MARINE CONTRACTORS

Sustainability Report 2023

Heerema Marine Contractors
April 2024 | Leiden

www.heerema.com/sustainability

a Heerema company

Silent piling technology

Heerema and the University of Dundee's School of Science and Engineering are working on a novel silent pile installation method.

The impact of noise pollution on marine life is two-fold; there are concerns about direct hearing damage for animals (temporary or permanent) alongside disruption to their communication and navigation signals. Consequently, these disturbances can affect migratory patterns.

During the installation of wind turbines, wind farm sub-stations, converter platforms, and traditional oil and gas facilities, pile-driving operations generate considerable noise. Globally, several countries are challenging noise pollution by introducing underwater noise restrictions. For Heerema, however, the ambition extends beyond mere compliance by creating 'silent foundations.'
The development of alternative pile foundations that could be installed without producing significant underwater noise is currently ongoing.

The foundation concept under development is called 'push-in piles': the traditional single open tubular pile is replaced with a cluster of four smaller diameter open tubular piles. This design can eliminate noise pollution as it requires no pile-driving or hammering - instead, after some strokes, each of the piles is pushed into the soil with two or three piles providing the uplift resistance required to push in the fourth.

Currently, testing is in the final stage of proof of concept, which demonstrates the ability to install the piles to the required depth. Stay informed about the progress and findings by visiting our website for updates as soon as they become available.

9 SDG 9 (Industry, Innovation and Infrastructure) by supporting technological development and encouraging innovation.
14 SDG 14 (Life Below Water) by mitigating the impacts on marine life.

Table of contents

1 Introduction

At Heerema Marine Contractors, we are committed to making the impossible possible offshore. Driven by our sustainability beliefs, we create sustainable value(s) for our clients and stakeholders.

Curiosity and innovation are ingrained in our Heerema DNA. We recognize that the future relies on bold ideas and groundbreaking technologies. From pioneering offshore installations to developing silent piling technology, our commitment to innovation drives us to constantly seek new opportunities and redefine what is achievable in the pursuit of a sustainable future.

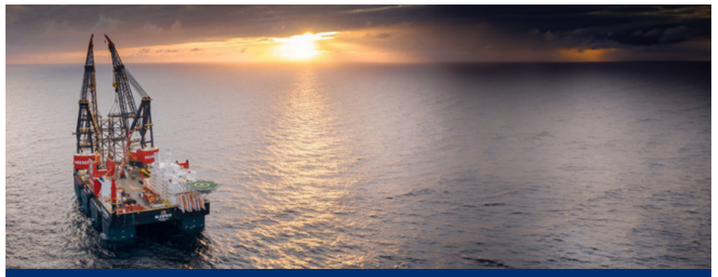
Sustainability remains a topic within a landscape filled with uncertainties and opportunities. Our learning mindset brings us the ability to reflect and adapt. In 2023, we reflected on challenges in our decarbonization approach and embarked on a renewed commitment; navigating to Net-Zero Heerema. Our commitment to Net-Zero Greenhouse Gas emissions by 2050 demonstrates our ongoing focus on decarbonization.

This year, we broaden our scope by introducing our fourth sustainability ambition Healthy Oceans. It underscores our intrinsic motivation to care for the environment we work in.

In light of this progress, I invite you to continue reading Heerema's Sustainability Report 2023. It details our collective commitment to sustainability across the company and shows how we, as a team, are delivering on our mission.

Pieter Heerema
Chairman

Heerema Highlights of 2023



Preparation of Carbon Capture and Storage prototype onboard Sleipnir in 2024 for EverLong project

Sustainability Visit onboard Thialf

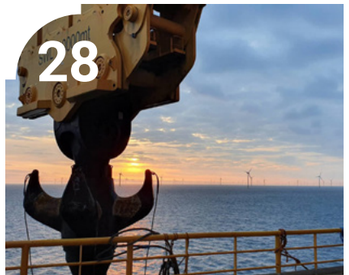
Environmental Sustainability IMCA Award on Silent Piling

Adopting our fourth Sustainability ambition: Healthy Oceans

Thialf Hybridization Orientation

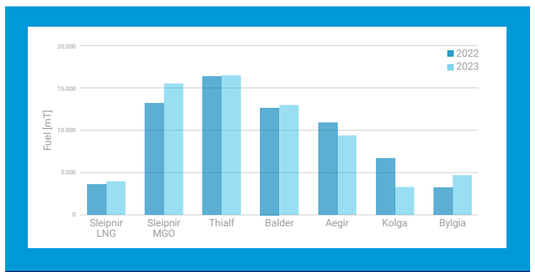
Successful execution of Double Materiality Assessment for CSRD

Software upgrade for Aegir

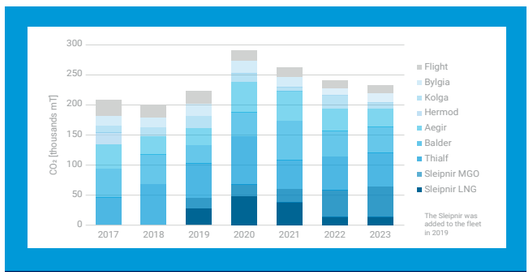


Heerema Decarbonization Fund

Learning Mindset: Keynote Mark Tuitert on Social Sustainability



Fleet consumption of fuel in mT



Fleet emissions in mT CO_2 eq.

Check the website for more information about our projects www.heerema.com

3
Our company at a glance

Making the impossible possible offshore

Our mission is to be the leading marine contractor creating sustainable value(s) for clients and stakeholders.

We deliver innovative and sustainable solutions for the transportation, installation, and removal of offshore infrastructure. We do so by managing the entire supply chain of project execution, offering solutions that include design and front-end engineering, planning, logistics, project management, and the execution of projects worldwide.

Our most valuable assets are the people who work at Heerema. Their passion and skills are the driving force behind the company's vision to make the impossible possible offshore. It is a highly skilled workforce working in offices worldwide and on its fleet of the world's largest crane vessels.

Within our fleet, different opportunities exist to execute our projects with a sustainable approach, one of them being our semi-submersible crane vessel Sleipnir, which runs on LNG. In the table, you can read more about our sustainability measures on board our fleet.

"Making the impossible possible offshore" Our Vision

Wind
Driving the global energy transition by bringing Heerema's experience to the offshore wind industry.

Decommissioning
Heerema has been removing offshore facilities safely, predictably, and sustainably for over thirty years.

Transport and Installation
Heerema transports and installs offshore structures in a safe, cost-effective, and sustainable manner.

		SLEIPNIR		THIALF	BALDER	AEGIR	KOLGA BYLGIA
Lifting capabilities		2 x 10,000 mT		2 x 7,100 mT	6,300 mT	5,000 mT	-
Average Fuel Consumption per day [mT] *3 year average*		6 LNG	61 MGO	43 MGO	37 MGO	31 MGO	12 MGO
Emission Factors (mT/mT) *For example 1 mT LNG produces 3.887 mT CO_2* *Emission factors under constant review*	CO_2 eq.* NOx	3.557 0.01020	3.24999 0.05090	3.24999 0.05886	3.24999 0.05375	3.24999 0.04080	3.24999 0.05076
Operational Footprint							
Alternative Low Emission Fuels (LNG/GTL/HVO)		LNG		HVO/GTL	In progress	In progress	In progress
Marine Gas Oil low sulphur		√		√	√	√	√
UREA system to reduce NOx emissions on MGO		√		x	x	x	x
Optional noise mitigation during pile driving		√		√	√	√	-
Occupational health measurements		√		√	√	√	√
Biodegradable oils non-floating spread and ROVs		√		√	√	√	-
Environmentally friendly cleaning products		√		√	√	√	√
Highly effective bilge water separators		√		√	√	√	√
Green Dynamic Positioning (DP) mode or equivalent		√		√	√	√	√
State-of-the-Art Crane Power Management System		√		√	-	-	-
Optional sailing on one engine		-		-	-	-	√
LED lighting cranebooms, deck, and exterior accomo		√		√	√	√	-
Ship Energy Efficiency Management Plan (SEEMP)		√		√	√	√	√
Strict waste separation procedures		√		√	√	√	√
Deck rainwater collection / treatment		√		-	-	-	-
High Performing Fluorine-Free Foams for Firefighting		√		-	-	-	-
Dedicated waste management controller		√		√	√	√	√
Green Passport EU Notation		√		-	-	√	√

** including methane slip*

Heerema's contribution to the energy transition

During the Q1 project in the North Sea, more than 95% of the outfitting of the three barges, including grillage and supporting structures, consisted of re-used steel!

27 WIND TURBINE GENERATORS
CAPACITY OF 257 MW

Exciting challenge for the Thialf: passing the Storebælt bridge!
A challenge creatively resolved by lowering the vessel's cranes!
This crossing inaugurated the first wind project for Heerema in the Baltic Sea.
The Baltic Eagle OSS Installation consisted off the installation of a jacket, piles and topside in the German sector of the Baltic Sea.
The steel utilized for structures in this project consisted for almost 40% of existing steel.
A great example of making the impossible possible offshore.

