

# INSIDE

MAY 2019 #31

FINDING THE RIGHT BALANCE  
FOR THE FUTURE



**GustoMSC**



an NOV company

THE PIONEERS OF OFFSHORE ENGINEERING

# CONTENTS

## 4 UP-TO-DATE AND AGENDA

What's going on and what's coming up.

- A first for Maersk Drilling
- Development of the MOPU
- Meet us at Global Offshore Wind and other events

## 10 FACTS & FIGURES

Floating wind turbines. GustoMSC aims to play a significant role in the floating foundation market.

## 22 OPERATING IN ITS ELEMENT

In January 2019 Apollo successfully completed the decommissioning of the Halfweg Platform in the North Sea.



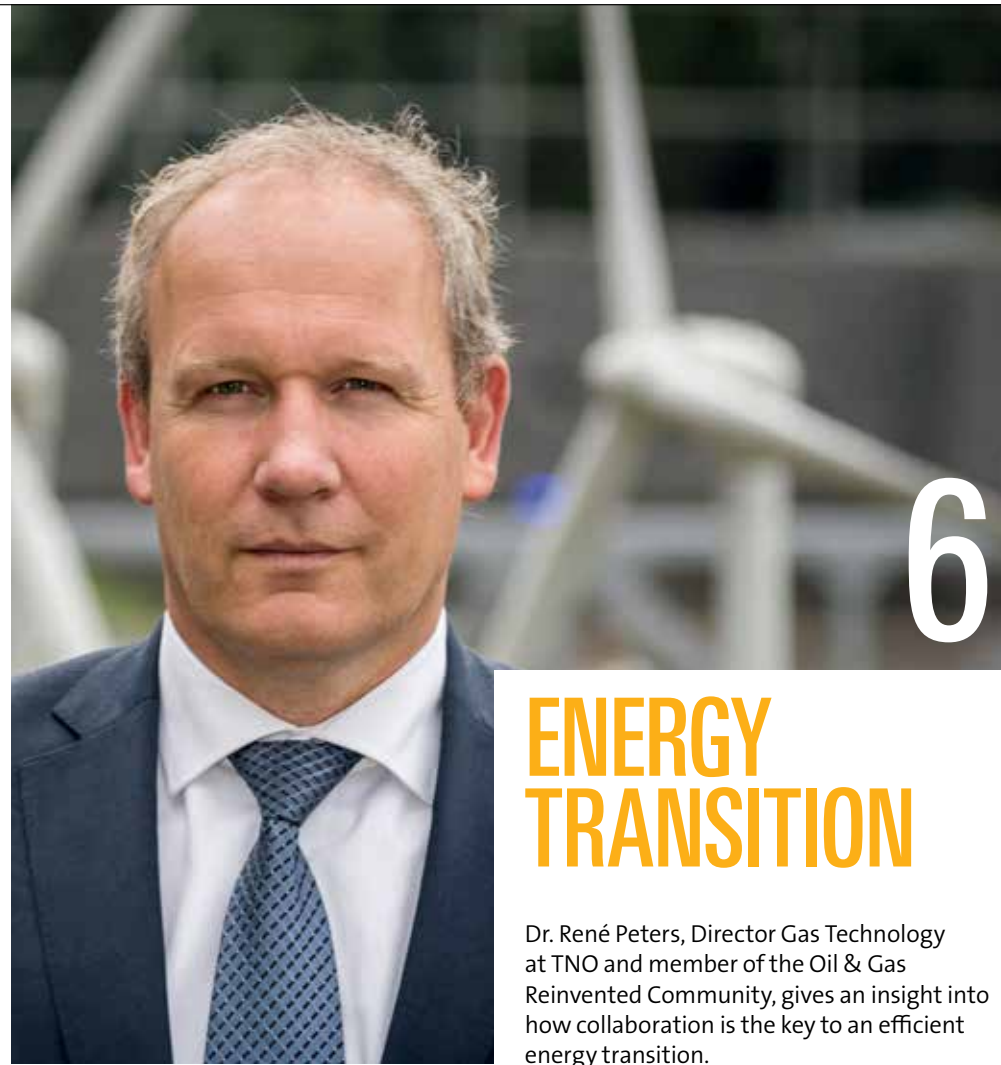
## GUSTOMSC INSIDE OUT STRATEGIC MOVES FOR THE GLOBAL ENERGY TRANSITION

In the playing field of the global energy transition, our commercial directors in offshore wind and oil & gas focus on the offshore energy market. Which strategies do they pursue and how do they tackle the challenges in the energy transition?



## 16 PIONEERING TECHNOLOGY BATTERIES IN WTIVS

Increasing sustainability through energy efficiency.



# 6

## ENERGY TRANSITION

Dr. René Peters, Director Gas Technology at TNO and member of the Oil & Gas Reinvented Community, gives an insight into how collaboration is the key to an efficient energy transition.



## 18 INTERVIEW PENTA-OCEAN SETS AN IMPORTANT MILESTONE

The CP-8001 is an important milestone for the Japanese offshore wind development, as this is the first and largest DP2 jack-up built in Japan for offshore wind and civil construction projects off the coast.

## COLOPHON

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# PREFACE BALANCING ACT



Dear readers,

Most of us, whether from the offshore oil & gas industry or from the offshore wind industry, will recognize that a shift in energy production and usage is currently taking place. It is no longer a question of when the energy transition will happen, but of what is actually going on now, as we grapple to end global warming – widely regarded as the most important challenge facing humankind in the 21<sup>st</sup> century.

As has been said many times, the Stone Age did not end because of a lack of stones. And it is difficult to see a defined moment in time when oil or gas will become obsolete either. There are just too many applications based on hydrocarbons that will be very difficult to replace.

However contradictory fossil energy and renewable energy sources may seem, at GustoMSC we see them coexisting for decades to come. The yin and yang concept on the cover of this magazine symbolizes this: two energy sources that form a dynamic system. It's about continuously finding the right balance. For GustoMSC, the common denominator is that both industries need safe and efficient mobile offshore units, based on the latest technologies and with the right innovative equipment.

The oil & gas industry is expected to face essential changes during the coming decades. In the main article in this issue we discuss the mission of the 'Oil & Gas Reinvented Community' with René Peters from the Netherlands Organization for Applied Scientific Research (TNO). As one of the founding fathers of the Oil & Gas Reinvented Community, he explains how the community fosters partnerships, shares ideas and discusses innovations in the industry, and how this contributes to the acceleration of the energy transition. You can read more about how traditional forms of energy and renewable energy can learn from each other and support each other in the interview.

The balancing act for energy supplies is a global challenge. For example Japan, dependent on traditional energy sources such as nuclear, coal, oil & gas, is investing in offshore wind. As part of these developments, the first jack-up built in Japan, Penta-Ocean's CP-8001, has recently been delivered. A brief interview with Penta-Ocean makes clear what Penta-Ocean and GustoMSC encountered when realizing this GustoMSC designed unit.

