Gas shifts to the front burner

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Significant fuel saving allows rapid pay-back
Magdalena Okopska
Head of Market Communication
ABB Turbocharging

The much anticipated IMO decision on when to implement IMO Tier III, together with the increase in demand for Liquefied Natural Gas (LNG) now also being seen in the marine sector, mark shifts in the marketplace that ABB Turbocharging is well positioned and equipped to respond to, with the technologies that will meet today’s and future needs.

In this issue of charge! we follow up on our successful launch of the A200-L for two-stroke engines announced at SMM Hamburg two years ago with an article highlighting the significant fuel saving possible when using these turbochargers in combination with High Pressure Tuning (HPT) (page 6). Another article looks at Valve Control Management (VCM), presented for the first time in its current form at the CIMAC World Congress last year, and at the great future we anticipate for it in dual-fuel and gas engines (page 16).

The benefits of turbocharger upgrades, introduced in 2013, are another topic; turn to page 4 to read what Reinier Bakker, Senior Manager, OEM Service Sales, has to say about how the saving in fuel consumption seen in power generation plants is equally possible for marine engines.

On the service front you can read about our latest efforts to ensure our customers always receive premium quality work and quick support whenever and wherever they need it. We have recently widened our network again, opening new Service Points in Batam, Indonesia, at Dubai Dry Dock in Dubai, in Bahrain and in Fredericia, Denmark.

As publication of this edition of charge! coincides with SMM 2014 being held in Hamburg from 9 – 12 September 2014, we heartily invite all our readers to visit Stand no. 202 in Hall A3 and learn how ABB Turbocharging can support you in running a sustainable business.

I hope you enjoy reading this issue of charge! and look forward to meeting you in Hamburg.
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Since introducing the option of turbocharger upgrades in 2013, ABB Turbocharging has won contracts on a number of medium-speed engines in power generation plants (see charge! 2|13).

With its benefits for fuel consumption at a time of rising fuel prices, upgrading turbochargers is, of course, equally possible for marine engines. Hence, in cooperation with engine builder Wärtsilä, ABB Turbocharging is anticipating strong demand by preparing upgrade packages for specific Wärtsilä marine engine models.

**Cruise ship study**

“As a first step, together with Wärtsilä, at ABB Turbocharging we have started to look at upgrading turbochargers on the Wärtsilä W12V46 engine in cruise ships,” notes Reinier Bakker, Senior Manager, OEM Service Sales. “This is a logical step because cruise ships are powered by what is essentially a floating electrical power plant, and they use the same Wärtsilä engine types as many land-based power stations. Hence, much of the work we have done on land can be readily translated to the cruise ship context.”

Cruise ships are among vessels benefiting from upgrades.

Upgrading marine turbochargers

ABB Turbocharging explores ways to save fuel at sea.

*Text Jonathan Walker, Photography Michael Reinhard*
Depending on the size of the cruise ship, up to six diesel generator sets will be in use. “The floating power station concept is a great idea, since the same diesel engines, powering electrical generators in so-called ‘generator sets’, can provide power for the electric motors which drive the propellers as well as all the many other electrical powered devices, including many associated with passenger comfort on a sea-going hotel. For example: the air conditioning for the whole ship as well as the kitchens cooking three meals a day for over 4,000 passengers, the lighting in cabins, large dining rooms and sumptuous ballrooms.”

New compressor wheel

The basis of the upgrade would be fitting a new design of compressor wheel to the existing turbochargers on the generator sets’ engines. “As a first project, together with Wärtsilä, we are looking at the upgrade of TPL 73-A30 turbochargers on their twelve cylinder, vee configuration type W12V46 diesel engines. The benefit we bring for the customer is to increase the efficiency of these turbochargers by incorporating the new compressor wheel, the so-called A32 model, which also has a wider compressor map, annual running time for a marine engine, at current fuel prices, it could amount to a saving in fuel worth well over USD 40,000 per year for every 10 MW of engine power – and cruise ships can require up to 80 MW,” Bakker stresses.

Bakker points to further benefits of ABB Turbocharging upgrades. “Since only the compressor wheel and some other components, such as the compressor wall insert, need to be replaced, we retain the vast majority of the hardware of the original turbocharger. So such an upgrade can be implemented in a short time – typically two days maximum.

“Moreover, we can maximize this benefit by incorporating the upgrade into a ‘SIKO’ overhaul.”

SIKO savings

SIKO is ABB Turbocharging’s advanced safety concept. Its designation derives from the German SicherheitsKonzept and denotes a sophisticated tool for calculating the effect of thermal and mechanical stresses on a given turbocharger’s rotating components on an engine with a given load profile.

“The calculation takes into account a range of operating factors and values, resulting in a realistic recommendation regarding the optimum time to exchange the rotating parts in order to keep the turbocharger operating within acceptable safety standards”, Bakker explains. “And, since a SIKO overhaul always includes replacement of the turbocharger rotor by the ABB Turbocharging service team, a rotor with an upgraded compressor wheel can be fitted as part of the normal SIKO overhaul process.”

Financially, combining the turbocharger upgrade with a SIKO overhaul has two benefits. “First, the cost of the upgraded rotor can be absorbed into a scheduled, expected service operation. Second, after the SIKO overhaul, the engine operator can expect an immediate reduction in his fuel costs. Indeed, we calculate the saving will be enough to rapidly amortize any additional costs, within about half a year.”

Additional benefits

In the upgrade case described, the new compressor wheel brings additional benefits via an increase in turbocharger speed margin and reduced engine exhaust gas temperature. “The increased speed margin in combination with the wider compressor map can be used to improve engine response to load changes,” Bakker observes.

“The reduced engine exhaust gas temperature means that many parts of the engine, including the exhaust manifold – but also the turbochargers – will experience less thermal load and a reduction in maintenance costs, although hard to quantify at the moment, will be the positive consequence.

