



ADB Working Paper Series

Lifestyle Choices and Societal Behavior Changes as Local Climate Strategy

Brahmanand Mohanty,
Martin Scherfler, and
Vikram Devatha

No. 398
November 2012

Asian Development Bank Institute

Brahmanand Mohanty is visiting faculty member at the Asian Institute of Technology. Martin Scherfler and Vikram Devatha are project managers at Auroville Consulting.

The views expressed in this paper are the views of the author and do not necessarily reflect the views or policies of ADBI, the ADB, its Board of Directors, or the governments they represent. ADBI does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of their use. Terminology used may not necessarily be consistent with ADB official terms.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. ADBI encourages readers to post their comments on the main page for each working paper (given in the citation below). Some working papers may develop into other forms of publication.

Suggested citation:

Mohanty, B., M. Scherfler, and V. Devatha. 2012. Lifestyle Choices and Societal Behavior Changes as Local Climate Strategy. ADBI Working Paper 398. Tokyo: Asian Development Bank Institute. Available: <http://www.adbi.org/working-paper/2012/11/30/5342.lifestyle.choices.societal.behavior.changes/>

Please contact the authors for information about this paper.

Email: mohanty@ait.asia; martin@aurovilleconsulting.com; vikram@aurovilleconsulting.com

Asian Development Bank Institute
Kasumigaseki Building 8F
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

© 2012 Asian Development Bank Institute

Abstract

The Asia-Pacific region is witnessing rapid economic growth. Along with rising incomes, the lifestyles of the large middle class are moving quickly towards a buy-and-discard consumer model that involves carbon-intensive products and services. These increase dependency on the Earth's finite natural resources and simultaneously produces waste, putting a significant strain on the environment. Such lifestyles, coupled with scarce resources and frequent natural hazards associated with climate change, pose serious threats to the future of the planet.

Developed countries with high footprint per capita are under pressure to adjust their lifestyles that respect the Earth's carrying capacity. As far as countries in the Asia and Pacific region are concerned, mere technological solutions such as improving production efficiency will not be adequate to address climate change; a paradigm shift to more resource-efficient and low-carbon lifestyles, that promote inclusive and efficient consumption is the need of the hour.

Several examples of good practices and community initiatives can be found around the world, but these have yet to be brought to the mainstream in order to achieve tangible results. Governments and policy makers in the Asia-Pacific can join hands with businesses and civil society to accelerate this transition—from a consumption-oriented economic paradigm, to a more sustainable way of production and consumption.

This paper attempts to identify lifestyle changes at the individual level, and behavioral changes at the community level that could offer high carbon abatement potential. It also provides some good practices of public policies and policy recommendations that can be pivotal in making a business case of low-carbon and eco-efficient lifestyles, strengthening collective awareness, and influencing public decision-making in developing countries in Asia.

JEL Classification: Q2, Q21, Q28, F18, H23

Contents

1.	Introduction.....	3
2.	Review of the Current Situation	4
2.1	Demographic considerations	4
2.2	Urbanization Trends	5
2.3	Food	6
2.4	Water.....	6
2.5	Electricity	6
2.6	Transport and Mobility	7
2.7	Housing and Construction	8
2.8	Waste	9
2.9	Carrying Capacity	10
2.10	Cost of Climate Change.....	11
2.11	Conventional and Alternative Indices of Progress and Development	11
3.	Ecological Lifestyle Choices	13
3.1	Food and Diet.....	15
3.2	Water.....	17
3.3	Electricity.....	21
3.4	Transport.....	24
3.5	Building and Construction.....	28
3.6	Waste	31
4.	Behavioral Change at Community Level	34
5.	Policies and Strategies	43
5.1	Food	45
5.2	Water.....	47
5.3	Electricity	48
5.4	Transport.....	50
5.5	Construction	51
5.6	Urban Planning.....	53
5.7	Waste	54
5.8	Awareness Campaigns.....	55
6.	Conclusion.....	57
	Bibliography	58

1. INTRODUCTION

Asia represents about 30% of landmass, 60% of the world's population, and 30% of the global consumption of energy (Mohanty 2010). Most countries in the region are in the process of development. The urban population in Asia is expected to grow to 2.7 billion people by 2030. Although Asia's contribution to climate change is relatively low at present, this is expected to change as a result of rapid population growth and urbanization. Asian cities have become engines of economic growth, producing 80% of the region's gross domestic product (GDP). However, along with this growth, poverty and income disparities are becoming more common—over 40% of the urban population lives in slums and lacks access to basic amenities and services. The wealth generated in the cities is at the cost of a high use of resources; cities account for 67% of all energy use and 80% of all greenhouse gas (GHG) emissions (ICLEI 2011), two-thirds of which are contributed by fossil energies that have become a necessity for modern-day living.

Industrialized nations went through three distinct phases of development—poverty alleviation, industrialization and mass production & consumption. Asia is experiencing a simultaneous occurrence of all three phenomena—while per capita energy consumption is low and poverty is rampant, there is massive growth in production, mostly to cater to the industrialized world. To satisfy their needs, demands and aspirations, the urban upper and middle classes are adopting lifestyles comparable to those of developed countries. In spite of the fact that Asia's average per capita ecological footprint is still relatively light, there is a need for serious reflection on whether it is wise to continue with the present exponential growth pattern that aims for a lifestyle that is unsustainable.

The western world is undergoing tremendous pressure to adjust to a lifestyle that matches the earth's carrying capacity, and several governments have initiated policies and programs in this direction. There have also been some interesting and successful initiatives, though limited in nature, to adopt the so-called “one planet living” lifestyle.

Growth patterns have demonstrated that it is not necessary to consume excessively in order to improve the Human Development Index (HDI) of the United Nations Development Programme (UNDP), which is used widely as a yardstick to measure the level of development in a country. Cuba for instance, has achieved a high HDI while remaining within the stipulated average bio-capacity threshold per person (WWF 2006).¹

Along with the economic growth that is taking place in cities, there is a trend to depend on more resources and produce more waste. On one hand, the present models of development tend to favor large centralized systems that offer economies of scale. On the other hand, thanks to the technological progress made in the last few decades, it is now possible to find solutions that are decentralized, efficient, reliable, cost-effective, and well suited to the developing countries' context. Moreover, governments have to understand that they cannot address climate change challenges without significant behavioral changes as well as active participation of the population.

¹ In the 2006 Living Planet Report Cuba was listed as the only country to fall into the “sustainable 14 category” with both a low ecological footprint and a rather high quality of living. By 2010 Cuba slipped just out of the sustainable category (WWF 2010).

This paper attempts to identify some lifestyle changes at the individual level, and behavioral changes at the community level that could offer high carbon abatement potential. It also provides some best practices of public policies and policy recommendations that can be pivotal in strengthening the collective awareness and decision making of people to change their lifestyle in lieu of climate change.

2. REVIEW OF THE CURRENT SITUATION

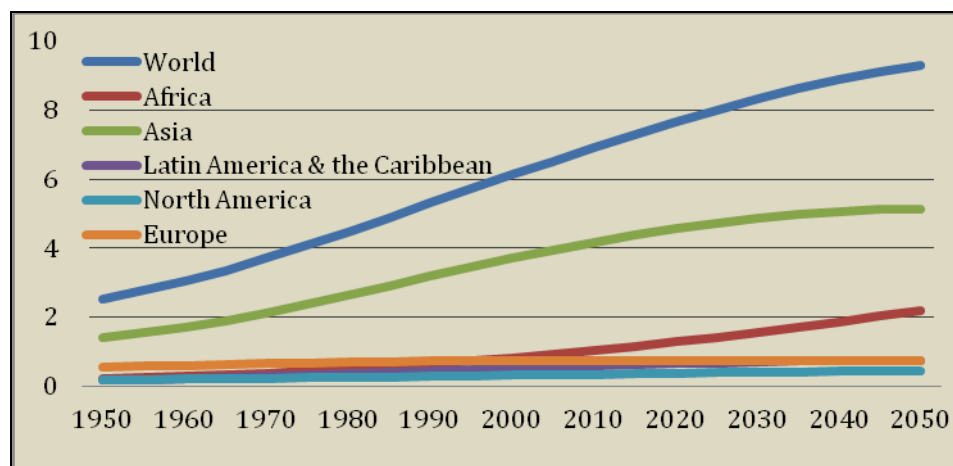
2.1 Demographic considerations

The 20th century can be described as an era of population explosion. At the beginning of the century, the world population was about 1.6 billion and it grew almost four times, to about 6.1 billion by 2000. In addition, the global economy grew sevenfold from 1950 to 2000 (GIZ 2010). The magnitude of this population change and economic growth is unprecedented in human history. In 2011, the Earth's population exceeded 7 billion and according to United Nations (UN) population projections, it will cross 9 billion by the middle of this century (United Nations 2011a).

Much of this projected increase in population will come from countries in Africa, Asia, Latin America and Oceania. Asia, the world's largest and most populous continent, covers 29.9% of the world's land area and hosts 60% of the world's current population (about 4 billion). It is not only the most populated continent but also has the highest population density per square kilometer—2.5 times the world average. Asia's population is expected to grow by another billion by 2050, putting heavy pressure on the planet's bio-capacity (Figure 1).

Figure 1: Population Growth for World Regions, 1950–2050

(billion)



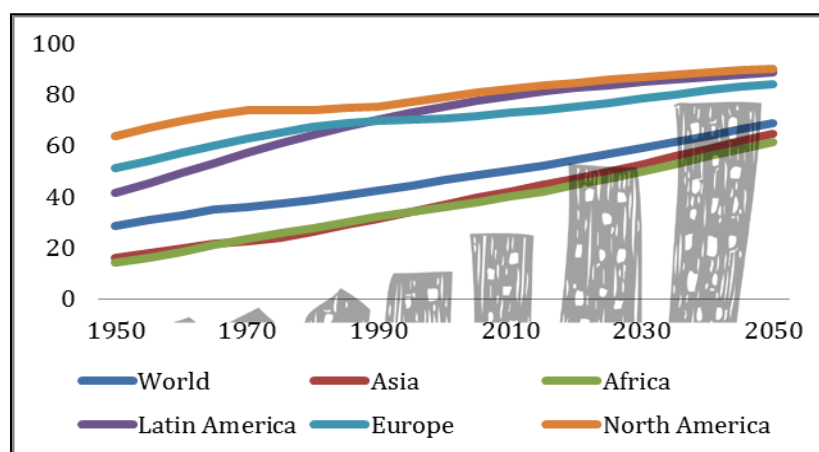
Adapted from: United Nations, Department of Economic and Social Affairs
Database. http://esa.un.org/unpd/wpp/unpp/panel_population.htm (accessed July 2011).

2.2 Urbanization Trends

In 2012, about 3.3 billion people, representing more than half of the world's population, live in cities. By 2050, another 3 billion people are expected to be living in urban areas, which will make a total of 6.3 billion urban dwellers or about 68% of the global population (Dodman 2009). Figure 2 shows the projected increase of urban population by continent till 2050. As a result, the size of built-up areas is bound to increase; urban centers will continue to absorb the hinterland, and thereby reduce the bio-capacity of the region. According to UN estimates, the total built-up area of urban spaces will triple by 2033 (United Nations, 2011a). The 21st century will symbolize urban development. Cities need vast amounts of water and energy for transportation, infrastructure, housing and food supply. Ironically, while cities become economic powerhouses of the world and account for a large percentage of the global consumption, many of their inhabitants remain below the poverty line. The way we cope with the social, cultural and environmental challenges of the future will have tremendous impact on the planet as well as on the future of humanity.

Figure 2: Proportion of Urban Population, 1950–2050

(%)



Adapted from: United Nations, Department of Economic and Social Affairs
Database. http://esa.un.org/unpd/wpp/unpp/panel_population.htm (accessed July 2011).

In Asia, the urban population is expected to double by 2030. For the first time, more people will be living in urban areas than in the countryside. Immigration from rural areas will be triggered mainly by the pursuit of employment and a better quality of life. Most of this growth will take place in informal settlements and slum areas. In 2012, about 1 billion urban dwellers live in slums, representing nearly a third of all urban dwellers worldwide. The following sections illustrate the current state in key areas, drawing from figures and statistics of the previous decades, and forecasting further into the 21st century.

2.3 Food

Feeding the projected population of 9 billion in 2050 would require a 70% increase in global food production. But even in 2012, with a global population of over 7 billion, 1 billion people do not have the required daily calorie intake. Paradoxically, many of them are farmers themselves (Organisation for Economic Co-operation and Development [OECD]-Food and Agriculture Organization of the United Nations [FAO] 2010). The challenge then, will be to feed the existing population as well as the projected increase of 3 billion people in the coming decades. This will lead to a higher demand for energy and land resources, in an era when the present usage already has adverse impacts on the environment. The global arable land per capita is projected to shrink from 2.00 hectares to about 0.18 hectare by 2025 (Kwang 2011). That means that there will be more mouths to feed, with less land available for crops or rearing livestock.

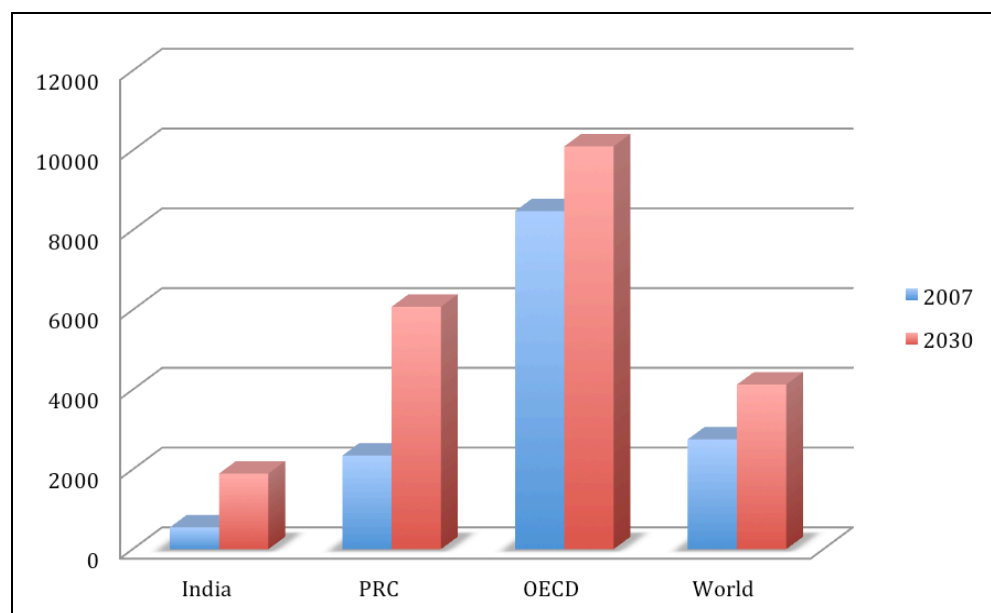
The rise in disposable income tends to induce a change in diet, such as a higher intake of meat, dairy and vegetable oil products. Meat and dairy production requires a relatively high level of energy, cereal and water input. It takes an average of 3 kilograms of grain to produce 1 kilogram of meat. If the cereal that is used to feed animals was instead used to feed the human population, the annual calorie requirement of more than 3.5 billion people could be provided for (Nellemann et al. 2009). In Asia, demand for meat products and processed foods will exacerbate the demand for arable land. Since arable land for agricultural expansion is highly limited (especially in countries like the People's Republic of China [PRC], India and Indonesia), Asia will not be able to meet this demand on its own, but will have to start importing food from the global market, leading to rising food prices.

2.4 Water

Water is one of the fundamental supporters of life and a basic commodity for mankind. Water resources are generally renewable, but water availability differs widely. The Asian continent, which supports about 60% of the world's population, has only 36% share of the world's fresh water resources. The per capita water availability for the PRC is about 2.138 cubic meters (m^3) per person a year; it is less for India at 1.719 m^3 and nearly five times more for the United States (US) 10,231 m^3 (Aquastat Database Query 2011). In 2012, about 470 million people are affected by severe water shortages and this is projected to increase to about 3 billion people by 2025 (International Energy Agency 2009). About 90% of the 3 billion people who are expected to be added to the population by 2050 will be in developing countries, many in regions where the current population does not have sustainable access to safe drinking water and adequate sanitation.

2.5 Electricity

Global electricity production and consumption are not sustainable. The main sources for energy are fossil fuels such as coal, oil and gas, which make electricity production one of the largest and fastest growing contributors to carbon dioxide (CO_2) emissions. These are finite resources that are being depleted at a rapid pace. According to forecasts by the International Energy Agency (IEA 2006), world energy demand will grow by almost 60% between 2002 and 2030. Population and economic growth in developing countries will drive most of this increase, with much coal-based generation capacity driving up CO_2 emissions. The IEA (2009) further estimates that under the current business-as-usual scenario, energy use in Asia will increase by 112% between 2007 and 2030 (Figure 3). India and the PRC are expected to triple their current per capita electricity consumption by 2030 (IEA 2009).

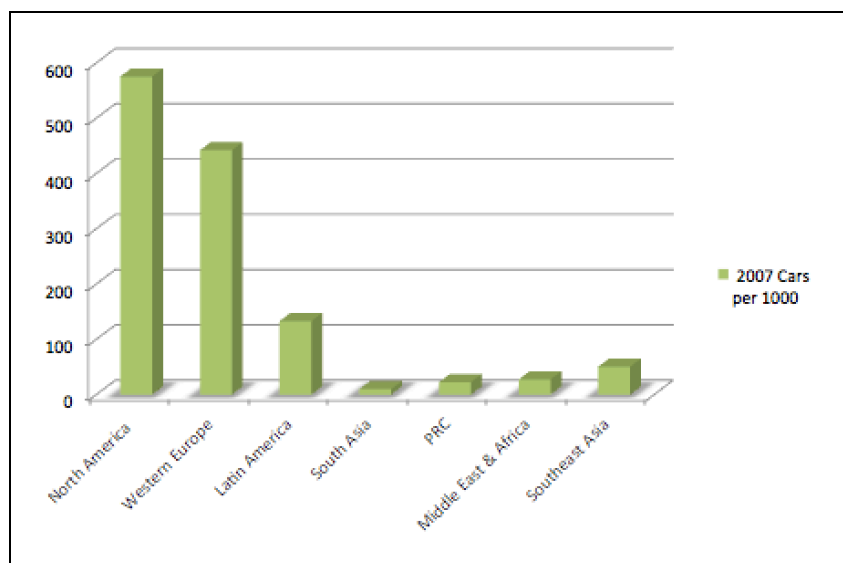
Figure 3: Annual Per Capita Electricity Consumption (kWh)

Adapted from: (IEA). 2009a.

