SWITCH-ASIA BOOKLET SERIES NO. 1

switchasia NETWORK FACILITY

A KEY SOLUTION TO CLIMATE CHANGE: SUSTAINABLE CONSUMPTION AND PRODUCTION

MAKING THE LINK

PART 1 | THE CHALLENGE

UNDERSTANDING CLIMATE CHANGE DIFFERENTLY: THE SUSTAINABLE CONSUMPTION AND PRODUCTION PERSPECTIVE

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ABOUT THIS BOOKLET

This booklet has been published by the EU funding programme SWITCH-Asia: Promoting Sustainable Consumption and Production. It is aimed at European and Asian businesses, organisations involved in developing sustainability solutions, policy-makers, and project developers wanting to help reduce the climate change impact of business in as broad a way as possible. It should be particularly useful to those interested in obtaining grant funds from the SWITCH-Asia programme, and in sharing the benefits of the network of SWITCH-Asia projects.

The booklet has two sides – side one deals with the 'challenges' in understanding the causal relationship between economic activities and climate change, and the flip side highlights some practical 'solutions' that can be funded, at least in part, by the programme.

Its objectives are:

- to present a picture of how business and consumers are contributing to climate change, with particular reference to the situation in Asia;
- to outline the concepts of the Sustainable Consumption and Production approach;
- to present sustainable consumption and production technologies and approaches that can be used for climate change mitigation and adaptation;
- to provide ideas for policy-makers and project developers seeking funding under the SWITCH-Asia programme;
- to show how SCP can support the EU climate change position and goals (for example at the Copenhagen COP15 in December 2009).

A KEY SOLUTION TO CLIMATE CHANGE: SUSTAINABLE CONSUMPTION AND PRODUCTION – *MAKING THE LINK*

THE CHALLENGE: CLIMATE CHANGE

I Understanding climate change differently
II Consumption and climate change
III Global value chains

A SOLUTION: THE SCP APPROACH

I Adressing climate change differently
II SCP for climate change mitigation and adaption
III SCP Practices in action
IV Innovative policymaking

- Wrapping Up
- Recommended further reading and bibliography

For more information on how to apply to the SWITCH-Asia programme or learn more about the SWITCH Network Facility please consult the following websites:

- Website of the SWITCH-Asia programme
  http://ec.europa.eu/europeaid/where/asia/regional-cooperation/environment/switch_en.htm
- Website of the SWITCH-Asia Network Facility
  http://www.switch-asia.net

UNDERSTANDING CLIMATE CHANGE DIFFERENTLY

The concept of sustainable consumption and production (SCP) allows the issues surrounding climate change to be viewed through a broader lens than has been the case in recent years. SCP integrates the two sides of business: production activities on the supply side, and consumption activities on the demand side. Considering both aspects can give rise to a complete and integrated picture of the overall impact of business on the environment and climate, and it especially acknowledges the importance of the interrelationships between business activities, political decisions, and everyday consumer behaviour. This naturally has implications for how decisions should be taken and who should be involved if we want effective results.

The beauty of SCP thinking is also in the insights it offers into relationships between the resources used during the development of products and services, the energy consumed during their use, and the protection of ecosystems – during the 'life-cycle' of a product or service. It can therefore clearly identify areas having a big impact on the climate, and consequently highlight key 'hot spots' for intervention.

> *Sustainable Consumption and Production (SCP) is an attempt to reconcile the increased demand for goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, in order not to jeopardize* ***the needs of future generations****. Materials, Water and Energy are the three key elements.* ***Sustainable Production*** *concerns the* ***supply side****, focusing on the economic, social and environmental impacts of production processes; while* ***Sustainable Consumption*** *addresses the* ***demand side****, focusing on consumers' behaviour and choices in use of goods and services, i.e. demand for products that environmentally friendly both in their production and in their use, as well as by promoting a sensible consumption behaviour, avoiding spillage and waste.*

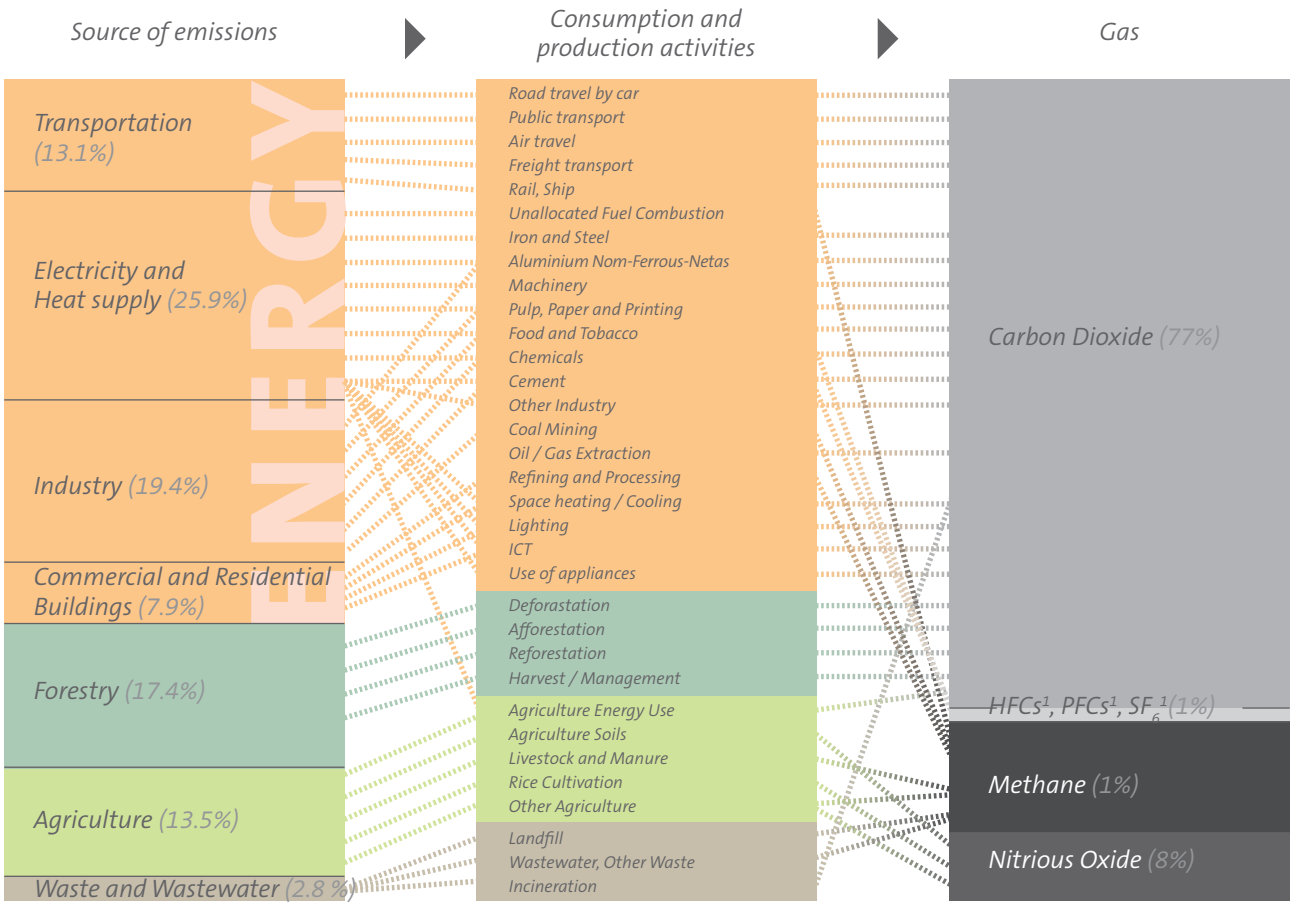
UNSUSTAINABLE PATTERNS OF CONSUMPTION AND PRODUCTION AS THE DRIVING FORCE IN CLIMATE CHANGE

The role of people, their needs, and their consequent fulfillment through the production and consumption of products and services are important to understand when considering the causes of climate change. This is especially so as the global population becomes increasingly urbanised. In 2008, for the first time, the world's urban population was larger than its rural population. Such urbanisation has intensified demand particularly for new consumer goods and services, modern residential and commercial buildings, and motorised transport.

