# This is Wärtsilä

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CEO review</strong></td>
<td>03</td>
</tr>
<tr>
<td>Wärtsilä in brief</td>
<td>05</td>
</tr>
<tr>
<td>Corporate strategy</td>
<td>05</td>
</tr>
<tr>
<td>Financial targets</td>
<td>07</td>
</tr>
<tr>
<td>Sustainability targets</td>
<td>11</td>
</tr>
<tr>
<td>Innovating for sustainability</td>
<td>14</td>
</tr>
<tr>
<td><strong>Sustainability highlights</strong></td>
<td>16</td>
</tr>
<tr>
<td>Energy solutions</td>
<td>26</td>
</tr>
<tr>
<td>Operating environment</td>
<td>27</td>
</tr>
<tr>
<td>Strategy</td>
<td>31</td>
</tr>
<tr>
<td>Energy Solutions and sustainability</td>
<td>31</td>
</tr>
<tr>
<td>Marine Solutions</td>
<td>33</td>
</tr>
<tr>
<td>Operating environment</td>
<td>36</td>
</tr>
<tr>
<td>Strategy</td>
<td>39</td>
</tr>
<tr>
<td>Marine Solutions and sustainability</td>
<td>40</td>
</tr>
<tr>
<td>Services</td>
<td>42</td>
</tr>
<tr>
<td>Operating environment</td>
<td>44</td>
</tr>
<tr>
<td>Strategy</td>
<td>45</td>
</tr>
<tr>
<td>Services and sustainability</td>
<td>46</td>
</tr>
<tr>
<td>Research and development</td>
<td>47</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>49</td>
</tr>
<tr>
<td>Why invest in Wärtsilä</td>
<td>50</td>
</tr>
</tbody>
</table>
CEO review

2016 was a satisfactory year, considering the continued challenges in our end markets. Thanks to a good fourth quarter highlighted by successful delivery execution, growth in Services’ revenues, and an improved project mix, we were able to meet our revised net sales and profitability targets for the year.

Our Services business, which in 2016 represented 46% of net sales, provides a good foundation for achieving our long-term target of profitable growth. Despite the headwinds we faced in the offshore segment, where weak market conditions caused customers to postpone equipment maintenance, our Services business performance continued to be resilient. Our growing installed base of medium-speed engines and propulsion equipment, as well as the shift to gas based technology, supports our long-term ambitions. We will continue to focus on developing our lifecycle service offering to provide enhanced value to our customers, and to explore opportunities beyond our installed base by expanding our business model to cover new market areas and multiple brands.

Activity improved in the power generation markets during 2016. This was mainly fuelled by demand from the emerging markets, where economic growth and energy infrastructure development drove interest in Wärtsilä’s power plant solutions. Policy reforms and increasing investments in renewable energy sources also contributed to power plant investments globally. These trends, which favour Wärtsilä’s flexible, clean, and efficient power plant solutions, are also expected to support positive market development in the coming year. During the year, Wärtsilä also entered the solar energy market with solar hybrid solutions, consisting of solar photo-voltaic (PV) plants and internal combustion engines. This decision will create new business opportunities as we find new ways to help our customers in their quest for less carbon-intensive energy systems.

In the marine markets, contracting activity fell to an exceptionally low level. The majority of the volume decline was seen in the shipping industry, where overcapacity and low earnings remain the key challenges. Low oil prices and reduced capital expenditures from oil companies continued to limit demand also in the offshore industry. For some years already, Wärtsilä has focused on developing an extensive offering and a wide market exposure. This positioning served us well in 2016, enabling us to capture opportunities in niche markets, such as cruise and ferry, where the demand for new vessels was unaffected by the general market weakness. Nevertheless, a certain pressure on order intake was unavoidable, and this meant that we had to react to the early signs of weakening markets by announcing in April additional efficiency improvement measures. Such measures, while unfortunate, are necessary for safeguarding our competitive position. Going forward, we will continue to pursue more cost-efficient and flexible ways of operating.

Marine environmental regulations took a step forward in 2016, with ratification of the ballast water convention in September. This was soon followed by the decision to implement the global sulphur cap in 2020, reducing the sulphur content of marine fuel to 0.5%. The investments we have made in developing our environmental portfolio will help us to support our customers as they evaluate means of complying with the upcoming regulations.

In order to secure our leading position in sustainable innovation, we must continuously look into new ways of developing our business. Wärtsilä’s digital transformation is important in this context, as not only does it provide enhanced value to our customers in the form of new, data-analytics driven solutions, it also enables us to develop our internal processes through, for instance, the increased use of robotics in our manufacturing and testing processes. The appointment of our Chief Digital Officer will surely accelerate this transformation as our digital strategy is formulated, and the related organisation takes root. From an organisational development perspective, our Operational Excellence initiative is also important. Its aim is to establish a mentality of continuous improvement, and to enable us to share best practices that exist throughout our business areas and functions. In 2016, we launched what we call the Wärtsilä Operational Excellence Academy, in which we aim to provide a learning environment where our people can develop new ways of working and set new standards of performance.
While working constantly to improve performance, we at the same time endeavour to foster an inclusive corporate culture, by respecting diversity and emphasising high ethical standards. In this context, we are committed to supporting the UN Global Compact and its principles with respect to human rights, labour, the environment, and anti-corruption. Equally important is providing a safe working environment for our people. I am pleased that we have continued to move steadily closer to our ongoing target of zero lost-time injuries.

Looking into 2017, we expect our business environment to remain largely unchanged. We continue to be well positioned to benefit from the trends of increasing demand for efficiency and changing energy needs. This, together with our efforts to optimise internal operations as described above, will support us in reaching our long-term target for profitable growth.

I would like to take this opportunity to thank our shareholders for your confidence in Wärtsilä’s future, our customers for your trust in our products and services, and the entire Wärtsilä personnel for your commitment towards reaching our common goals.

