

An LNG carrier is a special-purpose vessel in which sophisticated technology is used to transport liquefied natural gas (LNG), a highly flammable cargo. Ship safety is of course paramount, but also important are the reliability and availability of the propulsion system of such vessels as these factors influence the whole gas chain from well to consumer.

Wärtsilä has today about 300 operations and maintenance agreements for installations in the traditional power plant sector, marine and off-shore, as well as energy production for oil fields and pumping units for pipelines. This long experience and knowledge of extensive service agreements can benefit owners and operators of LNG carriers equipped with dual-fuel engines by ensuring that the engines perform according to expectations.

Maintenance of dual-fuel propulsion

Gas transportation contracts are typically long-term and the sailing schedules of LNG carriers are very precise. Missing a schedule can have far-reaching consequences as this could affect not only the ship operator's own business but the entire gas chain from well to consumer. For obvious reasons it is essential to make every effort to avoid such a risk. This calls for emphasis on maintenance to guarantee high availability and smooth operation.

Wärtsilä offers methods of servicing the engines even when schedules are tight and repair facilities onboard are limited. In situations like these it is possible to use exchange parts and extra resources from field service to be able to perform the maintenance without influencing the schedule of the vessel.

However, the most important aspect when the window of opportunity to service the engines is limited is to plan maintenance properly in the first place. The spare parts and people needed to assist in maintenance have to be in the right port at the right time.

It might sometimes be necessary to evaluate the possibility of extending the maintenance schedule to satisfy the vessel's operating needs without sacrificing reliability. On the other hand it may be better to replace parts earlier than scheduled depending on the window of opportunity.

Wärtsilä also has methods of monitoring the performance of the engine and determining the necessary maintenance actions based on actual needs instead of scheduled maintenance. Alongside scheduled maintenance, this method – which we call condition-based maintenance

Operations & maintenance for the oil and gas industry



Fig. 1 – The LNG carrier, the 75,000m³ Gaz de France Energy, is equipped with four 6-cylinder Wärtsilä 50DF engines.

(CBM) – offers a useful alternative when it is necessary to establish which port call to use to perform the maintenance. Another important benefit CBM offers is optimization of the engine performance. Being able to do that means lower fuel and lubricating oil cost.

Service agreements

Wärtsilä offers its customers a range of service agreements to ensure that the engines and other equipment perform as they should and in this way improve the lifetime efficiency of the investment.

The range, tailored to different needs, varies from simple supply agreements to extensive service agreements in which Wärtsilä people are constantly on hand to take care of the engines and other agreed equipment onboard. They are responsible, in other words, for ensuring that the power from the engines is always available when needed. In a sense, in signing an extensive service agreement the customer is buying reliable megawatts rather than engine service. Having Wärtsilä experts onboard doesn't however mean that they come on

top of the normal crew, but as a part of it. In this capacity, besides taking care of the dual-fuel engines, they also handle other duties belonging to their rank. This arrangement offers cost-effective way for the customers to ensure reliable power production and operation of the LNG carriers powered with the Wärtsilä 50DF engine.

Besides the personnel onboard Wärtsilä typically pulls in extra resources from its field service pool for major maintenance activities carried out, for example, during dry-docking, to shorten the time out of operation and ensure the work is done effectively. Wärtsilä has over 3000 specialists skilled in providing the resources to assist with or carry out dedicated tasks.

Customers and operators of course have their own procedures and policies which the service agreement provider naturally has to follow as well. Training in these must be performed during the preparation phase of the agreement.

The service provider will also apply any relevant procedures based on industrial standards and legislation where necessary.

