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Informal document No. **WP.29-149-03**
(149th WP.29, 10-13 November 2009,
Agenda item 8.5)

GLOBAL WARMING AND TRANSPORT: UNECE activities on the reduction in the transport sector of emissions of gaseous pollutants and greenhouse gases

Contents:

A. The UNECE activities on climate change mitigation and adaptation

1. Today the entire international community shares the concern of global warming, which became an area where the central role of the United Nations is uncontested, as testified by the fact that the Secretary-General has put climate change firmly at the top of the United Nations agenda. It is indeed a monumental challenge confronting humankind in this new century: the imperative need to both mitigate and adapt to climate change will have a major impact on everyday life through changes in consumption and production patterns, which themselves require significant changes in technology, legislation and economic policies. UNECE is well equipped to be a driving force for addressing this challenge in the region and beyond, having a strong mandate and recognized expertise in areas which are crucial for climate change adaptation and mitigation, namely through its environmental conventions, its regulations in vehicle construction, its work in the field of energy efficiency, forestry and timber, and more recently its initiatives to promote green housing as well as to improve the indicators measuring natural capital and sustainable development.

2. Sustainable transport development and, in particular, global warming calls for internationally harmonized measures and policies to ensure that our transport system provides for personal mobility and serves our people as well as future generations. At the same time, transport must ensure the efficient and secure functioning of our economies and international trade which are the foundations of prosperity, without becoming a burden on humans and the environment.

3. On 28-30 May 2008, transport ministers have met in the International Transport Forum (ITF) held in Leipzig (Germany) to discuss the energy and climate change challenges for the transport sector, especially global warming and the emissions of Greenhouse gases. The Transport ministers addressed the need of CO_2 abatement and improved fuel efficiency in the transport sector, mainly through:

(a) Innovative engine technologies, advanced engine management systems and efficient vehicle powertrains;

(b) The use of sustainable biofuels not only of the first generation (vegetable oil, biodiesel, bio-alcohols and biogas from sugar plants, crops or animal fats etc.), but of the second

generation (biofuels from biomass, non-food crops including wood) and third generation (biodegradable fuels from algae);

(c) An improved transport infrastructure together with Intelligent Transport Systems (ITS) in order to avoid traffic congestion and to foster the use of intermodal transport (road, rail and waterways); and modal transport

(d) Consumer information (e.g. campaigns for eco-driving, promotion of public transportation);

(e) Legal instruments (such as tax incentives for low carbon products and processes, taxation of CO_2 intensive products and processes, etc.).

4. In their key messages of the ITF in 2008, transport ministers urged the World Forum for Harmonization of Vehicle Regulations (WP.29) to accelerate the work to develop common methodologies, test cycles and measurement methods for light vehicles, including CO_2 emissions. It is obvious that the World Forum has the expertise to contribute essentially to promote innovative vehicle technologies and also to improve partially market fuel quality (see para. 2(a) and (b) above).

5. For the other measures (para. 2(c), (d) and (e) above), other fora, institution or organizations are invited to do their part in the mitigation of climate change. For instance, the UNECE Working Party on Transport Trends and Economics (**WP.5**) considered the internalization and possible reduction of external costs of transport activity during its annual sessions in 2008 and 2009 and should revisit this issue in 2010 with a view to arriving at evidence-based conclusions. Such conclusions should identify the socially optimal mechanism for internalizing externalities to enhance the sustainability of transport while addressing the concerns expressed by the road and rail industry representatives during the WP.5 sessions in 2008 and 2009.

6. The transport of chilled and deep-frozen foodstuffs also has an impact on global warming on a number of levels. Firstly, it depends on containers or refrigerated vehicles which are insulated using foams. These foams were traditionally produced using chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) which are greenhouse gases dangerous for the ozone layer and which have been phased out in accordance with the Montreal Protocol. HCFCs are prohibited in all new equipment after the end of 2009 and there is a ban on the refilling of equipment (including recycled fluids) with HCFCs after the end of 2014. The EU has confirmed its target of a 20% reduction in greenhouse gas emissions by 2020 compared to 1990 levels. Now international negotiations are turning their attention to the phase-out of hydrofluorocarbons (HFCs). In the last years in most if not all European countries, insulated foams are already blown with green gases (Pentane C5, N Pentane, Isopentane). Also, the major refrigerated transport equipment builders are already using green gases as the main fluids for their compression cycles (134A, 404A). The refrigerated and chilled transport industry is actively involved in finding new insulating foams and blowing agents that are both safe for the ozone layer and highly effective so that energy can be saved in maintaining the desired temperature. The Working Party on the Transport of Perishable Foodstuffs (**WP.11**) is following closely developments in this field. It has a standing item on this subject on its agenda and will discuss the possibility of holding a workshop on environmental aspects of the industry in 2010 or 2011. In this regard, WP.11 has recently added to the ATP Handbook [1] details of a procedure for determining the fuel consumption of vehicle-powered refrigeration units, or in other words the increase in diesel engine fuel consumption when the refrigeration unit is running. Energy efficiency is becoming a major concern both because of the scarcity of the primary sources but also because of the harmful CO_2 emissions that are released. In order to save energy, it is essential to measure fuel consumption. The influence of aging on the heat

[1] ATP means the Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be Used for such Carriage, done in Geneva on 1 September 1970.

transfer coefficient, or the K value, and its interpretation as well as the acceptance of a rule regarding the frequency of renewals of insulating foams are subject of frequent discussion by WP.11.

7. According to the IPCC guidelines [2] for national GHG inventories, the emissions from international aviation and maritime transport are excluded from the transport emissions and are reported separately. Therefore, UNECE is mainly addressing road, rail, inland water and intermodal transport at the pan-European and even global level, especially through its inter-governmental fora and more than 50 international treaties. In this respect, intergovernmental organs in the fields of rail (**SC.2**), inland water (**SC.3**) and intermodal transport and logistics (**WP.24**) work towards the goal of sustainable transport, including the concerns of global warming, by setting international regulations, standards and targets for more efficient, clean, safe and affordable land transport. This work also includes measures to shift traffic, wherever possible, to railways and inland waterways to free up capacity on roads, to tackle congestion and to arrive at a better carbon foot print of land transport in general. However, for most transport operations, lorries are indispensable to ensure terminal hauls and the final distribution of goods, particularly in case of consumer products. Therefore, very often rail and inland waterway transport entails transhipment operations using containers and other intermodal transport units that can be shifted swiftly and safely from one mode to the other. Efficient and well coordinated terminal and transhipment operations are therefore indispensable to ensure the competitiveness of intermodal transport operations vis-à-vis pure road haulages. In order to ensure that intermodal transport solutions are applicable within total logistics and transport chains, Governments have the responsibility to establish the necessary framework conditions that set a level playing field among all actors and modes of transport involved. This would allow the industry to establish and operate seamless intermodal transport operations that are economically viable and ecologically sustainable. Efficient intermodal transport operations are often only feasible beyond distances of 300-500 km. Thus, international cooperation and harmonized transport policies are required. At the pan-European level, UNECE is the only inter-governmental organization that contributes to internationally harmonized solutions in the field of intermodal transport infrastructures, technical minimum standards and service benchmarks. UNECE has negotiated a pan-European network of important road-rail-inland water transport lines (AGTC Agreement and its Protocol) and provides a forum for Government and industry experts to review the latest policy, legal and technical developments in reducing CO_2 emissions, to exchange best practices and to prepare policy guidance.