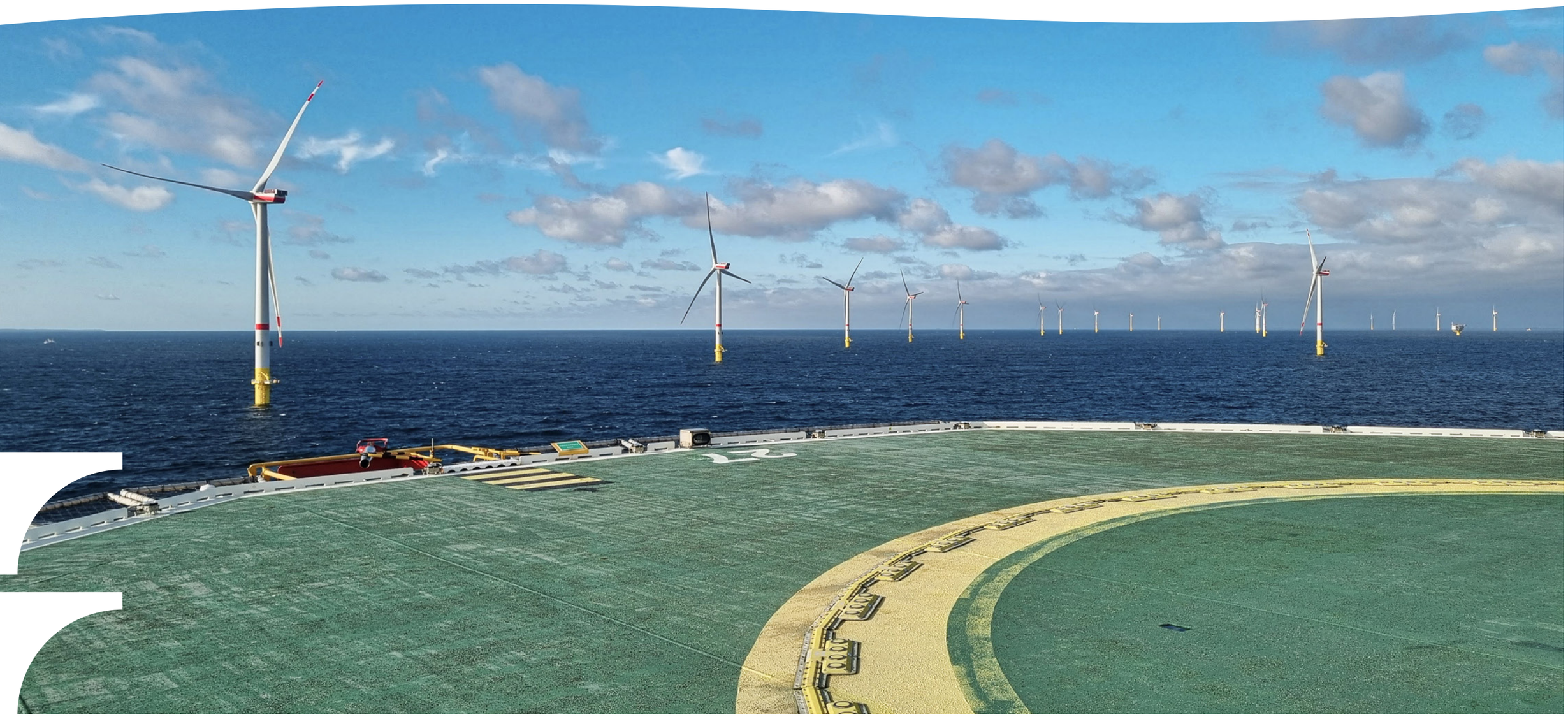
In 2023, the Heerema fleet removed and transported over 44,700 metric tons of old platforms, with over three-quarters of this material (33,000 metric tons) being offloaded onto recycling yards in the USA, UK, Australia, and The Netherlands.

33,000 MT
OFFLOADED ONTO RECYCLING YARDS

Two firsts for Heerema in 2023! On the Neptune project, the Balder removed its first SPAR in the Gulf of Mexico. After removal, the SPAR (measuring 215 by 22 meters!) was towed and sunk near Mobile Bay to expand the local artificial reef system as part of Alabama's Rigs to Reef program. This was also the first time Heerema contributed to a rig-to-reef initiative. Want to learn more about this project?
Check out chapter 6.3.2!

In 2023, Heerema completed the installation of 27 wind turbine generators for the Arcadis Ost 1 wind farm in the Baltic Sea. The wind park will have a production capacity of 257 MW, which will produce enough electricity to power almost 290.000 homes.

4 Our commitment to Sustainability



4.1
Sustainability Beliefs

We act sustainably because we care

For many years now, Heerema has believed that a responsible company has an obligation to act in a sustainable manner.

For Heerema, Sustainability means carefully balancing between people, planet, and profit. Taking the lead towards a more sustainable offshore industry is a natural instinct embedded in our mission and translated to our daily work practices. We aim to be part of sustainable solutions in our industry, taking into account existing targets and frameworks.

Our intrinsic motivation drives us to take care of the environment we work in. This is shown by our commitment to creating value(s) that encompass the three pillars of sustainability: Social, Environmental, and Economic values. To transform values into action, we use our Sustainability Strategy and roadmaps (chapter 4.2) that guide all employees and set out concrete ambitions and goals.

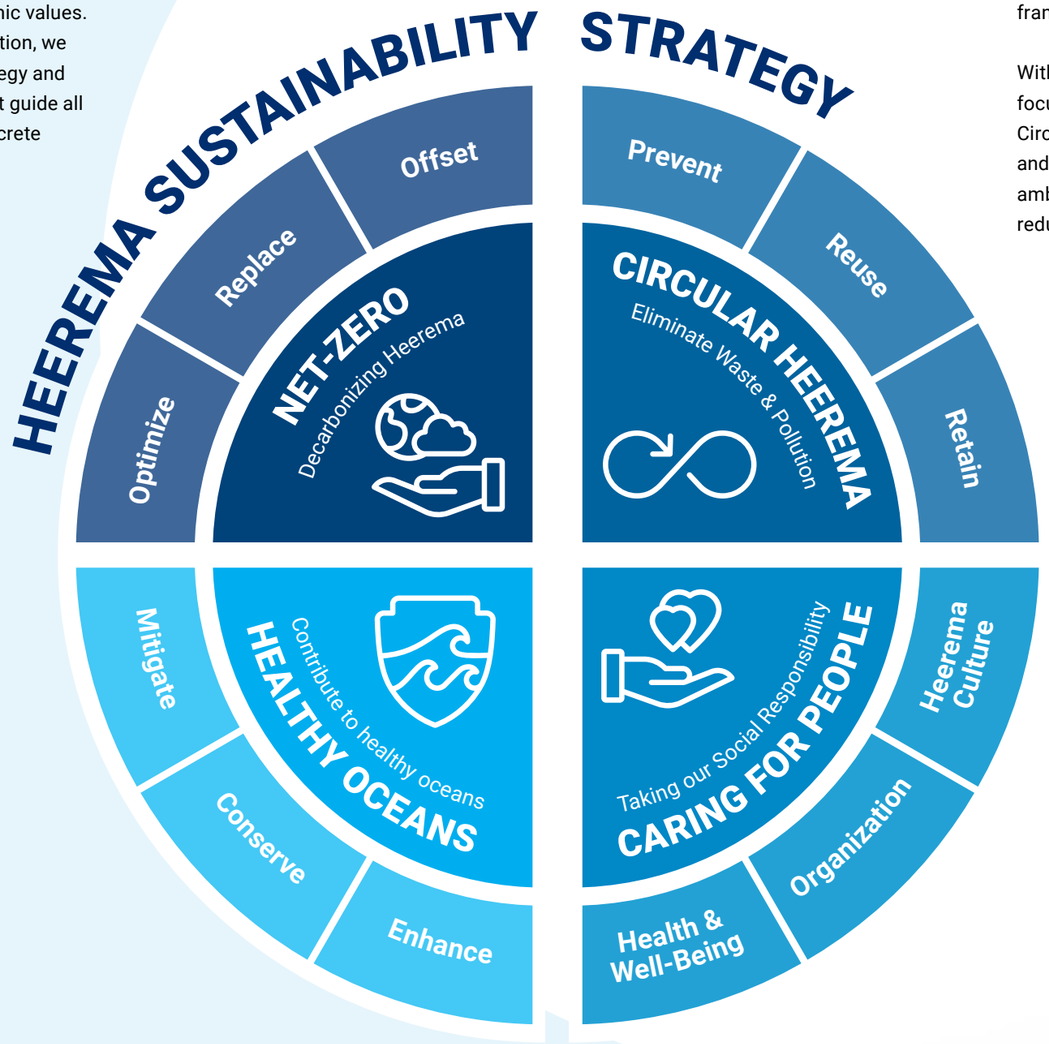
Over the past sixty years, we have established a reputation for excellence, innovation, and safety. Today, we apply these principles and experiences to our sustainability ambitions. Our ability to continually reflect and adapt is a key factor to our success in a changing world.

Pieter Heerema | Chairman

4.2
Sustainability Strategy

Our own course

To move values into action, we use our Sustainability Strategy and corresponding Roadmaps. Based on existing targets and frameworks, they provide focus on our way forward.



Our approach is based on the United Nations' Sustainable Development Goals, the sustainable ambitions of the International Maritime Organization, and additional relevant legislative frameworks.

Within our Sustainability Strategy we focus on four ambitions: Net-Zero, Circular Heerema, Caring for People and Healthy Oceans. Not only do these ambitions set targets on emissions reduction, resource consumption, sustainable employability, and marine life, they also define the strategy on how to get there. Ultimately, our initiatives move our sustainability agenda forward by creating sustainable values, awareness and involvement.

The pillars linked to the ambitions reflect the guidance given by our Sustainability Roadmaps. These roadmaps bundle our current initiatives and ongoing projects. They can be seen as the foundation on which we translate our values into action. Heerema's Sustainability Roadmaps all together achieve an optimal balance of the triple bottom line.

We use our Sustainability Strategy for long-term planning and sustainable development. It reflects our sustainability journey and is therefore being updated according to lessons learned along the way.

Meike Kolthof | Manager Sustainability

5

Caring for People

Health & Well-Being | Organization | Heerema Culture

One of the ambitions in the Heerema Sustainability Roadmap is to Care for People by taking Social Responsibility seriously.
To achieve sustainable employability, Heerema aims to create an environment where employees can feel happy, healthy, safe and motivated until retirement.
All measures currently taken by various departments focus on three pillars: Health & Well-Being, Organization and Heerema Culture.

5
Caring for people

5.1
LEARNING MINDSET

5.2
SYNTHETIC CHAINS

HEALTH & WELL BEING | ORGANIZATION | HEEREMA CULTURE **The Heerema Sustainability Strategy includes the Caring for People Roadmap divided into three pillars; Health & Well Being, Organization and Heerema Culture**

Health & Well-Being

In 2023, Heerema intensified its commitment to improving Health and Wellbeing for our workers under its Caring for People roadmap by implementing several key initiatives.
As part of efforts to improve Social Safety, we expanded our pool of confidential counsellors, prepared the launch of an anonymous reporting system called SpeakUp, and piloted Social Safety workshops to improve awareness. Additionally, Employee Assistance Programs were extended, offering broader support for employee health and well-being, consisting of both proactive measures as well as a wide range of support programs.

