United Nations E/ESCAP/MCT.2/7

Economic and Social Council

Distr.: General
24 August 2011

Original: English

Economic and Social Commission for Asia and the Pacific
Ministerial Conference on Transport

Second session
Bangkok, 12-16 March 2012
Item 3 (f) of the provisional agenda
Emerging issues in transport: Sustainable transport development

Sustainable transport development

Note by the secretariat

Summary

Sustainable transport development involves the provision of safe, reliable and environmentally friendly transport without aggravating adverse global phenomenon. Energy consumption in the transport sector in the Asia-Pacific region is growing faster than that of other sectors and other regions. As a result, transport sector green house gas (GHG) and CO_2 emissions are also increasing. One of the ways to address the issues of environmental sustainability in the transport sector is to reduce energy consumption and vehicle emissions through modal shifts in freight transport.

The document contains a review of policy options and initiatives to promote modal shifts to environmentally friendly transport modes such as railways and inland waterways, and the use of intermodal transport. It also proposes a number of national and regional activities that would support environmentally sustainable transport development.

Contents

Figures

I. Introduction

1. Sustainable transport development involves the provision of safe, reliable and environmentally friendly transport without aggravating adverse global phenomenon. A sustainable transport system incorporates three major aspects. The first is social development that aims at providing safe and affordable access and support to the achievement of the Millennium Development Goals (MDGs). The second is environmental protection that deals with safeguarding the ecosystem and the optimization of resources. The third is economic development that includes considerations of efficiency and effectiveness as well as financial sustainability of the transport system.

2. The paper focuses on environmental sustainability, as issues related to economic and social sustainability are dealt with in other papers submitted to the Meeting. However, since all three sustainability aspects are interrelated, intervention in one area can affect the other two.

3. Environmental sustainability of transport systems is an increasingly important issue given the need to optimize the use of scarce energy resources and reduce emissions.

4. The transport sector is the third largest consumer of energy and the largest consumer of petroleum products in the Asia-Pacific region. Energy consumption in the sector is growing faster than that of other sectors[1] and other regions. This growth is driven by a rapid increase in motorization and strong transport demand from economic development. Within the transport sector of the Asia-Pacific region, road transport consumes about 80 per cent

[1] The global energy used in the transport sector is expected to increase by 50 per cent by 2030. (International Energy Agency (IEA), *World Energy Outlook, 2009*).

of petroleum products whereas the share of rail is just 2 per cent. Evidently, road is the preferred transport mode in Asia for both the passenger and the freight.

5. Meanwhile, the transport sector is the primary source of air pollution and one of the largest contributors to CO_2 and other green house gas (GHG) emissions. Freight transport accounts for about one-third of the total transport emissions.

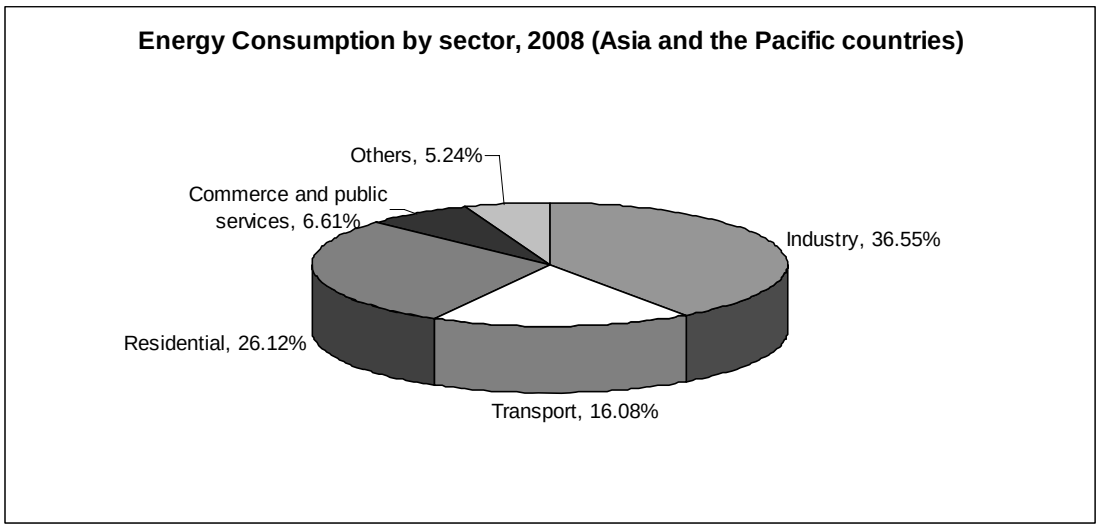
6. This document outlines energy use and emissions in the transport sector and proposes policies and initiatives to promote a modal shift to environmentally friendly transport modes such as railways and inland waterways, where appropriate, as well as actions to be taken at the national and regional levels.