The production processes behind such goods and services are extremely energy and resource intensive. Materials like cement, steel, non-ferrous metals or aluminium are produced and consumed at ever-faster rates, continually pushing up global greenhouse gas emissions. The increasing global demand for timber and paper products has led to unsustainable logging practices and land-use changes, frequently destroying rainforests that are vital for the operation of a healthy atmospheric system. The demand for food and clothing (especially cotton) is also causing an increase in emissions such as methane and nitrous oxide. In fact, many modern consumer products demand more energy during their use than they did during their production. Modern households and offices are equipped with computers, electric appliances and gadgets, air conditioning, and floor heating, etc. all creating a high energy demand in buildings. Road transport and air travel are also growing sources of CO2 emissions (see figure 1).

Figure 1: Split of global greenhouse gas emissions by source of emission and consumption and production activity

(after World Resources Institute, 2005, with data from IPCC, 2007)

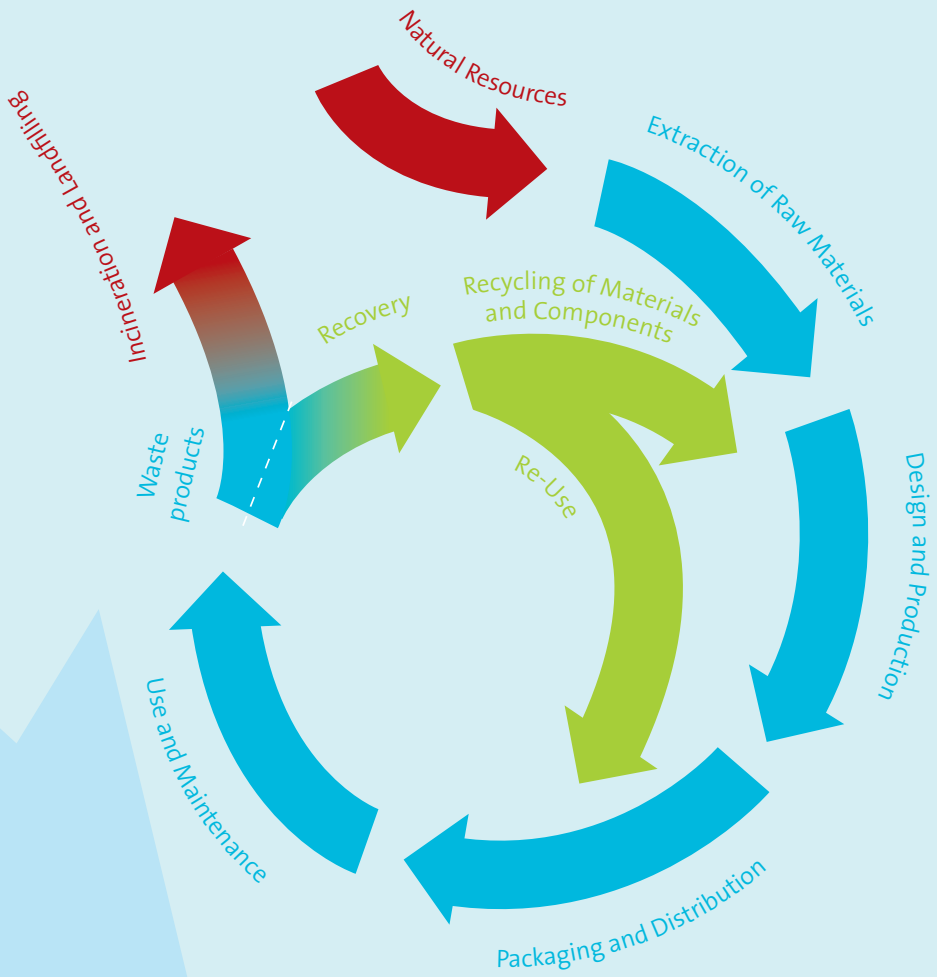


[1] HFC: Hydro-Fluoro-Carbon; PFC: Perfluorinated Carbons; F6: Sulfur Hexafluoride

LIFE CYCLE THINKING

To understand the full environmental impacts of products and services, it is necessary to adopt life cycle thinking, which is an important aspect of the SCP perspective. Through life cycle thinking it is possible to account for the impacts generated along each stage of the production and consumption process of a product or service - from cradle-to-cradle. This includes primary resource extraction, primary materials processing, design and production, packaging, distribution, retail, use phase and finally the end-of-life stage (see figure 2). By adding together and comparing the impacts of the different stages the life cycle approach gives a clear picture of both the overall environmental 'footprint' of products and services, as well as the hot-spots where the highest impacts occur. Life-cycle thinking suggests that energy consumption and emissions is not only about our use of oil and electricity, it is also about the energy embodied in all the raw materials consumed, the energy used to process these materials, and the energy used to dispose the waste after our products have served their purpose. Therefore, energy efficiency is not only about making cars run farther on the litre and light bulbs consume less electricity, it is also about saving the resources used to produce cars and light bulbs, the energy needed to dismantle them again, reuse the recyclable materials, and dispose of the end waste.

Figure 2: Product life-cycle from an SCP perspective



CONSUMPTION AND CLIMATE CHANGE

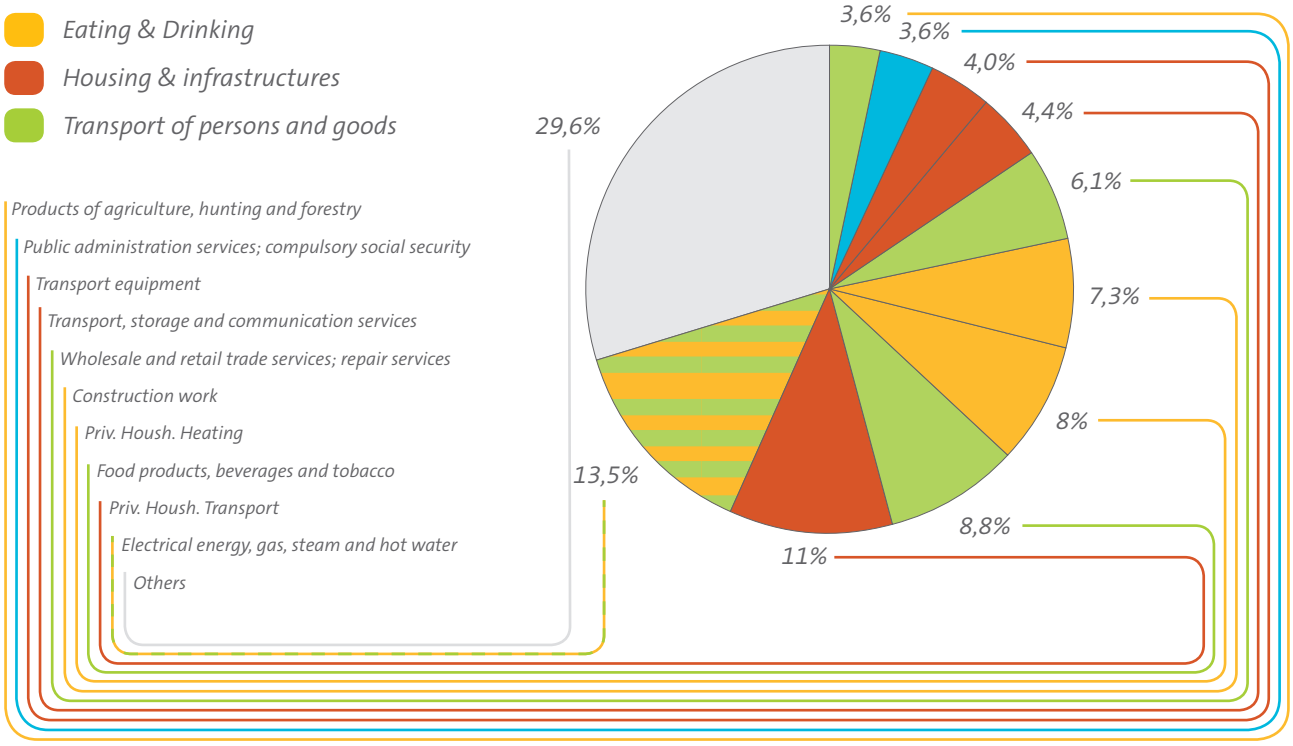
There are currently three sectors responsible for about 70-80% of the overall environmental impact of human consumption and production (EIPRO Study, 2006). They are also thought to be the causes for about 70% of the global warming potential in the European Union (see figure 3). They are:

HOUSING **TRANSPORT** **FOOD**

Even though reliable data are missing, it is likely that the main sectors of human consumption responsible for the most environmental impact in Asia are similar to those in Europe – but the underlying characteristics are contextually different. Traditional Asian lifestyles, which are still common in many countries, are generally less damaging to environment and climate. For example, there is more communal 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 of food, less processing and fewer "food miles". In the mobility sector, private car ownership is still the exception, rather than the norm. While it is obvious that Asia's future development path will not mirror that of Europe or the US, consumption trends in many regions are changing and approaching western consumption patterns.

Figure 3: Global warming potential of the consumption sectors housing, transport and food

(Source: ETC/RWM NAMEA data base)



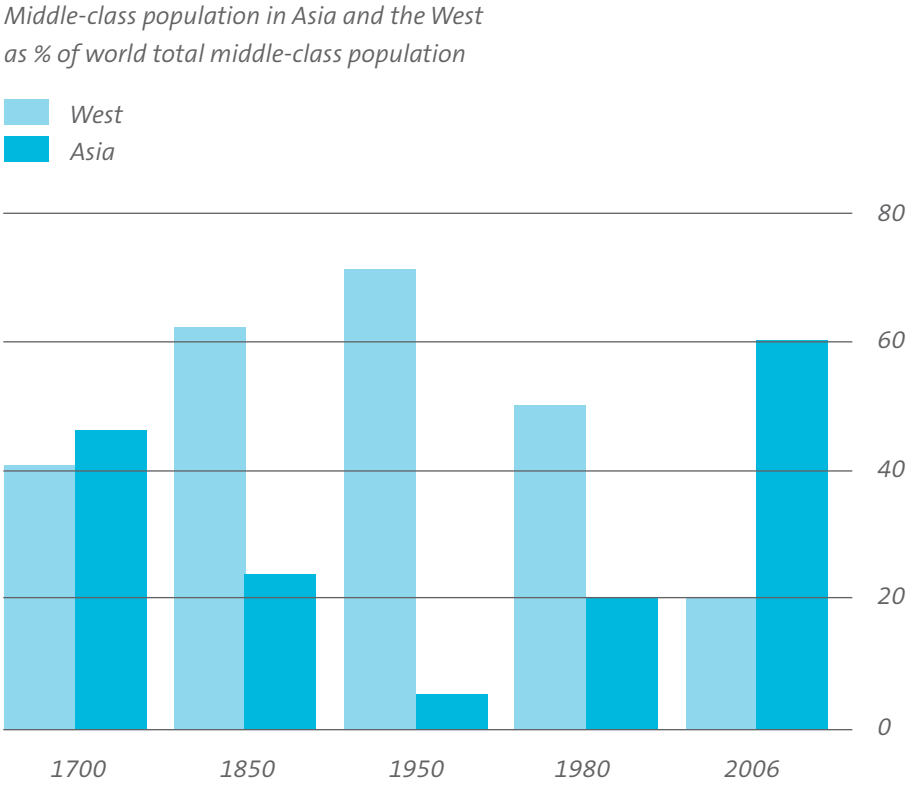
GLOBAL CONSUMER CLASS

While the industrialised nations of Europe and North America are still the 'prime culprits' of modern consumption patterns, the rapid growth in economic activity and incomes in the Asia-Pacific region has revolutionised access to modern consumer goods and services in Asia. The region has not only become a global manufacturing hub, but it is now home to an emerging consumer class. This consumer class is now estimated at around 600 million people, already more than in Europe and North America combined.

The consumption patterns of millions of consumers in the newly industrialised countries of the Asia-Pacific region are converging with those of western industrialised countries - especially within the younger generations. This emerging social group is known as the 'global consumer class' and comprises mostly urban consumers who share certain elements of a lifestyle of conspicuous consumption regardless of their cultural background or nationality – they are likely to live in modern apartments equipped with electronic appliances and gadgets, have access to information technologies and global brands, own their own cars, travel by air, etc. This global consumer class now totals 1.7 billion people – of which almost 40% are in Asia (Worldwatch Institute, 2004). The percentage of middle-class consumers in Asia is even higher, accounting for 60% of the global total (see Figure 4).

Figure 4: The world's middle-classes are increasingly found in Asia and decreasingly in the West

(Source: The Economist, 2009)



CARBON FOOTPRINT – A USEFUL MEASURING STICK

The greenhouse gas emissions generated over the life-cycle of a product form a product's 'carbon footprint'. The carbon footprint of agricultural goods is mainly formed during the early 'production' stages; but the carbon footprint of electronic equipment is generated mostly during the 'use' phase. The manufacture of a computer, for example, is very material and energy intensive, and emissions are generated during the extraction and processing of resources like silicon, platinum or copper, all required for the production of semiconductors and other electronic components. About 1,500 litres of water are also used during its manufacture. Actually using the computer, however, takes the most energy and generates the most emissions of all life-cycle stages. This phase accounts for about 940 kg of greenhouse gas emissions every year (see figure 5). Similarly, most of the carbon footprint of passenger vehicles lies in the 'use' phase and more than 80% of emissions are generated during the driving of the car (see figure 6).

