EBU-Statement on Inland Navigation and Environmental Sustainability in the Danube River Basin

25 JUNE 2007

Pollution reduction

Inland navigation is an environmentally friendly mode of transport: highly energy efficient and thus emitting relatively small amounts of harmful substances. Over the past decade, however, trucks have drastically reduced their NO_x, SO_x and Particulate Matter (soot) emissions. No reason for sorrow about NO_x, SO_x and PM, however: a variety of measures can be taken to restore or even increase the environmental advantage of inland navigation. What's needed are more stringent regulations and application of technical measures to the ship itself.

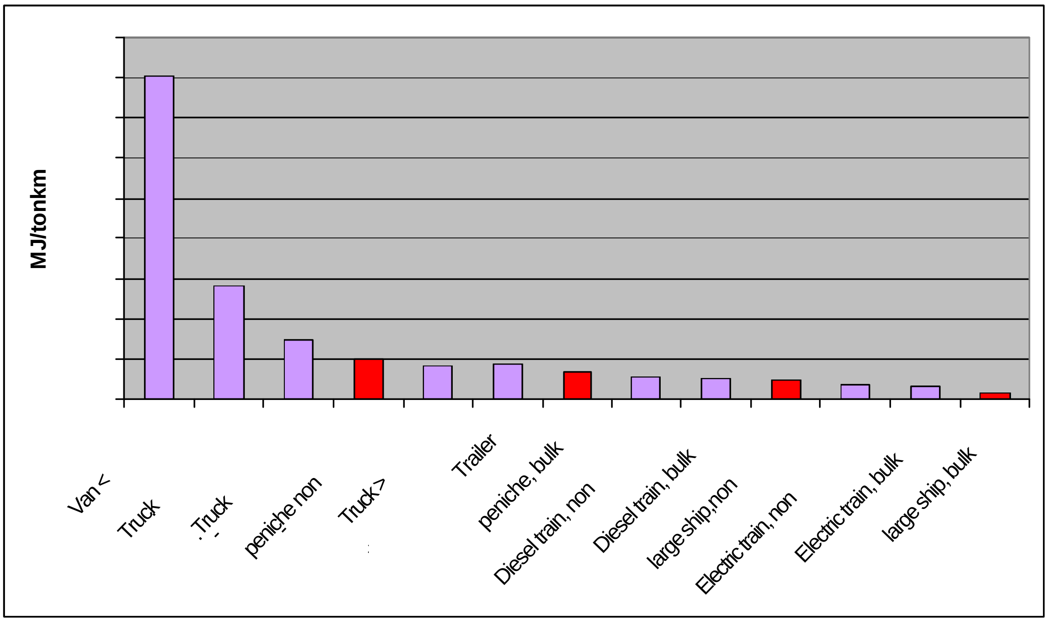

Figure 1: Energy consumption per tonkm, data from report "To shift or not to shift", CE Delft, 2003

The very first step leading to further emission reductions should be a fast introduction of low sulphur fuel. Low sulphur fuel will in itself reduce emissions considerably SOx by 98% and PM10 by 17%), but is also a prerequisite for application of various other after treatment emission reduction techniques like SCR catalysts, soot filters etc. By using these techniques 80 to 90% of the remaining NOx and PM10 in the exhaust gasses can be reduced.

New engines can run on low sulphur fuel without technical problems; for older engines potential problems can be coped with by fuel additives or fuel type adapted lubricants. From fuel quality tests it is for instance already concluded that the lubricity of the ultra low sulphur road diesel (EN-590) is better than the currently used gasoil with a maximum sulphur content of 2.000 ppm.

As indicated before, inland navigation has long been considered the cleanest way of transporting goods. Fuel consumption per tonkm of waterborne transport is roughly 1/3 of that of road transport. As a result, CO2 emissions in inland navigation account for 1/3 compared with the ones associated with road transport. Additionally, other emissions like NOx and PM are partly lower – depending on the specific transport case, the age of the ship engine and the truck EURO level used for comparison.

Road transport and inland navigation (CCNR) emission regulations have developed fully different, however, as shown in figures 2 and 3.