2.6 Transport and Mobility

Transport is a key component of today's economic development, and its volume and intensity is increasing around the world. The problems and challenges associated with transport are growing equally fast—including air pollution, GHG emission, petroleum dependency, traffic congestions, traffic fatalities and infrastructure costs. These are especially pronounced in developing countries that have rapidly growing economies and population.

Asia is experiencing a vehicle boom. From 1977 to 2008, the PRC's vehicle ownership increased by a factor of 51, from 1 million to 51 million. Together, PRC and Indian consumers bought about 19.9 million new passenger vehicles in 2010, which is 70% more than in the US (Power 2011). The PRC became the largest auto market in the world. The increase in global vehicle ownership, as compared with an increase of the overall distance that people travel, drives up the demand for oil. Figure 4 shows the car ownership per 1,000 for 2007 for various geographical regions, indicating that some regions still have a long way to go to reach European or North American car ownership rates. The Asian Development Bank (ADB 2007) estimates that the demand for oil in 2030 will be three times greater than it was in 2007.

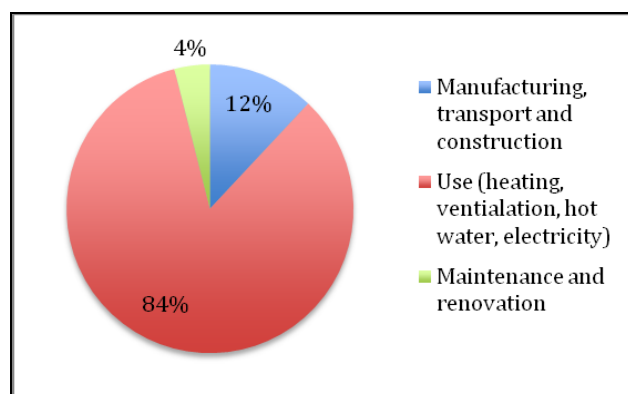
Figure 4: Cars per 1,000 in 2007

Adapted from: International Road Federation, World Road Statistics, various editions, OPEC Secretariat database. http://www.opec.org/opec_web/en/about_us/155.htm (accessed on 17 July 2011).

Urbanization and globalization have increased the need for transportation of goods. The World Economic Forum and Accenture (2009) estimate that the logistic and supply chain sector contributes to 5.5% of the global GHG emissions. In terms of emission intensity per ton-kilometer (km), airfreight is the most carbon-intensive, followed by road freight. On average, logistics and transport emissions account for 5%–15% of product lifecycle emissions (World Economic Forum and Accenture 2009). Given the current dependence on oil, the global transport sector faces a challenging future.

2.7 Housing and Construction

Most human needs (food, energy, water, and transport) revolve around the place of living and activity. Buildings are the convergence of humanity's end use of resources; they consume large amounts of raw materials, energy and water, and generate immense quantities of waste and pollution. The way we build is shaped by geography, by cultural values and by the availability of material resources. Buildings usually have a long life span, hence their effect on people and the environment is long and continuing; this makes the building sector a particular issue in terms of sustainability. According to a life cycle analysis in Building and Environment, more than 80% of energy demand in a building is used in operations such as heating, ventilation, hot water, etc. (Figure 5). The International Energy Agency (2006) estimates that current trends in energy demand for buildings will stimulate about half of the energy supply investments up to 2030. Buildings (both commercial and residential) account for about 40% of energy used, particularly in developed countries. In Asia, where large parts of the population are still not connected to the grid, and live in traditional houses, this figure is much lower but this is subject to rapid change with growing affluence.

Figure 5: Lifecycle Energy Use

Adapted from: Adalberth (1997a)

More than 50% of all new buildings constructed are in Asia. Construction is booming, especially in fast developing countries such as the PRC and India (Langer and Watson 2006). Construction alone is responsible for about 20% of global GHG emissions (Veolia 2008). According to the IPCC (2007) report, buildings have the largest potential of any sector for reducing GHG emissions, estimated at 30% by 2030 (Metz et al. 2007).

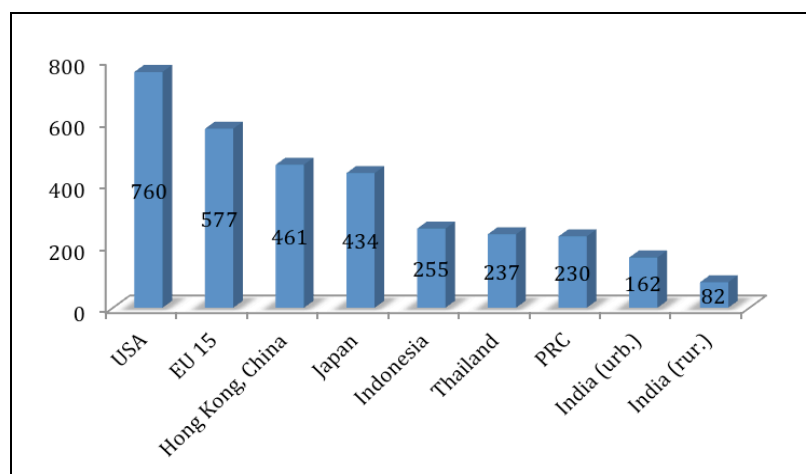
2.8 Waste

In the past, resources were regarded as rare and precious and each resource, including what we would define as waste, was used and reused, transmuting it into a new resource. This attitude of careful resource management still exists today in some cultures and especially in villages in developing countries, where everything has a value and the material cycle is completed, imitating the ecosystem.

We distinguish roughly between two different kinds of waste—municipal waste and industrial waste. It is estimated that the total amount of municipal and industrial waste produced annually is about 4 billion metric tons (Chalmin and Gaillochet 2009), and this figure does not include waste from construction, mining, agriculture, and forestry. The amount of municipal waste is directly linked to the standard of living, the level of commercial activities, consumption patterns, and lifestyle choices as well as the longevity of products. The total municipal waste collected worldwide in 2006 was estimated at 1.24 billion metric tons (Chalmin and Gaillochet 2009).

Low-income households have a higher percentage of organic waste than higher income households, whereas richer households discard more plastic, glass, paper, and metal because of their consumption patterns. In Europe, almost half of the generated municipal solid waste originates from packaging material (Eawag and Sandec 2008). Figure 6 illustrates the amount of municipal waste collected per inhabitant per year for selected countries.

Figure 6: Municipal Waste
(kg/inhabitant year)



Adapted from: Chalmin, and Gaillochet. (2009)

Chalmin and Gaillochet (2009) estimate the industrial waste collected to be 1.4 billion metric tons. That does not include hazardous waste (about 300 million tons), agricultural waste, waste from forestry or from construction and mining activities. About 70% of untreated industrial waste in developing countries is disposed of in water, contaminating existing water supplies; this leads to a loss of crop productivity in agriculture and to the contamination of our food chain, among other things. Processing of waste has a negative effect on global climate change because of high GHG output, especially of methane, which is known to have 21 times greater global warming potential than CO₂. ADB (2007) lists the global landfill sector as the third largest anthropogenic emission source, accounting for 12% of global methane emissions in 2005.

2.9 Carrying Capacity

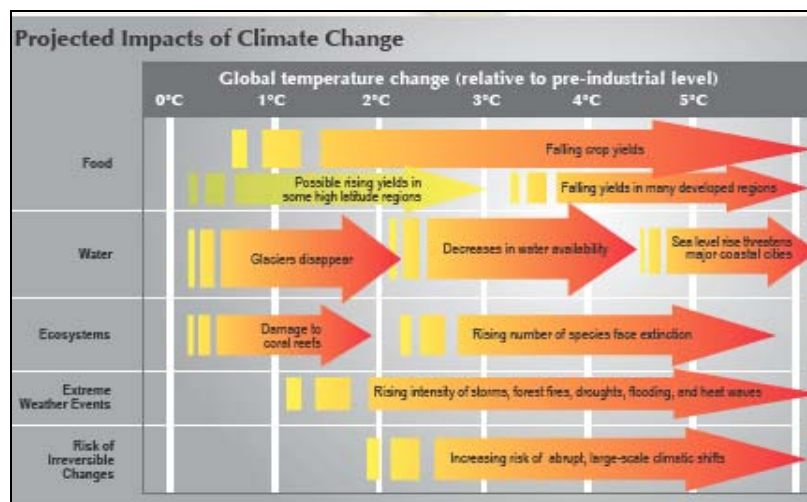
According to the Global Footprint Network (2011), humanity today uses the equivalent of 1.5 planets to provide the resources we consume and to absorb the waste we produce. Scenarios suggest that by 2030 we will need the equivalent of two Earths to support us—provided our current population and consumption trends continue. We are facing a global ecological overshoot, by consuming resources faster than the planet needs to replenish those resources in return. Some of the most noticeable effects of this overshoot are the buildup of CO₂ emissions and global climate change, the depletion of groundwater reserves, declining reserves of mineral resources, the loss of soil, and the depletion of forest cover. The existing world population cannot be brought up to the living standards of developed nations by using present technologies and consumption levels. For humanity to live within the boundaries of the planet's carrying capacities, new green technologies and smarter policy implementation will have to go hand in hand with lifestyles that promote less consumption and actively promote "prosumption."² The buy-and-discard principle of the developed world cannot be the model for the future, neither for developed nor developing countries.

² Prosumption is a concept that emphasizes producing what one consumes. The prosumption index can be used as a yardstick to measure what is produced as a share of resources consumed.

2.10 Cost of Climate Change

Climate change is a real and major threat to improving prosperity in the world and in Asia. If current trends continue, the GHG emissions of Asia and the Pacific will soon be comparable to those of Europe and North America. The region is responsible for 42% of all global energy-related emissions. Emissions from energy use alone are projected to be 127% higher in 2030 than they are in 2012 (ADB 2007), growing at 2.3% per year under business-as-usual scenarios. The costs of adapting to climate change will be colossal: a recent report suggests that by 2030, the world may need to spend more than €200 billion a year on measures such as building flood defenses, transporting water for agriculture, and rebuilding infrastructure affected by climate change (Martin et al. 2009). An ADB (2009) study estimates that by the end of this century, the total economic cost of climate change could be equivalent to an annual loss of 6%–7% of GDP of Asian countries. Decisive mitigation actions taken now can lower this impact. Figure 7 illustrates the projected impact of climate change.

Figure 7: Projected Impact of Climate Change



Source: IPCC. (2007a)

More intense typhoons, droughts, heat waves, landslides, and other natural hazards are results of accelerated global warming. Climate change threatens health, safety and livelihood of people. Coastal cities are vulnerable to climate change since the rise of sea level causes flooding and coastal erosion. Many coastal cities in Asia have tropical hot and humid climates in low-lying land, which heighten their vulnerability. Nowhere in the world are as many people affected by climate change as in Asia and the Pacific (ADB 2009a).

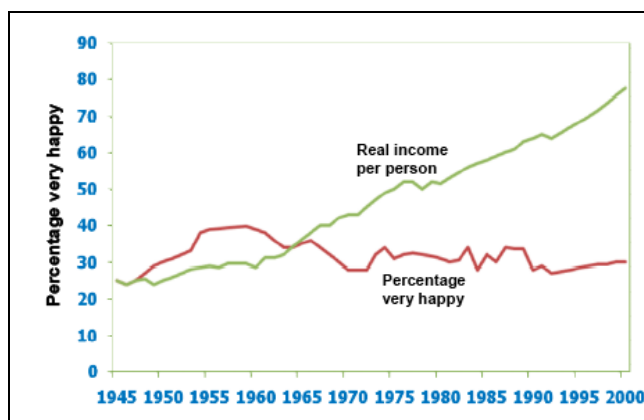
2.11 Conventional and Alternative Indices of Progress and Development

There seems to be a paradox connected to consumption and in the way we measure progress. Gross Domestic Product (GDP)—is the sum total of goods and services consumed by a nation in a given year—and is currently the most important measure of economic growth. As per this

definition, the more we consume the higher the GDP. If we were to consume less, then the economy is adversely affected, but continuing our current consumption pattern will exhaust the planet's carrying capacity. Obviously this measure of economic progress places consumption at top priority. The more we produce and consume, the more we prosper. External costs like environmental pollution, human well being, happiness, the distribution of income and wealth are not taken into account. We also fail to distinguish the costs incurred to compensate for undesirable events like environmental or natural disasters, which tend to inflate GDP since large sums are spent in mitigating such disasters.

Is it worthwhile to pursue further economic growth in developed countries? Does economic growth improve people's well being after a certain point? Data from surveys conducted in the United Kingdom (UK) and US reveal that life satisfaction has been stagnating in those countries since the 1950s, even though economic output per capita has tripled since then (Figure 8). When people's basic needs are met and they have enough goods and services, economic growth fails to improve people's well being (O'Neill, Dietz, and Jones 2010).

Figure 8: Income and Happiness in the United States



Source: Layard (2005)

An alternative to the endless economic growth paradigm is a steady state economy. Steady state economies aim at stable levels of resource consumption, a stable population, with resource use within the planet's ecological limit, equity in the distribution of wealth, and the pursuit of maximizing economic output is replaced by the goal of maximizing human well-being and quality of life (O'Neill, Dietz, and Jones 2010).

Indicators for measuring progress arise from a shared set of values; they also create and enhance those values in return. Changing indicators can be one of the most powerful and at the same time one of the easiest ways of making system changes (Meadows 1998). Over the past 20 years, new indicators of measuring human progress have been emerging. Some of them focus on selected aspects such as the environment (GHG emissions, eco-footprint), human well-being (Happy Life Years Index, Quality of Life, Human Happiness Index, Better Life Index), or economy (sufficiency economy). Others try to integrate these different aspects such as the Happy Planet Index (HPI) or the Gross National Happiness Index (Bhutan). Those indicators may eventually replace or at least complement GDP. The European Union (EU), for instance,

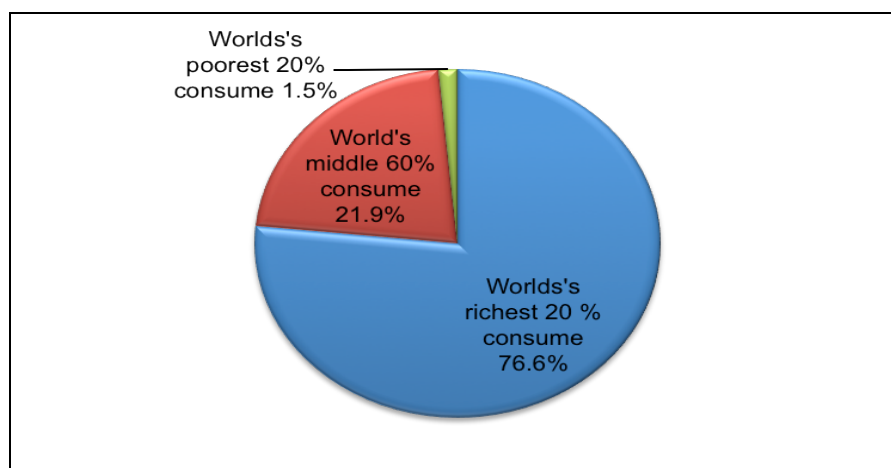
has identified 10 headline indicators (and sub-indicators) that should lead EU countries to a more sustainably integrated development (European Commission 2011):

1. socioeconomic development
2. sustainable production and consumption
3. social inclusion
4. demographic change
5. public health
6. climate change and energy
7. sustainable transport
8. natural resources
9. global partnership
10. good governance

To be truly effective, these indices need to be supported by strong policy frameworks and policy actions by governments at the national, state and city level.

3. ECOLOGICAL LIFESTYLE CHOICES

The rapidly escalating population growth in developing countries has often been named as one of the main causes of increasing demand for consumer goods and services and thereby pollution. However, we must note that the poor cannot afford resources, whereas wealthy people may use resources as a sign of affluence. About 86% of the world's resources are consumed by 20% of the world's wealthiest (World Bank 2008); this shows the close correlation between wealth and consumption (see also Figure 9). It also begs the question - what are the real needs and wants in terms of consumption and individual lifestyle choices. Making people aware of their needs and contrasting them with their wants, paired with a supportive policy environment, may have high potential in transforming lifestyles toward a low carbon society.

Figure 9: Share of the World's Private Consumption

Adapted from: World Bank. 2008. World Bank Development Indicators 2008. Poverty data: A supplement to World Development Indicators 2008. Washington, DC: World Bank.

Globalization and economic integration are giving consumers access to more goods and services. The media has increased its reach in many Asian nations, and this has had an unprecedented influence on the aspirations of consumers and their ways of life. Global middle-class consumers and global elites have become the target market for many consumer brands. The demand for consumer goods is rising rapidly. The PRC and India alone claim more than 20% of the global total—with a combined consumer class of 362 million (a mere 16% of the region's population), more than all of Western Europe (Worldwatch Institute 2011). The consumption patterns of these millions are merging with those of western countries—especially of the younger generations of urbanites who share a certain lifestyle that is independent of culture or nationality. Lifestyles in the developed countries are very energy-intensive and produce a high amount of waste.

Lifestyles are also largely driven by materialistic cultural values. Traditional Asian lifestyles were frugal, and are still common in many countries. These are generally less damaging to the environment and climate. For example, there is more communal living than individual housing in Asia, the number of occupants per unit is much higher, and traditional construction is based on natural materials like wood and mud. For food, there is less packaging and refrigeration, less processing, and fewer “food miles.”³ In the transport sector, private car ownership is still the exception rather than the norm (SWITCH-Asia Network Facility 2010). The sections that follow identify a few lifestyles changes among individuals and communities that could secure carbon mitigation.