8. UNECE conferences, workshops and studies undertaken within the Transport, Health and Environment Pan-European Programme (**THE PEP**) provide for a constant exchange of best practices in sustainable transport policies among UNECE member States and address the transport, environment and health challenges in an integrated and holistic manner. At the Third High-level Meeting on Transport, Health and Environment in January 2009, Governments, adopting the Amsterdam Declaration, gave renewed political impetus to THE PEP and agreed specifically to reduce emissions of transport-related greenhouse gases, air pollutants and noise. This should be achieved by supporting a shift in the vehicle fleet towards zero- or low-emission vehicles and fuels based on renewable energy, by promoting a shift towards clean transport modes and by fostering electric mobility as well as eco-driving [3]. THE PEP has already supported several measures to reduce CO_2 emissions in transport.

9. Recently, the UNECE Transport Division launched a new website on "Global warming and transport" [4], listing a large number of its current activities and measures on climate change

[2] IPCC means the International Panel on Climate Change.

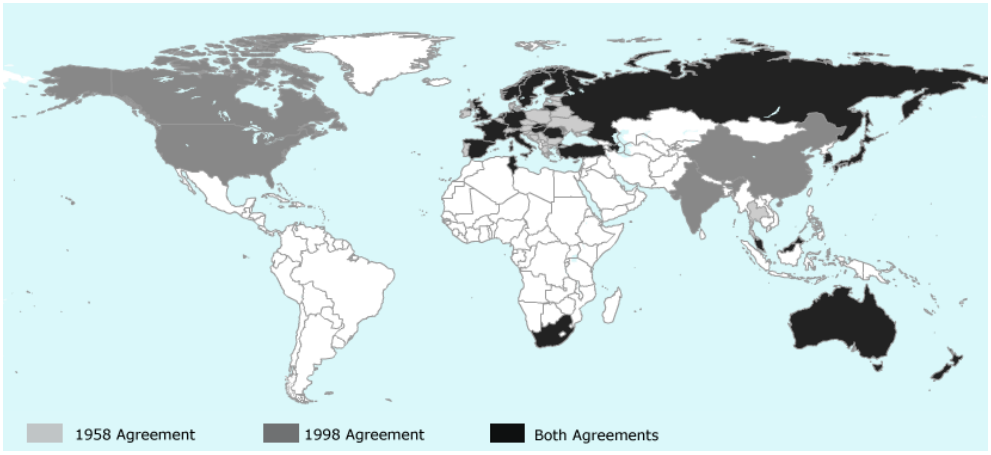
[3] An example of golden rules for eco-driving as well as additional information on this subject can be found at the website: http://www.ecodrive.org/

[4] See website address: http://www.unece.org/trans/theme_global_warm.html

mitigation and adaptation, especially with regard to the reduction of CO_2 emissions in the transport sector.

B. The World Forum for Harmonization of Vehicle Regulations (WP.29)

10. The UNECE World Forum for Harmonization of Vehicle Regulations (WP.29) is the unique global forum where vehicle regulations are developed. As a regulatory body, its responsibility for "greening the transport sector" is therefore huge. 53 Countries (including the European Union) are Contracting Parties to at least one of the two United Nations (UN) Agreements on vehicle regulations (1958 and 1998 Agreements) [5] and apply the vehicle regulations adopted by the World Forum (WP.29). These countries, representing the 5 Continents (almost all the European countries, USA, Canada, Japan, China, India, Korea, Thailand, Malaysia, Australia, New Zealand, South Africa, etc.), manufacture more than 80% of vehicles worldwide. Other countries (Vietnam, Philippines, Cambodia, Argentina, Brazil, Mexico, the Community of the Arab Gulf Countries, the Southern African Developing Community (SADC), the South East Asian Nations (ASEAN), etc.) are either in the process of acceding to the UN 1958 and 1998 Agreements or have shown interest in acceding to them. Some of them participate, as observers, in the World Forum.



Map: Geographical extension of the UN 1958 and 1998 Agreements on construction of vehicles, administered by WP.29

C. Structure and mandate of the World Forum WP.29

11. The World Forum is administering 2 parallel agreements regarding uniform technical provisions on the construction of vehicles, i.e. the 1958 Agreement and the 1998 (Global) Agreement as well as the 1997 Agreement on the periodical technical inspections (PTI) of vehicles in use. [1]

12. The global technical regulations (gtrs) under the 1998 Agreement have technical requirements regarding safety, environmental protection, energy efficiency and anti-theft performance of motor vehicles and their trailers as well as, wherever appropriate, performance requirements which have to be demonstrated. At the present time, 10 gtrs are established into the Global Registry and 31 Contracting Parties (CP) acceded to the Agreement (United States of

[5] The World Forum WP.29 administers the following 3 Agreements:
The 1958 Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be fitted and / or be used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, 1958
The 1997 Agreement Concerning the Adoption of Uniform Conditions for Periodical Technical Inspections (PTI) of Wheeled Vehicles and the Reciprocal Recognition of Such Inspections, 1997
The 1998 Agreement concerning the Establishing of Global Technical Regulations (gtr) for Wheeled Vehicles, Equipment and Parts which can be fitted and / or be used on Wheeled Vehicles, 1998

America, Canada, Japan, France, United Kingdom, European Community, Germany, Russian Federation, P.R. China, Republic of Korea, Italy, South Africa, Finland, Hungary, Turkey, Slovakia, New Zealand, Netherlands, Azerbaijan, Spain, Romania, Sweden, Norway, Cyprus, Luxembourg, Malaysia, India, Lithuania, Moldova, Tunisia and Australia).