Jaakko Eskola
President & CEO

Key figures

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<td>4801</td>
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<td>1 079</td>
<td>1 196</td>
<td>967</td>
<td>5 029</td>
<td>4 779</td>
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<td>Energy Solutions</td>
<td>943</td>
<td>414</td>
<td>177</td>
<td>220</td>
<td>132</td>
<td>1 126</td>
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<td>Marine Solutions</td>
<td>1 667</td>
<td>509</td>
<td>390</td>
<td>433</td>
<td>335</td>
<td>1 720</td>
<td>1 702</td>
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<td>Services</td>
<td>2 190</td>
<td>636</td>
<td>512</td>
<td>542</td>
<td>500</td>
<td>2 184</td>
<td>1 939</td>
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<tr>
<td>Depreciation, amortisation and impairment</td>
<td>-138</td>
<td>-34</td>
<td>-31</td>
<td>-42</td>
<td>-31</td>
<td>-124</td>
<td>-115</td>
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<tr>
<td>Comparable operating result</td>
<td>583</td>
<td>253</td>
<td>123</td>
<td>122</td>
<td>84</td>
<td>612</td>
<td>569</td>
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<tr>
<td>Comparable operating result, %</td>
<td>12.1</td>
<td>16.3</td>
<td>11.4</td>
<td>10.2</td>
<td>8.7</td>
<td>12.2</td>
<td>11.9</td>
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<tr>
<td>Profit before taxes</td>
<td>479</td>
<td>226</td>
<td>115</td>
<td>58</td>
<td>80</td>
<td>553</td>
<td>494</td>
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<tr>
<td>Earnings per share, EUR</td>
<td>1.79</td>
<td>0.87</td>
<td>0.43</td>
<td>0.19</td>
<td>0.30</td>
<td>2.25</td>
<td>1.76</td>
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<td>Order intake</td>
<td>4 927</td>
<td>1 324</td>
<td>1 139</td>
<td>1 194</td>
<td>1 271</td>
<td>4 932</td>
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<tr>
<td>Balance sheet total</td>
<td>5 391</td>
<td>5 391</td>
<td>5 326</td>
<td>5 444</td>
<td>5 657</td>
<td>5 589</td>
<td>5 280</td>
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<td>Interest-bearing liabilities, gross</td>
<td>629</td>
<td>629</td>
<td>735</td>
<td>881</td>
<td>1 088</td>
<td>724</td>
<td>666</td>
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<td>Cash and cash equivalents</td>
<td>472</td>
<td>472</td>
<td>345</td>
<td>357</td>
<td>428</td>
<td>334</td>
<td>571</td>
</tr>
<tr>
<td>ROI, continuing operations, %</td>
<td>17.1</td>
<td>17.1</td>
<td>16.6</td>
<td>17.5</td>
<td>20.5</td>
<td>21.0</td>
<td>20.3</td>
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<td>Gearing</td>
<td>0.07</td>
<td>0.07</td>
<td>0.18</td>
<td>0.25</td>
<td>0.32</td>
<td>0.17</td>
<td>0.05</td>
</tr>
<tr>
<td>Order book, end of period</td>
<td>4 696</td>
<td>4 696</td>
<td>5 024</td>
<td>5 083</td>
<td>5 103</td>
<td>4 882</td>
<td>4 530</td>
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<tr>
<td>Year-end market capitalisation</td>
<td>8 418</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8 314</td>
<td>7 315</td>
</tr>
<tr>
<td>Personnel, number at end of period</td>
<td>18 011</td>
<td>18 011</td>
<td>18 337</td>
<td>18 428</td>
<td>18 427</td>
<td>18 856</td>
<td>17 717</td>
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</table>

1 Figures exclude items affecting comparability.
Wärtsilä in brief

Wärtsilä is a global leader in advanced technologies and complete lifecycle solutions for the marine and energy markets. By emphasising sustainable innovation and total efficiency, Wärtsilä maximises the environmental and economic performance of the vessels and power plants of its customers.

In 2016, Wärtsilä’s net sales totalled EUR 4.8 billion with approximately 18,000 employees. The company has operations in over 200 locations in more than 70 countries around the world. Wärtsilä is listed on Nasdaq Helsinki.

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 and utility-scale solar photovoltaic (PV) power plants, as well as liquefied natural gas (LNG) terminals and distribution systems. Its flexible and efficient solutions provide superior value to customers and enable a transition to a more sustainable and modern energy system. As of 2016, Wärtsilä had 63 GW of installed power plant capacity in 176 countries around the world.

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 the experience, know-how, and dedication of our personnel, Wärtsilä is able to customise solutions that provide optimal benefits to its customers around the world.

Services

Wärtsilä Services supports its customers throughout the lifecycle of their installations by optimising efficiency and performance. The company’s service network of approximately 11,000 professionals in 160 global locations is unmatched in the industry, delivering services to more than 12,000 customers every year. The portfolio of services – from spare parts to complete operational, maintenance, and optimisation services – is constantly being developed, not only to improve the availability of customers’ installations, but to support them in growing their businesses. Wärtsilä is committed to providing high quality, expert support, and the availability of services in the most environmentally sound way possible, whenever, wherever.

Corporate strategy

Wärtsilä aims at profitable growth by providing advanced technologies and lifecycle solutions to its marine and energy market customers.

Increasing environmental awareness and changing energy needs are affecting the way that our customers operate. With our integrated offering of services and products, we are well positioned today to respond to the need for energy efficient, innovative, and flexible solutions. We will meet the increasing demand for gas-based technologies with our industry-leading multiple fuel products and LNG solutions. Our objective is to leverage our project management and engineering competences to achieve growth by offering our customers new and innovative solutions. Our digital transformation will provide increased customer value and optimised performance. Our growth ambitions are supported by our superior global service network.
With our production and supply chain management, we constantly seek new ways to maintain high quality and cost efficiency – often in co-operation with leading industrial partners in our key growth markets. Our market driven investments in R&D and our focus on digitalisation create a strong foundation for securing and strengthening our position at the forefront of market innovation. This innovative culture, together with our constant emphasis on safety, diversity, and high ethical standards, attract skilled and committed people and provides the basis for a high performing organisation. Our entrepreneurial drive, customer focus, and passion for doing right not only create new opportunities and environmentally sustainable solutions, but also bring value to all our stakeholders.

**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.

**Vision, mission and values**

**Vision**

We will be our customers’ most valued business partner.

**Mission**

We shape the marine and energy markets with advanced technologies and focus on lifecycle performance, to enhance our customers’ business and benefit the environment.
Financial targets

<table>
<thead>
<tr>
<th>NET SALES</th>
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</thead>
<tbody>
<tr>
<td><strong>TARGET</strong></td>
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<tr>
<td><strong>DEVELOPMENT</strong></td>
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Growth over the cycle

PROFITABILITY

TARGET
Our operating profit margin (EBIT%) target is 14% at the peak of the cycle. At the trough of the cycle, our target is to keep the operating profit margin above 10%.

DEVELOPMENT
In 2016, our comparable operating result was EUR 583 million, 12.1% of net sales.

Profitability

* Restated due to the revised IAS 19.
** Restated, figures include continuing operations.
CAPITAL STRUCTURE

TARGET
Our target is to maintain gearing below 0.50.

DEVELOPMENT
In 2016, our gearing was 0.07.

Gearing

* Restated due to the revised IAS 19.
DIVIDEND

TARGET
Our 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 1.30 euro per share be paid for the financial year 2016, which represents 73% of operational earnings.

