





Thinking outside the box, what's next?

To help the wind industry excel in the current energy market, we need to provide the proper protection to these vital systems, ensuring they have the longevity to make renewable energy truly sustainable.

We can use new materials, build taller turbines, increase blade lengths and enhance the generators for greater outputs, but longevity of assets still remains a challenge.

There must be a focus for manufacturers on developing products and applications to meet both current and future demands, seeking feedback, expertise and industry insight along the way. Adding to the requirements are considerations around waste management and its impact on the environment.

EasyQote has been working with an industry expert on the development of applications, an intermediary who is working with end users experiencing first hand the issues they face. With this knowledge EasyQote has been recommended for use and approval by some of the major operators.

Dinko Cudic, Business Line Director for Stopaq/EasyQote sat down with Jan van Bokhorst, Subject Matter Expert, to discuss the development of new applications for the brand.

Dinko Cudic: Hi Jan, it's good to speak with you. Let's start with your take on how EasyQote is used now.

Jan van Bokhorst: EasyQote has been used in the offshore wind industry as a repair coating system for almost 10 years. The main purpose is to repair coating damage of the original coating systems although, it is also used for sealing of irregular shaped structures like stabbing pins, sensors, voids, flange gaps at transition pieces (TPs), etc.

DC: Where do you see EasyQote being used next?

JvB: EasyQote technology is an innovative option for corrosion protection for offshore wind steel structures, for a number of purposes, including application on parts of the large beam/pile foundation structures. This can be executed inside coating halls or outside under field conditions. It can also be applied to welded joints or connections of the foundation structures and as coating repair during construction and offshore installation.

DC: What makes it so useful for these purposes?

JvB: The technology was once limited to small applications, but thanks to new developments now has lots of advantages for use on large steel structures during new build of offshore wind foundations structures

too. These include no abrasive blasting; no surface profile required; minimised surface preparation; non-curing corrosion prevention layer as first layer; optional fast-curing polyurethane coating as a mechanical protection layer; ready for transport within eight hours; four times faster than conventional liquid coating system; and a reduction in CO₂ emissions and drastic reduction in waste.

The 'wrap-able' technology can be applied to large areas of foundations, such as monopiles and floating structures as a single layer, or in combination with a second coating layer, if additional mechanical performance is required.

The limited surface preparation and ease of application, with far shorter application times than the conventional coating systems, are the beneficial application parameters.

DC: Tell us about the current approach to coating large structures.

JvB: In the case of monopiles and other large steel structures, the conventional coatings used for the foundations are a liquid hydrocarbon coating based on epoxy as the corrosion protection layer, and if required, a polyurethane for additional UV protection of the epoxy layer. These coating systems have been used for decades as the corrosion protection of steel structures in offshore conditions. It requires a thorough abrasive blast cleaning process and application of several layers with curing requirements for each layer.

This approach takes considerable time and has environmental implications. Just imagine the abrasive media waste, paint and thinner containers, VOC and Isocyanate release.

DC: What do you see as the alternative?

JvB: Using EasyQote technology requires only basic cleaning of the steel surface and no surface profile. This will reduce the amount of blasting material enormously and the residual amount of waste due to surface preparation.

The material can be applied to the steel surface by circumferential wrapping around the monopiles. This is a clean application process without the use of solvents and with no curing required, making the application process accelerated.

EasyQote will provide corrosion prevention for a lifetime of more than 30 years, confirmed by CQM measurements based on EIS measurements according to ISO 16773.

It is a unique, low temperature, cold applied, non-crosslinking, non-crystalline, monolithic applied viscous polymer coating. The composition of the coating system is based on the Stopaq coating technology, also delivered by Seal For Life. To apply this new type of coating, specifically engineered for the large steel structures, requires a



Dinko Cudic

different mindset. The same was seen during the introduction of Stopaq material as pipeline coating for offshore and onshore pipelines for the oil and gas industry, 30 years ago. Stopaq is now fully accepted as corrosion prevention method for pipelines and other steel structures.

