Transport analysis

The consequences of more stringent sulphur requirements in marine fuels

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Summary

When the EU Sulphur Directive's[1] more stringent regulations enter into force on 1 January 2015, the maximum sulphur content of marine fuels used on vessels in the Baltic Sea, the North Sea, the English Channel and the North American coastal areas will be reduced to 0.1% sulphur by weight. Outside of these so called sulphur control areas, the requirement will be set to 0.5% by weight starting in 2020. In view of this, Traffic Analysis was commissioned by the Swedish Government in mid-April 2013 to study the consequences of more stringent sulphur requirements in marine fuels. Transport Analysis has taken into consideration and benefited from the work done by the Swedish Maritime Administration in updating the cost structure for maritime transport and industry in Sweden.

In accordance with the Government's commission, Transport Analysis is to assess the possible consequences of the amended EU Sulphur Directive regarding permissible sulphur content in both the short and long terms. Transport Analysis are to address a number of issues, including:

- the availability and price level of low-sulphur fuel,
- what adaptations can maritime transport be expected to make to counteract higher costs,
- effects in the form of changing modes of transport, and
- support measures that other Baltic countries intend to implement.

This report constitutes the final report of this commission. The work has been carried out in consultation with the Swedish Maritime Administration, the Swedish Transport Administration, and the Swedish Transport Agency. The Swedish Maritime Administration has contributed with analyses and texts, mainly concerning fuel costs and consumption in the maritime transport sector. The Swedish Transport Administration has provided some analysis regarding the capacity in the rail system, while the Swedish Transport Agency has provided documentation regarding the regulatory framework being developed to administer the Sulphur Directive. Industry and the maritime transport sector have also contributed with constructive viewpoints and dialogue in various stages of the study.

Problem set and methodology

Describing the consequences of more stringent sulphur requirements for marine fuels poses a challenge. Supply and demand for both engine technology and fuels will affect future fuel prices and the costs of technology solutions. An increase in these costs will simultaneously result, to varying degrees, in cost-saving adaptations in the form of slow steaming (lower

[1] Council Directive 1999/32/EC of 26 April 1999 relating to a reduction in the sulphur content of certain liquid fuels, as amended by 2005/33/EC and 2012/33/EU

speed), lower arrival frequencies, and, in the long run, larger vessels. Technology choices and fuel prices will, in combination with other adaptations, influence freight rates and ticket prices. At the same time, some impacts on fuel prices for goods vehicles are likely, resulting overall in changes in the relative prices of various transport solutions. This will lead in turn to adaptations in companies' warehousing practices, shipping frequencies, route selections, and choices of transport solutions. Transport costs will change differently for different industries, whose transport mileage and vehicle mileage will be altered. The Swedish industry will be affected, and Sweden's competitive status relative to other countries might change.

In terms of methodology, the report is based on earlier studies in the field and on new (model) analyses. Additional information has been collected through interviews and in meetings with numerous relevant actors in this field (e.g., industry organizations, industries, shipping lines, and government agencies). Because the calculated fuel consumption figures in the sub-report drew criticism, we have reviewed those calculations. Consumption has been determined at the individual level for vessels travelling to and from Sweden, and is based on Automatic Identification System (AIS) data wherever possible.

Technology choices

According to previous studies, the options of the maritime transport industry in terms of meeting the requirements within the Sulphur Emission Control Area (SECA) as of 1 January 2015 are as follows:

- Change of fuels
    - Low-sulphur marine gas oil (LSMGO)
    - Liquefied natural gas (LNG)
    - Methanol
- Scrubber technology and continued operation with heavy fuel oil (HFO)

The industry's short- and long-term choices will depend on what is expected to occur, primarily, in the fuel markets, on the technology front, and in terms of regulation.

Most Swedish maritime traffic is expected to run on low-sulphur marine gas oil (LSMGO) in 2015, when it is believed that only 1% of the Swedish maritime fleet will run on LNG and another 1% on methanol. The development of the scrubber option is completely dependent on technological advances and on regulations governing scrubber use in the Baltic Sea; all in all, it is believed that less than 1% of the fleet will install scrubbers between now and 2016. These estimates are based partly on a lack of access to and experience with this option, and on the fact that most vessels do not sail in SECA often enough for it to be profitable to convert an existing vessel to LNG or methanol operation, or to install scrubbers.

Fuel price and fuel cost increases

The availability of LSMGO is considered assured, although its price is expected to rise somewhat. Our analyses assume that the price of LSMGO will increase by 5–20% in 2015 compared with 2013. It is therefore expected that LSMGO will cost USD 340–480 per tonne more than the fuel used today (i.e., HFO containing a maximum of 1% sulphur by weight), corresponding to a fuel price increase of 50–75%. This presumed price development is based on assessments and forecasts made in earlier studies and on interviews. The outcome over the long term (i.e., up to 2030) is highly dependent on how the fuel market responds to an altered demand structure, which will in turn be influenced by technology choices in the maritime transport industry. Transport Analysis finds that, in any case, the total increase in transport costs resulting from the Sulphur Directive over the long term will not outstrip the "shock effect level" that will occur in 2015.

All in all, the total fuel cost for maritime operations on Swedish ports is expected to increase by SEK 4.5–6.4 billion in 2015, assuming that no adaptations occur. The cost will be lower if the available adaptations are taken into account. It should also be mentioned that the entire estimated cost not is referable to the Swedish economy, but to the international economy.

Adaptations and mode changes

Higher fuel prices will create incentives for adaptations in maritime transport and logistic chains. The extent to which these may occur will vary from case to case. In interviews with Transport Analysis, several shippers and shipping lines have indicated that their options in terms of adaptations are limited. From a historical perspective, adaptation to higher fuel prices has on the other hand been considerable, for example, in the form of new route planning, changes in departure frequencies, reduced speeds, and groupage freight. Even if the maritime transport industry can absorb a degree of fuel price increase, its relative competitive status to other modes of transport will be degraded, at least unless the price of fuel for goods vehicles rises excessively as a side effect of the new regulation.

