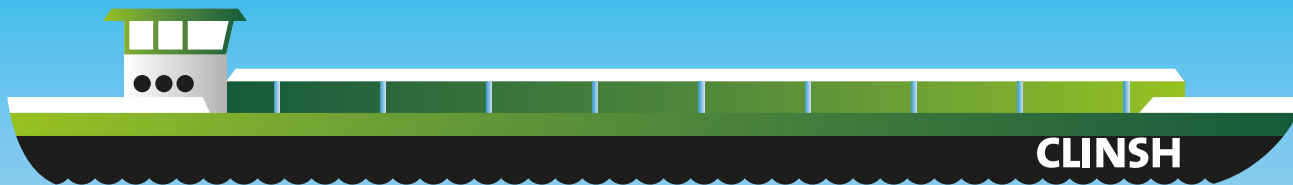




SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

# TALKING ABOUT CLINSH

*The human factor of sustainable inland shipping*







## **TALKING ABOUT CLINSH**

*The human factor of sustainable inland shipping*

CLINSH was officially launched on 1 of September 2016 and is co-funded under the European Commission's LIFE programme. The total project value is over € 8,5 million which will be invested in various projects.

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## Preface

We are now two years into our European CLINSH programme, which stands for **C**lean **I**nland **S**hipping. The CLINSH partners aim to improve air quality in urban areas by accelerating emission reductions in inland waterway transport. CLINSH comprises a demonstration project based on real-time emission monitoring and a programme stimulating onshore power supply. We collect valuable data and learn from experience in actual practice, hoping to inspire others and help them become more sustainable. The secret behind CLINSH? In my eyes, it's the human factor. A fleet of more than 30 vessels and their skippers play the main part in the demonstration project. Our skippers are the frontrunners in the development towards sustainable inland shipping. They collect the data we need to build a greener future. Who are these skippers, what are their expectations, and what makes them tick? We paid a visit to a number of CLINSH skippers and asked them to share their experiences as part of the programme as well as their views on the future of inland shipping. Ten of these interviews were brought together in this publication. I would like to invite you to read their stories, find inspiration in them, and join our efforts towards a greener, sustainable and future-proof inland shipping industry. When I talk to our skippers, I am always touched by their strong belief in the future of inland waterway transport and their willingness to invest in continuous improvement. I said it before, it's the human factor. I would like to thank the interviewed skippers for their hospitality and the entire CLINSH fleet for their highly valued cooperation. Together, we can make our dream of a sustainable future reality!

### **RIK JANSSEN**

Regional Minister, province of Zuid-Holland, the Netherlands  
Chairman of the CLINSH consortium



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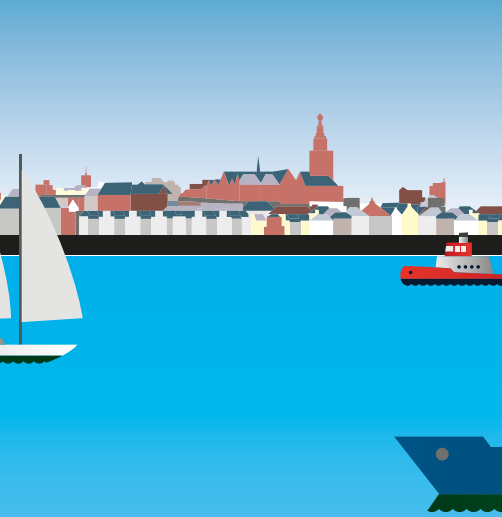


*“Transparency is what convinces people”*



**Skipper Gerrie van Neijenhoff**  
*MS Melvin*

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**Gerrie van Neijenhoff has been tackling the environmental problem for six years. He started with additives to conventional diesel fuel, but according to Van Neijenhoff, that yielded little in terms of greening and a cleaner engine. When Shell launched GTL (Gas to Liquid) – a liquid fuel based on natural gas – he made the switch at his own expense to embark on a trial. “It worked out well. An endoscopy of the engine showed that it was becoming cleaner. We could see it for ourselves at the exhaust – far fewer clouds of smoke and soot. We could see that we were being cleaner – you just notice it in everything, but you can’t prove it on a feeling alone. That’s what measurements and data are for.”**

In consultation with Shell, Van Neijenhoff therefore decided to take part in the CLINSH project to demonstrate the impact of GTL on emissions and answer questions like ‘What are your actual emissions at the moment?’ and ‘How clean or polluting are you?’. Since new fuels can often introduce problems that aren’t covered by insurance, Shell is guaranteeing the switch and the measurements. “We started the baseline measurement just a month ago, so it’ll be a little while before we have any real data.”

### **REVERSE INVESTIGATION**

As the engine on the Melvin has been running on GTL for four and a half years now, the investigation for this ship needs to be reversed. This means that the emissions from the GTL fuel will be measured first and then Van Neijenhoff will need to switch back to conventional diesel so that the results can be compared. “Then you’ll see how much more polluting we become – that’s something I know already. You can really see it at the exhaust.” It may be that a few adaptations need to be made to the turbos on the engine, to see if it remains cleaner. “They’re all investigations that are currently ongoing.”

## THE HUMAN SIDE TO THE ENVIRONMENTAL PROBLEM

Van Neijenhoff expects to be much cleaner with GTL, but for him it's more about the human side to the environmental problem. "Fine particulate is harmful to humans, and emissions of fine particulate are likely to be around 85% less after switching to GTL." There are also benefits in terms of NO<sub>x</sub> and CO<sub>2</sub> reduction, and Van Neijenhoff had never expected that the engine would become so much cleaner. "It's real progress, although GTL is not, of course, 100% clean. For that we'd need to switch to hydrogen."

What will the CLINSH project be a success at? "Demonstrating exactly how different fuels and technologies relate to one another, and their benefits and drawbacks. Transparency is what convinces people." For Van Neijenhoff, evidence is crucial. Without evidence, you cannot demonstrate the impact of GTL or convince people of its advantages.

## CCRO VERSUS CCR2

Are there any other low-threshold measures that can help to reduce emissions from inland shipping? Not without difficulty, according to Van Neijenhoff. "You wouldn't be able to keep your investments under € 125,000." The Melvin is still powered by an old CCRO engine, an engine with a relatively low fuel consumption. The new CCR2 engines use some 18% more fuel and emit more CO<sub>2</sub> as a result. The combination of a CCRO engine with GTL fuel is actually more sustainable than switching to a new CCR2 engine.

"Not enough consideration is given to the actual footprint of measures. If I take this engine out and scrap it to have another engine made and installed, I'm actually polluting more." Flawed reasoning which, according to Van Neijenhoff, is all too common. "A catalytic converter with a soot filter would be the only next step, but the investment would be at least € 125,000."

*“If I scrap the old engine and install a new one, I’m actually polluting more.”*

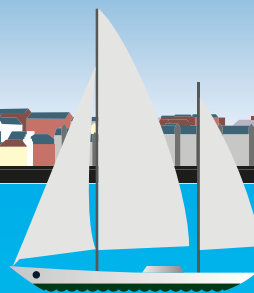
### **GTL AS AN INTERMEDIATE STEP**

For Van Neijenhoff, GTL is just an intermediate step towards a future for his grandchildren. “The current technologies are not yet good enough for cleaner inland shipping. When it comes to powering ships with electricity, the batteries themselves are not environmentally-friendly, and you don’t know where the electricity comes from. That’s why looking for the actual footprint is so critical.”

And who is going to pay for it all? “These investments are ultimately borne by the consumer, and they don’t want to pay for them right now. A second problem is that the inland shipping sector is a hugely fragmented market, with more than 5000 individual vessels in the Netherlands.” How can you create synergies and work together as a single bloc? “Put simply, you need to add a euro onto the freight charge in order to become greener. To be able to make a real transition, we need to join forces and make agreements.”

### **AND IN THE FUTURE?**

“In twenty years’ time, inland shipping will still be a relevant industry, certainly container transport, but we need to be realistic.” Greening is coming in the form of hydrogen, which to Van Neijenhoff, is a much better option than electrical shipping. “Shipping is moving towards hydrogen, but it will take time. At the moment, hydrogen based propulsion is the cleanest technology that I can imagine.”



