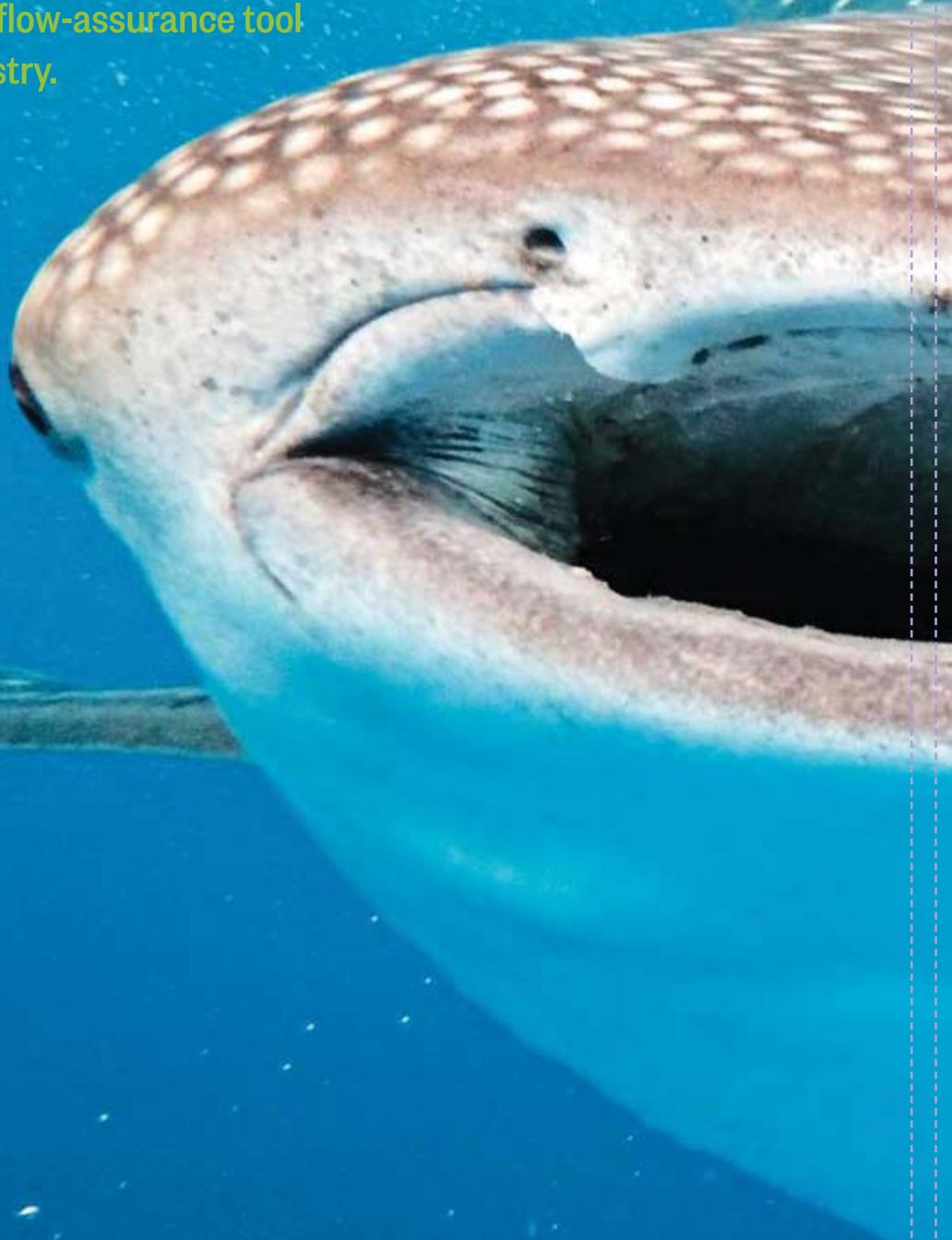


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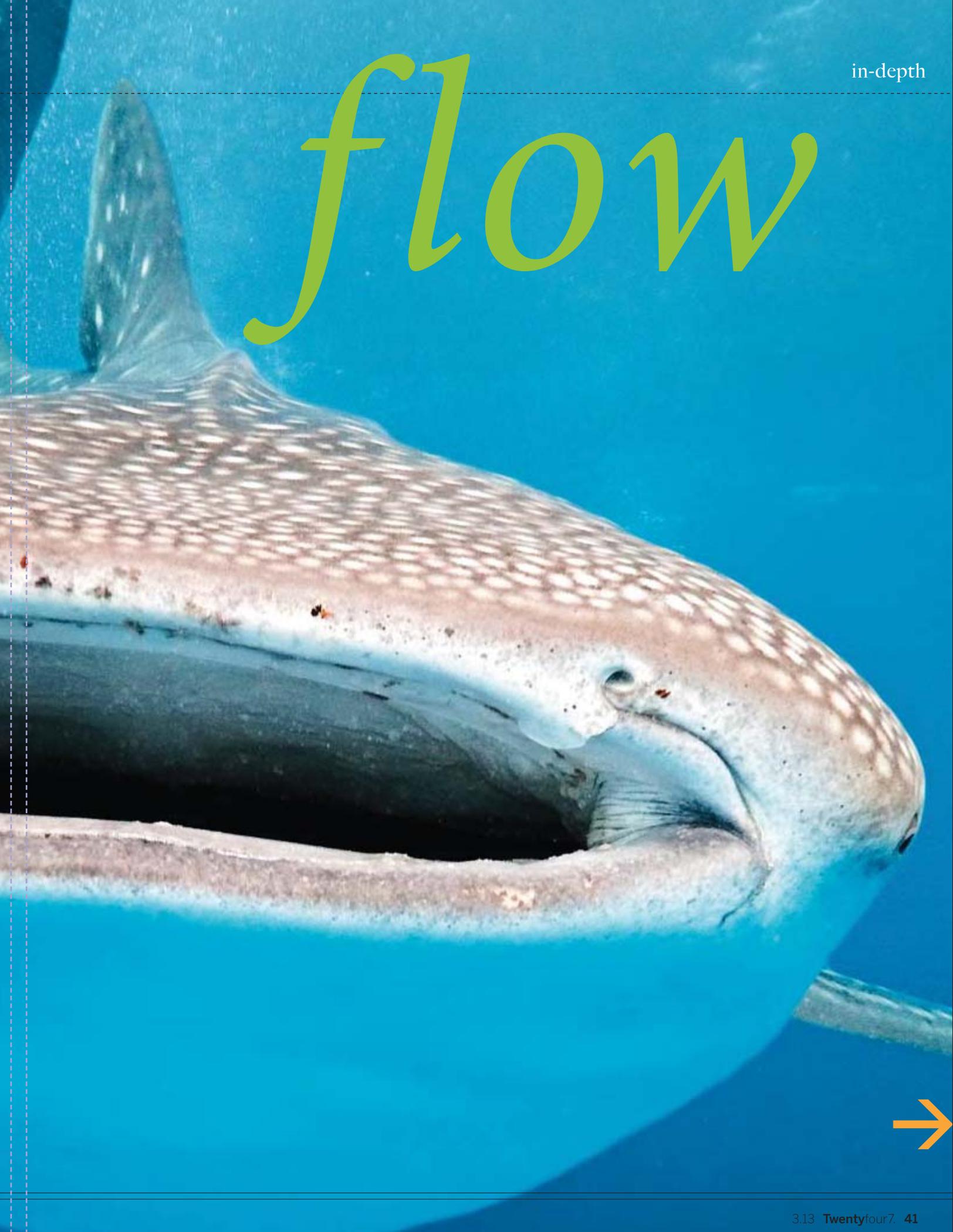
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