DC: You have been part of some of the initial trials for these larger structures, what was the approach?

JvB: Several trials were executed to test the application of EasyQote 'basecoat' wrap. At first, EQ combined with a fast-curing polyurethane was applied on a pup piece of 36-inch diameter and 3 meters long. The basecoat was wrapped manually around the pup piece and subsequently a fast-curing polyurethane coating, with nominal thickness 600-800 µm, was applied on top of the EQ basecoat. The addition of a PU coating was selected to provide mechanical protection, withstanding the harsh offshore



Jan van Bokhorst

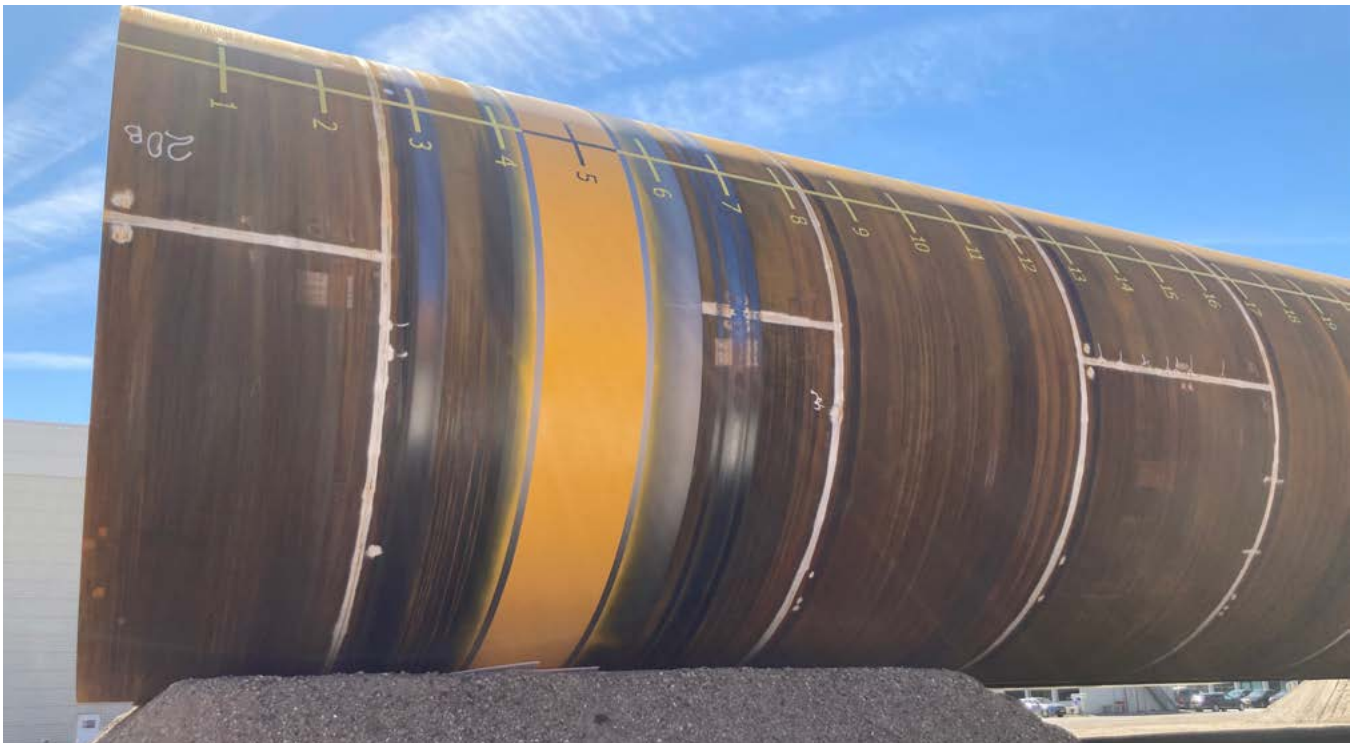
environment that monopiles and towers are subjected to.

