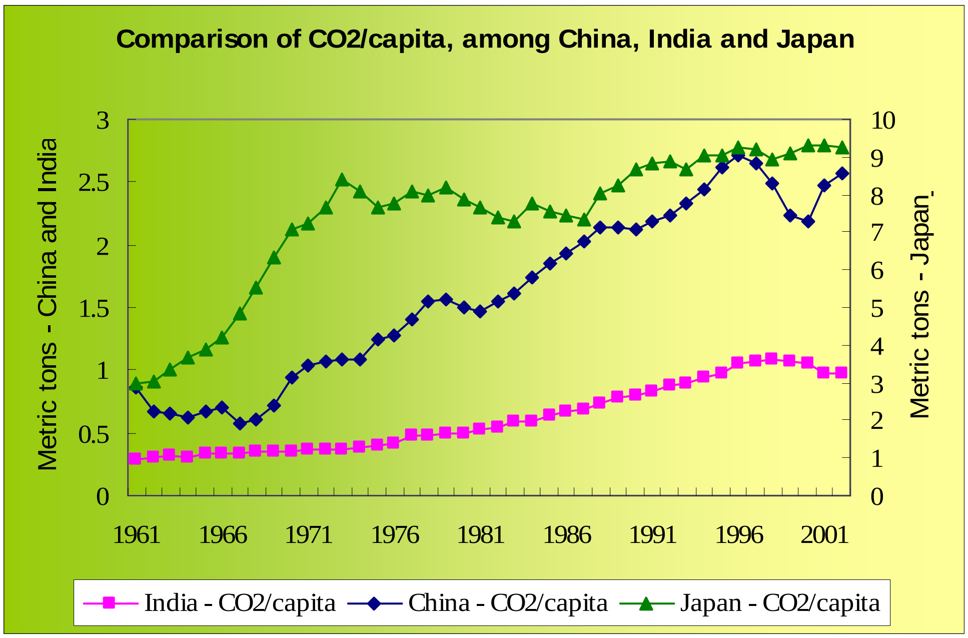
Figure 1.



Note: China and India's GDP per capita is on the left and Japan's on the right scale

By looking at the environmental impacts, in our case exemplified by CO_2 emissions, caused by economic development, large-scale industrialization and urbanization have made China the second largest CO_2 emitter in the world, and India ranked fifth. However the per capita values in both countries are still far behind Japanese per capita level. Figure 2 describes the CO_2 emissions of the three countries over the past 40 years. The level of CO_2 per capita in both developing countries has been increasing over years while the figure in Japan has been almost stable since the 1970s. In 2002, the per capita value in China has almost reached the Japanese level of the 1960s, 1/3 of the current Japanese level. India has much lower values in terms of per capita emission, only about 1/8 of the Japanese value.

Figure 2.



Note: China and India's CO_2 per capita is on the left and Japan's on the right scale

Looking at economic development and CO_2 emissions in Figures 1 and 2, the main question is: how can the population of poorer countries improve the quality of life without adopting the unsustainable consumption and production practices predominant in the 'North' which is often setting the global benchmark for lifestyle aspirations?

In this paper we are interested to take at first a back-mirror look and decompose these trends in CO_2 emissions and look at the contributing factors. We will apply a simple equation of *Impact= Population* × *Affluence* × *Technology*, or *I=PAT*, in order to estimate the effects of population, affluence, and technology on CO_2 emissions in China and India, accompanying with the economic growth over the past 40 to 50 years. The *I=PAT* equation was often used to estimate the effects of human population, level of affluence and choice of technology on environmental impacts or to project future environmental change based on changes in these main driving forces. The study will compare the development of population growth, affluence and CO_2 emissions in India, China and Japan over a period of more than four decades from 1960 to 2004. We will identify growth rates for per capita income levels (affluence) for these 3 countries and then look more specifically at three consumption items in China to exemplify lifestyle changes in developing countries.