“So when ABB Turbocharging and Wärtsilä cooperate on turbocharger upgrades, the engine operator can look forward to a really attractive set of benefits,” Bakker concludes.
A200-L: A small turbocharger builds a big reputation

The benefits of the A200-L turbocharger series in combination with High Pressure Tuning are highly welcome in the two-stroke low-speed engine market, as this customer testimonial from CMM shows.

Text  Peter Zijdemans,  Photography  ABB Turbocharging in Greece

Market acceptance of the new A200-L series turbocharger for two-stroke low-speed engines has been a tremendous success since it was launched by ABB at the SMM Hamburg in 2012. Already back then, a first shipowner decided to specify the A200-L for his new building project. Over 50% of the engines for all new ships decided in 2013 will be turbocharged with ABB turbochargers – a major part of it with one of the new A200-L series. Since its introduction just two years ago, over six hundred A200-L turbochargers have been specified for newbuildings.

The market has been quick to recognize the advantages of the new A200-L turbocharger series. A key benefit is that it can deliver approximately 30% more air volume than its predecessor, and in most engine applications this enables customers to install a smaller frame size of turbocharger than before. A smaller turbocharger with the same performance, in terms of volume flow, as a bigger one translates into lower first costs for the engine builder. The result has been that the two main suppliers of two-stroke low-speed engines have been very quick to adopt the new series, with each of them listing the new A200-L in their web based engine selection guides within months of its release.

Consolidated Marine Management, or CMM, is building three Aframax tankers for which they have specified the ABB A270-L turbocharger for the main engine. Sea trials for the first vessel were recently finalized. CMM comments: “The first thing that impressed us was the small size of the turbocharger compared to others that we have on vessels of the same size. Also remarkable was the low noise level in the engine room.”

A smaller turbocharger also means lower operating costs for shipowners. Since the saving in spare parts costs for a turbocharger which is one size smaller is approximately 25%, it is no surprise to
learn that many shipowners who have recently ordered new ships have decided to also benefit and take this step forward.

**High Pressure Tuning’s benefits**

2012 also saw another innovative idea developed by ABB turned into reality: High Pressure Tuning for MAN’s electronic two-stroke engines. Engine tuning, i.e. optimizing the engine’s fuel consumption to its expected load profile, has become popular since the 2008 crisis as a means of combating increasing fuel oil prices. Most vessels being built nowadays will have a trading pattern that only requires a high main engine output – above 85% Specified Maximum Continuous Rating (SMCR) – for a limited time. In almost every case where the main engine will run most of the time below 85% load, tuning makes sense, either “part load” optimized or “low load” optimized.

In order to gain the maximum benefit, each of these tuning methods requires additional hardware, for example an EGB (exhaust gas bypass) or variable turbine. However, while these offer the benefit of reduced fuel oil consumption at low engine loads, they also require additional investment, i.e. in first purchasing and then maintaining the additional equipment. On top of that, both the EGB and the variable turbine, being mechanical moving parts, are given a hard time in the harsh environment of heavy fuel oil exhaust gases in which they have to function. High Pressure Tuning combines the best of both worlds. It has the same benefits with regard to fuel oil consumption reduction at lower engine loads, but it does not need any additional hardware like an EGB or variable turbine. The results are lower investment costs and higher reliability.

**Additional 0.5 bar pressure**

The idea behind this innovative ABB Turbocharging concept is simple: To achieve lower specific fuel oil consumption at reduced engine loads, a higher scavenging air pressure than standard is required. Typically, the scavenging air pressure is increased by 0.5 bar. Until recently this was achieved by using an EGB valve or the variable turbine. Above 80% SMCR both the EGB and the variable turbine will open in order to protect the turbocharger against overspeed and the engine against too high combustion pressures. Another way to achieve a higher scavenging air pressure at low engine loads is, of course, to simply use a turbocharger that produces the additional 0.5 bar pressure over the whole range of its operation. This results, at low engine loads, in the same fuel oil consumption benefits obtained with the other systems. At high engine loads (above 80% SMCR) the flexibility of the exhaust valve is required. Closing the valve later than in the standard cycle avoids the compression and combustion pressure limits being exceeded. CMM comments that “We have selected High Pressure Tuning for our new tankers. From the results of the sea trials we conclude that the application of the A270-L turbocharger on our main engine together with High Pressure Tuning resulted in a very efficient combination. All our targets for fuel consumption have been achieved. We have a longstanding relation with ABB and we are grateful for their advice with regards to the most effective applicable tuning method.”

The simplicity and effectiveness of this innovative tuning concept are acknowledged by MAN, and in February of 2013 it was tested on a production engine in Japan with very good results. In the meantime, MAN has released it officially for its electronic engines. Shipowners have also seen the advantages of this innovation, with the result that the first High Pressure Tuned engines have already been operating since the beginning of the year.

### Benefits at a glance

<table>
<thead>
<tr>
<th><strong>A200-L</strong></th>
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<tr>
<td>Lower first costs due to a smaller frame size of turbocharger</td>
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<tr>
<td>Saving on spare parts in operation of approximately 25%</td>
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<table>
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<tr>
<th><strong>High Pressure Tuning</strong></th>
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<tr>
<td>No investment in ancillary equipment</td>
</tr>
<tr>
<td>Enhanced reliability due to fewer moving parts</td>
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Peter Zijdemans is Senior Manager Global Turbocharging Projects. He advises end users on the application of turbochargers for their newbuilding projects. A mechanical engineer (HRO Rotterdam, The Netherlands), he was ABB Service Station manager in Antwerp, Belgium, and for ten years LBU manager in the Benelux. He moved to Switzerland in 2011.
Vapor trails in the Nordic skies

Thanks to liquefied natural gas, the ABB turbocharged cruiseferry Viking Grace achieves low emissions as it carries passengers quietly and comfortably between Stockholm (Sweden) and Turku (Finland).

