

WÄRTSILÄ

# INSIDE STORIES 2011



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# PRESIDENT AND CEO BJÖRN ROSENGREN INTRODUCES WÄRTSILÄ INSIDE STORIES



Björn Rosengren

INSIDE  
STORIES

In Wärtsilä's Inside Stories on [www.wartsila-insidestories.com/en/](http://www.wartsila-insidestories.com/en/) you will find a video of Wärtsilä's President and CEO Björn Rosengren introducing the Inside Stories, a selection of videos, interviews and cases.

These stories highlight our commitment to sustainability with landmark LNG and environmental solutions as well as the continuing success of our Smart Power Generation concept.

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# CLOSE COLLABORATION WITH OUR STAKEHOLDERS



Wärtsilä's Suppliers' Day seminar focused on the importance of close co-operation between Wärtsilä and its suppliers.

## Wärtsilä participated in various sustainability-oriented partnerships and initiatives during 2011.

In April, Wärtsilä announced a co-operation agreement with Crisis Management Initiative (CMI), an independent Finnish non-profit organisation that works to resolve conflicts and build sustainable peace. The chairman of CMI is the Nobel Peace Prize laureate and former President of Finland, Martti Ahtisaari. As lead partner, Wärtsilä supports the activities of CMI and creates partnership programmes with CMI in selected areas throughout the world.

Wärtsilä hosted a Suppliers' Day seminar in August for 130 of its key suppliers to discuss current issues. The two-day seminar focused on the importance of close co-operation between Wärtsilä and its suppliers. Meeting the increasing demand for sustainable solutions and products was among the main topics of discussion.

Also in August, Wärtsilä and Shell Oil Company signed a joint co-operation agreement. The aim of the agreement is to promote and accelerate the use of liquefied natural gas (LNG) as a marine fuel. Gas-fuelled marine engines are seen as being a logical means for ship owners and operators to comply with increasingly stringent environmental legislation. The agreement will run for several years and will focus first on supplies from the US Gulf Coast, before being expanded to cover a broader geographical range.

Co-operation with the Baltic Sea Action Group (BSAG) continued with Wärtsilä participating in the International Sustainable Seas 2011 event in Stockholm (Sweden) and Turku (Finland), hosted by Sweden's Crown Princess Victoria. Together with a large group of environmental experts, researchers, and government officials, Wärtsilä discussed the future of the Baltic Sea and highlighted the fact that scrubbers, and other environmental products and services provided by Wärtsilä, already enable the transition to more sustainable shipping in the Baltic Sea and the other seaways of the world.

In October, Wärtsilä joined other global companies and NGOs in signing the Sustainable Shipping Initiative's (SSI) Vision 2040 to secure the industry's future. This also marked the start of a joint work programme to deliver long-term sustainability. Included among the key goals of the vision are diversification of the industry's energy mix, the dramatic reduction in greenhouse gas intensity, and enabling the financing of a large-scale uptake of technological and operational innovations to promote sustainability – as well as safety, health and transparency related issues. At the launch event in London, SSI members called on the industry to participate in its work streams in order to promote the most active knowledge transfer possible.

Continuous dialogue with our stakeholders is an integral part of Wärtsilä's way of working. Through dialogue in various forums, and via direct relationships with stakeholders, a deeper understanding of the key issues and expectations related to sustainable development can be attained.

# OUR CONTRIBUTION TO LNG AS A SOLUTION

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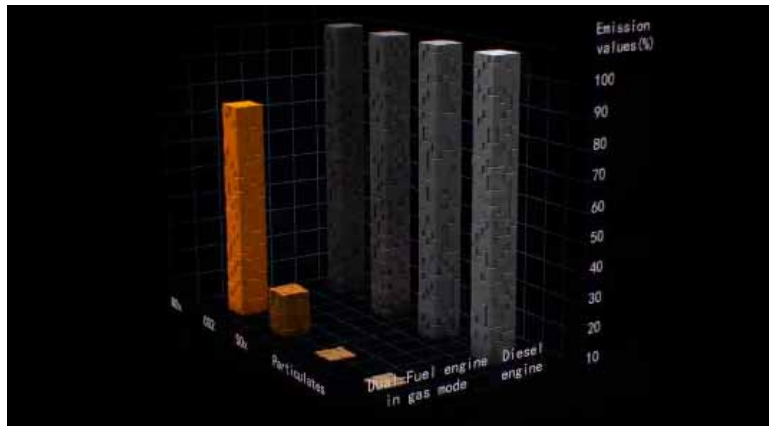
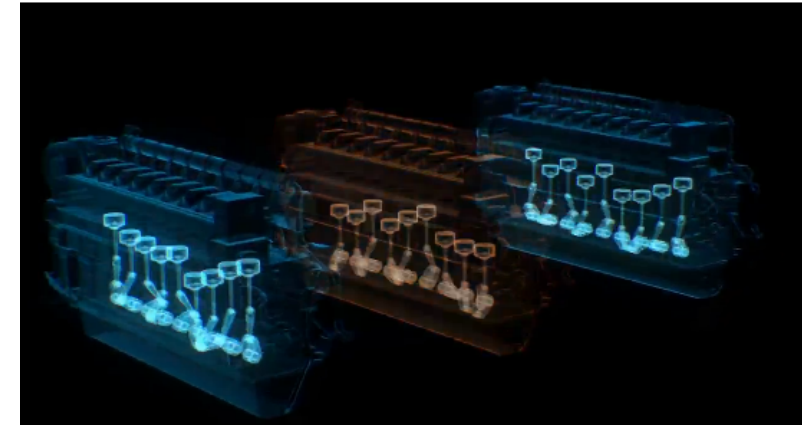
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**LNG enables flexibility and the transition to natural gas use in new end markets.**

In Wärtsilä's Inside Stories on [www.wartsila-insidestories.com/en/](http://www.wartsila-insidestories.com/en/) you will find a video, which gives an overview of how Wärtsilä sees the development of the gas as a fuel for marine and power sectors, along with the company's own role as technology and services provider for LNG related solutions.

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# X62 AND X72 LOW-SPEED ENGINES BOLSTER OUR PORTFOLIO

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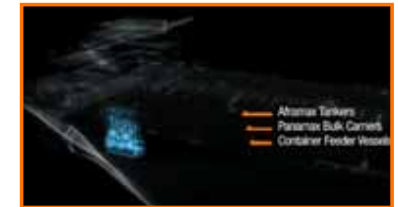
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Wärtsilä has strengthened its offering in the mid-size, low-speed engine sector by adding new 62 and 72-bore low-speed engines to its portfolio.

The standardised Wärtsilä X62 and X72 engines offer high propulsion efficiency, reliability, and optimised total cost of ownership for customers in the bulker, tanker and container vessel markets. Wärtsilä's common-rail technology provides a high degree of flexibility in engine settings to give lower fuel consumption, very low minimum running speeds, smokeless operation at all running speeds, and outstanding control of exhaust emissions. At launch, the new engines are IMO Tier II compatible and available with IMO Tier III solutions.

In Wärtsilä's Inside Stories on [www.wartsila-insidestories.com/en/](http://www.wartsila-insidestories.com/en/) you will find a video that demonstrates the 62 and 72-bore low-speed engines.



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# FIGHTING OIL SPILLS IN THE BALTIC SEA

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**In October, Wärtsilä learned that a Finnish oil spill response unit lacked equipment. Wärtsilä decided to donate the equipment needed to replenish the unit as a part of on-going co-operation with the Baltic Sea Action Group, a Finnish NGO. Now the Oilbuster container is ready to be moved to a disaster area at short notice and the equipment is available for use by WWF volunteers.**

The Baltic Sea is the world's busiest sea and one of the most polluted. Around 150 million tonnes of oil is transported annually to ports along the coast of the Gulf of Finland alone. Narrow straits and channels make navigation difficult, while heavy traffic and ice during winter further increase the risk of accidents.