13. The Regulations annexed to the 1958 Agreement have, in addition to the technical and performance requirements, also administrative provisions (such as the type approval procedure including the markings, the Conformity of Production (COP) procedure) as well as the mutual recognition of type approvals. At the present time, 127 Regulations are annexed to the 1958 Agreement and 48 CP acceded to the Agreement (Germany, France, Italy, Netherlands, Sweden, Belgium, Hungary, Czech Republic, Spain, Serbia and Montenegro, United Kingdom, Austria, Luxembourg, Switzerland, Norway, Finland, Denmark, Romania, Poland, Portugal, Russian Federation, Greece, Ireland, Croatia, Slovenia, Slovakia, Belarus, Estonia, Bosnia and Herzegovina, Latvia, Bulgaria, Lithuania, Turkey, Azerbaijan, The former Yugoslav Republic of Macedonia, European Community, Japan, Australia, Ukraine, South Africa, New Zealand, Cyprus, Malta, Republic of Korea, Malaysia, Thailand, Montenegro, Tunisia).

14. As a general rule by the World Forum WP.29, the provisions of the regulations under both Agreements (gtrs under the 1998 Agreement and Regulations annexed to the 1958 Agreement) are always kept in line.

15. Contracting Parties to the Agreements may/shall transpose the regulations into its national/regional legislation in order to make the provisions of the regulation mandatory on their territory.

16. The following international organizations participate on a regular basis in WP.29's activities:
Council of the European Union, European Commission/European Community (EC), European Free Trade Association (EFTA), International Energy Agency (IEA), International Transport Forum (ITF), United Nations Environment Programme (UNEP).

17. More than forty non-governmental organizations participate on a regular basis in the World Forum's activities:
American Motorcyclist Association (AMA), Association for Emissions Control by Catalyst (AECC/CEFIC), Association of European Wheel Manufacturers (EUWA), Bureau international permanent des associations de vendeurs et rechapeurs de pneu (BIPAVER), Committee for European Construction Equipment (CECE), Consumers International (CI), Engine Manufacturers Association (EMA), European Association of Automobile Suppliers (CLEPA), European Association of Internal Combustion Engine Manufacturers (EUROMOT), European Automobile Manufacturers Association (ACEA), European Committee of Associations of Manufacturers of Agricultural Machinery (CEMA), European Enhanced Vehicle-safety Committee (EEVC), European Federation for Transport and Environment, European Garage Equipment Association (EGEA), European Insurance Committee (CEA), European Liquefied Petroleum Gas Association (AEGPL), European Natural Gas Vehicle Association (ENGVA), European Tyre and Rim Technical Organization (ETRTO), Federation of European Manufacturers of Friction Materials (FEMFM), Federation of European Motorcyclists Associations (FEMA), the Foundation for the Automobile and Society (FIA Foundation), International Association of Natural Gas Vehicles (IANGV), International Confederation of Associations of Experts and Consultants (CIDADEC), International Electrotechnical Commission (IEC), International Motor Vehicle Inspection Committee (CITA), International Motorcycle Manufacturers Association (IMMA), International Organization for Standardization (ISO), International Organization of Motor Vehicle Manufacturers (OICA), International Petroleum Industry Environmental Conservation Association (IPIECA), International Road Federation (IRF), International Road Transport Union (IRU), International Union of Public Transport (UITP), Liaison Committee of the Body and Trailer Building Industry

(CLCCR), Motor and Equipment Manufacturers Association (MEMA), National Federation of the Blind (NFB), Natural Gas Vehicles Association Europe - (NGVA Europe), Retread Manufacturers Association (RMA), Society of Automotive Engineers (SAE International), Specialty Equipment Market Association (SEMA), Standardization Organization for Gulf Cooperation Council (GSO), Technical Committee of Petroleum Additive Manufacturers in Europe (ATC/CEFIC), The Oil Companies European Organization for Environment, Health and Safety (CONCAWE), Union of Technical Assistance for Motor Vehicle and Road Traffic (UNATAC), Working Party "Brussels 1952" (GTB), World Economic Forum (WEF), World Road Association (PIARC).

D. A possible strategy to reduce the transport CO_2 emissions

18. The World Forum WP.29 noted already during its session in June 2008 the ITF key messages as well as the results of the recent International Symposium on a global approach to automotive fuel economy, held in Paris on 15-16 May 2008, which had been organized by the International Energy Agency (IEA) in cooperation with ITF, the FIA Foundation for the Automobile and Society and United Nations Environment Programme (UNEP). At its November 2008 session, the World Forum WP.29 outlined that, with regard to the abatement of global warming and the reduction of CO_2 emissions, a possible strategy for the transport sector could be:

(a) a short term objective through an improved energy efficiency and the use of sustainable biofuels (2015);

(b) a mid term objective with the development and introduction into the market of plug-in hybrid vehicles (2020-2025), and;

(c) a long term objective with development and introduction into the market of electric, hydrogen and fuel cell vehicles (2030-2040).

This strategy would shift the automotive sector from the use of fossil energy to the use of hydrogen and electric energy. For the effectiveness of that integrated strategy, the energy sector has to ensure the sustainable and cost-effective generation of electricity and production of hydrogen.

19. With regard to "Inland transport" [6], the Ministerial Conference on Global Environment and Energy in Transport (MEET) [7] in Tokyo in January 2009 adopted a declaration that, for the purpose of reducing greenhouse gas emissions, countries should be encouraged to:

(a) Improve fuel/energy efficiency of motor vehicles, railways, and domestic aircraft and ships, through approaches such as: introducing fuel efficiency or GHG emission standards and improving vehicle components, noting IEA's energy efficiency policy recommendations and its development of energy efficiency indicators; strengthening international cooperation to develop and harmonize procedures for testing fuel efficiency or measuring GHG emissions through the UNECE/WP.29 and other regional or international fora; and facilitating, as appropriate, the introduction of energy-saving equipment and advanced technologies into ports and other transport facilities;

(b) Use strategic transport policies to reduce emissions, such as coordination of transport planning with urban spatial planning to realize, where applicable, more compact urban forms, transport demand management, enhanced modal integration, improvement of road and railway networks, and promotion of non-motorized means of travel; and

[6] "Inland transport" refers to transport activities excluding international aviation and shipping.

[7] Ministers and relevant Representatives from: Australia; Brunei Darussalam; Cambodia; Canada; France; Germany; India; Indonesia; Italy; Japan; Republic of Korea; Lao People's Democratic Republic; Myanmar; Philippines; Russian Federation; Singapore; Thailand; United Kingdom; United States; Vietnam, and the European Commission

(c) Facilitate behavioral changes, including eco-driving, the use of public transport, and, where applicable, modal shifts, taking the environmental impacts of each mode into consideration.

20. Furthermore, MEET agreed on the need to limit or reduce air pollutant emissions from inland transport, recognizing the fact that some countries have significantly reduced air pollutants such as carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), sulfur oxide (SOx) and particulate matters (PM), and encourage, in addition to the aforementioned measures, countries to:

(a) Review and strengthen, as necessary, their regulations on exhaust emissions from motor vehicles, railway locomotives and ships, both for new and in-use vehicles; and promote both low sulfur diesel and gasoline accordingly;

(b) Strengthen international cooperation to develop and harmonize procedures for testing exhaust emissions through the UNECE/WP.29 and other regional or international fora; and

(c) Work to incentivize the production and use of environmentally friendly vehicles (EFV) and clean fuels, and to promote public transport.

