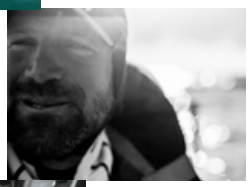
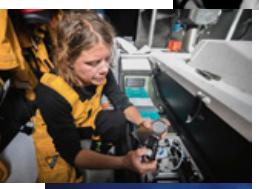
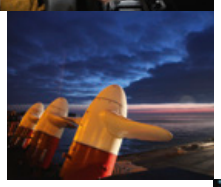
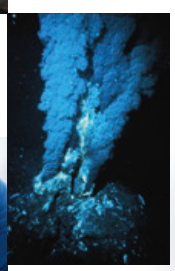
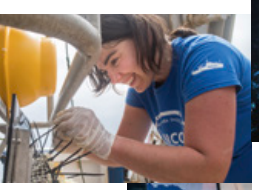
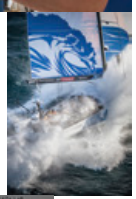
Ocean summit: Future of the Ocean

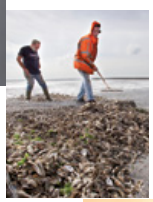
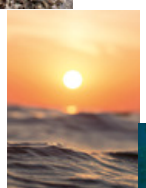
TOPSECTOR WATER & MARITIEM

Science programme // NICO-expedition // International enterprising // Blue Economy // Plastic-Circular Economy // Blue Sea Thinking // Sharing science and solutions // Blue revolution // Renewable energy and floating structures // Path to zero emission shipping

Content




Dear reader,

On 23 June 2018, the Volvo Ocean Race finished on my doorstep in Scheveningen, The Hague. I had been actively involved with one of the Dutch teams since well before the start of the race in Alicante in October 2017. The race is over but the knowledge and experiences that we gained from it remain with us.

Race This round-the-world race is an amazing event but it's also one of the toughest and most challenging around. The very first race started from Plymouth, England, in 1971. Initially, the race was designed to improve team spirit in its Royal Navy. Nowadays, it is hailed as the toughest and longest team challenge for sailors in the world. The Netherlands has had a team in the race since the second race, which went by the name of Whitbread Around the World Race at that time. Dutch skipper Conny van Rietschoten was the only person to win the race twice with his yacht Flyer. A sextant was still used on deck for navigation back then, whereas technology nowadays has a huge impact on the result.

Sports as a tool Linking sport to sustainability programmes as well as applied and academic research appears to be effective. The Dutch Applied Research Institutes (TO2) MARIN and Deltares, engaged in maritime and water research respectively, actively helped the sailors with computer models and data. MARIN's boat modelling research received less attention in the press than Deltares' currents models due to the decisive impact that the latter had on breaking the 24-hour record in the Volvo Ocean Race, which had stood for 10 years. Simeon Tienpont's team achieved this record through teamwork, MARIN's data analyses and Deltares' accurate currents predictions. While this team was visible to other teams, there was a significant difference in speed because Tienpont and his crew had the knowledge required to make more accurate and effective use of the Gulf Stream in the North Atlantic Ocean.
As the sailors were also challenged on all fronts, medical science can gather a wealth of data in such extreme conditions. During the race, data on temperature, salinity and pollution were collected from the boats among other things. This information was fed back to the researchers during the stopovers, so models could be improved and applied in ocean and climate research. That way, the sailors also contributed in turn to the sustainability programmes.

Award The Volvo Ocean Race organisation took the opportunity to raise awareness globally of the pollution in our oceans. At the prestigious global Beyond Sport Awards in New York, the programme won The Best Corporate Campaign or Initiative in Sport for Good category. The judges commended the programme for its "fantastic use of a global platform to spread an important message around the danger of plastic pollution". They also commended the campaign for encouraging young people to become climate activists and using robust scientific research.

Breakthru Sustainability Programme Leader Anne-Cecile Turner said: "We set out with the ambition to engender positive behaviour change to tackle the plastic crisis affecting our oceans. As a global sporting event we have minimised our own footprint and educated and empowered the millions of people the race touched. By working with a range of supportive and inspirational partners we were able to realise our ambitions."

Summit Seven Ocean Summits were organised to offer a range of key stakeholders, a global platform to present a range of innovative, scalable solutions to help solve the plastic crisis affecting our seas. We as Top Sector Water & Maritime, together with a number of different partners, were proud to organise the final two-day event Ocean Summit - Future of our Ocean in "The Hague - the ultimate destination" talking about plastic and more.

Energy This one-off magazine, which is the written version of this event, reflects the knowledge sharing, networking and energy of the two-day summit which was held in the Zuiderstrand Theater in The Hague. A princess, an astronaut and a team of elite yachtsmen took to the podium. Speakers such as HRH Princess Laurentien and astronaut André Kuipers shared the podium with plastic soup discoverer Charles Moore, Minister of Infrastructure and Water Management Cora van Nieuwenhuizen and EU Commissioner Karmenu Vella. Private sector speakers included CEO Thierry Vanlancker from the multinational AkzoNobel as well as start-up clean-tech companies Zyba and The Great Bubble Barrier. Blue economy, sharing data, the science programme, zero-emission shipping, renewable energy and plastic-free shopping are just some of the topics discussed in the nine themed workshops where speakers communicated their vision and demonstrated their expertise.

United The diversity, commitment and enthusiasm of speakers, visitors and organisation ensured that the event was a success. It paves the way for new initiatives as a starting point for further expansion of our capacity, while conserving and managing nature. Because of its commitment to the Dutch Diamond approach (public-private partnerships between the government, research institutions, the private sector and NGOs), the Netherlands currently holds third place in the Global Innovation Index. Let us now apply this successful formula to the problems of our oceans as well. As oceans are unique places on earth, we must treat them with care. ≈

I hope that this magazine will be enjoyable, amazing and inspiring for you to read!

Hans Huis in 't Veld

Sailing Ocean Science

On 1 April 2021, the Nobel Prize for Oceans was awarded to Sailing Ocean Science, an international organisation working to promote cooperation between competitive sailors and scientists.

The news was recently announced by the Nobel Committee in Oslo. The Sailing Ocean Science (SOS) initiative was launched in 2018 following the two-day oceans summit in The Hague. The event – themed "the future of our oceans" – had been co-organised by Volvo Ocean Race and the Top Sector Water & Maritime.

Post-summit, all participating organisations established a coalition aimed at securing the future of our oceans through sustainable use. SOS is receiving the Nobel Prize for Oceans in recognition of its solution-oriented approach and efforts to organise concrete partnerships between researchers and competitive sailors.

Threats As the Nobel Committee has emphasised, the oceans offer potential solutions to some of today's greatest social problems, such as the growing demand for natural resources (such as food, raw materials and energy) and our efforts to adapt to the effects of climate change. In this context, the committee

refers to *An Ocean Full of Opportunities, Visions of the Future of the Oceans* (Netherlands Study Centre for Technology Trends, 2016).
The Committee also pinpoints the greatest threats to this sensible use of our oceans. A spokesperson: "What with warming, acidification, pollution, habitat degradation and over-exploitation, it remains to be seen whether we will still be able make use of our oceans in the future.
SOS aims to communicate the importance of clean and healthy oceans to a broad audience. It will do so by linking a scientific research programme to an international boat race, along the same lines as the Volvo Ocean Race.

Top Sector Top Sector Water & Maritime, a co-founder of Sailing Ocean Science, is glad to see SOS receive the Nobel Prize for Oceans. Chairman Hans Huis in 't Veld: "Knowledge development can help us turn the tide. However, we will have to turn these threats to our oceans into challenges or opportunities."
Huis in 't Veld has been pushing this message for some time now. The issue of innovation was also *key* during the 2018 Oceans Summit. The concept for the Dutch *Pelagia II* research vessel is rumoured to have been developed at the event. The high-tech, zero-emission boat was then quickly built and presented as a global first in December of 2020.
Financial institutions supported the initiative from the outset. According to a blue investor, "The idea of a zero-emission boat seemed like a logical step after previous collaborations between Team AkzoNobel, the MARIN and Deltares knowledge institutions. The collaboration generated new knowledge that can also be applied in other arenas. We then helped the partners capitalise on those opportunities."

Interrelationships The Sailing Ocean Science campaign closely mirrors the themes of the 2018 Oceans Summit, which saw politicians, competitive sailors, scientists, entrepreneurs and policy-makers share the stage.

Participants discussed issues such as the blue economy (investing in blue innovations) and blue sea thinking. The latter concerns efforts to restore and work together with nature. Examples include coastal reinforcement using sand engines, or the construction of new coral reefs.
Various speakers also addressed the issue of renewable energy in the context of floating structures, and the notion of sharing science and solutions. Examples include *the VOR science programme* and the studies facilitated by the *NICO expedition*.
This broad approach proved popular: organisations from various sectors sought each other out in an effort to generate mutual added value. This helped build a bridge between the world of professional ocean racing and the marine and maritime knowledge sector.

Cash prize As the Nobel Committee acknowledges, this solution-oriented approach and cross-border collaboration will be crucial in stemming the negative trends currently affecting our oceans, and in ensuring that the social benefits generated by those same oceans are applied in a more effective and sustainable way. The Committee regards the Sailing Ocean Science campaign as an important driving force in the effort to activate participating organisations.
Although the Committee regrets the lack of a cash prize as part of the Nobel Prize for Oceans, it feels confident the parties will be able to maintain the current momentum.

Sailing past Nova Delta As we all know, it is not 2021 yet, and there is no such thing as a Nobel Prize for Oceans. The Sailing Ocean Science campaign does not actually exist either. However, the Volvo Ocean Race and Top Sector Water & Maritime are very real. What if the various smaller and bigger organisations attending the Oceans Summit in The Hague really kept helping one another in order to reach their common goal?

If that were to happen, the teams participating in the 2030 race might just pass by *Nova Delta*, the new energy island in the North Sea. Alternatively, we might see racing boats drop anchor at floating cities and ocean farms by 2050. After all, sailors will always be the ultimate witnesses to our changing oceans. ≈

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Contributing to Clean Seas by racing

Every participating boat of the Volvo Ocean Race '17-'18 edition shows #TurnTheTideOnPlastic. Amongst nerves, boldness and lots of other feelings, sailors are proud to contribute to a better environment.

Backed by the Mirpuri Foundation, the Ocean Family Foundation and Sky Ocean Rescue, Team Turn the Tide on Plastic aims to raise awareness of UN Environment's Clean Seas campaign while also carrying out scientific research into the presence of microplastics in our seas.

When the race sails through the Asian region, China implements its decision to no longer accept shipments of rubbish, such as waste plastic and paper, from other countries. China is the main destination for more than half of plastic waste exported by Western nations.

Dee Caffari skipper of Team Turn the Tide on Plastic believes the decision to halt these imports is crucial. "We need to deal with our own rubbish ourselves instead of sending it to other countries." she said. "Creating a virtuous circle is key. If the public demands more responsible policies, this will filter down to producers and force changes in manufacturing. Government legislation is also important to encourage people to think outside the box and accept the inevitability of change." ≈

clean seas
turn the tide on plastic

Carolijn Brouwer is the first woman to win the Volvo Ocean Race. (Volvo Ocean Race)

The fastest electricle powerboat clocked 142,6 km per hour. (Wikipedia)

Regenerating total amount of fishing nets from our oceans will produce enough Econyl yarn to make almost 9 million pairs of socks. (11th Hour Racing)

Ocean energy is highly predictable and always available

We use 60.000 plastic bags every 3 seconds (Emily Penn)

Pacific Bluefin tuna, targeted by the fishing industry for its use in sushi and sashimi, is now at risk for extinction. (Mirpuri Foundation)

The Volvo Ocean Race covers 45,000 nautical miles in 8 months. (Volvo Ocean Race)

Microplastics are pieces of plastic under 5 millimetres in length (wikipedia)

51 trillion microplastic particles float in our oceans that's 500 times more than stars in our galaxy (cleanseas)

Diamonds are forever and so are plastics (Charles Moore)

Throw away... where's away if non recyclable? (Emily Penn)

90% of all plastic in our oceans come from just 10 different rivers

A sailing boat as living lab

When competitive sailors join forces with scientists, the benefits are mutual. That much became clear from the Volvo Ocean Race Science Programme and Team AkzoNobel competitive strategy.

Science Programme The VOR is known as the world's longest and most challenging sailing regatta. The race across seven seas and past five continents lasts a total of nine months. All in all, competitors sail some 83,000 kilometres (45,000 nautical miles). This achievement becomes all the more impressive when you realise that the racing teams were also participating in a scientific programme aimed at gaining more insight into the state of our oceans.

All seven racing boats automatically gathered meteorological data. This concerned information on temperature, air pressure, wind force and wind direction. The data can be used to further improve global climate models.

The teams also placed buoys along the most isolated stretches of ocean. These buoys gather data on the composition and temperature of the ocean water and currents. This information will be key in improving the accuracy of hurricane predictions and getting a better grip on climate patterns. It will also provide insight into the distribution of contaminants, such as microplastics.

