Making cold ironing make sound business sense

Sustainable and efficient, ship-to-shore power supply is growing increasingly popular, but its success is all in the figures

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Shore-to-ship power supply is frequently presented as a way for port authorities and shipping lines to substantially reduce environmental impact, while the economic case for shore power has tended to remain more elusive. Rising fuel prices and tightening legislative requirements are however, creating conditions where the economic gains of shore power are becoming increasingly apparent.

The Cavotec engineering group has worked with partners in the industry for many years on developing shore-to-ship power supply applications.

"The already widespread use of shore power, upward pressure on fuel prices, and a series of regulatory requirements due to be introduced in the coming years, all combine to make cold ironing an increasingly viable option," notes Luciano Corbetta, Cavotec Group Market Unit Manager Ports & Maritime.

"Not only can shore power deliver environmental benefits, the switch from fuel oil can also offer opportunities for reduced operational costs," he adds.

Sustainable technology

Shore power – also known as 'cold ironing', and Onshore Power Supply (OPS) – refers to the practice of supplying electricity to ships in port to power their onboard power needs. Vessels require electrical power to run onboard services such as heating, lighting, food preparation and, where applicable, container refrigeration and cargo handling. The majority of vessels currently run their engines to generate power while docked.

Most ships use low-grade oil to fuel their engines, which creates substantial amounts of sulfur oxide (SOx), nitrogen oxide (NOx) and particulate matter – predominantly soot – that pollutes air in ports and in surrounding communities. Shore power enables vessels to switch off their engines once berthed, and plug into shore-side electricity, thus helping to improve air quality in and around port areas.

The environmental benefits of shore power are well documented. Supporters of the practice point to evidence that shows electricity produced by power stations and used by ships in port can have up to 35 times less nitrate oxide and 25 times less particle matter compared to the heavy fuel normally used by ships when docked [1].

The environmental benefits of shore power are enhanced further depending on how the electricity at a port is generated. For example, electricity supplied to the Port of Gothenburg, on the west coast of Sweden, is produced by renewable energy sources, primarily wind power. The Port of Gothenburg pioneered the use of shore power in the 1980s and continues to develop the technology with partners such as ABB, Stena Line, Processkontroll and Cavotec.

"Some 30 percent of calls at Gothenburg currently use OPS. We aim to offer shore power to all Ro/Ro and ferries calling at the port as soon as is feasible," says Åsa Wilske, Senior Management Sustainability, Port of Gothenburg.

"Shore power is not the only environmental measure we are taking at the Port [of Gothenburg]. We are also exploring ways of adapting our infrastructure to offer vessels LNG bunkering facilities," Wilske adds.

The Port, in conjunction with ABB, Stena Line, Processkontroll and Cavotec, opened the latest of a series of shore power facilities at the Port on January 26, the largest such application in the Nordic region. The unit will provide electrical power to the Ro-Pax ferry, Stena Germanica that serves the Gothenburg–Kiel route twice a week [2].

In addition to presenting a strong environmental case, the Port of Gothenburg has also indicated how an economic argument can be made for shore power systems.

The business argument

According to research presented by the Port of Gothenburg, based on a Ro-Ro vessel calling at a port twice a week, adopting shore power can save operators money when low sulfur fuel prices reach around US$920 per metric ton.

Figure 1. A ship-based Alternative Maritime Power™ (AMP™) system at the Port of Los Angeles.

Figure 2. Cavotec's Cable Management system at the Port of Gothenburg.

With the introduction of a favorable tax structure, designed to support the wider use of shore power, this point can be reduced further – in some cases to where bunker fuel prices are just over US$700 per metric ton. At the time of writing, fuel prices are around US$810 per metric ton.

In the example above, the frequency and the length of port calls, as well as comparative fuel and electricity prices determine medium and long-term savings.

According to Cavotec, costs related to installing shore power systems on ships are determined by the age of the ship. Broadly, the newer the ship, the lower the cost of installation, with the cheapest possible option being new-build vessels constructed with shore power systems. The type of ship and the type of interface equipment used – shore- or ship-based – the vessel's power requirement and the voltage of the ship all affect cost structures.

On the shore side, costs are related to the difference between the local power grid frequency and the required frequency for vessels, power availability and other infrastructure considerations.

Regulatory controls set to tighten

The growing financial sense of shore power systems on the back of rising fuel prices is compounded by the current regulatory climate that is currently growing increasingly robust and is set to continue to do so in the coming years.

Cuts in NOx, SOx and particulate matter – adopted by the International Maritime Organization (IMO) in 2008 – came into effect in July 2010, although reductions will not be fully implemented before 2020.

With effect from January 2010, the European Union (EU) prohibited the use of bunker fuel in EU ports that contained more than 0.1 percent sulfur [3]. In the US, the Californian Air Resources Board (CARB) has introduced new air quality requirements for ports, requiring the use of shore power from January 1, 2014 in Californian ports.

