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# Energy Security Insights

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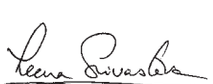
## Lifestyles, Energy Security, and Climate: a special issue

The issue of lifestyles is an extremely important one in the debate on climate change. It is the consumptive lifestyle of the rich nations that, while driving economic development, has led to increasingly higher levels of production, and hence energy use. Those who today enjoy a high quality of life are reluctant to compromise on the same, while those who do not, aspire for it. The challenge to humanity, therefore, is to meet peoples' aspirations without exacerbating damage to the environment and contributing to climate change.

It is also true that there exist in almost every country a population set that enjoys a high standard of living - what varies from country to country is the percentage that such people comprise of the total population and the disparities within. Developing countries like India, by virtue of their size, have a large affluent population by numbers but when looked at as a percentage of population they are not more than 10% to 15%. These factors affect the choice of instruments that governments may have to influence production and consumption levels. Since it is governments that are engaged in international negotiations, and not sectors or sections of the populations, it needs to be recognized that the challenge for governments lies in being able to represent the mass of their people, factoring in their levels of access to consumption goods and services.

The Fourth Assessment report of the IPCC emphasizes the need for a global reduction of greenhouse gases by nearly 50% to 85% of the 2000 levels by the year 2050, if humankind is not to interfere dangerously with the climate system. New and renewable energy sources and new technologies for production of energy and services are definitely important constituents of the solution to climate change. But, unless we learn to organize our lives in a less resource intensive manner - individually and collectively - it is highly unlikely that we will have the desired effect. While developed countries have to show the way by establishing the lifestyle trends, the developing countries cannot dawdle in catching up. Today, unfortunately, there still exists a wide gap in the best available technologies and practices in the world and those that are predominantly prevalent in the developing countries. Ensuring a market saturation of efficient appliances and providing efficient transportation services in the developing world could go a long way in curtailing the emissions from its large, increasingly prosperous population.

This issue draws on a special event on 'Lifestyles, Energy Security, and Climate', organized as part of TERI's Delhi Sustainable Development Summit.



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# Lifestyles, energy consumption, and climate change: a global view of the links*

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The link between consumer lifestyles and carbon emissions, energy use, and the climate change problem, lies at the heart of the debate on global warming and sustainability. It is also at the centre of global and national energy security concerns. Even so, when solutions are sought to these problems, lifestyle changes often seem to become the proverbial elephant in the room with attention focusing instead on technology, market interventions, and so on. It is quite clear that energy use in modern economies (and more importantly the *evolution* of energy demands and intensities) is determined by efficiency and technology improvements, market prices, and the choices made by consumers. Perhaps the most important driver of these is that of lifestyles (which is an index of consumer preferences), because it is this that partly determines the evolution of technology and the nature of energy use patterns. Figure 1 illustrates this interaction.

Unsustainable ways of living that require the consumption of high amounts of energy are strongly associated with urbanization and modern lifestyles in the developed nations of the world. But there are clear variations in energy use characteristics even within the developed world, and there are significant and increasing contributions to high energy use from the lifestyles of the urban rich in developing countries. One interesting way of visualizing these differences is suggested by a paper by Reuss, Lotze-Campen, and Gerlinger (2003). The authors use a set of four fundamental variables to cluster countries into different groups having similar characteristics. The variables in question are Income level (GDP [gross domestic product] in PPP dollars), industrial $CO_2$ emissions per capita, carbon intensity ($CO_2$ per unit primary energy used) and energy intensity (primary energy per unit GDP). A clustering analysis was then used to yield the map in Figure 2.

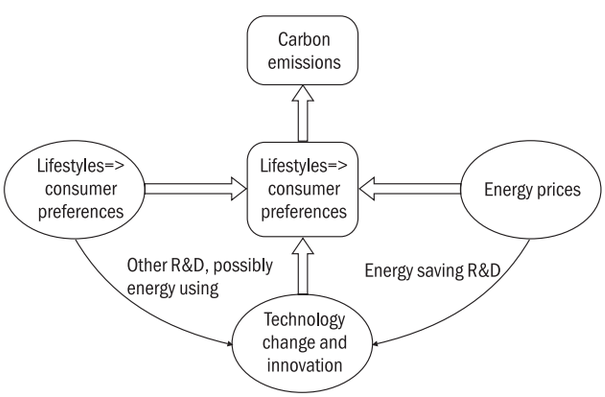


**Figure 1** Lifestyles and energy use. Note the influence of consumer lifestyles on R&D, which may actually serve to increase energy use. An example is the preference in the US for large, powerful cars.

The authors found that energy-economy patterns could be grouped into six clusters. While the variables used for clustering are macroscopic, each emergent group is roughly correlated with a distinct lifestyle pattern. It is for this reason that the map above is particularly interesting. The countries depicted in red such as the US and Australia, display high energy intensities, growing economies, very high per capita emissions, and improving efficiency on a relatively inefficient baseline. These are also examples of nations where lifestyles have been criticized as being exceptionally wasteful in terms of energy. The countries highlighted in blue (mainly in Western Europe and Japan) not only show significantly lower per capita emissions than the previous group, but also lower growth rates—both in energy use and economically. These nations happen to be those that have led the developed world in emission reduction efforts and in many ways have more efficient and sustainable lifestyles than those in the US for example. Finally, the

* This paper was circulated as an issues paper at the DSDS Special Event on 'Lifestyles, Energy Security, and Climate'.

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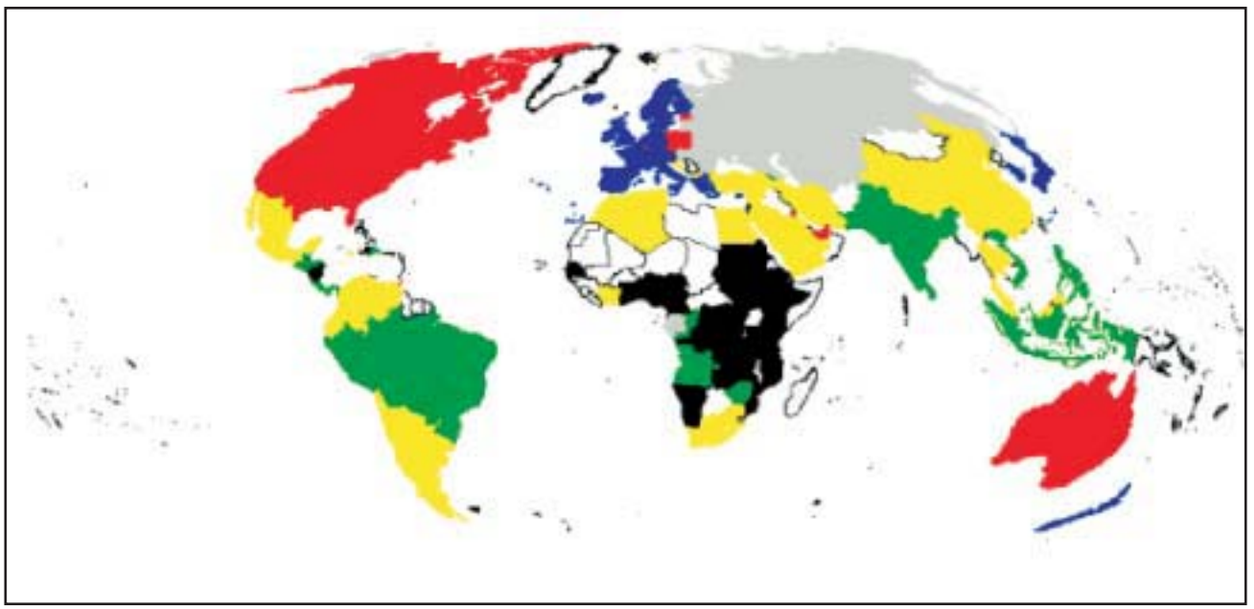

**Figure 2** Global lifestyle groups
**Source** Reusswig, Lotze-Campen, and Gerlinger (2003)

developing nations show a plurality of types. Much of Africa has seen a decarbonization of the economy due to extreme energy poverty and use of biomass. In other countries such as India and China (green and yellow clusters), emission growth and energy use has risen rapidly. At the same time energy poverty remains a serious issue and the overall per capita emissions remain low. Hidden behind this macroscopic picture is a sharp duality of lifestyles in these nations, with the urban rich living more and more like the developed world, while the rural poor continue to suffer from basic energy access concerns. The last cluster (in grey) is made up by the erstwhile Soviet nations. These nations have shown a decline in carbon emissions since 1990 but under the special circumstances of an economic collapse and a very inefficient and energy wasteful baseline.

This paper seeks to briefly present some of the issues associated with unsustainable lifestyles and some of the policies that have been suggested in order to make them less energy and carbon intensive. It also presents evidence from the US that suggests that changing the way people live is a necessary part of meeting carbon stabilization targets. To ignore this issue in the search for solutions is to make our task not just more difficult but possibly impossible.