21. At its sixty-third session of UNECE, held in Geneva on 31 March 2009, the Economic Commission for Europe welcomed, during its a high level segment on climate change mitigation and adaptation, the consideration by WP.29 of specific market fuel quality requirements that could be a step forward towards further reduction of vehicle emission levels in a comprehensive global frame work, based on harmonized and technologically neutral regulations.

22. It is also a common understanding that there is also a need to increase the capacity of countries by linking and mainstreaming the UNECE work to other international agendas, and focus on those components that can enhance results in some key areas such as the attainment of:

(a) The Millennium Development Goals (MDG), in particular MDG 7 to ensure environmental sustainability.

(b) The Kyoto Protocol.

(c) Draft resolution of the UN General Assembly A/C.2/62/L.38, titled "Protection of global climate for present and future generations of mankind".

(d) UN Framework Convention on Climate Change (UNFCCC).

E. WP.29 activities on fuel efficiency and quality, and on innovative technologies to the further reduction of emissions of gaseous pollutants and CO_2

23. The activities of the World Forum are focussed on active safety (i.e. crash-avoidance) and passive safety (i.e. crash-worthiness) of road vehicles as well as on the environmental protection and general safety issues. Road vehicles means two- and three-wheeled vehicles, passenger cars, buses and coaches, light and heavy duty vehicles, agricultural and forestry tractors as well as non-road mobile machinery.

24. The World Forum has already developed more than 140 regulations and rules on vehicles. These regulations and rules are performance oriented and continuously adapted to technical progress.

25. In order to perform these tasks, World Forum has six permanent subsidiary Working Parties. The Working Parties on lighting and light-signalling (GRE) and on braking and running gear (GRRF) are working on subjects to avoid vehicle crashes. The Working Party on Passive Safety (GRSP) is working on crash-worthiness issues. The Working Parties on Noise (GRB) and on Pollution and Energy (GRPE) are working environmental issues, especially on the reduction of engine emissions of gaseous pollutants and of vehicle noise levels. The Working Party on General Safety Provisions (GRSG) is considering general safety issues. Under these six permanent Working Parties, more than 30 informal groups have been established as expert groups with a time-limited mandate (~2 years) to work on specific subjects.

26. More than 2000 experts from the whole world are participating on a regular basis in all these meetings: governmental experts representing the Contracting Parties to the Agreements, experts from the above mentioned Non-Governmental Organizations (NGOs) representing e.g. the automotive industry or their suppliers, the vehicle drivers or other road users. All participants may submit draft proposals on specific subjects. However, the final decision on the adoption of a proposal for a regulation or an amendment to an existing regulation lies only with governmental representatives of the Contracting Parties to the Agreement concerned.

27. In the framework of the 1958 Agreement the World Forum has developed several UNECE Regulations limiting the maximum admissible level of vehicle emissions for various gaseous pollutants (CO, HC, NOx) and particulate matters. [8] The successive amendments of these UNECE Regulations have resulted in substantial abatements, of 95-97 per cent, of the emission limits of CO, HC and NOx for new private passenger cars as compared with the limits established in the 1970's (see Figure below). This means that the latest emission limits established by UNECE Regulations for these pollutants are today more than 20 times lower than those established thirty years ago. Similarly, the amendments to the relevant UNECE Regulations have reduced emission limits of particulates by over 90 per cent as compared with those established in 1990, which means that the latest limits approved are over 10 times lower than those in 1990.

[8] Exhaust gas emissions of vehicles fall into the two main categories of greenhouse gases (CO2) and pollutants (CO, HC, Nox, PM):

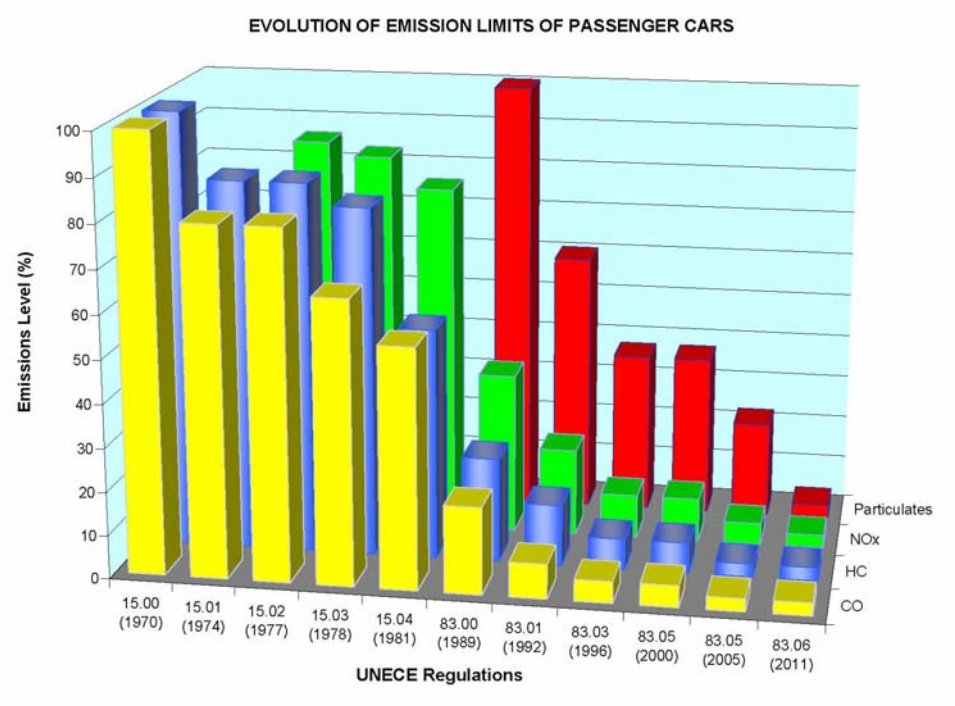
Carbon Dioxide (CO_2), which is an inevitable product of burning a fuel which contains carbon (as all petroleum products do). CO_2 does not an air pollutant *per se*, but a greenhouse gas and, therefore, contribute to global warming. The reduction of CO_2 emissions in the transport sector can only be achieved by reducing the combustion of fossil fuels, either by improving the energy efficiency of vehicles and their engines or by using low-carbon fuels (i.e. alternative fuels including sustainable biofuels) or other energies (e.g. use of hydrogen and fuel cell vehicles or electric vehicles) in their propulsion system, or a combination of all.

