

# TRENDS IN SUSTAINABLE DEVELOPMENT

## ENERGY

FOR SUSTAINABLE DEVELOPMENT



## INDUSTRIAL DEVELOPMENT



## ATMOSPHERE & AIR POLLUTION



## CLIMATE CHANGE



Department of Economic and Social Affairs  
Division for Sustainable Development

# TRENDS

## IN SUSTAINABLE DEVELOPMENT



United Nations  
New York, 2006

# DESA

The Department of Economic and Social Affairs of the United Nations Secretariat is a vital interface between global policies in the economic, social and environmental spheres and national action. The Department works in three main interlinked areas: (i) it compiles, generates and analyses a wide range of economic, social and environmental data and information on which Member States of the United Nations draw to review common problems and to take stock of policy options; (ii) it facilitates the negotiations of Member States in many intergovernmental bodies on joint courses of action to address ongoing or emerging global challenges; and (iii) it advises interested Governments on the ways and means of translating policy frameworks developed in United Nations conferences and summits into programmes at the country level and, through technical assistance, helps build national capacities.

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Since the United Nations Conference on Environment and Development in 1992 and the subsequent World Summit on Sustainable Development in 2002, significant efforts have been made in pursuit of sustainable development. At the political level sustainable development has grown from being a movement mostly focusing on environmental concerns to a widely recognized framework utilized by individuals, governments, corporations and civil society that attempts to balance economic, social, environmental and generational concerns in decision-making and actions at all levels. At the September 2005 World Summit, the UN General Assembly reiterated that “sustainable development is a key element of the overarching framework for United Nations activities, in particular for achieving the internationally agreed development goals”, including those contained in the Millennium Declaration and the Johannesburg Plan of Implementation (A/RES/59/227).

This report highlights key developments and recent trends in the areas of Energy for Sustainable Development, Industrial Development, Atmosphere/Air Pollution and Climate Change — the four interrelated topics being considered by the Commission on Sustainable Development at its 14th and 15th sessions (2006-07). It notes progress in a number of areas while, at the same time, acknowledging that in other areas significant work is still needed to advance implementation of intergovernmentally agreed goals and targets.

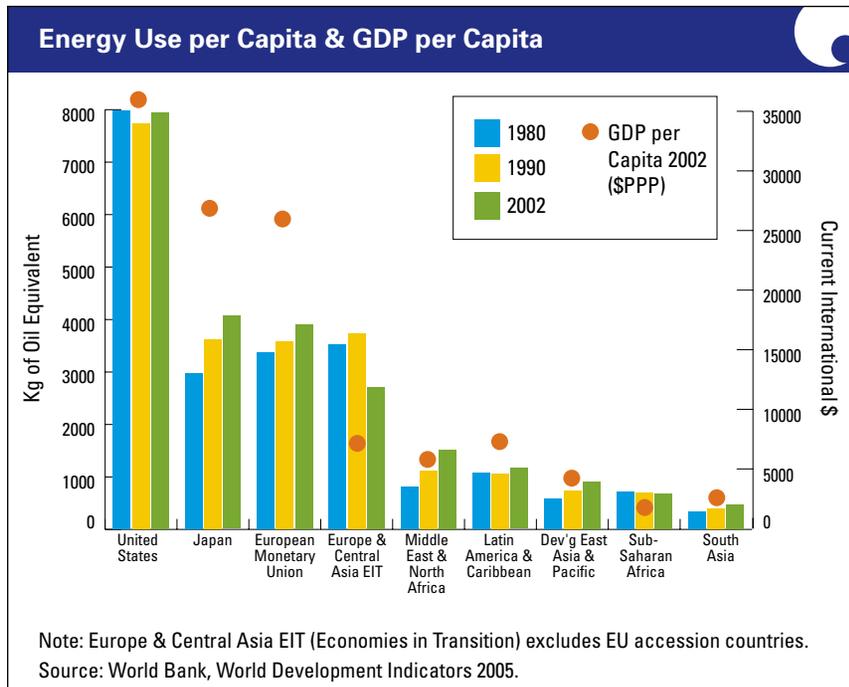
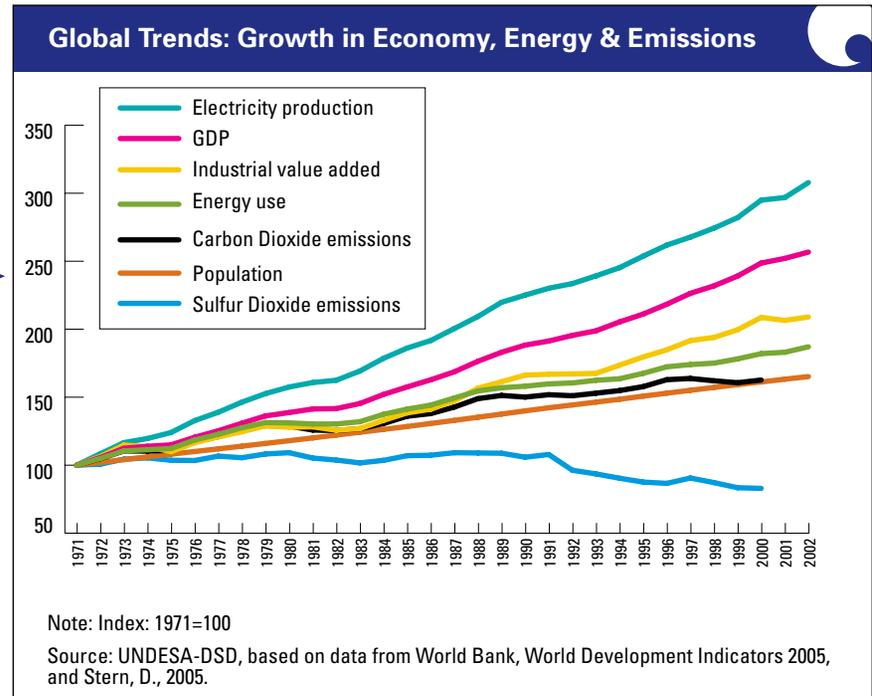
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# GLOBAL TRENDS

## in Economic Activity, Energy, Electricity Use, and Emissions

- Energy consumption has generally grown more slowly than economic activity as energy efficiency has improved and economies have shifted to less energy-intensive industries and services.
- Electricity use has outpaced GDP growth, particularly in developing countries, as access to electricity and the use of appliances have grown with rising living standards.
- Energy efficiency combined with increased use of natural gas — and to a lesser extent nuclear and renewable energy — have helped keep the growth in CO<sub>2</sub> emissions slightly lower than the growth in energy consumption.<sup>1</sup>



- Globally, per capita CO<sub>2</sub> emissions remained roughly constant, as emissions grew at about the same rate as population.<sup>2</sup>
  - Since the early 1970s, particularly in developed countries, major investments in technologies to control SO<sub>2</sub> emissions, combined with greater use of low-sulphur fuels, have contributed to reducing SO<sub>2</sub> emissions.<sup>3</sup>
- ◀ In developing countries, per capita energy consumption is between one-third and one-fifteenth what it is in developed countries. While per capita energy consumption is correlated with per capita income, Europe and Japan are considerably less energy intensive for their income levels than is the USA. Among developing countries, South Asia's lower per capita energy consumption than sub-Saharan Africa's, despite slightly higher per capita income, results in part from a lesser reliance on inefficient biomass fuels.

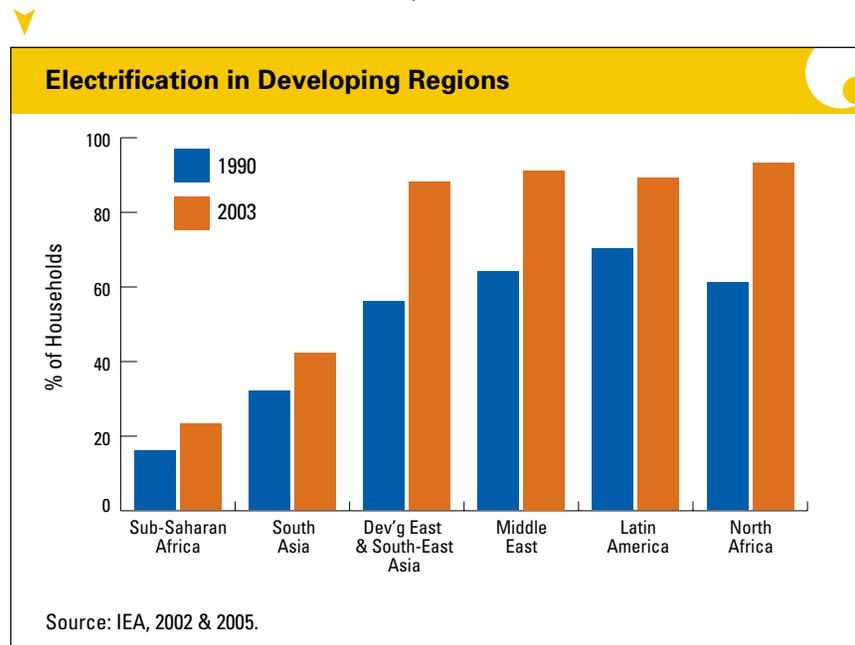
# ENERGY FOR SUSTAINABLE DEVELOPMENT

Energy use is closely linked with economic development, poverty reduction and the provision of vital services. Yet, energy production, distribution and consumption can have adverse effects on the local, regional and global environment. Efforts are underway across the globe to improve access to modern energy services, increase energy efficiency, reduce air pollution and shift to cleaner energy sources.

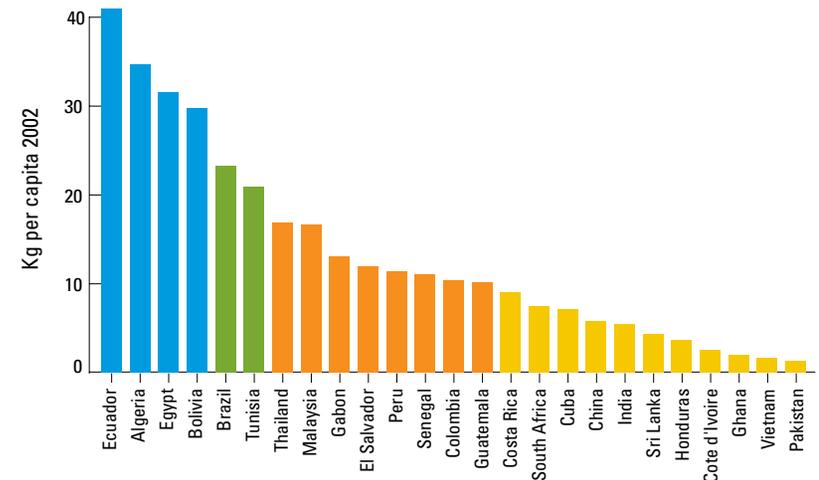


## Access to energy is steadily improving

Over the past fifteen years, progress has been made in electrification in all developing regions. However, electrification rates in South Asia and sub-Saharan Africa remain a half to a quarter of those in the rest of the world.



## Liquefied Petroleum Gas: Residential Use

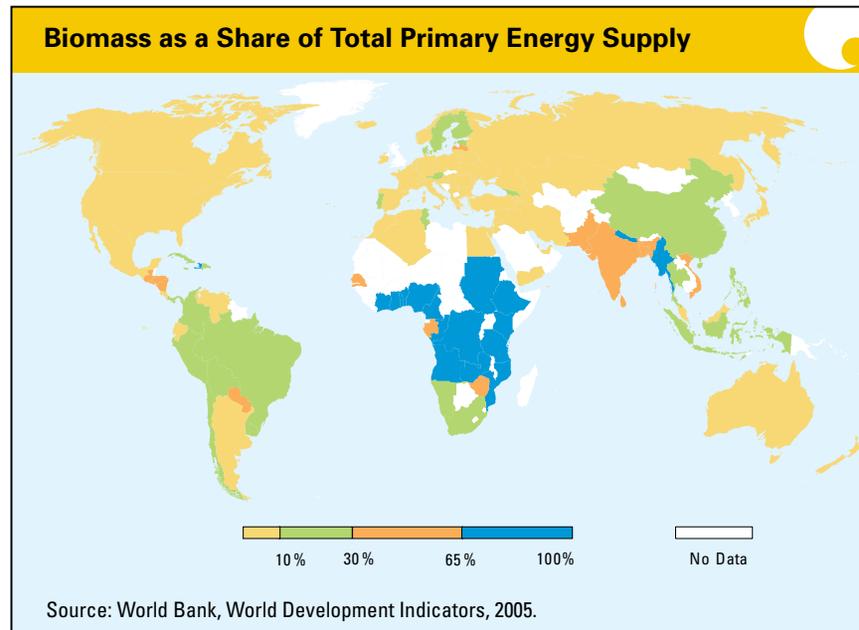
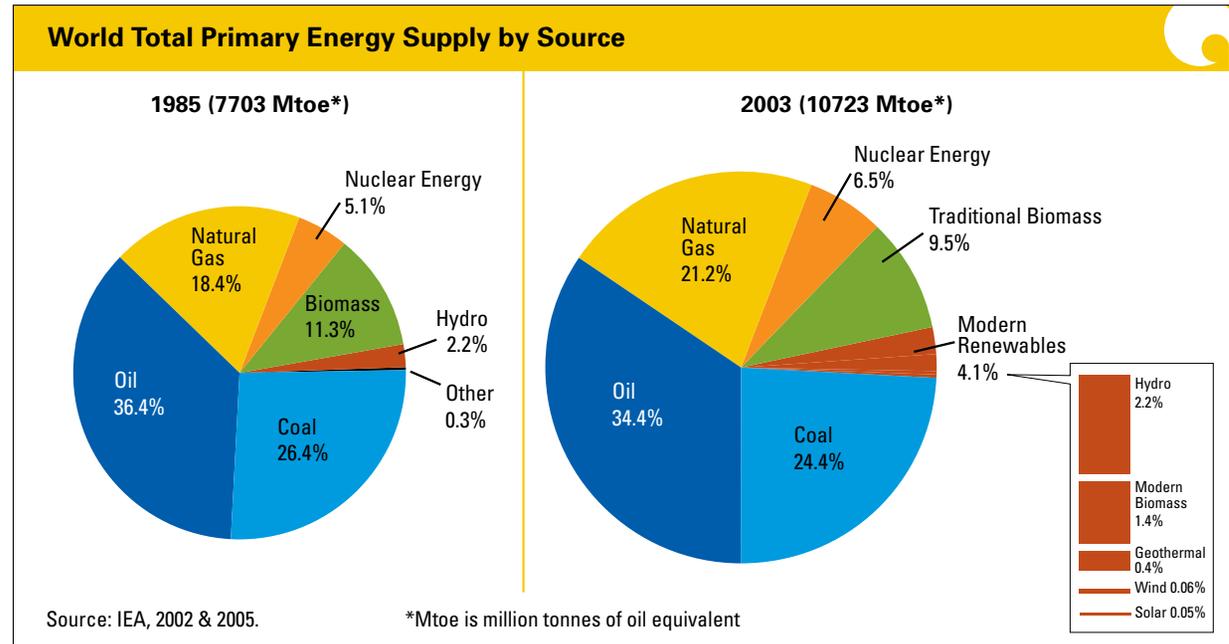


Source: UN, Energy Balances & Electricity Profiles, 2002; UN Demographic Yearbook, 2002; Unpublished data from the World LP Gas Association.

