Impact of lifestyle pattern on energy consumption and carbon emissions – A view from India Mitali Das Gupta

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Abstract: There is a clear link between the patterns of lifestyles that individuals or households lead and its impact on energy consumption and emissions. Historically it has been the developed countries that have accounted for high levels of energy consumption. However, with a growth in population and urbanization, per capita emissions from the more affluent segment of the household sector in some developing countries are gradually converging towards those recorded in developed countries. The present study by looking at the city of Kolkata aims to underline this link. By conducting 200 surveys across various income groups in the city and looking at the transport and residential sectors only, it is found that a middle income household has a carbon footprint almost equal to the world average, where as a high income household has a carbon footprint nearly half of that of an average US citizen and nearly equal to an average UK citizen. The paper also discusses the policy issues and implementation barriers for these two sectors in India and compare with the policy initiatives in Japan. Finally it is suggested that unless government sets an example and makes sustainable lifestyles possible through its strategies and operating practices, the country will not be able to overcome consumer inertia.

Keywords: Lifestyle, Carbon footprint, Emissions

1. Introduction

Over the past few years, the issue of family lifestyle and its impact on sustainable energy consumption and emissions have become very important. According to the report for policymakers approved by the Intergovernmental Panel on Climate Change (IPCC) Working Group III, Changes in lifestyles and consumption patterns that emphasize resource conservation can contribute to developing a low-carbon economy that is both equitable and sustainable. The developed countries have been historically responsible for high levels of energy consumption and emissions, and account for the use of most of the ecological space. According to the World Wildlife Fund, an average U.S. citizen requires 10 hectares of the planet to support his or her lifestyle, while an average European needs over five hectares. When compared to the rest of the world, US households account for over six times more carbon dioxide emissions than the remainder of the world per year on an average.ⁱ But what is of concern is that with the growth in population, urbanization and globalization, per capita emissions from the more affluent segment of the household sector in some developing countries are gradually converging towards those recorded in developed countries. Lifestyles in the modern cities of the developing countries are becoming energy intensive and people are being conspicuous and over-consumptive. In China, a study by Wei et al (2007) suggests that approximately 26 per cent of total energy consumption and 30 per cent of CO2 emissions in the country every year are a consequence of residents' lifestyles, and the economic activities that support these demands. In an era of globalization, and with huge metropolitan areas accelerating across the developing world, the rich are going for more energy intensive consumption, shaped by the familiar western themes and values brought via the mass media. This is a matter of grave concern since such lifestyle changes in the developing countries will pose a serious problem as far as energy and climate sustainability is concerned.

Against this background, the objective of the present study aims to underline the importance of household lifestyle pattern on energy consumption and carbon emissions by looking at the urban centre of Kolkata, a key metropolitan city of India. The issue in general, is of utmost importance especially in a country like India, where the middle class households with high consumption aspirations are growing at a faster pace than the overall population.

According to a study by ICLEI South Asia, Kolkata is largest emitters of carbon di oxide among 41 key Indian cities, with total emissions of around 9.3 million tonnes (in absolute terms), and hence the issue of converging lifestyles is quite evident. The city of Kolkata has 4.4 million residents, and the metropolitan area has a population of approximately 15.7 million, making it the third most populous metropolitan area in India and the 13th most populous urban area in the world (UN, 2005). The city is also classified as the eighth largest urban agglomeration in the world.

2. Brief literature review

A few studies on the developed countries have been reported that have tried to analyse and quantify the impact of lifestyle factors on current and future energy demand. However, studies on developing countries like India, where converging lifestyles could pose a real problem are very limited. In a study by Pachauri (2007) titled 'An Energy Analysis of Household Consumption: Changing Patterns of Direct and Indirect Use in India', the author adopts a socio-economic approach to analyze the energy system and energy consumption in India from a household perspective. In addition, the work incorporates two crucial aspects that are characteristic of most developing countries, namely the importance of noncommercial sources of energy, mostly biofuels, and the very large diversity in the patterns of energy use in households with widely diverging lifestyles and well-being. On China, there has been few studies by Wei et al (2007) that quantifies the direct and indirect impact of lifestyle of urban and rural residents on China's energy use and the related CO2 emissions during the period 1999-2002. Bin and Dowlatabadi (Bin and Dowlatabadi, 2005) used the consumer lifestyle approach (CLA) to study the relationship between consumer activities and energy use and related CO2 emissions. Their results showed that 80% of energy consumption and CO2 emissions could be attributed to consumer behavior and related economic activities. The indirect effects of consumer behaviour caused by energy consumption and CO2 emissions were twice those of direct actions. Another recent study on China by Zhen-Hua Feng et al (Feng et al 2011) uses the Grey Model to compare the relationship between energy consumption, consumption expenditure and CO2 emissions for different lifestyles. The results show that direct energy consumption is diverse for urban households and simple for rural households in China. Direct energy consumption and CO2 emissions are increasing faster for urban than for rural households. Indirect energy consumption and CO2 emissions for urban households are much greater than the direct consumption values. The present study has limitations since it only captures the direct impact of household energy consumption, however, this is the first time a survey based quantitative analysis is being attempted for India, highlighting the issue of converging lifestyle.