*“Every little step helps.”*



**Skipper Otto Klinkenberg**  
*Vintage Cargo Shipping Logistics*

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**Otto Klinkenberg is an inland shipping entrepreneur who has sailed on a variety of ships since 1980. He has always set great store by greening, and has seen many changes in the past 40 years. “In 2007, we started to run on EN950 fuel, a cleaner, low-sulphur diesel that all shipping subsequently switched over to on 1 January 2011.”**

Through CLINSH, Klinkenberg is now switching over to GTL (Gas to Liquid), a liquid fuel based on natural gas. GTL burns more cleanly than conventional diesel, with fewer local emissions and less visible black smoke. He has chosen to participate in CLINSH to demonstrate that using GTL is actually a cleaner option. “This data will help to convince more inland skippers.”

### **COSTS AND BENEFITS**

“GTL is more expensive than conventional diesel, which for many inland skippers means it’s a question of costs versus benefits. Everyone wants to introduce greener processes to their work, but no one wants to pay for them. If GTL were used by more skippers, it would become cheaper automatically. If we can then demonstrate without any doubt that using GTL is actually cleaner, we’d be able to convince more people.”

Klinkenberg has only recently started working with CLINSH. The equipment has now been installed and a baseline measurement is being carried out of the use of conventional gas oil. Once these measurements are complete, the switch to GTL will follow. These measurements will allow comparison between gas oil and GTL. Klinkenberg anticipates that the exhaust fume measurements will make the difference. “GTL has a couple of other benefits too – the engine is cleaner and it makes less noise.”



*“This data will help to convince more inland skippers.”*

## **CCR2 STANDARD**

Klinkenberg continues to operate an older CCR1 engine, while CCR2 engines are now the standard. Starting next year, all engines will be expected to comply with stage five standards. “A stage five certificate cannot be obtained with older engines, even if the engine’s emissions do satisfy the standard.” For Klinkenberg, however, the transition to GTL means that he does not need to invest in a new engine.

## **SHARED RESPONSIBILITY**

Are there any other low-threshold measures that can help to reduce emissions from inland shipping? “It can only really be done with GTL. Otherwise, you have to start using catalytic converters and then you’d be faced with huge investment costs (at least € 100,000 a year, ed.). Urea costs a lot of money and that’s a real barrier as operation then becomes more expensive. People will not freely invest in that, that’s something you need the government for,” explains Klinkenberg. “At some point in time, we will need to look at all of the options. In terms of the amount, GTL is fairly low-threshold, but some people just don’t have anything left with which to invest.”



How much does the transition to GTL cost then? “Our ship is pretty big, which means that the operational costs for the transition to GTL are between € 20,000 and € 30,000 a year. Thus far, the investment has only cost money. You do get a discount on port fees, but that’s peanuts when considered on an annual basis. When you’re making investments like this, unfortunately you can no longer be the cheapest. The business community needs to be forced by the government to respond. Greening is not always the best way to run a business. There needs to be a push, or customers need to be prepared to pay more. At the moment, people unfortunately still opt for the cheapest quote. If the entire chain is prepared to pay for it, then individual investments can be reduced to just small amounts.”

### **THE FUTURE OF INLAND SHIPPING**

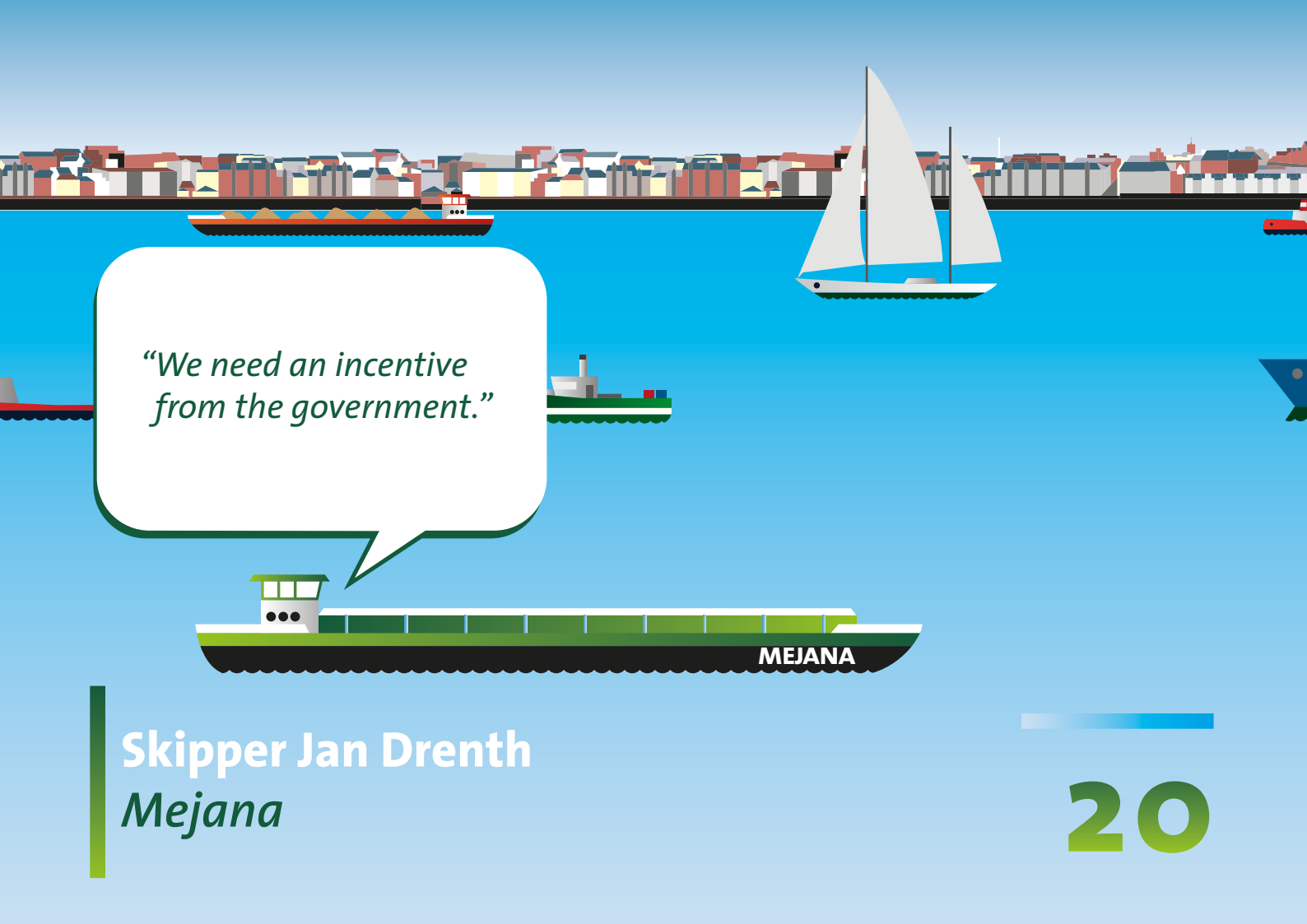
Klinkenberg is clear on the future, “We need to skip a step.” Switching to hybrids is a costly investment and other options will certainly be available in the future. These are still in the early stages though. Klinkenberg believes that in twenty years’ time, everything will be run on hydrogen and electricity. “It’s still a long way off, but sometimes things move quicker than you think. Hydrogen is not yet harmless (explosive under extreme pressure, ed.), but H<sub>2</sub>fuel is on the agenda – that’s hydrogen in powdered form that can be mixed with a water-based substance. That’s the future.”

Klinkenberg concludes by pointing out that we need to look at things from a positive angle. “Of course, we need to continue to improve, but if you look back at the steam era, ships have become so much cleaner. Every little step helps.”

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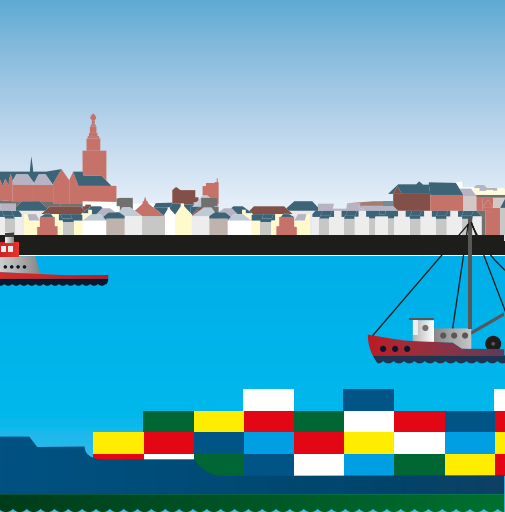




*“We need an incentive  
from the government.”*

**Skipper Jan Drenth**  
*Mejana*

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**Jan Drenth is the operator of two inland vessels: the Mejana and the Marajo. “We are taking part in the CLINSH project with the Mejana. First and foremost, with the aim of becoming greener, but I also believe it is important to learn more about the impact of various measures. Everyone keeps telling us what to do, but if you then ask what difference it will make in terms of emissions, how much it will help us personally, and how much cleaner it will actually be, then no one has any real answer. This is what we are now measuring as part of the CLINSH project.”**

### **BENCHMARKING IS IMPORTANT**

In the CLINSH project, various entrepreneurs are investing in a range of different technologies with a view to comparing them and obtaining a realistic picture of the impact of certain measures. “We invested in an aftertreatment system with catalytic converters and soot filters. If the stories are true, then NO<sub>x</sub> emissions will be reduced by no less than 80% and soot emissions will apparently be reduced by 95%. Measurements are now being carried out to see whether these figures are correct.”