Current policies that address GHG emissions are top-down in nature; they identify industries that emit the largest amount of GHGs and try to promote technologies that can reduce the emissions. However, bottom-up approaches to policy making could have an equally contagious effect, especially if it acquires a critical mass. These should emphasize nontechnical measures such as individual habit changes and improved knowledge.

Available low carbon technologies or appliances usually demand a high up-front investment, even though they prove to be energy and cost-efficient in the long run. High initial costs are a

³ The term food miles refers to the distance that food travels before it is eaten.

barrier for implementing these technologies. These vary among low-, middle-, and high-income countries. For example, compact fluorescent lamps (CFLs) are affordable for most people in high-income countries. For people in low-income countries, who are at the bottom of the pyramid, these are literally out of reach. Hence, policies that promote innovative business and market models need to be formulated. For example, CFLs can be handed out by power companies and paid back by the consumer in installments through the monthly savings in electricity bills. This will not only result in higher energy efficiency and GHG emission reduction but will also avoid the need for additional power generating capacity.

Another new market mechanism to support ecological lifestyle changes and GHG emission reductions is the product service system (PSS). This shifts the focus from selling products like washing machines to selling services, like a laundry service. The equipment (washing machines in this case) may still be at the client's home, but the company retains ownership, maintains and stores the cleaning equipment, will be responsible for the quality of the appliance, and will take care of waste disposal. This incentivizes the company to prolong the use of the product, reuse components, and recycle materials. At the same time, the consumer's costs are spread over time, which make it easier to opt for low energy and carbon-intensive solutions (United Nations Environment Programme 2001).

3.1 Food and Diet

Many individual lifestyle changes linked with food will have a positive impact on the eco-footprint or GHG emissions. Some of those choices require a dietary shift, while others require a change of habitual shopping practices.

The carbon impacts of the meat industry are known to be significant, not only from its high energy use, but also from its land use impacts. The Food and Agricultural Organization (FAO) estimates that direct and indirect emissions from the livestock sector contribute 18% of global GHG emissions. Indians, for instance, consume around 1/11th of the meat eaten by an average Chinese and 1/25th of that eaten by an American. A global transition to a low meat-diet would drastically reduce mitigation costs (Rao, Sant and Rajan 2009). Box 1 introduces a series of lifestyle changes that are related to food.

Box 1: Lifestyle changes in Food and diet

- ✓ Reduce food miles by eating locally grown food. If you eat local food just once a week you can save 2,268 kilograms (kg) of carbon dioxide (CO₂) (Hart District Council 2011). With a population of 4 billion in Asia, even if a mere 1% adopted such a change, over 100 million tons of CO₂ emissions could be averted.
- ✓ Switch to organic food as organic farming consumes 30% less energy than conventional farming (Rodale Institute 2005)
- ✓ Reduce consumption of meat and dairy products, which are responsible for 18% of global greenhouse gases (GHGs) and a major drain on water supplies (Agriculture and Consumer Protection Department, 2006).
- ✓ Grow your own food in the garden and do not waste food: Combining these actions could reduce our footprint by 11% (WWF 2011).
- ✓ Promote community kitchens, and save on bulk purchases and distribution.
- ✓ Promote food courts in public spaces – these have common maintenance facilities, common dining area, and common cutlery - help to reduce energy consumption, transportation requirements and wastage.

Case: Buying Organically Produced Food

Opting to buy organic food products can reduce an individual's personal carbon footprint. It is estimated that organic farming uses about 26% less energy to yield the same amount of products as conventional agriculture. Artificial fertilizers used in conventional agriculture are the largest source of nitrous oxide, a green house gas (GHG) that is 310 times more potent than CO₂ (Soil Association 2011). Synthetic fertilizers are also a source of water pollution and soil degradation. Organic agriculture contributes to the restoration of soils and to the building up of carbon storage.

Table 1 lists lifestyle changes related to food, potential hurdles that are associated with such changes, policies that can support these changes and example policies.

Table 1: Lifestyle Changes and Associated Factors for Food

Lifestyle Change	Hurdles	Policies and Initiatives	Examples	Level
Buy locally produced food	Lack of knowledge, personal preference	Offer free space for farmers market, events, awareness campaigns, food mile labeling	Rome, Italy: Public Food Procurement for schools tries to use locally produced food as much as possible (Liquori, year unknown)	Local
Buy organic food	Higher costs, lack of awareness, lack of availability	Cohesive labeling, support of organic agriculture through financial incentives, capacity building and market creating	Denmark has strong organic labeling and support for organic agriculture development (www.Organic.dk)	National; middle and high income groups
Community kitchens	Cultural values, quality of food	Awareness campaigns and events that strengthen the sense of community	Community Kitchen Auroville, India offers lunch and dinner for up to 800 people a day (www.auroville.org)	Local
Reduce consumption of meat and dairy products	Cultural values	Higher taxes on meat and dairy products, awareness campaigns		National

Lifestyle Change	Hurdles	Policies and Initiatives	Examples	Level
Food prosumption, promote edible landscaping	Land use patterns, lack of awareness	Mixed land use plan, supportive infrastructure, building codes for rooftop gardening, training and capacity building	Urban agriculture in Cuba increased with the allocation of urban land for food production, and strong support for seed and tool banks, training centers and corporations (Pinderhughes, Murphy, Facultad and Gonzalez, 2000)	Local and National
Bulk buying of groceries	Logistics	Legislation for supermarkets to offer certain food items in bulk or awards like incentives for supermarkets	Simple Bulk Market in Colorado, USA offers bulk purchase only (simplybulkmarket.com)	Local and National
Take packaging material and containers while shopping	Inconvenient, forgetfulness	Ban plastic covers and plastic packaging, provide containers on a deposit base	Deposits system for beverage containers in Germany (Ankerandersen 2011)	Local and National
Promote environment-friendly food courts in public spaces	Lack of infrastructure	Infrastructure and management support, certification	Certification scheme to boost the environmental practices of food courts in Singapore (Eco-business.com 2012)	Local

3.2 Water

Each individual can contribute to protecting water resources. Two main actions can be taken—reduce the demand for water through efficiency and conservation, and harvest rainwater. As with all lifestyle choices, these actions are dependent on socioeconomic status and geographical region.

Case: Changing Dietary Habits

Changing dietary habits by reducing meat and dairy products can significantly reduce the water footprint. Meat production requires a relatively high level of energy, cereal, and water input; and agriculture accounts for 70% of the global water withdrawal (Aquastat Database Query 2011). The Water Footprint Network estimates the global average water footprint at 15,500 liters of water for every kilogram (kg) of beef, 5,000 liters of water for a kg of cheese, 3,900 liters for a kg of chicken meat, and 1,300 liters of water per kg of barley (Water Footprint Network 2011). Rockström (2003) estimated that a diet consisting of 80% of plant-based foods and 20% meat (in industrialized countries, the proportion of meat is 30%–35%) requires 1,300 m³ of water per year, while a purely vegetarian diet requires around half this amount (Rockström et al.1999).

Case: Water Savings at the Household Level

Adopting a no-drip policy is vital, since all leakages waste water round the clock and need to be repaired. One may also adopt low-flush toilets that use less water, or switch to dry compost toilets. Other options to be considered are installation of water-efficient showerheads or the use of energy-labeled/rated washing machines, since they not only use less energy per load but also lower water consumption. Simple actions like turning off running taps while washing dishes, having a shower, or brushing teeth, or collecting unused water from the tap and using it to water plants will help reduce water usage. The treatment and reuse of grey water⁴ for flushing toilets needs to be considered. Householders can grow native plants in their gardens since these usually have lower water requirements. Owners of cars and bikes can either bring their vehicles to a carwash that uses recycled water or wash their vehicles themselves by using a sponge and rinse sparingly. Recycling will enable households to increase consumption without having to spend additional money.

Table 2 introduces a few lifestyle changes associated with water, along with possible hurdles in implementing those changes.

⁴ Grey water refers to “waste” water that is generated in homes and commercial buildings as a result of laundry, dishes and bathing. Grey water can be efficiently utilized for a variety of purposes such as irrigation or toilet flushing.

Table 2: Lifestyle Changes and Associated Factors for Water

Lifestyle Change	Hurdles	Policy and Initiatives	Example	Level
Conserve water, fix leaks	Lack of awareness, initial costs	Mandatory water metering, water pricing	Toronto, Canada has implemented a citywide water metering system to keep better track of water consumption across the city and to detect water losses (City of Toronto 2012)	Local
Use dry compost toilets	Inconvenient, lack of space for retrofitting, lack of knowledge, psychological barrier, availability of technology	Tax incentive for purchase and installation, education and awareness campaigns, mandatory installation in public buildings	Erdos eco-town project in the PRC is a full-scale urban residential area with urine diversion dry toilets, recycling of human excreta, and grey water treatment (Sustainable Sanitation Alliance 2011)	Local and national
Harvest rainwater	Unplanned growth, lack of space, lack of knowledge	Directive by state, correct water pricing	Ahmedabad, India made rainwater-harvesting mandatory for all buildings covering an area of over 1,500 m ² (Centre for Science & Environment 2011)	Local and national
Install water efficient flushes and showerheads	Initial investment, lack of awareness	Correct water pricing, innovative financing mechanism where the installations are paid for through monthly savings in the water bill, mandatory for new buildings	Jordan has implemented new codes for buildings that include water efficiency standards (DAI 2012)	Local and national

Lifestyle Change	Hurdles	Policy and Initiatives	Example	Level
Use Energy-Star compliant washing machines and dishwashers	Initial investment, lack of awareness	Correct water pricing, innovative financing mechanism where the installations are paid for through the monthly savings in the water bill	Washing machine rebate scheme in Sydney, to increase the availability of water and energy efficient machines. About 43% of the market are 4.5 star or greater machines (Sydney Water 2011)	Local and national/middle and high income groups
Turn off tap while brushing, shaving and washing dishes	Lack of awareness, inertia	Mandatory water metering, correct water pricing, awareness campaigns	In Singapore demand management is implemented by using an increasing block rate water tariff structure (Tortajada 2006)	Local
Treat and reuse grey water for flushing	Initial investment, lack of awareness, lack of infrastructure	Correct water pricing, innovative financing mechanism where the installations are paid for through the monthly savings in the water bill, legislation	In Tianjin, PRC, all sewer water will be collected, treated and sent back to families for flushing toilets (Liu 2011)	Local and national

m² = square meter, PRC = People's Republic of China.

3.3 Electricity

Individuals can significantly reduce their carbon-footprint in electricity consumption. This could entail using better appliances, but much can be achieved with higher awareness of the issues involved, along with motivation for adapting good practices.

Case: Energy-Efficient Appliances

Many opportunities for higher efficiency do not involve one large investment with a substantial return. Instead, they consist of many small actions that add up to offer significant energy savings. The most common household appliances today—including lamps, fans, fridges, televisions, washing machines, water heaters and computers—are still quite energy-inefficient and draw electricity in excess of what is normally required for using the appliance. Most of these appliances are left in standby mode, thereby offering the convenience of turning them on in an instant when required. It is estimated that turning off appliances at plug point would result in saving over 133 kg of CO₂ emissions per household annually (Centre for Environment Education 2010), and an immediate reduction in electricity bills.

Case: Compact Fluorescent Lamps

Another area of energy savings is to switch from incandescent bulbs to CFLs. CFLs are five times more efficient than regular incandescent bulbs. They also last longer and, hence there is a reduction in wastage. A switch offers an annual saving of 83 kg of CO₂ for every 100 Watt (W) bulb that is replaced with a 20 W CFL (Centre for Environment Education 2010). On the negative side, CFLs are more expensive, and have high mercury content. Also, the future of lighting may lie in light-emitting diodes (LEDs). However, at present the benefits of energy efficiency from CFLs, far outweigh their costs.

Numerous initiatives in Asian countries have encouraged the substitution of incandescent lamps by CFLs. In Bangladesh, which has long hours of power outages throughout the year, the World Bank supported the free distribution of 10 million CFLs to consumers to bridge the gap between demand and supply. Rather than giving away CFLs for free, governments or power utilities could also have a buy back policy for old bulbs, or even rent CFLs to households as a means of financing these initiatives. This will address the high adoption cost of these technologies and better appreciation of their benefits by end-users. Another initiative that will help in financing these schemes is to charge a small token deposit that is refunded when the bulbs are returned after their use. Box 2 introduces individual lifestyle choices related to energy, whereas Table 3 lists hurdles for such lifestyle choices, supportive policy actions and examples from policies around the world.

Box 2: Lifestyle Choices in Energy

- ✓ Use of pressure cookers instead of regular cooking pots has a carbon abatement potential of around 125 kilograms (kg) of carbon dioxide (CO₂) per household (Singer, Denruyter, & Jeffries 2011)
- ✓ Solar appliances such as cookers, water heaters, and lamps offer immediate carbon abatement. A single solar water heater, for instance, offers an annual saving of 687 kg of CO₂ emissions per year (Centre for Environment Education 2010). There are over 180 million households in a country like India. If 1% of these households switch to solar cookers, over 1 million tons of CO₂ emissions could be abated annually.
- ✓ Refer to energy labels for making purchasing decisions. An energy-efficient refrigerator or air conditioner offers savings of over 250 kg of CO₂ emissions per year, amounting to over \$30 savings in the annual electricity bill per appliance. A switch from desktop to notebook computers will result in over 275 kg of CO₂ abatement per cathode ray tube (CRT) monitor per year (Centre for Environment Education 2010). The high up-front costs are negated by the long-run savings from lower running and maintenance costs.
- ✓ Optimizing the settings in household appliances can also lead to great carbon emission savings. Using a cold cycle in the washing machine, rather than a hot cycle for washing day-to-day clothes, will use less electricity and result in about 100 kg of CO₂ saving. In the United Kingdom, it has been estimated that turning down the thermostat by 1°C will reduce the heating bill by 10%, amounting to a saving of £50 per year, as well as cutting down on CO₂ emissions (SOL₂O).
- ✓ Encourage sport and outdoor entertainment rather than computer games. This can save up to 90 kg of CO₂ emission per child per year (Centre for Environment Education 2010).

Table 3: Lifestyle Changes and Associated Factors for Energy

Lifestyle Change	Hurdles	Policies and Initiatives	Examples	Level
Encourage sport and outdoor entertainment	Lack of infrastructure, poor city plans, government priorities	Mandatory recreation/playground for certain density/region,		Local
Optimizing settings in household appliances	Lack of knowledge and awareness	Awareness campaigns, training programs, support energy service companies	National Energy Efficiency Awareness Campaigns (SWITCH!) in Malaysia (www.switch.org 2011)	Local
Switch to CFL lamps	High initial investment for low-income groups, lack of awareness	Payback schemes based on monthly savings through CFLs, government subsidies, awareness campaigns, phase out of incandescent light bulbs	Scheme to phase out incandescent bulbs from homes and replace them with CFLs in India. Partially financed by Clean Development Mechanism (Chadha 2010a)	Local and national and middle and low income class
Use energy-efficient appliances	High up-front investment, lack of awareness, lack of uniform standards	National standards and labeling, product service systems as market mechanism, tax incentives, soft credits	Energy labeling program for appliances and houses, promotion of energy efficiency in home design, and public awareness campaigns in Thailand (Climate Parliament 2009)	National and middle and high income class
Use of pressure cookers	High initial investment for low-income groups, lack of awareness	Payback schemes based on the monthly fuel savings through usage of pressure cooker, awareness campaigns	REEEP promotes CFLs, pressure cookers, stoves, and solar lighting systems. By applying a sustainable, replicable supply chain business model in Karnataka, India (Renewable Energy & Energy Efficiency Partnership 2011)	Local and low income class

Lifestyle Change	Hurdles	Policies and Initiatives	Examples	Level
Use of solar appliances such as water heaters, solar cookers, solar lamps, solar photovoltaic panels	High initial investment, lack of awareness, lack of availability	Loan systems, provide tax incentive /exemption for installation/use, rooftops are rented to corporate entities that will install grid-connected solar panels	Sustainable financing mechanisms for delivering renewable energy systems and fiscal incentives in South Africa e.g., Eskom Incentive Scheme for solar water heaters, Renewable Energy Finance Subsidy Office, and tax incentives for energy efficiency (Thabethe 2010)	Local and national

3.4 Transport

With rising population, the number of vehicles on the roads and the frequency of travel set to increase, it is critical that individuals learn to change behavior and lifestyles and become more efficient in transport. From initiatives around the world, and their successes, there is sufficient evidence to prove that individuals and communities are capable of altering their lifestyles and travel habits to become more environmentally friendly. This could take various forms, including and not limited to reduced car usage, a smaller number of road trips, better coordination with colleagues and partners in day-to-day travel, green driving, as well as walking and cycling for short trips. In the long term, they could change their homes and workplaces and work from home to reduce travel time. According to Anable (2008), individual travel behavior change can manifest itself in a variety of ways to help in carbon abatement. Though some of these may appear as small measures, when implemented at a city level or even at the community level, they can result in large carbon abatement.

Case: Walking and Cycling

Walking and cycling are often neglected, as they are viewed as modes of transport for short distances only. However, studies in the UK have shown that the average car journey is for less than 3 km and over half of all car trips are for distances less than 8 km (Department for Transport 2006). “Around half of all local car trips could be replaced using existing facilities by walking, cycling and/or public transport, although this potential varies between urban areas.” (Socialdata and Sustrans 2005: 12). It is likely to be the same in Asia, i.e., most trips are likely to be for short distances, for which resorting to walking and cycling can bring advantages in terms of time and money. The status symbol associated with owning a big car must be replaced with values and ideologies that are in tune with the environment.

Emissions are high for short journeys, especially when the engine is cold and the fuel catalyst is not yet working at full efficiency. As a result, if the bicycle replaces motorized vehicles for short

distances, the benefits gained are particularly high. These benefits include better health, air quality, zero carbon emissions and cost savings (Anable 2008).