3. Methodology

To illustrate how lifestyle changes can affect overall energy consumption and carbon footprint, we have done a simple exercise. We try to calculate the carbon footprint of various income classes in the city of Kolkata. Here we shall essentially focus on urban Kolkata. Carbon footprint measures the impact of our activities on the environment, and in particular climate change. It relates to the amount of greenhouse gases produced in our day-to-day lives through burning fossil fuels for electricity, heating, transportation etc. It takes into account all greenhouse gases we individually produce and is measured in tonnes (or kg) of carbon dioxide equivalent per year.

It further requires mentioning that the carbon footprint calculated is only an estimate. The actual footprint is likely to be much larger. In fact, there is a direct and indirect impact of it. Direct impact refers to home energy use and personal travel. Home energy use refers to direct living energy use including lighting, appliances, cooking, space heating and water heating. Indirect impact refers to the energy consumption and CO2 emission occurred in the preparation of a product or service before its use. However, in this study due to limited scope of the paper, we have concentrated only on the direct impact of energy use at homes.

The carbon footprints of households are being calculated by the carbon calculator provided by Clean India, an initiative of Development Alternatives, a leading NGO in India working to build a carbon free society. **Community Led Environment Action Network (CLEAN-India)** programme of Development Alternatives is a nation-wide programme that works with school children and communities to make them environmentally aware and active. The online calculator allows people to calculate carbon dioxide emissions directly from their day to day activities, for instance from their use of home energy, cars, bikes, buses, trains, air travel etc.

We do a stratified random sampling where households are classified under 4 income classes.

- a. A low income household with monthly income \leq Rs.8,000
- b. A lower middle income household with monthly income between Rs.8,000-20,000
- c. A middle income household with monthly income between Rs. 20,000-60,000
- d. A high income household with monthly income higher than Rs. 60,000

It should be mentioned at this point that no pre conceived definition of income classes have been adopted in this case. These income classes have been defined on the basis of observed sample values of incomes. Fifty surveys for each income categories have been conducted in urban Kolkata using the online carbon calculator.

4. Results

On the basis of the surveys conducted, the following results are obtained. The average carbon footprints are reported in table 1.

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Income categories	Tonnes of CO2 per year*
1. Low income (L)	1 - 1.3
2. Lower middle (LM)	2.2 - 2.5
2. Middle income (M)	4 - 5
3. High income (H)	8 - 9

Note: The calculator does not include cooking as an energy consuming activity for the urban

household

* Values are indicative- please do not quote

Superimposing the figures for Kolkata that we get from the household survey using the carbon calculator and calculating the per capita carbon footprint by adjusting it according to the household sizeⁱⁱ, along with the figures that we obtain for the other countries from WHO and UNDP, we get a comparative assessment of the carbon footprint of an individual in an Indian metropolitan city(classified on the basis of income) with the rest of the world. As can be seen from figure 1, the global average is 4 tonnes of CO2 per person, with wide variation among countries. Approximate national average for the United States of America is 20,

United Kingdom 9 and China 3. The per capita footprint in the city of Kolkata is 1.2 approximately, taking into account the defined income classes.



Fig 1. Comparison of per capita carbon footprint in Kolkata with rest of the world

Source: WHO (2008); UNDP

Looked at from a per capita basis, an individual in an Indian city has a carbon footprint which is just 30 per cent of the world average and 6 per cent of that of an average US citizen. On the other hand if the population is categorized on the basis of affluence, it is found that an individual in the high income category has a carbon footprint equal to almost 45 per cent of the world average and that in a middle income category has about 23 per cent of the global average. Again if looked at from the perspective of a household (see table 1), a middle income household in Kolkata has a carbon footprint almost equal to the world average, where as a high income household has a carbon footprint nearly half of that of an average US citizen and nearly equal to an average UK citizen. As development progresses, given that there is no significant deterioration of income distribution, we can assume that per capita income rises and households move up the income ladder. As households move from lower income strata to a higher one, total emission changes because the people moving to the higher income strata adopt more energy intensive lifestyle than before. In such cases total emission will increase owing to an increase in income growth and consequent lifestyle changes, even if we assume that population remains constant. If we factor in population growth, then it is obvious that the total emission will increase even more.

This clearly suggests that with a growth in population, urbanization, incomes and improving lifestyles, the per capita energy consumption and resultant emissions from the more affluent segment of the household sector in developing countries will gradually converge towards those recorded in developed countries, which is a matter of grave concern as far as energy security and climate sustainability is concerned.

