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Joint United Nations Economic Commission for Europe/ United Nations Conference on Trade and Development Workshop "Climate Change Impacts on International Transport Networks"

Joint Workshop "Climate Change Impacts on International Transport Networks"

Note by the United Nations Economic Commission for Europe and United Nations Conference on Trade and Development secretariats

I. The Mandate

1. The United Nations Economic Commission for Europe (UNECE) Inland Transport Committee decided during its seventy-second session in February 2010 to invite its subsidiary bodies to incorporate global warming and transport in their agendas (ECE/TRANS/208, para. 94). This note provides annotations to the agenda item pertaining to global warming and transport.

II. Introduction and background

2. Compelling scientific evidence[1] and a better understanding of the potential economic impacts of climate change,[2] have moved the issue to the forefront of the international agenda as one of the "greatest challenges of our time".[3] Climate change poses a serious

[1] See the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), 2007

[2] See Stern N., Stern Review: The Economics of Climate Change. 2006; Lenton T., A. Footitt and A. Dlugolecki. 2009. Major Tipping Points in the Earth's Climate System and Consequences for the Insurance Sector. 89 pp., http://knowledge.allianz.com.

[3] See Copenhagen Accord, (Decision 2/CP.15, FCCC/CP/2009/11/Add.1, 30 March 2010), para.1.

threat to human development and prosperity,[4] with implications for water and food security, human health, biodiversity, coastal infrastructure and economic development, migration, global trade and security. The latest scientific findings indicate that matters may be worse than previously thought, with forecasts about global warming, sea-level rise and the intensity and frequency of extreme climatic events exceeding earlier predictions[5] and adding weight to the worst-case scenarios outlined in 2007 by the Intergovernmental Panel on Climate Change (IPCC) in its Fourth Assessment Report.[6] Given the magnitude of the challenge, it is imperative that climate change impacts and related adaptation requirements be considered as a matter of priority, along with initiatives aimed at mitigating greenhouse gas emissions (GHG) and climate change. A better understanding of climate change impacts, risks and vulnerabilities[7] is a precondition for well-designed and effective adaptation response measures[8] that enhance the resilience of systems, structures and processes and minimize the adverse effects of climatic changes.

3. Climate change presents a significant challenge for both freight and passenger transport. Demand for transport services grows in tandem with the global economy, trade and world population and transport relies heavily on oil for propulsion. With projected growth in all these areas and the high carbon intensity of fossil fuels, transport is one sector at the centre of the climate change debate. While the contribution of the transport sector to global GHG emissions is well understood, less is known about the potential impacts of climatic changes on transport infrastructure, including ports, the key nodes of the global supply chains and major drivers of economic growth, as well as on transport services and networks across the broader supply-chain[9]. Developing an effective strategy for adequate adaptation measures in transport requires information on likely vulnerabilities and a good

[4] Given their high vulnerability and low adaptive capacity, developing countries, particularly Least Developed Countries (LDCs) are likely to be hardest hit. See, for instance Dasgupta, S., B. Laplante, S. Murray and D. Wheeler, 2009. *Sea-Level Rise and Storm Surges: A Comparative Analysis of Impacts in Developing Countries*. Policy Research Working Paper 4901, the World Bank Development Research Group, Environment and Energy Team. 41 pp. A key-finding of the study is that very heavy potential losses are much more concentrated in highly vulnerable large cities at the low end of the international income distribution.

[5] See e.g. Richardson, K., W. Steffen, H.J. Schellnhuber, J. Alcamo, T. Barker, D. M. Kammen, R. Leemans, D. Liverman, M. Munasinghe, B. Osman-Elasha, N. Stern and O. Wæver, 2009. *Synthesis Report. Climate Change: Global Risks, Challenges and Decisions*. University of Copenhagen, 39 pp. www.climatecongress.ku.dk

[6] See for instance I. Allison, N. L. Bindoff, R.A. Bindschadler, P.M. Cox, N. de Noblet, M.H. England, J.E. Francis, N. Gruber, A.M. Haywood, D.J. Karoly, G. Kaser, C. Le Quéré, T.M. Lenton, M.E. Mann, B.I. McNeil, A.J. Pitman, S. Rahmstorf, E. Rignot, H.J. Schellnhuber, S.H. Schneider, S.C. Sherwood, R.C.J. Somerville, K.Steffen, E.J. Steig, M. Visbeck, A.J. Weaver, 2009. *The Copenhagen Diagnosis: Updating the world on the latest climate science*. University of New South Wales Climate Change Research Centre (CCRC), Sydney, Australia, 60 pp.

