



Renewable

MacArtney marine renewable energy solutions

MacArtney
UNDERWATER TECHNOLOGY



The MacArtney Group

The MacArtney Group is a global supplier of underwater technology specialising in the design, manufacture, sales and service of a wide range of solutions to offshore industry operators, subsea surveyors, the renewable energy sector, ocean science institutes, maritime civil engineering industries and navies across the world.

MacArtney offers an extensive range of advanced and reliable products and systems ranging from subsea cables and connectors to state-of-the-art integrated packages and systems. All systems combine our in-house expertise and design capabilities, covering connectivity, fibre optic telemetry, underwater cameras and lights, oceanographic instruments, marine winch systems and remotely operated towed vehicles.

All solutions supplied are designed and tested to supply high quality, efficiency and reliable performance in harsh underwater environments.

By MacArtney

The MacArtney Group supplies and services a wide range of integrated systems and products designed, developed and manufactured by MacArtney. We are also trusted representatives of other leading manufacturers of underwater products.

MacArtney product lines include underwater connectivity systems (SubConn®, OptoLink, TrustLink and GreenLink), advanced fibre optic telemetry systems (NEXUS and EMO), electric CORMAC and MERMAC winch and

handling systems with active heave compensation winches for ROV systems. Our range of fast, versatile and precise remotely operated towed vehicles (ROTV) include the MacArtney FOCUS and TRIAXUS vehicles. Moreover, MacArtney supplies a versatile range of LUXUS underwater cameras and lights.

System design and integration by qualified, experienced engineers are also an important part of the MacArtney portfolio. Combined with a wide range of products and systems, MacArtney can offer turnkey solutions designed specifically to customer requirements and installed ready for use wherever needed. All MacArtney system solutions are available with dedicated service, maintenance and training packages.

A global presence - with local solutions

MacArtney is a privately owned corporation established in 1978 with group headquarters in Esbjerg (DK). The MacArtney group also has offices in Aberdeen (UK), Stavanger (NO), Mölnlycke (SE), Aix-en-Provence (FR), Bologna (IT), Rotterdam (NL), Kiel and Bremen (DE), Houston, Boston and San Diego (US), Victoria and Dartmouth (CA), Ningbo (CN), Perth (AU), Singapore (SG) and Santiago (CL).

Moreover, MacArtney operates an extensive network of representatives and agents spread across every continent. This way, MacArtney products are available locally - with global 24/7 support.



MacArtney marine renewable energy solutions

MacArtney renewable energy solutions, empowered by decades of experience and expertise, operate within diverse marine technology and offshore-related industries.

The MacArtney Group has been actively working with marine renewable energy projects for over a decade, supplying state-of-the-art solutions to wave, tidal and offshore wind applications and projects across the world.

The MacArtney portfolio of underwater technology systems and products has proven itself to be an ideal basis for advising and supplying the rapidly growing renewable energy sector. Many of our existing products are directly transferable to offshore renewable energy applications, where our termination, rotary, infrastructure and connectivity solutions offer reliability and a proven track record.

MacArtney's skilled engineers also further develop and customise products and conceive innovative solutions to suit specific projects and advanced customer specifications. This way, MacArtney can tailor entirely new systems using the latest techniques and modelling software.

The renewable energy sector continues to face new challenges. New and exciting technological solutions are continuously designed and refined and at MacArtney, we recognise that the scope and scale of these solutions remain extremely variable. Our extensive and flexible portfolio of solutions combines reliable and tested technologies and innovative new thinking.

Why choose MacArtney

Our experience has provided us with specialist knowledge that is essential for providing effective engineering advice and project support for offshore renewable energy technologies and solutions.

We know the value of time. Expert advice throughout the design stage coupled with qualified and timely service

and support helps to reduce lead time, optimise pricing and minimise downtime during service, maintenance and repair. Installed offshore renewable energy systems, supported by MacArtney's commitment to local service and global support, are empowered by our 24-hour engineering support service.



▲ GreenLink HV ILT (InLine Termination).



MacArtney interconnectivity, infrastructure and integrated monitoring packages

Subsea interconnectivity and infrastructure play an important role in the offshore renewable energy sector - gathering the energy is just part of the equation. Our range of medium and low power cables, terminations, high power connectors, penetrators, underwater hubs, junction boxes, SubConn® and OptoLink connectors are ideal for transferring power and data for renewable energy systems. They are also tested and certified for reliability and performance in harsh offshore environments.