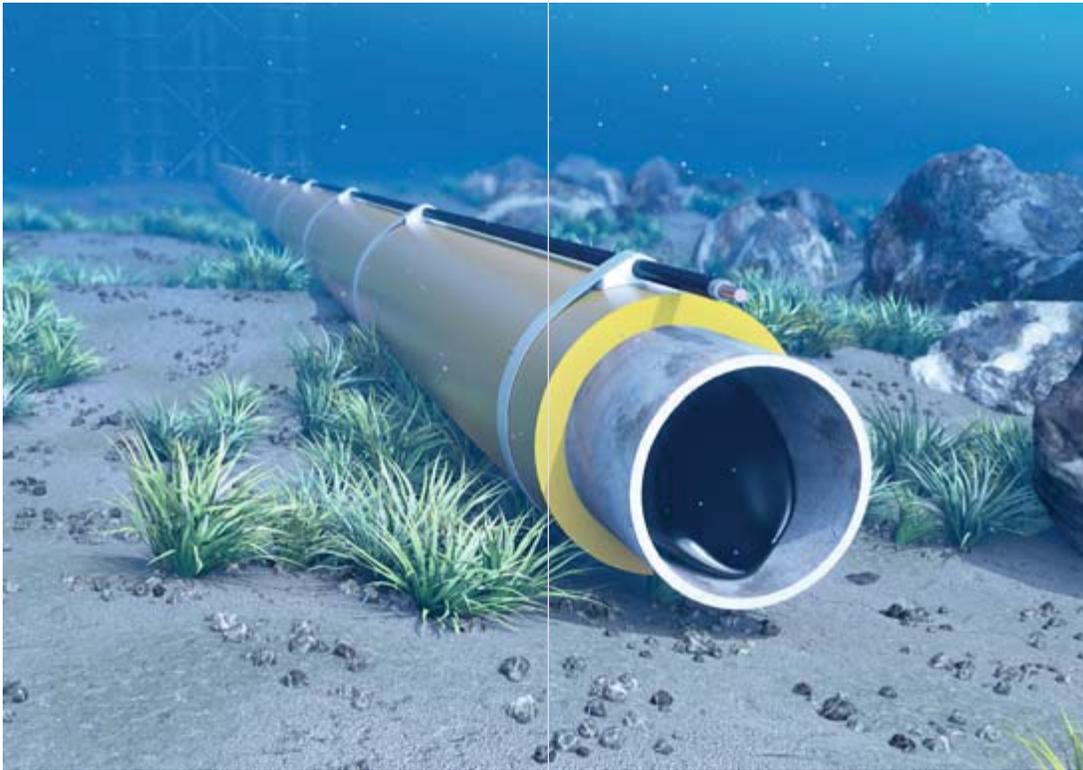
Direct Electric Heating (DEH) is poised to become a standard flow-assurance tool in the offshore industry.