[7] See e.g. Niang, I., M. Dansokho, S. Faye, K. Gueye and P. Ndiayeet, 2010. Impacts of climate change on the *Senegalese coastal zones: Examples of the Cap Vert peninsula and Saloum estuary*. Global and Planetary Change, doi:10.1016/j.gloplacha.2010.01.005

[8] See e.g. Von Storch, H., G. Gonnert and M. Meine, 2008. *Storm surges—An option for Hamburg, Germany, to mitigate expected future aggravation of risk*. Environmental Science and Policy, 11, 735-742.

[9] One of the best available relevant studies is that by The US Department of Transportation, *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Savonis, M. J., V.R. Burkett, and J.R. Potter (eds.)]. 2008. Department of Transportation, Washington, DC, USA, 445 pp, http://www.climatescience.gov/Library/sap/sap4-7/final-report/.

understanding of relevant climatic impacts, including their type, range and distribution across different regions and industries.

4. Against this background, the United Nations Conference on Trade and Development (UNCTAD) and UNECE, drawing on their respective mandates[10] areas of expertise and previous work in the field of climate change, are jointly convening a one day workshop with a focus on "*Climate change impacts on international transport networks*". An important objective of the workshop is to help raise awareness of this important issue, with a view to assisting policy makers and industry stakeholders, including transport planners, operators, managers and investors, in making informed adaptation decisions. It is hoped that the workshop will provide a useful platform for considered discussions and set the pace for future work on how best to bridge the knowledge gaps relating to climate change impacts on transport networks and effective adaptation responses for both developed and developing countries.

5. Earlier related work by the UNCTAD secretariat[11] includes an intergovernmental expert meeting on "*Maritime Transport and the Climate Change Challenge*", that was held on 16–18 February 2009 in Geneva and brought together around 180 delegates from 60 countries, including representatives from 20 international organizations, as well as the international shipping and port industries. The three-day meeting was the first of its kind to deal with the multiple challenges of climate change for the maritime transport sector in an integrated manner, focusing both on mitigation and adaptation, as well as on related issues, such as energy, technology and finance. Experts highlighted the urgent need to reach agreement in the ongoing negotiations on a regulatory regime for GHG emissions from international shipping. At the same time, they noted with great concern that so far, insufficient attention had been paid to the potential impacts and implications of climate change for transportation systems, and in particular for ports, which are key nodes in the supply chain and vital for global trade. The central role of technology and finance was highlighted, as was the need for international cooperation among scientists and engineers, industry, international organizations and policymakers in relation to the preparation and design of adequate adaptation measures. Key points that emerged from discussions at the meeting are set out in Annex I, whereas a summary of the proceedings, published in December 2009 (Document UNCTAD/DTL/TLB/2009/1[12]) and submitted to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat ahead of the Copenhagen Conference may provide useful reference material, including a substantive background note prepared by the UNCTAD secretariat.

6. The work of the UNECE secretariat on climate change has focused on the mitigation of environmentally harmful effects of inland transport. In particular, activities of the UNECE have targeted the reduction of emissions of gaseous pollutants and greenhouse gases in the road transport sector through more stringent emission requirements for new vehicles elaborated by the World Forum for Harmonization of Vehicle Regulations (WP.29).[13] The World Forum's Round Table on Climate Change and Transport in June 2010 identified potential scenarios from which WP.29 would develop its future work

[10] See UNCTAD, Accra Accord, paras. 100 and 168 and the UNECE Report of the Inland Transport Committee on its seventy-second session, ECE/TRANS/208, para. 94.

