# This is Wärtsilä

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CEO review

The year 2017 developed in line with our expectations. Increased power plant deliveries supported some growth in net sales, while profitability was in line with the previous year. The highlight of the year was the order intake growth seen in all of our business areas. This provides a sound foundation from which we can develop our business in the coming years.

Services’ net sales remained solid, thanks to steady demand for power plant related service work, and healthy activity in the cruise and gas carrier markets. While this performance was satisfactory, bearing in mind the challenges we faced in the offshore and merchant segments, our ambitions are still higher. Central to achieving growth is developing stronger partnerships with our customers, and providing them with greater value in the form of new service concepts, and through utilising the opportunities provided by digitalisation. The strategic partnership with Carnival Corporation, announced in the beginning of the year, is a compelling demonstration of where we are headed. The agreement emphasises continuous joint improvement efforts, and targets the increased safety, reliability, and operational efficiency of Carnival’s cruise vessels. This will include using the latest digital solutions.

In the energy industry, many emerging countries are now prioritising increased access to clean and reliable power to support their economic and social growth. Meanwhile, in the developed markets, the demand for operational flexibility is becoming increasingly relevant. This is largely because the decline in solar and wind prices is increasing the competitiveness of renewable sources of energy. These converging trends have together created a strong demand environment for our energy solutions during the year. I am pleased that there has been an increase in orders, both for our traditional engine-based plants, and in newer business areas, such as LNG-terminals and solar PV plants.

2017 saw a recovery in vessel contracting from the record low levels of the previous year. Although overcapacity and a lack of financing continue to burden the marine industry, an increased confidence in economic growth resulted in improved sentiment, particularly among our merchant customers. This, in combination with a favourable vessel mix and our broad offering of solutions, was supportive of growth in Marine Solutions’ orders received.

During the year, we launched our company purpose – enabling sustainable societies with smart technology – to provide an even stronger sense of direction to our work, both now and in the future. Central to the purpose is our commitment to promoting a low emissions economy, and providing intelligent ways of producing and using energy. Equally important is being at the forefront in developing new technologies and new business models that create increased value for our customers.

Indicative of this is our acquisition of Greensmith, which was a strategic response to the transformation that is taking place in the energy industry as the world moves from traditional baseload generation to renewable energy. Through Greensmith, we strengthen our system integration capabilities, and expand our offering to include storage technology and advanced software. This complements our portfolio of flexible power generation solutions, and supports our Smart Energy vision by positioning us at the very core of future energy systems.

Our Smart Marine vision on the other hand, emphasises the opportunities offered by connectivity and digitalisation to promote safety, alleviate environmental impact, and improve efficiency. Our innovations will increasingly centre around this vision. Prime examples from 2017 include the introduction of our marine hybrid solution and the development of our competences in intelligent shipping, for instance through the acquisition of Guidance Marine. By emphasising collaboration with our customers and partners, and supported by our deep industry know-how and broad offering of solutions, we will continue to develop the innovations and competences needed to lead the transformation into a new era of shipping.

Protection of the environment, and supporting the general well-being of the community and its people, are at the heart of a sustainable society. To this end, Wärtsilä is committed to supporting the UN Global Compact and its principles with respect to human rights, labour, the environment, and anti-corruption. Fostering an inclusive corporate culture by respecting diversity, providing equal opportunities, and demonstrating high ethical standards is high on our agenda. Ensuring safe working conditions is another priority, and the decline in our lost time injury frequency shows that we are moving in the right direction. However, reaching our target of zero lost-time injuries will require an even stronger effort to develop safety consciousness throughout the organisation.
Looking ahead, I am confident that an essential element for creating customer value will be our continued focus on developing smart technology and integrating new business models into our offering. Our shareholders, stakeholders and society at large will also benefit from this approach. By emphasising energy efficiency, lifecycle optimisation, and innovative solutions in our offering, we shall be able to reach our long-term target of profitable growth. In terms of 2018, we expect our demand outlook to improve somewhat. We see a good demand environment for our Services business, thanks to growth opportunities related to our portfolio of long-term agreements and the increasing technological sophistication of our installed base. The demand for our energy solutions is anticipated to be at a good level, supported by a healthy project pipeline and favourable market trends. In the marine industry we expect market conditions to improve, and this will support a solid demand outlook.

I would like to take this opportunity to thank our personnel for their continued dedication and for enabling us to achieve our common goals. To our customers, I say thank you for your trust in our solutions and services, and finally yet importantly, I thank our shareholders for their confidence in our continued future success.

Jaakko Eskola
President & CEO

Key figures

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<td>Net sales</td>
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<td>1 292</td>
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<td>Services</td>
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<td>490</td>
<td>2 190</td>
<td>2 184</td>
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<td>Energy Solutions</td>
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<td>943</td>
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<td>Marine Solutions</td>
<td>1 307</td>
<td>366</td>
<td>328</td>
<td>334</td>
<td>279</td>
<td>1 667</td>
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<tr>
<td>Depreciation, amortisation and impairment</td>
<td>-134</td>
<td>-42</td>
<td>-30</td>
<td>-30</td>
<td>-33</td>
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<tr>
<td>Comparable operating result</td>
<td>590</td>
<td>244</td>
<td>135</td>
<td>126</td>
<td>86</td>
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<td>612</td>
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<tr>
<td>Comparable operating result, %</td>
<td>12.0</td>
<td>16.9</td>
<td>11.4</td>
<td>9.7</td>
<td>8.5</td>
<td>12.1</td>
<td>12.2</td>
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<td>Profit before taxes</td>
<td>506</td>
<td>215</td>
<td>114</td>
<td>103</td>
<td>74</td>
<td>479</td>
<td>553</td>
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<tr>
<td>Earnings per share, EUR</td>
<td>1.95</td>
<td>0.86</td>
<td>0.43</td>
<td>0.38</td>
<td>0.28</td>
<td>1.79</td>
<td>2.25</td>
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<tr>
<td>Order intake</td>
<td>5 644</td>
<td>1 514</td>
<td>1 354</td>
<td>1 363</td>
<td>1 413</td>
<td>4 927</td>
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<td>Balance sheet total</td>
<td>5 607</td>
<td>5 607</td>
<td>5 365</td>
<td>5 264</td>
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<td>Interest-bearing liabilities, gross</td>
<td>619</td>
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<td>729</td>
<td>637</td>
<td>670</td>
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<tr>
<td>Cash and cash equivalents</td>
<td>379</td>
<td>379</td>
<td>292</td>
<td>332</td>
<td>403</td>
<td>472</td>
<td>334</td>
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<tr>
<td>ROI, continuing operations, %</td>
<td>18.9</td>
<td>18.9</td>
<td>19.5</td>
<td>19.5</td>
<td>16.9</td>
<td>17.1</td>
<td>21.0</td>
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<tr>
<td>Gearing</td>
<td>0.10</td>
<td>0.10</td>
<td>0.20</td>
<td>0.14</td>
<td>0.13</td>
<td>0.07</td>
<td>0.17</td>
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<tr>
<td>Order book, end of period</td>
<td>5 064</td>
<td>5 064</td>
<td>5 075</td>
<td>5 065</td>
<td>5 096</td>
<td>4 896</td>
<td>4 882</td>
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<tr>
<td>Year-end market capitalisation</td>
<td>10 375</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8 418</td>
<td>8 314</td>
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<tr>
<td>Personnel, number at end of period</td>
<td>18 065</td>
<td>18 065</td>
<td>17 859</td>
<td>17 783</td>
<td>17 832</td>
<td>18 011</td>
<td>18 856</td>
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</table>

1 Figures exclude items affecting comparability.
Wärtsilä in brief

Wärtsilä is a global leader in smart technologies and complete lifecycle solutions for the marine and energy markets. By emphasising sustainable innovation, total efficiency and data analytics, Wärtsilä maximises the environmental and economic performance of the vessels and power plants of its customers. In 2017, Wärtsilä’s net sales totalled EUR 4.9 billion with approximately 18,000 employees. The company has operations in over 200 locations in more than 80 countries around the world. Wärtsilä is listed on Nasdaq Helsinki.

Services

Wärtsilä Services creates lifecycle services for its customers, enhancing their business – whenever, wherever. Wärtsilä provides the industry’s broadest range of services for both shipping and power generation. The service solutions range from spare parts and basic support to ensuring maximised lifetime, increased efficiency and guaranteed performance of customer’s equipment or installation – in a safe, reliable, and environmentally sustainable way.

Energy Solutions

Wärtsilä Energy Solutions is a leading global systems integrator offering a broad range of environmentally sound solutions. Wärtsilä supplies ultra-flexible internal combustion engine based power plants, energy storage systems, and utility-scale solar photovoltaic (PV) power plants, as well as liquefied natural gas (LNG) terminals and distribution systems. These flexible and efficient solutions provide superior value to customers and enable a more sustainable and modern energy system for future generations.

Marine Solutions

Wärtsilä Marine Solutions enhances the business of its marine and oil & gas industry customers by providing innovative products and integrated solutions that are safe, environmentally sustainable, efficient, flexible, and economically sound. Being a technology leader, and through collaboration and knowledge sharing, Wärtsilä is able to customise solutions that provide real value to its customers around the world.