Text Tiziana Ossola Auf der Maur, Thomas Matt (box page 12), Photography Viking Line
Passenger ferry Viking Grace works to a tight daily schedule. Traveling overnight from Turku across the Baltic Sea to Stockholm, it arrives in the Swedish capital at 6.30 in the morning after a ten hour voyage. Just 75 minutes later, at 7.45, the ferry heads back to Turku. During the Stockholm stopover the Viking Grace is refueled in less than an hour with liquefied natural gas (LNG), stored in two 200 m³ LNG tanks on the aft deck.

Viking Grace’s dual-fuel engines run on re-vaporized natural gas. This is prepared for transport and handling by cooling it to –162 °C, at which temperature it becomes liquid and has its volume reduced around 600 times. As a result, the pressure in the ferry’s tank and piping system is very low.

Refueling of the vessel is done ship-to-ship. The fueling vessel, Seagas, is the first LNG bunkering ship in the world. This unique vessel is a converted double-ended car and passenger ferry, built in 1974 as the M/F Fjali, with an overall length of 47 meters and an 11 meter beam. The tank deck was installed in place of the former car deck. The LNG tank holds 84 tons (187 m³) of LNG and is made of vacuum-insulated stainless steel to prevent excessive evaporation (“boil-off”). In Stockholm, Seagas supplies 60 to 70 tons of LNG to Viking Grace, essentially enabling the ferry to make the crossing three days in succession without refueling.

Viking Grace in figures

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<th>Parameter</th>
<th>Value</th>
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<tr>
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<tr>
<td>Draft</td>
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<td>Gross tonnage</td>
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<tr>
<td>Year of delivery</td>
<td>2013</td>
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</table>
Elegant and green

Passengers lucky enough to occupy a lounge in the Spa area on Deck 11 enjoy “an oasis with the Baltic Sea’s best views”, the Viking Line’s advertising proudly proclaims. The interior design of the EUR 240 million Viking Grace is a successful combination of elegance and style. In short, chic.

While the shipping line places a high priority on comfort and aesthetics, that alone was not the goal. Viking Line’s declared aim is to provide passengers with the opportunity to admire the Archipelago Sea while safeguarding the environment. This was also the reason that Viking Line chose LNG as the fuel for Viking Grace, which at its launch in 2013 was the first passenger ferry to feature this innovation. Its four inline eight cylinder Wärtsilä W8L50DF dual-fuel main engines can also operate on heavy fuel oil or diesel oil, but LNG is the main fuel. What passengers see coming out of the funnel is mainly vapor.

The advantage of LNG is that, as the simplest combination of hydrogen and carbon in the hydrocarbon series, it is essentially clean-burning. Hence, Viking Grace’s engines meet all current and planned environmental regulations. When operating on LNG, the dual-fuel engines emit oxides of nitrogen more than 80% lower than limits currently specified by the International Maritime Organization (IMO Tier II). At the same time, particulate matter emissions are more than 90% lower than for a diesel engine, while the ferry’s engines emit virtually no oxides of sulfur, since LNG is rated as not just a low sulfur fuel, but a “no sulfur fuel”.

To help passengers combine business and pleasure, Viking Grace has been especially designed to cruise in the shallow waters of the Archipelago Sea between Sweden and Finland. Specialists from engine builder Wärtsilä and shipbuilder STX, as well as Viking Line’s newbuilding team, optimized the hull of the ferry hydrodynamically to minimize its fuel consumption and cause the smallest possible wake, which is particularly important when passing through the archipelago. The ship is designed and built to Ice Class 1A Super, meaning that it can operate in ice up to a thickness of one meter. A new soundproofing technology was developed to keep noise levels low, both when operating at sea and while in port. Viking Grace is a quiet vessel.
EMMA advises

ABB’s contract also covered the transmission of the electrical energy produced by the generator sets powered by Wärtsilä’s LNG-burning dual-fuel main engines. ABB Marine delivered the complete power generation and distribution system for the Viking Grace. Most of the electrical power is transmitted to the ship’s propellers, with the balance used for other consumers on board the ship, including the hotel load, i.e. the equipment responsible for ensuring passenger comfort.

ABB also installed its energy measurement and advisory system, EMMA™. EMMA continuously collects the ship’s operating data, such as its operational profile, trim, speed, energy production and onboard consumption, including the air conditioning, among other loads. Significant improvements have already been noted and the aim is to continuously improve operations by constantly monitoring and comparing the current performance with the baseline. EMMA provides advice on optimum trim, energy lost to weather, sea state and shallow waters amongst other items such as energy cost and production efficiency.

The electric propulsion system is based on the “floating power plant” principle and is one of the key contributions to energy efficiency aboard the Viking Grace. In each loading situation, the system operates only as many of the four main engines as are necessary, thereby optimizing fuel consumption and reducing the ship’s total emissions. And, thanks to the chosen power plant concept, planning service intervals for the dual-fuel main engines is easier and more accurate than with conventional HFO engines.

Turbocharging Viking Grace

Installed on each of the four W8L50DF engines is a TPL76-C ABB turbocharger. This turbocharger type enables pressure ratios of up to 5 to be achieved with a high efficiency level.

By carrying out engine cycle simulations in collaboration with Wärtsilä, the optimum turbocharger specification was defined for the W50DF engines, which require a constant air to fuel ratio in gas operation. This is controlled by the exhaust waste gate (EWG).

When matching the turbocharger and optimizing the design, the challenge is to adjust the boost pressure such that the EWG control margin is an optimum. On the one hand, the EWG opening in gas mode must be minimized for optimum fuel consumption. On the other, the EWG opening must be sufficient to cope with part load operation and different site conditions, for example varying suction air temperature or humidity.