The Baltic Sea Action Group (BSAG) is an independent organisation that does valuable work to preserve and rescue the Baltic Sea. It gathers practical action commitments from companies and other organisations to help secure the future of the sea, while co-ordinating a number of local initiatives as well. Focus areas include the adverse effects caused by agriculture, maritime activities and hazardous substances.

In 2010, Wärtsilä made three commitments with the BSAG: to promote the installation of sulphur-removing scrubbers on vessels sailing the Baltic Sea, to offer consultancy services, and to increase the availability of environmental training to ship operators and crew.

In October 2011, Wärtsilä took advantage of another opportunity to support the group's work. During a meeting at the BSAG office it was learned that another Finnish company, Muuttopalvelu Niemi, had donated a container to be used by WWF volunteers as an oil spill response unit, but that the container lacked equipment. Wärtsilä soon offered to donate the needed items, including a variety of tools for cleaning, protective equipment for the volunteers, an aggregate for producing energy, and a tent for shelter.

This 'Oilbuster' container is constantly ready to be moved to an oil disaster area or crash site, and will also be used in oil spill response rehearsals.

**Sustainability assured 2011**

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# WÄRTSILÄ NORWAY'S EXCELLENCE IN SAFETY

Wärtsilä has been actively promoting a Zero Injury approach since 2008. This has resulted in a constant downward trend in corporate injury frequencies. Wärtsilä Norway has been a safety pioneer in reducing work related injuries, and in 2011, Wärtsilä Norway achieved a lost-time injury frequency of 0.7, which is a world-class result.

In reaching this exceptional safety performance, Wärtsilä Norway has exhibited leadership commitment, employee participation, and practical safety programmes. These combined efforts have created a safety culture, which does not allow accidents to happen. Furthermore, Wärtsilä Norway provides services to offshore industry customers that require a high level of safety in all contractor operations. This has been a contributing factor in increasing the importance of safety within the company.

## Leadership commitment

In Norway, top management has adopted safety as a regular topic for discussion in high-level meetings. Management has established targets for reducing the frequency of injuries, as well as initiating preventive measures, such as reporting unsafe practices and conditions, in order to maintain a safe workplace. Besides occupational injuries, management also monitors sick leave within the company, as this is an indicator of the overall "health" of the organisation. The significance of safety in the workplace has also been communicated in a positive way to employees.

## Safety programmes

Wärtsilä Norway's safety management system is certified according to OHSAS 18001. As part of safety management, Wärtsilä Norway has identified some key programmes that have improved safety performance during recent years:



In Norway, there are more than a thousand Wärtsilä employees who develop, produce, repair and maintain various types of equipment.

- Reporting of unwanted incidents, such as unsafe activities or conditions, defining corrective actions and following up on their implementation
- Communicating lessons learned through safety bulletins
- Regular safety inspections of the workplace to verify safe conditions and work practices
- Regular training of employees

## Employee participation

Wärtsilä Norway has a motivated Safety Delegate organisation and Working Environment committees, which guarantee effective employee participation and practical solutions to prevailing problems.

A good indication of the effectiveness of employee participation is that a total of 605 unwanted incident reports were completed in 2011.



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## To go forward

Improving safety is a continuous process and Wärtsilä Norway considers that there are still things to learn in order to be even more proactive in reducing injuries. The company is implementing a new campaign called "Stop and Care", which is based on the approach of taking care of your colleagues. As an example, the company has prepared video clips of unsafe and safe work practices, demonstrating how to react in these situations. The message is communicated in an upbeat manner, and includes elements of humour to remove the barriers to intervening in unsafe actions.

"The work towards occupational health and safety never ends and it demands continuous attention by all of us," Wärtsilä Norway.

Sustainability assured 2011



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## Q1

Wärtsilä's Sustainability  
Report 2010 published as a  
part of the Annual Report.



A new occupational health &  
safety video published.

The revised Wärtsilä  
Code of Conduct  
published.



Wärtsilä received an  
order for gas engines and  
equipment to Viking Line's  
new environmentally sound  
passenger ferry.



Wärtsilä Power Plants  
launched the Smart Power  
Generation concept.

## Q2

The new Corporate  
Environmental, Health and  
Safety Directive approved.



Wärtsilä entered into  
co-operation with Crisis  
Management Initiative, an  
independent Finnish non-  
profit organisation working  
to resolve conflicts and to  
build sustainable peace.

Wärtsilä contracted to  
deliver the main engines  
running on liquid biofuel for  
a new multi-purpose cargo  
vessel.



Wärtsilä Power Plants  
launched the Smart Power  
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Wärtsilä BLRT Estonia Oü  
received the OHSAS18001  
certification.

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## Q3

Wärtsilä contracted to supply Africa's largest gas fuelled combustion engine power plant.

A global safety handbook issued as a part of Wärtsilä's zero injury action plan.

The international Sustainable Seas 2011 event, hosted by Sweden's Crown Princess Victoria, was held on 12-19 September, beginning in Stockholm, Sweden and ending in Turku, Finland.



The new 2-stroke, low-speed gas engine technology successfully tested in trials conducted in Trieste, Italy.

Wärtsilä BLRT Lietuva UAB received the OHSAS18001 certification.



The 4th global Suppliers' Day gathered Wärtsilä's key suppliers to Helsinki, Finland.



Wärtsilä's first full-size commercial installation of a marine SO<sub>x</sub> scrubber completed.

Wärtsilä Switzerland received the OHSAS18001 certification.

Wärtsilä contracted to supply a turnkey power plant to Rwanda. The plant will run on methane gas from Lake Kivu.

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## Q4

Wärtsilä and the State University of New York, Maritime College jointly hosted the NASDAQ Closing Bell ceremony in October. This occasion coincided with the dedication of the Wärtsilä Lab and donation of a diesel engine and equipment by Wärtsilä to the SUNY Maritime College.



Wärtsilä contracted to deliver the first U.S. flagged offshore supply vessels running on LNG.



Wärtsilä contracted to supply two gas-fired Flexicycle power plants totalling 430 MW to be installed in the Dominican Republic. The dual-fuel flexibility of the plant enables the fuel switch from HFO to natural gas.

Wärtsilä Finland Oy received the AEO (Authorised Economical Operator) certificate from the Finnish Customs.



Wärtsilä joined Maersk Line and fifteen other global corporations in signing the Sustainable Shipping Initiative's Vision 2040 to secure a sustainable future for the industry.

Wärtsilä won the Finnish Media's Choice award for its Sustainability Report 2010.

The revised zero injury e-learning modules released.

New corporate environmental and social targets approved.



The unique fuel conversion of the product tanker Bit Viking from heavy fuel oil to gas operation successfully completed.

The first Wärtsilä black and grey list of substances released.

The e-learning course for the revised Code of Conduct released.

The annual lost time frequency index reached record low level.

# SMART POWER GENERATION – CAPACITY THAT MEETS THE NEEDS



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## POWER PLANTS

### Smart Power Generation

Grid stability for  
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Africa's largest gas  
engine plant

Caribbean LNG

First FlexiCycle plant

Water issues in India

Wärtsilä's Smart Power Generation concept has been developed to ensure operational and fuel flexibility as well as energy efficiency.

With demand increasing exponentially and new forms of supply creating instability in the power system, the challenge of power production is one that requires flexible, well-planned solutions and peerless execution backed up by tried and tested products.

In Wärtsilä's Inside Stories on [www.wartsila-insidestories.com/en/](http://www.wartsila-insidestories.com/en/) you will find a video that demonstrates Wärtsilä's Smart Power Generation concept.



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# SMART POWER GENERATION SUPPORTS THE ESTONIAN NATIONAL GRID

Estonia is a small country but one in which an efficient and well-maintained grid system is of paramount importance. When Elering, the state-owned independent transmission network operator responsible for this system's functioning, required a reserve power plant to guarantee high-quality electricity supply to the country's consumers, they selected Wärtsilä's Smart Power Generation as the ideal solution.