Strategy

Wärtsilä’s purpose is to enable sustainable societies with smart technology. The demand for clean and flexible energy and the need for efficient and safe transportation are increasingly affecting the way that customers operate. This forms the basis for Wärtsilä’s offering of smart solutions to the marine and energy markets. With an integrated portfolio of services, systems and products, the company is well positioned to respond to the demand for energy efficient and innovative solutions. The emphasis is placed on optimising installation performance throughout the lifecycle, using data analytics and artificial intelligence to support customers’ business decisions. Wärtsilä’s digital transformation will provide increased customer value through a new era of collaboration and knowledge sharing. A strong presence in key markets and a superior global service network support the company’s profitable growth ambitions.

With its flexible production and supply chain management, Wärtsilä constantly seeks new ways to maintain high quality and cost efficiency – often in co-operation with customers and leading industrial partners. The investments in R&D and the focus on digitalisation create a strong foundation for securing and strengthening a position at the forefront of market innovation. This innovative culture, together with a constant emphasis on safety, diversity, and high ethical standards, attracts skilled and committed people and creates the basis for a high performing organisation. The implementation of operational excellence ensures that Wärtsilä is easy to do business with, and drives increased productivity and efficiency throughout the lifecycle.

Smart energy

Wärtsilä’s objective is for customers to recognise the company as the leading energy systems integrator, providing all the essential technologies, services, and solutions for sustainable and reliable power systems.

The energy landscape is experiencing a paradigm shift, thus creating a more complex operating environment for the industry. The world is moving from traditional baseload generation to renewable energy, while storage technology is disrupting old design
principles and the importance of gas is increasing. Simultaneously, the role of consumers in energy production is increasing.
Digitalisation brings new opportunities for predicting consumption and maintenance needs and can deliver improved competitiveness.

Wärtsilä is at the very core of future energy systems. The company’s engine power generation solutions provide a unique combination of energy efficiency, and both fuel and operational flexibility. Wärtsilä supports the continued development of the gas infrastructure with small and medium size LNG terminals and liquefaction solutions. Responding to the increasing use of renewable power sources, the company seeks growth by offering solar PV power plants, energy storage solutions, and advanced integration software. The aim is to continuously develop optimal and environmentally sound solutions for customers by focusing on Wärtsilä’s core competences; market and system understanding, EPC capabilities, systems integration, and lifecycle optimisation.

Smart marine

Wärtsilä’s aim is to lead the industry’s transformation towards a Smart Marine Ecosystem. Building on the sound foundation of being a leading provider of innovative products, integrated solutions, and lifecycle services to the marine and oil & gas industries, Wärtsilä aims to unlock new customer values through connectivity, digitalisation and smart technology.

The marine industry is moving towards a future that is increasingly connected. The opportunities offered through smart technology will foster a new era of collaboration and knowledge sharing with customers, suppliers, and partners. Industry players are faced with major sources of inefficiency that impose a significant negative impact on business operations and profitability, the three most notable being overcapacity, inadequate port-to-port fuel efficiency, and time wasted waiting when entering ports and other high traffic areas. Eliminating these inefficiencies forms the basis of the Wärtsilä marine strategy towards ecosystem thinking. Wärtsilä sees four primary forces that will re-shape the industry. Shared capacity will improve fill rates and reduce unit costs; big data analytics will optimise both operations and energy management; intelligent vessels will enable automated and optimised processes; and smart ports will result in smoother and faster port operations.

Wärtsilä is ideally positioned, together with its customers and partners, for positive disruptive development and to lead the transformation into a new era of shipping. Building on Wärtsilä’s broad portfolio of products, systems, solutions, and lifecycle services, and its vast installed base and industry know-how, the company will continue to develop the smart technologies, business models, and competences needed to create a Smart Marine Ecosystem.

By applying smart technology and performance optimisation services, Wärtsilä aims to deliver greater efficiencies, minimised climate impact and a higher safety to the shipping industry, leading to more sustainable, safe and profitable operations for ship owners and operators around the world. The ultimate goal is to enable sustainable societies with smart technologies.

Sustainability

Wärtsilä’s aim is to meet shareholder expectations and contribute toward the well-being of society. This requires efficient, profitable, and competitive company operations. Good economic performance establishes a platform for the other aspects of sustainability – environmental and social responsibility.

Wärtsilä’s overriding promise is to supply technologies and services that offer high efficiency with low environmental load. Our objective is to continuously improve the environmental performance of our products and services taking into account the lifecycle perspective, as well as to maintain technological leadership through R&D and by utilising new technologies and collaborating with our customers and other stakeholder groups. In doing this, we help our customers and society at large to meet the goals of the tightening global environmental regulations and guidelines.

Wärtsilä acts as a good corporate citizen wherever we are active. Our business operations and relations with our stakeholders are governed by our Code of Conduct. Wärtsilä is a responsible employer, and we seek to offer our employees an interesting and exciting workplace where openness, respect, trust, equal opportunities, and scope for personal development prevail. A further aim is to offer a hazard-free working environment to our employees and contractors, and to minimise the health and safety risks associated with the use of our products and services. Supply chain management and development are integral elements of our operations.
Wärtsilä’s strategy

INCREASED CUSTOMER VALUE

Lifecyle optimisation

Wärtsilä as a service

Enabling sustainable societies with smart technology

ENERGY

INCREASING DEMAND FOR CLEAN AND FLEXIBLE ENERGY

Innovative solutions

Energy efficiency

MARINE

DEMAND FOR SMART AND SAFE TRANSPORTATION

Strong presence in growth markets

High performance culture

Operational excellence

ENABLERS
Targets

Financial targets

Net sales

Target
Wärtsilä’s target is to grow faster than global GDP.

Development
In 2017, net sales increased by 3% to EUR 4,923 million. Wärtsilä’s CAGR 2007-2017 was 2.7%.

Growth over the cycle

- * Restated, figures include continuing operations.
Profitability

Target
Wärtsilä’s operating profit margin (EBIT%) target is 14% at the peak of the cycle. At the trough of the cycle, the target is to keep the operating profit margin above 10%.

Development
In 2017, the comparable operating result was EUR 590 million, which represents 12.0% of net sales.
Capital structure

**Target**
Wärtsilä’s target is to maintain gearing below 0.50.

**Development**
In 2017, gearing was 0.10.
Dividend

**Target**

Wärtsilä’s target is to pay a dividend of at least 50% of earnings over the cycle.

**Development**

The Board of Directors proposes that a dividend of 1.38 euro per share be paid for the financial year 2017, which represents 70.8% of operational earnings.

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**Dividend**

<table>
<thead>
<tr>
<th>Year</th>
<th>Dividend per share</th>
<th>Extra dividend per share</th>
<th>Earnings per share</th>
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<tbody>
<tr>
<td>2008</td>
<td>1.75</td>
<td>2.75</td>
<td>1.15</td>
</tr>
<tr>
<td>2009</td>
<td>2.00</td>
<td>1.90</td>
<td>1.95</td>
</tr>
<tr>
<td>2010</td>
<td>1.75</td>
<td>2.75</td>
<td>1.15</td>
</tr>
<tr>
<td>2011</td>
<td>1.38</td>
<td>1.38</td>
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The free share issue approved by Wärtsilä Corporation’s Annual General Meeting on 3 March 2011 increased the total number of Wärtsilä shares to 197,241,140. Earnings per share in comparison periods 2008–2010 have been adjusted to reflect the increased number of shares.
### Sustainability targets

