

Fuel choices for public transport Environmental demands and efficiency

Update 2006

A FIRST UITP POSITION PAPER ON FUEL CHOICE WAS PUBLISHED IN SEPTEMBER, 2000. SINCE THEN THE DEBATE HAS INTENSIFIED WITH AN INCREASED NUMBER OF ALTERNATIVES NOW AVAILABLE AND A GREATER GLOBAL FOCUS ON FOSSIL FUEL SUPPLIES.

IT IS NECESSARY THEREFORE TO UPDATE UITP'S POSITION WITH NEW ELEMENTS AND RECOMMENDATIONS, TAKING INTO CONSIDERATION THE VIEWS OF THE DIFFERENT ACTORS: ORGANISING AUTHORITIES, OPERATORS, THE BUS AND FUEL INDUSTRIES AS WELL AS THE GENERAL PUBLIC. THIS PAPER WILL COMPLEMENT A UITP POSITION PAPER ON CLIMATE CHANGE.

THE REPORT ON "CLEAN FUELS FOR ROAD PUBLIC TRANSPORT", PUBLISHED IN 2005 BY UITP, IS TAKEN AS A REFERENCE FOR THE PURPOSE OF THIS UPDATE. UITP RECOGNIZES AND THANKS THE VALUABLE INPUT FROM ITS MEMBERS WHO CONTRIBUTED TO THAT PUBLICATION AND TO UPDATING THIS POSITION PAPER.

1. State of play

Public urban and peri-urban bus transport (PT) systems with buses are only responsible to a very low degree for local environmental pollution, as their energy consumption per passenger/km is one-third of that of a car and as the number of vehicles involved is extremely low. Vehicles with internal combustion engines generate 22% of total CO₂ emissions, and of

these only 5% is generated by buses and coaches. Therefore, bus transport is not, in principle, an essential target in the fight against CO₂.

But because of the public nature of their activity, usually in close relation with or even regulated or funded by public bodies or authorities, bus operators have an extended responsibility in environmental matters. And in this respect, the evolution in recent years has been dramatic:

- a) much greater public awareness about climate change and fossil fuels shortage
- b) press coverage of the latest technical developments (fuel cells, electric vehicles, diesel engines)
- c) stricter local operating requirements stemming from sensitivity about quality of air and urban life
- d) coming into force of the Kyoto Protocol, having an unavoidable, though indirect, impact on PT

This means that the PT operators and the relevant authorities in this sector have to step up their commitment. Possibly, in the long term, new forms of advanced propulsion systems (hybrid drive, fuel cells, induction, etc.) will become widely accepted due to their low noise emission levels, comfort and environmental friendliness. But until these advanced

Trend of peak values of the four regulated pollutants (in g/kWh)						
	EURO I (1993) ¹	EURO II (1996) ¹	EURO III (2000)	EURO IV (2005)	EURO V (2008)	EEV optional (from 2008)
Carbon monoxide (CO)	4.5	3	2,1	1.5	1.5	1.5
Unburnt hydrocarbons (HC)	1.1	0.95	0.66	0.46	0.46	0.25
Nitrogen oxides (NOx)	8	7.2	5	3.5	2	2
Particles	0.36	0.14	0.1	0.02	0.02	0.02

¹ 13-mode cycle equivalent

road vehicles reach a reasonable price and level of technical efficiency, the strategic policy question of the choice of fuel and drive for immediate compliance with increasingly strict legislation (see table above) must clearly be answered.

Involvement in environmental issues is taking place with similar or even stronger commitment in different parts of the world. The EURO emissions limits are taken as reference in almost all continents (America, China, Australia), and thus, the US Environmental Protection Agency more stringent emissions standards, to be phased in between 2007 and 2010, whereby the emission limits are about *half of those specified in Europe* for EEV engines, have to be strongly welcome.

Also the fact that compliance with these emissions limits has to be demonstrated *either* over the useful life of the engines *or* over a number of years or range is a consistent approach, and these periods have been defined respectively in the US and in Europe as well.

A major concern regarding air quality is the fact that recent scientific discoveries indicate that the toxicity of particles is linked more to their size than to their number and mass – the smaller they are, the more carcinogenic their impact. The emissions standards are likely therefore to evolve in more stringent requirements for particle size and other sub-products limitations.

Buses with EEV-Standard certifications, together with gas, diesel-electric and other hybrid drivelines are perfectly suited to particularly sensitive zones, complementing other measures such as a ban on cars, or segregated lanes for PT, and the like.

2. Fuels, drive-chains, vehicles

Numerous alternative fuels exist. A European Commission action plan provides for a 20% substitution of conventional fuels such as petrol and diesel with alternative fuels by 2020, heading in the direction of policies aiming to ensure that a certain percentage of newly commissioned vehicles fulfil the EEV-standard. This is the proof of how many changes there have been in the last five years.

Some of the most important technical developments are:

- Exhaust gas aftertreatment;
- Sulphur-free diesel fuel (35 to 10 ppm in Europe, 15 ppm in US);
- Natural gas as a practical, conventional fuel alternative;
- Renewable biofuels (eg. liquids, biodiesel and ethanol, and biogas) – these are already realistic alternatives;
- Electric vehicles (e.g. diesel-electric vehicles, hybrid vehicles, fuel cells);
- Renaissance of tramways and trolleybuses.

