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Transport, Energy, and Global Climate Change

Improving Energy Efficiency for Sustainable Mobility

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Global climate change and high energy prices are increasingly moving into the focus of international debate and prompting the emergence of action plans. Thus, the September 2006 ASEM Summit held in Helsinki was devoted primarily to the topic of climate change. In a joint statement the heads of government of 13 Asian and 25 European countries and the European Commission agreed to cooperate in making climate-friendly technologies accessible to developing countries.

Possibilities for delivering efficiency improvements on the generation and distribution side are being explored. On the consumption side, however, the potential for improving efficiency is often overlooked, and the transport sector is a prominent example. In many developing countries transport is the fastest growing energy consumer and source of greenhouse gas emissions, but clean alternatives are available, so action is urgently needed. Climate protection and developmental objectives could thus be addressed jointly with great effectiveness.

Development Needs Mobility

Mobility is a central prerequisite for economic and social development, poverty reduction and the achievement of the millennium development goals (MDGs). The division of labour, benefits from trade, regional cooperation and successful participation in globalisation cannot be reached without a well-functioning transport system that ensures mobility for people and commodities. The transport sector, therefore, plays a crucial role for developing and sustaining the economic and social basis of both developed and developing countries. In most developing countries there is still a great need for improving transport infrastructure and services.

Key Facts About Transport and Energy Consumption

- Transport accounts for about 34% of energy and 62% of oil consumption in OECD countries. In many developing countries this share is still considerably lower (India 9% and 34%, China 11% and 39%) but increasing fast. In fact, the rapidly increasing road and air transport makes the sector the fastest growing energy consumer in the developing world, with global impacts on energy consumption, oil prices and greenhouse gas (GHG) emissions.
- Transport offers many opportunities to reduce energy consumption. One way is to increase energy efficiency by influencing the modal split. Some transport modes are up to 10 times more energy-efficient than others. Energy consumption can also be reduced through improved infrastructure, policies that take environmental concerns into account, and the use of modern technologies.

• Mobility Needs Energy

Development needs transport and transport, in turn, needs energy. The energy required for transport accounts for a substantial part of total energy consumed. In the OECD countries, on average, transport accounts for approximately 34% of total energy consumed. In the developing and emerging countries the share is clearly lower – about 9% in India, 11% in China, but already 31% in Brazil.[1] However, due to the virtually "exploding" motorisation in the more dynamic developing countries, this share is increasing rapidly. In fact, transport-related energy consumption in the developing countries has been growing more than 4 times faster than overall energy consumption during the last 30 years and is projected to exceed overall energy consumption growth rates by a factor of 3 during the next 30 years in a business-as-usual scenario (see Figure 1).

