

**Conditions and policy instruments
for electrified vessels** **Summary
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Transport Analysis

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Summary

There are some twenty electrified vessels in Sweden. The corresponding global figure is roughly 400, which is a fraction of the total fleet size. The number of electric vessels is, however, growing rapidly, albeit from a low level, and good opportunities exist to electrify parts of our maritime transport operations, while there are also limitations.

The term 'electric vessel' encompasses technologies and installations that utilise electricity, such as energy storage or energy carriers, usually in the form of batteries. The electricity as energy carrier can be used to produce power for the entire vessel (battery-electric), for parts of it (battery-hybrid), or for propulsion. Although other alternative fuels such as electrofuels or fuel cells are not included in the analyses in this particular report, they are covered to some extent in the proposed policy instruments, as such technologies are often combined with a battery onboard the vessels. The approach taken in the future studies that we are proposing regarding a number of the policy instruments could also be broadened to include other alternative fuels.

The market for electrified vessels is growing

The potentials and markets for battery-electric and battery-hybrid vessels differ dramatically. Conditions favourable for battery-electric vessels are found primarily in the area of passenger service, which often involves short trips and regular travel to the same ports, and particularly if the need for speed can be kept low. Our analyses of the energy required per trip for passenger and RoPax ferries indicate that the total potential for battery-electric vessels corresponds to 12–20 per cent of the energy usage within that segment. With regard to most other maritime segments, the trips require more energy than current battery installations can deliver.

Conversely, the flexibility associated with battery-hybrid vessels is greater, and the market potential is considered to encompass the entire vessel fleet, as batteries can fill a role in the total energy system onboard, leading to higher energy efficiency and a roughly 10 per cent reduction in fuel consumption. Such vessels are not dependent upon charging current, although it is beneficial.

Port electrification goes hand in hand with vessel electrification

The electrification of our ports via infrastructure for charging current and shore-side power goes hand in hand with the development of electrified vessels. Sweden is a European leader in terms of the number of ports which offer some form of shore-side power, although total usage of shore-side power is low. According to our calculations, shore-side power accounts for just 5 per cent of the total energy used by dockside vessels in Sweden. The rest of the energy is produced onboard, mainly by diesel-powered generators. Negotiations are underway at the European level which, all things considered, will result in heavier requirements in terms of Swedish ports' offerings of and use of shore-side power by vessels, but this is a costly process for both ports and shipowners.

Transport Analysis calculations indicate that roughly 700 GWh are needed annually to meet the demand for shore-side power from all port calls in all our ports, excluding smaller passenger vessels. Added to this is an estimated 175 GWh in charging current, yielding a total of some 900 GWh. This figure may be compared to the estimated amount of electricity consumed by vessels in 2020, which totalled 34 GWh. The capacity demand may serve as the basis for future mapping of the need for investments in building out electrical infrastructure in ports, and how it can be integrated into the electrical grid. This information is reported as one of the measures in the Swedish government's electrification strategy and is not included in our report.

Even as emissions from domestic road transport have decreased over time, greenhouse gas emissions from domestic maritime transport are increasing, which points to a need for policy instruments to accelerate

the transition of our maritime transport operations. The long service lives that vessels have are also contributing to the relatively slow pace of the transition of our vessel fleet compared to the transition of our road vehicle fleet. The maritime segment will require subsidisation in this still early phase of its transition in order to stimulate market growth and achieve the electrification of ports and vessels more quickly. An increased degree of electrification, where possible, will entail a comparatively suppressed demand for the other alternative fuels that will be needed for the transition of our maritime transport operations, such as biofuels with limited availability. Available volumes of alternative fuels can then be directed towards those segments and vessels whose operational requirements make electrical operation unfeasible.