The project, with its total contract value of EUR 129 million, is part of the Estonian electricity sector's development plan to have new dynamic power stations available for operation by 2014. The requirement for these plants is that they must be able to compensate for lost generating capacity in no more than 15 minutes in the event of a plant shut down. The 10-minute start-up capability of the Wärtsilä power plants is therefore vital. Built to meet sudden drops in the electricity supply, the reserve plant actually takes the form of two completely independent units, ensuring that if a problem were to occur with one, the other can continue and consumers will not be affected.

Wärtsilä's scope for delivery includes engineering, procurement of equipment and materials, construction and commissioning of the plants with a capacity of 110 and 140 MWe respectively. Construction will take place on an EPC "turnkey" basis, with 27 Wärtsilä 20V34DF engines to be built in our factory in Vaasa, Finland. The project also offers significant opportunities for construction firms in Estonia, as Wärtsilä employs local partners for the on-site work, directed by our own project management team.

As is often the case when working with companies responsible for grids covering relatively large areas, location is a key issue. In this case, the ideal site for the reserve power plant is at the intersection of most of the country's main voltage lines in the small borough of Kiisa. This location's substation,



The ideal site for the reserve power plant is at the intersection of most of the country's main voltage lines in the small borough of Kiisa.

about 25 km from Tallinn, is at the very heart of Estonia's electricity system, and has the advantage of strong connections through high-voltage lines to the other substations in Estonia.

Timo Mahlanen, Business Development Manager at Wärtsilä, identifies the chief benefits this case offers the customer, "Although in ideal circumstances this reserve power station should not see a great deal of use, its high efficiency and low lifecycle cost are still of vital importance when taking escalating fuel costs into account. Wärtsilä's broad service organisation is another key benefit, encompassing support in the local language. These factors, combined with our track record as an EPC project implementer, decided the case for us over the course of a demanding public procurement process."

Mr Taavi Veskimägi, Elering's Chairman, emphasises the necessity of this plant, "This is an important project for the Estonian energy sector, and one that will ensure the supply of electricity to consumers should any existing power station unexpectedly lose production. The capacity of the new plants is equal to one-sixth of Estonia's peak demand, so in an emergency they will be able to cover a large part of Tallinn's, the capital, winter electricity consumption."

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# KEEPING SASOL'S CARBON REDUCTIONS ON TRACK

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Most of South Africa's electricity is generated by large coal-fired power plants and this results in substantial emissions of carbon dioxide – considered a major contributor to global warming. In July 2011, Sasol New Energy (SNE) Holdings contracted Wärtsilä to provide a 180 MW facility. This plant will become the African continent's largest to be based exclusively on gas-fired engines.

SNE is a business division of alternative fuels and chemicals company Sasol, and was established in 2010 to explore technologies that could be integrated into Sasol's core processes to reduce greenhouse gas emissions and meet the company's long-term targets for energy efficiency. Sasol has an industrial facility in Sasolburg, near Johannesburg, which currently relies on a company-owned coal-fired plant to meet part of its electricity and steam requirements.

In line with its carbon reduction strategy, Sasol began introducing the use of gas for power generation by installing two gas turbines at another of the company's facilities located at Secunda. Another gas-fired plant, this time based on gas engines, is now being built at Sasolburg to replace the existing coal-fired power plant. Industrial customers in the region are keen to establish reliable supply due to persistent problems involving interruptions to the existing grid supply, and Wärtsilä's gas-fired engines were therefore seen as a potent solution.

Explaining the thinking behind the new project, Henri Loubser, Managing Director, SNE, says, "Expansion of the Sasolburg facility means that new power plant technology can be used to meet increased demand for electricity, while also replacing our old generating equipment with more efficient units. It will also enable us to reduce our reliance on drawing power from Eskom. On average, the carbon footprint of Eskom's electricity is almost 1,000 kg/MWh. Using gas-engine technology will allow us to reduce that figure by more than 40%." Completion of the project will mean a cut of approximately one million tonnes to Sasolburg's annual carbon emissions.



Wärtsilä's solution will help reduce greenhouse gas emissions and allow Sasol to meet their long-term targets for energy efficiency.

Another key environmental factor is that the new plant operates with a closed circuit cooling system, thus consuming absolutely no water. This is of signal importance in a region where water is scarce.

The plant follows Wärtsilä's new power plant design philosophy – building architecture and interiors that improve functionality and safety. The powerhouse is divided into three sections and each set of six engines is connected to a medium-voltage room. Radiators are located on the roof for improved cooling, minimising the building's footprint. High-voltage equipment is located in a separate building. The efficiency of the Wärtsilä gas engines to be deployed is also noteworthy, as the Sasolburg plant is located at an altitude of 1,700 m, yet the deployed gas engines can operate well even in these conditions.

The Sasolburg plant is being built as a turnkey contract in which Wärtsilä is carrying out all engineering, civil works and building construction, as well as supplying all the power generating equipment and performing the electrical and mechanical installation work. Civil engineering operations have already begun and the first engines will arrive at the site next May. Handover of the completed plant is scheduled to take place in December 2012.

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Sasol facilities in Sasolburg, South Africa.



Civil engineering operations have already begun and the first engines will arrive on site next May. Handover of the completed plant is scheduled to take place in December 2012.

The Sasolburg plant is a pioneering project and similar ventures are expected to follow. The new facility is clear evidence that technologies which do not involve coal offer good business opportunities in power generation.

For Wärtsilä, the project's significance extends much further than being the company's first power plant in South Africa. "Our ability to execute a complete turnkey contract with both schedule and performance guarantees was key," says Arnaud Gouet, Business Development Manager at Wärtsilä. "The ability to help the customer in arranging project financing and provide ongoing maintenance and support is likely to prove attractive in future project negotiations."

Commenting on Wärtsilä's offering and the company's all-round capabilities, Loubser says, "Wärtsilä has very good and competitive technology – powerful engines which operate at high levels of efficiency and a good track record. Our relationship has been very professional – a really positive experience."

**Sustainability assured 2011**



The new plant will become the African continent's largest to be based exclusively on gas-fired combustion engines.



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# THE DOMINICAN REPUBLIC – AN LNG BENCHMARK

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Sampo Suvisaari, General Manager, Central America at Wärtsilä's LNG Symposium in Panama City in January 2011.

**Sampo Suvisaari**  
General Manager, Wärtsilä Central America

**The Dominican Republic was the second island in the Caribbean to receive the benefits of an LNG import terminal, but has since come to embody developments remarkable even on a global scale. The country's private LNG import terminal was constructed almost ten years ago, together with a 300 MW power plant that, in the early years, was exclusively fuelled by gas.**

In 2008, AES, the private company that owns the terminal, started offering gas for industrial customers, to be used instead of diesel in boilers and other factory processes. The response was very positive, and many factories now get their LNG delivered by truck from the AES terminal through distribution companies. In addition to industrial use, gas has also been successfully promoted as a transport fuel. Already thousands of cars in Santo Domingo use clean natural gas for fuel. This is a very significant figure, and a great

benchmark for other forward-thinking cities worldwide. Few other places in the world are so advanced in their use of natural gas as transport fuel.

Seaboard, a Wärtsilä customer, made a gas supply agreement with the LNG terminal's owners in 2010 to supply gas to their new 106 MW Flexicycle™ floating power plant in Santo Domingo. The 430 MW Quisqueya combined cycle plant, Wärtsilä's first land-based Flexicycle™ power plant, will be another noteworthy addition to the country's LNG-capable roster. Located in San Pedro de Macoris, the plant will be equipped with 24 Wärtsilä 18V50DF dual-fuel engines and will begin electricity production in 2013.

By this point, it is perfectly clear that LNG will become an important fuel in Central America and the Caribbean. The main unresolved questions simply concern when the next LNG import terminal will be constructed and where it will be located. Three official announcements have already been made for new terminals, but things frequently change fast in this industry, and there are no certainties as to which projects will be realised and at what precise point in time.



The Dominican Republic was the second island in the Caribbean to receive the benefits of an LNG import terminal.