5. Lessons from Japan

Japan is a country where energy consciousness is quite high and a number of measures have been taken to make household lifestyles more energy efficient and sustainable.

The two oil crises of the 1970s had a great impact on Japan's subsequent energy policies. Japan enacted the "Law concerning the Rational Use of Energy" (Energy Conservation Law) in 1979 and this provided a legal basis for energy conservation activities. The Top Runner Program was developed in this context in 1999, in addition to the existing Energy Conservation Law. It applies to machineries and equipments in the residential, commercial, and transportation sectors. The program sets the fuel efficiency standards higher than the performance of the best product commercially available in the product category. Manufacturers who do not meet the standards are given advise, publicly announced, given an order, or fined (one million yen or less). 21 categories of products have been covered by the Top Runner program since 2006 (Miki 2006). Target appliances included air conditioner, TV, refrigerator, stove, gas heating appliances, personal computer etc. As a result of this policy, significant improvements have been achieved in developing energy efficient electronic appliances. LCD and plasma TV sets and heavy vehicles have been added recently.

In April 2005, the Global Warming Prevention Headquarters, led by the Japanese government, launched a large-scale national campaign called "Team Minus 6 per cent" in collaboration with the private sector. This aimed at providing information and raising public awareness about the issue of climate change. The campaign focuses on sharing simple tips to help prevent climate change, as some surveys show that people are less likely to translate intent into action, without knowing where to start. The campaign aims to have individuals, businesses, and other organizations work together to achieve a 6 per cent reduction in GHG emissions. In particular, it calls on people to:

- set air conditioners at 28 degrees Celsius (temperature control)
- avoid wasting water at the tap by not letting it run unnecessarily (wise use of water)
- choose and buy energy-efficient and eco-friendly products (green purchasing)
- stop car idling (smart driving)
- say no to excessive packaging (waste reduction)
- unplug devices when they are not being used (wise use of electricity).

Apart from that, the old custom of sprinkling water with a ladle on streets and gardens, called "uchimizu" is a well-known example of the use of water in Japan's daily living. People sprinkle water especially in the summer time in their house entrances and gardens or in front of their shops, offices to lay the dust and ease the heat. Another interesting campaign called the light-down campaign started in 2003 (Mori 2008). In 2007, the campaign asked voluntary participation of business facilities and households to turn off the light at night over a three day period in the month of June. The number of facilities participated rose from 2,278 in 2003 to 63,138 in 2007. The estimated savings of energy amounted to 2.9 million KWh and the estimated reduction on GHG emissions totalled 1,136 tonnes of CO2.

There is also a nation-wide campaign in Japan to reduce indoor air conditioning by wearing clothes which make people feel much cooler in summer and much warmer in winter. The campaign called 'Cool Biz' (during summers) and 'Warm Biz' (during winters) help office workers adapt to set room temperatures. Engaged in this energy conservation program, many companies have reported large savings on their electricity bills. A similar initiative called 'Uchi Eco' has been launched, encouraging individuals to save energy at home by focusing on appropriate clothing, food and housing.

In the transport sector, fiscal incentives have been given to the purchase of low emission vehicles. However, further reductions in the transport sector require more comprehensive measures. The Government has started EST (Environmentally Sustainable Transport) model

projects in 27 localities throughout Japan, to pursue a number of measures like road pricing, advanced traffic management system, car-pooling, promotion of public transport etc. In many cities the no-idling campaign has been promoted for public buses, by developing an automatic idling stop-start system. The white paper also expresses a strong sense of urgency for implementing energy-saving technologies, including high-performance fuel-cell batteries to help commercialize electric cars.

This shows that the Japanese have undertaken a number of initiatives, though each one of them may have only a small and sometimes invisible impact in reducing GHGs. Nevertheless, in the long-run such measures raises awareness among people and communities, and create significant changes in the way people use energy and other natural resources.