Figure 6: Carbon footprint of passenger cars

(Source: WWF-UK Evidence Base 2006 taken from WWF-UK, 2008)

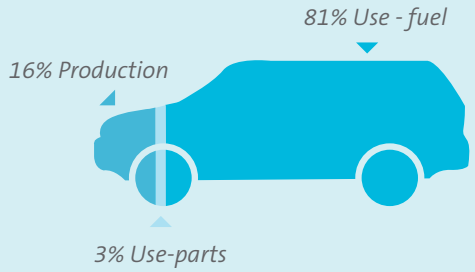
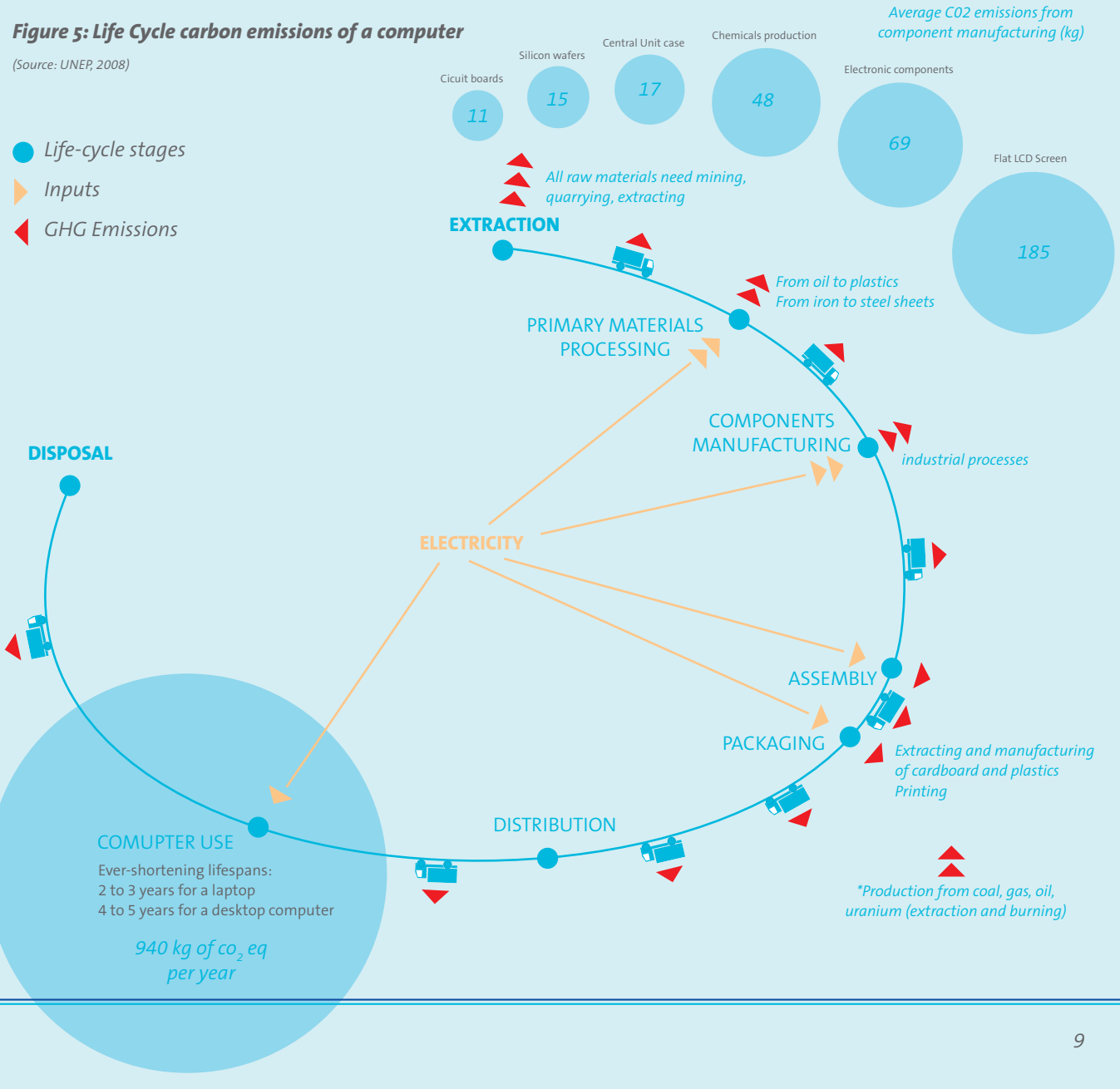


Figure 5: Life Cycle carbon emissions of a computer

(Source: UNEP, 2008)



FUTURE IMPACT AREAS IN ASIA – HOUSING, MOBILITY AND FOOD

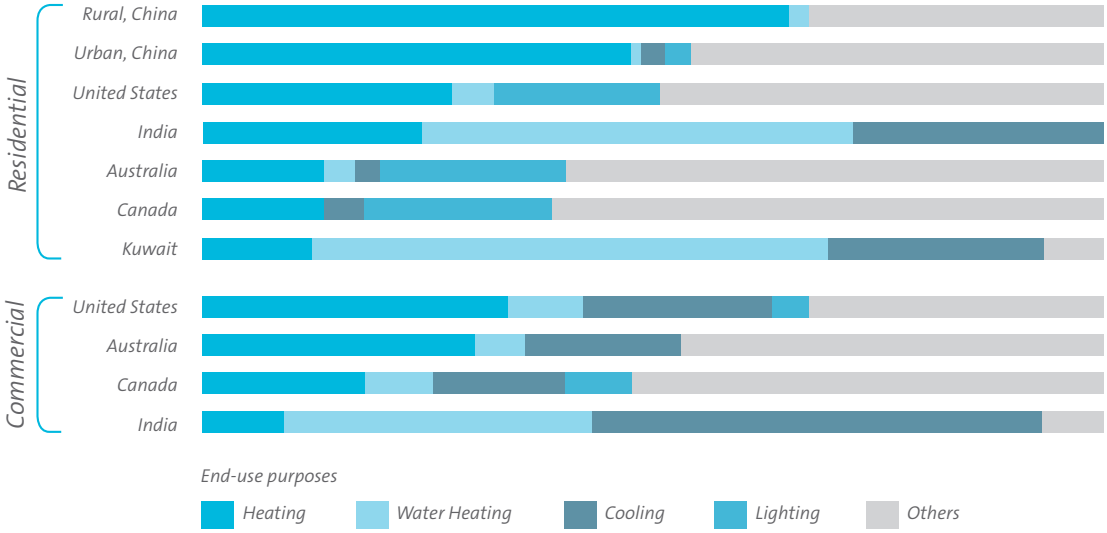
THE IMPACT OF HOUSING

One of the greatest challenges in reducing the ever-rising atmospheric levels of greenhouse gases – in 'mitigating' climate change – lies with buildings and housing. At a global level residential and commercial buildings account for 10-15% of all greenhouse gas emissions. In Asia, by around 2035 the urban population will have ballooned by 70% to more than 2.6 billion people (ADB, 2006a). More than half the construction going on in the world is now taking place in China and by 2030 this one country is expected to have more than 200 cities each with over one million people (McKinsey Global Institute, 2008a).

The building needs are immense. About 20% of the total energy consumption of buildings occurs during the construction period, and more than 80% during the 'use' phase. This means that energy efficient building solutions should be designed and realised early on, at the start of any building project. But they cannot be one-fits-all solutions, they will have to be tailored to geography and climate. For example, in China most energy is needed for warming space, while in India and South East Asia most is needed for cooling. Building solutions which consider local climatic conditions will be the best fit (see figure 7).

Figure 7: Energy consumption patterns of buildings are different from country to country

(Source: UNEP, 2007)

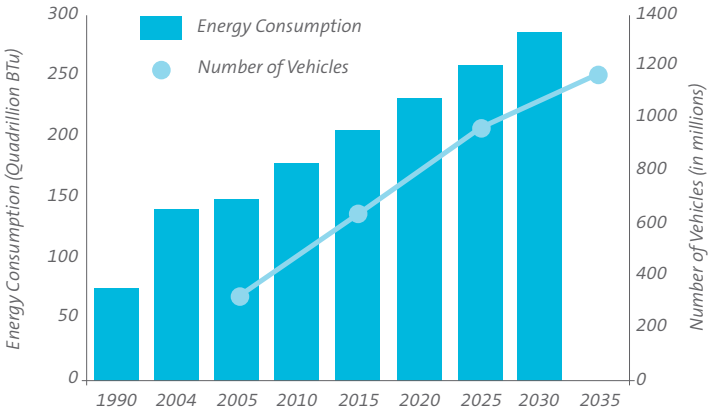


GROWTH PATTERNS IN A METROPOLIS

The evolution of building and housing developments in Asian mega-cities follows the same path as it did in industrialised countries: as the number of people per household goes down, the number of households goes up, as does the living floor space and the number of electrical appliances in each newly home built. The market for air-conditioners in the metropolis of Bangkok grows about 15% every year and has contributed to the massive 240% increase in residential electricity consumption over the past 20 years. Urban centres and new communities are emerging throughout the greater metropolitan area, connecting themselves by the rapid spread of suburbia, and eating away at the remains of the green belt. Source: Wangpattarapong, K et al (2008)