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Another key question is what we call small-scale LNG. When will we see LNG distribution with smaller LNG ships (10-30,000 m<sup>3</sup>) become more commonplace?

The problem with LNG gas infrastructure is that until recently only large terminals were considered feasible. But small and medium-scale LNG storage and transportation technology has made significant advances in recent years, bringing costs down and offering more alternatives. This means that more and more unconnected regions, such as islands, may now consider LNG an alternative.

Wärtsilä's dual-fuel engine technology is an ideal solution to this chicken and egg dilemma. These engines are designed with the necessary flexibility in mind, meaning that they can be operated on heavy fuel oil indefinitely. This means that the investor is not forced to make a gas terminal investment at the same time as their power plant investment. The power plant contract can be separate from the LNG supply contract. Once the power plant is under construction or ready, it becomes significantly less risky for whoever builds the gas terminal (and this need not be the power plant owner) to set things in motion.

Wärtsilä's dual-fuel technology also, of course, makes it possible to take advantage of changeable fuel costs, previously something of a bugbear. If one type of fuel sees a temporary jump in fuel costs, it is always possible to go back to the other fuel, for as long or short a period as circumstances merit.

Looking forward to the immediate future, one of the most highly awaited developments in this sphere is the construction of LNG export terminals on the US Gulf of Mexico coast. Both Cheniere and Freeport LNG have announced

plans to build liquefaction facilities to export gas from the US, which has enormous implications for the Dominican Republic and, indeed, the entire region. The two companies built large LNG import terminals some years ago when the US was relying on gas imports, and expected this trend to continue. Since then, the availability of domestic shale gas has taken everyone by surprise, and the country is not only going to become self-sufficient in natural gas, but also develop into a net exporter of gas (in the form of LNG).

Since the locations of Cheniere and Freeport LNG on the US Gulf of Mexico coast are very convenient for both Central America and the Caribbean, they are seen as very good candidates for LNG supply to the region in addition to the current supply from Trinidad. Pacific Rubiales has also announced plans to export LNG from Colombia, another interesting development.



Many industrial customers get their LNG delivered by a truck.

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# QUISQUEYA I – WÄRTSILÄ'S FIRST FLEXICYCLE™ PLANT

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The Quisqueya I combined cycle plant, promoted also as the first Wärtsilä Flexicycle™ power plant, will be located in San Pedro de Macoris, Dominican Republic. The plant will be equipped with twelve Wärtsilä 18V50DF dual-fuel engines able to run on either natural gas or heavy fuel oil. The plant begins its electricity production in 2012.

All twelve engines are equipped with separate waste heat recovery steam generators. These ensure maximum production of superheated steam, which is used in a condensing steam turbine for secondary electricity production. The turbine has a water-cooled condenser with the water being cooled using cooling towers.

The output from steam turbines represents 7.6% of additional power, which is generated from the waste heat of the main engines. This directly improves the electrical efficiency of the power plant, while at the same time reducing CO<sub>2</sub> emissions accordingly.

Wärtsilä engines already have very good internal efficiency. This, in combination with a properly designed combined cycle system, enables very high electrical efficiency for power production. Output from the Quisqueya I plant, including the steam turbine, will be tested and verified during the commissioning phase in 2013.

Wärtsilä will also deliver an identical power plant, Quisqueya II, which will be located at the same site. The two power plants will have a total output of 430 MW. They have separate owners, but both plants will be constructed on the same site as a single unit, that can be operated from one control room. When operational in 2013, the Quisqueya I and II power plant complex will be the biggest Wärtsilä engine driven power plant in the world.



The Quisqueya I combined cycle plant will be located in San Pedro de Macoris, Dominican Republic.

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When operational in 2013, the Quisqueya I and II power plant complex will be the biggest Wärtsilä engine-driven power plant in the world.

## The Wärtsilä Flexicycle™ advantages

The Wärtsilä Flexicycle™ solution combines the advantages of a flexible simple cycle plant with the superb efficiency of a combined cycle plant, in a unique way. Flexicycle™ power plants can be optimised for different outputs in the 100 to 500 MW range. The power plant solution is based on gas-fired combustion engines and a steam turbine combined cycle. Each engine is equipped with a waste heat recovery steam generator. The power plant has one common steam turbine and a condenser. The power plant cooling is typically arranged so that the combustion engines are cooled with closed-loop radiators and the steam cycle with cooling towers.

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# INDIA'S IMPENDING WATER CRISIS – AN EXPERT VIEW

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In the coming years, India will be threatened with severe water scarcity issues. We spoke to Mr Suresh Prabhu, region expert and former Union Minister in India, to discover how decision makers, industry, and consumers should approach these challenges.



Suresh Prabhu

**Q: How is water scarcity related to the impact of climate change and demographic pressures in India?**

**A:** India is one of the most susceptible countries in terms of water resources because we get almost 85% of the rain during the monsoon season. That means about 15 days per year, to take a good quality monsoon, and the number of hours for which you get that rain may not be more than 350. Natural water available to India is only four per cent of global water resources, while we have 17% of the world's population and rising, so as you will appreciate, the water situation in India is an extreme one. To compound the problem, water availability in terms of space and time is extremely variable. When we consider the demand for water in all spheres of society, this matter assumes very serious proportions – availability of water is the most critical part of India's socio-economic activity.

**Q: When will water scarcity escalate to the point of crisis?**

**A:** I think that today we are almost at that point. Things may escalate at any time. Today's situation is as alarming as it could be – there is really no point in saying that we have to wait and see – the trigger is already here. But as the years advance, the availability of water itself will be under stress due to climate change; the rainfall patterns, which are already changing, will put reserves under stress; natural disasters will increase; and all of these in parallel will put us indisputably at crisis point.

**Q: Is there significant public awareness of the risks posed by water shortages?**

**A:** I think we need to create more public awareness of these risks. In fact, in my capacity as parliamentary minister, I have personally organised 5,000 meetings looking at water issues, and thereby in my humble way raised a great deal of political awareness, but we need to do much more.

I am currently working on the very interesting idea of creating a network to discuss water, energy, and environmental issues at all district levels. Such solutions are helpful in creating awareness, but also in providing a platform to work on these issues in a meaningful way.

**Q: What are the risks water shortages pose to power generation, and specifically coal-powered plants?**

**A:** Water reserves in India are quite low. Without reserves, you can't do power generation, unless of course you are using river water. But reserves for power generation have become extremely contentious due to the probable necessity of submerging land that is extremely rich in terms of biodiversity. Displacement of people is another associated issue that can cause enormous political upheaval.

All in all, then, reserves are a very risky proposition. Thermal power plants, particularly coal-based facilities, are going to face serious challenges for these reasons. So changing the energy mix is a must, not only because of carbon emissions and so on, but also due to water availability.



Natural water available to India is only 4% of global water resources, while the country has 17% of the world's population and rising.

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# INDIA'S IMPENDING WATER CRISIS – AN EXPERT VIEW



**Q: Is desalination a possible alternative for water security?**

**A:** Desalination is definitely a very good option because of India's 7,800 km coastline. But desalination using fossil-fuel-based power will not be the solution. Desalination using renewable energy will give the best results for India with the least cost, and I think there is a huge opportunity waiting to be exploited there, in India and elsewhere.

**Q: How are the government, as well as investors and utilities, responding to the risks related to water availability?**

**A:** Governments are obviously trying to address these challenges by way of making water one of their principal strategic areas. India's 12th 5-year plan, which will be unveiled in April 2012, actually talks about water as a major challenge for India's economy, India's social issues and India's development at large. Of course, there are many policy challenges – water pricing is one of them and I don't see that the government has released any significant and comprehensive strategies for this, but it's one of the

most important topics. Investors see great potential in water now. Water is seen as the next big investment area. When there are challenges, they have to be solved, so this is what people are working towards.

**Q: Besides optimising water use at the plant level, how should power utility companies be responding to the problem?**

**A:** I think water and power utilities alike must establish how to use less water. So this is a technological challenge. Some power companies are considering the issue, but I believe a great opportunity in this area in terms of technological innovation will emerge very soon.

