

4.4.2 The spread of dematerialised content, in particular when it is the product of digitalisation, must not be allowed to prevent lending libraries from pursuing their educational role. Economic and technical models for the circulation of digitalised content must therefore take into account the role of lending libraries and enable them to continue in that role, in the context of closed circuits (intranets) and as part of the lending service to library members.

4.5 Ensuring service users have local access

4.5.1 Lending libraries should be able to supply their members with local access to dematerialised content through closed circuits (intranet) in the same way as for material content; i.e. with computer work stations, printers, software, high-speed connections, assistance and coaching. The initial and

on-going training given to librarians and the organisation of their work must from now on take dematerialised content into account.

4.6 Organising events and coaching for access to digitalised and dematerialised content for the general public

4.6.1 In the absence of training and information, the general public tend to view PCs, which are increasingly common fixtures in homes, as sources of multimedia recreation, unaware of the cultural, educational, teaching and information resources available on the Internet. In the same way that lending libraries use events to offer all ages an active interface with books and reading, they must take responsibility for coaching and events on dematerialised content.

Brussels, 13 February 2008.

The President
of the European Economic and Social Committee
Dimitris DIMITRIADIS

Opinion of the European Economic and Social Committee on an Energy mix in transport

(2008/C 162/12)

In a letter dated 19 March 2007 the European Commission asked the European Economic and Social Committee, under Article 262 of the Treaty establishing the European Community, to draw up an exploratory opinion on an:

Energy mix in transport.

The Section for Transport, Energy, Infrastructure and the Information Society, which was responsible for preparing the Committee's work on the subject, adopted its opinion on 18 December 2007. The rapporteur was Mr Iozia.

At its 442nd plenary session, held on 13 — 14 February 2008 (meeting of 13 February), the European Economic and Social Committee adopted the following opinion by 130 votes to 11 with 8 abstentions.

1. Conclusions and recommendations

1.1 The Committee is pleased to respond to the request from the Commission Vice-President and Commissioner responsible for Transport, Jacques Barrot, to draw up an opinion on the energy mix in transport, being convinced of the need to build up an on-going dialogue between the Commission and the Committee, representing organised civil society.

1.2 The Committee agrees with the conclusions of the spring Council, which highlighted the following priorities:

- increasing security of supply,
- ensuring the competitiveness of European economies and the availability of affordable energy,

— promoting environmental sustainability and combating climate change.

1.3 Guideline policies for the most appropriate energy mix must, therefore, be based on these priorities, as already put into practice by the Commission in its communication on fuel targets 2001-2020.

1.4 While believing that oil will remain the main transport fuel for many years to come, and that natural gas — also a non-renewable resource — will be able to supplement and partly replace oil-based products, the EESC considers a sharp increase in funding for research into the production and use of hydrogen and second-generation agro-fuels to be vital. It therefore

welcomes the initiative on the part of the Commission, which decided on 9 October 2007 to finance a Joint Technological Initiative worth EUR 1 billion for the 2007-2013 period, and echoes the calls from businesses and research centres engaged in developing hydrogen use for the Council and Parliament to speed up the process of adopting the proposal.

1.5 Growing public concern over climate change, together with the risks associated with the rising average global temperature — which, in the absence of specific action, could increase by between 2 and 6,3 °C, points to the need for a reinforcement of all appropriate means of countering the negative effects of greenhouse gas emissions into the atmosphere. The EESC appreciates the work of the EAA and its major contribution to disseminating data and reporting on the progress of measures to combat atmospheric pollution.

1.6 The EESC agrees with the conclusions of the Environment Council of 28 June 2007 and supports the proposal for the Commission to review the 6th environmental action programme in the light of the priorities identified:

- tackling climate change,
- halting the loss of biodiversity,
- reducing the negative impact of pollution on health,
- promoting sustainable use of natural resources and sustainable waste management.

1.7 Means to achieve these aims are being studied in all transport sectors, and the main European agencies are gearing their efforts to securing practical results in a few years. The decision to apply the system of emission certificates to air transport, whose contribution to the production of greenhouse gases is increasing, will enable the development of new fuels to be stepped up. Some companies are already examining the possibility of using agro-fuels, as the results with hydrogen are still only partial and hydrogen-based alternatives remain a long-term prospect. Large naval engines are more easily converted to mixed fuels with lower carbon content, while in the rail sector a combination of electricity and developing renewable sources will certainly boost the existing outstanding environmental performances.

1.8 The best fuel is fuel that is saved. In the EESC's view, the decisive choice on the most suitable energy mix — a choice which should increasingly be elevated to the rank of a community policy — must take account of all these factors, with the health and wellbeing of European citizens, and of the planet, clearly coming first. Tax policies and incentives, recommendations and regulations must always reflect this priority, by favouring the most eco-compatible and economically sustainable option. Savings must be made for the benefit of public transport, alternative means of transport and economic and social policy choices that boost individual mobility while reducing the unnecessary movement of goods.

1.9 The EESC is convinced that the future of transport necessarily lies in the progressive decarbonisation of fuels, and should achieve zero emissions. H₂ production using renewable energy, such as biomass, photolysis, thermodynamic or photovoltaic solar energy, wind power or hydroelectric energy is the only option which amounts to more than a 'green daydream'. As an energy storage element, hydrogen allows energy supply, which is periodic by nature (night/day, yearly cycles, etc.), to be brought into line with variable, de-coupled energy demand.