The turbocharger matching test carried out at Wärtsilä’s Trieste (Italy) engine factory confirmed that the turbocharger specification secured optimum fuel consumption, thus ensuring reliable operation under different conditions as well as the ability to cope with emissions legislation.
A turbo boost for LNG

Demand for liquefied natural gas (LNG) is on the increase – in the power generation industry as well as, more recently, the marine sector. ABB Turbocharging is strongly committed to continuously developing technologies and maintenance solutions that support this market.

Text Marco Burgwal, Photography Michael Reinhard, Viking Line

1,700 TPL and TPS turbochargers run on over 1,100 engines powered with LNG.
Natural gas, cooled to –162 °C and, liquefied, is arguably the most discussed fossil fuel today, and it is likely to remain so in the coming years. Industry in general continues to favor it as an environmentally attractive alternative to other hydrocarbon fuels. In fact, ABB Turbocharging has delivered over 1,700 TPL and TPS turbochargers on over 1,100 engines powered with LNG so far.

Natural gas is the preferred choice for electric power generation and industrial sectors because of its low greenhouse emissions – a result of its lower carbon intensity in comparison with coal and oil. And for new power generation plants it is especially attractive because of the relatively low capital investment needed. Also, abundant natural gas resources and stable production contribute to the strong competitive position of natural gas among all the available energy sources. This trend is clearly visible in the medium and large bore power generation market, where the volume of newly produced diesel fueled engines has dropped significantly since the introduction of the new spark ignited lean burn gas engines and multi-fuel engines.

Another clear trend in the global energy market, and especially in electricity generation, is the need for high flexibility, reliability and fuel efficiency to be available over a wide load range. These requirements can no longer be met by traditional “inflexible” gas turbines, and it is here that the highly efficient gas engines have a key advantage. A multiple engine setup easily outperforms the traditional gas turbines by enabling an existing power system to operate at maximum efficiency. It does this by effectively absorbing system load variations, allowing a significant saving at the system level, and therefore for consumers. A 2012 study of the California power system by the energy consultancy DNV KEMA showed that adding highly efficient gas engines, instead of traditional, high-start-cost, inflexible gas turbines, enables up to twelve percent of the annual system costs to be saved.

ABB Turbocharging actively supports the gas and dual-fuel engine development trends through the introduction of high pressure, high efficiency two-stage turbocharging Power2® and Valve Control Management (VCM®).
Environmentally relevant

This increasing importance of natural gas is not only evident in the power generation industry; the marine sector, too, has taken note of its environmentally and commercially attractive benefits compared with other fossil fuel solutions. With natural gas as fuel, NO\textsubscript{x} emissions are reduced by 85\% and SO\textsubscript{x} and particulates are practically non-existent compared with traditional diesel engines. The key commercial benefit is that no additional expensive aftertreatment systems are required to meet the new regulations coming into force. Looking at the total cost of ownership, natural gas is potentially a more attractive solution for meeting new emission regulations than any kind of diesel configuration.

While dual-fuel engines are already widely used in the LNG carrier market, pure spark ignited gas engines still tend to be rare in the marine sector. Although operators of ferries, cruise vessels, offshore support vessels and others are showing a growing interest in this technology, the LNG boom in the marine sector for non-LNG carriers is progressing more slowly than was anticipated. This is mainly due to the IMO Marine Environment Protection Committee’s decision to enforce new regulations for ships’ NO\textsubscript{x} emissions in 2016 for already designated NO\textsubscript{x} Emission Control Areas (NECA) only. Another reason is the lack of a global LNG infrastructure, which is currently limited to specific regions.

Increased engine output

ABB Turbocharging actively supports the gas and dual-fuel engine development trends through the introduction of technologies that include high pressure, high efficiency two-stage turbocharging (Power2) as well as Valve Control Management (VCM) – see page 16. These technologies offer the possibility of increasing engine output and operational flexibility, enable fixed pitch propeller (FPP) operation and allow an increase in engine efficiency.

ABB turbochargers are used right across the medium-speed gas and dual-fuel engine market, and cover a broad range of marine and power plant applications. ABB Turbocharging also has well-established maintenance management agreement packages, such as the Operation Performance Package (OPAC), that fully support these markets. OPAC enables customers to maintain highest plant efficiency, flexibility and uptime, through monitoring, planning and completion of turbocharger maintenance at a fixed price per running hour – a key factor in today’s market environment.

Marco Burgwal graduated in 1995 in Naval Architecture and Marine Engineering in Haarlem, The Netherlands. He worked as a technical superintendent at a Dutch shipping company before joining ABB Turbocharging in 2002. After a 6 year spell in Japan, which included heading the West Japan turbocharger service business, he returned in 2008 to join the global medium-speed sales and application engineering department, which he has headed since 2011.
Two words best describe the technical benefits of ABB Turbocharging’s Valve Control Management (VCM): flexibility and efficiency. To be precise, VCM allows engine valve timings to be varied at all engine loads to control engine emissions, while at the same time improving engine response, idling and starting behavior. The result is, above all, a significant fuel saving.

In 2009 ABB Turbocharging took up the challenge of applying this technology to large engines. To achieve this aim, it forged a development partnership with the German company Schaeffler, a proven specialist in the field. Schaeffler’s UniAir-System is an electro-hydraulic, variable valve control system developed for smaller internal combustion engines and already running in hundreds of thousands of cars.

**Fast load changes enabled**

The results of the engine tests that ABB Turbocharging has conducted have been extremely positive. In fact, as ABB Turbocharging VCM project leader Ville Pellinen notes, “In many respects, the results are better than we were expecting.” The operating principle of ABB’s VCM system distinguishes itself from other, existing solutions, in a number of ways. “We can vary the amount of air reaching the engine any time we like,” Pellinen adds. “Each cylinder is able to work differently thanks to the rapid variation in valve timings in every single engine working cycle.”