II. Energy consumption and emissions in the transport sector

A. Energy use

7. Figure 1 illustrates energy consumption in Asia and the Pacific region by sector[2] and shows that transport is the third largest consumer of energy after industrial and residential consumption.

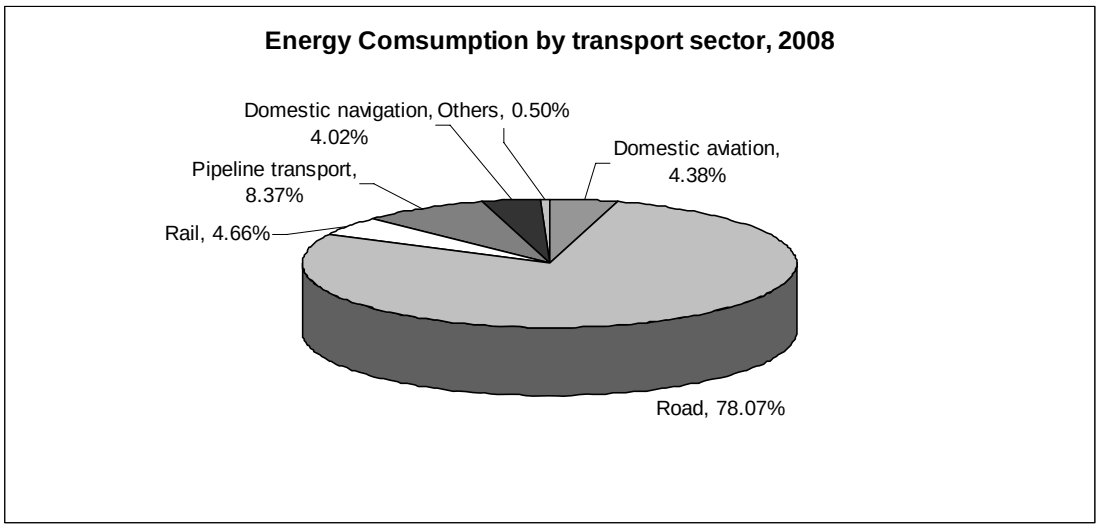
Figure 1
Energy consumption by sector in Asia and the Pacific, 2008



[2] International Energy Agency, "World energy balances", IEA World Energy Statistics and Balances (database). doi: 10.1787/data-00512-en (2010) (Accessed 5 August 2011). Countries included in the calculation are as follows: Afghanistan; Armenia; Australia; Azerbaijan; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; China; Cook Islands; Democratic People's Republic of Korea; Timor-Leste; Fiji; French Polynesia; Georgia; India; Indonesia; Japan; Kazakhstan; Kiribati; Kyrgyzstan; Lao People's Democratic Republic; Malaysia; Maldives; Mongolia; Myanmar; Nepal; New Caledonia; New Zealand; Palau; Pakistan; Papua New Guinea; Philippines; Republic of Korea; Russian Federation; Samoa; Singapore; Solomon Islands; Sri Lanka; Tajikistan; Thailand; Tonga; Turkmenistan; Uzbekistan; Vanuatu; and Viet Nam, as well as Macau, China.

8. Figure 2 further illustrates energy consumption by the transport sector[3] and clearly shows that the road transport subsector consumes 436.2 million tonnes of petroleum products or about 78 per cent of the total consumption of the transport sector. This is followed by the pipeline transport consumption of 8.37 per cent and rail subsector share of 4.66 per cent.

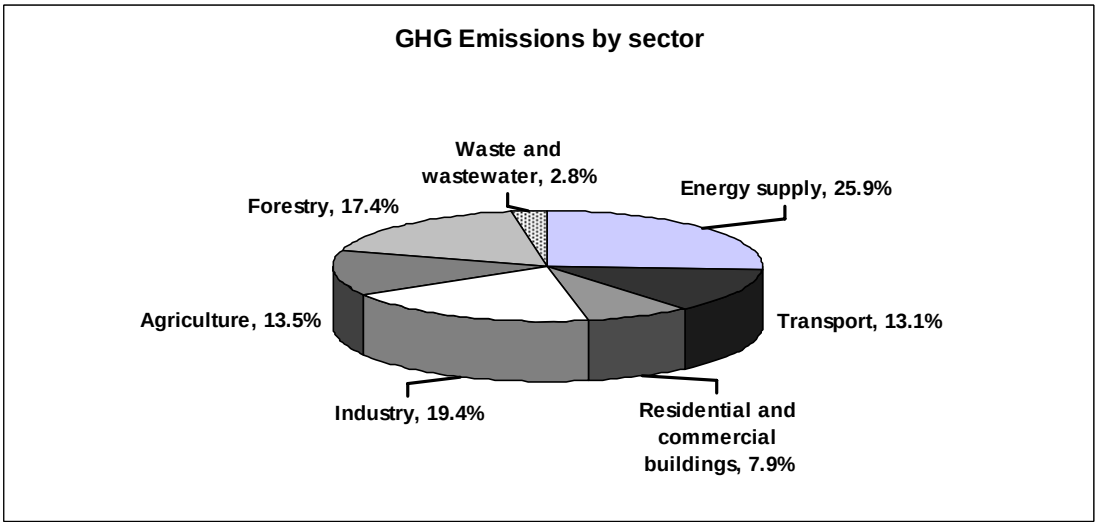
Figure 2
Energy consumption by the transport sector, 2008