2 Co-evolution of production possibilities and consumption patterns

Economic development

The latter half of the 20th century was a period of the 'economic miracle' for Asian countries. Asian countries including Japan, South Korea and Singapore achieved a high annual growth rate of GDP per capita at an average of 8% during the 1960s – 1970s. They achieved industrialization, motorization and wealth in a short time period of about 20 - 30 years while China and India were almost closed economies with central planning[1] and less engaged with the outside world in terms of trade and foreign investment. China initiated its economic reforms in 1978, accomplishing a flying economic growth at an average annual rate of 9.7 %. A decade later, India has followed a similar economic growth path with a consensual democratic market model; GDP has expanded at 5.8 % a year since the economy was opened up in 1991 [e.g. 2]. China and India have been recognised as one of the two largest and booming developing economies in the world, and China ranks as the second largest economy in term of GDP in PPP (purchasing power parity) dollars after the U.S. and fourth in real values; and India is the fourth world-largest economy by PPP [3]. To date, together the two nations are home to more than one third of the world population and contribute 19.2% of world GDP - China 11.5% and India 7.7%. On the other hand, China and India are contributing 18.1% of world carbon emissions; 13.7% and 4.4% respectively.

Lifestyle Changes

The economic successes in these developing Asian countries have resulted in considerable improvements of people's quality of life. Large sections of the population

[1] Before 1978, China was a centrally-planed economy. The government allocated materials and production activities. In India, agricultural activities were with private farmers but industrial investment was controlled through industrial licensing till 1991.

have been experiencing a transition from 'poverty' to 'adequate food and clothing'; today growing parts of the population are getting closer to 'well to do' lifestyles. These segments of society are not satisfied with only enough food and clothes, but are also eager to obtain a quality life of high nutrient food, comfortable living, health care, and other quality services. On the other hand, in both nations, despite significant efforts, a large number of people are surviving with only the daily essentials. Uneven development between regions and poverty in rural areas are the main characteristics in the two countries even after the economic reforms were implemented. Although the governments have made great progress in poverty reduction, there were still approximately 100 million (8% of the total population) in China [4] and 260 million (26% of the total population) in India [5] under the poverty line of one dollar per day at the end of last century. About 90% of this poorer population groups are living in rural areas.

Structural Economic Transformation

Meanwhile, we could also witness a gradual transformation of both countries' economic structure from a shifting dominance from agriculture to growing shares of industrial and service sectors, accompanied by an increasing availability of a wider range of products and a change of consumption patterns. By 2003, China's secondary and tertiary industries contributed approximately 85% of the national GDP. While in India agricultural sector share in GDP has been declining from over 50% in the early 1950s to 26% in recent years and the shares of transportation and banking and other service sectors have doubled. It is interesting to point out that secondary industries are dominant in China's economy while tertiary industries contribute almost half of GDP in India. That may one of the reasons why India produces less CO_2 emissions per capita than China.

Carbon Dioxide Emissions

CO_2 emissions by Asian developing countries grew substantially between 1980 and 2001, rising by 151% -- 4.5% per year -- from 2,398 MMT[2] to 6,027 MMT. The bulk of the region's carbon dioxide emissions comes from India and China. In 2001, these two countries accounted for two thirds of all of Developing Asia's carbon dioxide emissions.

[2] Million Metric Tons (MMT)

China and India are the second and the fifth largest contributors to world carbon emissions, respectively. Between 1980 and 2001, China's carbon dioxide emissions grew by 111%, or 3.6% per year, from 1,445 MMT to 3,050 MMT. During the same period, India's carbon dioxide emissions more than tripled (annual growth of 5.4%), increasing from 303 MMT to 922 MMT [6].

In recent years, China has aimed to improve the energy efficiency by diversifying its fuel types. For example, a national improved stove program has allowed 160 million urban households to abandon coal and replace it by natural gas for their daily usage [7]. Since 1996, China shut down more than 60,000 inefficient industrial boilers and thousands of small coal-burning electricity generators [8]. All these efforts have annually reduced its per capita emissions by 4.4% since 1996 while its annual per capita economic output has increased by over 9%[8]. A steady decrease of per capita carbon emissions can also be observed in India since 1998, as shown in Figure 2.

