



TT-Line

Efficient and environmentally sound transportation of people and goods across the sea

The Green Bridge Concept

(2nd revised edition, Dec. 2008)

An information brochure on

- Ships as environmentally sound and climate friendly carriers
- The Baltic Sea as the first SO₂-reduced shipping area in the world
- TT-Line's Green Bridge Concept



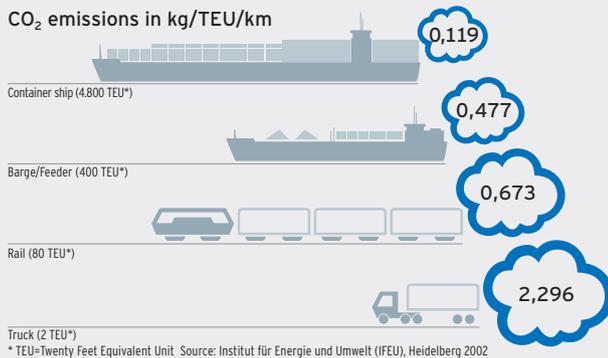
Introduction

Our globalized economy is dependant on reliable and effective transportation while increasing traffic is at the same time a burden for our environment. The key to finding the most environmentally sound means of transporting goods and people is the choice of carrier.

Ships have the best environmental track record

Due to their large carrying capacity compared with rail, air and road, ships have the lowest emission of toxic substances per transported load and consequently the best environmental performance.

CO₂ emissions in kg/TEU/km



For each tonne of transported freight the emission levels of nitrogen oxides (NO_x), particles and particularly carbon dioxide (CO₂) from ships are clearly below those of other carriers. The environment benefits most when shipments are moved from road to sea (e.g. the EU programme 'From Road to Sea').

In order to reduce emissions further, the biggest challenge for shipping is the lowering of SO₂ emissions. Sulphur dioxide arises from the sulphur in marine fuel. The more sulphur the fuel contains, the more SO₂ is released into the atmosphere through the funnel.

The sulphur content of marine fuels and consequently the level of sulphur dioxide emissions are regulated by international regulations of the International Maritime Organization (IMO). In Europe, further regulations by the European Union are setting additional and to some extent higher demands on shipping.

Challenge: sulphur in fuel

Present

The most widely used fuel worldwide for ocean-going ships is a by-product of crude oil processing and therefore contains a certain proportion of sulphur derived from the crude oil. Compared with this so-called heavy fuel oil, the sulphur content of diesel oil is lower, as diesel oil is a distillate. Diesel oil is rarely used as fuel for large marine diesel engines because it is about 80% more expensive.

According to information from DNV Petroleum Services, the average sulphur content of all fuels used in the second half of 2007 was 3.53% in the Middle East and 2.62% worldwide. There are now various techniques available that make it possible to reduce the sulphur content of heavy fuel oil to about 0.5%, but not much more below that. The diesel oil used for sea transport has a maximum sulphur content of 0.1%.

The Baltic Sea - the first 'SO₂ reduced' zone

With effect from 19th May 2006, the IMO designated the Baltic Sea the world's first marine area to be subject to tighter restrictions on the sulphur content of fuel. Within this ECA (Emission Control Area), marine fuel must not contain more than 1.5% sulphur. Since August 2007, the same rules also apply in the North Sea.



Special EU regulations for clean air at ports

From 1 January 2010 new rules come into force for EU ports in addition to the IMO regulations: in all EU ports, ships at berth will only be allowed to use fuels containing no more than 0.1% sulphur. This rule applies to vessels docked for more than two hours. As no heavy fuel oil is available with such a low sulphur content, this regulation means that ships will have to change over to a different fuel, i.e. diesel oil, for a certain time. In technical terms this is not a straightforward procedure and is also not without its risks.

Future

Two different targets

In October 2008, the IMO decided on a phased reduction in the limits on the sulphur content of marine fuels. Two different targets were set, one for global shipping and one for the ECA zones (the North Sea and the Baltic Sea).

Global:

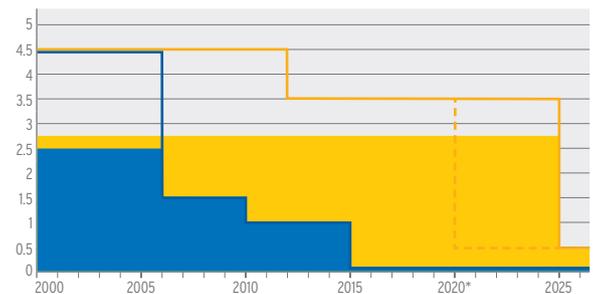
For global shipping, the IMO is planning a long-term reduction in sulphur content to a maximum of 0.5%. After an initial, small reduction from 4.5% to 3.5% with effect from 2012, all worldwide shipping apart from in the North Sea and Baltic Sea has until 2025 to switch to a fuel with a maximum sulphur content of 0.5%. This means that global shipping will continue to use heavy fuel oil for now.