B. Emissions

9. Figure 3 illustrates the contribution of various sectors to GHG emissions and shows that the transport sector accounts for 13.1 per cent of total world emissions.[4]

Figure 3
Global GHG emissions by sector



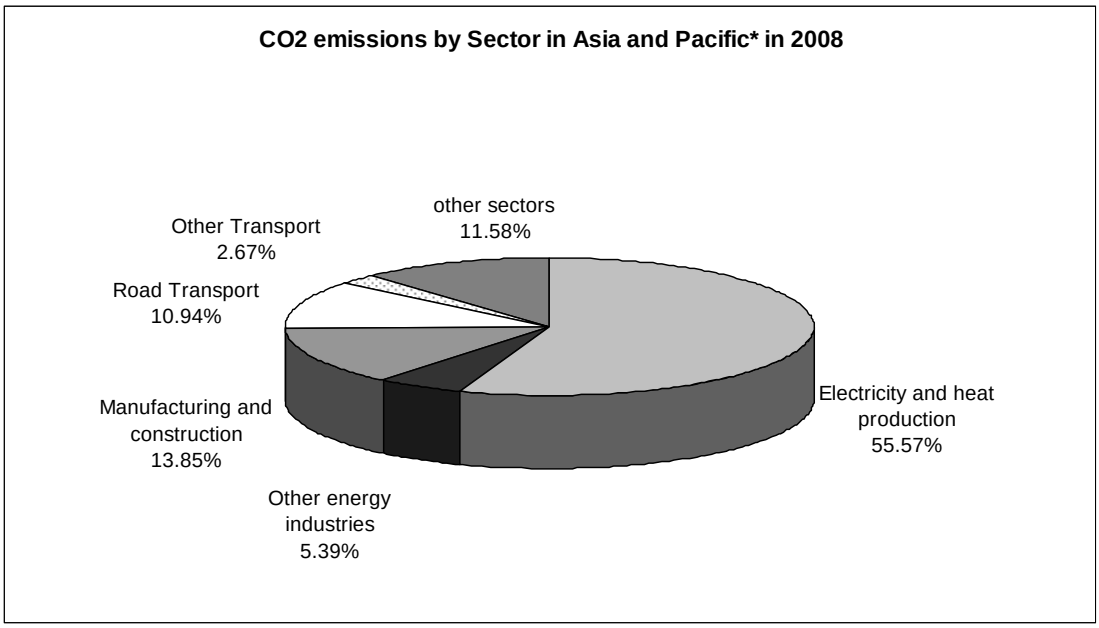
[3] Ibid.

[4] Intergovernmental Panel on Climate Change, *Fourth Assessment Report* (Geneva: IPCC, 2007).

10. Globally, CO_2 accounts for 75 per cent of the total GHG emissions, of which the transport sector accounts for 23 per cent.[5] Road transport accounts for 75 per cent of transport CO_2 emissions whereas the combined share of rail and water transports is 12.5 per cent compared to that of aviation's 12.5 per cent.[6]

11. Figure 4 showed that in Asia and the Pacific region CO_2 emissions from the transport sector were 1,587.4 million tonnes, of which 1,275.8 million tonnes or more than 80 per cent was from road transport. While the transport sector ranked third in terms of CO_2 emissions and accounted for 13.6 per cent of total emissions, road transport accounted for almost 11 per cent of the total emissions.[7]

