Facts about shore-based electrical power

Ships require a great deal of electrical power, also when they are berthed - for lighting, ventilation, heating and operation of technical installations. Normally, ships will generate this power from their own generators on board. These generators are driven by auxiliary engines using diesel oil or other fossil-based fuel. This leads to discharge affecting the environment negatively both locally and globally. Shore-based electrical power comes from the onshore grid. In Norway, we depend mostly on hydro-electric power which is pure renewable energy. Using shore-based power will mean a reduction in harmful discharge when in port.

Ordinary electrical plugs do not work when supplying large ships with electrical power. High tension shore-based electricity is connected up to the ship which has its own transformer on board for conversion to low tension electricity. This requires advanced technology both onshore and on board the ship. In Oslo, we will install a fully automatic solution so that no-one either onshore or on board will be in direct contact with the high tension installation. This will be the first facility in Norway that can supply electrical power to such large ships. The facility can supply up to 4 500 kW (4.5 megawatts) effect.

Air pollution from ships lying in port contribute towards poor air quality in the ports. Ships discharge CO2 contributing towards global heating while discharge of particles (suspended dust), sulphur dioxide and nitrogen dioxide contribute to poor air quality in the local environment. Such discharge increases, for example, the risk of asthma. In addition, there is the noise factor from auxiliary engines that can inconvenience neighbouring areas.

Color Line, Port of Oslo, Bellona and Hafslund Nett have implemented pioneering work in organising shore-based electrical power to ships in the port of Oslo. Color Line's two ships "Color Fantasy" and "Color Magic" are the world's two largest cruise ships equipped with car decks and have as many rooms (cabins) as the tenth largest hotel in Europe. These ships consume approx. 5 000 000 kWh (5.0 GWh) each year when they are berthed in Oslo. This is equivalent to the annual electricity consumption of approx. 300 households.

Today, our ships operate up to three auxiliary engines when they are berthed. When the ships switch to shore-based electricity, the discharge of CO2 will be reduced by 3 000 tonnes per year. This is the equivalent of the annual discharge of CO2 from 1700 cars. Moreover, discharge of nitrogen oxide (NOx) will be reduced by 50 tonnes and this will greatly improve the local air quality in the centre of Oslo. Discharge of sulphur oxide (SOx) will be reduced by approx. 2.5 tonnes and particles (suspended dust) will be reduced by approx. 0.75 tonnes. Moreover, the electrical power from the grid is generated in a much more efficient manner than the electricity generated by the auxiliary engines. The improvement in energy effect by converting to shore-based electricity is approx. 60%. Depending on the prices for oil and electric-

ity, Color Line will probably be able to reduce its expenses for energy when the ships are berthed in Oslo.

The Color Line ships are the first large vessels in Norway to convert to onshore electrical power. Hopefully, we will be able to start up the installation before the summer. The first of Color Line's two ships will then be converted to onshore power and according to plan, the next ship will convert to the new technology in 2012.
During the preparation of this project, Port of Oslo , Bellona and Color Line have gained valuable experience which can benefit others who plan to convert to shore-based electrical power.

It is no easy task to introduce shore-based power for all ships. Firstly, the technology is most suited for ships arriving frequently and that are berthed for longer periods. An international standard for connecting up to shore-based electrical power will shortly be introduced. The technical specifications have been prepared and the proposal is expected to be adopted shortly. It is likely that the work of converting ships to shore-based electrical power will accelerate following this initiative.

Equivalent to the annual discharge from 1700 cars

When Color Line's two ships switch to shore-based electrical power, the discharge of CO2 will be reduced by 3 000 tonnes each year.

According to Statistics Norway, a one-year old passenger car covers a distance of approx. 15 000 kms. each year. We have based our calculations on a fuel consumption of such a relatively new car of approx. 0.55 litres petrol per 10 km. The Norwegian Climate and Pollution Agency's calculator for calculating discharge to the environment shows that this type of car discharges 1737 kg. CO2 each year. On this basis, we have found that the reductions in discharge of CO2 from Color Line's two ships will be equivalent to the discharge from 1700 cars each year.

Electrical power to 300 households

During the course of one year, Color Line's two ships consume almost 5 million kWh while berthed in the Port of Oslo. According to Statistics Norway, an average household in Oslo consumes approx. 15 800 kWh each year. On this basis, we have calculated that the electrical power consumed by Color Line's two ships while berthed in Oslo is the equivalent of the annual electrical power consumption of approx. 300 households in Oslo.

Environmental cooperation

Color Line, Port of Oslo, Bellona and Hafslund Nett have worked in close cooperation in order to organise shore-based electrical power in the Port of Oslo.
Port of Oslo has contributed financially to the technical supply of electrical power to the onshore facility. Port of Oslo has also contributed with technical competence and has assisted in applying for support so that the onshore power facility could be achieved.

Bellona has been the driving force in implementing the project and has played a leading part in procuring a joint financing arrangement. Hafslund Nett have arranged the supply of sufficient electrical power to the quay.
Color Line will carry out major investments on board its ships and through its forward-looking environmental initiative is the party to which most credit is due as the first shipowning company to be connected up to shore-based electrical power in the Port of Oslo.

Subscribers

The total cost of converting both Color Line ships to shore-based electrical power will be NOK 23 million.
Port of Oslo: NOK 2 million
Color Line: NOK 15.2 million
Support from Transnova: NOK 2 million
Support from Enova: NOK 3.7 million

Better quality air in Oslo

NOX is the common designation for nitrogen oxides that are created in internal combustion engines under high temperature and pressure. Discharge of NOx contributes towards respiratory diseases and acid precipitation that can cause forest damage and fish death.

Sulphur dioxide is a gas in the SOx family. It is formed during the combustion of substances that contain sulphur, mainly oil and coal. In large concentrations, sulphur dioxide can cause health problems, particularly in those suffering from asthma.

Suspended dust is the term used for invisible particles (diameters less than 10 micrometers) that are suspended in the air over a certain period. Some particles can irritate the upper respiratory organs while others can cause heart and lung disease. The main sources of suspended dust in cities in Norway are road traffic and wood burning stoves and fires.

CO2 is the most important climate gas. An increased concentration of CO2 in the atmosphere results in the greenhouse effect i.e. global warming. This is the climate gas that is mainly discussed when dealing with measures for limiting global warming.