A highlight of the year were the Dare to Care safety days, which focused on “lowering thresholds to become more proactive” by introducing Psychological Safety.
The goal was to cultivate an environment where employees feel safe to express concerns and ideas. These efforts mark Heerema’s dedication to enhancing both the physical and psychological safety of its workforce, promoting a culture of openness and support.

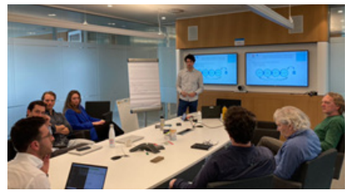
Organization

At Heerema, we provide our new colleagues with a quick start through an intensive onboarding program. We empower people to take ownership of their own career journey through several initiatives such as Personal Development Plans and the Heerema Development Program.
Continuous improvement and internal partnerships that cross departments, locations and vessels are fundamental building blocks of our learning organization.

Heerema Culture

Working globally in a rapidly changing environment drives us to be agile, curious, and resilient, fostering a culture of empowerment, collaboration and experimentation. These principles are embedded in everything we do and are fuelled by our passion and pride.

5.1
Learning Mindset



At Heerema we believe that, in the ever-evolving landscape of business, a learning mindset is a key element for organizational success.

FIT WITH SDGs

To move values into action, we use our Sustainability Roadmap. Based on the United Nations' Sustainable Development Goals (SDGs), it provides focus on our achievements, ongoing projects, and ambitions.

These initiatives contribute to a number of Sustainable Development Goals, among others:
3 **SDG 3** (Good health and well-being) by focusing on mental health awareness.
4 **SDG 4** (Quality Education) by promoting learning opportunities that acquire the knowledge and skills needed to promote sustainable development.
17 **SDG 17** (Partnerships for the Goals) by sharing knowledge, expertise, technology and resources, to support the achievement of the Sustainable Development Goals.

FIT WITH STRATEGY

As part of the Caring for People Roadmap, we concentrated on initiatives spanning all three pillars. Mental Well-Being was integrated into our social sustainability event. Through round tables and offshore sustainability sessions, we actively engaged both office and fleet personnel, fostering Workers Participation. Simultaneously, by collaborating with high school and graduate students, we aimed to focus on the Career Journey of future engineers.

We are convinced that, by prioritizing and instilling a culture of continuous learning, we empower our colleagues to adapt, innovate, and excel in the face of change. Many learning opportunities occurred throughout 2023, of which the highlights are shown in this chapter.

Round table sessions

At Heerema, we organize round table sessions where colleagues gather to engage in discussions and exchange ideas on diverse and relevant topics. These sessions aim to enhance collaboration and enable the sharing of knowledge.
In 2023, the round table sessions focused on themes within our Circular Heerema ambition. In diverse groups, made up of colleagues of various disciplines, open discussions took place on Heerema's way forward on sustainable procurement and circular design. One of the take aways was that open communication, collaboration among different departments and sharing ideas is key to achieving circular goals.

Social sustainability key-note event

With our Caring for People ambition, we promote social sustainability throughout all of Heerema's practices. To shed a light on this topic, the Sustainability department, in collaboration with Young Heerema, invited Mark Tuitert, former ice speed skater and Olympic champion, to the Leiden office for an inspiring lecture on building strength through adversity. His empowering speech emphasized on taking personal responsibility, showcasing courage and developing personal leadership – values that resonate seamlessly with Heerema's Founders Mentality. The event concluded with Heerema's own expert panel, consisting of colleagues with various roles and disciplines who shared their experiences on social sustainability within the workspace.

Sustainability Vessel Visit

To inform and engage all Heerema's colleagues on the company's sustainability initiatives, the sustainability department organizes vessel visits to present and discuss Heerema's sustainability strategy with the fleet. This year, we went aboard Thialf and spoke with more than 60 colleagues on how to further enhance sustainability on Thialf and throughout the company. As colleagues from various disciplines were involved, interesting insights were shared and ideas were raised such as introducing Green Teams aboard vessels, who can work on sustainability topics daily offshore.

Graduate Symposium

To improve knowledge sharing within the Heerema Group, we encouraged students graduating from all three Heerema divisions to pitch their graduation thesis and share their state-of-the-art research during a graduate symposium event.

Collaboration with DaVinci college

In 2023, Heerema once again invited students from the Da Vinci College Leiden, who specialize in research and design, to explore new ideas on how blades of a floating wind turbine at sea can be installed safely and efficiently. The students, or potential engineers, proposed solutions that not only inspired our colleagues but also demonstrated, once again, that a fresh perspective can yield insightful and creative solutions.

> **When I learned that a member of the Sustainability Department would be onboard Thialf, it seemed like a golden opportunity to learn more about our companies goals. Several sessions were given to the officers onboard, and these were very effective, in getting to know each other better, and to better understand where the mindsets of the people meet about Sustainability. As a result, quite a few crewmembers asked to be more involved in the plans and would like to help the Sustainability department, the company, and therefore ourselves, to achieve the goals we have set together.**
>
> **Arjan Udo** | Captain Thialf

> **The design exercise for the students of the Da Vinci College was a success for all parties: on one hand, we are happy to excite a new generation for offshore engineering. Introducing them into this world might leave a long-lasting memory that could inspire their career decisions, which I find uplifting. On the other hand, we shaped the exercise such that their effort would be put into a true challenge for the entire floating wind industry. The assignments were created so that the students would gradually be introduced to the subject. This led to them being surprisingly well-equipped for problem-solving and concept development. The energy and creativity of the Da Vinci students may not have directly resulted in the ideal blade installation machine, but I am quite certain we sparked a few future engineers.**
>
> **Hugo Kerckhoffs** | Junior Engineer leading the DaVinci project

5.2
Synthetic Chains

Dyneema synthetic lifting chains

Within the Health and Well-being pillar of our Caring for People roadmap we work on improvements to working conditions, both onshore and offshore.

FIT WITH SDGs

To move values into action, we use our Sustainability Roadmap. Based on the United Nations' Sustainable Development Goals (SDGs), it provides focus on our achievements, ongoing projects, and ambitions.

These initiatives contribute to a number of Sustainable Development Goals, among others:
3 **SDG 3** (Good health and well-being) the lighter design promotes physical health and increases ease of handling.
12 **SDG 12** (Responsible consumption and production) by using equipment made of sustainable materials.

FIT WITH STRATEGY

As part of the Caring for People roadmap, Working Conditions and Physical Health were further improved through use of the lighter chain designs.

One of the initiatives is the use of Dyneema synthetic lifting chains - a first for Heerema. These chains are significantly lighter, making them more user-friendly for our crew which contributes to healthier working conditions.

On the Arcadis Ost I project, the sea fastening for the nacelles needed to be quickly and easily connected and disconnected, and due to the project's specific requirements, welded sea fastening was not an option. The traditional solution to this scenario would be heavy metal chains and a chain block. However, the project team investigated the possibility of using synthetic chains instead. The benefits of using these synthetic chains are that they are significantly lighter and easier to handle for our offshore crew, resulting in an improvement in working conditions. Sándor Hötte works as an Installation Engineer on the Arcadis Ost I project and was involved with the implementation of the synthetic slings: "After a colleague suggested the option of using synthetic chains on the Arcadis Ost I project, we started the engineering process to see how this solution could be implemented. First, the transport loads were determined, and a concept sea fastening was made. This provided input for an open dialogue with our suppliers and enabled us to actively collaborate with all stakeholders involved in the Arcadis Ost I project. Conversations were also held with the Marine Warranty Surveyor, as their approval is required before execution. After a short iterative process, the design was finalized. During a different project, the chains were also found to be a success in lifting applications, showcasing their adaptability in terms of length. This flexibility allows for easy adjustments of chain lengths, by selecting a different link within the chain.

Offshore we found that the solution worked well, and the crew were content working with the synthetic chains. The chains' lightness was much appreciated, also because it impacted the speed at which the crew could connect or disconnect the sea fastening positively. As a result of our success on Arcadis Ost I, Heerema aims to increase the use of synthetics chains onboard our vessels going forward."

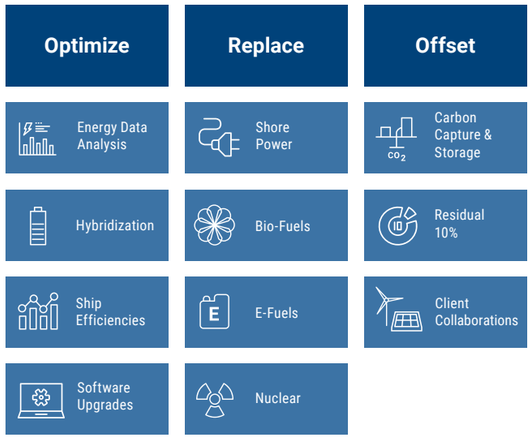
Dyneema Synthetic chains are eight times stronger than steel chains and 85% lighter. The lifting chains are made from bio-based Dyneema fiber, which is 90% more environmentally friendly than traditional oil-based chains.