Figure 4
CO_2 emissions by sector in Asia and the Pacific, 2008



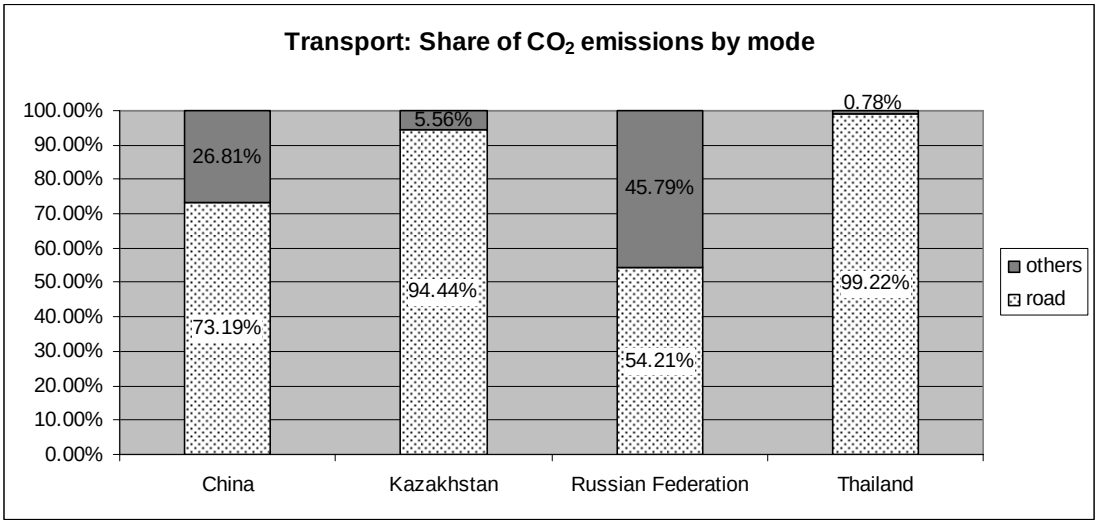
12. While in aggregate, 80 per cent of the region's CO_2 emissions from the transport sector originate in the road subsector, this percentage varies from country to country, depending upon the importance of each mode of transport in the overall transport task. Figure 5 showed that the road subsector in Thailand and Kazakhstan accounted for more than 90 per cent of the total CO_2 emissions generated from transport activities whereas road transport activities in China and the Russian Federation generated 73 per cent and 54 per cent of total CO_2 emissions of the transport sector respectively in 2008.

[5] International Energy Agency, *IEA Statistics: CO_2 Emissions from Fuel Combustion - Highlights 2009* (Paris: IEA, 2009).

[6] Nicholas Stern, *The Economics of Climate Change: the Stern review* (Cambridge, UK: Cambridge University Press, 2007).

[7] International Energy Agency, *IEA Statistics: CO_2 Emissions from Fuel Combustion Highlights* (2010 Edition) (Paris: IEA, 2010). Available from www.iea.org/co2 highlights/co2highlights.pdf. Countries included in the calculation are the same as indicated in footnote 3.

Figure 5
Transport share of emissions by mode, 2008[8]



13. The measurement of transport emissions is necessary to plan and implement policy measures. In this regard, the secretariat in cooperation with other regional commissions is initiating a United Nations Development Account project on "Development and implementation of a monitoring and assessment tool for CO_2 emissions in inland transport to facilitate climate change mitigation." The project aims at enhancing international cooperation and assisting member States in setting up sustainable transport policies through the development and use of a standard monitoring and assessment tool for CO_2 emissions in inland transport (road, rail and inland navigation), including a transport policy converter that will support implementation of the policy measures.