Microplastics Two racing teams also gathered underwater samples during the regatta, which will be used to analyse microplastics. To this end, the Turn the Tide on Plastic racing boat (from Leg 1 onwards) and Team AkzoNobel (from Leg 7 onwards) were equipped with special measuring equipment. The boats measured salinity and other parameters related to the acidification of ocean water (chlorophyll, pCO_2) and microplastics. Some ocean racers sacrificed ten valuable minutes of sleep a day in order to gather up the samples. The samples were then brought on land and analysed during stopovers.

Results According to initial preliminary results, microplastics can now already be identified in all the world's oceans (with the exception of three measurement points south of Australia). Microplastics at levels varying from 9 to 26 parts per m3 were even found at Point Nemo, the remotest part of the world's oceans. The highest microplastics content was found in seas near densely populated urban areas, such as the Mediterranean Sea and the South China Sea (357 parts per m3). ≈

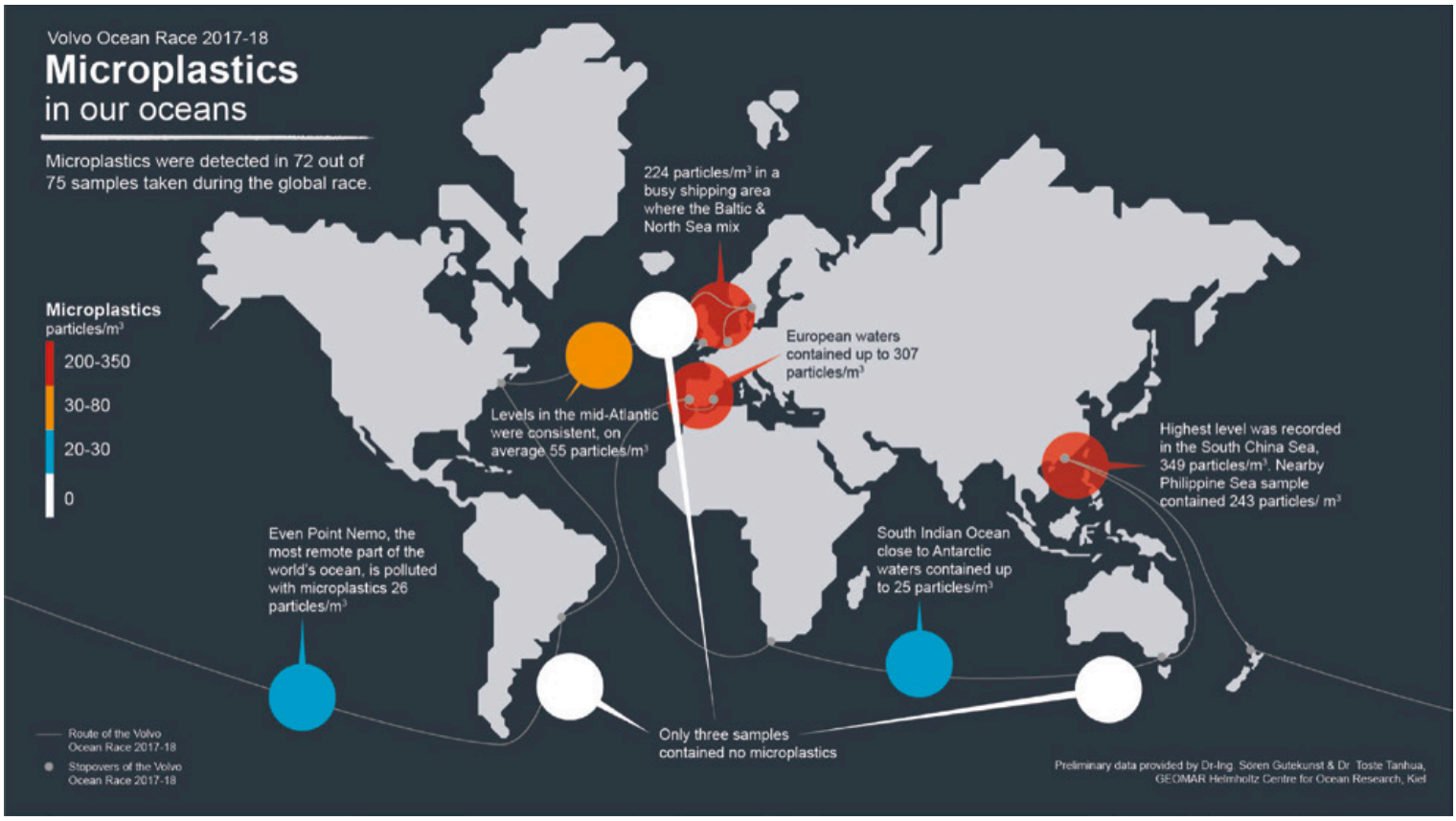
Further details on the programme:
https://www.volvooceanrace.com/en/sustainability/legacy.html

What if we use our bodies as an indicator for climate health?

Emily Penn is an oceans advocate, skipper and artist; a graduate of Cambridge University with a degree in Architecture.

She has organised the largest ever community-led waste cleanup from a tiny Tongan island, trawled for micro plastics on a voyage through the Arctic Northwest Passage and rounded the planet on the record-breaking biofuelled boat Earthrace.

EXXpedition Emily runs among other eXXpedition, a series of all female voyages which focus on the relationship between plastics, toxics and female health. In 2016 during one of her expeditions the team came up with the idea to measure climate health through their bodies. 'During our lives we collect different materials into our bodies which represent the area's we live in. All team members tested their bodies on 35 different kind of toxics. The results displayed interesting material. For example: a 67-year old team member tested very high contamination of p,p' DDE in her blood. This product was used around the 1960's to control malaria. In 1972 this chemical was banned and the younger expedition members carried almost no levels. This means that the amount of toxics in our bodies relate to the pollution of our climate. It also means we have to ability to change our footprint. ≈



Motto: it takes brains to break records.

All teams participating in the VOR used the same boat, the Volvo Ocean 65. This advanced, light racing boat is made from carbon fibres. So, if the boat is not the deciding factor, what sets the winning team apart?

Science as a competitive strategy

Skipper *Simeon Tienpont* (Team AkzoNobel) puts it all down to strategy and decided to seek out scientific partners. He eventually joined forces with the MARIN (boat technology), Deltares (meteorological data, currents) and Erasmus MC (life sciences/ health) knowledge institutions.

The AkzoNobel team broke the 24-hour record, sailing 1100 kilometres (602.5 nautical miles) within the space 24 hours. They earned a place on the podium for six of the ten legs, eventually ending fourth in the final ranking. To what extent did science help them achieve these results?

Tienpont: "Winning is about incremental improvements, tenths of percentage points. Everything has to be just right, including the boat, the conditions and the people in the team. The team members have to cooperate seamlessly."

Boating technology "The MARIN maritime knowledge institution helped us gain a real understanding of the Volvo Ocean 65. The focus was on the relationship between the boat and factors such as wave motion, inclination angles and wind angles. We conducted various simulations in advance, which we then regularly validated during the race. Our boat was equipped with a total of 183 sensors. This enabled us to analyse the boat's performance with increasing accuracy, so that we could make better predictions and improve our speed. The simulation programme offered us a unique tool."

Metereological data "Once we had run the boat simulation, we needed input on external conditions during the various legs of the race, on the weather, the waves and the currents. We gathered this information through a collaboration with the Deltares knowledge institution. We used their computer programmes to improve the accuracy of our own predictions, and to make decisions on navigation. We also consulted with Deltares before each new leg in order to find out about expected currents and the options for breaking away from the other boats."

Win-win situation So why take part in the research? "As a professional sailor and engineer, I like to apply Dutch maritime expertise. Our country may not be a major player when it comes to boat racing, but we are world leaders in the field of maritime knowledge. Applying that knowledge to the race helps draw attention to Dutch innovations."

Sleep/wake cycle research The team also took part in a study by Erasmus MC. The aim was to determine how a disrupted sleep/wake cycle affects our DNA. Brad Farrand, board medic of Team AkzoNobel, was one of the trial subjects: "The crew on board constantly alternated four hours of sleep with four hours of awake time. Scientists want to find out how our body reacts to that type of rhythm. We got our first bit of feedback during the stopover in Hong Kong; as it turned out, the levels of cortisol - a stress hormone - in our blood had increased since the start of the race. They'll keep monitoring us for a while longer to see whether the hormone levels return back to their original state."

"How did the study benefit our team? Team members participated on a voluntary basis. I like the fact that scientists are interested in what we do, and can help us to advance our sport. We're already pushing the boat to its limits, so if this study can help us gain a competitive edge in other areas, I'm all for it. ≈

Life science

Pitch by Bert van der Horst, research coördinator for the Erasmus MC VOR Team AkzoNobel project.

Why is Erasmus MC conducting research on professional athletes? "The time of day (our biological clock 'setting') has an effect on our athletic performance. Any disruptions to that clock can thus affect our results. This tends to affect professional athletes more than non-professionals, as they often travel around the world. Furthermore, boat racers have to perform around the clock."

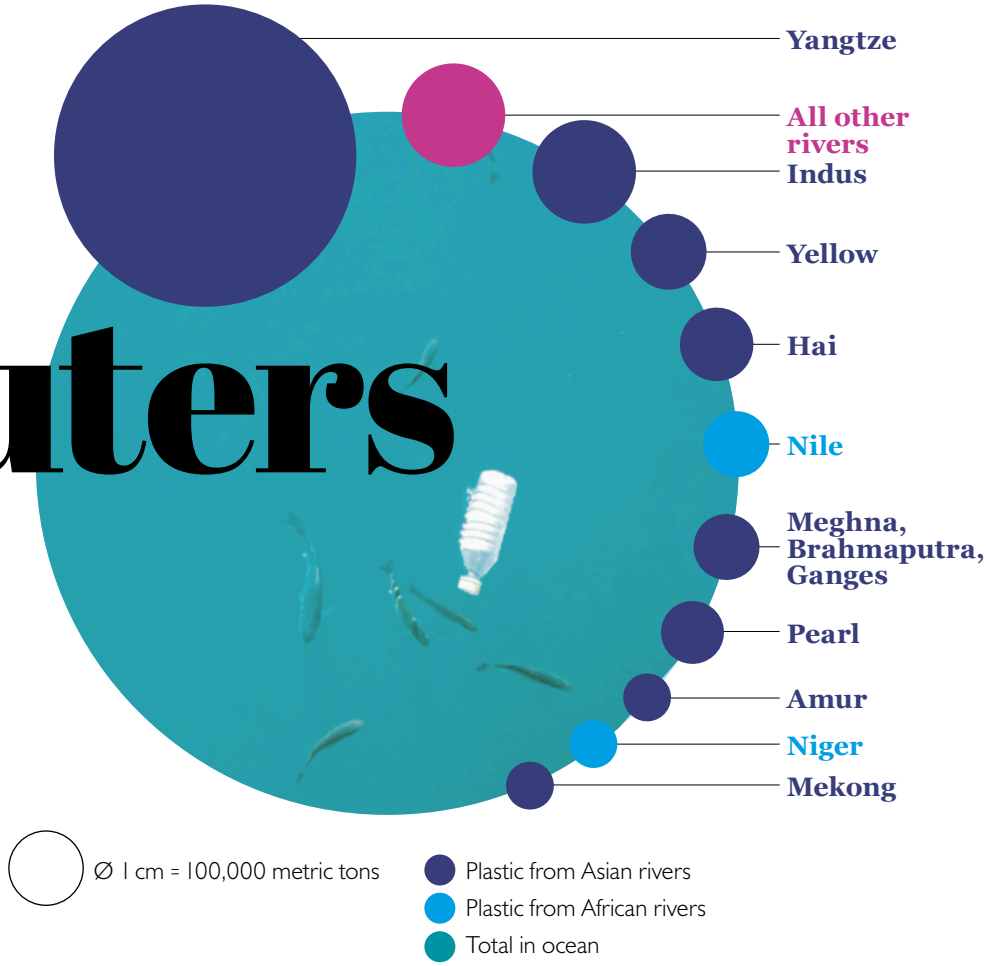
Which parameters will the study focus on? "Throughout the race, we keep track of body weight, blood pressure and sleeping/waking behaviour (circadian disruption). Prior to, halfway through and after the race, we measure biological markers, such as cortisol in hairs (stress), epigenetic DNA mutations and immunoprofiles. These data will then be linked to information on boat and team performance."

What have the results been so far? The study is still underway. According to initial results, the boat racers slept less and/or slept more irregularly during the race (as expected), leading to potentially higher cortisone levels in hair samples. This is indicative of long-term exposure to stress. We also found a correlation between sleep deprivation and the degree of DNA methylation."

How will the results be applied? "We want to determine the extent to which body clock disruptions affected the racers' performance. Boat racers currently operate on the basis of standard time, with a four-hour sleep, four-hour waking system. As a result, the light-dark cycle and duty roster get completely mixed up during legs that run from the West to the East. We may find that it's better to adjust duty rosters to the day length and to individual boat racers' chronotypes (morning or evening person).