Liquefied petroleum gas distribution networks and household consumption are growing steadily, in some cases replacing traditional biomass, with environmental, social and economic benefits. The switch to modern household energy sources can be of particular benefit to women and girls — in terms of health, schooling, and productive employment.

**The world is gradually shifting to cleaner forms of energy, but biomass is still widely used in the household sector of some developing regions**

More than 2.4 billion people still rely on traditional biomass, including wood, agricultural residues and animal dung, for cooking and heating, with severe health impacts due to indoor air pollution. Biomass remains the main source of energy in sub-Saharan Africa. South Asia has seen a steep drop in the biomass share of energy since 1980, as has East Asia, as economic growth has enabled people to shift to cleaner and more convenient forms of energy.



**Fossil fuels dominate energy supplies**

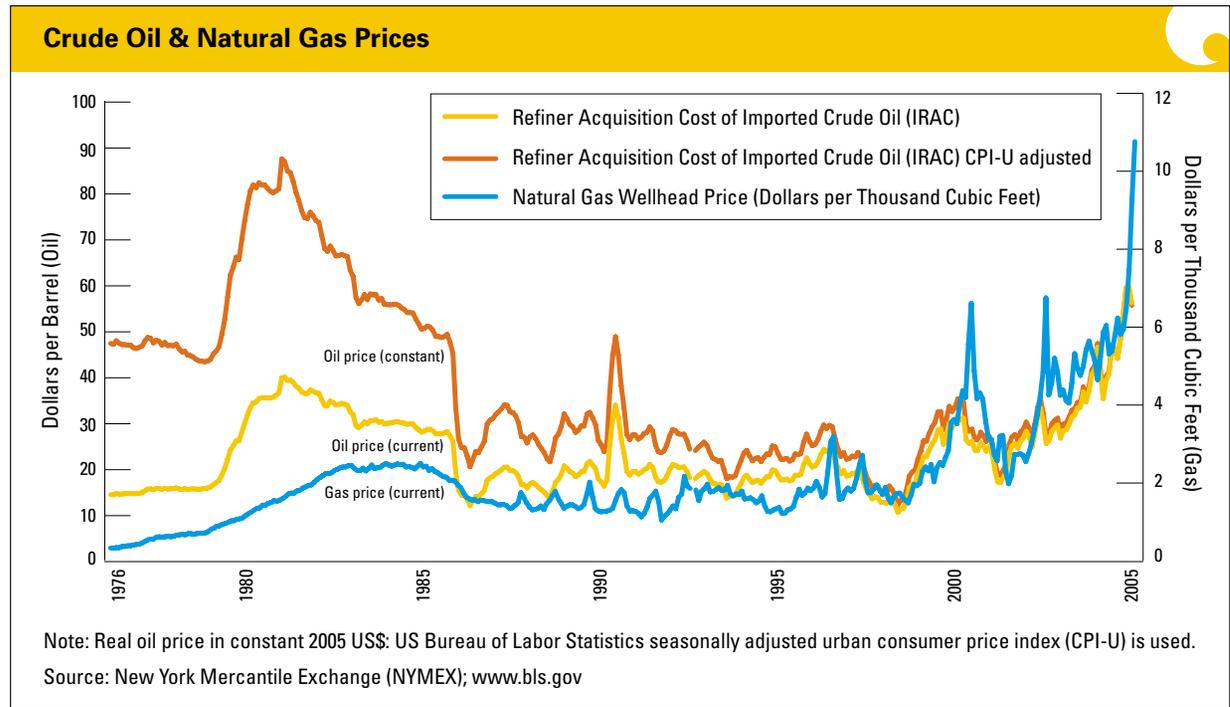
Fossil fuels are expected to continue to dominate energy supplies for the next few decades at least. Oil remains the single most important fuel, amounting to 35% of total primary energy supply, with the largest share of the increase in oil use coming from the transport sector. From 1971 to 2003, global oil consumption in transport increased four times faster than consumption in industry.<sup>4</sup>

Use of natural gas, which is cleaner and less carbon intensive than oil or coal, is growing faster than other fossil fuels, driven mainly by power generation where technological innovation, economics and regulatory changes have resulted in gas becoming the preferred fuel, at least until recent price hikes.

Renewables other than hydro and biomass, including geothermal, solar and wind energy, are growing faster than any other energy source, but still account for only a tiny fraction of global energy supply.

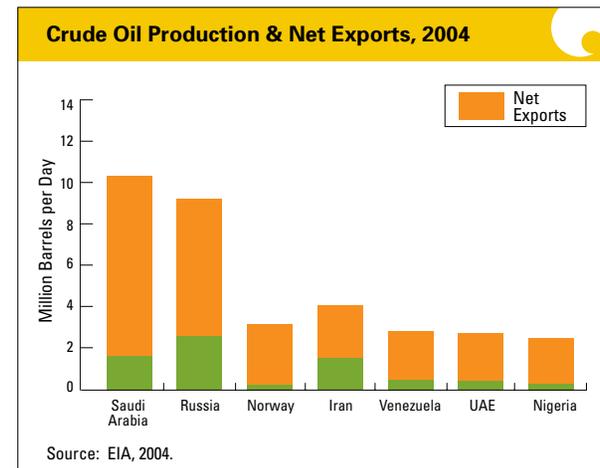
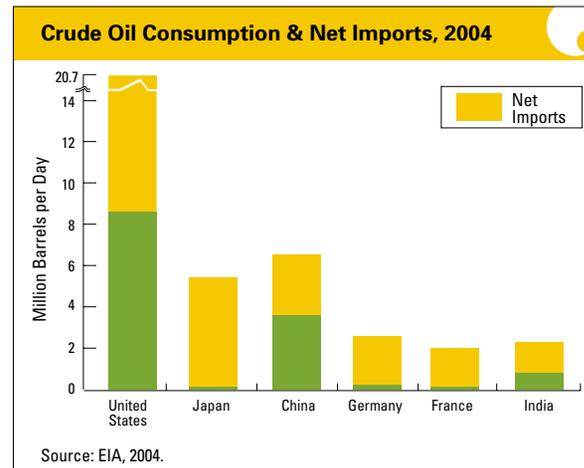
**Higher energy prices are promoting energy efficiency but also causing concerns**

International gas prices have risen in late 2005 and early 2006 to the highest levels in history. Oil prices are at record highs in current dollars, but below the peak of the early 1980s when adjusted for inflation. These high prices are promoting energy conservation and efficiency efforts and making alternative energy sources, such as renewable energy, more competitive. However, the possibility of continuing price increases is raising concerns over adverse global economic impacts. Energy price volatility poses problems for sustainable development in both exporting and importing countries.



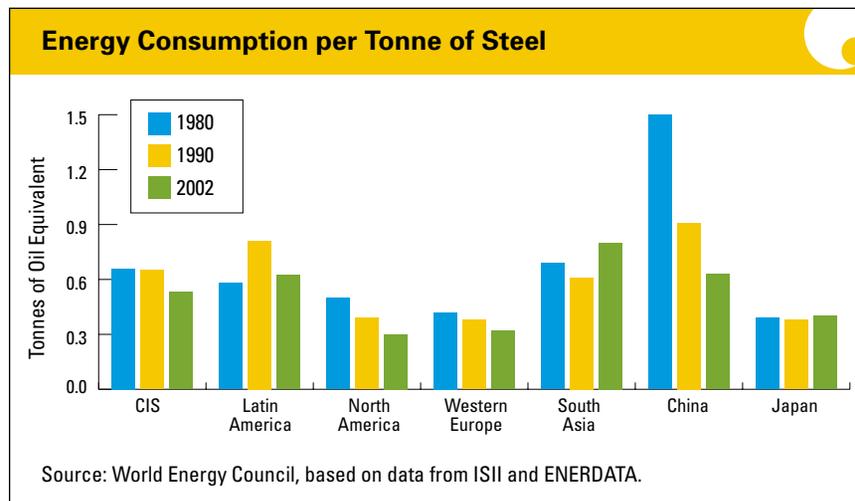
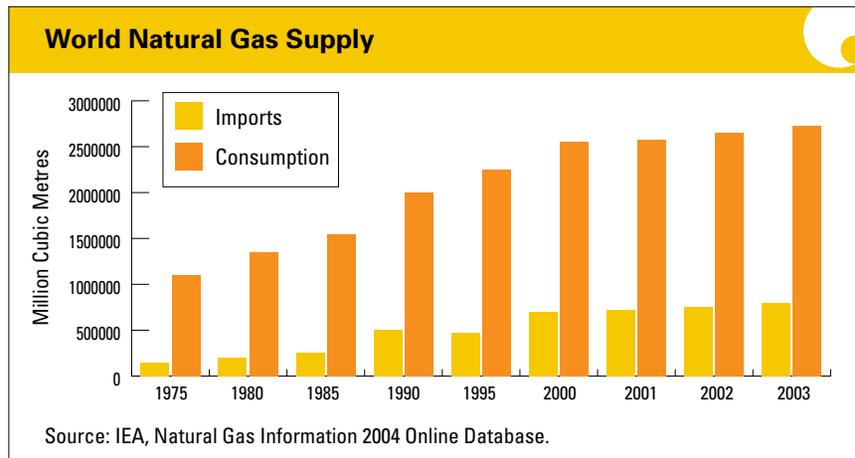
**Energy integration through trade is a growing trend**

Oil is the most highly traded commodity, as it is essential to all modern economies yet commercially recoverable reserves are found in relatively few countries. Reliance on oil imports is growing rapidly in some major economies: e.g., in China, as recently as 2000 net imports accounted for 30% of consumption, while in 2004 they accounted for half; in the United States, from 1991 to 2004, net oil imports went from 40% to 59% of domestic consumption.



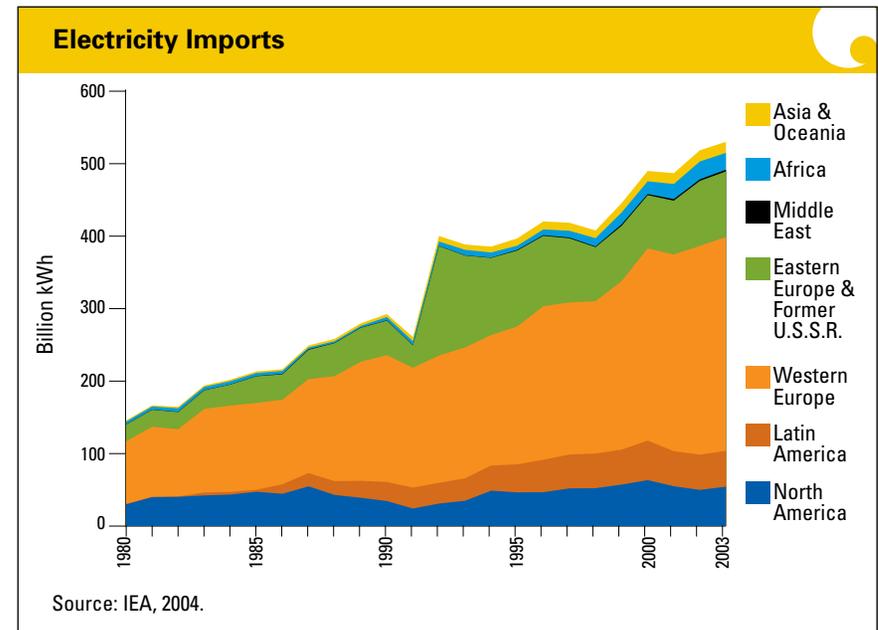
## Cross-border gas trade has been growing rapidly, especially LNG trade

Rapid growth of natural gas networks across national boundaries, particularly in Europe but also in Latin America and North Africa, is putting pressure on legal, regulatory and policy frameworks that have not kept pace.<sup>5a</sup> From 1980 to 2003, world natural gas imports have risen by 6.2% a year, on average, increasing as a share of gas consumption from 13% to 29%.<sup>5b</sup> Over the past decade, global liquefied natural gas (LNG) imports have been growing by 10 billion cubic metres per year — an average annual increase of 7.2%.