Figure 8: Emissions from the transport sector in Asia will continue to rise alongside the growing number of vehicles

(Source: Clean Air Initiative for Asian Cities Center, 2008)



THE IMPACT OF TRANSPORT

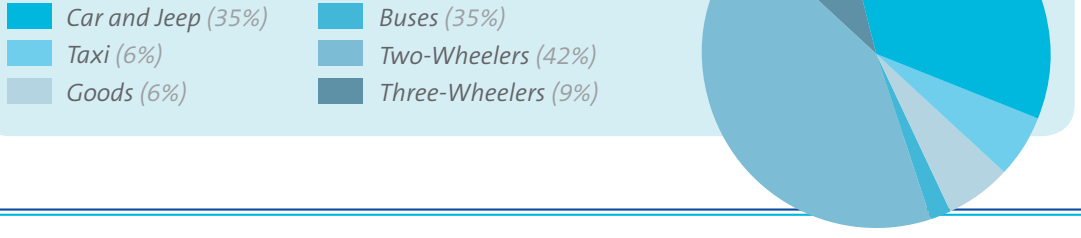
At the global level greenhouse gas emissions issuing from the transport sector continue to grow. The increase is mainly due to the private use of cars and air travel. It is estimated that the transport sector will be the source of 60% of the increase in emissions worldwide between 2002 and 2025. Car sales are growing fastest in Asian newly industrialised countries where the number of vehicles on the road is expected to rise from 300 million in 2005 to more than 1.2 billion in 2025 (see figure 8). At present car ownership is low: 2% of the population in China and less than 1% in India, compared with 40-50% in Europe and North America. But this level is expected to rise steeply, and estimates put the number of private cars in China at 190 million, and in India at 80 million, by 2035 (ADB, 2006b).

GETTING AROUND IN MUMBAI – OR NOT

Mumbai is a good example of an Asian mega-city with, according to the UN, a population of 19 million which could rise to more than 26 million by 2025. It is also a good example of a city with an old transportation infrastructure that, despite the most extensive suburban rail network in the country, cannot keep pace with its growing population. As bus services deteriorate, the use of private cars goes up as does the number of fatal road accidents. Pollution, especially from the many old two-tact engines used in old motorbikes, tuk-tuks, mopeds (see figure 9), causes chronic respiratory problems - not helped by the low emission and fuel standards. The need for a Rapid Bus Transport system and other modern transportation innovations, as used in other mega-cities, is now urgent.

Figure 9: Two wheelers dominate the vehicle scene in Mumbai

(Source: The Nuffield Foundation, 2003)



THE IMPACT OF FOOD

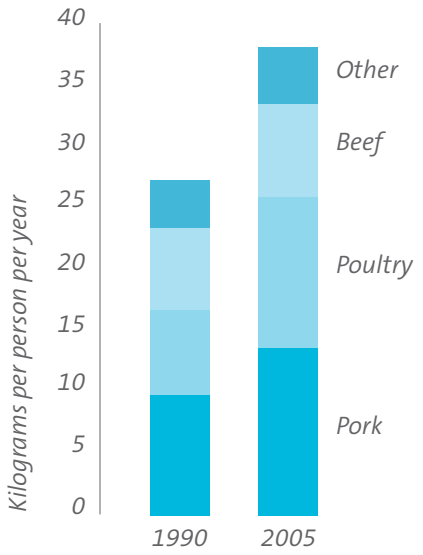
The impacts of food production on greenhouse gases have been under-estimated. Until recently most discussion relating to the food and drink sector has focused on 'food miles' and transportation. Food is often transported over long distances which accounts for around 10% of the food-related climate impact, but the food production phase has a much higher impact, and contributes more than 80% of food life-cycle emissions (Weber and Matthews, 2008). The contribution of meat production is astounding: it has the highest impact and is responsible for up to 80% of all emissions from agriculture, and 18% of global greenhouse emissions. The latter figure is even expected to double by 2050 (FAO, 2006). On average, red meat is around 150% more greenhouse gas intensive than chicken or fish, and beef, lamb and shrimp are the worst (UNEP, 2008).

Traditionally, Asian diets have been low in dairy and meat products, with fish and soy as the main sources of protein. They still are low if compared to the 112 kg consumed per person in the United states, or even the 89 kg/person consumed in Europe. In the 5 years from 2000 to 2005 the production of meat doubled worldwide, from about 229 to 465 million tonnes, and milk production increased from 590 to 1043 million tonnes (FAO, 2006). But, as Asian incomes rise, meat and dairy consumption is also rising (see figure 10). Extremely intensive land-use practices, such as meat production, cause the deterioration of productive land.

They drive overgrazing, deforestation and desertification, not only in Asia, but also South America. The annual loss of fertile soil is worldwide approximately 25 billion tons. In the last 20 years the surface of approximately one million square kilometres of productive land was lost. This not only contributes to food insecurity, especially for millions of people in Asia who are still trying to meet recommended daily calorie intake, but also results in the release of carbon stored in the soil (Baedeker et al. 2008).

Figure 10: As global incomes rise so does the demand for meat

(Source: UNEP, 2008)



COFFEE WITH MILK ONLY SOUNDS HARMLESS

Have a thought about a country where agriculture, rather than industry, is helping to make it the world's third largest producer of greenhouse gases. Coffee, palm oil and beef have become dangerous crops for the Indonesian environment. Their massive cultivation has been possible only because they are replacing large tracts of forests. As a result, on the island of Sumatra nearly half of the forest has been lost since 1985.

Through illegal plantations in protected areas endangered species such as forest elephants, rhinos and tigers are being pushed towards extinction. Further negative effects are declining soil fertility, erosion is more common, and flooding more likely. Such 'high impact foods' are no friends of the poor either who still need to make a living from the depleted land.

Source: WWF-Indonesia (2007)

III

GLOBAL VALUE CHAINS

LINKING EUROPEAN CONSUMPTION AND ASIAN PRODUCTION

The concept of 'global value chains' is closely related to life-cycle thinking. Presenting a product's life-cycle can show how much greenhouse gases are being released into the atmosphere, and during which phase of its production or use. Presenting a product's value chain can in addition show the geographic locations where the gases are being released.

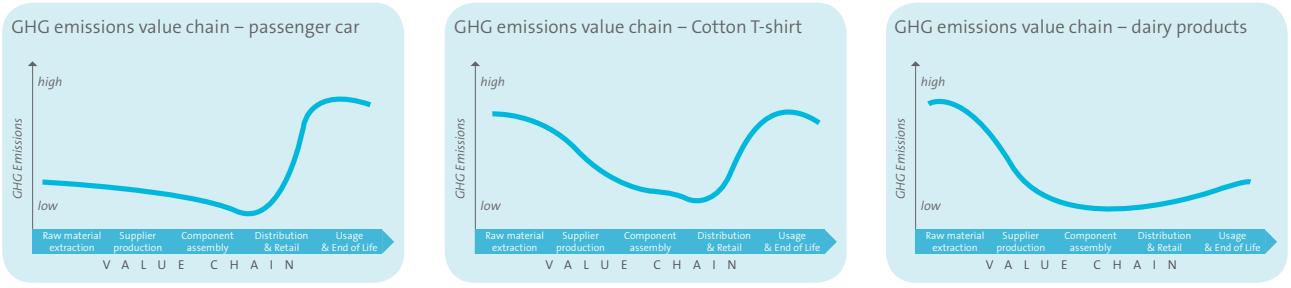
Through economic globalisation the value chains of a single product have become increasingly complex – often so much so they are no longer transparent. A product's many materials and components are now being supplied, manufactured and assembled by a multitude of companies, particularly small and medium-sized enterprises (SMEs), from different locations and often in Asia. The environmental 'hot spots' of the value chain have shifted, effectively outsourcing many energy and emission intensive processes to developing countries, particular in Asia (Kuhndt et al, 2008).