[11] See more generally the UNCTAD climate change website at http://www.unctad.org/Templates/StartPage.asp?intItemID=4342&lang=1

[12] The document is available at www.unctad.org/ttl/legal, where a link to the expert meeting website can also be found, providing access to all documentation, as well as audio-files and speakers presentations.

[13] For details, see http://unece.org/trans/main/welcwp29.htm?expandable=99

programme on climate change mitigation and adaptation.[14] These scenarios will be adopted by the World Forum at its November 2010 session.

7. In addition, the joint programme "Transport, Health and Environment" of the UNECE and World Health Organization (WHO) (Regional Office for Europe), established in 2002, brings together key players from these sectors with a view to making policy integration for sustainable transport a reality. The programme pools capacities and skills from Europe, Caucasus, Central Asia and North America, linking regional and grassroots players. The Third High-level Meeting on Transport, Health and Environment, prepared by the joint UNECE-WHO Europe programme, adopted in January 2009 the Amsterdam declaration that addresses the challenges posed by transport, health and environment and specifies priority goals, including the reduction of transport-related GHG emissions. [15]

8. A number of key issues, relevant to the debate on climate change impacts on transport networks, are set out in this note, for consideration at the workshop. For a more detailed coverage of issues related to maritime transport, see UNCTAD's background note on "Maritime Transport and the Climate Change Challenge" (UNCTAD/DTL/TLB/2009/1, Part Two);[16] for a more comprehensive overview of the climate change/inland transport interactions, see UNECE documents ECE/TRANS/WP.29/2010/85 and ECE/TRANS/WP.29/2010/86, which provide reviews of the recent relevant scientific literature and identify who does what in the field of inland transport and climate change.

III. Vulnerability of transport networks to climate change impacts

9. Climate change is expected to have various environmental, social and economic effects, the severity of which varies by geographical location, country and region.[17] Rising mean sea levels,[18] increased frequency and intensity of extreme storm surges and waves,[19] droughts and/or river floods and increased mean temperatures as well as extreme

[14] Detailed information about the WP.29 Round Table is available at: http://www.unece.org/trans/events/ClimateChange_Transport.html

[15] The text of the Amsterdam declaration is available at http://www.unece.org/thepep/en/hlm/documents/2009/Amsterdam_Declaration_ENG.pdf

[16] This document also addresses mitigation in shipping and some key cross-cutting issues of relevance to climate policy action, namely climate finance, energy and technology.

[17] Note for instance that low elevation coastal zones, while covering only 2 per cent of the world's land area, contain 10 per cent of the world's population and 13 per cent of the world's urban population (e.g. small island countries and countries with heavily populated deltas). See McGranaham G., Balk D., Anderson, B., 2007. *The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones*. International Institute for Environment and Development (IIED).

[18] See Rahmstorf, S., 2007. *A semi-empirical approach to projecting future sea-level rise*. Science, 315, 368–370.

[19] For an update of the recent findings on the increase in the frequency and intensity of coastal extreme phenomena, see Ruggiero, P., P.D. Komar and J.C. Allan, 2010. *Increasing wave heights and extreme value* projections*: The wave climate of the U.S. Pacific Northwest*. Coastal Engineering, 57, 539–552, Fiore, M.M.E., E.E. D'Onofrio, J.L. Pousa, E.J. Schnack and G.R. Bertola, 2009. *Storm surges and coastal impacts at Mar del Plata, Argentina*. Continental Shelf Research, 29, 1643–1649. Brominski , P.D. and Kossin, J.P., 2008. *Increasing hurricane wave power along the US Atlantic and Gulf coast*. Journal of Geophysical Research, 113, CO7012 doi: 10.1029/2007/JC004706. See also references in fn. 2, 4, 5, 7 and 8, above.

temperature variability[20] constitute some of the climatic changes that pose serious threats to both coastal (e.g. ports) and inland transport infrastructure and services (see table below). Direct threats include accelerated coastal erosion, port and coastal road inundation/submersion, water supply problems, access restrictions to docks and marinas, deterioration of the condition and problems with the structural integrity of road pavements, bridges and railway tracks; in addition, transport operations (e.g. shipping volumes and costs, cargo loading/capacity, sailing and/or inland transport schedules storage and warehousing) may also be severely impacted. Indirect impacts on international transport networks, which are even harder to assess, arise through changes in the population concentration/distribution, as well as through changes in production, trade and consumption patterns, which are likely to lead to considerable changes in demand for transportation.