The technology and measuring instruments have already been installed on the Mejana so the first measurements have already begun. “However, it is not yet possible to measure soot emissions with this equipment at the moment. A soot measurement will therefore be carried out three times over the next three years.”

What will make the CLINSH project a success? “For us, it is important to obtain the results of the measurements. Not just for the technology in which we have invested but for all the systems. I am, of course, hoping for very positive results for the catalytic converters and soot filters.”


### SHAFT GENERATOR

Are there any other low-threshold measures that can help make inland shipping more sustainable? Drenth believes that the inland shipping industry has come a long way in terms of the optimum streamlining of ships, nozzles, and special rudders. “Electric-powered ships is still a step too far for the type of vessel that we use. We would need too many batteries for the distances we cover. We could perhaps increase sustainability with our generators and, for example, use a shaft generator.”

A shaft generator would replace the conventional diesel generator on the main engine and is driven by the ship’s engine. The shaft generator is used to supply the ship with electrical power during the journey. Adding this electrical energy conversion makes it possible to create a stable supply of energy even though speeds may vary. This expansion makes ships more efficient and reduces power consumption thanks to optimum control of the propulsion system at various speeds. “It is an investment that can be made when you need to replace a generator. As the shaft generator is attached to the engine,” Drenth explains, “you make optimum use of the catalytic converter and soot filter.”

### GOVERNMENT INCENTIVE

How can inland shipping entrepreneurs be encouraged to invest in these types of solutions? “That’s a tough question. The market is still quite rigid and that is mainly due to the sky-high prices. Besides the investment in the installation (€ 300,000, ed.) – a third of which was financed by the CLINSH project – we now have additional costs of € 30,000 per year to keep everything running.”




*“Personally, I would advocate taxes that stimulate these developments”*

“Personally, I would advocate taxes that stimulate these developments. At present, the costs are so high that most entrepreneurs are being cautious and waiting to see what happens. People are waiting until it becomes compulsory, but this may perhaps take another five to ten years.” In addition, the technology is continuously developing. It is therefore not always advantageous to be an ‘early adopter’ in Drenth’s view. The longer you wait, the better the technology will be.

“I want to be honest about this. Three years ago, we made the switch on the Marajo with the help of a subsidy programme. This time, we made the switch on the Mejana with the help of the CLINSH project. Without the subsidies, I wouldn’t have done it either. The banks are now showing greater flexibility, which is a positive sign, and we also get a small amount of the port fees back, but this isn’t really commensurate with the investment that we’re making. I would advocate tax benefits on green installations, as is the case with electric cars. I think people would then start making calculations to see what is best for them. Even if entrepreneurs do not necessarily earn more as a result, there would be more enthusiasm for these types of measures. We need an incentive from the government.”

#### **FUTURE SCENARIO**

Drenth believes that inland shipping will definitely continue to exist but it is difficult to assess whether it will become better or worse. “It’s still a long way off. Container shipping is booming at the moment. When it comes to greening, coal and oil will certainly be given a smaller role to play, but the shipping industry will continue along its course in its current form for now. Only time will tell.”



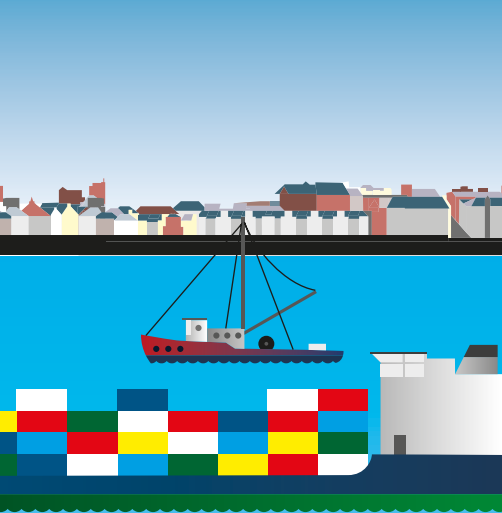
*“Systems are sold at artificially inflated prices, partly due to the subsidies.”*



**Skipper Frank Rycquart**  
*MTS RyGo*

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**Frank Rycquart is an entrepreneur in the inland shipping industry and collaborates within a larger company (AMS based in Zwijndrecht) that focuses on several entities, including tanker shipping and dry bulk. “We focus on industrial transportation. It is no longer a family business but a conglomerate of several companies working together on various aspects in a partially cooperative form.”**

Rycquart has been appointed as technical supervisor within the group and is taking part in the CLINSH project for MTS RyGo, a 4000-tonne tanker.

What makes MTS RyGo so suitable? “The new standards for CCR2 engines have been in force since 2007. Essentially, these engines emit fewer soot particles due to a higher temperature in the combustion chambers. This increase is achieved by injecting more fuel. In other words, CCR2 engines are cleaner but do consume more fuel. If you install aftertreatment systems in older engines, you can save 10% of extra fuel consumption. This is why it is attractive to install aftertreatment systems in CCR1 engines, especially as they have often not even reached half of their life cycle.”

### **STALEMATE IN THE INLAND SHIPPING INDUSTRY**

According to Rycquart, a second reason for investing in an aftertreatment system is the ‘stalemate’ in the development of the inland shipping industry. “The industry is hardly developing any new engines within the Euro 6 standard as only around 1000 engines are sold per year in our sector (this is an estimate, ed.). Engineers are unable to pursue any developments with these quantities, as they do, for example, in the truck transport industry.”

## SIDE NOTE

Rycquart believes that part of the success of the CLINSH project is the fact that part of the investment is subsidized. However, he wishes to add a side note to that: “The RyGo was built under our own management at the time, which means that we are reasonably aware of the cost and material prices. I find it frustrating that producers are selling technologies at extremely high prices compared to the type of materials and components that are actually incorporated within them. If such systems were to be sold at realistic prices, then many more entrepreneurs would be inclined to invest in them.”

As soon as you start talking about the environment or the greening process, you can see dollar signs in the eyes of the producers, Rycquart explains. “When you buy a new diesel car, it already contains the catalytic converters. In the shipping industry, you are charged the price of a second engine to have a catalytic converter installed. Producers are asking a disproportionately large amount for these systems and this is partly due to the subsidies. It is a free market so they can charge what they want, but if you analyse the prices, the relationship between the material costs and the so-called ‘engineering’ costs is shocking.”

It sounds like a vicious circle. “Exactly! In terms of my goals, needless to say the environment is a top priority. We all have a responsibility in this regard, certainly as an entrepreneur, but really you are boycotted by the systems that have been artificially brought into the world. Who triggers what first? Unfortunately, green ideas always revolve around money, often large sums of money. This slows down the ultimate objectives.”

*“Investors in after-treatment should be able to obtain certification first”*

### **CERTIFICATION**

Rycquart believes that certification is an important next step. “I have a ship that has been running with an aftertreatment system for three or four years and a lot of measurements have already been taken. However, no one can issue me with a certification for this as the measurement systems have not been calibrated and government approved.”

### **SOLUTION**

What would be the best step to break this vicious circle? “It should firstly be made possible for entrepreneurs who have invested in aftertreatment to obtain certification. The government could then, for example, reward shippers with an environmentally-friendly fleet.”