1.10 The development of combustion and traction technologies has triggered the rapid spread of hybrid vehicles. The most appropriate solution for reducing emissions seems to be fully electric traction, entailing the development of electricity generation from renewable sources, or hybrid use of natural gas and hydrogen, at least for as long as significant availability exists. Another intermediate possibility might be the use of a hydrogen/methane blend, with low hydrogen content. This method represents an initial step towards the use of hydrogen in mobility.

1.11 The use of hydrogen as an energy carrier adapted to transport purposes — albeit subject to the limitations identified at present — represents a challenge for the future, and the possibility of seeing vehicles running partly or fully on hydrogen may become a fact in only a few years, provided that research continues to be supported by the national and European authorities. In this context, the results of the CUTE (Clean Urban Transport for Europe) project are encouraging.

1.12 As it has previously said in relation to energy efficiency, the EESC considers that it would be most helpful to have a web portal, where university research and national, regional and city-based experiments could be shown to a broader audience, and in particular local administrators. The EESC considers that in order to obtain an optimal energy mix, a proper mix is necessary in transport, boosting the efficiency of hydrocarbons and transport priorities. While awaiting reliable and efficient production of hydrogen, the use of electricity, generated from renewable sources, cannot be delayed. The challenge facing transport is to make increasing use of electricity, as soon and wherever possible.

1.13 The EESC would underline the importance of informing and involving civil society which, through its patterns of behaviour, is contributing to the achievement of consumption reduction objectives, and is helping to support research and innovation regarding clean, sustainable fuels. These choices should be mainstreamed into European and national policies, emphasising the added value represented by the Member States' capacity for cooperation and cohesion. This entails upholding common values and a European social model which is alert to the protection of environmental assets, the health and safety of its citizens and those living and working in the Union, and which is concerned with the living conditions of humanity in general.

2. Introduction

2.1 Commission Vice-President and Commissioner for Transport, Jacques Barrot, has asked the European Economic and Social Committee to draw up an opinion on an *Energy mix in transport*.

2.2 The Committee shares the Transport Commissioner's concerns regarding fuel supplies and the need to bring forward research and studies on possible solutions relating to developments in transport policy and the need to adopt measures regarding the relevant fuels.

2.3 The contextual challenges the EU faces with regard to achieving full compliance with the Kyoto protocol objectives, the urgency of climate change, reducing its energy dependence on third countries, pursuing options implemented in line with the Lisbon agenda, achieving the objectives of the Transport White Paper and developing co-modality, and energy efficiency options, make this a central issue in the EU energy strategy.

2.4 Back in 2001, the Commission pointed to the need to tackle the issue of the fuels mix, in its communication on fuel targets 2001-2020, setting out a number of objectives for non-oil fuels, and considered the following scenario to be possible and compatible:

- natural gas could increase its market share to approximately 10 % by 2020,
- hydrogen is the potential future main energy carrier. Its share of fuel consumption could reach a few percent,
- biomass-to-liquid (BTL) fuels could largely enhance the market share of agro-fuels beyond 6 % by 2010, with the maximum potential for all biomass-derived fuels being estimated at about 15 %,
- liquefied petroleum gas (LPG) is an established alternative motor vehicle fuel with scope for additional market share, possibly up by 5 % by 2020,
- in brief, alternative fuels have the potential to increase their market share in the coming decades and, in the long term, to exceed the 20 % target indicated for 2020.

2.5 The EESC welcomed this communication, and in a previous own-initiative opinion ⁽¹⁾ singled out the development of natural gas ⁽²⁾, research into crop-based fuels, and improving the energy performance of fuels currently on the market as the best way to diversify supply and, at the same time, reduce greenhouse gas emissions.

⁽¹⁾ OJ C 195 of 18.8.2006, p. 75-79.

⁽²⁾ The development and promotion of alternative fuels for road transport in the European Union (OJ C 195 of 18.8.2006, p. 75-79).

3. Climate change

3.1 A growing body of scientists now agree that the climate is directly affected by greenhouse gas emissions. During the 20th century, the average temperature has risen by approximately 1 °C. A number of scenarios based on current climatic models reflecting trends of global GHG emissions are being put forward predicting that the average global temperature could rise by 2 °C to 6,3 °C, with devastating effects on the weather, sea levels, agricultural production and other economic activities.

3.2 The Environment Council held in Luxembourg on 28 June 2007 reaffirmed the relevance of the 6th Environmental Action Programme and the Commission's proposal for a mid-term review, emphasising the four priorities it sets out: tackling climate change; halting the loss of biodiversity; reducing the adverse effect of pollution on health; and promoting the sustainable use of natural resources and managing waste sustainably.

3.3 The Environment Council endorsed the strategy for an integrated climate and energy policy and the need to open negotiations to achieve a comprehensive post-2012 agreement by 2009. In a statement to the High-level meeting held on 27 September 2007 in New York, the President of the European Council, José Sócrates said that 'The UN climate change process is the appropriate forum for negotiating future global action. In this context, the Bali Summit ⁽³⁾ at the end of this year stands as a milestone, where we expect the international community to launch an ambitious roadmap for negotiations on a global and comprehensive climate change agreement'. The presence of the United States, which only overcame its reservations about participating in mid-October, and its vote in favour of the final resolution, have significantly strengthened the decisions taken, given the economic weight of the United States and its responsibility for greenhouse gas emissions.