10. The special case of ports is worth noting. With over 80 per cent of international merchandise trade carried by sea, seaports are crucial links in international supply-chains, providing vital access to globalized markets for all countries, including landlocked countries. Seaports as well as their hinterland connections are vulnerable to various climatic events; in particular ports located in low-lying island settings, estuaries and deltas in developing regions, which are characterized by high-exposure potential and low adaptation capability.

11. A study by the Organization for Economic Cooperation and Development (OECD),[21] assessing the exposure of 136 of the world's largest port cities to coastal flooding found that in 2005 the top 10 cities in terms of exposed population were Mumbai (India), Guangzhou and Shanghai (China), Miami (United States of America), Ho Chi Minh City (Viet Nam), Kolkata (India), New York (United States of America), Osaka-Kobe (Japan), Alexandria (Egypt) and New Orleans (United States of America). In terms of asset exposure, the most vulnerable cities were Miami, New Orleans (United States of America), Osaka-Kobe, Tokyo (Japan), Amsterdam, Rotterdam (Netherlands), Nagoya (Japan), Tampa–St. Petersburg and Virginia Beach (United States of America). Another recent study commissioned by Allianz and World Wide Fund for Nature has estimated that assuming a sea level rise of 0.5 m by 2050, the value of exposed assets in the 136 port megacities will be as high as US$ 28 trillion.[22] This potentially significant risk exposure and the related adaptation costs - which for developing economies would be devastating – are matched by important knowledge gaps about vulnerabilities, impacts and adaptation strategies as well as insufficient levels of preparedness. This is illustrated by a recent survey carried out by the International Association of Ports and Harbours (IAPH), American Association of Port Authorities (AAPA) and Stanford University,[23] which revealed that while 81 per cent of respondent ports consider that climatic changes may have serious implications for the port community, only 31 per cent feel that they are sufficiently informed on the potential risks and costs concerning port operations.[24]

[20] See also fn. 5 and 6, above.

[21] See Nicholls, R.J., S. Hanson, C. Herweijer, N. Patmore, S. Hallegatte, J. Corfee-Morlot, J. Château, R. Muir-Wood, 2007. *Ranking Port Cities With High Exposure And Vulnerability to Climate Extremes: Exposure Estimates*. OECD ENV/WKP 2007-1. 62 pp.

[22] Lenton T, A. Footitt and A. Dlugolecki. 2009. *Major Tipping Points in the Earth's Climate System and Consequences for the Insurance Sector*. 89 pp. ,(http://knowledge.allianz.com).

[23] Becker, A. and Inoue, S. 2009. IAPH/AAPA Survey Results: Impacts of Climate Change on Seaports. Unpublished report.

[24] See also Becker, A., *Climate Change Impacts on Ports: A Global Survey, Preliminary Results*, International Conference on Sea Level Rise in the Gulf of Mexico, March 2010.

12. Effective climatic adaptation measures require an improved understanding of the type, range and distribution of climatic impacts across different regions and transport segments. Therefore, as a first step, it is important to identify vulnerable segments/aspects of transportation networks, assess the related potential climate impacts, set priorities and devise relevant strategies. Adaptation measures will likely involve interventions to enhance the resilience of transportation networks, through changes in infrastructure design and operation planning and management. They will also involve integrating climate change considerations into a broader development agenda and long term planning including into resource management and infrastructure development.