6

Our impact on the environment

6.1 Net-Zero

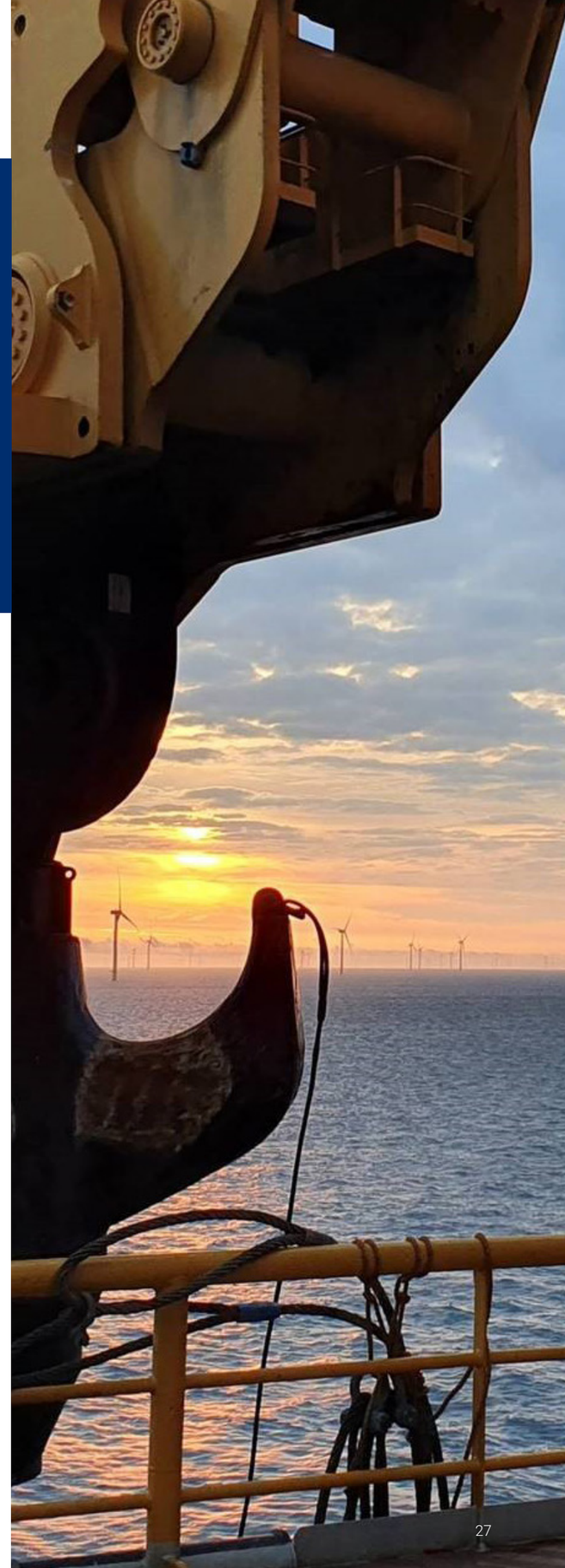
OPTIMIZE I REPLACE I OFFSET The Heerema Sustainability Strategy includes our Net-Zero ambition, which contains the commitment for Net-Zero Greenhouse Gases by 2050. We are exploring a variety of projects, such as Shore Power, alternative fuels and hybridization to reach this target.



Within our Net-Zero ambition, we commit to decarbonizing Heerema by means of optimizing, replacing and offsetting towards Net-Zero Greenhouse Gas Emissions by 2050. Emissions will be reduced by optimizing our fuel use and increasing efficiency or eliminated by replacing fuel with alternative power systems. Additionally, we implement and invest in projects and technologies to offset remaining emissions where feasible in collaboration with clients and stakeholders.

With our dedication we have already prevented 12% of our Scope 1 emissions accomplishment since 2020.
We are proud that we hit this target with our Shore Power connection in the Port of Rotterdam, the use of cleaner fuels, and additional efficiency measures. Other relevant technologies that contribute to our future reduction are bio-fuel trials onboard, software upgrades, hybridization studies, and Carbon Capture pilots.

With our dedication we have already prevented 12% of our Scope 1 emissions at the source since 2020.



6.1.1 Heerema's Net-Zero ambition

A commitment to Net-Zero Greenhouse Gas emissions by 2050

With our learning mindset, we have refined our decarbonization strategy and updated our ambition. While reviewing, the triple bottom line (people, planet, profit) remained the basis.

> With our learning mindset, we can continuously reflect and adapt. This enables us to recognize challenges in our approach and apply this in our decarbonization solutions.
>
> **Meike Kolthof** | Manager Sustainability

The strength of our current Net-Zero commitment is the connection of technical maturity and our role in the supply chain to our ambition and goals. This results in a robust and action focussed ambition. In addition to the quantifiable incentives, the added value of a sustainable fleet and organization goes beyond numbers - we are taking our responsibility.

With Heerema's intrinsic motivation to act sustainably, we already have a successful track record. To name a few: Sleipnir on LNG, Shore Power for the Thialf and Sleipnir, our energy-neutral head office in Leiden, a software upgrade onboard Aegir and trials with biofuel on board Thialf.
To enable further action, we are working with the Heerema Decarbonization Fund. This fund provides financial resources for initiatives within our organization.

The Net-Zero ambition is a commitment to Net-Zero Greenhouse Gas emissions by 2050. As shown in the cartoon, we focus on three pillars to decarbonize:

1. OPTIMIZE

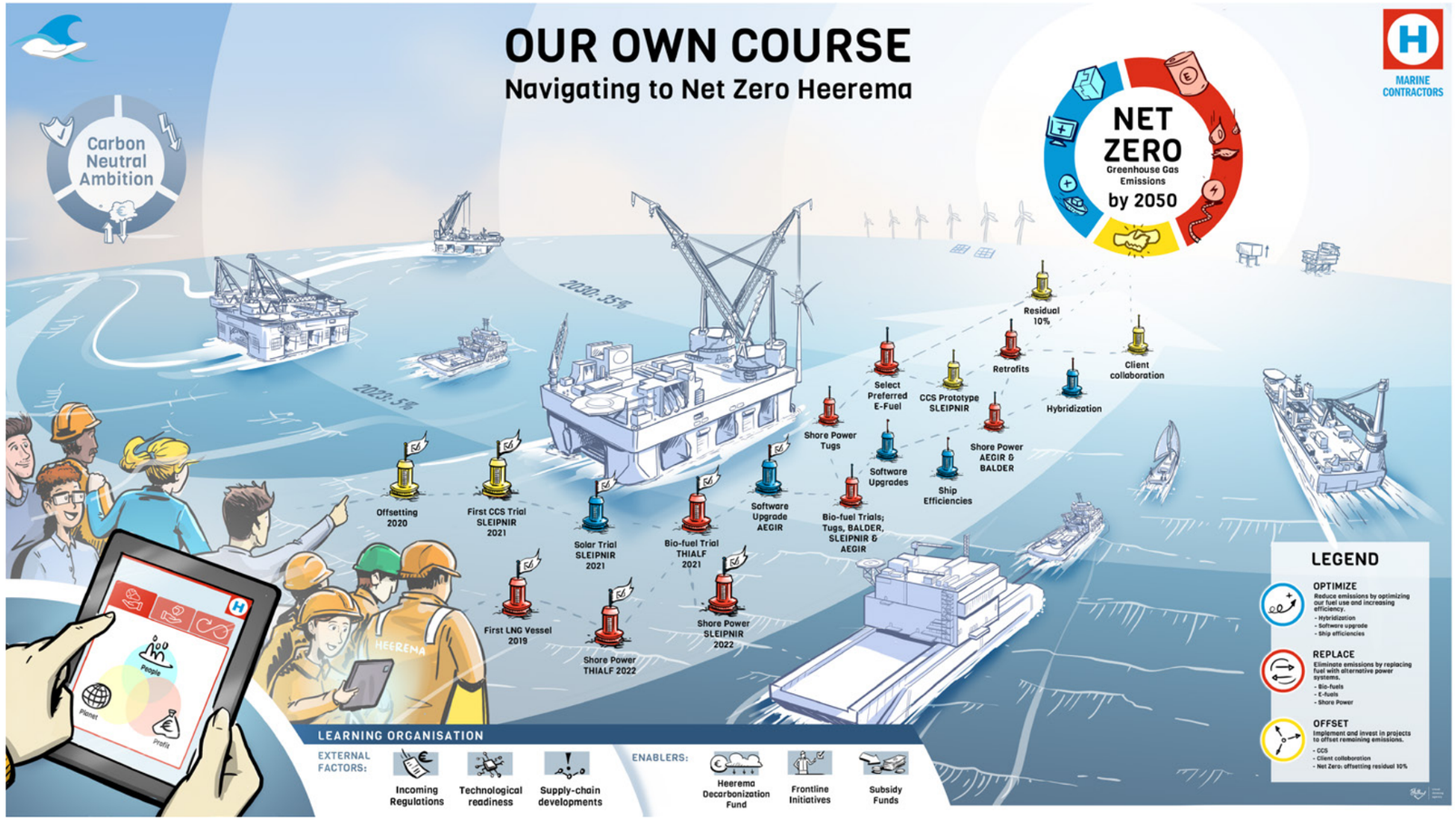
Reduce emissions by optimizing our fuel use and increasing efficiency. We need to raise awareness of the energy used and investigate alternative technical solutions; for example, by implementing batteries onboard our vessels.

2. REPLACE

Eliminate emissions by replacing fuel with alternatives; for example, bio-fuels, e-fuels and shore power within the existing fleet.

3. OFFSET

Implement and invest in projects to offset remaining emissions; such as onboard Carbon Capture and Storage and offsetting via external projects in collaboration with clients.



6.1.2
E-fuels

An essay by one of our Net-Zero experts Hedzer Keulen

The coming decades, fossil fuels are to be phased out to limit global warming. The marine sector is defined as a 'hard to abate' sector, but Heerema has committed itself to reduce emissions to Net-Zero by 2050.

FIT WITH SDGs

To move values into action, we use our Sustainability Roadmap. Based on the United Nations' Sustainable Development Goals (SDGs), it provides focus on our achievements, ongoing projects, and ambitions.

This sustainability initiative contributes to a number of Sustainable Development Goals, among others:

7 **SDG 7** (Affordable and clean energy) by replacing traditional with clean fuels.sustainable development.

9 **SDG 9** (Industry, innovation and infrastructure) by researching innovative, clean fuel alternatives.

FIT WITH STRATEGY

As part of the Net-Zero roadmap, focus on our e-fuels initiative contributes to the Replace pillar.

"Apart from an environmental driver, energy will become more expensive the coming years due to carbon taxation (EU ETS). How are we going to reach our Net-Zero goals? Answers to this question are solutions like shore power, batteries, biofuels, carbon capture & storage (CCS), but foremost 'simply use less'. However, these solutions also pose limitations.
For instance, batteries are expected to be expensive to store the large quantities of energy we require for our vessels. And bio-fuels and CCS are expected to be intermediate solutions that are still under development.