## Electricity grid interconnections enhance energy security

Electricity trade among countries is also growing, particularly in Europe, enhancing security of supply and increasing competition among suppliers. For a few countries (e.g. Paraguay, Mozambique, and Lithuania), exports represent a very sizeable proportion of total electricity generation.<sup>6a</sup> In southern Africa, a power pool with 12 interconnected countries has been operating successfully for the past decade. Although electricity trade within the pool is relatively small, it is growing at over 20% per year.<sup>6b</sup>

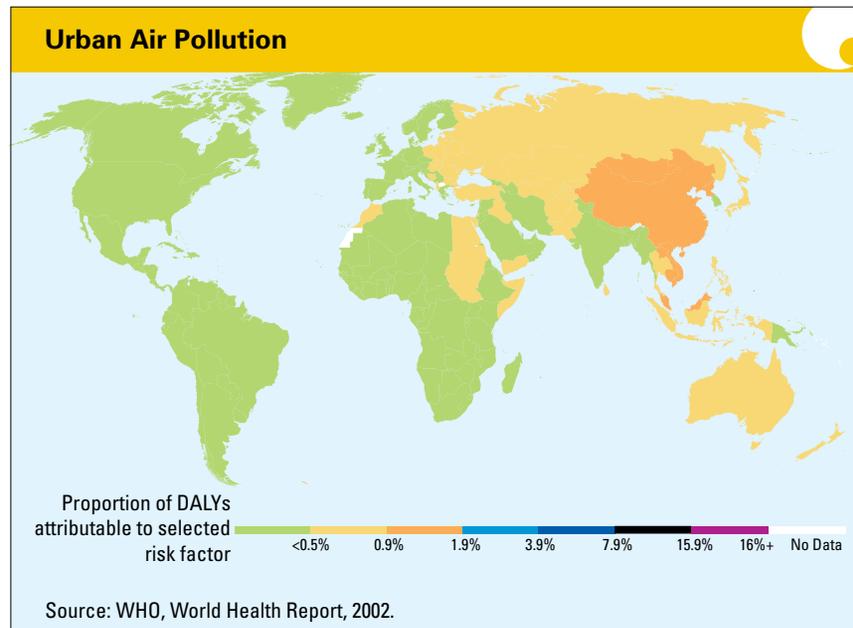


## Energy efficiency in industry is improving

A wide variety of energy efficiency policies and programmes have been implemented in many countries to increase productivity while reducing energy consumption. Many of these measures were initiated between 1973 and 1986 in response to energy price increases and have achieved substantial gains, as illustrated by the steel sector, where process improvements have played an important role. The recent increase in fuel prices is promoting further investments in energy efficiency, which will increase productivity in the future.<sup>7</sup>

### Energy consumption is a main source of urban air pollution

Urban air pollution has its source mainly in industry and transport. Lack of emissions control technologies in industry, power generation, district heating and transport vehicles is a main reason for much of the observed air pollution in cities. Rapid growth in motor vehicle traffic has compounded the challenge of controlling air pollution in many metropolises.

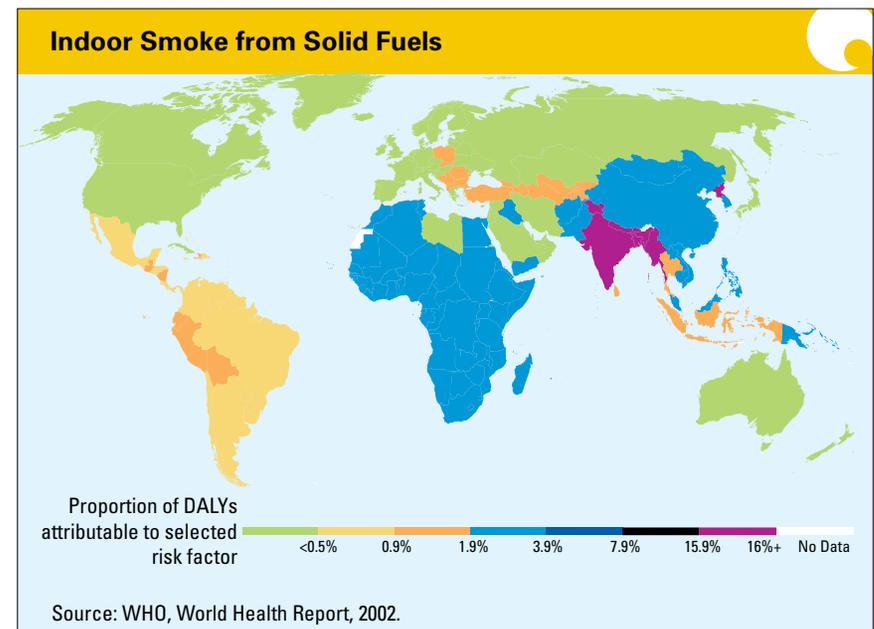


Note: Disability Adjusted Life Years (DALYs) is a measure of disease burden which incorporates both mortality and morbidity.

Indoor air pollution is a major cause of mortality in Africa and Asia, while outdoor air pollution is damaging health in cities worldwide.

### Lack of modern energy services contributes to ill health and early death

Reliance on traditional fuels for cooking and heating in poorly vented conditions has serious health impacts on women and children in developing countries. Almost 2 million children die each year from respiratory infections caused in part by such indoor air pollution, with countries in Africa and Asia suffering the most. Indoor air pollution has a bigger health impact than urban air pollution by a large margin.<sup>8</sup>

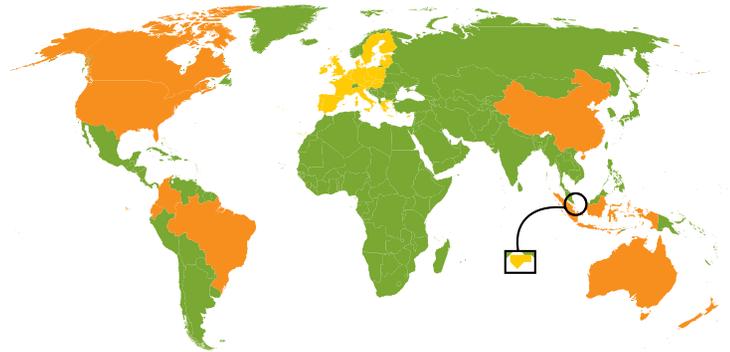


# Transport Policies to Enhance Energy Efficiency & Reduce Air Pollution

Note: Key country and regional examples of particular measures are highlighted in orange and yellow in the maps.

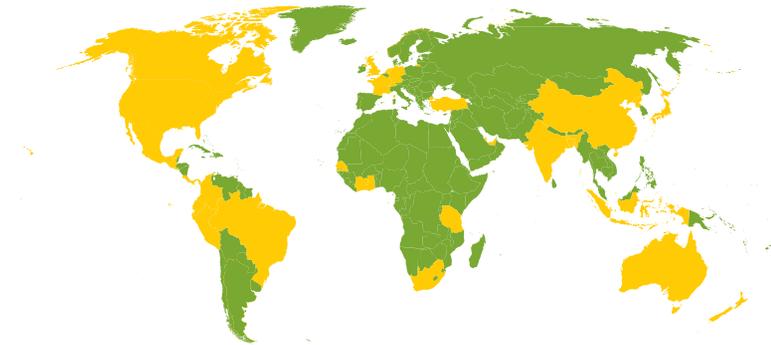
## Clean Fuels & Vehicles:

Vehicle fleets in many cities around the world are converting to compressed natural gas (CNG). This is substantially reducing air pollution in Asian cities as 3-wheelers are converted. Ethanol is also being blended with gasoline to reduce pollution and dependence on oil. On the vehicle side, governments are adopting more rigorous vehicle standards, such as EURO3 and EURO4, particularly in the major cities of Asia. Cities are also phasing out 2-stroke engines, which are highly polluting.<sup>9a</sup>



## Integrated Urban Road Pricing:

Singapore has long had a road pricing scheme with tolls for those entering the city center. This has now been fully automated and the tolls are variable with the time of day and day of week, to reflect congestion. A similar system has been established in London and the EU has launched a European Transport Pricing Initiative involving eight other cities.<sup>9b</sup>

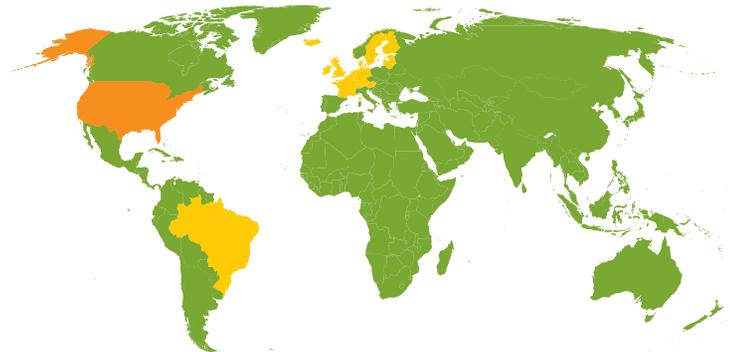


## Bus Rapid Transit Systems:

A new paradigm in urban mass transit is being developed in a number of cities, particularly in Latin America and Asia, which shows promise for revolutionizing bus systems around the world. BRT systems get buses out of traffic, increase their average speeds, improve their reliability and convenience, increase system capacities and attract high ridership levels, thus increasing the profitability of systems. They are much less expensive and represent a significantly more efficient use of capital than construction of rail-based metros and, can be implemented in a fraction of the time.

## Intelligent Transport Systems (ITS):

ITS encompass a broad range of communications-based information, control and electronics technologies to help monitor and enhance system wide performance, reduce congestion, provide alternate routes to travelers and enhance productivity.<sup>9c</sup>

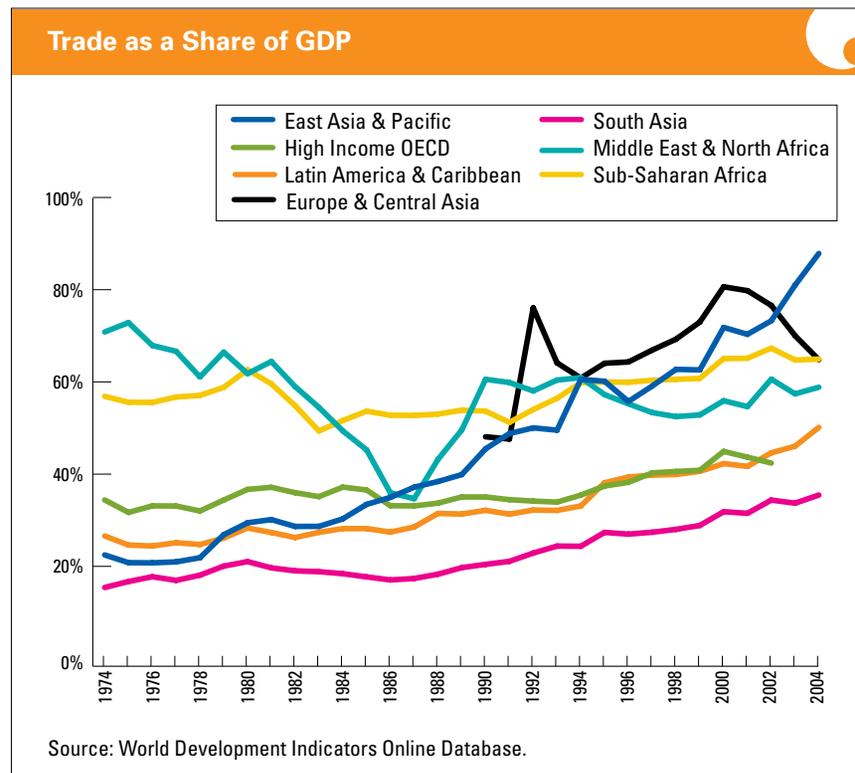


## Pedestrian & bicycle facilities:

As cities change their vision of future development toward a more people-centered approach, they are building more infrastructure dedicated to pedestrians and bicycles as a means of encouraging a safer and healthier environment.

# INDUSTRIAL DEVELOPMENT

Sustained industrial development has been a major contributor to economic growth and poverty reduction over the past half century, notably in Asia. Industrializing countries have benefited from liberalization of markets for industrial goods, improvements in telecommunications, and reduced transportation costs. Not all countries have shared in those benefits, however: limited supplies of human capital, poor infrastructure, weak government institutions and unfavorable investment climates have been key constraints.<sup>10</sup>

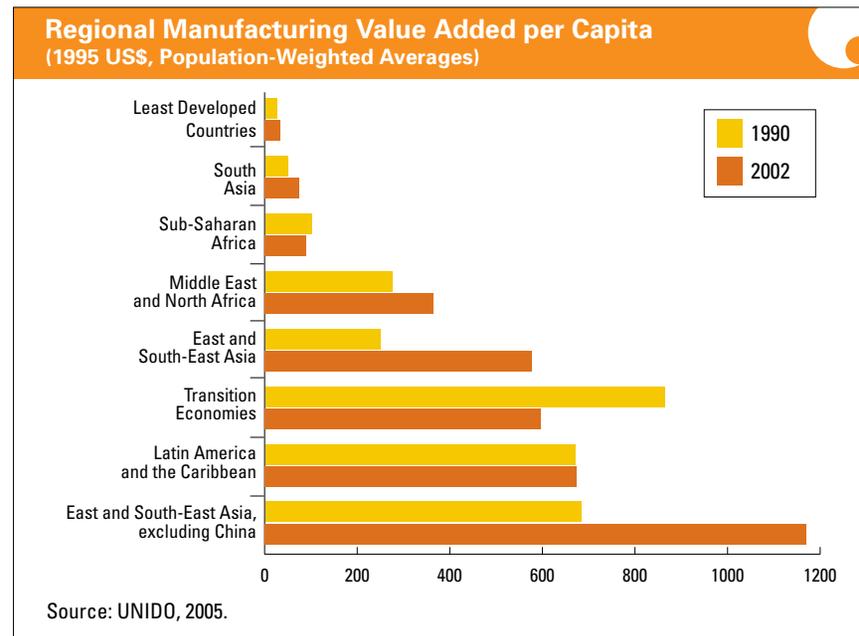


The developed countries remain the world's largest industrial producers, but the centre of gravity has begun to shift towards the developing world.