13. While the cost of inaction has been estimated to be much higher than the cost of action, [25] existing studies on adaptation costs provide only a wide range of estimates[26] with limited information of relevance to the transport sector.[27] However, adequate funding is key for a proactive and effective climate policy in transport, especially for developing countries. In this context, the commitment by developed countries in the Copenhagen Accord to provide new financing for mitigation and adaptation in the form of short term (2010–2012) funding of US$10 billion per year and long term funding (by 2020) of up to $100 billion a year, is crucial, as is its effective implementation.[28] Together with financing and capacity building, other key considerations for effective adaptation in the transport sector include access to energy at reasonable costs, access to the relevant technology as well as the sharing of best practices and information.

IV. Some considerations for a way forward on climate change impacts on transport

14. The contribution of the transport sector to GHG emissions is well documented, and the important role it plays in relation to an effective and efficient global GHG emission reduction strategy is increasingly well understood. In contrast, the potential impacts of climatic changes on transport networks have so far received little attention. Thus, the understanding of risks and vulnerability associated with climatic changes and of corresponding adaptation requirements remains, as yet, rather vague. Given the strategic role of transport for trade and development, responding to the climate challenge by planning for the already known and predicted impacts should be pursued without delay. New initiatives, which can provide a significant contribution to improving the

[25] Stern, N., 2006 estimates the cost of inaction as 5–20 per cent of global Gross Domestic Product (GDP) annually, with the cost of action equivalent to 1 per cent of global GDP (by 2050).

[26] A very recent World Bank study estimates the cost for developing countries of adapting to an approximately 2^0 C warmer world over 2010–2050 as being in the range US$75 – US$100 billion a year. This is much higher than previously estimated and of the same order of magnitude as the total aid given to developing counties each year. World Bank. *The cost to developing countries of adapting to climate change, new methods and estimates. The Global Report of the Economics of Adaptation to Climate Change Study (EACC)*, Consultation Draft, 2009.

[27] The World Bank study (previous note) contains some adaptation cost estimates for infrastructure, including some transport infrastructure, by climate scenario, region and infrastructure category. Total adaptation costs for all infrastructure (health and education, power and wires, urban infrastructure, water and sewers, roads, other transport) are estimated at US$ 29.5 billion (2005 prices, no discounting), with road infrastructure adaptation costs accounting for US$ 6.3 billion of the total (2010–2050).

[28] United Nations Framework Convention on Climate Change (UNFCCC), Decision 2/CP.15, Copenhagen Accord, FCCC/CP/2009/11/Add.1, 30 March 2010.

understanding and propose effective response measures are required; these may include the following areas of priority:

(a) Conduct appropriately-funded and well-targeted vulnerability studies based on adequate data to improve the understanding of impacts and assist in the planning of effective adaptation responses. Such studies would benefit from greater availability of information on climate variability and should adopt a supply chain perspective so that loopholes are avoided.

(b) Undertake empirical studies to determine the costs of climatic impacts for transport, including the broader implications for trade and development of impacted countries as well as identify the requirements for corresponding adaptation responses.

(c) Ensure that adequate funding and access to technology are forthcoming and explore ways in which funding levels and sources may be upgraded and diversified and technology solutions for adaptation be further developed and made more accessible for the global transport industry, including in developing regions.

(d) Reflect on the more efficient integration of climate change impact considerations into transportation design and management, as well as into broader economic and development policies. Relevant work should benefit from cooperation among scientists and engineers, the transport industry, policy makers and international organizations.

(e) Consider how the role of the insurance industry in terms of incentivizing adaptation may be further explored and its contribution mobilized.

15. Policy action and collaborative research in relation to the above priority areas would help bridge the significant knowledge gaps that have been identified so far. Accordingly, there would be considerable merit in establishing a new Expert Group (government, transport and climate experts) to further study the impacts of climate change on international transport networks and the corresponding adaptation requirements. The draft terms of reference of the Expert Group, prepared by the UNECE and UNCTAD secretariats, are attached (Annex II). Delegates may wish to decide whether the Expert Group would operate under the auspices of the Working Party on Transport Trends and Economics. If so, the Inland Transport Committee would be invited to approve the formation of the new Expert Group at its seventy-third session in March 2011.