Penta-Ocean is an example of how the energy transition will be heavily supported by smart technology and equipment. We have a strong

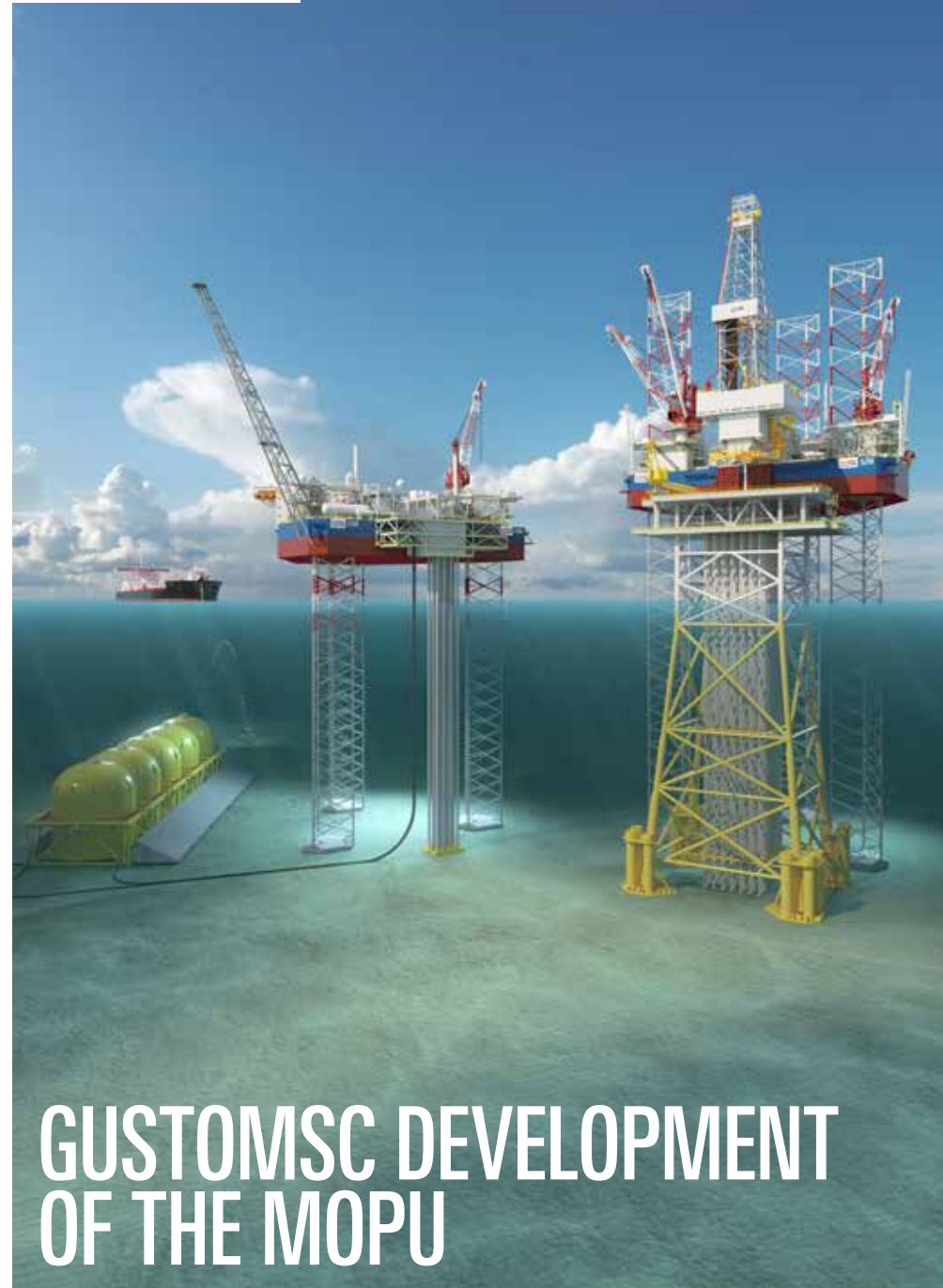
position in the offshore wind installation market, and our technical developments with regards to on-board temporary energy storage are gaining more traction. This issue features an article about the technology that reduces the carbon footprint of installation vessels and consequently increases sustainability.

Now as part of NOV, we continue to invest in our proprietary designs as well as in developing solutions together with our business partners and clients. We aim to create the ideas and innovations that our clients need to move forward as the global energy transition takes hold. In the Inside Out item in this issue, our colleagues share what it takes to achieve this from a commercial perspective.

It is very clear that offshore challenges will continue to keep us busy for a long time to come, regardless of which energy transition scenario becomes a reality.

Enjoy reading this InSide issue.

**Nils van Nood**  
Managing Director GustoMSC



# GUSTOMSC DEVELOPMENT OF THE MOPU

At OTC Houston 2019 GustoMSC presented the Mobile Offshore Production Platform (MOPU) as an effective alternative for an increasing number of applications. In close cooperation with NOV, the design is being further developed and integrated with solutions such as subsea storage, subsea production and compact topsides to bring further potential to the development of MOPUs as a cost-effective alternative for more and more applications.

As MOPUs have to compete with both jackets and floating concepts in field developments, the choice usually comes down to economics. But the self-installing and self-decommissioning capabilities of a MOPU, and the possibility to redeploy, are cost-effective advantages. Recent developments in jack-up technology, topside sizes and weights and subsea technology are also changing these economics, making MOPUs a potential solution for an increasing number of applications. Combined with a continued need for economical solutions for field developments, the interest in MOPUs has recently picked up again.

Jack-up based production platforms have been around for quite some time and have proven to be flexible and reliable solutions for specific field development concepts. Such as fields that have a shorter expected production life, that are very remote and that have smaller topside facilities. Also for the North Sea, GustoMSC has MOPU applications under study, based on the GustoMSC CJ series of drilling units, utilizing the same load carrying capacity and deep-water capabilities of the larger jack-ups such as the CJ70 design.

## CM-SD1000 SHOWS ALLIANCES BOOST INNOVATION



GustoMSC and China Merchants Heavy Industry (CMHI) have consolidated their 2016 agreement to work together on drilling semi-submersible development with a steel cutting ceremony for the CM-SD1000, the first design of the new alliance.

The new-generation midwater drilling rig will be dual classed, DNV-GL & CCS, and equipped with advanced elements including an integrated drilling tower arrangement and a large self-contained mooring system.

GustoMSC has been able to demonstrate that the rig is suited to operations in survival

conditions with acceptable levels of safety for deck box slamming, without compromising on overall efficiency. In addition, extensive model testing in close cooperation with CMHI has shown the hull design offers the highest level of safety.

The layout allows simple and easy access to the drill floor from the main deck. This, combined with a relatively slender deck box structure, has significantly stretched the usual engineering approach to derrick load integration. Nevertheless, with an integrated design approach, the team has succeeded in getting it right.

The CM-SD1000 is being built for COSL with completion set for end 2021. The combined efforts of the CMHI and GustoMSC design teams show that collaboration within the offshore industry, beyond usual company barriers, makes innovative projects possible.

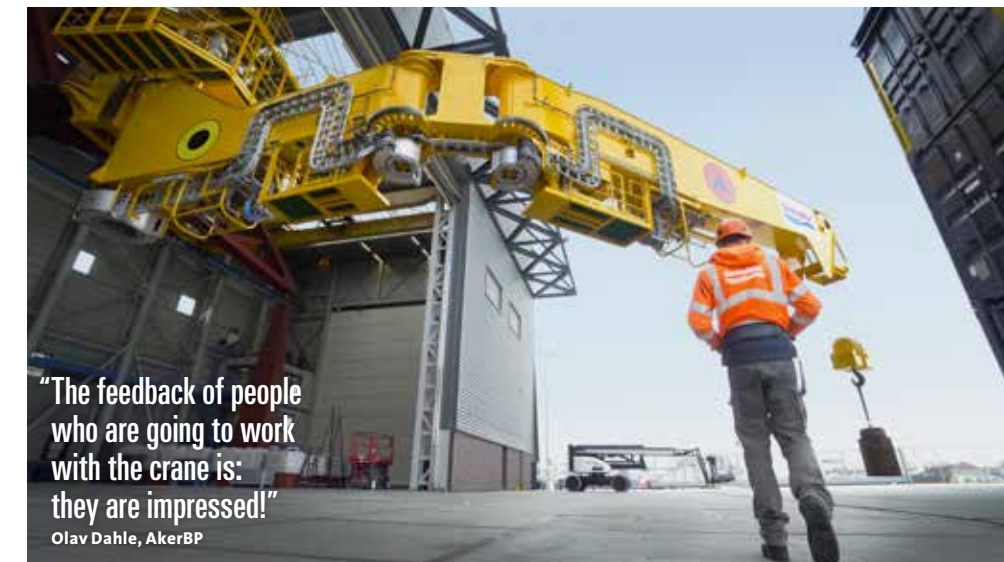
## GUSTOMSC'S CHELA A FIRST FOR MAERSK DRILLING

GustoMSC's Chela, an innovative, multi-functional arm, can look forward to a great deal of interest. First customers were invited to visit the fabrication site and witness Chela in its final stage of construction. Soon after, Chela was ready for final testing in the presence of Maersk Drilling, AkerBP and GustoMSC. Chela is specially developed in collaboration with Maersk Drilling which is the first company to use the crane.

