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Even by DEME’s standards, 2018 was quite an extraordinary year in its history as its ambitious, fleet investment programme, which spearheads innovative, green vessels, continues apace. During the busy year, DEME brought its expertise and tailored solutions to many projects across the globe, which address challenges such as rising sea levels, scarcity of land, a growing population, coastal erosion and the transition to green and blue energy.

1.1 Fleet Investment Programme

DEME is already the greenest operator amongst its peers and most of its new vessels are equipped with dual-fuel engines, which are capable of running on LNG and diesel fuel. The two new dual-fuel hoppers, the 3,500 m³ ‘Minerva’ and 8,400 m³ ‘Scheldt River’, being the first dredgers in the world equipped with dual-fuel engines, got straight to work, ‘Minerva’ in Uruguay and ‘Scheldt River’ in Germany. In line with this success, DEME has a new vessel under construction with the same innovative design as its dual-fuel sister vessel ‘Scheldt River’. As well as large trailing suction hopper dredgers, DEME is also building a vessel with a hopper capacity of 2,300 m³. The compact design ensures high manoeuvrability and optimised dredging works in shallow waters.

Highlighting that innovation is at the company’s core, in November the giant cutter suction dredger (CSD) ‘Spartacus’ was launched at the Royal IHC shipyard in the Netherlands. In a class of her own, and with a total installed capacity of 44,180 kW, ‘Spartacus’ is simply the most powerful and environmentally friendly CSD that has ever been built. The four main engines can run on LNG, marine diesel oil and heavy fuel oil. The two auxiliary engines also incorporate dual-fuel technology. Therefore, ‘Spartacus’ can be powered by any type of fuel, enabling the operator to choose the cleanest fuel available. ‘Spartacus’ also features several additional innovations such as a waste heat recovery system, a one-man operated dredge control and a heavy-duty cutter ladder that can reach a dredging depth of 45 m.

DEME is also set to take delivery of the new generation of trailing suction hopper dredger, the 15,000-m³ ‘Bonny River’. This innovative vessel is able to dredge very hard soils and also in deeper waters of more than 100 m. The new dredger combines a very long suction pipe, a large transport capacity with a limited draught and additionally, a heavy-duty trail pipe with a rock draghead.
Another very specialised vessel is the compact ‘Blanew’, an electrically-driven cutter suction dredger specially designed for dredging works in marinas, canals and lakes. Entering service in 2018, ‘Blanew’ is already busy at work in several Belgian marinas. In order to reduce the exhaust gas emissions and to minimise noise when working in marinas, ‘Blanew’ is powered by means of an umbilical, floating electric cable, which is directly connected to the shore-based network.

In a spectacular ceremony DEME’s next generation, giant new offshore installation vessel ‘Orion’ was successfully launched at the COSCO Qidong shipyard in China in November 2018. ‘Orion’ will feature an unrivalled combination of exceptionally high transport and load capacity, impressive lifting heights and green technology.

DEME’s DP3 vessel ‘Living Stone’, one of the most advanced multipurpose vessels in the world, entered service in 2018. ‘Living Stone’ has a unique cable installation system on board with two 5,000-tonne cable turntables located below the main deck. The cable installation system is able to install cables in a completely new and innovative way. Well aware that the offshore wind industry is keen to reduce costs, a system has been designed whereby the ‘Living Stone’ can install one cable, while fully preparing the second one on deck. This minimises the time needed for preparation of the cables, which saves significant time and costs.

DEME’s new self-propelled, DP2 jack-up vessel ‘Apollo’ entered the fleet in spectacular style when she carried out the only platform decommissioning project in the Dutch sector of the North Sea in 2018. The installation vessel has extremely long lattice legs allowing the vessel to jack-up in up to 65 m water depth. Apollo’ will serve the offshore energy industry and will mainly be deployed to provide services to the oil and gas industry, with a particular focus on the installation and decommissioning of platform facilities.

1.2 Projects Across the Globe

DEME’s innovative new and existing vessels have been performing a variety of challenging projects in 2018 in each corner of the globe.

In Asia and in one of the largest land reclamation projects DEME has ever worked on, Dredging International Asia Pacific Pte Ltd (DIAP) and its joint venture partner Daelim Industrial of South Korea, had completed more than 80 % of the Tuas Terminal Phase 1 (TTP1) project by the end of the year. This project was originally awarded by Singapore’s Maritime and Ports Authority in 2015. Construction of the last of 221 caissons, which will form the future quay wall, was actually completed four months ahead of schedule. DIAP is well on track to finish the project by the end of 2020.

Ultimately, 70 million m$^3$ of land will have been reclaimed to create the first phase of the Tuas mega container terminal. At its peak, some 2,500 people and around 150 vessels were working on the project. A number of highly advanced, sustainable techniques are also being deployed.
Meanwhile in Australia, Dredging International Australia Pty Ltd (DIAU), successfully performed the Sunshine Coast Airport Expansion Project (SCAEP). This involved dredging and reclamation works to create the foundation for a new runway of around 2,450 metres long. Overall, 1.2 million m$^3$ of sand was dredged by the Trailing Suction Hopper Dredger 'Nile River' and this was pumped ashore without the use of a booster station.

In Africa, DEME carried out coastal protection works along the Cotonou shoreline in Benin. Works went on throughout the year and will run into 2019. Beach nourishment with a total volume of 1 million m$^3$, as well as revetment works and a groyne construction are included in the scope.

1.3 First Project in Sierra Leone

Additionally, DEME’s first project in Sierra Leone was successfully completed in March. A consortium including DEME, worked on the extension of the Freetown Terminal, which is operated by the French group Bolloré Transport & Logistics. The expansion programme encompassed the construction of a 270-m quay wall to enable the terminal to accommodate larger vessels. Soil improvement, reclamation and compaction works, as well as the deepening of the existing and future container berths was all under the responsibility of DEME.
Closer to its home base, DEME was very active in a number of projects on the major rivers of Northern Europe. In Belgium itself, DEME continued a number of long-term maintenance dredging contracts on the main waterways and the North Sea. The TSHD ‘Palliete’ executed several maintenance dredging campaigns on the Scheldt River and along the access channels to the port of Antwerp locks.

1.4 Maintenance Dredging on Major Rivers

After the successful execution of deepening works in the Courval-Duclair section of the River Seine in France, Société de Dragage International focused on the last phase of this project. SDI has actually been working on the Seine deepening since 2012 and has realised the four major phases of this challenging project, which is carried out on behalf of the Grand Port Maritime de Rouen.

The company has handled approximately 800,000 m³ of material under the latest phase and despite the dredged material often being sharp gravel, SDI has successfully managed to reclaim them, so they can be reused by the port authority.

Then on the River Elbe, DEME’s German subsidiary Nordsee Nassbagger- und Tiefbau (Nordsee) has acquired a two-year maintenance dredging contract for the River Elbe in a joint venture in 2017. This was extended for another year and will now run into 2020. DEME has to maintain the 116-km long fairway of the Elbe between the North Sea and Hamburg. Nordsee was proud to be the operator of the first LNG-fuelled dredger to operate along the River and carried out several successful trials with the new, ‘Scheldt River’ TSHD, including the largest LNG bunkering operation in Germany and the first bunkering of a hopper dredger as well. This move was very much welcomed by the port authorities and other stakeholders in the region.

1.5 Major Contract in Poland

In a joint venture DEME will design and execute the construction and dredging works for the modernisation of the Świnoujście-Szczecin fairway in Poland. The fairway currently has a depth of -10.5 m and will be deepened to -12.5 m enabling the port of Szczecin to handle larger draught vessels and thus, maintain its competitive position in the Baltic Sea.

The main scope of the project includes design works, the survey and removal of ferromagnetic objects and unexploded ordnances (UXOs), capital dredging of more than 20 million m³ and the relocation of the dredged soil to create two artificial islands in the Szczecinski Lagoon. The civil works also include the revetment and the construction of several quay walls and river banks in order to cope with the design of the new fairway.

For the Nouvelle Route du Littoral in la Reunion, SDI has been performing dredging, gravel bed installation and backfilling works for 48 gravity-based foundations for the 5,400 m viaduct. DEME’s backhoe dredger ‘Pinocchio’, two split hopper barges and the multicat ‘Aramis’ were deployed.
In a joint venture DEME is executing deepening and maintenance of the Canal Martin García. The Canal is located between Uruguay and Argentina in the northern part of the 50-km wide Rio de la Plata estuary. The main objective of the dredging programme is to deepen the Canal and subsequently maintain a depth of 34 feet.

At the end of 2018, DEME was nearing completion of the dredging scope part of the prestigious Seabird Phase II project in India. Eventually, around 10 million m$^3$ of materials will have been dredged and if suitable, these are also being reclaimed. The dredging, reclamation, soil improvement and revetment works for the project are being carried out in a joint venture with Larsen & Toubro.

### 1.6 Three Dutch Mega-Projects

The Netherlands saw three mega-projects get underway – the RijnlandRoute, New Lock Terneuzen and Blankenburgverbinding. Besides the infra marine works, a major dredging and ground works component is included in the projects.

DEME is supplying all of the sand for the RijnlandRoute project, which represents more than 1 million m$^3$. For the New Lock Terneuzen, dredging and dry earthmoving works will be executed. A staggering 9 million m$^3$ of material has to be dredged. The design and build projects are due to run until 2022.

The financial close for the prestigious A24 Blankenburgverbinding was achieved in October. Rijkswaterstaat (The Directorate-General for Public Works and Water Management of the Netherlands) awarded the € 1 billion Public-Private Partnership project ‘A24 Blankenburg Tunnel’ to the BAAK Consortium (DEME Concessions Infrastructure, Ballast Nedam and Macquarie Capital). Dredging and backfilling represents approximately 1 million m$^3$ and dry earthmoving works around 2 million m$^3$. The contract comprises the design, build, finance and maintenance for a period of 20 years.
Staying in the Netherlands, de Vries & van de Wiel is working in a joint venture to carry out a 145-hectare, land reclamation project to create a new island, ‘Strandeiland IJburg’), which will be a new residential area in Amsterdam. In the second half of the year, de Vries & van de Wiel delivered more than 1 million m$^3$ of sand for the project. In total 12 million m$^3$ will be delivered when all the phases are realised.

1.7 DEME Offshore

Offshore, DEME was equally busy, particularly with the increasing number of renewables projects. The 309 MW, Rentel offshore wind farm, located in the Belgian North Sea was fully commissioned earlier than the original schedule and is producing in line with expectations. Rentel was a true ‘family affair’. The 1,200-tonne substation was installed by Scaldis’ heavy lift crane vessel ‘Rambiz’ and this followed DEME successfully completing the installation of the monopile foundations and transition pieces with the jack-up installation vessel ‘Innovation’. Infield and export cables have been installed by DEME as well. Additionally, DEME also installed the turbines. With their peak height of 183 metres they will be the largest wind turbines so far in the Belgian North Sea.

1.8 Suction Bucket Jacket Expertise

In the summer, DEME’s jack-up ‘Innovation’ successfully completed the installation of 20 suction bucket jackets at Borkum Riffgrund 2 offshore wind farm in Germany. Borkum Riffgrund 2 will feature 56 Vestas turbines of 8 MW. The 20 suction bucket jackets each weighed 950 tonnes and have a height of 58 m. This is the first time Ørsted has utilised this type of foundation at one of its wind farms on such a large scale. The suction bucket structure becomes firmly embedded in the seafloor by vacuum pressure, eliminating the need for hammering and significantly reducing noise during installation.
The completion of the project further established DEME’s strong track record in providing innovative solutions for our offshore wind farm customers. DEME is now one of the few companies with vast expertise in suction bucket jacket installation.