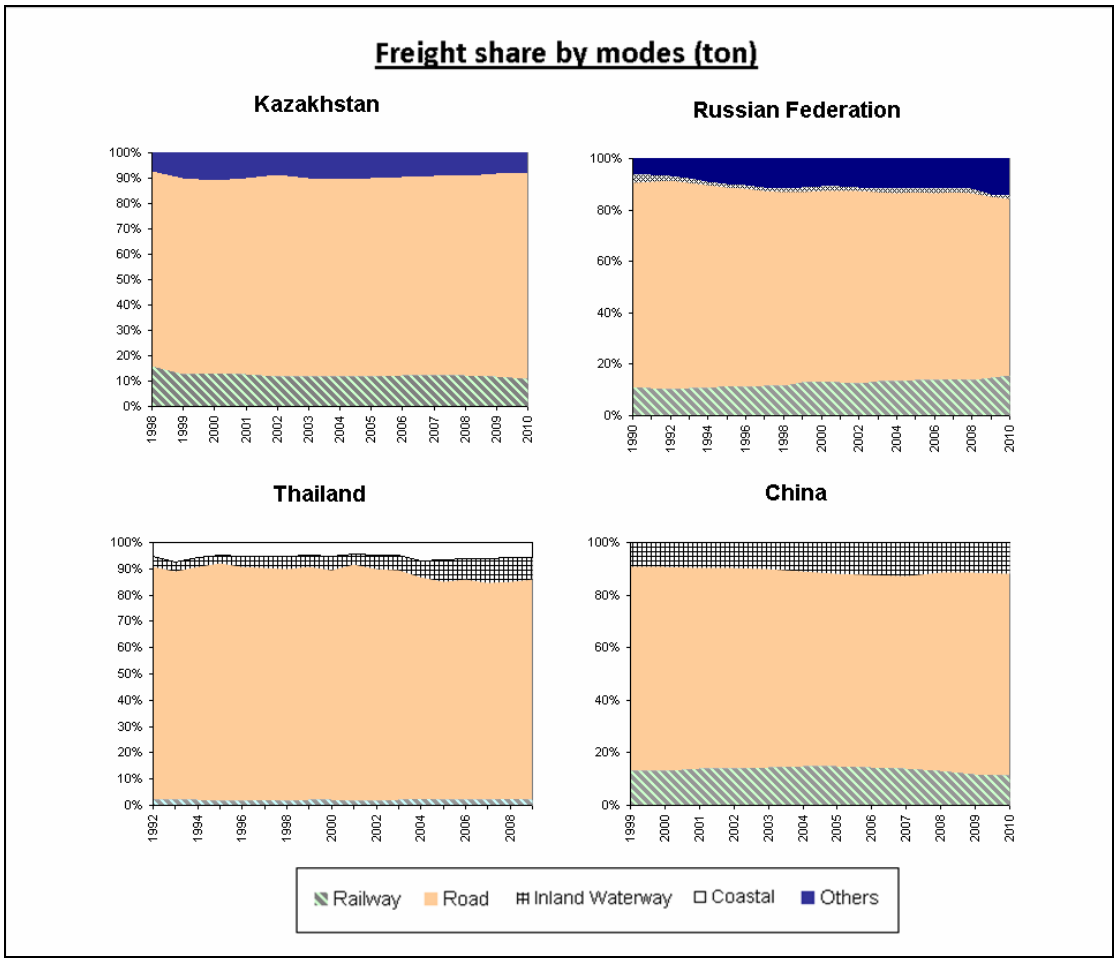
C. Freight modal share

14. The large share of energy consumption by the transport sector, in general, and the road subsector, in particular, clearly shows the need to implement policy measures for reducing energy consumption and emissions from transport, particularly from road transport. One of the key policy challenges for sustainable transport development therefore would be to increase the share of "greener" modes of transport, such as railways and waterways through the increased use of multimodal transport in the context of an integrated transport network.

15. Figure 6 illustrates the freight modal split in selected Asian countries and indicates that road transport is responsible for a major share of freight carried in these countries. The figure also shows a slight growth in the amount of freight carried by railways in the Russian Federation, and by inland waterways in China, the Russian Federation and Thailand.

[8] Ibid.

Figure 6
Freight modal split for selected countries[9]



16. However, when considering freight transportation in tonne-kilometres, total freight in China was 12,213 billion tonne-kilometres in 2009. Of that figure, highways accounted for 30 per cent, railways for 21 per cent and water transport for 47 per cent.[10] In India, total freight was 1,410 billion tonne-kilometres in fiscal year 2007-2008, with road transport accounting for 50 per cent, railway transport for 36 per cent and water transport for 6 per cent.[11]

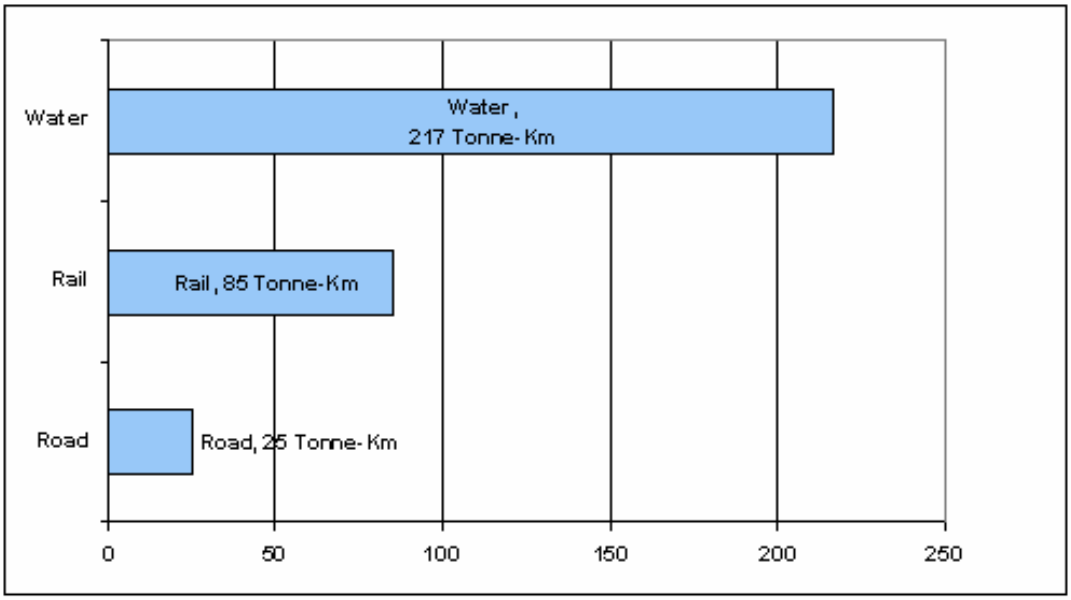
17. Figure 7 shows the number of kilometres various modes of transport need to move one tonne of freight using one litre of gasoline. It clearly demonstrates that water and railway transport are far more energy efficient than road transport. Therefore, in order to have net environmental benefits, countries need to explore ways and means to encourage modal shifts to more environmentally friendly modes.