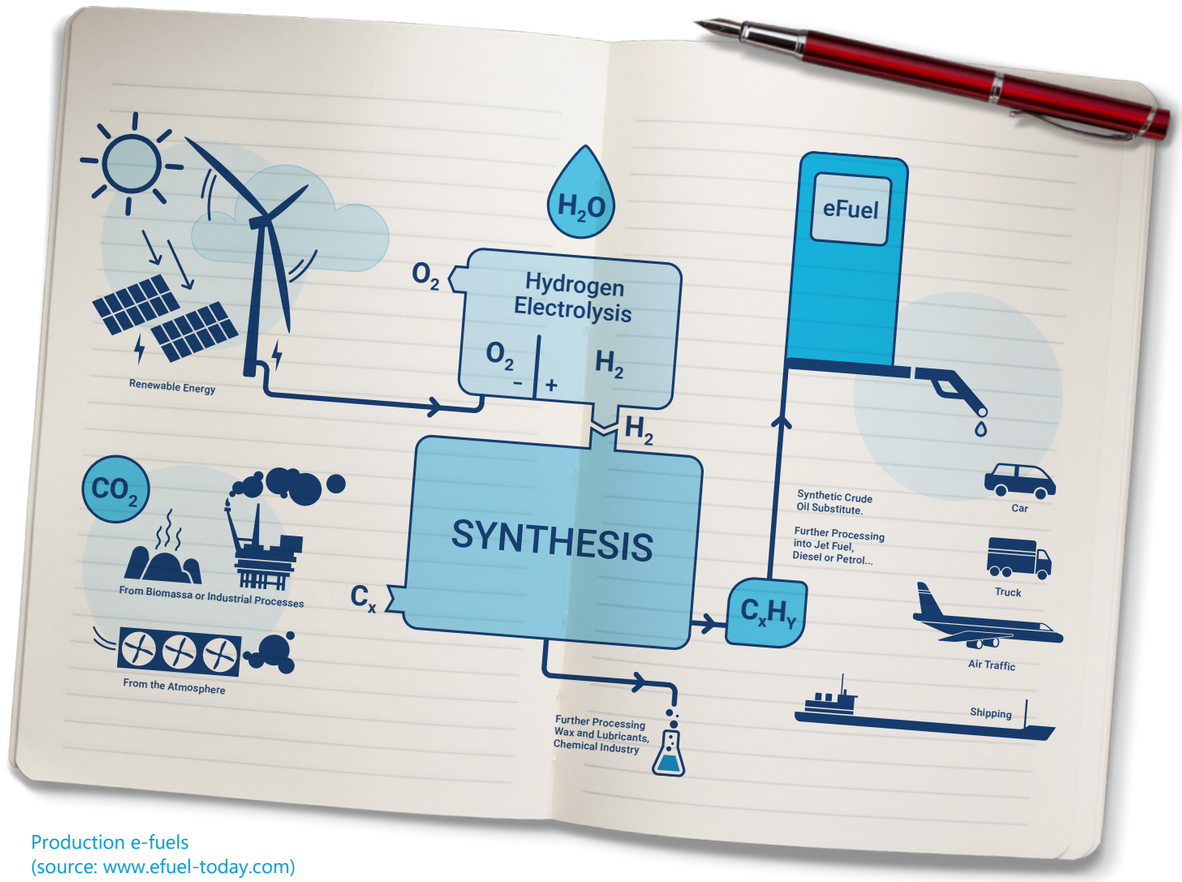
Therefore, another answer to the question posed above is the use of 'e-fuels'. The future of energy supply will be driven by non-fossil sources like solar, wind and possibly nuclear. These sources produce electrons which can be stored in batteries, but also in molecules. Some examples are e-hydrogen, e-ammonia, and e-methanol.

So, how are these e-fuels produced? You start by producing Net-Zero electricity, which is used to split water into hydrogen via electrolysis. Hydrogen can be used in fuel cells, but also in combustion engines resulting in Net-Zero emissions. Unfortunately, this e-fuel comes with challenges: it requires a lot of volume, as even in liquified state (minus 253 degrees Celsius!) it requires up to 7 times the volume of conventional fuels. Together with other HSE related characteristics, this makes it a challenge to store and transport. To resolve this, hydrogen could be refined into other fuels, like the above-mentioned methanol or ammonia. However, as every step in the refinement process requires energy, the final product will become more expensive. The key is to identify a fuel that minimizes conversion losses while still possessing the necessary characteristics, particularly in terms of emissions.

In essence, all fossil fuels can be copied via the e-fuel method. Chemically, most fossil fuels are composed of C's and H's. The H's come from hydrogen and the C's from carbon dioxide. To create a Net-Zero (i.e. from renewable, zero emission sources) e-fuel, carbon dioxide can be captured and combined with hydrogen to form, for example, e-diesel, e-methane (LNG) or e-methanol. Of course , many challenges are found within this process. For starters, to produce a clean e-fuel, the carbon dioxide that is used should be 'green' as well. E-ammonia does not require carbon dioxide, only nitrogen.
In general ammonia is expected to become the cheapest e-fuel, due to the minimal loss in its conversion and the abundantly available nitrogen in the atmosphere. Unfortunately, ammonia too has its downsides. It is highly toxic and can produce N_2O as a by-product which is much worse compared to CO_2.

There is consensus that the silver bullet does not exist (yet). Technical and supply chain development worldwide is required to define the solution. At Heerema, we participate in this process by developing options to use methanol or ammonia on board existing and new vessels. Only by doing we aim to find our silver bullet."

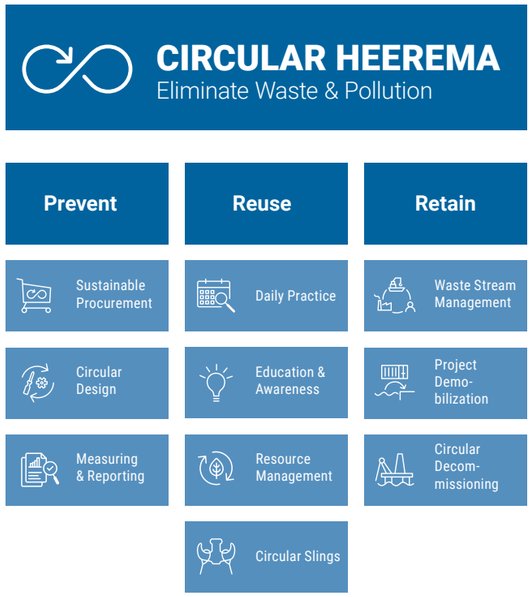
> **The future of energy supply will be driven by non-fossil sources like solar, wind and possibly nuclear.**
>
> **Hedzer Keulen** | Net-Zero Lead



Production e-fuels
(source: www.efuel-today.com)

6.2
Circular Heerema

PREVENT I REUSE I RETAIN **Heerema contributes to a circular economy by eliminating waste, pollution and unnecessary use of resources through prevention, reuse, and retention. These three pillars form the foundation of our Circular Heerema Roadmap and are derived from the MacArthur Foundation's 9 R's framework, facilitating an overview of circular strategies.**



Prevent

Prevention measures are classified as those that prevent unnecessary and unsustainable purchases and, therefore, prevent waste. Heerema aims to expand its sustainable procurement practices by obtaining clear insights into our supply chain.

Reuse

The projects within the reuse pillar focus on extending the lifespan of products, parts and materials. Resource management is a key focus area, exemplified by Heerema's steel marketplace. Additionally, the incorporation of circular slings, made from post-consumer plastic, serves as an excellent example of our commitment to conserving the value of materials.

Retain

Retain measures are classified as useful applications of materials at their end of life to retain their maximum value. One focus is waste stream management, supported by a multidisciplinary workgroup focusing on several waste related initiatives offshore. Additionally, standardizing project demobilization ensures focus on which end-use of material and equipment is considered in the engineering phase.

> **Resource management is a key focus area, exemplified by Heerema's steel marketplace.**

6.2.1
Heerema Waste Management

Embed sustainability in all our practices

Our main office in Leiden, the Netherlands is a proud example of how we try to be embed sustainability in all our practices. Apart from our green roofs, thermal energy storage system and A+++ energy label, we pay special attention to our waste management system.

FIT WITH SDGs

To move values into action, we use our Sustainability Roadmap. Based on the United Nations' Sustainable Development Goals (SDGs), it provides focus on our achievements, ongoing projects, and ambitions.

These initiatives contribute to a number of Sustainable Development Goals, among others:
12 **SDG 12** (Responsible consumption and production) by aiming to retain value of consumed products through effective waste management.

FIT WITH STRATEGY

As part of the Circular Heerema roadmap, Waste Stream Management (both onshore and offshore) plays an important role in preserving the value of materials, thereby supporting our Retain pillar.

The waste separation and collection strategy of our head office in Leiden aims to streamline the waste of employees. Through strategically placed waste stations and containers, the company ensures efficient waste collection and management. A 2023 milestone involves the implementation of a soda can deposit system since April 1st, 2023, with proceeds directed towards Kika, a charity supporting childhood cancer research. The success of this program highlights Heerema's dual commitment to waste reduction and social impact.

Beyond efficient waste handling, Heerema emphasizes the transformation of waste into valuable resources and energy within its production cycle. After the waste leaves our office, it's processed by a partner external organization with an impressive 98-100% conversion rate into either reusable resources or energy.

Looking ahead, Heerema plans to enhance its main office waste management efforts, particularly in catering. Initiatives include eliminating disposables, transitioning to reusable materials, and exploring dispenser tap systems to reduce single-use packaging. Already, we have completely switched from paper cups to reusable ceramic cups in our office, saving nearly a million paper cups from being discarded.

Did you know that even our frying oil is being recycled? By partnering with an external organization, Heerema makes sure it's frying fat is recycled into feedstock for second-generation biodiesel: fuel made from waste!

> **Would you like change? Then try to see the beauty in 'waste', by looking at what you can positively extract from it by applying reuse and repair where possible.**
>
> **Richard Nathalia** | Facility Coordinator

6.2.2
3D Printing

Innovating Sustainability at Heerema Marine Contractors

Today, new technologies focusing on sustainability can help reduce harm to the environment. Among these technologies, 3D printing stands out as a manufacturing method with high potential.