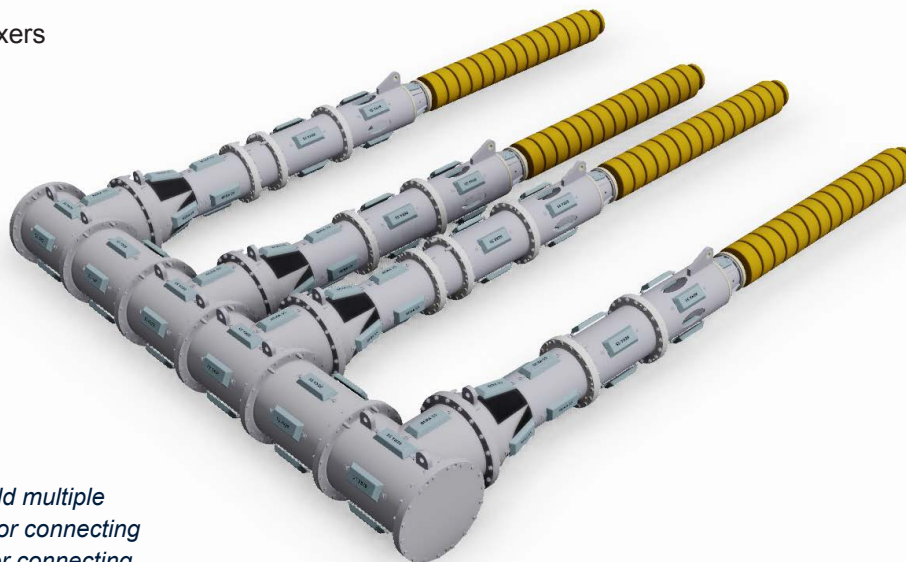
Additionally, MacArtney designs and integrates completely integrated monitoring packages for multiple applications and projects within the renewable energy industry. Integrated packages can vary enormously in terms of scale and scope, and can be suited to fit exact customer requirements and specifications. For instance, MacArtney integrated monitoring packages can include various telemetry and sensor configurations.

Examples of interconnectivity and infrastructure products:

- Special junction boxes
- Dry mate connectors (low, medium and high voltage)
- Low and medium voltage penetrators
- OptoLink dry mate fibre optic connectors (multi-mode or single-mode applications)
- SubConn® connectors and harnesses
- Standard and customised cables
- Rotary products for turbine axis and vertical power swivels
- Connectivity to onshore (AC and DC applications) and subsea export and dynamic power cables
- InLine (IL) connectors and terminations (AC and DC applications)
- Special cable terminations
- Subsea medium and high voltage hubs
- Cable protection, distributed buoyancy modules, bend limiters and restrictors
- Device connectivity and jumper cables

Examples of Integrated monitoring packages:

- Sensor systems including navigation
- MacArtney LUXUS cameras and lights
- MacArtney electric and fibre optic multiplexers



► *The MacArtney Medium and High Voltage Hubs hold multiple applications as a subsea termination unit (UTU) used for connecting dynamic cables to export cables. It can also be used for connecting cables from wind, tidal and wave energy converters to export cables or for interconnecting multiple energy converters.*