3.4 The Environment Council emphasised the importance of internalising environmental costs as well as energy consumption costs in order to achieve long-term sustainable policies. Equally important is the increased use of market instruments in environmental policy, including taxes, levies and emission certificates, for the benefit of the environment. Eco-innovation should be rapidly integrated on a large scale into the impact assessments of all relevant EU policies as well as wider and more effective use of financial instruments, especially in connection with fuel and energy consumption.

3.5 On 29 June 2007, the Commission adopted its Green Paper on adapting to climate change. During his presentation of the Green Paper, EU Environment Commissioner Stavros Dimas set out a number of practical and immediate measures for adapting to the climate change that was already underway. Rising temperatures, flooding and torrential rain in the north, drought and heat waves in the south, endangered ecosystems, new diseases were just a few of the problems mentioned in the text.

⁽³⁾ United Nations Climate Change Conference in Bali, December 2007

3.6 'Adapt or die' — according to Dimas, this was the choice facing some of Europe's sectors. Agriculture, tourism and energy would suffer devastating consequences and we needed to act now in order to limit future economic, social and human costs.

3.7 The document puts forward a number of practical solutions: reducing water waste, building dykes and flood barriers, developing new crop protection techniques, protecting the populations most affected by climate change, adopting measures to safeguard biodiversity. Nevertheless reducing CO₂ emissions remains the key objective for EU countries.

4. The European Council

4.1 The Spring 2007 European Council discussed energy and the climate and proposed adopting 'an integrated climate and energy policy', identifying it as an absolute priority and stressing 'the strategic objective of limiting the global average temperature increase to not more than 2 °C above pre-industrial levels'.

4.2 The Energy Policy for Europe (EPE) clearly sets out a strategy based on three pillars:

- increasing security of supply;
- ensuring the competitiveness of European economies and the availability of affordable energy;
- promoting environmental sustainability and combating climate change.

4.3 With regard to transport policy: 'The European Council stresses the necessity of an efficient, safe and sustainable European transport policy. In this context, it is important to proceed with actions to increase the environmental performance of the European transport system. The European Council notes the European Commission's ongoing work regarding the assessment of external costs for transport and their internalisation'. The European Council of 21 and 22 June took note of the Commission's intention to come forward no later than June 2008 with a model for assessing internalisation for all modes of transport and mapping out further steps consistent with the 'Eurovignette' Directive, by extending, for instance, the field of application to urban areas, making all types of vehicles or infrastructure subject to tolls.

5. Greenhouse gas emissions

5.1 With regard to emissions, transport is currently responsible for 32 % of total energy consumption in Europe and 28 % of total CO₂ emissions⁽⁴⁾. The sector is believed to account for

⁽⁴⁾ The EEA (European Environment Agency) recently published its annual report on Transport and Environment: on the way to a new common transport policy, which assesses the performance and efficiency of the transport sector in integrating environmental policies and strategies.

90 % of the increase in emissions between 1990 and 2010 and could be one of the main reasons why the Kyoto objectives will not be met. Road passenger transport is set to rise by 19 %, whereas road haulage should increase by over 50 %, according to the Commission's estimates.

5.2 Another sector to have experienced exponential growth is aviation transport, which registered an 86 % increase in emissions between 1990 and 2004 and makes nowadays 2+ % of global emissions.

5.3 TERM 2006 (Transport and Environment Reporting Mechanism)⁽⁵⁾ considers that the progress made by the transport sector in 2006 is still unsatisfactory. The report examines the mid-term review of the 2001 Transport White Paper, which could bring improvements or negative effects depending on how it is interpreted at national and regional level. The EEA considers that, concerning the environment, the mid-term review changes the focus from managing transport demand to addressing existing negative side effects, i.e. transport demand growth is no longer explicitly identified as one of the main environmental issues within the transport sector. Key issues such as climate change, noise and landscape fragmentation caused by excessive transport infrastructure still hinge on the need to manage transport demand. This is something which the White Paper appears to have failed in this respect.

5.4 Another significant point raised in the report is transport subsidies, which in the EU amount to around EUR 270–290 billion. Almost half this amount is spent on road transport, one of the least eco-friendly modes. 'Transport contributes to several environmental problems such as climate change, air emissions and noise and is at the same time favoured by significant subsidies. Road transport receives EUR 125 billion in annual subsidies, most of it as infrastructure subsidies, assuming that taxes on road transport are not regarded as contributions to finance infrastructure. Aviation, as the mode with the highest specific climate impact, gets significant subsidies in the form of preferential tax treatment, in particular exemptions from fuel tax and VAT, which add up to EUR 27 to 35 billion per year. Rail is subsidised with EUR 73 billion per year and benefits the most from other on-budget subsidies. For water-borne transport, EUR 14 to 30 billion in subsidies have been identified. (Size, structure and distribution of transport subsidies in Europe EEA)'.

5.5 According to the Annual European Community greenhouse gas inventory 1990–2005 and inventory report 2007:

- EU-15 GHG emissions decreased by 0,8 % (35,2 million tonnes CO₂ equivalents) between 2004–2005

⁽⁵⁾ The report is published on the website: Annual European Community GHG inventory 1990–2005 and inventory report 2007, European Environment Agency, Technical Report No 7/2007.

