Göteborg Hamn leading the world's port business to ecology

Cold ironing can reduce air pollution and noise at the port

Photo: Port of Göteborg

Nowadays we are accustomed to pay attention to reducing air emissions from power stations, factories and cars.

Authorities of countries from all over the world have agreed to reduce their emissions and sign proper resolutions. Those actions have a positive effect. However, another problem has surfaced – emissions from ships.

Shipping transport is continuously growing, ships are bigger and they carry more and more goods, causing emissions to grow significantly. If nothing is done, ships' air emissions will exceed those from land-based sources by 2020. There are attempts to minimize this impact in many ways, e.g., in the Baltic Sea area ships are obliged to use low sulphur fuel (a sulphur content not exceeding 0.1% by mass). This way they emit less sulphur oxide SOx, which is one of the most dangerous factors contributing to air pollution. Negative aspects of shipping are especially important for people living in port cities. The ships still produce harmful fumes, noise and vibrations when berthed at the port. It affects the whole environment; the health of port workers, onboard personnel, and the inhabitants of port cities. That is why authorities from many countries have joined forces to fight this problem.

The idea presented by Stora Enso

One option is to reduce the negative impact of ships during their stay in the port. While a ship is berthing its auxiliary engines are used for lightning, heating, hot water, fans, engines, etc. These operations consume diesel or heavy oil and generate exhaust fumes and noise. The solution is "cold ironing", also called "shore-side power". "Cold ironing" means supplying vessels with electricity from the shore during their stay in port enabling their auxiliary engines to be shut down and not use fuels to run necessary operations. Today this solution is found in a few ports around the world. The world's leader here is the port of Göteborg, Sweden, which first introduced this concept. The idea was proposed by Stora Enso, a global pulp and paper company, which wanted to be environmentally friendly. The idea was met with interest in Göteborg and special cooperation between the ship-owners Cobelfret and Wagenborg Shipping and the electrical equipment supplier ABB was established. Some funds were obtained from the Swedish government. The first ro-ro vessel successfully used the new high-voltage connection in January 2000. Expectations came true – this allowed avoiding forestalled harmful emissions, noise, and vibrations during an ordinary ship's operation while in port. It was the first electrical connection for ro-ro vessels in the world; even though low–voltage connections already existed for ferries. The source of shore-side electricity is also environmentally friendly – the Port of Göteborg uses renewable energy sources such as wind power.

It takes 10 minutes

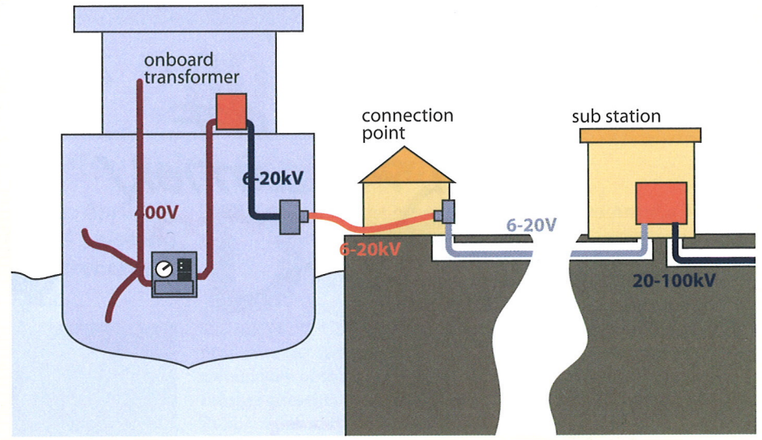
"Cold ironing" gives the best results in the ports where specific vessels (with appropriate installation onboard) frequently arrive and stay for a longer period of time. General principles for modern high-voltage systems can be seen in the Figure 1.