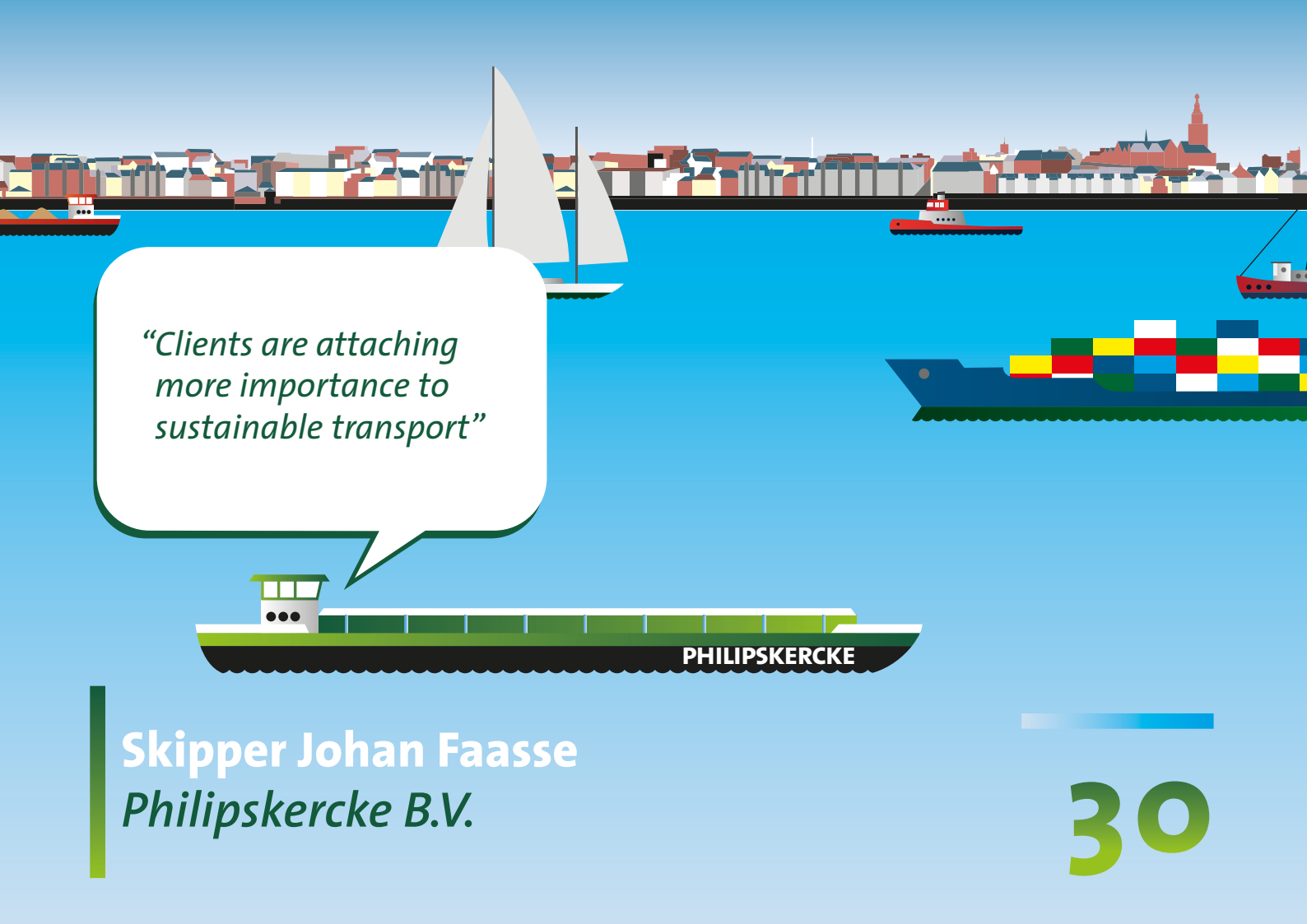
An example of a reward could be a tax compensation. “As soon as cleaner ships become more popular due to this compensation scheme, other skippers will also start thinking about the future. This will lead to far more parties installing an aftertreatment system, which will result in producers being able to offer their technology more cheaply.”

### **THE FUTURE OF INLAND SHIPPING**

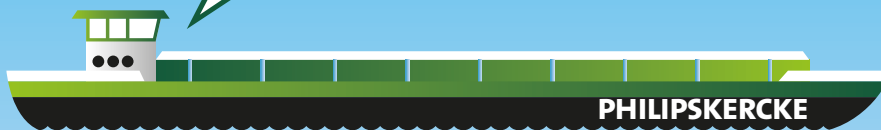
Rycquart thinks that small entrepreneurs will encounter problems in the future. “Sole proprietorships will find it difficult to sustain their business and will seek greater consolidation.” This will lead to larger industrial exploitation groups. In addition, Rycquart believes that we are still in a transition phase lasting around 15-25 years. “As far as I’m concerned, hydrogen is the future, but it’s not that simple. A lot of pioneering work is needed to be able to use hydrogen on an industrial scale in the inland shipping industry.”







*“Clients are attaching more importance to sustainable transport”*



**Skipper Johan Faasse**  
*Philipskercke B.V.*

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**Johan Faasse, director of Philipskercke B.V., did not hesitate when he read about the CLINSH project and the opportunity to invest in cleaner operations. “I’m doing it for my customers, my business and my children.”**

Faasse’s vessel is currently being retrofitted with a post-treatment system: a soot filter and a catalytic converter added to the existing engine. The total cost of these measures, together with equipment to monitor fuel consumption and emissions, is € 196,000. Subsidies under the CLINSH project will cover approximately half of this amount.

### **INVESTING IN THE FUTURE**

“The majority of our clients are in the construction sector. I’ve noticed that many are now devoting far greater attention to the environmental impact of their activities, including the transport of materials. By taking part in the CLINSH project, I want to ensure that my vessel is more environmentally responsible. I am investing in the future of my company and that of my children. We all want future generations to enjoy a healthier environment, right?”

Faasse does not expect an immediate return on his investment in the form of a sudden influx of new orders. But he has no intention of standing idly by. “Projects like this need forward-looking people who are willing to take the lead. We want to be at the forefront of developments. It seems likely that stricter environmental legislation will be introduced in future, making measures like this mandatory. We want to be ready. Moreover, the market will demand greener transport and we must be able to respond promptly.”

### **A 98% REDUCTION**


Last summer, Faasse closely monitored the MS Philipskercke’s fuel consumption and emissions. The engine was modified in late December and the vessel could resume operations in January with its new, cleaner system. “I expect a spectacular reduction in both NO<sub>x</sub> and PM emissions – up to 98%. I had already invested in measures to reduce CO<sub>2</sub> emissions, so I’m now in a very strong position compared to my competitors. I hope that my ‘greener’ vessel will be even more interesting to existing clients and anyone else who needs to transport construction materials. In future, the European Union is likely to introduce even stricter legislation to limit emissions. Bring it on – I’m ready!”

### **MARKET VALUE**

“Of course, there are commercial considerations when making this type of investment. I hope to attract more clients. But my main motivation is to help achieve a cleaner environment. Someone has to take the lead otherwise nothing will get done. I get satisfaction from knowing that my investment will also benefit society. And the bonus is that my vessel will be worth more if I ever want to sell it.”



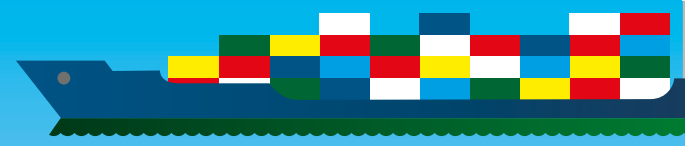
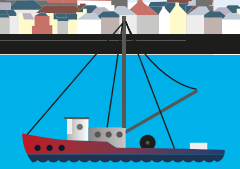
*“I expect a spectacular reduction in both NO<sub>x</sub> and PM emissions”*



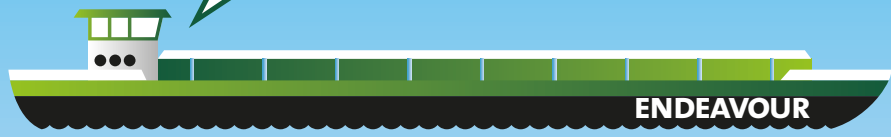
#### **SMALL BEGINNINGS**

Some operators may be hesitant about making such a significant investment but they too can become more sustainable by installing a simple filter system. For a relatively modest investment, this will vastly reduce emissions – perhaps by as much as 99%. Another way of increasing sustainability is better route planning to ensure that the engine always operates at optimum efficiency. ‘Slow steaming’ is not just for the huge container vessels!

“I have been trying to spread the word but very few of my colleagues who transport construction materials have implemented this type of sustainability measure as yet. They focus on the commercial side and seem to think that they have already invested enough. There is no shortage of work in this sector, so they can continue to do business with clients who are not yet particularly concerned about the environment. They can probably carry on like this for a while but I prefer to take a longer-term view. And I want to do my bit for society,” states Johan Faasse.