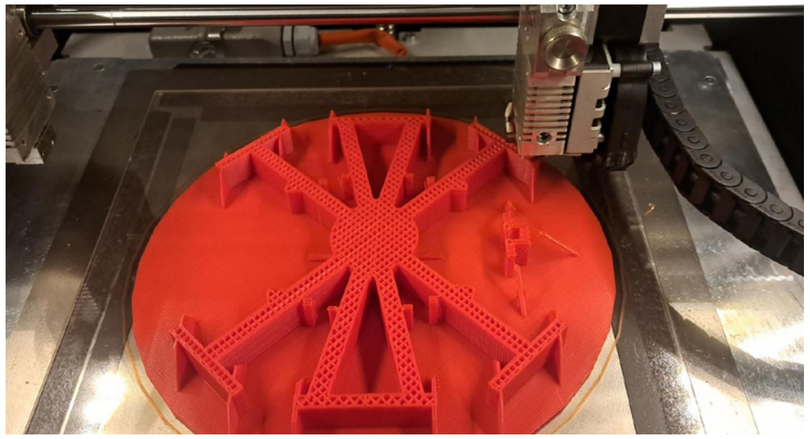
Not only can 3D printing prolong equipment lifetime (for instance by printing a defective part of a machine avoiding having the need for a completely new machine), but it also encourages our learning mindset as we strive to keep up with new technologies. Throughout 2023, Heerema used 3D printing both in our main office in Leiden and onboard two of our crane vessels, Sleipnir and Thialf.

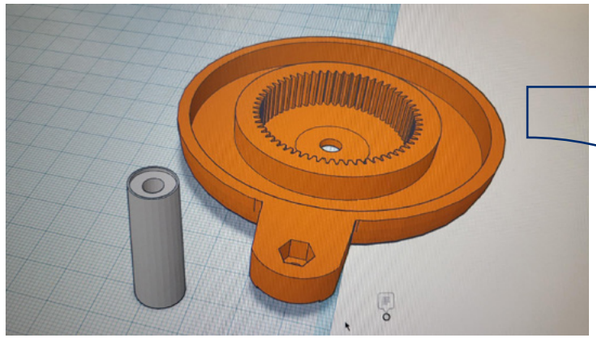
Vessels

Over the years, our offshore engineers have become adept in overcoming spontaneous challenges with creative solutions. By being able to replace small equipment parts with 3D printed material, we can avoid wasting valuable materials and mitigate project disruptions. This not only avoids disruption of ongoing projects but also eliminates the necessity of shipping new equipment and materials to often remote locations. And of course, our engineers take their creativity and 3D skillset to the next level, as you can see on the photo.

Office

Seeing your digitized designs come to life during the execution of an offshore project is amazing, but wouldn't it be valuable to have them available beforehand, as well? One of our engineers had such an idea. In collaboration with our visual design team, a 3D model of a project component was printed to enhance team collaboration and to spark creativity. Another great example of innovation and education crossing paths is our partnership with the DaVinci Technasium, a high school near our main office in Leiden. To provide students with a practical and authentic offshore project experience, our engineers created a 3D model of a floating wind turbine. Equipped with detachable, magnetized blades, the model allowed students to test their skills in replacing and installing blades offshore.





FIT WITH SDGs

To move values into action, we use our Sustainability Roadmap. Based on the United Nations' Sustainable Development Goals (SDGs), it provides focus on our achievements, ongoing projects, and ambitions.

This sustainability initiative contributes to a number of Sustainable Development Goals, among others:
SDG 9 (Industry, innovation and infrastructure) by facilitating the use of an innovative technology in our colleague's day to day jobs

FIT WITH STRATEGY

As part of the Circular Heerema roadmap, the production of 3D printed models enhances Daily Practice and contributes to Education & Awareness, as our colleagues learn from and incorporate new technologies in their daily work.

6.3
Healthy Oceans

MITIGATE I CONSERVE I ENHANCE **As the world's oceans form our primary operational area, it is crucial that we contribute to their health. Heerema's fourth sustainability ambition, Healthy Oceans, focuses on mitigating, conserving, and enhancing our impact on marine life.**

Mitigate

Mitigation measures focus on avoiding or minimizing negative impacts on marine life. Within our Mitigate pillar, we have focused on reducing noise pollution, for instance by engineering bubble curtains or using our silent piling methodology (developed in collaboration with the University of Dundee's School of Science and Engineering).

We have already been working for decades to mitigate the possible harmful effects of our activities.

Conserve

Conservation focuses on methods to preserve marine biodiversity, habitats, and ecosystems. As part of our commitment to conservation, we place a strong emphasis on Education & Awareness. We gather knowledge and spread it within our organization and beyond. Our aim is to raise awareness of the importance of protecting the diversity of marine life.

Enhance

Enhancement focuses on creating a net positive impact on marine life. By focusing on giving back to the oceans rather than just extracting from them, we aim to promote the resilience and productivity of ecosystems. We strive to discover possibilities for using artificial reefs and integrating eco-engineering into our designs. Additionally, we aim to exchange knowledge with other organizations in the industry through our Research & Partnerships initiative.

I see working collaboratively with other contractors, companies, and institutes as the guiding force leading us towards a sustainable and thriving future for marine biodiversity.

Joost van Arkel | Engineer,
Healthy Oceans team member

6.3.1
Noise Engineering

Real-time noise monitoring

Heerema's contribution to the wind energy market has not only brought about innovation but also posed challenges that underscore our commitment to environmental responsibility.

FIT WITH SDGs

To move values into action, we use our Sustainability Roadmap. Based on the United Nations' Sustainable Development Goals (SDGs), it provides focus on our achievements, ongoing projects, and ambitions.

This sustainability initiative contributes to a number of Sustainable Development Goals, among others:
9 **SDG 9** (Industry, innovation and infrastructure) as we implement innovative technologies, such as bubble curtains, in our projects to set industry standards.
14 **SDG 14** (Life below water) by improving marine life by mitigating or preventing possible harmful effects on mammals due to noise.

FIT WITH STRATEGY

As part of the Healthy Oceans roadmap, we aim to Mitigate the impact of our practices on the marine environment by focusing on possible impactful factors, such as Noise.

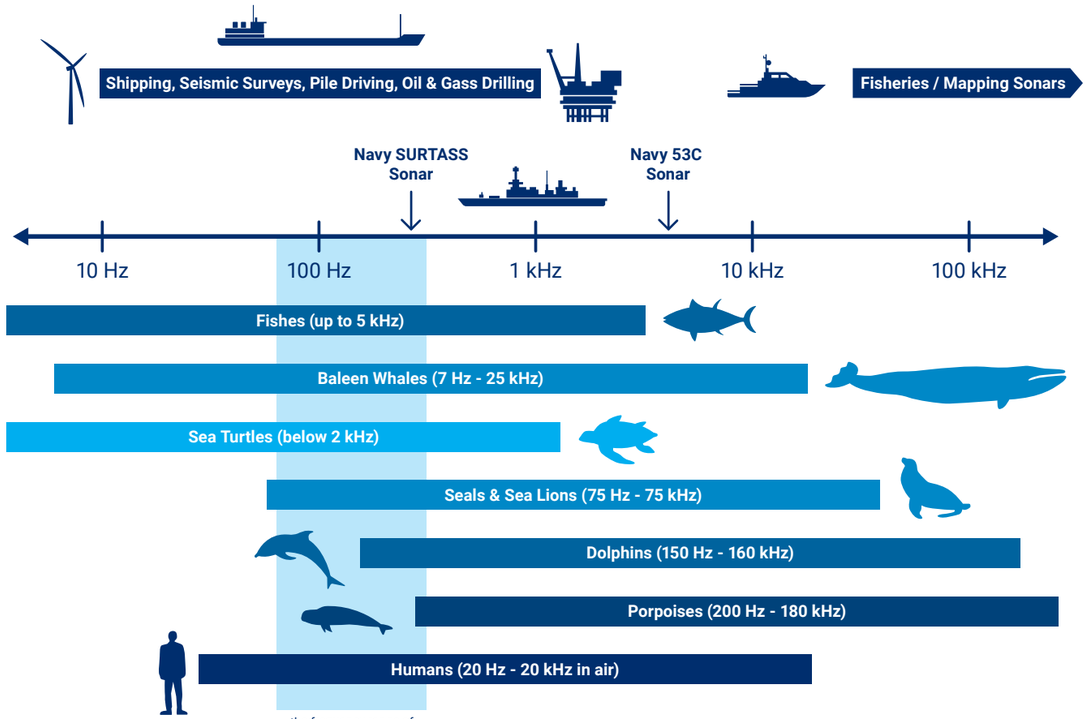
One such challenge is noise pollution as a potential by-product of pile driving activities, which, if left unchecked, has the potential to pose a threat to the local environment. The impact of noise pollution on marine life is two-fold; there are concerns about direct hearing damage for animals (temporary or permanent) alongside disruption to their communication and navigation signals. Consequently, these disturbances can affect migratory patterns. In response to this challenge, Heerema has established a dedicated noise engineering team committed to both monitoring and, whenever possible, mitigating the adverse effects of noise generated during project activities.

IMPORTANCE

The highlighted section in the diagram below shows the frequency range of underwater piling noise. It is clear that the noise associated with piling overlaps with the frequency ranges of most species which is why we implement various noise monitoring and mitigation methods to protect our marine life.

MEASURES TAKEN

Heerema's approach to limit negative effects caused by noise pollution are based on three main pillars: mammal monitoring, noise monitoring and implementation of noise mitigation measures.



General overlap between the auditory range of marine species and frequencies produced by man-made underwater sound sources (source: Amy R. Scholik-Schlomer: Where the Decibels Hit the Water. Acoustics Today, volume 11, issue 3, 2015)

By monitoring mammal activity, the project team can make sure to only execute project activities when there are no mammals in harm's way. Marine Mammal Observers (MMOs) are based on a project to visually detect mammals in the area, making sure piling doesn't begin until the area is free of marine mammals.
To support MMOs, in case of poor visibility circumstances, passive acoustic monitoring (PAM) is used to detect mammal acoustic activity.

Real-time noise monitoring allows us to continuously monitor the sound level to ensure that limits, set in place to protect marine life, are not exceeded. Noise mitigation measures are implemented to reduce underwater piling sound levels and they are either near-field or far-field. As the name already implies: near-field measures focus on the system directly surrounding the pile (e.g. NMS, Noise Mitigation System) while far-field measures (e.g. bubble curtains) are deployed further away from the pile driving activities to help capture ground borne sound.

CHALLENGES

Producing noise models for each different project is challenging, as for each project, the circumstances can differ immensely: from soil type to water depth to local noise regulations. The first two relate to the constant uncertainty of how noise will travel through the soil. Due to these uncertainties, models don't always represent reality. As stated by one of our noise engineers, Annabel Smith Moorhouse: "We always learn on the job. That's precisely why we have to go offshore: to adaptively monitor the sound levels and hammer energy to ensure that they do not become critical as this could result in an exceedance of the sound level thresholds."