In comparison, Japan's per capita income and CO_2 emissions are much higher than India's and China's figures. Having already achieved a high level of energy efficiency Japan has been slow to take further effective measures to cut emissions of CO_2 and other greenhouse gases. Under the Kyoto Protocol, which set emissions reduction targets, Japan is required to cut its annual average greenhouse gas emissions by 6% from its 1990 level between 2008 and 2012. In fact, Japan's emissions in 2002 increased by 7.6% from the 1990 level; so Japan will have to cut 13.6% altogether. The nation now finds itself hard-pressed to achieve the target.

3 Growing economy, population and technical change

We employ the *I=PAT* framework to examine the contribution to CO_2 emissions of population growth, affluence (representing different lifestyles and consumption patterns) and changes in technologies of China and India and compare these with the development in Japan.

The *I=PAT* equation was first proposed in the early 1970s [e.g. 9, 10, 11], and resulted from the efforts of population biologists, ecologists, and environmental scientists who tried to assess the relationship between population growth *(P)*, economic growth or affluence *(A)*, technical change *(T)* and environmental impacts *(I)*. The original argument of Ehrlich and Holdren [10, 11] was that population growth was the major threat to human welfare. They claimed that “whatever other factors were involved, population growth caused a disproportionate negative impact on the environment” [10]. Commoner [12] pointed out the economic growth and per capita consumption played an important contributing role to pollution. This discussion has been part of an ongoing debate concerned with the question of whether or not the increase in population and affluence can be balanced by increasing efficiencies provided by technological systems. For example, Olson [13] used the *IPAT* equation to discuss three scenarios of sustainable futures for an industrialized nation: continued growth with pollution control, technology improvements and transformation of the society. These original contributions have sparked a wider discussion on the importance of the various contributing factors but also on methodological issues leading to reformulations of the original equations [see e.g. 14]. In the following, we analyze the influences of the three factors (population, affluence and technologies) on CO_2 emissions, and how the major contributor shifts between the factors in the three Asian countries over a time period of 40 years.

Table 1: IPAT for China, India and Japan from 1960 - 2000

		Population	Affluence	Technology
1960s				
	China	1.27	**1.53**	0.71
	India	**1.22**	1.18	1.04
	Japan	1.10	**2.19**	1.08
1970s				
	China	1.20	**1.53**	1.05
	India	**1.25**	1.08	1.33
	Japan	1.12	**1.38**	0.80
1980s				
	China	1.15	**2.11**	0.67
	India	1.23	**1.43**	1.11
	Japan	1.06	1.41	0.78
1990s				
	China	1.12	**2.33**	0.44
	India	1.19	**1.43**	0.93
	Japan	1.03	1.12	0.96

Note-1: $CO2 = POP \times \frac{GDP}{POP} \times \frac{CO2}{GDP}$, where CO_2 is the impact *(I)*, *POP* is population *(P)*, *GDP/POP* represents affluence (*A*; consumption of goods and services per capita), and CO_2/GDP represents Technology (*T*; i.e. emissions per unit of output). Values in cells are calculated by dividing the endpoint of each decade by its initial value for the respective decade (e.g. I_{1990}/I_{1980}).
Note-2: the largest contributing factors, i.e. decadal growth rates, are shown in bold letters.

Over the observed time period of 4 decades, the calculation shows that for China, India and Japan the affluence factor showed the highest growth rates with the exception of India in the 1960s and 1970s where population growth dominated the overall contribution to CO_2. In India population grew by 22% in the 1960s, 25% and 23% in the 1970s and 1980s and is still at about 20% in the 1990s. In comparison, affluence levels increased from an 18% decadal growth rate in the 1960s to a 43% increase in the 1980s and 1990s. More dramatic differences but similar trends can be observed in China. While we could observe a 27% population growth rate during China's second baby boom in the 1960s and 1970s, its subsequent one-child policy reduced population growth rates to around 12% in the 1990s despite a large part of population, the 'baby boomers', reaching the fertile age. In comparison, affluence levels increased by more than 50% in the 1960s and 1970s and after the open-door policy in 1978 tripled in the 1980s and the 1990s.