This VCM principle opens up a wide area of potential applications on marine engines – for example in offshore ships or passenger ferries. Generally speaking, VCM is of assistance wherever fast load changes are expected of engines on a regular basis. Pellinen continues: “VCM enables engine power to be changed by 50% within fractions of a second. And it also provides a tremendous power reserve at lower engine speeds. In the future, many vessels could be fitted with simpler fixed pitch propellers (FPP) instead of controllable pitch propellers (CPP). This would reduce both the first costs and the operating costs associated with the much more expensive and complex CPP alternative.”

In addition, ABB Turbocharging’s tests show that VCM considerably improves gas and dual-fuel engine combustion. Efficiency increases of 1.5% – corresponding to a 3% lower fuel consumption – have already been demonstrated on engines with VCM. In combination with ABB Turbocharging’s high pressure, high efficiency two-stage turbocharging Power2, VCM also enables a further

### VCM: Benefits at a glance

- Significant fuel saving
- Especially helpful in marine applications with frequent and fast load changes
- Increased tolerance of different fuel qualities and ambient conditions
VCM is of assistance wherever fast load changes are expected of engines on a regular basis.

Increase in engine power and additional operating robustness. Gas and dual-fuel engines with "diesel-like" performance are within reach with very strong, controlled Miller cycle combustion. The high pressure, efficiency and flexibility of Power2 and VCM complement each other here.

VCM compensates for low gas quality
Currently, only about 60% of the worldwide liquefied natural gas (LNG) supply is of a high enough quality to allow full power operation on the current generation of gas engines. Further, gas quality is expected to diminish in the future. In the worst case, a bigger engine will need to be installed in order to compensate for the reduction in power potential due to low gas quality. "In some cases VCM even allows an engine with fewer cylinders to be used. That, of course, also translates into a saving in first and operating costs," Pellinen says.

Political decisions that increase the relevance of LNG are on the way. The limitations for oxides of nitrogen (NOx) and sulfur (SOx) in Northern Europe, the USA and Canada are boosting the use of gas or dual-fuel engines, since commercial LNG is not just a "low-NOx" fuel, but also a "no-sulfur fuel". LNG is set to be an economically viable alternative to liquid fuels by 2020/2025 – when it is planned to introduce worldwide limits – especially when compared with the alternative of relatively expensive diesel oil and aftertreatment equipment. Also, the EU is set to provide LNG refueling points for maritime and inland waterway transport at 139 ports in the Trans-European Transport (TEN-T) core network by 2025/2030. This is an important step for both the shipping industry and the harbors themselves. For VCM project leader Pellinen it goes without saying that "ABB Turbocharging is equipped to face a future in which the significance of LNG will grow."
Support spotlight on Africa

Overseeing nearly thirty offshore support vessels operating between Gibraltar and Mozambique keeps Swire Pacific Offshore (SPO) Africa Technical Manager Aart Rikkers extremely busy.

Text Hugh O’Mahony, Photography Constantin Ledes

From Douala, Cameroon, Swire Pacific Offshore Africa oversees operations stretching from Gibraltar in the north, all the way down the west coast of Africa, and round the Cape of Good Hope to Mozambique. Within this area of operation SPO Africa controls a 26-strong fleet of offshore support vessels, recently expanded from 22 vessels.

With a 27th unit – the platform supply vessel Pacific Leader – due in service, SPO Africa Technical Manager Aart Rikkers is a busy man. His duties extend across a fleet split between charter and spot tonnage, ranging in power from 5,000 bhp to 20,000 bhp, in age from 16 years to newbuild, and in function from anchor handling to supply and maintenance in some of the world’s most challenging offshore markets.
Technical monitoring is key

“Our policy is that vessels should be able to perform to expectations 100% of the time and our maintenance program is there to assure our customers that this is so,” explains Rikkers. “While fleet management is centralized in our head office, technical monitoring is critical and around 85 – 90% of the detail comes from us within the region.”

“And this applies whether the vessel is supplied under a five year contract or via a one day spot charter,” Rikkers points out. “For example, fuel is paid for by the client, and meeting fuel consumption efficiency laid out in the tender is a really important topic for us.”

As well as routine monthly full power testing to establish engine and turbocharger performance is in line with the engine specifications, service support must be in place to ensure that – where possible – maintenance is a planned rather than an emergency procedure. “Reliability, availability and low fuel consumption outweigh any other factors when it comes to the performance of engines on our vessels,” adds Rikkers.

A complex undertaking

Class rules dictate acceptable intervals for full (every five years) and intermediary (2.5 years) vessel surveys. Rikkers says he faces particular challenges on yard scheduling beyond those of making sure surveys coincide with standard engine/turbocharger overhaul intervals of 20,000 running hours. The owner prefers to dock its vessels in Walvis Bay and Abidjan rather than use facilities closer by, a preference that Rikkers says calls for extended dock planning time.

Getting supplies to vessels can also be testing, with 50 – 60% of consumables coming from Europe. In terms of maintenance spares, the logistics challenge is even greater, with around 80% of parts delivered from Europe and the rest coming from Asia.

“We draw upon Swire Pacific Offshore’s (SPO) synergy with Altus Logistics in the Netherlands to consolidate parts shipments for us, but the newer vessels coming into regional operation are more advanced than their predecessors and so servicing them is a more complex undertaking,” says Rikkers.

One of the first suppliers through my door was ABB, a visit that was quickly followed by a tour of ABB Turbocharging’s local workshop.