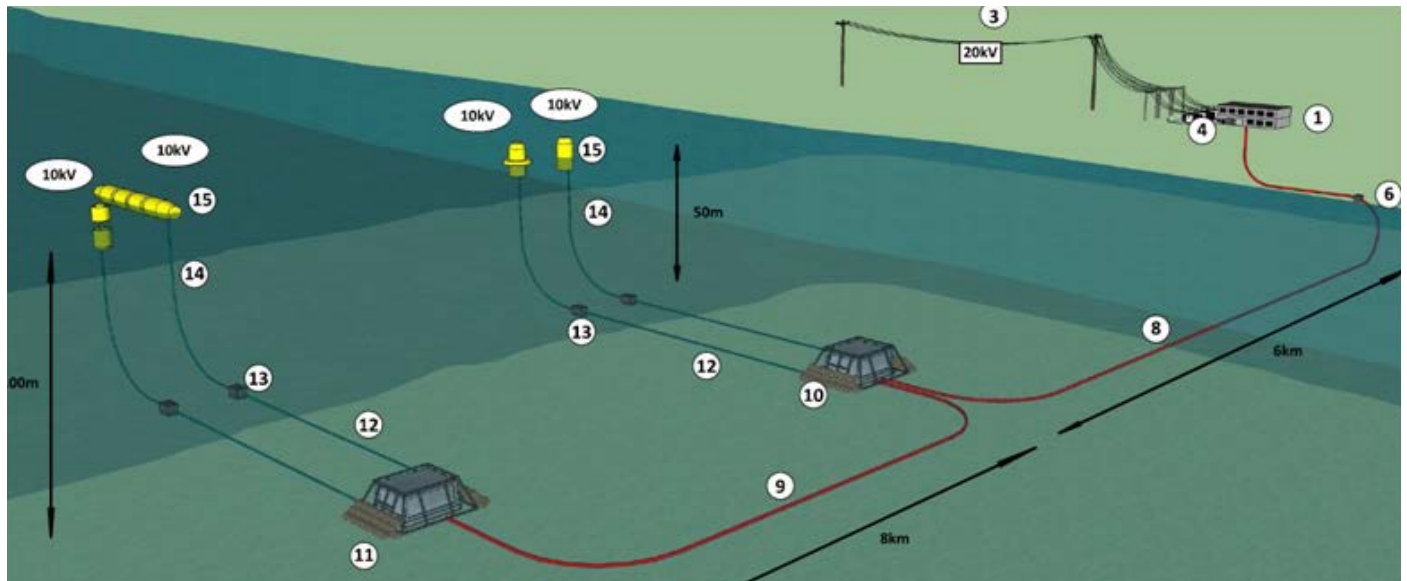


MacArtney project examples

Year	Location	Client	Device	Solution
2016	France	French river tidal test site	250 kW river tidal device	LV ILT (InLine Termination)
2016	France	French tidal energy company	Tidal energy converter	Medium voltage ILT assembly solution, abandonment head
2015	France	French tidal energy company	Tidal energy converter	Medium voltage ILT assembly solution, junction box and cable assembly
2014	Italy	Commercial wave and tidal energy company	Wave & tidal unit	SubConn® connectors & cables
2013	United Kingdom	Major developer of tidal turbine technology	Floating tidal device	Medium voltage special swivel 2 MW tidal device
2013	United Kingdom	Major developer of tidal turbine technology	Connecting offshore tidal energy to the onshore grid	Medium voltage ILT assembly solution
2012	United Kingdom	Energy Technologies Institute (ETI)	1 kV (7,6 MW) hybrid wet mate connector	Study, design and manufacture 11kV / 7,6 MW hybrid wet mate connector
2012	France	Large French energy provider	FEED study for a 1.2 MW hybrid wet mate AC and DC connector solution	Tidal array study
2011-12	France	World leader in power generation	Tidal power application	Junction box for power and sensors, c/w connectors, jumper cables
2011-12	United Kingdom	Large European wave energy device manufacturer	Wave power application	Power and communication system, junction boxes, data logging, power and signal umbilical and termination, wet mate fibre optic connectors
2011	Portugal	Major US manufacturer for the MRE marked combined with a Portuguese cable manufacturer	Floating wind turbine application	ILT hang-off clamp, bend stiffeners, distributed buoyancy modules and general cable protection equipment. Termination of dynamic MV umbilical and retrofitting of water blocking device
2011	United Kingdom	Large European RE test site	Trial site	ADCP cable, connectors assembly
2011	United Kingdom	European wave power device manufacturer		Wet mate connectors, SubConn® connectors
2011	United Kingdom	Leading tidal energy device developer	Floating tidal turbine	Vertical swivel, wet mate connectors, dynamic export umbilical and terminations, connector harnesses