NICE TO KNOW

NMS is a steel construction that goes around the pile and prevents noise to travel further at its original volume, thereby reducing sound levels at the source.

Bubble curtains are designed to absorb and dampen sound. Hoses with nozzles are placed on the seafloor surrounding the pile driving activity and filled with air supplied via compressors on a vessel. As air escapes, a barrier of bubbles is formed that attenuates the sound waves passing through.

6.3.2
Rig-to-reef initiative

Neptune project

In the offshore industry, a SPAR platform consists of a floating vertical cylinder that supports a deck. Once oil and gas production comes to an end, platforms need to be decommissioned, which means either recycling the steel and / or reefing the structures on the seabed.

FIT WITH SDGs

To move values into action, we use our Sustainability Roadmap. Based on the United Nations' Sustainable Development Goals (SDGs), it provides focus on our achievements, ongoing projects, and ambitions.

This sustainability initiative contributes to a number of Sustainable Development Goals, among others:
9 **SDG 9** (Industry, innovation and infrastructure) by executing innovative engineering designs.
14 **SDG 14** (Life below water) by enhancing marine life.

FIT WITH STRATEGY

As a component of the Healthy Oceans roadmap, the Enhance pillar strives to contribute to the enrichment of marine ecosystems, notably through rig-to-reef initiatives that support the development of Artificial Reefs and Decommissioning Research.

Depending on the client's wishes and the characteristics and regulations of the region in which the structure is located, Heerema can offer two solutions:

- The structure can be brought to shore, where the material gets recycled, or
- The structure can be sunk at a designated location to the seabed to enhance marine life

In the summer of 2023, Heerema successfully completed option two when decommissioning the Neptune project. The Balder undertook the removal, towing and reefing of a SPAR; a first for Heerema in the Gulf of Mexico. Heerema's successful transformation of the Neptune SPAR to an artificial reef underlines the potential for repurposing decommissioned structures to foster marine biodiversity in the Gulf of Mexico.

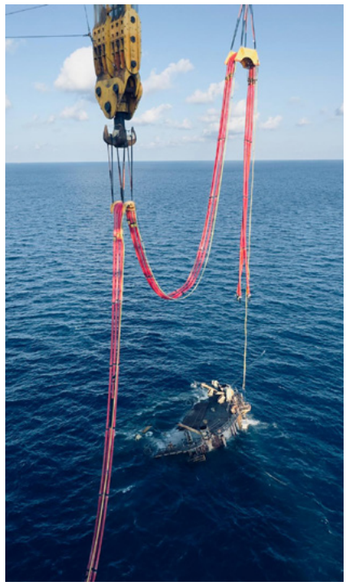
The potential of reefing

How does the process rigs-to-reef work? First the structure is decommissioned, which means all hazardous liquids are removed from the topsides.
Then the topsides are removed and sent to a recycling facility for disposal and recycling of the steel. Afterwards, the risers and mooring lines are removed from the SPAR. Lastly, the hull is towed away and sunk at a different location to function as an artificial reef.

The Neptune SPAR was reefed approximately 60 nautical miles off the coast of Alabama, to a depth of more than 200 meters. The initiative to reef the Neptune SPAR was part of the state's Rigs-to-Reefs program, which aims to repurpose decommissioned oil and gas rigs as artificial reefs to support marine life and enhance ecosystems.

The Neptune SPAR removal was a pioneering first for Heerema. Our teams developed innovative new procedures to safely reef this platform through dedication and flawless execution. This success establishes our reputation as industry leaders and opens new opportunities.

John Everett | Senior Specialist Engineer at Heerema Houston office



In adopting the Rigs-to-Reefs Policy, the U.S. Bureau of Safety and Environmental Enforcement has shown a proactive response to the concerns voiced by coastal states regarding the potential loss of marine life associated with the decommissioning of offshore structures. As the natural seabed of the Gulf of Mexico is a flat plain of clay, mud and sand, it is not conducive to reef habitat. Therefore, the placement of an artificial reef could enrich the local habitat to enhance marine life, by providing habitat, shelter and food. Repurposing these structures as artificial reefs not only effectively manages the decommissioning process, but can also create thriving marine ecosystems that benefit biodiversity and support recreational activities such as diving and fishing.

Heerema is looking forward to receiving the results regarding the impact of this project on marine life.

On a personal level I was very interested in this project as well. Growing up on the gulf coast and spending time fishing around the platforms sparked a curiosity which ultimately drew me to this industry. So getting the opportunity to play a part in repurposing the Neptune hull into an artificial reef for future generations to enjoy was special in its own right.

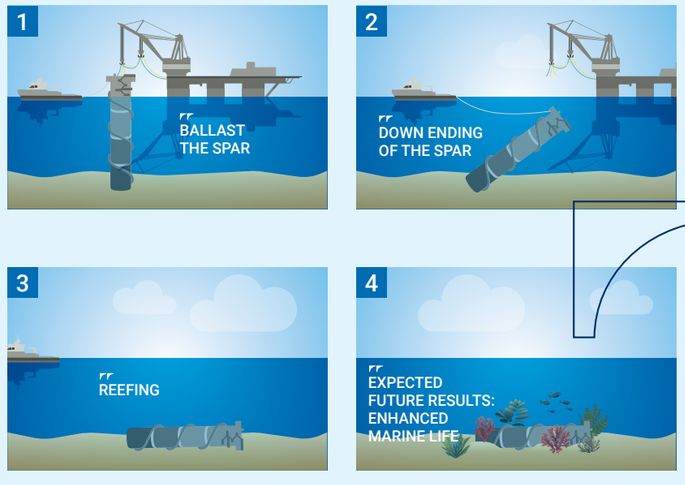
Taylor Mitchell | Senior Engineer at Heerema Houston office

The power of innovative engineering

The execution of this project posed notable challenges, particularly due to the SPAR's considerable length of 200 meters and the need for precise placement required within a 500-foot radius of a predetermined location, while adhering to specific orientation parameters. Adding to the complexity of the project was the fact that SPAR structures are designed to be "impossible" to flip over once installed, thus making it difficult to convert to a horizontally placed artificial reef.
The successful execution of the Neptune SPAR project once again shows that Heerema is able to make the impossible possible offshore.

As stated by Taylor Mitchell, working from Heerema's Houston office as a Senior Engineer: "The opportunity to work on the Neptune project was a welcome challenge as it was a new scope of work for all of us at Heerema and presented unique engineering challenges which we all had to tackle as a team."

In the below figures, a simplified step-by-step process of the Neptune project is displayed. Would you like to know more? Please contact one of our dedicated engineers!



7

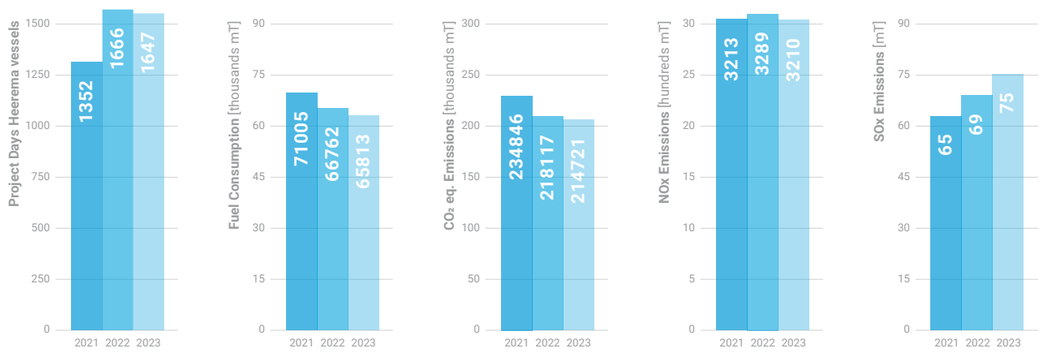
Our impact in numbers

7.1 Reduce Footprint & Emissions

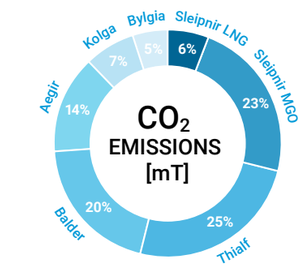
Transit & Work per Vessel

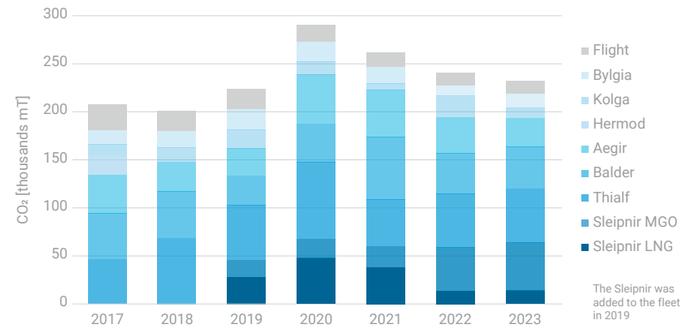
	Consumption (mT)		CO_2 eq. emissions (mT)		NOx Emissions (mT)		SOx Emissions (mT)	
	2022	2023	2022	2023	2022	2023	2022	2023
Sleipnir LNG	3,719	3,847	13,228	13,684	38	39	0.1	0.08
Sleipnir MGO	13,252	15,120	43,069	49,068	675	770	18.1	14.2
Thialf	16,420	16,921	53,364	54,914	967	996	21.8	26.1
Balder	12,604	13,065	40,963	42,398	678	702	8.9	13.4
Aegir	10,951	9,102	35,589	29,538	447	371	8.6	10.4
Kolga	6,607	3,082	21,474	10,002	326	132	6.7	5.1
Bylgia	3,209	4,658	10,430	15,117	158	200	6.7	6.1
UREA		18.5						
Total	**66,762**	**65,813.5**	**218,117**	**214,721**	**3,289**	**3,210**	**69.3**	**75.38**

Yearly Reduction Footprint (Scope 1)