1.9 World’s Largest Wind Farm

DEME also worked on the world’s largest offshore wind farm in 2018. Right at the end of the year, a world first and a major construction milestone was reached at Ørsted’s Hornsea Project One when Tideway the export cable installation was completed. With an offshore export cable totalling 467 km, roughly the same distance as Amsterdam to Hamburg, it is the longest AC offshore wind cable ever to have been installed. Additionally, the cable manufacturing and installation were completed months ahead of schedule.

When fully operational in 2020, Hornsea Project One’s 174 turbines will generate enough clean electricity for well over one million homes. The huge wind farm was the first project for the new cable installation and multifunctional vessel ‘Living Stone’. With its 10,000-tonne cable capacity and cutting-edge dual-lane cable system, ‘Living Stone’ significantly improves cable installation production rates.

2018 highlights DEME’s efforts to make continuous fleet improvements in terms of productivity and environmental performance, and to bring its experience and innovative solutions to the ongoing global challenges.
2 JAN DE NUL IN 2018

Creative, Sustainable and Innovative Solutions.
To the Future.

DESIGN. BUILD. CONNECT. Jan De Nul Group shapes water and land. Worldwide. From complex offshore services for the fossil as well as the renewable energy sector, over large dredging and reclamation projects on the edge of water and land, to all possible civil constructions on land. Well-integrated competences and investments lead to creative, sustainable and innovative solutions. In this way Jan De Nul Group meets the customers’ current and future wishes. To the future.

2.1 Awarded for Sustainability and Innovation

In November 2018, Jan De Nul Group was awarded twice for sustainability. In Amsterdam, the Group won the ‘DPC Coastal Port Dredging Project of the Year Award’ for its sustainable approach in port dredging, presented by IHS Dredging and Port Construction. With these annual awards, DPC is promoting innovation, efficiency and sustainability in the industry. One week later, Jan De Nul Group pocketed the Lloyd’s List South Asia, Middle East and Africa Environment Award for its innovative and green design of Ultra-Low Emission Vessels.

2.1.1 Sustainable Use of Dredged Sediments in Taiwan

DPC Coastal Port Dredging Project of the Year

It was the Linkou Port project team in Taiwan who won the DPC Award for the sustainable use of dredged sediments and efficient production planning.

From August 2017 to April 2018, Jan De Nul Group dredged 4 million m³ of mudstone in the Port of Linkou, Taiwan, and re-used the dredged sediments to extend the nearby port of Taipei by means of reclamation. A beautiful example of circular economy and a win-win for the environment as well as for the client.

In order to be able to dredge and reclaim these quantities within the set period, a cutter suction dredger and a trailing suction hopper dredger worked simultaneously on this project: the cutter pre-cut the hard mudstone after which the hopper dredged the sediments and transported them directly to Taipei Port for reclamation.

Pre-cutting of mudstone with a cutter and subsequent dredging and reclaiming with a hopper on this scale was unprecedented.

This simultaneous working method also required the operations to be perfectly synchronised to enable joint production optimisation, which was vital to execute this huge pre-cut scope efficiently and on time.
2.1.2 Better Air Quality by Designing and Building Ultra-Low Emission Vessels

Lloyd’s List SAMEA Environment Award

Lloyd’s List recognised Jan De Nul Group for its in-house sustainable and innovative solution to treat exhaust gases of dredging vessels by means of an on-board two stage gas treatment system. A solution which is pioneering and new to the maritime industry. Jan De Nul Group’s starting point is different than others who have chosen clean burning fuel vessels. With its ULEv’s, Jan De Nul focuses on minimising the impact of maritime transport and port development on public health and ambient air quality.

In a world of climate change, and overall environmental consciousness, Jan De Nul Group has chosen to equip its latest generation of dredging vessels with an ingenious system of filtering to actually remove or eliminate toxic substance from exhaust gases. Jan De Nul developed this technology based on the Swiss example of filtering exhaust gases in the tunnelling industry. Since the 1990s, the tunnelling industry has used exhaust gas filtration on vehicle and heavy-duty machinery emissions to provide clean, breathable air for tunnelling activities under the Alps.

The Group designed in-house and ordered five ultra-low emission hopper dredgers, called Ultra-Low Emission Vessels: three small 3,500 m³ and two medium-sized 6,000 m³. These ULEv’s are diesel-electrical powered, with engines allowing optimal use of generated power but with low fuel consumption and emissions. In addition, the vessels are equipped with a two stage highly efficient exhaust gas filter system, resulting in emissions complying with the European Stage V regulations for inland waterway vessels.

Jan De Nul Group is delighted to be leading the way with his innovative approach, in compliance with the most stringent global emission limits with the world’s first EU Stage V dredgers, which will be highly fuel-efficient, reliable, versatile and productive. Their use will enable dredging projects to be completed with the lowest levels of emissions to date.

As the new dredgers will frequently operate in estuaries, rivers and coastal areas near urban areas, Jan De Nul decided to limit the NOx emissions to a level below the actual IMO Tier III requirements, and to reduce other potentially harmful contaminants that are currently not regulated by IMO.
The maritime transport regulator International Maritime Organisation (IMO), states that clean burning fuel vessels have to comply with the IMO Tier III regulation. The European regulations for inland waterway vessels, Stage V, are far stricter. Mainly because for the first time, particles emitted down to 23 nanometres are taken into account.

_Two stage filtering technique_

The new vessels will operate with normally available ultra-low sulphur gasoil, with the exhaust gas treated in two stages by means of a Selective Catalytic Reduction (SCR) system and a Diesel Particulate Filter (DPF). The SCR system, combined with AdBlue (Urea), is currently the most efficient de-NOx system for internal combustion engines. On the other hand, the Diesel Particulate Filters removes the particulates and nano particulates from the exhaust gases. All DPF systems on board of the vessels have a VERT-label (Swiss BAT label). Moreover, the DPF also filters the Black Carbon. As such, Jan De Nul Group also significantly reduces the climate impact of these vessels.

2.1.3 **Embracing the Circular Economy**

**Charter Sustainable Entrepreneurship from Flanders’ Chamber of Commerce**

The environmental subsidiary of Jan De Nul Group, Envisan, received the Charter Sustainable Entrepreneurship from the Flanders’ Chamber of Commerce (Voka) as a recognition for its sustainability programme. This programme includes various action points, including the investment in two brand new physicochemical installations for the soil and sediment treatment centres in Belgium and France. In this way, Envisan and Jan De Nul contribute to the Sustainability Development Goals of the United Nations (UN SDG). Corporate social responsibility, ensuring short chains and endorsing the circular economy, it is in the genes of this environmental company – thus being awarded for its efforts with respect to sustainability and circular economy.

Envisan remedies soil and groundwater, executes environmental dredging (to remove contaminated dredging sediments and to treat them afterwards), creates landfill sites, valorises waste and operates its own treatment centres for contaminated soils and/or sediments. Each activity aims at the remediation of contaminated sites (industrial sites, port areas, etc.) in order to offer them a second life. In addition, the contaminated soils are treated in the centres after which they can be reused as secondary raw materials. These centres are at the disposal of all core activities of Jan De Nul Group, but also third parties can supply contaminated materials and/or purchase secondary raw materials for their infrastructure or construction works.

Precisely for the reason of strengthening the strategy towards reuse and circular economy, Envisan invested in two semi-mobile physicochemical installations for its centres, which will enable the company to treat heavily polluted soils with heavy metals, hydrocarbons, PAHs, asbestos, etc. Residual streams such as sand, rubble, etc. are valorised: they are given a second life as secondary raw materials in building activities. As a result, the use of new raw materials can be avoided. With both installations, Envisan is fully committed to the circular economy.
2.2 Awarded for Creativity

The creative team behind these innovative and sustainable solutions was also awarded in 2018. Jan De Nul won Silver Dolphin during the Corporate Media & TV Awards in the category Human Resources for its corporate video #WEAREITA about the internal Imagine Think Act programme, a film made by and for our own employees.

For this video, Jan De Nul asked its own employees from different departments to talk in front of the camera as real ambassadors about how it is to work with Jan De Nul Group. No actors, but the true people behind the multinational Jan De Nul Group. It is no ordinary corporate video or a message from management. The film highlights the enthusiasm and energy that live within the company.

Project managers, welders, management, captains, crew members, etc., they all show that Jan De Nul stands for one integrated team with a common plan! This corporate culture of Jan De Nul Group has a name: ‘Imagine Think Act’, or in short ITA. It is the way in which Jan De Nul employees execute their projects. It’s about communication, planning and being in control of things. And it is the leitmotiv in the winning corporate video.

2.3 Nature-Based Solutions: Innovating with Nature

Nature-based solutions (NBS) is the collective name for building methods that make use of natural materials. Nature is the oldest and longest running trial-and-error lab of the past couple of million years: so why try to reinvent the wheel? The answer to many problems is in our natural capital: building with, to the benefit of, and like nature itself. Eco-engineering, in other words. NBS depart from natural ecosystems, their functions and services to tackle climate problems, among other things. Besides, innovating with nature is not only sustainable but also cost-effective.

2.3.1 Coastbusters: Experimenting with Shellfish, Seaweed, Grasses and Sand Mason Worms

Under the heading of ‘Coastbusters’, Jan De Nul Group collaborated in 2018 in designing and building a living reef off the coast in Belgium. The reef will stabilise the foreshore base, strengthen the ecosystem and reduce erosion. In this project, three ‘biological builders’ have been tested: shellfish (mussels and oysters), seaweed, grasses and sand mason worms. As such, Coastbusters experiment with structures on the seabed that lend a helping hand to these biological builders. Coastbusters use natural and bio-degradable materials so that the human share in the reef becomes smaller throughout the years. Through this project, ‘Coastbusters’ also develop and test installation methods in view of their later application on an economically bigger scale.

2.3.2 Sustainable Development of Vulnerable Coastlines

Jan De Nul Group executed in the course of 2018 one of the biggest dike reinforcement operations in the Netherlands ever: the Prince Hendrik sand dike in Texel. Texel is one of five Frisian Islands, off the Frisian coast. The Wadden Sea is a natural monument and has been awarded Unesco World Heritage status. Not only is it a crucial resting place and foraging area for birds on their migration routes between north and south, but it has with unique flora and is also the ideal habitat for thousands of seals. It was no surprise
that Jan De Nul had to meet several ecological conditions. The design of Jan De Nul Group won the tender, because of its sustainable and nature-based character. Between July 2018 and January 2019, TSHD ‘Bartolomeu Dias’ dredged 5.5 million m³ of sand for the construction of a new 3-km long safety dune and connected nature area. The sand dune and nature reserve will protect the coastline of Texel in a sustainable way. After delivery of the project, Jan De Nul remains responsible for its maintenance for a period of 5 years.

Another nice sustainable project is located in Benin, Africa, where Jan De Nul Group kicked off the works for the construction of two submerged dikes at about 150 metres off the coast. This project design was developed and tested in-house at Jan De Nul Group. Both dykes will have a wave damping effect, which means that the waves of the ocean are broken before they reach the coast. A wave-free climate develops between the submerged dyke and the coast, which will significantly reduce the impact on the beaches. As a result, the sand will move less and the erosion will decrease. Because the dyke is submerged, the view of the horizon will not be disturbed. From the beginning, Jan De Nul Group has worked on maintaining that aesthetic character, which is very important in the context of the government plans to fully develop coastal tourism in Benin.