Case: Green Driving

Changes to the way in which vehicles are driven are crucial in securing emission reductions. The Driving Standards Agency in the UK found that eco-driving training yields at least 8% improvement in fuel efficiency, amounting to over £2 billion in fuel bills. Eco-driving or green driving includes measures such as regular servicing to ensure fuel efficiency, keeping tires correctly inflated since underinflated tires increase drag, removing any extra luggage from the vehicle and combining many short trips to one long trip (AA 2011). Turning off the engine at traffic lights is found to save 63 kg of carbon emissions per car per year, translating into about \$30 at 2010 fuel prices (Sodhi et al. 2010). Many metropolitan cities now feature a traffic light change counter (a timer that counts down to the next light change). This is helpful in reminding people how much longer they will need to wait for the lights to change, and encourages them to turn off their engines. Driving smoothly, with smooth acceleration and reducing unnecessary braking, being conscious of the air conditioning in the car and changing gears early are all fuel-efficient measures.

Case Study: Better Place

Better Place is a company that develops and provides services for electric vehicles with the aim of achieving sustainable transportation. By collaborating with the government, businesses and utility companies, Better Place arranges for drivers, systems and infrastructure for electric vehicles globally. By establishing an international standard, compatibility of different providers and cars are guaranteed. Solutions to challenges such as availability of charging stations and the need to exchange the battery for longer trips are also provided. By matching the need to reduce CO₂ emissions of cars with the growing availability of electricity generated by renewable energy, Better Place has found an innovative business model (Tuncer & Groezinger 2010)

Case: Carbon Offsetting at Intrepid Travel, Australia

Intrepid is a “sustainable travel company” that tries to minimize the negative impact of climate change. All intra-trip travel including flights is offset; the company measures its footprint, and avoids activities that contribute to emissions and reduce carbon emissions of its essential activities. In 2009, approximately 5000 tons of CO₂ were offset through 38 carbon-offset trips. With the expansion of carbon offset across the majority of their portfolio in 2010, Intrepid expects to offset 25,000 tons of carbon emissions by the end of the year, equivalent to taking 4,800 passenger cars off the road for a year (Mitrovic 2010). A unique selling point of Intrepid is its sustainability campaign and it caters to those who understand the environmental issues at stake. More and more businesses are discovering this niche market, and contributing to the cause.

Box 3 refers to travel and mobility related lifestyle choices. List 4 provides mobility related lifestyle choices, hindrances in implementing them, supportive policy actions and existing policies from around the world.

Box 3: Travel Lifestyle Choices

- ✓ Restrict air travel; use land and rail for short distances as these emit less carbon: A passenger on a flight from London to Paris is responsible for ten times more carbon dioxide (CO₂) emissions than a person using the Eurostar train for the same route (WWF 2011).
- ✓ Adopt green driving practices: For the United Kingdom (UK), a 7% average saving across all road vehicles through green driving practices would represent a cut of 1.2% of all UK CO₂ emissions a year (Forum for the Future 2008).
- ✓ Use public transport and reduce dependence on private vehicles: a single person, who switches a 32 km round trip commute to existing public transportation, can reduce his or her annual CO₂ emissions by 2,180 kilograms (kg) a year (CUNY and SAIC 2007)
- ✓ Use home delivery for routine purchases. Home delivery has been found to be four times more efficient than individual shopping trips, resulting in a 13 mega tons of global carbon abatement potential (World Economic Forum and Accenture 2009).
- ✓ Walk or cycle short distances: emissions are high for short journeys, especially since the engine is still cold and the fuel catalyst is not yet working at full efficiency. As a result, if these trips are replaced by the cycle for short distances the benefits gained are particularly high (Anable 2008).
- ✓ Work from home when possible and reduce travel miles.
- ✓ Teleconference rather than commuting to conference.

Table 4: Lifestyle Changes and Associated Factors for Travel

Lifestyle Change	Hurdles	Policy	Examples and Initiatives	Level
Adopt green driving practices	Lack of awareness and knowledge	Mandatory component for acquiring a driving license, awareness campaigns, smart signage	ASEF initiative in green driving in Beijing (United Nations Development Program 2011)	Local and national, middle income class
Restrict air travel	Culture, lack of alternatives	Taxes for exceeding a certain number of air miles a year, promote rail transport as alternative	Taxes and fees being charged to passengers using air miles in the UK (Gordon 2011)	National, high income class
Teleconference rather than commuting for conferences	Corporate policies	High-speed internet connections, awareness campaigns	IT sector in India	Local
Use home delivery for routine purchases	Infrastructure unavailable	Tax incentives for home delivery	Home delivery store in Bangalore (Grocby.com 2011)	Local, middle and upper income class
Use public transport and reduce dependence on private vehicles	Poor public transport solutions	Make city centers motor-vehicle free, entry tax for private vehicles, integrated public transport solutions	Cordon area congestion pricing in Singapore and London (Transportation Alternatives 2011)	Local
Walk or cycle short distances	Poor city planning, e.g., urban sprawls, existing infrastructure is not conducive	Implement pedestrian- and cycle-friendly environment, make/improve cycle paths, smart and compact city planning, give cycles on hire	Vélib cycle hire service in Paris (Mairie de Paris, 2010)	Local, middle and upper income class
Work from home	Corporate policies	High-speed internet connections, awareness campaigns	IT sector in India	Local

3.5 Building and Construction

Given the large proportion that buildings and habitats contribute to carbon emissions, building dwellers should make the necessary changes to their lifestyles that help mitigate CO₂ emissions. There are two ways in which buildings consume energy and hence have the potential for mitigation and adaptation interventions: (i) energy used for the construction, including the embodied energy in building materials used; and (ii) energy consumed during operation and maintenance.

Even though buildings are market driven, many of the lifestyle choices in this sector are largely dependent on policies, market creation and capacity building of builders and architects. The easiest carbon saving interventions for individuals seem to be energy cost saving measures and retrofitting of existing buildings with greener technologies. Analysis of a study conducted by the World Business Council for Sustainable Development (WBCSD 2009) concludes that technology alone is unlikely to guarantee building energy performance. “Wasteful behavior can add one-third to a building’s designed energy performance, while conservation behavior can save a third” (WBCSD 2009: 62) On the whole, wasteful behavior uses twice as much energy.

Case: Local Materials

Locally available materials like wood, mud and stone do not need a large amount of external energy to keep temperatures inside comfortable. Conventional building methods use tremendous quantities of material, many of them nonrenewable and toxic, and pay little attention to the impact the building has on the environment. Switching to green building methods and technologies can offer significant benefits.

Box 4 gives a list of criteria of “What Makes Buildings Green” by the Ministry of New and Renewable Energy India

Box 4: What Makes Buildings Green?

The following measures could be considered while designing and constructing a green building:

- ✓ Site selection—easy availability of public transport and public conveniences.
- ✓ Soil and landscape conservation. The topsoil and existing vegetation need to be preserved during construction. Changes to the soil conditions can affect the ecosystem, which takes a long time to revive itself.
- ✓ Conservation and efficient utilization of energy and resources. Water used during construction should be recycled and reused as much as possible. Proper measures should be taken to harvest rainwater even during the construction phase and wastage should be curbed.
- ✓ Waste management—waste generated during construction should be recycled and reused.

(MNRE and TERI 2010)

Initiative: Auroville Earth Institute, Auroville, India

The Auroville Earth Institute in India has been extensively researching and promoting earthen blocks as building material. These technologies have been found to be both cost-effective and energy-efficient. The main task is in finding ways to minimize the use of steel, cement and reinforced cement concrete with the use of composite blocks (earth, fibers and stabilizer). The Institute is also researching a “homeopathic” milk of lime and alum as an alternative to cement, along with alternative waterproofing with stabilized earth.

Case: Energy-Efficient House

Houses and office buildings can be converted into places of production with relatively minor alterations. By installing fuel cells, rooftop solar shingles, living machine wastewater treatment, rooftop gardens, etc. existing structures can contribute by minimizing their dependence on fossil fuel resources and thereby reducing their carbon emissions (Milani 2001).

Box 5 gives an overview of lifestyle choices related to building and housing. Table 5 presents potential hurdles for such choices, as well as supportive policy initiatives.

Box 5: Building and Habitat Lifestyle Choices

- ✓ Switch to green building and green technologies where possible.
- ✓ Use alternatives to cement and steel in constructions like rammed earth or bamboo as those contain less embodied energy.
- ✓ Use compact building spaces, and save on energy needs for heating and lighting.
- ✓ Use lighter-colored cabinets and countertops make rooms look more spacious and require less lighting.
- ✓ Divide the building into separate zones, each with a different indoor climate and hence different energy requirement; this will result in the best use of natural sources for heating, cooling and lighting and can achieve up to 30% energy use (Hyde 1998).
- ✓ Retrofit existing buildings with insulation: a study for Malaysia shows that mineral wool insulation of buildings would result in savings of over 32 million tons of carbon dioxide (CO₂) across Malaysia (MIMG 2009).
- ✓ Capture heat from water that goes down the drain from various activities such as dishwashing, clothes washing, and showers, saving up to 60% of heat energy that is otherwise lost (Wikipedia: The Free Encyclopedia 2011a).

Table 5: Lifestyle Changes and Associated Factors for Building and Construction

Lifestyle Change	Hurdles	Policy and Initiatives	Examples	Level
Capture heat from water that goes down the drain	Costs, availability of technologies, awareness	Tax incentives and special loans for equipment, awareness campaigns	Union Gas (Canada) sells drain water heat recovery systems to its customers (UnionGas 2011)	Local and national
Retrofit existing buildings with insulation	High initial upfront costs, lack of awareness	Tax incentives and special loans for retrofitting, awareness campaigns	The German Government provides tax incentives for thermal retrofitting (<u>Climate Policy Initiative 2012</u>)	Local and national, high income class
Switch to green building technologies	Lack of capacity, higher initial costs	Make green technologies mandatory for gated communities and big housing developments, tax incentives for private home builders	CALGreen is a mandatory green building standards code in California (Building Standards Commission 2011)	National, state
Use alternatives to cement and steel in constructions	Availability, lack of knowledge and capacity	Training centers for alternative building materials, higher taxes on steel and cement to boost the alternative building market	Earth compressed bricks being used by Auroville Earth Institute, India (Auroville Earth Institute 2011); cement production tax in Texas, United States (Onecle 2007)	National
Use compact building spaces, and save on energy needs for heating and lighting	Lack of design knowledge	Awareness campaigns, training centers on bioclimatic architecture	Bioclimatic Architecture Department of the National Renewable Energy Centre, Zaragoza, Spain (Zaragoza 2011)	Local and national

Lifestyle Change	Hurdles	Policy and Initiatives	Examples	Level
Zoning of buildings	Lack of design knowledge	Awareness campaigns, training centers on bioclimatic architecture	Zoning of buildings is mandatory for new buildings in Shanghai (Lausten 2008)	Local and national

3.6 Waste

On the consumer side, individuals have a range of choices to help reduce their waste. These need to be oriented toward the 3Rs—reduce, reuse, and recycle. Wherever possible, emphasis should first be on reducing one's waste. Each income class has very different lifestyle and shopping habit; the points listed below address mainly the consumer class.

Case: Green Shopping

Changing existing shopping patterns can help in reducing waste. Smart and green shopping habits such as purchasing durable goods or equipment, purchasing locally manufactured goods have a large impact on carbon emissions. Goods that use fewer resources for manufacturing, that are made of non-hazardous materials, and that do not produce hazardous waste can be given preference over others. Also, buying products with minimum packaging is an important choice a buyer can make.

Case: Waste Segregation

Waste segregation at the household level is important for waste materials to be turned into valuable resources later. Kitchen waste and other organic waste can be turned into compost. Special attention should be given to hazardous waste and electronic waste. Some companies have a buy-back policy that allows consumers to send back old equipment, and this should be used. Segregating waste and recycling allows individuals and communities to increase their consumption without having to incur additional expenses.

Box 6 summarizes some lifestyle choices for the waste sector. In Table 6 hurdles, supportive policy actions and existing policies from around the world are introduced.

Box 6: Lifestyle Choices Regarding Waste

- ✓ Use durable products made of nonhazardous and recyclable materials.
- ✓ Avoid heavy packaging. You can save 540 kilograms of carbon dioxide (CO₂) per annum if you cut down your garbage by 10% (Earthforce 2011). If a mere 1% of Asia's urban population avoided heavy packaging, over 6 million tons of CO₂ could be abated annually.
- ✓ Take your own bags when shopping, relying less on plastic bags. The US uses 100 billion plastic bags annually, consuming about 12 million barrels of oil. Less than 1% of plastic bags are ever recycled (WWF 2011).
- ✓ Buy in bulk where possible, avoiding excessive packaging material.
- ✓ Switch to e-accounts and e-statements, helping reduce paper waste. In the US, paper products make up the largest percentage of municipal solid waste, and hard copy bills alone generate almost 2 million tons of CO₂ per year (WWF 2011).
- ✓ Reuse cans, bags, and containers wherever possible.
- ✓ Segregate household waste, making it easy to recycle material. Recycling 1 ton of paper saves 26,500 liters of water, 2.3 cubic meters of landfill space and 4,100 kilowatt-hours of electricity (WWF 2011).
- ✓ Make your own compost from waste from the kitchen. Composting waste food can result in 0.09 kg–1.13 kg CO₂ eq avoided per kilogram (Sand-Arun and Bengtsson 2009)
- ✓ Send back old appliances like laptops to the company. About 40% of heavy metals including lead, mercury, and cadmium in landfills come from electronic equipment and discards (EPA 2008).

Table 6: Lifestyle Changes and Associated Factors for Waste

Lifestyle Change	Hurdles	Policies and Initiatives	Examples	Level
Avoid heavy packaging	Packaging design of products	Awards for companies that reduce packaging material, awareness campaigns	Packaging policy in the UK focuses on optimization of materials and improving rates of recycling (Roberts 2008)	National
Buy in bulk	Not available at supermarkets	Legislation and incentives for supermarkets to offer certain food items in bulk	eFoods Direct sells groceries in Utah, US (eFoodsDirect 2012)	Local and national
Make your own compost from kitchen waste	Inconvenient, lack of space, lack of knowledge	Mandatory, provide support infrastructure, free compost bins, micro business based on kitchen composting	Solid waste management program in Surabaya City, Indonesia (Samuel 1987)	Local
Reuse cans, bags, and containers	Inconvenient	Tax on waste, refund for cans, bags, and containers	Most EU countries have introduced landfill taxes (Economic Instruments in Environmental Policy 2010)	Local and national
Segregate household waste	Inconvenient, lack of supporting infrastructure	Mandatory, taxing of waste in high-income countries, purchasing of waste in low- and middle-income countries	NSW state government (Australia) purchases waste office paper for its needs (NSW Government 2011); segregation of garbage (wet and dry) is compulsory for large structures in Bangalore (Deccan Herald News Service 2011)	Local and national
Send back old appliances like laptops to the company	Inconvenient, awareness	Awareness campaigns	Dell (2012) and Apple (Price 2011) buy back old products when one buys a new computer from them. Both refurbish and resell their own computers with a 1-year warranty.	National

Lifestyle Change	Hurdles	Policies and Initiatives	Examples	Level
Switch to e-accounts and e-statements	Technological implementation, not everyone is connected to the internet	Directive by state, provide terminals to check account statements for those without internet access, extra charges for paper bills	Vodafone charges extra for providing paper bills (eBillingNews 2009)	Local and national
Take your own bags while going for shopping	Inconvenient, lack of awareness	Higher taxes on plastic bags, ban plastic bags at department stores	Ban on plastic bags in Coorg, India (Coorgnews 2011)	Local and national
Use durable products made of nonhazardous and recyclable materials	Lack of availability, lack of awareness	Stringent product labeling, lower taxes on such products	The EU has introduced a tire-labeling scheme intended to encourage consumers to buy greener tires for their vehicles (Phillips 2009)	National, upper income class

4. BEHAVIORAL CHANGE AT COMMUNITY LEVEL

Communities and neighborhoods can adopt significant changes in their behavior to help in carbon mitigation. Many of these will need the support of local authorities and the participation of most, if not all, residents for them to be truly successful.

Initiative: Subsidies in Los Angeles

The Los Angeles Department of Water and Power gives low-income households a new energy-efficient fridge for free or at a subsidized rate. “The program hopes to remove 50,000 old, inefficient refrigerators off the market and save the City \$12 million a year in fuel costs and reduce CO₂-related greenhouse gas emissions, equivalent of removing 40,000 cars off the road.” (The Scottish Government Riaghaltas na h-Alba 2009: 33)

Initiative: Top Runner Program

The “Top Runner” is a Japanese program addressing efficient energy use of products. Since the beginning of the program in 1999, mandatory energy performance standards were set for a variety of products. The most energy-efficient product in the market is identified as the “Top Runner” and the program sets a target year by which all other products should achieve the same level of efficiency. On that target year, the cycle starts again with the assessment of the

new Top Runner Product (Siderius and Nakagami 2007). This program has been very successful. For instance, the energy efficiency of video tape recorders improved by 73.6% from 1976 to 2003, which was 15% above original expectations. Similarly, personal computers achieved their Top Runner Standard well before their 2002 target year. This program is notable as it focuses on the positive incentives of being the “Top Runner” in comparison with the more negative incentives imposed by the mandatory energy performance standards in other parts of the world. Moreover, with increased awareness of products, these schemes resulted in less energy-efficient products being removed from the market in a phased manner and supported more carbon-neutral individual lifestyle choices.

Eco villages

Eco villages are communities that attempt at becoming socially, economically and ecologically more sustainable. Some aim for a population of 50–150 individuals, while larger eco villages have about 2,000 individuals. The main goal is to create the smallest possible ecological footprint, and to produce the lowest quantity of pollution possible, through efficient land use, recycling, composting and converting waste to energy (Wikipedia 2011b). Eco villages contribute to other climate change initiatives and have large carbon mitigation potential if adhered to. One large benefit is the reduction in travel time for residents in the community, as eco villages are planned around walking and cycling paths. A case in point is the Los Angeles Eco-Village located in the Korea Town area in Los Angeles, California. Distances between the various facilities are kept to a minimum, encouraging (and at times mandating) that residents either walk or cycle.