## Quantifying the influence of lifestyles

It is common practice when discussing the energy and carbon intensity of an economy to employ a sectoral description wherein energy consumption is allocated between residential, industrial, and commercial sectors. Bin and Dowlatabadi (2005) point out that this approach has the disadvantage of underplaying the importance of household consumer lifestyles by allocating only end-use energy consumption (space conditioning, lighting, and so on) to the residential sector. In reality, of course, much of the activity in the industrial and commercial sectors exists as a response to consumer demand for goods and services. Consequently, they suggest an alternate perspective to the description of energy use in an economy—the CLA (Consumer Lifestyle Approach). The authors use this approach to quantify the energy used for household and individual consumption.

Other researchers have also attempted to quantify the energy used by a household in a variety of countries. Examples include Vringer and Blok for the Netherlands (1995), Lenzen for Australia (1998), Weber and Perrels (2000) for West Germany, the Netherlands, and France, and Pachauri and Spreng (2002) for households in India. It has become increasingly clear that

consumers can be identified as being responsible for a significant fraction of the energy consumption in the economy through two means: *direct* and *indirect*. Direct energy use includes the consumption of oil to run cars, electricity for household appliances, natural gas for heating, and so on. Indirect energy consumption occurs at points before or after the consumer end use, for example in the manufacture of vehicles, or the energy expenditures in running shops and movie theatres. Bin and Dowlatabadi (2005) find for the US that about 27% of US energy is consumed for direct household end uses, a further 57% in indirect uses, and only about 16% for non-household expenditures. Similarly, while direct household end uses made up only 4% of the GDP, they contributed over 40% of total carbon emissions. The particular figures would of course differ from country to country, but placed in this context it is immediately clear how important household consumption decisions are to a nation's energy use and carbon intensity.

### The development – lifestyles link

The preceding discussion makes it clear that consumer decisions play a major role in influencing energy consumption. Yet it is insufficient to note that modern lifestyles are oft times unsustainable without simultaneously asking what characteristics of modern societies most contribute to such behaviour. That is to say, while it is certainly the case that consumers can and should be educated and made more aware of the costs of their lifestyles, it is equally true that living more sustainably should ideally flow as a natural consequence of the ways in which societies and communities are structured. It is only if this is the case that switching to greener ways of living becomes a long term, stable choice. On the flip side, if communities are structured in a manner that encourages or even requires a highly carbon-intensive lifestyle then it is naturally going to be difficult to convince people to repeatedly make sacrifices for a 'higher' ideal.

The energy intensity of economies is particularly high for the developed world, in large part due to the manner in which consumption patterns have developed and urbanization has occurred. For example, a major contributor to carbon emissions in developed societies is the use of personal vehicles for transportation. The US is an egregious example, with the transportation sector accounting for 28% of its total GHG (greenhouse gas) emissions (a significant fraction given that the nation as a whole contributes nearly one quarter of *global* GHG emissions). Yet the use of personal vehicles is strongly influenced by patterns of development such as urban sprawl and a lack of sufficiently convenient public transportation system. Staying with the US, land consumption for development occurred at three times the rate of population growth between 1982 and 2002. Between 1980 and 2000, the rate of increase of VMT (vehicle miles travelled) was also over three times the population growth. These figures are a reflection not just of changing habits, but also the growth of communities that make cars a necessity—with poor public transport, widely dispersed urbanization, residences far from the work place, poor civic amenities for pedestrians and cyclists, shopping and entertainment amenities separated from homes, strip development, and so on.

This is of course not to suggest that redesigning our communities is enough to alleviate the problem of unsustainable lifestyles. It will still be necessary to ensure that consumers take account of the externalities of high energy use in their economic choices. In all probability this will require more rational pricing, perhaps other economic incentives, and certainly greater education. However, these options do not remove the pressing need to make greener lifestyles a more inherently convenient choice as well.

### Why are lifestyle changes essential to climate security?

While the way we live clearly drives the extent of energy use and carbon emissions in modern societies, there remains a reluctance to directly address lifestyle changes as a carbon mitigation measure, or as a means to enhance energy security. At one level this is understandable, since the ways in which people live and consume are extremely hard to change and even harder to reform in a popular, democratic fashion. Recent work has suggested however, that difficult

though lifestyle changes may be, they are a necessary part of any successful strategy to tackle energy and climate concerns.

The recently published *Growing Cooler* report on urban development and climate change (Ewing, Bartholomew, Winkelman, *et al.* 2007) provides a good example in its discussion of the transportation sector for the US. The authors make the case that vehicle and fuel technology alone cannot be expected to provide anything near the emission cuts the transport sector must make to meet $CO_2$ stabilization targets. For such reductions to be made, it will become necessary to reduce the VMT per capita—fundamentally a lifestyles issue. Much of the reason for this lies in the fact that $CO_2$ emission is a direct consequence of the combustion reactions in internal combustion engines. As such, unlike other air pollutants that are by-products and can be significantly reduced or trapped in situ, it is very hard to see how the same could be done for $CO_2$. From an energy security point of view too, the transportation sector poses a particularly thorny problem because it is a major consumer of oil, which is in turn the focus of most energy security concerns.

The US Department of Energy projects that in a business-as-usual scenario, driving will increase 59% between 2005 and 2030, even though population is expected to rise by only 23%. This increase in VMT is more than sufficient to overwhelm the benefits gained from improving efficiencies (forecast at 12% over the same period). Under baseline conditions, $CO_2$ emissions are expected to rise by 41% over 2005 levels by 2030 – a far cry from the climate stabilization goal of reductions below 1990 levels. The rise in the amount of miles driven is easily the dominant factor in determining GHG emissions, such that even larger than expected increases in efficiency (miles per gallon) would not suffice to flatten the emission trajectory, let alone reduce it below 1990 levels. Even under a nationwide imposition of California's planned low carbon standard for transportation fuels, coupled with the 2007 CAFE (corporate average fuel economy) standards, the rise in the amount of driving would still overwhelm efficiency and fuel quality gains (Figure 3).

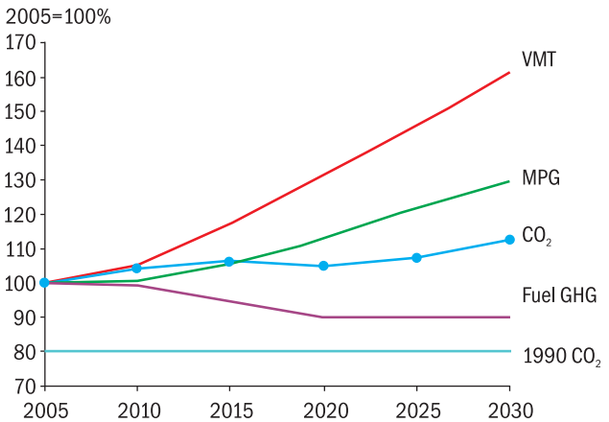


**Figure 3** Expected trends in various parameters determining transport emissions. Note the dominance of vehicle miles travelled, fundamentally a lifestyles issue.

It is these facts that underlie the argument that lifestyle changes (represented here by VMT) are essential to solving our energy climate concerns. It is useful to reiterate that while population growth plays some part in the increase in vehicle miles, the growth of unsustainable lifestyles is equally important with people driving more often and greater distances. In fact, over the last couple of decades in the US, population growth has been responsible for only about a quarter of the increase in VMT. Naturally, the numbers presented here are specific to the US. But the US, as mentioned earlier, is a particularly important part of this problem. In addition, while nations will differ in specifics, these problems exist to a greater or lesser extent in most of the developed world.

## Lifestyles research from around the world

While there is a need for more research and a stronger policy position on changing lifestyles in the developed (and indeed sections of the developing) world, there does exist a growing literature that has sought to clarify the link between households, lifestyles and energy use, and carbon intensities. This section, briefly discusses some of the work in this area. In the final section, the paper looks at some of the policy options that exist or have been suggested.

Noorman, Biesiot and Moll (1999) carried out a scenario-based analysis of household energy use for the Netherlands, and concluded that achieving a sustainable level of energy use (using a baseline for sustainability defined by the authors based in

part on global energy equity) would mean reducing household energy budgets by about four times by 2050. Meeting a target of this nature was seen as possible only with significant changes in lifestyles and the authors quantify possible reductions as emerging from a number of sources, including reducing meat consumption; improving appliance and building efficiencies, reducing standby use of electrical appliances, taking fewer vacations especially those requiring long air trips, and increasing use of public transport, walking and cycling. These options span a breadth of types wherein some involve making the choice or being given the option of using energy more efficiently, while others involve more substantive changes in consumption choices. Figure 4 presents the effects of different lifestyle changes on energy use for this study. These numbers are of course only illustrative in this context and specific to the Netherlands, however they do allow us to observe broad trends. The particular importance of specific measures will differ from nation to nation.