The ship is connected by a high-voltage cable to the shore-side electrical connection point. The power is distributed to the connection point from the local high-voltage sub-station. The high-voltage cable allows transferring 25 times more power than a standard 400 V cable of the same dimension. It takes 10 minutes to connect the ship to the shore-side installation and to switch off the auxiliary engines. The exception is during bunkering operations when the auxiliary engines are run for safety reasons. High-voltage power (6-20 kV) is easily available when a quay is located close to a residential or industrial area. In the case of Europe almost all ports have high-voltage electricity available nearby. And, what is needed onboard a vessel? An entrance for connecting a cable, a socket for the cable and the transformer (preferably located near the main switchboard in the engine room) which transforms high-voltage power to the 400 V power used on the ship. There are some parameters that must be taken into consideration when discussing the system's costs and requirements:

- shore-side frequency (50 Hz in Europe),
- onboard frequency (50 or 60 Hz),
- shore-side supply of high-voltage electricity (voltage, distance to the nearest supply point and installation practicalities),
- required power level,
- available space for the onboard transformer (also, if this space is weather-sheltered or not) and the weight restrictions of the vessel,
- onboard cable installation practicalities,
- cost for shore supplied electricity versus the electricity generated onboard.

The parameters that have the biggest impact on installation costs for shore-side electricity are changing the onboard frequency and supplying the quay with high-voltage electricity. "Cold ironing" may also be realized without an onboard transformer. Older vessels, like *M/S Stena Scandinavica* (Stena Line), receive shore-side electricity, transformed onboard from 11 kV to 400 V and carry only a connecting, high-voltage cable. The ship uses shore-side power from 1990, at which time the Port of Göteborg started to supply low-voltage shore-side power to ferries.

Fig. 1. Shore-side, high-voltage power installation.



Vessels are the main source of SOx

The costs of supplying high-voltage power at the quay-side may vary greatly as it depends on the distance to the nearest high-voltage supply and other local conditions. In spite of this, several independent studies have shown that costs (total costs for society) of onboard power generation are much higher than the total direct costs for the ship-owners and the ports. The cost of electricity in Europe is high, but it may be lowered for "cold ironing" purposes if there is a tax exemption. Due to the fact that fuel prices with a low sulphur content are rising, "cold ironing" will still allow significant savings. Many organizations, like the Port of Göteborg together with Stena Line, the European Commission, IMO and ISO, work to develop harmonized international standards concerning the voltage level, frequency, electrical outlets and plugs, capacity for the electrical outlets, safety functions and cable location onboard ships and on land. These actions speed up the implementation of the process.

According to expectations in Göteborg the carbon dioxide emissions from shipping would be reduced by 10 percent if all vessels would have access to the electricity supply in the ro-ro terminal, assuming the electricity is environmentally labelled. The reduction in sulphur oxide and nitric oxide emissions could be even greater – around 95 percent. This should also positively affect tourism.

Authorities at the Port of Lübeck, Germany, went on with a project several years ago on the implementation of Agenda 21 in European ports by the example of Lübeck-Travemünde. The parties involved were Lübeck's municipal utility and GAUSS mbH (Environmental Protection and Safety in Shipping company). The project examined the effect of emissions from different sources in the Lübeck-Travemünde area and analyzed what could be done to reduce emissions. Research showed that ships and ferries are the main source of sulphur dioxide and nitrogen oxide emissions and "cold ironing" is the most favourable solution.

Honours for the Port of Göteborg

Until now, thirteen ports from all over the world have implemented the idea of shore-side electricity. In July they will convene at a conference in Rotterdam to sign a climate declaration. The declaration will consist of five parts. The Port of Göteborg is one of the world's leaders when it comes to "cold-ironing" and has been asked to prepare one of the sub-documents related to shore-side electricity. "It is quite an honour that the Port of Göteborg has been given such a prominent role in this collaboration and even more so in light of the fact that we are much smaller than the other ports," says CEO Magnus Kårestedt. "We have been presented with a unique opportunity to assist the biggest ports of the world in reducing their environmental impact." Other ports involved in this collaboration are: Shanghai, Santos, Melbourne, Singapore, Tokyo, New York and New Jersey, Houston, Los Angeles, Hamburg, Antwerp, Amsterdam, and Dubai.

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