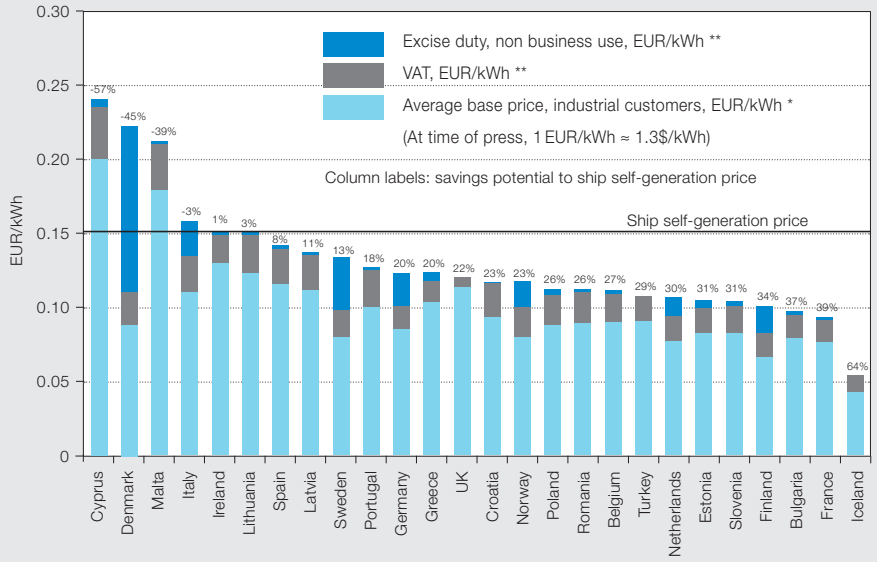
Clean air in the docks

Taxation incentives can improve air quality in ports

PETR GURYEV – Maritime shipping is the backbone of global trade, and the ports in which goods are loaded and unloaded are vital assets in assuring the economic viability of regional economies. However, the numbers of large and heavy ships docking in ports can lead to unacceptable levels of local pollution. Even though a moored ship does not need to power its propellers, the diesel engines are typically left running to meet the ship's auxiliary power requirements. These can range from the accommodation of the crew to cooling and other needs of the cargo handling. One alternative to using the ship's own diesel engines is to connect the ship's onboard electricity network to a dockside power supply. The technology behind such connections has been discussed in past issues of *ABB Review*.[1] Although there are several technologies available on the market for emissions reduction, ie, scrubbers, purified fuel and LNG,[2] only shore-to-ship power provides absolute emissions reduction from ships at port. The rate of adoption of this solution, however, does not depend on technical and environmental arguments alone, but also on regulative and fiscal incentives.

1 Electricity price structure in 2013 before exemptions on excise duties



* Average half-yearly electricity prices for industrial end-users without taxes and levies (first semester of 2013). Band Ic with annual consumption between 500 and 2,000 MWh. Eurostat. Accessed February 2014, base nrg_pc_205.

** a) Excise Duties Tables (2013) REF 1038 rev 1. European Commission, Brussels. Accessed February 2014.
b) Electricity taxes and duties tables for the Netherlands. Belastungdienst. Accessed February 2014.
c) Taxes and Levies on Electricity in 2012 (for Norway and Turkey). Union of the Electricity Industry – EURELECTRIC. Accessed February 2014.

Stricter local, national and regional legislation on port emissions has caused the market for shore-to-ship power to grow from a handful of projects to dozens per year over the last five years. The two main drivers of this market are:

– The environmental benefits of emissions reduction
– The operation expense reduction by saving on the difference between the self-generation price and the electricity price from the grid

To provide an incentive for this development, governments usually provide either subsidies for capital investments or exemptions on excise duties for shore-power electricity. Although North America and Asia presently prefer support in the form of subsidies, Europe has used both options. Several countries in Europe have already adopted or applied for excise duty exemption for shore-power electricity. Although news on this has been reported in the media, a clear picture of the real economic benefits has so far been lacking. The electricity price structure in Europe and the excise duty exemption has had a marked impact on the payback period of shore-to-ship power in different European countries.

Several countries in Europe have already adopted or applied for excise duty exemption for shore-power electricity.