So what's the next step? "We're trying to raise funds for a more in-depth study during the next VOR. Amongst other parameters, we'd like to focus on psychological stress, bone structure, muscle mass, fat content and metabolism.
We also aim to measure these biological markers in nurses and others who work in shifts. The idea is to develop biomarkers that can alert us when people have worked in shifts too long and are susceptible to health risks as a result." ≈

Top Ten Polluters



90% of all the plastic in our oceans come from the ten major rivers of the world, seven of which are in Asia.

That is why it is so important that we do research and trials to collect plastic, even micro plastics in river mouths before it flows into open water. Our entire food chain is already infected.

Concrete solutions are being created all over the world. In the port of Rotterdam data is being analyzed by Allseas with EU commission-funded research. "Working every day at sea, Allseas has become increasingly concerned about the future of our oceans, and more specifically with plastic pollution." says Marjolein Engels R&D Project Coordinator. "In 2017 'Project Plastic' started, aiming to develop a solution to reduce the amount of plastic entering the oceans by removing it as close from the source as possible: rivers. We are focusing on developing a plastic collection system. Collecting large and small plastic particles. One objective is to gain more knowledge in the transport of macro and micro-sized plastic waste in rivers in order to optimize plastic collection. We mainly investigate the distribution of plastic particles in the river cross-section and the effect of river bends." ≈

The FlipFlopi project build a boat using over ten tonnes of plastic waste and thousands of repurposed flip-flops collected in Kenya. Using traditional dhow builders and techniques, the world's very first 100% recycled plastic dhow sets sail. Ben Morison, project founder: "We hope people to inspire to find their own ways to repurpose 'already-used' plastic. The next step in our journey is to sail our boat to Zanzibar sharing our message along the east African coast, talking to law makers, companies and communities. Join the #plasticrevolution and make your voice heard!"

http://www.theflipflopi.com

Maritime research prompts new questions

https://nico-expeditie.nl/nieuws/voor-het-eerst-opgemeten-stilte-de-storm
https://nico-expeditie.nl/nieuws/nico-expeditie-onthult-allereerste-beelden-van-nederlandse-diepzee-bij-saba

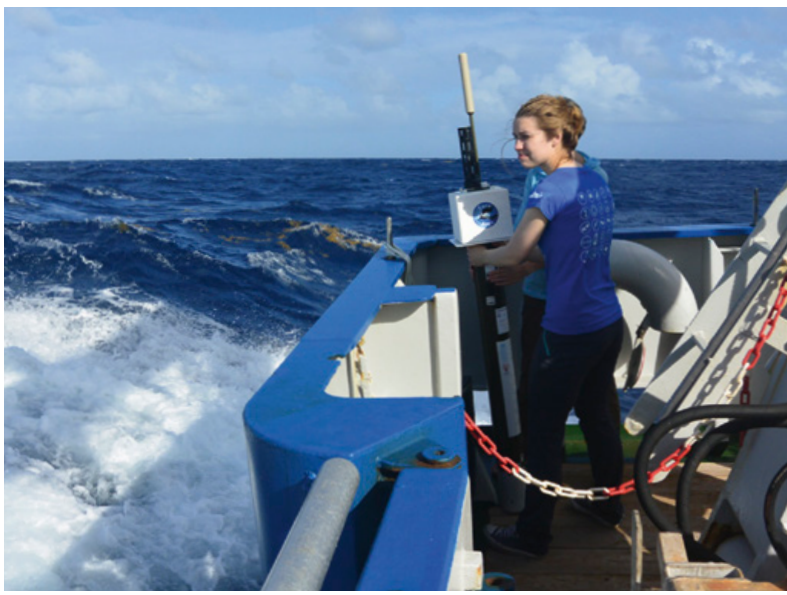
Climate research through historic reconstructions

The Netherlands Initiative Changing Oceans – or NICO for short – research expedition ended on 28 July 2018. Various disciplines were involved in the scientific voyage. The researchers will be reporting on their findings over the coming period. These include results on key issues such as climate change and the uncharted deep seas. Here's a small teaser.

Climate research As maritime researcher Femke de Jong of the Royal Netherlands Institute for Sea Research (NIOZ) explains, the world's oceans are still somewhat of a blind spot in terms of climate research. "And this is despite the key role oceans play in shaping our climate. About 90 percent of the additional warmth added to our atmosphere by human activity is absorbed by the oceans. A cubic metre of sea water can contain far more energy than a cubic metre of air, which means the smallest fluctuations in sea temperate have major potential climate effects."

Absorbed versus produced The oceans contain evidence of previous periods of climate change, which can help us understand the future. The balance between the amounts of CO_2 absorbed and produced by our oceans is extremely important for the climate. In order to know just how much these CO_2 levels fluctuated in the past, we will have to create optimally accurate reconstructions. Utrecht University is currently developing a new way of determining historic CO_2 values. The method is based on dinoflagellates, which are microscopic algae.

Fossils Researcher Joost Frieling: "Analysis of cultivated dinoflagellates showed that their chemical composition alters dramatically when CO_2 levels change. A considerable portion of these miniscule algae build 'survival tents' from bioplastic, also referred to as cysts. These cysts can remain intact in the sediment for hundreds of millions of years. I will be analysing the chemical composition of these fossilised cysts in order to reconstruct historic CO_2 level variations. I took samples of living dinoflagellates from sea water and the cysts from their sediment during the NICO expedition, in order to 'translate' the fossils' chemical composition."



Underwater storms Another climate change-related research theme focused on currents in the Caribbean Sea. Caroline Katsman (TU Delft) researches ocean currents as part of the effort to develop more accurate climate models. These cyclonic underwater "storms" can have diameters of up to 300 kilometres. The researchers studied the characteristics of these currents up to a depth of several kilometres from their boat. They also launched various floats, which are measuring buoys that bob up and down,

Underwater currents: calm below the storm

measuring temperature and salinity. The current can be determined by measuring the distance travelled by each float between two consecutive "dives".

The NICO floats were configured to float at a depth of 500 metres. Once every three days, they would dive to a depth of two kilometres and subsequently float up to their original position. Having reached its normal floating depth, the float would contact the satellite network to transmit its data, after which it would dive down again.

What were the findings? "As it turns out, there's barely any movement at a depth of between 300 and 700 metres below the current. It's a bit like the underwater version of still air. It was a completely unexpected finding." It remains to be seen how this will affect current climate models. In the meantime, the NICO floats will continue to dive and gather data.

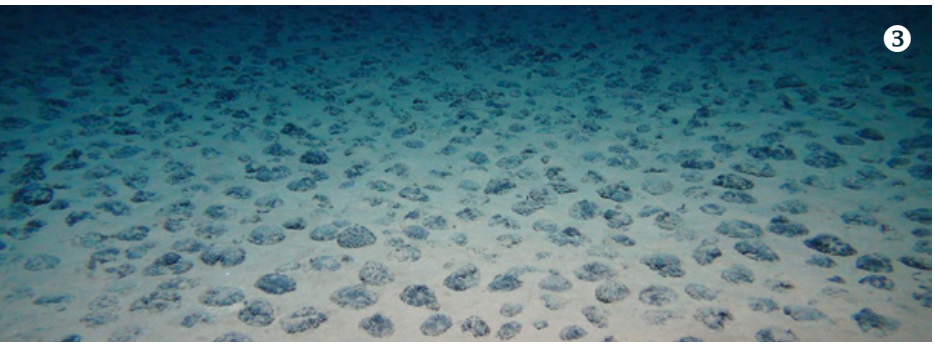
Uncharted deep seas NIOZ director Henk Brinkhuis: "Many people think we have sufficient knowledge of the oceans, but we actually barely know anything. For example, the growing oxygen deficiency in our oceans will require a lot more research. The same applies to changing ocean currents. However, the water pressure is so great at a depth of 1500 metres that you need special equipment to work there in any capacity. So far, we have practically no access to any observations at greater depths. The situation is comparable to space exploration."

Giganteus isopods Biogeologist Furu Mienis (NIOZ): "The Caribbean Sea expedition saw researchers capture the very first images of the Netherlands' only deep sea area at Saba Bank. The Saba Bank rises up to a height of several hundred metres and is known for the coral reefs on its shallow peak. These play an important role, serving as hiding places, breeding grounds and living environments for fish and crustaceans. Underwater cameras and experiments with bait have now helped us gain an initial impression of life at those depths. As it turns out, the deep slopes of the Saba Bank harbour a diverse range of marine life. The giant Bathynomus cf. giganteus isopods are an especially impressive sight to behold. The species is unique to tropical seabeds with a depth of between 300 and 2100 metres. The isopods feed on fish, shrimp and worms, and can reach a length of up to 46 centimetres.

Life per layer The bait at stations closer to the surface, at a depth of 450 metres, mainly attracted sharks and shrimp, while the stations at 1,400 metres mainly drew sharks and conger eels. These observations point to a correlation between biodiversity and sea depth. The images offer us a basis for further monitoring of this unique Dutch deep ocean area." ≈

We need deep-sea mining to realise the energy transition

Four statements challenged participants in the Ocean Summit to debate the future of our oceans. Key themes included the issue of deep-sea mining.



1. Black smoker (Page 17)
2. Rock around black smoker
3. Manganese Nodule
4. Black Smoker
5. Video observation off RV Pelagia
6. Manganese Nodule
7. Expeditionleader Sabine Gollner experiments with mussles on the Azores to study ecology at 4km depth.

'Non-sustainable fishing should be banned immediately', 'Fishing is a thing of the past and aquaculture is the future', 'Offshore wind energy should not be allowed if it negatively impacts the ecosystem', and 'We need deep-sea mining to realise the energy transition'. These were the four statements central to the debate.

The debate organisers opted for a new approach. Once each statement had been explained in further detail, the participants all chose a side. A prize for 'best debater' was also awarded at the end of each session. The organisers' approach was based around the notion that any genuine effort to make our oceans more sustainable will require a rational and cooperative debate between stakeholders.

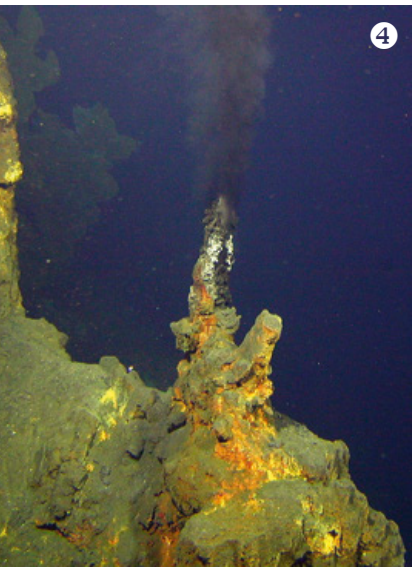
We asked Gert-Jan Reichart, responsible for the statement on deep-sea mining, to explain. Reichart is head of the Oceaan Systemen department at the Royal Netherlands Institute for Sea Research (NIOZ) and professor in marine geology at Utrecht University.

So what is deep-sea mining and what benefits does it offer? 'Deep-sea mining is a form of mining whereby minerals or elements are extracted from the deep-sea bed. These include copper, zinc, manganese, cobalt and rare earths with interesting names like dysprosium, praseodymium, ytterbium and yttrium. These elements can be extracted from two key sources: manganese nodules and "black smokers".

Manganese nodules are clumps of ore half-buried on the ocean floor. They look a bit like potatoes or small cauliflowers. The nodules are the result of dissolved manganese in deep-sea water that gradually precipitated over the course of tens of thousands to millions of years. In addition to manganese, the nodules also contain iron, copper, cobalt and nickel.

Black smokers are volcanic chimneys. They can be found along major deep-sea fault lines. The chimneys spew out boiling hot water from the ocean floor. This water is rich in metal sulfides, which crystallise into chimney-like structures with a height of up to dozens of meters as they cool down.'

Can you offer arguments in support of the statement 'We need deep-sea mining to realise the energy transition'? 'We are in the midst of a transition from fossil fuels to renewable energy sources. This process involves the 'electrification' of society. For example, we are seeing the rise of electric cars, and electrically-powered industries. This is causing growing demand for a range of highly specific elements. For example, nickel, lithium and cobalt are all crucial to the manufacture of batteries,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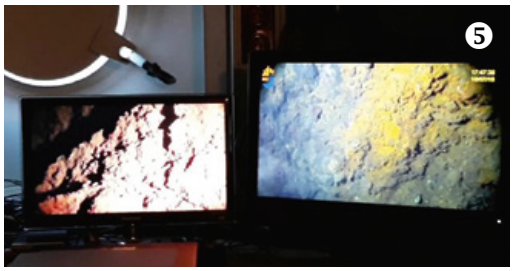
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while the production of wind turbines and solar panels requires rare earths. The land-based supply of these raw materials is dwindling. Furthermore, they are often controlled by a highly limited number of countries.

You can't simply stick your head in the sand and say "forget about electrification, we'll just go back to using natural gas". Deep-sea mining is inevitable. It's a matter of when, not if.