Since its introduction in 2016, GustoMSC's Chela has grown from the drawing board

into a piece of equipment that has made all expectations come true. The test at the beginning of April in Ijmuiden, the Netherlands, showed the capabilities of Chela. The FAT test was successful, facilitating a fast-track start up for Maersk. Before the summer of 2019, Chela will be installed on the "Maersk Invincible" drilling platform, a GustoMSC CJ70 design. Chela is about to operate offshore in the giant oilfield Valhall in the southern Norwegian North Sea for AkerBP.

Chela offers striking efficiency benefits and is a major improvement in terms of safety. Chela, capable to lift 22 tonnes at 21 m radius underneath the cantilever at any position, does not obstruct any wellhead deck space. Both are value drivers for Maersk Drilling and AkerBP.



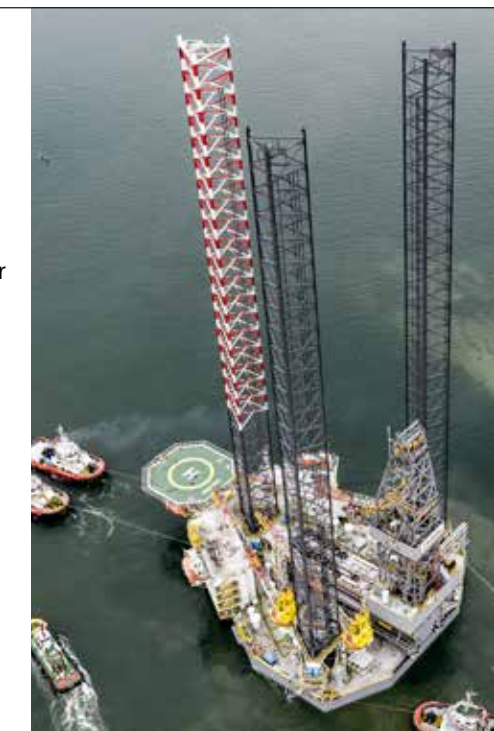
"The feedback of people who are going to work with the crane is: they are impressed!"  
Olav Dahle, AkerBP

## SUPPORTING NOBLE WITH ITS NEW ASSETS

Noble has agreed the purchase of a second new build CJ46 design jack-up, which is expected to go into service in the third quarter of 2019. The new buy means Noble, which owns and operates one of the most modern, versatile and technically advanced fleets, now will have three drilling jack-ups and six drilling vessels built to GustoMSC design.

Like the Noble Johnny Whitstine, which the company purchased in September 2018, the new CJ46 design jack-up, named Noble Joe Knight, is being commissioned and outfitted for operations in moderate drilling environments and is ideal for many applications in the Middle East.

GustoMSC performed the inspection, training and delivery for spare parts for the jacking, skidding and fixation systems for both units, and assisted during the Johnny Whitstine move. In addition, GustoMSC took care of the concept and structural design of a modification to the aft end of the cantilever for a dual BOP arrangement, taking all Noble's requests into account.



The Noble Joe Knight is expected to commence operations during the third quarter of 2019 while the Johnny Whitstine is, at time of writing, being readied to go into production in the Middle East. GustoMSC will provide jacking assistance for both units at their first offshore locations.

## CIMC AWARDS GUSTOMSC CONTRACT FOR DELIVERY JACKING SYSTEM

CIMC Raffles shipyard has awarded GustoMSC the contract to supply the jacking system for the Living Quarters Unit which will work on the BP operated Greater Tortue Ahmeyim (GTA) project off the coast of Senegal and Mauritania.

GTA is a large deep-water offshore gas field that supports the industry's drive for a more sustainable, lower carbon future. The unit will become part of the inshore LNG terminal and will provide control and accommodation as well as supply support facilities for tugs and other vessels. It is designed for a 25-year lifetime in line with ABS standards. Prior to being awarded the EPC contract, GustoMSC supported BP and CIMC in the FEED phase with specialist analyses and jacking system technology.

The jacking system uses hydraulic pin-in-hole technology based on the system supplied earlier for the JB-117 and JB-118 multi-purpose jack-up barges. The technology has been specifically adapted for use in this one-off jacking application and subsequent 25-year on-site operation and decommissioning. The robust single acting system is especially well suited for applications like this, providing an optimum economic solution for clients.

## AGENDA

6 – 9 MAY 2019  
OTC HOUSTON  
HOUSTON  
Stand 115

16 – 21 JUNE 2019  
ISOPE  
HONOLULU

Paper: Predicting wind loads on the topside of a drillship using CFD

25 – 26 JUNE 2019  
GLOBAL OFFSHORE WIND  
LONDON  
Stand 78

9 – 10 SEPTEMBER 2019  
OFFSHORE WIND  
EXECUTIVE SUMMIT  
HOUSTON

11 – 14 NOVEMBER 2019  
ADIPEC  
ABU DHABI  
Participation in the Dutch Pavilion

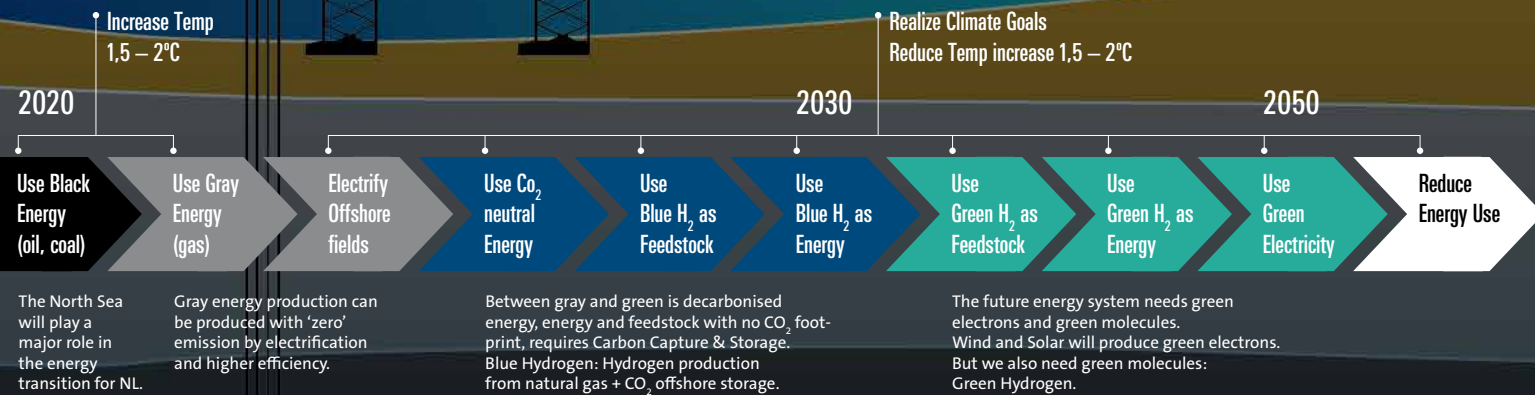
26 – 29 NOVEMBER 2019  
WIND EUROPE OFFSHORE  
COPENHAGEN  
Stand C2-B6