In mid-2011 Germany and Sweden received approvals from the European Commission to reduce excise duties for electricity used for shore-to-ship power. The exemptions allowed reductions in excise duties of 97 to 99 percent for three years with the right to extend this further. In 2014 approvals for exemption were prolonged by the EU council implementing decisions for another 6 years for both countries (directive documents COM/2014/0538 and COM/2014/0497). In 2013, the Finnish Port Association and Danish Energy Association also proposed excise duty reductions to their governments. The Danish parliament voted for the exemption of the excise duties to more than 99 percent on May 27, 2014 (Law L 171), whereas for Finland a final decision has yet to be made.

The existing electricity price structure with tariffs, VAT (value-added tax) and excise duties (including environmental taxes) but without exemptions for shore power are compared in → 1 together with the savings potential relative to ship self-generation using MDO/MGO[3] fuel.

Title picture
The title picture view shows the port of Ystad in Sweden. Sweden is one of the countries that has taken the lead in providing tax incentives to encourage use of dockside power supplies.

Footnotes

1 See: K. Marquart, "Power from shore: ABB shore-to-ship power solutions are cutting noise and greenhouse gas emissions by providing docked ships with shoreside electricity," *ABB Review* 2/2010, pp. 82–83,
K. Marquart *et al.*, "Shore-to-ship power: ABB's turnkey solution is effectively reducing portside emissions," *ABB Review* 2/2010, pp. 82–83,
ABB Review 4/2010, p. 56–60, and
L. Thurm *et al.*, "Onshore and onboard: Looking at the shoreside and shipside technologies and the case for standardization in shore-to-ship power" *ABB Review* 1/2011, pp. 36–40.

2 LNG: liquefied natural gas

3 MDO and MGO are typical marine fuels used by ships at port. MDO is marine diesel oil, and MGO is marine gasoline oil. The self-generation price is calculated in ABB's shore-to-ship power business case tool using an MDO/MGO fuel price of $950/MT and fuel consumption of 210 g/kWh, euros/$ = 1.2982.

The highest share of excise duties in the electricity price is found in Denmark and Sweden. It is also high for Finland, Germany, Italy and Norway.

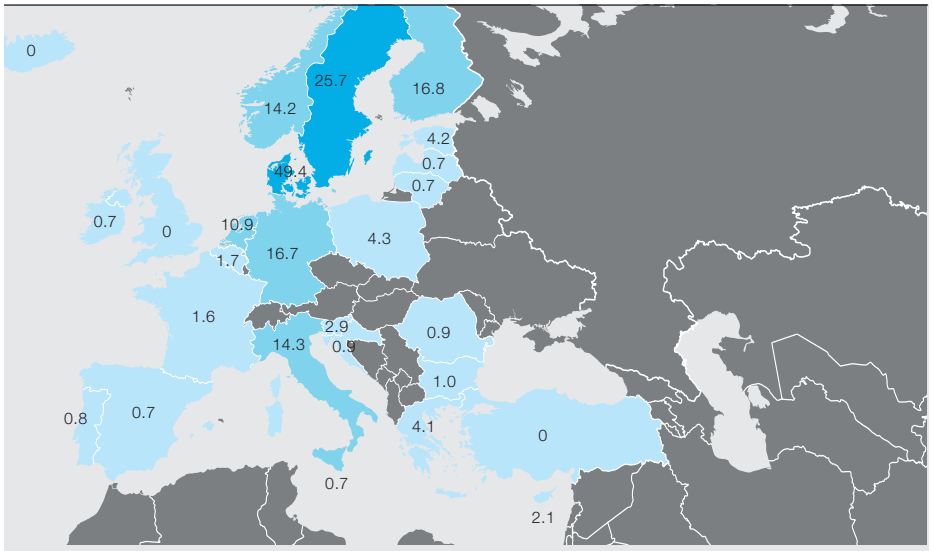
The countries considered can be classified into two main groups: those whose total electricity price is higher than that of ship self-generation and those whose total electricity price is lower than that of ship self-generation. Although countries in which the total electricity price is higher than the self-generation price are not likely to have commercially attractive business cases (unless a special lower base tariff is provided, eg, the Venice cruise project), it does not mean that these countries are principally unsuitable for shore-to-ship power projects. The main benefit of shore-to-ship power remains emissions reduction, and such projects will continue as long as notable subsidies are provided for capital infrastructure (eg, the Livorno cruise project in Italy). Cyprus, Denmark, Malta and Italy fall into this group of countries.