◀ **Integration of the world economy through expanding trade, investment and technology flows continues, though unevenly**  
 International trade (exports plus imports) increased from about 35% of global GDP in 1974 to almost 50% in 2002, with increases in almost all regions. In East Asia, the increase was four-fold, surpassing the share in high-income OECD countries, as well as in export commodity dependent regions such as the Middle East and sub-Saharan Africa. At the same time, production has become more widespread geographically and more integrated through international production chains. Increasing trade has also been driven by increased foreign direct investment, particularly towards developing countries.<sup>11</sup>

## East and South-East Asia has experienced the fastest rate of industrialization

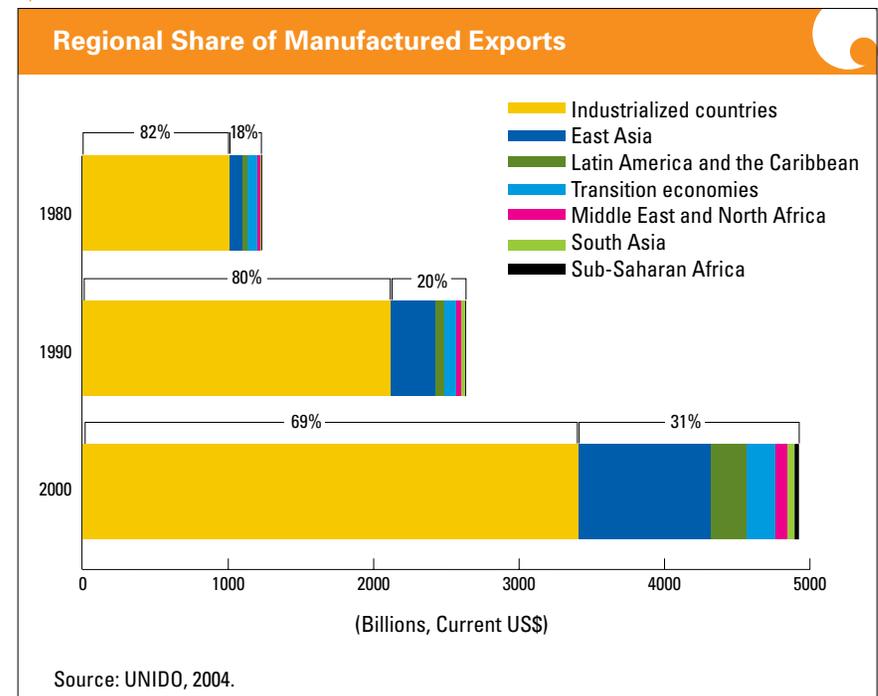
With the collapse of state industries in countries with economies in transition, those countries have been overtaken by Latin America in terms of manufacturing value added (MVA) per capita since 1990. East and South-East Asia has more than doubled MVA per capita, and if China is excluded, the region's MVA per capita now exceeds by far Latin America's. South Asia has also achieved a marked increase, but from a much lower initial level. Meanwhile, sub-Saharan Africa has seen an industrial decline, as measured by MVA per capita.



Increasing trade in manufactures has supported industrialization and economic growth in a number of developing countries.

## Developing countries — especially in Asia — account for a growing share of global manufactured exports

Industrialized countries still account for over two-thirds of world manufactured exports, but developing countries' share has increased steadily. Since 1980, East Asia has shown the largest gains, followed by Latin America and the Caribbean — but only as a result of the sharp growth in Mexico's exports as NAFTA came into force. South Asia exhibits the second largest proportional increase, although from a very low base.<sup>12</sup>

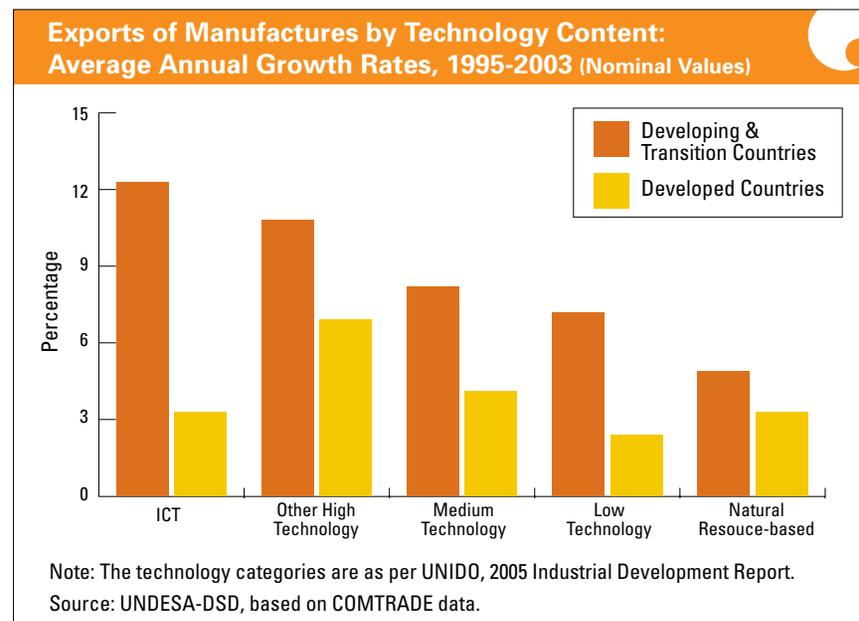


### The shares of high- and medium-technology production and export have risen rapidly in recent years, particularly in developing countries

The composition of global exports is shifting towards higher technology content. Since the early 1990s, developing and transition economies have increased their export market shares most in information and communications technology (ICT) products, and developing countries competitive in those products have generally enjoyed the fastest manufacturing sector growth. High-technology exports are thought to offer the greatest learning opportunities, contributing to strong productivity growth.

The slower growth of low-technology and natural-resource-based exports partly reflects the continuing market protection of labour-intensive sectors like textiles and clothing in developed countries, and partly the high Most Favoured Nation tariffs and increasingly stringent non-tariff barriers in the agrifood sector.<sup>13</sup>

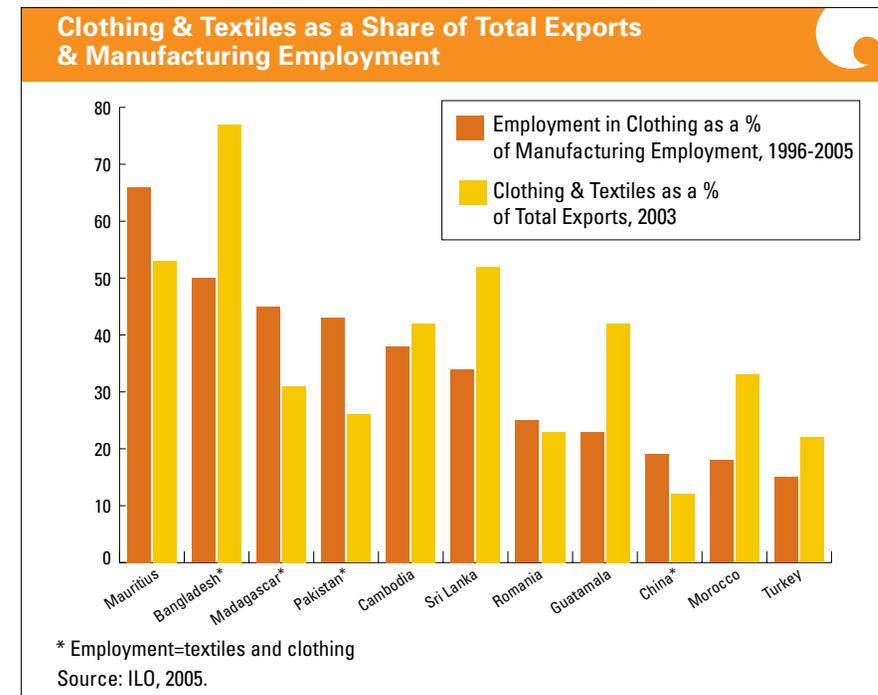
In absolute terms, however, exports of low-tech manufactures are still important for many developing and transition economies.



### Small countries exporting clothing and textiles face major challenges

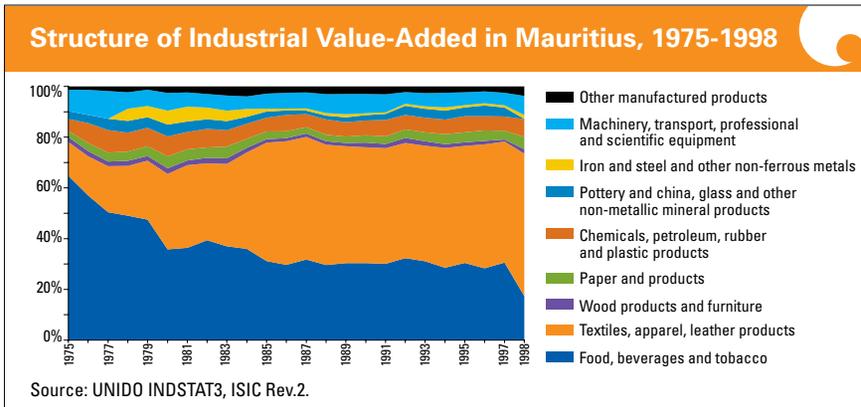
The expansion of export-oriented labour-intensive textile and garment industries in countries like Bangladesh, Cambodia and Mauritius has made an important contribution to pro-poor industrial development. The clothing and textile sector employs workers with relatively low educational attainment, as well as a high proportion of women, which can contribute to greater gender equity.

However, smaller clothing exporting countries that developed their industries under the pre-2005 quota regime for textiles and clothing are facing the challenge of adjusting to competition from large, low-cost producers such as China and India. This will pose particular challenges for small countries relying heavily on clothing exports and distant from major markets, such as Lesotho, Madagascar, Mauritius and Tajikistan, to name a few.<sup>14</sup>

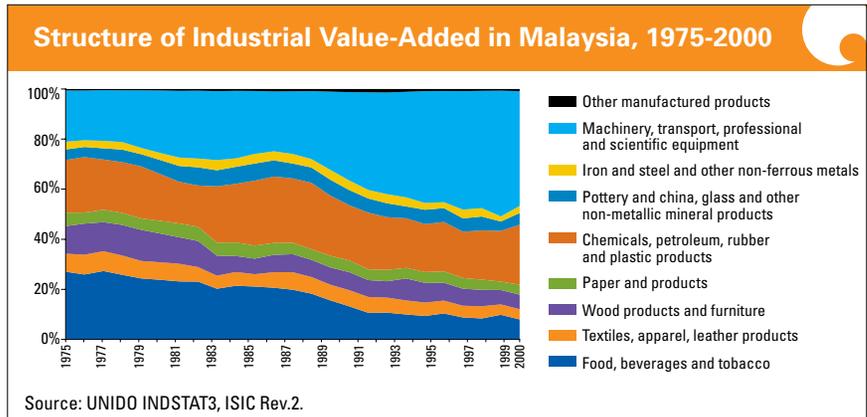
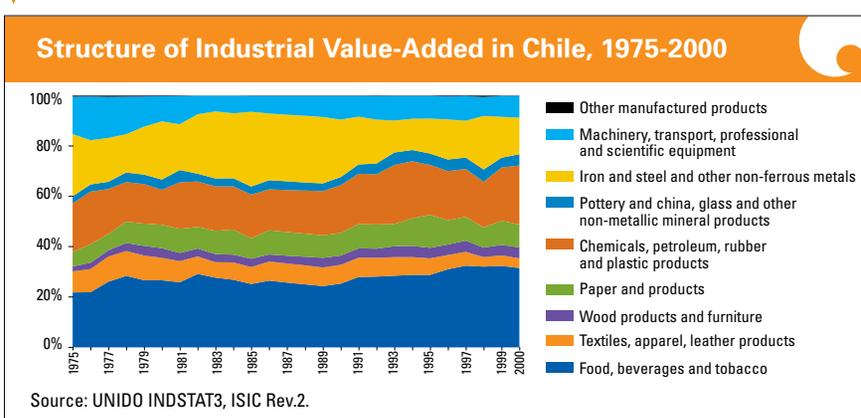


## Industrial development can follow different patterns

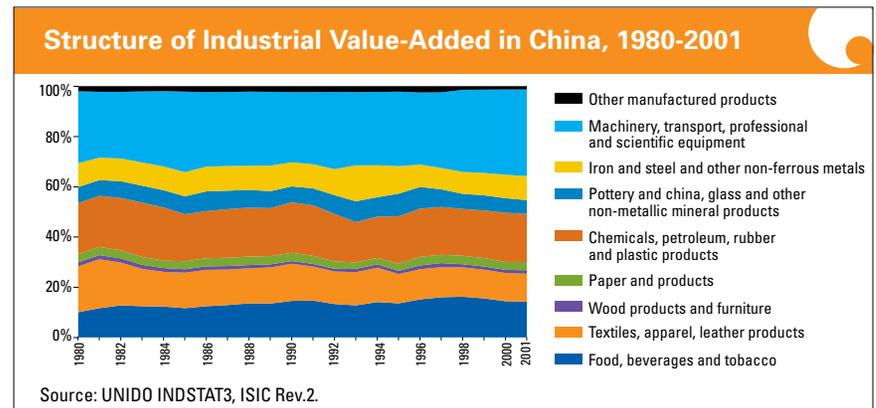
**Mauritius** has succeeded in transforming itself from a poor sugar exporter into a stronger, more diversified economy through production and export of clothing and textiles, as well as tourism. Supportive policies included establishment of an export processing zone, which allowed duty-free import of inputs for export production.