All stages of the value chain are inextricably linked. Decisions and actions taken in one part of the chain influence on the 'upstream' (production) and 'downstream' (consumption) phases. Companies and researchers are now aware that the carbon footprint of many products, such as textiles, vehicles or agricultural products, can only be measured, and ultimately reduced, by considering all parts of the value chain. It is no longer enough to just consider the environmental impacts of in-house operations (see figures 11-13).

In the global value chain communication is the key. Measuring and reducing the carbon footprint of a product requires good communication with suppliers, and maybe even the suppliers of suppliers, who are often located on the other side of the world. Reducing the footprint of energy consuming products, such as cars, requires good communication with end-users as it is they who are responsible for the use of most of the energy.

Figures 11-13: The value chains show where the emission 'hot spots' are for different products*

** based on various LCA data sources*

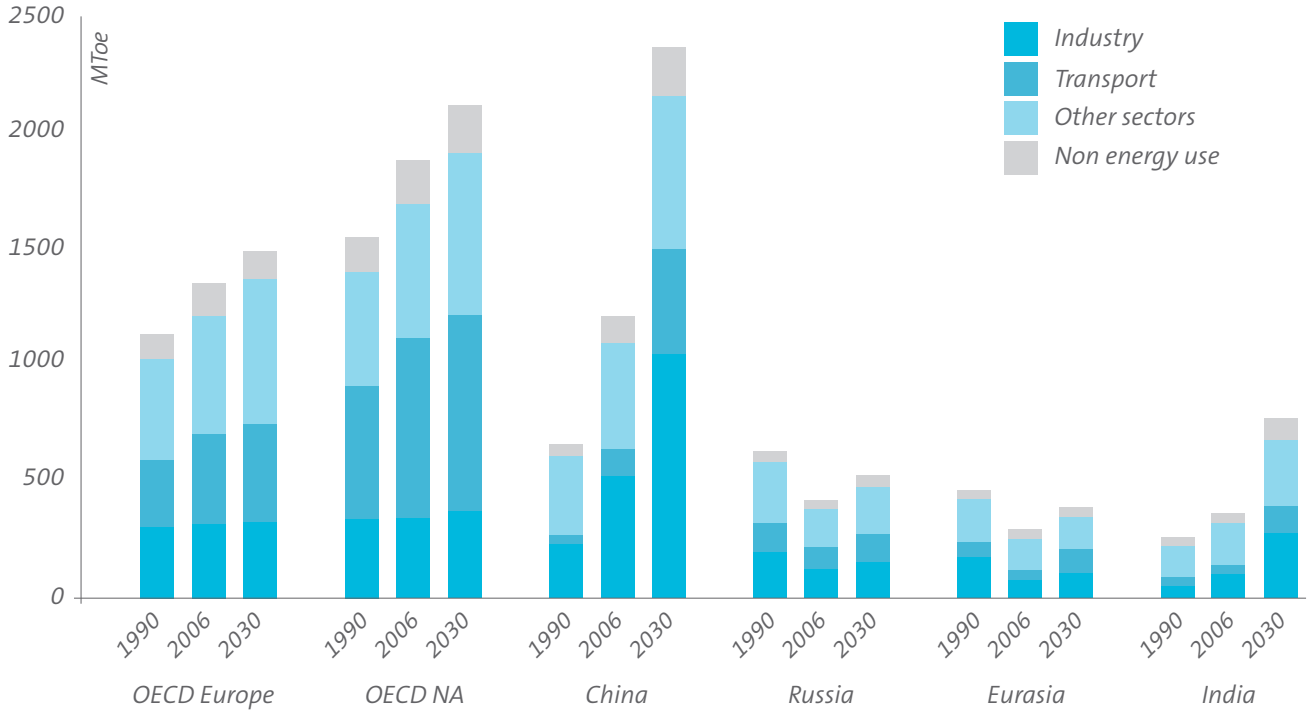


Global value chains are also shedding more light on the economic and social imbalances in the distribution of emissions and highlighting where they need to be curtailed. Because industrialisation and mass production and consumption started much earlier in the industrialised countries of Europe, North America and Japan, the developed countries are responsible for about 75% of historic cumulative greenhouse gas emissions and almost 60% of current global emissions. In contrast, the developing and least-developed economies, which form around 80% of the world's population account for only 23% of historic global cumulative emissions and about 40% of current global emissions (Raupach et al, 2007). Industrialised countries are responsible for the largest amount of historical and current emissions, but newly industrialised countries in Asia are accountable for the largest growth in emissions, now and in the future. The responsibility for this growth in emissions can largely be laid at the door of industrial SMEs and their increasing energy and resource usage.

Although much resource and energy intensive industrial production now takes place in developing countries and drives up emissions, developed countries still have a significantly larger share of per capita emissions. The growth in emissions is also more easily attributed by using the value chain concept: in OECD countries energy consumption and related emissions from industry have remained roughly stable since 1990 and are not expected to grow significantly in the future. Major increases in energy consumption are occurring in other sectors on the consumption side, particularly in transport and housing (see figure 14).

Figure 14: All projections are upwards for energy consumption

(Source: EEA, 2008)



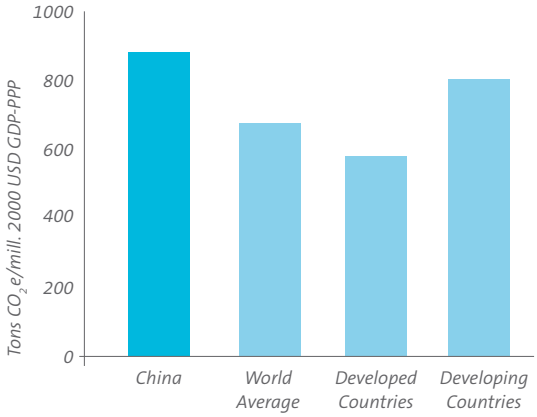
Industrial production, land-use and deforestation are giving rise to most emissions in Asia, with most of the related economic activities being undertaken by SMEs. The SWITCH -Asia programme is offering support and encouraging change in these areas as SMEs have few resources and capacity of their own to improve environmental performance.

INDUSTRIAL PRODUCTION IN ASIA

In Asia, the main sources of greenhouse gas emissions are related to the energy used in industrial production and emissions from deforestation. Despite the financial crisis, economic development continues and is largely responsible for the growing demand for industrial energy. Total greenhouse gas emissions are growing and their intensity ('CO2 equivalent' per unit of GDP) is falling, but in Asia the intensity remains amongst the highest in the world (see figure 15). The potential for reduction in many industry sectors such as cement, steel, chemicals, non-ferrous metals or aluminium, and particularly in small and medium-sized enterprises SMEs is therefore huge.