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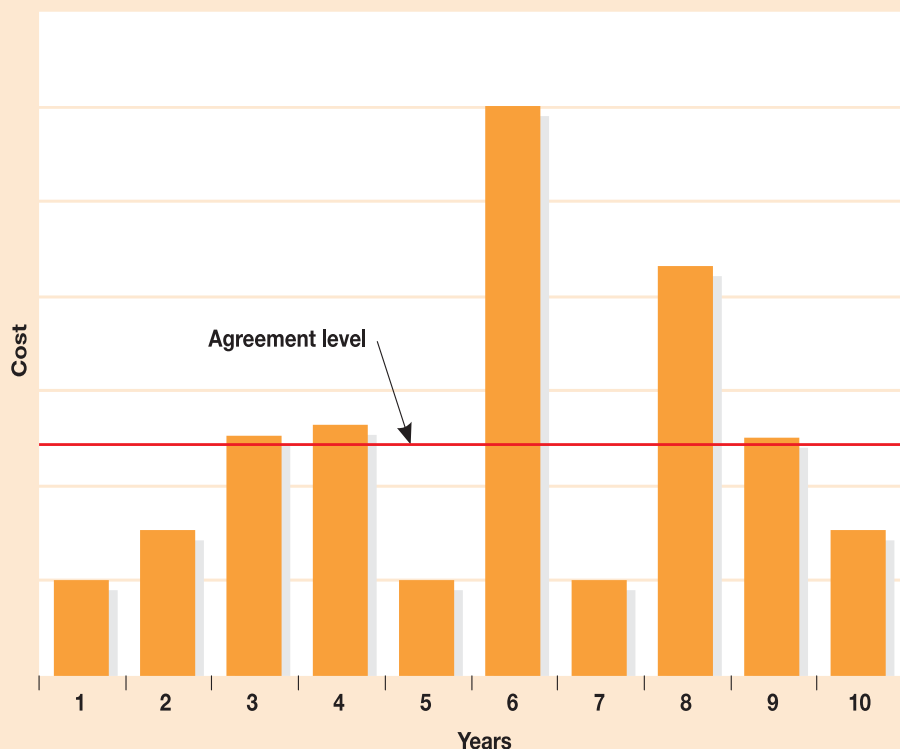


Fig. 2 – Typical maintenance cost distribution over several years.

In addition to people onboard, effective service also requires land-based coordination for planning the maintenance and handling the necessary logistics. This is typically the responsibility of the Wärtsilä service office at the most convenient location to the customer to ensure smooth co-operation.

The cost of maintaining diesel and dual-fuel engines varies depending on the running hours and the lifetime of the engine will include both major maintenance operations and also periods of marginal activity with necessary spare parts. In service agreements Wärtsilä provides a flat fee over the contract period including spare parts and maintenance work. Having a constant cost over the years means easier financial planning for the customer, as illustrated in Figure 2. And performance-based fees mean that customers only pay for what they get. Thus it is up to the supplier to ensure the availability of the spares and services when needed.

Outsourcing service and maintenance does not mean losing control over what is going on. Active communication between the ship operator and the service provider

is essential for both parties to ensure good planning. Reporting in the agreed manner will be frequent and this will also verify that the performance parameters are being met.

Ready-made templates for reporting exist of course, but Wärtsilä can also tailor the reporting procedures to satisfy the needs of a particular customer. Although the process of specifying and building a vessel like an LNG carrier takes a long time and servicing of the main propulsion unit might not be at the top of the list early in the process, it is still necessary to start preparing the service and maintenance procedures in good time. Since recruitment and proper product training takes time, the best results are ensured when discussion about the service agreement is started at the engine selling stage.

Service agreements combine service products

Service agreements are an excellent way of exploiting the synergies from Wärtsilä's different service products. This is done internally to bring the agreed results effectively to the customer.

One important area in which Wärtsilä's

various service products can be combined is personnel training. When required, Wärtsilä also uses the services of its Land & Sea Academy to train the personnel working with service agreements.

Even if LNG carriers sail on a dedicated route for a long time it is vital that engine service is available in the ports around the world where the vessel calls. Wärtsilä has more than 130 service points in over 60 countries to ensure good service to its customers.

Whenever possible, the service agreements are handled locally by the appropriate Wärtsilä service office. However, thanks to Wärtsilä's organized approach to handling service agreements, there is always support available from the product factories and main service locations for the local offices.

To be cost-effective maintenance must be based on accurate information. Onboard modern ships megabytes of data are produced either automatically by sensors on the engine or manually by computer keyboards. However, this data needs processing and evaluating to create economically valuable information. Such information gives an accurate picture of the condition of the engines as well as a list of actions necessary to maintaining the engines at their optimal performance.

Analysing and optimizing performance can be combined with the service agreement to gain most benefit from Wärtsilä's knowledge as an engine builder. To have performance data analysed by Wärtsilä's engine experts also helps maintenance planning and improves the reliability of the engines when possible malfunctions can be detected before they cause any damage. This also means savings for the customer not only in engine maintenance but notably through optimum operation of the vessel.