I must say I was surprised to see most debaters come around to my side so quickly. "Well, if we have to I suppose we should". I'd honestly expected a more critical response from people concerned about the deep-sea environment.'

So what sort of environmental damage can deep-sea mining cause? 'The sea bed is a unique environment that is still largely uncharted. We have no way of knowing what sort of damage mining activities will do to these environments. Still, we only need to look to land-based mining to get some idea what the potential devastation might look like. What's more, you can actually see what you're doing on land, which isn't the case underwater.

Damage can be caused in a number of ways. Machines at the extraction site will scrape the sea floor clean, causing unique organisms to die and damaging their living environment. However, this damage can also spread out to a wider area. For example, dust clouds can coat living environments or muddy the water. Alternatively, damage may be caused by light and sound penetrating the dark, silent world. To make matters worse, ecosystems in this type of stable, cold and nutrient-poor environment tend to recover extremely slowly.'

Deep-sea mining is inevitable. It's a matter of when, not if.

So if we do have to engage in deep-sea mining despite these concerns, how do we go about it responsibly? 'That will be the key question going forward, but a clear answer will require more research. Which types of organisms live in the deep sea? What are the effects of deep-sea mining and how – and with which extraction methods – can they be minimised? For example, I'm currently taking part in the "Blue Nodules" project. We're developing new ways of extracting manganese nodules from the sea floor that have a minimal impact on the environment. We'll have to have a set of clear rules in place by the time the first mining permits are applied for. Despite ongoing efforts, we're not there yet.' ≈

First aid for European enterprise

Innovations in the water sector spread across the globe. Small entrepreneurs collaborate with major consortia on large-scale issues. In which ways can "blue" businesses find each other and work together on a solution?

Knowledge and information from Brussels The European Commission has developed various programmes for the water sector. These programmes are intended to share innovative power and achievements between regions and Member States. For example, the Enterprise Europe Network (EEN) has a "Water Catalogue" detailing technology supply and demand, water activities, European EEN-water sector contacts and an overview of the European calls. For a number of European programmes, one of the requirements is that a consortium must comprise multiple Member States. The programmes have been developed to increase the innovative power of Europe.

Subsidies in practice Here is an example. A start-up called VanderSat measures soil moisture and temperature across the globe with the aid of satellites. Using these satellite data, drought, harvests and floods can be predicted with increasing precision at any time of day. Not only are the data easily readable, but – believe it or not – the process is also 1,000 times cheaper than using traditional soil sensors. The method has already been patented.
Under the auspices of the European Horizon 2020 programme, VanderSat was awarded a subsidy early this year in the "water for agriculture" theme. This part of the programme is intended specifically for SMEs. Between 2018 and 2020, €1.6 billion will be made available to innovative entrepreneurs. Up until now, projects in Europe have been financed to the amount of around € 86 million.

To a large extent, founders Richard de Jeu and Robbert Micca financed VanderSat themselves, complemented by a €1 million investment made by Menno van der Marel. Income is expected to increase by 200% this year.
Whether VanderSat will again request funding from the European Union remains to be seen. Thanks to EEN and the SME instrument of Horizon 2020, however, their innovation is now ready for the market.

Types of assistance John Heynen, an adviser with the Dutch Enterprise Agency (RVO.nl), explains how Dutch entrepreneurs receive assistance."Everyone at RVO.nl is a specialist in certain aspects. For example, I can help people in the Netherlands when they attempt to find funding for innovative ideas that support the European nature, environmental and climate policies via the EU programme called LIFE (L'Instrument Financier pour l'Environnement). If your project better suits another subject, I'll gladly refer you to my colleagues or to the National Contact Points."
This way, Interreg stimulates innovative and sustainable projects that focus on strengthening European regions, Horizon 2020 supports research and innovation tackling social challenges in Europe, and Eurostars assists innovative SMEs in developing new products, processes and services.

"The overarching aim is to accelerate the time to market and help small businesses grow. Experience has shown us that the 'valley of death' proves difficult to cross for small companies. Wonderful innovations go lost despite their being viable. This outcome is something that we want to prevent."

Special attention to sustainable offshore FORESEA is a project aiming to help sustainable offshore energy technologies make it to the market. It does so by providing free access to the leading network of test centres in north-west Europe.

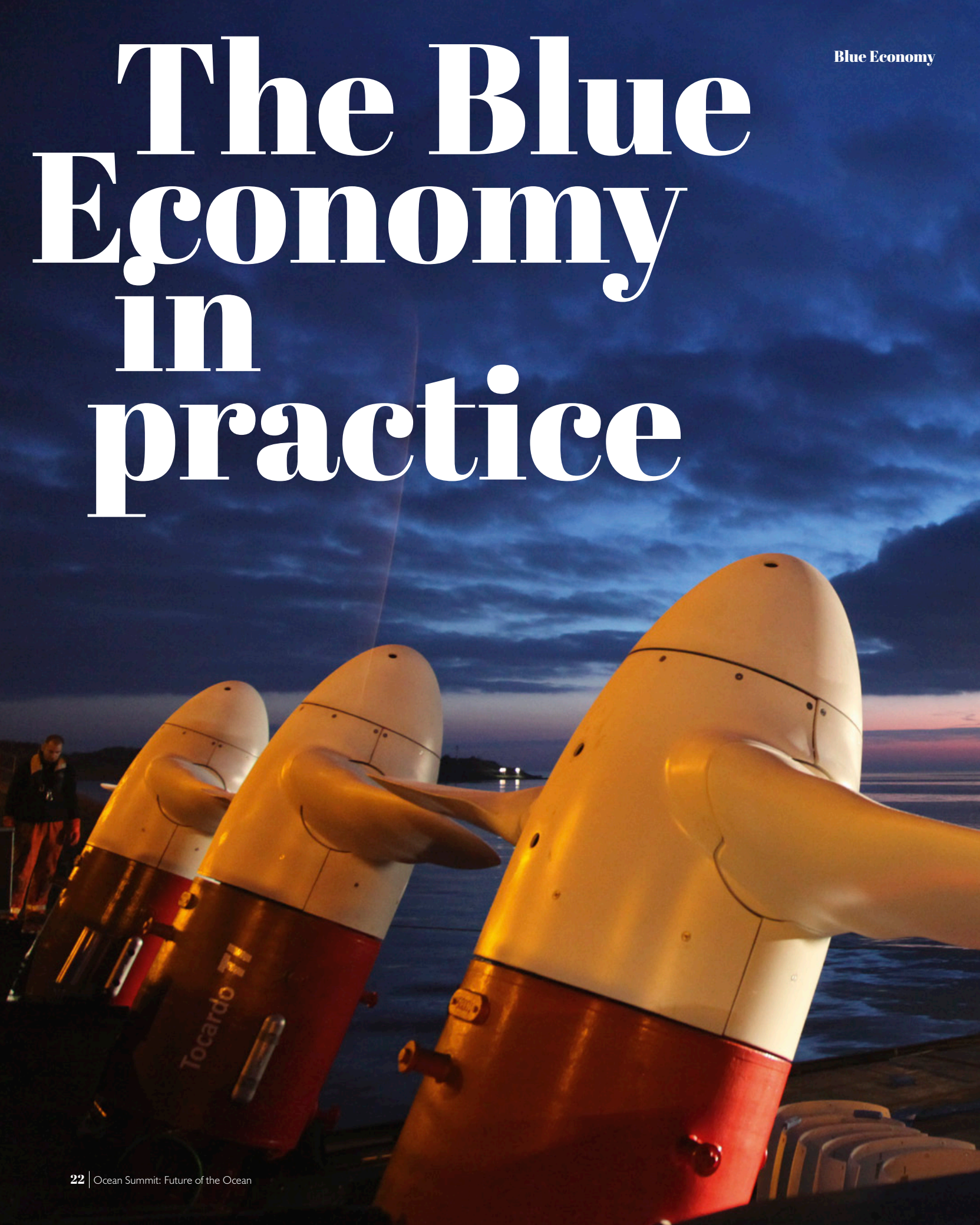
The financing for renewable energy from the oceans involves a project in the amount of € 11 million. Jacqueline Brouwer, the contact person at RVO.nl for the Interreg NorthWestEurope (NWE) scheme, is enthusiastic about offshore energy. "The major advantage of energy from the oceans is that it's totally inexhaustible! My reason to be engaged in it, however, is that it enables Europe to remain global leader in the maritime energy sector."

Bear in mind that the global market is worth in excess of €100 billion. Over 50% of the marine energy companies are based in the European Union. Since the launch in 2016, activities related to ocean energy have increased rapidly. Ten projects have used the European test centres with the support of FORESEA, with many more to come in the next 18 months.

Subsidies are awarded via a series of calls implemented by the project consortium. The programme uses test centres on the Orkney Islands, in Ireland and in France, as well as the Dutch Marine Energy Centre in Alkmaar. These test centres are supported by Ocean Energy Europe, the European industry body for ocean energy, based in Brussels.

Scouts and coaches The European Union scouts and subsidy coaches also take to the field. EEN organises various matchmaking activities and missions for the water sector, such as "AquaMatch" during the Amsterdam International Water Week and "WaterMatch" during the "Water Technology Week" in the Netherlands. In addition, EEN is active at the IFAT, Wasser Berlin and the International Water Week in Singapore. ≈

The Blue Economy in practice



The marine-maritime industry is capital-intensive by definition. So how do innovative SMEs obtain funding for their 'blue products'? An interview with Hans van Breugel, CEO of tidal turbine manufacturer Tocardo.

Tocardo has been developing water turbines that convert tidal currents into electricity since 2008. It's 2018 now, so how has the blue innovation been faring? "In December of 2015, we installed our low-maintenance tidal turbine in the Oosterschelde storm surge barrier. That moment marked the official maturation of our product, and the end of the innovation phase.
Once proven, however, technologies still need to find a commercial market. This phase can be challenging, as the innovative new product still lacks customers and financiers. This applied to Tocardo as well. We managed to finally crawl out of this so-called 'valley of death' in 2016, and are currently in the midst of the implementation phase."

So what does it take to implement a blue innovation? "An implementation budget and some visionary investors. That's what you need. By way of comparison, an innovation can be funded with grants and own capital. The implementation phase is different, though. In our case, the banks and pension funds didn't want to invest because they thought the risks were too great. In the past, the government would occasionally step in as a shareholder. These days, they'll only go to those lengths for the big banks ('too big to fail'). In order to shepherd a new technology through the implementation phase and onto a mature market, you'll need a combination of supportive government agencies, stable government policies and a stable kWh price. Together, these factors will also incentivise financiers to invest.

Are there any implementation funds for SMEs? "In the Netherlands, we have so-called SME innovation loans. However, there's no safety net for investors. You'll simply have to find them yourself. There aren't any investment banks out there buying up shares. Invest-NL (the former Energy Transition Fund) is set to become an important resource for companies like ours. The fund is expected to be launched in 2019.
Invest-NL will help to fund key social transition processes in areas such as energy and sustainability. Invest-NL should also help improve access to European funding. A special European fund for marine and maritime innovations would be very helpful as well. A proposal to that end has already been submitted to the European Commission."

How would you rank your innovation in comparison with wind and solar power? "In terms of development, tidal energy is now in the same phase as 'wind and solar' were just before they became successful. To put things in context, the first 1000 Megawatts from offshore wind farms were still entirely facilitated by the government only five years ago. At the time, wind and solar energy still cost about 20 to 30 cents per kilowatt-hour. Government assistance enabled these technologies to develop effectively,

Blue innovations need investors with a broad visionary look

and costs eventually dropped. Wind and solar have since become mature markets with a huge global turnover of 220 billion euros. In other words, when comparing different types of green energy, it's important to factor in the technology's current development phase. That's the most important cost factor. 'Solar and wind' currently have a finance cost of four percent. In the case of tidal energy, that figure now stands at ten percent. As a result, tidal energy is still relatively expensive. The market is small and domestic.

There's a great amount of global interest in tidal turbines, and you're aiming to supply Nepal and Japan in future. What sort of problems have you run into while upscaling the product?

"Although the tidal turbine is intended as an export product, our main markets are currently still in the Netherlands and Great Britain. The governments in both countries opted to introduce market forces several years ago by adopting a tender-based system. As experience has shown, the free market competition model doesn't work for industries that are still in the implementation phase. Just consider previous experiences in the wind turbine manufacturing industry; the entire industry left the Netherlands as a result of indecisive government policies (withdrawal of subsidies, introduction of market forces). We need to make sure tidal turbines don't suffer the same fate."