The highest share of excise duties in the electricity price is found in Denmark and Sweden. It is also high for Finland, Germany, Italy and Norway; moderate for the Netherlands; and small for Poland, Estonia and Greece. In the remaining countries analyzed it is between 0 and 2.9 percent. Denmark, Sweden, Finland and Germany already have excise duty exemption or have applied for it. The 10 countries with the highest share of excise duties are shown in → 2 along with the influence of excise duty exemption on savings potential compared with ship self-generation costs.[4]

Footnote

4 In addition to the excise duty reduction for shore power in Sweden and Germany, the law approved by the Danish parliament implies a reduction to 0.004 DKK/kWh (circa 0.0007$/kWh), which is also 99 percent, while the Finnish Port Association did not specify an exact amount in its proposal.

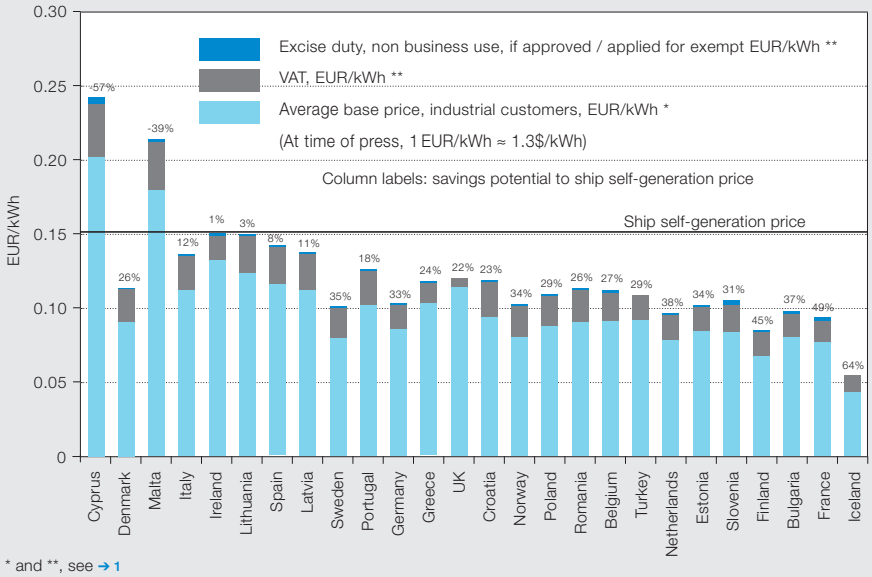
2 Excise duty share in total electricity price and its exemption effect on savings potential



Country	Share of excise duties in electricity price (%)	Excise duties exemption status	Saving potential			
			Before exemption (%)	After exemption * (%)	Delta (%)	Relative growth of saving potential * (%)
Denmark	49.4	Approved by parliament	-45	26	71	273
Sweden	25.7	Approved and prolonged	13	35	22	63
Finland	16.8	Proposal prepared	34	45	11	24
Germany	16.7	Approved and prolonged	20	33	13	39
Italy	14.3		-3	12	15	125
Norway	14.2		23	34	11	32
Netherlands	10.9	No information	30	38	8	21
Poland	4.3		26	29	3	10
Estonia	4.2		31	34	3	9
Greece	4.1		20	24	4	17

* Considering either already approved/proposed in application or 99 percent exemption

3 Electricity price structure in 2013 with approved, proposed or potential exemption on excise duties for shore power in selected countries



* and **, see → 1

4 Formulas expressing savings potential

4a Improvement of payback period

$$\text{P.b.period improvement} = \frac{\text{P.b.period 1} - \text{P.b.period 2}}{\text{P.b.period 1}} \cdot 100\%$$

4b Model for expressing simplified – not discounted – payback period used in ➔ 4a.