### 2.3.3 Cleaning Up Oil-Polluted Beaches in France

End 2018, Jan De Nul Group was awarded a project in France to clean up oil-polluted beaches along the Mediterranean Sea. Envisan, the environmental subsidiary of the dredging and construction company, signed the contract with the French company ‘Le Floch Dépollution’ for cleaning up the polluted sand using Envisan’s soil treatment centre near Toulon, where it will be subjected to a physical-chemical washing process. The re-use of the decontaminated sand to replenish the excavated beaches is being investigated, leading to a fine example of how Envisan embraces the circular economy.
The soil treatment centre of Envisan near Toulon

Over the past few years, Envisan, a leading environmental company, has set up a network of sediment and soil treatment centres: five centres in Belgium and one in southern France in Toulon. The French centre, which opened in 2015, offers the Mediterranean construction and marine industry a solution for contaminated soils and dredged sediments. In this centre, sediments can be dried both in lagoons and by way of filter presses, and from this year, the centre also features a physical-chemical plant that is able to wash and revalorise heavily contaminated soils.

2.4 Investing in Resources and Innovation

2.4.1 Acquisition of the Offshore Installation Vessel Taillevent

Jan De Nul Group continues investing in its offshore wind resources in order to support its growth in the industry worldwide and to be able to offer the market a reliable solution for pioneering projects. In July, Jan De Nul acquired the jack-up vessel ‘Taillevent’ (formerly known as MPI Discovery) from the Dutch company Vroon Group. The 2011 built ‘Taillevent’ is designed specifically for the transport and installation of offshore wind turbines and their foundations. It is also perfectly suited to other offshore sectors, such as the oil and gas industry. This installation vessel has an on-board crane with a lifting capacity of 1,000 tonnes and an auxiliary crane of 50 tonnes.

In September, the ‘Taillevent’ successfully completed the installation of a new 83-tonnes crane on top of the offshore substation of the 350-MW Wikinger Offshore Wind Farm in Germany, 75 kilometres off the coast.

2.4.2 Investing in Research to Develop the Next Generation of Offshore Wind Turbines

The European Commission signed the grant agreement and awarded 25 million Euro to the ReaLCoE project for the development of the next generation of 10+MW offshore wind turbines, involving the most experienced offshore industry stakeholders. Jan De Nul Group is proud to be part of this strategic mission within the EU Horizon 2020 programme. ReaLCoE stands for Robust, Reliable and Large Offshore Wind Energy Converters for Clean, Low Cost and Competitive Electricity. ReaLCoE’s vision is to unleash the full potential of offshore wind energy to be in direct competition with conventional energy sources in electricity markets worldwide.
2.5 Some Further Jan De Nul projects of 2018

2.5.1 Port Extension Works in Denmark

Lindø port of Odense in Denmark is growing and needs expansion to be able to host Danish and international companies in the harbour. This port expansion project is executed by a joint venture with Jan De Nul Group and Züblin A/S. An additional 400,000-square metres port area and a one-kilometre new quay with a special heavy load-area is to be constructed. The joint venture started the works in 2018. Jan De Nul Group is in charge of the dredging and reclamation of 2 million m³ sand to establish the new harbour area.

2.5.2 Dredging the Largest Container Handling Port in India

In India, Jan De Nul executed, also in joint venture, the widening and deepening of the access channel towards Jawaharlal Nehru Port in Mumbai. The areas dredged include the 35.5-km long access channel and various turning basins and anchorage areas. In total, more than 48 million m³ of sand, silt, clay and rock is to be removed. Jawaharlal Nehru Port is the largest container handling port in the country. Upon completion of the project the port will be able to accommodate larger container vessels.

2.5.3 Old Doha Port Redevelopment for Growing Cruise Tourism

Jan De Nul Group, as part of a joint venture, was awarded the Old Doha Port Redevelopment project in Qatar. To comply with the growing cruise tourism industry, the port will be redeveloped. It will serve as a cruise terminal and will accommodate the largest cruise ships of the latest generation. Dredging works will be executed for the realignment of the access channel and a new mooring dolphin structure will be constructed. The works commenced in 2018.

2.5.4 Developing the Black Sea Main Export Centre in Turkey

Jan De Nul executed dredging and revetment works for the extension of the main port of Filyos, becoming the third largest port in Turkey. In total, 24 million m³ of sediments had to be dredged and disposed of over a distance of more than 3 kilometres. 21,000 X-blocks have been constructed and installed for the construction of a breakwater to protect the port from the fury of the elements. After completion of the works, Filyos will become the Black Sea main export centre, having a loading and unloading capacity of 25 million tonnes per year.
2.5.5 Confirming its Presence in Argentina

Mid-2018, Jan De Nul Group was awarded major contracts in two Argentinean ports. A first contract for the 50-feet deepening dredging works of the Port of Quequén, the second project concerns the maintenance dredging of the Port of Bahía Blanca. In order to open the Port of Quequén for vessels over 46 feet, deepening dredging works need to be performed in the external and internal access channel, as well as in the inner port basin. The maintenance dredging works in the Port of Bahía Blanca are performed with a 3-feet over depth, which will create a buffer in order to provide several months of draught certainty. The works started immediately after contract signing.

2.5.6 Important Concession Contract in Ecuador

End 2018, Jan De Nul signed the concession contract for the deepening and maintenance dredging of the 95-km access channel to the port of Guayaquil in Ecuador. Under this agreement, Jan De Nul Group will finance the capital dredging works to deepen the existing access channel guaranteeing a new authorised draught of 12.5 m, as well as to deepen the Guayas River to an authorised draught of 7.5 m. Meanwhile, a modern Vessel Traffic Service system and toll collection system also need to be installed. For the dredging works, three modern medium-sized Trailing Suction Hopper Dredgers and one large self-propelled Cutter Suction Dredger will be mobilised. For the capital dredging works, an estimated volume of 25 million m³ is to be dredged.

2.5.7 Gigantic Masterpieces in the Baltic Sea

Jan De Nul Group successfully finished the installation works for the offshore wind farm Kriegers Flak in Denmark. Two Gravity Based Foundations of 8,000 tonnes and 10,000 tonnes were floated off a semisubmersible barge and towed to the installation location where the heavy lift vessel ‘Rambiz’ in combination with an in-house designed ballast system set the structure down onto the seabed.

For the Danish Horns Rev 3 offshore wind farm, Jan De Nul transported and installed 49 Transition Pieces of 500 tonnes each using its jack-up vessel ‘Vole au vent’.

2.5.8 Offshore Installation Services for Borkum Offshore Wind Farms in Germany

In Germany, Jan De Nul Group executed offshore services for the offshore wind farms near the island of Borkum. The Group successfully completed the export cable installation works in the German North
Sea in order to connect the offshore wind farms Trianel Windpark Borkum II, developed by Trianel, and Borkum Riffgrund II, developed by Ørsted, to Tennet’s German transmission grid. For both cable installation projects, Jan De Nul Group’s cable laying vessel ‘Willem de Vlamingh’ and trenching support vessel ‘Adhémar de Saint-Venant’ were mobilised. Also, the installation works of the 36 monopiles and transition pieces for the Borkum Riffgrund II offshore wind farm was executed with success.

2.5.9 Preparatory Works for the Largest Offshore Wind Turbines Ever Installed

In July, Jan De Nul Group signed the contract for constructing Northwestern 2, the seventh wind farm off the Belgian coast, entering for the third time into a partnership with wind farm developer Parkwind, a branch establishment of Colruyt. Jan De Nul will be responsible for the design, construction and installation of 23 foundations, the transportation and installation of the cables and the transportation and installation of the wind turbines on top of the foundations. Preparatory works started immediately after contract signing. Installation works will start in the summer of 2019.

2.5.10 Largest Umbilical Installation Project Successfully Ended

Mid 2018, Jan De Nul Group successfully completed the installation and burial of the two main umbilicals in Egypt. These umbilicals will serve for the exploitation of new gas fields in the West Nile Delta concessions, located in the North Alexandria region.

2.5.11 First Offshore Wind Farm Installation Projects Outside Europe

In April, Jan De Nul Group signed the contract, together with Hitachi Ltd., for the construction of an offshore wind farm including the manufacturing and installation of 21 wind turbines (in total 109.2 MW) for the TPC Changhua Offshore Wind Farm Project off the coast of Fangyuan in Central Western Taiwan. The work includes manufacturing and installation of all equipment as well as maintenance for a period of five years. Under the Changhua Offshore Wind Farm Project Jan De Nul will be responsible for the foundation design, fabrication and installation, wind turbine installation, supply and installation of cables off- and onshore as well as for the upgrading of the substation. The onshore cable installation works were kicked off end of August.

Mid-May, Jan De Nul Group was awarded another important offshore wind contract in Taiwan for the design, procurement and installation of the wind turbine foundations for the Formosa 1 (Phase 2) Offshore Wind Farm, owned by Formosa Wind Power Co. The second phase will add 20 offshore wind turbines with a total capacity of 120 MW to Formosa 1’s current 8 MW capacity. The scope includes scour protection and cable installation.
3 VAN OORD IN 2018

We are a Dutch family-owned company with 150 years of experience as an international marine contractor. We value open communication with our clients and stakeholders. Our company culture is one of entrepreneurship and engaged employees. We think and act with responsibility and focus on the long term.

Vision
Our vision is to create a better world for future generations by delivering marine ingenuity.

Mission
As a global maritime contractor, we focus on dredging, oil and gas infrastructure and offshore wind. We work safe and closely with our clients and stakeholders to create innovative and sustainable solutions.

3.1 Dredging

More than half of the world’s population lives in cities. The world’s urban population currently stands at 3.7 billion people and is, with an expected to double by 2050. This has resulted in a growing worldwide demand to create more living space. Van Oord is adapting to these changing market conditions with our global marine engineering projects.

Dredging is our signature talent, one that we have perfected continuously since our business was founded. We maintain our position in traditional dredging markets and in our home markets thanks to the best dredging equipment and operational experience, supported by our local branches.

3.1.1 Dredging Contract in Bali Awarded to Van Oord

State-owned port operator Pelindo III has contracted Van Oord to carry out dredging works in the port of Benoa, Bali. Access to this port needs to be improved to accommodate the increasing number of tourists. Execution of the work will start soon and is expected to be completed within the year.
3.1.2 Celebration 150th Anniversary of Van Oord Starts with the Naming of the First LNG vessel

With a two-day event on the quay of the Biesboschhaven Zuid harbour in Werkendam, Van Oord will launch its first LNG-powered vessel: the Werkendam. Because of Van Oord’s 150th anniversary, this event is taking place in Werkendam, the cradle of the company.

3.1.3 Van Oord Begins Sand Suppletion Operations on Texel, Ameland and Vlieland

Starting today, Van Oord’s trailing suction hopper dredger Geopotes 15 will be replenishing the beaches of the Dutch island of Texel. RWS, the Dutch public works agency, contracted Van Oord in spring 2018 to maintain the coasts of the Wadden Islands Texel, Ameland and Vlieland. Beach replenishment will stabilise the basic coastline and guarantee safety along the coast.

3.1.4 Van Oord Adds Two New LNG Vessels to Dredging Fleet

Van Oord has ordered two trailing suction hopper dredgers with a hopper capacity of 10,500 m³ each. Two fine examples of Van Oord’s sustainability ambitions, because both vessels will be fitted with an LNG installation. Keppel Singmarine Pte Ltd will build the vessels at its yard in Singapore.

3.1.5 Rijkswaterstaat Awarded Van Oord the Contract to Dredge Marker Wadden Channel

Acting also on behalf of the Dutch Nature Preservation Society (Natuurmonumenten), Rijkswaterstaat has awarded Van Oord the contract for dredging an extra channel to the south of Marker Wadden. Dredging the channel will create more space for the underwater capture of silt. It will contribute to restoring the environmental and water quality of the Markermeer and also to the objectives for the FPES (Future-proof Ecological System).