What else needs to be done in addition to setting up implementation funds? "The Dutch are known to be water experts around the world. That's just a given. The next level, generating energy from water, is simply the logical next step, especially in combination with our delta technology. We should be embracing tidal energy a lot more. The technology is more than ready, and there's no lack of tidal currents; just go sailing between the Scottish islands and witness the Atlantic flowing to and from the North Sea twice a day." ≈

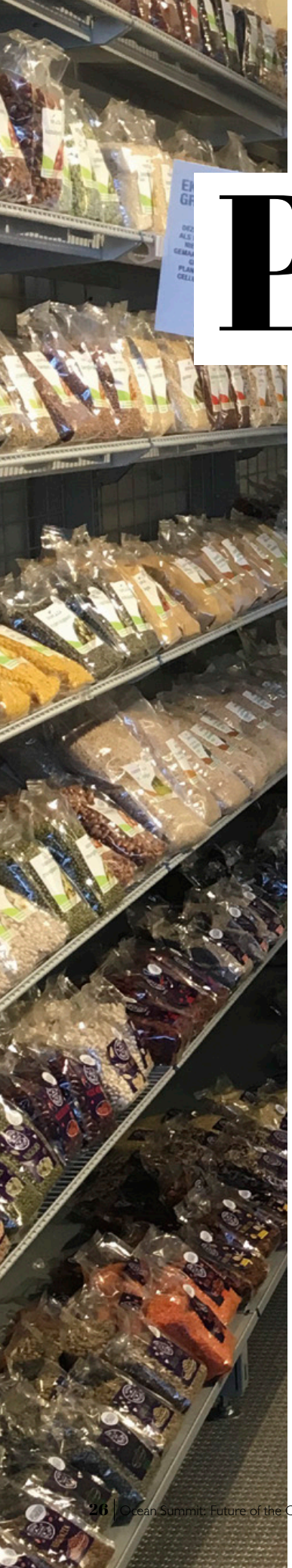
The Great Bubble Barrier

We want to stop the plastic soup! In 2015, Francis Zoet, Anne Marieke Eveleens and Saskia Studer were brainstorming about a solution to plastic waste. "Our aim was to create a world without coral clogged with microplastics, without sea turtles with straws stuck in their nostrils and without albatrosses perishing with stomachs full of plastic."

By installing two bubble screens diagonally in a river, smart use is made of the current to transport waste towards the riverbanks. A bubble screen comprises a perforated tube lying on the riverbed of a passage. Air is pumped through the tube. The upwards current is caused by the rising bubbles and transports waste to the surface, where it can easily be handled. This solution is friendly to fishery and marine transport, as well as being scalable.

The concept was tested at the 'Delta flumes' at Deltares in early 2017, after which Philip Ehrhorn from Germany joined the team. He had designed something similar in Berlin. A pilot study in collaboration with RWS, Deltares and BAM/vdHerik has been successfully completed. It was conducted in the river IJssel, involving a 200-metre long prototype.

This year, the clean-tech start-up was admitted to the EU accelerator programme. Since eight of the ten rivers causing the most ocean pollution are in Asia, the team hopes to begin construction there in the near future. ≈



Plastic-free

Plastic-free shopping, how does that work?

Short story based on an interview with Erik Does of plastic-free supermarket Ekoplaza.

The entrepreneur Once upon a time, there lived a sustainable entrepreneur named Erik Does. Does had specialised in organic retail, and supplied health food stores with groceries, fruit and vegetables, meat, fish and vegetarian products. He made a point of buying the most sustainable packaging materials he could find, and had built up a large network of suppliers.

Over the years, the retailer managed to supply all his customers with products packaged in compostable materials. Lettuce, macaroni and muesli: all the packaging simply degraded back into water, carbon and compost.

One evening in 2017, he received a phone call from the Plastic Soup Foundation. The Foundation was looking for supermarkets interested in setting up a plastic-free aisle. Just to prove it could be done. They wanted to know whether he was interested.

Does didn't hesitate for a second, and accepted the challenge. A firm believer in the possibility of a plastic-free world, Does and his supply chain partners invested a great deal of time and money developing a plastic-free supermarket. After much blood, sweat and tears, the end result was finally there for all to see: Ecoplaza. Within one year, the new supermarket was stocked with 1370 different plastic-free products.

One day, the entrepreneur heard about the Volvo Ocean Race Ocean Summit. The sailing event fit right in with his anti-plastic mission and personal interest in sports. The organic retailer had previously sponsored Dutch surfing champion Dorian van Rijsselberghe. Organising a pop-up plastic-free supermarket at the event's innovation village in Scheveningen seemed like a more or less logical next step.

The Consumer Elsewhere, we find a conscious consumer on holiday in Scheveningen. At home, she was responsible for shopping, cooking and recycling household waste. Every day, she bought organic, ecologically sustainable products, which brought back from the shops on her bicycle in a sustainable shopping crate.
As she cooked, she would separate the various packaging materials (glass, cardboard, organic waste, cans and plastic), which she stored in separate little waste piles in the kitchen. Everything under control. Until the moment that she walked over to her local recycling bins. As she opened the container for plastic waste – which was always filled to the brim – her shoulders hunched over, and she blushed in shame. She knew only too well that plastics would continue to have a destructive impact on our planet for centuries to come. She decided it was time to take action.

supermarket

At the plastic-free supermarket They met in the tiny plastic-free supermarket in Scheveningen – the conscious consumer and the entrepreneur. The consumer was just about to buy a bag of organic currant buns. The bag featured the Seedling logo, a certificate for compostable packaging materials. Suddenly, she hesitated.

The consumer, who worked as a policy officer during the day, recalled a recent debate at the office. Apparently, the Netherlands Institute for Sustainable Packaging had expressed a preference for reusable and recyclable packaging materials over biologically degradable (compostable) packaging. This news was the focus of much debate amongst government officials. What to do: was this compostable bag really a responsible purchase?

She wanted to ask one of the supermarket staff, but he was busy talking to a journalist from Al Jazeera. As fate would have it, that staff member was Erik Does, CEO of Ekoplaza. He was visiting the store in order to speak with the international press. The plastic-free concept had sparked interest from around the world. The consumer overheard part of the interview.

'…My core message? We can make plastic-free retail a reality. There's simply no excuse not to. Every party in the plastic chain will have to take action. The government, the waste processing industry, industry organisations and businesses, and consumers. There's no single best solution to the problem, it's a matter of combining the most effective ideas. A deposit system, regulation, recycling, biodegradable materials. We need every solution we can get.'

There's no time to waste The consumer didn't hesitate. She paid for the currant buns, and decided to interrupt her holidays for a visit to the nearby Ocean Summit. She arrived just in time for speeches by EU Commissioner Karmenu Vella (environment, maritime affairs and fishing) and Minister Cora van Nieuwenhuizen (Ministry of Infrastructure & Water Management). Both speakers emphasised the importance of the proposed EU-wide ban on single-use plastics.

Vella explained: 'Plastic waste ends up in the air, the soil, the water, the oceans and our food. We need all countries to create legislation that tackles the problem. Not just in Europe, but around the world.' Minister Van Nieuwenhuizen linked the issue of plastics to the much-needed transition to a circular economy. Encouraging words, to be sure – but the consumer no longer has to wait for those changes. ≈

Seedling

OK Compost Home

OK Compost

Source: https://meldpuntverpakkingen.nl/357/composteerbare-verpakkingen-bioplastics.html

Blue Sea Thinking

Approach things from a systemic, ecological perspective, don't get bogged down in any one challenge and dare to collaborate. Only then can we develop innovative solutions for the problems of the future.

Our climate is changing, sea levels are rising, the population is growing, demand for transportation is rising and the transition towards sustainable energy is in full swing. We are facing some major problems, and our efforts to address them will inevitably involve the seas. The challenge lies in finding sustainable, integrated solutions that make smart use of nature and the environment rather than harming them.

Building with Nature Erik van Eekelen, a member of staff at Van Oord and programme manager of EcoShape (a consortium researching the potential of Building with Nature), is highly familiar with the notion of nature-based offshore infrastructure. As he explains: 'Nature provides all sorts of ecosystem services we can apply to hydraulic engineering purposes such as coastal protection. Sand flats, corals, oyster reefs and coastal vegetations form resilient zones that can naturally absorb the force of a stormy sea. Tsunamis have far less impact on coasts lined with mangrove forests. We can also apply the capacity of streaming water to transport sand and sludge during hydraulic engineering projects. Solutions based around the notion of Building with Nature are sustainable by definition. They blend in with the ecosystem, so the natural environment always benefits.'

This principle is also applied during the 'nature-inclusive' construction of wind farms. With new wind farms springing up all over the North Sea, we need construction methods that can also benefit the natural environment. This could include eco-friendly substrates with large cavities that can be used as hiding places by species such as crabs and codfish. Another example would be the construction of oyster beds in between the pylons.

From thought to action So how can we ensure that these innovative ideas are applied during the construction of wind farms? This could take various forms:

Regulatory control A Ministry of Economic Affairs and Climate Policy policy officer explains: 'In order to understand this mechanism, let me start by explaining how wind farms are developed. The central government designates locations for wind farms and takes a wind farm site decision for each planned development. This decision contains detailed specifications as to where and under which conditions the farm may be built. Companies interested in building the farm can then submit an offer, and the party capable of delivering energy at the lowest cost will be awarded the permit. The conditions might specify that the farm is to be built in a "nature-inclusive" manner. This concerns a best efforts obligation: the actual outcome is not described in any great detail at this stage.

Reefguard: The Coral Engine

It's all a bit unbelievable. A dredging company which usually moves millions of cubic metres of sand and rock is currently developing something as extremely delicate as a "coral nursery". This past year, Van Oord achieved a milestone in ecologically responsible marine construction, a groundbreaking achievement that holds promise for the future of many reefs.

The first thing to note is that coral is both animal and plant. Coral polyps are animals involved in a symbiotic relationship with microalgae. The polyps feed on matter in the water. Algae living in the polyp tissue transform light into nutrients and energy. In their millions, the polyps construct a calcium carbonate skeleton to form a coral colony. In turn, all these elements together form a coral reef.

The key threats to coral reefs are the rising temperatures and acidity of the oceans, hurricanes, over-fishing, and urban and agricultural pollution.

Van Oord used its ReefGuard mobile breeding facility to grow coral in the Bahamas. "We are keen to use our projects' momentum to do something extra for local nature and local stakeholders", says Mark van Koningsveld, Manager Research & Development Engineering. "After years of development, we are now at the stage that we can be taken very seriously by anyone interested in large-scale reef rehabilitation. We won the bid for a project involving the Great Barrier Reef in Australia this summer." ≈

https://vimeo.com/251114088

Nova Delta: an appealing prospect

The various Dutch top sectors launched the Nova Delta initiative in early 2018 in an effort to demonstrate the potential of our oceans. Nova Delta will bundle the various sustainable North Sea initiatives and technologies into a single concrete project, which can then serve as a basis for further collaboration. Nova Delta aims to structurally contribute to the challenges facing both the Netherlands and our planet as a whole. What sort of initiatives and technologies will this involve? The cultivation of seaweed in order to increase global food production. The generation of wind, tidal and solar energy as a part of the ongoing energy transition. The development of a self-sufficient floating city in order to create the ultimate sustainable climate-proof housing. Furthermore, recovery of the North Sea ecosystem, also as a basis for sustainable fishing.

The top sectors have formulated the following key message: "We're at a turning point, and will have to approach our delta from a fresh perspective if we aim to meet the challenges ahead. We need to start by pushing our boundaries and embracing the sea. The time is right, we have the technology, the economy demands it and our environment will need it to survive. We are moving towards a new relationship between land and water, a new balance between man and nature, a prosperous and safe future for our children and a new perspective on the deltas of the future.' ≈

We may come up with new innovation strategies in the short term, as soon as the amendment to the Wind Energy Act is adopted. This proposal will lead to new selection procedures for businesses seeking to obtain a construction permit. These include the so-called comparative test, whereby we describe the various assessment criteria for tendering parties (such as nature-inclusive construction). The party with the best plan will be awarded the highest number of points, and thus a fictitious deduction from the bidding price.'

'Front-end' control Innovative solutions and knowledge can also be developed by linking wind farm construction to a major public-private experiment. Van Eekelen is referring to EcoShape: 'The first phase (2008-2012) is an especially wonderful example of public-private partnerships and joint investments. As private sector parties, we worked hand in hand with knowledge institutions and government parties to achieve a common goal: further developing and demonstrating the potential of the Building with Nature concept, at a national and international level. This combination proved to be rock solid, and generated a wealth of innovations, knowledge and enthusiasm.'

Van Eekelen is a great proponent of this method. It offers an opportunity to pre-competitively develop knowledge and seek out and apply innovations without being immediately judged on the concrete results. This offers researchers the freedom and incentives they need, while ensuring that no single company can 'hold on' to the knowledge they develop.