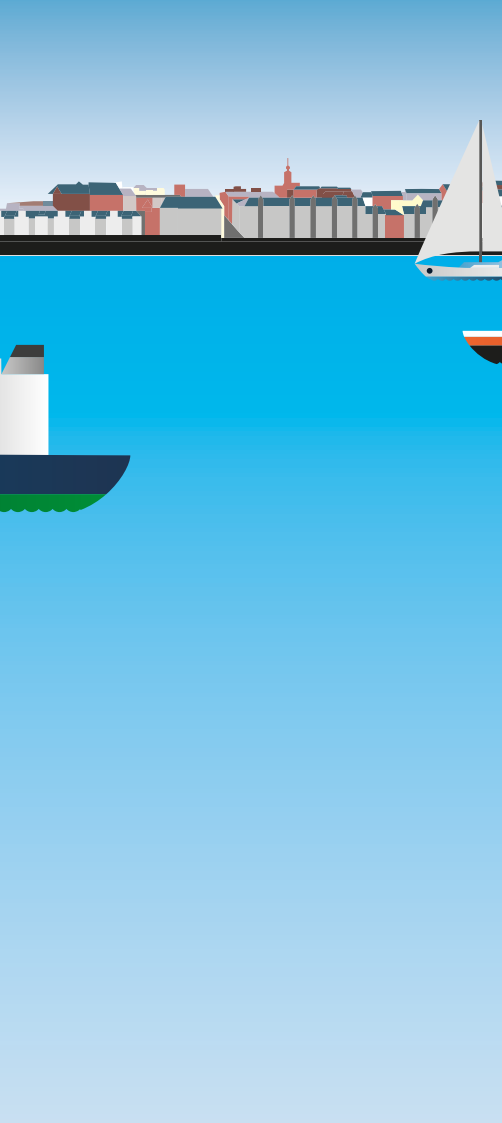


*“Sustainability and cost reduction go hand in hand”*



**Skipper Wiemer Hoekstra**  
*Endeavour B.V.*

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**“We participate in CLINSH because we want to make our business more sustainable and because we are eager to know the measurement data,” says Wiemer Hoekstra of Endeavour B.V. The Endeavour will be equipped with an FWE (fuel water emulsion) system.**

Hoekstra’s attention was drawn to CLINSH by the installer, who also provided such a system for another of the company’s vessels. “Our client required it. At that time, we took up the challenge of getting two ships within the CCR2 standards. That was a great success. We have achieved an 88% reduction in NO<sub>x</sub> emissions. That was above expectations. The ship was awarded a Green Award Gold.

### **CCR2 STANDARD**


“We anticipated that slow-running engines would go out, but our example shows that they can indeed perform within the standard,” says Hoekstra proudly. “Indeed, with less fuel, the engine now delivers more power. Sustainability and cost reduction go hand in hand. In 2025, everyone must be CCR2 certified. Installing a new engine is not a solution. Removing a properly running engine to install a new one that meets the CCR standard is pure capital destruction. The investment costs are too high to be borne. And we showed that there is no need for it.”

## FINANCING

In order to be able to make sustainability adjustments to a ship, financing is needed, Hoekstra says: “The payback period on an FWE system is 14 years. Grants and other forms of financing are necessary. Techniques such as catalysts are otherwise not affordable. And the banks? Hoekstra: “It would be good if banks would also finance relatively old ships and engines. If a ship is maintained properly, it lasts for a very long time. The banks need not be afraid of the value of the ship as collateral. Banks may prefer to finance new and therefore also more expensive ships, but for (starting) entrepreneurs the takeover of an existing ship is easier to bear.”

## FUEL SAVINGS

CLINSH is also interesting for Hoekstra because of the continuous measurements. The CLINSH skippers can view their own measurement data. “After personnel, fuel is the biggest cost item. Fuel savings are very easy to achieve. There are many possibilities. FWE is one way, but we now also have, for example, battery packs to replace the generator”. Steering skills also play a role. The Hoekstra family transports salt from AkzoNobel in Hengelo to the Bayer factories in Leverkusen and Dormagen. They know the route like the back of their hand: “We know where and when to sail cleverly. The CLINSH measurement data is very important in this respect.”



*“If a ship is maintained properly, it lasts for a very long time”*

Hoekstra's efforts bear fruit: "It is estimated that we save 3 to 4 percent of fuel with the FWE system alone. Fuel additives add another 5% fuel savings. Installing the battery pack also has had a major effect. Not only for us, but also in the broader context: to get 1 liter of gas oil in our tank, 2.2 liters of gas oil are needed to get it there; think of costs for extraction, transport and the like. We consume approximately 24,000 liters a year. If you don't need that anymore, that's a considerable saving on costs and environmental impact."

#### **GOVERNMENT ROLE**

So Endeavour B.V. is working diligently on sustainability. What does Hoekstra expect from other parties? "In the Netherlands, 75% of all inland shipping companies are family businesses. That adds up to approximately 3150 independent companies. We estimate that sustainability is not really a matter of concern in most family businesses. Perhaps shippers should make more of a demand for greening. Certainly, the government also has a role to play. All kinds of requirements are being set for existing ships but in the end, the implementation date is postponed or the plan is even completely abandoned. People don't understand it anymore. The government must communicate more clearly about what is expected and when. In addition, the government plays a role in creating a clear overview of all greening possibilities and their effectiveness. All alternative techniques are now small islands: electric, FWE, LNG. We expect CLINSH to provide an overall picture."

Finally, the question of what inland navigation will look like in 20 years' time. Hoekstra has to think for a moment: "In 20 years is too fast, but in the end we will sail autonomously. I'm almost sure of that."



FACTOTUM

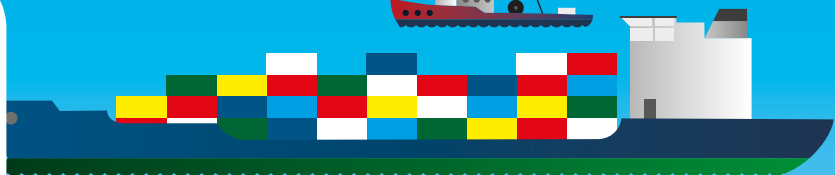
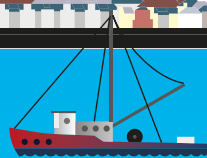
CMA SHIPPING

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CMA CGM



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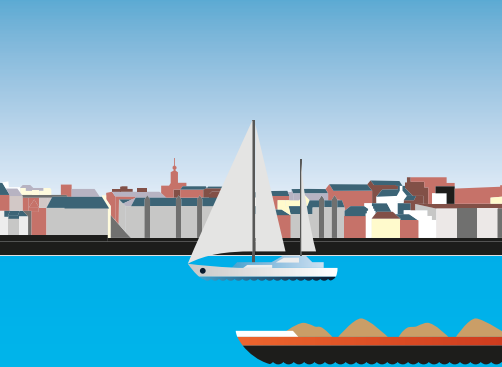
*“Too many decisions are made on the basis of theoretical assumptions.”*



**Skipper Jan Albert Bosma**  
*Tharsis*

**40**





**Jan Albert Bosma is the joint owner of a small shipping company specializing in the transport of high-quality steel and aluminium products – something of a niche market. The company is participating in the CLINSH project with the ‘Tharsis’, technically an ocean-going vessel, but also capable of navigating rivers and canals. “The Tharsis was built in 2012 and is the first ship to be equipped with a diesel/electrical drive system.”**

### **DIESEL/ELECTRICAL DRIVE SYSTEM**

With a conventional drive system, a vessel has one or two diesel engines and one or two propellers that are directly driven by the engine(s). “If the circumstances dictate that you need to run at a calmer pace (which is very common for this vessel on account of its sailing profile, ed.) and your vessel is driven by a relatively large diesel engine, then you’ll run with a low load, and a low engine load means relatively high fuel consumption and relative high emissions. The advantage of the diesel/electrical drive system is that instead of propellers with diesel engines, we have propellers with electrical engines.”

At the moment, these electrical engines are still fuelled by conventional diesel engines. “We now have three converted HGV engines on board, which act as generators, so we have a relatively small generator set that can run at optimal load when we need to sail at slower speed. We can start up additional engines if we need more power. Together they generate electricity to drive the electrical engines. Sometimes we can navigate the river with just one HGV engine running with 100 HGV loads on board.”