At Horse-Shoe Point near Pattaya, Thailand, Cellennium Company has worked for years to establish a working model of a sustainable eco-village. Applying energy saving design and architectural features, insulated, panelized pre-fabricated houses have been constructed that are aesthetically appealing, comfortable and energy efficient. Renewable energy technologies such as solar thermal and photovoltaic, biomass and electricity storage, among others, are being employed with the objective of selling excess electricity back to the grid. Water is being captured, cleaned, used, treated and recycled. Fertilizer, bio-char and carbon dioxide derived from solid waste generation and from biomass to power processes are captured for soil enrichment and to enhance further growth of biomass. All of these taken together create powerful regenerative forces that can sustain and enhance the bio-sphere (Cellennium Thailand 2009).

Initiative: Local Currencies

Local currency that circulates only within a community can greatly help reduce carbon footprint, as it encourages members of a community to buy only local products. Communities such as the Findhorn Ecovillage have successfully implemented such initiatives, having their own bank and community currency (Findhorn Foundation 2010).

Initiative: Territorial Climate and Energy Plan in France

In France, cities are estimated to contribute directly to 12% of national emissions while citizens' account for over 50% of emissions. Therefore the Government has taken initiatives to enable cities to play the role of orchestrator and promote local dynamics. For instance, a city that exceeds 40,000 people is obliged to develop and adopt a territorial climate and energy plan, in line with the national target of reducing energy consumption by a factor of four by 2050. It is widely accepted that there can be no miraculous technical solutions but citizens have to adopt a lifestyle that matches the reality. Media campaigns have been launched with slogans such as "Let's act, the earth is heating up" and "Let's reduce our waste, the garbage bins are overflowing." Several hundred energy information centers have been established in cities for sensitizing citizens to change their daily habits and adopt a lifestyle that can help reduce their ecological footprint (Mohanty 2010).

Initiative: Eco-District, Kronsberg/Germany

Kronsberg is an eco-district situated in the city of Hannover, Germany, which is built on 1,200 hectares on the city outskirts and planned for a population of 15,000 people. Emphasis was laid on low land occupancy, by means of high-density construction. A direct light rail links the settlements to the city center; there are designated paths for cycling throughout the district and a dense layout of footpaths offers an attractive alternative to private motorized transport. Ecological standards for developers were defined in areas of energy, construction waste, soil management, water and nature conservation. For the energy sector, the goal was to reduce the carbon footprint by 60% as compared to the national level, through measures such as innovative building methods and renewable energy using solar photovoltaic and wind (Rumming 2007).

Initiative: Green Cities

Broadening the concept of eco villages and eco districts, the governments of India and Japan are planning to develop green cities, which would be planned and executed around sustainable growth. Of the various benefits to the environment, the cities would have better transport facilities and promote public transport. In addition, the micro infrastructure within the cities would be designed such that it will be easily accessible to all residents and not require any kind of transportation (Chadha 2010b). The Government of the UK has initiated special programs to recognize the efforts of sustainable communities (Anable 2008). Three towns were chosen as Sustainable Travel Towns and £10 million was made available over 5 years for promoting alternative modes of transport. This initiative saw a 12%–13% reduction in car use, development of new cycling paths, and a big increase in alternative modes of transport.

Initiative: 2000-Watt Society, Switzerland

The average per capita energy consumption worldwide is about 2,000 Watts (W), but discrepancies are enormous between developed and developing countries. The Vision of a 2000-Watt society was formulated in Switzerland by the Federal Institute of Technology in Zurich. It entails the reduction of energy consumption by two-thirds for Switzerland. It calls for a

significant lowering of energy consumption and a simultaneous rise in energy efficiency—substituting fossil fuels with renewable forms of energy, adopting a more sustainable way of life, and rethinking current business practices. Changes in the construction sector through the implementation of solar passive design, zero emission buildings, and fundamental changes in the road, transport, and freight sector are envisioned. This should be achieved by adopting already existing technologies and without compromising the present quality of life (Stulz and Lütolf 2006).

Box 7 lists ways to mitigate the Urban Heat Island Effect through green technologies.

Box 7: Mitigating the Urban Heat Island Effect

The urban heat island refers to an area in a city that has significantly higher temperature than the surrounding areas, resulting in more energy needed for cooling the habitat. The Heat Island Group estimates that the heat island effect costs Los Angeles a minimum of \$100 million per year in energy (Chang 2000).

If more houses in the neighborhood adopt green technologies such as green roofs, curbside planting, and lighter-colored facades that reflect sunlight and absorb less heat, the heat island effect could be mitigated and the community would depend less on external energy sources (Columbia University; Hunter College – CUNY; SAIC Corporation 2006).

When a number of green buildings are located in proximity, they create a green zone, providing a much healthier environment and minimizing the heat island effect. The ultimate aim will then be to create many such areas, which would help the towns and cities and therefore the nation in reducing the total energy requirement and the overall global carbon footprint (MNRE and TERI 2010).

Initiative: Teleconferencing

Under WWF-UK's One in Five Challenge, businesses and organizations are committing to cut 20% of their air travel by 2016. A dozen large companies have signed up for the program, including the Scottish government. Audio, video, and teleconferencing provide alternatives to face-to-face meetings (WWF, Ecofys, and OMA 2011). Corporate policies such as these will go a long way in setting examples for employees and for the population at large.

Initiative: Car Pooling

An online initiative in India (<http://www.carpooling.in>) tries to bring together people who have space available in their cars, with those who are looking for a car ride. In the US, an organization called GreenXC created a campaign that encourages people to adopt carpooling with the main intention of reducing the carbon footprint. The goal is to travel cross-country and explore various national parks and forests exclusively via carpooling. Without driving or renting a car, they hope to reach their destinations with the help of others with the sole intention of

being green (GreenXC 2011). Carpooling can be an effective means for individuals and communities to combat climate change.

Case: Sharing Resources

Sharing is one of the easiest and most powerful ways of conserving resources (Gardner 1999). Communities can share buildings, open areas, vehicles, tools, appliances, and other facilities to cut down on the amount of materials used and the total energy requirement. Items such as ladders, lawn mowers, saws, washing machines and automobiles sit idle for long durations of time. Communities can initiate groups and resources to engage these idle resources and make sharing convenient for its residents. Sharing can even improve the quality of these items as such pieces of equipment normally degrade when not in use (Milani 2001).

Initiative: Buying Goods and Services Using Ecological Criteria in Vienna, Austria

The city of Vienna purchases goods and services according to ecological criteria. A list of requirements for classifying whether a product and/or service is ecological was created, and made binding for all departments of the city administration. This ensures that ecology is sufficiently taken into consideration over the course of public procurement and tendering by Vienna city government. Vienna spends about €5 billion per year on ecological goods and services (Jerrod, 2012). It can thus significantly influence the quality of products and services offered in the local market.

Initiative: Calgary, Canada

Programs and initiatives that aim at increasing people's awareness of issues related to climate change, and options that are available for reducing carbon emissions are of crucial importance. The city of Calgary has undertaken an effort to create awareness and understanding of climate change, and to engage the private and corporate sectors in their efforts to reduce carbon emissions. This includes educating the public, including the business community, about the impact of personal actions on GHG emissions, marketing ways of curbing climate change and empowering the community to take its own emissions reduction actions (City of Calgary 2000). Undertaking campaigns such as these in urban as well as rural areas will be fundamental to securing people's participation in combating carbon emissions. Such "soft policies" will need to be implemented frequently and at regular intervals for them to have the desired effect.

Initiative: National Public Scheme for the Conservation of Drinking Water, Egypt

Training and education play an important part in sensitizing the population to the issues involved. The National Public Scheme for the Conservation of Drinking Water in Egypt aimed at conserving drinking water, locally and nationally, through intensive public awareness and training programs for the local plumbers. It also promoted the use of 16 locally developed sanitary fixtures. These measures resulted in lowering water consumption by 36 million m³ per year, with annual cost savings of about US\$5 million. Consequently, the load on the sewerage system has also been reduced (The Together Foundation and UNCHS 1998).

Initiative: Deposit refund program, Micronesia

Pacific island states are also increasingly relying on the deposit refund program as an effective means of inducing behavior change such as recycling. A deposit is collected at the time of purchase of the product if it is found to degrade the environment. This deposit is returned when the customer returns the product to a designated facility. Such programs are common in many cities today, and are usually being applied to glass, aluminum cans, or polyethylene terephthalate (PET). However, the Pacific Islands have taken this a step further and have started applying the same scheme to items such as automobile batteries, pesticide containers, and even electronic waste.

Kiribati has introduced a deposit/refund system on car batteries, among others. A small deposit is paid on purchase and 80% of this is re-paid when the items are returned to privately operated depots. The Government acts as the Administrator of the fund holding all the deposits collected. In Yap and Kosraean states of the Federated States of Micronesia, government mandates that a recycling deposit fee of 6 cents is collected for aluminum, glass and PET beverage containers and PET cooking oil containers. A refund of 5 cents is given for every container brought to the designated collection center. The regulations also require that the funds be deposited into a separate account, which is expressly for the use of the state's recycling program (Richards, 2009).

Box 8 explores potential behavioral changes for carbon mitigation at the community level, while Table 7 lists hindrances to such changes as well as supportive policy actions and examples from around the world.

Box 8: Behavioral Changes at Community Level

- ✓ Check with your neighbor on starting a carpooling network. It has been estimated that with each car that goes off the Indian roads, about 1,300 kilograms (kg) of carbon can be mitigated per year, amounting to over \$600 in fuel bills (Sodhi et al. 2010).
- ✓ Share gardening and other idle household equipment with your neighbors to cut down on the amount of materials used and the total energy requirement.
- ✓ Encourage children to play outside with neighbors rather than sitting in front of the television or computer. This could potentially save over 61,000 tons of carbon dioxide (CO₂) emissions per year, assuming about 1 million children adopt this change (Centre for Environment Education 2010).
- ✓ Plant more trees in your community to offset carbon and engage in green community initiatives, saving 183 kg–500 kg of CO₂ emissions for every 50 trees over 100 years (Centre for Environment Education 2010).
- ✓ Create a community-supported agriculture program.

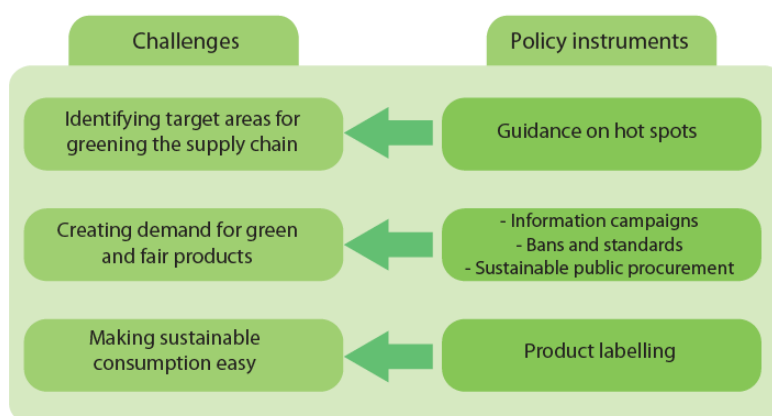
Table 7: Behavioral Changes and Associated Factors for Communities

Lifestyle Change	Hurdles	Policy and Initiatives	Example	Level
Create a community-supported agriculture program	Lack of awareness, lack of infrastructure support	Awareness programs, communication and marketing assistance for community-supported agriculture programs	Community-supported agriculture programs in Portland (Portland Area Community Supported Agriculture Coalition, 2011), Chiang Mai, Thailand (Fair Earth Farm 2011)	Local
Encourage children to play outside with neighbors rather than watch TV	Lack of outdoor playgrounds and outdoor leisure opportunities	Mandatory playground per certain density/region, support of sport clubs		Local
Plant more trees in your community	Availability of land	Assign space for tree planting along streets and pedestrian paths, organize events for tree planting, provide saplings	Green Leap Delhi, India—an initiative by the government of Delhi to plant 1 million trees in different parts of Delhi in 2011 (Green Leap India 2011)	Local
Share gardening and other idle household equipment with neighbors	Organization, sense of ownership, maintenance of tools	Support community- or neighborhood-based tool and equipment banks	ToolBank provides a platform for sharing tools (ToolBank 2011)	Local
Starting a carpooling network	Communication and anonymity in big cities	Provide online platforms that connect people for car pooling	US Environmental Protection Agency has several carpool incentive programs in Cincinnati (United States Environmental Protection Agency 2005)	Local

The Role of Business in Influencing Change

Promoting a more sustainable lifestyle needs active participation of business, policy makers and civil society. Sustainable consumption needs to be mainstreamed through all policy areas and linked with existing policy plans and strategies (CSCP 2010). To choose the most effective policy instruments in promoting sustainable consumption a better understanding of the needs of these companies is needed. Policies based on dialogues with companies can assist in creating a demand for sustainable products, identifying target areas for greening the supply chain and in making sustainable consumption easier for consumers.

Figure 10: Creating and Satisfying Demand for Green and Fair Products



Source: CSCP (2010)

Business organizations are powerful players in today's market driven economy. The policies that they adopt and their goals and visions have an enduring impact on society through their large customer network. A number of business organizations around the world have changed their practices and became more environmentally conscious.

For instance, in the automobile sector, stakeholders have argued that car companies have to respond to the growing consumption of fossil fuels. However, actual market trends tell a different story: Instead of smaller and more efficient cars, customers increasingly requested more horsepower and heavier vehicles such as SUVs. As public awareness for climate change increased, Toyota was one of the first to have innovative concepts available and meet rapidly changing demand. This made Toyota the first to offer hybrid technology and get a competitive advantage, and increased profits due to considerable market share (Tunçer et al. 2010).

Other initiatives by companies are given in the box below:

Box 9: Green Initiatives by companies

- ✓ Memo's strategy of selling most sustainable office supplies has resulted in superior business growth.
- ✓ Henkel gains competitive advantages by optimizing all life-cycle phases of its products.
- ✓ Skysail's innovative technology to use the power of high winds to save oil in cargo ships has successfully created a new market.
- ✓ RICOH relieves customers from buying, installing and maintaining printing equipment and sells printed pages instead.

Tunçer et al. (2010) have shown that several business opportunities can arise from creating value in the environmental sector, such as:

1. Designing new products and services that cater to the rising demand for "green" solutions.
2. Many products have a high initial cost e.g. automobiles, heating systems, etc. Hence, there is a market by devising new ownership mechanisms such as service-oriented business models that provide a solution rather than a product (e.g. energy service companies that provide energy-related services instead of selling energy).
3. Providing innovative after-sales services, that includes a buy-back of environmentally harmful products.

As more and more businesses adopt such practices, policymakers will find it easier to effectuate lifestyle and behavioral changes in their communities.

Initiative: Life Cycle Assessment Center, Denmark

In order to identify harmful environmental impacts of consumption, the entire life cycle of products and services needs to be assessed. For a single company with limited financial and human resources, such data collection and assessment may not be possible. Governments can support business by identifying priorities for improvement, creating guidelines and in capacity building. The Danish government for example established the LCA Center Denmark, a knowledge center for life cycle assessments (LCA). The center promotes product-orientated environmental strategies in private and public companies by assisting them in implementing life cycle thinking (CSCP 2010).

Initiative: Green Label Thailand

The Thai Green Label is an environmental certification awarded to specific products that have shown minimum detrimental impact on the environment in comparison with other products serving the same function. The scheme was initiated by the Thailand Business Council for Sustainable Development and launched formally in August 1994 by Thailand Environment Institute (TEI) in association with the Thai Ministry of Industry. The scheme is developed to promote the concept of resource conservation, pollution reduction and waste management. The purposes of awarding the green label are:

- To provide reliable information and guide customers in their choice of products.
- To create an opportunity for consumers to make an environmentally conscious decision, thus creating market incentives for manufacturers to develop and supply more environmentally friendly products.
- To reduce environmental impacts resulting from manufacturing, utilization, consumption and disposal of these products

The Scheme generated a total of 48 valid product criteria for the green label. In June 2011, 75 companies registered over 500 products in 25 categories for availing the green label (TEI 2011).

5. POLICIES AND STRATEGIES

Given the projected impact that climate change will have on the future of the planet, policy makers need to pursue policies and legislation that can help curb carbon emissions. Policies to enable low-carbon and climate-resilient development need to be integrative and they need to be brought to the mainstream. They should provide and foster an environment for individual and collective behavioral change, offer financial incentives, promote new market mechanisms and support mechanisms for industries to switch to a non-polluting mode of production, create a market for green products and services, support capacity building, promote research and dissemination of knowledge and technology, and raise public awareness.

Low-income and developing countries such as Bhutan and Cuba have made significant changes to their lifestyles and economies with the use of innovative policies and demand for resources, clearly showing that successful action is possible. It is important for policy makers to recognize that a large percentage of investments and capital flowing into infrastructure development comes from the private sector. Policy measures will have to capitalize on this fact for all efforts to address climate change. Market distortions through subsidies on carbon-intensive technologies and products need to be dealt with and more resources will have to be directed toward climate change adaptation and mitigation.

In general, there has been criticism for government policies. It is a challenging task to devise and implement policies that account for all the different components of climate change and environmental degradation. When one component or sector is addressed, it often ends up adversely affecting other sectors and components in the system. For instance, in Australia, the National Climate Action Summit of 500 participants representing 140 climate groups nation-wide has condemned the cap and trade system of emission reduction that was to be introduced as law in Australia, and successfully campaigned to prevent it from becoming law. Major concerns have been voiced on the announced targets (describing them as inadequate), granting of property rights to pollute and providing free permits to major polluters.

The Government of Japan has a clear position on building a low carbon society which, along with the promotion of innovative technology has been identified as the key to lower Japan's emissions by as much as 50% by 2050. The Ministry of the Environment of Japan is entrusted with the task of developing principles, priority areas and strategies to achieve the target (Ministry of Environment of Japan 2007). The low carbon society as envisioned by Japan is founded on three principles: minimizing CO₂ emissions from all economic sectors, shift from mass-consumption to a society that focuses more on the quality of life, and maintaining and restoring natural environment. The strategy to realize a low carbon society involves tackling technical, economic, social and informational barriers by formulating policies that motivate citizens and companies to act towards the ultimate goal. The four policy instruments employed by the government include:

1. Institutional incentives through regulation, economic instruments, and awards and recognition
2. Creating hard infrastructures such as urban structure, buildings, transportation network and energy supply
3. Adopting soft approaches such as information and sensitization, capacity building, education and financial resources
4. Reinvesting in natural capitals such as carbon sinks, biomass and adaptation.