# ENERGY TRANSITION

BRINGING PEOPLE TOGETHER TO DEVELOP BREAKTHROUGH TECHNOLOGIES



## ENERGY TRANSITION PATHWAY



Source: TNO: The North Sea Energy Program and Beyond

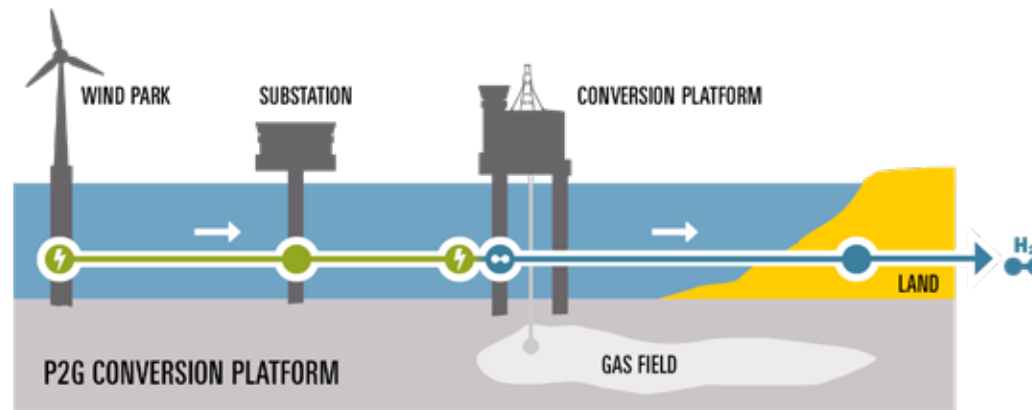
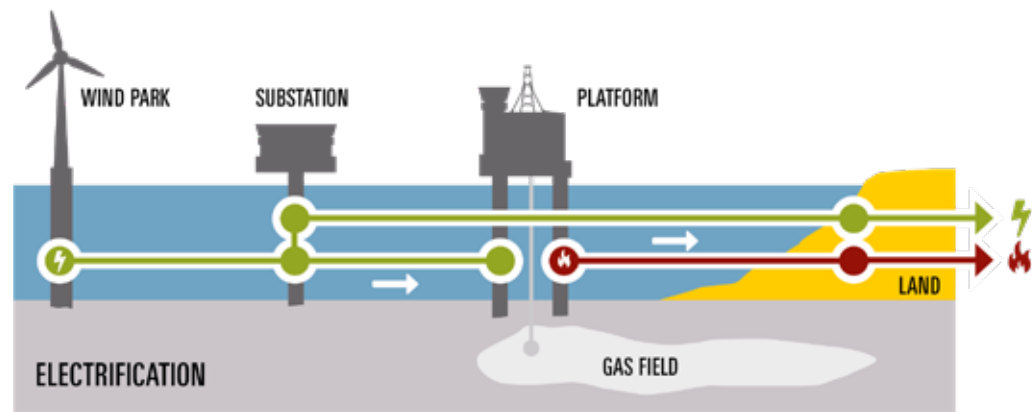
The Oil & Gas Reinvented Community, founded about five years ago, wants to connect a wide range of stakeholders related to the oil & gas industry. The aim is to foster partnerships, share ideas and discuss innovations that deserve a wider audience, especially outside the sector. The primary goal is to boost collaboration along the full length of an inclusive energy supply chain and build a strong network of stakeholders and professionals who can contribute to the acceleration of the energy transition. This Dutch initiative is an example of how the global energy transition can be managed. As a leading member of the Oil & Gas Reinvented Community, René Peters brings people together to develop the innovative business models and breakthrough technologies that our societies require.

As the oil and gas industry is expected to undergo fundamental changes in the coming decades, new technology and a close working relationship between oil and gas companies and their suppliers are crucial to ensure stable supplies, while limiting the impact on the environment. René Peters explains the implications this has for the oil and gas sector, as well as for companies and organisations that are active in renewable energy.

*The Oil & Gas Reinvented Community (OGRC) is bringing together people and organisations from both within and outside the energy sector: How is this working out in practice.*

“During a discussion between Shell, Siemens and TNO – this was about five years ago – we wondered whether there might be a useful role for them to play in the future. We realised that there is a considerable amount of technology in the oil and gas sector that could be used in the energy transition. This is especially true for the offshore industry. Originally, fixed wind turbines were used for shallow offshore wind energy and they were followed by floating wind turbines for deeper water. This is actually exactly the same development that the offshore oil and gas industry has undergone worldwide. The idea of using the people, knowledge and investments involved in the offshore industry to play a role in the energy transition was the starting point for the community.

If we look into the future, a lot awaits us. On the one hand, the oil and gas fields in the North Sea will be depleted within 20 years and on the other hand, advances are being made towards a CO<sub>2</sub> neutral energy supply. As representatives of technology and science in the energy sector, our goal is to bring together people and organisations from various disciplines. We started out with three people and have now grown into an organisation with about a thousand members: from banks to offshore companies and from universities to computer scientists – people with all sorts



**How can system integration accelerate the energy transition on the North Sea?**

CO<sub>2</sub> storage in depleted fields using existing infrastructure enables the introduction of blue hydrogen.

Production of green hydrogen on existing platforms or energy islands and transport in existing pipelines.

Buffering of green hydrogen in existing pipelines and energy storage in depleted fields. Platform electrification is not an accelerator, but a key enabler for the transition.

**“We realized that there is a considerable amount of technology in the oil and gas sector that could be used in the energy transition.”**



**René Peters**  
Director of Gas Technology, TNO

Currently Dr. René Peters is director of gas technology at TNO in Delft in the Netherlands. TNO is an applied research and technology organisation with over 4,500 highly educated experts operating in the fields of energy, mobility, industrial innovation, information technology, built environment, health, and security. René is responsible for technology development related to gas technology, including LNG, gas transport and storage, unconventional gas, exploration, hydrogen and biogas. Together with Ewald Breunese of Shell and Jan Prins of Siemens, he initiated the Oil and Gas Reinvented Community.

of different backgrounds. As an offshore design and engineering company, GustoMSC is also an active OGRC member.

We organise an event three times a year and the most recent was themed Embracing the Energy Transition: The Digital Transformation. After all, digitisation makes a major contribution to the energy transition, too. The plenary sessions featured keynote speakers from companies including Next47 and Microsoft. The presentations covered top sector insights, market trends and innovations.”

**How is the Oil & Gas Reinvented Community working on the synergy between traditional and new sources of energy?**

“Everyone is convinced of the urgency and the need to tackle the energy transition together. What we do is more than just talk: we initiate actual projects and these projects show that this synergy works. We started the North Sea Energy consortium to look for the potential reuse of oil and gas assets in the North Sea together with a group of companies from the oil and gas and offshore wind sector. The next step is to install a hydrogen plant on an existing oil or gas platform. Using the wind power from a neighbouring wind farm, this plant will produce hydrogen, which is a more efficient way of transporting wind power to shore. The Ministry of Economic Affairs and Climate Policy gave the green light – and the necessary funding – for this plan at the end of last year. The North Sea is a great testing ground for innovations, since it is easily accessible and fairly shallow. As a result, we can relatively easily test new techniques that can subsequently be applied worldwide.

Once the oil and gas fields are depleted, drilling platforms and pipelines will have to be removed and the main share of the costs are covered by the government. The estimated cost in the Netherlands alone is about €7 billion. But if the

platforms and pipelines can be put to a different use, they can have a second life. We look at CO<sub>2</sub> transport and storage, platform electrification and hydrogen production. This is where we see the tremendous advantages of working together. If we use the drilling platforms for the production of hydrogen and then transport it via the existing pipelines – something that is fairly easy to do – it will be a lot cheaper than building a large-capacity electricity infrastructure, in particular for far offshore wind parks.

Wind farms with a hundred wind turbines require billions of euros of investment, which is new to the wind sector, while the gas and energy sector is used to it. Oil and gas can support the wind sector with risk management, offshore installations and operations, project management and chain design, working towards synergy between the new and existing forms of energy.”

**Offshore energy extraction at sea is primarily an international affair. To what extent are national and international governments working with OGRC?**

“More and more foreign players, both governments and companies, are interested in our approach. For example, people from Germany, Belgium and Great Britain are coming on board. They have been looking at the way in which we bring groups together and stimulate collaboration. It is a typically Dutch thing to join forces with others and to take advantage of the opportunities that come up, even when the groups involved may initially seem at odds. Take companies from the oil and gas sector arguing in favor of wind energy, for example.”