9 Sources: CEIC data (available from www.ceicdata.com/) and Economic Commission for Europe (ECE) database (available from http://w3.unece.org/pxweb/).

10 *China Statistical Yearbook 2010*, available from www.stats.gov.cn/tjsj/ndsj/2010/indexeh.htm.

11 Raghu Dayal, presentation made at the Seminar on "Promoting the Use of the Trans-Asian Railway Network through Improved Awareness of Commercial Requirements", Busan, Republic of Korea, 14-17 June 2011.

Figure 7
Energy intensity of different transport modes (tonne-kilometre/litre of gasoline)[12]



18. Sustainability of the transport system could be greatly enhanced through innovations in design, construction and technology as well as in funding for development and maintenance. For example, innovations in maintenance and vehicle technology could ensure smooth operation of the transport systems, reduce operating costs and emissions. Innovative approaches to funding could ensure adequate funding for maintenance which, in turn, could reduce maintenance costs and prolong the life of transport infrastructure.

19. Many mitigation initiatives and measures in the transport sector focus on the issues of passenger and urban transport. These should include emission reduction through a modal shift from private to public transport and mass transit systems, establishing a system of congestion charging, improvement of vehicle efficiency, and the use of non-fossil fuels. Further information on passenger, urban and road transport are available from different sources, including the GTZ Modules[13] and Asian Development Bank (ADB)[14] as well as Asian Institute of Transport Development (AITD)[15] publications. The following section outlines policies and measures relating to modal shifts in the freight transport sector.

[12] Chamroon Tangpaisalkit, "Low Carbon Development in Thailand – Opportunities and Challenges for the Transport Sector", First National Seminar on Green Growth Policy Tools for Low Carbon Development in Thailand, Bangkok, 23-24 February 2011.

[13] GTZ, *Sustainable Transport: A Sourcebook for Policy Makers in Developing Cities* (2007).

[14] Asian Development Bank, *Energy Efficiency and Climate Change Considerations for On-road Transport in Asia* (Manila: ADB, 2006).

[15] AITD, "Environmental and Social Sustainability of Transport: Comparative Study of Rail and Road" (New Delhi, 2002).

III. Policy options and initiatives to promote modal shift in freight transport

20. The challenges facing policymakers in attempting to reduce energy consumption and vehicle emissions include: a large existing fleet of vehicles with relatively high fuel consumption and emissions; the time involved in introducing new technologies into mass production lines; the existing transport infrastructure that locks countries on energy-intensive development paths; the impact of increased transport costs on landlocked and island developing countries; and the recognition that the increased volume of emissions from growing vehicle numbers offsets improvements in fuel efficiency use. Most of these challenges require long-term commitment to substantial changes in transport policy.

21. Transport requires management decisions regarding optimization of factory locations and markets and rationalization of freight trips through consolidation and distribution centres that could be effective in reducing freight transport fuel consumption and emissions.

22. Policies aimed at influencing modal split could, inter alia, be directed towards integrated transport planning, improving connectivity of intermodal transport networks through dry ports or other transfer facilities, investment in railway infrastructure, improvements of operational efficiency, revival of inland waterways and coastal shipping, fiscal and regulatory measures including modal regulation, transport pricing and incentives. These policy elements should be employed in a manner that increases the attractiveness and, consequently, the competitiveness of the desired modes, in particular rail as well as inland waterways and coastal shipping. Modal shifts could happen only if they fulfill shipper's logistics requirements, and fit into their logistics chain.[16] Some of the policies and initiatives that could be beneficial to inducing freight modal shifts in Asia and the Pacific region are outlined in the following paragraphs.

A. Development of dry ports and logistics centres

23. Railways alone cannot provide door-to-door freight services. In order to provide this service, railways need to be integrated with intermodal transport and logistics networks. Therefore, integrated planning and development of dry ports, inland container depots (ICDs) and freight terminals could extend the reach of the rail mode through intermodal services. In this context, dry ports are not only seen as facilities providing physical transfer installations, but also as logistics service centres that render administrative and commercial services necessary for the optimization of supply chains. Furthermore, railways and, where available, inland waterways are considered to be an ideal means of transport for connecting seaports and dry ports. Intermodal transport and interfaces between railways and other transport modes offer opportunities to encourage a modal shift from one mode to another.