3.1.6 Anaklia Deep Sea Port Marine Works Awarded to Van Oord

Anaklia Development Consortium (ADC) has awarded the early dredging and reclamation works for the Phase 1 Anaklia Deep Sea Port project to Van Oord. The port will be the first deep water port in Georgia.
3.1.7 Deepening and Widening of the Świnoujście-Szczecin Fairway in Poland Awarded to a Consortium Including Van Oord and Dredging International

Van Oord and Dredging International, a DEME Group subsidiary, have been awarded a major contract for the modernisation of the Świnoujście-Szczecin fairway in Poland. The contract covers the deepening and widening of the fairway along a section of approximately 62 km.

3.1.8 Queen Máxima Christens Trailing Suction Hopper Dredger Vox Amalia

Her Majesty Queen Máxima performed the christening ceremony for Van Oord’s trailing suction hopper dredger Vox Amalia in Rotterdam on Friday 14 December in presence of 1,400 employees and guests. This was also the final event in the celebrations marking Van Oord's 150 th anniversary in 2018.

3.2 Offshore Wind

Climate change and the need to reduce CO₂ emissions are drivers for the rising demand of renewable energy sources. With proven experience and an impressive 15-year track record, Van Oord is leading the way in the energy transition towards renewable energy by constructing offshore wind projects. We are the proud builder of the Gemini Offshore Wind Park, one of the largest offshore wind projects in the world. With its 150 wind turbines, it supplies 600 megawatts of renewable energy to 785,000 households.

3.2.1 Specialised Offshore Wind Equipment

Our vessels are solid evidence of our Marine ingenuity. With our specialised offshore wind equipment, we remain competitive in the fast-growing offshore wind market. Van Oord’s offshore installation vessel Aeolus, which we designed in-house, is purpose-built to transport and install foundations and offshore wind turbines. Heavy lift installation vessel Svanen is the largest crane vessel in the world, with a lifting capacity of 8,000 tonnes. The Nexus, Van Oord’s first cable-laying vessel, is equipped with a deck layout that was designed and developed in-house to anticipate of future market requirements for challenging cable installation works.

Like our clients, Van Oord operates according to the highest Quality, Health, Safety and the Environment (QHSE) standards. Our latest safety programme, say YES to safety, reflects our attitude about working safely.

3.2.2 Consortium Excited with Winning Tender for Borssele V

The Two Towers consortium, consisting of Van Oord, Investri Offshore and Green Giraffe, has won the tender for Borssele Wind Farm Site V. MHI Vestas Offshore Wind is the preferred supplier for the wind turbines.
3.2.3 **Blauwwind Consortium Reaches Financial Close on Borssele III/IV**

The Blauwwind Consortium today announced Financial Close on the Borssele III/IV wind farms in the Dutch North Sea. This sets in motion the construction and subsequent operation of 77 V164 9.5 megawatt (MW) turbines produced by MHI Vestas, with a total installed capacity of 731.5 MW, enough to power some 825,000 households*. Total expected production is 3,000 gigawatt hours (GWh) per year. The main construction work is due to start in the fourth quarter of 2019, with commercial production expected in early 2021.

3.2.4 **Van Oord to Install Innovative Suction Bucket Foundations at Deutsche Bucht Offshore Wind Farm**

Financial close has been reached for two pilot wind turbines at the Deutsche Bucht Offshore Wind Farm. The project will test Mono Buckets, a new type of foundation structure, equipped with a 8.4-MW turbine. In addition to its Balance of Plant contract for the wind farm, Van Oord will also be responsible for manufacturing and installing the two additional Mono Bucket foundations.

3.2.5 **Van Oord-Siemens Gamesa Named Preferred Contractor for Fryslân Nearshore Wind Farm**

The consortium of Van Oord and Siemens Gamesa Renewable Energy has been selected by Windpark Fryslân B.V. as the preferred contractor for the construction of the Fryslân nearshore wind farm. The wind farm will contain 89 wind turbines with a capacity of 4.3 MW each in the Frisian section of the IJsselmeer Lake, next to the Afsluitdijk dam, in the Netherlands. With a total rated power output of over 380 MW, it will give a boost to the sustainable supply of energy for the Province of Friesland. Following successful completion, Siemens Gamesa will service the wind farm for at least 16 years.

3.2.6 **After Major Upgrade, Aeolus Starts Work on Belgium’s Largest Offshore Wind Farm**

Starting in 2019, some 400,000 households will be running on green energy supplied by Norther, set to be Belgium’s largest offshore wind farm. Offshore installation vessel Aeolus underwent a major transformation before installing the very first foundation in the seabed this month.

3.2.7 **Van Oord–Hellenic Cables Consortium Assigned to Connect Hollandse Kust (South) Project to Grid**

TenneT has awarded the Van Oord-Hellenic Cables consortium the assignment to supply and install sea and land cables for the Hollandse Kust (South) Alpha project. The 700 MW grid connection will transmit offshore wind energy to electricity users in the Netherlands.
3.2.8 Ørsted Contracts Van Oord for Cable Installation Borssele I & II

Van Oord has been awarded the contract for cable installation works at the Borssele I & II offshore wind farm. The wind farm has a capacity of 752 MW and will be located 23 km off the coast of Zeeland, the Netherlands. Borssele I & II will supply enough renewable energy to meet the needs of approximately one million households each year. Construction of the offshore wind farm is scheduled for 2020.

3.2.9 Oysters and Artificial Reefs for New Nature Development within North Sea Wind Farm

On 5 November 2018 Van Oord installed, in cooperation with the North Sea Foundation, the Natuur & Milieu organisation and Eneco, reef balls and cages containing flat oysters within the Luchterduinen offshore wind farm, 23 kilometres west of the Dutch port city of Ijmuiden. The ‘Rich North Sea’ project will investigate how nature conservation and sustainable energy generation can reinforce one another.

3.2.10 Van Oord Heavy Lift Installation Vessel Svanen Takes on Another Baltic Project

Van Oord has signed a contract with the Swedish energy company Vattenfall for the transport and installation of the foundations for Kriegers Flak wind farm. Van Oord will install the project’s 72 monopiles and transition pieces.

3.3 Offshore Oil and Gas

The growth of the world economy and population is driving the global demand for energy. To meet this demand, Van Oord delivers ground-breaking projects in a challenging offshore market. Our offshore oil and gas activities provide integrated solutions with a focus on the installation, stabilisation, and protection of offshore oil and gas infrastructure. Van Oord has led the market in subsea rock installation for more than thirty years. We have managed to maintain that position by continuously challenging ourselves and improving our expertise.

Van Oord is a niche specialist in two services.

3.3.1 Subsea Rock Installation

We are market leader in the seabed intervention technique Subsea Rock Installation (SRI). Our fleet of flexible fallpipe vessels enables us to stabilise and protect pipelines, cables and other installations.

3.3.2 Offshore Pipeline Installation

We provide integrated solutions for the installation of nearshore pipelines, cables and offshore constructions. With over fifty years of experience in this niche market, Van Oord offers the best specialists on the job.

3.3.3 Van Oord Marks 150th Anniversary with Christening of SRI Vessel ‘Bravenes’

Subsea rock installation (SRI) vessel ‘Bravenes’ on Monday 21 May at the Wilhelminakade in Rotterdam. The vessel was christened by Ms Yvon van Oord-Barbier, the wife of CEO Pieter van Oord. The well-attended christening ceremony marked the start of a two-day event celebrating Van Oord’s 150th anniversary.
3.3.4 Offshore Contract for the West White Rose Project Awarded to Van Oord

Van Oord has been awarded the contract to carry out offshore installation works for the West White Rose Project of the east coast of Newfoundland, Canada. The project will give operator Husky Energy access to resources west of the existing White Rose field.

3.4 Other News

3.4.1 Rijkswaterstaat Awards Afsluitdijk Project to Levvel Consortium

Rijkswaterstaat (part of the Dutch Ministry of Infrastructure and the Environment and responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands) has awarded the Afsluitdijk project to the Levvel consortium. Levvel will be responsible for design, build, finance and 25 years maintenance of the strengthened Afsluitdijk.

3.4.2 Construction of New Highway Awarded to Van Oord Consortium

To improve access to and quality of life in the Rotterdam region, Rijkswaterstaat plans to construct a new motorway. Rijkswaterstaat awarded the A16 Rotterdam motorway project to De Groene Boog consortium, of which Van Oord is part.

3.4.3 Three PortXL Start-Ups are Collaborating with Van Oord

Van Oord is collaborating with three start-ups who have been scouted via innovation platform PortXL. On 14 June, the contracts were signed in the presence of CEO Pieter van Oord. In the search for new cooperative partners, Van Oord focused on two innovation themes: sustainability and digitisation.

3.4.4 Debris Removal Platform by Van Oord wins IADC Safety Award 2018

Van Oord’s Debris Removal Platform – developed in-house – has won the 2018 IADC Safety Award. By changing the existing technique of manually removing debris to an automated system, the risk of personal injury is reduced.

3.4.5 Van Oord Acquires MPI Offshore

Van Oord completed the acquisition of MPI Offshore, a specialist offshore wind installation contractor, from Vroon Group. By acquiring MPI Offshore, Van Oord will further strengthen its global wind organisation and in particular its position in the UK wind market.
3.4.6 Van Oord and Ace Aquatec Making FaunaGuard Available for the Rest of the World

Van Oord and Ace Aquatec have formed a strategic partnership whereby the FaunaGuard will be made available to all marine contractors and other interested parties. The FaunaGuard is an innovative acoustic device to protect marine fauna near marine construction activities.

3.4.7 Van Oord Awarded Royal Designation

His Majesty King Willem Alexander of the Netherlands has conferred the right to use the designation ‘Koninklijk’ (‘Royal’) on Van Oord. Jaap Smit, King’s Commissioner in the Province of Zuid-Holland, presented the certificate to Van Oord’s CEO Pieter van Oord during an international symposium at the Laurenskerk in Rotterdam, where 450 guests had gathered to mark the company’s 150th anniversary.

3.4.8 Scaling Up Great Barrier Reef Coral Restoration

A consortium consisting of Van Oord, Australian research institute CSIRO, and Delft University of Technology have reached a new milestone. They are testing a new method for large-scale coral rehabilitation at the Great Barrier Reef in Australia. Climate change and coral bleaching have resulted in the reef in losing more than half of its coral cover since 1985. The consortium hopes to identify the best method for overcoming a crucial bottleneck in the upscaling of reef rehabilitation.
4 PORT OF ROTTERDAM IN 2018

4.1 Digitisation and the Port of Rotterdam

The government drew up a 'Dutch Digitisation Strategy' for the first time in 2018. The reason for this is that digital technologies play a key role in achieving breakthroughs in social and business issues almost everywhere. The same also applies for the future of the Port of Rotterdam. “We may be the market leader in some sectors and have the best infrastructure in the world, according to the World Economic Forum, but that doesn’t mean we can rest on our laurels”, said Allard Castelein, CEO of the Port of Rotterdam Authority. “This new era will be all about digitisation and energy transition, two developments that are fundamental to our existence.

As a port, we have two options: join in or do nothing and lose our position in the future.” Unprecedented technological developments including in the field of processors, sensors and data communications enable much more information to be collected than before. In addition, existing information can be converted into electronic form. Because all this information is available in binary (countable) form, it can be processed by computers, providing real-time insight into processes. This concerns, for example, the availability of goods and services, price development and location.

4.2 Change of Era

This digital transformation leads to fundamental changes in society. In other words, we are not living in an era of change, but we are living in the change of an era. Digitisation leads to much greater transparency, predictability and efficiency, which, among other things, makes certain links in chains superfluous. In retail, the travel sector and the banking and insurance sector, this is already in full swing. For the port this means that digitisation will be used to further improve the port infrastructure and digital solutions will also be developed to make ports smarter.