Our calculations indicate that the transport tonne mileage for maritime operations could decrease by roughly 0.7 billion tonne kilometres. Including high prices for fuel for goods vehicles, the transport tonne mileage is estimated to decrease by, at most, roughly 0.5 billion tonne kilometres. The estimated impact is further reduced if the planned increase in Swedish rail track charges is taken into account as well. Rail traffic is initially expected to see an increase in demand, with the maximum increase in transport tonne mileage estimated at roughly 0.9 billion tonne kilometres. If high rail track charges are factored into the calculations, the corresponding figure is on the order of 0.7 billion tonne kilometres. However, the effects on rail traffic are considerably less in many of the cost scenarios tested. Transport tonne mileage by road is estimated to fall by, at most, just over 0.6 billion tonne kilometres, but this applies in connection with a dramatic increase in the price of diesel and more moderate cost increases for maritime shipping. If we look at lower cost increases for transport by road, we estimate that the transport tonne mileage could decrease by, at most, 0.4 billion tonne kilometres. Assuming no cost increase for transport by road, the transport tonne mileage by road will instead increase by 0.2 billion tonne kilometres. However, these scenarios, performed in this case using the Swedish national freight model (*Samgods)*, are encumbered by a degree of

uncertainty. The analysis still indicates that adaptation options potentially exist in the form of mode changes, as well as changes in route choices.

We estimate that transport volumes on the waterways of the Baltic Sea and along the Swedish west coast (Kattegat) will decrease, while the volumes on most ferry lines could instead increase. The Sulphur Directive could also increase the pressure on the Kiel Canal. With regard to railroads, higher volumes are anticipated via the bridge between Sweden and Denmark (the Öresund Bridge) and continuing on toward the northern European mainland. According to some scenarios, the volumes on the railroads to Gothenburg, at the Swedish west coast, could even decrease as shipments by rail toward Europe become more cost-effective. If we factor in dramatic cost increases for maritime shipping, the volumes to Gothenburg could increase somewhat as well. With respect to road traffic, the calculations indicate that the traffic flows to western Sweden (Västra Götaland) and southern Sweden (Scania) could increase, partly due to maritime shipments being relocated from ports along the east coast to ports along the west coast. The results also point to higher volumes to and from ferry terminals.

Simulated effects for the paper and steel industries

Because dependence on maritime transport, sensitivity to transport costs, and the options available in terms of adaptation differ between manufacturing industries, two specific transport chains have been studied in greater detail. The transport chains for paper and steel via the northern Baltic coast (Bothnian Sea) to destinations in Europe have been analysed using an agent-based model. The choice of transport chains has been made with a view to identifying chains representative of each type of goods in terms of shipments within the SECA. The simulations indicate that, given the transport cost situation that the Sulphur Directive is expected to generate, alternative transport chains that could be cost-effective are available. The alternatives tested were direct shipment by train to northern parts of mainland Europe, shipment via a west coast port rather than an east coast port, and co-loading using larger vessels. If these alternatives can be made feasible, they could reduce the anticipated transport cost increases. We estimate that the transport cost per tonne could increase by roughly 10% for the studied transport chain for paper from the ports in northern Sweden to England and the Benelux countries, and by roughly 3% for steel shipments from Mid-Sweden to Denmark.

If we study the Swedish counties' total transport costs for trade within SECA, Dalecarlia (a Swedish inland county with no coastline) is found to be affected relatively strongly, due to its high proportion of steel shipments. The northern counties will, except for Jämtland (antoher inland county), also be affected more than average.

A structural transformation resulting from higher transport costs could be both severe and costly to industry as a whole. Individual companies could be hit hard. In the long term, a structural transformation could however result in that Sweden is in a better position for the future.

Improvements for the environment

The Sulphur Directive will yield environmental benefits that are expected to fall within the range of SEK 1–4 billion, depending on the calculation method used. These environmental benefits are unevenly distributed, mainly benefitting the south-western parts of Sweden. However, an increase in goods vehicle traffic in this region as a result of the Sulphur Directive could counteract these benefits.

The Sulphur Directive is consistent with the basic environmental policy principle that polluters should pay for their environmental impacts and for measures to limit them.

Strained rail capacity

Combined with other impacting factors, the Sulphur Directive will further aggravate both known and new bottlenecks in the railroad system. However, according to the Swedish Transport Administration, sufficient capacity to absorb some more traffic is generally available. Efforts will nevertheless be required on the part of all actors involved, including railroad operators. The Transport Administration's forecasts also indicate that the railroads will, over time, collectively face significantly increased transport demand.

Support measures in other Baltic nations

Transport Analysis has noted certain initiatives in its inventory of state support measures in other Baltic nations. These initiatives appear to be most extensive in Finland, and include investment funding for purification measures and LNG technology. A corporate tax cut has also been tied to the issue. In Denmark we see a desire to support projects to establish bunker stations for LNG as well as certain other more minor measures.

Regulations falling into place

Efforts are underway at the Swedish Transport Agency to put the necessary regulations into place. This involves the requisite statutory changes and any other measures necessary for Sweden to implement the changes in the Sulphur Directive. An effort is also underway to determine how the monitoring of and compliance with the stricter sulphur requirements should occur.

Transport analysis

Transport Analysis is a Swedish agency for transport policy analysis. We analyse and evaluate proposed and implemented measures within the sphere of transport policy. We are also responsible for official statistics in the transport and communication sectors. Transport Analysis was established in April 2010 with its head office in Stockholm and a branch office in Östersund.

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