Table

Select potential climate change impacts and adaptation requirements in transport

Climate change factor	*Potential implications*	*Adaptation measures*
Rising temperatures		
• High temperatures • Melting ice • Large variations (spatial and temporal) • Frequent freeze and thaw cycles	• Longer shipping season (NSR), new sea route (NWP) • Shorter distance for Asia–Europe trade and less fuel consumption • Additional support services and navigation aids such as ice-breaking search and rescue	• Heat-resistant construction and materials • Continuous inspection, repair and maintenance • Monitoring of infrastructure temperatures • Reduced cargo loads, speed and frequency of

Climate change factor	*Potential implications*	*Adaptation measures*
	• Competition, lower passage tolls and reduced transport costs • New trade, diversion of existing trade, structure and direction of trade (indirectly through impact on agriculture, fishing and energy) • Damage to infrastructure, equipment and cargo • Increased construction and maintenance costs; new ship design and strengthened hulls; environmental, social, ecosystem related and political considerations • Higher energy consumption in ports • Variation in demand for and supply of shipping and port services • Challenge to service reliability	service • Refrigeration, cooling and ventilation systems • Insulation and refrigeration • Modal shift • Transit management scheme and regulation of navigation in northern regions • Ship design, skilled labour and training requirements • Upgrading of infrastructure parameters in UNECE agreements on pan-European rail, road, inland waterway and combined transport networks
Rising sea levels		
• Flooding and inundation • Erosion of coastal areas	• Damage to infrastructure, equipment and cargo (coastal infrastructure, port-related structures, hinterland connections) • Increased construction and maintenance costs, erosion and sedimentation • Relocation and migration of people and business, labour shortage and shipyard closure	• Relocation, redesign and construction of coastal protection schemes (e.g. levees, seawalls, dikes, infrastructure elevation) • Migration • Insurance • Upgrading and/or relocation of transport infrastructure on hinterland connections of seaports

Climate change factor	*Potential implications*	*Adaptation measures*
	• Variation in demand for and supply of shipping and port services (e.g. relocating), modal shift • Structure and direction of trade (indirectly through impact on agriculture, fishing, energy) • Challenge to service reliability and reduced dredging, reduced safety and sailing condition	
Extreme weather conditions		
• Hurricanes • Storms • Floods • Increased precipitation • Wind	• Damage to infrastructure, equipment and cargo (coastal infrastructure, port-related structures, hinterland connections) • Erosion and sedimentation, subsidence and landslide • Damage to infrastructure, equipment, cargo • Relocation and migration of people and business • Labour shortage and shipyard closure • Reduced safety and sailing conditions, challenge to service reliability • Modal shift, variation in demand for and supply of shipping and port services • Change in trade	• Integrate emergency evacuation procedures into operations • Set up barriers and protection structures • Relocate infrastructure, ensure the functioning of alternatives routes • Increase monitoring of infrastructure conditions • Restrict development and settlement in low-lying areas • Construct slope-retention structures • Prepare for service delays or cancellations • Strengthen foundations, raising dock and wharf levels • Smart technologies for abnormal events detection • New design for sturdier ship • Upgrading and/or

Climate change factor	*Potential implications*	*Adaptation measures*
	structure and direction	relocation of transport infrastructure on hinterland connections of seaports

Source: based on UNCTAD/DTL/TLB/2009/1, Part Two (Background Note) and UNECE inputs.

Annex I

UNCTAD Multi-year Expert Meeting on Transport and Trade Facilitation: Maritime Transport and the Climate Change Challenge, 16–18 February 2009

Summary of key points that emerged from the discussions

(a) The available scientific evidence suggested that growing concentrations of GHG in the atmosphere had already resulted in significant climatic changes, which were predicted to increase in the future. The scale of the global challenge was enormous and, as climate change accelerated, there was an increasingly urgent need for action;