Mr. Suresh P. Prabhu, former Union Minister for Industry, Power, Environment & Forest, Chemical & Fertilizers and Heavy Industries & Public Enterprises. Member of United Nations Commission for Biodiversity & land use change and several energy, environment & water-related forums. Chair of the Global Water Partnership.

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# DUAL-FUEL TECHNOLOGY PUTS VIKING LINE IN CONTROL OF EMISSIONS

**In a climate of tight regulation and media focus on the threat emissions pose to the environment, maritime operators are under increasing pressure to look carefully at the way they do business and introduce solutions that will be effective both now and for the foreseeable future.**

In March 2011, Wärtsilä helped Viking Line address this challenge when it was contracted to supply the propulsion machinery of a new passenger ferry for the Finnish ship owner. The ship in question, to be built by STX Finland Oy, will be the largest passenger ferry yet to operate on liquefied natural gas (LNG), making it the industry's most environmentally sound and energy-efficient large passenger vessel to date.

The vessel will sail between Turku and Stockholm on the Baltic Sea and is scheduled to enter service in 2013. It will be capable of transporting cars, trucks and road trailers, and it has been designed to carry 2,800 passengers and a crew of 200.

The selection of LNG as an energy source enables a reduction in particulate emissions of more than 90% compared to those of conventional diesel engines, while carbon dioxide emissions are 20-30% lower. Additionally, the use of Wärtsilä's dual-fuel engine technology, running on gas in this instance, will enable the ferry to sail without restrictions in Sulphur Emission Control Areas (SECAs) and Nitrogen Emission Control Areas (NECAs).

Environmental regulation limits the levels of SO<sub>x</sub> that vessels are permitted to release in SECAs, to which the Baltic Sea belongs. These SO<sub>x</sub> limits will become more stringent in 2015. Jukka Paananen, Business Manager, Special Vessels, at Wärtsilä, highlights, "The vessel's four Wärtsilä 8L50DF dual-fuel gas engines will surpass these requirements and stand Viking Line in good stead for the vessel's lifecycle."

Paananen also outlines the unique benefits LNG offers in the passenger ferry industry, "The reductions in emissions through the use of LNG enables ship owners like Viking Line to navigate increasingly tight environmental regula-



The forthcoming ship, to be built by STX Finland Oy, will be the largest passenger ferry yet to operate on liquefied natural gas (LNG).

tion, helping them to stay one step ahead of society's expectations, while preserving their operating environments in a sustainable fashion."

Wärtsilä has consistently been at the forefront in development of dual-fuel technology, and during recent years has launched a series of gas engines. These 4-stroke engines, namely the Wärtsilä 50DF, Wärtsilä 34DF and Wärtsilä 20DF, represent the best technology available in terms of efficiency and low emissions. The Wärtsilä 50DF engine is becoming one of Wärtsilä's most successful products and has been used in marine applications since the introduction of dual-fuel propulsion in 2003.

Viking Line's management has high expectations regarding the new ferry. Tony Öhman, Senior Vice President, Marine Operations & NB, points out, "As one of the cruise ferry companies operating in this environmentally sensitive archipelago, we believe that LNG will be the most cost-effective fuel in the future and that its usage also confers a boost to our environmental profile." He goes on to state, "More capacity, lower operating costs, lower emissions and a new treat for our passengers will provide increased profitability for this route between Turku and Stockholm."

This timely project will be a demonstration of the fact that LNG as an energy source offers the most economical and environmentally sound solution on the market. Customers of Viking Line's popular cruise services are particularly interested in the ecological effects of vessel traffic in the Baltic Sea, and the company's environmental profile is, of course, also of signal importance to its consumer-oriented business.

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# POWERING P-63 OFF THE COAST OF RIO

The use of gas as a marine fuel has several benefits, both for the shipping industry and for society at large. Natural gas provides greater fuel flexibility, especially in connection with multi-fuel engines, and enables a significant reduction in emissions of all polluting substances. Wärtsilä has been awarded a breakthrough contract to deliver a totally integrated power solution for a new gas-fuelled Floating Production Storage and Offloading (FPSO) vessel.

The order includes three main power modules, each of which includes two 50DF tri-fuel engines, alternators and auxiliary equipment. It also covers the commissioning, start-up, and operational supervision of the equipment. The vessel is unique in that it will be the first FPSO vessel ever to operate on more than 100 MWe of installed gas engine power.

Wärtsilä's efficient gas-fired power solution also features significantly lower levels of carbon dioxide emissions. Compared to conventional technologies, the CO<sub>2</sub> emissions from a 100 MWe output installation can be reduced by as much as 93,000 tons per year. Furthermore, since Wärtsilä's engines can be run on treated well gas, as well as various diesel oils, the customer's operating costs can be notably reduced.

Installation of the power modules was completed in 2011. The vessel will operate on Brazil's new Papa Terra oilfield, located some 110 kilometres off the coast of Rio de Janeiro in the southern Campos Basin.

"It is significant that Wärtsilä's technology has been selected for this important project. It endorses the fact that our fully integrated power modules offer the high levels of reliability, availability, efficiency, and fuel flexibility required



for successful offshore operations," says Magnus Miemois, Vice President, Offshore, Wärtsilä. "Our technology enables customers to minimise both their operating costs and their environmental impact."

This P-63 project represents a practical demonstration of how Wärtsilä's broad portfolio of products and integrated, value adding solutions can serve the offshore industry. The broad scope of this oil & gas industry project and the complex delivery requirements entailed demand experienced project management and problem solving capabilities.

In Wärtsilä's Inside Stories on [www.wartsila-insidestories.com/en/](http://www.wartsila-insidestories.com/en/) will find a video of the P-63 project from Brazil's new Papa Terra oilfield.



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# WHAT DOES SUSTAINABILITY LEADERSHIP ACTUALLY MEAN?



Jaakko Eskola,  
Group Vice President, Ship Power

**Jaakko Eskola, Group Vice President, Ship Power, answers questions.**

**Q: What makes a company reputable when it comes to sustainability?**

**A:** Sustainability is about long-term responsibility towards the environmental, economic, and social dimensions. A company is reputable in these fields when it centres its strategy, R&D investments, and product portfolio development towards these long-term responsibilities, while demonstrating that by doing so it can be profitable. This is nothing new to Wärtsilä: already today we focus our strategy and way of working on sustainable practices. We also deliver products and services with sound environmental and economic performance for our customers.

**Q: What is the role of leadership in making a company into a sustainability-oriented business?**

**A:** Leaders play a key role in defining and implementing sustainability initiatives. Shaping a vision and committing to it is part of the job of leaders. However, what is most important is to be able to build up a solid business case, clear goals and smart measures that help support and deliver this vision.

**Q: What are the major issues that the shipping industry faces in terms of sustainability?**

**A:** Reduction of greenhouse gas emissions is one of the big environmental topics, but our responsibility also extends to protecting biodiversity in

the oceans and to other issues. On the social front, issues like piracy and labor conditions for seafarers demand clear actions. At Wärtsilä when we develop a product or service, we take into account the global issues that our customers face.

**Q: How should companies in the shipping industry communicate on the topic of sustainability development?**

**A:** Communication and transparency are critical. For decades, the shipping industry has operated without being visible to normal citizens. This situation is now changing, as people want to know more about the products that they consume. This means that shipping companies and their providers feel an increasing demand for sustainable practices in their work and transparent reporting of all their activities.

**Q: Who has a bigger impact on companies in terms of sustainability: shareholders and investors or consumers and the general public?**

**A:** The importance of neither side can be underestimated. Consumers and the general public create the baseline demand for sustainable practices and products, and the shipping industry is steadily adapting to these changes. Shareholders and investors demand solid economic performance backed up by high-level sustainability practices, with focus on the opportunities that lie ahead.

**Q: How can companies concerned with sustainability use social media wisely?**

**A:** Companies that excel in sustainability have great opportunities in using social media to interact with the general public. A wise use of social media includes engaging and promoting healthy discussion about issues affecting sustainability; informing people about the company's practices in a transparent, easy to understand way; and harvesting for good ideas and innovation opportunities.