Developing countries in Asia generally adhere to the principle of "common but differentiated" responsibilities, agreed in the United Nations Framework Convention on Climate Change, giving higher priority to economic development. For instance, even though the People's Republic of China (PRC) accounts for a bulk of the worldwide GHG emissions, the government argues that emissions per capita in the PRC are low and that raising incomes must be their highest priority. They also advocate that industrialized countries bear the primary responsibility for the buildup of GHGs and should therefore lead the way in mitigating emissions domestically (Leggett et al. 2008). There is a general consensus among many countries that the industrialized countries should assist the developing countries to mitigate emissions and adapt to climate change.

Regional cooperation at this juncture is crucial in bringing as many countries on board as possible, so that there can be constructive and fruitful cooperation between industrialized and developing countries and exchanges of good practices among Asian developing countries. Policies taken to mitigate GHG emissions in one country can give undue benefit to another country economically if both the nations do not act together. For instance, potential climate change legislation in the United States has been influenced by the GHG emissions in PRC and uncertainty over how and when it might alter that trend. There is concern that strong domestic action taken without PRC reciprocity would unfairly favor PRC in global trade, and fail to slow the growth of atmospheric concentrations of GHGs significantly (Leggett et al. 2008). Governments need to come to a common understanding over not only the causes and impacts of GHG emissions, but also the path for curbing it. The initiatives of ADBI are a positive step in this direction.

The following section details some of the policy options available to governments in the Food, Water, Electricity, Transport, Construction, Urban Planning and Waste sectors.

5.1 Food

Policies in the food sector will have to address the issues of food security, management of food waste, and healthy food and pollution control as well as the conservation of agricultural land and biodiversity.

Case: Develop policies to promote and support urban agriculture

Implementing urban agriculture can have a positive impact on a region's food security; it will reduce food miles and organic waste in landfills. It will also improve the quality of urban life by greening city spaces. This needs to be incorporated in a city's land use plan. A legal framework that allocates urban areas such as idle and/or under-used land for food production will support the development of urban agriculture. Building codes need to be adapted so that they reflect the actual structural contingencies for rooftop gardening. Institutions to conduct research on urban agricultural techniques, food processing and centers for training, dissemination and soil testing need to be established. Creating a support infrastructure for urban farming that includes tool banks and input material like compost, seeds, organic fertilizers and pesticides will have to be supported. Unemployed persons can be trained in food related business. A financial mechanism like start-up capital or special loan schemes needs to be established. Public institutions can be encouraged to buy locally produced food from urban farmers. Cooperation with the municipal waste collection system for collecting and composting organic waste can be forged to close the material loop. Cuba has an outstanding history in developing urban agriculture. By 2003, urban agriculture provided 60% of the vegetables consumed by Cuban city dwellers. The planting of several million trees (including fruit and nut trees) in and around Havana increased groundwater recharge, improving the water security and water quality of Cuban citizens (Wolfe 2005).

Case: Policies to promote organic farming

Organic agriculture should not be considered any longer as an alternative to conventional agriculture but should be turned into the mainstream agricultural approach. Tailored policy instruments need to be flexible and region-specific, making reference to geographical, natural and socio-cultural conditions (Urs, Christia, & Matthias 2010). A multi-objective policy instrument can capture both the strong interrelations and potential trade-offs between food security, biodiversity and climate. Governments have to play an important role in providing a supportive framework for organic farming. In most successful organic farming countries, similar policy measures exist, such as strategic action plans, redirection of agriculture subsidies to organic farmers, organic labels and standards, organic research and education programs as well as marketing campaigns. A plan for phasing out existing subsidies and redirecting them to the organic agriculture sector needs to be drafted and the feasibility and potential risks for the food security of a given country needs to be considered. Support mechanisms and incentives for farms that convert from conventional to organic farming need to be created. Marketing of organic agricultural products, hence creating a consumer demand, should be supported by the state as well, especially so in the initial phase. Coherent labeling of organic products and stringent internationally accepted quality standards need to be adopted. Another interesting tool for stimulating demand is integrating organic produce into public procurement (e.g. schools, government institutions, hospitals). Besides stimulating demand, it may also help in raising consumer awareness. One important policy option to support organic agriculture is accurate pricing that considers environmental services, carbon sequestration, clean air and clean water.

Top priority should be given to achieving prices and fees that reflect the full economic and environmental costs, including all externalities.

Initiative: Organic Agriculture in Austria:

Austria is among the best performing countries in Europe when it comes to organic agriculture. Twenty per cent of its agricultural land is under organic production. The per capita consumption of organically produced food is among the highest in Europe and this demand keeps rising. The market entry of major retail chains has significantly contributed to the creation and stabilization of this market. Support for conversion and management, the creation of markets, clear target plans, awareness campaigns, training and capacity building, market development, research and increase of farm efficiency are accountable for the success of organic agriculture in Austria (Lehner 2010).

Though Asia has a very active organic movement, the total area under organic cultivation is relatively small, over 400,000 hectares, of which 75% is in China. Several Asian countries have developed national regulations for organic agriculture, to increase export and domestic consumption. The Indian National Programme for Organic Production (NPOP) was launched in April 2000. This includes framing of national standards for organic production, processing and certification. Regulations for the use of the trademark “India Organic” have also been put in place (IFOAM 2003).

Box 9 summarizes policy actions related to the food and agricultural sector that promise a potential for carbon mitigation.

Box 9: Policy Actions for Food Sector

- ✓ Promote organic farming policies.
- ✓ Promote urban agriculture: city’s land use plan, building codes, supportive infrastructure (tool banks for input material, training) and financial support mechanism.
- ✓ Create agro-eco-industrial parks (AEIP).
- ✓ Tackle food waste: national policy to reduce food waste in the entire food cycle, invest in agricultural infrastructure, (technological skills and knowledge, storage, transport and distribution), special subsidies, loans and grants for small farmers and food producers, awards for the best performing food processors.
- ✓ Improve water resource management: support improved irrigation technologies (drip irrigation systems), training programs in water management, passive rainwater harvesting, promote synergies between industries and agriculture to use effluent wastewater, scale pricing of water or electricity that is used to pump water.

5.2 Water

Managing water resources is essential if the world is to achieve sustainable development. Governments must make immediate investments in water management and water related infrastructure. Corruption remains a stumbling block in the water sector. This can lead to “uncontrolled pollution of water sources, over pumping and depletion of groundwater, lack of planning, degradation of ecosystems, weakened flood protection, urban expansion leading to heightened water tensions, and other harmful effects” (United Nations 2009b: 3). Financial costs of managing water can be met through tariffs, taxes and transfers through external aid and philanthropy (United Nations 2009). Policy makers need to decide on the trade-offs between different objectives for the water sector and who will bear the costs.

Case: Losses in Water Distribution

A conservative estimate of the global annual water losses in distribution is estimated to be 35% of the total water supplied. For some low-income countries the loss may be up to 80%, amounting to nearly \$9 billion per year in Asia (Kingdom, Liemberger, and Marin 2006). Indian cities like Delhi and Indore lose about 50% of their water production, which contrasts with the losses of cities that have successful water resource management like Berlin (3.0% losses) or Singapore (2.5% losses) (WWF 2009). Reducing the total water losses by half would help serve 150 million more people, and would cost about \$20 billion. In addition, the total revenue of Asia’s urban water facilities will increase by \$4.3 billion annually (GIZ, Federal Ministry for Economic Cooperation and Management, VAG 2006).

Currently, investments in water infrastructure are spent more on increasing production than on maintenance, improvement and extension of the existing system. By reducing water losses, water utilities have additional supply to expand services to underserved areas. Water scarcity is certainly not only an issue of availability of water, but very much also lack of appropriate management and governance. Repairing only the visible leaks will not be sufficient in curbing water loss. Box 10 summarizes policy actions for the water sector.

Box 10: Policy Options for Water

- ✓ Make rainwater harvesting mandatory.
- ✓ Encourage recycling of grey water in households and for industries.
- ✓ Make water saving devices for toilets, flushes, sinks, and washing machines mandatory.
- ✓ Support farmers to adapt water saving practices like drip irrigation; provide special subsidies and innovative financing for small farmers.
- ✓ Undertake measures to reduce water losses in distribution.
- ✓ Consider higher pricing to reduce water consumption and wastage.

5.3 Electricity

Access to reliable and affordable energy for electricity, cooking, transport and production is necessary for meeting the basic needs and sustained economic development of Asia. Toward this end, governments should promote energy policies that help mitigate carbon emissions. It is equally important not to emphasize only scaling up the production side, but also to address losses in energy transmission and the high-energy consumption of the end users with suitable policy interventions. A long-term policy for energy development, with a strong focus on reaching a low-carbon society, needs to be formulated. Policy mixes like incentives for renewable energy development along with awareness programs have proven to be quite effective. Rather than investing in new electricity generating plants and increasing supply, governments would achieve a lot more by helping the population buy energy saving devices such as liquid crystal displays (LCDs), compact fluorescent lamps (CFLs), and other energy complaint technologies that have lesser carbon emissions but a higher up-front cost.

Case: Renewable Energy

Government intervention can prove helpful in the uptake of expensive renewable energy investments by low-income neighborhoods and help in the achievement of the Millennium Development Goals. It can help with installations of wind energy for communities, including offshore wind parks to reduce CO₂ emissions, new solar panels for existing buildings and houses, and solar water heaters for households in regions that are well exposed to the sun. Even though these options have high up-front costs, they offer significant potential for carbon abatement. There can be innovative ways of financing such investments. In Australia, for instance, households have the option of renting their rooftops to a company that installs the solar system and then feeds the excess electricity generated into the grid (Energy Matters 2011). Having a feed-in tariff system will help in the uptake of renewable energy ventures, which are currently not common in Asian countries. Emerging Asian countries that have already introduced feed-in tariff include India, Malaysia, Philippines, Sri Lanka, and Thailand. In fact, fixed feed-in tariffs have proven to be one of the most effective policy actions for the promotion of renewable energy. A mandatory electricity utility quota for industries and public institutions, net metering, and financial incentives like production tax credits and capital subsidies are other interesting options for policy makers. The high first cost of energy-efficient equipment can be overcome by making it available for hire, or by charging a deposit that is refunded when the equipment is returned after its use.

Initiative: Renewable Energy Target in India

The Government of India has set ambitious targets for the renewable energy sector. The National Action Plan on Climate Change (NAPCC) targets a 1% annual increase in renewable energy generation, which stood at about 3.5% of the total in 2008. Meeting this goal may require 40 gigawatt (GW)–80 GW of additional capacity in renewable energy capacity by 2017. To achieve these goals, a tremendous increase in renewable energy is needed. Steps for an enabling environment have been taken but significant barriers to renewable energy development remain. Renewable energy systems have high up-front capital costs. Besides financial barriers, lack of support for infrastructure—limited grid interconnectivity, lack of quality data, and hurdles in the regulatory approval (delays in clearances)—inhibit the development of the sector significantly (World Bank 2010).

Measures that Improve the Allocation of Resources

An important policy action that could motivate people to take these small measures would be to correct the pricing of energy resources. Currently, most sources of energy are subsidized by the government, but this leads to market failure with an inaccurate allocation of resources as the user does not pay the real cost of consuming the resource. All traditional sources of energy are derived from fossil fuels, which are heavily subsidized by governments. Eradicating subsidies to fossil fuels would enhance energy security, reduce emissions of greenhouse gases and air pollution, and bring economic benefits (IEA 2010). Fossil fuel subsidies worldwide amounted to \$558 billion in 2008 and \$312 billion in 2009, with the majority of them in non-OECD countries (IEA 2010). Sadly, only a small proportion of these subsidies actually reach the target group who they are intended for—the poor.

Removing subsidies will result in rising prices of fossil fuel sources, and as a result, most traditional forms of energy will become more expensive. This will prompt people to conserve energy and reduce wasteful consumption. It will also motivate them to resort to energy-efficient devices and modes of transport. The International Energy Agency has projected that removing all fossil fuel subsidies by 2020 would cut global primary energy demand by 5%, compared with a baseline in which subsidies remain unchanged (IEA 2010). Alongside the removal of subsidies, governments should actively explore increasingly taxing products that are energy-inefficient and environmentally harmful.

Policy actions, related to the energy sector that can be taken by governments to reduce a nations' carbon footprint are listed in Box 11.

Box 11: Policy Actions for Electricity Sector

- ✓ Formulate national policy on renewable energy targets.
- ✓ Promote energy efficiency: green standards and labeling, subsidies, grants, and interest free loans for products and investments that improve energy efficiency.
- ✓ Promote renewable energy installations.
- ✓ Correct the pricing of energy resources.
- ✓ Tax products that are energy-inefficient and environmentally harmful.
- ✓ Implement Smart Grid technologies: develop a national framework, create incentives for investments, and demonstrate benefits to consumers.
- ✓ Undertake public awareness campaigns on measures that save electricity.

5.4 Transport

Given the amount of CO₂ abatement potential in the transport sector, it is critical that policy makers strive to influence behavioral changes in travel at the individual and community level. Policies to address climate change will involve large sums of money. However, according to the Stern Review, incurring costs now for carbon abatement, and avoiding serious and expensive consequences at a later date, will be a wise investment (Stern 2006). Policy initiatives in the transport sector will need to be implemented at all levels—national, state, and city level; they also need to be integrated with urban planning policies. A guiding national policy law for low-carbon footprint transportation with tangible targets will provide a framework for this. The increase of personalized motorized vehicles especially needs to be curbed by policy to provide alternative solutions and discourage personalized motorized vehicles.

Case: Make City Centers Motor Vehicle Free

Many cities around the world have designated areas as pedestrian zones (also known as auto-free zones and car-free zones). There are several types of traffic policies in these areas for the use of cycles, skates, and kick scooters. Some ban anything with wheels, while others ban only certain types of traffic. Many Middle Eastern centers have no motorized traffic, but use donkeys for freight transport. European city centers, such as Venice, have a strict ban on all forms of motorized traffic. In the UK, Birmingham has turned its central area over to pedestrians. London has implemented congestion charges for vehicles accessing the city center during peak hours. Montpellier in the south of France has made its central retail and entertainment district a place for walking (Low 2007). In Japan, some streets (Nishiki, Teramachi, Shinkyogoku) have been designated pedestrian-only streets and feature food market and shopping facilities (Wikipedia 2011c). By restricting traffic in city centers, either by mandate or by charging a high enough entry tax, non-motorized forms of transport are encouraged. Noise and air pollution is abated, and citizens are made more aware of the benefits and ease of walking and cycling. This could also encourage them to adopt these sustainable modes of travel in the rest of the city.

Case: Provide Cycles on Rent in the City Center

Policymakers could consider providing cycles on rent in city centers to encourage their uptake. An often-cited example is that of Paris where the metropolitan authority rents out cycles at various locations around the city. Cyclists have the option of picking up a cycle in one part of the city, cycling around, and then dropping it off at another point close to their destination. This provides an income-generating opportunity in addition to the environmental benefits. A comprehensive global study of what happens when road space is reallocated (i.e., because of bus lanes or unexpected events) reported an average 18% of traffic went “missing” from the road network (Cairns et al. 2004 cited in Anable 2008). Policy makers could thus consider planning traffic flows such that there are lanes dedicated to sustainable modes of transport i.e. pedestrians, cyclists and public transport.

Box 12 lists some policies which offer carbon reduction potential in the transport sector.

Box 12: Policy Actions for Transport Sector

- ✓ Formulate national policy on low-carbon transport system.
- ✓ Promote public transport: needs better urban planning, dedicated lanes, and improved information system on time schedules, investment in high-speed rail infrastructure.
- ✓ Make city centers motor vehicle free.
- ✓ Provide cycles on rent within the city center and support their uptake.
- ✓ Car labeling: laws for information on fuel consumption and carbon dioxide (CO₂) emissions for cars, higher taxes on heavy vehicles.
- ✓ Discourage personalized motorized traffic: road pricing, higher pricing for parking, higher taxes on vehicles, encourage car sharing.
- ✓ Change air travel policies: restrict the number of air trips per year, fees for additional air miles.
- ✓ Promote electric cars and biofuels: legislate all public transport and taxi companies to use biofuels or electric cars, provide tax incentives for purchase of electric cars, infrastructure support (loading stations, battery banks, biofuel stations).
- ✓ Green driving: make green driving lessons mandatory.
- ✓ Launch public awareness campaigns on the dangers of using fossil fuels.

5.5 Construction

Building material and building waste, together with the energy consumed by most buildings, form a large proportion of the total GHG emissions of a region. The construction sector is a fairly unregulated sector and any policy interventions will have to work with incentives as well as mandatory regulations.

Case: Green Building Certification

Certification and labeling of materials that are considered “green” can help the building industry and builders to select the right material and technologies. Currently, there is a vast array of material available, with no clear guidelines on which are environmentally sound. The state obviously has a key role to play in certification and labeling, a role that can greatly benefit local green economic development (Milani 2001). Compiling a green building directory, with details on green products, distributors, consultants and engineers can be helpful for the industry. Such an initiative can finance itself, with sales providing a source of revenue; it will also create green jobs.

The Building Construction Authority (BCA) of Singapore has developed BCA Green Mark, which includes the following criteria: energy and water use, indoor air quality, along with other types of environmental impacts. BCA Green Mark is supported by the National Environment Agency and is applicable to new residential and commercial buildings. There is also a special version for labeling existing buildings too.

The Energy Star is a voluntary scheme developed by the US Department of Energy (DOE) and is awarded to new buildings with energy performances that exceed the 2006 IECC Code by at least 15%. Energy Stars are also used in labeling schemes to highlight the energy efficiency of buildings in some parts of Asia, such as Australia, China and India.