Wei, Yi-Ming, Liu, *et al.* (2005) used the CLA discussed by Bin and Dowlatabadi (2005) to analyse households in China. Similar to the US, a substantial share of carbon emissions (about 30%) was attributed to residents' lifestyles and their

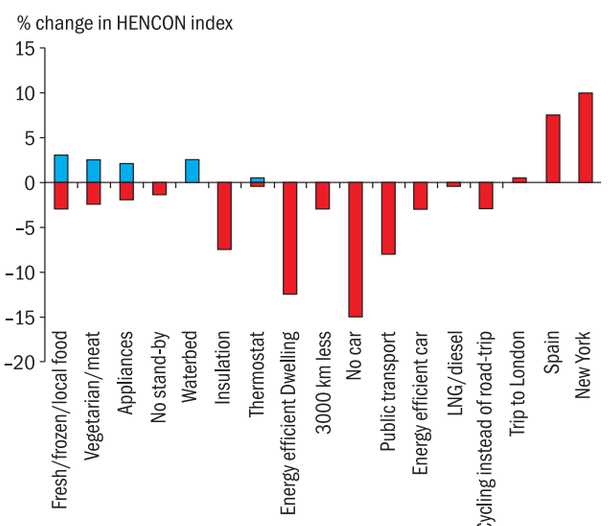


**Figure 4** Effect of different lifestyle choices on household energy consumption for the Netherlands . Percentage changes are in terms of HENCON index points, where 80 points corresponds to the value for an average Dutch household. The zero baseline corresponds to the average household (in 1990), and 1 HENCON change corresponds to 3 GJ per annum
**Source** Noorman, Biesiot, and Moll (1999)

direct and indirect energy consumption. Of course for a country such as China, this overall figure hides wide disparities within the nation between the energy hungry urban rich and the energy deprived rural poor. Christensen (1997) attempted to compare four different lifestyles in order to understand their energy use and environmental impacts. The most energy-intensive lifestyle, referred to by the authors as an 'American Lifestyle' was estimated to consume over eight times as much energy (and consequently emit about eight times as much $CO_2$) as the most 'green' lifestyle considered. The latter involved a low and renewable-energy-powered house, more vegetables than average, and biking to work. This is admittedly a somewhat radical shift from present patterns so while it may be true that modern lifestyles use too much energy, it seems unlikely that a reduction by such a large factor could be achieved in practice.

A larger study was carried out by Weber and Perrels (2000) where household survey data on expenditures of time and money for different uses was combined with input–output models to quantify the effect of different lifestyles on energy use and emissions for West Germany, the Netherlands, and France. A set of alternative scenarios was analysed and the effect of different lifestyles studied. The focus on household consumers allowed the disaggregation of energy-use patterns by household characteristics such as income or education level. An approach of this kind is especially useful in two ways: it clarifies the role of consumers in influencing energy consumption and emissions at any time, and allows one to map specific consumption patterns to socio-economic characteristics. In addition to this, however, it allows the construction of scenarios expressed in terms of consumption patterns and preferences. Consequently, model runs can reveal (to an extent) the link between a change in lifestyle and the resultant change in fuel mix of the economy.

## Key policy issues

The discussion so far has focused on a description of the link between lifestyles and the energy-climate problem and how this link may be measured and quantified so that it can be more

explicitly tackled—both as a subject for research and as a social concern requiring positive policy action. We have also described evidence from one sector – transportation – to argue that adopting more sustainable lifestyles must be viewed as a necessary and complementary means (along with technological efforts) towards reducing the energy intensities of our economies.

With this background in place, it remains to be asked precisely what kind of policy measures may be helpful in reforming unsustainable ways of living. This is a hard question to answer, particularly because not much effort has been made in the past to consciously address this question. In part, this is a reflection of the political difficulties in implementing policies that restrict or change the way people live, but it is also indicative of the difficulties involved in coming up with such measures in the first place.

This concluding section lays out some of the approaches that have been discussed (or are being implemented). This is not intended to be a comprehensive treatment of the subject, but rather a brief overview of some of the policy issues that are seen as most important.

### *Education*

An increase in the general environmental awareness in society, and access to information and options that allow sustainable consumption decisions to be made, is absolutely important to achieving lifestyle reform. Examples of 'educational' policy efforts include public campaigns, providing messages to students in schools and universities, as well as making information on energy use characteristics of appliances easily accessible through labelling schemes. The effects of such policies may be hard to measure directly, especially when programmes to spread information and change mindsets are carried out alongside more coercive measures such as market interventions. Even so, the fact that modern markets do not take into account the true costs of energy use makes it imperative to educate the populace to make consumption decisions that incorporate these externalities. Unfortunately, as long as energy prices continue to be heavily determined by state policy and biased so as to ignore environmental externalities, it will remain unrealistic to depend only on the market to achieve socially optimal consumption behaviour. As a matter of fact, it could be argued that given the political difficulties of directly increasing the monetary costs of energy, changing the parameters that influence consumer preferences (to include not just market costs but also perceptions of environmental harm) is a more feasible means to the end.

It remains highly debatable, however, as to what extent mindsets can be changed through education alone, and whether actual behavioural changes can be made to occur quickly enough in this way. This is an admittedly fair concern and is part of the reason why policies that choose to rely only on 'educating' citizens are accused of choosing not to confront the problem head on by taking hard decisions (such as imposing taxes or fees). Having said this, there is still reason to believe that concrete differences can be made through the spread of information. A good example is the state of California in the US where there is some evidence to show, based on the Energy and Information Administration's Residential Energy Consumption Survey, that citizens have behaved in more environmentally responsible ways (in the use of heating equipment and appliances for example) than the rest of the country. There is also relatively strong public support for legislation and regulation aimed at tackling issues such as climate change and excessive energy use—even where this requires some sacrifices by citizens, and even where such policies may be far more stringent than in the nation as a whole. While it is difficult to answer exactly why these differences exist, it is reasonable to allocate at least part of the credit to a consistent history of pro-sustainability messages sent out by the state, by public utilities and by educational institutions.

### Smart community design

Another means to changing lifestyles is to create communities and living spaces that make sustainability a more convenient and natural choice. As we have pointed out in Section 3, there is a clear link between the form that development takes and the lifestyles people adopt. It is hard to make lasting or important enough changes to the

way we live if this is made difficult by the manner in which communities, especially urban societies, are constructed.

Smart community design implies a conscious effort to develop towns and cities in a way that enables the emergence of less energy-intensive lifestyles. For example, neighbourhoods with mixed land use allow for the possibility of living close to ones place of work and thus help minimize commuter travel. They also allow other tasks such as basic shopping to be carried out in one's immediate neighbourhood. In many developed countries (and indeed increasingly in developing countries) such communities have not developed. Instead the phenomenon of urban sprawl has meant the creation of residential areas separated from offices and commercial centres. Other aspects of smarter urban design include a much greater emphasis on public transport, bicyclists, and pedestrians. Unfortunately, the failure of public transport systems to be truly viable options for many people – even for daily work commutes – has led to the widespread use of personal vehicles for transport.

While it is admittedly hard to quantify the link between urban development and land-use choices, and the energy and carbon intensities of communities, there is an increasing acknowledgement today that more appropriately designed communities can make substantial differences to living patterns. The clearest possibility for an improvement in efficiency in this regard comes from achieving reductions in transport energy. The *Growing Cooler* report (Ewing, Bartholomew, Winkelman, *et al.* 2007) points out that there is evidence to suggest that compactly designed communities allow for reductions in driving between 20% and 40%, in turn translating to significant reductions in overall energy use.

### *Energy pricing*

Ensuring that the price of energy is more accurately reflective of the externalities involved with energy use (whether they be environmental or include perceptions of security risks associated with high energy dependence), is an essential tool to improve efficiency. Unfortunately it has proven politically difficult, particularly in the first world, to tax energy consumption or otherwise increase prices. That said, the increasing use of options such as time-of-day pricing of electricity and demand side management are part of a move towards more rational electricity prices. Even so, it is by no means easy to determine the relationship between energy prices and demand. For example, while estimates of consumer price and substitution elasticity for energy sources and electricity have been derived in the past (see for example, Roy, Sanstad, Sathaye, *et al.* 2006 and Branch 1993), there remains considerable debate about how consumers respond to price changes, how much lag exists in their demand shifts (especially accounting for the fact that most consumers are not exposed to real time prices). For a commodity such as electricity, short- and long-run elasticities are likely to be quite different, further complicating such an analysis. Similarly, consumer demand for petrol and diesel has often been relatively inelastic with respect to small to moderate price changes.

## Conclusions

This paper provides a broad, global view of the link between lifestyles and energy-climate security. To that end, it discusses how the relationship between our way of life and our use of energy has been quantified in literature. It also describes the link between the design of modern communities and the choices made by people. This is followed by a review of the literature that looks at lifestyles and energy, from different parts of the world, in order to stress the point that many of these concerns are globally cross-cutting, and consequently of concern to both developed and developing nations. Finally, the paper presents some broad policy approaches that have been used or could be used to change consumer preferences. It should be reiterated that this is not intended as a comprehensive discussion of policy options but rather as a starting point for a discussion on positive steps that can be taken to encourage the adoption of more sustainable lifestyles.

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# Energy security and climate change: why we should be concerned with converging lifestyles*

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## Introduction

Energy security and climate change are amongst the most serious concerns for many developing countries. Countries are now trying to reduce energy demand to mitigate climate change risks through efforts targeted at various sectors of the economy, for instance increasing energy efficiency and enforcing conservation measures in industry and service sectors; using alternative fuels in the transport sector; reducing electricity usage in the agricultural sector; and so on . They are also paying attention to consumption at the household level. It is important to bear in mind that personal consumption at the household level is inseparably connected with energy use, emission of GHGs (greenhouse gases), and thus, climate change.