6. Policy issues in India

In India, policies have generally focused on promoting increased motorization to stimulate economic development and to cater to the popularity of private transport among the relatively affluent section. Central and state governments offer a range of tax breaks, subsidies, and regulatory concessions that enhance the automobile industry's profitability. Indian roadway network lag in terms of quality and carrying capacity. Since India's new and improved roadways are mostly between cities, their main impact is on intercity and interstate travel and therefore have an important impact on urban travel. While there have been considerable improvements in rail services, bus services continue to deteriorate, thus forcing many passengers to choose faster motorized modes such as cars and motorcycles. Although walking and cycling account for about half of all trips in the urban areas, they do not receive adequate funding for betterment in quality, infrastructure provision, legal rights, or even traffic priority. Like the big cities in the Asian and Latin American countries, the Indian Government has too has recently introduced the BRT (bus rapid transit) system in some of the states to ease the traffic situation. But since the bulk of urban trips are conducted over short and medium distances, the number of motor vehicle owning commuters who would use such a circumscribed network is likely to be limited especially given the unmatched navigability of two-wheelers and three-wheelers in congested road conditions, ease of parking, the ability to carry passengers and luggage at low cost and most importantly the preference of personal mobility over dependence on public transport. Therefore, provision of mass transit has to go hand in hand with policies to price personal motor vehicles to discourage their use. While such policies would be unacceptable without providing adequate quality mass transit, mass transit will not be truly effective without measures to curb motor vehicle activity (Badami 2007). Hence in the present scenario, it is unlikely that the trend towards increased motorization and its impact on energy usage and emissions is going to reverse. With dramatic government policies, it can be only slowed down.

Within the residential sector, not too many policies are prevalent to cut down energy consumption (and sometimes wasteful energy consumption) in the residential sector. However, in May 2006, in order to reduce energy consumption of the household sector, the following action points on demand side management were agreed upon by the Bureau of Energy Efficiency (BEE):

- Bulk procurement and distribution of CFLs (compact florescent lamps)
- The standards and labelling programme to promoting the use of energy efficient equipments/appliances (products include frost free refrigerator, tubular fluorescent lamps, air conditioners, refrigerator, induction motors, pump sets, ceiling fans, eElectric geysers, colour TVs etc).

The scheme on CFLs seeks to replace an estimated 400 million incandescent bulbs with CFLs, which could save 6000 MW to 10,000 MW. It seeks to make available high quality CFLs at the cost of incandescent bulbs. The basic premise for action points is to create appropriate legal and regulatory environment for energy efficient end use products, and to provide the consumer with options to make an informed choice. The plan aims to reduce overall energy consumption by 3000 MW by the end of 2012. Again, objective of the standards and labelling programme is to provide the consumer an informed choice about the energy saving ,and thereby the cost saving potential of the marketed household and other equipments. However, these star rated products are much costlier than the normal products. Also one of the major stumbling blocks towards promoting the sense of energy efficiency is the lack of information and awareness among households and also the lack of monitoring and regulation. The problem is also acute for the very poor consumers. Nearly half of the residential consumers in most states have electricity usage of less than 50 kWh/month. The monthly electricity bill of these consumers is barely Rs 50 to Rs 85. These consumers are too poor to afford CFL at present prices. These would be over 50 million households. Additionally about 100 million un-electrified houses, which would be connected to the grid in the coming five years, would also fall in this category.

Possibly India should take lessons from Japan as to how the government can take modest and bold steps that lead to significant energy savings in the household sector by implementing methods, which are simple, but are important in raising public awareness and also doesn't impinge on one's comfort level.

7. Concluding remarks

This paper aims to underline the importance of household lifestyle pattern on energy consumption and carbon emissions by looking at the urban centre of Kolkata, a key metropolitan city of India. According to a study by ICLEI South Asia, Kolkata is one of the largest emitters of carbon di oxide among 41 key Indian cities and hence the issue of converging lifestyles is quite evident. The issue in general, is of utmost importance especially in a country like India, where the middle class households with high consumption aspirations are growing at a faster pace than the overall population. Hence adopting sustainable lifestyles must be viewed as a necessary and complementary means towards controlling the energy consumption of our economy. This is followed by a discussion on the policy initiatives that are there in place in Japan in the residential and transport sectors, which enables significant changes in the way people use energy at homes. Finally the paper presents the existing policies in India and reasons why they are largely ineffective in bringing about a sustainable lifestyle pattern.

It is not easy to make lifestyle changes since it is very difficult to change the mind-sets of people even if they do not have to compromise on their comfort level to a large extent. People who maintain a high lifestyle are reluctant to compromise on the same, while those who do not, aspire for it.

Unless government sets an example and makes sustainable lifestyles possible through its national strategies, planning and operating practices, the country will not be able to overcome consumer inertia. The first and the most important step is, probably, to make the individuals aware of the problem, so that they can recognize the responsibility for their own contribution and voluntarily adjust their personal consumption. This calls for design of action plans, and spread of ideas and initiatives. India should take lessons from Japan in policy design and implementation. Possible future policy directions include:

- More incentives should be put in place to encourage consumers to choose energy saving products and services. These could include tax cuts or point cards to reward them for the energy saved through changes in spending behavior.
- Consumers should be informed of the impact of their choices and actions, and the possible ways of reducing their carbon footprint, through the media and public campaigns like in Japan. There should be a special focus on educating children and the young as well as making information on energy use characteristics of appliances easily accessible through labelling schemes.
- Some kind of regulation by stipulating energy usage or standardizing a quota should be introduced by the government for consumers to make the right choices.

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