At present, the use of following fuels and related drivelines seems feasible, and their current state-of-the-art can be seen in the enclosed Appendix, under the following headings:

- Diesel fuel
- Natural gas - CNG
- Liquid gas - LPG
- Biofuels
- Hydrogen and fuel cells
- Hybrid vehicles

UITP RECOMMENDS

In general:

- Ensure that the choice of fuel is based on an in-depth economic and ecological (“well-to-wheels”) study*, taking local circumstances into account.
- Encouraging an approach to reconcile the economic aspects, the environmental requirements and special local needs.
- Support research, development, testing and demonstration projects in the field of clean fuels and vehicles.

To Organising Authorities and other regional, national and international agencies:

- Promote public transport and modal shift as an excellent means of saving energy and reducing emissions.
- Incorporate environmental impacts, clean fuels use and energy savings in the tender evaluation process.
- Recognize that there is a need for public funding and fiscal incentives to encourage clean energy use and cleaner vehicles;
- Generate public awareness that the environmental benefits of using clean fuels, energy efficiency and cleaner vehicles are of substantial public interest.

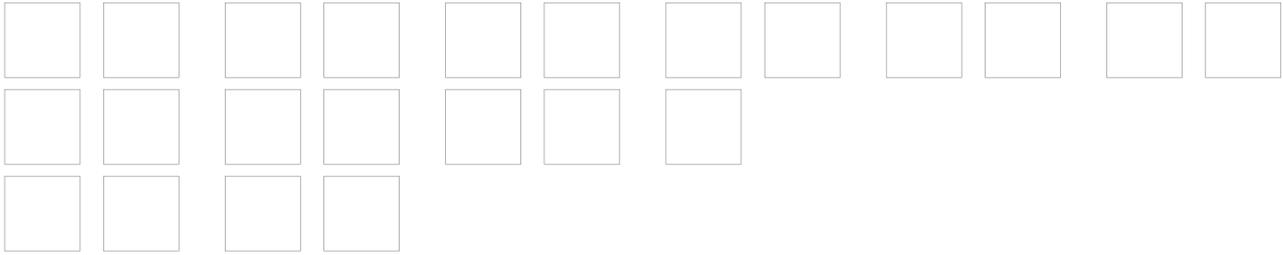
To Operators:

- To report on their overall energy use and performance;
- To recognize that additional comfort levels (such as air conditioning) must be compatible with a wider energy savings policy;
- To devote more effort and resources to the training of driving personnel in energy saving, environmentally friendly driving styles.
- Undertake information campaigns on energy issues and fuel choice in order to attract future customers.

To Vehicle- and Energy-Providers:

- Enhance the global use of clean-fuel powered vehicles and the use of new energies;
- Research and develop new drive systems and reduce the cost of them ;
- Endeavour to develop energy storage, energy efficient technologies, recycling and to reduce the weight of vehicles.

* Well-To-Wheels: the integration of all steps required to produce and distribute a fuel (starting from the primary energy resource) and use it in a vehicle.



3. What price for which environmental performance?

Due to the differing experiences and development of the different technologies it is difficult to evaluate operational costs. Through UITP Sustainable Development Charter signatories, real experience has been acquired. The adoption of the possible alternatives must be also evaluated considering the possibilities of the research institutions and those of the industry in granting the necessary investments for the new technologies, which in turn depends on real market expectations and requirements.

Other economic factors not to forget are the increasing incidence of infrastructure costs, in procurement, maintenance, safety provisions, along with some legal concerns (eg. a bus depot is not a fuel manufacturing or treatment station).

Experience has shown that alternative fuels are not likely to become competitive versus conventional solutions unless an increase in these prices occurs (as it is the case now). Only then will alternatives become economically sustainable, but in any case at a rather higher price than now.

Environmental requirements and sustainability needs are therefore pushing costs up, and consequently the big dilemma surrounding how this higher cost is to be paid by society will require a mixed answer, because all environmental issues affect society as a whole and not only PT users.

The manner in which the necessary public funding of public transport can be secured will depend very much on how the costs can be reduced and how a *market for new technologies* (allowing profits to be invested in further development) can be built.

4. The greenhouse effect

Experts claim that carbon dioxide (CO₂) will be THE challenging problem of the century. Therefore, sustainable fuels producing fewer greenhouse gases are needed and in the meantime, as a general practice of good governance, an energy saving effort should be made.

This goal can be reached in two ways: first by means of energy storage systems (well suited to the stop-and-go operating mode of PT in cities), and secondly by speeding up the flow of PT vehicles. In this case, not only the fuel consumption is reduced, but as a result of an increase in the average driving speed of 3 km/h (for example by systematic right of way) pollutant emissions can be halved.

Some considerations on reduced consumption auxiliary elements (air conditioning, which is currently responsible for some 10% of increase in fuel consumption) or on best usage of the systems are also useful in this respect.

This is an official position of UITP, the International Association of Public Transport. UITP has over 2700 members in 90 countries throughout the world and represents the interests of key players in this sector. Its membership includes transport authorities, operators, both private and public, in all modes of collective passenger transport, and the industry. UITP addresses the economic, technical, organisation and management aspects of passenger transport, as well as the development of policy for mobility and public transport world-wide.

This Focus Paper has been prepared by the Bus Committee in cooperation with the Sustainable Development Commission and the UITP-EuroTeam and has been approved by the UITP Policy Board.

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