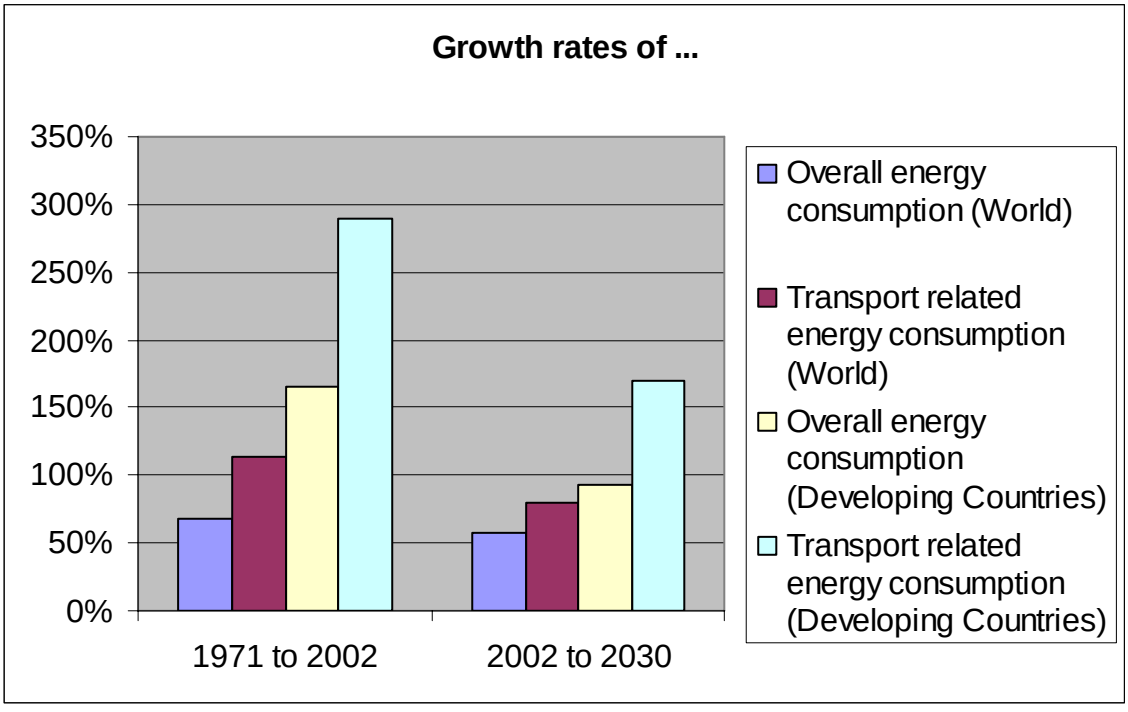

Figure 1: Transport is the fastest growing energy consumer with global impact
Source: Based on data for final energy consumption from IEA World Energy Outlook 2004

• World Energy Prices and Global Climate Change

As 97% of transport energy is based on oil, the rapid increase in energy demand from transport – especially in the large emerging countries in Asia – has global consequences on world oil prices and greenhouse gas emissions. The growth rates of transport-related CO_2 emissions in China between 1971 and 2002 was over 400% whereas it was less than 90% in OECD countries. Given the current trends in motorisation and if no countervailing measures are taken, transport-related GHG emissions in developing countries are likely to increase accordingly, putting a significant burden on efforts to mitigate global climate change.

• Promoting Energy-Efficient Mobility

Developing countries need to extend and improve their transport systems. Limiting mobility is not a viable option. However, there are various ways to ensure mobility – with significantly different impacts on energy demand, GHG emissions and levels of pollution. The challenge is to increase energy-efficiency in transport and to promote means of transport that minimise the burden on the environment. This is particularly important for developing economies with big populations, dynamic growth and rapidly increasing energy demand.

The following sections will highlight five approaches towards more energy-efficient mobility in developing countries that are important in KfW Entwicklungsbank's transport sector policy:

Approaches to Promote Energy-Efficient Mobility

1. **Rail Transport**: Help to improve railway infrastructure and management in countries where freight and passenger volumes are sufficiently high in order to increase the share of rail as an energy-efficient alternative to road or air transport.
2. **Mass Rapid Transit**: Assist city governments to plan, finance and manage public transport systems and limit individual motorised transport with the objective of maintaining urban mobility in an energy-efficient and environmentally friendly way.
3. **Travel Distances**: Support the extension of national, regional and urban transport networks in a way that avoids long detours. Detours result in longer transport times and higher energy consumption, emissions, and costs.
4. **Market-economy Instruments**: Promote the gradual adoption of the "the user/polluter/beneficiary shall pay" principle to avoid excessive transport demand and ensure adequate funding of transport energy-efficient and environmentally friendly investments.
5. **Technologies**: Help modernise vehicle fleets and introduce energy-efficient and environmentally friendly transport technologies.

➢ Energy-efficient Rail Transport

Rail transport is a very energy-efficient alternative to other modes of transport if freight and passenger volumes are sufficiently high. Freight transport by rail may use up to 20 times less energy than on-road freight traffic over larger distances. Long-distance passenger transport by rail may use up to 4 times less energy than road transport by car and up to 9 times less energy than air

traffic. Promoting rail transport can therefore have a significant influence on total transport-related energy consumption. It can also help reduce pollution especially if powered by renewable sources of energy.

However, to compete with road and air transport, railways must invest to become faster and more efficient and flexible with respect to customer requirements.

➢ Urban Mass Rapid Transit

In spite of the many problems caused by the fast pace of urbanisation in developing countries, it is within urban agglomerations that growth and development are generated and the population is therefore set to increase more rapidly than anywhere else. Assuring urban mobility is a key pre-requisite for cities to play their role. The rapid motorisation that can be observed especially in urban agglomerations threatens urban mobility and poses additional burdens on its population such as noise, air pollution, and accidents.

Energy consumption in motorised individual passenger traffic is up to 10 times as high as consumption in a well-organised and demand-oriented public transport system. The same holds for GHG emissions. A recent study of 52 cities, mainly in developed countries, shows the strong correlation between modal split in cities and emissions (Figure 2): Cities with a high share of public and non-motorised transport need up to 10 times less energy per inhabitant for passenger transport than cities where urban transport is mainly based on individual motorisation.