The EU has set its own emission limits for inland ships, but those are based on marine engines and therefore are less stringent, at least for EU stage IIIA limits to be implemented in 2007. These rules allow up to 0.5 g/kWh of PM and 11.0 g/kWh of HC and NOx combined. At the end of 2007, the European Commission will consider further tightening of these demands. This is also reflected in the CCNR rules regarding NOx emissions: as engines get bigger ((power over 560 kW and rpm under 2800 (phase 1) or 3150 (phase 2)) more NOx may be emitted. For phase 2, this value becomes as high as 11 g/kWh at revolution rates under 343 per minute. Proposed EU stage IV envisions similar rules as CCNR stage III.

Both EURO (truck) and CCNR (inland ship) standards define maximum emissions per kWh of energy consumed, resulting in the following comparative graphs for NOx and PM emissions:

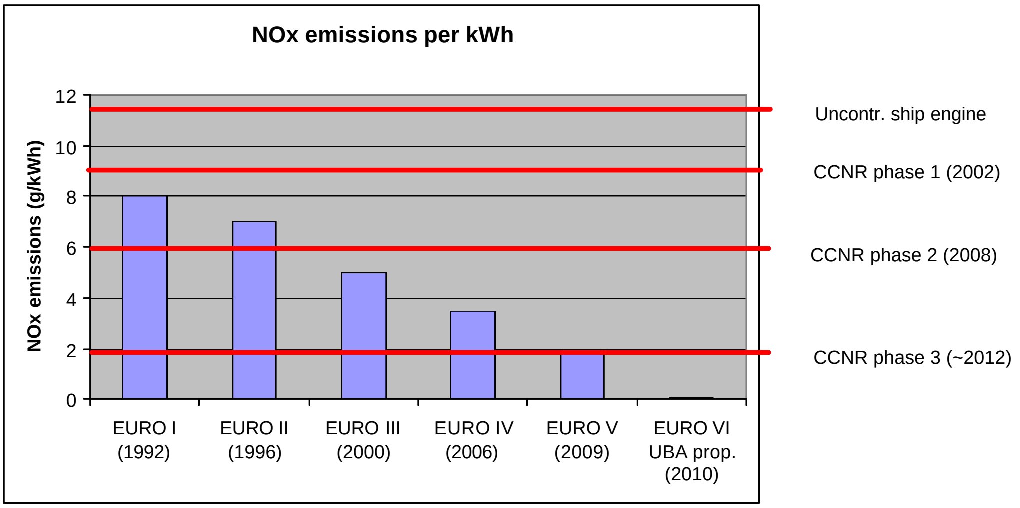

Figure 2: Maximum NOx emissions according to EURO (truck) and CCNR (ship) standards

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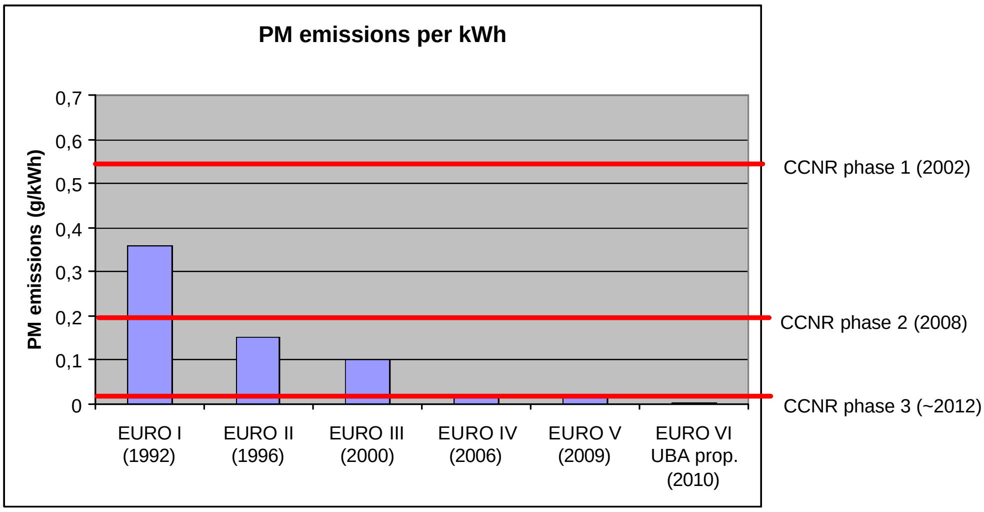