Earnings/share, dividend/share

```
<table>
<thead>
<tr>
<th>Year</th>
<th>Earnings/share</th>
<th>Dividend/share</th>
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</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2013</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2014</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2015</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2016</td>
<td>2.5</td>
<td>2.5</td>
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1 Proposal by the Board 2016.
## Sustainability targets

<table>
<thead>
<tr>
<th>Target</th>
<th>Schedule</th>
<th>Status</th>
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<tbody>
<tr>
<td><strong>EFFICIENCY COMMITMENT:</strong> Reduce energy consumption by at least 10% in terms of absolute consumption (GWh) by 2016, compared to mean energy consumption in 2005.</td>
<td>2016</td>
<td>By the end of 2016, energy savings of 43 GWh were reached, which represents 92% of the final target.</td>
</tr>
<tr>
<td><strong>ENERGY SAVINGS:</strong> Reduce energy consumption by at least 7% in terms of absolute consumption (GWh) by 2025, compared to the energy consumption in 2015.</td>
<td>2025</td>
<td>New target</td>
</tr>
<tr>
<td><strong>ETHICAL BEHAVIOR:</strong> 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 2016, 14,182 employees, covering 79% of the total number of employees, successfully participated in the renewed Code of Conduct training programme.</td>
</tr>
<tr>
<td><strong>OCCUPATIONAL SAFETY:</strong> Reach the long-term goal for zero injuries.</td>
<td>2020</td>
<td>In 2016, 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 2.50, and the result of</td>
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2.59 was slightly above this. However, the result represents a 9% improvement compared to the previous year’s result (2.85). As a highlight, proactive near miss and hazard reporting increased by 46% in 2016 compared to 2015.

<p>| CLIMATE CHANGE: Prepare an analysis of the impact of the Paris Climate Change Agreement on Wärtsilä. | 2018 | During 2016, a project plan was prepared and a steering committee for the project established. Additionally, an update on the Paris Agreement and an analysis of the greenhouse gas reduction ambitions of key nations was conducted. |
| SUSTAINABLE POWER SYSTEMS: Contribute to the development of an affordable, reliable, sustainable, and modern power system worldwide. | 2020 | New target |
| SMALL-MEDIUM SCALE LNG SOLUTIONS: Become a global actor in the LNG value chain that develops opportunities, creates solutions, and builds infrastructure for clean-burning LNG to replace liquid fuel. | 2020 | New target |</p>
<table>
<thead>
<tr>
<th>SOLAR AND HYBRID SOLUTIONS:</th>
<th>2018</th>
<th>New target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar and solar hybrid power plants for cleaner energy and fuel savings. Delivery of 200 MW solar power by the end of 2018.</td>
<td></td>
<td></td>
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<tr>
<td>CLIMATE CHANGE:</td>
<td>2020</td>
<td>New target</td>
</tr>
<tr>
<td>Reduce greenhouse gas (GHG) emissions from gas engines by 15% from 2015 to 2020.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DECARBONISATION OF TRANSPORT:</td>
<td>2020</td>
<td>New target</td>
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<tr>
<td>Contribute to the development of more sustainable transportation through gas based and other technologies.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLIMATE CHANGE:</td>
<td>2020</td>
<td>New target</td>
</tr>
<tr>
<td>Reduce over 300,000 tons of annual CO₂ from vessels with the help of Eniram solutions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WELL-BEING AT WORK - CAREER:</td>
<td>2020</td>
<td>In 2016, 58% of open vacancies were filled through internal selections for job level 3 and up, and 42% through external selections.</td>
</tr>
<tr>
<td>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></td>
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<tr>
<td>PERSONNEL DEVELOPMENT:</td>
<td>2020</td>
<td>By the end of 2016, altogether 96% of the company’s employees had completed development discussions.</td>
</tr>
<tr>
<td>Development discussion coverage 100%.</td>
<td></td>
<td></td>
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<tr>
<td>DIVERSITY:</td>
<td>2020</td>
<td>New target</td>
</tr>
<tr>
<td>Increase the share of female employees to 20%.</td>
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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
During 2016, an overall supplier assessment process was defined for new suppliers and supplier lifecycle management. A self-assessment questionnaire was prepared and requirements for it clarified.

SUPPLIER MONITORING:
Reach the following rating coverage of suppliers:
• 96% of direct supplier spend rated
• 65% of indirect supplier spend rated
• 75% of local supplier spend rated.

2020
In 2016, the target of rating 96% of direct supplier spend was achieved. The rating coverage of indirect supplier spend was 62% and 71% of local supplier spend.

Innovating for sustainability

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 also assesses the benefits that its solutions bring to, for example, power systems.

Innovation in product development and the willingness to explore new technologies is essential in order to meet the current customer needs, to be prepared for future requirements, and to remain an industrial frontrunner. Wärtsilä strives to develop environmentally sound products and solutions across a wide 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’s commitment to invest in
research and product development benefits both its customers as well as the environment - in the short-term and over a longer time span.

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

- Reliability, safety, and long lifetime
- Solutions to reduce emissions
- Alternatives to heavy fuel oil
- Flexibility in fuel use
- Solutions to maximise efficiency with the lowest lifecycle cost
- Solutions to minimise water consumption
- Optimisation of vessel design and operations

By combining the key features and through 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 2016**

| Sustainable Power Systems | • Wärtsilä contracted to supply a Smart Power Generation propane power plant to Honduras  
|                          | • Wärtsilä enters the solar energy business with its first solar energy project in Jordan  
|                          | • Wärtsilä contracted to supply a 225 MW Smart Power Generation plant to the City of Denton, US, helping to integrate renewable energy  
|                          | • Wärtsilä contracted to supply a 101 MW Smart Power Generation plant to Argentina  
|                          | • Wärtsilä to supply a flexible 100 MW combined heat and power plant to Germany  
| Improved performance through environmental solutions | • Wärtsilä launches a new ferry concept featuring zero or low local emissions running on batteries  
|                                                      | • Wärtsilä Ballast Water Management System chosen for the first time for a newbuild crane ship  
|                                                      | • Wärtsilä provides an environmental seal system to a hydro plant in Nebraska  
|                                                      | • World’s largest cruise ship Harmony of the Seas, featuring Wärtsilä hybrid scrubber systems, was delivered from the yard  
|                                                      | • Wärtsilä introduces a new water lubricated seal to increase the reliability of workboats while posing no risk of polluting the marine environment  
|                                                      | • Wärtsilä launches energy-saving Wärtsilä EnergyPro®+ propeller cap, which increases efficiency of controllable and fixed pitch propellers  
| Flexibility in fuel use | • Wärtsilä delivers the Nordic countries’ largest biogas plant to provide fuel for buses  
|                                                      | • Wärtsilä contracted to power the first UK dual-fuel newbuild vessel  
|                                                      | • Wärtsilä to supply a 135 MW Flexicycle (combined cycle) power plant to Lombok, Indonesia  
| Solutions for the LNG value chain | • Wärtsilä delivers complete gas solution for two Canadian RoPax ferries to be converted for LNG operation  
|                                                      | • Wärtsilä contracted to supply a new LNG satellite terminal in Raahne, Finland  
|                                                      | • Wärtsilä contracted to power the Mediterranean’s first LNG powered passenger ferry aiming to be an eco-efficient smartship  
|                                                      | • Wärtsilä was contracted to supply a biogas (biomass, LNG) and LNG production plant to a German energy company  

Sustainability highlights

12.1. Wärtsilä contracted to enhance performance and environmental efficiency of a Mexican Flexicycle power plant.


13.1. Wärtsilä launches a new ferry concept utilising batteries for power featuring zero or near zero local emissions.

15.1. Wärtsilä design chosen to enable environmentally sustainable krill fishing in Antarctic waters.
19.1.
Wärtsilä 20DF engine attains a milestone 100 deliveries.

25.1.
Wärtsilä and Cavotec initiate a co-operative effort to increase safety by developing the world’s first combined wireless charging and mooring concept.