Case: Encourage Green Building Standards for New Buildings

Policymakers could mandate that new buildings beyond a certain size or meant for a certain use, have to be green. For instance, in Europe, the energy performance certification of buildings of more than 50 m² is mandatory. The certificates must be accompanied by recommendations for the cost-effective improvement of the building's energy performance (Directorate-General for Energy and Transport 2005). To boost the green building market, new public buildings and offices could be required to follow green building standards. Governments could also mandate old buildings to be retrofitted with insulating walls, roofs and ground floors, energy efficient windows and ventilation system. These may need to be supported with tax incentives or other types of subsidies. Energy efficiency for buildings should be made transparent so buyers and sellers can make informed choices. Currently, there is much less emphasis on energy efficiency when purchasing buildings even though energy costs are substantial for the maintenance of a building. Labeling and certification of buildings should be reliable and need to be controlled by governments (Lausten 2008). Green building standards need to be adapted to local climatic and cultural conditions, with equal emphasis on construction material used and on the energy required for maintaining the building.

Policies that support a low-carbon construction and building sector are listed in Box 13.

Box 13: Policy Actions for Construction Sector

- ✓ National policy on low-carbon building and land use.
- ✓ Enforce/Encourage green building standards for new buildings: make it mandatory for new public and commercial buildings, create green certification.
- ✓ Promote sustainable building materials: create markets, build capacity, and provide training.
- ✓ Policies to retrofit exiting buildings: mandatory for commercial and public buildings, provide tax incentives.
- ✓ Encourage reclamation of material from the construction sector: promote recycling, taxes on construction debris.

5.6 Urban Planning

Urban planning in the future will be largely affected by environmental challenges caused by climate change and the need to reduce the overdependence on fossil fuels. Authorities must strive for a carbon neutral city that manages its energy demands through renewable energy. Improving the eco-efficiency of the city should also be a priority, where waste and by-products from one section of the city can serve as input for other sectors of society. An example is that of waste being used to create biogas, or heat from electricity generation being used for district heating (UN-Habitat 2009). Urban planning needs to be integrated with policies for waste, water, transport, energy and food.

Case: Plan Cities for Human Beings rather than Automobiles

Many cities and urban areas have been designed in sprawl, making the automobile increasingly difficult to avoid. If cities and neighborhoods are designed to be energy-efficient by offering walkable, transit oriented options, the uptake of public transport and sustainable modes of transport can be increased (UN-Habitat 2009). This will help cities reduce their ecological footprints from their reduced use of fossil fuels. Unfortunately, the reduction of car usage is not yet a priority for many cities, and as a result traffic growth and environmental impacts have grown. Urban planners need to start giving increasing importance to designing cities with smaller sprawl, and more reliance on public transport, walking paths and bicycle lanes.

Policies related to Urban Planning that will have a positive effect on reducing carbon emissions are listed in Box 14.

Box 14: Policy Actions Regarding Urban Planning

- ✓ Plan cities around the dimensions of human beings, rather than around the car.
- ✓ Prevent urban sprawl.
- ✓ Incorporate bicycle lanes and walking paths in all urban plans.
- ✓ Develop sustainable modes of transport to reduce dependence on fossil fuels.
- ✓ Envision at least one eco village per district and support its growth and development.
- ✓ Strive for a carbon-neutral city, reduce energy consumption by a set factor.
- ✓ Make a commitment to tap the maximum amount of renewable energy.
- ✓ Promote land use plans for more green areas and urban agriculture.

5.7 Waste

The waste sector has huge potential to be turned from a curse into a cure. A global shift on how waste is perceived - as a valuable resource instead of a nuisance - is in the coming. Waste pervades all sectors of human production, which makes it challenging for policy makers to take comprehensive actions. Formulating a national zero waste policy based on the model of a circular economy, paired with a step-by-step implementation plan and a target time line, is the first step. Policies for effective handling of waste can be grouped under the following categories:

- Waste prevention through eco-design or cradle-to-cradle design
- Improving the availability of the resource: recycling and reclaiming materials
- Consumer awareness programs

Case: Eco-Industrial Parks

Eco-Industrial parks should be given priority over conventional industrial parks. Special land allocation and fast-track approvals can act as an incentive for the setting up of these Parks. A policy framework, including a time line for the transformation of the existing industrial sector into an environmentally-friendly and resource-efficient industry based on a circular economy and a zero waste approach, needs to be formulated. Financial incentives for the establishment of eco-industrial parks or the transformation of existing industries can include tax exemption or revolving loans on pollution control equipment or fixed feed-in tariffs for surplus electricity.

Case: Waste Prevention and Eco Design

Waste prevention needs to address both the production and the consumption sides. Examples of waste prevention include the design of durable, long-lasting goods or the selection of products and packaging that are free of toxic substances. There should be switching from disposable to reusable products, or redesigning a product to use fewer raw materials or to last longer. Implementing stricter environmental standards for industries that are not based on a cradle-to-cradle approach, along with support of research and knowledge dissemination in this field, need to be promoted.

Policy actions related to the waste sector are listed below in Box 15.

Box 15: Policy Actions for Waste Sector

- ✓ Adopt zero waste policy at the national level.
- ✓ Introduce laws to enforce eco-design: implementing stricter environmental standards for industries, support of research and knowledge dissemination.
- ✓ Transform the industry into eco-industrial parks.
- ✓ Mandate waste collection and segregation on the industrial and municipal level and the construction sector.
- ✓ Support the development of production systems that use recycled materials.
- ✓ Encourage reclaim of material for agricultural or energy use, such as eco-industrial parks.
- ✓ Mandate solid waste treatment: enforce legislative measures, offer technical and managerial support, promote biogas from digestion, fee-for-service collection.
- ✓ Launch consumer awareness programs to educate people on waste management.
- ✓ The practice of giving plastic bags for free at shopping centers can be banned, and shopping establishments can be made to charge the consumer for each plastic bag.

5.8 Awareness Campaigns

Any policy action that will bring along shifts in habitual practices and lifestyles needs support and acceptance among the population. Awareness campaigns that inform and educate citizens and businesses about the issues at stake and the benefits of interventions have proven to be successful in securing acceptance for hard policy interventions.

Awareness campaigns are important and should be part of designing and implementing new policies. Individual choices and community behavior can be changed more easily by showing the benefits of the changes and by reducing the obstacles to acting in a low carbon way. For example, the uptake of waste recycling can be raised by increasing the awareness of the potential of emission reduction, and by making recycling opportunities available.

Case: Desirable actions to move towards low-carbon society in Japan

The Japanese government believes citizens and businesses should initiate action proactively for achieving low-carbon society status. Various policy instruments are therefore designed to encourage citizens through “eco-participation”, “eco-thinking” and “eco-sharing” so that they practice “eco-learning”, “eco-buying”, “eco-use” and “eco-disposal”.

Case: Educate Population about Food System Issues and the Value of Eating Local

Comprehensive campaigns and education about the benefits of eating locally produced food will result in a well-informed citizen and may result in citizens buying more locally produced food. Locally produced label systems or labels that indicate the food miles of a produce could be adopted.

Policy actions for education and awareness creation that support the low-carbon development are listed in Box 16.

Box 16: Policy Actions Awareness Campaigns

- ✓ Implement a school curriculum on the environment at the national level.
- ✓ Educate the population about food system issues: food waste, food miles, organic farming, and food security.
- ✓ Initiate awareness campaigns about waste issues: sensitize and inform citizens and industries about the 3Rs, with concrete actions that can be taken.
- ✓ Raise awareness on water-related issues: promote water saving technologies and practices for recycling of water.
- ✓ Launch awareness campaigns to inform people about energy issues: information about energy-saving appliances, carbon dioxide (CO₂) emissions and climate change, train companies in energy reducing practices.
- ✓ Promote greener transport: celebrate cycling and walking, educate citizens about the carbon intensity of current transportation systems, inform them about green alternatives.
- ✓ Inform and enhance knowledge about green buildings.

6. CONCLUSION

Current global trends are more than alarming. We are witnessing a tremendous increase in the consumption of raw materials and products. Population growth and a change in lifestyle patterns caused by economic growth are accountable for most of this. The planet's bio-capacity is limited and already overshoot, raw materials are being depleted at a rapid pace, global waste production is increasing, agricultural land is being converted into nonproductive land, natural aquifers are depleted, and water bodies are polluted. Environmental pollution is on the rise; CO₂ emissions are projected to increase and global warming will result in devastating calamities for life on earth. Mitigation and adaptation strategies to climate change will need to become a top priority for all governments. Since climate change is a global issue, it will also require global solutions built on common but differentiated responsibility for each nation.

However, the responsibility for action does not only lie with governments; each individual will have to re-examine his/her own lifestyle in terms of consumption patterns and volumes. This calls for a deep and sincere examination of the true needs of the individuals versus the wants. Changing individual habits requires effort and it needs support at different levels. Governments need to create conducive environments that enable and foster lifestyle changes; strong incentives and enforcements are suitable tools for that.

Businesses need to adopt strategies and pursue the creation of new business models, including environmentally friendly technologies and financial products that facilitate the propagation of sustainable consumption practices. The concept of "fair trade practices" is better known in developed countries though it benefits developing countries even more. There is considerable scope for companies to make their businesses more viable by creating awareness and promoting "fair trade" concept among the growing upper and middle class consumers in developing countries, also helping to better connect the rich with the poor.

Hegemonic cultural practices orient themselves along the lifestyles of elites. Media and the advertising sector still promoting carbon-intensive consumption patterns will have to be held responsible for promoting low-carbon lifestyles. Campaigns and information on alternative options, carbon mitigation actions and support of strong peer groups are other tools to support individuals on the path to a more sustainably integrated life. Hard and soft policy instruments, with a step-by-step action plan and tangible targets for the industrial and commercial sector to implement carbon mitigation and adaption strategies, are already being implemented in many nations, but their effectiveness as well as speed and range of implementation needs to improve. Globally, we can learn from many initiatives and pilot projects. Some of those are at the national level, but concerned citizens who are committed to change have promoted the bulk of these initiatives. These initiatives need to be supported and can be scaled up; governments need to recognize the value of such movements by providing legal and administrative support for experimentation.

BIBLIOGRAPHY

- Adalberth, K. 1997a. Energy use during the life cycle of buildings: A Method" *Building and Environment* 32(4): 317–320.
- Anable, D.J. 2008. The cost-effectiveness of carbon abatement in the transport sector. The Centre for Transport Policy. The Robert Gordon University, and The UK Energy Research Centre. London: Campaign for Better Transport.
- Ankerandersen, Deposit system law - Germany, <http://anker-andersen.com/deposit-laws/germany.aspx> (accessed 15 September 2011).
- Aquastat DatabaseQuery.2011.<http://www.fao.org/nr/water/aquastat/data/query/index.html> (accessed 2 August 2011).
- Asian Development Bank (ADB). 2007. Climate Change: Strengthening Mitigation and Adaptation in Asia and the Pacific. Manila: ADB.
- . 2009a. The Economics of Climate Change in Southeast Asia: A Regional Review. Manila: ADB.
- . 2009b. Understanding and Responding to Climate Change in Developing Asia. Manila: ADB.
- Auroville Earth Institute. http://www.earth-auroville.com/earth_in_auroville_introduction_en.php (accessed 18 September 2011).
- Auroville. The Solar Kitchen, <http://auroville.org/society/solkitchen.htm> (accessed 12 September 2011).
- Automobile Association (AA). 2011. Eco-Driving Advice. http://www.theaa.com/motoring_advice/fuels-and-environment/drive-smart.html (accessed 20 August 2011)
- Balasubramanian, S. 2011. Special Report: The Greenest Cities of the World. Terra Green. http://terragreen.teriin.org/index.php?option=com_terragreen&task=detail§ion_id=1015&category_id=9&issueid=48 (accessed 12 September 2011)
- Building Standards Commission. 2011. CALGreen. <http://www.bsc.ca.gov/Home/CALGreen.aspx> (accessed 18 September 2011).
- Cairns, S., L. Sloman, C. Newson, J. Anable, A. Kirkbride, and P. Goodwin. 2004. Smarter Choices – Changing the Way We Travel. Final Report. London: Department for Transport.
- Cellennium Thailand. 2009. Eco Village: First Step Towards Clean-Electron Economy and genuine sustainability, Presented at the “Bazaar of Ideas: Applying the Green Growth Approach for Basic Service Delivery and Poverty Reduction” organized by United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), Bangkok.
- Centre for Environment Education. 2010. Low Carbon Lifestyles. New Delhi, India

- Centre for Science & Environment. Legislation on Rain Water Harvesting. <http://www.rainwaterharvesting.org/policy/legislation.htm> (accessed 14 September 2011).
- Chadha, M. 2010a. India to Replace 400 Million Incandescent Lamps with CFLs. Earth and Industry. <http://earthandindustry.com/2010/05/india-to-launch-worlds-largest-cdm-project-will-replace-400-million-incandescent-lamps-with-cfls/> (accessed 16 September 2011).
- _____. 2010b. Japan to Help India Build 24 Green Cities. CleanTechnica. <http://cleantechnica.com/2010/11/28/japan-to-assist-india-build-24-green-cities/> (accessed 12 September 2011).
- Chalmin, P., and C. Gaillochet. 2009. From Waste to Resource - An Abstract of World Waste Survey 2009. Paris: Cyclope and Veolia Environmental Services.
- Chang, S.C. 2000. Energy Use. Heat Island Group. <http://eetd.lbl.gov/HeatIsland/EnergyUse/> (accessed 12 August 2011).
- City of Toronto. 2012. Water Meter Program. <http://www.toronto.ca/watermeterprogram/index.htm> (accessed 14 September 2011).
- City of Calgary. 2000. Carbon Dioxide Emissions Abatement Action Plan. Calgary: City of Calgary.
- Climate Policy Initiative. 2012. *Tax Incentives for Thermal Retrofits in Germany: Experiences from Practitioners*. <http://climatepolicyinitiative.org/publication/tax-incentives-for-thermal-retrofits-in-germany-experiences-from-practitioners/> (accessed 18 September 2011).
- Climate Parliament. 2009. Efficiency: Thai Voluntary Energy Labels Improve Efficiency. <http://www.climateparl.net/cp/101> (accessed 16 September 2011).
- Collaborating Centre on Sustainable Consumption and Production (CSCP). 2010. What public policy framework is required to encourage sustainable consumption business strategies? Making the Business Case Towards Low Carbon and Resource Efficient Lifestyles. Wuppertal: UNEP/Wuppertal Institute Collaborating
- Columbia University, Hunter College (CUNY) and Science Applications International Corporation (SAIC). 2006. Mitigating New York City's Heat Island with Urban Forestry, Living Roofs, and Light Surfaces. New York City Regional Heat Island Initiative. New York: Columbia University Center for Climate Systems Research at the Goddard Institute for Space Studies
- DAI. 2012. Instituting Water Demand Management (IDARA) <http://dai.com/our-work/projects/jordan—instituting-water-demand-management-idara> (accessed 14 September 2011).
- Deccan Herald News Service. 2011. Garbage segregation to be mandatory. <http://www.deccanherald.com/content/39574/garbage-segregation-mandatory.html> (accessed 10 October 2011).
- Dell. 2012. *Leaders in Recycling*. <http://content.dell.com/us/en/corp/dell-environment-recycling> (accessed 12 October 2011).
- Department for Transport. 2006. Transport Demand to 2025 and the Economic Case for Road Pricing and Investment. London: Research for the Eddington Review.

- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) 2006. Guidelines for water loss reduction: A Focus on Pressure Management. Eschborn: GIZ
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). 2010. A Big Foot on a Small Planet? Accounting with the Ecological Footprint Succeeding in a world with growing resource constraints. Sustainability Has Many Faces. Eschborn: GIZ
- Directorate-General for Energy and Transport, European Commission. 2005. Doing more with less: Green paper on energy efficiency. Luxembourg: Office for Official Publications of the European Communities.
- Dodman, D. 2009. Urban Density and Climate Change: Analytical Review of the Interaction between Urban Growth Trends and Environmental Changes. New York: United Nations Population Fund.
- eBillingNews. 2009. Customers to be slugged fee for paper bills. <http://www.ebillingnews.com/general/articles/customers-to-be-slugged-fee-for-paper-bills.html> (accessed 10 October 2011).
- Economic Instruments in Environmental Policy. 2010. Economic Instruments - Charges and taxes. Landfill Tax (EU). <http://www.economicinstruments.com/index.php/solid-waste/article/280-> (accessed 10 October 2011).
- eFoodsDirect. 2012. <http://www.efoodsdirect.com/> (accessed 20 September 2011).
- Earthforce. 2011. What You Can Do. www.salesforcefoundation.org/files/Earthforce-WhatYouCanDo.PDF (accessed 20 September 2012)
- Eawag and Sandec. 2008 (April). Global Waste Challenge - Situation in Developing Countries. Switzerland: Eawag (Swiss Federal Institute of Aquatic Science and Technology) and Sandec (Department of Water and Sanitation in Developing Countries).
- Energy Matters. 2011. Australia's First Commercial Solar Roof Lease Launched In the ACT. 2 June. http://www.energymatters.com.au/index.php?main_page=news_article&article_id=1548 (accessed 21 September 2011)
- European Commission. 2011. Headline indicators. (European Commission) Eurostat: Your Key to European Statistics. <http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators> (accessed 27 September 2011).
- Eco-business.com, January 2012 Green waste management for Singapore's food courts. Singapore. <http://www.eco-business.com> (accessed 5 November 2011)
- Fair Earth Farm. 2011. Sustainable Food in Chiang Mai, Thailand. <http://www.fairearthfarm.com/> (accessed 20 September 2011).
- Findhorn Foundation. 2010. The Findhorn Ecovillage. <http://www.findhorn.org/aboutus/ecovillage/ecovillage-at-findhorn/> (accessed 2 November 2011)
- Food and Agriculture Organization of the United Nations (FAO), Agriculture and Consumer Protection Department. 2006. Livestock impacts on the environment. <http://www.fao.org/ag/magazine/0612sp1.htm> (accessed 30 August 2011)
- Gardner, H. 1999. Intelligence Reframed: Multiple Intelligences for the 21st Century. New York: Basic Books.