Figure 3: Maximum PM emissions according to EURO (truck) and CCNR (ship) standards

Conclusions and recommendations regarding emission regulations are:

- The various graphs show a serious time lag in implementation: requirements for inland navigation will not be up to the current standard for road transport until 2012. Even then, since the lifespan of marine engines may be up to 20 years, it will take a very long time for CCNR phase 3 standards to be common practice in the inland navigation sector.
- The most crucial and first step, at the shortest notice possible should be: reduce the allowed sulphur content for diesel oil used for marine diesel engines to 10 ppm.
- Lower emission limits are required in order to keep the future emissions caused by inland navigation (related to the transported mass) below road transport emissions.
- Only a combination of lower emission limits, low sulphur diesel oil and financial incentives for implementation of emission reduction techniques will pave the way for a major improvement in emission reductions from inland navigation.

Ship technology

The current inland shipping fleet can mainly be divided in dry cargo ships and tankers. The major part of the fleet exists of the dry cargo ships which are, with exception to a few specialised ships, mainly designed as multi-purpose ships. Even the container ships are in principle dry cargo ships for which the cargo hold dimensions are adapted to the container dimensions. The hull forms, materials, construction methods and propulsion systems are almost identical for the complete fleet and in principle based on standard drawing packages. Dedicated optimised ship designs are not common in the inland shipping sector. Pending on the size, type and sailing area of the ships, it is expected that the ship designs can be further developed and optimised.

Two major innovation themes within the inland shipping market are:

1. the application of new materials and construction methods for light weight constructions with equal strength and safety requirements as the current fleet, and
2. energy efficiency, that can be improved by the use of more energy efficient propulsion systems and/or by more optimised hull forms

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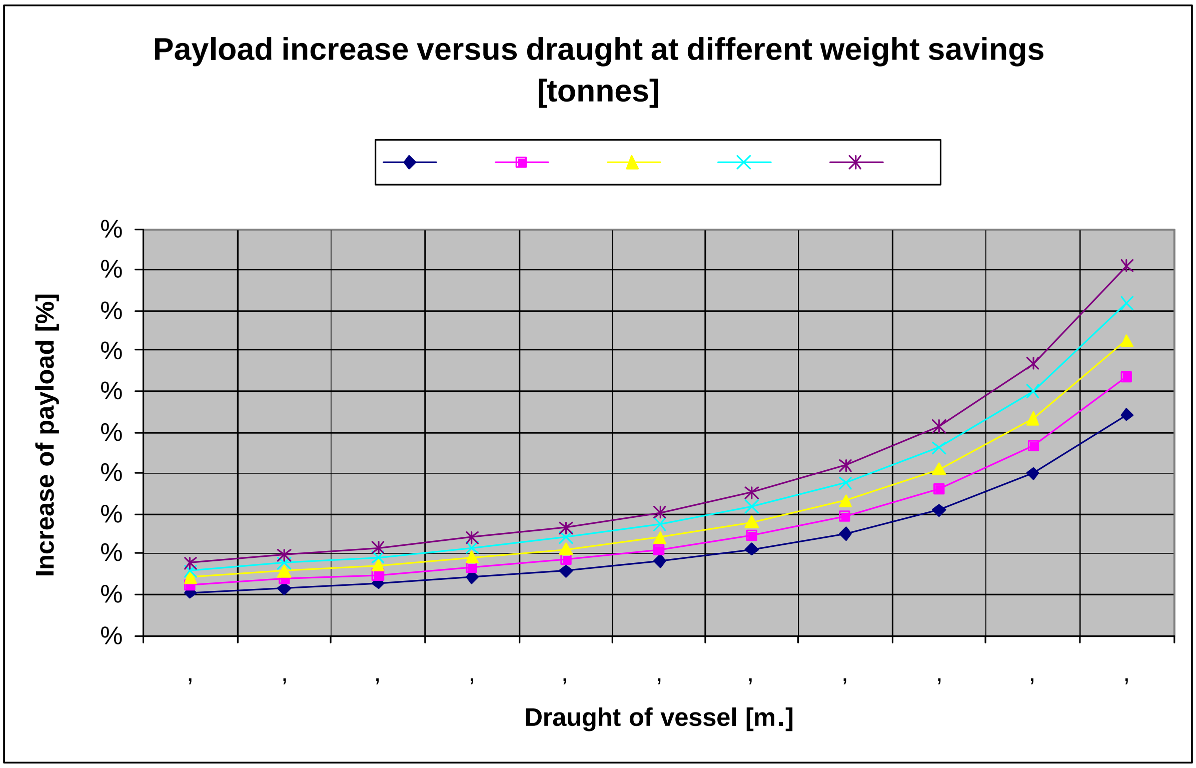
With respect to the light weight materials and/or construction methods, the ship types can mainly be divided in dry cargo ships and liquid cargo ships, in especially the double hull tankers are relatively heavy.