**“Win-win for everyone: that is the idea behind our platform.”**

**In June, the OGRC will host the event Embracing the Energy Transition. What does the subtitle “from our backyard to the North Sea” mean?**

“In the Netherlands, there is a lot of public resistance to the impact of renewable energy on land, and it is expected that moving offshore will reduce the opposition. Innovation is still needed. For example: to produce hydrogen with electrolysis offshore we will have to scale up from megawatts to gigawatts - we need another 10 to 12 years to reach that thousand times larger capacity. This actually coincides with the depletion of the oil and gas fields in the North Sea and will create a perfect opportunity to reuse platforms and pipelines around 2030 and beyond.

In order to produce enough green energy – enough to replace traditional energy sources – you need massive capacity. Are we going to move the wind turbines and solar panels to the North Sea? Or build an island for the production of hydrogen in the North Sea? In that case, of course, we also have to look at the impact on nature and how the shipping and the fishing industry deal with it, as well as sand extraction and recreation. We are faced with the question of whether it is possible to create new energy systems in balance with food production, nature conservation and other economic functions.”

**How do you envision the energy supply in the future?**

“Oil and gas will continue to be important after the energy transition, for example as a feedstock for plastic products, for medical products and the chemical sector. But oil and gas should be produced in the most climate-neutral means, for example by using offshore wind power for the offshore operations. OGRC is looking into the smartest combinations between renewable energy and oil and gas. The oil and gas industry has acquired a vast amount of expertise that is also important for the energy transition. Take geothermal energy – the oil and gas companies have extensive knowledge of safe drilling and what goes on underground. Perhaps old

wells can generate geothermal energy if we drill deeper. By using these assets in a smart way, we can get the most out of the energy transition and control the costs to society. We are looking into how we can ensure that everyone embraces the transition, that people really participate, rather than feel all they are doing is footing the bill. Some people think that the transition means stopping using oil and gas today and carrying on tomorrow using renewable energy. But it is not that simple. The transition entails a period of 20 to 30 years during which both will still be needed in parallel.

Instead of thinking in terms of expensive and complicated, think in terms of opportunities and possibilities, because the transition can also be a profit model. If you make smart use of the combination of traditional and new forms of energy during that period, you will have minimised the social costs and made maximum use of your investments, your assets and your people from the oil and gas sector, and everyone benefits. It is a win-win for everyone. We believe that the energy transition is an opportunity, but we have to get everyone on board and forge connections between them. We have to communicate and show that these are opportunities that will advance all of us.”

# UNLOCKING MASSIVE ENERGY POTENTIAL

## FACTS & FIGURES

Short and medium term market potential GW in US, Europe and Far East.  
 75 Projects have been identified, of which:  
 40 projects with known capacity and 35 projects with unknown capacity.  
 All projects are either concept/early planning or development status  
 Source: 4C Offshore, <https://www.4coffshore.com/>

# 2,600

Global cumulative number of units in 2030

Source: 4C Offshore, <https://www.4coffshore.com/>



## FLOATING WIND TURBINES

Floating wind turbines are seen as key to unlocking the massive energy potential in global offshore deep water, where there are strong winds and bottom-founded structures are not economically feasible. GustoMSC is a market leader in the offshore wind installation vessels market and now aims to play a significant role in the floating foundation market as well.

Floating wind farms do not compete against bottom founded offshore wind. They should be seen as an enabler for offshore wind energy at sites with deep waters or challenging soil conditions. The Tri-Floater, a semi-submersible wind turbine foundation, has been designed by GustoMSC specifically for this purpose.

GustoMSC has applied proven semi-submersible technology developed for the offshore oil and gas industry to a completely new setting in a new industry. The GustoMSC Tri-Floater is a three-column semi-submersible with an offshore wind turbine positioned in the centre of the foundation. The semi-submersible foundation can be tailored to fit any desired turbine, and optimized for local environmental conditions.

The key requirements for commercializing floating wind turbines are lowering the costs and enabling a large-scale industrialisation set-up. The robust and cost-effective GustoMSC Tri-Floater meets both these demands. The flat-plated design allows for an efficient and highly automated fabrication process, which lowers the construction costs considerably and can be easily scaled up for commercial floating wind farms. In addition, the columns are not connected by bracings, which avoids having fatigue-sensitive spots below the still water line, where access for inspection and maintenance is expensive.

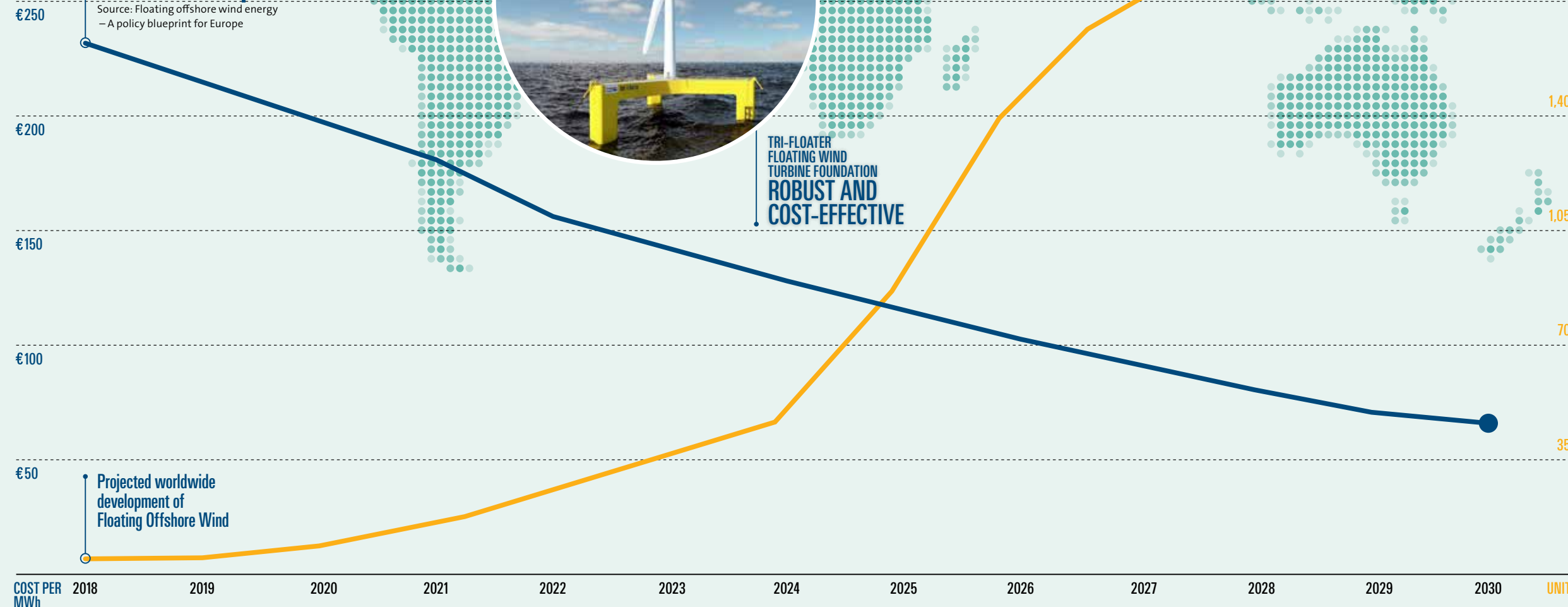
### Developments

The global floating wind market is maturing, moving from single prototypes to pilot farms with three to five floaters. With the first pilot farm installed by Equinor in 2017, the first commercial scale floating wind farms are expected in 2024 – 2030. Currently GustoMSC is involved in several floating offshore wind projects worldwide, investigating the potential of Tri-Floater technology.

With GustoMSC joining the NOV family, the Tri-Floater concept will make use of in-house synergy and related offshore technology, potentially involving a variety of different NOV companies. This will optimize and strengthen the Tri-Floater's overall proposition towards the clients.