- Global Footprint Network. 2011. World Footprint. Advancing the Science of Sustainability. http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/ (accessed 17 September 2011)
- Gordon, S. 2011. Airmiles to charge customers up to £600 for 'free' flights. MailOnline. <http://www.dailymail.co.uk/travel/article-2032975/Airmiles-charges-Customers-face-fees-free-flights-Airmiles-rebrands-Avios.html> (accessed 16 September 2011).
- Green Leap India. 2011. Thanks Delhi for the overwhelming response to the Green Leap Delhi drive! <http://www.greenleapdelhi.org.in/> (accessed 10 October 2011).
- Grocery.com. 2011. <http://www.grocery.com/> (accessed 18 September 2011).
- Hart District Council. 2011. *Taking Action on Climate Change*. <http://www.hart.gov.uk/index/environment-and-planning/climate-change/taking-action-on-climate-change.htm> (accessed 24 September 2011)
- Hyde, R.A., 1998. A Lighting Thermal and Ventilation (LTV) Design Tool for Non-domestic Buildings in Tropical and Subtropical Regions: Preliminary Assessment of Design Integration,' in the proceedings of the ANZASCA Conference, pp.41-48.
- International Federation of Organic Agriculture Movement (IFOAM). 2003. Local Marketing for Organic Products: A Guide for SMEs. Bonn: IFOAM
- IFOAM EU Group. 2010. Organic Food and Farming: A system approach to meet the sustainability challenge. Brussels: IFOAM EU Group.
- International Council for Local Environmental Initiatives (ICLEI). 2011, Briefing Sheet on Green Urban Economy. Bonn: ICLEI World Secretariat
- International Energy Agency (IEA). 2006. Key World Energy Statistics. Paris: IEA.
- . 2009a. World Energy Outlook 2009. Paris: Organisation for Economic Co-operation and Development (OECD) and IEA.
- . 2009b. Key World Energy Statistics. Paris: International Energy Agency.
- . 2010. World Energy Outlook 2010. Paris: Organisation for Economic Co-operation and Development (OECD) and IEA.
- Intergovernmental Panel on Climate Change (IPCC). 2007a. Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press.
- . 2007b. Summary for Policymakers. In Metz, B., O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer, eds. Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press.
- Jerrold. March 2012. Green economy forum to explore smart city opportunities. Urban Systems Collaborative, <http://urbansystemscollaborative.org/green-economy-forum-to-explore-smart-city-opportunities/> (accessed on 18 September 2012)
- Kingdom, B., R. Liemberger, and P. Marin. 2006. The Challenge of Reducing Non-Revenue Water (NRW) in Developing Countries – How the Private Sector Can Help: A Look at Performance-Based Service Contracting. Washington DC: World Bank

- Kwang, S.H. 2011. Sow and reap. Agribusiness.
- Langer, K., and R. Watson. 2006. Green Jobs: Bringing LEED to China. <http://www.sustainablebusiness.com/index.cfm/go/news.feature/id/1289>.
- Lausten, J. 2008. Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings. International Energy Agency. Paris: OECD/IEA.
- Lausten, J. 2008. Energy Efficiency Requirements in Building Codes, Energy Efficiency Policies for New Buildings. France: OECD/IEA.
- Layard, R. 2005. Happiness: Lessons from a new science. New York: Penguin Press.
- Leggett, J., J. Logan & A. Mackey. 2008. China's Greenhouse Gas Emissions and Mitigation Policies. Congressional Research Service
- Lehner, M. 2010. Policies to Promote Organic Agriculture. Copenhagen: Copenhagen Resource Institute
- Liquori, T. ed. year unknown. Rome, Italy: A Model in Public Food Procurement What Can the United States Learn? Liquori and Associates, LLC. USA: Center For Ecoliteracy.
- Liu, C. 2011. China's City of the Future Rises on a Wasteland , The New York Times: Energy & Environment. Environment & Energy Publishing.
- Low, N. 2007. A car-free city centre by 2030. The Age. http://www.theage.com.au/news/in-depth/a-carfree-city-centre-by_2030/2007/09/08/1188783555462.html (accessed 23 November 2011)
- Malaysian Insulation Manufactures Group (MIMG). 2009. First Malaysian Study on Mineral Wool Insulation in Malaysia. Solidiance Analyzes and Quantifies the Potential Impact of Housing Insulation in Malaysia. Kuala Lumpur: FMM
- Mairie de Paris. 2010. Velib Mairie de Paris. <http://en.velib.paris.fr> (accessed 23 November 2011)
- Meadows, D. 1998. Indicators and information systems for sustainable development: a report to the Balatan Group. Hartland, VT: The Sustainability Institute.
- Milani, B. 2001. Building Materials in a Green Economy. Canadian Society for Ecological Economics. Montreal: McGill University.
- Ministry for New and Renewable Energy (MNRE) and The Energy and Resource Institute (TERI). 2010. GRIHA Manual, Volume 1. Introduction to National Rating System, New Delhi: GRIHA. TERI Press
- Ministry of Environment of Japan. 2007. Building a Low Carbon Society, First Draft.
- Mitrovic, J. 2010. INTREPID TRAVEL - Reducing Climate Impact. (I. TRAVEL, Producer, & INTREPID TRAVEL).
- Mohanty, B. 2010. Methods & tools to assess and reduce GHG emissions of urban territories: sharing the French experience, Indo-French Workshop on Science, Technology and Humanities: A Tryst with Sustainable Development, Bangalore, India,
- NSW Government. 2011. Purchasing office paper and products. <http://www.environment.nsw.gov.au/sustainbus/officewasteguides.htm> (accessed 10 October 2011).

- O'Neill, D., R. Dietz, and N. Jones. 2010. Enough is Enough: Ideas for a Sustainable Economy in a World of Finite Resources. The Report of the Steady State Economy Conference. Leeds, UK: Center for the Advancement of the Steady State Economy and Economic Justice for All.
- Onecle. 2007. Texas Tax Code - Section 181.001. Tax Imposed. <http://law.onecle.com/texas/tax/181.001.00.html> (accessed 18 September 2011).
- Organisation for Economic Co-operation and Development (OECD) and Food and Agriculture Organization of the United Nations (FAO). 2010. Agricultural Outlook 2010-2019. Paris: OECD Publishing.
- Phillips, L. 2009. EU parliament passes green tyre-labeling law. Euobserver.com. <http://euobserver.com/885/29052> (accessed 19 September 2011).
- Pinderhughes, R., Murphy, C., Facultad and M.A., Gonzalez, M. 2000. Urban Agriculture in Havana, Cuba, San Francisco State University, USA: Urban Studies Program, http://online.sfsu.edu/~raquelrp/pub/2000_aug_pub.html (accessed 14 September 2011).
- Portland Area Community Supported Agriculture Coalition. <http://portlandcsa.org/> (accessed 20 September 2011).
- Price, E. 2011. Apple Offering Buyback Program for Old Macs, iPads and iPhones. TechnoBuffalo. <http://www.technobuffalo.com/companies/apple/apple-offering-buyback-program-for-old-macs-ipads-and-iphones/> (accessed 12 October 2011).
- Rao, N., G. Sant, & S.C. Rajan. 2009. An Overview of Indian Energy Trends: Low Carbon Growth and Development Challenges. Pune: Prayas Energy Group
- Renewable Energy & Energy Efficiency Partnership. Clean energy supply chain in Karnataka villages, India. <http://www.reeep.org/showProject/2518.107010425/clean-energy-supply-chain-in-karnataka-villages-india.htm> (accessed 16 September 2011).
- Richards, E. 2009. The Application of Economic Instruments to Solid Waste Management in Pacific Island Countries and Territories. Apia, Samoa: SPREP
- Roberts, A. 2008. New UK packaging policy to change focus of recycling. Recycle.co.uk. <http://www.recycle.co.uk/news/1161000.html> (accessed 19 September 2011)
- Rockström, J. 2003. Water for food and nature in drought-prone tropics: vapour shift in rain-fed agriculture. *Philosophical Transactions: Biological Sciences*. 358 (1440). 1997–2009. Delft: The Royal Society
- Rockström, J., L. Gordon, C. Folke, M. Falkenmark, and M. Engwall. 1999. Linkages among Water Vapor Flows, Food Production, and Terrestrial Ecosystem Services. *Conservation Ecology* 3 (2). <http://www.ecologyandsociety.org/vol3/iss2/art5/> (accessed 30 August 2011)
- Rodale Institute. 2005. Organic farming produces same corn and soybean yields as conventional farms, but consumes less energy and no pesticides, study finds. <http://www.news.cornell.edu/stories/July05/organic.farm.vs.other.ssl.html> (accessed 29 September 2011)

- Rumming, K, ed. 2007. Hannover Kronsberg Handbook - Planning and Realisation. Directorate of Environmental Services and Directorate of Construction and Planning, Altener Energy Frame Programme DG TREN. Hannover, Germany: European Commission.
- Samuel A. V. 1987. Surabaya Indonesia: Options in Solid Waste Management". Proceedings of the 2nd European Conference on Environmental Technology: Amsterdam, The Netherlands Jun. 1987: 707–715.
- Sang-Arun, J., and M. Bengtsson. 2009. Improved Organic Waste Management: Climate Benefits through the 3Rs in Developing Asian Countries. Hayama, Japan: Institute for Global Environmental Strategies.
<http://enviroscope.iges.or.jp/modules/envirolib/view.php?docid=2636> (accessed 2 September 2011)
- Siderius, P, and Nakagami, H. 2007. Top Runner in Europe? Inspiration from Japan for EU ecodesign implementing, Measures. European Council for an Energy Efficient Economy.
- Simply Bulk Market. <http://simplybulkmarket.webs.com/> (accessed 14 September 2011).
- Socialdata America. 2007. Individual Transportation Options Pilot Project. IndiMark, Oregon Department of Transportation. Portland, US: Socialdata America.
- Socialdata and Sustrans. 2005. Darlington Sustainable Travel Demonstration Town: Travel Behaviour Research Baseline Survey 2004. Darlington: Socialdata and Sustrans
- Sodhi, P., R. Gopal, S.N. Srinivas, R.K. Jalan, and K.V. Sarabhai. 2010. Low Carbon Lifestyles. New Delhi, India: Centre for Environmental Education
- Soil Association. 2011. Energy use. <http://www.soilassociation.org/Whyorganic/Climatefriendlyfoodandfarming/Energyuse/tabid/580/Default.aspx> (accessed 12 September 2011)
- SOL₂O Green Building Solutions. Reduction in CO₂. http://www.sol2o.co.uk/reduction_in_co2.html (accessed 28 August 2011)
- Stern, N. 2006. Stern Review on The Economics of Climate Change (pre-publication edition). Executive Summary. London: HM Treasury.
- Stulz, R., and T. Lütolf. 2006. What would be the realities of implementing the 2,000 Watt society in our communities? Paper from IMAGINE Seminar. p. 6. Novatlantis.
- Sustainable Sanitation Alliance. 2011. Urine diversion dry toilets and greywater system, Erdos City, Inner Mongolia Autonomous Region, China. <http://www.susana.org/lang-en/case-studies?view=ccbktypeitem&type=2&id=1049> (accessed 13 September 2011).
- SWITCH-Asia Network Facility. 2009). A Key Solution to Climate Change: Sustainable Consumption and Production - Making the Link. Wuppertal, Germany: SWITCH-Asia Network Facility.
- SWITCH, 2011. <http://www.switch.org.my/v1/> (accessed on 16 September 2011).
- Sydney Water. Water Efficient Washing Machines. <http://www.sydneywater.com.au/Water4Life/InYourHome/WashingMachines/> (accessed 13 September 2011)
- Thabethe, H. E. 2010. Renewable Energy Policies in South Africa. South Africa: Parliament of Republic of South Africa.

- Thailand Environment Institute. 2011. List of Thai Green Products. <http://www.tei.or.th/greenlabel/eng%20pdf/2011-07-Name-GL-eng.pdf>. (accessed 12 October 2011)
- The Scottish Government: Riaghaltas na h-Alba. 2009. Policy relating to Eco Design. <http://www.scotland.gov.uk/Publications/2009/08/18161245/8> (accessed 10 October 2011)
- The Together Foundation and the *United Nations Centre for Human Settlements* (UNCHS). 1998. National Public Scheme for the Conservation of Drinking Water, Egypt, Egypt. <http://www.globenet.org/preceup/pages/fr/chapitre/etatlieu/acteurs/e/i.htm> (accessed 9 August 2011)
- ToolBank. 2011. Tool Bank 101. <http://www.toolbank.org/ToolBank101/ToolBankFAQ.aspx> (accessed 20 October 2011).
- Tortajada, C. 2006. Singapore: An exemplary case for urban water management. Case Study for the 2006 HDR. Mexico: Third World Centre for Water Management.
- Transportation Alternatives. Congestion Pricing | International Examples. New York. <http://transalt.org/campaigns/congestion/international> (accessed on 18 September 2011).
- Tunçer, B., M. Kuhndt, & S. Schaller. 2010. How can business value be increased through sustainable consumption business strategies? (draft version). In M. K. (CSCP) (Ed.), *Making the Business Case Towards Low Carbon and Resource Efficient Lifestyles*. UNEP/Wuppertal Institute Collaborating Centre on Sustainable Consumption and Production (CSCP), Marrakech Task Force on Sustainable Lifestyles and the Swedish Ministry of Environment.
- UnionGas. 2011. Drain Water Heat Recovery. http://www.uniongas.com/residential/energyconservation/energysavings/drain_recovery/index.asp (accessed on 19 September 2011).
- United Nations (UN) 2009a. The United Nations Water Development Report: Water in a Changing World. UN Water: World Water Assessment Programme. London: *United Nations Educational, Scientific and Cultural Organization* (UNESCO) and Earthscan.
- . 2009b. The United Nations Water Development Report: Water in a Changing World. Overview of Key Messages. UN Water: World Water Assessment Programme. London: UNESCO and Earthscan.
- . 2011a. World Population to reach 10 billion by 2100 if Fertility in all Countries Converges to Replacement Level. 3 May. [esa.un.org/unpd/wpp/ other-information/Press_Release_WPP2010.pdf](http://esa.un.org/unpd/wpp/other-information/Press_Release_WPP2010.pdf)
- . 2011b. World Urbanization Prospects: The 2007 Revision Population Database. <http://esa.un.org/unup/> (accessed 13 August 2011)
- United Nations Development Program. Low Carbon Campaign Encourages Greater Environmental Awareness among Drivers. <http://www.undp.org.cn/modules.php?op=modload&name=News&file=article&catid=14&topic=33&sid=44688&mode=nocomments&order=0&thold=0> (accessed 17 September 2011).
- United Nations Environmental Programme (UNEP). 2001. Product-Service Systems and Sustainability – Opportunities for Sustainable Solutions. Paris: UNEP.

United Nations Human Settlement Program (UN-Habitat). 2009. Planning Sustainable Cities: Policy Directions. Global Report on Human Settlements, United Nations Human Settlements Program. London: Earthscan.

- United States Environmental Protection Agency. 2005. Carpool Incentive Programs: Implementing Commuter Benefits as One of the Nation's Best Workplaces for Commuters. Cincinnati: National Service Center for Environmental Publications (NSCEP).
- United States Environmental Protection Agency (EPA). 2008. Municipal Solid Waste in the United States. Facts and Figures 2007. www.epa.gov/osw/nonhaz/municipal/pubs/msw07-rpt.pdf (accessed 15 August 2011)
- Velib. 2010. Mairie de Paris / SOMUPI. <http://en.velib.paris.fr/> (accessed 18 September 2011).
- Veolia Environnement. 2008. Proposals for the responsible management of environmental services. Veolia Environnement's Sustainable Development Department. Paris: Veolia Environnement.
- Vishwanath, S. 2001. Domestic Rainwater Harvesting – Some applications in Bangalore, India. Rain Water Harvesting Conference. H2-1, p. 5. New Delhi, India: April 2001
- Water Footprint Network. <http://www.waterfootprint.org> (accessed 16 August 2011)
- Wikipedia. 2011a. Water heat recycling. http://en.wikipedia.org/wiki/Hot_water_heat_recycling (accessed 8 10, 2011).
- . 2011b. Ecovillage. <http://en.wikipedia.org/wiki/Ecovillage> (accessed 7 August 2011).
- . 2011c. List of car-free places. http://en.wikipedia.org/wiki/List_of_car-free_places (accessed 8 September, 2011)
- Wolfe, L.R. 2005. Rural-Urban Migration and the Stabilization of Cuban Agriculture Food First. Consultant's report. Food First: Institute for Food and Development Policy; and Global Exchange.
- World Bank. 2008. World Bank Development Indicators 2008. Poverty data: A supplement to World Development Indicators 2008. Washington, DC: World Bank.
- . 2010. Unleashing the Potential of Renewable Energy in India. Energy Sector Management Assistance Program, South Asia Energy Unit: Sustainable Development Department. World Bank.
- World Business Council for Sustainable Development (WBCSD). 2009. Energy Efficiency in Buildings: Transforming the Market. Switzerland: WBCSD
- World Economic Forum and Accenture. 2009. Supply Chain Decarbonization: The Role of Logistics and Transport in Reducing Supply Chain Carbon Emissions. Logistics and Transport Partnership Programme. Geneva: World Economic Forum.
- Worldwatch Institute. 2011. The State of Consumption Today. <http://www.worldwatch.org/node/810> (accessed 15 August 2011)
- World Wildlife Fund (WWF). 2009. The Alternative Urban Futures Report. Urbanization and Sustainability in India: An Interdependent Agenda. WWF for a living planet. India: Mirbilis Advisory.
- World Wildlife Fund (WWF). 2010. Living Planet Report. Gland, Switzerland: WWF International
- World Wildlife Fund (WWF), Ecofys, and OMA. 2011. The Energy Report: 100% Renewable Energy by 2050. Gland, Switzerland: WWF International, Ecofys, and OMA.

www.Organic.dk. Organic label in Denmark, <http://www.organic.dk/market/import/label.htm> (accessed 14 September 2011).

Zaragoza. Renaissance Project in Zaragoza. http://www.zaragoza.es/ciudad/medioambiente/renaissance/en/zara_renai_en.htm (accessed 18 September 2011).