ECA (North Sea and Baltic Sea):

The plan for the North Sea and Baltic Sea (the ECAs) is quite different: a further two-stage reduction is planned, starting from the 1.5% limit on sulphur content already in place (since 2006). From March 2010, the limit for ships in the ECAs, i.e. the North Sea and Baltic Sea, is cut to 1% (through its Green Bridge concept, TT-Line already meets this requirement). The second stage involves a further reduction, for the ECAs, to

the very low limit of 0.1% from as early as 2015. As explained above, this not only involves a further lowering of the regional sulphur limit by the relatively small amount of 0.4%, but will also require ships to switch to a different type of fuel, resulting in considerably higher running costs.

Maximum fuel sulphur content under IMO rules (in %)



- Average for global shipping**
(inc. Irish Sea, Mediterranean, Black Sea)
99.7% of the global marine area
- Average for shipping in the ECAs (North Sea and Baltic Sea)**
0.3% of the global marine area
- Maximum fuel sulphur content under IMO rules, global shipping**
- Maximum fuel sulphur content under IMO rules, ECA shipping (North Sea and Baltic Sea).**

* subject to a feasibility study in 2018. If in 2018 the study finds that it is not possible for a sulphur content limit of 0.5% for global shipping to be implemented by 2020, the limit will come into force in 2025.



In view of the global nature of shipping and the whole problem of SO₂ emissions, uniform limits do have to be set worldwide in the future to ensure a lasting improvement. The IMO's favoured solution involving special regional rules for the ECAs is problematic.

The stipulation, which applies only to the ECAs, that only fuels with a maximum sulphur content of 0.1% (diesel oil) may be used from 2015, will put North Sea and Baltic Sea shipping companies at a massive disadvantage. The high price of diesel oil will push up shipping costs on the North Sea and Baltic Sea considerably, resulting in a potentially ecologically damaging modal shift from shipping onto the roads, as this cost disadvantage will not affect road transportation. This goes against the EU's drive for a shift 'From Road to Sea'. If they are no longer profitable, shipping companies may pull out of the North Sea and Baltic Sea. Modern, environmentally friendly but expensive ships may be withdrawn from the economically unattractive ECA zone and used in other areas that promise to be more profitable. The maritime economy (ports, shipyards etc.) of the North Sea and Baltic Sea is bound to be affected by this.

Unequal conditions within the EU

A severe imbalance in the maritime economy is emerging within the European market, as the ECA special rules do not apply to the Irish Sea, the Mediterranean and the Black Sea. In the long term, this inequality in shipping conditions within Europe poses the risk of a decline in the maritime infrastructure of the North Sea and Baltic Sea, resulting in restricted (ecologically sustainable) marine mobility in the North Sea and Baltic Sea. The IMO's special solutions for the ECAs must therefore be rejected.

Solutions

In the long term:

Technical developments may help to further reduce the pollutant emissions of transport modes in the future. Marine diesel engines, for example, are constantly being improved with the aim of increasing efficiency while at the same time cutting pollutant emissions. Some pollutants can be further reduced with the use of catalytic converters and filters. In the medium to long term, the use of alternative fuels such as liquefied natural gas (LNG) or hydrogen is conceivable for specialized regional transport. Research on these is already in progress, but the supply issue also needs to be solved first.

Many of these techniques can only reasonably be used on new vessels, often for reasons of space. Ships currently have a service life of around 30 years. In the case of ferries, the figure is often far higher. It is clear from this that the introduction of new technologies across the board is not going to happen overnight, and most probably will not be feasible until 2015.

In the short term

The best solution is to set the sulphur reduction target for the ECAs at the same level as for global shipping. A maximum sulphur content of 0.5% is feasible in the ECAs, by as early as 2015, in other words much sooner than stipulated for global shipping. Most of the problems already mentioned would be avoided by doing this. The cost of sulphur-reduced heavy fuel oil (0.5% sulphur) would be about 20% more, and not 80% more as would be the case for diesel oil (0.1% sulphur). The region would be spared the problem of modern fleets abandoning the North Sea and Baltic Sea with all the negative follow-on effects. With a 0.5% limit, sulphur emissions would be cut by a factor of 5 within 10 years, from 2.5% in 2005 to 0.5% in 2015 - a major step towards better environmental protection in shipping.