Changes in lifestyles and consumption patterns can immensely contribute to improving energy security and mitigating climate change. The recommended changes in this regard, in effect, boil down to the choices that we make in our everyday lives, for instance, what food we buy, the way we cook, and the modes of transport we use.

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 WWF (World Wildlife Fund), an average US citizen requires 10 hectares of the planet to support his or her lifestyle, while an average European needs over five hectares. An average person in Africa, by contrast, draws on about one hectare of the earth's resources to live. When compared to the rest of the

* This paper was circulated as an issues paper at the DSDS Special Event on 'Lifestyles, Energy Security, and Climate'.

world, US households account for over six times more $CO_2$ (carbon dioxide) emissions than the remainder of the world per year on an average.[1] But what is of concern is that with growth in population, urbanization, and globalization, the per capita energy consumption and emissions from the more affluent segment in the developing countries are gradually converging towards those recorded in developed countries. For instance, in the past few decades, gains in household income and urban development in many countries in Asia have led to significant shifts in household use of fuels away from traditional, biomass-based household fuels to modern fossil fuels. There is also evidence of dramatic increase in electricity consumption. These changes clearly demonstrate an improvement in living conditions but their long-term implications for energy consumption and atmospheric emissions are troubling.

Lifestyle changes are not easily achievable as it is difficult to change mindsets of people, even if the recommended actions do not involve any significant compromise on comfort. Also changes in people's lifestyles and the switch to energy-efficient products, cannot be forced on consumers. Therefore, it becomes extremely difficult to restrict energy use at homes purely through market mechanisms. When governments talk about securing energy at the national level, sectors other than the household sector are targeted more, when the household sector should be the priority sector targeted by the government since much of the activity in the industrial and commercial sectors exists as a response to consumer demands for goods and services. It is evident that with betterment in living conditions, the lifestyles lead by the relatively affluent households in the developing countries will add to global energy insecurity and climate change concerns.

Against this background, this paper addresses the issue of converging lifestyles by examining select Asian countries.

## The problem of converging lifestyles

Figure 1 shows the residential sector's energy consumption in OECD and non-OECD countries. For the non-OECD region as a whole, real GDP (gross domestic product) is projected to grow by more than 5% per year on average from 2004 through 2030, population by more than 1% per year, and household energy use is projected to grow at a robust rate of 2.4% per year. This is because higher incomes will foster increased use of energy-using appliances. As a result, households in the non-OECD nations are projected to consume about 10% more energy than households in the OECD nations in 2030. China and India are expected to account for more than 40% of the increase in residential energy use in the non-OECD countries, as their economies continue to grow rapidly over the projection period. By 2030, the non-OECD countries' consumption will constitute about 53% of the global residential sector's energy consumption. This is indicative of the converging lifestyles of the relatively affluent section in the developing countries with that in the developed countries.

Table 1 compares some Asian developing countries with the US and Japan. It is evident that the per capita emission levels in the developing countries are still far below that in the developed countries. For instance, the figure for India is 0.05 times that of the US and 0.16 times that of Japan. China's is 0.16 times that of the US and 0.32 times that of Japan. It shows that as far as $CO_2$ emissions are concerned, China is close to reaching the US,

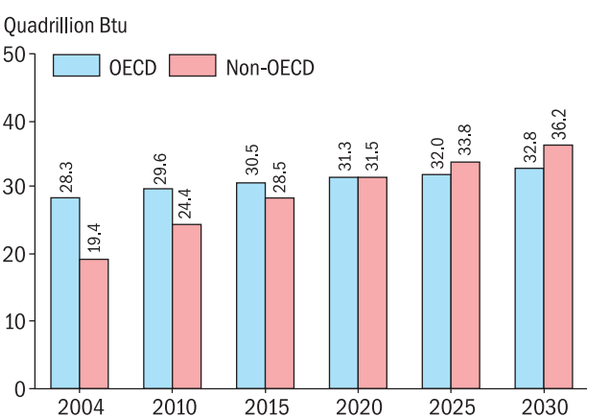


**Figure 1** OECD and non-OECD residential sector delivered energy consumption 2004–30 (Quadrillion BTU)
**Source** *http://www.eia.doe.gov/oiaf/ieo/excel/figure_26data .xls*, last accessed on 5 February 2008

[1] Details available at *http://www.thehcf.org/emaila5.html*, last accessed on 2 February 2008

**Table 1** Basic emission statistics in selected countries

| Countries | *Population* (million) | *$CO_2$ emissions* (million metric tonnes) | *Share of global emissions* (%) | *Per capita $CO_2$ emissions* (tonnes /capita) | *Residential per $CO_2$ emissions* per capita (tonnes /capita) | *Share of residential $CO_2$ emissions per capita in total electricity per capita emissions* (%) | *Electricity consumption per capita* (kilowatt hours per person) | *Access to electricity* ( %) |
|---|---|---|---|---|---|---|---|---|
| USA | 298 | 5956.98 | 21.13 | 20.14 | 1.26 | 6.28 | 13242.8 | 100 |
| Japan | 127 | 1230.36 | 4.36 | 9.65 | 0.52 | 5.40 | 7846.2 | 100 |
| India | 1130 | 1165.72 | 4.13 | 1.07 | 0.09 | 8.42 | 434.8 | 43 |
| China | 1310 | 4821.42 | 18.88 | 4.07 | 0.19 | 4.56 | 1378.5 | 99 |
| Thailand | 64.2 | 234.16 | 0.83 | 3.65 | 0.07 | 2.02 | 1751.7 | 84 |
| Indonesia | 245 | 359.47 | 1.28 | 1.57 | 0.13 | 8.24 | 440.1 | 55 |
| Korea (South) | 48.6 | 499.63 | 1.77 | 10.27 | 0.70 | 6.86 | 7018.4 | 100 |

**Source** http://www.eia.doe.gov/emeu/international/contents.html, http://earthtrends.wri.org/searchable_db/index.php?theme=6, last accessed on 4 February 2008

and India has almost reached Japan's levels. However, emission levels in the East Asian countries like Thailand, Indonesia, and `1 are much less, though the per capita emissions in these countries are higher than the South Asian economies like India. Total energy consumption in these countries is projected to grow at about 3% per annum till 2020 (IEA 2004).

A wide variation can be seen in the overall per capita $CO_2$ emissions of countries. However, the contribution of particular sectors varies significantly across countries. For instance, the share of residential sector $CO_2$ emissions per capita in overall per capita emissions is higher in India, Indonesia, and Korea, as compared to the US or even Japan. Again, the per capita electricity consumption figures show wide variation. This is primarily because a large fraction of the population in some of the developing countries does not have access to electricity. For instance, in India only about 43% of the rural population has access to electricity. Similarly in Indonesia, merely 55% of the population enjoys electricity in their homes. But an average person in Indonesia enjoys a better lifestyle than in India and therefore, registers a higher per capita emission. The same is true for Thailand where figures for electricity access are better and the per capita emission level is higher. In China, close to 100% of the population has access to electricity, but owing to the high population, the per capita usage is much less. In Korea, the per capita emission is just about half of that in the US, but it has a population which is only 16% of that of the US. The per capita $CO_2$ emissions of the residential sector in Korea are higher than that in Japan, though the per capita electricity consumption is not much less than Japan. From the table it is clear that though in some of these countries, per capita emissions are still lower than the global average, they are rising. In the years to come, with accelerating development, urbanization, and population growth, coupled with better electricity access, overall per capita energy consumption and emissions including those from the residential sector are projected to rise faster.

## Impact of lifestyles on energy consumption and emissions from the household sector in select Asian countries

### *India*

India is home to two contradictory realities. On the one hand there is a rapidly growing rich consumer class, which has made the country the 12th largest luxury market in the world. On the other, about 57% of rural India does not have access to electricity. According to the NSSO (National Sample Survey Organization) data, in 2004/05, firewood and wood chips continued to be the most important sources of energy for cooking in rural India, with 75% of the rural households

dependent upon them (NSSO 2007). In the urban sector, kerosene (10%), firewood and chips (22%), and LPG (liquefied petroleum gas) (57%) are important sources of energy used for cooking. There has been an increase of about 13 percentage points in the use of LPG and a reduction of 12 percentage points in the use of kerosene since 1999/2000. Also, electricity and kerosene together served 99% of the households as the primary source for lighting in both rural and urban areas. Between 1999/2000 and 2004/05, there has been an increase in the proportion of households using electricity for lighting purposes, by 7% (from 48% to 55%) in rural areas and by 3% (from 89% to 92%) in urban India. The residential sector in India accounted for about 25% of sectoral electricity consumption in 2004/05. Conversion to modern fuels has added to increased energy use per capita of households (Figure 2).

A Greenpeace (2007) report says that the richest consumer class in India produces 4.5 times more $CO_2$ than the poorest class. While even the rich Indians still have half the carbon footprint of an average European, they have reached the global average. The relatively rich consumer segment uses all kinds of modern electronic devices. High energy consumption and emissions from the richer section of the population is offset by low energy use and emissions from the poorer section, resulting in overall low per capita energy use and emissions.