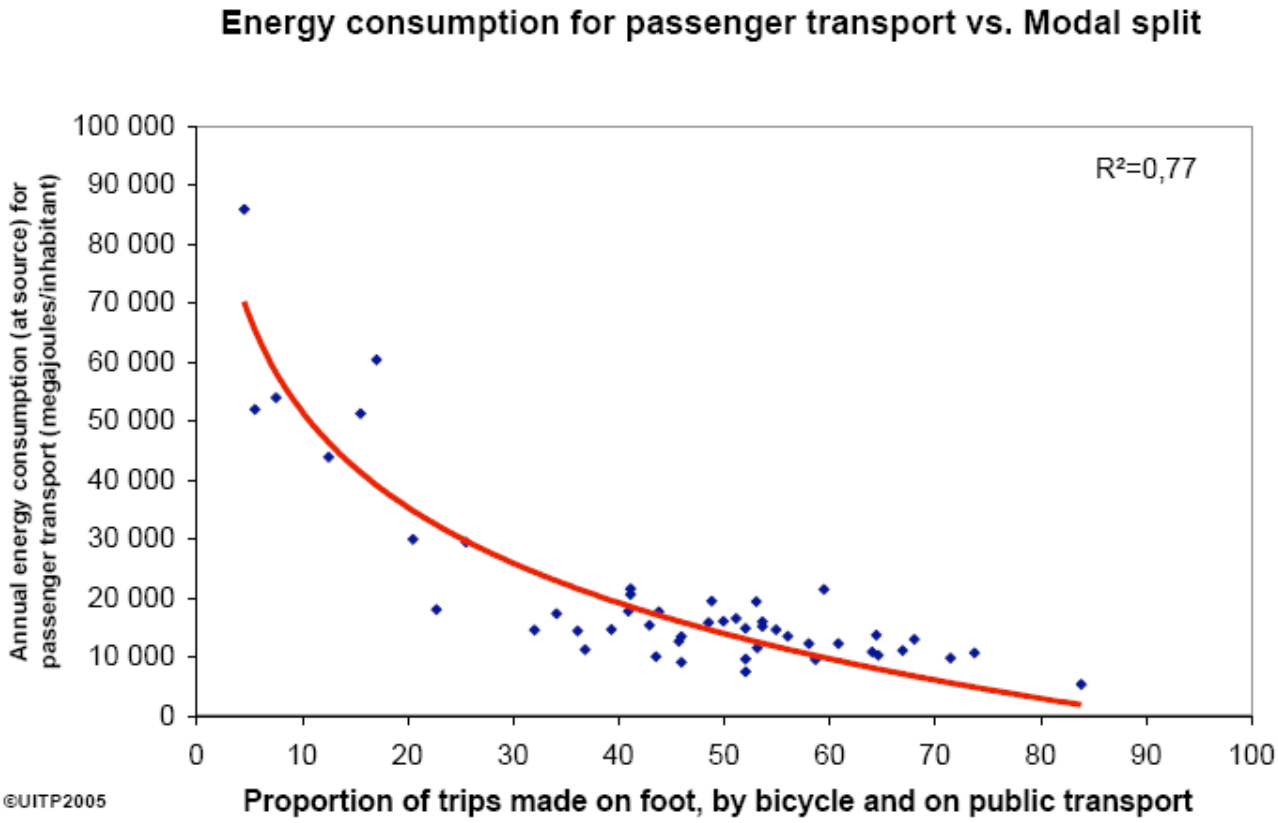

Figure 2: Modal split and energy efficiency in cities
Source: UITP Mobility in Cities Database 2006

Walking and cycling alone is no alternative to motorised transport in fast growing cities. However, in conjunction with prioritising and improving public mass transit by rail or bus it offers big opportu-

nities for higher energy-efficiency and, at the same time, lower levels of pollution. Laying transport corridors with efficient public transport systems at an early stage also contributes significantly to condensing the landscape and avoiding uncontrolled urban sprawl.

To be successful, the promotion of public transport must go hand in hand with well-designed overall city development. In addition, more local funds must be mobilised by charging not only the passengers but also urban road users (e.g. through fuel levies, parking fees and city tolls) and other beneficiaries of a public transport system (e.g. real-estate owners, restaurants, and hotels).

- Shorter Travel Distances

Transport networks in many developing countries are quite rudimentary. This often leads to long transport distances as detours must be taken to travel from one place to another. Extending the transport network can help to avoid detours and save energy and emissions. However, the right balance must be struck between the economic and environmental benefits of enlarging transport networks on the one hand and the costs of investment and maintenance on the other hand.

