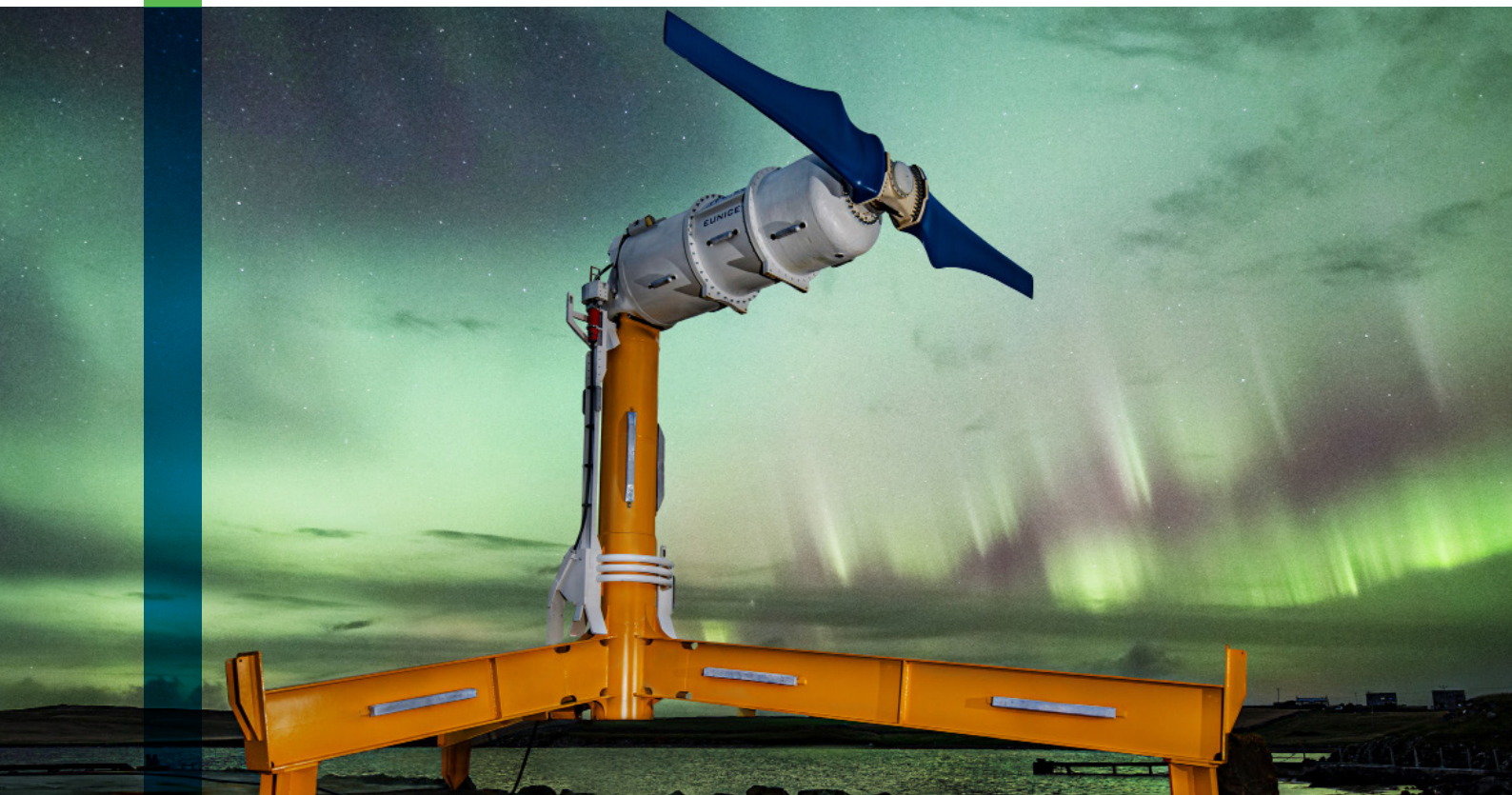




Ocean Energy

Key trends and statistics 2020

February 2021



Ocean Energy
Europe

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Key findings



Europe

Ocean energy proves its resilience despite a challenging year



TIDAL STREAM

Power production on the up

2020 INSTALLATIONS

260 kW
capacity added.

Despite multiple lockdowns, deployments still went ahead.

CUMULATIVE INSTALLATIONS

27.9 MW
installed in Europe since 2010.

10.1 MW is currently in the water.

Tidal energy hits

60 GWh

power production milestone.



WAVE ENERGY

Shift to full-scale underway

2020 INSTALLATIONS

200 kW
capacity added.

Majority of installations delayed but no cancellations.

CUMULATIVE INSTALLATIONS

12 MW
installed in Europe since 2010.

1.1 MW is currently in the water.



Rest of World



TIDAL STREAM

- ▶ New deployments in China & the US.
- ▶ Big projects announced in Canada.



WAVE ENERGY

CHINA

Full-scale device hits the water in China, which is positioning itself as a global competitor.



Milestones

Significant industrial and investment milestones achieved



TIDAL STREAM



WAVE ENERGY

attracted **€45M** in private and public investments.

- ▶ Several new factories and industrial partnerships announced.
- ▶ European developers secure and deliver new export projects.