- EU-15 GHG emissions were 2,0 % lower in 2005, compared to the Kyoto Protocol base years
- EU-15 GHG emissions decreased by 1,5 % between 1990 and 2005
- EU-27 GHG emissions decreased by 0,7 % (37,9 million tonnes CO₂ equivalents) between 2004 and 2005
- EU-27 GHG emissions decreased by 7,9 %, compared to 1990.

CO₂ emissions from road transport decreased by 0,8 % (6,0 million tonnes CO₂ equivalents) between 2004 and 2005.

6. Security of primary energy supplies

6.1 The European Union depends on imports (91 % of which being oil) for over 50 % of its energy needs. Unless this tendency is drastically reversed, this dependence rate will have risen to 73 % by 2030. The Council, as well as the European Parliament on several occasions, and the Commission itself have dwelt on this vital issue, stressing the need to adopt policy measures aimed at achieving the highest possible level of energy self-sufficiency.

6.2 In its Resolution on the macro-economic impact of the increase in the price of energy⁽⁶⁾, adopted on 15 February 2007, the EP noted that the transport sector accounted for 56 % of total oil consumption. It advocated an EU strategy to phase out fossil fuels completely, arguing that 'transport fuel supplies could be expanded by facilitating the production of unconventional oil and liquid fuels based on natural gas or coal where this is economically reasonable'. The EP also called for a framework directive for energy efficiency in transport to be adopted and the harmonisation of passenger car legislation, including an EU-wide harmonised CO₂ based vehicle taxation with labelling procedures and fiscal incentives to diversify energy sources. Finally, the EP called for the development of vehicles with low CO₂ emissions, using second generation biofuels and/or bio-hydrogen fuels (biomass-derived hydrogen).

6.3 The crisis with Russia, which culminated in the decision taken on 1 January 2006 to reduce energy supplies to Kiev, and endemic political instability in the Middle East, have confronted Europe with epochal challenges, i.e. successfully ensuring secure and sustainable energy supplies in anticipation of increased future pressure on the demand for fossil fuels.

6.4 At present, European production of alternative and renewable energy sources for the transport sector is almost exclusively restricted to biofuels, which currently cover only 1 %

⁽⁶⁾ Resolution on the macro-economic impact of the increase in the price of energy — Rapporteur: Manuel António dos Santos (PES, PT).

of Europe's energy needs in the transport sector. In its opinion⁽⁷⁾ on the progress made in the use of biofuels, (the Committee argued that the policy thus far pursued should be reconsidered, emphasising second-generation agrifuels. At the same time, the development of second-generation conversion technologies should be promoted and supported: they can use raw material from 'fast-growth crops', based principally on herbaceous or forestry crops or agricultural by-products, thereby avoiding the use of the more valuable agrifood seeds. Bioethanol and its by-products in particular, which are currently obtained by fermenting (and subsequently distilling) cereals, sugar cane and beet, may in future be produced from a wide range of raw materials, combining waste biomass from agricultural crops, residue from the wood and paper industries, and other specific crops.

7. Transport mix

7.1 The energy mix in transport is to a large extent determined by the modes of transport chosen to meet various freight and passenger journey needs. It is important because different modes of transport have more or less dependence on hydrocarbons. Accordingly, any strategy for the optimum energy mix in transport must seek to reduce passenger and freight dependence on fossil fuels.

7.2 The main options for doing this are twofold. First, changes need to be made in hydrocarbon efficiency and transport priorities; these are discussed elsewhere in the Opinion. Second, priority must be given to the use of electrical power. With existing energy sources and the future potential of alternative energy sources we can be optimistic about the future for clean electricity supply. The challenge is to use more electricity in transport.

7.3 The transport mode with the greatest electric potential is rail, whether for passengers or freight and whether international, national, regional or urban. The expansion of rail transport powered by electricity can reduce short haul air traffic, long distance road freight transport and bus and car usage generally.

7.4 In its agenda, the European Rail Research Advisory Council (ERRAC) emphasises the challenges it faces in enabling rail transport to triple its freight and passenger volume by 2020. The development of energy efficiency and environmental issues are at the heart of the initiative. Research under the TEN projects is focusing on the possible applications of hydrogen fuel cells, which could be integrated in the traction vehicle electric system and which would gradually substitute the fossil fuel-driven locomotives currently in operation.

⁽⁷⁾ Communication from the Commission to the Council and the European Parliament Biofuels Progress Report — Report on the progress made in the use of biofuels and other renewable fuels in the Member States of the European Union (COM(2006) 845 final), rapporteur: Mr Iozia.

7.5 For the foreseeable future air transport will remain dependent on hydrocarbon fuels but the introduction of high speed train (HST) services should significantly reduce the number of scheduled flights over distances of less than five hundred kilometres. Air freight is growing faster than air passenger traffic, using dedicated transport aircraft. Some of it, especially commercial mail services, could be diverted in future to the HST network. This change in the transport mix would be accelerated by an increase in HST links to airports.

7.6 The Advisory Council for Aeronautical Research in Europe (ACARE) is engaged in upholding its own Strategic Research Agenda, which examines the general issue of climate change, noise pollution and air quality. The 'Clean Skies' Joint Technology Initiative will explore the best solutions for sustainable aviation transport in terms of design, engines, and fuels. The SESAR project should make it possible to achieve vast economies by rationalising the air traffic management system (see EESC opinion).