24. Improvement of urban logistics through the construction of freight consolidation and distribution centres near urban and other strategic locations

[16] Modal choice of individual shippers is largely determined by three factors, i.e. transport cost, transport quality (including frequency, reliability, speed and accessibility) and habits. Modal shift policies should aim at systematically exploiting the strong points of rail and water modes, facilitated by the widespread introduction of containers not only in the maritime sector but also in inland transport.

have potential to reduce the number of partial truck loads as well as empty truck trips, which currently account for around one-third of total freight truck trips. For example, the percentage of trucks running empty is around 12-30 per cent in Pakistan and 43 per cent in China.[17] Establishment of freight consolidation centres in London for construction materials was able to minimize construction traffic for building and development, and resulted in a smaller number of freight trucks as well a 75 per cent reduction of CO_2 emissions.[18] Another study on freight emissions in London revealed that use of consolidation and distribution centres has resulted in a combined reduction of emissions by 25.7 per cent.[19]

25. The share of rail transport in the throughput handled at the Uiwang, Republic of Korea, and Latkrabang ICD, Thailand, was about 25 per cent in 2009, even though both ICDs were handling cargoes that were above their design capacity. These examples illustrate that the development of dry ports and ICDs could encourage modal shift to railway.

26. Birgunj ICD developed in 2001 in Nepal is connected to Kolkata port by a railway. The freight handled at Birgunj ICD in 2008-2009 was 16,928 TEU (equivalent to 406,272 MT[20]) and 237,104 MT of break bulk cargo. As the freight to the ICD was transported by railway, the total CO_2 emissions were estimated to be 12,818 tonnes. Had there been no dry port and rail connection, all freight from Kolkata[21] would have been transported to the dry port by road, thereby releasing 70,505 tonnes of CO_2. The resulting reduction in emissions through use of railways and dry ports is about 82 per cent.

B. Modal shift to railways

27. Asia has a number of countries with extensive railway networks, such as China, India and the Russian Federation. Consequently, there is a huge potential for considering a modal shift in the region. Improving physical rail infrastructure and operational efficiency of rail services and introducing competitive pricing are major policy measures that could influence a modal shift to the increased use of rail.

28. Recent investment trends, favoured by Governments as well as development banks, preferred the road sector to any other despite proclaiming investment in sustainable transport initiatives as their priority. The road sector accounted for 74 per cent, railways for 15 per cent and water transport for seven per cent of the total transport lending by ADB during 1970-2009.[22] Similarly, roads and highways accounted for 75 per cent, railway for seven per cent and ports, waterway and coastal shipping for three per cent of the total transport funding of the World Bank.[23]

---

[17] P. Londono-Kent, *Freight Transport for Development Toolkit: Road Freight* (Washington, D.C.: World Bank, 2009).

[18] Transport for London, London Construction Consolidation Centre, *Interim report, 2007*.

[19] Alberto M. Zanni and Abigail L. Bristow, "Emissions of CO_2 from road freight transport in London: Trends and policies for long run reductions", *Energy Policy*, vol. 38, No. 4 (2010), pp. 1774-1786.

[20] Using maximum allowed weight, 1TEU=24 MT.

[21] Kolkata–Birgunj: road distance, 924 km; railway distance, 704 km.

[22] Asian Development Bank, *Sustainable Transport Initiative Operational Plan* (Manila: ADB, 2010).

[23] Cornie Huizenga, presentation made at ADB Transport Forum, Manila, 25-27 May 2010.

29. Railways were first developed to carry freight. The energy intensity and long life cycle of rail cars as well as recent speed innovations create a potential for the railways taking up a major share of the growing demand for both freight and passenger transport. Efforts and policy shifts between governments, development partners, and the private sector are necessary to mobilize further investment in railways and maintain their environmental superiority among other modes of transport.

30. Quality of service is the single most significant challenge in railways freight operation. Therefore, in order to attract more freight, the quality of service and reliability of railways have to improve. This may require a reform of existing railway operation systems and new approaches to railway operation and marketing.

31. The turnaround of Indian Railway, for example, is often cited as an example of railway reform and of a case where top-down policy direction has worked. The financially struggling Indian Railways has turned around and is now considered the second best public company in India.[24] The Indian Railways' 11th five-year plan includes priorities related to freight, such as the development of dedicated freight corridors and freight villages.

32. Use of different railway gauges requiring transhipment, existence of only a single track, old wagons and locomotives as well as diesel traction hamper the operational efficiency of railway systems in Asia. Investment would be necessary for the construction of double tracks, the electrification of railway lines, and the replacement of old locomotives and wagons.

33. In order to improve the efficiency of rail freight, China has been running double-stack container train services to and from main coastal ports on some chosen routes using new specialized wagons and powerful locomotives. In 2007, Chinese Railways operated 680 double-stack trains and carried 53,161 TEU in 2007 compared to 454 trains carrying 39,437 TEU in 2006.[25] India has also introduced the double-stack concept.

34. There are new concepts emerging in freight transport such as development of dedicated freight corridors in India and an underground freight corridor in the Netherlands. These initiatives could take a share of freight transport and contribute to a reduction in emissions.