### **A STEPPING STONE TO THE FUTURE**

A system like this has a great many benefits, beginning with reduced wear. The fact that the engine is more efficiently loaded also means fewer emissions and lower fuel consumption. “Another great benefit is that electrical engines don’t need much maintenance. You literally have nothing to look out after.”

What's more, the system is an easy stepping stone to further greening. "In the future, we have the opportunity to switch over to another source of power relatively easily. The current generators make it relatively easy to switch over to a different technology – the electrical engine, propeller, and propeller shaft can stay where they are. With a conventional diesel engine, you need to modify everything, and that costs a lot more in terms of both money and time."

### **WHY CLINSH?**

"We're always looking for ways to innovate and save fuel and reduce emissions. CLINSH is an interesting project as we're really curious to have accurate information about the emissions from the Tharsis." Bosma is taking part in the emissions monitoring aspect of the CLINSH project. "All three of the generators I mentioned earlier, that generate the electricity for our electrical drive system, have now been fitted with emissions monitoring equipment to help us better understand their impact. We haven't been running all three generators simultaneously for some time now."

The measurements will be of great interest to Bosma and will provide real insight into what's actually happening. The Tharsis was built without any subsidies, so there was already an intrinsic motivation for greening. "Our vessel had already been running an innovative drive system before we started working with CLINSH. The emissions monitoring may help us to do more to bring our emissions down further, such as by using the configuration differently."

*“In the future, we can switch over to another source of power relatively easily”*

### **A DISCREPANCY BETWEEN THEORY AND PRACTICE**

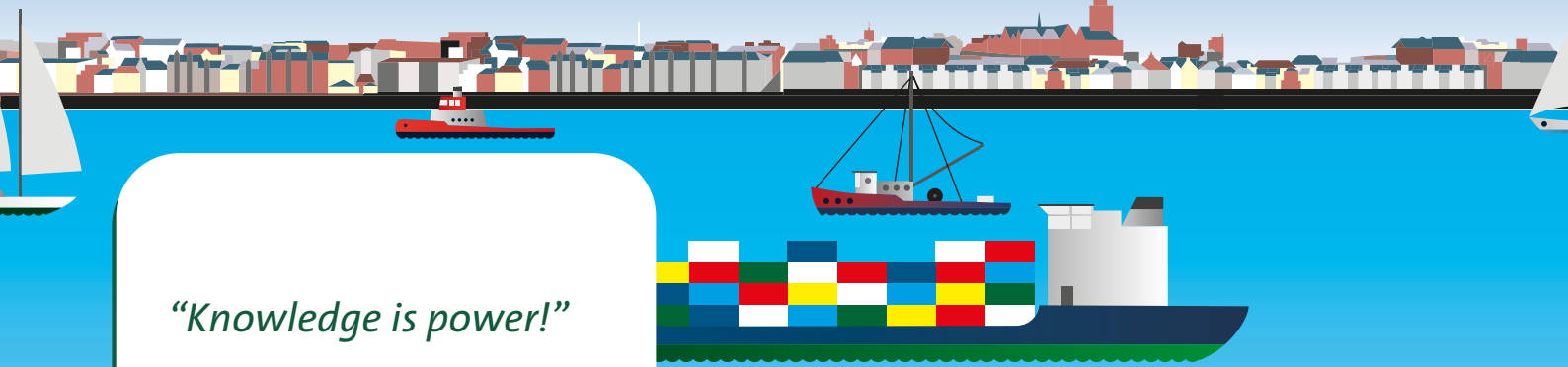
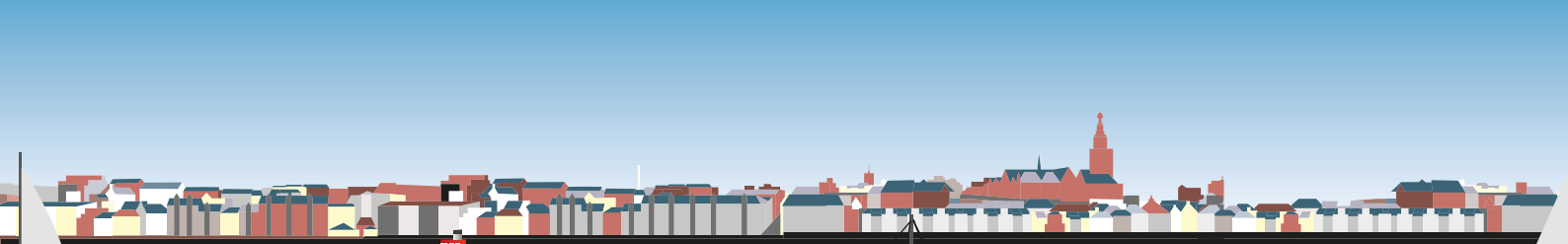
“Our participation is limited to a small part of the project, so for us, success is consistent with being able to determine what type of drive system is the best in a few years’ time. Hopefully it will become clear what will work in practice. That’s the problem at the moment – too many decisions are made on the basis of theoretical assumptions, while in practice there are a great many factors that are not taken into account. Theories sometimes let you down in practice.”

According to Bosma, there’s a huge discrepancy between theory and practice. CLINSH will now calculate the concrete figures from practice to determine the extent to which theoretical assumptions are correct. “Since the project will extend over several years, it’ll be highly accurate. It’s part of a much bigger picture, and that’s never happened before.” Bosma sees that as a positive, “It’ll provide us with valuable information.”

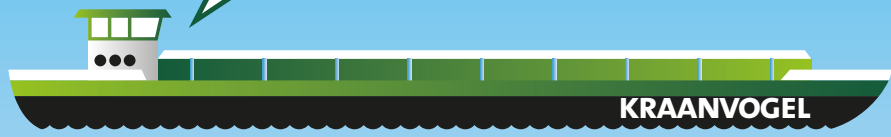
### **CHICKEN AND EGG**

How do you motivate fellow inland shipping companies to make the switch? “All of the links in the logistics chain need to be prepared to pay a little bit extra for clean transport. We’ve been working with the same office for seventeen years now, something that seldom happens in practice. Competition based on price is still the reality faced by three quarters of companies, despite all the positive noises about sustainability.”

“Normally, I’d say that the market needs to sort it out, but in this case, the government needs to encourage companies to pay more for clean transport. Otherwise, it will never get off the ground. We have a good relationship with the office that we sail for, but many inland shipping companies have to rely on themselves. They cannot easily stamp their feet and impose requirements, if they do, companies will quickly opt for someone else.”



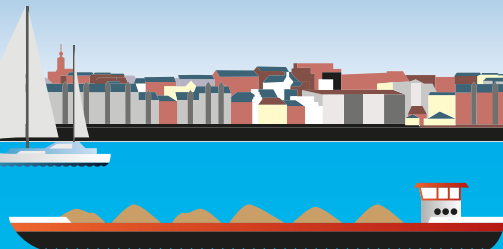
*“Knowledge is power!”*



**Skipper Mark van der Meulen**  
*Kraanvogel*



**44**



**Together with his brother Klaas, Mark van der Meulen runs a hydraulic engineering company with approximately 28 vessels, ranging from tugs up to crane vessels. In addition to transport, the company also specializes in dredging, embankment construction and maintenance, and earth movement. Van der Meulen Woudsend B.V. is participating in the CLINSH project with the crane vessel ‘Kraanvogel’, which is to be converted to run with a hybrid propulsion system.**

“We’d long been looking for the right solution. I think that the future is in electrical drive systems, so we’re eager to adjust our fleet accordingly. We became aware of the CLINSH project through the Dutch ‘Vereniging van Waterbouwers’. Hybrid systems are more expensive than conventional drive systems, so we’re grateful for all the help that we can get. We also want to learn as much as we can from the project – after all, how everything works is still largely an unknown to us.”

An increasing number of vessels are equipped with electrical propulsion, but the manner in which this electricity will be generated in the future remains unclear. “I hope that it will be hydrogen. With a hybrid vessel, you no longer need to make any modifications to the drive system. The intention is for the entire vessel to run on electricity in a few years time – by then we’ll have learned a thing or two from the CLINSH project.”

### **HYBRID KRAANVOGEL**

Kraanvogel’s involvement in the project is still in its early stages. “At the moment we’re monitoring the conventional diesel engine, which will take three months. We’re nearly done with that and in a month’s time, we’ll start the conversion of the hybrid system in our own yard. We hope to be finished in June.” The sensors now fitted to the propulsion engine will then be fitted to the generator engine so that the figures can be compared.