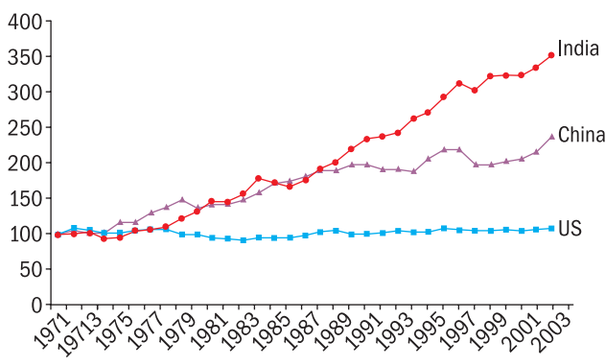


**Figure 2** Residential primary energy consumption per capita (1971= 100)
**Source** Sathaye (2006)

As far as the demand for transportation is concerned, consumption of petrol and diesel grew at 7.3% and 5.8% per annum respectively between 1980/81 and 2004/05 (Planning Commission 2006). This is the outcome of the growth of personal motorized transport and the rise in share of road haulage due to an increase in urban sprawl. With improving income and changing lifestyles, many can now afford a car. As a result, the automobile industry, particularly the small car segment, is booming. The number of cars, jeeps, and taxis, has increased at an average annual growth rate of 10%, whereas the two-wheelers have shown the highest average annual growth rate of 14% during the period 1980–2003 (TERI 2006). According to the EIA (Energy Information Administration) [2], India is expected to show the largest increase in transportation sector energy consumption among the non-OECD countries. The combined growth rate for transportation energy use in all the countries of Central and South American economies is projected to be similar to that in India. This could have serious implications for the country's energy security.

The construction sector in India too is growing rapidly. Though the construction sector includes industrial construction, roads, ports, and other infrastructure, it is in real estate (both residential and commercial) that the maximum investment is directed. There is significant demand for quality housing in India. With younger people wanting to own a house, owing to greater affordability due to reasonable interest rates on home loans and favourable tax treatment, the demand for residential housing is expected to continue to grow in the near future. However, construction activities in India have been pursued without attention to environmental issues. Construction materials used are energy intensive, and there is scope for the use of appropriate materials and design that can save energy, both in construction and use.[3] At the national level, domestic and commercial buildings account for more than 30% of annual electricity consumption.

In order to reduce energy consumption of the household sector, in May 2007, the following action points on demand side management were

[2] Details available at http://www.eia.doe.gov/oiaf/ieo/enduse.html, last accessed on 5 March 2008
[3] Air-conditioning and lighting are two most energy consuming end-uses in the building sector.

agreed upon by the BEE (Bureau of Energy Efficiency)

- Bulk procurement and distribution of CFLs (compact fluorescent lamps)
- Adoption of ECBC (Energy Conservation Building Code)
- Promotion and mandating of the use of energy-efficient pumps and other energy-efficient appliances.

The scheme on CFLs seeks to replace an estimated 400 million incandescent bulbs with CFLs, which could save 6000 MW (megawatt) to 10 000 MW of power. It seeks to make available high-quality CFLs at the cost of incandescent bulbs. The basic premise for the second and third action point is to create the 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.

### *China*

In China, overall emissions are quite high because of the large population size but energy requirements vary significantly within the country due to different weather conditions, indoor environment, residence type, and lifestyle of the region. In rural areas of China, large quantities of biomass fuel such as stalks and firewood are used for cooking and space heating. In urban areas, biomass is not used. Nevertheless, lifestyle differences between rural and urban residents are gradually reducing. In rural regions, commercial energy sources such as coal, oil, electricity, and natural gas are becoming popular and affordable, and this is gradually substituting the use of non-commercial energy sources such as straw and firewood. Figure 3 shows that in the year 2002, the most energy-intensive residents' behaviour in China is the use of direct energy, followed by food, education, cultural and recreation services, and personal travel.

Consumer behaviour in urban China is following that of developed countries. In the automobile segment, bigger cars are more popular.

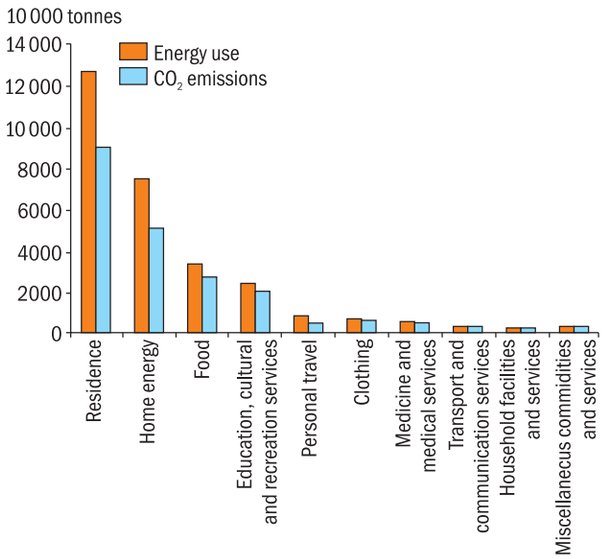


**Figure 3** Energy use and the related $CO_2$ emissions caused by China's urban residents' lifestyle in 2002
**Source** Wei, Lan, Ying, *et al* (2007)

Excessive air conditioning and heating are not uncommon. Economic reforms have resulted in considerable improvements in people's quality of life, with large sections of society experiencing a transition out of poverty towards western lifestyles. Of the increase in $CO_2$ emissions due to household consumption, the largest increase has been from electricity consumption, followed by strong growth in many service sectors such as education, real estate, and restaurants. Increased electricity consumption reflects increased use of computers, refrigerators, television sets, and air conditioners. The number of air conditioners in use has increased significantly to about 30 sets per 100 households. The popularization of household electronics has enormously boosted household appliance production. A recent study by Wei, Lan, Ying, *et al* (2007) suggests that approximately 26% of total energy consumption and 30% of $CO_2$ emissions in China every year are a consequence of residents' lifestyles, and the economic activities that support these demands.

### *Thailand*

Thailand's annual energy consumption has soared at 13% during the past decade, and retains a similar pace.[4] The residential sector in

[4] Details available at *http://www.dede.go.th/dede/index.php?id=875*, last accessed on 15 January 2008

Thailand accounts for about 14% of the total energy consumed in the country (DAEDE 2007). Per capita $CO_2$ emissions in Thailand have doubled between 1990 and 2004 as a result of increasing economic activity (Shrestha, Malla, and Liyange 2006). Figure 4 shows the pattern of residential energy consumption. As can be seen from the figure, air conditioning among the Thai households is very common and accounts for the largest energy consuming activity.

Rural Thailand constitutes 78% of the total energy consumed by the residential sector, whereas Bangkok metropolitan and the municipal area consume 13% and 8% of energy respectively (DAEDE 2005). In order to improve energy efficiency in the household sector, the Ministry of Energy in Thailand has taken up certain measures which include studies on managing and sustaining consumer awareness; promotion of high-efficiency equipment via MEPS (Minimum Energy Performance Standards) in air-conditioners, refrigerators, ballast, fluorescent lamps and CFLs; energy efficiency labelling; establishment of standards for LPG-fired cookers; promotion of high-efficiency cooking stoves; and establishment of a building code and building material standards (Pichalai 2006).

During the period between 1990 and 2002, energy consumption for transportation increased two-fold, mostly as a result of an increase in road transport. The number of passenger vehicles grew at an annual rate of 10.4% during this period. Of the total vehicular emissions of particulate matter in Bangkok, motorcycles and passenger cars contributed about 11%. The rise of Bangkok as one of Asia's prime economic locations posed a fundamental problem for the city—how to ensure the mobility of the millions of people who travel through the city everyday. About 82% of all daily journeys were by bus, car, motorbikes or taxis. As a result, large parts of Bangkok's infrastructure were congested and traffic jams were a daily problem. Not only commuter mobility but also the quality of everyday life was affected. The situation deteriorated to a point where Bangkok figured amongst cities with the highest air pollution levels in the world. To counter this situation, an efficient mass transit system was developed by expanding road transport and adding railway infrastructure. BMA (Bangkok Metropolitan Administration) has now initiated three mass transit system projects. One of them represents the most advanced urban railway, the BTS (Bangkok Transit System). This is an elevated heavy rail system running above the business district of Bangkok. The BTS is an environmentally sound solution, since it reduces Bangkok's road space only minimally. All cars are powered by electric motors fed by an electrified third rail, thus avoiding air pollution. It also incorporates a signalling system that allows automatic operation of the trains at optimum performance and therefore ensures energy-efficient driving conditions. As a result of this, the transport sector's energy intensity has been reducing since the late 1990s.