“Pacific Leader, for example, features diesel electric propulsion as well as Azipod propulsors, which is in line with the other newbuilds specified by SPO and is the future of the supply vessels industry in my opinion.”

Maintenance planning has a high priority

Rikkers continues, “If there is a problem that falls outside our planned maintenance, we rely on the equipment makers and their technical teams. We have our own technical experts and we will solve technical problems where we can, of course, but sometimes we do not have the time to drill down into a specific issue and it is more effective to bring the maker into direct contact with the vessel operator.

“Of course, it remains our responsibility to ensure that all equipment onboard is maintained using original spare parts that are both up to date and according to the specifications promised. Fortunately, this has not been a major issue, especially when it has come to ABB Turbocharging. Personally, I have been here for two years and one of the first suppliers through my door was ABB, a visit that was quickly followed by a tour of ABB Turbocharging’s local workshop. Since that time, we have undertaken seven or eight dockings that have involved overhauling the turbochargers.

“We also appreciated being visited by ABB Turbocharging director-level representatives from Switzerland and France in recent months, and being taken through the latest developments, technical and otherwise. If it was like this with all of our suppliers, I would be a happy man.”
Inauguration in Fredericia, Denmark

Fredericia. In June ABB Turbocharging opened a new Service Station in Fredericia, Denmark. This also marks the completion of the amalgamation of the company’s activities in Norway, Denmark and Sweden into a single Local Business Unit (LBU).

Fredericia is a multi-purpose service facility that allows literally all locations of Denmark to be reached in about 2-3 hours. The location also has the additional advantage of being both an established and a big ABB site, with a considerable number of ABB employees in the large workshop and with excellent logistics and more facilities. The turbocharging workshop meets the high safety standards required for service operations.

The opening of the new Fredericia station is a move in the stepping up of service operations in a strong market. As home to leading shipowners, including the globally active container market leader AP Møller-Maersk, Denmark is a major shipping nation and the country’s power generation grid includes a number of decentralized power and cogeneration plants based on piston engines.

New Turbocharging Service Point in Batam

Batam. As part of its commitment to help its customers in maintaining and improving their productivity, ABB has opened a new Turbocharging Service Point in Batam, Indonesia. The Service Point will be the base for maintenance and repair of ABB turbochargers and support the sustainability of ABB customers’ operations in the marine industry, power sector and other industry sectors in Batam.

Batam is a free trade zone and lies on one of the world’s busiest shipping lanes between Sumatra and Singapore. This has made Batam one of the key areas for ship repairs in Indonesia. Moreover, Batam’s basic infrastructure, such as its electric power systems, is growing significantly, as witnessed by the independent power producers who have invested heavily in Batam.

TPR turbochargers for Chinese locomotive “Smart Loong”.

Railways. ABB Turbocharging is dedicating a special issue of charge! exclusively to railways. charge! rail special takes a close look at the four great railway systems of the world in Russia, China, India and North America. The magazine will analyze their special characteristics and current trends, as well as their needs for engine turbocharging. For decades, ABB Turbocharging has been supplying reliable turbocharger technology to the world’s diesel locomotive industry. The company provides an offering of products and product servicing precisely tailored to the railway market, to meet both the technological and economic needs of the industry. The latest TPR turbocharger generation, now including the option of variable turbine geometry (VTG), is enjoying a highly positive reception from operators of heavy main line and shunting locomotives around the world.

charge! rail special is available during Innotrans, the International Trade Fair for Transport Technology (23 – 26 September 2014), from the ABB Turbocharging exhibit in Hall 9, Stand 204 at the Messe Berlin exhibition center.
Wärtsilä and ABB Turbocharging collaborate in ten-year service agreement with Royal Caribbean Cruises Ltd.

Collaboration. Wärtsilä, the marine industry’s leading provider of innovative products, solutions and services, has signed a ten-year maintenance and technical support agreement with Royal Caribbean Cruises Ltd. (RCL). ABB Turbocharging, the world leader in the manufacture and maintenance of turbochargers for 500 kW to 80+ MW diesel and gas engines, has been subcontracted by Wärtsilä in the servicing of the agreement, which covers 142 Wärtsilä engines and 170 ABB turbochargers in 36 RCL vessels, 32 already in operation and four newbuilds, with an option to add more vessels in the future.

Under the terms of the contract, Wärtsilä will provide a broad range of services for RCL, including condition monitoring of the engines, individualized technical support, the development and design of new components as well as a spare parts supply agreement. ABB Turbocharging will work with Wärtsilä to provide a customized service package for turbochargers on the vessels, including scheduled and unscheduled spare parts and labor at ABB workshops.

The agreement is one of the largest between Wärtsilä and a marine customer. It supports Wärtsilä’s strategy of offering long-term service agreements that allow customers to focus on their core business. ABB’s agreement with Wärtsilä will bolster their strategy of responding effectively and intelligently to customers’ needs to make a positive, lasting difference in their applications’ operation.

“By combining the knowledge from the customer’s side with the knowledge and experience from Wärtsilä and ABB, we made this agreement a reality. The contract will enhance the predictability of Royal Caribbean’s operational costs, minimize scheduled and unscheduled maintenance costs as well as optimize the planning of maintenance and spare parts deliveries,” says Kimmo Kohtamäki, director of four-stroke engines at Wärtsilä.

“Our focus has always been to ensure safe, cost-effective and reliable turbocharger operations so that RCL can focus on what is most important of all, namely the safety and comfort of their passengers and their business. We are very pleased to be able to work with Wärtsilä to offer RCL the very best standard in turbocharging,” says Axel Kettmann, Senior Vice President and global head of sales, marketing and service at ABB Turbocharging.