9.2.
Wärtsilä’s Sustainability Report 2015 published as a part of the company’s Annual Report.

9.2.
Wärtsilä’s Ballast Water Management System chosen for the first time for installation in a newbuild crane ship.

10.2.
Wärtsilä dual-fuel engines ordered to power 16 Japanese gas carriers.
3.3. Wärtsilä introduces Lifecycle solutions: an innovative, comprehensive offering that optimises the efficiency and performance of marine and offshore customers’ assets.

10.3. Global Wärtsilä Safety Day 2016 with the theme ‘Safe by Choice’.

15.3. Wärtsilä contracted to supply a Smart Power Generation propane fuelled power plant to Honduras.

17.3. Wärtsilä to deliver the Nordic countries’ largest biogas plant to provide fuel for buses.
11.4.
Wärtsilä to deliver complete gas solutions for converting two Canadian RoPax ferries to LNG operation.

14.4.
The Wärtsilä 31 engine wins the European Marine Engineering Conference’s Marine Engines Award.

21.4.
Wärtsilä enters the solar energy business by offering utility-scale solar photo-voltaic (PV) solutions.

9.5.
Wärtsilä contracted to power the UK’s first dual-fuel newbuild vessels.

10.5.
Wärtsilä participates in a shipping industry project to develop a concept for equipping future dry bulk carrier vessels with LNG propulsion.
12.5. The world’s largest cruise ship, the Harmony of the Seas, featuring Wärtsilä hybrid scrubber systems, is delivered from the yard.

27.5. Wärtsilä donates an 8-cylinder Wärtsilä 20 engine to the Technology Department at Texas A&M University at Galveston.

6.6. Design and technical aspects of the world’s first LNG-powered icebreaker Polaris presented at CIMAC, the International Council on Combustion Engines.

10.6. Wärtsilä to help in reducing lifecycle costs by providing an environmental seal system to a hydro plant in Nebraska, USA.
1.7.
Wärtsilä enhances its digital offering by acquiring Eniram, a Finland-based technology company providing the marine industry with energy management and analytics solutions.

13.7.
Wärtsilä participates in the SEA/LNG coalition with other leading marine players to promote LNG as a marine fuel.

22.7.
Renewed Wärtsilä Code of Conduct e-learning course launched for all employees.

25.7.
The Great Place to Work® Institute elects Wärtsilä Brazil as one of the best companies to work for in Rio de Janeiro.

26.8.
2 million work hours without lost time injuries is achieved at the Musandam power plant in Oman.
29.8.
Wärtsilä and Gasum sign a co-operation agreement aimed at developing future LNG markets.

1.9.
Wärtsilä is contracted to supply a new LNG satellite terminal in Raahe, Finland.

5.9.
Wärtsilä donates EUR 1.3 million to Finnish universities.

9.9.
Wärtsilä included in the Dow Jones Sustainability Index.

21.9.
Wärtsilä contracted to supply a 225 MW Smart Power Generation plant to the City of Denton, USA, thus helping the city to integrate renewable energy into its energy system.
28.9.
The world’s first LNG-powered icebreaker Polaris delivered to customer, featuring Wärtsilä dual-fuel engines.

29.9.
Wärtsilä donates a rainwater collection system to a primary school in South-Sudan through Finn Church Aid.

14.10.
Wärtsilä contracted to power the Mediterranean’s first LNG-powered eco-efficient passenger ferry.

20.10.
Wärtsilä signs up to the IMO’s initiative to support emission reduction efforts in the shipping industry.
21.10.
Wärtsilä selected to the Ethibel PIONEER Investment Register.

25.10.
Seals & Bearings Sweden goes over 1,000 days without lost-time injuries.

31.10.
The Wärtsilä Sternguard In-Water Serviceable Seal triumphs at the Seatrade Maritime and Ship Efficiency Award ceremonies.

3.11.
Wärtsilä and IDRO sign co-operation agreement to develop power generation in Iran.

21.11.
Wärtsilä contracted to supply a 101 MW Smart Power Generation plant to Argentina.
1.12.
Wärtsilä complements its range of environmental solutions by offering dry waste treatment for cruise ships.

9.12.
Wärtsilä included in the Euronext Vigeo index Eurozone 120.

20.12.
Wärtsilä contracted to supply Germany with groundbreaking biohybrid plant to produce both bioLNG and LNG.
Energy Solutions review

Wärtsilä Energy Solutions is a leading global system integrator offering ultra-flexible internal combustion engine based power plants and utility-scale solar PV power plants, as well as LNG terminals and distribution systems. Its flexible, efficient and environmentally advanced solutions provide superior value to customers and enable a transition to a more sustainable and modern energy system.

Wärtsilä serves three main customer segments

Wärtsilä’s 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 dependent on the type of application.

Industrial customers are mainly private companies with energy intensive production operations, such as cement or mining facilities. By investing in captive power, they can achieve lower energy costs and compensate for any grid reliability problems so as to ensure 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 are used for a wide variety of applications. These include base load generation, capacity for grid stability, peaking and load-following generation, and back-up power for the integration of wind and solar energy.

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. Wärtsilä also provides financial services to help customers arrange financing and assemble complex projects, as well as a broad offering of services to support them through the lifecycle of their installations.

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.

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

Growth through LNG, solar and system integration

The replacement of carbon-intensive energy sources with 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 also participates in the global shift to gas with 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 customer interest in increasing the share of renewables within the energy mix, in early 2016 Wärtsilä became the first company in the world to offer utility-scale hybrid power plants that unite large fuel-based power stations with utility-scale solar PV power plants. Wärtsilä’s hybrid solutions are provided on an EPC basis, with solar PV modules sourced from leading module suppliers. Engine-solar hybrids are all about saving fuel, which results in lifecycle cost savings and environmental benefits. The two assets are optimised in such a way that solar energy is automatically utilised to the maximum, with the engines providing a secondary source of generation. The solar hybrid plant can be either a new build or retrofit project. For new build projects, the Smart Power Generation power plant and the adjacent solar asset are integrated and optimised, in terms of both the investment and lifecycle points of view. Thus, more customer value is provided as compared to building two separate power plants. In a retrofit project, solar modules are combined with an existing plant delivered by Wärtsilä.

Co-operating with leading energy storage software and integration service providers has enabled Wärtsilä to further strengthen its energy system integration capabilities. As a combined solution, Wärtsilä’s Smart Power Generation, solar PV and energy storage, together with its 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 base load power plants, as well as for industrial self-generation, is being driven by the price of electricity purchased from the grid, and by fuel price developments. With the introduction of gas supply networks to the emerging markets, the demand for gas and dual-fuel driven power plants is increasing, and Wärtsilä has a leading position in these markets.
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, which is resulting in rapidly increasing levels of renewable generation. This has already created a substantial need to add flexibility to power systems. Wärtsilä’s Smart Power Generation power plants represent the most efficient solution for providing back-up support to variable renewable generation, and enabling the transition to a sustainable, reliable, and affordable low carbon power system.
Energy Solutions’ competition

In larger gas-fired projects, Wärtsilä is facing competition from 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 combustion engine suppliers, such as MAN Diesel & Turbo, GE Jenbacher, Caterpillar (MAK), and Rolls-Royce.

When competing against gas turbines, Wärtsilä’s combination of competitive efficiency, greater fuel flexibility, and superior operational flexibility enables the presentation of better value propositions and business cases 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.

**Wärtsilä is well positioned in the gas and liquid fuelled power generation market**

1-9/2016 market <500MW 17.4 GW (17.0)

Wärtsilä, 15% (10%)
GE, 35% (39%)
Siemens, 25% (25%)
MHI, 12% (20%)
Ansaldo, 7% (5%)
Other gas turbine manufacturers, 6% (1%)

Market data includes all Wärtsilä power plants and other manufacturers’ gas and liquid fueled turbine based power plants with prime movers above 5MW, as well as the estimated output of steam turbines for combined cycles. The data is gathered from the McCoy Power Report. Other combustion engines not included. In engine technology Wärtsilä has a leading position.

**Wärtsilä is the market leader in engine power plants**

3.084 MW in 2015

Wärtsilä, 79%
Other internal combustion engines, 21%
Energy Solutions' strategy