In **Chile**, the development of agro-industrial clusters, such as salmon farming, wine and fresh fruit, shows that natural-resource-based growth can also be sustainable if focused on high value products. The promotion of public-private partnerships was instrumental in providing research and technology extension services in new activities that later proved to be very profitable.<sup>15</sup>



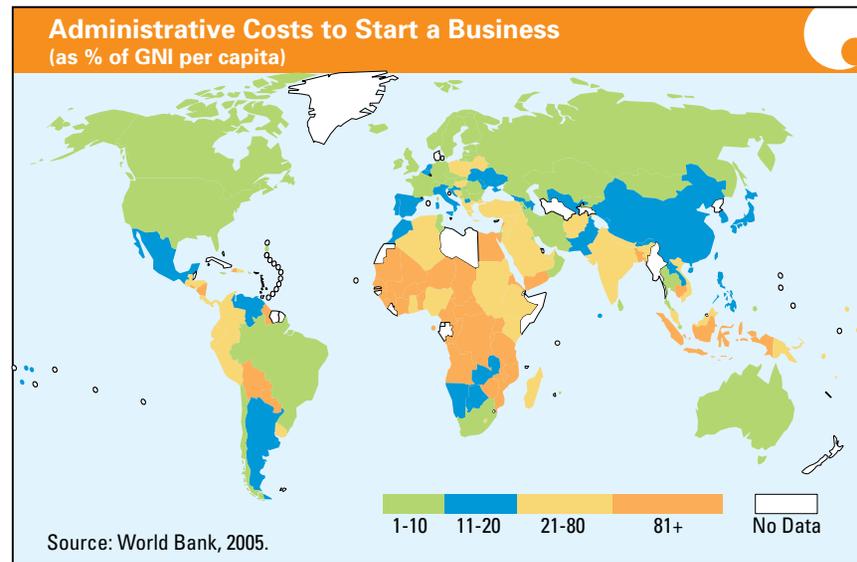
**Malaysia**, once a commodity-based economy, has diversified to become a leading producer and exporter of manufactured goods, especially electrical and electronic equipment, even as it remains a major world supplier of agro-industrial products based on palm oil and rubber.<sup>16</sup>



In **China**, rapid economic growth has built on production and export of a range of manufactured products. Productivity increases based on learning from technologically advanced foreign firms have also been significant drivers.<sup>17</sup>

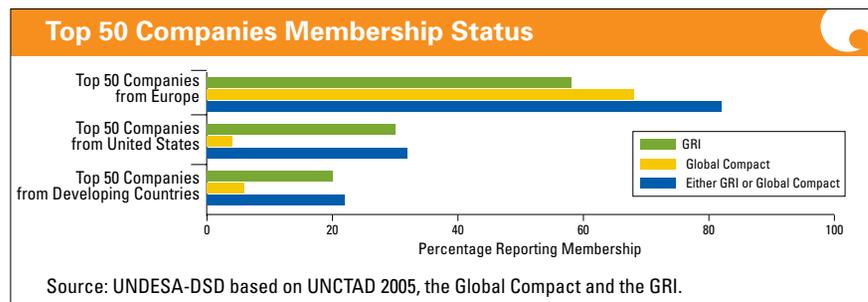
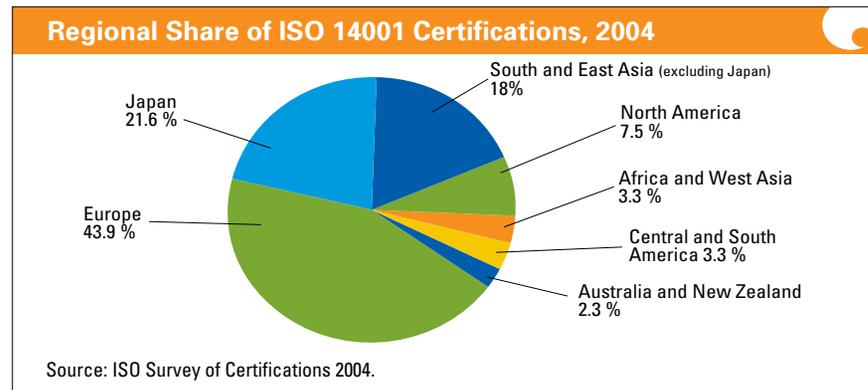
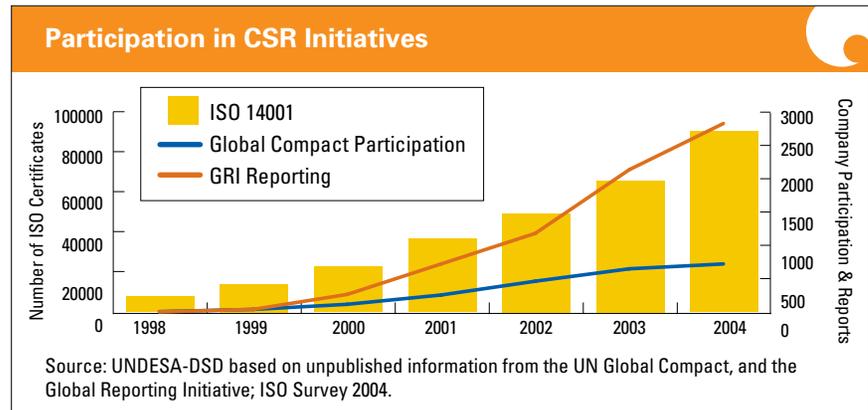
### A supportive environment for entrepreneurs can encourage industrial development

Governments provide the regulatory framework within which entrepreneurs operate. While regulation is necessary to protect workers, consumers and the environment, small and medium enterprises (SMEs) are especially handicapped by excessive regulation as they have few human and other resources for compliance. Since SMEs tend to be more labour-intensive, onerous regulation can also impede job creation. Many low-income countries are among those in which it is costliest to start and run a business.<sup>18</sup>



### Corporate Social Responsibility is a growing movement in response to public pressure

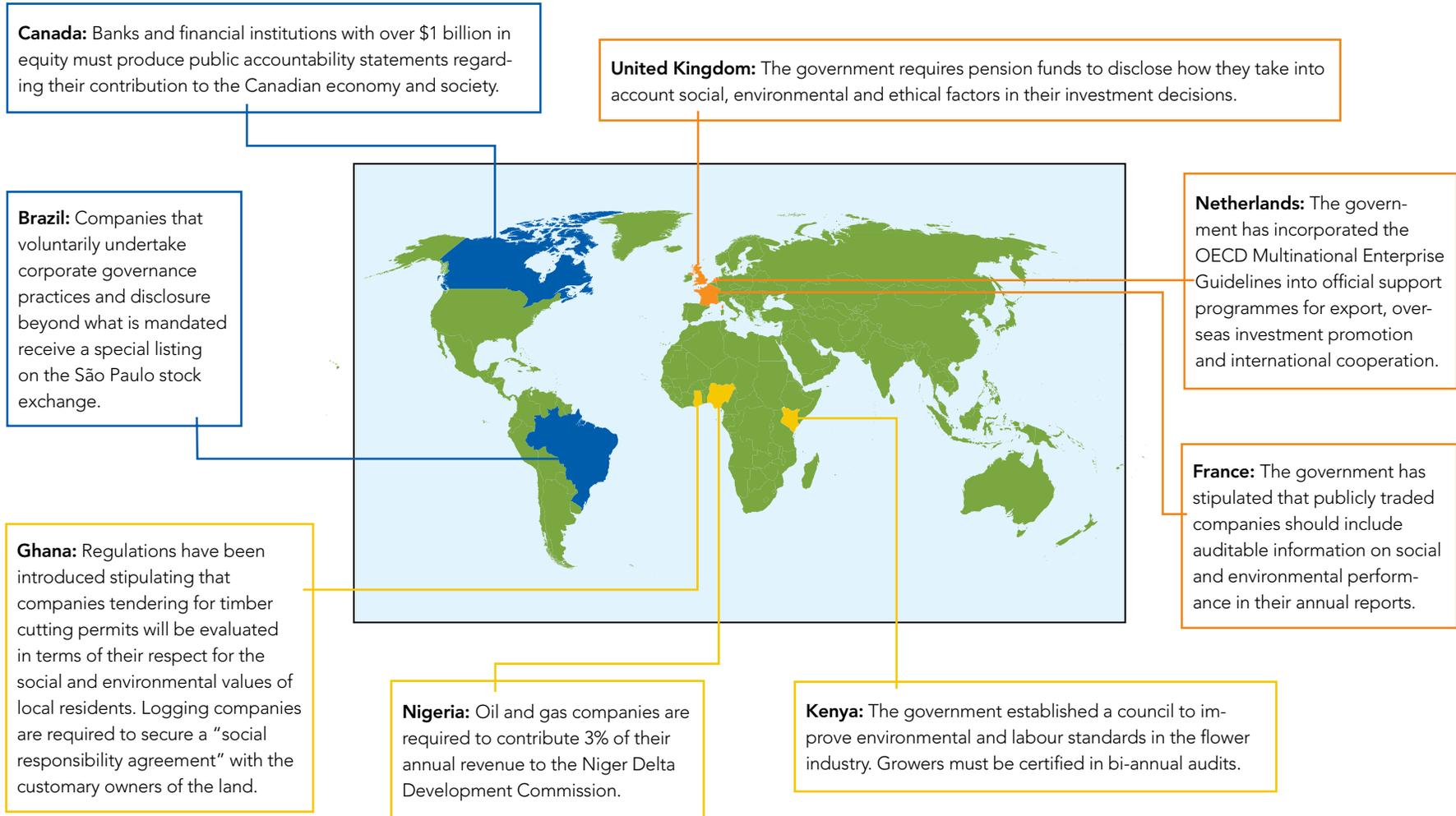
Corporate Social Responsibility (CSR) refers to business activities guided by codes of conduct that exceed legal and ethical standards relating to labour conditions and environmental impacts. The globalization of production networks means that corporations increasingly source their products and services from overseas, making it more difficult to regulate corporate activities through a single country's national legal and regulatory mechanisms. CSR has been demanded by various stakeholders as one response to this challenge.



Major international CSR initiatives include systems of general norms such as the UN Secretary-General's Global Compact and the OECD Guidelines for Multinational Enterprises, process standards such as the ISO 14001 standard for environmental management systems of the International Organization for Standardization (ISO), and reporting guidelines such as those of the Global Reporting Initiative (GRI). In 2008, ISO plans to release the ISO 26000 guidance standard on social responsibility, which is currently under negotiation.

# Examples of Corporate Social Responsibility Legislation

Public demand for better working conditions and environmental responsibility in global production systems is influencing government policy.



# ATMOSPHERE & AIR POLLUTION

Developed countries' efforts to address air pollution beginning in the 1970s have resulted in the substantial reduction of serious pollutants. Due to knowledge of the impacts of air pollution and the availability of pollution control technologies, developing countries are "turning the corner" on air pollution sooner. Nonetheless, the quality of air in many cities in developing countries is far below WHO recommendations.



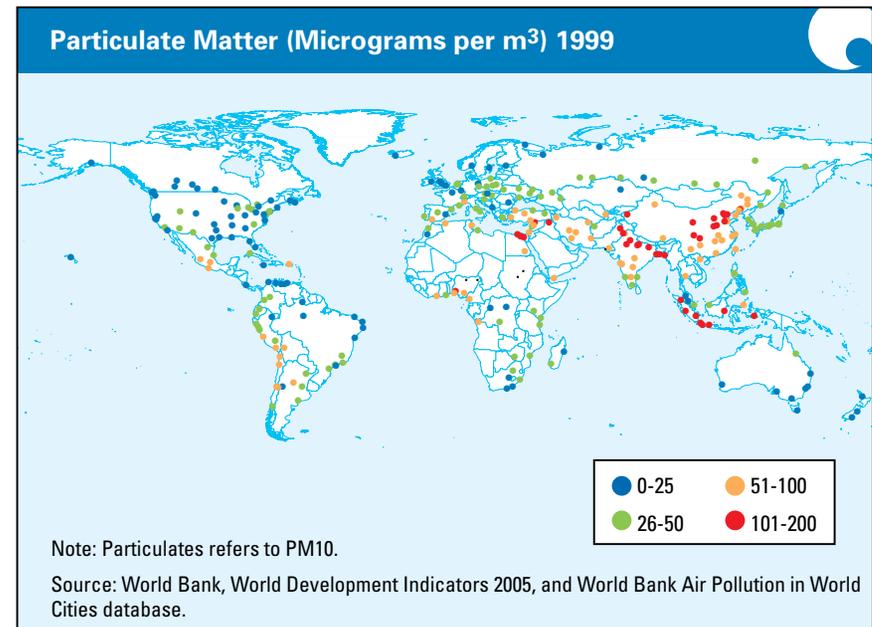
## Particulate air pollution has been reduced worldwide but remains high in large cities in developing countries

The main human sources of particulate matter are power plants, industry, vehicles, household cooking and heating fuels, construction and waste incinerators. Particularly high concentrations of suspended particulates are found in countries relying on coal for energy, notably in Asia.