4.3 High Potential in Logistics

Even though many initiatives have already started, the impact of digitisation on the logistics sector in the Rotterdam ports is currently still limited. However, there is no doubt that the digital transformation will also lead to a rearrangement of the chains in this sector. Perhaps especially in that sector, since there is an enormous potential for efficiency improvement in logistics. Thirty percent of the cargo is not on time and shippers do not know exactly where their containers and freight are. Sometimes cargo is
even lost. Moreover, in 2019, each shipment in the logistics chain requires around 200 interactions (documents). On average, a shipper has to deal with 28 organisations, varying from terminals and forwarders to shipping companies and customs. For the companies involved, this means there is a potential for huge profits that can be realised with digitisation. This will, of course, be at the expense of various (traditional) links in the logistics chain.

4.4 Rotterdam: 'Taking the Lead'

As one of the leading ports in the world, with the ambition to be the smartest port, Rotterdam is taking the lead in the digital transformation of port and logistics. In addition to its geographical location and available infrastructure, efficiency is the determining factor for the route along which logistics chains develop. To secure employment and prosperity for the future, the Port of Rotterdam Authority embraces digitisation as an opportunity to make logistics chains via Rotterdam more efficient, reliable and therefore more competitive. In addition to being a port city with one of the world's best and most efficient use of physical infrastructure and facilities, Rotterdam will increasingly expand to become a digital platform.

4.5 Cooperation is Crucial

In addition, digitisation is such a sector-wide and innovative process that companies cannot be expected to individually create the necessary fundamental innovation in this area. As an independent authority, the Port Authority gladly takes its responsibility to drive digitisation processes, involve external expertise and forge 'coalitions of the willing'. The fact is, cooperation is crucial. Innovation cannot be forced. However, you can create an environment in which innovation is likely to take place and be in line with the market. This will take place partly by facilitating an extensive innovation ecosystem in Rotterdam in which global players and pioneers, researchers and entrepreneurs are brought together. Leading parties from the port-maritime cluster and logistics, large tech companies, but also knowledge institutes and start-ups will co-create the solutions for tomorrow.

4.6 The Port of Rotterdam is the Breeding Ground

Rotterdam is an excellent breeding ground for this. The scale of the port-industrial complex and the logistics sector, the willingness to invest, the presence of institutes such as Erasmus University, TU Delft, SmartPort and the RDM campus, which ensure a high knowledge level, and the already existing intensive cooperation between companies and organisations, educational institutions and government, make Rotterdam the ideal testing ground for innovations in the field of digitisation.
4.7 Strong Foundation

Obviously, the process of digitisation is not new for the Port of Rotterdam and the Port of Rotterdam Authority. In fact, in recent years a strong foundation has already been built with digital projects, such as the Port Management Information System (HaMIS) and Portbase’s Port Community System. As a result, the Port Authority already possesses an enormous collection of data and digital information, which is used in the ongoing initiatives.

4.8 Internal Core Processes and Logistics Efficiency

Broadly speaking, the digitisation initiatives of the Port of Rotterdam Authority move along two axes. Although the distribution is not entirely black and white, there are, on the one hand, projects in which a better administration and management of the port and port infrastructure are paramount; the internal core processes, as it were. On the other hand, there are processes that mainly require better insight into or better efficiency of logistics processes. In these processes, the added value and competitive position of Rotterdam play a more prominent role. In both areas, the applications developed can lead to international applications, whether or not on a commercial basis. After all, digital services can be used in ports and logistics chains worldwide from the coast to the hinterland. This results in new revenue streams and revenue models for the Port of Rotterdam Authority which are developed and operated under the name PortForward.

4.9 Autonomous Sailing and the ‘Digital Twin’

If we look at the digitisation projects in the field of improved administration and management of the port and port infrastructure then the projects in the area, among others, are relevant. The technology to enable autonomous operation is in full development in the field of aircraft and cars. This will undoubtedly also be the case in the shipping industry in the future. All the afore-mentioned projects therefore also contribute to the ambition of the Port of Rotterdam Authority to make autonomous sailing within the Port of Rotterdam possible by 2030. An essential step in this process is the development of a ‘digital twin’ of the port. This is an exact digital copy, including all infrastructure, ship movements, weather conditions and hydro-information. The first stage in this process started in 2018 with the development of an IoT cloud platform in collaboration with IBM, Esri Cisco and Axians, which collects and provides insight into hydro and meteorological data such as water levels, salinity, wind speed, visibility and flow via sensors. The platform should help the port reduce waiting times and optimise berthing, loading and departure times. The platform allows us, for example, to predict the best time to berth and depart, depending on the water level, while guaranteeing a maximum cargo.
4.10 Competitive Position

Digitisation projects that take the improvement of logistics processes as their starting point are aimed at direct investment in the competitive position of the Port of Rotterdam, and the added value Rotterdam offers its clients. The initiatives that were taken up include:

- **Pronto**: this application allows shipping companies, agents, terminals and other service providers to optimally plan, execute and monitor all activities during a port call based on standardised data exchange. The exchange of planned, expected and realised times leads to shorter port call turnaround times, better terminal utilisation and faster service through better predictability. To remain relevant, Rotterdam chooses to share its own innovative technology, such as Pronto, with competitors. The more parties use smart technology, the more everybody benefits. By now, a number of ports around the world have shown serious interest in Pronto.

- **Navigate**: this route planner offers a total overview of the most efficient deep sea, short sea, rail and inland shipping routes. So, importers and exporters can choose the best transport options for containers they want to ship. Until now, a shipper had to call a number of different carriers or visit their websites and then hope to choose the most efficient route. Navigate brings transparency to a fragmented world of providers. Navigate has also become an export product of the Port of Rotterdam Authority. The more ports use Navigate, the more valuable the application becomes.

- **BlockLab**: this is the joint municipality and Port of Rotterdam Authority field lab that develops concrete applications and solutions based on blockchain technology. One of its uses is achieving a complete, paperless integration of physical, administrative and financial streams within international distribution chains. The transportation, monitoring and financing of freight should be just as easy as ordering a book online. To this end, ABN AMRO, the Port of Rotterdam Authority and Samsung SDS, the logistics and IT arm of Samsung, launched a pilot in 2018.

4.11 Share Knowledge

Digitisation is a significant contemporary trend. All ports and maritime companies are aware of the need for change. The question is: how and where to start? We would like to share our knowledge and experience with others. For example:

- **Whitepaper ‘Step by Step Towards a Digital Port’**: digitising ports and their hinterland is a complex undertaking. We strongly believe in a step-by-step approach. This paper outlines a model for digital maturity that shows how we, as ports need to develop and exchange data in order to keep up with digital developments around us.

- **Whitepaper ‘Data as Fuel for the Digital Port’**: data is the raw material for a digital port. But how do you guarantee the reliability of the data you work with? What is your primary purpose of data sharing? How do you handle it correctly and which other technical, economical and legal aspects play a part? In this paper you can read more about the importance and use of data.

More knowledge about ports and digitisation.
5 TRELLEBORG'S MARINE AND INFRASTRUCTURE OPERATION: 2018 YEAR IN REVIEW

Trelleborg’s marine and infrastructure operation has a longstanding association with PIANC and has for over a decade supported the association’s commitment to driving up standards for fender best practice through its on-going investment into fender performance research and development. Over the course of 2018, Trelleborg has further strengthened its relationship with PIANC on several fronts. As a PIANC Platinum Partner since 2014, Trelleborg places great importance on the role PIANC plays in the industry as a facilitator of shared best practice, knowledge and expertise between stakeholders.

As a Platinum sponsor of PIANC’s 2018 Congress, which took place in Panama City (7-11 May 2018), Tommy Guldhammer-Mikkelsen, Managing Director at Trelleborg's marine and infrastructure operation, Denmark, gave a technical presentation on the subject of Future Ports and Piloting in Panama. While Mishra Kumar, Global Technical Director, took to the stage to discuss the importance of performance verification in marine fenders, and a new test process for ensuring performance verification is carried out effectively and accurately.

In partnership with PIANC, Trelleborg hosted ‘Smarter Approach Technical Seminars’ in both Argentina (October) and Denmark (November). Trelleborg experts were on hand to discuss everything from fender design to quality and specification, the latest in docking and mooring to Trelleborg’s Port of the Future initiative.

Trelleborg is involved in a number of PIANC working groups, including WG 145, which investigates berthing velocities and fender design, and WG 153, which seeks to provide new guidelines for marine oil terminal design. 2018 saw the launch of PIANC’s new MarCom Working Group 211, which will consult with a number of leading fender suppliers and consultants, including Trelleborg, with the objective of updating its 2002 ‘Guidelines for the Design of Fender Systems’ – marking a ‘significant step towards industry-wide fender best practice’. These changes will include updated guidance on the design, manufacture and testing of fender systems, including both the rubber element of the system and associated components. The group will also review guidelines for durability, maintenance and repair of fender systems and the implications of automated mooring systems on fender design.
5.1 Raising the Bar for Marine Fender Best Practice

5.1.1 The Fender Quality Framework

Trelleborg has long invested significant time and resources to arm specifiers with the information they need to take a smarter approach to fender specification, design and manufacturing. In 2018, this saw Trelleborg launch ‘The Fender Quality Framework’, a new online resource hub designed to help port owners, operators, and specifiers take a smarter approach to fender design and selection. The Fender Quality Framework comprises research reports, webinars and more. From design best practice to ingredient selection, manufacturing to performance verification testing, it provides visitors with access to Trelleborg’s near decade of in-depth marine research, which continues to drive up standards for port equipment. The resource will be continuously updated in line with Trelleborg’s ongoing efforts to evolve best practice guidance for fender systems.

5.1.2 Independent Fender Performance Testing

In 2018, Trelleborg has further strengthened its commitment to helping port consultants ensure that the equipment or fender systems their clients specify successfully meets project specifications with extensive research to highlight the importance of independent verification testing. Performance verification testing is usually performed in a large press or test frame with either load cells or pressure transducers. Outside of manufacturers’ facilities, these test frames are extremely rare. As a result, performance testing usually occurs in manufacturers’ own factories, meaning results can be manipulated to suit their aims – similar to the challenges faced in the car industry with environmental emissions.

During testing it is not uncommon for fenders to be specifically selected for the test rather than chosen at random. These fenders will be built to pass performance tests, but when it comes to creating the products that actually go to market, these manufacturers will use low cost, substandard materials in production. Similarly, some unethical manufacturers may also simply manipulate test results before going on to build and sell low quality fenders which aren’t fit for purpose.

The industry’s response to this has been to introduce independent witnessing to verify the authenticity of results. However, the implementation of this process has also been flawed. Common practice in the industry has relied on factory testing with witnessing by either a third party or a consultant. But, there is no easy way for witnesses to verify the results independently of what the manufacturer is reporting. Modern data acquisition methods rely on computers to interpret the data and produce a report. The witness rarely has any understanding of how the data acquisition system functions, making it easy for unscrupulous manufacturers to manipulate the recorded data in the computer without the witness knowing.

The fender industry involves big contracts and vast sums of money and there is too much at stake to allow manufacturers to serve as their own regulators. The industry must move towards true independent testing, rather than just witnessed testing, and the simplest way to get objective, trustworthy results is to conduct tests in an independent laboratory.

The long-term goal for the industry should be, something Trelleborg will highlight as part of PIANC’s new MarCom Working Group 211, for manufacturers to have testing at their own facilities but with independently recorded results. This will remove any uncertainty from results and enable end users to have confidence that the lifecycle and performance of fenders meet specification, and that fenders are therefore fit for purpose.

5.1.3 Ongoing Investment

Trelleborg also continues to invest in and strengthen its facilities in Qingdao, China. With a long-standing commitment to investing in the most advanced best-in-class equipment, the factory, which fully complies
with PIANC guidelines, enables Trelleborg to manufacture its marine fenders in-house. This ensures complete control over all manufacturing and quality control processes, from raw materials through to fully manufactured high performance, advanced fenders.