Wärtsilä Energy Solutions’ mission is to provide superior value to its customers with distributed, flexible, efficient, and environmentally advanced energy solutions, which enable a global transition to a more sustainable and modern energy infrastructure. The aim is that customers recognise Wärtsilä as being the world’s best energy solution provider.

Wärtsilä is focused on capturing growth through global system integrator capabilities by offering solutions in the following segments:

- Engine Power Plants - Power generation solutions with a unique combination of energy efficiency, fuel flexibility and operational flexibility
- LNG Solutions - Small and medium sized LNG terminals and liquefaction solutions with EPC delivery
- Solar Power Plants - Solar PV, energy storage and hybrid solutions

In the Engine Power Plants segment, Wärtsilä aims at becoming a globally recognised leader in liquid fuel and gas power plants by offering Smart Power Generation solutions to customers in the utility, IPP, and industrial segments. Value propositions will continue to be enhanced by developing new solutions emphasising energy efficiency, fuel flexibility and operational flexibility.

In the LNG solutions segment, Wärtsilä seeks growth in small to medium scale LNG terminals and liquefaction solutions by introducing new value propositions to selected markets. By entering the solar PV power plant segment, Wärtsilä will provide customers with turnkey solar PV solutions. The company’s hybrid solutions provide an integrated solution for balancing variable solar power production.

Wärtsilä’s value propositions are based on customised solutions with guaranteed performance, one-stop-shop project services, and lifecycle commitment through long-term operation and maintenance agreements. Modularity and repeatability are key enablers for ensuring cost competitive solutions.

Energy Solutions and sustainability

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 low emissions. Many different fuels, including bio-fuels, can be used efficiently, which helps reduce greenhouse gas emissions. Wärtsilä’s Smart Power Generation technology enables the development of a reliable energy infrastructure, wherein most of the sustainable characteristics are already known. Moreover, integrating more wind and solar energy with flexible back-up capacity has great potential for reducing carbon emissions.
Towards sustainable power systems

The effects of climate change require a dramatic decrease in coal-based power generation and a major increase in low-carbon power generation, including wind, solar, and natural gas-fired plants. In modern power systems, the majority of the electricity generated will be from wind and solar power, while thermal power generation will be increasingly used for system balancing and back-up. The inherent variability of renewable energy generation requires the balancing and back-up power to be flexible and dynamic. 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 CO₂ 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 CO₂ levels in 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 technology. It enables maximised utilisation of valuable renewable power, the smooth operation of non-flexible base load thermal power plants and, according to the results from future power system modelling, also enables dramatic reductions in system level CO₂ 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 of the highest penetration of wind and solar power capacity without related balancing problems
  - Enabling baseload plants to operate at high output and efficiency, thereby lowering CO₂ 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 allowing the entire system to operate in the most cost-effective way they:
  - Remove the abusive cyclic load from plants that are not designed for it, thereby enabling them to operate in their most cost-effective way
  - Provide high efficiency over a wide load range, thus enabling flexible power plants to operate in the most cost effective way.

- They ensure system reliability, even during extreme conditions, such as wind variations and contingency situations.

- They enable decentralisation of the intermediate and peak load capacity with:
  - Flexible plant sizing that facilitates later expansions to match local needs
  - The installation of generating capacity in load pockets to reduce grid losses while helping to avoid investments in new high voltage grid expansions
  - Fast track delivery that enables local capacity deficits to be rapidly overcome.
Marine Solutions review

Wärtsilä Marine Solutions has a strong position in the marine and oil & gas industries, providing solutions that are optimised, and environmentally and economically sound to enhance the business of its customers. 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. The decision-making process of shipyard customers is typically affected by product prices, delivery times and reliability, project management, ease of installation, and the supplier’s ability to manage large delivery scopes. 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. Furthermore, both ship owners and operators are increasingly considering other factors, such as environmental compliance and fuel flexibility 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 system and hybrid solutions
- Environmental solutions, including e.g. exhaust gas cleaning and ballast water management systems
- Pumps and valves
- Gas systems, including LNG and LPG 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 reduced risks 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, pipelayers, 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>
</tbody>
</table>
Growth through gas, environmental solutions, and vessel efficiency

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 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 was the first manufacturer to have been awarded the International Maritime Organisation’s certificate for exhaust gas cleaning systems by the classification societies Det Norske Veritas, Germanischer Lloyd, and Bureau Veritas. During 2016, the Singapore flag state authorities approved Wärtsilä’s exhaust gas cleaning systems, making it the first systems to be approved by an Asian flag authority. 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 have US Coast Guard (USCG) AMS status. Full USCG Type Approval will follow in 2017 and, together with the Wärtsilä global lifecycle support network, this offering makes Wärtsilä a partner of choice for all BWMS needs.

Wärtsilä was also 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.

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. The price, availability, and demand drives development 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 development 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, 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 and Caterpillar, 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.
<table>
<thead>
<tr>
<th>Wärtsilä’s offering</th>
<th>Main application</th>
<th>Main competition</th>
<th>Wärtsilä’s market position</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-stroke main engines</td>
<td>Small merchant vessels, offshore, special vessels</td>
<td>MAN D&amp;T, MAK (CAT)</td>
<td>51% of the market (in kW) is controlled by Wärtsilä.</td>
</tr>
<tr>
<td>4-stroke auxiliary generating sets</td>
<td>All vessel types</td>
<td>The market is highly fragmented, price sensitive, and with heavy competition. The main competitors are MAN D&amp;T and its local license manufacturers, Yanmar and HiMSEN. High-speed engines also compete in the auxiliary engine market.</td>
<td>Wärtsilä’s market share is 18%.</td>
</tr>
<tr>
<td>Propulsion</td>
<td>All vessel types</td>
<td>Rolls-Royce, Schottel, Voith, Mecklenburger Metallguss, Thrustmaster, Brunvoll, Kawasaki, Caterpillar (Berg Propulsion)</td>
<td>CPP &amp; FPP: fragmented market, in which Wärtsilä is among the top players. Steerable thrusters: Wärtsilä is among the top players. Tunnel thrusters: a highly fragmented market in which Wärtsilä is a market challenger.</td>
</tr>
<tr>
<td>Electrical &amp; Automation</td>
<td>Cruise, cargo, offshore, special vessels, navy</td>
<td>ABB, Siemens, Kongsberg, Rolls-Royce, GE</td>
<td>Navigation and automation leader in the cruise and large cargo segments, and an established position in the offshore markets.</td>
</tr>
<tr>
<td>Ship design</td>
<td>OSVs, merchant vessels, specialised vessels, fishing vessels</td>
<td>Skipsteknisk, Marinteknikk, MMC, Rolls-Royce, Ulstein, Vard</td>
<td>Among the leading independent ship design houses.</td>
</tr>
<tr>
<td><strong>Oil &amp; Gas systems</strong></td>
<td><strong>Pumps and valves</strong></td>
<td><strong>Environmental solutions</strong></td>
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<tr>
<td>• Mobile LNG (barge) offering</td>
<td>• Deepwell cargo pumps</td>
<td>• Exhaust gas cleaning</td>
<td></td>
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<td>Offshore gas processing &amp; storage vessels, LNG/LEG/LPG carriers, floating production systems, industry applications, fuel gas systems for all vessel types</td>
<td>All vessel types, on- and offshore oil &amp; gas facilities</td>
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<td>Wärtsilä is among the top players.</td>
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Marine Solutions' strategy

The strategic goal of Wärtsilä Marine Solutions is to be the leading provider of innovative products and integrated solutions to the marine and oil & gas industries. To achieve this, the aim is to build on a deep understanding of the customers’ needs and:

- Solidify Wärtsilä’s leading position in solutions for gas fuelled vessels, environmental compliance, and efficiency optimisation
- Further develop Wärtsilä’s position as the shipbuilding industry’s leading systems integrator
- Provide a competitive offering of products for the growing needs of the marine and oil & gas markets
- Seek further growth through the ability to offer customers the most efficient lifecycle solutions.

Wärtsilä is uniquely positioned as the industry’s only true provider of a total marine offering. The extensive range of products is supported by world-class ship design, engineering, and project delivery capabilities, all of which facilitate the provision of solutions that optimise the lifecycle value of customer installations. As a solutions provider, Wärtsilä is ready to deliver everything from a single product to complete lifecycle support of complex systems for powering ships; from concept development to operational use.

Important mid-term growth opportunities are envisioned in solutions for gas-fuelled vessels, environmental compliance, and efficiency optimisation. Wärtsilä is well positioned in these areas, having the most extensive experience and an unrivalled track record in delivering gas engines, a unique portfolio of products for emissions control and abatement, and a holistic approach to ship-level efficiency optimisation through the company’s engineering and ship design capabilities.

Wärtsilä Marine Solutions seeks organic growth that will be supported by targeted acquisitions and partnerships. The offering of innovative and competitive products is developed and delivered based on the requirements of the various customer segments and the operating profiles of their vessels. Together with the Services business, Wärtsilä Marine Solutions offers ship owners and operators integrated lifecycle solutions with guaranteed performance and availability. Wärtsilä will maintain its position as the shipbuilding industry’s leading systems integrator, and will further strengthen its already strong foothold in the oil & gas business.
Finally, the company will invest further in strengthening its presence and maximising the efficiency of its supply chain, engineering and sales, especially in the key shipbuilding areas, notably China and South Korea.

**Marine Solutions’ strengths**

- The broadest portfolio of reliable and high performing products and solutions in the marine and offshore oil & gas industries, supported by the industry’s strongest global service network
- An unmatched track record in providing gas fuelled vessels with dual-fuel technology and gas systems
- The most comprehensive selection of options for meeting the needs of customers concerning fuel flexibility, efficiency, and environmental requirements
- A strong position and good customer understanding in navigation and automation systems for cruise and large cargo vessels
- A unique synergy between ship design and engineering capabilities enabling the maximisation of a vessel’s efficiency throughout its lifecycle
- A strong presence in all the major marine and offshore oil & gas segments, thereby allowing shipbuilding cycles to be navigated.

**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 well proven low-pressure dual-fuel technology are many:

- Emission reductions (when operating in gas mode): 85% less NO\(_x\), 99% less SO\(_x\), up to 99% reduction in particulates, 20-30% less CO\(_2\) 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.

Services review

Wärtsilä Services supports its customers by offering the most comprehensive portfolio of services in the industry, thereby optimising operational and lifecycle performance. Wärtsilä Services offers expertise, local availability, responsiveness, and the most environmentally sound solutions for all customers. The Services offering builds strongly on digitalisation in order to utilise the opportunities created by real-time data and related analytics. Customers recognise Wärtsilä as being a reliable service partner; namely competitive, trusted, and easy to deal with.

Improving lifecycle efficiency

The service offering

Wärtsilä Services develops close relationships with its customers, thus enabling an in-depth understanding of their business so as to extend the offering accordingly. Services provides complete support for its customers operating in the marine, energy and oil & gas industries, as well as a comprehensive package of seals, bearings, and associated solutions for hydropower installations and industrial plants worldwide. While this support is based primarily on equipment sold and designed by Wärtsilä, Wärtsilä Services has the capability to retrofit and service equipment by other brands as well, thereby offering customers the most comprehensive support.

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:
• Spare parts for equipment, with an emphasis on excellent delivery performance and the availability of a broad range of parts
• 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 of operational reliability, performance and uptime of customer assets.

Areas of expertise include:

Engine services
A full range of services for medium- and low-speed diesel, gas, dual- and multiple-fuel engines, and other related systems. The broad extent of the offering ranges from standard engine overhauls, to optimisation retrofits that improve the performance of mature engine designs.

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.

Seals & Bearings services
A wide range of sealing, bearing, and sterntube solutions in the form of integrated systems, packages, and products. These services provide marine and industrial customers with increased efficiency, reduced running costs, and operational longevity.

Hydro & Industrial services
The offering includes seals, bearings, and associated equipment for hydro and industrial installations (e.g. in mining, paper, and oil & gas), including hydropower, tidal power, and offshore wind installations. These are complemented with a comprehensive array of services, ranging from repairs and fabrications to underwater services, retrofits, component reconditioning, and refurbishments.

Environmental services
An extensive set of services aimed at improving efficiency and minimising emissions for energy and marine installations. These solutions include fuel conversions, low NOx solutions, and propulsion efficiency services. Furthermore, Wärtsilä’s field service organisation supports the marine retrofit market in the installation and commissioning of environmental solutions.

Lifecycle solutions
Wärtsilä Services’ lifecycle solutions offer measurable and guaranteed benefits in a safe, reliable and environmentally friendly way. These include improved availability and performance, productivity gains and cost benefits, as well as maximised installation life.

Wärtsilä tailors these lifecycle solutions to enable customers to choose from different levels of partnership agreements. Optimised maintenance solutions include provisions for regular inspections, monthly reporting, and exchange programmes for spare parts. Solutions for optimised operations focus on energy efficiency, real-time monitoring and advisory services, maximised uptime and performance improvement plans. Guaranteed asset performance solutions can cover complete operational, management, and maintenance services, as well as installation performance guarantees.

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

Training services
Training services cover all aspects of management, operational, maintenance, and safety issues, and range from traditional hands-on training to advanced remote training systems and e-learning opportunities.
Services operating environment

Wärtsilä Services supports customers in the marine, energy, oil & gas industries, as well as in hydro and industrial related businesses. In 2016, Wärtsilä further strengthened its hydro & industrial offering by acquiring American Hydro, a leading supplier and installer of large equipment upgrades, and a provider of servicing for the hydroelectric and water distribution industries, specialising in consultancy, design, and precision performance enhancements for hydro-turbines and pumps.

Marine customers are generally ship owners, operators, or charterers operating in the merchant shipping, cruise and ferry, navy, or other special vessels segments. Oil & gas customers are typically those either operating ships in the offshore segment or having land based oil and gas installations. Hydro & industrial customers are companies operating in the hydropower, ocean energy, and offshore wind sectors, and customers with specific installations in industrial applications.

The main driver for the Services business is the size and development of Wärtsilä’s installed equipment base. However, the offering and competences are constantly being developed in order to extend the capabilities to multiple brands of equipment.

Installed base by business

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 re-deployments. 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, the implementation of regulations, or increased safety requirements. The outsourcing of power plant operations and management to a reliable partner is normal practice in the energy industry, and interest for lifecycle solutions in the form of partnership agreements is increasing also in the marine and oil & gas service markets. This is because such agreements further the optimisation of both maintenance and performance, thereby improving operational efficiency, reducing costs, and creating business growth.