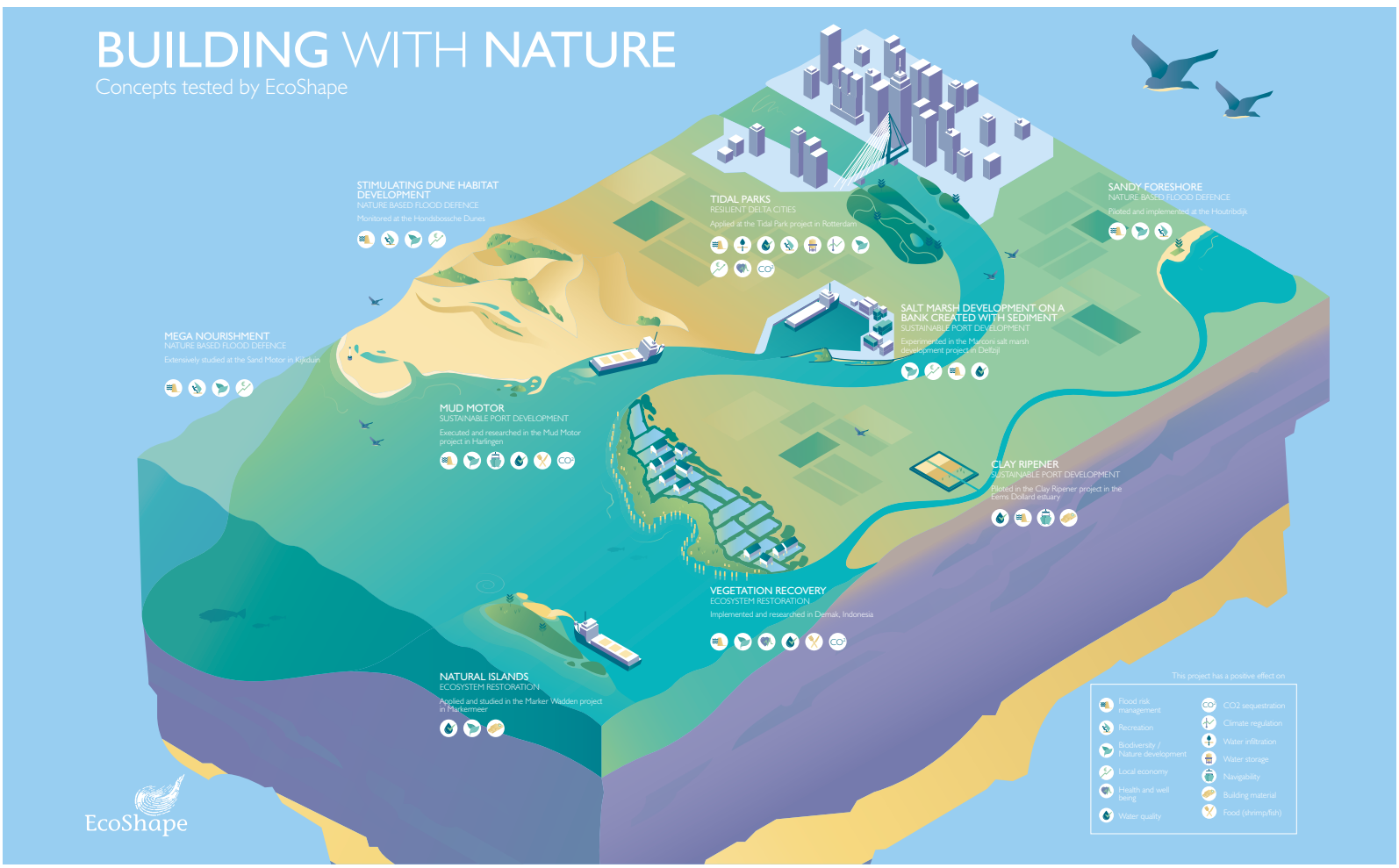
Dutch Diamond As Van Eekelen points out, this form of cooperation between government agencies, businesses, knowledge institutions and NGOs is really quite remarkable. 'The Netherlands is known for its culture of dialogue, and we're quite accustomed to consultations between the various parties. We refer to this phenomenon as the Dutch Diamond. That willingness to explore interdisciplinary issues stimulates the parties to find innovative, integrated solutions. That's far less common in other countries. The market parties there wouldn't dare ask governments to co-invest in their innovations, even if this would clearly benefit the country.'

Still, there are some dilemmas:

The lack of a common goal By way of illustration, Van Eekelen recalls the second phase of EcoShape, which started in 2013: He explains: 'We're mainly financing this phase from the bottom up. That means we enter into partnerships with a private sector party for each individual project. In addition to some wonderful results, this approach also brings some inherent problems. Our main goal is still the development of pre-competitive knowledge on Building with Nature. However, the partners in each individual project are working to find concrete solutions to concrete problems. Innovation processes run into problems from time to time, which inevitably spark debate on targets and budgets.'

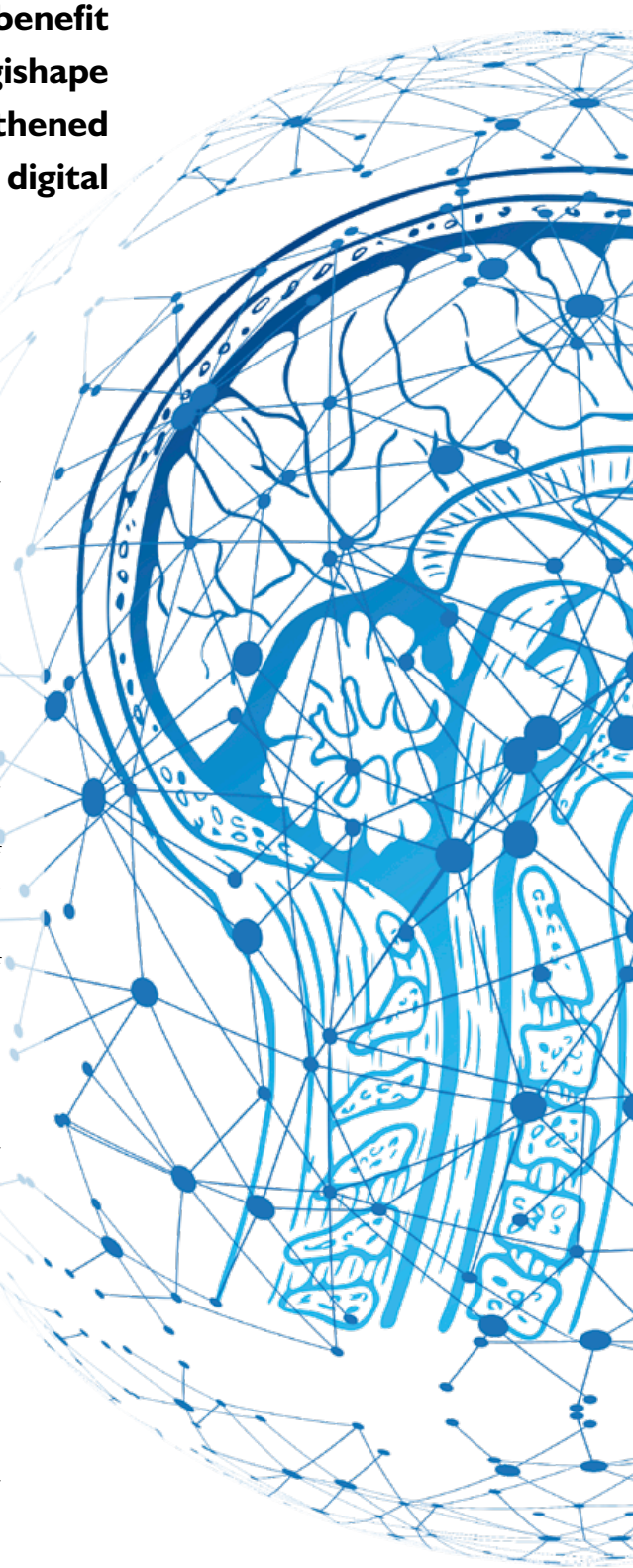
A willingness to combine targets There's also the matter of 'polluting' offshore wind energy projects with other objectives, such as Building with Nature or co-use. Some parties feel the Energy Transition should be our first concern: it's all about the number of megajoules per euro, and other forms of usage will have to be accommodated elsewhere if we are to meet our ambitious targets. On the other hand, other parties point to the added value and economic benefits of multi-purpose use of space, which they regard as an enabling factor.

So who's willing to take a risk? And finally: how do we deal with risks, and who is willing to take them? Van Eekelen: 'If the Netherlands wants to maintain its current pace of commercial innovation, the entire "diamond" will have to share the risks of innovative project development. The more effectively we do that, the better the results. I really believe that.' ≈



Digishape

Dutch knowledge institutions, businesses and government bodies joined forces in an effort to help the water sector benefit from rapid digitisation: The Digishape project. 'Ties will have to be strengthened if we are to truly benefit from the digital revolution.'

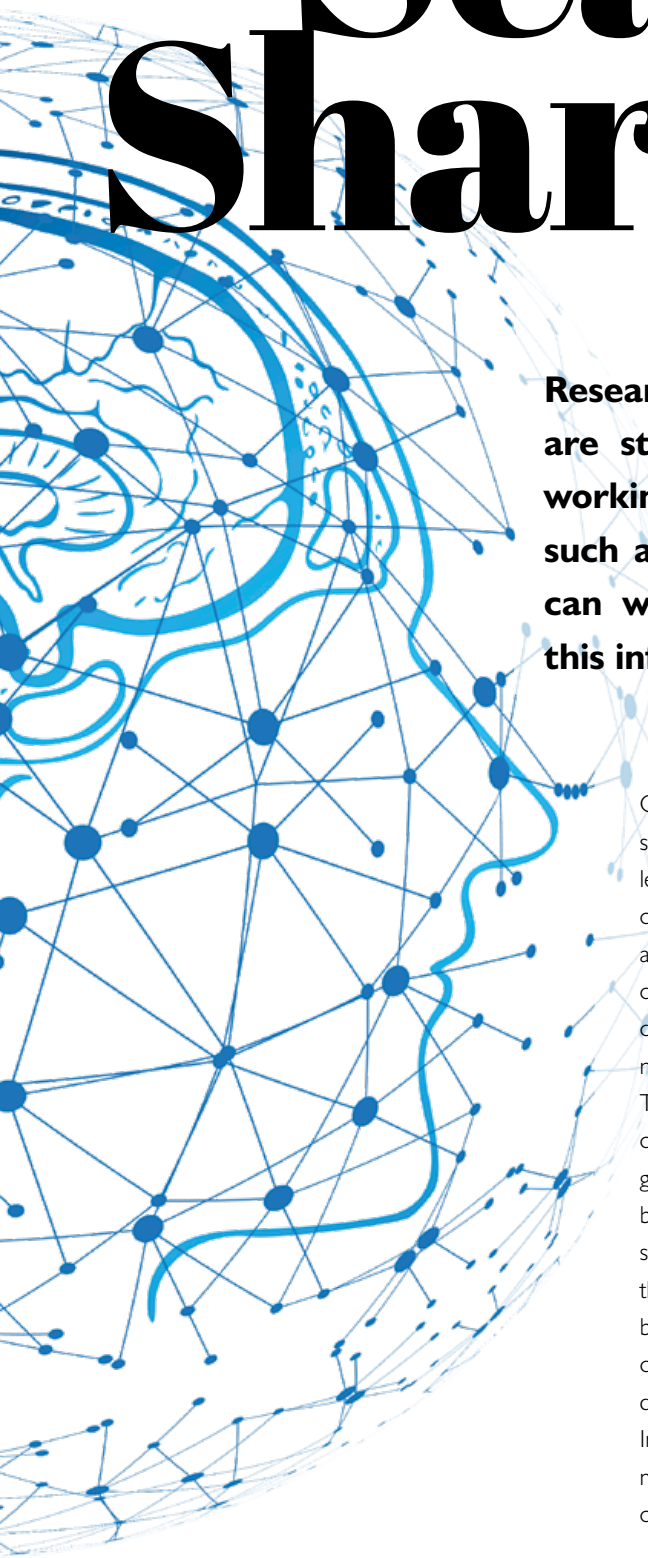


John Schobben, strategic advisor at the Directorate-General for Public Works and Water Management explains: "We need parties willing to co-invest in business cases, so that we can test and demonstrate new data innova- tions. We can create new opportunities by applying data science in projects, helping to further strengthen the Dutch water sector's position. To put it in metaphorical terms, if we build a huge trampoline together, we can jump higher than any of us could on individual trampolines."

How can Digishape be harnessed on behalf of the marine world? Schobben: "Amongst other subjects, we aim to carry out a case study on the North Sea. With vastly ambitious plans for new wind farms, the sea is getting increasingly overcrowded. How can this be reconciled with other uses, and which cumulative and individual effects will it have on marine ecology and morphology? The situation is simply too complex to grasp in its entirety. We can help offer more insight into the system and support decision-making processes through the exchange of digital data and use of new technologies such as Big Data analysis. These new technologies include 'Digital Twin North Sea', a digital replica of the North Sea. This is similar to technology in the medical sector, with which doctors create 3D images of patients on the basis of their CT scans, allowing them to examine patients from every angle without being physically present. We aim to do the same for the North Sea. Data visualisation will allow us to share images, ensuring broader support for new decisions."