flow



Wärtsilä DEH is a modern and environmentally sound flow-assurance tool.



Subsea flow lines face various hazards that may hinder operations or stop them entirely. For instance, water content in the line can form an ice-like structure, known as a hydrate plug, that will interfere with the flow. Another problem common in many regions is the build-up of wax in flow lines.

Hydrate plugs and wax formation can severely reduce production volumes or – in the worst case scenario – bring production to a grinding halt. Preventing this has become a top priority for the oil and gas industry.

Traditionally, various chemicals have been used to combat the problem, but with the advent of more environmentally minded business approaches, the industry has sought other solutions.

GREEN EDGE

Wärtsilä has been very successful in addressing the issue with Direct Electric Heating (DEH). DEH is a modern and environmentally sound flow-assurance tool that can reduce capital and operating expenses in field development, says **Ingebjørg Lien**, Wärtsilä's General Manager for Direct Electric Heating.

"DEH reduces the probability of pollution and the need for handling toxic disposals, which are both results of

traditional chemical flow-assurance methods," she says. "It also opens marginal fields for development. Fields that previously were not viable can now turn a profit."

Open-loop DEH is not exactly new. The innovation was piloted in the 1990s in Norway, when the oil company Statoil was looking for a greener flow-assurance tool. The first DEH system was launched in 1998.

The technology has come a long way since then and has proved itself seaworthy. The long and detailed qualification process that is performed on DEH systems before they are implemented has reinforced industry confidence.

DELIVERING THE TOTAL PACKAGE

From the start, Wärtsilä's strength in this scenario has been the design and supply of the complete topside power package – in addition to electrical and optical protection specially developed for DEH systems.

There are currently around 20 DEH systems installed around the world. Most of them are located where it all started, on the Norwegian continental shelf, but there are others too.

"Two DEH systems are in operation in Gabon, West Africa. Due to heavy and waxy oil, they are in continuous operation, unlike the systems on the Norwegian

With DEH, fields that previously were not viable can now turn a profit.

continental shelf,” says Lien. In Norway DEH is normally needed only during production breaks, when there’s a risk that the temperature will fall below the critical limit for hydrate and wax appearance.

Africa will continue to be at the forefront of DEH development. Wärtsilä recently signed a contract for a new project in West Africa with Chevron. “It will be delivered in 2014,” Lien confirms.

BIG SAVINGS

At the same time as DEH is branching out geographically, the scope of individual operations keeps expanding. Currently, Wärtsilä DEH has been used for flow lines up to 42 kilometres long and with a power requirement of up to 12 MW. In the past, DEH systems have been delivered to projects where the water depth reaches 400 m, but there are ongoing projects with water depths of 1000 m.

How successful has DEH technology been so far? A couple of years ago Statoil calculated that the use of DEH at the Tyrihans Field had saved about USD175 million. This finding has added to the growing interest in DEH worldwide. Green-tech flow-assurance tools are now in heavy demand.

Lien believes that the market is likely to grow significantly, but big change rarely happens overnight. “We are seeing a large focus on DEH in all parts of the world although it will take time to qualify and to turn it into deliveries.”

Topside DEH module with medium voltage equipment, protection and control system and cooling system which is the Wärtsilä scope of supply for a DEH project

GRADUAL GROWTH

Lien points out that it takes about three to five years for the initial contact with Wärtsilä DEH experts to materialise into a contract. Nevertheless, Wärtsilä believes that DEH will eventually become a standard flow-assurance tool globally. For Statoil, DEH is already the standard method.