Figure 15: Greenhouse gas intensity varies greatly across countries

(Source: Pew Center, 2007)

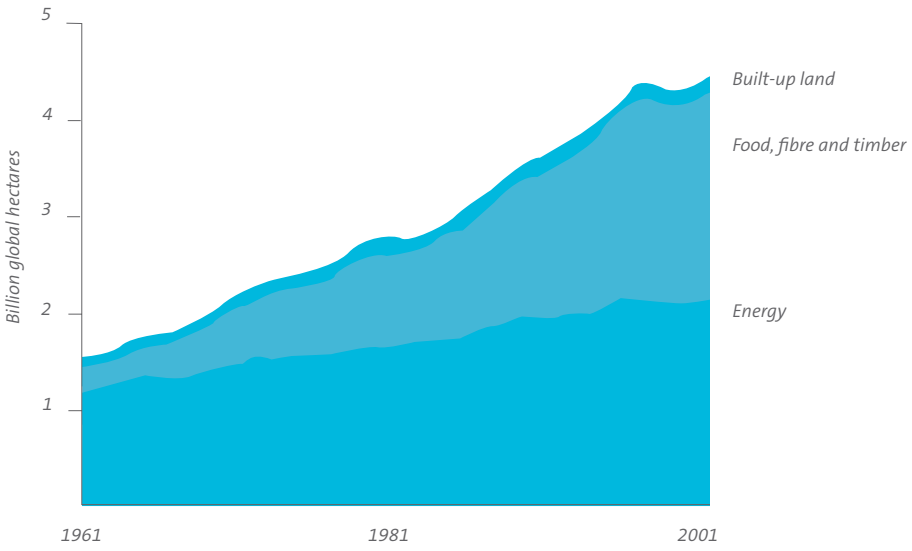


LAND-USE AND DEFORESTATION IN ASIA

Growth in energy demand in Asian countries is not the only cause for climate change. The growing domestic and international demand for food, fibre and timber has an equally large environmental footprint as energy demand (See figure 16).

Figure 16: Ecological footprint of the Asia Pacific region 1961-2001

(source: WWF 2005)



These demands lay heavily on Asia's ecosystems, particularly the forests. This is especially worrying because of their important 'carbon sink' function which lessens the impact of our changing climate on the Earth. Deforestation causes 35% of emissions in developing countries and 65% in the least developed countries. While some countries in Asia have implemented reforestation programmes, in most South East Asian countries, such as Indonesia, Malaysia and Myanmar, forests continue to be depleted at an incredible rate. Why? The global demand for tropical timber for furniture is still growing, as are the demands on large-scale agriculture and palm oil plantations for food and transport biofuel production (See figure 17).

Figure 17: Rates of annual forest change in the Asia Pacific region

(source: FAO 2007)

SMALL AND MEDIUM-SIZED ENTERPRISES IN ASIA

The role of SMEs in Asian economic development cannot be overstated. They are important in Asian supply chains and are significant actors in Asia Pacific industrial sectors. They account for more than 90% of enterprises and in the coming decades most of the world's manufacturing will move to Asia, to be largely taken up by SMEs (see Table 1). Through sub-contracts with larger companies, SMEs will increasingly become part of global value chains. SME suppliers, or suppliers of suppliers, must also go 'green' to make the whole production process environmentally friendly and sustainable (Rao, 2005). Unfortunately, the poor condition of SMEs in Asia is one of the reasons for the growth in industrial emissions in Asian countries.

Table 1: Economic contribution of SMEs in selected Asian countries

(after Ho, 2005)

Country	SMEs as a proportion of total enterprises (%)	Employment attributed to SMEs (%)	Industrial output value attributed to SMEs (%)
China	99	73	60
Singapore	98	80	36
Taiwan	97	58	41
Vietnam	97	56	42

It is often difficult for SMEs to implement environmental and sustainability goals. In contrast to large corporations, they lack incentives, awareness, and human and financial resources. Especially today, in the midst of the global economic downturn and financial crisis, SMEs are short of capital and have limited access to bank loans. For these reasons, they continue to operate with outdated and polluting machinery, and have limited ability to adopt clean technologies.

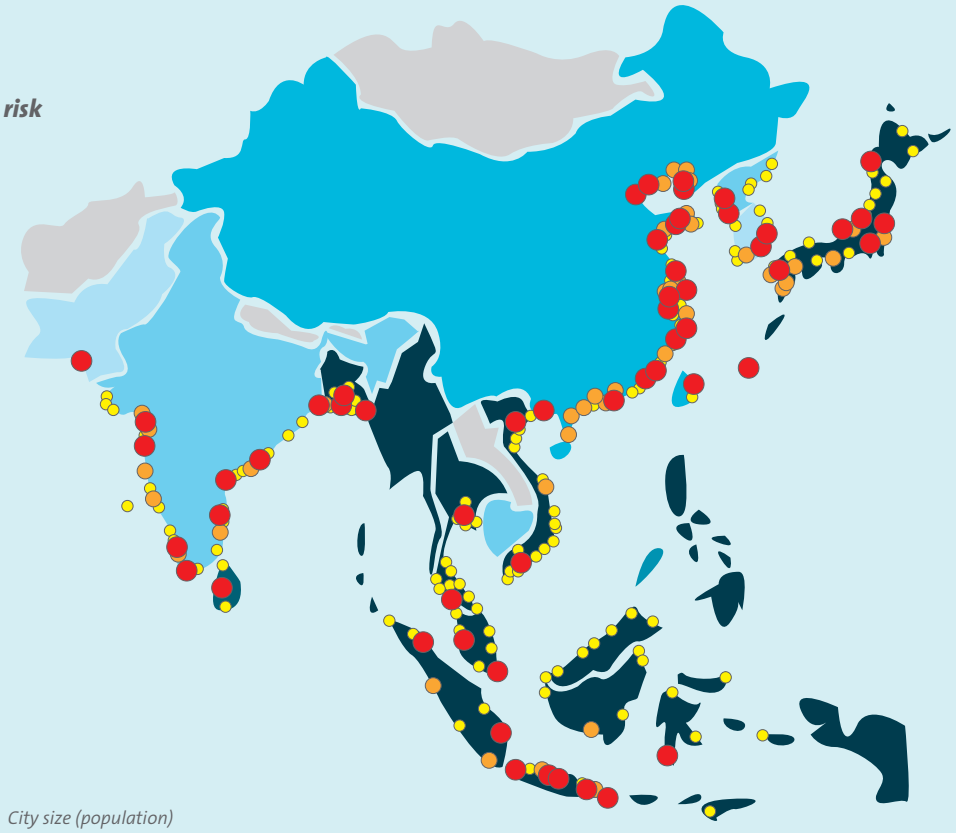
SMEs are also often disadvantaged by being located in residential areas, where they lack access to even the most basic sanitation services such as sewers and waste disposal and treatment facilities. They are typically unregulated by local and municipal governments and strongly affect the quality of life of local people. In Eastern Mumbai, for example, the air's dangerously high lead content caused by SME emissions is affecting its communities. To some extent the introduction of supply chain management is beginning to influence environmental management in the region but much more effort is required to ensure lasting changes.

CLIMATE CHANGE EFFECTS IN ASIAN COUNTRIES

In Asia not only mitigation of climate change is a challenge, but also adaptation to climate change. Asia already has plenty of environmental problems and climate change is just exacerbating and adding to them at an alarming rate. What are they? Water and soil pollution, land degradation, deforestation, biodiversity loss and over-fishing, desertification, melting glaciers in the Himalayas flooding the lower Mekong region and leaving less water to be carried by rivers in the future. Monsoons are changing, severe droughts are already felt in India, freak storms and typhoons are increasingly common in the Philippines and Japan. Desertification is spreading in Central Asia, Mongolia and China damaging agriculture. But most worrying of all is the anticipated one-metre rise in sea-level forcing 100 million people from their homes, mostly in Bangladesh, eastern China, and Vietnam.