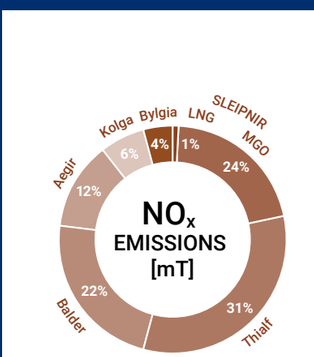


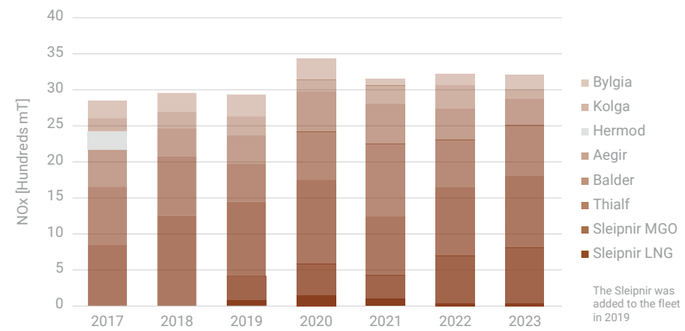
CO_2 eq. emissions per Vessel



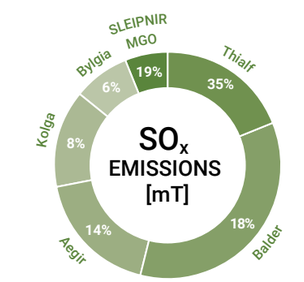


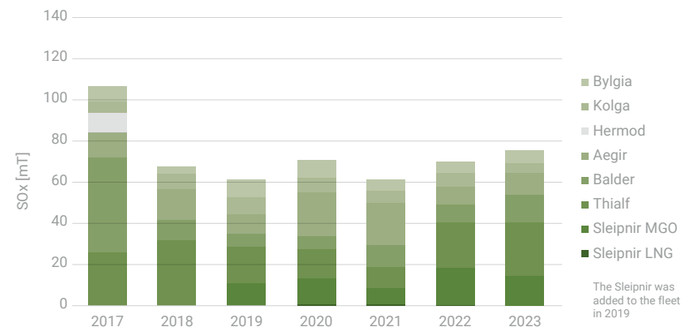
NOx emissions fleet





SOx emissions fleet





7.2
Waste Management

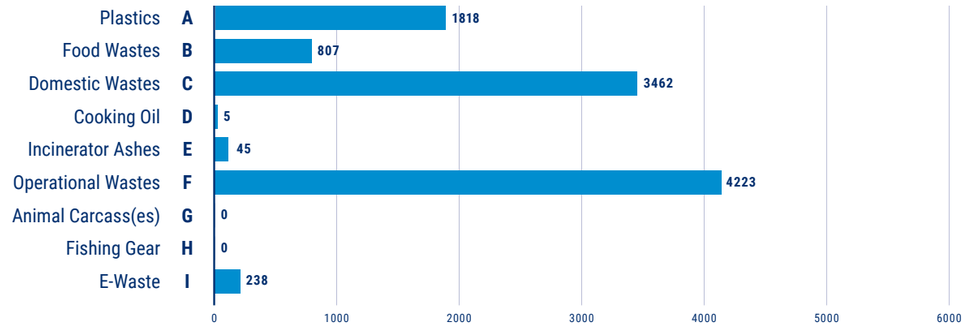
Total amount of waste

from Heerema vessels in 2023

10,598 m³

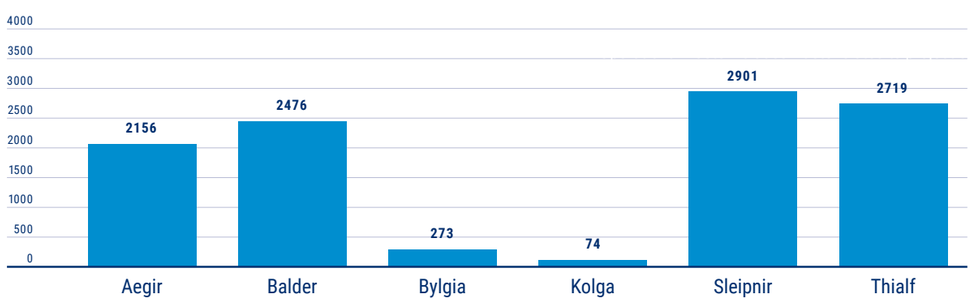
	2021	2022	2023	3 year average
Environmental Fines				
Total recorded oil spill incidents	7	8	1	5.3
Contained Spill	2	2	0	1.3
Uncontained Spill	5	6	1	4
Amount of oil spilled uncontained	144	93	6	81

Total waste per category



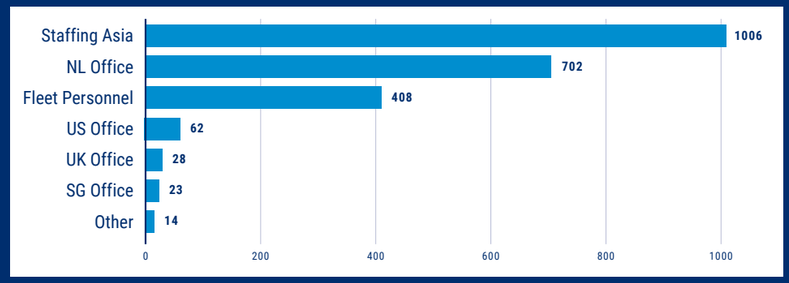
Operational waste includes waste related to project execution

Waste per vessel



7.3
People

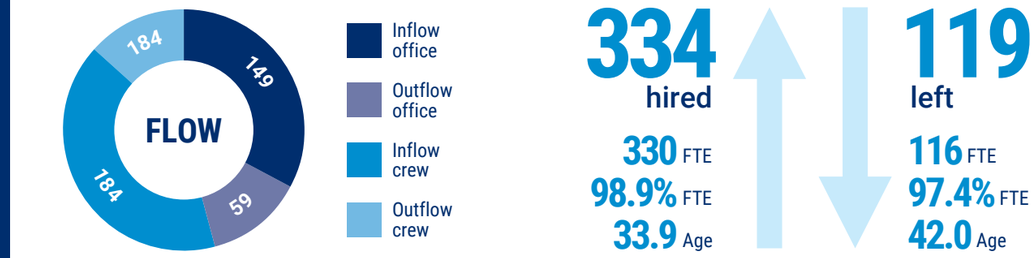
Population by location



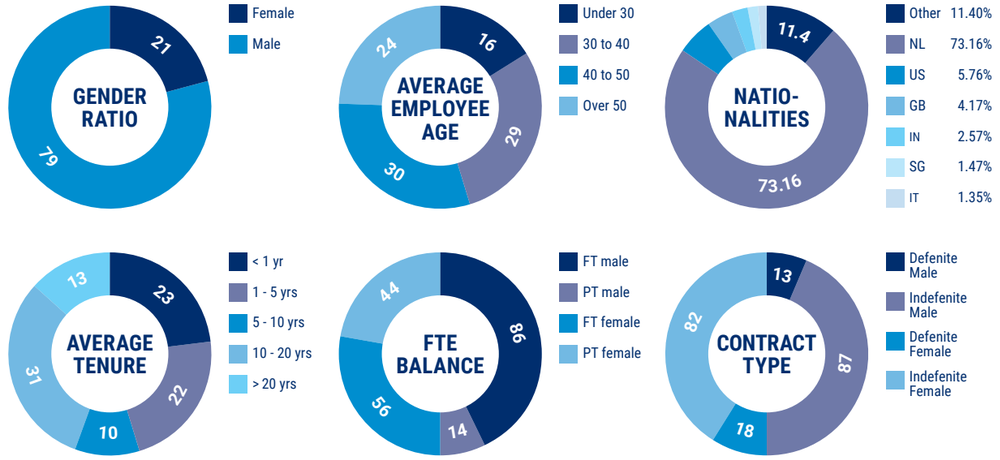
Total workforce

Workforce	2243
FTE's	2215
Average age	43.1
Different nationalities	48

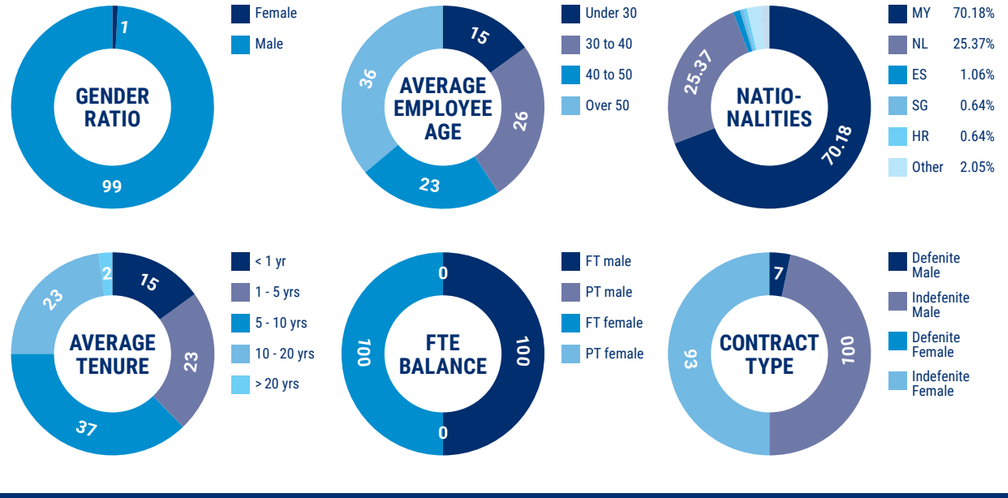
Inflow / outflow employees



Offices (in percentages)



Fleet (in percentages)



7.4 Safety

Total workforce statistics

Manhours	6,103,209 hours
LTIFR (Lost Time Incidents / manhours * 1,000,000)	0.33
TRIR (Recordable injuries / manhours * 1,000,000)	2.13
Total accidents	87 • 53 equipment asset • 30 people • 3 environment • 1 security
Total nearmisses	20 • 10 equipment asset • 10 people
# DaretoCare training sessions	113 (1198 participants)
# Safety boosts (fleet)	168 (all vessels)
# Safety instructions (fleet)	424
# Drills (fleet)	683

This Heerema Marine Contractors Sustainability Report covers our relevant projects and performance on the four Sustainability Ambitions over the year 2023

Sustainability Report 2023

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