<table>
<thead>
<tr>
<th>Target</th>
<th>Schedule</th>
<th>Status</th>
</tr>
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<tbody>
<tr>
<td>ENERGY SAVINGS: Reduce energy consumption by at least 7% in terms of absolute consumption (GWh) from 2015 levels by 2025.</td>
<td>2025</td>
<td>By the end of 2017, energy savings of 942 MWh were achieved, representing 3.2% of the final target.</td>
</tr>
<tr>
<td>ETHICAL BEHAVIOR: Ensure commitment to the Code of Conduct throughout the organisation (Code of Conduct training coverage 100%).</td>
<td>2020</td>
<td>Training records are continuously monitored. At the end of 2017, the Code of Conduct training programme coverage was 89.3% of all employees.</td>
</tr>
<tr>
<td>OCCUPATIONAL SAFETY: Reach the long-term goal of zero injuries.</td>
<td>2020</td>
<td>In 2017, the positive trend in improving, consolidating, and spreading a safety culture within Wärtsilä continued. The corporate lost-time injury frequency rate target for the year was 2.35. The result 2.48 was above the target, however, it represents a 4% improvement compared to the previous year’s result (2.59). As a highlight, proactive near miss and hazard reporting increased by 49% in 2017 compared to 2016.</td>
</tr>
<tr>
<td>CLIMATE CHANGE: Prepare an analysis of the impact of the Paris Climate Change Agreement on Wärtsilä.</td>
<td>2018</td>
<td>During 2017, Wärtsilä monitored changes in international climate policy and updated its analysis of the greenhouse gas reduction ambitions of key nations. Further steps for internal work were planned.</td>
</tr>
<tr>
<td>SUSTAINABLE POWER SYSTEMS: Contribute to the development of an affordable, reliable, sustainable, and modern power system worldwide.</td>
<td>2020</td>
<td>In 2017, some 3,800 MWs of new modern, highly efficient gas and liquid fired Smart Power Generation plants were sold. This represented substantial growth from previous years. Additionally, Wärtsilä launched the world’s most efficient gas engine 31SG with its first 31SG power plant sold to the USA. Wärtsilä also acquired Greensmith, a leading energy storage company, and proceeded in the development of hybrids.</td>
</tr>
<tr>
<td>SMALL-MEDIUM SCALE LNG SOLUTIONS: Become a global actor in the LNG value chain, which develops opportunities, creates solutions, and builds infrastructure for clean-burning LNG to replace liquid fuel.</td>
<td>2020</td>
<td>In 2017, Wärtsilä signed a contract to supply an LNG terminal to Hamina. In addition, the mechanical completion, and the successful unloading of the first shipment of LNG, at the Tornio Manga LNG terminal were achieved. Wärtsilä extended its technologies in the biogas value chain by acquiring Puregas, a company that delivers biogas upgrading solutions. Wärtsilä also delivered regasification solutions for FSRU vessels.</td>
</tr>
<tr>
<td>CLIMATE CHANGE: Reduce greenhouse gas (GHG) emissions from gas engines by 15% from 2015 to 2020.</td>
<td>2020</td>
<td>During 2017, Wärtsilä identified and determined the technology packages for the reduction of greenhouse gas emissions. The product specific implementation schedules were also decided. Greenhouse gas emissions from gas engines were reduced by 7% from the baseline year.</td>
</tr>
<tr>
<td>DECARBONISATION OF TRANSPORT: Contribute to the development of more sustainable transportation through gas based and other technologies.</td>
<td>2020</td>
<td>The W31 engine with the best efficiency in the market was introduced. Also, the Wärtsilä HY hybrid concept combining engines and batteries was introduced. Wärtsilä raised its market share for orders of liquid natural gas fuel tanks from 36% to 50% (tank capacity) compared to 2016.</td>
</tr>
<tr>
<td>CLIMATE CHANGE: Reduce over 300,000 tons of annual CO₂ from vessels with the help of Eniram solutions.</td>
<td>2020</td>
<td>The estimated reductions of CO2 emissions in 2017 were approximately 175,000 tons.</td>
</tr>
<tr>
<td>WELL-BEING AT WORK - CAREER: Balance between external and internal recruitments: More than 50% of the open vacancies filled from internal applicant pool, including promotions and lateral moves.</td>
<td>2020</td>
<td>In 2017, 45% of open vacancies were filled through internal selections for job levels 3 and up, and 55% through external selections.</td>
</tr>
<tr>
<td><strong>PERSONNEL DEVELOPMENT:</strong> Development discussion coverage 100%.</td>
<td>2020</td>
<td>By the end of 2017, altogether 96.4% of the company's employees had completed development discussions.</td>
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<tr>
<td><strong>DIVERSITY:</strong> Increase the share of female employees to 20%.</td>
<td>2020</td>
<td>In 2017, the share of female employees was 16%.</td>
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</table>
| **SUPPLIER LIFECYCLE MANAGEMENT:** Risk-based supplier assessment and management process in use by 2018:  
  - Phase I: new suppliers by 2017  
  - Phase II: existing suppliers by 2018 | 2018 | In 2017, Wärtsilä defined the requirements and created a prototype for a Supplier Relationship Management tool. Additionally, criteria for supplier compliance and performance levels were determined. The Supplier Relationship Management tool supports the risk-based supplier assessment and will be taken into use during 2018, starting with the assessment of new suppliers. |
| **SUPPLIER MONITORING:** Reach the following rating coverage of suppliers:  
  - 96% of direct supplier spend rated  
  - 70% of indirect supplier spend rated  
  - 75% of local supplier spend rated. | 2020 | In 2017, the rating coverage of direct supplier spend was 94%. The rating coverage of indirect supplier spend was 73%, and of local supplier spend 77%. |
Sustainability highlights


10.2. Wärtsilä joins Seabin Project in the battle against ocean plastics.

20.2. Wärtsilä contracted to supply its first ever gas-fired power plant to China.

22.3. Wärtsilä contracted to supply a solar PV plant to Burkina Faso – creating Africa’s largest engine-solar PV hybrid power plant.
15.5. Wärtsilä acquires Greensmith Energy Management Systems Inc. enabling Wärtsilä to expand its footprint in the energy storage market and position itself as a leading global energy systems integrator.

30.5. A new era of technological evolution arrives with the first order for the Wärtsilä HY, a hybrid power module that combines engines, an energy storage system, and power electronics.

31.5. Wärtsilä introduces its Eniram SkyLight 2.0 monitoring & predictive analysis system update. The Eniram SkyLight 2.0 adds nautical maps, weather layers, and route importation to make predictive analysis and proactive planning more available. The updated system can visualise a vessel’s route from economic, environmental, and safety perspectives.

30.6. Wärtsilä joins the Global Industry Alliance, a new public-private partnership initiative of the IMO, which aims to bring together maritime industry leaders to support an energy efficient and low carbon maritime transport system.
4.7. Wärtsilä will enhance the reliability of the world’s largest offshore wind farm in the North Sea. Wärtsilä low voltage switchboards will be installed for the world’s first offshore reactive compensation station. The reactive compensation station enables the high voltage AC system to work with cable lengths longer than those previously used for offshore wind applications.

7.9. Wärtsilä included in the Dow Jones Sustainability Indices (DJSI).

12.9. Wärtsilä partners with AW-Energy to add wave power generation to its capabilities as an energy system integrator.

20.9. Wireless charging of a hybrid coastal ferry successfully tested.
24.10. Wärtsilä to build an energy storage system for Singapore’s Energy Market Authority and SP Group. Energy storage capacity will support Singapore’s use of solar power by providing energy reserves and reducing peak demand. It will also assist in evaluating the performance of ESS technologies in the country’s hot and humid climate, its impact on the electricity grid, and to establish future guidelines for ESS deployments.

31.10. Wärtsilä combines competences to ensure ultra-silent propulsion for a research vessel.

15.11. Introduction of the Wärtsilä 31SG engine raises simple-cycle efficiency to an entirely new level.

4.12. Wärtsilä Voyage Emissions Reduction (VER) system saves oil tanker cargo losses, fuel costs, and the environment. The system effectively eliminates the problem of evaporated cargo and resulting volatile organic compound (VOC) emissions from tankers during laden voyages. The VER system reduces VOC emissions by up to 75 percent.
**Services**

Wärtsilä Services supports its customers throughout the lifecycle of their installations by optimising efficiency and enhancing their operations, thus helping to grow their business. Wärtsilä’s service network of approximately 11,000 professionals in 160 global locations is unmatched in the marine and energy delivering services to more than 12,000 customers every year.

Wärtsilä’s portfolio of solutions and services is the broadest in the industry, ranging from supplying spare parts to optimising customer operations and providing performance guarantees. Wärtsilä is committed to providing high quality, expert support, and to making its services available in the most environmentally sound way possible, whenever, wherever. By developing close relationships with customers, Wärtsilä enables an in-depth understanding of their business so as to extend the value of its services accordingly.

The Services business generates value for customers by providing reliable performance, improving environmental efficiency, and by optimising the performance of their assets. By providing analytics of installations, operational transparency is ensured, performance improved, and customers’ revenue potential increased. Digitalisation means leveraging new technologies, enhancing the core business, and building capabilities enabling installation-as-a-service future offering. Wärtsilä’s competences are constantly being developed in order to extend the service capabilities to cover multiple brands of equipment.

While working together with customers, Wärtsilä also believes it can make a difference in those markets in which the company operates by actively harnessing its capabilities to shape the transformation taking place in the marine and energy industries. This is done by providing a cleaner, safer and more energy intelligent environment to live in, taking an active role in shaping the market and working to fulfil Wärtsilä’s purpose in enabling sustainable societies with smart technology.

**The service offering**

Wärtsilä Services creates lifecycle value propositions together with its customers, based on the broadest portfolio of solutions and services. A comprehensive knowledge of the customer’s business and operational challenges, combined with technical expertise, forms the basis for being able to offer different levels of support:

- Full maintenance and performance monitoring, utilising both spare parts and services (field services, condition based maintenance, dynamic maintenance planning).
- Optimising customers’ businesses via analytics, proactive recommendations, efficiency improvements (e.g. fuel cost savings), and shared performance targets for the operation and maintenance of their equipment.
- Guarantees for the operational reliability, performance and uptime of customer assets.
- Spare parts for equipment, with an emphasis on excellent delivery performance and the availability of a broad range of parts.

**Areas of expertise include:**

**Lifecycle solutions**

Wärtsilä Services’ lifecycle solutions enhance asset performance and help business growth by utilising digital innovations and advanced data analytics to create a holistic approach that goes beyond maintenance and servicing. Lifecycle solutions offer measurable and guaranteed benefits in a safe, reliable and environmentally friendly way. These include increased competitiveness in daily operations, improved asset and business availability and performance, productivity gains and cost benefits, as well as maximised installation life. New to the agreement offering is the additional capability connected to renewables, including PV Solar and Energy Storage technology.

Wärtsilä tailors its lifecycle solutions to enable customers to choose from different levels of partnership agreements. The scope of the agreements may vary from covering every aspect of day-to-day operations and related maintenance and administration tasks, to guaranteed asset performance solutions where Wärtsilä guarantees the operational reliability, performance and uptime of the customer’s assets.
Wärtsilä Genius services

Wärtsilä Genius services utilise the advantages available from connectivity and real-time data gathering to optimise operations, deliver more value, and enable growth. A tailored security support for the installation helps keep industrial control systems secure and compliant.

Eniram services

Eniram – a Wärtsilä company – provides the marine industry with leading insights for asset, operational, and commercial shipping management. Eniram solutions range from single vessel services to comprehensive fleet wide solutions to maximise efficiency through digital insights, cost savings, and maximising overall profitability, while reducing emissions that harm the environment.

Service projects

Project management capabilities enable Wärtsilä to optimise the performance of its customers’ installations through upgrades, modernisations, fuel conversions, and safety solutions.