7.7 National and international road freight traffic is a major user of hydrocarbon fuels. A 21st century high speed freight network operating between major inter-modal nodes could achieve a material reduction in road freight transport. As the HST network develops, it could be used overnight for freight traffic. Such a change in mix would be accelerated by a pricing strategy for roads, fuels and vehicle licences.

7.8 The European Road Transport Research Advisory Council (ERTRAC) has also adopted a strategic research agenda, with the environment, energy and resources as its focal points. A reduction of up to 40 % in specific CO₂ emissions (per kilometre) for passenger cars and up to 10 % for heavy duty commercial vehicles by 2020 are among the agenda's foremost objectives. There is also a specific chapter on fuels.

7.9 Water transport is generally supported by public opinion, whether it be river canal, coastal or oceanic. River, canal and coastal freight are energy efficient alternatives to road transport and should be encouraged in the transport mix.

7.10 Intercontinental maritime transport is actually a greater user of hydrocarbons than aviation and is also growing faster. It accounts for about 95 % of world trade by volume and it is relatively efficient but it is a serious source of sulphur and nitrogen oxide emissions.

7.11 With the globalisation of supply chains and the emergence of the Asian economies, intercontinental maritime transport is expected to increase 75 % by volume over the next fifteen years, with the consequent growth in emissions because this traffic is diesel powered. With the growth in emissions and the reducing supplies of hydrocarbon fuels, will we finally reach an era when long distance freight traffic between major ports on all five continents is going to be shipped in super-scale bulk

carriers powered by alternative fuels rather like modern submarines, aircraft carriers and ice breakers? That would certainly change the energy mix in transport.

7.12 In the maritime sector, the 'Waterborne' technology platform is developing research in order to improve marine engine yields overall, reduce drag, and test for alternative fuels, including hydrogen.

7.13 Passenger cars are multifunctional and indispensable vehicles which most people need to carry on their daily lives. Nevertheless, within a strategy to change the transport mix, there are opportunities to replace urban and suburban bus and passenger car journeys by electric powered trains and trams.

7.14 The relative energy density of different fuels must be taken into account when selecting the most appropriate and efficient ones. Efforts should therefore focus on the use of the highest energy density fuels. The following table provides examples of a number of density values, expressed in MJ/Kg.

Fuel	Energy content (MJ/Kg)
Pumped stored water at 100m dam height	0,001
Bagasse ⁽¹⁾	10
Wood	15
Sugar	17
Methanol	22
Coal (anthracite, lignite)	23-29
Ethanol (bioalcohol)	30
LPG (liquefied petroleum gas)	34
Butanol	36
Biodiesel	38
Oil	42
Gasohol or E10 (90 % petrol and 10 % alcohol)	44
Petrol	45
Diesel	48
Methane (gaseous fuel, compression dependent)	55
Hydrogen (gaseous fuel, compression dependent)	120
Nuclear fission (Uranium, U 235)	85 000 000
Nuclear fusion (Hydrogen, H)	300 000 000
Binding energy of helium (He)	675 000 000
Mass-energy equivalence (Einstein's equation)	90 000 000 000

⁽¹⁾ From Wikipedia: biomass remaining after sugar cane stalks are crushed to extract their juice.

Source: J.L. Cordeiro based on IEA and US Department of Energy

7.15 In summary, there are clearly opportunities to change the transport mix in a way which would have a material impact on the hydrocarbon dependency of the EU transport sector. The key to this is the generation of more electricity which will allow the further development of electric powered transport as well as providing the energy source for any ultimate development of hydrogen power.

8. A hydrogen society

8.1 Environmental damage is caused mostly by the products of combustion of fossil fuels, but also by the technologies used to extract, transport and process them. However, the worst damage results from their final use. More specifically, in addition to carbon dioxide, combustion releases elements added at the refining stage (lead substances for example) into the atmosphere.

8.2 Global demand of 15 billion tonnes of oil equivalent is predicted in 2020, with an average rate of growth of more than 2 %. This demand will have to continue being met principally by fossil sources, currently accounting for between 85 % and 90 % of world energy supply. However, a progressive shift in focus is already under way regarding low carbon/hydrogen (C/H) ratio fuels, moving away from carbon to oil and methane, and gradually progressing towards full decarbonisation, i.e. using hydrogen as an energy carrier.

8.3 Interesting data on experiments with hydrogen fuel cell technology, as applied to public transport buses in Porto, was presented at a hearing in Portugal. The changing attitude of the general public towards hydrogen was of particular interest: the information provided has helped to substantially reduce mistrust regarding this energy carrier. It should be borne in mind that hydrogen is not a freely available primary energy vector, but must be produced by using:

- hydrocarbons such as oil or gas, resources which are still plentiful but not renewable,
- electrolysis from water, using electrical energy.

Annual world hydrogen production stands at 500 billion cubic metres, equivalent to 44 million tonnes, 90 % of which is obtained from the chemical process of reforming light hydrocarbons (mostly methanol) or cracking heavier hydrocarbons (oil), and 7 % from coal gasification. Only 3 % is produced by electrolysis

8.4 Calculations according to the lifecycle method have shown that the quantity of greenhouse gas emissions produced when using hydrogen produced by conventional means (i.e. electrolysis), in the light of the energy mix in Portugal, which already includes a significant renewable component, is 4.6 times greater than the emissions from engines using diesel or natural gas, and three times greater than those from petrol engines. This means that the prospects for widespread use of hydrogen

depends on the development of renewable energies with very low greenhouse gas emissions.