Royal Caribbean Cruises Ltd. operates a substantial number of Wärtsilä engines, and can point to over 40 years of cooperation and partnership with Wärtsilä. Wärtsilä and ABB Turbocharging also have a longstanding collaboration around turbocharging in several key areas, including service agreements, research and development and sales.
When “both…and” is simply perfect

The floating university Semester at Sea combines study and travel. Equipped with ABB turbochargers, the ship sails safely and reliably to ten or more countries in about 100 days. This year Semester at Sea is celebrating its 50th year in business.

Text: Tiziana Ossola Auf der Maur, Photography: Semester at Sea
All students know the dilemma: they want to complete their studies as soon as possible, but they also badly want to see something of the world. The answer is available: the “both…and” alternative. It is called Semester at Sea. The idea: you study on a ship and simultaneously explore the world. The organizers call their school ship “the coolest campus on earth”.

The MV Explorer sets sail three times a year with up to 720 students on board. The next trip, planned for spring 2015, is a voyage around the world. Embarkation is in San Diego, California. From there the ship goes to Hawaii, Japan, China, Southeast Asia, India, around the Cape of Good Hope and via Ghana to Morocco. 112 days, 16 cities and 12 countries later, the students disembark in Southampton, England.

It’s an exciting thing to do. Whether in the Swinging Sixties or Post-Millennium: 60,000 alumni have enjoyed the Semester at Sea experience. This year Semester at Sea is fifty years old.

Learning about offshore issues

Semester at Sea is a global study-abroad program operated by the non-profit Institute for Shipboard Education (ISE) in Charlottesville, Virginia. The University of Virginia is the program’s academic sponsor. Semester at Sea offers up to 75 courses across several disciplines of study. Learning aboard ship is exactly like studying on dry land. The Semester at Sea courses are fully accredited and meet the generally accepted standards for transfer – i.e. students benefit from credits earned at their home institution. About two thirds of the courses are offered on every voyage, while the remaining third is unique to the voyage concerned.

The detailed route, the lecturers and the content of the courses are fine-tuned to each other for each itinerary planned. The stopover in Scotland brings science and engineering students and their lecturers to the University of Strathclyde in Glasgow. They visit the nearby Whitelee Wind Farm, the largest in the U.K. This academic field trip is used to discuss offshore and onshore wind energy issues. On summer voyages to the Mediterranean, the World Literature course focuses mostly on literature from the nations en route.

Semester at Sea does not, of course, see itself as an enabler of country-hopping consumer tourism. Every stay ashore is part of the syllabus. As the organizer’s website explains, first-hand observation should help to broaden horizons and promote an understanding of world issues. Comparisons between cultures aim to help develop a better awareness of one’s own culture.

A proven engine configuration

The 180 meter MV Explorer was built in 2002. She has classrooms, lecture theaters, a library and a swimming pool. Two hundred crew members accompany every MV Explorer voyage. They are more than service providers. “Crew members,” Semester at Sea says, “typically originate from more than twenty countries and are an important component of the overall learning experience during the voyage.”

Accommodation aboard is – according to the students’ (parents’) financial resources – in single or multi-berth cabins. Irrespective of the level of comfort, students want to experience something while traveling safely – ship management is handled by V-Ships, a globally active provider with representatives at major ports.

The MV Explorer is equipped with Wärtsilä 9LW46 diesel engines turbocharged with TPL 77-A30s from ABB Turbocharging. “The W46 line of Wärtsilä engines coupled with ABB’s TPL-A line of turbocharger are both a proven and reliable configuration. Having four of these power units on the MV Explorer also guarantees a high degree of redundancy”, explains Tomas Lorentz, Global Cruise Line Manager at ABB Turbocharging in Miramar, Florida.
All major international container lines are nowadays operating their vessels in so-called “slow steaming” or even “super slow steaming” mode at engine loads down to 10% MCR (Maximum Continuous Rating). Slow steaming reduces specific fuel consumption, lowers carbon emissions and considerably improves companies’ environmental balance sheets into the bargain. The one big advantage of slow steaming is that it provides shipowners with a flexible solution to the problem of how best to save on fuel oil. Many of ABB Turbocharging’s customers need and wish to have the possibility to run on full load, yet also be able to save on fuel oil when the possibility of slowing down arises.

Turbocharger cut out is a popular choice for slow steaming solutions.

Slow steaming – a proven strategy

With bunker costs increasing, “slow steaming” has become a universally accepted means of significantly reducing fuel consumption and is used by major shipping companies around the world.

Text Holger Markow, Photography Michael Reinhard
Tips for the operator

Part-load and low-load operations
To meet this growing demand for running large vessels on varying loads, all major two-stroke engine builders have developed customized slow steaming solutions that improve the main engine performance during part-load or low-load operation.

A popular technical solution is turbocharger cut out. This practice has widely recognized benefits and is in use on large container vessels operating across the globe.

When one turbocharger is cut out, the remaining turbochargers benefit from the higher exhaust gas energy they receive. This causes the scavenge air pressure to increase and provide higher cylinder compression and maximum combustion pressure. The outcome is lower fuel oil consumption and a good overall engine condition.

Cleaning regime and slow steaming
Over the past five years ABB has been successfully involved in hundreds of slow steaming projects, either with a fix or flexible cut out solution.

Over the past five years ABB has been successfully involved in hundreds of slow steaming projects, either with a fix or flexible cut out solution.

Two ways to achieve a turbocharger cut out:

1. In the so-called “fix or permanent cut out”, the rotating and bearing parts are completely removed and stored, and the gas, air and oil ports are closed with blanking plates.
2. With the “flexible cut out”, no parts are removed from the turbocharger but controlled cut out valves are installed in the exhaust gas inlet and air outlet. The turbocharger can be engaged whenever needed. As oil is still supplied to the turbocharger, the provision of external sealing air to the turbocharger is mandatory for an oil- and gastight sealing, plus modifications to the turbocharger are required.