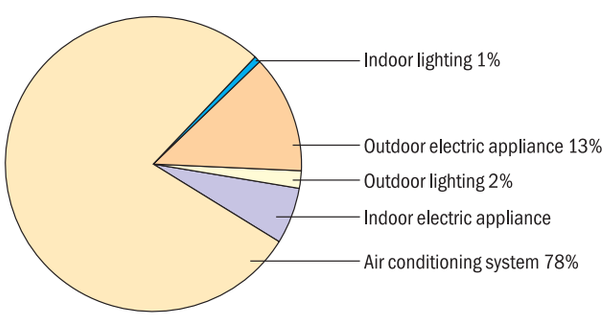


**Figure 4** Energy consumption by the residential sector in Thailand
**Source** DAEDE (2007)

### *Indonesia*

Indonesia is among the top five emitters in the world, mainly due to land use, land use change and forestry. Indonesia has a rapidly growing energy demand, estimated at 9% per annum (Iwan 2006). The electricity demand in the country is dominated by the industrial sector and the residential sector, comprising 69% and 18% respectively. Though energy intensity is one of the highest, per capita energy consumption is the lowest, particularly among the Southeast Asian countries. Emissions per capita have been growing at about 67% since 1990. The residential sector in Indonesia accounts for 10% of the total emissions in the country.

In order to reduce the growth of residential sector emissions, solar cooking is being encouraged in the country. As part of the Indonesian Sun Cooking Project, sponsored by Earthwatch since

1995, almost 1000 local participants have been trained in the new technology by over a hundred international volunteers from 11 countries.[5] At present, the Jakarta administration has stepped up its campaign to reduce kerosene consumption by distributing solar-powered cookers to households.[6] The City Environmental Management Board (BPLHD) will distribute 30 000 parabolic solar cookers in the first phase of the plan. The cookers will be used for cooking meals and supporting small-scale fisheries in the area.

The Government of Indonesia has also started labelling activities targeted towards reducing the evening peak demand emerging from household electricity usage. The label presently being considered for household appliances is showed in Figure 5. The purpose of this label is to promote energy-efficient appliances. The labelling activity is in its early stages in Indonesia, and needs to be appropriately designed to ease its buy-in from equipment suppliers and manufacturers.

In the transport sector in Indonesia, the CALTI (Clean and Lean Transportation Initiative) programme on energy conservation has been active. This is a pilot programme that includes emissions testing on company vehicles, and employment of bio-diesel as an alternative fuel.


**Figure 5** Label envisaged for household appliances
**Source** World Bank (2006)

### *South Korea*

The Korean household sector was responsible for about 52% of the national primary energy requirement in the period from 1980 to 2000 (Park and Heo 2007). Households continue to consume more and more electricity-intensive goods and services. A study by Lim and Kang (2004) indicates that changing lifestyles which include the participation of women in public affairs, individualism, changes brought by the information age, and the increase of leisure time, have been altering and diversifying the energy consumption pattern. The survey undertaken as part of the study reveals that the energy consumption per household and per person is 2.341 TOE (tonnes of oil equivalent) and 0.639 TOE respectively.

South Korea has a long winter, and energy use for heating comprises a big proportion of total household energy consumed. The energy consumption per household under different heads, as found from the survey, is 0.415 TOE for heating water, 1.490 TOE for heating space, 0.307 TOE for lighting, and 0.131 TOE for cooking. With rapid urbanization, city gas grids too have been expanding rapidly and gas is now the dominant cooking fuel.

Korea's energy consumption for transport is dominated by the road transport sub-sector, representing more than 75% of the economy's total transport energy consumption in 2002. Over the past two decades, income growth, improvements in living standards, expansion of residential suburbs and development of vehicle manufacturing industries, have all contributed to a thirty-fold increase in the stock of vehicles, which has in turn resulted in a ten-fold increase in gasoline and diesel consumption (APEC 2006).

The KEMCO (Korea Energy Management Corporation) is a non-profit government agency in charge of implementing energy efficiency and conservation policies in the country. KEMCO launched the 'Energy Efficiency Standards and Labelling Programme' in 1992 to eliminate inefficient designs from the market and help

[5] Details available at *http://solarcooking.wikia.com/wiki/Indonesia#The_History_of_Solar_Cooking_in_Indonesia*. last accessed on 2 February 2008

[6] Details available at *http://solarcooking.org/regional/Indonesia/solar_cookers_sent_to_islands_to.htm*. last accessed on 20 January 2008

consumers choose more energy-efficient goods, which grade the energy efficiency from 1 to 5.[7] This programme covers electric refrigerators, air-conditioners, incandescent bulbs, fluorescent lamps, and self-ballasted lamps, as well as ballasts for fluorescent lamps and passenger cars. It is applied both to domestic products and imported products.

### *Japan*

Since 1990, Japanese household emissions have gone up nearly 40%. Some of Japan's environmental experts attribute this rise to increasing consumerism.[8] Consumer behaviour thus holds the key to Japan's ability to fulfil its commitments under the 1997 Kyoto Protocol (Kitazume 2007).

Switching to energy-saving electrical appliances can reduce household emissions of GHGs by up to 40%, according to Japan's white paper on the environment, released in June 2007. The white paper expresses a strong sense of urgency for implementing measures against global warming, and calls for developing energy-saving technologies, including high-performance fuel-cell batteries to help commercialize electric cars. The paper also emphasizes on the need to apply existing energy-saving technologies. The Japanese government also has plans to cut emissions especially from homes and offices. In 2005, emissions from offices increased 45% from the 1990 level, while emissions from homes rose 36%. The government estimates that if all homes in Japan use fluorescent bulbs, it could cut some 2 million tonnes of $CO_2$, or 1.3% of all household emissions.[9]

Japan is a country where energy consciousness is quite high. In 2005, the government introduced a national campaign, urging the Japanese to replace their older appliances and buy hybrid vehicles, all part of a tremendous effort to save energy and fight global warming. In April 2005, the Global Warming Prevention Headquarters, led by the government, launched a large-scale national campaign called 'Team Minus 6%' in collaboration with businesses, 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% reduction in GHG emissions. In particular, it calls on people to

- set air conditioners at 28 degrees Celsius (temperature control)
- avoid wasting water at taps (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).

In addition, business-wear fashions called 'Cool Biz' (during summers) and 'Warm Biz' (during winters) help office workers adapt to set room temperatures. Engaged in this energy conservation programme, many companies have reported large savings on the electricity bill. A similar initiative called 'Uchi Eco!' has been launched, encouraging individuals to save energy at home by focusing on appropriate clothing, food, and housing.

Also, Japan's Top Runner programme in the commercial and transport sectors has realized a substantial improvement in energy efficiency. The programme 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). Twenty-one categories of products have been covered by the Top Runner programme since 2006. LCD and plasma TV sets and heavy vehicles have been added recently (Miki 2006). The energy-saving labelling system has also been introduced in Japan to inform consumers of energy efficiency of home appliances and promote energy-efficient products.

[7] Details available at http://www.wrweb.com/escap-ngo-profiles/ngo-profile-kemco.htm, last accessed on 5 February 2008.

[8] Details available at http://www.npr.org/templates/story/story.php?storyId=15321013, last accessed on 25 January 2008.

[9] Details available at http://search.japantimes.co.jp/cgi-bin/nb20071220a1.html, last accessed on 2 January 2008

## Conclusions

Affluent households of key Asian countries are following lifestyles similar to those in the developed countries, and are becoming highly energy intensive. A study of developing Asian countries shows that though the per capita energy consumption and emissions in these countries are still well below the world average, with development, growth in population, urbanization, and changing lifestyles, energy consumption by, and emissions from, the relatively affluent section of the household sector are increasing fast and will soon reach the levels observed in the developed countries. This will have a significant impact on energy security and climate.

Making individuals aware of the problem is important, so that they recognize their role in formulating solutions, and voluntarily adjust their personal consumption. Also, it is noticed that even though awareness and concern about energy security and climate is widespread in some cases, these are rarely translated into consistent and adequate action. This calls for the spread of ideas and initiatives, and the design of widespread action plans. Countries need to exchange information on best practices in policy design and implementation. Possible action points include the following.

- 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 energy saved through changes in spending behaviour.
- Consumers should be informed of the impact of their choices and actions, and the possible ways of reducing their carbon footprint, through the media. There should be a special focus on educating children and the young.
- The use of energy conservation technology should be encouraged with the aid of appropriate policies and tax instruments.
- Regulation by stipulating energy usage or standardizing a quota should be introduced by the government to facilitate right consumer choices.

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# Towards sustainable lifestyles

## DSDS special event on 'Lifestyles, Energy Security, and Climate': a report

Deepti Mahajan
The Energy and Resources Institute

### Introduction

The pursuit of energy security and climate change mitigation has, over the last decade, registered a sharp rise on national and international agendas. In the context of growing energy demand to sustain growth levels, and related increase in GHG (greenhouse gas) emissions, the focus is on global, cross-sectoral action to chart a path of sustainable development. According to the *World Energy Outlook 2007*, the world's primary energy needs are projected to grow by 55% between 2005 and 2030, at an average annual rate of 1.8% per year (IEA 2007). In the same period, GHG emissions are expected to jump by 57%. While the international negotiations under the UNFCCC (United Nations Framework Convention on Climate Change) have provided a legal framework to further global cooperation, there are significant domestic and international policy debates on the need for technological innovations, sound policy-making, and financial instruments to enhance efficiency and promote use of alternative fuels. It is notable here that a large proportion of consumption accrues from energy-intensive lifestyles.[1] Appropriately, therefore, there is now recognition of the need to push for 'greener lifestyles' through both micro- and macro-level interventions.