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# WHAT DOES SUSTAINABILITY LEADERSHIP ACTUALLY MEAN?



Reduction of greenhouse gas emissions is one of the big environmental topics, but our responsibility also extends to protecting biodiversity in the oceans and to other issues.

**Q: What impact have recent dramatic events (i.e. Fukushima, oil spills, tsunamis and other natural disasters) had on sustainability and environmental matters?**

**A:** For both businesses and the general public, events like those mentioned have been a reminder of the need to increase standards in safety and environmental performance. Furthermore, they have made us reflect on our long term responsibilities towards our planet, resources and living beings. The shipping industry needs to learn that such improvements are needed now and continuously from this point onwards. At Wärtsilä, we accept this need to invest in developing more safe and sustainable solutions for our customers.

**Q: Are sustainability-related actions actually boosting profits?**

**A:** Efficiency and environmental performance go hand in hand, as the Dow Jones Sustainability Index benchmarking performance of companies

based on a triple bottom line reporting has demonstrated. Shipping companies are on a constant search for improving efficiency, and so yes, investing in efficiency brings lower operating costs and hence increases profits.

**Q: What is the role that legislation has in sustainability issues within the shipping industry?**

**A:** Legislators have the role of creating rules and standards to level the playing field and ensure that goals are achieved. In shipping, the International Maritime Organization (IMO) has a global responsibility for safety and environmental performance. Wärtsilä respects the work done by IMO and other legislators and is deeply committed to working with regulators and industry stakeholders to promote rules that will help the industry tackle its most important issues. Rules alone won't change the game. They must be well thought out, provide the right incentives, and be correctly enforced.

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# LNG IN SHIPPING – WÄRTSILÄ'S LEADERSHIP IN PRACTICE

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Wärtsilä, the marine industry's leading gas solutions provider, has been able to expand its offering to various shipping segments. Wärtsilä is focused on developing gas power technology, which increases the flexibility, lowers the operational costs, and reduces the environmental impacts of shipping. During 2011, new milestones have been reached in this field.

#### First U.S. flagged LNG offshore vessels

Wärtsilä will deliver liquefied natural gas (LNG) propulsion equipment for two advanced offshore supply vessels owned by Harvey Gulf International Marine. These supply vessels will be the first ever U.S. flagged platform supply vessels (PSV) to be powered by clean, safe and efficient LNG.

Wärtsilä will deliver an integrated system that includes the dual-fuel machinery, electrical and automation package, complete propulsion, and also the LNG fuel storage and handling components. The STX Marine Inc SV310DF Offshore Support Vessels will be powered by 6-cylinder Wärtsilä 34DF dual-fuel engines. The LNG storage capacity of 290 cubic meters (m<sup>3</sup>) enables more than a week of vessel operational time.

#### LNG powered Platform Supply Vessels

Wärtsilä supplies design and propulsion solutions for LNG fuelled PSV's. Norwegian operator Eidesvik Offshore has placed an order for its fifth gas PSV (VS489). All of Eidesvik's gas PSVs, including this latest order, have been designed by Wärtsilä, and they utilise Wärtsilä's unique dual-fuel technology.

Wärtsilä has been contracted by Kleven Maritime of Norway to design a new LNG powered PSV for Norwegian operator Rem Offshore. The scope of the order also includes the propulsion machinery, which is based on a combination comprising the Low Loss Concept system for Electric Propulsion, Wärtsilä 34DF main engines and the recently introduced Wärtsilä 20DF engine, as well as automation and other equipment for the same vessel. Rem Offshore's new LNG powered PSV, the first such vessel for its fleet, will be a Wärtsilä Ship Design VS499 LNG PSV, a state-of-the-art vessel based originally on



Wärtsilä Ship Design is constantly working to ensure that its designs offer maximum efficiency, reliability and environmental performance.

the successful VS489 LNG PSV design. The ship features outstanding energy efficiency, a unique hull form, fuel flexibility, and exceptional performance in areas such as fuel economy and cargo capacity.

Wärtsilä Ship Design is constantly working to ensure that its designs offer maximum efficiency, reliability and environmental performance. The company's latest development within LNG PSV's is the VS4410 DF-PSV. This PSV is equipped with the Wärtsilä Low Loss Concept system, which ensures not only safer operations, but also a high level of redundancy in the auxiliary system. As a result the vessel has been awarded the highest possible Environmental Regularity Number (ERN) score of 99.99.99.99. The optimal choice of installed power is achieved with four Wärtsilä 9L20 engines. In combination with LNG as the main fuel, new standards in low emissions can be set for the global fleet.

#### 2-Stroke gas engines soon available

New 2-stroke gas engine technology has successfully been tested. The new RTX5 low-speed test engine is part of Wärtsilä's 2-stroke dual-fuel gas engine technology development programme. This is an important part of

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# LNG IN SHIPPING – WÄRTSILÄ'S LEADERSHIP IN PRACTICE



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The recent acquisition of Hamworthy has complemented Wärtsilä's competencies in marine gas applications.

Wärtsilä's strategy to lower emissions, increase efficiency, and to develop its low-speed engine portfolio to include dual-fuel gas engines alongside its medium-speed dual-fuel engines. The strategy serves to meet the needs of our customers.

**Stronger growth platform for gas applications**

The recent acquisition of Hamworthy has complemented Wärtsilä's competencies in marine gas applications. This has strengthened Wärtsilä's offering, especially in highly advanced and established systems for the onboard storing and handling of fuel gas.

**Sustainability assured 2011**

## Wärtsilä's LNG technology offering in a nutshell

**Products and solutions**

- Leading ship designer in gas fuelled OSVs**
- Widest power range in gas fuelled engines**
  - W20DF (1-1.5 MW)
  - W34DF (2.7-9 MW)
  - W50DF (5.8-17.5 MW)
  - Electrical and Mechanical propulsion
  - 2-stroke DF under on-going development
- Fuel system on board**
  - Bunkering connection
  - LNGpac: fuel handling, storage and evaporating unit
  - Gas valve unit (space saving enclosed design)
- Propulsion and automation**

**Experience**

- 10 ship designs**
- Merchant**
  - 89 vessels
  - 353 vessels
- Offshore**
  - 17 vessels
  - 87 engines
- Cruise and ferry**
  - 1+1 vessels
  - 4 engines per vessel
- Gas conversions**
  - 1 chemical tanker
  - 2 engine conversions
- 1.5 million running hours with DF technology and over 3 million running hours in total with gas**

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# BEING TIER III COMPLIANT TODAY



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Wärtsilä focuses on the development of environmentally sound solutions that are cost-efficient, reliable, and compliant with the requirements of the International Maritime Organisation. The forthcoming IMO Tier III nitrogen oxides emission limits require new solutions in shipping.

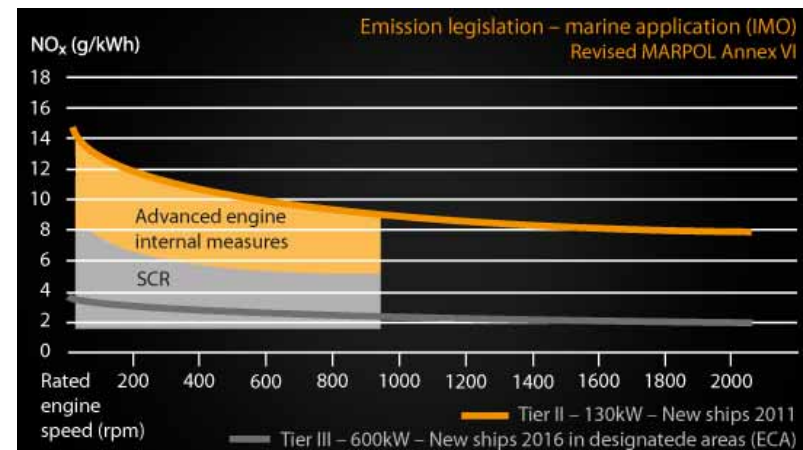
The IMO Tier II NO<sub>x</sub> emission levels have recently come into force, and Wärtsilä's development work is now focused on the Tier III requirements. The Tier III emissions levels will be applied from 2016, which may seem to be still a long way off. Wärtsilä has, however, already developed technologies that allow operations to be TIER III compliant today.