Let's make the waves "Connecting all interdisciplinary data and experiences would provide meaningful advice to policy makers, business, government and members of the general public on how to manage the future of the oceans. Join this interactive adventure of co-creation and challenge us with your ideas to create a sustainable world." ≈

Sea Data Sharing



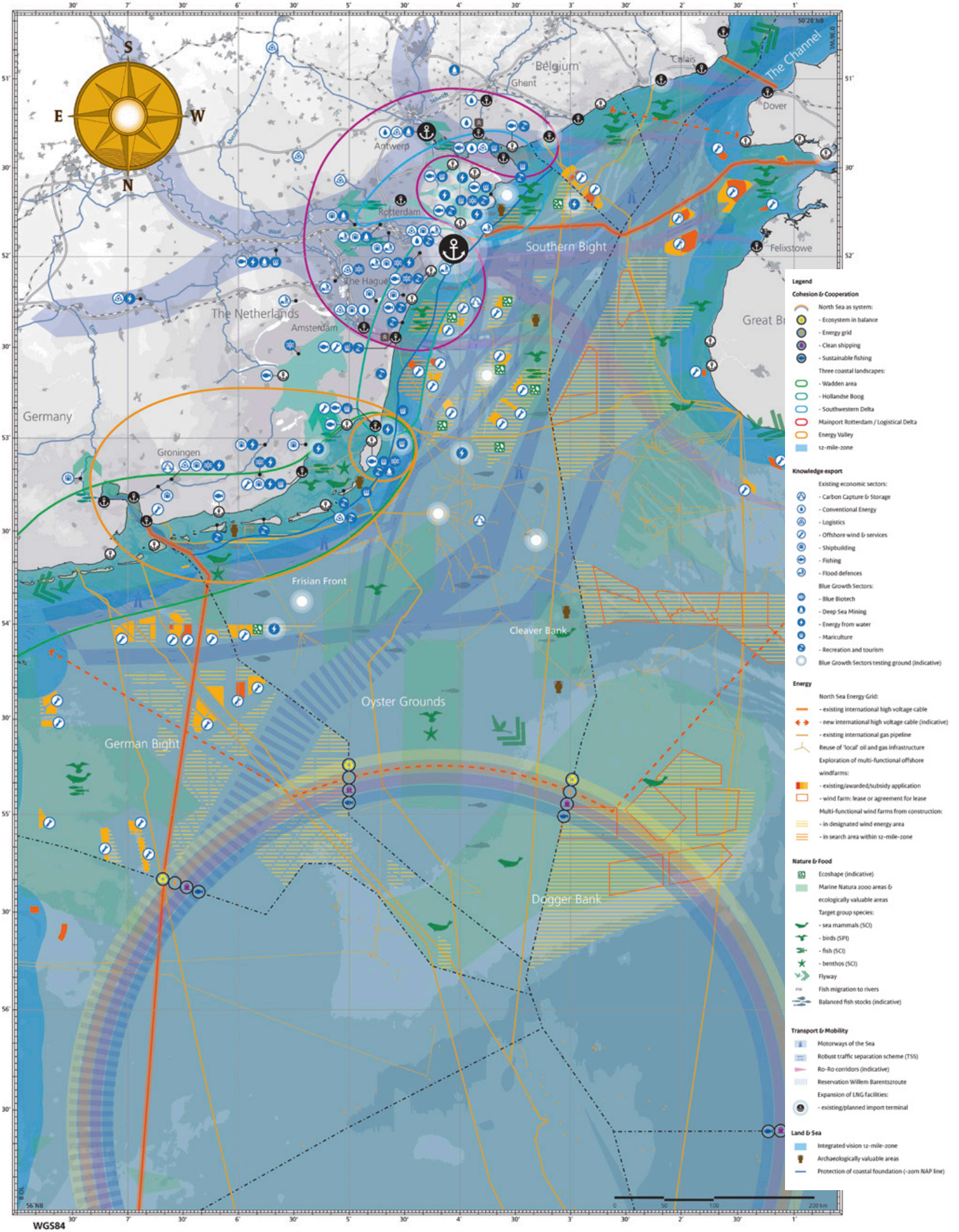
Researchers around the world are studying the oceans and working to solve problems such as plastic pollution. How can we provide access to all this information?

Oceans cover over 70% of the earth's surface, and are a real lifeline on many levels. They regulate the climate, produce oxygen and provide us with food, energy and raw materials. Researchers the world over are trying to gain an understanding of complex oceanic systems and to develop new methods to protect our blue world. This involves gathering enormous amounts of data. The past few years have seen us gather more data on the oceans than ever before. For example, every day, sensors, satellites and micro satellites gather data on the world below, intelligent buoys (Argo buoys) provide data on water temperatures, conductivity and pressure and underwater drones chart the ocean beds.

In addition to applying high-tech measuring methods, researchers are also increasingly outsourcing the data gathering process and relying on the manpower, knowledge and creativity of third parties. The Volvo Ocean Race is a great example of a collaboration between researchers and professional ocean racers, yielding a wealth of information on the state of our oceans.

Data science The amount of digital data on our oceans is growing exponentially, as more and more measurement data become openly available. "We can gain new insights by combining and linking Big Data more intelligently", according to an article by digitisation specialist Joost de Haan of WaterWindow in response to the Ocean Summit, where one breakout session was devoted entirely to the issue. ''Machine Learning will help doing that, by using computers to analyse further, though. This means that machines learn from the task given, without being explicitly programmed to do so. Such application of machine learning will yield yet unknown results and knowledge. With the help of vast data sets, it will be easier to create aggregated models, able to make predictions on a vast range of issues.''

However, we'll need to go further if we aim to make the most of this "digital Valhalla". Data accessibility brings its own set of technological challenges, while data analysis and application involve methodological issues. There are also social and legal aspects to be considered. For example, what about data and knowledge property rights? Agreements will have to be reached on all these issues, on both a national and international level. ≈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Legend
Cohesion & Cooperation
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- Energy grid
- Clean shipping
- Sustainable fishing
Three coastal landscapes:
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- Hollandse Boog
- Southwestern Delta
Mainport Rotterdam / Logistical Delta
Energy Valley
12-mile-zone
Knowledge export
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- fish (SCI)
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Transport & Mobility
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Land & Sea
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Archaeologically valuable areas
Protection of coastal foundation (-20m NAP line)

Seas of possi bilities

Our seas are getting more and more crowded

The wind blows hard and often, the sun shines brightly and waves and tidal systems keep the water in constant movement. It is no wonder, then, that the sea seems to offer such great potential for sustainable energy generation. New wind farms are springing up at a rapid pace, there are plans for the construction of a floating solar farm at sea and numerous new ideas are being bandied around. However, the generation of clean, sustainable energy is not the only activity here; the North Sea is amongst the most intensively used seas anywhere in the world. Ships sail to and fro, sand is being excavated, there are platforms, cables and military training zones, as well as commercial fishing, tourism, and – last but not least – abundant marine life.

The generation of sustainable energy at sea can significantly contribute to the ongoing energy transition in North Sea countries. This leads us to the question: how can we combine this green energy with our other uses of the North Sea in a sustainable manner?

In order to manage the busy waters and protect the ecosystem, North Sea countries are legally required to prepare maritime spatial plans. In doing so, they must take account of economic, social and ecological aspects, requiring collaboration and coordination with the various involved industries and other North Sea countries, clear choices and effective management. The plans should be finished by 2021, offering a guideline for major changes affecting the North Sea. This concerns the issues of energy, food supply and ecological recovery. ≈

The sun forms the earth's largest energy source, and 70% of the earth's surface is covered in water. Floating solar farms thus offer great potential for the global generation of sustainable energy.

Sun on the waves

An increasing amount of solar energy is now generated by floating solar farms. Whereas countries such as China and Japan have already been building such parks for a while now, the phenomenon is still relatively novel here in Europe. The number of initiatives is growing steadily, especially in "fresh" waters.

Floating In early 2018, both the Netherlands and Flanders announced their intention to build floating solar farms in the North Sea. Solar panels at sea: a first.

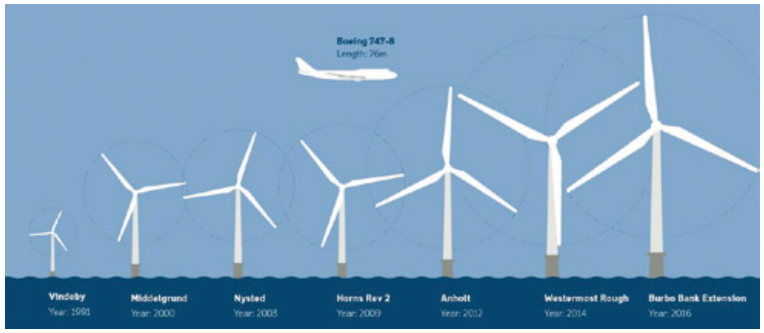
Here in the Netherlands, a consortium of six companies and knowledge institutions will be conducting a trial project over the next three years. The trial facility will be built 15 kilometres off the Scheveningen coast, and is set to cover an area of 2,500 square metres.

Solar farms Oceans of Energy, the company behind the project, proudly published the following statement on their website: "We're going to build something very special that's never been done before. Solar farms on inland waterways have been around for a while, but no one's attempted to build one on sea due to the high level of difficulty involved. At sea, you have to deal with enormous waves and other destructive forces of nature."

Belgium aims to install the first floating solar panels by 2020. "The North Sea can become a real solar farm", according to State Secretary Philippe De Backer.

Benefits Floating solar farms offer various benefits, in that they do not take up valuable space on land, can be combined with wind farms or other facilities and have a higher kilowatt-hour yield than land-based panels. This is due to the reflection of light and the cooling effect of the water. ≈

Booming business



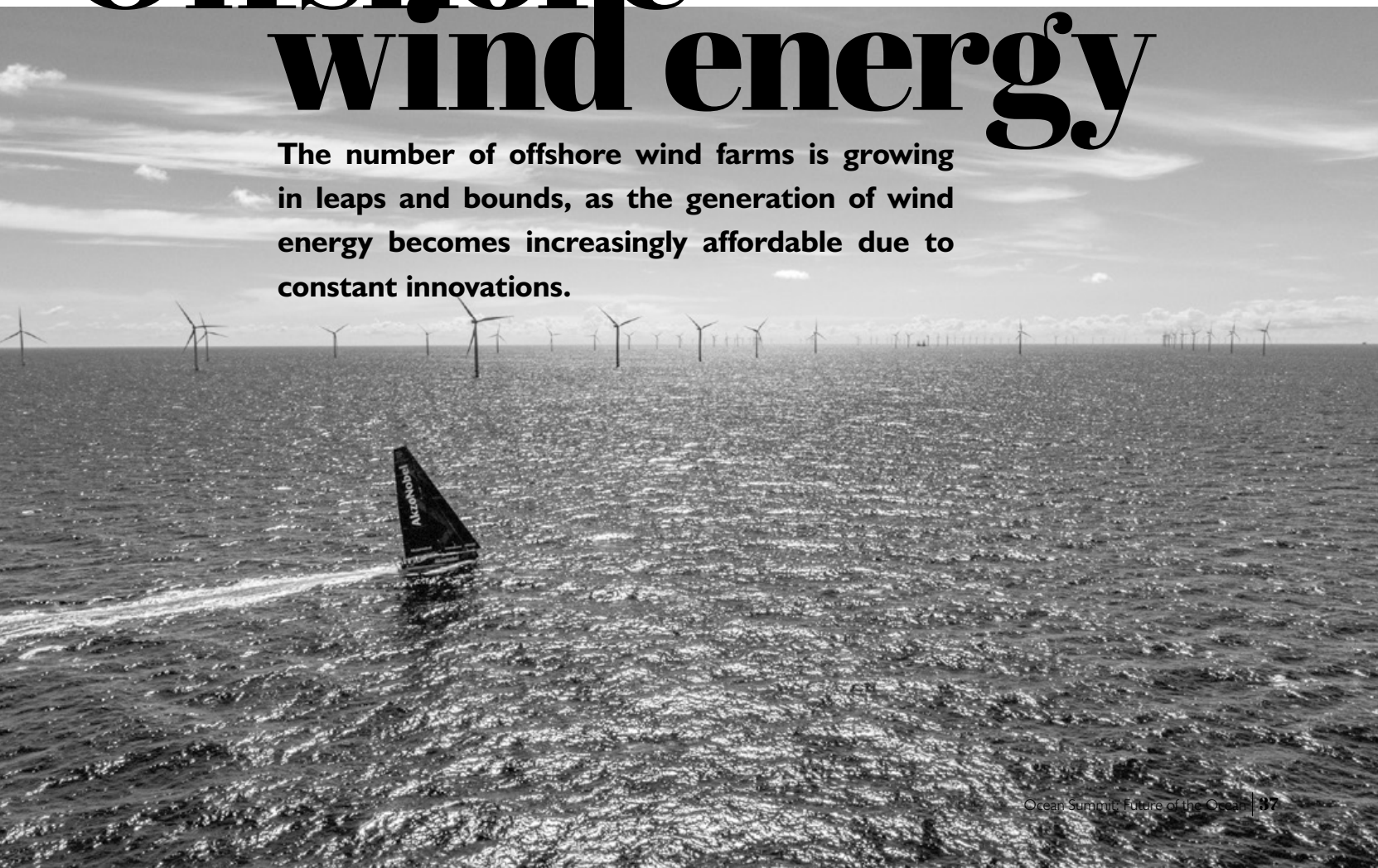
The industry set a new record in 2017; across Europe, a total of 560 new offshore wind turbines were built, representing a total capacity of 3.1 gigawatts. This brings the total European offshore capacity to 16 GW; 98% of this capacity is located in the United Kingdom, Germany, the Netherlands and Belgium.