8.5 The consumption curve has shown that to keep engines at peak efficiency, even when turning over, considerably greater higher amounts of hydrogen than of conventional fuels must be consumed. This clearly demands further thinking on its future use in urban transport, which entails frequent stops on account of both traffic and its inherent service patterns.

8.6 It should however be remembered that the Porto experiments were carried out in a much broader context than the CUTE (Clean Urban Transport for Europe) project. The overall results of the project differ from those discussed during the hearing, due to a number of differences concerning terrain, traffic conditions and methods of use. The project's overall results are encouraging and also shed light on problems associated with its development. The key problem, in the opinion of the Commission, is an apparent inability among high-level political leaders to grasp fully the potential and advantages presented by significant progress in the use of hydrogen for road transport.

8.7 The most appropriate solution for reducing emissions seems to be fully electric traction, entailing the development of electricity generation from renewable sources, or hybrid use of natural gas and hydrogen, at least for as long as significant availability exists. Reliable studies on this alternative have not yet been carried out, but it does appear to be the most efficient, according to some efficiency and energy potential parameters.

8.8 Another intermediate possibility might be the use of a hydrogen/methane blend, with low hydrogen content. This method represents an initial step towards the use of hydrogen in mobility. It involves few disadvantages: since the distribution and on-board storage systems are the same, it can be used by existing cars, yielding performances similar to those with methanes, but reducing emissions and increasing the speed of combustion, thereby reducing particles and the formation of nitrogen oxides.

8.9 Recent research carried out by the Denver Hithane Project, Colorado State University, and in California, with the support of the Department of Energy and the National Renewable Energy Laboratories, has demonstrated that a blend of 15 % H₂ with CH₄ cuts total hydrocarbons by 34,74 %, carbon monoxide by 55,4 %, nitrogen oxide by 92,1 % and carbon dioxide by 11,3 %, as reported by a study presented by ENEA (*).

8.10 H₂ production using renewable energy is the only option which amounts to more than a 'green daydream'. As an energy storage element, hydrogen allows energy supply, which is periodic by nature (night/day, yearly cycles, etc.), to be brought into line with variable, de-coupled energy demand. Hydrogen should be produced using the least energy-intensive technology,

(*) Ecomondo — Rimini, November 2006 — Mr Giuseppe Nigliaccio ENEA.

with a full analysis of the production cycle and its match with the requested energy service. All renewable energies that can be linked to use in the form of heat, electrical energy or fuel, should be pursued without passing through the longer hydrogen cycle, and therefore put into direct use.

8.11 Another factor that should be considered is production close to consumption, cutting the transport-related costs and emissions. This theory, which is valid in general, is all the more valid if applied to energy efficiency, in view of the costs of dispersion due to transmission and distribution: in consequence, the other aspect to be considered is the territorial spread of production.

8.12 Prospects for the use of hydrogen also depend on the territorial spread of the distribution network. As with the problems encountered with CNG (compressed natural gas), whose distribution network is extremely patchy and, in some Member States, virtually absent, distribution centres for vehicles using hydrogen fuel cells are non-existent. The introduction of CNG, and further ahead of hydrogen, must be backed up by mass distribution policies.

8.13 The European Commission has earmarked EUR 470 million to set up the Fuel Cells and Hydrogen Joint Undertaking (COM(2007) 571 final), on which the EESC is currently drawing up an opinion. This should speed up the use of hydrogen — something which is clearly also of interest to the transport sector. The Community funding is matched by the same amount from private industrial sector, providing a total of some EUR 1 billion to speed up the introduction of hydrogen in Europe. The fund will finance technology initiatives for producing hydrogen fuel cells, and a programme of technological research and implementation. The research is to be carried out by public-private partnerships in industrial and academic circles, and will continue for a six-year period. The aim is clear: to put hydrogen vehicles on the market in the course of the ten years between 2010 and 2020 — in other words, starting three years from now.

8.14 Many hydrogen vehicles could be ready to enter the market today. But there is no common, standard and simplified procedure for the type-approval of hydrogen powered vehicles. At present, hydrogen vehicles are not covered by the Community type-approval system. Defining European standards would help to reduce the risk margin in research for car manufacturers, as they would be able to assess which prototypes would have real market potential.

8.15 The Zero Regio project, co-financed by the European Commission, comprises the construction and experimental use of two innovative multifuel and hydrogen supply structures, one in Mantova and the other in Frankfurt, using various technological options to produce and supply hydrogen. In Mantova, the hydrogen is produced within the service station using a 20 mc/h natural gas reformer. The technology employs a high-temperature catalyser process with a pre-blended flow of vapour and natural gas that is converted into hydrogen in a series of steps.

The vehicle fleet currently comprises three hydrogen fuel cell-drive Fiat Panda cars. There are also plans to supply hydro-methane. The Mantova and Frankfurt service stations are also considered to be 'Green Petrol Stations', as in order to help reduce CO₂ emissions, they are fitted with photovoltaic equipment of 8 and 20 kWp respectively, capable of generating renewable source electricity equivalent to approximately 30 000 kWh/year, representing a reduction of about 16 tonnes/year of CO₂ emissions.