- Wider Use of Market Economy Instruments

Transport is often not charged at its full costs. This is particularly true for road transport, which often neither bears the costs of construction and maintenance of the road network nor its external costs in the form of accidents, pollution, or congestion. In fact, some countries even subsidise fuel and, thereby, subsidise motorised transport too. The consequences are higher transport demand, energy consumption and GHG emissions. In addition, such a policy can lead to unfair competition between different modes of transport, favouring road over rail transport, for example, as the latter often has to charge its customers the full cost of operation and maintenance of both rolling stock and the rail network. In a transport policy that is based on the market economy principle "the user/polluter/beneficiary shall pay" avoids subsidising motorised transport and offers a level playing field for different transport modes. At the same time it ensures that enough funding is available for maintaining and extending transport networks and services. The gradual adoption of the "the user/polluter/beneficiary shall pay" principle therefore makes sense from both an economic and environmental point of view.

- Introduction of Modern Technologies

The transport system in many developing countries is characterised not only by a very rudimentary network but also by very old vehicle fleets on road and rail with high levels of fuel consumption and emissions. Modern vehicle technologies as well as the introduction of emission standards can help to decrease energy consumption, GHG emissions and pollution significantly. Renewable energies in road transport do not yet play a major role but promising developments can be observed with respect to the use of biofuels in some countries. In the case of rail transport, electrification can help to increase energy efficiency and to reduce GHG emissions, especially if electricity comes from renewable energies or modern technologies such as regenerative braking in electrified railways.

• The Contribution of KfW Entwicklungsbank

On behalf of the Federal Government of Germany and with budget funds from the Federal Ministry for Economic Cooperation and Development as well as with capital market funds, KfW supports transport projects in developing countries in the context of German Financial Cooperation (FC) with average annual commitments between 2000 and 2005 of EUR 185 million. This amount corresponds to about 12% of total FC commitments. Over the last years commitments for the transport sector have declined considerably both in absolute and relative terms. As a consequence, KfW is currently active in only a very limited number of partner countries.

Many transport interventions contribute to higher energy efficiency and a better environmental situation in the developing countries as illustrated by the following two examples:

- Strengthening the railway as an energy-efficient and environmentally friendly alternative to road and air transport in China

The traffic sector plays a key role in China. The development of the underdeveloped provinces in western and central China is largely dependent on the traffic infrastructure being improved. The aim is both to reduce energy consumption and to protect the environment. China is now the world's second largest emitter of carbon dioxide and is thus making a major contribution to climate change. The traffic sector is the fastest growing energy consumer.

In the late 1990s the Chinese government launched the "Go West" transport programme in support of the disadvantaged provinces. Part of this programme is the new railway connection between Huaihua and Chongqing, which is being supported by German FC. This connection will reduce the transport distance by about 300 kilometres and the time needed for passengers and goods to reach the Sichuan basin, which is home to around 120 million people. Domestic trade will be boosted and the people living near the railway line will be given a fast rail link to larger markets. This new environmentally friendly alternative should avoid around 440,000 tonnes of carbon dioxide emissions a year.

Economic growth and environmental protection are also the objectives to be achieved by building a new 356 kilometre-long high-speed line between the urban agglomerations of Wuhan and Hefei which is supported by Germany and Austria. It will connect several million people to the rail network for the first time and cut around 200 kilometres off the previous route. The dramatic reduction in travel distance and time will cut energy consumption and enable a substantial decrease of an estimated 430,000 tonnes of carbon dioxide emissions a year. The new rail connection represents an energy-saving alternative to environmentally unfriendly and costlier road and air traffic.

- Promoting public transport in urban agglomerations – the Jabotabek commuter railway in Indonesia

The region of Jabotabek is one of Asia's fastest growing urban agglomerations. Around 21 million people live in the area around the Indonesian capital of Jakarta. Most jobs, however, are in the capital. This means that every day vast numbers of commuters travel from the suburbs into the metropolis and back. The local transport infrastructure has long been inadequate to meet this challenge.

Poor people cannot afford taxis or private cars. Although there are private and public buses, these are often caught up in traffic jams and contribute to the substantial air pollution in the conurbation.

The old but energy-efficient commuter rail network in the Jabotabek region, which is 160 kilometres long, is suffering from underinvestment in infrastructure and rolling stock. On behalf of the German Federal Ministry for Economic Cooperation and Development, KfW is financing new trains and improvements to the maintenance workshop, electricity supply and signalling equipment.

The improvements to the suburban railway make it easier for people in the greater Jakarta area not only to get to work but also to reach education and health care facilities. Rail transport is environmentally friendly and far safer than road transport.

Further information:

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[1] Unless indicated otherwise, figures on energy consumption and CO_2 emissions are based on IEA World Energy Outlook 2004 data for final energy consumption with statistical values for the years 1971 and 2002 and reference scenario projections for the years 2010, 2020 and 2030.