## Levelized Cost of Electricity (LCoE) for Floating Offshore Wind in Europe

Source: Floating offshore wind energy – A policy blueprint for Europe



TRI-FLOATER  
 FLOATING WIND  
 TURBINE FOUNDATION  
**ROBUST AND  
 COST-EFFECTIVE**

Projected worldwide development of Floating Offshore Wind



“Based on in-depth knowledge of our product’s functionalities, and a thorough understanding of the client’s operational needs, we help our clients make responsible and carefully-considered decisions.”

This is the fourth article in a series addressing developments around the theme of working safely and efficiently at sea. In this edition the Commercial Team of GustoMSC focusses on the significance of the global energy transition. What are the most important developments in the offshore wind energy market and the traditional oil & gas markets? And what is needed to guide our clients in both markets towards and during the global energy transition? Both sectors require a different approach and strategy.

# STRATEGIC MOVES FOR THE GLOBAL ENERGY TRANSITION

GustoMSC is an important player in the energy transition field as we enable companies to operate more efficiently and sustainably in both the offshore wind energy and offshore oil & gas markets. We are engineers of integrated total solutions that enable these companies to expand their possibilities. Based on our history and our experience with designing over 250 units, we are able to develop smart applications, anticipate the latest developments and make the right moves at the right times. In this playing field, commercial directors Barend Jenje and Jan-Mark Meeuwisse are mainly active in the offshore wind energy market and commercial directors Alain Wassink and Rutger Baan focus on the offshore oil & gas market. Which strategies do they pursue in the current offshore market and how do they tackle the challenges in the energy transition?

## The global energy transition and current market developments

GustoMSC is right in the middle of the current market developments. It is clear that the role of oil & gas in the global energy supply is changing, with an increasing contribution of offshore wind. The transition and how it will unfold cannot be predicted accurately. Our sales and business development teams work closely with our clients on how to deal with the energy transition and, from a practical point of view, they provide advice on the solutions that are available. We have always focused on consultative sales, on understanding what we sell and understanding the client’s needs in order for our clients to be able to make responsible and carefully-considered decisions, and that is even more important in view of the current market developments.

What we currently see in the rapidly changing energy markets is that we have fewer traditional projects in oil & gas. In the offshore oil & gas market, we are shifting towards niche or special projects. Most projects are now in the area of harsh environments, local content, and special applications for production units. This shift is also a consequence of the uncertainty in this market with regard to long-term investments.

In addition we see that parties are increasingly diversifying and are active in both the renewables and the oil & gas markets. As more and more countries that

can utilize offshore wind are participating in the global energy transition, offshore wind has become a mature energy source within the renewable energy sector. This is a huge growth market. The global drive towards the energy transition offers many opportunities for GustoMSC. For us as commercial directors, this means that we are getting busier and busier. But we also explore new areas and, together with our technical team, we are overcoming challenges. In the offshore wind market this has also led to the design of Scylla for Seajacks, derived from our NG-14000X design, which is the most efficient and largest installation jack-up in the world, and our latest delivery in Japan for Penta-Ocean, the CP-8001 based on our GJ-3750C design.

## Implementing new technologies and processes

Our commercial team has to constantly keep an eye on the market and provide the correct information to our clients, translated into practical impact on design and equipment. Due to workforce reductions at contractors and energy companies in the past years, at their side of the table there is now a shortage of resources to implement new technologies and processes. This is an opportunity for GustoMSC: to help the industry bring together the multiple building stones needed to create the rigs of the future. This will result in potentially longer design cycles, a more thorough sales buy-in process and potentially a shift in responsibilities for the

rig performance. Knowledge of our clients' markets but also staying up to date on our clients' current projects. This relationship is being strengthened by the continuous engineering and operational support we provide for existing and new units. Being more involved with the client, regionally engaged and being able to provide more details to our clients. You could call it taking customer intimacy a step further.

### New markets are arising as a result of the transition

The energy transition is receiving a lot of attention, and the internationally agreed sustainability goals are far-reaching. Sustainability certainly plays a role in the western world of contractors, such as in the case of heavy lifting, pipelaying and oil field services in oil & gas, often in combination with new markets that are arising as a result of the transition.

In the Drilling sector, increasing sustainability is a process that is unfolding relatively slowly. In particular, because drilling is a day-rate driven market. The clients, i.e. the oil companies, usually pay the fuel bill, so there is little economic incentive to increase sustainability. Nevertheless, important changes can be observed. Oil & gas parties are not only increasingly looking at renewables as an extra alternative, there is also a growing

focus on gas instead of oil and there is interest in CO<sub>2</sub> injection in empty fields. Moreover, due to the increasing demand for sustainability, Plug and Abandon and the Decommission markets are gradually becoming more interesting.

### Europe in the lead

The European Union is far ahead where alternative energy forms are concerned. Europe appears to be preparing for a real energy transition. The renewable energy market in the EU is maturing and the Levelized Cost of Energy (LCoE) has been reduced significantly. The industry, supported by a few governments such as in Norway, is now considering CO<sub>2</sub> and NO<sub>x</sub> footprints when producing a barrel of oil. Some energy companies are promoting their field development investments stating that emissions can be reduced through integrated design process optimizations. They are focusing more on how this industry can reduce its environmental footprint.

Traditional developers, originating from the EU, are usually the first to develop projects, often in consortia with local players. The EU supply chain is initially used, which then fills in the obligations for local content. EU developers are frontrunners and leaders where it concerns investments in renewable energy.

### Local offshore wind industry in ascendency worldwide

Offshore wind is spreading its wings overseas, for instance in the US and Asia, and is transitioning towards the new double-digit wind turbines. Other countries can benefit from the experience gained by the EU market leaders and jumpstart their local developments. The ambitious energy and climate plans are a boost to offshore wind industry worldwide. The GustoMSC Commercial Team is active where we see a clear incentive for countries to invest in sustainable energy. Local developments often go hand in hand with local content, so the local industry can benefit as well from the capital investment, which is beneficial for the development but more complicated for our clients. It is hard to be competitive with a local content solution with respect to the established EU propositions on cost and operational excellence.

Outside Europe a growing population and increasing prosperity are resulting in an exponential increase in the demand for energy. This has led to an energy mix of hydrocarbon and renewables. India is an example of a typical energy mix: huge growth in renewables, often onshore and a combination of solar and wind energy, as well as large investments and growth in oil & gas. Moreover, it turns out that

it is possible to increase sustainability considerably by making the switch from coal to gas.

### Cooperation is crucial

As is the case in the oil & gas market, we see that cooperation is very important in the renewables market. Cooperation with other parties and our parent company NOV is crucial to develop the necessary advanced technology which in itself is not directly sustainable, but which does enable sustainability and support the market to take steps in the energy transition.

GustoMSC is not able to innovate without the internal and external experience. With this experience, the market leaders are recognizing that we are playing an important role in the offshore wind market and are very keen to cooperate with us, resulting in more efficient, innovative and safer designs. Consequently, we are in constant contact with the industry leaders. We aim to be a trustworthy and reliable partner that can make the difference for the client.

However, the question is: can we realize the agreed goals through evolution or is a revolution required for the energy transition? This is the challenge in which innovation plays an important role. It is a challenge and at the same time an opportunity to make working offshore not only safer and more efficient but also more sustainable through open innovation in cooperation with other parties.

In our company we benefit from the open communication lines across various technical disciplines, as the new optimum design will look different in several aspects. It is still a car that brings you from "A" to "B", but underneath the hood the system specifications will look a lot different. Intercompany cooperation is also a must. GustoMSC needs to understand cost drivers for the operators as well as the upcoming developments of battery technology and power regeneration devices for example.

### Looking ahead at the market in 10 years' time

The offshore wind market is spreading globally, and business development in other countries is ongoing. This has resulted in expansion of our commercial and technical team. However, we do not know what this market will look like in 10 years' time. Will the turbine suppliers consolidate or not, are they going to build even larger installations or collaborate more? Our sales process will not change in this case, but there could be a change in the type of client or this could result in fewer clients. The current offshore market is stabilizing. We see clients that are terminating their activities in the sector, but also new and former clients that are able to find us or find their way back to us.