High levels of airborne particulates cause respiratory diseases, as well as inhibiting plant growth and requiring costly filtration equipment in certain high-tech manufacturing industries.<sup>19</sup> The WHO does not set guideline values for particulates because there is no evident threshold below which there are no adverse health effects. Long-term exposure to particulates appears to be associated with a reduction of life expectancy of up to 2 years and higher prevalence of bronchitis and reduced lung function in children.<sup>20</sup>

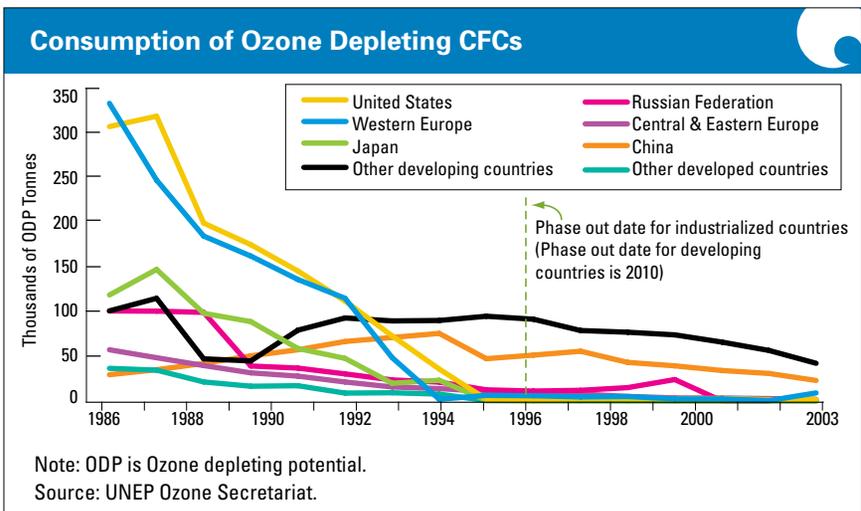
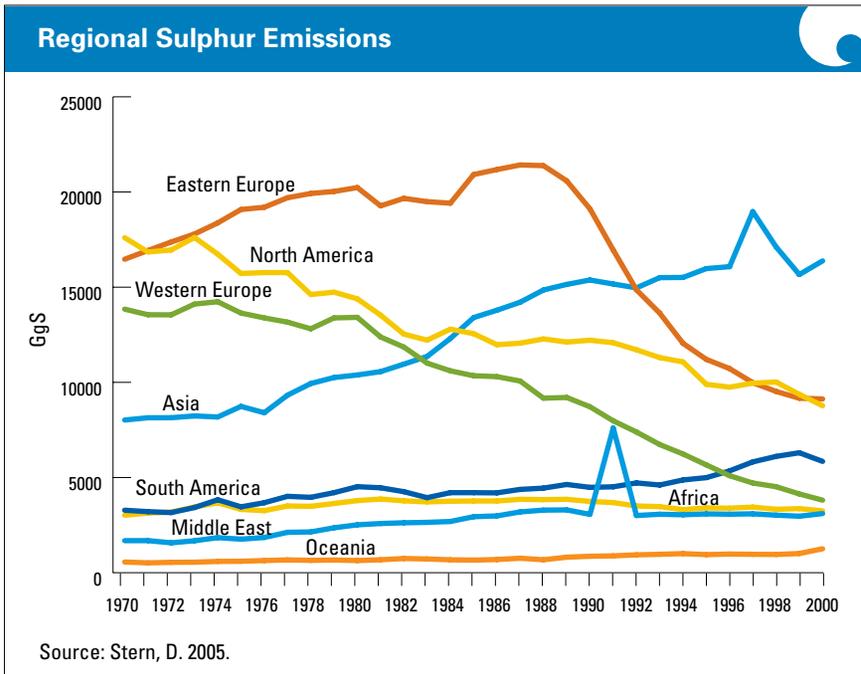
Since about 1970 in developed countries, and more recently in developing countries, particulate air pollution has been reduced by particulate control systems on power plants and industrial facilities, use of cleaner fuels such as natural gas, and requirements for catalytic converters on vehicles. Nonetheless, particulate concentrations are still very high in large cities in developing countries whose economies are growing yet are still in the process of introducing pollution control measures.<sup>21</sup>

Despite some improvement, in many Asian cities air pollution levels are an order of magnitude higher than in major developed country cities.





In Asia SO<sub>2</sub> emissions have increased steadily since the mid 1970s due to the combustion of coal and high-sulphur oil that is fueling the rapid growth of emerging economies;<sup>24</sup> it is too early to know whether the apparent recent downturn in emissions will be sustained.



Global action in phasing out CFCs and leaded gasoline is protecting the ozone layer and reducing airborne lead pollution.

**Concerted global action guided by a multilateral agreement has been highly effective in phasing out CFCs**

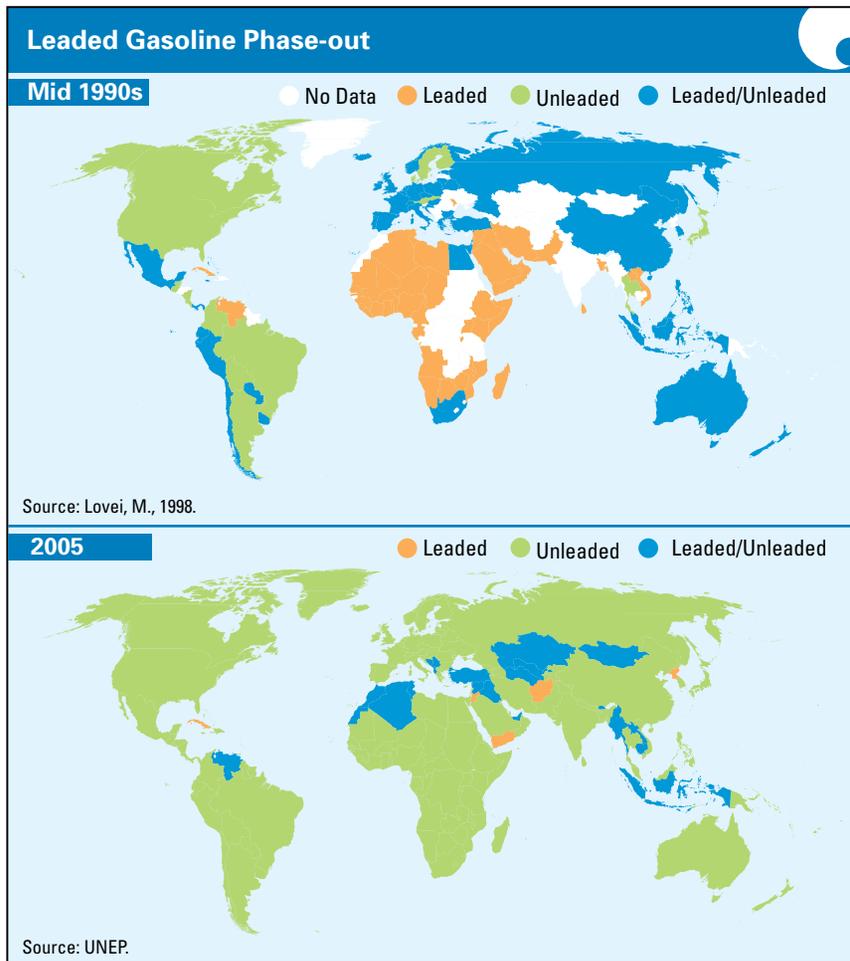
Since 1985, when depletion of the stratospheric ozone layer that protects the Earth from damaging ultraviolet radiation was recognized as an important problem, efforts have been made to reduce and eliminate the use of chlorofluorocarbons (CFCs) and other ozone depleting substances (ODS). The Montreal Protocol on Substances that Deplete the Ozone Layer, adopted in 1987 and strengthened in a number of subsequent amendments, called for the phase-out of the use of CFCs in developed countries by 1996 and in developing countries by 2010. A Multilateral Fund was established in 1990 to assist developing countries in phasing out ODS with the Global Environment Facility supporting phase-out in the economies in transition.

By 2003, developed countries had reduced consumption of CFCs by over 99% and developing countries by more than 50%. Taking into account the long delay between surface emission and diffusion of CFCs into the upper atmosphere and their long residence time in the stratosphere, the CFC concentration in the stratospheric ozone layer is expected to decline to pre-1980 levels in the middle of this century.<sup>25</sup>

However, some challenges remain. Some of the chemicals replacing CFCs are also ozone depleting substances although less damaging than CFCs, and there are difficulties in replacing the ODS methyl bromide.

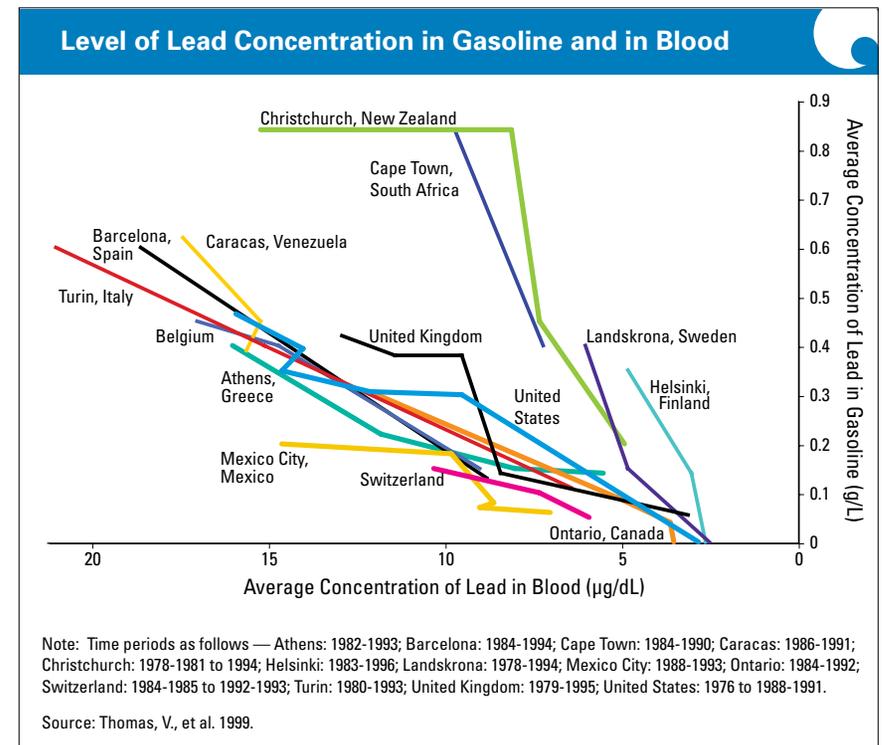
## Airborne lead is declining in all regions as leaded gasoline is phased out

Airborne lead pollution increased over much of the 20th century with increasing motorization and the use of leaded fuel. Lead additives were used from the 1930s until the 1970s, when the recognition of serious health effects, especially in children, eventually led to a ban in many countries. The phase-out of lead in gasoline also allowed the introduction of catalytic converters, the most cost-effective method of reducing harmful exhaust emissions. As a result of the phase-out of leaded gasoline, there have been substantial drops in concentrations of lead in the air and in the human body.<sup>26</sup>



## The switch to unleaded gasoline has sharply reduced blood lead levels

The costs of leaded gasoline phase out are modest and the health benefits substantial. The political commitment of government is a key factor along with industry cooperation, and the recent action by sub-Saharan African governments to eliminate lead from gasoline as of 1 January 2006 is noteworthy. All high-income countries have now phased out leaded gasoline, as have most countries in Latin America. However, in Asia-Pacific, Eastern Europe and the Middle East, a number of countries still sell leaded gasoline as well as unleaded. In Eastern Europe, most countries have recently banned leaded gasoline or will do so in 2006.<sup>27, 28</sup>



Note: In some instance, a country may be declared unleaded (as leaded gasoline is no longer produced) although the remaining stocks of leaded gasoline are still being sold. This is currently the case of some African countries. In addition, some countries with a very small percentage of leaded fuel in the market declare themselves unleaded and are labeled as such.

# CLIMATE CHANGE

The Intergovernmental Panel on Climate Change (IPCC) projects that, due to the accumulation of carbon dioxide in the atmosphere, global mean temperatures could increase by between 1.4 and 5.8 degrees Celsius by 2100. The IPCC states that there is compelling evidence that most warming observed in the last 50 years can be attributed to human activity.<sup>29</sup>



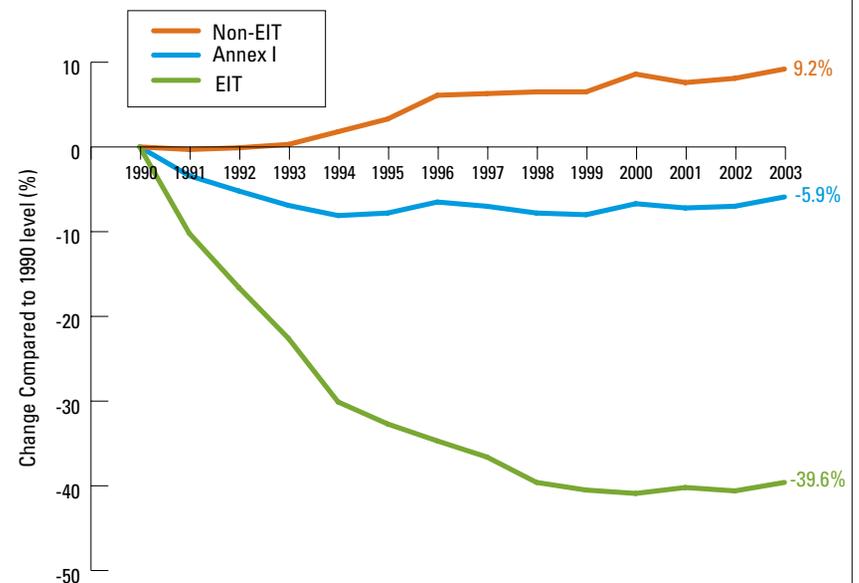
## GHG emissions from Annex-I countries decline but largely due to lower emissions from economies in transition

Aggregate greenhouse gas (GHG) emissions for Annex I Parties declined by 5.9% over the period 1990–2003. Total emissions for the 14 Parties with economies in transition (EIT Parties) have decreased by almost 40%, although most of these Parties reported that CO<sub>2</sub> emissions increased from 2000 to 2003. Emissions from other Annex I Parties as a group increased by 9.2%.

“One of the greatest environmental and development challenges in the twenty-first century will be that of controlling and coping with climate change.”

—Kofi Annan,  
“In Larger Freedom”, 2005

Changes in GHG Emissions (without LULUCF) from Annex I, EIT & Non-EIT Parties



Note: LULUCF: land use, land use change and forests; EIT: economies in transition.