On the other hand Japan had the largest growth in per capita affluence levels in the 1960s with a 119% growth in GDP per capita, which subsequently dropped to around 40%

increase during the 1970s and 1980s and further dropped to a 12% increase in the 1990s. In comparison population growth dropped from a 10% increase to a 3% increase per decade.

In terms of technical change, which is an aggregate of factors such as energy mix, structural change and efficiency, measured as CO_2 emissions per unit of GDP, we could see large efficiency gains in Japan in the 1970s and 1980s and in China in the 1980s and the 1990s with a decrease of CO_2/GDP of 33% and 56%, respectively.

4. A thought experiment using *I=PAT*

China and India are among the fastest growing economies in the world contributing significantly to global resource depletion, pollution and global warming. Previous studies have intensively discussed whether technology improvements are the solution to preventing environmental degradation while developing the economy [e.g. 15, 16, 17]. Therefore in this analysis, we try to examine which efficiency gains would be necessary to compensate for China's and India's rapid population and economic growth rates and their continuation over the next few decades. This 'experiment' is implemented in two steps: Firstly, we calculate the level of improvement in technology China or India would need in order to maintain the current level of CO_2 emissions in absolute numbers given the predicted growth rates in population numbers and income. The second part of the experiment provides a discussion of whether the level of technology is realistic to be achieved by the two developing countries in comparison to a Japanese technology trajectory.

In this section, we employ the basic *I=PAT* equation to calculate the levels of technology China and India would need in 2050 (e.g. $T_{China\text{-}2050}$) in order to maintain the same amount of CO_2 emission in 2000 ($CO_{2\ China\ -2000}$)[3] given growing population ($P_{China-2050}$) and a growing economy ($A_{China-2000}$).[4]

We need to obtain the data for the elements of $I_{China-2000}$, $P_{China-2050}$, and $A_{China-2050}$ to acquire the results of $T_{China-2050}$. CO_2 emissions for India and China are kept constant. For countries who signed Kyoto Protocols, for example Japan, the CO_2 reduction target is 6% of 1990 levels. China and India are Annex 1 countries which means have no emission reduction targets in the first phase of the Kyoto Protocol. According to the predication of the United Nations' "World Population Prospects", China will be populated by 1.392 billion in 2050, and India will overtake China to become the most populated country in the world and its population will reach 1.593 billion by then. Goldman Sachs annual report 2003 of "'Dreaming with BRICs: The Path 2050" predicted the major shift in the global economics [18]; and Appendix-1 summarizes a scenario for the annual growth rate of GDP and GDP per capita in China and India by 2050. Therefore, we compute the affluence levels (GDP per capita) for China and India in 2050 with 33,251.3 and 17,803.8 US dollar in 1995's value. After using this values in basic $I=PAT$ equation, we see that Chinese technology has to be improved by 97.9% to reduce its CO_2 emission to 0.06 metric tons per 1,000 US$ of GDP. India will also need 98.2% of their efficiency gains to reduce its CO_2 emission to 0.04 metric tons per 1,000 US$ of GDP.

The above results of achieving 98% of efficiency gains for both countries indicate that China and India will require large-scale technology improvement in the next 50 years in order to be on track with current CO_2 agreements. However, it is doubtful if this can be achieved. For example historical data show that China had achieved 78% of efficiency gains over the last 40 years by reducing per capita CO_2 emission from 12.84 metric tons per 1,000 US$ output in 1960 to 2.84 metric tons per 1,000 US$ output in 2000. Furthermore by looking at the CO2 emission coefficients changes in Japan, the trend has been almost stable at 0.2 metric tons per 1,000 US$ since 1980s, and it may not have

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[3] Hitherto, China and India have not committed themselves so any international agreements to CO_2 reduction thus we assume that in the long-run China would want to commit to future rounds of international agreements. In the absence of these we assume a CO_2 level of 2000.