### Wärtsilä NO<sub>x</sub> Reducer (NOR)

Wärtsilä is currently able to offer a Tier III compliant solution based on Selective Catalytic Reduction (SCR) technology. SCR technology has already been available for some years, mainly for use in power plants. However, in order to introduce SCR for marine installations, engine technology development work has been necessary since the optimum exhaust gas temperature range for SCR is narrow. To achieve optimal engine tuning in combination with SCR, an intelligent control system and variable valve train are required. This technology has been developed and validated, and it is available as standard on all Wärtsilä 4-stroke engines. Thus, with a properly designed and controlled SCR solution, compliance with the Tier III requirements can be achieved – even when using HFO together with a scrubber.

### LNG technology

LNG as a fuel enables Tier III NO<sub>x</sub> emission requirements to be met. Pre-mixing of the fuel with air enables combustion with low emissions. Our 4-stroke engine portfolio now includes the new W20DF engine, the latest dual-fuel engine to be introduced to the market. To have LNG as a fuel for 2-stroke engines without compromising energy output or efficiency has, however, always been considered extremely challenging. In order to meet the strong market need for a 2-stroke low pressure gas engine, Wärtsilä has begun the



development of a 2-stroke gas engine. Technologies used to control combustion in 4-stroke engines, while avoiding knocking and misfiring, cannot be used directly on a 2-stroke engine. Nevertheless, Wärtsilä's vast experience in gas engine development, together with new innovations, has resulted in a technology that has enabled Wärtsilä to successfully perform engine testing on a 2-stroke gas engine capable of complying with Tier III emission levels. The first installation is planned for 2013.

### Exhaust Gas Recirculation

Distillate fuels, meaning both heavy fuel oil (HFO) and light fuel oil (LFO), will remain as the main marine fuels for the foreseeable future. The need for lifecycle optimised products is high. Investment costs need to be minimised, engine efficiency should be significantly improved and NO<sub>x</sub> emissions must become dramatically lower than what the industry is used to. In order to combine and meet all these requirements, new technologies must be developed and adopted in a cost effective way. The next generation of Wärtsilä's products will be Tier III compliant without the need for separate after-treatment equipment. There is no obvious single solution for meeting the Tier III emission requirements, as several technologies are still under evaluation.

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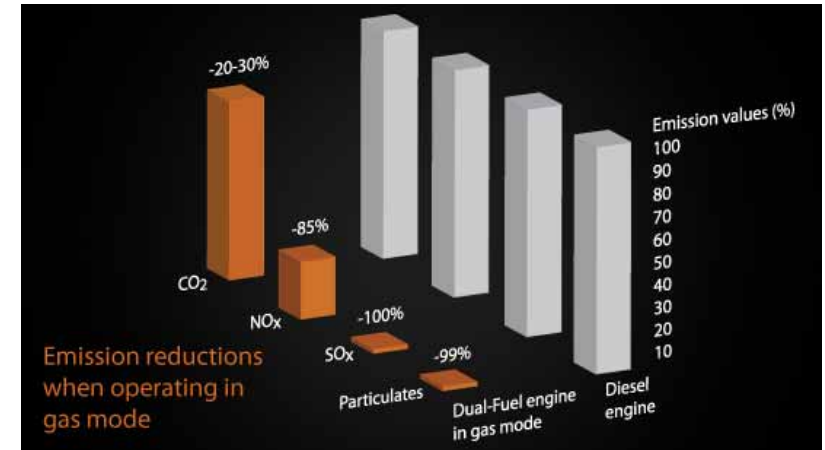
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# BEING TIER III COMPLIANT TODAY

The basic challenge for shipping is that there will be two areas with different emission standards, and much of the world's fleet will operate in both. As there is no standardised fuel, the technical solution needs to be different from the one currently used in cars and trucks. The technologies currently being evaluated include 2-stage turbo charging in combination with EGR (exhaust gas recirculation) and/or engine integrated SCR.

The different emissions technologies must be capable of being adapted to the current engine platforms. The first installation fulfilling the Tier III emission requirements using only engine technology is foreseen in 2014.

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# OUR MOST EXPANSIVE SUPPORT AGREEMENT YET

Wärtsilä's long-term agreement with Royal Caribbean Cruises Ltd. (RCL) is the most extensive maintenance and technical support partnership we have formed with a marine customer yet. "Although we have been working with RCL and its predecessors for more than 40 years, the new agreement covers more vessels and involves much more detailed operational planning than our previous partnerships," explains Leif Rönnskog, Wärtsilä's Vice President for Strategic Account Management.

The maintenance support agreement covers 29 cruise ships owned by RCL, operating the cruise brands Royal Caribbean International, Celebrity Cruises, and Azamara Club Cruises. "The main idea behind the new deal is that Wärtsilä will organise the work that needs to be done on the ship engines, leaving RCL to concentrate on its core business – looking after cruise guests." Wärtsilä can provide maintenance services for marine installations all around the world, from its operations in 160 ports in 70 countries.

The ships covered by the agreement have 118 Wärtsilä engines in all, with an output of approximately 1400 MW. "Most of these are Wärtsilä 46 engines," Rönnskog tells us, "which we see as the workhorse of the global cruise business." Wärtsilä's Condition Based Maintenance (CBM) engine monitoring systems also enable the performance of individual engines to be monitored online anywhere in the world. Rönnskog points out that the new collaboration with RCL will take related monitoring and reporting procedures to the next level.



The new maintenance support agreement covers 29 cruise ships owned by Royal Caribbean Cruise Lines Ltd.

Regular engine condition reports can be sent automatically to Wärtsilä and to customers' operational offices using an easily understood "traffic light system". Green lights mean that everything is running smoothly, amber shows where maintenance measures should soon be taken, and red means that corrective action is needed urgently.

After overall reliability in terms of keeping ships sailing, energy efficiency is the most important consideration in dealings between cruise firms and technical service providers. "Fuel costs are a huge part of the running costs of a cruise operator like RCL, amounting to several hundred million dollars a year," says Rönnskog. "Closer collaboration on maintenance, including the recording of annual reference measurements for the fuel economy of each engine, can certainly help us find innovative new ways to reduce and optimise fuel consumption."

Working more closely together with the customer can greatly speed up the identification and realisation of investments that will generate significant improvements in fuel economy – often with very rapid payback-on-investment times.

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Investments are also needed to meet ever-tighter environmental controls. Emissions of sulphur and nitrogen oxides are central to the planning of engine maintenance. Rönnskog explains that Wärtsilä and RCL are already collaborating closely to find ways to reduce emissions and meet the challenges posed by demands for cruise lines to use more environmentally sound fuels.

Through the new agreement, Wärtsilä's own personnel will also provide on-board supervision and training for RCL's own crews. The new deal includes harmonising and aligning procedures within both companies to facilitate streamlined scheduling and accurate budgeting by eliminating uncertainties.

Wärtsilä and RCL are both convinced that by combining their knowledge and experience, this new kind of cooperation will bring concrete benefits in terms of the optimised availability of ships and improvements in fuel economy.

"This type of long-term maintenance support agreement has previously been more common on the energy side of our business at Wärtsilä, but we're very pleased to be asked to make such a commitment on the marine side too," Rönnskog enthuses.



The whole process of shaping this groundbreaking agreement has taken a full year and involved dozens of people from both companies. "We ran a series of detailed workshops focusing on issues like fuel economy, engine component lifetime, logistics and overhauls. This enabled everyone from both sides to learn about each other's needs. Everyone involved at Wärtsilä and RCL is excited about this new page in our common history."