Wärtsilä has delivered more than 80% of the DEH topside solutions in the world. The Wärtsilä package includes FEED Studies (Front End Engineering & Design Key Benefits), topside system design to meet subsea power requirements, delivery of DEH module and equipment and power system analysis.

The topside package is tailor made. After project execution, Wärtsilä provides start-up assistance.

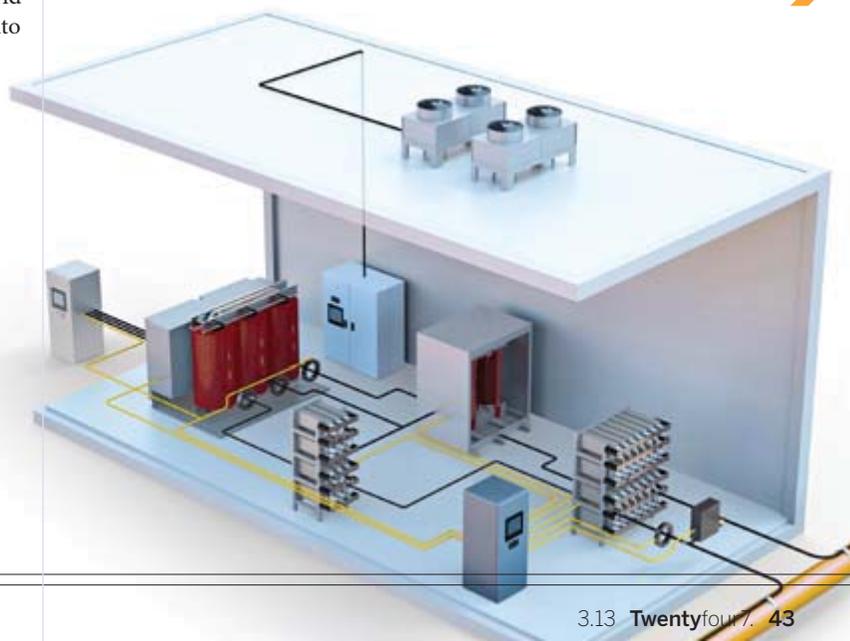
DEH users enjoy lower capital and operating expenses in a number of ways. Open loop DEH gives a more simple, less costly and a robust subsea solution. The need for anti-freeze chemicals and infrastructure is reduced or eliminated, which also cuts storage and delivery costs.

The process plant becomes more efficient because the arrival temperature is higher.

The lifetime of the field is extended by managing water cut during tail production. DEH can make marginal fields profitable even if it is required continuously.

Ingebjørg Lien has seen the technology grow and go global. Along the way, she has come to know all its aspects.

“I have been working with DEH projects for the last 10 years, taking part in everything: design of the topside systems, system calculations, project execution, commissioning and product development.”



DIRECT ELECTRIC HEATING

in a nutshell

The open-loop DEH method is based on a single pipeline with an outer thermal insulation with U-values ranging from 3–7 W/m²K. The pipeline is part of a single-phase circuit and a piggy-back cable is strapped onto the pipeline.

The piggy-back cable is connected to the far end of the pipeline. At the platform end, the pipeline is connected to a feeder cable/riser cable from the platform. Both connections are wet and – unlike other heating methods – there is full connection to earth/seawater at both ends of the pipeline with the open-loop DEH.

To avoid corrosion and high current density through parts of the pipeline, this method requires anodes at each end of the pipeline (transfer zone) and also along its length.

With this method, 30–40% of the current returns to the near end through the seawater. The method is not as efficient as the pipe-in-pipe and heat-trace methods which are also used in the industry. However, the open-loop DEH method has the advantages of simplicity and robust design.

With open-loop DEH, the pipeline needs thermal insulation only, not electric insulation. Another advantage is that the connection points to the pipeline can be made as wet connections not exposed to any voltage. Because all cables are accessible, they can be repaired or replaced.

The topside package comprises tailor-made medium voltage components that control the current in the flow line, convert the load from single phase to a symmetrical 3-phase load, and compensate for the low power factor. Wärtsilä delivers electrical and optical protection and control packages that have been specially developed for DEH.

The Wärtsilä Direct Electric Heating package can be installed in suitable indoor locations, or in outdoor locations within a steel or aluminium module with HVAC or water cooling. Power system analysis ensures DEH integrity with the platform system.

On the Norwegian continental shelf, DEH is used in nearly 20 flow lines; the longest flow line with DEH is 42 km and is operated with about 11 MW and 22 kV.

A U value is a measure of heat loss. It is expressed in W/m²K, and shows the amount of heat lost in watts (W) per square metre of material when the temperature (K) outside is at least one degree lower.