Engine services

Wärtsilä provides complete global services for medium- and low-speed diesel, gas, dual- and multiple-fuel engines, and related systems. The broad extent of the offering ranges from standard engine overhauls, to optimisation retrofits that improve the performance of older installations.

Customers operating with multiple engine brands are served by QuantiServ, which offers specialised, fast and reliable support, as well as maintenance and repair services. Specialised professionals provide re-manufacturing and in-situ services, as well as flexible repair and overhaul services for auxiliary engines and generating sets.

Turbocharger services

The offering includes spare parts, maintenance and repair services, and versatile conversion and upgrade solutions for turbochargers – provided by a global network of certified turbocharger workshops. Turbocharger maintenance is essential for the overall performance of the engine.

Propulsion services

A complete range of services to maintain performance throughout the lifecycle of propulsion systems. Parts, repairs, maintenance, modernisation solutions, and efficiency upgrades are also provided in order to keep propulsion systems running powerfully and efficiently.

Environmental services

Many of Wärtsilä’s products and services are designed to have a direct and positive environmental impact, either by improving efficiency or by eliminating or reducing polluting emissions from customer processes. These solutions include, for example, fuel conversions, low NOx solutions, upgrades or modernisations, ballast water management systems, and exhaust gas cleaning systems.

Seals & Bearings services

The company offers a broad range of sealing, bearing, and stern tube solutions in the form of integrated systems, packages, and products. These services offer lifecycle efficiency and reduced risk, and are environmentally sustainable.

Hydro & Industrial services

The offering includes seals, bearings and associated equipment and lifecycle services focusing on modernisations and retrofits to optimise operational performance for hydropower, tidal power, and industrial power applications.

Services’ operating environment

Wärtsilä Services operates in the marine, energy and oil & gas industries, as well as in hydro and industrial related businesses. The main driver for the Services business is the size and development of Wärtsilä’s installed equipment base, which consists of
propellers, engines and other products. However, the offering and competences are continuously being developed in order to extend the service capabilities to cover multiple brands of equipment.

The market conditions faced by Wärtsilä’s end customers have a direct impact on the utilisation rate of installations in operation, and dictate the need for services relating to maintenance, lay-down, or redeployments. Throughout the lifecycle of any installation, there are various maintenance requirements, as well as possible needs for upgrades or life-extension services. Wärtsilä’s customers may also face the need for retrofits and upgrades of their equipment based on structural changes to their operating environments, such as changes in the availability or pricing of fuels, regulatory developments, or increased safety requirements.

The interest for lifecycle solutions in the form of partnership agreements is evident in the marine and oil & gas markets, as well as in the energy industry. Such agreements further the optimisation of both maintenance and performance, thereby improving operational efficiency, reducing costs, and creating business growth. Real-time monitoring and analytics are driving further opportunities for using data to optimise customer business performance.

**Competition and market position**

Wärtsilä has a strong position in servicing equipment that has been sold and designed by Wärtsilä. The key differentiators are a truly global presence with a fully owned service network and the capability to provide support and optimise performance throughout the lifecycle of the installation. Only a few other players are able to provide such a broad service offering globally; these being other Original Equipment Manufacturers (OEM) focusing on their own equipment brands, and independent service companies.

Competition is, therefore, fragmented in nature and consists mainly of local players with a limited offering scope, such as parts traders, repair yards, local workshops, component suppliers for spare parts (non-OEM), and field service businesses. Wärtsilä is constantly developing its global footprint and local operations in order to serve its customers with superior quality, while at the same time meeting increased demands for a speedy response.

In the energy industry, the competition for lifecycle solutions comes from a few regional players capable of offering plant operational services. In the marine market, the competition for lifecycle solutions is even more fragmented with some ship management companies serving this segment.

Digitalisation is expected to bring new types of players to the market, leading to new types of potential disruption. However, it also provides opportunities for structured players developing ecosystems based on increased collaboration and connectivity.

**Services’ strengths**

- Long-term relationships with customers and an in-depth understanding of the operation of their assets.
- A complete lifecycle service offering
- An unmatched global service network
- The capability to deliver operational and asset performance optimisation globally
- State-of-the-art digital solutions for enhancing customer businesses based on optimising, predicting and solving, utilising the benefits of real-time data, and data analytics
- Technical support capabilities and know-how
- The track record and capability to deliver complex projects with performance guarantees.

**Services and sustainability**

As one of the marine and energy industries’ leading partners, Wärtsilä Services supplies efficient solutions that can benefit both the customer and the environment.

**Environmental compliance**

Environmental efficiency should be seen as a holistic process of identifying and planning activities to optimise installation performance and reduce emissions. It starts with analysing the true condition of an installation and optimising the equipment, operations and maintenance to meet the appropriate standards and requirements.
Many of Wärtsilä Services’ products and services are designed to have a direct environmental benefit. By eliminating or reducing polluting emissions from customer processes, they are able to continue operating without restrictions in sensitive areas around the world. Wärtsilä provides customers with the tools for enabling compliance with both current and future environmental legislation, helping them contribute towards a clean society.

**Energy efficiency provides a competitive advantage**

**Improving power plant energy efficiency**

With up-to-date equipment, well-planned maintenance and skilled operation, a power plant’s energy efficiency can be kept at a high level throughout its lifecycle. With customized lifecycle upgrades, its energy efficiency can even be considerably increased. A boost in energy efficiency decreases emissions, thus reducing negative environmental impacts.

Wärtsilä offers a range of solutions for improving the energy efficiency of a power plant – from the replacement of a single component, to complete modernisation or operation and maintenance solutions. A site audit by Wärtsilä’s energy efficiency experts helps identify equipment and processes with improvement potential.

**Energy efficiency in the marine industry**

The overall energy efficiency of a vessel is determined by choices made throughout its lifecycle. Improvements in energy efficiency lead to increased profitability, reduced emissions, and a more sustainable brand image. When looking for ways to improve the energy efficiency of a vessel, optimising its operation and engine and propulsion systems can offer significant opportunities for savings. Utilisation of the latest digital technologies and data intelligence enable continuous monitoring and optimisation of the operations of the entire fleet. Predictive analytics and optimisation systems help the crew and operators to become more energy efficient.

Wärtsilä can develop a holistic optimising strategy that covers the entire lifecycle of a fleet, or provide a customised solution to a specific challenge.
Energy Solutions

Wärtsilä Energy Solutions is a leading global system integrator offering ultra-flexible internal combustion engine based power plants, energy storage systems, and utility-scale solar PV power plants, as well as LNG terminals and distribution systems. These flexible and efficient solutions offer superior value to customers and provide access to a more clean and modern energy system for future generations. This supports Wärtsilä’s purpose in enabling sustainable societies with smart technologies. As of 2017, Wärtsilä had over 65 GW of installed power plant capacity in 177 countries around the world.

Wärtsilä serves three main customer segments

Wärtsilä Energy Solutions’ three main customer segments are Utilities, Independent Power Producers (IPPs), and Industrial customers.

Utilities supply electricity and gas to residential, commercial, and industrial end users. They invest in gas infrastructure projects and various types of power plants to ensure adequate load coverage, and the right palette of cost-effective and reliable products and services for their customers.

IPPs are financial investors investing in the gas infrastructure, power plants, and in selling the generated power to utilities. Their investments are return driven, and as with utilities, their technical requirements are application driven.

Industrial customers are mainly private companies with energy intensive production operations, such as cement or mining facilities. By investing in captive power, they are able to achieve lower energy costs and can be prepared for any grid reliability issues, thus ensuring security of supply. Wärtsilä serves the top end of this customer group, i.e. large industries requiring a relatively high electrical load.

Focus on flexibility

Wärtsilä’s engine based power plants, referred to as being Smart Power Generation, are used for a wide variety of applications. These include base load generation, capacity for grid stability, peaking and load-following generation, and the integration of wind and solar power.

Wärtsilä’s power plant solutions are tailored according to the specific requirements of its customers, utilising modular products and services. The delivery scope ranges from equipment deliveries to complete turnkey power plants, all of which are supported by Wärtsilä’s superior project management capabilities. The fuel flexibility of Wärtsilä’s solutions enables the choice and utilisation of the most feasible fuels, including natural gas and many other gases, as well as most fuel oils. The customer can also choose to run their plant on multiple fuels. In addition to a broad offering of services to support customers through the lifecycle of their installations, Wärtsilä also provides financial services to help them arrange financing and assemble complex projects.

The increasing level of intermittent renewable energy sources in many power systems has created a rapidly growing need for greater flexibility. Gas fuelled power plants represent the most flexible and environmentally sound alternative for balancing the variability of these renewable sources. Smart Power Generation plants provide the best means of support to the power system by offering the highest degree of flexibility, enabling major savings, and creating an optimised response to rapid changes in intermittent generation.