From full size compression testing of large rubber fenders, to small scale model testing and durability testing, the facility not only has the capability to test for specific project requirements, but its test laboratory is also offered to customers as a service. As a result, potential new customers can send Trelleborg older existing fenders to conduct testing in order to determine if they have useful life remaining.

The result is a marine fender offering that comprises the best design and materials for a low maintenance, long service life whatever the working demands and environmental conditions. The Qingdao facility also houses a dedicated research and development team comprising over 20 engineers, each with a vast history of expertise in polymer technology. This ensures that Trelleborg is able to continue to push the boundaries in fender design and performance.

One recent example is the in-house manufacture of Hydro Pneumatic Fenders. Thanks to the reliability and performance of Trelleborg equipment, a major European port requested Trelleborg to supply the fenders in order to facilitate the safe berthing of the latest submarines.

5.1.4 New Online Tools

2018 has seen the launch of Trelleborg’s new and improved online tools for simplified fender and bollard selection. The updated tools, which have been developed in accordance with PIANC guidelines and British Standards, encompass a number of enhanced features, designed to allow specifiers to select and specify the most appropriate fender for their application.

In addition to an existing vessel berthing Energy Calculator and Fender Selection Tool, the tool’s new capabilities include a fender and bollard specification generator which helps to combat the issue of inadequate specifications, which can result in the specification of equipment which isn’t fit for purpose. This is because the generator enables consultants, in just a few clicks, to create robust specifications that comprise the right materials and the quality control testing required to guarantee that their equipment will perform as required in their intended application.

5.2 Notable Contracts

5.2.1 Marine Fenders

Over the course of 2018, Trelleborg has further strengthened its position as a world leader in the design and manufacture of high performance, advanced marine fender systems with several high-profile contract wins.

This includes the supply of multiple fender systems containing Trelleborg’s Cell Fenders to the dock of a 2,300 acre, multi-million dollar refinery and chemical plant located in Texas along the Houston Ship Channel. With an annual average of more than 2,500 vessels loaded or off-loaded at the site, which represents roughly 100 million barrels of crude oil and products, in terms of volume, the dock is one of the 25 largest ports nationwide. The fenders, which had an interlocking articulated panel arrangement, with integrated pipe mooring bollards, were pre-assembled prior to shipment at Trelleborg’s North American operation.

Trelleborg Super Cone Fenders, complete with frontal panel and accessories, and its Pneumatic Fenders, were supplied to a global leader in the energy infrastructure business for installation at an LNG terminal in Jamaica. The project came as a result of the establishment of LNG as a strategic priority for the country which aims to reduce the cost of energy for households and businesses.

Trelleborg Super Cone Fenders have also been supplied to a major cruise terminal in Singapore as part of an overhaul of its existing fender system in order to accommodate the latest generation of cruise
vessels. To combat the potential for structural damage caused by drilling in the existing fender system’s anchors into the concrete structure, Trelleborg used a customised adaptor plate which enables the utilisation of the existing fender anchors and the successful upgrade to a larger fender. This, coupled with the ease of installation of the Super Cone Fenders, ensured little disruption to berthing cruise vessels at the terminal.

In 2018, Trelleborg also supplied multiple fender panel systems for the fabrication of a multi-million dollar crude oil terminal in Louisiana. Supplied as part of an upgrade of its dock which receives crude oil and condensate from ships and inter-coastal barges, the fender systems’ large dimensional panel packages were transported by water from Trelleborg’s North American manufacturing facility.

5.2.2 Marine Technology

2018 was a successful year for Trelleborg, with a number of contracts secured globally for a variety of solutions within its ever expanding SmartPort enabled product portfolio. For instance, Trelleborg supplied its SmartPort technology to SOHAR Port and Freezone, in Oman - a huge step forward in their ‘Port of the Future’ strategy. Previously, Trelleborg had supplied the port with Quick Release Hooks (QRHs), Docking Aid Systems (DAS), fenders and SafePilot Portable Pilot Units (PPUs). However, while each solution provided a touchpoint for data collection, they were supplied across disparate projects, so were not integrated and were manually managed. With the port determined to take a more holistic approach to operations, Trelleborg’s ability to support smart, connected technologies, ensured an ideal collaboration.

SafePilot from Trelleborg successfully helped to pilot Allseas’ 200-metre long barge, Iron Lady, from the Tees Bay to Able UK’s Seaton Port in Hartlepool which transported Shell’s 24,200-tonnes Brent Delta topside to Able’s facility on 2 May 2017. The Shell-operated Brent field, is located 115 miles east of the Shetland Islands, in 140 metres water depth, and has been in production since 1976. As part of Shell’s complex Brent Decommissioning Project, the Brent Delta topside, was lifted from the concrete legs of the Gravity Base Structure using innovative single lift technology. This was made possible by Allseas’ 382-metre long Pioneering Spirit vessel, marking the world’s heaviest offshore single lift. Pioneering Spirit then transported the Brent Delta topside to Tees Bay where it was transferred to the Iron Lady, before embarking on its journey along the Seaton channel to Able UK’s decommissioning port, where around 98 % of the platform topside will be recycled.

To ensure the safe and efficient piloting of the Iron Lady to Able UK’s Seaton Port, Tees Bay Pilots, the official maritime pilot group for the ports of Tees and Hartlepool, required holistic oversight of the 1,000-metre long Seaton Channel. Trelleborg supplied Tees Bay pilots with a SafePilot PPU, an ‘all-in-one’ unit with built in roll and pitch sensors, and SafePilot CAT II, a precise, reliable tool for navigation and berthing, providing all required navigational data.
Trelleborg’s Answer to The Port of the Future

SmartPort is Trelleborg’s contribution to the question – what will the port of the future look like? It started as a concept some three years ago and has now become a standardised model to collect, store and act upon maritime data. It’s a tech stack with API underpinnings that allow for collaboration with third party systems and data to enable the maritime industry to compete better in the wider shipping sector. It’s a solutions portfolio that takes ‘dumb’ or passive port equipment and turns these assets into active and intelligent ‘digital twins’.

Trelleborg continues to develop this suite of smart products and solutions to an advanced stage, underpinned by cloud and Internet of Things (IoT) technologies, bringing benefits and efficiencies for ports across the globe.

Earlier in the year, Trelleborg strengthened its mooring offering with the launch of AutoMoor, a rope-free, automated mooring system that uses smart technologies to enable a faster berthing process and improve safety levels within the port environment. AutoMoor will be supplied to the Port of Langnas’ international cruise ferry and domestic ro-ro ferry berths. The Port of Langnas is situated in the Baltic Sea on the archipelago of Åland, which has intensive ferry traffic between Sweden and Finland via Åland. Developed following several years of customer consultations and recently successfully trialled at the Port of Melbourne in Australia, AutoMoor uses smart technologies to enable a faster berthing process and improve safety levels within the port environment.

The port’s international cruise ferry berth alone accommodates nearly 3,000 vessel moorings per year. The majority of which are some of the most advanced cruise ferries worldwide with sizes ranging from 34,000 GT to 66,000 GT and between 165 to 230 metres in length. Given what is a significantly high volume for just a single berth, it was vital that both berths in the port were upgraded to ensure they continue to sustain such a high vessel throughput. With that in mind, it was essential that the upgrade saw the adoption of automated mooring systems to facilitate quick, safe and reliable mooring operations. Through the use of AutoMoor at Langnas, ship operators such as Viking Lines, Tallink-Silja and Finnlines, will be able to manage crew rest periods more efficiently while reducing onboard personnel and operating costs.

2018 has also seen the addition of a new SmartPort product line, further strengthening Trelleborg’s mooring offering, with the addition of DynaMoor, which combines the functionality of Trelleborg’s class leading QRH with constant tension capabilities to pay in and out mooring lines, absorbing energy and maintaining a constant tension.

Bolstering its advanced navigation and piloting offering, Trelleborg launched SafeTug, a new software solution that through real-time data sharing, helps tugboat operators and ports to optimise safety and efficiency in their day-to-day operations.
Enhancing collaboration between the tug skipper, bridge team, pilot and port, the SafeTug system uses dynamic data to give tugboat skippers accurate, real-time information on the movement of the ship they are manoeuvring. This includes the ship’s speed and direction, rate of turn, trajectory, heading and course over the ground. The software also shows the position of other tugboats using the system.

Piloting requires the safest, most efficient and reliable technology. It demands exceptional performance, ease of operation and high position accuracy to facilitate optimum approach, berthing and departure.

Utilising the latest technology, SafeTug improves the range and accuracy of navigational measurements, offering true 360° visibility and enhancing situational awareness in real time. This helps the pilot to know exactly where the tugs are located and for the tug master to know exactly what the movement of assisted vessel is, creating a safer and more effective pilotage experience.

SafeTug integrates with SmartPort Cloud, exchanging data to provide an overview of port and piloting operations. It features over-the-air (OTA) differential corrections, real-time traffic overview, live positioning data with predicted paths, data recording, storage and more. Furthermore, the on-shore crew can monitor the whole operation as it happens and by playback for investigation.

Trelleborg has recently launched SafePilot CAT MAX, the latest addition to its SafePilot range, which utilises state-of-the-art software and smart technology to help pilots and ports optimise safety and efficiency in their day-to-day operations. Replacing its SafePilot CAT III, developed for high positioning accuracy required applications, Trelleborg’s new SafePilot CAT MAX has been specifically designed for use in even more demanding applications including as the piloting of ultra large container vessels and LNG ships in confined waters and offshore operations.

The dual antenna solution, which consists of heading and positioning units that can communicate with each other and the pilot’s display via Wi-Fi, boasts an integrated six-axis gyro/motion sensor, offering precise and independent rate of turn, roll, and pitch. This, coupled with the capability of charging wirelessly, makes the SafePilot CAT MAX the ideal solution for operations where accurate under keel clearance is critical.

**5.3 2019 and Beyond**

2018 has proved yet another extremely exciting and successful year for Trelleborg. With PIANC continuing to set best practice guidance for the industry, Trelleborg looks forward to continuing its support of this important organisation throughout 2019 and beyond, as well as further building out its SmartPort platform in support of ports and terminals in their drive towards the Port of the Future vision.
SHIBATAFENDERTEAM: SETTING STANDARDS AROUND THE WORLD IN 2018

Engineering top quality marine fenders has been the objective of our expertise and know-how of our group for more than 50 years. As one of the leading designers and manufacturers of world-class fender systems, our true ambition in the course of all these years has maintained to accomplish a perfect combination of the highest level of technical expertise and thus providing highly customised fender solutions. We are dedicated to support our clients and business partners as world-class fender experts.

However, our dedication goes far beyond designing and manufacturing first-class rubber fender systems. As a company that is integrated in influential international associations, we always do our best to foster potential progress. We acknowledge the responsibility that comes with our role as a PIANC Platinum Partner in terms of improving industry standards and recommendations. Many of our achievements in 2018 took place under the banner of promoting scientific research – including the first part of our ShibataFenderTeam White Paper Series that contributes to clearing up any misunderstandings concerning the chemical composition of rubber fenders.

We are more than happy to look back at an exceptional business year of innovation, breaking records and unconditional commitment to our core values such as engineering excellence, value engineering and passionate dedication to first class fender solutions.

6.1 RUBBER COMPOUNDING. A WINDING ROAD

Safety, reliability, durability – the performance requirements of a marine fender boil down to these three aspects, which have represented the heart and soul of our group for half of a century. In order to guarantee the highest performance standards and state of the art fender engineering, one of our main focuses is the customisation of every individual fender project. Each project has unique requirements that necessitate customised rubber compositions.

The international guidelines for the physical properties of rubber fenders such as PIANC2002 and ASTM D2000 are merely a directive towards the quality of a fender. There is no international specification on the chemical composition of rubber fenders to determine how to reach the qualities a fender should have.