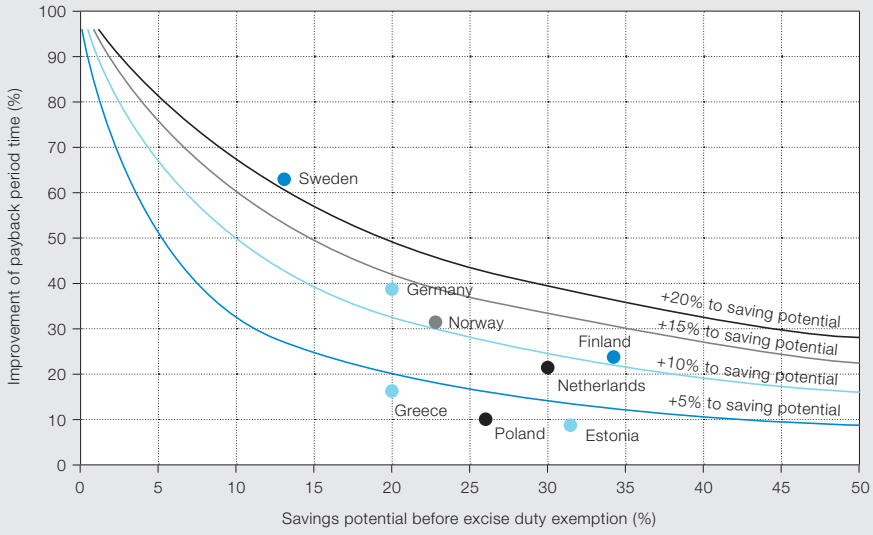
$$\text{P.b.period years} = \frac{\text{CAPEX [EUR]}}{\left(\text{El.selfgen price } \left[\frac{\text{EUR}}{\text{kWh}}\right] - \text{El.grid price } \left[\frac{\text{EUR}}{\text{kWh}}\right]\right) \cdot \text{Annual consumpt.kWh}}$$

4c Payback period improvement for shore-to-ship power after excise duties exemption

$$\text{P.b.period improvement} = \frac{\text{Sav.pot.2} - \text{Sav.pot.1}}{\text{Sav.pot.2}} \cdot 100\% = \text{Relative growth of sav.pot \%}$$

where Sav.pot.1 is savings potential without exemptions in place and Sav.pot.2 is savings potential with exemptions in place.

5 The improvement of the payback period for shore-to-ship power projects depending on initial savings potential and its change after excise duties exemption



The effect of 99 percent excise duty exemptions on savings potential compared with the ship self-generation cost applied for the seven countries listed above, in addition to those already approved by Sweden, Germany and Denmark, is shown in ➔ 3.

To measure the effect of excise duty exemption on business case, the payback period was analyzed. The improvement of the payback period can be assessed by formula ➔ 4a where payback period is estimated by the simplified – not discounted – model expressed in ➔ 4b.

The final formula of payback period improvement for shore-to-ship power after excise duties exemption is shown in ➔ 4c.

The improvement of the payback period is shown in ➔ 5 (Denmark and Italy are not shown here because savings potential before excise duty exemption was negative.)

This graph can furthermore be used to measure the influence on the payback period of other electricity price elements (base tariff and VAT).

Most European countries have attractive electricity prices that permit savings compared with ship self-generation in the range of 1 to 30 percent.

Incentives can reduce emissions

Most European countries have attractive electricity prices that permit savings compared with ship self-generation in the range of 1 to 30 percent. Exemption of excise duties for shore-side electricity is an attractive instrument for countries where excise duties constitute a high percentage of the total price. The lower the initial savings potential with respect to the self-generation price, the higher the effect of excise duty exemption on the payback period. Sweden and Germany have already adopted such measures and in a recent parliament vote Denmark decided to follow suit. Finland is presently developing a proposal for exemptions of excise duties on electricity used for shore power.

By implementing such exemptions in the 10 European countries with the greatest share of excise duties in total electricity price, the business case would improve by 10 to 60 percent depending on the total initial electricity price and share of excise duties. Denmark should thus get the EU council approval for excise duty exemption, while Finland, Italy, Norway, the Netherlands, Poland, Greece and Estonia should adopt such measures at a national level first.

Petr Guryev
Independent consultant
petr.guryev@gmail.com

For ABB information, please contact
shore-to-ship@ch.abb.com