[4] $CO_{2\ China-2000} = P_{China\ -2050} \times A_{China\ -2050} \times T_{China-2050}$ *which is then reformulated to* $T_{China-2050} = CO_{2\ China-2000} / (P_{China-2050} \times A_{China-2050})$

significant changes by 2050. Therefore even if China and India both imported Japanese technology by 2050, their required technology coefficients will differ by a factor of 3 and 5 than the Japanese technology (e.g. 0.2 metric tons/1,000US$). To achieve this would need unprecedented amount of technology transfer and leapfrogging.

Furthermore there are huge regional inequalities within countries such as China or India. For example, “China can be perceived as a group of co-evolving, disparate economies rather than a homogenous entity. On one hand, China has fast-developing urban growth centres in the coastal areas and, on the other hand, backward rural areas that are each associated with distinct income, lifestyle and expenditure patterns” (Hubacek and Sun, 2001, p. 369). Population growth rates and per capita income rates greatly differ in rural China as compared to urban populations and differences also exist between the poorer western parts and within regional areas. Similar gaps can be observed in India and is probably true for most of the developing countries. But in order to understand which lifestyle changes are associated with these increases in income we will have to look at specific goods and services.

5. A case study for changes in energy consumption in China

The significant economic and lifestyle changes that have been taking place in China, have led Chinese to require more and better quality of energy. People directly consume energy for lighting, cooking and other daily uses. But they also aspire to a ‘higher-quality life’ by purchasing fashionable goods and services, such as houses with air conditioning and other modern electrical household appliances As well as the weekly visit to the gym. All these products and services consume energy during their production processes and usage.

Domestic energy production cannot meet anymore the rapid increases of consumption requirements on both domestic and industrial usages; hence China has become a net energy importer in 1993. China has been speeding up exploration and development of energy sources (at home as well as abroad, e.g. in Sudan and Nigeria) to support their fast growing economy.

In the following, we will show changing consumption of three important product categories which are indicative of some of the ongoing trends in lifestyle changes in China and India, as examples for fast growing developing countries.

Housing

The outstanding increase of expenditure on housing shows people's willingness to improve their immediate living conditions. Many rural households rebuilt and extended their bungalows by using building materials of concrete bricks and tiles instead of marl and woods. At the same time, average per capita living space expanded from 8.1 m^2 to 24.2 m^2. [19].

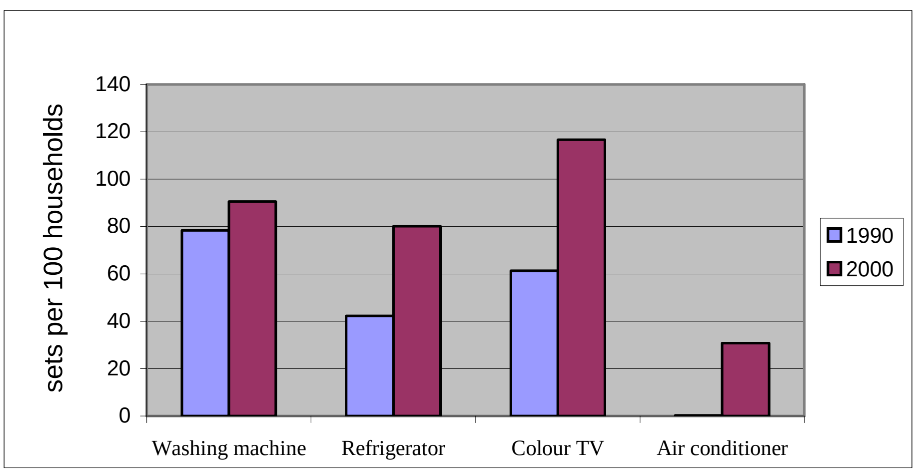
In urban China, the problem of housing shortage was much more serious than in rural areas. The per capita net living space for urban residents was only 3.6 m^2 prior to 1978, mainly because of restrictions on private house ownership. In the early 1980s the Housing Reform Policy had been introduced to solve the problems of urban housing shortages and poor housing conditions. This policy encouraged commercialization of the housing sector and private ownership allowing people to buy their own apartments. Meanwhile, the government, state owned enterprises, domestic private companies and oversea developers invested significant funds into the urban housing development. [20] estimated that the total housing investment between 1979 and 1990 was 6.74% of total GDP. As a result, city dwellers started to move from previously tiny bungalows or apartments to new multi-stories apartment blocks; thus effectively increasing per capita net living space. People's requirements on housing boosted the development of the construction sector. Directly associated with this was the amount of energy consumption in the construction sector which increased from 7.89 Mtce[5] in 1980 to 145.3 Mtce in 2001.