Wärtsilä also has other Operations & Maintenance systems to support maintenance and spare parts logistics, examples including installation-specific Technical Service Information (TSI) letters and the Maintenance Management Program (MamaPro).

Since the needs and expectations of each case vary, even in the case of similar vessels, every service agreement is tailored with the customer to gain the desired benefits.

Reducing risk, improving safety and reliability

The causes and consequences of accidents depend strongly on the ship's operation and most of them at sea are man-made in origin. Obviously onboard an LNG carrier there is no room for negligence.



Fig. 3 – Petrojarl 1 with two Wärtsilä 18V32DF prime movers is one of the FPSO's (Floating Production Storage and Offloading vessel) of PGS where Wärtsilä has permanent personnel onboard as a part of the engine room crew.

When performance of the vessel has significance in a wider perspective, as in LNG carriers, engine performance is very important. When Wärtsilä personnel perform service, there must be economic benefits for the customer, besides safety, to make the relationship worthwhile. Wärtsilä is prepared to guarantee the performance of its engines by providing management and technical know-how. This is possible when all the elements of maintenance that influence the performance can be controlled. Having its own personnel working with the engines, Wärtsilä is able to do this.

Regardless of the preparations there is always the risk that parts break, resulting in unplanned maintenance. Wärtsilä is also prepared to take care of unplanned engine maintenance up to agreed limits, which reduces the risk for the customer.

Extensive service agreements offer fixed-price long-term contracts, which is a clear advantage that gives the customer a predictable and stable cost profile over the years and reduces their financial risk.

Experience

Wärtsilä offers a wide range of service agreements up to full operation and maintenance. Wärtsilä is currently responsible for operating more than 140 power plants around the world with a total output of about 2600 MW. We also have about 150 maintenance agreements on land and sea representing a total output of

about 2300 MW. Customers entering into an agreement with a partner like Wärtsilä that already manages such a large portfolio of similar agreements can be assured of a deep base of knowledge that can only be of benefit.

Wärtsilä Operations & Maintenance, under which the extensive service agreements are handled, has certified the global management of its operation and maintenance business according to ISO 9001 ed. 2000.

Conclusion

In the long run service agreements, besides reducing risks for our customers, also save money as our performance-based payment means that customers only pay for what they get.

In extensive service agreements, Wärtsilä takes care of logistics and personnel issues, enabling customers to concentrate on their core business. Instead of a supplier-customer relationship, entering into a service agreement means a close partnership relationship based on mutual goals.

We also believe that extensive service agreements offer clear benefits to customers, especially in installations where availability and reliability are of critical importance, as in the case of LNG carriers. This is confirmed by experience of existing agreements in which Wärtsilä people are responsible for looking after the engines. ■

The costs of operating diesel engine applications has increased in recent years mainly because of rising fuel prices. This has forced owners and users to find means of keeping this increase to the minimum. Condition-based maintenance (CBM), a solution developed by Wärtsilä, supports this aim both by optimizing maintenance costs and by reducing fuel costs. This lengthens component lifetime while at the same time reducing the number of unplanned stops and failures.

Many owners and users of medium- and low-speed diesel engines today have adopted the CBM solution for planning and performing their engine maintenance. Almost 100 different installations are now connected to the Wärtsilä CBM system and the number is increasing in both new and old applications.

CBM is more than just a maintenance system, as it covers both the maintenance and operation of the engine. This offers users the additional advantage of regular monitoring of actual operating conditions as well as support and feedback from the engine supplier.

Continuous monitoring of performance

The most common form of maintenance on installations today is scheduled maintenance based on the operating hours of the equipment, the supplier's experience and the worst-scenario operating conditions. Scheduled maintenance is a safe solution for many installations but it is also expensive. Operating conditions differ considerably from one installation to another, and therefore the need for maintenance also differs widely.

CBM, on the other hand, offers continuous and detailed monitoring of the real performance of each installation. Wärtsilä's CBM system is based on automatic collection of performance data from the existing control and monitoring system and automatic transfer of this data for remote analysis by CBM experts. The measured performance data is compared with calculated 'ideal' values for the equipment considering the unique environmental conditions of the application such as operation profile, design data, actual operation conditions, load, ambient condition, fuel in use, etc.

Continuous follow-up of the performance of the installation, including regular feedback with predictions for the future, comments, recommendations and statistics at least once a month, enables the