Growth through energy storage, solar, LNG and system integration

The global transition from carbon-intensive energy sources to low carbon fuels, such as natural gas and renewable source solutions, presents Wärtsilä with many opportunities for growth. As a forerunner in gas and multi-fuel engines, fuel systems, technology and services, Wärtsilä supports the global shift to gas with its LNG infrastructure projects. The company provides a full range of project and lifecycle support services, from small and medium scale LNG liquefaction plants and terminals, to the delivery of complete Equipment, Procurement and Construction (EPC) projects worldwide. Wärtsilä has the capability, in partnership with its customers, to develop the entire LNG value chain. When providing a complete turnkey solution, an LNG terminal can be integrated with a Smart Power Generation power plant, thereby utilising gas as fuel in places where gas was not earlier available.
Responding to the increasing share of renewables within the energy mix, Wärtsilä has developed its offering to include utility-scale hybrid power plants that unite large fuel-based power stations with solar PV power plants. Wärtsilä’s hybrid solutions are provided on an EPC basis, with solar PV modules sourced from leading module suppliers. The aim of engine-solar hybrids is to save fuel, which results in lifecycle cost savings and environmental benefits. The two assets are optimised in such a way that the amount of solar energy is maximised, with the engines providing a secondary source of generation. The solar hybrid plant can be part of a retrofit project, where solar modules are combined with an existing Smart Power Generation plant.

The acquisition of Greensmith Energy Inc., USA’s leading energy storage software and integration service provider, enables Wärtsilä to take the leading position in the emerging energy storage market and further strengthen its energy system integration capabilities. As a combined solution, Wärtsilä’s Smart Power Generation, solar PV and energy storage, together with Wärtsilä’s integration capabilities, decades-long experience in delivering complex turnkey engine power plants, and a wide palette of services, will provide sustainable, reliable, and affordable power — particularly in countries and regions with isolated or weak electricity grids.

### Energy Solutions' operating environment

The main drivers for Wärtsilä’s Energy Solutions business are:

- Economic growth, electrification and improving standards of living
- Growth in sustainable energy, reducing carbon emissions
- Rapid growth of intermittent renewable generation and escalating demand fluctuation
- Replacement of other fossil fuels with natural gas
- Ageing installed capacity driving investments in new technologies

Economic growth, improving standards of living, and consequential electrification are jointly resulting in an increase in electricity consumption in non-OECD countries. The demand for flexible baseload power plants, as well as for industrial self-generation, is driven by the price of electricity purchased from the local grid, and by fuel price projections. The introduction of gas supply networks to the emerging markets is resulting in increased demand for gas and dual-fuel driven power plants, solutions in which Wärtsilä has a leading position.

### Final electricity generation by region

![Final electricity generation by region](image)

In the OECD countries, tightening emissions legislation is forcing the closure of ageing capacity, which in turn drives the demand for new investments. Another driver is the political emphasis towards low carbon power systems, resulting in rapidly increasing levels of renewable generation. This has already created a substantial need to add flexibility into power systems. Wärtsilä’s Smart
Power Generation power plants represent the most efficient solution for integrating intermittent renewable energy, thereby enabling the transition to a sustainable, reliable, and affordable low carbon power system.

Global power generation capacity, retirements and additions

![Graph showing power generation capacity, retirements and additions by type.]

Share of renewables in electricity generation by region

![Graph showing the share of renewables in electricity generation by region.]

Source: Bloomberg New Energy Outlook 2017
Energy Solutions’ competition

Wärtsilä is facing new types of competition while broadening its offering portfolio. The main competitors in larger gas-fired projects are gas turbine manufacturers, such as GE and Siemens. In smaller gas power plant projects, and in the heavy fuel oil power plant market, the competitors are mainly other internal combustion engine suppliers, such as MAN Diesel & Turbo, GE Jenbacher, Caterpillar (MAK), and Rolls-Royce.

When competing against gas turbines, Wärtsilä’s combination of high efficiency, greater fuel flexibility, and superior operational flexibility enables better value propositions to many customer projects. Wärtsilä’s systematic market development is shaping the energy sector by utilising a value based market approach, which builds on monetising the benefits of Smart Power Generation.

Wärtsilä’s advanced gas and dual-fuel engine technology, optimised modular power plants, superior project management capabilities, and the global service support provided throughout the lifecycle of installations, have led to Wärtsilä’s market leading position in the gas and liquid fuel combustion engine power plant markets.

In the utility scale solar PV business, independent, regional, and local EPC companies are the main competitors. The competition in LNG infrastructure projects comes mainly from contracting companies.

When looking at energy system integration, software and battery storage systems, the competition comes from companies such as NEC and Tesla, among others.
The development of a more sustainable energy infrastructure is being driven by climate policies, energy security, and economics. Carbon-intensive energy sources are being replaced by low carbon fuels, such as natural gas and renewable source solutions. Energy savings and efficiency improvements are encouraged, and even legally enforced, at every level. This development is evident on a global scale, even though short-term actions can vary in different regions.

In line with its commitment to sustainability and responsible business conduct, Wärtsilä has taken an active role in the development of markets and solutions. This includes advising national decision makers on changes in the power markets and on relevant technical and commercial norms. In this way, Wärtsilä helps and enables the transition to more sustainable power systems. Wärtsilä strives to maintain a deep understanding of market requirements and drivers, and to develop its solutions in a way that enables them to contribute effectively to improved energy system performance in the various regions of the world.

Wärtsilä’s solutions for the energy sector offer a unique combination of flexibility, high efficiency, and sustainability. Many different fuels, including bio-fuels, can be used efficiently, which helps to reduce greenhouse gas emissions. Thus, Wärtsilä’s Smart Power Generation technology enables the development of a reliable and sustainable energy infrastructure. The integration of wind and solar energy with flexible Smart Power Generation capacity is already reducing carbon emissions across the globe. In addition to this, Wärtsilä’s strong capabilities to offer energy storage, utility-scale solar PV power plants and hybrid solutions, including the most advanced software for energy management, enables maximising the share of renewables into the energy mix, which in turn ensures the widest optimisation of the different assets and the reliability of the system.

Towards sustainable power systems

The challenges associated with climate change require a dramatic decrease in baseload coal based power generation and a major increase in low carbon power generation, including wind, solar, and natural gas fired plants. In future power systems, the majority of the electricity will be generated by wind and solar power, while thermal power generation will be increasingly used for system balancing and back-up. The inherent variability of wind and solar sources requires operational flexibility from the thermal capacity.
Current and earlier power systems were not designed for this purpose, and in order to meet the required capacity, new flexible power generation assets need to be added to the system. Such flexible capacity is based on three elements: operational flexibility, energy efficiency, and fuel flexibility.

Operational flexibility is needed for reacting to the rapid changes in wind and solar output and for sudden power system disturbances. Power plant requirements include the following features:

- Frequent and fast starts and stops without negative wear and tear consequences
- Cyclic operation with high up and down ramp rates
- High full and part load efficiency
- A broad load range
- Minimal CO\(_2\) emissions.

Energy efficiency means that less fuel is needed to generate electricity. In combined heat and power generation, energy efficiency can be significantly improved. Lower fuel consumption results in lower CO\(_2\) levels from power generation.

Fuel flexibility enables the transition to more sustainable fuels whenever they become available. This feature becomes increasingly important when investing in new power capacity, because the plant is not fixed to any particular fuel where more sustainable fuels may be available in the future.

These three elements form the cornerstones of the Smart Power Generation solutions. Such solutions enable maximised utilisation of valuable renewable power, smooth operation of inflexible baseload thermal power plants and, according to the results from future power system modelling, a dramatic reduction in system level CO\(_2\) emissions.

Wärtsilä’s Smart Power Generation power plants allow true operational optimisation of the entire energy system in an affordable, reliable, and sustainable way, and offer benefits that include:

- The achievement of extremely low carbon emissions from the entire power system
- Enabling high penetrations of wind and solar power without power system issues
- Enabling baseload plants to operate at high output and efficiency, thereby lowering CO\(_2\) levels
- Enabling wind curtailment to be minimised while helping to avoid negative price developments
- Reducing the amount of spinning reserve required
- Enabling the efficient use of bio gas- and liquid bio-fuel resources.

By removing the abusive cyclic load from plants that are not designed for it and providing high efficiency over a wide load range, Smart Power Generation plants allow the entire system to operate in the most cost effective way and ensure system reliability even during extreme wind variations and contingency situations. They also enable decentralising the intermediate and peak load capacity with flexible plant sizing and installing generating capacity in load pockets to reduce grid losses, while helping to avoid investments in new high voltage grid expansions. The ability to deliver Smart Power Generation solutions on a fast-track basis enables local capacity deficits to be rapidly overcome.
Marine Solutions

Wärtsilä Marine Solutions has a strong position in the marine and oil & gas industries. By providing solutions that are optimised, and both environmentally and economically sound, Wärtsilä enhances the viability and profitability of shipping operations and enables the development of sustainable societies. Wärtsilä’s reputation is based on an in-depth understanding of its customers’ businesses, its design capabilities, a broad product portfolio, and technological leadership. The organisation is structured into end-to-end business lines with full control over sales, R&D, engineering, procurement, and manufacturing. This enables increased flexibility, fast decision-making, and the optimal utilisation of resources to provide superior customer service.

Serving both shipyards and ship owners

Wärtsilä’s marine customers comprise both shipyards and ship owners; the needs and demands of which differ significantly. Product prices, delivery times and reliability, project management, ease of installation, and the supplier’s ability to manage large delivery scopes typically affect the decision-making process of shipyard customers. Ship owners, on the other hand, require safe and efficient operations, reliability and support, as well as the availability of services. Their decision-making is also impacted by freight rates, interest rates, and the capital and operating costs of the ship. Both ship owners and operators are increasingly taking other factors, such as environmental compliance and fuel flexibility, into consideration in their decision-making.

Wärtsilä is committed to meeting the needs of both customer groups. Success is achieved through a comprehensive understanding of their businesses, operating models, and requirements. This understanding is backed by an extensive network, a broad product portfolio, and the ability to be involved in the life of the vessel as early as the design process. This enables Wärtsilä to support its customers throughout the lifecycle of their installations with products and solutions that best serve their business interests.