With respect to the energy efficient propulsion methods, also looking at optimised hull form to minimise the resistant, the ship types can mainly be divided in deep and shallow draught ships. The deep ships in this respect are defined as ships where the loading capacity is limited due to the weight of the cargo (ore, coal, sand, oil etc.) and the shallow ships are defined as ships where the loading capacity is limited due to the volume (containers, RoRo, passengers, gas etc.).

The application of other materials and/or construction methods for hull construction

Due to climate changes, it is expected that the water levels on the so called rain rivers will fluctuate more in the near future. Due to more extreme rain and dry periods, longer periods of respectively high water levels and low water levels will appear. Especially during the low water level periods the loading capacity will be reduced due to the limited draughts of the ships. By using light weight types of construction materials and/or construction methods, the light ship weight can be reduced. This weight saving can be fully used as additional cargo capacity within the same dimensions of the ship. In other words, at the same draught, the light constructed ships will be able to carry more cargo weight, compared to the current ships. The advantages of light weight ships are valid in all water depths, however, the effectiveness of it will be relatively more when the water depth is restricted, like during dry periods, but also for canals and rivers like the Danube which have already limited water depths in some bottleneck areas. For instance, a “normal” constructed ship with a loading capacity of 2.500 tonnes at a draught of 3,0 meters will have a loading capacity of 1.400 tonnes at a draught of 2,0 meters. When it is assumed that the weight reduction for this ship can be 200 tonnes, the loading capacity at 3,0 meters will become 2.700 tonnes and at 2,0 meters 1.400 tonnes, respectively an increase of 8% versus 14%. The relative gains in payload are shown in the following figure.



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The effectiveness is also dependent for the type of ship. For instance, the double hull inland tanker ships are relatively heavy compared to dry cargo ships. This is by the additional steel which is required for the double hull construction. Another consequence of the double hull vessels is the loss of cargo tank volume. This loss of volume is compensated by the depth increase of these type of ships, which results in an additional increase of the lightship weight. The photograph bellows gives a good impression of the depth increase.

This volume compensation can be achieved by the larger ship sizes with a beam of at least 11,40 meter. For the smaller ship with a smaller beam the volume cannot be completely compensated and for the very small ships, the double hull construction cannot be applied at all due to the loss of cargo tank volume.

Besides the weight saving aspect, also the safety aspect should be taken in account, especially for the tanker market. The goal should be to examine the application of other materials like sandwich panels and the use of other construction methods that result in the same safety level against possible leakage of cargo in case of collisions, as the current double hull constructions.

A third aspect of the use of other materials like sandwich panels, which should be taken in account in the examination is the insulation value of these materials. An increased insulation value will enable for instance the transport of cooled cargo.

