BEHIND THE CONSTRUCTION FENCES | CONSTRUCTION DETAILS | INTERVIEW | SUSTAINABILITY

ElbX: Underwater Tunnel Construction

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Civil engineering/ Infrastructure

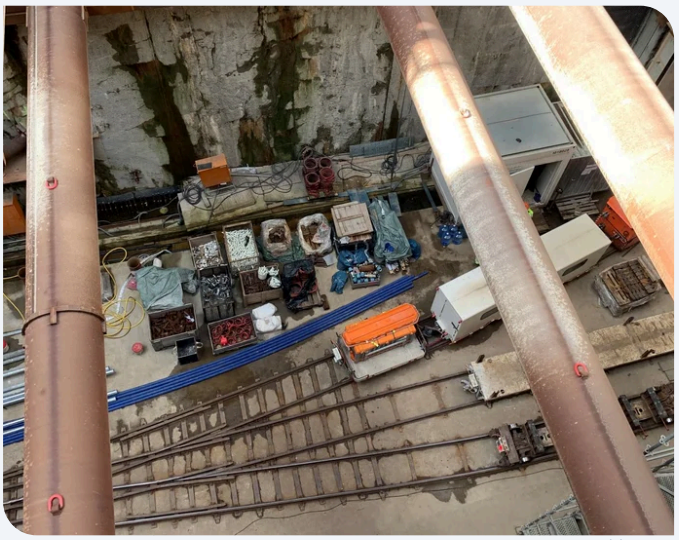
While ships sail above on the Elbe, PORR is carrying out their pioneering work below. For one of the key projects in the energy transition, ElbX, we are digging 5.2 kilometres through incredibly challenging ground conditions.

Twenty metres below the riverbed of the Elbe, hidden beneath one of the busiest waterways in Europe, a hydro shield tunnel boring machine (TBM) is boring its way through the ground. Up to 4.8 bar support pressure is applied down here – conditions that demand precision, experience, and nerves of steel. While shipping traffic continues undisturbed, a structure is being built underneath that will help shape Germany's energy future.

Shoulder to shoulder
and tunnel construction technology

ElbX connects Schleswig-Holstein and Lower Saxony. The Elbe crossing is a central component of the SuedLink power line, which is around 700 kilometres long. Four high-voltage direct current (HVDC) transmission cables, operating at a voltage of 525 kV, are being laid to transport the energy – two further cables serve as spare cables. Tunnel construction is one of our specialities at PORR. But a tunnel under one of the busiest rivers in Europe, in challenging geology, and with an ambitious schedule is unusual for us and places the toughest demands on logistics, construction methods, and occupational safety. But we know that when we work shoulder to shoulder, we can do everything from tunnel construction and special civil engineering to construction engineering.

For the start and finish shafts, we constructed diaphragm walls up to 60 metres deep, supplemented by elaborate bracing and underwater construction work. Engineering work being carried out in parallel in both shafts makes our construction organisation even more complex. The hydro shield tunnel boring machine used is constructing the tunnel with an internal diameter of 4 metres and segments 30 centimetres thick. In order not to disrupt shipping on the Elbe and to meet the challenges of the subsoil conditions, the tunnel runs with a cover of around 40 metres below the waterline. Every cutting wheel inspection and every tool change is carried out under com pressed air. That's why we have to plan everything precisely and carry it out with the utmost care. The combination of high pressure, small diameter, and longlength without intermediate access is one of the greatest challenges in tunnel construction.