[5] Mtce: Million tons coal equivalent

Household Appliances

These more spacious living places allow consumers to buy and store more household appliances and other durable goods. For example, since the 1980s, urban residents spent increasing amounts on large durable furniture (e.g. wardrobes, beds and sofas). Also in the late 1980s and 1990s the connection of a larger number of households to the electrical grid helped increase the sales for household electrical appliances. For example, purchases of refrigerators and colour TVs in urban areas have doubled in 2000 as compared to 1990. Colour TVs have already covered over half of rural households, and other categories of electric appliances have been rapidly spreading throughout China (as shown in Figure 3). Another example is air conditioners, previously a sign of the wealthy, which increased significantly to about 30 sets per 100 households [19]. The popularisation of household electronics enormously boosted the household appliance production. The electronic industry has become the largest industry in China, which contributed about 8-10% of GDP, and 30% of exports.

Figure 3: Urban Household Electrical Appliances



Data source: *[19]*

Residential Energy Consumption

There are huge differences of types of residential energy consumption between rural and urban households in terms of quality and quantity. Until recently, non-commercial energy sources such as stalks and firewood still dominated rural residential energy consumption patterns and contributed approximate 85% of residential energy in 1980 [21]. The overuse of biomass energy contributed to land degradation of cultivated land and destroyed forest resources. Since the policy of biomass energy conservation and forestation was established in the mid of the 1990s, the absolute amount of biomass energy consumption has fallen from 250 Mtce in 1995 to around 200 Mtce in 2000. However, the total amount of residential energy is continuously growing, with major increases from commercial sources. The total amount of commercial energy consumption grew remarkably by 3.6 times, from 41 Mtce in 1980 to 149 Mtce in 2000 [22]. Therefore, it is interesting to point out that the commercial energy for rural residential uses will gradually replace biomass energy and become the major energy source in the future. At the same time also coal consumption shows a descending tendency after 1988 due to the introduction of fuel-saving stoves. By the end of 1997, the fuel-saving stoves had been installed in 180 million rural households, which accounts for 89% of total rural households [7].

Urban household energy consumption has also undergone significant changes. In terms of heating, most urban areas still keep the traditional way of heating by burning coal. The increase of per capita net living space is likely to result in more coal being consumed. However, the previous type of individual heating has been switched to large-scale central heating as people moved from bungalows to apartment blocks, which effectively enhanced energy efficiency. Furthermore, many richer cites (e.g. Beijing) have been installed the ‘consumer control system’ of heat supply to allow heat supply to best match demand. On the other hand, the government provides LPG (liquefied petroleum gas) or gas pipelines for people’s daily cooking instead of traditional cooking by burning coal, to reduce urban coal consumption and associated pollution. Per capita coal consumption for urban residential use rapidly declined from 348.5kg/year in 1985 to 88.2kg/year in 1999. As the outstanding growth of household electrical appliances for urban households, the per capita residential electricity consumption increased more than four times during 1985-1999. Electricity became the dominant fuel in all Chinese cities, accounting for 59% of the whole household energy consumption [19].