Cut out information reminder.

Over the past five years ABB has been successfully involved in hundreds of slow steaming projects, either with a fix or flexible cut out solution.

Cut out information reminder.

Holger Markow is an environmental and process engineer with a post-graduate degree in economy engineering. He joined ABB Turbocharging in 1996. Today Markow is Senior Manager Technical Service, responsible for claims management, breakdown investigation and technical support for end users, operators and Service Stations.
We have said farewell to port A, but we are not yet at our destination, port B. In between lies a voyage on which we are encapsulated in the confining world of the high seas.

In works of fiction voyages aboard ship always have added significance. Departures are exciting. “I had the feeling I was starting a new life,” says the fifty year old engineer in the Swiss novel “Homo Faber” (Max Frisch), as he boards the steamer from New York to Le Havre. Walter Faber has just left his partner. He finally feels free, young – and uninhibited. It doesn’t take long before a young lady catches his eye …

For Mynah, the eleven year old protagonist in “The Cat’s Table” by Michael Ondaatje, his passage from Ceylon to England is an unrestrained journey of adventure, diving “like needles into the gold-painted first-class pool with barely a splash”. And discovering the questionable rituals of the adult world, that at the captain’s table one is “constantly toasting one another’s significance”.

A sea journey often means change and even personal transformation. Walter Faber will learn later that the young lady he has fallen for is his own daughter. He, the man of facts and figures, who only believes what can be proven, now has to come to terms with something as unfathomable as chance.

What is your poetry of passage? If you are lucky enough to travel from Sweden to Finland on Viking Grace (see page 8 in this issue of charge!) consider this question while enjoying Viking Grace’s culinary recommendation of fillet of lamb.
Fillet of lamb, lamb sausages, purée of parsley root, wild garlic and butter sauce

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>fillet of lamb (trimmed)</td>
<td>480 g</td>
</tr>
<tr>
<td>caul fat of pork</td>
<td>1</td>
</tr>
<tr>
<td>pesto of thyme: 1 bunch of thyme, 7 tsp. of grated parmesan cheese, 3 garlic cloves, 2.5 dl oil, salt and pepper</td>
<td>2 tsp.</td>
</tr>
<tr>
<td>salt</td>
<td>to taste</td>
</tr>
<tr>
<td>pepper</td>
<td>to taste</td>
</tr>
</tbody>
</table>

Season the fillets with the pesto, salt, pepper, and wrap them into the caul fat. Fry the surface, bake in oven at 108 °C until the inner temperature is 48 – 50 °C. Allow to rest for 15 minutes.

Purée of parsley root

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>parsley root, cream, butter, salt, pepper</td>
<td>500 g</td>
</tr>
</tbody>
</table>

Peel and cut the root, cook with cream until soft. Liquidize to a purée, add butter, salt and pepper.

Lamb sausage

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>(approx. 150 g) lamb roasts (trimmed) in cubes</td>
<td>2</td>
</tr>
<tr>
<td>(approx. 40 g) pork loin in cubes</td>
<td>⅔</td>
</tr>
<tr>
<td>bacon</td>
<td>60 g</td>
</tr>
<tr>
<td>flake salt</td>
<td>8 tsp.</td>
</tr>
<tr>
<td>black pepper</td>
<td>2 tbs.</td>
</tr>
<tr>
<td>brown sugar</td>
<td>7 tsp.</td>
</tr>
<tr>
<td>paprika</td>
<td>5 tbs.</td>
</tr>
<tr>
<td>garlic powder</td>
<td>2 tbs.</td>
</tr>
<tr>
<td>fresh thyme</td>
<td>3 tbs.</td>
</tr>
<tr>
<td>fresh rosemary</td>
<td>3 tbs.</td>
</tr>
<tr>
<td>garlic cloves</td>
<td>5</td>
</tr>
<tr>
<td>red chili-peppers seeded</td>
<td>2</td>
</tr>
<tr>
<td>grated Pecorino cheese</td>
<td>12 tbs.</td>
</tr>
<tr>
<td>ginger</td>
<td>50 g</td>
</tr>
</tbody>
</table>

Combine all ingredients. Allow to rest until next day in vacuum. Grind twice in meat grinder. Add 7 dl of sour cream, mixing by hand. Fry a test piece to ensure the seasoning. Get some cleaned lamb intestine from the butcher. Fill the lamb intestines with the mass. Simmer the sausages in hot, but not boiling water. Grill or fry them before serving.

Wild garlic and butter sauce

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>white wine</td>
<td>3 dl</td>
</tr>
<tr>
<td>white wine vinegar</td>
<td>2 dl</td>
</tr>
<tr>
<td>sour cream</td>
<td>7 dl</td>
</tr>
<tr>
<td>salt</td>
<td>to taste</td>
</tr>
<tr>
<td>pepper</td>
<td>to taste</td>
</tr>
<tr>
<td>cream butter in cold cubes</td>
<td>50 g</td>
</tr>
<tr>
<td>wild garlic leaves (minced)</td>
<td>1 handful</td>
</tr>
<tr>
<td>beef stock</td>
<td>2 dl</td>
</tr>
</tbody>
</table>

Bring the white wine, vinegar and cream to the boil, add the butter and mix to thicken the sauce. Season with the minced wild garlic. Prepare some stock according to the instructions on the packet.
Turbocharging upgrades. The smart move to higher efficiency and savings.

An ABB turbocharging upgrade utilizes the latest technology to enhance your investment and your engine’s performance. Upgrading your turbocharger will increase your application’s efficiency, thereby saving fuel consumption significantly and increasing your productivity through an increase in your application’s speed margin. What’s more, an upgrade increases your engine’s operational life, the time between overhauls, thus reducing maintenance costs. Make the smart move to an upgrade.

www.abb.com/turbocharging