Carbon Monoxide (CO), which is product of incomplete combustion. CO reduces the blood's ability to carry oxygen. It's dangerous to people with heart disease and in high concentrations, it is poisonous. Thus, CO is a gaseous pollutant which can be reduced by a more efficient combustion in vehicle engines (so that CO_2 is produced instead of CO) and further reduced after its combustion by an oxidizing process in a catalytic converter. [$2xCO + O_2 = 2xCO_2$]

Hydrocarbons (HC), also known as "Volatile Organic Compounds (VOC)", are made up of unburned or partially burned fuel. As being toxic, they can harm people by causing liver damage and even cancer. HC are a major contributor to "photochemical smog" in certain climatic conditions. They can also be reduced by a more efficient combustion in the engine and further reduced after its combustion by an oxidizing process in a catalytic converter. [$4H_xC_y + (x+4y)O_2 = 2xH_2O + 4yCO_2$]

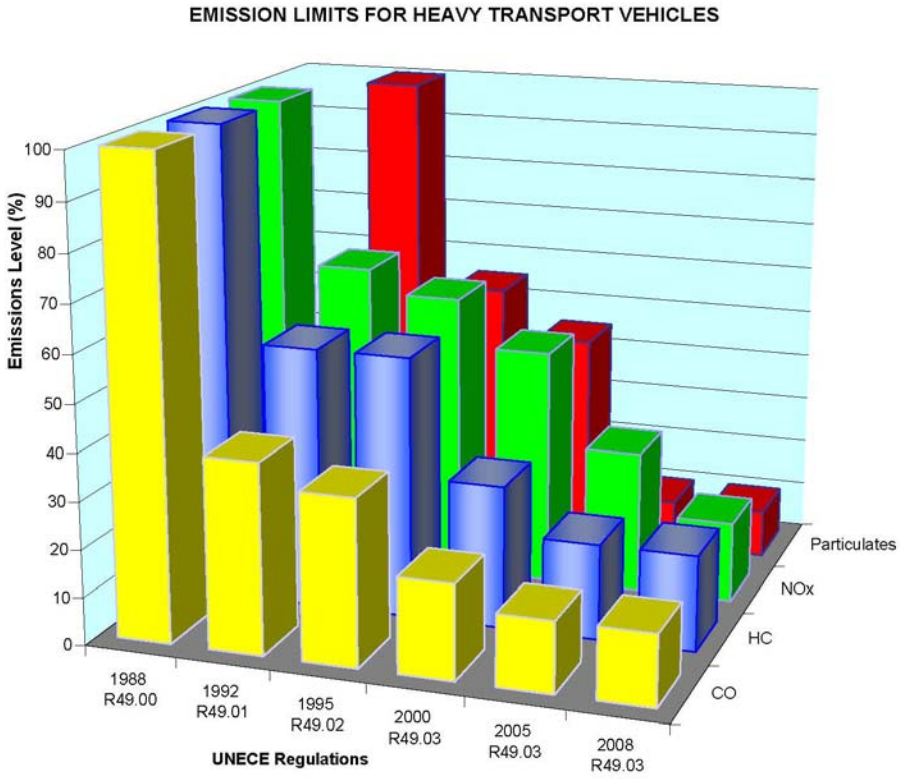
Nitrogen Oxides (NOx) are generated when nitrogen N_2 in the air (78% N_2, 21% O_2) reacts with oxygen O_2 at high temperature and pressure in engine combustion chamber. NOx can be an irritant to the lungs and is a precursor to "photochemical smog" and acid rain. It cannot be removed by oxidation (like CO and HC), but the opposite process, i.e. the removal of oxygen. This "reduction" process is necessary to convert NOx back to nitrogen and oxygen. The exhaust gas recirculation and selective catalytic reduction have significantly reduced NOx emissions by vehicle engines.

Particulate Matter (PM) is very small particles (micrometer size range), mostly of un-burnt carbon. PM causes respiratory health effects in humans and animals. Improvements of vehicle injection, combustion process and vehicle particle filters have significantly reduced the PM emissions.



28. At the present time, the World Forum considers a proposal by the European Commission to further reduce, by September 2011, the limit values of the above mentioned pollutants, especially the emissions of particles by more than 80 per cent. These new limit values will not only have to be fulfilled, as it is still the case today, by diesel engines but also by petrol engines.

29. The emission limits for heavy-duty vehicles have also been abated although with lower percentages and work is under way to abate them further (see Figure below).



30. With regard to the reduction of the greenhouse gas emissions (especially CO_2) in the transport sector, the World Forum and its subsidiary Working Parties consider or have already considered a large number of measures to improve the energy efficiency of the vehicle fleet, especially:

(a) support of innovative engine technologies, i.e. Environmentally Friendly Vehicles (EFV), Plug-in Hybrid Electric Vehicles (PHEV), Hydrogen and Fuel Cell Vehicles (HFCV), Electric Vehicles (EV), etc.

(b) advanced engine management systems (e.g. stop and go function, gearshift and eco-drive indicators),

(c) efficient vehicle powertrains (e.g. low friction components, tyres with low rolling resistance, tyre pressure monitoring systems)

(d) the use of other alternative energy sources such as liquefied petroleum gas (LPG), compressed natural gas (CNG) and sustainable biofuels (liquid and gaseous),

(e) development of quality specifications for market fuels in relation with the vehicle emission levels and engine technology type,

(f) installation on vehicles of electric devices with a low energy consumption to reduce the energy consumption (e.g. headlamps with Light Emitting Diode (LED) technologies),

(g) development of Intelligent Transport Systems (ITS) in order to avoid traffic congestion and driver assisting features.

31. The following table lists only the most important activities of the World Forum WP.29 specifically on emissions of pollutants and CO_2, energy efficiency, fuel efficiency and quality as well as on innovative technologies of vehicle engines and powertrains:

1	**WLTP**	**Worldwide harmonized Light vehicles Test Procedures**
	Goal:	Develop new emissions test cycles and procedures for light vehicles with regard to the emissions of gaseous pollutants (NOx, CO, HC) and particles, including CO_2.
	Timeline:	Establishing a gtr on the WLTP emission test cycle and procedure by 2014. Further development of additional test cycles for low temperature and high altitude, durability and in-service conformity by 2018, including off-cycle emissions, mobile air conditioner, if feasible. Correlation tests and definition of reference fuels as well as emission limit values by 2022.
	Status:	Detailed preparatory work had been finalized by the Working Party on Pollution and Energy (GRPE) in a roadmap for the development of the WLTP gtr for gaseous emissions of pollutants and particles, including CO_2. In June 2009, WP.29 considered that roadmap and recommended that GRPE should start, as soon as possible, the work on the development of the WLTP gtr.
	Remark:	The technical co-sponsors of the WLTP gtr are the European Community, Japan and the United States of America. The GRPE informal group on WLTP is chaired by France. More information can be found on: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/wltp03.html in GRPE report ECE/TRANS/WP.29/GRPE/58, paras. 26-32 available at: http://www.unece.org/trans/doc/2009/wp29grpe/ECE-TRANS-WP29-GRPE-58e.pdf as well as in WP.29 report ECE/TRANS/WP.29/1077, paras. 104 and 105 at: http://www.unece.org/trans/doc/2009/wp29/ECE-TRANS-WP29-1077e.pdf