Figure 18: Asian cities at risk from rising sea levels

(Source: UNEP, 2009)



Per cent of national urban population in low elevation coastal zones in Asia

- *Non LECZ*
- *0.0 - 5.0*
- *5.1 - 10.0*
- *10.1 - 15.0*
- *15.1 - 20.0*
- *20.1 - 25.0*
- *> 25,0*

City size (population)

- *Small (100-500 thousand)*
- *Intermediate (500 thousand - 1 million)*
- *Big (more than 1 million)*

LECZ: Low Elevation Coastal Zones are land areas that are contiguous with the coast and ten metres or less in elevation

SHARING RESPONSIBILITY FOR GHG EMISSIONS BETWEEN PRODUCERS AND CONSUMERS

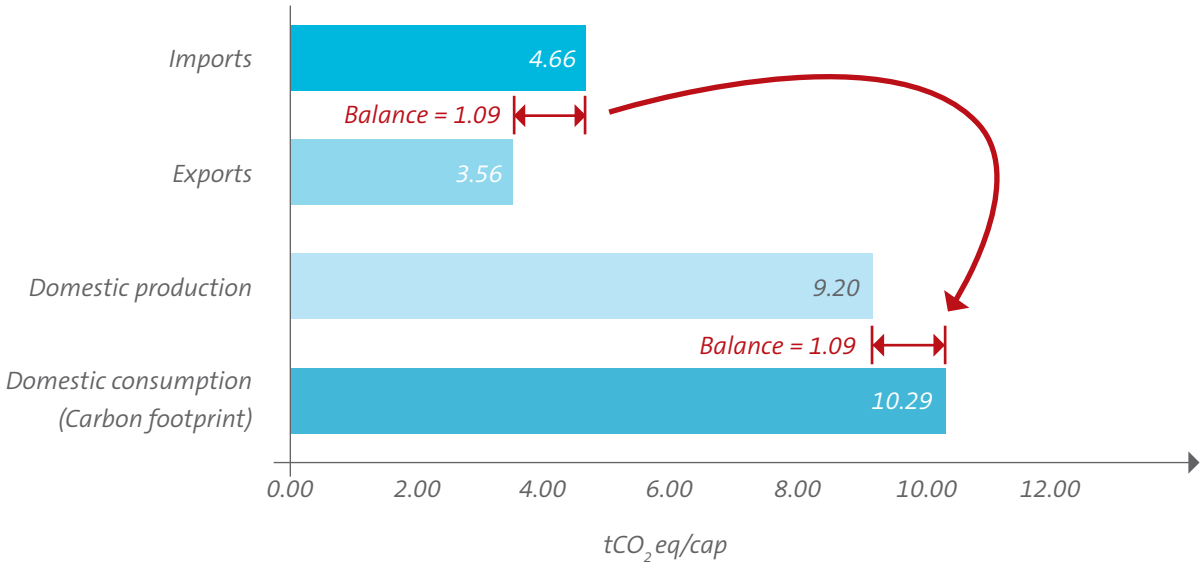
To successfully mitigate climate change we must reduce greenhouse gas emissions across the world. There is little dispute about this. It is no good shifting or displacing emissions from one location or country to another, they must be reduced altogether. New carbon accounting systems which fully acknowledge the role of consumers in this challenge can contribute to effective governance of global climate change.

At present, a country measures its emissions through an inventory of what it produces on its own soil. But this, unfortunately, does not fully take into account global value chains and trade. Stimulated by consumption inside one country, industrial production and therefore greenhouse gas emissions often occur elsewhere outside the country, sometimes on the other side of the planet. In the current emission accounting systems this 'virtual carbon', embodied as it is in products, is not visible.

Considering the part consumption has to play in global and national emissions provides a new perspective. In the case of the UK, a consumption-based inventory for 2002 gave a total carbon footprint of 176.4 million tonnes of carbon (MtC), compared to the national emission inventory of 149.0 MtC which only covered emissions generated inside the UK (Carbon Trust, 2006). Similarly for Spain, the consumption-based footprint of GHG for 2005 was nearly 17% higher than the official, production-based, inventory (Santacana, 2008). Personal carbon footprints are similarly also higher (see figure 19).

Figure 19: Balance of Spain's carbon footprint per capita in 2000

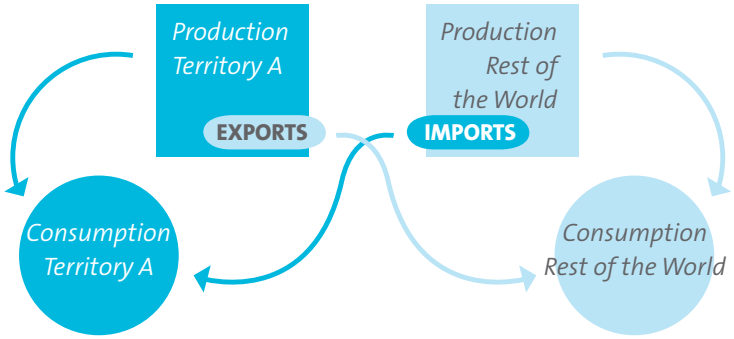
(Source: Santacana, 2008)



How does a consumption-based accounting system work? The export emissions of a country are deducted from the national inventory, and the emissions embodied in a country's imports are being added. When the balance for a country is positive, it is said to "export" emissions. When the balance is negative, it "imports" emissions (see figure 20).

Figure 20: Consumption-based carbon accounting of countries

(Source: Carbon Trust, 2006)



Consumption-based approaches are already becoming popular for dealing with this 'carbon leakage' (see box). 'Consumption-based GHG emission accounting' or 'country carbon footprints' (Hertwich and Peters, 2009) are being put forward as more comprehensive accounting systems and are generally becoming more widely known and understood.

However, the feasibility of applying consumption-based accounting is still being debated. On one hand, it is considered more accurate, fair, and potentially more engaging for both developed and developing countries. It could also help to address the issue of 'common but differentiated responsibilities' under the UN Framework Convention on Climate Change (UNFCCC). On the other hand, data are not always available and altering the current territorial production-based carbon accounting system, which is at the core of the post-2012 policy debates, could delay current negotiations towards a global deal.

Furthermore, embodied emissions cannot be accounted for solely based on consumers' responsibility for the reason that producing countries are benefiting economically from trade.

The challenge therefore is to effectively introduce some elements of a consumption-based approach into both trade policies and the current set of international negotiations. There is a place for trade policies, which enable low-carbon technology transfer and even technology 'leapfrogging' for developing countries. As Lord Stern, author of the influential 2006 report 'The Economics of Climate Change', remarked in May 2009: "That's what trade is all about and that's why trade can help development... and there is a definite responsibility with the consumer and not just with the producer." (The Guardian, 2009). At the same time, exporters of carbon-intensive products need to take responsibility and action to reduce their domestic industrial emissions.

"CARBON LEAKAGE"

The term 'carbon leakage' describes the phenomenon of increased emissions in one region resulting from an emissions constraint introduced in another (such as through national policy). This causes changes in global value chains and alters the flow of international trade in carbon-intensive products. Whilst a policy might be seen to be successful nationally, carbon leakage will reduce its ultimate effectiveness and impede any global reduction of emissions. To manage carbon leakage, more information is needed about the emissions embodied in products, more focus is needed on 'hot-spots' along the global value chains, and emissions have to be reduced within national boundaries.

This side of the booklet has been about the ‘challenges’ in understanding the causal relationship between current economic activities and climate change.

Please 'switch' now to the other side to read about practical sustainable consumption and production ‘solutions’ which can be applied to address climate change – and can also receive funding under the SWITCH Asia programme.