Without significantly compromising on comfort and convenience, individuals can contribute to reducing energy demand and climate risks. Clearly, the solutions offered to address the twin concerns of energy security enhancement and climate change mitigation are in consonance with each other, at times overlapping. The suggestions may be as simple as walking small distances instead of driving; using energy-efficient appliances; and minimizing wastage of resources, but their large-scale internalization and cumulative impact may go a long way in addressing energy and climate concerns.

To bring to the fore the important strand of lifestyle changes in the energy and climate debate, the Centre for Research on Energy Security, TERI, and the Asian Energy Institute organized a special event part of the Delhi

[7] In India, during 2005/06, the residential sector accounted for 13.6% of final energy consumption (TERI 2007). This is exclusive of the energy used for transportation.

Sustainable Development Summit 2008. Supported by the Nand and Jeet Khemka Foundation, the event brought together a panel of eminent speakers: Dr R K Pachauri, Director-General, TERI, and Chairperson, Intergovernmental Panel on Climate Change; Dr Ajay Mathur, Director, Bureau of Energy Efficiency, India; Dr David Jhirad, Vice-president, Rockefeller Foundation; Dr Prodipto Ghosh, Distinguished Fellow, TERI; Mr Hideyuki Mori, Vice-president, IGES (Institute for Global Environmental Strategies); Ms Urvashi Sibal, Associate Producer, Headlines Today; and Mr Uday Khemka, Vice Chairman, SUN Group. The session was chaired by Dr Leena Srivastava, Executive Director, TERI. The event was attended by a distinguished audience that included important political and business leaders, educationists, academicians, research scholars, NGO (non-governmental organization) representatives, and students.

## Rallying resources for lifestyle transitions

Lifestyle changes provide an important scope for intervention because patterns of conspicuous consumption exhibited by elites the world over today provide a huge possibility for energy use reduction. The issue though is a sensitive one, for economic growth and individual achievement are directly linked to a move towards more energy-intensive lifestyles. Lifestyle changes thus call for a multi-pronged effort that encompasses spread of awareness and building of synergies between policy, regulation, technology, market forces, and ethical imperatives.

An assessment of carbon footprints reveals differential contributions to GHG emissions from different countries. A large amount of GHG emissions can be attributed to a few countries. However, the growing demand for energy will see a growth in carbon footprints of all countries. Carbon reduction scenarios point towards immense possibilities for changes in lifestyles across the world, which can help reduce energy insecurity and emissions. Apart from launching large-scale information campaigns for conservation of energy, a range of technological and planning options are available for building greener homes, determining efficient land-use patterns, following less-energy-intensive eating habits, making transportation environment friendly, and lighting and heating buildings in an energy-efficient manner. Increasing efficiency through adoption of energy-efficient technologies and processes spells a win-win situation, for it saves energy while reducing costs to the user.

In conjunction with raising the level of general awareness, it is important to ensure that policy and economic forces push consumers towards lifestyle changes. To promote the use of energy-efficient technologies, a series of economic signals is required, which reinforce each other. Dr R K Pachauri cited the instance of employing tax instruments to promote energy-efficient, green cars. According to Dr Ajay Mathur, three kinds of interventions are significant.

- *Inform people about the impact of their decisions* Consumers must be equipped with the knowledge to make informed decisions. Appropriate labelling and price signals should be employed to draw people's attention towards the efficiency of the products they buy and use.
- *Establish building codes* The application of energy conservation building codes can contribute in reducing the energy used in a building, by determining construction design and fittings, and heating and lighting mechanisms.
- *Institute codes and standards for efficiency of private transport, and promote public transport* The use of efficient private vehicles should be incentivized, while keeping in view the long-term goal of increasing reliance on public transport.

Dr David Jhirad reiterated that energy efficiency needs to be the centrepiece of efforts towards both improving energy security and reducing GHG emissions, suggesting that not all new technological options put forth may be equally good for both energy security and climate change mitigation, or may even impact one adversely while helping the cause of the other (Figure 1). While raising automobile fuel economy standards increases energy security and reduces carbon intensity to different extents, coal liquefaction may be good for energy security but not for reducing carbon intensity. Special attention must, therefore,

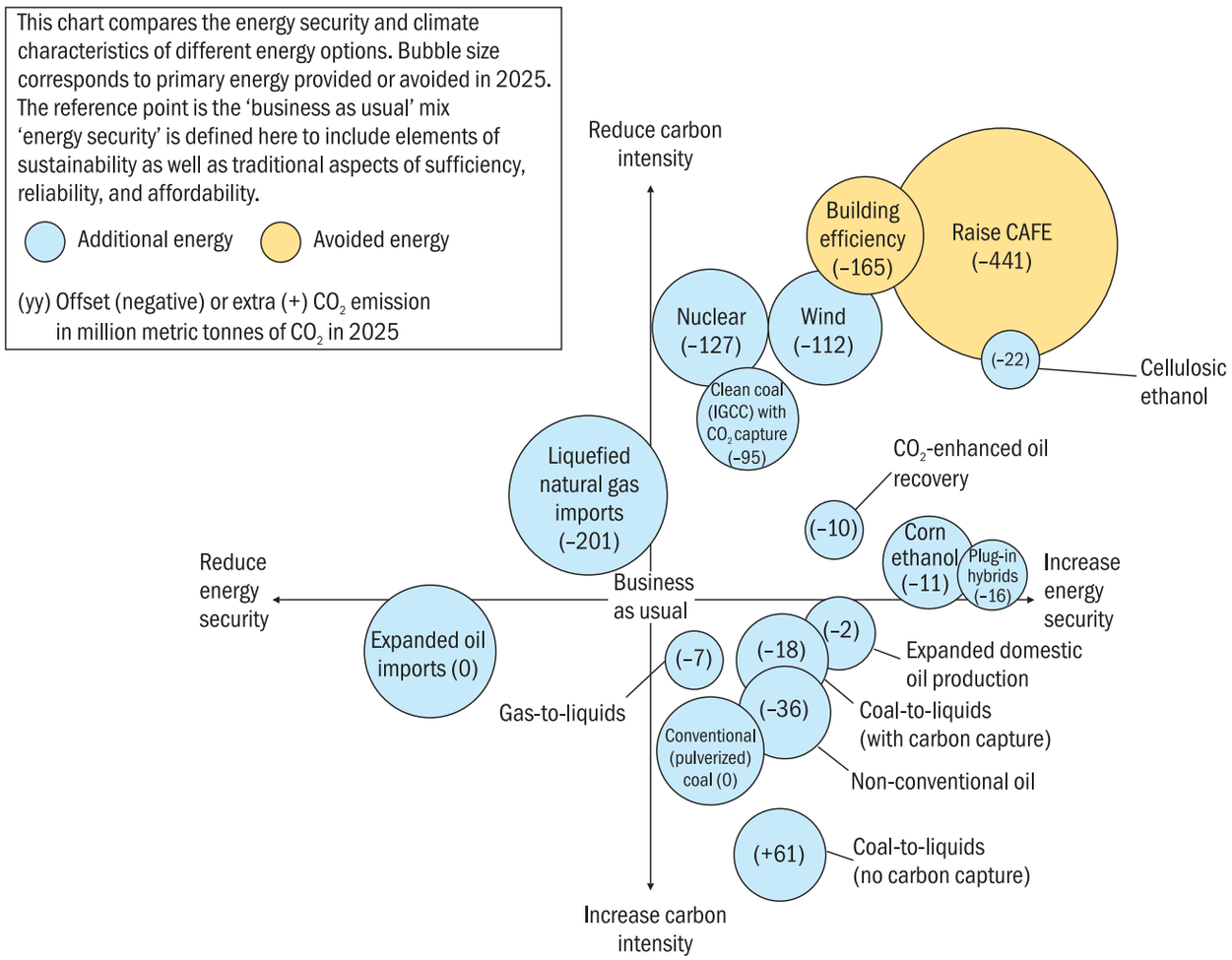


**Figure 1** US policy options: energy, security, and climate impacts (World Resources Institute, cited by Dr David Jhirad)

be paid to end-use fuel efficiency, the switch from coal to gas and renewables, use of nuclear energy, and deployment of carbon sequestration and storage.

## Assimilating equity and ethics

The intra-generational equity aspect of the energy security and climate change debate focuses on burden-sharing of GHG mitigation across countries/societies, and among different classes within a country. During the course of his presentation, Dr Prodipto Ghosh referred to possible equity formulations, as mentioned below.

- *Intra-generational*: 'Equal per-capita entitlements of GHG emissions globally' *versus* 'equal percentage reductions from current levels by all countries'.
- *Inter-generational*: 'Discount valuation of future impacts by (for example) 5% per annum to arrive at present value of future impacts' *versus* 'do not discount'!
- *Responsibility for impacts*: 'Responsibility strictly in line with aggregate GHG emissions by countries' *versus* 'past emissions involve no guilt and hence each country bears its own costs'.
- *Determination of level of 'catastrophic impacts'*: 'Small island states may not drown' *versus* 'monsoon may not shift dramatically' *versus* 'cherry may not blossom in NY in December'.