8.16 Carbon dioxide capture and sequestration techniques are very costly and affect final production efficiency, raising serious issues regarding possible future risks of pollution of water tables or sudden, massive releases of carbon dioxide. The idea of producing hydrogen by using carbon is problematic⁽⁹⁾.

8.17 Recent studies⁽¹⁰⁾ have revealed a hitherto neglected problem, i.e. the potential consumption of water if the hydrogen society develops rapidly. The study is based on current levels of water consumption by electrolysis production and power plant cooling systems. The resulting data is worrying since it is estimated that 5 000 litres of water are required to produce one kilo of hydrogen for cooling alone, and at present efficiency standards, over 65 kW per kg.

8.18 The use of hydrogen as an energy carrier adapted to transport purposes — albeit subject to the limitations pointed out — represents a challenge for the future, and the possibility of seeing vehicles running partly or fully on hydrogen may become a fact in only a few years, provided that research continues to be supported by the national and European authorities.

8.19 As it has previously said in relation to energy efficiency (TEN/274), the EESC considers that it would be most helpful to have a web portal, where university research and national, regional and city-based experiments could be shown to a broader audience, and in particular local administrators. The exchange of best practices is essential for highly subsidiarity-based policies, i.e. decided at local level.

⁽⁹⁾ The currently established technology involves pulverised coal plants using the classic vapour cycle and processing of the products of combustion discharged during the procedure. In practice, vapour is produced at 'conventional' pressures and temperatures to drive turbines in plants which are as yet few and far between. There are currently four types of plant, in descending order in terms of technological development and environmental impact: supercritical and ultra-supercritical pulverised coal; fluid bed combustion; combined cycle gasification; and lastly combustion with oxygen. Two solutions exist today which in any case provide for geological CO₂ sequestration; these are coal combustion in boilers, in which oxygen is used to bring about a high concentration of CO₂ at discharge, thereby reducing capture and sequestration costs; and the use of integration gasification combined cycle technologies, which produce a synthetic gas which is then purified, therefore separating the high-grade, combustible part of the CO₂.

⁽¹⁰⁾ Webber, Michael E. 'The water intensity of the transitional hydrogen economy.' *Environmental Research Letters*, 2 (2007) 03400.

8.20 The following European average figures should be published on the web portal:

- grams of CO₂ emitted into the atmosphere in generating 1 kWh of electricity;
- quantity of CO₂ emitted in agriculture and diesel fuel manufacture for the production of one litre of diesel substitute;
- quantity of CO₂ emitted in agriculture and bio-ethanol manufacture for the production of one litre of bio-ethanol.

This is the only way of quantifying actual CO₂ emissions and savings and converting kilowatt-hours saved correctly into the equivalent weight of CO₂.

9. General comments and recommendations of the EESC

9.1 In response to Commissioner Barrot's request, the EESC has drawn up this opinion in order to provide the Commission and other EU institutions with civil society's views on what needs to be done to meet the challenges presented by the Kyoto Protocol.

9.1.1 The EESC considers it essential to combine discussions on the future fuel mix with a significant change in current modes of transport, giving preference to urban and extra-urban public transport, which will entail modernised vehicle fleets and better infrastructure. The quality and efficiency of rail transport will have to be improved through investment in infrastructure and rolling stock and, as a result, the electricity generation required to sustain the development of rail transport will have to rely increasingly on renewable energy and low carbon fuels.

9.2 In a previous opinion (TEN/274, rapporteur Mr Iozia), the EESC had stated clearly that 'the transport sector has striven hard to reduce energy use and pollutant emissions, but it is right to call for a further effort, given that it is the fastest-growing sector in terms of energy use and a source of greenhouse gases' and that the 'fact that European industry relies on third countries for transport fuel increases its responsibility to make a key contribution to energy efficiency and the reduction of emissions and gas and oil product imports'.

9.3 The EESC shares and supports the view that efficiency, security and sustainability will therefore serve as the European institutions' baseline principles for evaluating the policies to be followed and the measures to be adopted to promote cleaner energy use, a cleaner and more balanced transport sector and greater corporate responsibility in Europe without compromising the competitiveness of European firms, as well as to create a framework that fosters research and innovation.

9.4 The future transport fuel mix will therefore have to include these characteristics: reducing greenhouse gas emissions

overall; reducing as far as possible energy dependence on third countries and diversifying energy sources; keeping costs consistent with the competitiveness of the European economic system.

10. Challenges relating to the EU transport sector's future fuel choices: investing in research

10.1 If the absolute priority is compliance with the Kyoto objectives, the bulk of available public and private resources should be channelled into research on fuels that fully meet the indispensable requirements of economic efficiency, environmental sustainability and low emissions for managing eco-friendly transport.

10.2 Cooperation between universities, research centres, the fuel industry and manufacturing industry, and the automotive industry in particular, must be further developed. The Seventh Framework Programme (7FP) implemented by Council Decision No 971/2006/EC concerning the Specific Programme 'Cooperation', sets leadership in key scientific and technological areas as one of its objectives. These priorities include the environment and transport.

10.2.1 The need to improve the efficiency of traditional batteries is being neglected. Developing electric cars depends on reducing the weight and improving the autonomy and performance of traditional batteries. The EESC recommends that the Commission make a specific commitment in this direction.