We stick to our engineering excellence at any point in our projects – especially when it comes to the most sensitive part in fender manufacturing which consists in developing the compounding recipe including the scientific research on rubber compounds as the premise to deliver outstanding quality to our clients worldwide.

For this purpose, we have published the first part of our STF White Paper Series that covers the correlation between the performance properties of a superior fender and its constituent components. It goes into detail on the raw materials, providing an unbiased view on the correlation of the chemical composition of a rubber fender and its physical properties, especially when it comes to the ratios of fillers and reinforcement agents.

The upcoming second part of the White Paper Series will focus on the next step of the fender production, the mixing process. It will discuss the equipment as well as different processes and their impact on the compound quality, as mixing is a pivotal part of the fender production.
6.2 Global Breakthrough

In 2017 we announced the expansion of our production capacities with the opening of a new factory in Klang, Malaysia. In August 2018, we celebrated the inauguration of the cutting-edge Malaysian-based rubber compound mixing plant with an investment worth about US$ 7 Million in predominantly Japanese rubber mixing equipment. The strong increase in demand for our world-class rubber fenders made this far reaching investment decision possible and strengthens our international position as a leading fender manufacturer.

The factory building is a new three-story complex which hosts the mixing facilities, office space, a thermal insulation room, and additional fender production facilities. ShibataFenderTeam will be the first fender manufacturer to use the latest-generation compound mixers and associated technology.

6.3 On the Spot

Since 2013, the Steel, HD-PE and Foam Fender production facility of ShibataFenderTeam had been fully owned by SFT Group. In 2018, ShibataFenderTeam AG has merged the daughter company into the legal entity of the AG. Together with our long-standing colleagues and their valuable experience, the production plant will continue its strong performance.

The aim of the merger was to streamline the organization with regards to the complexity within the SFT Group and to offer higher flexibility for our clients. Thanks to our ongoing investments in state-of-the-art production facilities such as the new factory in Malaysia, we are perfectly prepared for future challenges.

6.4 Research and Progress

PIANC’s ‘Guidelines for the Design of Fender Systems’ have been a well-established reference for the entire marine industry for decades. The new MarCom Working Group (WG) 211, consisting of members of the industry, including leading fender manufacturers, focuses on needed updates of the guideline to meet latest requirements set by stakeholders, and to ensure an approach to fender testing and design that leaves no room for interpretation. Content matters include changes in vessel designs and hull pressure requirements, advances in design methods of fender systems, and important research of fender manufacturers.

We at ShibataFenderTeam are happy to fully support the goals of the new Working Group with our own research on rubber fender compounding. We are proud to be a member and contribute our expertise to the group, continuing the long-term cooperation between PIANC and the SFT Group. With our holistic approach to bridging the gap between science and art, as well as our proven track record and engineering excellence, we are looking forward to the fruitful exchange with all WG members. We trust that the outcome will reflect changing needs of the industry, further enhance fender design guidelines to always ensure port safety. PIANC as an independent body is the driving force, ensuring that its Working Groups act in line with the industry’s common goal: providing safe work environments and efficient operational conditions in ports and harbours.
6.5 Up-and-Coming: PIANC’s Young Professionals

As one of the world's leading fender specialists, we consider it our responsibility to do our part for the industry by sharing our know-how with engineers and end users alike. In October, we supported PIANC YPs from Argentina and Spain. Argentina’s YPs started off for an excursion to Puerto Madryn. The 2-day excursion was supported by the SFT Group and accompanied by our local partner. 50 participants enjoyed a diversified program where site visits alternated with educating presentations. A similar networking event was organized in Seville, Spain where more than 40 enthusiastic participants provided for an inspiring networking conversation.

In the spirit of our role as PIANC Platinum Partner we are glad about the opportunity to support young successful engineers with great potential.

6.6 Corporate Commitment

In the review of a successful 2018, we are further establishing our connections to important associations. Since the beginning of 2019, ShibataFenderTeam Spain, our Spanish branch, is a Corporate Member of the Spanish Section of PIANC, the 'Asociación Técnica de Puertos y Costas' (ATPYC). ATPYC was founded in 1998 and is one of the many National Sections of PIANC.

ATPYC has a very active and engaged community of members and as a Corporate Member, we become part of a well-connected association and will be able to further expand our connections to the national port association including main port authorities, contractors and engineers. Our sales engineers in Spain are members of the Spanish Working Group for fender design which we support with our expertise and experience. Our strong position on the Spanish market leaves us with a fantastic outlook into the new year’s operations.

6.7 Innovation First

Since our ultimate objective is to tailor every component to the needs of our clients, we are aware of the uniqueness of each project that requires engineering excellence. Calculating the berthing energy of vessels is the first and most important step in the fender design process. If something goes wrong here, the entire waterfront design could be at risk.

As part of the wide range of services, ShibataFenderTeam provides a new Berthing Energy Calculation Tool to support our clients during the berthing energy calculation process.

Our tool considers all relevant parameters such as ship type, berthing mode or point of contact from bow, amongst others, and also offers the option to choose among different design methods, addressing the particulars of your project or region.

The list of suitable fender units based on the calculated energy is long, but typically there are only a few types and combinations that would work properly for a specific project, and therefore it is essential to
work together with an experienced fender manufacturer when it comes to choosing the proper fender type and size. Our experts analyse every condition in detail to design the most suitable fender system. Our experienced and highly skilled colleagues all around the globe are value engineers, in a sense, creating outstanding solutions that are ideal for our clients’ requirements and on-site conditions.

6.8 Our Projects

We are looking back on a very eventful and productive 2018. We have exceeded 5,000 orders and 100,000 installed fenders by now, which reflects our absolute dedication to engaging globally in the field of fender design and production. We would like to take the opportunity to present some examples of last year’s projects:

6.8.1 Panama International Terminal, Panama

ShibataFenderTeam played an important role in the transformation of PSA Panama International Terminal into a 2 million TEU facility. The new PSA Terminal is located at the Pacific entrance of the Panama Canal, well positioned as a strategic hub.

ShibataFenderTeam delivered 55 SPC 1,400 Cone Fender systems and 54 Bollards of different types. The high-quality fender systems will enable container vessels to berth safely at the new 750 m berth. The port is located in a highly corrosive environment, therefore special requirements regarding corrosion protection applied to the project. Most of the hardware was delivered in stainless steel. The panels were equipped with sacrificial anodes.

The new terminal enables Panama to handle additional container volume and demonstrate the country’s ambition to position itself as the logistics hub in the Americas. The project is closely tied to the enlarging of the Panama Canal.

6.8.2 Port of Málaga, Spain

Our new office in Spain is not even a year old and we already celebrated two successfully completed installations in 2018 – the Cylindrical Fenders for the Port of Málaga is one of them. The very first order for the Spanish office did not only include the production and the delivery of the new fenders, but also the installation at site. The Quay ‘Muelle 2’ is essential for the Port of Málaga, as it is used by cruise ships, a very important business for the fifth largest cruise port in Spain with about 300 calls in 2017. The project was completed in record time – the installation took place within only two days which ensured a smooth and successful procedure for all the scheduled cruise arrivals.

The Port Authority of Málaga relied on us and has been very satisfied with our high-quality products and especially with our ongoing design and engineering support for their fender equipment, as well as with the performance of the fender installation.

6.8.3 Nesserlander Schleuse Emden, Germany

The 129-year old Nesserlander Schleuse is a lock located in Emden, Northern Germany. The lock is vital for the area because barges and recreational vessels use it to enter the port of Emden.

The reconstruction work started in 2006 by a joint venture of several companies. In order to ensure a safe entry for vessels to the lock, Donut Fenders were chosen. Donut Fenders are self-adjusting to changing water levels, the installation costs are low, and they are generally maintenance free. With a size of 3,300 mm diameter and 4,500 mm length these Donut Fenders are the largest that were produced in our production facility in Rechlin, Germany yet. After the reconstruction the lock has a length...
of 170 m, it is 18-metre wide and the depth is minus 7 under sea level. Emden Port can now finally use its main transport artery again.

In light of these outstanding worldwide projects, we continue to look forward to future ventures to further strengthen our role as one of the leading fender manufacturers in the industry. Our strong commitment to research, education and engineering excellence encourage us at ShibataFenderTeam to take on all the new challenges of 2019.
7.1 Creating New and Sustainable Horizons

Boskalis is a leading dredging and marine expert. In addition to our traditional dredging activities we offer a broad range of maritime services for the offshore energy sector. We also provide towage services as well as emergency response and salvage-related services.

As a partner we are able to realise complex infrastructural works for our clients within the chain of design, project management and execution on time, safely and within budget, even at vulnerable or remote locations around the world. We strive for sustainable design and realisation of our solutions.

Demand for our services is driven by growth in global trade, growing energy consumption, growth in world population and climate change. We operate worldwide but concentrate on regions that have the highest growth expectations. This spread gives us both a solid foundation and the flexibility to be able to secure a wide range of projects, as well as providing good prospects for balanced and sustained growth.

Our principal strategic objective is aimed at a healthy balance between long-term profitability and our social and environmental responsibility.

7.2 The Infrastructure We Build Today Will Shape Tomorrow’s World

Infrastructure – ports, waterways, airports, roads and bridges – drives economic development. It enables job creation and facilitates services, trade and availability of goods. On a planet stressed by population growth, climate change and energy transition, infrastructure needs to be sustainable.

Sustainable infrastructure not only enables economic growth, it also enhances our quality of life, helps protect our vital natural resources and environment and promotes a more effective and efficient use of financial resources. To facilitate economic growth in the coming years, the expanding complexity of project development processes with sustainable functioning of ecosystems and societal demands and expectations need to be well-balanced.

Our ability to offer flexible and adaptable sustainable solutions is essential to our business and can create both environmental as well as economic value.

Beneficial re-use of material is an important part of the development and construction of sustainable infrastructure as it creates ecological and economic benefits, whilst improving the project environment.

In the case of the Markermeer lake in the Netherlands, a series of islands were constructed using fine sediments from the bottom of the lake in an effort to reduce turbidity, improve the light climate and the
ecological value of the entire lake system and subsequently the (touristic) value of the lake. The islands are designed to be an ideal habitat for birds because of the shelter and the typical vegetation, such as reed.

The main challenges to overcome in the design and construction works were how to:

- create the islands with mud and silt in an economical way
- ensure ideal elevations and gradients were created for vegetation growth
- promote the biodiversity on the islands
- enable the catching of fines with which islands could be created improving the water quality even more

7.3 Ensuring Ecological and Economic Interests Work Together

The Building with Nature philosophy was launched in 2008 as a design philosophy for the development of marine infrastructure solutions that utilise and, at the same time, enhance the natural system in such a way that ecological and economic interests reinforce each other. The programme, of which Boskalis was an initiator, is executed by the EcoShape Foundation (www.ecoshape.org). Partners in the Building with Nature programme represent academia, research institutes, consultancies, NGOs and public authorities.

The Marker Wadden Project in The Netherlands shows that fine clay can be reused as environmentally and economically valuable building material. As the project nears completion and nature will take over, the Marker Wadden will develop into a unique ecosystem in which biodiversity is enhanced, water quality is improved and more opportunities for recreation are created.

The mangrove restoration project in Central Java aims to build a stable, sustainable mangrove coastline that can adapt to rising sea levels while at the same time enabling economic growth. Natural materials are adaptive – sand to wave impacts and mangrove capture sediment – thereby offering natural barriers to rising sea levels.
Building with Nature offers independent know-how and effective solutions to clients, public authorities and other stakeholders. It empowers these parties to make informed decisions upfront about integrating marine infrastructures with nature and society, thereby creating sustainable maritime solutions.