Testing of combined coating system started with the general coating properties such as visual appearance, thickness and holiday testing. The adhesion of the total coating system was tested using a peel test and a 100% cohesive fracture was achieved. An overview of the test properties is given in the table.

To optimise the surface preparation for this application, a trial was performed using various surface preparation methods and different EasyQote viscosity grades. For all applications, the fast-curing polyurethane was applied.

It was observed that the optimum adhesion was achieved when the low temperature viscosity grade was applied with St2/St3 surface preparation.

Property	EasyQote VE Basecoat LT/Topcoat
Visual appearance	Good uniform coverage
Thickness	1.7 -1.9 mm
Holiday testing	No holidays
Impact resistance	Max 6 J
Indentation resistance at 50 °C for 24 hours	Load is 10 N/mm ² equals to 1000 ton/m ² ; residual thickness is 0.45 - 0.65 mm
Hardness (Shore D)	53
Thermal cycling - 50 cycles Each cycle is 6 h at +50 °C and 6 h at -20 °C	No cracking/delamination/blistering etc.
Adhesion, dolly pull off	7-8 MPa, cohesive fracture in base layer
Peel strength	Cohesive fracture in base layer



DC: How did this perform?

JvB: Trials on parts of a monopile with EasyQote were performed last year and it was shown that the semi-automated wrapping application went incredibly smooth. Fast-curing polyurethane cured within one hour and the steel structure could be transported within 8 hours.

This whole surface preparation and coating application process is four times faster than the conventional coating application.

With expanding diameter and overall length of the monopiles and tower steel structures, the time required for surface preparation and coating application becomes more critical. A coating system with limited surface preparation and faster application times could be beneficial for the offshore wind industry and to top it off with lifetime, then we are really making a true impact.

DC: What benefits does this technology offer?

JvB: If we look beyond the corrosion protection, other advantages of this coating system are the limited waste production due to no blasting material and usage of 100% solids, solvent and VOC-free materials.

A study was carried out to define the 'Cradle-to-Grave' sustainability for EasyQote vs conventional liquid coating systems using the Life Cycle Assessment (LCA) method. The study was based on a case of coating of 100 m² of an offshore structure in Europe.

Over the lifetime of 25 years, EasyQote applied with mechanical preparation in comparison with solvent based paint system applied with blasting cleaning, the following was observed. Ninety-six per cent; reduction in overall carbon emission; 98% reduction in carbon emission in end-of-life process; 96% reduction bulk waste and 90% reduction in hazardous waste per m²; and 91% reduction in single score impact, that is ecosystem, human health, and resources.

It can be concluded that the use of EasyQote has a large ecological advantage compared with liquid coating systems.

DC: So what's next?

JvB: The next phase should be to work with OWF owners and construction & installation contractors and include this innovative corrosion protection system into their specifications.

Courage is needed to change to this innovative and sustainable corrosion preventative solution but the payback will be far shorter application cycles and large waste savings during application. The result is a long-term performance coating system without offshore maintenance.

Due to the fact that the surface preparation requirements and application conditions are less stringent climatic concerns compared to conventional liquid coating systems, EasyQote systems can also be applied in outside conditions. This can be beneficial for on-site application at construction sites.

Large steel structure components for Floating Offshore Wind projects can be transported to the construction sites at the

ports and EasyQote application can be performed at the job site due to the large environmental application window.

DC: Thank you for your time Jan.

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Change for good

The only constant is change.

In order to support renewable energy systems for the long term, we need to be open to new technologies.

EasyQote has already seen approvals by some of the larger operators for carrying out repairs, showing an acceptance to move away from the way things have always been done and to seek new and better solutions.

Next, we need to see the application of this new-build coating on parts of the large beam/pile foundation structures; that has the potential to be a gamechanger.

Its advantages include limited surface preparation, ease of application, and significantly shorter application times compared to conventional coating systems.

With a lifespan exceeding 30 years and significant ecological advantages over liquid coating systems, EasyQote is an innovative option for corrosion protection for offshore wind steel structures.