(b) Although predictions based on current trends already suggested an enormous challenge, it must be stressed that there was an inherent degree of uncertainty associated with those predictions. Natural systems were complex and non-linear, and there was a very real risk that growing GHG concentrations could trigger various feedback mechanisms that would drive climatic changes and their consequences to levels that were extremely difficult to manage. From a risk-management perspective, it would be unwise to wait for perfect scientific predictions concerning the response of the non-linear natural system before taking action. In view of the potential very substantial monetary and non-monetary costs of climatic change, particularly the very worrisome consequences of "tipping points"/abrupt climatic changes, inaction and business-as-usual approaches were not viable options. Dealing with the climate change challenge was a priority, which should not be undermined by other concerns, including the current global economic and financial constraints;

(c) Time-frame was a real concern. Current trends in terms of energy consumption and carbon path suggested that if no action were taken within the following two years, including relevant investment decisions which would determine the type of technologies that would be locked in, the world would forever miss the opportunity to stabilize emissions at "manageable" levels along either the 450 ppm or the 550 ppm CO_2 equivalent scenarios. It was crucial that the world be informed very soon of which scenario would be realistically achievable. This information was of the essence for adaptation planning;

(d) Despite the current unfavourable economic conditions, projected growth in international trade suggested that GHG emissions from shipping would continue to increase, unless effective regulatory, technical and operational measures were agreed and implemented without delay. Thus, there remained an urgent need to address GHG emissions from the maritime transport sector and to step up mitigation efforts. In view of the global dimension of international maritime transport and the climate change challenge, a global and concerted solution was urgently required. To this end, negotiations towards regulation of CO_2 emissions from international shipping should be pursued with all due speed;

(e) Various technical, operational and market-based mitigation measures were currently under consideration under the auspices of the Marine Environment Protection Committee (MEPC) at the International Maritime Organization (IMO). While the reduction potential and the effectiveness of each measure were yet to be fully established, there remained a need to improve the understanding of the respective merits of different options and to assess the potential implications of the proposed mitigation measures for global trade and market distortions. UNCTAD was encouraged to make use of its expertise and conduct

relevant work in this area, especially regarding the trade and development of developing countries. There was also a need to ascertain the added value of these proposals in terms of energy efficiency to be achieved by the world fleet and their impacts on international shipping;

(f) The meeting was an eye-opener in that it helped raise awareness about the importance of climate change impacts and adaptation in relation to maritime transport systems. While international maritime transport was responsible for around 3 per cent of global CO_2 emissions from fuel combustion, it was important to note that more than 80 per cent of global trade (by volume) was carried by sea, from port to port. Given the potential impacts and implications of climate change for transportation systems, and in particular for ports – key nodes in the supply-chain, and vital for global trade – maritime transport should be seen much less as a culprit than as a victim. Thus, increased focus on responding to the challenge was important for the long-term prospects of the maritime transport sector and, more generally, global trade. Planning for the already-predicted impacts should be pursued without delay;

(g) Further studies were required to improve the understanding of potential climate change impacts for the maritime transport sector and the hinterland. For ports and transport infrastructure in coastal zones, especially in developing countries, appropriately funded, well-targeted vulnerability studies based on adequate data – as well as better data and dissemination of existing information – were required to assess potential climate change impacts and to develop appropriate adaptation responses;

(h) Studies on the vulnerability of the maritime industry to the impacts of climate change would strongly benefit from the availability of information on climate variability and change both at the global and regional scales. Efforts to develop a system to provide such information should be encouraged and supported;

(i) Scientific research based upon accurate and relevant data was essential for better predictions of climatic impacts on maritime transport and coastal infrastructure, especially in more vulnerable regions such as SIDS and low-lying areas. In this respect, there was an important need for cooperation among scientists and engineers, industry, international organizations and policymakers to ensure that up-to-date relevant information on climate change impacts and adaptation measures was available, widely disseminated and taken into account by policymakers, transportation planners and development strategists;

(j) Further awareness-raising, knowledge sharing, education and information dissemination was needed. The intention to pursue the possibility of including a compulsory subject on climate change in the undergraduate curriculum at the Cass Business School of City University, London – as well as a series of lectures for postgraduate students – was a step in this direction. As noted by experts, other approaches in this respect could include capacity-building and technical assistance initiatives, especially with a view to helping developing countries and the most vulnerable gain an improved understanding of the climate change challenge from a maritime transport perspective to ensure that they were better prepared to cope with its various effects;