“You can run vessels on batteries but if you do, you lose a lot of capacity as batteries are very heavy. So, we don’t really have a viable alternative at the moment. For now, we’ll continue to burn diesel with a generator that can then generate electricity. A generator helps to ensure more efficient combustion, meaning fewer emissions and lower fuel consumption.”

### **QUIET POWER**

Hybrid engines also operate much more quietly – you have just one generator set that you can hear externally. As a result, the vessel hardly makes any noise at all. “Running on electricity is very quiet – you might still be able to hear the pumps, but otherwise it’s a bit like driving a Tesla car. All of Kraanvogel’s engines are located at the fore of the vessel, leaving only the electrical engine at the back and giving the skipper a much quieter working experience. “It enhances the general well-being of our crew, which is a great benefit.”

### **A STANDARD SHARED IS A PROBLEM HALVED**

As a sector, inland shipping has its own set of rules. HGV engines need to satisfy the Euro standard, cranes the TIER standard, and marine engines the CCR standard. According to Van der Meulen, shipping is such a small, niche market that standardization along the lines of other sectors would not be beneficial. “There are far more HGV engines on the roads than there are marine engines on the waterways, so engine manufacturers have a greater interest in developing engines that meet the Euro standard than engines that meet the CCR standard. There would be far fewer emissions and things would be cheaper if Euro standard engines could also be used on vessels, but at the moment they can’t.”

## *“The future of shipping is hydrogen”*

“Some engine manufacturers are no longer interested in producing engines for vessels, so the sector is falling behind in terms of development, and the prices are only heading upwards.” According to Van der Meulen, it’s quite a problem in the shipping sector, and one that gets very little attention. “We should probably stick less to our own certifications; something that produces fewer emissions in an HGV will produce fewer emissions in a vessel as well. If shipping could switch over to the Euro standard, things would cost only half as much.”

### **COMPARATIVE DATA**

CLINSH is carrying out research into a number of categories of approach, which produces valuable comparative data. “It’s easy to think that the hybrid approach is the cleanest, but the CLINSH research may well demonstrate that other approaches are cleaner. Knowledge is power, as I always say. That’s the important thing about the CLINSH project – it looks at all of the options.”

### **HYDROGEN**

According to Van der Meulen, hydrogen is the future of shipping. “Where there’s a will, there’s a way,” he says. “On a technical level it’s feasible, but the legislation needs to be changed, new infrastructure needs to be put in place, and the hydrogen needs to be available. That’s not how things are at the moment, but if everyone gets behind it, it’ll be possible. After all, gas was very quickly rolled out across the Netherlands.” Van der Meulen envisages a transition period of five to ten years, “If plenty of investment goes in, it won’t take as long, but if the investment isn’t shared, then these developments will move much more slowly.”

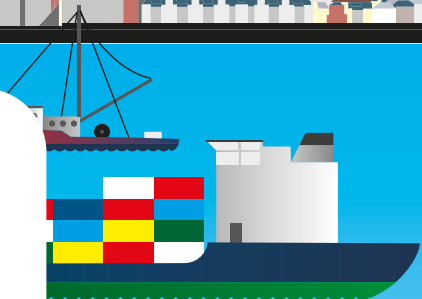
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BMC  
RIVER



*“Gathering practical data on greener barge transport”*



**Skipper Patrick Hermans**  
*Deseo Estuaire*

50



**Patrick Hermans, CEO of Deseo Estuaire, eagerly welcomed the CLINSH project as an opportunity to demonstrate at last how green barge transport can be. “We now use engines that on paper at least are cleaner, but until now we haven’t been able to demonstrate that they actually are in practice over a period of two years. We’ll soon be able to prove this, black on white.”**

The barge that Hermans operates was fitted with two new CCR2 diesel main engines last year, one of them with hydrogen injection. “This is actually the ideal test set-up: one engine with and one without hydrogen injection, so you can actually measure the benefits.”

#### **AT LAST: FIGURES FROM OPERATION IN PRACTICE**

“We hear a lot of figures being bandied about at the moment, with the Euro 6 standard for vehicle engines, telling us that diesel is polluting, the future lies with hybrid and electric, and so on ... but we don’t have any solid information about practical performance. There are no measurements carried out over a period of years demonstrating that a CCR2 engine is actually cleaner. It’s all based on laboratory tests and paper calculations.”

Hermans looks forward to having practical comparisons of both engines on the same vessel over a period of years. “The great added value of CLINSH is that we will have genuine, realistic measurements for barge activities. We will then be able to demonstrate to the outside world how green (or how polluting) we actually are, per tonne-km or per TEU-km.”

“We mainly travel between Zeebrugge and Antwerp, and now and then to Rotterdam, i.e. in a densely populated area where environment-friendly measures are desperately needed. Over the past 10 years we have carried 550,000 TEU and burned some 4 million litres of fuel. We will be able to measure our consumption accurately, calculate the emissions and draw conclusions. Then we will be able to show our figures to the outside world.”

### ENVIRONMENT-FRIENDLY PRE-TREATMENT


If the measurements demonstrate that hydrogen injection offers significant advantages in terms of emissions and cleaner air, Hermans won't hesitate to fit it on the other engine as well. "With these measurements I hope I can prove to the other barge operators that it actually works." In contrast to conventional post-treatment technology (exhaust filter and/or catalyser), fitting this pre-treatment technology to a CCR2 engine is much simpler. "It's about the size of a domestic fridge and is fairly quick to install. Perhaps I'll be able to convince my colleagues to invest in it."

### CHANGES IN BEHAVIOUR ALSO HELP

Hermans sits on the board of the Flanders Barge Knowledge Centre (Kenniscentrum Binnenvaart Vlaanderen), where making the barge fleet more environment-friendly is high on the agenda.

"The measures don't always have to be drastic. For instance, take the speed at which most bargees drive their vessel around the port. How fast do you actually have to go when carrying a load from A to B inside a port area? At the moment they easily go at 20 kph, but perhaps a speed of 14 kph would be just as efficient. These are things you can measure."

"Another possibility is to simply let the current help you along. That can easily yield fuel savings of 30%, and so also lower emissions. Now we can measure things like that. And if for instance we can demonstrate that carrying x TEU requires y litres of fuel and only creates z emissions, then you can easily make the comparison with road transport. There's no way they can argue against that."



*"it's worthwhile fitting  
new technology in  
a older ship"*

### THE FUTURE CAN ONLY GET BETTER

Hermans has no illusions about the difficulties of persuading other barge operators to invest in environment-friendly technology. “These are difficult times for barge companies. We have emerged from a deep recession, and we’re only now getting our heads above water.”

But in his opinion the technology for more environment-friendly operation can only get better. “Things have already improved so much in the past five years, and this trend will continue in future. And now with this project I look forward to demonstrating conclusively that it’s worthwhile not only fitting new technology in a recent ship but also retrofitting it in an older one.”

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### HYDROGEN INJECTION

The process starts by electrolysing demineralised water in the hydrogen gas generator. The generator runs on a 24 V supply produced by the barge engine and splits water into hydrogen (H<sub>2</sub>) and oxygen (O<sub>2</sub>). The hydrogen in dry gas form is then injected by underpressure into the air intake of the diesel engine. The addition to the air/diesel mixture is less than 1%. The injection of hydrogen yields better, more complete combustion and thus lower levels of harmful emissions. The engine also delivers more power, thus permitting lower fuel consumption.