International policy instruments are important to maritime transport

Policy instruments already exist to encourage increased climate adaptation in the maritime sector, and they offer indirect support for electrification as well. However, most reports and studies indicate that additional policy instruments will be needed to climate-transition our maritime transport operations, even assuming extensive improvements in energy efficiency and fuel switching. This applies in particular to our national maritime transport operations, which are not covered by EU policy, including the Fit for 55 proposals. Transport Analysis also finds that there is a need for policy instruments that will steer us towards the increased electrification of both ports and vessels. This is particularly valid insofar as conventional vessel fuels are tax-exempt, which contributes to a switch to alternative fuels entailing major cost increases compared to switching fuels for road transport.

Greater energy efficiency will play a key role in the ongoing electrification process in Sweden, and in the achievement of our national electrification aims. Policy instruments to expand electrified maritime transport should consequently include measures to increase energy efficiency. The long service lives that vessels have entail that such policy instruments should cover not only newbuilds but also existing tonnage and rebuilds.

A great deal of work is being done to create new and to further develop existing maritime policy instruments, both globally within the International Maritime Organization (IMO) and within the EU. Various policy measures have been proposed in Sweden as well, e.g. in a current Transport Analysis report on climate policy instruments for the transport sector, in which one of the background reports analyses a number of different climate policy instruments for the maritime sector. These existing and proposed policy instruments are not included in our report, although the most important ones with a bearing on electric maritime transport are summarised, as they are of major importance to the total picture and to the policy instruments we are proposing, and consequently need to be viewed in a single context.

It is believed that the proposals in the EU Commission's Fit for 55 package will have a pervasive impact on maritime transport. The package includes proposals regarding emission rights trading for maritime transport, carbon dioxide-based fuel requirements, and requirements to offer and use shore-side power and to tax vessel fuels. Implementing Fit for 55 could increase the costs of emissions, and thus incentivise investment in the electrification of maritime transport. Swedish policy instruments should be configured so as to support and, to some extent, complement the ongoing European and international initiatives.

Policy instruments for road transport electrification can be developed for maritime transport

The trend towards greater electrification is progressing more rapidly with regard to roads, with targeted policy instruments to encourage greater electrification, such as climate prizes and subsidies for charging infrastructure. Opportunities exist to craft corresponding policy instruments that target maritime transport. There are also certain policy instruments that target electric aircraft and the electrification of aviation. Both aviation and maritime transport are characterised by being largely international, which means that the configuration of policy instruments for the one mode of transport could yield new solutions based on the configuration of policy instruments for the other.

There is also an international perspective in the report, as we cite examples of solutions from Norway and the Netherlands which, through goal-based policies, have made relatively good progress in electrifying their maritime transport operations compared to other countries.

Proposed policy instruments

To conclude, we will discuss seven proposed policy instruments and a pair of other measures. The policy instruments are described individually, although a broad-based effort and a combination of policy instruments will be needed to lower the thresholds for more electrified maritime transport. Investments in economic policy instruments, public procurements, regulations, cooperation, and agreements between various actors will all play a part. Policy instruments to increase electrification in the maritime sector need to be configured so that they work together with rather than against one another, or against other transport policy objectives. Given the early stage of development in which electrified maritime transport finds itself, investments in onshore infrastructure for supplying electricity to vessels must, for example, be combined with investments in the vessels themselves.

In the policy instruments proposed below we identify each instrument's target group in parentheses in order to indicate whether the instrument targets the vessels and shipowners or the ports and electrical infrastructure. The target group may also be viewed as a guide as to which of our two government assignments the proposal is referable.

➤ ***Tax credit for onshore power supplies for smaller vessels (vessels)***

Transport Analysis proposes that the existing tax credit for shore-side power for larger vessels be expanded to include vessels with a gross tonnage of less than 400 that are being used commercially.

Such smaller vessels often travel shorter distances and constitute a category that is generally well suited for electrification. This proposal would promote greater electrification by lowering the costs of the electricity and levelling the playing field, as the diesel used by commercial vessels is tax-exempt.

➤ ***Climate premium for electric vessels (vessels)***

Transport Analysis proposes that the Swedish Energy Agency be tasked with conducting a detailed analysis and proposing how a climate premium could be configured to stimulate the market introduction of electric vessels.