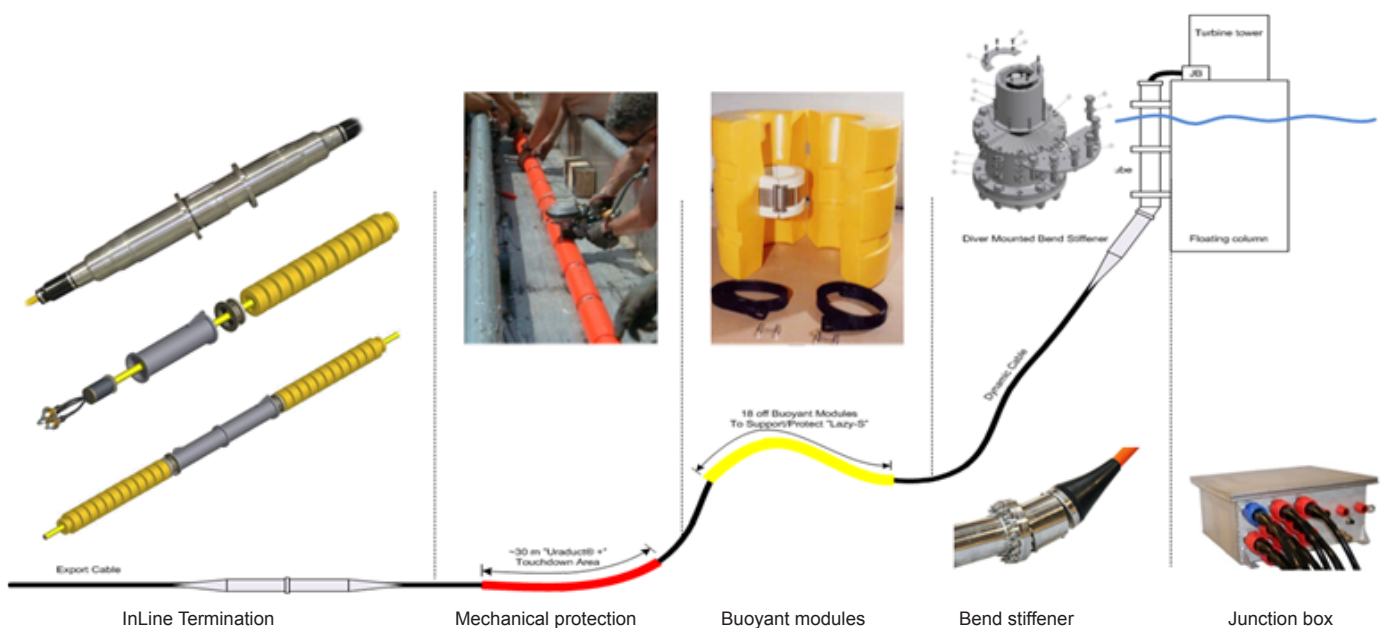
Photo gallery - Renewable energy solutions



▲ A typical marine renewable energy application using MacArtney products and solutions.

Subsea termination and distribution junction box system:

- 1-4: Onshore installation and distribution
- 6: Export cable interface
- 8-9: Static export power cable
- 10-11: Subsea distribution junction box (hub)
- 12: Static seabed power cable
- 13: ILT (InLine Termination)
- 14: Dynamic power cable
- 15: WEC (Wave Energy Converter)

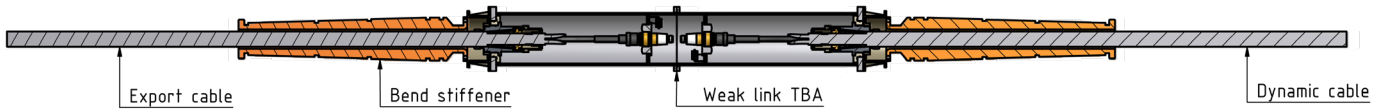


▲ An application like this often includes InLine Termination assemblies, general cable protection equipment and distributed buoyancy modules, hang-off clamps, bend stiffeners, J-tube and junction boxes.