35. One of the classic debates between road and rail relates to the cost of capital. With the exception of some toll roads, road users do not generally pay directly for the cost of capital or, as in many cases, for the maintenance costs of road infrastructure; whereas railways generally incur these costs. There are, however, examples of government support in the form of fiscal and regulatory incentives to increase the competitiveness of rail compared with other modes. In the United Kingdom of Great Britain and Northern Ireland, for example, freight facility grants, track access grants, and company neutral revenue support grants have been introduced. These grants target intermodal flows and railway improvement. There are also examples of

[24] G. Raghuram, "'Turnaround' of Indian railways: a critical appraisals of strategies and processes", W.P. No.2007-02-03 (Ahmedabad: Indian Institute of Management, 2007).

[25] Economic and Social Commission for Asia and the Pacific, *Policy Framework for the Development of Intermodal Interfaces as Part of an Integrated Transport Network in Asia*, ST/ESCAP/2556 (ESCAP, 2010). Available from www.unescap.org/ttdw/common/TIS/TAR/text/study_report_final.pdf.

subsidies being provided to the rail freight in Europe as well as the introduction of tolls on highways to induce a modal shift towards railways.

36. European polices related to liberalization, development, and access to the trans-European rail freight corridor as well as facilitation at international borders are examples of some policy measures to promote the use of rail in freight transport. Giving priority to the development and operationalization of the Trans-Asian Railway is also an important regional policy measure.

C. Use of inland waterways and coastal shipping

37. Even though water transport is more energy efficient than railways and roads, there are a limited number of inland water transport (IWT) routes in operation in Asia. Some of the navigable rivers such as the Mekong in Southeast Asia, the Padma in Bangladesh, the Ganges in India and the Yangtze in China[26] are being used for passenger and freight transport. About 1.5 billion tonnes of cargo passed through the Yangtze River in 2010, ranking it first in terms of cargo throughput handled.[27] Revival and improvements of canals and river routes through dredging and widening to increase capacity and the addition of river ports would help to improve services and increase capacities.

38. Maritime transport has already taken a major share of international transport. Coastal shipping in China and the Republic of Korea is also significant and is taking some share of domestic freight. Further enhancement of short-sea and coastal shipping in the region could increase its share of domestic trade. In the north of Taiwan Province of China, the use of coastal shipping and trucks rather than distributing cargoes by trucks only showed a 60 per cent reduction in emissions due to the fuel efficiency of coastal shipping.[28]

IV. Issues for consideration

39. The transport sector is the third largest energy user in the region. Transport is also one of the fastest growing sectors in the region. Expectations are that energy costs will continue to rise, thus increasing pressure on all sectors to seek greater efficiency, and that the levels of harmful emissions will continue to increase unless appropriate measures are taken. In the transport sector, substantial gains can be made through modal shifts and improved organizational efficiency.[29]

40. At the national level, Governments may wish to consider:

(a) Developing policies and/or strategic plans for environmentally sustainable transport development;

(b) Creating favourable conditions for modal shifts to greater use of rail and water transport, as appropriate;

[26] Other Chinese waterway system includes Pearl-Xijiang, Grand Canal, and Heilongjiang.

[27] Available from www.chinadaily.com.cn/business/2011-05/25/content_12578521.htm.

[28] Chun-Hsiung Liao, Po-Hsing Tseng, and Chin-Shan Lu, "Comparing carbon dioxide emissions of trucking and intermodal container transport in Taiwan", *Transportation Research Part D: Transport and Environment*, vol. 14, No. 7 (October 2009), pp. 493-496.

[29] Technology improvements related to motive power and energy sources will be dealt with under parallel programmes implemented by the Environment and Sustainable Development Division of ESCAP and other partners.

(c) Investigating and implementing measures to increase the operational efficiency of railways and integrated logistics;

(d) Promoting short-sea and coastal shipping and revitalizing IWT.

41. At the regional level, Governments are invited to provide further guidance on the following elements suggested for inclusion in the Regional Action Programme for Transport Development in Asia and the Pacific, phase II (2012-2016).

Immediate objective:

To increase awareness and understanding of alternative freight transport policy options that can reduce energy consumption and emissions.

Outputs:

1. Proposals to encourage, through appropriate mechanisms, a modal shift from road to rail and water transport, and the use of the Asian Highway, Trans-Asian Railway and dry ports for the intermodal distribution of goods and carriage of people;

2. Regional meetings to share experiences in the adoption of energy-efficient and more environmentally friendly freight transport logistics systems;

3. Inclusion of sustainable transport-related issues in the *Review of Developments in Transport in Asia and the Pacific*, the *Transport and Communications Bulletin for Asia and the Pacific* and ad hoc regional transport policy studies;

4. Capacity-building to increase awareness and promote environmentally sustainable transport development.

Indicators of achievement:

1. Measures taken by member States to promote modal shift policies in line with the secretariat's proposals and policy advice.

2. Measures taken by member States to consider sustainable transport issues when designing transport policies and projects.