Global shipping will not yet have to reduce its emissions during the same period - the far higher limit will continue to apply (see table/chart above).



TT-Line: A Green Bridge between Germany and Sweden

Based on the Green Bridge Concept, TT-Line proves that an efficient and environmentally friendly link for carrying goods and people across the sea is possible today, not just in the future.

Harnessing technology to protect the environment

Diesel-electric propulsion

Four of TT-Line's six ships are fitted with a diesel-electric propulsion system. This propulsion concept means that the ships' diesel engines can always operate under optimum conditions, irrespective of the speed and operating condition of the ship, leading to lower emissions. These ships are called Green Ships due to their high environmental compatibility.

More pollution control at sea

Sulphur-reduced fuel with just 1% sulphur

At sea, TT-Line voluntarily exceeds the current (2008) legal requirements. Its Green Ships run on fuel containing only about 1% sulphur. So TT-Line is actively contributing to the reduction in global SO₂ emissions wherever this is economically feasible.

Cleaner air in residential areas close to ports

Diesel oil containing just 0.1% sulphur

Since 1st January 2008, TT-Line ships have been using only diesel oil with a sulphur content of no more than 0.1% for on-board power generation when in port in Trelleborg. With six ships and up to eight arrivals daily, this is producing a substantial improvement in air quality in the residential areas in the immediate vicinity of the berths. This means that TT-Line has already more than met the future EU requirements in Trelleborg, although using diesel oil entails considerable additional costs.



Maximum sulphur content of fuel in 2008

	International shipping (outside ECA)	North Sea and Baltic Sea (ECA-Region)	TT-Line
At sea	4,5%	1,5%	approx. 1%
In ports	4,5%	1,5%	0.1 to approx. 1%
In EU ports from 2010		0,1%	



TT-Line: Lasting commitment to climate and environmental protection

For years now, TT-Line has been implementing solutions for an environmentally sound ship operation, as far as this is economically possible. Since 1995, TT-Line has introduced four newbuildings with an environmentally friendly diesel-electric propulsion system (Green Ships), two of them with innovative pod propulsion.

Unlike conventional drives where the diesel engine transmits the power directly to the shaft line, diesel generators on board these four TT-Line ships produce electric power for all the shipboard power requirements just like a power station. Even the ship's propellers are driven by two large electric motors. This has the advantage that the diesel engines can run with constant speed which ensures always low emissions even during unfavourable operating conditions. Consequently, when running at part load (e.g. during manoeuvring in port or estuary trading), the diesel-electric propulsion will reduce nitrogen oxide emissions by up to fifty percent. At the same time, emissions of carbon monoxide, hydrocarbons and particles are considerably reduced.

The pod drives of the two latest diesel-electric ships PETER PAN and NILS HOLGERSSON represent a further technical innovation. In pods, the electric propulsion motors and the propellers are fitted in resp. to azimuthing gondolas, which are situated at the stern below the hull. Compared to conventional propulsion systems, these so-called pods achieve fuel savings of up to 15%. Consequently, climate-damaging CO₂ emissions are reduced while at the same time manoeuvrability is considerably improved.

Streamlined underwater hull forms ensure low fuel consumption, resulting in lower CO₂ emissions.



Further energy saving is achieved through utilization of heat recovery, e.g. from the cooling water for the diesel generators or from the exhaust gases.

Sewage is treated biologically on board. Solid waste, sludge and hazardous waste are separated and taken ashore for recycling and disposal.



Awards

- **In 2000** TT-Line was honoured as 'transport company of the year 2000' by the Swedish transport industry for its Green Ship Concept and its commitment to the environment.
- **In 2001** the Swedish information service 'ShipPax' nominated TT-Line for the '**Pioneering Ro-Pax Technology Award**' as 'the first Ro-Pax ferry with an installed pod drive, offering remarkable advantages in speed and manoeuvrability'.
- **In 2002** TT-Line was awarded the '**Lucia Prize**' by the Swedish government.
- **In 2003** TT-Line received the '**Innovation Prize**' from the Swedish Transport Industry Association.



Since 1962, TT-Line has been connecting Germany and Sweden. During this time it has been a market leader in direct passenger and cargo traffic between these two countries.

The shipping company has six vessels in operation in the Baltic Sea and offers up to 16 daily departures between Travemünde, Rostock and the southern Swedish ports of Trelleborg and Helsingborg.



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