The broadest offering in the industry

Wärtsilä Marine Solutions is active in all the main vessel segments with a broad range of products, services, and solutions. The company understands the particular needs and requirements related to each of these segments – from the initial vessel design choices to everyday operations throughout the vessel’s lifecycle. Wärtsilä’s portfolio also covers gas systems for land-based installations, such as gas terminals. Innovative and competitive products, delivered efficiently and with high quality, form the basis of Wärtsilä’s offering, which consists of:

- Medium-speed diesel and dual-fuel engines
- Propulsion systems and gears
- Seals and bearings
- Navigation and automation systems
- Entertainment systems
- Communication and control systems
- Power distribution and management systems
- Electrical design for complex vessels
- Energy management systems and hybrid solutions
- Environmental solutions, including for example, exhaust gas cleaning and ballast water management systems
- Pumps and valves
- Gas systems, including LNG, LPG and biogas handling, inert gas systems, compressors, liquefaction, regasification, and equipment for small-to-medium scale onshore gas installations
- Ship design.

The ability to combine the products offered into larger systems and solutions supports Wärtsilä’s strategy of being the main solutions provider to its customers. This strategy provides added value to both shipyards and ship owners. Shipyard customers can focus on their areas of expertise and benefit from a reduced risk of product interface problems, while ship owners can rely on operational and maintenance benefits.
<table>
<thead>
<tr>
<th>Segment</th>
<th>Vessel type</th>
<th>Main offering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merchant</td>
<td>Gas carriers</td>
<td>4-stroke dual-fuel engines, auxiliary engines, controllable pitch propellers (CPP), gearboxes, tunnel thrusters, environmental solutions</td>
</tr>
<tr>
<td></td>
<td>Tankers, containers, bulkers</td>
<td>Auxiliary engines, fixed pitch propellers (FPP), tunnel thrusters, 4-stroke engines for smaller vessels, navigation and automation systems, electric power distribution, environmental solutions</td>
</tr>
<tr>
<td></td>
<td>Other: cargo, RoRo, car carriers</td>
<td>All of the above</td>
</tr>
<tr>
<td>Offshore</td>
<td>Floating exploration: drillships, semi-submersibles, etc.</td>
<td>4-stroke engines, steerable thrusters, tunnel thrusters, vessel automation systems, electric power distribution, gearboxes, environmental solutions</td>
</tr>
<tr>
<td></td>
<td>Floating production units: FPSO’s, FSO’s, floating LNG, etc.</td>
<td>4-stroke engines, steerable thrusters, tunnel thrusters, CPP, vessel automation systems, electric power distribution, gearboxes, environmental solutions</td>
</tr>
<tr>
<td></td>
<td>Service/Supply vessels: OSV’s, PSV’s, AHTS, AHS</td>
<td>4-stroke engines, steerable thrusters, tunnel thrusters, CPP, electrical propulsion systems, ship design, automation systems, gearboxes, environmental solutions</td>
</tr>
<tr>
<td></td>
<td>Other: crane vessels, pipe layers, accommodation vessels</td>
<td>All of the above</td>
</tr>
<tr>
<td>Cruise and Ferry</td>
<td>Cruise vessels</td>
<td>4-stroke engines, FPP, tunnel thrusters, navigation, entertainment and automation systems, electric propulsion and power distribution, environmental solutions</td>
</tr>
<tr>
<td></td>
<td>Ferries</td>
<td>4-stroke engines, CPP, FPP, steerable thrusters, tunnel thrusters, navigation, entertainment and automation systems, electric propulsion and power distribution, environmental solutions</td>
</tr>
<tr>
<td></td>
<td>Other: Ro-Pax, yachts</td>
<td>All of the above</td>
</tr>
<tr>
<td>Special vessels</td>
<td>Tugs</td>
<td>4-stroke engines, FPP, steerable thrusters, tunnel thrusters, vessel automation systems, ship design, environmental solutions</td>
</tr>
<tr>
<td></td>
<td>Dredgers</td>
<td>4-stroke engines, CPP, FPP, steerable thrusters, tunnel thrusters, vessel automation systems, environmental solutions</td>
</tr>
<tr>
<td></td>
<td>Other: fishing vessels, ice breakers, research vessels, work boats, inland waterway vessels</td>
<td>All of the above</td>
</tr>
<tr>
<td>Navy</td>
<td>Frigates, corvettes, patrol vessels, aircraft</td>
<td>Waterjets, seals and bearings, tunnel thrusters, 4-stroke engines, navigation and automation systems, electric solutions</td>
</tr>
</tbody>
</table>
Wärtsilä Marine Solutions is uniquely positioned for growth driven by the increasing availability and use of gas as a marine fuel, the introduction of new environmental regulations, and the increased demand for more efficient vessels.

Stricter environmental regulations are driving the interest in gas as a marine fuel, as well as in emissions abatement technologies, such as exhaust gas cleaning and ballast water treatment systems. Marine Solutions offers its customers alternative solutions for meeting these requirements in a way that best meets the needs of their businesses and operating models, both as part of new build projects and as retrofits to vessels already in operation.

Wärtsilä was the first company to introduce dual-fuel engines to the shipping sector, thereby facilitating the use of liquefied natural gas (LNG) as a marine fuel. Since LNG contains no sulphur, there is an increasing trend towards the use of LNG fuel as a viable means of complying with the sulphur cap requirements. Wärtsilä also has a strong position in exhaust gas cleaning systems, with the most extensive reference list on the market. Today, the portfolio of SOx scrubber systems is the broadest in the industry and consists of closed loop systems for fresh water use, open loop systems for seawater use, and a combination of the two, i.e. the hybrid system. Wärtsilä’s scrubber systems are approved by the IMO and by the Singapore flag state authorities. For NOx reduction and IMO Tier III compliance, Wärtsilä provides its customers with products based on selective catalytic reduction (SCR) technology. For ballast water treatment, customers can select systems utilising the two most common technologies: ultraviolet treatment and electro-chlorination. Both BWMS systems are IMO Type Approved, are available for both safe and hazardous area installation, and are expected to receive full USCG Type Approval in 2018.

Efficiency has become one of the top concerns for ship owners and operators. Wärtsilä’s in-depth expertise and system skills help to optimise the efficiency of vessels, and make it possible for customers to achieve the performance, cost, and environmental compliance parameters that specifically match their operating profile.

Marine Solutions' operating environment

Wärtsilä Marine Solutions serves the marine and oil & gas industries. The main vessel segments covered in the marine industry are traditional merchant vessels, gas carriers, cruise & ferry, navy, and special vessels. In the oil & gas industry, Wärtsilä is active in serving offshore installations and related industry vessels, as well as land-based gas installations.

General shipbuilding and shipping market drivers

The global demand for new vessels in the shipbuilding and shipping industries is mainly driven by developments within the global economy and the resulting impact on trade and transportation capacity requirements. The global economy also influences fuel prices, which in turn have both a direct and an indirect impact on the marine and oil & gas industries. Price, availability, and demand are the driving factors in the oil & gas industry, while in the general shipping industry, fuel costs increase the demand for more efficient vessels. Other factors, such as shipyard capacity, newbuild prices, decommissioning and scrapping, as well as interest and freight rates, also affect these industries. Another important driver is the increasing level of environmental regulations and their impact on the demand for optimised vessel efficiency, environmental solutions, and gas as a marine fuel.

Main drivers for Wärtsilä's Marine Solutions business

- Developments in the global economy
- Development of world trade and needed transportation capacity
- Global energy demand growth
- Development of oil and gas prices
- Development of oil & gas fields and infrastructures
- Environmental regulations
- Technological developments and innovations
**Competitors and market position**

Wärtsilä Marine Solutions has continuously broadened its portfolio, which today ranges from engines and propulsion equipment to electrical equipment, navigation & automation, ship design, environmental solutions, gas systems, and pumps and valves. This is backed by the capability to build environmentally sound solutions, and by superior service support throughout the lifecycle of the product. Wärtsilä’s competitive advantage lies in having the industry’s broadest marine focused offering comprised of leading, innovative products, integrated systems, and engineering, which is supported by a unique sales and service network in touch with customers globally.

The field of competitors is extensive. It includes engine companies, such as MAN D&T, Caterpillar and HiMSEN, propeller makers such as Schottel and Thrustmaster, and environmental and auxiliary equipment providers like Alfa Laval. It also includes electrical and automation houses, notably Siemens, GE, ABB, and Kongsberg, pump and gas system providers, such as TGE Marine and Framo, and companies with broad offerings such as Rolls-Royce. Wärtsilä is recognised as a proven supplier of innovative and sustainable technologies across its portfolio serving the marine and oil & gas markets.

**Marine Solutions and sustainability**

The marine and oil & gas industries are at the centre of converging megatrends, namely a move towards a more diverse and cleaner energy mix, decarbonisation, increased transparency and accountability with regards to environmental performance, and a need to improve economic performance despite uncertainties in the global economy. For Wärtsilä it is clear that improved sustainability is central to addressing all these trends.

Wärtsilä is committed to becoming the most valued business partner to its customers. Thus, it is essential for Marine Solutions to have sustainability at the very core of its product and solutions development. The company’s R&D and business development activities are based on a deep understanding of how these megatrends affect customers. The expansion and development of Wärtsilä’s offering to the marine and oil & gas industries over the years demonstrates the response made to the needs of its customers. Gas, environmental compliance, and efficiency are the three pillars on which Marine Solutions builds its offering.