At present, the energy transition is still a development that is mainly taking place in

**World population growth and increasing prosperity are leading to a huge increase in the demand for energy. Often in the form of an energy mix: hydrocarbon and renewable energy sources.**

relatively wealthier countries, such as Europe, Japan, Korea, Taiwan and the United States. Although the larger developing countries such as China and India also see this as a theme and are expected to take steps in this direction as well. 'Transition' might be too strong a term for what is actually taking place. In any case, the transition is first following a route with an energy mix. Which is then also leading to a constant shifting in the market, uncertainty, but also opportunities for renewable energy, for innovation and for new developments. For GustoMSC this means that we need to focus on creating designs that integrate the latest technology in order to achieve energy savings and significant emission reductions.

## THE PIONEERS OF OFFSHORE ENGINEERING

GustoMSC is a reputable design & engineering company of mobile offshore units and equipment. In close cooperation with our clients, we translate experience, science and technical knowledge into realistic & innovative ideas. The performance of new and existing jack-ups, vessels and semi-submersibles is further optimized by our operational support and engineering consultancy. In this way, GustoMSC enables and supports safe and efficient operations at sea, contributing to a sustainable future.

From left to right: Alain Wassink, Jan-Mark Meeuwisse, Barend Jenje and Rutger Baan.







IN SEARCH OF OVERALL ENERGY EFFICIENCY

BATTERIES IN WTIVs

# INCREASING SUSTAINABILITY THROUGH ENERGY EFFICIENCY

GustoMSC has a strong position in the offshore wind installation market, and is committed to developing new solutions to improve customer benefits and increase sustainability. One of the developments that has recently gained more traction is to optimize power generation and consumption by using temporary energy storage systems.

Storing energy on a temporary basis is a way to contribute to increased sustainability. A Wind Turbine Installation Vessel (WTIV) has a highly fluctuating power profile during a turbine offshore installation campaign, and is therefore perfectly suitable for implementation of energy storage solutions.

**WTIV – Changing perspective on energy storage**

Only a few years back in time, energy storage solutions seemed relatively inefficient, and it was challenging to make a convincing case to demonstrate both the operational benefits and the reduced carbon footprint.

Since then, however, a combination of factors has led to significant changes in thinking. The increasing size of wind turbine components, requiring larger installation vessels, is one key element in this shift. Larger installation vessels require a significantly larger propulsion plant for transit and dynamic positioning, while at the same time the required power during idling, waiting for weather, loading in harbor or even installing wind turbines on site, has only risen moderately.

In addition, significant improvements have been made on hull resistance in recent years, reducing power requirements for transit conditions. This often makes the power required for dynamic positioning the dominant driver. The high demand for power for a relatively short period, leading to a fluctuating power profile, is ideally suited to temporary energy storage systems. And last but not least, energy storage solutions have significantly matured in terms of technology. The capital cost has dropped (\$/kWh) while energy density (kWh/kg) and energy efficiency have increased substantially.

**Energy storage application**

When it comes to the latest generation of wind turbine installation vessels, GustoMSC takes a case-by-case approach to assess whether implementation of energy storage systems is beneficial and supported by the end customer.

For example when the power requirements during leg handling and DP operations are well above what is needed for transit, batteries can be an attractive option. A WTIV arrives on site after several hours in transit with relatively predictable power consumption. During

this period, the batteries can be charged. If a minimum filling rate can be guaranteed, and DP operations are time limited and relatively predictable, batteries can be an effective solution.

Rather than an extra generator set, batteries can be installed to supply short-term extra peak power. In addition, batteries can supply instant power, so operators don't have to rely on spinning reserve – generators running on standby to guarantee that sufficient power is available to maintain position during a generator failure. Furthermore, a battery on standby is not using fuel or wasting running hours, offering an effective and clean alternative.

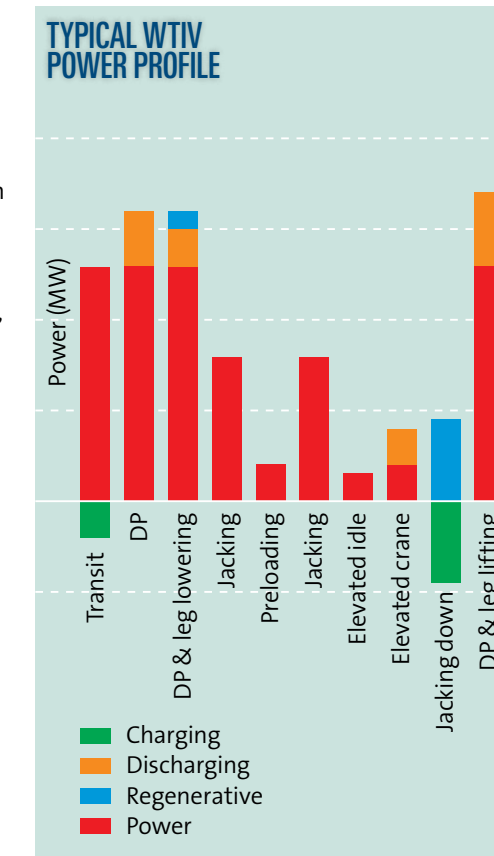
**Store and reuse energy**

A second possible application identified several years ago, but which was not thought viable at the time, is that of feeding power back into the batteries instead of dissipating the energy via resistor banks. Today, advances in battery technology have made it possible to effectively store and reuse that energy rather than let it dissipate. This application could be useful for jacking down, lowering legs to the seabed, lowering the crane boom, lowering the hook, and so on.

GustoMSC has developed an integrated solution, where the jacking system and crane are combined with a main vessel DC grid and battery packs. To be effective, the system needs proper integration, customized to the specific WTIV particulars and client operating profile. This is essential for cost effectiveness, reduced running hours, and an overall reduced carbon footprint.

**Future outlook**

GustoMSC is continuing to work on smart integration of energy storage technology. However, overall energy efficiency is key, not just battery storage. The regeneration of heat, optimizing weights and displacement, hull shape and on-board processes are equally relevant to providing customers with the best value, while contributing to a sustainable future.



CP-8001 JACK-UP

# AN IMPORTANT MILESTONE FOR JAPANESE RENEWABLES AMBITIONS



Global concerns about climate change have led to a different view of energy supply in Japan. In addition to traditional energy, such as coal, oil and gas on which Japan depends, more and more investments are being made in renewable energy forms. Nuclear energy has become less popular because of Fukushima and together with the climate change a movement has been started towards a more sustainable energy supply. Not only does the government strive to be less dependent on the import of fossil fuels and nuclear energy for safety and to achieve the CO<sub>2</sub> emission targets by 2030, but the large Japanese companies have also committed themselves to these ambitions. Wind farm projects are slowly materializing in the region and the first jack-up built in Japan, Penta-Ocean's CP-8001, is close to be active.

In a short interview it becomes clear what Penta-Ocean and GustoMSC encountered when realizing the unit. We speak to Mr. Yasuhiro Murota, Technical Superintendent responsible for the development of the CP-8001.

## THE GJ-3750C GUSTOMSC JACK-UP DESIGN

The GJ-3750C is a multi-purpose jack-up design able to undertake transit and positioning offshore without tug assistance. The four legs and diagonal preloading capability allow for easy, fast and secure jacking and preloading operations. The GJ-3750C is able to install large-scale marine structures such as 10 MW class wind turbines in water depths up to 30m with leg lengths of 66.7m, while the unit is designed for 86m legs for 50m water depth. The accommodation offers living quarters for a maximum of 120 people as well as office rooms and recreational rooms. In addition, and not often seen in Japan, the GJ-3750C is equipped with a heli-deck for crew changes and emergency response. The "CP-8001" certified Class NK DPS-B, a high precision automatic position system (DP2). With four thrusters the jack-up remains in a precise position even in severe conditions.