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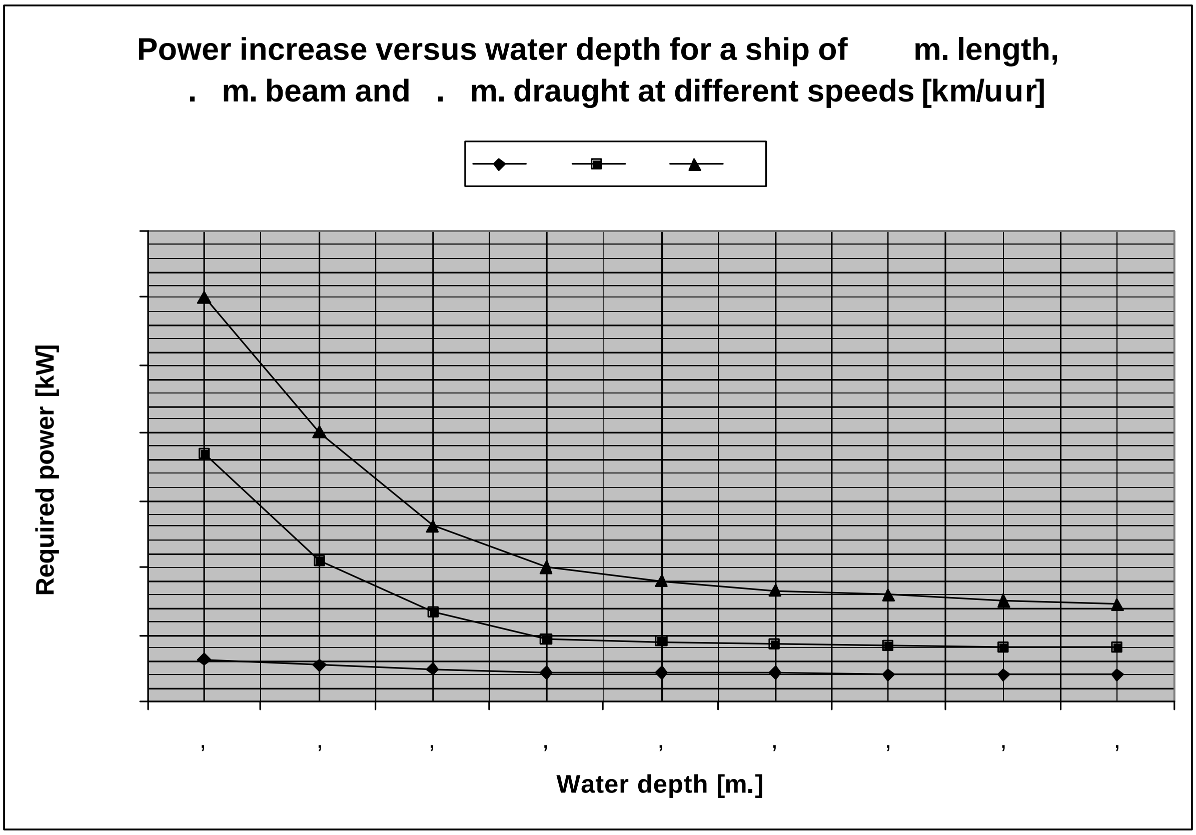
Energy efficiency

A way of emission reduction is the use of cleaner engines and exhaust treatment equipment as described before. Another method is the use of fuel saving techniques. This is not only good for reducing the emissions but also for reducing the costs if inland water transport.

Fuel saving can mainly be done by reduction of the ship's resistance due to hull optimization or air lubrication or by increasing the propulsion efficiency by using different propulsion techniques like contra-rotating propellers, tip plate propellers or by optimising the water flow towards the propellers.
Also weight reduction as described above, leads to fuel consumption reduction when based on the transport capacity. If the loading capacity of the ship is increased within the same ship dimensions, the required energy for propulsion will not be changed while reaching the same speed, simply as the hull dimensions (and herewith the resistance) remains the same. Per transport capacity (weights x distance) the use of energy, and the consequential emissions, will be reduced with the same percentages as the increase of loading capacity.

The influence of the water depth is very important for the resistance of the ships as well as the efficiency of the propellers. The influence hereof is shown in the following figure:



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Up to the present situation, only little is known on behaviour of ships in relation to its restricted environment. Research focussed on improving this situation can improve the inland water transport. This can lead to better design of the aft ship (allowing the propellers to get more water) as well as better performance of the propellers itself.

26 June 2007

The European Barge Union EBU was founded on 14 December 2001 with seat in Brussels and in Rotterdam.

EBU represents the interest of inland navigation on a pan European level and deals with all questions, arising out of the future development of the inland navigation industry and inland waterway transport.
To realise this aim EBU is active in the field of

- the development of the European transport policy
- the improvement of the economic position of inland navigation
- the structured cooperation with national and international institutions
- the exchange of information and experience between the parties involved

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