**The shift towards natural gas**

The global energy landscape is shifting towards a more diverse and sustainable energy mix, and natural gas – the cleanest fossil fuel – has a key role to play in this transition. During recent years, along with the increase in supply of natural gas, the oil & gas industry has seen a dramatic rise in demand. The marine industry is also affected by this transition, with interest in the use of gas as a marine fuel rising sharply.

Wärtsilä develops products and services that enable the safe use, handling, and distribution of natural gas for the marine and oil & gas industries. Wärtsilä is the marine industry’s undisputed leader when it comes to gas-fuelled propulsion, with dual-fuel medium-speed engines ordered for more than 300 vessels, and more than 19,000,000 running hours having been accumulated in both land-based and marine applications. These milestones represent achievements that cannot be matched today by any other engine manufacturer. Thanks to a strong and safe track record in the use of gas as a marine fuel for LNG carriers, the industry is increasingly keen on expanding the use of LNG to other vessel types.

The benefits of using Wärtsilä’s proven low-pressure dual-fuel technology are many:

- Emission reductions (when operating in gas mode): 85% less NOx, 99% less SOx, up to 99% reduction in particulates, 20-30% less CO₂ emissions, and no smoke
- Fuel flexibility to enhance operational security and competitiveness, with the use of heavy fuel oil, marine diesel oil, bio fuels, and crude oil possible
- Capital expenditure reductions of 15-20%, since the use of low pressure technology means simpler (lower cost) gas handling systems, and no need for further exhaust gas cleaning systems
- Reduced waste streams (liquid waste)
- No need to use secondary emission reduction systems (and hence no consumption of reagents)
- Redundancy and safety
- Stable operation on gas fuel across the entire load range, with no need to switch to diesel fuel at low loads
- Lower consumption of pilot fuel (just 1% of the total fuel used).
Enabling the use of gas as a marine fuel means much more than merely applying a proven technology to gas engines. For Wärtsilä, it also means maintaining its leading position in the design of gas-fuelled vessels, and offering reliable and competitive gas storage and handling systems. Wärtsilä also supports the development of the broader gas value chain in the oil & gas industry with, for instance, its liquefaction and regasification solutions.

**Environmental compliance**

The marine industry is undergoing the implementation of changes needed in order to comply with existing environmental regulations, while at the same time evaluating the possibilities for complying with upcoming regulations. Emissions to air (CO₂, NOx, SOx, particulate matter, volatile organic compounds (VOC), and others) and water are under scrutiny. Similarly, regulations relating to safe and clean operations are becoming stricter, especially for the oil & gas industry.

Wärtsilä offers a broad set of options for compliance with environmental regulations. All include working technologies, fast installation, and support throughout the company’s global network. Wärtsilä is committed to providing its customers and society at large with reliable and safe technologies for environmental compliance, which will be available for use as new regulations come into force. The company can also assist customers in evaluating the best options for compliance so as to adopt a solution that meets their specific operational needs.

In the marine industry, Wärtsilä’s offering for environmental compliance covers the following:

- For SOx and NOx compliance: gas propulsion, conversions to gas propulsion, NOx reducers, SOx scrubber systems, and retrofit services
- For ballast water compliance: products based on ultraviolet treatment and electro-chlorination technologies, and retrofit services
- For Energy Efficient Design Index (EEDI) compliance: improved efficiency of individual products and ship design
- For emissions to water compliance: waste water, bilge water, scrubber water, and sealing systems.

In addition to these, Wärtsilä’s offering to the oil & gas industry includes the following solutions to facilitate safe and clean operations:

- VOC recovery
- Flare gas recovery
- Inert gas and nitrogen systems
- Oil separation
- Waste water systems
- Oily and slop water cleaning
- Fresh water generation
- High pressure compressors.

**Focus on efficiency**

The global economic downturn has put enormous pressure on the cost structure of the marine industry in particular, while the oil & gas industry is also deeply affected by low oil prices. In the marine industry especially, the cost of fuel is a key driver for upgrading equipment, rethinking operational profiles, and for new vessel designs. Investments in improved energy efficiency have both economic and improved environmental performance benefits.

Wärtsilä strives to optimise the lifecycle cost of installations. This is done because it makes economic sense to customers, and because of the company’s in-house understanding of the pressure for reducing operating costs. Hence, Wärtsilä is committed to investing in developing products and solutions that will help achieve significant savings for its customers. Furthermore, improved efficiency results in better environmental performance.

In 2017 Wartsila launched the Wartsila HY, a fully integrated hybrid power module combining different power sources, an energy storage system, and power electronics optimised to work together through a newly developed energy management system. It is the marine sector’s first hybrid power module of this type produced, thereby establishing a new industry benchmark in marine hybrid propulsion and providing a lower environmental impact than conventional machinery solutions.
Manufacturing

Wärtsilä’s manufacturing is focused mainly on the assembly, testing, and finishing of products and key strategic components. The company’s business model, which is strongly connected to a broad network of suppliers, guarantees flexibility in capacity. Being close to the customer is important, as is the focus on quality and the continuous emphasis placed on technology leadership in the company’s R&D activities. Wärtsilä provides products and systems that are reliable, cost efficient, environmentally compatible, and technologically advanced. They are capable of being integrated into overall solutions or delivered as standalone equipment.

Manufacturing footprint

Wärtsilä’s manufacturing footprint is global and continuously optimised for competence, availability, customer presence, and efficiency. Being close to customers enables Wärtsilä to provide better service to customers locally, and allows savings to be achieved in both production and transportation costs.

Wärtsilä’s global supplier network supports flexibility in manufacturing

Through close co-operation, excellent relations, and the sharing of information with suppliers, the supply of components and market-comform lead times are secured. Wärtsilä has numerous suppliers globally. The sourcing strategy is to focus on carefully selected suppliers, with a strong emphasis on performance, innovation, and a presence close to Wärtsilä’s manufacturing units and joint ventures. The aim is to continuously develop and strengthen the company’s global supply chain with a strong emphasis on quality and cost competitiveness.

Wärtsilä’s sites with more than 50 FTEs

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Research and development

Wärtsilä is strongly committed to research and development. The aim of its R&D activities is to continuously strengthen the company’s technology leadership position, and to further improve its competitive edge in the global marine and energy markets. This is achieved by developing products and services that are based on reliable, efficient, and cost-competitive technologies, and which address customer needs.

The focus of Wärtsilä’s R&D activities is on digitalisation, smart technologies, new products, and solutions that are flexible, efficient, reliable, safe, cost-efficient to operate, and that have a minimal environmental footprint throughout their lifecycles. A substantial proportion of the company’s investments in product development is targeted at securing environmental compliancy, providing short- and long-term benefits for the company’s customers, and enabling sustainable societies.

By focusing on the initial stages of the development process, and by utilising modularity, simulation, virtual testing, and validation, Wärtsilä is able to reduce the lead time for new solutions thereby securing reliability and safety aspects without compromising quality.

Validation testing on site with existing installations, in co-operation with the customers, is an important element in furthering the improved performance of existing solutions. It also assists in finding new and better solutions while, at the same time, gaining long-term experience under real field conditions. A field installation also provides an opportunity to gain valuable learning and insight regarding new technologies and solutions.

When the product has successfully passed all the validation process steps, both in the laboratory and in the field, and its performance meets Wärtsilä’s high standards, it can be delivered to the market.

Wärtsilä protects innovation and competitiveness through close attention to Intellectual Asset Management and the continuous development of internal key competences. Networks and clusters are formed to further extend the company’s know-how, skills, and capabilities by committing to long-term relationships with suppliers, engineering companies, university partners, and with licensees and other Original Equipment Manufacturers.

Research and development expenditure

* Restated, figures include continuing operations.
The HERCULES programme and sustainable innovation through partnerships

The long-term HERCULES R&D programme was conceived in 2002, and has been set up within the context of the EU’s sixth and seventh Framework programmes. Sharing a joint vision, the major low- and medium-speed engine manufacturers, Wärtsilä, Winterthur Gas & Diesel, and MAN Diesel & Turbo, are collaborating with universities, research institutions, and other industrial partners to develop new technologies for marine engines and related systems. The fourth phase kicked off in 2015 in the form of the HERCULES-2 project that aims at creating fuel flexible large marine engines that are optimally adaptive to their operating environment.

The project HERCULES-2 comprises four R&D Work Package Groups:

- I: Fuel Flexible Engine
- II: New Materials (Applications in engines)
- III: Adaptive Powerplant for Lifetime Performance
- IV: Near-Zero Emissions Engine

The HERCULES-2 consortium comprises 32 partners of which 30% are Industrial and 70% are Universities or Research Institutes. HERCULES-2 is planned to run for three years, from 2015 to 2018, with a total budget of EUR 25 million. The project was made possible by a EUR 20 million funding through the European Commission Horizon 2020 Innovation Programme and a contribution from the Swiss government.

In November 2017, Wärtsilä entered into a unique co-operation program with four leading Finnish universities on developing world-class research into sustainable future applications for internal combustion engines. The academic institutions participating in this Engine Research Initiative (ERI) programme are Aalto University, Tampere University of Technology, Åbo Akademi University, and the University of Vaasa. The ERI aims at creating an open research ecosystem wherein cutting-edge technologies involving internal combustion engines can be developed together with other partners, and matured to meet the evolving future needs of the shipping and power production sectors.
Innovating for sustainability

Wärtsilä’s purpose is to enable sustainable societies with smart technologies. As a global leader in complete lifecycle solutions for the marine and energy markets, Wärtsilä plays a key role in providing environmentally sound solutions and services that enable its customers to develop their businesses in a sustainable way. This approach is the basis of the company’s sustainability work and is supported by its strong commitment to responsible business conduct.