2	**WHDC**	**Worldwide harmonized Heavy-Duty emission Certification procedure (gtr No. 4)**
	Goal:	To develop a new test procedure for the emissions of gaseous pollutants (NOx, CO, HC) and particles from heavy-duty vehicle engines.
	Timeline:	This gtr was established on 15 November 2006. Gtr No. 4 is available at http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29glob_registry.html The time schedule for the insertion of performance requirements has still to be defined.
	Status:	This gtr is not yet fully harmonized and includes a number of options. WP.29 will consider, at its November 2009 session, solutions for these unresolved issues. GRPE is expected to resume, in 2010, its work on the elaboration of limit values for the gaseous pollutants (NO_x, CO, HC, particles). The provisions of the equivalent Regulation No. 49 were aligned with those of this gtr.
	Remark:	The technical sponsor of the WHDC gtr is the European Community. The GRPE informal group on WHDC is chaired by the European Commission. More information can be found on: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/whdc_minutes.html
3	**WMTC**	**Worldwide harmonized Motorcycle emission Test Cycle (gtr No. 2)**
	Goal:	To develop a new test procedure for emissions of gaseous pollutants from motorcycle engines, including the measurement method for CO_2 emissions (in g/km).
	Timeline:	This gtr was established on 22 June 2005. Gtr No. 2 is available at http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29glob_registry.html It does not yet include limit values for the gaseous pollutants (NO_x, CO, HC). A proposal for the insertion of performance requirements is expected to be adopted in June 2010.
	Status:	The work on the insertion of limit values for the gaseous pollutants was finalized by GRPE in June 2009. WP.29 is expected to consider a proposal for limit values in March 2010. The provisions of Regulation No. 40 have still to be aligned with those of the gtr.
	Remark:	The technical sponsor of this gtr is Germany. More information can be found on: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/grperep.html
4	**NRMM**	**Engine exhaust emission test protocol for Non-Road Mobile Machinery (draft gtr No. 11)**
	Goal:	To develop new worldwide harmonized provisions for the measurement of emissions of gaseous pollutants (NO_x, CO, HC, particles) from Non-Road Mobile Machinery (NRMM) engines.
	Timeline:	The draft gtr on the NRMM is expected to be established in November 2009 on the basis of: http://www.unece.org/trans/doc/2009/wp29/ECE-TRANS-WP29-2009-120e.pdf http://www.unece.org/trans/doc/2009/wp29/ECE-TRANS-WP29-2009-121e.pdf.
	Status:	At its June 2009 session, GRPE finalized the draft gtr on NRMM emissions (without performance requirements) and submitted it to WP.29, for consideration and adoption at its November 2009 session.
	Remark:	NRMM engines means combustion engines intended to be fitted on agricultural or forestry tractors and machineries as well as on locomotives, vessels and ships. The technical sponsor of the NRMM gtr is the European Community. The informal group on NRMM concluded its work. For more information, see: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/nrmm_mtng_minutes.html

5	**OCE**	**Off-Cycle Emissions for heavy-duty vehicles (gtr No. 10)**
	Goal:	To develop, in addition to the normal emission test cycle for heavy-duty vehicles (WHDC), further specifications for OBD systems especially regarding the adherence to a Not-to-exceed (NTE) protocol to ensure that emission limits are met in use, not only under normal conditions, but under a wide range of operating conditions (e.g. low temperatures, high altitude, etc.).
	Timeline:	This gtr was established as gtr No. 10 on 24 June 2009. Gtr No. 10 is available at http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29glob_registry.htm.
	Status:	At its June 2009 session, WP.29 agreed to establish into the Global Registry the draft gtr on OCE. CP have to initiated, at a national or regional level, the process to transpose the gtr into their national or regional legislation.
	Remark:	The technical sponsor of the OCE gtr is the United States of America. The informal group on OCE concluded its work. More information can be found on: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/oce.html
6	**WWH-OBD**	**World-Wide harmonized Heavy duty On-Board Diagnostics (gtr No. 5)**
	Goal:	To develop harmonized prescriptions for On-Board Diagnostics (OBD), which are used on light-duty and heavy-duty vehicles, in order to ensure in their daily service proper engine performance and to assist in malfunction diagnostics and repair.
	Timeline:	This gtr was established on 15 November 2006. Gtr No. 5 is available at http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29glob_registry.htm. The prescriptions for light-duty vehicles have not yet been included into gtr No. 5.
	Status:	The provisions of the equivalent Regulation No. 49 were aligned with those of this gtr.
	Remark:	The technical sponsor of this gtr was the United States of America. More information can be found under WWH-OBD at the GRPE website: http://www.unece.org/trans/main/wp29/meeting_docs_grpe.html
7	**PMP**	**Particulate Measurement Programme**
	Goal:	To develop new test protocols, with instrumentation, to assess and control nano-particle emissions from (a) light duty vehicles and from (b) heavy-duty vehicle engines within the range of 10 to 500 nm (with respect to health effects).
	Timeline:	(a) The PM measurement procedure for light-duty vehicles has been finalized in 2008 and was incorporated into Regulation No. 83 (per Suppl.7 to 05 series, see: http://www.unece.org/trans/main/wp29/wp29regs/r083r3a2e.pdf). (b) The PM measurement procedure for heavy-duty vehicles is expected to be finalized by the end of 2010.
	Status:	(a) The new PM measurement procedure for light-duty vehicles improved the former particle mass measurement procedure and incorporated a new one for particle numbering. GRPE continue its work to further improve the calibration and the accuracy of that measurement method. (b) With regard to the PM measurement procedure for heavy-duty vehicles, the validation exercise is still ongoing. In this respect, GRPE is expected to consider a first proposal for amendments to Regulation No. 49 at its January 2010 session.
	Remark:	The informal group on PMP is chaired by the United Kingdom. More information can be found on: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/pmp22.html