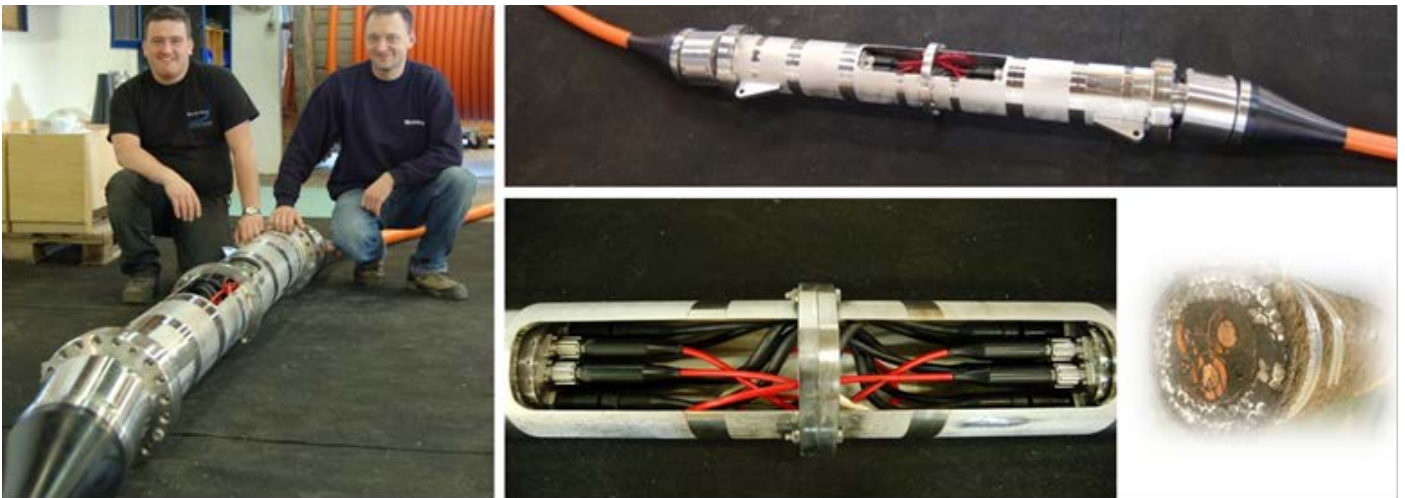


Photo gallery - MacArtney InLine Termination work

MacArtney Medium and High Voltage InLine Terminations (ILT) have been designed to make offshore InLine Terminations faster and easier, saving valuable ship time. The mechanical connection of the two halves takes less than two hours and makes it possible to connect and disconnect cables repeatedly.



▲ A MacArtney ILT configured to provide connectivity between a dynamic cable and an export cable.



▲ Examples of inline cable termination work performed by MacArtney specialists.

MacArtney Medium Voltage ILT solutions are often used to connect dynamic cables from offshore renewable wind, tidal and wave energy converters to static export cables. Moreover, they are often deployed to interconnect subsea units. InLine Terminations can also be mounted onto cable ends for installation in two stages, with half of the system to be left on the seafloor with a pressure cap mounted to the connector - and the second half of the cable mated at a later stage.



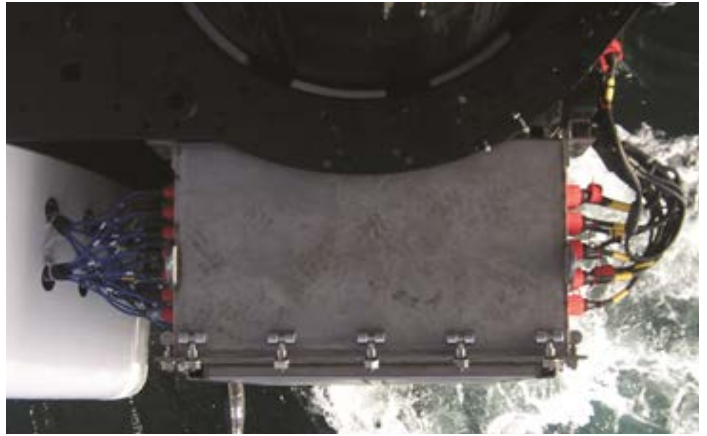
▲ MacArtney ILT connects a tidal turbine to the grid (image courtesy of Andritz Hydro Hammerfest).



▲ MacArtney ILT deployed to connect multiple tidal turbines within an offshore tidal farm, to a central power conditioning unit (image courtesy of EDF).



Photo gallery - MacArtney renewable energy projects



▲ MacArtney has supplied junction boxes and instrumentation to OpenHydro tidal turbines installed at EMEC (European Marine Energy Centre) in the UK (images courtesy of OpenHydro).



▲ Funded by ETI, MacArtney has developed and supplied an industry-first 11 kV wet mate connector. Providing a safe and reliable connection of renewable energy units and applications (such as wave energy converters, tidal energy converters and floating wind turbines to the power grid) the wet mate connector eliminates the need to bring cables to the surface. This shortens the time needed for connection, thereby making it possible to operate in waters with limited time windows.



▲ The prototype WindFloat (floating wind turbine) moored offshore Portugal. The scope of MacArtney supply included an InLine Termination, hang-off clamps, bend stiffeners, distributed buoyancy modules, general cable protection equipment, termination of dynamic medium voltage umbilical and retrofitting of a water blocking device.



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