"We hope to continue our association for a long time to come."

Yasuhiro Murota

### Which geographical conditions had to be taken into account when developing the Penta-Ocean CP-8001?

"The environmental conditions in Japan are different from those in Europe. For example, it is unusual to have sandy sea beds, and seas that are shallow for a long distance from land; a steeply sloping seabed composed of rock, clay or silt is more common. In addition, as you will be aware, earthquakes occur frequently on the coasts of Japan and East Asia. In terms of climate, the phenomenon known as "explosive low pressure" sometimes occurs, leading to sudden, extremely heavy rainfall and strong wind. That is why the delivery of "CP-8001" is an important milestone for the Japanese offshore wind development as this is the first and largest DP2 jack-up built in Japan for offshore wind and civil construction projects off the coast of Japan with its special geographical conditions."

### How did you and your team overcome these challenges?

"During the development of this jack-up, the responsible personnel at GustoMSC discussed these challenges with us numerous times from the design stage onwards. Together we delivered solutions which were essential for the safety of all employees in relation to climate and natural surroundings."

From the start, especially severe earthquakes in these regions were significant for the design of this unit. GustoMSC provided engineering and consultancy support regarding the structural response and verifications of the

CP-8001. GustoMSC provided analyses of a time domain in which (scaled) historical earthquakes were applied to the structural model. The advanced calculations increase the safety of the operations and enable us to take maximum advantage of the capabilities of the CP-8001."

### For what purpose is the CP-8001, a GJ-3750C GustoMSC jack-up design, especially suited?

"We think that the vessel can be used in various types of civil engineering projects, primarily those involving the installation of offshore wind turbines. Examples of projects in which the vessel could be used, include construction of deep-water breakwaters, construction of seabed foundations for harbor roads, and maintenance and development of harbour facilities. We initially presented numerous requirements, relating to wind-turbine facilities of the 5-MW class or higher; civil engineering in shallow water; jack-up vessels for steeply sloping, rocky surfaces; the dimensions of ships that can enter even narrow and irregularly shaped inlets of the sea, etc. And these were all fully met. The GustoMSC GJ-3750C jack-up design is specifically tailored to Penta-Ocean's requirements."

### How did the relationship with GustoMSC develop throughout the project?

"We aim to build a trustful relationship through providing high quality workmanship and safe products backed by solid technologies. Since the first in-house discussion about construction of a jack-up vessel, we decided to task GustoMSC with this, since GustoMSC has a wealth

Nils van Nood and Mr. Takuzo Shimizu, President Penta-Ocean Construction, during the completion ceremony of CP-8001.



**Yasuhiro Murota**  
Technical Superintendent  
Vessel and machinery management department  
of Penta-Ocean Construction CO., LTD.

Yasuhiro Murota joined Penta-Ocean Construction in 1994 with a degree of machinery system engineering. He was in charge of the concept and basic design, modification and repair for Penta-Ocean's fleet in Asia. He has been in charge of the new building and operations of the CP-8001.



of experience with jack-up designs and jacking systems. We have learned a great deal from GustoMSC, from the decision about specifications, through the construction process and trial operation, to full operation. Having had no prior knowledge about jack-up vessels ourselves, we are very grateful for this. We are currently receiving advice from GustoMSC about, among other things, a pre-construction assessment and a site-specific assessment for a wind farm project."

### What are the ambitions of Penta-Ocean for the future?

"As a company we strongly believe that the cornerstone of all our activities is to provide a nature-rich environment for future generations. That is why we demonstrate an enterprising spirit in dealing with a changing society that influences our business in order to conscientiously respond to the needs of our customers and communities. We aim to become a globally No.1 contractor in port, coastal and waterfront areas. Our mentality of continually seeking challenges in new fields and the power of flexible self-innovation to respond to the needs of each new era are therefore essential. At Penta-Ocean, we are never satisfied with things as they are, and we continue to move steadily forward, step by step. We hope to do that in a continuous cooperation with GustoMSC for a long time to come."

## JAPAN, A SPECIAL COUNTRY WITH A SPECIAL LOCATION

Japan is a special country in many aspects, and that also applies when it comes to energy. Because Japan itself does not have natural energy sources, such as coal, oil or gas, it is dependent on the import of these products. This makes the country extra vulnerable to price fluctuations on the world market. Its location also makes Japan a special country. Sensitive to extreme weather conditions such as typhoons and heavy rainfall, and, located on a fracture plane, Japan regularly has to deal with earthquakes. The seaquake on 11 March 2011 followed by a tsunami has shown that nature can have a major impact on energy supply. The meltdown of the Fukushima nuclear reactor was a daunting result.

# APOLLO COMPLETED DECOMMISSIONING JOB WITH SUCCESS

In January 2019 Apollo successfully completed its third job: decommissioning of the Halfweg Platform in the North Sea.

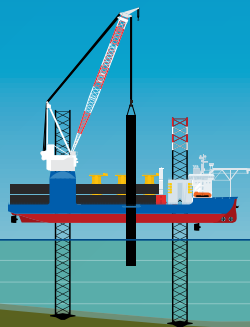
The Halfweg platform is a three-well unmanned gas production facility in the North Sea, installed in 1995. The 500-tonnes topside of the Halfweg gas platform, including the four foundation legs, has been removed in between stormy weather and brought to shore for recycling.

The project is illustrative of the growing market for dismantling in the North Sea. In the Dutch sector alone, 77 of the 150 remaining platforms must be removed by 2025. The Uljanik Shipyard delivered the Apollo to DEME subsidiary, GeoSea, in mid-August 2018. The Apollo is a GustoMSC NG-5500X self-propelled jack-up design capable of undertaking autonomous transit and positioning offshore. The jack-up is equipped with well-balanced DP2 capability and VSD driven jacking system. Its 106.8m legs allow it to operate in a secure and fast way in water depths of up to 70 meters.

The Apollo was designed as a green vessel with solar panels and wind turbines on board, use of biodegradable grease and oil and heat recuperation, in order to operate it with the lowest possible fuel consumption while also keeping CO<sub>2</sub>, NO<sub>x</sub>, and SO<sub>x</sub> exhaust to the minimum.



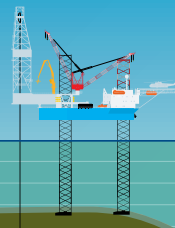
# THE PIONEERS OF OFFSHORE ENGINEERING



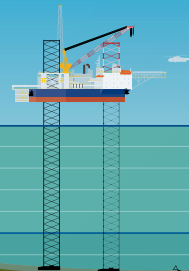
NG-2000X  
SELF-PROPELLED  
INSTALLATION JACK-UP  
**RIGHT CAPACITY  
AT THE RIGHT  
HEIGHT**



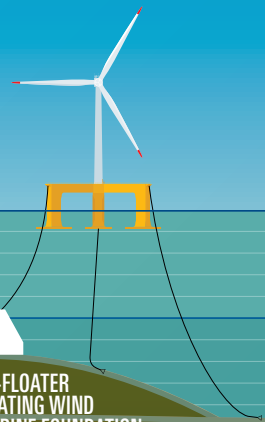
NG-5500X  
SELF-PROPELLED  
MULTI-PURPOSE JACK-UP  
**DEEPER WATERS  
& LIFE CYCLE  
SUPPORT**



CJ46  
CANTILEVER  
DRILLING JACK-UP  
**HIGH EFFICIENCY  
DRILLING**



PJ58  
PRODUCTION JACK-UP  
**VERSATILE MOBILE  
PRODUCTION  
SOLUTION**



TRI-FLOATER  
FLOATING WIND  
TURBINE FOUNDATION  
**ROBUST AND  
COST-EFFECTIVE**

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GustoMSC is a reputable design & engineering company of mobile offshore units and equipment. In close cooperation with our clients, we translate experience, science and technical knowledge into realistic & innovative ideas. In this way, GustoMSC enables and supports safe and efficient operations at sea, contributing to a sustainable future.

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