8	**FQ**	**Fuel Quality**
	Goal:	To develop recommendations on market fuel quality to enable that vehicles, which were tested in conformity with the UN regulations or other equivalent regulations and using specific reference fuels for the tests, use in their daily service fuels with specific characteristics relating to the vehicle emission levels and engine technology type. In this respect, the recommendations contribute to environmental protection, specifically to the reduction of air pollution.
	Timeline:	GRPE is expected to finalize a first set of recommendations (solving the technical concerns) by the end of 2010. The completion of the full set of recommendations is a huge task, which timeline is still under consideration.
	Status:	The WP.29 Round Table on Fuel Quality, held on 15 November 2007, showed that there is a close link between the market fuel quality and the emissions of pollutants from motor vehicles. It was recognized that a further reduction of emissions through more stringent emission regulations requires more advanced emission control technologies, which drives the crucial need for improved fuel quality. GRPE set up an informal group on Fuel Quality (FQ) and to proceed in a two-step approach to develop: (a) first the specifications for parameters which influence emission control devices (i.e. solving the technical concerns), and, (b) if agreeable by the oil industry, specifications for parameters which influence the engine tailpipe emissions (i.e. addressing health risks) at a further step. At its forthcoming session in January 2010, GRPE is expected to consider a first set of fuel quality parameters (ranges or limit values for the content of lead, sulphur, benzene, metallic additives etc.) deemed necessary to enable the corresponding motor vehicle emission levels starting from EURO 2 up to EURO 5, if possible. GRPE also agreed that this exercise could be carried out for liquid fuels (gasoline and diesel, including biofuels) and, subsequently, for gaseous fuels (including biogases).
	Remark:	The informal group on FQ is chaired by France. For more information see: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/fq04.html
9	**EFV**	**Environmentally Friendly Vehicles**
	Goal:	(a) To continue a fruitful cooperation between WP.29 and future international conferences on Environmentally Friendly Vehicles (EFV) and to foster the development and introduction of EFVs as well as renewable fuels. (b) To review, in a short term view, the feasibility of the proposed EFV concept (evaluation method, integrated approach).
	Timeline:	The GRB/GRPE informal group work in parallel to the international EFV conferences, held every two year.
	Status:	Following the positive outcome of the EFV conferences in Tokyo (2003) and Birmingham (2005), it was decided at the third EFV conference in Dresden (2007) to develop a close cooperation with the World Forum WP.29 and its subsidiary bodies, especially with GRPE and GRB, and to establish a new informal group on Environmentally Friendly Vehicles. Future EFV conferences will focus on: (a) Status report regarding the set goals; (b) Exchange of experiences regarding ongoing measures for promoting and facilitating the introduction into the market of EFVs; (c) Exchange of experiences and analysis regarding the legal and economic framework; (d) Regular status report to the G8-Leaders (according to the decision at Heiligendamm/Germany). The forthcoming fourth EFV Conference is scheduled to be held on 23-24 November 2009 in New Delhi (India). With regard to the feasibility statement for the development of a methodology to evaluate EFV, GRPE agreed that, from a procedural point of view, the development

		of a harmonized EFV concept was feasible. Concerning potential target groups and purposes of an EFV concept, a political guidance is expected from the next EFV conferences.
	Remark:	It was agreed that the organizing country of the EFV conference will chair the EFV informal group (Germany 2008-2009, India 2010-2011). The presentations and the conclusion paper of the EFV conference in Dresden are available on the website: www.bmvbs.de and those of New Delhi at: www.4efv.in More information about the EFV informal group can be found on: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/efv04.html
10	**HFCV**	**Hydrogen and Fuel Cell Vehicles**
	Goal:	To develop and establish a global technical regulation (gtr) on Hydrogen and Fuel Cell Vehicles (HFCV) that attains equivalent levels of safety as those for conventional gasoline powered vehicles, without any restriction for future innovative technologies. In addition, all aspects regarding the environmental protection are considered under the development of the new gtr or as amendments to existing gtrs.
	Timeline:	Establish by the end of 2010 a gtr for the safety of hydrogen-powered vehicles based on a component level, subsystems, and whole vehicle crash test approach. Beyond 2010, the gtr will be amended to include crash test requirements for HFCV regarding whole vehicle crash testing for fuel system integrity, based on research results and taking into account the latest status of technologies.
	Status:	In June 2005, WP.29 considered a roadmap for the development of a gtr for HFCV and agreed to set up an informal group on HFCV. In order to address adequately safety and environmental provisions, it was agreed to set up two subgroups to address environmental issues (SGE under GRPE) and safety concerns, including crashworthiness (SGS under GRSP). Three main areas are under consideration: fuel system, electrical safety and hydrogen storage system. The gtr will cover, in the first step, passenger cars with fuel cells (FC) or internal combustion engines (ICE), or engines using compressed gaseous hydrogen (CGH2) or liquid hydrogen (LH2). For crash testing, it is planed to develop new provisions for a maximum allowable level of hydrogen leakage and to specify in the gtr that each CP can use, in a first step, its existing national crash tests.
	Remark:	The technical sponsors of the HFCV gtr are Germany, Japan and the United States of America. The GRPE informal group on HFCV is chaired by Germany. More information can be found on: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grsp/sgs_6.html http://www.unece.org/trans/main/wp29/wp29wgs/wp29grsp/elsa_6.html http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/grpehfcv-sge03.html
11	**GFV**	**Gaseous-Fuelled Vehicles**
	Goal:	To foster vehicles using Liquid Petroleum Gas (LPG) or Compressed Natural Gas (CNG) as an alternative fuel in their propulsion system as well as to evaluate regulatory requirements regarding the use of LPG and CNG components and systems on vehicles, with the aim to adapt existing Regulations to technical progress and to consider the performance requirements, taking into account new technologies.
	Timeline:	The mandate is limited to the end of 2009
	Status:	The GRPE informal group made good progress and has prepared a number of amendments to existing Regulations. At the present time, the group considers, among others, new provisions for methane and non-methane hydrocarbons.
	Remark:	The informal group on GFV is chaired by the Netherlands. More information can be found on: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/gfv07.html