There are currently two climate premiums, one for electric buses and another for lorries and work machines. The Swedish Energy Agency has also been tasked with analysing and proposing how a climate prize for electric aircraft could be configured. As noted, the conditions surrounding electric aircraft share a number of similarities with those that apply to electric vessels and based on the Swedish Energy Agency's experiences from its study of electric aircraft, Transport Analysis considers this to be the most effective working process.

➤ ***Subsidy for onshore power supplies for vessels (ports)***

Transport Analysis proposes that the appropriate government agency be tasked with formulating proposals for arranging subsidies for shore-side power and charging infrastructure for vessels.

There are two existing subsidies for road transport, i.e. one for rapid-charging stations along motorways, which are administered by the Swedish Transport Administration, and another for regional electrification pilot projects, which are administered by the Swedish Energy Agency. The logic and principles involved in these subsidies could serve as models.

➤ ***Exemption from network licence requirement for ports (ports)***

Transport Analysis proposes that a study be launched to clarify how exemptions from network licence requirements for electrical cables and electrical networks in ports could be introduced.

According to the Swedish Electricity Act, the principal rule is that a licence, the so-called 'network licence', is required to build and use high-voltage power lines. The process could be simplified by exempting power lines and networks in ports from the network licence requirement. Corresponding exemptions exist for a host of other similar areas. The Swedish Energy Markets Inspectorate is looking into an exemption for ports, and any need for further study will depend upon the results of the current one, which will be reported on in January 2023.

➤ ***Clearer climate requirements for national vessels (vessels)***

Transport Analysis proposes that the Swedish Transport Agency be tasked with studying the need for clarified requirements regarding reduced greenhouse gas emissions from national vessels.

Greenhouse gas emissions are being regulated to a growing extent at the international level via the IMO and the EU, but national vessels are not subject to such regulations. National vessels are subject to general environmental performance requirements and goal-based regulations, in which detailed and explicit requirements regarding increased energy efficiency and greenhouse gas emissions are lacking.

➤ ***Facilitate the certification process for vessels converting to electric power (vessels)***

Transport Analysis proposes that the Swedish Transport Agency be tasked with implementing measures to facilitate the certification process for new solutions associated with electrified maritime transport.

Function-based regulations are usually considered to have the advantage of driving innovation, and normally work well. On the other hand, in the context of the major technology shift analysed in our report, such regulations have in some cases proven to entail difficulties, uncertainties and special costs for those in the vanguard of this development process.

➤ ***Innovation in procurements of regionally procured ferry service (vessels)***

Transport Analysis proposes that the State take the initiative in cooperating with regions with a view to bringing about innovation in the procurement of nationally and regionally procured service in order to promote the development of electrified maritime transport. National guidelines should be formulated within such a cooperative arrangement for the purpose of applying modes of procurement in a way that drives the development process forward together with suppliers and offers accommodation for new technical and economically feasible solutions.

Other measures

In addition to the foregoing policy instrument proposals, Transport Analysis proposes the following two additional measures.

➤ ***Environmentally differentiated shipping dues***

Transport Analysis calls for a broader discussion of the use of environmentally differentiated shipping dues to stimulate the introduction of electrified maritime transport.

Environmentally differentiated fairway dues and port charges constitute existing policy instruments that also favour the trend towards greater electrification. They could be developed further, either separately or in a coordinated fashion. A coordinated effort in which multiple parties use the same or similar grounds for differentiation would be preferable in terms of enhancing the efficacy of environmentally differentiated dues and fees as incentives.

➤ ***Environmental zones in ports***

It is the view of Transport Analysis that it would not be appropriate to implement environmental zones in certain ports to increase the use of charging current and shore-side power.

Environmental zones are generally seen as a policy instrument that may have its place when the market is mature and there are multiple operators within the relevant segments who are able to live up to the imposed requirements. The electrification of maritime transport has not yet reached that point. There could also be discussion as to how an arrangement under which certain vessels would be excluded from a public port would stand in relation to current Swedish law, which, in principle, gives all vessels the right to call at ports, assuming that space is available.



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 2010 with its head office in Stockholm and a branch office in Östersund.