Amplification A lot has changed since the first offshore wind turbine was built in 1990. The turbines became increasingly large and productive, reaching an average capacity of 5.9 MW in 2017 (up 23% from 2016). The cost of generating wind energy has also dramatically declined over a relatively short period. In fact, the very first "subsidy-free" wind farm is set to be built in the Dutch North Sea, and is scheduled to be operational in 2022.

Scalable Not only have costs already dropped dramatically, they are set to decline further still in future. In addition to thinking bigger, the offshore wind industry will now have to develop a smarter approach. Examples of smart new solutions include floating wind farms, innovative transportation and storage methods and creative combinations of existing functions. We are already seeing the first fruits of this approach, such as a floating wind farm off the Scottish coast and water-powered pile driving systems. One thing is certain: plans for the future are highly ambitious. ≈

Offshore wind energy

The number of offshore wind farms is growing in leaps and bounds, as the generation of wind energy becomes increasingly affordable due to constant innovations.



The tidal system: an eternal source of energy

The tidal system is an almost endless source of energy. This energy can be 'harvested' using turbines and generators, and subsequently converted into electric energy.

Tidal energy is extracted by making use of the different water levels between high and low tide. We can distinguish between kinetic energy (current), whereby energy is generated with free flow turbines in tidal currents, and potential energy (difference in water levels) In the latter case, flood water is retained by means of a dam in the tide pool, and routed back to sea with turbines during low tide. These turbines power generators, which produce electrical energy.

Pro-and-con The generation of tidal energy offers various benefits: energy output levels can be accurately predicted, the process does not require the extraction of any raw materials and the power plants are barely visible, leading to easier acceptance by the general public.
Unfortunately, tidal energy also has a number of drawbacks. For example, energy can only be generated once every twelve hours, in line with the pattern of the tides. The turning rotor blades can also have an impact on the seabed and marine life, such as seals and fish.

Potential Tidal farms at locations with a large difference between high and low tide levels (tidal range) offer the greatest potential. Accordingly, the very first tidal farm was built at Saint-Malo, France – over 50 years ago – where this difference is about 8 metres. Plans are currently being developed for the world's largest tidal farm at a comparable location: Swansea Bay.

Centre However, areas with a less dramatic tidal range, such as the Netherlands, also offer potential. A Tidal Technology Centre (TTC) is set to be opened at the Grevelingen dam drainage sluice in Flakkee in 2018. The facility will be used to test, demonstrate and certify new technologies. ≈

North Sea for people and wildlife

How can the North Sea countries factor the cumulative environmental effects of wind farms into their maritime planning? The SEANSE project will support them in this process.

Affected Porpoises disturbed by the sound of underwater pile driving, birds losing their foraging zones due to the presence of farms or hit by turbine rotors during their migratory or day-to-day flights, bats dying after being struck by a rotor blade or the rapidly alternating air pressure around it – the rapid construction of new wind farms is having an impact on all sorts of animals living in and around the North Sea. The cumulative effect of these farms is especially great, as the multitude of sea-based wind farms create a new North Sea landscape.

Co-operation In an effort to control these cumulative, cross-border effects, governments and official bodies from five North Sea countries launched the Strategic Environmental Assessment on North Sea Energy (SEANSE) project in early 2018. Directorate-General for Public Works and Water Management Project Coordinator Leo de Vrees explains: "It is important that species can migrate to suitable areas with sufficient food and rest. In order to master cross-border cumulative effects of large-scale wind farms, new arrangements must be made to foster a uniform, coherent evaluation system that applies to the entire North Sea. This is the purpose of the SEANSE project."

Spatial plans The SEANSE project will be carried out by governments and official bodies from five North Sea countries. Activities include the development and testing of a new environmental effect measurement method, a demonstration of the new method's benefits and the sharing of knowledge and information. North Sea countries can apply the new method when preparing their maritime spatial plans. ≈

Path to zero emission shipping

Alarming messages from the United Nations, responsible country leaders, scientists and major institutions point out steadily and repeatedly that we are losing the battle against climate change and will have to face ever more dramatic consequences as years even weeks pass by. Even our financial sector gets nervous about the environmental disaster approaching and the irreversible damages already occurring and promote sustainable developments, just to stress the urgency and relevancy of this matter. The path to zero emission human activity should now become a sprint. All sectors need to take their responsibility and handle the energy transition. Shipping is no exception.

Because of its global nature, a success of shipping in its energy transition would impact positively and rapidly the other sectors. But the path is full of challenges. Disruptive solutions are needed, and science, no science-fiction, could provide such solutions.
Four disruptions, compared to our standard way of designing, building and using ships, could form the path to zero emission in the shipping sector.

Design ships for service conditions and keep promoting energy sobriety

Onboard monitoring of actual ships in service and the smart analysis of the measured information will certainly help defining how ships are actually sailing. Such conditions are often quite far from the ideal trial conditions specified at contract stage. The increased difficulty of checking such performance should not be a break to adopt it.

Performing multi-objective optimisation is nowadays possible, for a combination of trim, sinkage and speed. Adding additional parameters such as the added resistance in waves and manoeuvring capabilities is on its way. Whatever energy source the future ships will use, performance optimisation and energy sobriety will always bring benefits.
In order to validate the design choices, use can be made at concept stage of so-called voyage simulations. A digital-twin of the future design performs the expected operations based on hindcast weather data (historical spatial variation of wind and waves conditions). Such methodology, scarcely used in ship design nowadays, will be of great help to obtain designs that are fit for service.

Ban fossil fuel and use solely renewable energy source

Shipping goods around the world with zero emission will need however more than optimum designs. The end of fossil fuels in shipping is possible, with the use of electric engines powered by renewable electricity. The carrier of electricity will come in the form of hydrogen and batteries. Such step will influence the way we design and engineer ships and the way we operate them. As an example, hydrogen in its compressed from, would represent only 20% of the weight of oil that contains equivalent energy. But would require 4 times more volume of tanks. Will we need larger displacement to account for the additional volume? Or plan extra bunkering during operations to prevent loosing payload capacity? The design spiral will be different, for sure, but optimum balance will be found by integrating system choices and hydrodynamic performance optimisation.

Make smart use of the environmental forces Use of wind energy, as an additional propulsion source, is also a great possibility. Efficient and automated sail devices allow to harness a power which is freely available in all the oceans. The argument of its variability as reason not to use it is as idiot as when it was used 15 years ago for windmills intended to become an important source of electricity. Such technique has become meanwhile the largest share in the energy production in Europe, above all other sources. It is important to realise that, depending on the area of operations and ship types, reduction of energy use within 5 to 40% is simply achievable. Far more than any devices applied systematically on the hull to further improve few percent of their efficiency! Special designs on niche markets could even go up to 80%, keeping motor assistance for coastal approach or manoeuvring in harbour only. Unfortunately, as any innovation, many are waiting for final products to implement them on their ships. It just cost however a hand full of visionary decision makers to generalise the use of such devices when concept studies prove their potential benefit on a given service for a given design.

Modify drastically the energy infrastructure Last but not least, the energy infrastructure will also suffer a transition. For the good, but a transition with important turbulences. It will touch upon core activities of certain harbours, oil terminals, refineries and the all logistics chain of oil and gas transport, from well to wheel.
To conclude, the necessary energy revolution in shipping does not only represent a difficult challenge, it is also a great opportunity to create better ships and probably the last chance to keep blue oceans. Keeping in mind such benefits will give hopefully confidence in the shipping sector to make disruptive choices. ≈

Quality stamp for emission free shipping

'How much would it costs to ship my pair of sneakers without emissions?' This is what we asked ourselves while preparing keynotes for the Ocean Summit.

We are able to choose for sustainable energy and biological products, but we do know little about the way our sneakers are shipped around the world. Let alone being able to choose for a sustainable alternative. To provide a take away for the audience at the Ocean Summit, we took on the challenge to make a rough estimate of the additional cost to ship a pair of sneakers without emissions from Asia to Europe. We assumed an electric propelled container ship running on a hydrogen fuel cells and compared this to a 14400 TUE container ship running on Heavy Fuel Oil. Of course this estimate assumes some technology that is not yet available. However it is realistic enough to inspire consumers and industry to aim high.

The conclusion: if you are willing to pay an additional 3.4 EUR for a pair of ordinary sneakers, you will be able to cover the additional fuel costs to sail on hydrogen. And including the estimated cost to adept an existing container ship from HFO to H2, this ballpark figure would only increase to a total of 3.6 EUR. And by introducing a quality mark, we can recognize this sustainable alternative. ≈

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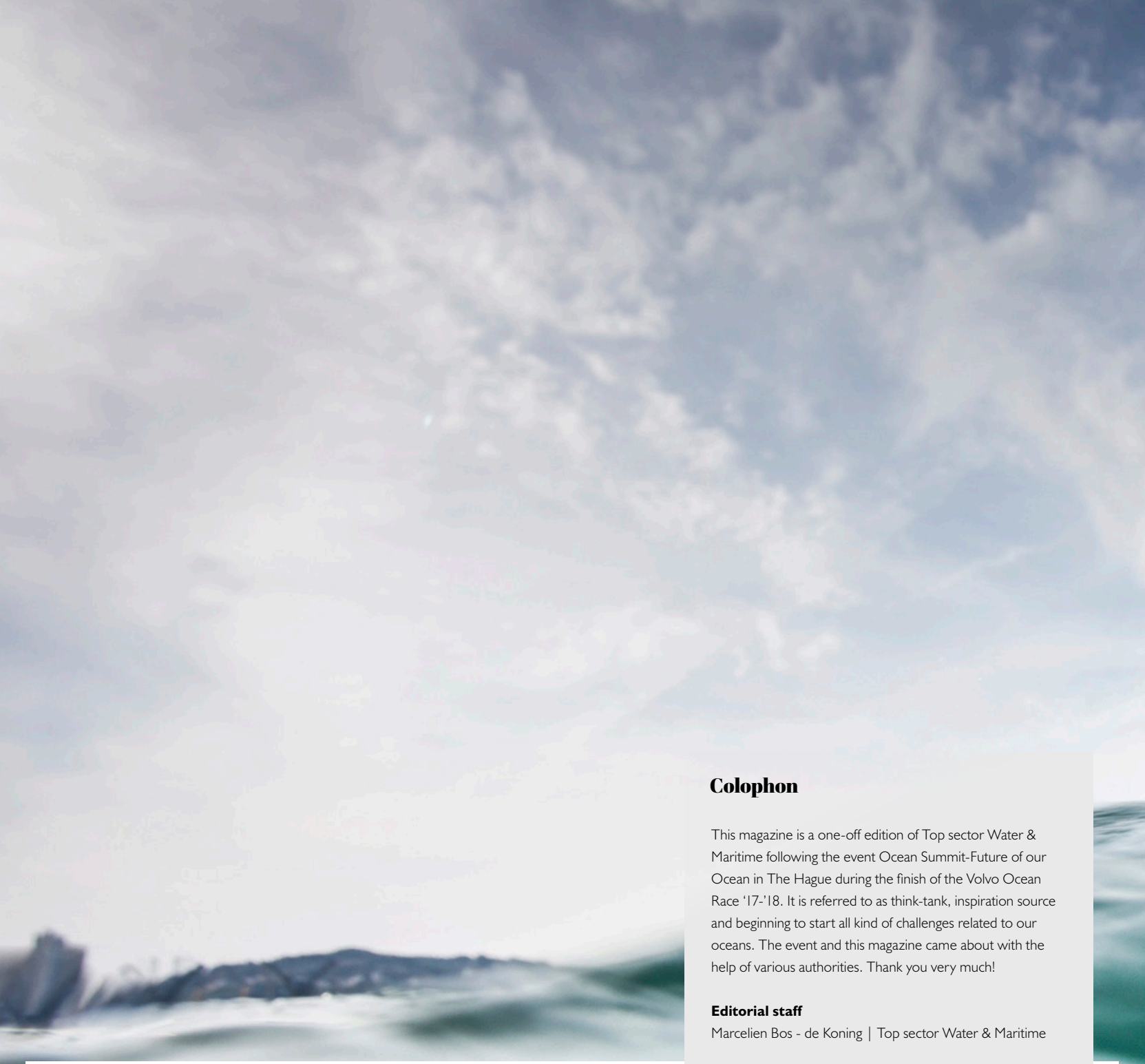

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MARIN

Colophon

This magazine is a one-off edition of Top sector Water & Maritime following the event Ocean Summit-Future of our Ocean in The Hague during the finish of the Volvo Ocean Race '17-'18. It is referred to as think-tank, inspiration source and beginning to start all kind of challenges related to our oceans. The event and this magazine came about with the help of various authorities. Thank you very much!

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