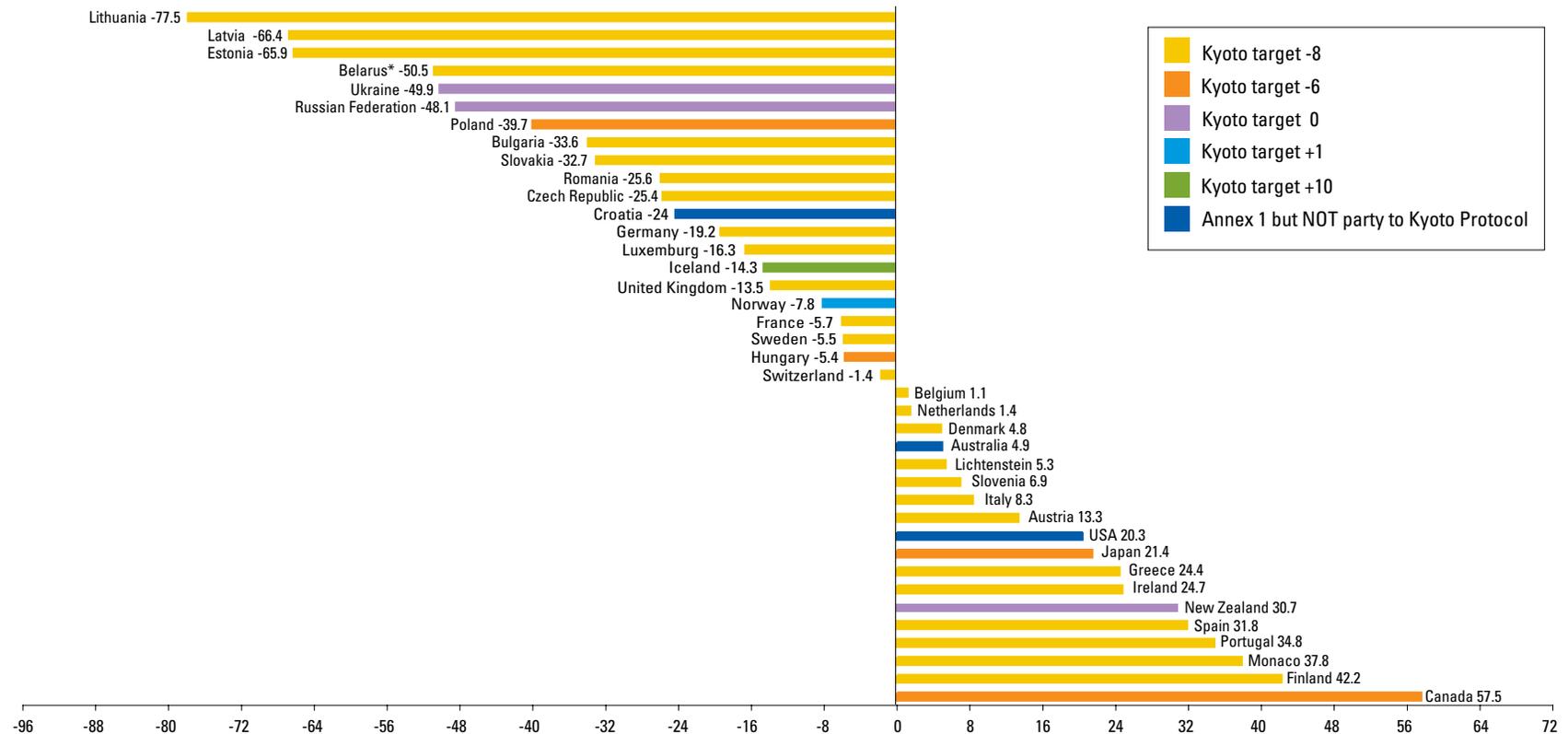
Source: UNFCCC, 2005.

**While many countries have made significant progress towards reaching their Kyoto goals, others have far to go**

Several non-EIT Annex I Parties, notably in the EU, had individually achieved or exceeded their Kyoto commitments as of 2003. On the other hand, several countries have emissions well above their Kyoto commitments. Of the EU-15, only four countries — France, Greece, Sweden and the UK — have thus far reached their EU target, while Germany is close. <sup>30</sup>

Many countries are using innovative policy instruments to reduce GHG emissions in cost-effective ways.

**Change in GHG with LULUCF (%), 1990-2003**



\*Belarus' Kyoto target is -5%

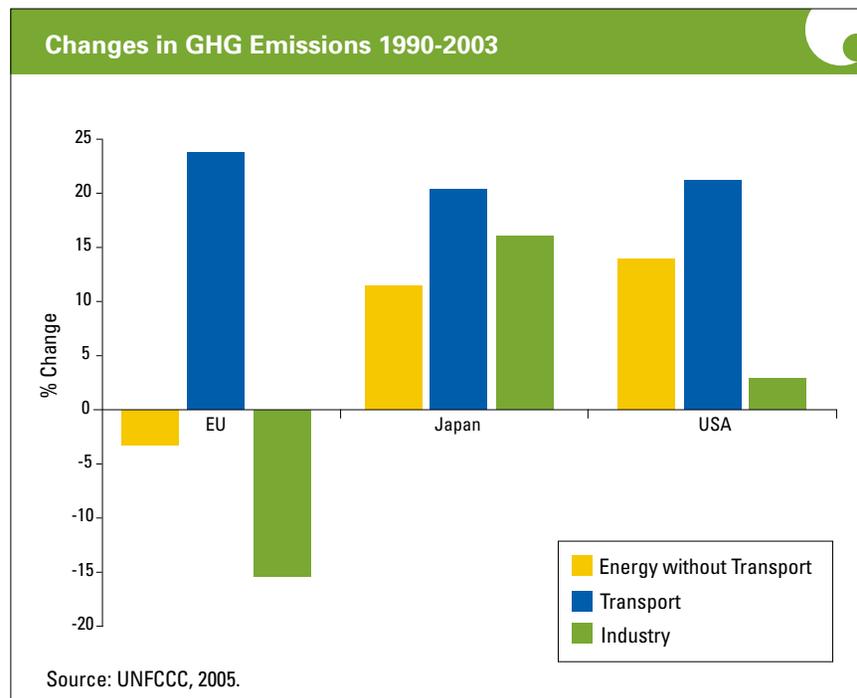
Note: The colours in the legend represent a country's Kyoto Protocol target, while the numbers beside each country indicate the reported % change in greenhouse gas emissions with LULUCF from 1990 to 2003. Hence for example, Lithuania, which has a Kyoto target of -8%, has as of 2003 more than met the target at -77.5%.

LULUCF: land use, land use change and forests; EIT: economies in transition.

Source: UNDESA-DSD based on UNFCCC, 2005.

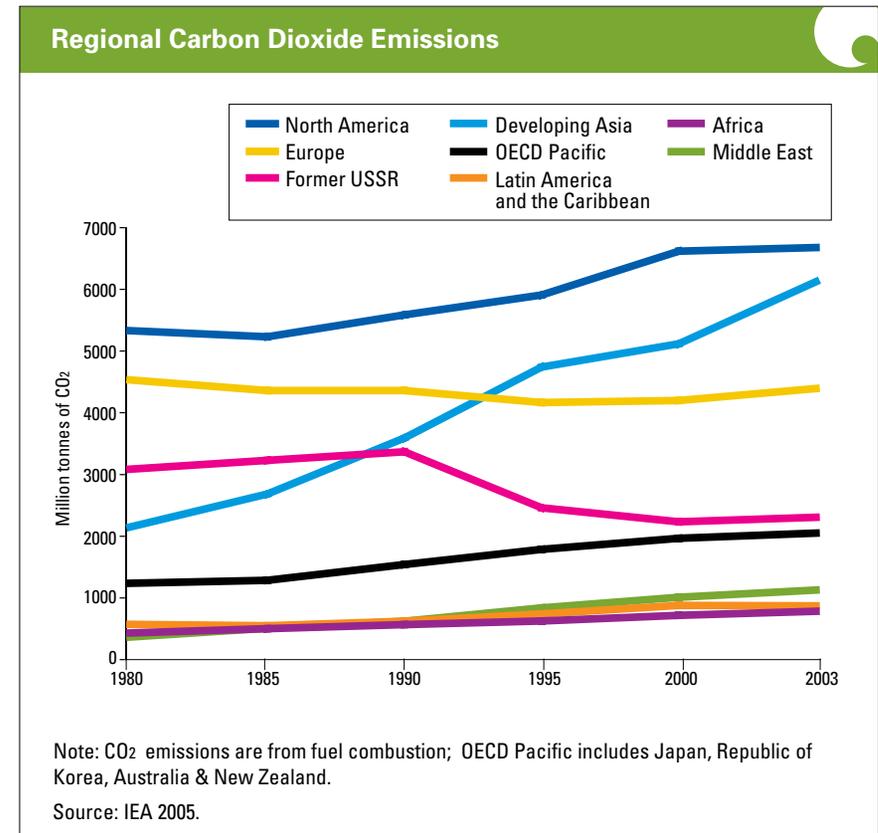
## GHG emissions from transport grow fastest of any sectoral emissions

The contribution of the energy sector (including transport) to GHG emissions from Annex-I Parties remained roughly steady between 1990 and 2003, with the share in 2003 standing at 84%. Within that total, however, transport emissions — including from international aviation — have increased substantially (21 and 50%, respectively). Of the three major developed economies — EU, Japan and USA — the first saw the biggest percentage increase in transport emissions, combined with a steep drop in industrial emissions. Agriculture, industrial processes and waste management all saw their shares of overall emissions decline over the period but their rates of decline have slowed.<sup>31</sup>



## GHG emissions from North America and developing Asia grow rapidly

Strong economic growth has more than offset any GHG mitigation measures in the United States and Canada, resulting in increased levels of GHG emissions in North America. Meanwhile, rapid growth in the emerging economies of Asia, powered in large measure by coal combustion, has resulted in a tripling of emissions compared to 1980. For some developing countries with large forested areas and high deforestation rates, land-use change represents a much larger net contributor to GHG emissions than energy and industrial processes.<sup>32</sup>

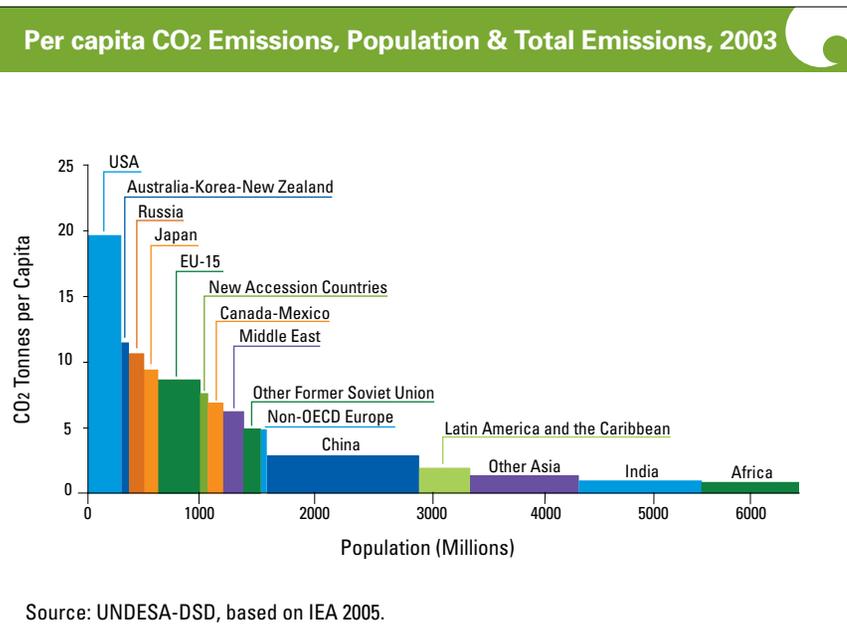
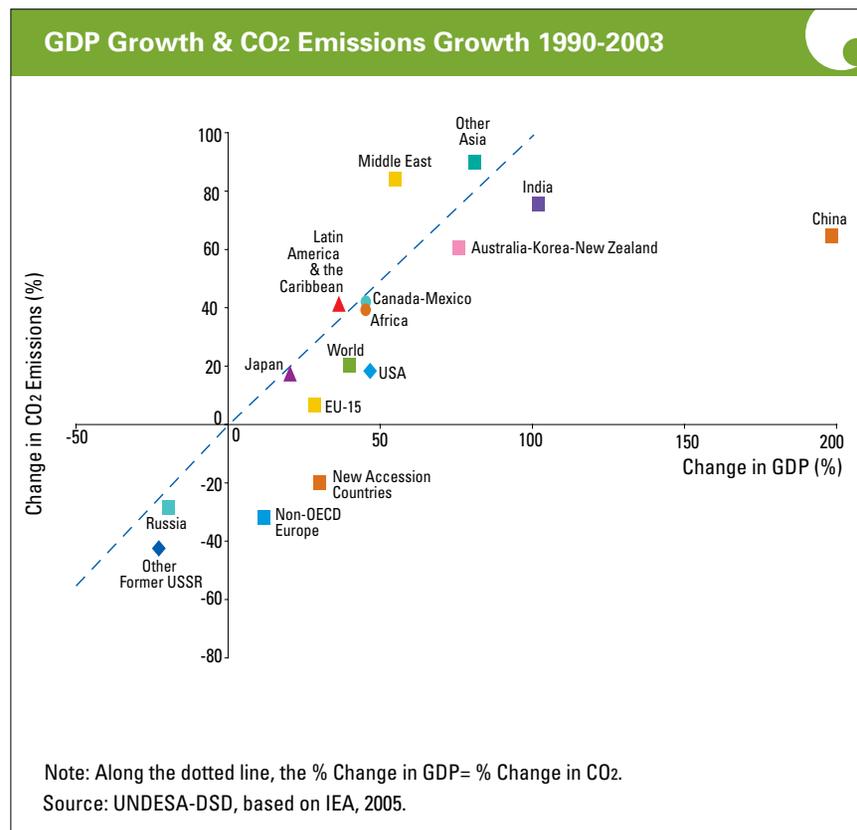


## Economic growth in the large emerging economies of Asia has been significantly faster than growth in CO<sub>2</sub> emissions

China and India have thus seen the emissions intensity of their economies fall. In many countries with economies in transition, the decline in CO<sub>2</sub> emissions has been the result of economic decline.