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# FIRST CERTIFIED SO<sub>x</sub> SCRUBBER ORDERS

In order for its customers to meet the new reduction targets for marine sulphur emissions that were decided by the International Maritime Organization (IMO) in October 2008, Wärtsilä aims to deliver optimal and cost-efficient solutions. These may be based on the use of low-sulphur fuels, sulphur scrubbers, or LNG as fuel. Wärtsilä has extensive experience from delivering exhaust gas scrubbers for stationary power plants, and now also offers such solutions for ships.

The Wärtsilä scrubber concept works with fresh water in a closed-loop system in which sulphur oxides are neutralised with caustic soda. A small amount of scrubbing water is extracted to remove contaminants in a treatment unit on board, thereby fulfilling all the quality and monitoring requirements stipulated by the IMO. In the so-called zero discharge mode, the clean effluents are led to a holding tank for scheduled and periodical discharge. Contaminants are always disposed of at reception facilities in port. Wärtsilä is the first manufacturer to have been awarded a marine scrubber certificate by the classification societies Det Norske Veritas, Germanischer Lloyd and Bureau Veritas.

In 2010, the Finnish company Containerships ordered a fresh water scrubber for installation after the main engine on their "Containerships VII" vessel. The installation was completed during 2011. In 2011, Wärtsilä was awarded a contract to supply propulsion systems and integrated fresh water scrubbers for a series of six vessels for the Canadian owner Algoma Central Corporation. The vessels are being built to transport bulk commodities on North America's Great Lakes and St. Lawrence Seaway.

Sustainability assured 2011



Wärtsilä has extensive experience from delivering SO<sub>x</sub> scrubbers for stationary power plants, and now also offers such solutions for ships.



The Wärtsilä scrubber concept works with fresh water in a closed-loop system in which sulphur oxides are neutralised with caustic soda.

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# ENVIRONMENTALLY SUSTAINABLE OPERATION IN THE ARCTIC OCEAN

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STORIES

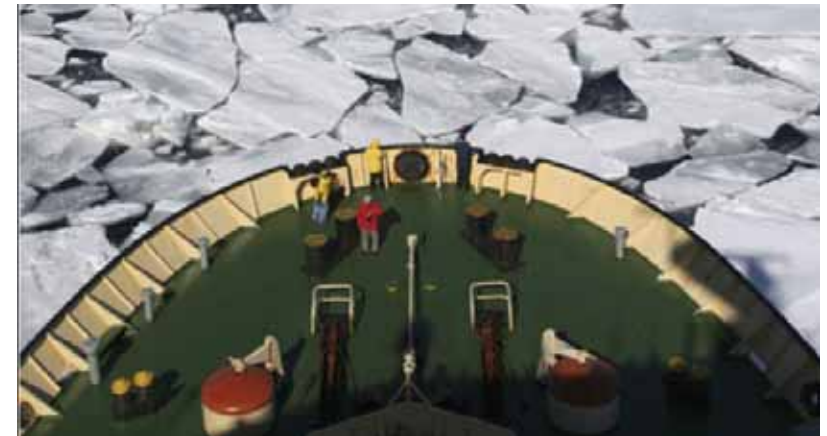
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In September 2011, Wärtsilä was contracted by Finland-based Arctia Offshore Oy to carry out modification work to two of the company's vessels. This turnkey project involves the fitting of combined Wärtsilä NO<sub>x</sub> Reducer (NOR) and Oxidation Catalysts (OXI) to the MSV Fennica and MSV Nordica, both of which are multi-functional vessels based on a modified icebreaker design. The ships will also be converted to enable the use of ultra-low sulphur diesel fuel.

When this conversion work is completed, the vessels will fulfil the United States Environmental Protection Agency's (EPA) emission requirements for operating in the Arctic Ocean. This opens up the possibility for Arctia Offshore to participate in arctic oil exploration projects in an environmentally sustainable manner.

The work will involve fitting the combined Wärtsilä NOR/OXI solution to each of the eight engines that drive the two vessels. The installation schedule is divided into two parts, whereby the first set was completed in the first half of January 2012 and the second set is scheduled to be completed by the end of April 2012. The emissions control device consists of a combined abatement system, designed to reduce nitrogen oxides (NO<sub>x</sub>) and to enable the oxidation of carbon monoxide and unburned hydrocarbons. The NOR is a customised solution specifically engineered to meet the EPA's emission standards and reduce NO<sub>x</sub> emissions by approximately 90%.

**Sustainability assured 2011**



When conversion work is completed, the two Arctia Offshore vessels will fulfil the United States Environmental Protection Agency's emission requirements for operating in the Arctic Ocean.

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# BIT VIKING'S GROUNDBREAKING CONVERSION TO LNG

In October 2011, thanks to a unique, groundbreaking conversion from heavy fuel oil to liquefied natural gas (LNG) operation, the Bit Viking became the first vessel in the world to be equipped with a fully mechanical propulsion system powered by Wärtsilä dual-fuel (DF) engines using gas as the primary fuel.

Back in August 2010, Wärtsilä announced that a turnkey project to convert the Bit Viking to LNG operation had been signed with Tarbit Shipping, a Swedish company that has been transporting bitumen, petroleum products and chemicals since 1962. The scope of the conversion package from Wärtsilä included deck-mounted gas fuel systems, piping, two six-cylinder Wärtsilä 46 engines converted to Wärtsilä 50DF engines with related control systems and all adjustments to the ship's systems necessitated by the conversion. This enables a significant improvement in propulsion efficiency, reduced fuel consumption, and corresponding reductions in emissions. The Bit Viking is the first LNG-fuelled vessel to be classified by Germanischer Lloyd, and the vessel's classification certificate was updated as a result of the conversion.

The re-commissioned vessel is operated by Statoil along the Norwegian coastline, and the conversion carried out by Wärtsilä also enables it to qualify for lower NO<sub>x</sub> emission taxes under the Norwegian NO<sub>x</sub> fund scheme. The fund is a cooperative effort whereby participating companies may apply for financial support in return for introducing NO<sub>x</sub> reducing measures.



The Bit Viking is the first LNG-fuelled vessel to be classified by Germanischer Lloyd, and the vessel's classification certificate was updated as a result of the conversion.

As well as the NO<sub>x</sub>-related benefits, LNG operation means lower carbon oxide emissions and virtually no sulphur oxide or particle emissions whatsoever. All in all, equipped with a double-engine installation, propellers, steering gear, rudders and duplicate control systems, the conversion has made the Bit Viking one of the world's most environmentally-sound product tankers in its class.

"This onboard conversion of marine engines is a world-first," says Kai Alavilamo, Project Manager, Services, Wärtsilä. "It's a natural step. We have more than two decades of experience with dual-fuel technology and converting land-based power plant engines from running on heavy fuel oil to run on gas is a well-established procedure world-wide, but no company has carried out this type of work onboard until now."

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# BIT VIKING'S GROUNDBREAKING CONVERSION TO LNG

The Bit Viking also utilises Wärtsilä's new LNGPac system, which enables the safe and convenient on-board storage of LNG. Two 500 cubic metre LNG storage tanks are mounted on the deck to facilitate bunkering operations and to permit the bunkering of LNG at a rate of 430 cubic metres per hour. The storage tanks provide the vessel with 12 days of autonomous operation at 80% load, with the option to switch to marine gas oil if an extended range is required. When visiting EU ports, which have a 0.1% limit on sulphur emissions, the vessel operates on gas.

"The final result is a significant improvement in propulsion efficiency, reduced fuel consumption and corresponding reductions in emissions," says Giulio Tirelli, Marketing and Application Development Manager at Wärtsilä Ship Power. "The Bit Viking engine conversion will open up the market for many additional applications powered by Wärtsilä's gas-fuelled engines."

**Sustainability assured 2011**



Wärtsilä's gas conversion has made the Bit Viking one of the world's most environmentally sound product tankers in its class.



The Bit Viking utilises Wärtsilä's DF engines as well as a new LNGPac system, which enables the safe and convenient onboard storage of LNG.