The accepted equity formulations have immense practical consequences. In the context of lifestyle changes, the prevalent understanding of 'equity' and 'responsibility' may require messages to be narrow-casted to reach particular audiences. But it is questionable whether one can go beyond pure subjective intuition/decibel level/power (political/

military/economic) in deciding these issues. Dr Ghosh suggested that formal ethical theory can help structure and provide rational foundations to particular equity arguments, taking it beyond the ambit of sheer power. Equity is synonymous with 'fairness' and 'justice' and is a subset of 'ethics', which refers to the acceptability of 'goals/processes' of various actions. Clearly, the appraisal of goals/processes can only be with respect to some general principle(s) or standard(s), which must be rationally justified.

However, the determination of intra-country equity on the basis of consumption levels of class segments comes across some conceptual/technical problems: separation of activities involving energy use between consumption and production; and recognition of beneficiaries of diverse, interconnected activities involved in production or a productive activity involving consumption. Dr Ghosh pointed out that, in practice, the only feasible indicator of societal sustainability is societal per-capita GHG emissions.

### Building a low-carbon society: lessons from Japan

A low-carbon society is characterized by actions compatible with the principles of sustainable development, while ensuring that the development needs of all groups (current and future) within a society are met; there are deep reductions in GHG emissions in order to avoid dangerous climate change; there is high energy efficiency and use of renewable energy sources; and there is emphasis is on sustainable lifestyles and institutions with reduced carbon footprint. Mr Hideyuki Mori shared Japan's experience of working towards building a low-carbon society. Citing a study, Mr Mori remarked that in both a technology-oriented scenario and a slower, societal change oriented scenario, a 70% cut in Japan's GHG emissions is possible by 2050, at the additional annual direct cost of about 1% of the GDP (gross domestic product) in 2050. Both the scenarios, however, assume significant demand side management and thus lifestyle changes. Japan's initiatives have been targeted across sectors. Housing is now characterized by improved insulation (double glazing, sash insulation, use of insulation materials in ceilings, walls, floors, and soon); maximum use of sunlight (natural heating); installation of solar heaters/panels; and promotion of roof gardens. Subsidies for the installation of solar panels and tax incentives have also been introduced. In the area of transport, purchase of low-emission vehicles (hybrid, small cars) and eco-driving (no idling) are being encouraged. Car pools, use of public transport, walking, cycling, and advanced traffic management systems are being promoted. The Japanese government has applied the environmentally sustainable transport model in 727 cities.

The country's Top Runner approach promotes manufacture and development of energy-efficient products. The use of energy-saving bulbs and energy-efficient appliances, maintenance of appropriate room temperatures, plugging-off of appliances during sleep mode, and recycling and reduced use of plastic bags are being encouraged. The IGES has piloted an innovative scheme as part of which it establishes a local consortium to diagnose a household's potential to improve efficiency and offers consultancy. The Cool Biz/Warm Biz campaigns that define appropriate clothing for summers and winters so as to reduce use of heating and air conditioning have had a huge impact on public awareness levels.

The Japanese experience suggests that a movement in the direction of lifestyle changes calls for the 'building of a coalition' amongst the various components of the social structure. According to Dr Pachauri, it is important that people in positions of political and social leadership highlight the significance of the matter, and draw public attention to the possibilities for change. Industry too has an important role to play, and more so because valuable business opportunities lie in the large emerging markets for eco-friendly products and services. Dr Jhirad highlighted the work of philanthropic organizations and political coalitions such as the US Climate Action Partnership that comprises about 27 large industries (GE, Caterpillar, British Petroleum, and others); policy research groups such as the World Resources Institute; and non-profit organizations that have called upon the US government to enact mandatory legislation to give a price to carbon and work towards strong cap and trade systems. In addition, what is required is a 'ground-swell of desire, opinion, and aspiration'

that moves people towards adopting lifestyle changes. It is important for people to identify with the cause of energy security and GHG mitigation.

### Leveraging the media

Scientists use a language that is difficult for a layperson to understand. If consumers need to change the way they live to mitigate climate change and improve energy security, outreach through media has an important role to play. Documentary film-makers, radio content developers, and media persons from print and broadcast today are increasingly talking about the issues related to climate change and reporting the same. It is the media's task to initiate common people into thinking about these pertinent issues, and to convey messages to the public in a language that they can understand and relate to. Also, there are many who are willing to embrace a more climate-conscious lifestyle, but either lack the motivation to take action or are uninformed as to how they can contribute. Here, the media's role extends to empowering people with relevant information, and initiating and sustaining a revolution of ideas at the grass roots. The media is also in a position to influence policy-making by informing and engaging policy-makers.

Ms Urvashi Sibal shared that conveying the message – that energy saved is money saved – through the media is an important part of the movement to change lifestyles. She cited the example of a village in Haryana where CFLs (compact fluorescent lamps) have completely replaced inefficient bulbs. The consumers may not be able to explain the positive impact of their shift to CFLs on the environment but are aware that this saves energy and is therefore cost-effective. Reduced electricity bills are an important incentive for change.

### Decoupling consumption and happiness

Large cuts in GHG emissions required to stabilize temperatures are clearly difficult, if not impossible to achieve, if we continue to think within a paradigm of growth that is based on increase in GDP per capita and rising living standards. Mr Uday Khemka urged the audience to look beyond the technocratic view of climate change and interrogate the current paradigm of progress. The arithmetic dilemma that faces our civilization, with regard to addressing the problem of GHG emissions and climate change, can only be resolved by establishing a connection with human realities. Happiness thus needs to be decoupled from conspicuous consumption. Referring to Maslow's 'hierarchy of needs', Mr Khemka said that intuitively one realizes that the marginal return on happiness in the early parts of the hierarchy is enormously higher than that in the final parts of the hierarchy. The work of the New Economic Foundation, London, empirically corroborates this. The values created by utilitarianism and materialism in the context of capitalism were useful in bringing society up to a point, but a perpetuation of these values are pushing people to ever higher levels of unsustainable consumerism.

Humankind today needs to draw from ancient resources of knowledge and spirituality. To aid this, India has immense spiritual resources to offer to the planet. Today's times offer an opportunity to bring a different level of discourse and dialogue to the table that engages with the role world religions and spiritual training can play in addressing the problem of climate change and energy insecurity. Spirituality must be well-integrated into the education system and the focus should be on training the body, mind, the spirit, and the intellect. Mr Khemka articulated the need for a new *satyagraha* that implies 'holding to the truth'—one that has an 'institutional expression' in political and social life.

### Conclusion

Societies often tend to *react* to environmental changes, which proves costly in the long term. Lifestyle changes provide a window of opportunity for, gradually and incrementally, enhancing energy security and mitigating climate change. A comparative analysis of countries with regard to energy inputs per unit of output energy delivered through food; waste generation and recycling; and energy and emissions per unit of passenger transportation movement reveals that 45%–55% of total energy used is influenced by consumers' choices with regard to personal transportation, personal services, and homes. The core question is

how to influence personal activities and choices in the interest of sustainability.

Educating the youth, and consumers in general, is crucial for initiating change in lifestyles. There is a need to recognize the ethical basis for change and the spiritual basis for happiness that values justice and economy of use. Clearly, none of this can be achieved without the support of policy changes, technological research and development, marketing of energy-efficient products, and financial incentives. Cross-sectoral involvement, public–private partnership, and government–citizen collaboration can successfully chart the way towards sustainable lifestyles.

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# *Contributions*

*Energy Security Insights* is a quarterly bulletin of the Centre for Research on Energy Security, The Energy and Resources Institute (TERI), New Delhi. It seeks to further a multistakeholder and multi-disciplinary engagement with issues that characterize the energy security debate, encompassing its domestic and international dimensions. It examines global developments in the energy sector and how these affect India's choices, and encourages policy-relevant research. While exploring issues of contemporary relevance, the bulletin seeks to expand the contours of the debate on energy security in the interest of inclusiveness, intellectual rigor and sound policy-making.

The next issue of *Energy Security Insights* will focus on

- ***Pricing and Energy Security***

We welcome contributions for subsequent issues which will include articles on the following

- ***International energy collaborations*** (Last date for submission – 20 May 2008)
- ***Renewable energy and energy efficiency*** (Last date for submission – 20 August 2008)

Please email the contributions to Deepti Mahajan at *deeptim@teri.res.in*

# Centre for Research on Energy Security

CeRES (Centre for Research on Energy Security) was set up on 31 May 2005. The objective of the Centre is to conduct research and provide analysis, information, and direction on issues related to energy security in India. It aims to track global energy demands, supply, prices, and technological research/breakthroughs – both in the present and for the future – and analyse their implications for global as well as India's energy security, and in relation to the energy needs of the poor. Its mission is also to engage in international, regional, and national dialogues on energy security issues, form strategic partnerships with various countries, and take initiatives that would be in India's and the region's long-term energy interest. *Energy Security Insights* is a quarterly bulletin of CeRES that seeks to establish a multistakeholder dialogue on these issues.

Previous issues of this newsletter are available at <http://www.teriin.org/div_inside.php?id=41&m=3>.

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