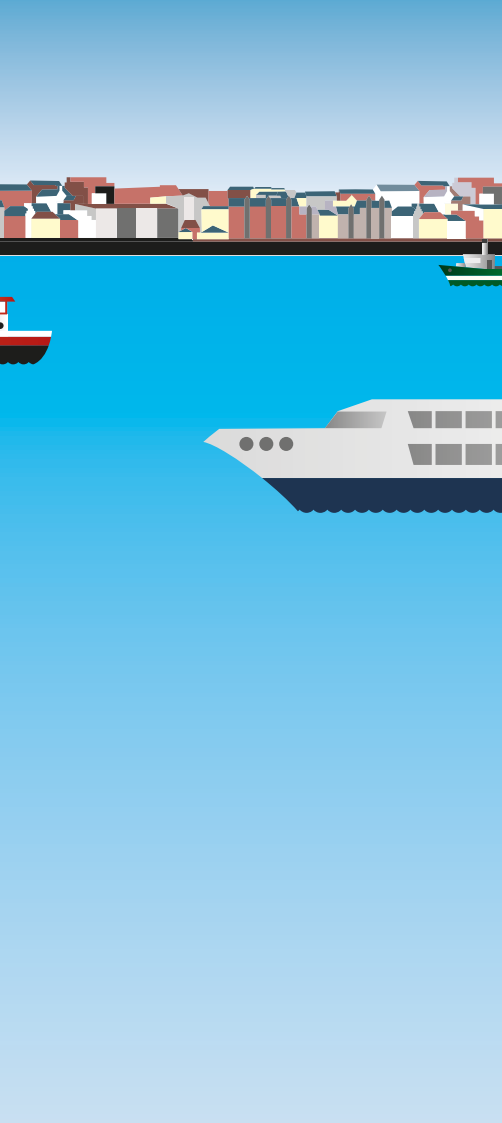


*“Fossil-free power as  
the ultimate goal”*



**Skipper Jos Meijer**  
*Jofra Scheepvaart VOF*

**54**



**Jos Meijer, managing director of Jofra Scheepvaart, was enthusiastic about joining the CLINSH project because among other things that would give him realistic measurements for the emission levels of his diesel-electric power train.**

Meijer has invested € 40,000 in an electric motor and a generator, while CLINSH has paid for fitting measurement equipment on the generator exhaust. This equipment was installed at the end of last year, and baseline measurements are now being carried out on the diesel exhaust. Once this has been done it will be time to carry out measurements on the electric power train. A comparison of the measurements will demonstrate the differences between the two power trains. “This will tell us precisely what the effects of this investment are. The equipment measures not only emissions of NO<sub>x</sub> and particulates, but also fuel consumption relative to the number of kilometres travelled.”

### **A FIRST STEP**

Meijer considers this phase as only the first step towards a much more ambitious goal, namely fossil-free barge transport. “At the moment we still use fossil fuel, but with the electric power train we now have the infrastructure to also use other applications. That’s the technology we have to aim for. With the present configuration we do save on local emissions, but the CO<sub>2</sub> emissions are still 75% too high. We can avoid this by using fossil-free power trains.”

“At my age there isn’t much chance of seeing this happen in my working life (*editor’s note: Meijer is nearing retirement*), but I would still like to install a hydrogen-powered drive. However it’s not economically feasible at the moment. I’m pinning my hopes on the automotive industry because a lot of research is being done there. Perhaps it will become profitable in four years or so, who knows?”

Jos Meijer will consider the CLINSH project to be a success if the measurement data over several years show that his NO<sub>x</sub> and particulate emissions have been reduced by 75% in line with theoretical predictions.

### **CUSTOMERS ENTHUSIASTIC ABOUT ENVIRONMENT-FRIENDLY BARGES**

Meijer does not have any illusions about his environment-friendly barge attracting more customers: “Our customers may be very enthusiastic about it, but they won’t pay extra to make their transport greener. Unless, that is, they have this option at the same price, in which case they will probably go for the cleaner vessel. Otherwise the government would have to impose obligations, but we’re still a long way from that.”

### **A FUTURE FOR BIOFUELS**

As much as he would wish otherwise, using biofuels practically amounts to economic suicide. “We can indeed make CO<sub>2</sub> emissions sustainable by using biofuels, but they are so expensive in comparison with fossil fuels that they are not economically feasible. At the moment they cost around double and I don’t see much improvement in future if it’s left to the free market. In fact the natural trend is exactly opposite, because as more alternative fuels become available the demand for fossil fuels falls, making them less expensive. At the same time the demand for alternative fuels outstrips supply, so that they become more expensive. If the government were to do something about this price ratio then biofuels could become a realistic alternative, but it won’t happen by itself. I’m all in favour of this type of government intervention, because I would be only too happy to use biofuel. And I’m sure that my colleagues would too, if something was done about the price.”



*“There are large differences in the fuel consumption of our members”*

#### **OPERATIONAL SAVINGS**

Jofra Scheepvaart is a member of ELV (see box text) which is considering the possibility of equipping its 100 own barges with fuel consumption meters. “There are disconcertingly large differences in the fuel consumption of our members. Fitting this type of monitoring equipment would make it possible to optimise the consumption. By monitoring the consumption the skipper can make sensible choices about speed, arrival times, scheduling, avoiding sudden dashes, not exceeding certain economic speeds ... you name it.”

Meijer himself is a proponent of “slow barging.” Prior to installing the electric drive in his barge, the optimum speed was determined on the basis of extensive measurements and the electric power capacity was calculated accordingly. The new motor has only a quarter of the power of the old one, but in France the speed achieved is still the same. In the Netherlands it is only one kph less. But: “99% of the time we go on electric power. Sometimes even more, as recently on the trip Amsterdam-Szczecin-Paris where we motored electric for 256 out of the 258 hours.”

#### **ELV**

“Europese Logistieke Vervoerderscoöperatie” is a cooperative association of Belgian, German, French and Dutch barge companies which has existed for 25 years.

The cooperative has 100 of its own vessels with capacities ranging from 350 to 950 tonnes that can serve the smaller-gauge channels of the European inland waterway network. It specialises in transport to and from France.

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## Participating ships

SHIP	SKIPPER / OWNER	TECHNIQUE
RyGo	Mr P. Boontjes	SCR DPF
MS Philipskercke	Mr P. Faasse	SCR DPF
Mejana	Mr J. Drenth and Mrs A. Drenth-Meinen	SCR DPF
MS Liane	Mr F. Rennings	SCR DPF (Euro VI)
MS Aude	Mr. B. Tromp	Diesel
<i>+ reference ship</i>		
Vera Pax	Mr F. de Wachter	SCR DPF
Endeavour	Mr A. Hoekstra	FWE
MS Invontes	Mr P.J. de Waardt	FWE
Kraanvogel	Mr G. Hosper	Diesel electric
Vantage	Mr O. Klinkenberg	GTL
Melvin	Mr G. Neijenhoff	GTL
Mon Desir	Mr T. Bosman	GTL
Tharsis	Mr J.A. Bosma	Diesel electric
MTS Vlaardingen	Mr R. Rivecourt	SCR
MS Semper Fi	Mr C.W. Ooms	Hybride, SCR DPF
Sulomaro	Mr M.W. Woltheus	Hydrogen injection, SCR DPF

SHIP	SKIPPER / OWNER	TECHNIQUE
Osar	Mr R. Kerkhof	GTL
MS Ora en Labora	Mr C. le Sage	GTL
Salute	Mr C.W. Pikaart	SCR
Factotum	Mr C.W. Pikaart	SCR
Seba	Mr H. Boersma	SCR DPF
MS Delta	Mr T. Gerrits	SCR
Comienzo	Mr J. Oorburg	SCR
MS Essex	Mr J. Meijer	Hybride
Watna	Mr H.A. van Laak	GTL
Max Pruss	LANUV	SCR DPF
Ecotanker II	Mr I. Jansen	LNG
Lotus	Mr I. Jansen	Diesel
Copenhage	Mr I. Jansen	Diesel electric
Deja	Mr I. Jansen	Diesel
MSC Poolster	Mr P. Borms	Diesel electric
Westropa	Mr J.A. Kranenburg	Biodiesel
MS Deseo	Mr P. Hermans	Diesel hydrogen injection
Ecotanker III	Mr I. Jansen	LNG electric
Amulet	Mr I. Jansen	Diesel electric

## About

CLINSH is a European consortium that promotes clean waterway transport. CLINSH brings Dutch, Belgian, German, and English public and private organisations together in an effort to improve air quality in urban areas by accelerating emission reductions in inland waterway transport. CLINSH receives support from the European Life Programme. The project runs from 1 September 2016 until 31 August 2020 and is co-funded by the European LIFE Fund.

### **REAL-TIME MONITORING**

As part of CLINSH, over 30 ships were selected and equipped with measuring equipment. Emissions will be continuously measured on board over a period of one to two years, yielding priceless information on the environmental performance and operating costs associated with the various technologies.

The results of the project will provide a tool for local, regional, national, and European governments to formulate (new) policies on improving sustainability in and around European waterways. The project will also yield valuable information for skippers so they can select the most cost-effective environmental measures for their ships.

### **ONSHORE POWER SUPPLY**

CLINSH also aims to highlight the benefits of onshore power supply for local governments. Until now, the energy needed for heating, lighting and other activities on board is mostly provided by generators. A switch to onshore power supply will help reduce ships emissions and improve air quality around ports.

*For more information and to subscribe to our digital newsletter, please visit [www.clinsh.eu](http://www.clinsh.eu)*

## Partners



## Acknowledgements

The following people and companies contributed to this publication:

- Awareness The Hague (interviews) [www.awareness.nl](http://www.awareness.nl)
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