Competition and market position

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

Competition is, therefore, mainly local, consisting of parts traders, repair yards, local workshops, component suppliers for spare parts (non-OEM), and field service businesses. The number of local players is quite large; consequently competition is rather fragmented and focused on a limited offering scope. 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 the increased demands for a speedy response.

The competition for lifecycle solutions for operating power plants 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. Wärtsilä Services offers a broad variety of options to ensure the best solution for the end user.

Services' strategy

Wärtsilä Services strives to be recognised as a reliable service partner; namely competitive, trusted, and easy to deal with. Wärtsilä is committed to growing its service business by:

- Developing closer partnerships with existing customers through superior customer service
- Developing and digitalising the offering to create new competitive advantages
- Exploring opportunities within new customer segments by leveraging on current competences
- Acquiring businesses in growing markets.

Services continuously develops its global footprint and operations in order to meet and exceed customer expectations. This is the basis upon which business with existing customers will grow. Further growth is sought by strengthening our service offering in response to our customers’ increased interest in lifecycle solutions, thereby providing them with both lower costs and improved operational efficiency.

An important growth area is the digitalisation of the existing offering and the development of a new digital offering to further increase revenue potential, transparency, availability, and performance. Wärtsilä Genius services enable the real-time optimisation of customers’ assets, improved predictability, and help in the solving of issues with digital solutions. Other examples of the increased transparency and availability made possible through digital innovations are the Wärtsilä Online Services platform for spare parts ordering and tracking and technical support, as well as remote service concepts, such as the Virtual Service Engineer. In 2016, Wärtsilä’s digitalisation capabilities were enhanced with the acquisition of Eniram, a Finland-based clean technology company providing the marine industry with energy management and analytics solutions. The acquisition of Eniram will enable Wärtsilä to grow and strengthen its in-house know-how, and expand its offering from asset performance optimisation to operations optimisation.

Wärtsilä’s current competences and capabilities within, for instance, in-situ machining, reconditioning, and field services, place the company in a unique position to provide services to new customer segments, such as Hydro and Industrial, and to extend the offering to customers who operate a variety of equipment – regardless of the manufacturer.

Services' strengths

- Long-term relationships with customers and an in-depth understanding of their operations and needs
- A complete lifecycle offering
- The broadest service portfolio in the industry
- An unmatched global service network
- Operations and asset performance optimisation enabled by holistic business understanding and extensive customer legacy
- State-of-the-art digital solutions for enhancing customers’ businesses based on optimising, predicting and solving, utilising benefits of real-time data, and data analytics.

**Services and sustainability**

Environmental legislation, the need for energy efficiency, and safety requirements are currently the main drivers for customers’ actions towards developing their businesses in a more sustainable way.

Wärtsilä Services strives to be a leader in supporting its customers’ efforts to meet and exceed current and future business and sustainability demands. This is the essence of Wärtsilä Services’ role as regards sustainability: we continuously develop the offering in order to provide customers with solutions that will enable them to run their businesses and grow in the most sustainable way.

Furthermore, Wärtsilä conducts its business in a responsible way, including providing services from locations in close proximity to the customers’ installations, and by investing and offering employment opportunities in local communities.

**Energy efficiency and emissions**

The increasing availability of alternative liquid fuels and gas, together with stricter environmental and safety requirements, creates opportunities for the Services business to improve the operational efficiency of customer installations, while at the same time reducing their environmental impact. Wärtsilä develops and provides services, such as upgrades, reconditioning projects, fuel conversions, and retrofit solutions, which improve both fuel efficiency and environmental performance. This enables compliance with stringent environmental legislation while extending the operational lifetime of the application.

For existing installations, a set of primary upgrading solutions are available, including:

- Engine, propulsion, or electrical & automation system efficiency upgrade packages that reduce fuel and/or lube-oil consumption, thereby contributing to lower emissions and the generation of economic benefits.
- Low NO\textsubscript{x} solutions that combine various engine modifications designed to find the ideal combination of compression ratio, injection timing, and injection rate. The concept has been developed so as to achieve the best possible trade-off between NO\textsubscript{x} reduction and fuel consumption.
- The conversion of propeller shaft sealing systems to an anti-pollution version that eliminates the risk of water pollution.
- Diesel to gas conversions that considerably reduce emissions from the installation. The conversion of heavy fuel oil or marine diesel oil installations to operate on natural gas offers extended benefits.

For new and existing installations, secondary methods are available to integrate additional emissions abatement equipment. Wärtsilä Services provides unparalleled environmental solutions, as well as the field experts needed for their installation and commissioning.

**Optimising the environmental efficiency of customer operations**

Wärtsilä’s offering goes beyond retrofits, upgrades, conversions, and field service expertise. Solutions supporting the lifecycle approach allow Wärtsilä to offer customers guarantees for reduced fuel consumption, and hence have a direct impact on reducing emissions. Furthermore, the Wärtsilä Genius and Eniram...
optimisation services enable increased competitiveness and effectiveness in daily operations with real-time efficiency and emissions abatement improvements. To name just a few concrete examples:

- **Engine efficiency monitoring**: the bridge/dashboard monitor indicates specific fuel oil consumption to create awareness of fuel usage, and to enable a vessel’s crew to make the necessary operational adjustments to optimise the consumption. Measuring fuel consumption online, visualising it, and comparing it to other performance data over time is the first step towards energy efficiency monitoring plan services for ships.
- **Trim optimisation**: provides an indication to the bridge/dashboard of the optimal vessel trim. Real-time optimisation of the ship’s trim provides significant fuel savings, thereby contributing to lower levels of emissions.
- **Hull and propeller cleaning interval optimisation**: calculates the optimal cleaning dates for the hull and propeller. This service results in the avoidance of substantial fuel consumption increases caused by surface roughness, and hence enables emissions optimisation.
- **Fleet optimisation**: combining Wärtsilä’s data intelligence and analytics with the seafaring experience of the ships’ crews enables the optimisation of the energy efficiency and overall performance level of entire fleets.

**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, 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 and providing short- and long-term benefits for the company’s customers.

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 securing without compromising quality, reliability, and safety aspects.

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.
The HERCULES programme and sustainable innovation through partnerships

The HERCULES 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.

Research and development expenditure

Minimising environmental footprint through R&D

Improvements in efficiency

- **TOTAL SHIP EFFICIENCY:** An efficient and low emission system for the entire vessel is achieved by combining optimised ship design with Wärtsilä’s knowledge of automation, machinery, propulsion, and control systems. Wärtsilä has developed numerous efficiency concepts, such as Low Loss Concept (LLC) and Low Loss Hybrid (LLH).
- **ENGINE EFFICIENCY IMPROVEMENTS:** A long-term focus on improving engine efficiency has resulted in Wärtsilä engines having the highest efficiency ratings among existing prime movers. A key success factor has been the development of integrated engine functionalities that enable low emissions and high engine efficiency. The new Wärtsilä 31 has the best 4-stroke engine fuel economy in the world.
