Internally lead-sheathed cables are fuelling the surge in wind power

According to Eurostat, nearly 50% of EU electricity came from renewables in 2024, with wind accounting for the largest share (38%). WindEurope predicts that Europe's installed wind power capacity will increase by 58% and reach 450 GW by 2030. Looking further ahead, sustained wind deployment in the EU in the 2030s would allow wind to almost quadruple its output by 2040 compared to today.

While onshore wind installations are expected to represent 81% of new capacity in the EU during the period 2025 to 2030, European governments have recognised the many advantages of offshore wind. The average size of onshore wind turbine blades manufactured today is 50m, and so the land required to build effective wind farms is at a premium. Offshore wind speeds are stronger and more consistent than on land, meaning much more energy can be generated with more predictable and stable output - meaning easier integration into the grid. With many coastal areas requiring higher energy supply due to larger population centres and the presence of more industrial zones, building offshore wind farms close to coastal areas can help to meet those energy needs from nearby sources. Offshore wind farms can also power hydrolysis plants for green hydrogen production, further helping with decarbonisation efforts.

Thanks to these benefits and more, the total offshore wind capacity is expected to reach 274 GW in the Northern Seas countries (EU, Norway and UK) by 2040 - a tenfold increase on the 2023 installed capacity.

To best utilise the energy generated offshore for the mainland grid requires reliable infrastructure. Internally lead-sheathed high-voltage subsea 'export' cables are critical to delivering this. Operational since 2022, Ørsted's Hornsea 2 project is the world's largest offshore wind farm. It utilises over 200km internally lead-sheathed high-voltage cables linking the wind farm's substation to the onshore substation. And Hornsea 3, which will be the world's single largest offshore wind farm once operational from 2027.

A growing reliance on onshore and offshore wind installations means an increasingly important role for lead. Lead extrusion was first introduced as a water barrier for subsea cables in 1924. Today, internally lead-sheathed cables are a critical piece of the infrastructure supporting Europe's growing renewable energy demands, the cable's sheathing provides necessary and continuous protection from water across thousands of kilometres of cable. According to ENTSO-E´s 2020 Ten-Year Network Development Plans and national TSO plans,

some 45,000km of high and extra high voltage submarine cables are to be deployed in Europe in the coming decade, covering a route of around 23,000 km. This length only accounts for around 39% of the total route length of all high and extra high voltage power lines needed in Europe by 2030.

A key advantage of lead is its durability. Internally lead-sheathed cables have a usable lifetime of up to 50 years and are free of corrosion, minimising the need for maintenance. There is no alternative that provides the same level of continuous extrusion, water protection, longevity and corrosion resistance. The EU's workforce is also well-protected as it manufactures and installs these cables – industrial manufacture follows strict risk management processes where the lead is fully contained inside the cable and cannot be released during its operational lifetime.

High-voltage internally lead-sheathed cables for sub-marine applications are vital to the growth of Europe's renewable energy market, and vital in keeping Europe connected. They are used for power transmission and super-grid power balancing between offshore islands, between countries, and even across geographic regions, which means they are as central to offshore power transmission as they are on land. With internally lead-sheathed cables enabling this highly efficient transmission, lead is a key enabler in the future wind energy system.

Testing underway on a prototype lead extruder. Used to apply lead sheathing to cables, extruding the metal onto the cables in this way enables longer service life under high stress.

Fact file

- The usual guaranteed commercial lifespan for a sub-sea cable is 25 years, but internally lead-sheathed cables double this and offer a useable lifetime of up to 50 years – a reliable and durable solution for high-voltage installations in harsh conditions and environments with limited possibilities of intervention in case of a failure In 1954, the world's first HVDC link – 96km of
- internally lead-sheathed cable linking the Swedish island Gotland to the mainland – became operational. By 2015, there were almost 8,000km of HVDC submarine power cables in the world, more than 70% of which are in European adjacent seas Internal lead sheathing is used in the
- world's longest subsea high-voltage cables. VikingLink, the world's longest onshore and subsea HDVC interconnector stretches a record-breaking 765 km – with 630 km under the North Sea. The 1400 MW lead sheathed link enables the sharing of clean energy between Denmark and the UK and has been operational since 2023. NorNed, the previous record holder at 580km, has connected Norway and the Netherlands since 2008 and also relies on lead sheathing Current offshore wind farm and interconnector projects underway in the EU will rely on more than
- 3,000 km of new internally lead-sheathed cables to become operational
- Stretching over a million kilometres, the EU electricity infrastructure is the most extensive and integrated grid in the world. Lead-sheathed cables are an essential part of the investment needed under the EU Grids Package to modernise and expand Europe's energy network and accelerate renewables integration

Developed in conjunction with Europacable and H Folke Sandelin AB, this case study highlights just one of the many essential uses of lead that provide societal benefits and boost the EU's economy

For Europe's future, lead matters.

Lead Matters