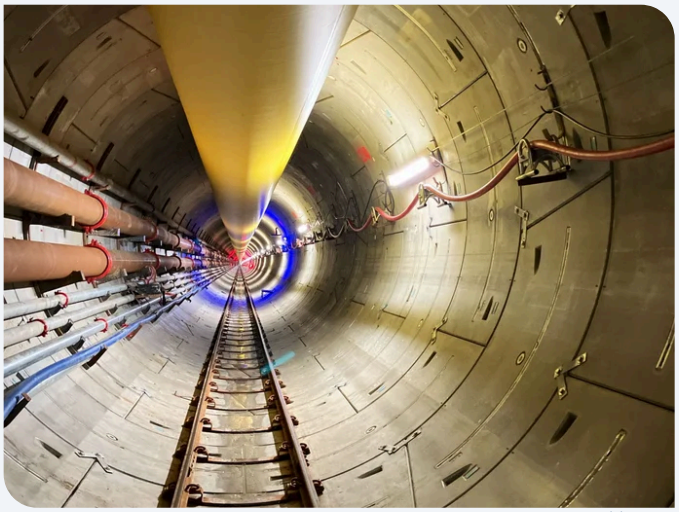


(c) PORR

Update:
Breakthrough

On 22 June, the breakthrough was achieved in the construction of the ElbX electricity tunnel under the River Elbe on behalf of TenneT Germany and together with the project partners. The tunnelling works carried out by PORR connect Schleswig-Holstein and Lower Saxony over a length of around 5.2 kilometres. "The successful breakthrough shows what is possible when modern tunnelling technology is combined with experience and a well-coordinated and motivated team", says René Hallbauer, Tunnelling Project Manager at PORR. "This achievement is based on precise planning and close cooperation across all trades". Throughout the entire construction period, the advance was characterised by changeable and challenging ground conditions in the groundwater of the Elbe. The fact that the breakthrough was nevertheless achieved earlier than forecast underlines PORR's high level of technical expertise in tunnelling as well as the close coordination between all project partners. With the successful breakthrough now complete, the interior works and technical fit-out of the tunnel are set to begin. Once completed, the Elbe crossing will make a significant contribution to Germany's stable and secure power supply and is a central building block for the success of the energy transition.

Safety concept
and time saving



(c) PORR

A project like this also requires a particularly well-thought-out escape and rescue concept. In addition to an escape chamber directly on the tunnel boring machine, we installed an extra escape container in the tunnel that had already been driven. Smoke barriers ensure safe access every 500 metres. A tunnel barrier is available around the clock on the construction site. Occupa tional safety is always our top priority.

Together with *Wayss & Freytag*, we developed an idea for the assembly and launch of the long tunnelling system that saves time and money: instead of a conventional sealing block, we concreted in a wooden barrel the size of the TBM under water. After draining the excavation pit, we used this launch tube as an additional space. This shows once again how much innovative strength PORR has. Despite the relatively small machine diameter, we are moving enormous quantities. Separation systems, water treatment, and segment logistics are therefore generously designed. We are achieving peak outputs of more than 400 metres per month. In addition, we are laying the permanent walkway floor for later operation at the same time as the tunnelling process – another time saver. More than two-thirds of the tunnel has been driven, the special civil engineering work has been completed, and the construction engineering work ran at full speed even in the unusually harsh northern German winter.

Short Talk
with Major Projects Manager René

When did tunnel boring begin?

Since January 2025, we have been working our way from Wewelsfleth towards Wischhafen.

Why are the geological conditions so challenging?

We are passing through Lauenburg clay, a soil that tends to clump together and can therefore hinder drilling.

What do you need to bear in mind when working in compressed air at up to 4.8 bar?

The strictest safety standards apply under the Elbe shipping channel. The German Compressed Air Ordinance regulates work at pressure of up to 3.6 bar. We are operating outside the rules. To this end, we have worked with the relevant authorities, doctors, and specialists to develop concepts that enable us to work safely.

What motivates you and your team?

Making an important contribution to the energy transition. Without the technically demanding Elbe crossing section, contin uous operation of SuedLink would not be possible.

What does ElbX mean to you?

It demonstrates our close work shoulder to shoulder across the PORR Group and how we successfully deal with complex geological conditions, tough technical requirements, and strict safety specifications together. We are proving that PORR is a strong and reliable partner for key infrastructure projects in the energy transition.