6 Conclusions and outlook

Since the economic reform both China and India have experienced significant economic growth accompanied by enormous environmental pollution and increasing income inequalities. At the same time the gap between the poorer and the richer countries has not significantly decreased.

In addition, national averages often obscure the similarities among different consumption classes across state borders. The United Nations Human Development Program [23] divided world economic activities into five income categories. The richest fifth accounts for 85% of global income, trade exchange, and savings. After that these indicators drop dramatically forming the so-called "champagne glass" figure. The remaining three fifths contribute considerably to global population but relatively little to the global economy. Acknowledging these differences between countries Alan Durning [24] categorized the world's population not by country but by consumption classes; he forms three broad socio-ecological classes based on consumption patterns and the degree of environmental impact [25]:

Table 2: World Consumption Classes

Consumption Type	High Consumers (1.3 billion)	Middle Income (3.9 billion)	Under-Consumers (1.3 billion)
Diet	meat, packaged food, soft drinks	grain, clean water	insufficient grain, unsafe water
Transport	private cars	Bicycles, buses	walking
Materials	Throwaways	durables	local biomass

Source: Modified from Alan Durning [24]

Our case study on energy use has shown that more and more people 'move up' the consumption ladder as a result of increasing income levels, increasing availability of infrastructures and availability of products and services even at remote rural locations. With expansion of the national electricity grid and improvement in living conditions and available space have naturally enabled acquisition of electronic appliances and other consumption goods. Similarly, improved transport infrastructure, i.e. roads and airports, together with increasing levels of available income will lead to more car and air miles. A trajectory of further increase in consumption and pollution levels can easily be foreseen as compensating gains in efficiency levels.

But a variety of consumption models for each of the consumption types exist. For example, in comparing income and consumption levels between Japan and the US one finds that despite relatively similar per capita income levels the average US consumes more resources as her fellow consumer in Japan. Examples of sustainable consumption and production patterns in other developed countries could therefore help the US to leapfrog to a higher level of well being with lower pollution and resource consumption. This might be even easier for developing countries. Wasteful infrastructures, institutions and habits have not been developed to such an extent than in the resource addictive 'North'. Similarly technological and institutional leapfrogging could help the 'under-consumers' to achieve higher level of consumptions but given the links or dependencies created through global trade, foreign direct investments and marketing in these emerging economies the possibilities for developing countries to successfully contribute to global efforts for sustainable production and consumption might be difficult.

From technological and energy efficiency points of view much in this direction is already going on in some of the more advantaged areas such as the coastal areas in China which is evidenced through the high amount of foreign direct investment and improved efficiency rates. With regards to the consumption side, this is much more difficult in developing or transition countries trying to emulate Western lifestyles. Even though influencing consumers is difficult but this is routinely done by companies and marketing agencies and thus why should 'green campaigns' not be able to achieve the same. On the other hand, one has to notice the huge differences in money and resources that is spent on marketing for consumption items and in comparison the miniscule amounts available for e.g. recycling campaigns, a problem shared by public agencies and NGOs in developed and developing countries alike.

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Acknowledgement

We would like to give out thanks to Shilpa Rao International Institute of Applied System Analysis (IIASA), Austria, and Masahito Takahashi, Central Research Institute of Electric Power Industry, Japan, for their helps with data collection.

Appendix-1: The growth rate of GDP and GDP per capita in China and India

	China GDP % growth	India GDP % growth	China GDP per capita % growth	India GDP per capita % growth
2000-2005	8.0	5.3	9.2	3.7
2005-2010	7.2	6.1	11.2	7.5
2010-2015	5.9	5.9	9.2	7.4
2015-2020	5.0	5.7	7.8	7.2
2020-2025	4.6	5.7	7.3	7.4
2025-2030	4.1	5.9	6.9	8.2
2030-2035	3.9	6.1	6.5	8.9
2035-2040	3.9	6.0	6.3	8.9
2040-2045	3.5	5.6	5.9	8.3
2045-2050	2.9	5.2	5.4	7.6

Source: Wilson and Purushothaman [18]