(k) Assessing the costs of climate change impacts on ports and, more generally, supply chains, was seen as important. Understanding the implications for trade and development especially for developing countries needed to be enhanced and relevant studies should be carried out;

(l) Climate change mitigation in maritime transport and the need to adapt to climate change impacts posed a particular challenge for geographically disadvantaged landlocked countries with significant population, especially for their already-volatile trade and development prospects. In that context, further attention should be focused on the impact of potential mitigation measures and adaptation requirements for the trade and

development prospects of landlocked developing countries, as well as LDCs. In that context, financial and technical assistance, as well as capacity-building, were important;

(m) Adequate funding was paramount for successful climate action in maritime transport and the wider supply chain, in particular for adaptation purposes. In that context, it was important to explore ways in which financial resources could be generated as part of mitigation efforts in relation to maritime transport and ensure that any proceeds were reinvested within the industry for climate change action, in particular for the purposes of effective adaptation, especially in developing countries;

(n) Taking advantage of existing technology and development of new technologies would go a long way in helping address the climate change challenge in maritime transport. For developing countries, being able to access and benefit from such technologies and advances would be crucial;

(o) The international shipping and port industries were already active in addressing the climate change challenge and were committed to stepping up their efforts to ensure that broader climate change implications for maritime transport were taken into account. In that respect, indications by representatives of the global port industry of their willingness to explore the possibility of including considerations on impacts and adaptation in work under the World Ports Climate Initiative constituted an important step in the right direction;

(p) It was felt that it would be useful to preserve some continuity to these deliberations and plan for a follow-up meeting in a year's time to assess progress with respect to the key issues raised and take stock of achievements made, as well as reflect on potential next steps.

Annex II

Terms of reference of the Group of Experts on Climate change impacts and adaptation for international transport networks

1. The Group of Experts will define the scope of activities of the Working Party on Transport Trends and Economics and its involvement in this area.

2. The Group of Experts, based on existing resources of the secretariat, along with additional financial support provided by participating countries, and by other international organizations and bodies concerned, and in close collaboration with the UNCTAD secretariat, will take stock of the available data and analyses of climate change impacts on international transport networks in the UNECE region and beyond.

3. The Group of Experts will collect information on all relevant planning, management, organizational and other initiatives for an adaptation of transport networks to climate change with a view to raising awareness and sharing and drawing on good practices and different national strategies.

4. The Group of Experts will prepare in a coordinated manner recommendations or proposals to UNECE and UNCTAD member governments for the consideration by the Inland Transport Committee with a view to improving the adaptability of transport networks to climate change in some areas, including infrastructure; risk-assessment methodology; evaluation of adaptive measures; risk management; training tools; and cross-border information sharing by national transport authorities.

5. The above recommendations should aim to improve long-term sustainability of international transport and set best examples of national policies addressing the issues of vulnerability of transport networks amongst UNECE and UNCTAD member States, including developing and landlocked countries, as well as small island states.

6. It is proposed that the Group should be composed of experts in the relevant fields, including in particular international transport and climate change, appointed by UNECE and UNCTAD member States as well as competent representatives of relevant international governmental and non-governmental organizations and academia.

7. The Group of Experts is expected to start its work in May 2011, following the approval by the Inland Transport Committee and the UNECE Executive Committee. It will terminate its activities within two years with a submission of a full report of its accomplishments, including policy-oriented recommendations. The report will be considered by the Working Party on Transport Trends and Economics and, if approved, submitted to the Inland Transport Committee for its endorsement.

8. If a UNECE or UNCTAD government decides to host the International Conference on Adaptation of Transport Networks to Climate Change that was proposed by the Working Party on Transport Trends and Economics at its twenty-third session, the Group of Experts will also act as a steering committee for its preparation.

9. The Group of Experts will be assisted in its work by the UNECE secretariat and will report to the Working Party on Transport Trends and Economics. The UNCTAD secretariat would be invited to join efforts and assist the work.