- **PROPELLER EFFICIENCY UPGRADES:** Propulsion products incorporate environmental features and are critical for the overall environmental impact of the vessel. The new generation propulsion units from Wärtsilä result in significant efficiency improvements (5–12%) that also result in fewer emissions.

Reducing emissions to air

- **GREENHOUSE GASES (GHG):** Wärtsilä focuses on the development of technologies that reduce GHG emissions and improve engine efficiency.
- **SO₂ EMISSIONS:** Wärtsilä’s technology development supports solutions that enable the use of fuels with different sulphur contents, as well as systems that clean sulphur from the exhaust gas, and enable alternative fuels, e.g., natural gas. Wärtsilä’s scrubber systems reduce SO₂ emissions, but also particulate matter (PM) and black carbon.
- **NOₓ EMISSIONS:** All Wärtsilä engine portfolio products are IMO NOₓ Tier II compliant. Wärtsilä solutions for IMO NOₓ Tier III are:
  - Selective Catalytic Reduction (SCR)
  - Gas engine (dual-fuel in gas mode)

Reducing emissions to water

- **BALLAST WATER MANAGEMENT SYSTEMS:** Wärtsilä’s Aquarius® range of Ballast Water Management Systems offer solutions to limit the spread of ballast water-related invasive species and prevent their introduction to aquatic ecosystems.
- **WASTE WATER CLEANING:** Wärtsilä solutions are designed to facilitate the management and treatment of both grey and black wastewater, and to monitor discharges to the sea.
- **OILY WATER SEPARATORS:** The Wärtsilä Oil Water Separator (OWS) handles bilge water with a separating process, which sorts out oil traces even from complicated emulsions.

This pdf is composed of selected elements from Wärtsilä’s Annual Report and may deviate from other generated documents. To view the report in full, please visit www.wartsila.com/ar2016
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.

2016 saw the completion of the Future Flexible Energy Systems (FLEXe) research programme, which was started on 1 May 2015. FLEXe is a consortium in Finland gathering 27 organisations covering the entire value network of energy systems. FLEXe combines smartness, flexibility, environmental performance, and economic success with customer acceptance and engagement.

In 2016, Wärtsilä defined joint future research roadmaps with many leading universities in and outside of Finland. These roadmaps contain shared visions on activities to be performed at these universities with varying levels of support from Wärtsilä. Wärtsilä strived to further grow the number of key universities it collaborates with, making these roadmaps into the foundation of a sustainable collaboration.

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 stand-alone equipment.

Manufacturing footprint

Wärtsilä’s manufacturing footprint is global and continuously optimised for competence, availability, customer presence, and efficiency. As structural changes continue in the end markets, the focus remains on strengthening the company’s presence in key markets, notably China. This enables better service to customers locally, and allows savings to be achieved in both production and transportation costs.

Wärtsilä currently has five joint ventures globally. In Korea, dual-fuel engines are manufactured for the LNG carrier markets in partnership with Hyundai Heavy Industries Co. In China, engines are produced for local markets in three joint ventures. The Wärtsilä Qiyao Diesel Company Ltd joint venture manufactures medium-speed auxiliary engines, while the Wärtsilä Yuchai Engine Co. Ltd joint venture manufactures medium-speed auxiliary and main engines. The CSSC Wärtsilä Engine Company Ltd began its manufacturing of medium and large bore medium-speed diesel and dual-fuel engines in December 2016. The Wärtsilä CME Zhenjiang Propeller Co. Ltd. joint venture, also located in China, produces fixed pitch and controllable pitch propellers.

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-conform lead times are secured. Wärtsilä has approximately 1,100 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.

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**Why invest in Wärtsilä**

*Our strengths are our technological leadership, our integrated services and solutions offering, our close and long-standing customer relationships, and our unparalleled global presence.*

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**Supporting our customers with lifecycle solutions**

Our Services business, representing nearly 50% of Wärtsilä’s total net sales, offsets the cyclical nature of our end-markets, while supporting our aim for faster than market profitable growth over the long term.

The growth of our installed equipment base and increasing technological complexity supports the demand for our services, while digitalisation provides further opportunities to develop our value-adding offering and customer loyalty. We also seek growth beyond our installed base by expanding our business model to cover new market areas and multiple brands.
A leader in advanced technology for the marine and energy markets

The demand for our services and solutions is driven by megatrends, such as global transportation needs, the growing demand for energy, and increasing environmental awareness. As a frontrunner in our field, we are well positioned to respond to the need for innovative, energy efficient, and environmentally advanced solutions. Our presence in two different end markets with a global spread, together with our wide portfolio of products and solutions, offsets cyclical developments and reduces market risk exposure. Continuously investing in research and development is vital for ensuring the competitiveness of our product portfolio, and for securing a leading position in sustainable innovation.

A capital-light business model focused on increasing efficiency

Our business model is focused on lifecycle services of high-tech equipment. Wärtsilä’s facilities comprise asset-light assembly lines, with shared production and R&D. This creates flexibility in aligning our operations to market conditions, and synergies in our innovation processes, thereby supporting stability in earnings over the cycle and enhancing our future competitiveness.

Achieving operational excellence by focusing on continuous process improvement throughout the organisation, and driving the benefits of a business line based organisation with decentralised accountability are key enablers for reaching our long-term targets.

Investing in technological leadership and providing shareholder returns

Our financial position enables us to develop our business by expanding our offering of services and solutions through research and development activities and acquisitions. It also enables us to offer solid dividends to our shareholders.

Q&A:

What is your outlook for Wärtsilä’s end markets going into 2017?

The demand in our service markets is expected to be solid, and we continue to see growth opportunities in selected regions and segments. Our sizeable installed base and opportunities in new market areas, as well as the interest our customers express in long-term service agreements, support our long-term ambitions for the Services business.
Demand in the energy markets is expected to be solid. Our systematic market development efforts have positively impacted our position in the energy market. Therefore, we consider ourselves well positioned to capture opportunities related to the growth in electricity demand in the emerging markets, the global shift towards renewable energy sources, and the need for distributed, flexible power production.

We expect the marine markets to remain soft. Although the outlook for the cruise and ferry segment is positive, the merchant, gas carrier, and offshore segments continue to suffer from overcapacity, slow trade growth, and customer financial constraints. Our exposure to all the main marine segments and the breadth of our offering continues to position us relatively well in a challenging market.

Why is digitalisation important for Wärtsilä?

We have a clear appetite for development within the field of digitalisation. Not only does this provide enhanced value to our customers in the form of new, data-analytics driven solutions, it also enables us to develop our internal processes through, for instance, the increased use of robotics in our manufacturing, and mathematic modelling in our testing processes. During the year, we strengthened our digital foundation with the appointment of a Chief Digital Officer to the Board of Management, as well as with the acquisition of Eniram. We are also currently in the process of finalising a new digital organisation, with the aim of accelerating Wärtsilä’s digital transformation.

How far are you in terms of rolling out Operational Excellence?

Operational Excellence is one of the building blocks for reaching our 14% profitability target and its aim is to achieve gradual, continuous improvement. Although not fully rolled out, we have already seen certain benefits in terms of, for example, improved inventory management and optimised production flow.

Is there scope for acquisitions going forward?

At the end of 2016, our net debt was EUR 150 million and our gearing was 0.07. Our ambition is to find good investment opportunities for our owners and we have a number of potential acquisitions on our target list. We look for asset light companies with a high services content and strong technological capabilities.