10.3 In its opinion on the 7FP ⁽¹⁾, the European Economic and Social Committee expressed its concerns regarding the scarcity of fossil fuels, steadily rising prices and the effects of climate change. It advocated allocating more funds to the energy sector in general while stressing how the challenge in dealing with the critical issues in the transport sector could secure sufficient funds, estimated at EUR 4 100 million for 2007-2013.

11. Ensuring the competitiveness of European economies and the availability of affordable energy

11.1 The EESC underscores the fundamental aspect of the Union's strategy, ensuring the EU's competitiveness, which is undoubtedly based on affordable and stable prices. Transport has always been the only means of transferring freight, passengers and animals to markets. It is now of vital importance to another crucial European industry, i.e. tourism. The third aspect of sustainability, price, is the most complex challenge. At present, there are no alternative fuels that can compete with oil and natural gas in terms of price. Despite increases in recent years, these products are still the most competitive.

⁽¹⁾ Official Journal — 2006/C 185/02, 8/8/2006 (rapporteur: Mr Wolf, co-rapporteur: Mr Pezzini).

11.2 Nevertheless, while advocating a steady increase in the use of biofuels and other renewable energy fuels, the EESC considers it essential to step up applied research into second-generation agro-fuels, which use waste or non-food biomass, and are free of the disadvantages of the first generation, i.e. those derived mainly from cereals, beet and sugar cane, or from oilseeds for human or animal consumption ⁽¹²⁾. The Committee stresses that the cost assessment should not be restricted exclusively to the cost of the final product. A correct comparison of costs vis-à-vis fossil fuels must take into account the internalisation of all external costs (environmental damage, location of production sources, processing costs, water consumption and land use, etc.).

11.3 Gradual substitution, where component mixing processes are not possible, should run parallel to a gradual adaptation and/or overhaul of distribution systems that take into account the physical quality of the new products.

11.4 Although the EESC supports the positive aspects of this strategy, it is nevertheless aware that it will be expensive, especially in its initial phases, and therefore liable to reduce the European system's competitiveness. However, the EESC underlines that, in order to avoid this risk and so as not to limit the global impact, Europe must spearhead a movement that will ultimately lead other parts of the planet in the same direction.

11.5 The investment required in the field of alternative biomass-derived energy sources must be able to rely on a stable regulatory framework. This entails adapting directives on fuel to the new production methods, clear cooperation with the manufacturing industries, in order to enable innovation processes to proceed in line with the industry's true potential. Specific attention, in addition to 7FP projects, has to be focused on relevant innovation and research at both central and peripheral levels.

11.6 If the efforts and investment put into developing new efficient and sustainable fuels are not to be wasted, we need to bolster these processes with initiatives aimed at increasing the service speed of vehicles, reducing consumption, taking action, for instance, on European road junctions that create bottlenecks in national and urban traffic. The Lisbon public transport authority Carris, which supplements its traditional trams (the legendary No 28) with a fleet of eco-friendly buses, has reduced CO₂ emissions by 1,5 %, by means of measures which have boosted service speeds, such as doubling priority bus lanes.

11.7 The Coimbra transport authority, SMTUC, has for its part experimented with a blue line comprising electrically-powered buses, which operate in the city centre along reserved lanes with no specific stops — they may be boarded at any point. A blue stripe painted on the roadway indicates the route, partly for the benefit of non-residents and the many tourists who prefer this type of efficient and clean transport. Coimbra's trolley buses are also particularly appreciated: thanks to their back-up batteries, they can avoid traffic congestion by diverting from their overhead lines. This mode of transport combines very low levels of atmospheric and noise pollution with a well above average vehicle service life, absorbing the higher initial purchasing costs.

11.8 The EESC recommends appropriate tax incentives for these urban transport vehicles (reduced rates for purchasing eco-friendly vehicles or, alternatively, special funding for local authorities, lower prices for ecobuses), and publicity campaigns on the use of ecobuses, which should be carried out with coordination at European level, upgrading and expanding park-and-ride facilities — where necessary stepping up security — and maintaining low prices, and integrating them with urban transport facilities, as is already the case in many European cities.

11.8.1 The Green Paper *Towards a new culture for urban mobility* COM(2007) 551, published by the Commission on 25 September 2007, looks at these problems and proposes solutions involving support for urban public transport rehabilitation projects financed under the ERDF and the CIVITAS programme. The Commission's Green Paper sends out a powerful message promoting eco-friendly urban transport, and the EESC agrees with this approach and recommends exploring other practical initiatives on the basis of positive experiences and through strengthened cooperation with the EIB and the EBRD.

11.9 The future of urban transport, as discussed in a previous EESC opinion ⁽¹³⁾, clearly lies with public transport. Two research projects, already at the experimental stage, were presented during the hearings for the present opinion: an electric minicar, that can be driven without a driving licence, and a cybernautic vehicle, operated by a complex system of remote controls, that can run along predetermined routes. These vehicles could be hired for inner city travel, perhaps replacing the toll charges applicable to bulky and polluting vehicles.

Brussels, 13 February 2008.

The President
of the European Economic and Social Committee
Dimitris DIMITRIADIS

⁽¹²⁾ See EESC opinion TEN/286 following the plenary session of 24/25 October.

⁽¹³⁾ OJ C 168 of 20.7.2007, p. 77-86.