12	**HEV**	**Hybrid-Electric Vehicles**
	Goal:	To develop new provisions for HEV with regard to the measurement of the fuel consumption and CO_2 emissions, electric energy consumption and to prepare the corresponding amendments to the existing Regulations.
	Timeline:	Concluded in 2004 and included in Regulations Nos. 83 and 101 available at: http://www.unece.org/trans/main/wp29/wp29regs/r083r3e.pdf http://www.unece.org/trans/main/wp29/wp29regs101-120.html
	Status:	The provisions of the corresponding Regulations have been updated with the requirements for HEV and CP have already transposed them into their national/regional legislation by applying the amended Regulations.
	Remark:	More information can be found on: http://www.unece.org/trans/main/wp29/wp29regs.html
13	**PHEV**	**Plug-in Hybrid-Electric Vehicles**
	Goal:	To better reflect in the existing Regulations Nos. 83 and 101 the environmental benefits of hybrid vehicle based on plug-in hybrid concepts.
	Timeline:	Concluded in 2008
	Status:	The provisions of the corresponding Regulations have been updated with the requirements for HEV and CP have already transposed them into their national/regional legislation by applying the amended Regulations.
	Remark:	More information can be found on: http://www.unece.org/trans/main/wp29/wp29regs.html
14	**EV**	**Electric Vehicles (Regulation No. 100)**
	Goal:	To update Regulation No. 100 concerning battery electric vehicles (specific requirements for the construction, functional safety and hydrogen emission) with additional provisions regarding the protection against electric (high voltage) shocks.
	Timeline:	WP.29 is expected to consider and adopt a final proposal for amendments in 2010.
	Status:	Most of the CP have already been transposed into their national/regional legislation by applying the provisions of Regulation No. 100.
	Remark:	More information can be found on: http://www.unece.org/trans/main/wp29/wp29regs81-100.html http://www.unece.org/trans/main/wp29/wp29wgs/wp29grsp/elsa_7.html
15	**CO_2**	**Fuel consumption, CO_2 emissions and electric energy consumption (Regulation No. 101)**
	Goal:	To set up a new Regulation for the measurement of the fuel consumption and CO_2 emissions of motor vehicles as well as the electric energy consumption of electric and hybrid electric vehicles.
	Timeline:	Concluded in 2004
	Status:	The provisions of the corresponding Regulations have been updated with the requirements for fuel consumption and CO_2 emissions (without any limit values) of vehicle engines as well as the electric energy consumption, for the purpose of consumer information. CP have already transposed them into their national/regional legislation by applying the amended Regulations.
	Remark:	More information can be found on: http://www.unece.org/trans/main/wp29/wp29regs101-120.html
16	**ITS**	**Intelligent Transport Systems**
	Goal:	To set up the information basis on which a new gtr on Intelligent Transport Systems (ITS) could be developed in a long term view. In this respect, a common understanding of driver assistance systems should be developed, taking into account the latest information on technology trends.
	Timeline:	WP.29 is reviewing this activity every second year.
	Status:	WP.29 organized a Round Table on "Intelligent Transport Systems" which was held in Geneva on 18 February 2004 in conjunction with the sixty-fifth session of the Inland Transport Committee (ITC). It was recommended to focus the topics of the

		round-table on vehicle-based systems only and to establish, under WP.29, an informal working group on ITS. The informal group is considering different types of assistance with regard to human processing and driving conditions and possible follow-up to the driver as an information, as a warning or, in certain pre-crash conditions, as control function, if necessary. Such Intelligent Transport Systems can also interact between vehicles and road infrastructures. The goal of such ITS is to identify and manage the traffic flow in order to reduce or even avoid traffic congestion and road accidents. For this purpose, the World Forum set up an informal group to develop harmonized provisions for such intelligent vehicle systems. The informal group meets at least once a year. At the present time, GRRF is also considering such innovative technologies, specifically Advanced Emergency Braking Systems (AEBS) and Lane Departure Warning (LDW) systems.
	Remark:	The informal group on ITS is co-chaired by Japan and the United Kingdom. For more information, see: http://www.unece.org/trans/main/itc/itcrt_its.html or http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/genits16.html
17	**RR**	**Reduction of the Rolling Resistance of pneumatic tyres**
	Goal:	To develop new provisions for the indication by the tyre manufacturers of the tyre rolling resistance coefficient in the type approval communication. This will allow approval authorities to collect data on tyre rolling resistance coefficients and enable them to consider, at a later time point, the possible introduction into the corresponding Regulations of limit values for rolling resistance. In a long term view, the new provisions will contribute to environmental protection, specifically to the reduction of fuel consumption of vehicles by a reduced rolling resistance of vehicle tyres.
	Timeline:	By 2012 at latest
	Status:	For the purpose of rolling resistance, GRB is considering to revise the tyre family definition as it is different from that used for rolling noise and wet grip adhesion. Furthermore, the title and the scope of Regulation No. 117 have to be adapted. In this respect, the European Commission is preparing, jointly with the experts from ETRTO, a proposal for amendments to Regulation No. 117 for consideration at the next GRB session in September 2009.
	Remark:	More information can be found on: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grb/grbrep.html
18	**RB**	**Regenerative Braking (Regulations Nos. 13 and 13-H)**
	Goal:	To develop electric regenerative braking systems able to recover the vehicle braking energy.
	Timeline:	Concluded in 2008 and included in Regulations Nos. 13 and 13-H available at: http://www.unece.org/trans/main/wp29/wp29regs/r013hr1e.pdf http://www.unece.org/trans/main/wp29/wp29regs/r013r6e.pdf
	Status:	The provisions of the Regulations have been updated with the new requirements and CP are transposing them into their national/regional legislation by applying the amended Regulations.
	Remark:	More information can be found on: http://www.unece.org/trans/main/wp29/wp29regs1-20.html

19	**TPMS**	**Tyre Pressure Monitoring Systems (Regulation No. 64)**
	Goal:	To develop new harmonized provisions for Tyre Pressure Monitoring Systems (TPMS) in order to (a) ensure the correct inflation of tyres fitted on vehicles and, thus, (b) to improve vehicle safety and an improved energy efficiency by reducing the rolling resistance.
	Timeline:	WP.29 is expected to consider and adopt a final proposal in November 2009 on the basis of: http://www.unece.org/trans/doc/2009/wp29/ECE-TRANS-WP29-2009-129e.pdf.
	Status:	GRRF will have a final review of the proposal for an amendment to Regulation No. 64 in September 2009.
	Remark:	The informal group on TPMS concluded its task. For more information see: http://www.unece.org/trans/main/wp29/wp29wgs/wp29grrf/grrf-inftpm5.html
20	**LED**	**Headlamps with Light Emitting Diode technologies**
	Goal:	To improve the active safety and energy efficiency of vehicle headlamps by developing new provisions for the installation on vehicles of much more energy efficient lighting devices based on Light-Emitting Diode (LED) technologies.
	Timeline:	Provisions for LED headlamps were concluded in 2008 and inserted into Regulation No. 112: http://www.unece.org/trans/main/wp29/wp29regs/r112r1a3e.pdf Technical provisions for LED light sources are currently under development.
	Status:	With regard to the LED headlamps, the corresponding Regulations have been updated and are already in force. In March 2010, WP.29 is expected to consider and adopt a new Regulation on LED light sources for lighting and light-signalling devices.
	Remark:	Such LED light sources can be used in headlamps, the dedicated Daytime Running Lamps (DRL) and in light-signalling devices. Thus, the introduction into the market of such LED light sources will further reduce the consumption of energy.

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