Work continues on standardization for shore power systems, overseen by the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO). These organizations published a document in April 2009 that outlines specific requirements for high voltage shore power including installation, testing, high-voltage shore distribution, shore-to-ship connection, transformers, ship distribution systems, control, monitoring, interlocking and power management systems.

Engineering overview

Onshore power has been used for several decades. The US Navy, for example, has used the practice since the 1950s to power vessels berthed for long periods and thus becoming the origin for the term 'cold ironing'.

The Cavotec engineering group has been involved in developing the technology in close cooperation with engineering partners, shipping lines and port authorities since the 1980s. The Group works on shore power solutions for container and cruise ships, tankers and Ro-Ro ferries.

Cavotec's shore power interface equipment consists of cable management systems installed in or on the quayside, or on board ship, able to transfer electrical power from the grid to the ship. These systems handle extremely high power transfers – around 7.5 MVA at 6.6kV for container ships, and up to 20 MVA at 11kV for cruise ships. Shore power has enjoyed substantial global success. Today there are more than 200 shore power units that are

Figure 3. A Cavotec AMP™ Mobile unit at the POLA.

installed, or currently being installed, on ships, while ports such as Long Beach, Vancouver, Seattle, Antwerp, Gothenburg, Stockholm and other ports across northern Europe use this new technology.

Cavotec has built connection pits into the quayside at the Port of Los Angeles (POLA) to power container vessels. Cavotec has also designed and manufactured a new wheel-mounted cable handling system. One such unit successfully connected the latest generation of cruise ship to shore power at the POLA at the end of January. Shore power is also used at cruise terminals in Juneau, Vancouver, Seattle, San Francisco and San Diego.

POLA Yusen Container Terminal (NYK) and West Basin Container Terminal (CSL) also use the technology, as do Pier G Terminal at the Port of Long Beach and the Totem Ro-Ro terminal at the Port of Tacoma. The technology is also currently being commissioned at the STS Terminal at the POLA, and other applications are under construction at the APL container terminal at the Port of Oakland and in Canada.

Shore power is also used widely in Europe – for example, at Ro-Ro terminals at the Port of Gothenburg, the Port of Luebeck, the Port of Kemi, the Port of Oulu, and the Port of Zeebrugge, and at the Port of Antwerp's IMT Container terminal. Ports on the Mediterranean Sea are now studying ways in which shore power could be introduced – primarily for passenger ferries and cruise ships.

In Asia, shore power is used at the Waigaoqiao Container Terminal at the Port of Shanghai and the Nanko Ferry Terminal at the Port of Osaka.

Partnering for progress

How does the industry bring these elements together? Åsa Wilske at the Port of Gothenburg stresses the importance of partnerships and cooperation.

"Everyone needs to be involved. It needs to be a joint effort between suppliers, shipping companies, ports and government agencies. For example, tax incentives and a willingness on the part of the port and shipping lines were crucial to getting work on shore power at the Port of Gothenburg underway," Wilske says.

This view is one shared by Cavotec. "We need to continue to work with our partners on the technical side, the ports and end-users to ensure all parties can gain from the introduction of shore-to-ship power," says Corbetta.

Coming legislation will help to encourage the use of shore connection, together with higher oil prices. Remaining issues include infrastructure investment – and how to share these costs and savings – and power availability: the physical delivery of electrical power to port areas sufficiently close to vessels to be a practical solution.

A short film showing Cavotec's shore-to-ship power application at the Port of Los Angeles is available on Cavotec's YouTube page at: http://www.youtube.com/user/cavotecfilms.

REFERENCES

[1] Natural Resources Defense Council report: *Harboring Pollution: The Dirty Truth about U.S. Ports*, Figure 2: http://bit.ly/cavotec1.

[2] Port of Gothenburg news release, *Cleaner shipping at the Port of Gothenburg*: http://bit.ly/cavotec2.

[3] Further details on EU emission legislation for ports can be found on the European Commission's website: http://bit.ly/cavotec3.

ABOUT THE SPOKESMAN AND THE COMPANY

Luciano Corbetta is Group Market Unit Manager Ports & Maritime at Cavotec Specimas, an engineering Centre of Excellence of the Cavotec group. Before joining Cavotec in 2005, he was employed by an international engineering company active in the energy market. During his time at Cavotec, Corbetta has been responsible for the development of advanced maritime power supply solutions and he has been involved in many major projects regarding High Voltage shore-to-ship electrical supply. He is also actively involved in the ongoing standardisation process of shore power equipment. Corbetta is 41 years old and holds a BSc. from the Politecnico di Milano, Italy.

Cavotec MSL is a global engineering group that supplies innovative technologies to help the ports and maritime, airports, mining and tunnelling and general industry sectors operate more sustainably. Working closely with clients, Cavotec engineers develop and integrate complete systems to help drive operational efficiency, improve sustainability and reduce environmental impact.

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