We share our broadly acquired knowledge and experience with our sector, including universities and knowledge institutes. In this way, we ensure that know-how is available to the engineers of the future.

Building with Nature applies the basic principles of the circular economy by substituting materials such as concrete, basalt and rock with natural, renewable materials.

A Building with Nature pilot project currently under execution in Indonesia proves how a sustainable mangrove development concept can be an economic and effective alternative to traditional (rock/concrete) coastal protection. The chosen mangrove concept is a combination of ecological- and hydraulic engineering based on a solid stakeholder involvement whereby the interest and economic wellbeing of the local community forms an integral part of the overall approach and physical solution.

7.4 Restoring Marine Ecology while Executing Coastal Protection Works

Coral reefs are a vital source of life for a range of ecosystems and, at the same time, provide an initial line of coastal defence by dissipating incoming wave energy. About a quarter of the marine life on our planet depends on these calcium carbonate structures which have to deal with the impact of global warming, coastal urban and industrial development, tourism and seawater pollution.

The idea of executing coastal construction works, while at the same time contributing to reef restoration through application of new techniques and ecological processes, is what triggered Boskalis to manufacture artificial reefs based on a site-specific design. Where a damaged reef may take years up to decades to recover under natural circumstances, human support in this recovery process can substantially reduce this timeframe. Manufacturing an artificial reef to substitute degraded reefs in the right way is difficult since reefs are complex 3-dimensional systems in which chemical, ecological and physical parameters are delicately balanced.

In consultation with material- and 3-D printing experts, as well as specialists from the Dutch universities of Delft and Eindhoven, a large scale 3-D printer was installed by Boskalis on its campus in Papendrecht to reproduce two 2 x 1.5 m reef structures based on a situation specific, tailor-made ecological design consisting of outer and inner structures reflecting the flora and fauna present in the marina area where the reef would be deployed. The 3-D printing technology enabled that a distinctive habitat enrichment solution could be shaped that met the site specific physical and ecological conditions.

In collaboration with the Prince Albert II Foundation and the Monaco Association for Nature Protection, a pilot is being carried out for which we successfully installed six full-scale 3-D printed artificial reef units in the Larvotto Reserve in November 2017.

A dedicated team of scientists is monitoring the ecological development of the reefs to be able to compare them with other artificial and natural reefs in the reserve. The outcome provides Boskalis with expertise to contribute to the improvement of local marine life where possible. In addition, monitoring of the placement methods and strengths of the structures will provide information with regards to installing such reefs in areas where, in addition to the creation of added value for nature, recreation and economy (fisheries, tourism), they can benefit navigation (currents), port infrastructure and/or coastal protection (wave dissipation).

Each Monaco reef module takes 13 hours to print and is approximately 2 metres in diameter and 1 metre high, weighing 2.5 tonnes when dry. These reefs are the largest 3-D printed reef modules to date produced for marine installation.
7.5 Using Sand as a Breakwater for Sustainable Port Development

The Nigerian business conglomerate Dangote selected Lekki as the location for a fertilizer factory and the establishment of the largest oil refinery on the African continent. This required the construction of a complete new temporary port area and breakwater for the transport of factory modules.

The sea port of Lekki is located in an environment dealing with high energy hydrodynamic conditions. To protect the new port area from the swell of the Atlantic and the high waves that threaten the Nigerian coastline every year between mid-March and November, an approximately 700 metres long, curved breakwater was planned to be constructed.

Traditionally, sea defences tend to be hard structures focusing on coastal safety and can, to a limited extent, deal with changing boundary conditions. To facilitate an improved transition between land and water, adding value or even realising habitat restoration while safety requirements are ensured, an alternative approach was developed.

By applying soft outer contours made of sand (readily available), the transition between land and water can be improved. A design was made based on knowledge gained from the modelling and monitoring of the Building with Nature sand engine concept in the Netherlands and aimed at using the natural longshore sediment transport. In addition, the design considered that the protection would be temporary and needed to be removed once the port was not needed anymore.

Instead of using two million tons of large rock (not available in the area), with major logistical challenges as a result, Boskalis built a breakwater mainly from sand, protected by approximately 250,000 tonnes of rock. For the final strengthening of the breakwater (last volume of sand), the natural sand transport flow along the coast was used. A cost-effective alternative solution with added value for the project.

7.6 Using Biofuel as a Sustainable Way to Reduce CO₂ Footprint

In addition to a sustainable infrastructure design and construction focus, Boskalis aims to reduce its CO₂ footprint. This is done by measuring, monitoring and managing the CO₂ emissions of the fleet, equipment and buildings. By operating more efficiently, thereby consuming less fuel and causing less emissions, or by choosing alternative fuels, value can be created.

Using biofuel during marine and civil infrastructure construction projects, is one aspect of the ‘Boskalis on Bio’ programme for which a long-term partnership was signed with biofuel supplier GoodFuels. The program is aimed at achieving a 35-% reduction in the CO₂ emitted by the Boskalis fleet and equipment in the Netherlands in the next five years. An important part of the partnership with GoodFuels is that its biofuels are made of pure sustainable residual flows that do not compete with the food chain or result in deforestation of rainforests. The programme takes place under the supervision of an independent sustainability board consisting of leading NGOs and academics.
Sustainable biofuels have a number of major advantages for vessels. They have a high energy density, are easy to store and transport, and have ease-of-use in conventional diesel motors. Moreover, it is possible to blend them with fossil fuels. Because the existing fuel provision infrastructure can be used for biofuels, the introduction of such fuels is relatively easy to carry out.

Due to the pilot projects carried out in cross-sectoral collaboration with GoodFuels, Boskalis is currently frontrunner in the area of sustainable marine biofuels. However, the success of the large-scale implementation of these sustainable solutions largely depends on the willingness of clients to invest in projects allowing for low-emission alternatives. In the meantime, Boskalis has – where possible – made biofuel the fuel of choice in projects in the Dutch market.

Boskalis is currently using a biofuel blend of up to 30 % on the Borssele offshore windfarm project in the Netherlands resulting in a more sustainable realisation of this renewable energy project. After only a few weeks on the job, our Trailing Suction Hopper Dredger ‘Prins der Nederlanden’ has already shown substantial CO₂ reduction levels.

LET’S TALK!

Boskalis operates in 90 countries, across six continents. We have an extensive network of offices worldwide and are available to discuss sustainable initiatives, projects and opportunities with you. Visit our website www.boskalis.com for more information.
8 HIRA INDUSTRIES LLC in 2018

History Fact: Since 1980, Hira Group is into the Manufacturing Products for the Building and Construction Industry.

Hira Industries was founded in 1980, by Ramesh Hira an engineer that migrated to Dubai from Mumbai. Ramesh moved to Dubai in 1975 and after just a few years of working in Dubai he realised the entrepreneurship opportunities in the building and construction supply chain industry in the UAE. By 1980 as a start up from a small office in Sharjah was the beginning of Hira industries, which started its operations as an agency rep to a few brands in the HVACR industry. Over the past 4 decades of growth with the UAE, the company has been able to expand into multiple manufacturing platforms in the building and construction space.

Our strategic objectives are to manufacture niche products in the building and construction space, where we strive to grow and maintain as the top vendor to our clients in the product lines we manufacture.

Hira Group exemplifies the success of a true enterprise starting from the visionary acumen to breaking newer grounds and excelling at every given instance, from the project conception to execution, and proven time and again.

Committed to world-class quality and manufacturing.

8.1 Message from Hira Management

“At Hira we provide our customers with the most innovative and flexible solutions for their needs in the building and construction industry.

Our employees have the right experience in their field to service our customers in each and every product line. We always believe in exceeding every customer’s expectation by providing the best service within our industry.

We have invested in some of the best technologies in production for our Rubber and all of our products to provide our customers with the highest quality products in our industry.”

8.2 Mission

Hira Industries is dedicated to provide customers in the Construction Sector with products of the highest quality, by developing a successful partnership with them, exceeding their expectations and gaining their trust through outstanding performance by every member of our team. We provide work environments where our employees can meet their potential and thrive in an atmosphere of professionalism. Our aim is to become the ‘Employer of Choice’ within the Building Supply Industry.

8.3 Vision

Hira Industries’ aim is to provide value added products and services in the niche building products industry. We aim to be the market leaders in the segments and the regions we choose to compete in.

8.4 Rubtech® is the Manufacturing Division of the Hira Industries LLC.

Rubtech®, which was established in 2003, with the state-of-the-art rubber plant in its range to cater to the markets demand for molded and extruded rubber products that includes Rubber Speed Humps, Rubber Wheel Stoppers, Wall Guards, Corner Guards, Rubber Profiles, Custom Extruded and Moulded Products and Marine Fender Systems. Rubtech® brand of rubber products are made to the customer’s specification for the industrial, marine and construction industries.
Our production unit houses a full-fledged modern laboratory with latest state-of-the-art equipment’s and gadgets that facilitates our design and engineering team to:

- create a product from general specifications
- formulate a custom compound to fit specific applications
- conduct extensive product testing to meet set standards

Our designing and engineering team specialises in:

- developing new products or modifying current designs
- product development, testing and prototyping
- designing tool, die and mould
- Computer Aided Designing (CAD)

8.5 Year 2018 Activities in Brief

The year 2018 was a good year for Rubtech®, we had awarded and completed various projects in the region included but not limited to Dubai, Abu Dhabi, Saudi Arabia, Oman and Kuwait.

8.5.1 Rubtech® Fender Systems High Quality Standards

We are committed to delivering to our clients the highest quality products, services and supply chain solutions in the industry. Our world class quality system is backed by a team with decades of rubber manufacturing quality experience driving continuous improvement into all we do for you.

Quality of Rubber Fenders can never be assessed by visual inspection, we provide our client with transparent material test and performance test.

Beyond normal tests we provided our clients with Fatigue tests, recently we are executing a big project in Kuwait in which our client has witnessed a 5,000 cyclic test to insure the quality of our product, we also do the same practice for all of our products to insure the design life.

8.5.2 Rubtech® Coloured NON Marking Rubber Fenders for Luxury Marinas

As the increasing demand of coloured products by customers is a current trend of the industry. It is been extreme challenge to develop coloured rubber products particularly for outdoor applications, here we would like to share the experience about the development of coloured fenders in a brief manner.

The extreme challenge is to formulate a rubber compound for coloured fenders to prevent UV degradation, as we could not able to use carbon black as a reinforcement, which is naturally UV resistant material, hence there is a need of alternate white fillers, which does not have much resistant against UV like carbon black.

Titanium dioxide are used to light coloured compounds as a UV screen, & commercially available HAS (Hindered Amine Stabilisers) & UV absorbers are being deployed to prevent the UV degradation.

UV absorber acts as a scavenger to deactivate the radicals forming during UV attack, which causes the degradation and thus the degradation due to UV radiation is prevented.

We will be sharing a full report with PIANC so that it may be of help to the industry.
8.6 Our Partnership with PIANC

Since we are committed to improve our product quality to cope with new technologies and high-quality standards of rubber fender manufacturing, we joined PIANC in 2016 and we will be actively participating with PIANC by sharing our experience and knowledge in Rubber Fender Manufacturing Journey.

8.7 Some of our Completed Projects in 2018

1 Marsa Al Seef New Marina, Dubai, UAE
2 Marsa Al Seef Heritage Area, Dubai, UAE
3 Marasi Business Bay, Dubai UAE
4 Port Rashid Meaga Yachts Marine, Dubai, UAE
5 Al Khobar Fishery Harbour, Saudi Arabia

6 Jeddah Corniche Development, Jeddah, Saudi Arabia

8.8 Hira World Map

Moustafa Said
Product Manager – Rubtech Fender Systems

+971529768341
M.said@rhira.com
www.rhira.com