The growth in the world’s energy needs, combined with increasingly stringent environmental requirements and the scarcity of natural resources, create a challenging operating climate for the marine and power sectors. To secure its leading position at the forefront of sustainable innovation, Wärtsilä continuously invests in technology development. Wärtsilä focuses on improving the energy efficiency of its products, while simultaneously striving to reduce their emissions. As part of its sustainable innovation approach, Wärtsilä seeks to create solutions that benefit the entire power system and marine ecosystem.

Innovation and product development, and the willingness to explore new technologies are essential for meeting current customer needs, as well as for being prepared for future requirements, and remaining an industrial frontrunner. Wärtsilä develops environmentally sound products and solutions across a broad front, including technologies related to efficiency improvement, the reduction of gaseous and liquid emissions, waste reduction, noise abatement, as well as effluent and ballast water treatment. The company’s proactive approach to meeting future demand has resulted in the development of both primary and secondary abatement technologies, and has broadened the range of usable fuels. Wärtsilä actively seeks to utilise opportunities provided by the digital transformation taking place in the maritime and energy sectors. Wärtsilä’s commitment to investing in research and product development benefits both its customers as well as the environment, both in the short-term and over a longer time span.

The key features of Wärtsilä’s environmentally sound solutions include:

- Reliability, safety, and long life span
- Low emission levels
- The ability to utilise renewable energy, including storage systems
- Fuel flexibility
- Efficiency improvement with lower lifecycle costs
- Low water consumption
- Design and operational optimisation of vessels

By combining these key features, and understanding the system level benefits of its offering, Wärtsilä is able to provide solutions that enable the development of sustainable shipping and power systems.
Sustainable Innovations in 2017

Smart Energy Systems

- New hybrid power plants, engines, storage, and energy storage solutions introduced to power markets globally. These new and innovative solutions deliver added value to customers by utilizing energy storage technology together with traditional engine based power generation.
- Greensmith, a Wärtsilä Company, and AEP announced a hybrid solar energy storage project in the USA. The integration of advanced energy storage and software with hydro-electric generation is seen to be the world's first hybridized system of its kind to provide ancillary services.
- A Letter of Award received for a 95.3MWp (75MWac) solar photovoltaic (PV) power plant in Nigeria. The solar power plant will deliver electricity to a million homes in Nigeria and is the first utility-scale solar PV project exclusively for an on-grid application.
- The introduction of Wärtsilä’s 31SG, a gas fueled version of the successful Wärtsilä 31 engine. The defining feature of the Wärtsilä 31SG is its ability to achieve simple-cycle efficiency levels in excess of 50% (compared to around 45% with modern gas turbines), which represents a milestone achievement in the energy sector.

Smart Marine Ecosystems

- The introduction of the Wärtsilä HY, a fully integrated hybrid power module combining engines, an energy storage system, and power electronics optimised to work together through a newly developed energy management system. It is the marine sector’s first hybrid power module of this type produced, thereby establishing a new industry benchmark in marine hybrid propulsion.
- The launch of the Eniram SkyLight 2.0 monitoring and predictive analysis system update. The Eniram SkyLight 2.0 adds nautical charts, weather layers, and route importation to make predictive analysis and proactive planning more available. The updated system can visualize a vessel’s route from economic, environmental, and safety perspectives.
- Wärtsilä Energflow, an innovative pre-overload state to improve fuel efficiency, was launched. With increased preoperative efficiency and subsequent energy savings, the Wärtsilä Energflow reduces the level of emissions from ships.
- The launch of SmartPredict, a system designed to provide safer and more efficient vessel operations by reducing the risks associated with manoeuvring.
- The successful testing of an automatic wireless induction charging system on a hybrid powered coastal ferry. This was the first commercial ferry in the world operating with high power wireless charging capability for its batteries, and the successful project represents a notable breakthrough in the evolution of plug-in electrically operated vessels.
- Wärtsilä took an important step towards developing its Smart Marine capabilities by successfully testing the remote control of a ship’s operations. In the future Smart Marine ecosystem, connecting ‘smart’ vessels with ‘smart’ ports will enable an even more efficient use of resources, and will reduce the impact on the climate while also enhancing safety.
Why invest in Wärtsilä

Wärtsilä’s strengths lie in its integrated services and solutions offering, data-driven innovations, close and long-standing customer relationships, and an unparalleled global presence.

Supporting customers with lifecycle solutions

Wärtsilä’s business model is based on providing the marine and energy markets with smart technologies and optimised lifecycle services. The Services business, which represents nearly 50% of Wärtsilä’s net sales, provides a good foundation for achieving the company’s long-term target of profitable growth.

The demand for Wärtsilä’s services is supported by the increasing technological sophistication of the installed equipment base. Digitalisation provides further opportunities to develop a value-adding customer offering. It also enables the leveraging of new technologies to build capabilities that will create a future offering with equipment-as-a-service.

A leader in smart technology for the marine and energy markets

The shift towards clean and flexible energy production, and the need for efficient and safe transportation, form the basis of Wärtsilä’s offering of smart solutions. As an industry frontrunner, Wärtsilä is well positioned to respond to the need for innovative and energy efficient solutions. Wärtsilä’s digital transformation will provide increased customer value through a new era of collaboration and knowledge sharing. Continuous investing in research and development is vital for ensuring the competitiveness of the company’s product portfolio, and for securing a leading position in sustainable innovation.

A capital-light business model emphasising increased efficiency

Wärtsilä’s manufacturing model is assembly-based, with shared production and R&D facilities. This creates flexibility in aligning operations to market conditions, and synergies in innovation processes.

Achieving operational excellence by focusing on continuous process improvement throughout the organisation is a central pillar for reaching Wärtsilä’s financial targets. So too is the driving of benefits related to a business line-based organisation with decentralised accountability.

Investing in technological leadership and providing shareholder returns

Wärtsilä’s financial position enables the securing of future positioning by allowing investments in research and development activities, and by developing the business through acquisitions. It also enables solid dividends to be offered to the company’s shareholders.
Dividend

The free share issue approved by Wärtsilä Corporation’s Annual General Meeting on 3 March 2017 increased the total number of Wärtsilä shares to 137,241,320. Earnings per share in comparison periods 2006–2010 have been adjusted to reflect the increased number of shares.

Wärtsilä’s share price development in 2017

- Q1: Positive development in order intake
- Q2: Net sales developed well, largely due to an increase in the number of power plant deliveries, and earnings were solid
- Q3: Order intake developed well, thanks to good demand for offshore wind energy solutions, favourable vessel value and continued interest for long-term service agreements
- Q4: Favourable order trends continued in the fourth quarter, providing a solid basis for the coming years

Events in 2017:
- CSGC Wärtsilä engine Co Ltd (CSGC), the joint venture company formed between Wärtsilä and China State Shipbuilding Corporation (CSSC), opened its new production facilities.
- Wärtsilä and Carnival Corporation announced a strategic performance-based partnership.
- Wärtsilä celebrated 175 years at the MesseKulosaari history Expo and Convention Center in Helsinki.
- China State Shipbuilding Corporation (CSSC) and Wärtsilä established a new Electrical & Automation joint venture.
- First dividend payment of EUR 0.45 per share paid.
- Launch of the Wärtsilä HY, a fully integrated hybrid power module combining engines, an energy storage system, and power electronics optimized to work together through a newly developed energy management system.
- Wärtsilä will supply two power plants with a combined gross capacity of 184 MW to Upper Michigan Energy Resources Corporation (UMERC).
- Wärtsilä joins Global Industry Alliance to support low carbon shipping.
- Successful testing of the remote control of ship operations in collaboration with GulfMark Offshore.
- Wärtsilä selected as an index component of the Dow Jones Sustainability Indices.
- Partnership with AW-Energy adds wave power generation to Wärtsilä’s capabilities as an energy system integrator.
- Second dividend installment of EUR 0.65 per share paid.
- Acquisition of Puregas Solutions, a provider of biogas upgrading solutions.
- Acquisition of Guidance Marine, a leader in sensor solutions for dynamic positioning and other vessel control systems.
- The first Digital Acceleration Centre opened to speed up innovation and co-creation with customers.
- Wärtsilä will supply a broad scope of products and systems to Viking Line’s new environmentally friendly ferry.
- Wärtsilä and GTT finalize cooperation agreement to create one-stop availability for LNG fuel tanks and supply systems.
- Acquisition of Trident B.V., specialized in undersea ship maintenance, inspection, and repair services.
Wärtsilä is included in the following sustainability indices:

- **FTSE4Good**
  - FTSE4Good Index

- **MSCI**
  - MCSI Global Sustainability Index Series

- **Ethibiel**
  - Ethibiel Sustainability Index (ESI) Excellence Europe

- **OMX**
  - OMX GES Sustainability Nordic Index
  - OMX GES Sustainability Finland Index

- **ECPI**
  - ECPI Global Carbon Equity Index & ECPI Global ESG Best in Class Equity Index

- **Euronext Vigeo**
  - Euronext Vigeo index: Eurozone 120

- **STOXX ESG Leaders Indices**
  - STOXX Global ESG Leaders Index

- **RobecoSAM**
  - RobecoSAM Sustainability Yearbook

- **Dow Jones Sustainability Indices**
  - Member of Dow Jones Sustainability Indices

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