Some high-income countries as well as some middle-income ones have seen their CO<sub>2</sub> emissions rise more rapidly than economic output.

The Latin American and Caribbean region stands out for the combination of slow economic growth and relatively high emissions growth.



## Per capita CO<sub>2</sub> emissions vary enormously across countries and regions

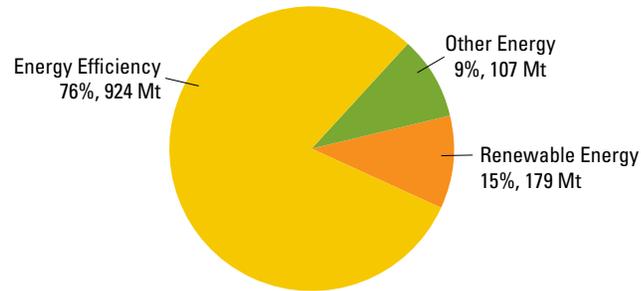
High per capita CO<sub>2</sub> emissions in the United States — twenty-seven times those of sub-Saharan Africa — mean that, even with a population roughly a fourth of China's and a third of India's, it is the world's largest emitter. In China, the combination of a large population and rapid growth of CO<sub>2</sub> emissions in recent years has brought total emissions almost on a par with those of the EU-15. Meanwhile, sub-Saharan Africa's total emissions are roughly on a par with those of Canada and Mexico combined.<sup>33</sup>

### GEF climate change mitigation projects are making an impact

Over 120 full-scale climate change mitigation projects have been approved by the Global Environment Facility (GEF) since 1991, with GHG reduction goals identified for most. These projects largely aim to abate CO<sub>2</sub> emissions from the energy sector. Estimates are that the GEF climate change portfolio will result in a global environmental benefit of over 1.2 billion tonnes of CO<sub>2</sub> avoided. While the majority of projects funded address renewable energy, the largest impact by far is attributable to energy efficiency projects.



#### Estimated CO<sub>2</sub> Mitigation Results from GEF Climate Change Projects, 1992-2005



Source: GEF Project Database.

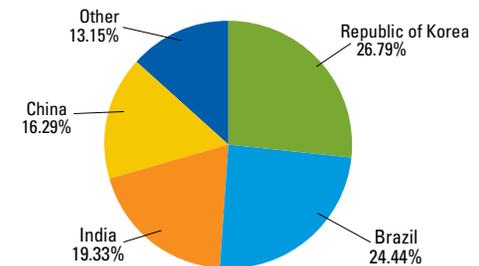
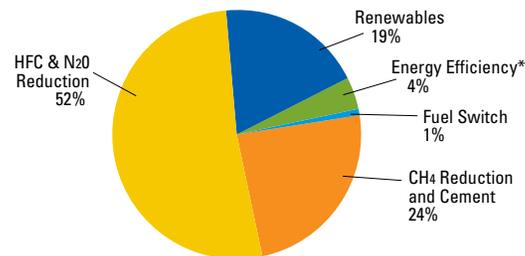
### With the entry into force of the Kyoto Protocol in February 2005, the Clean Development Mechanism (CDM) was launched

The CDM allows industrialised countries or their companies to earn emissions credits for investments in emissions-reducing projects located in developing countries, while developing countries acquire technology, capital and clean energy. As of March 2006, 135 CDM projects had been registered while more than 500 were in the pipeline. The first group of registered projects principally addresses power generation through renewable energy sources (mostly biomass and run-of-river hydro, and increasingly wind), methane gas recovery and HFC and N<sub>2</sub>O emissions reduction, but the scope for CDM projects is broad.<sup>34</sup>

Geographically, Latin America registers the largest number of CDM projects (60%), followed by Asia-Pacific (34%). In terms of certified emission reductions from those projects, four countries account for over 85%. Three are large countries, so some concentration there is to be expected. The very small fraction of projects in Africa remains a concern.



#### Registered CDM Projects by Focal Area & by Country/Region: Expected Annual Average CERs, 2008-2012



\* Inter alia, energy efficiency includes conversion from single cycle to combined cycle power generation.

Note: Distribution by the estimated number of certified emission reductions, 2008-2012.

Sources: (Left chart) URC & UNEP, November 2005. (Right chart) UNFCCC March 2006.

# Climate Change Programs Around the World

**UK's Climate Change Levy** is an energy tax applied to industry, commerce, agriculture and the public sector. Companies meeting their agreed-upon targets benefit from an 80% discount on the Levy. The Levy is part of the Climate Change Program (2000) which aims to meet the domestic goal of a 20% reduction in CO<sub>2</sub> emissions by 2010, as well as Kyoto Protocol commitments.<sup>35</sup>

**2005 Climate Change Plan for Canada:** Legislation is being created that sets mandatory targets for the 700 Large Final Emitters, which are responsible for half of total domestic GHG emissions. Options for compliance include investing in in-house reductions or domestic offset credits and purchasing certified international credits. **The Climate Fund** is a market-based mechanism that will be responsible for purchasing emissions reduction and removal credits on behalf of the Government of Canada.<sup>36</sup>

**In the US,** climate change mitigation actions are being initiated by several states and municipalities. Currently, 30 states have developed GHG action plans, either independently or under a regional agreement. Actions include voluntary and mandatory mechanisms and have focused on energy issues, including vehicle GHG emission standards. Several northeastern states have recently initiated a regional cap-and-trade program.<sup>37</sup>

**National Biodiesel Program in Brazil** was created with the intent of reducing GHG emissions by progressively increasing the share of biodiesel content in diesel fuel. From zero use at present, the goal is to have at least 3% of biodiesel added to fossil diesel by 2008, and 5% by 2012. Biodiesel can be produced from several beans and palms that grow in Brazil.<sup>38</sup>

**Australia's GHG Abatement Program** is a subsidy program that supports activities likely to result in substantial emission reductions or sink enhancement.<sup>39</sup>

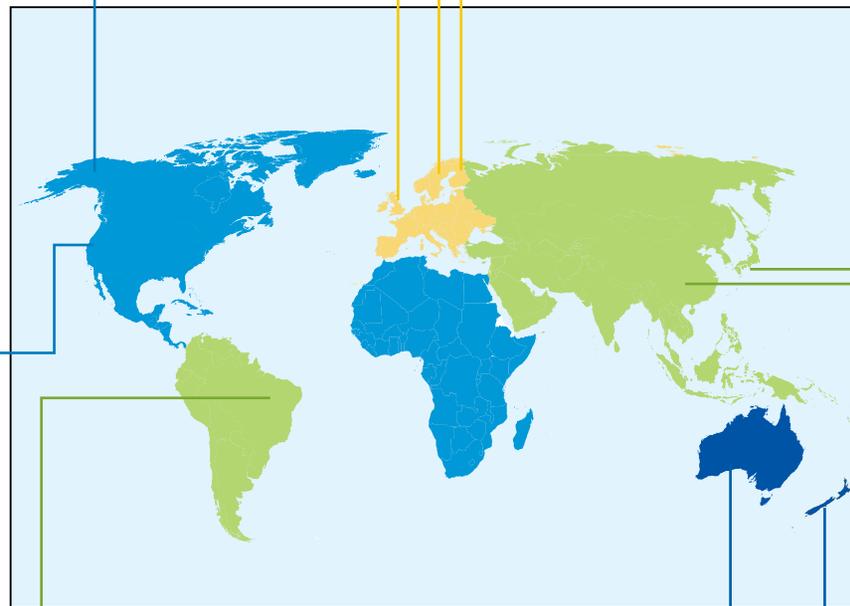
**EU Greenhouse Gas Emissions Trading Scheme (2005)** is the first international trading system for CO<sub>2</sub> emissions in the world and covers about half of the CO<sub>2</sub> emissions in the EU. Allocations of emissions allowances are done by Member-States on the basis of historical emission trends, expected production levels and the respective CO<sub>2</sub> emission reduction commitments under the Kyoto Protocol.<sup>45</sup>

Several European countries **tax energy use or energy-related CO<sub>2</sub> emissions.** However, implicit taxes applied to fossil fuels are inversely related to carbon content (Sweden and Denmark are exceptions). Some firms joining voluntary agreements to improve energy efficiency pay a reduced carbon tax rate.<sup>44</sup>

**Green Taxation Plan for Automobiles in Japan,** which provides tax relief for low-polluting vehicles and for certain fuel-efficient and low-emissions vehicles, has been in place since 2001, and taxes on old polluting vehicles have been increased.<sup>42</sup> Under the **Kyoto Protocol Target Achievement Plan** approved in 2005, an environmental tax on all fossil fuels is planned for 2007.<sup>43</sup>

**Carbon tax and negotiated GHG agreements in New Zealand:** under these agreements, firms or industries that, as a result of the carbon tax to be introduced in 2007, face significant risk to their competitiveness vis-à-vis producers in countries with less stringent climate change policies are eligible to receive full or partial exemption from the tax in exchange for moving to world best practice in emissions management.<sup>40</sup>

Although **China** does not have GHG reduction obligations under Kyoto, its proactive stance in energy efficiency policy-making has contributed to reducing emissions. **The 2005 Law on renewable energy,** for instance, establishes that, by 2020, 10% of total power consumption should come from renewable sources (the share was 3% in 2003). In 2004, China also adopted its first vehicle fuel efficiency standards.<sup>41</sup>



## Evidence of climate change and its impacts is steadily accumulating

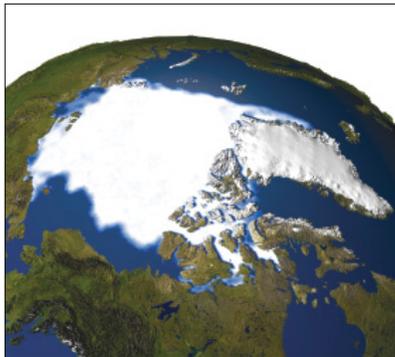
Recent evidence indicates that current atmospheric CO<sub>2</sub> concentrations are high compared with levels over the last million years.<sup>46</sup>

Historical and current pictures of Arctic sea ice and tropical glaciers indicate the extent of warming and melting that has occurred over the past 25-35 years.<sup>47</sup>

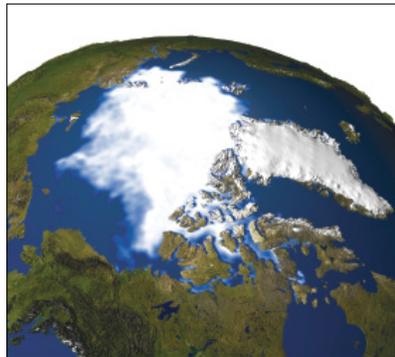
Global warming is currently raising sea-levels by almost 2 cm per decade,<sup>48</sup> and that rate is expected to increase with rising atmospheric CO<sub>2</sub> concentrations, leading to flooding of low-lying coastal areas. Recent research suggests that global warming is increasing the intensity of hurricanes and other storms,<sup>49</sup> leading to greater storm damage and coastal flooding. Increasing atmospheric CO<sub>2</sub> is also increasing ocean acidity,<sup>50</sup> with negative impacts on marine biodiversity, including coral and plankton, and thus on the fish that rely on them for habitat and food.<sup>51</sup> Agricultural models suggest that climatic warming will tend to reduce agricultural productivity in the tropics.<sup>52</sup> There are also some indications of changing oceanic circulation patterns, notably in the North Atlantic Gulf Stream, which could lead to disruptive climate change.<sup>53</sup>

### Arctic Sea Ice

September 1979



September 2003



Source: NASA Earth Observatory.

### Oori Kalis Glacier, Peru

1978



2000

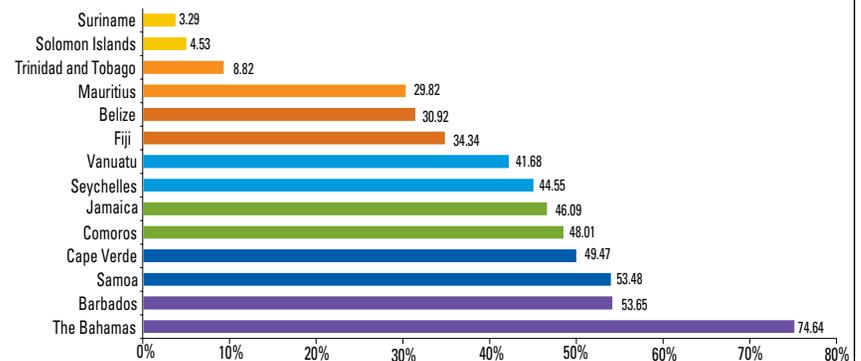


Source: Thompson, L., Byrd Polar Research Center, Ohio State University.

## Sea-level rise and damage to marine biodiversity from climate change are increasing the vulnerability of small island developing States (SIDS)

The dependence of SIDS on tourism poses a long-term sustainable development challenge as many of these countries are atolls and low-lying island states that are vulnerable to sea-level rise as a result of climate change. Expected impacts include loss of beaches, salinization of soils and freshwater sources, increased stress on coastal ecosystems such as coral reefs, and infrastructure damage. These threaten the tourism industry and other economic activity and make adaptation to climate change a priority in these countries.<sup>54</sup>

### International Tourism Receipts as a % of Total Exports in Selected SIDS, 1995-2003



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## CLIMATE CHANGE

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- b. UNDESA-DSD based on UNFCCC 2005, Greenhouse Gas Emissions Data for 1990-2003
- c. UNFCCC 2005, Greenhouse Gas Emissions Data for 1990-2003
- d. IEA 2005, CO<sub>2</sub> Emissions from Fuel Combustion
- e. UNDESA-DSD based on IEA 2005, CO<sub>2</sub> Emissions from Fuel Combustion
- f. UNDESA-DSD based on IEA 2005, CO<sub>2</sub> Emissions from Fuel Combustion
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