Political supports hits a new high

EU sets new ocean energy targets:

100 MW
BY 2025

3 GW
BY 2030

40 GW
BY 2050



USA



CANADA

increase public investments in ocean energy.



2021 outlook

A strong project pipeline in the year ahead



TIDAL STREAM

EUROPE

OUTSIDE OF EUROPE



2.9 MW
of capacity is lined up for deployment.



1.2 MW
of capacity is lined up for deployment.



WAVE ENERGY

EUROPE

OUTSIDE OF EUROPE



3.1 MW
of capacity is lined up for deployment.



0.9 MW
of capacity is lined up for deployment.



Global total



TIDAL STREAM

2020 INSTALLATIONS

865 kW

CUMULATIVE INSTALLATIONS

36.3 MW



WAVE ENERGY

2020 INSTALLATIONS

700 kW

CUMULATIVE INSTALLATIONS

23.3 MW



Europe: Ocean energy proves its resilience despite a challenging year

The challenges and uncertainty of 2020 tested the sector's resilience. The industry proved to be up to the task: several devices were installed in Europe, major industrial milestones were achieved, and political support continued to strengthen.

Cumulative installations – 27.9 MW of tidal stream technology has been deployed in Europe since 2010. Of this, 10.1 MW is currently operating, and 17.8MW has been decommissioned as projects have successfully completed their testing programmes.

Three new projects hit European waters

Three devices were deployed in Europe in 2020 as part of demonstration projects. Nova Innovation installed a horizontal axis, direct-drive turbine to expand its Shetland array, Minesto deployed its first kite in the Faroe Islands and Design Pro tested its floating vertical axis turbine in Orkney.

Although the trend in the tidal sector as a whole is moving towards consolidation of device design, different device types enable the exploitation of varying resources, sites and applications.



TIDAL STREAM: New capacity additions despite multiple lockdowns

Manufacturing and planned deployments slowed but not stopped

Annual installations – 260 kW of tidal stream capacity was deployed in Europe in 2020, down from 1.52 MW in 2019. While this represents a drop in terms of projected installations, no projects were cancelled, and the deployments originally planned for 2020 will come online in 2021. To install devices and avoid cancellations during a global pandemic is clear evidence of ocean energy's resilience to shocks and slowdowns.

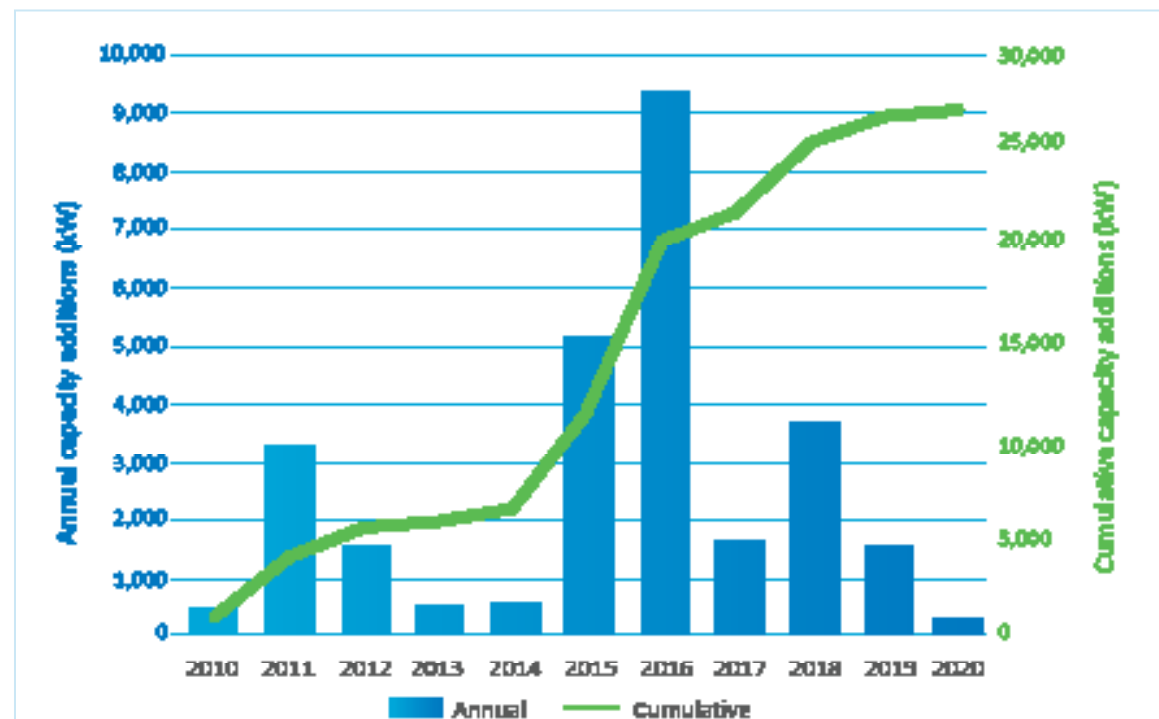


Figure 1: Annual and cumulative tidal stream capacity in Europe

Source: Ocean Energy Europe

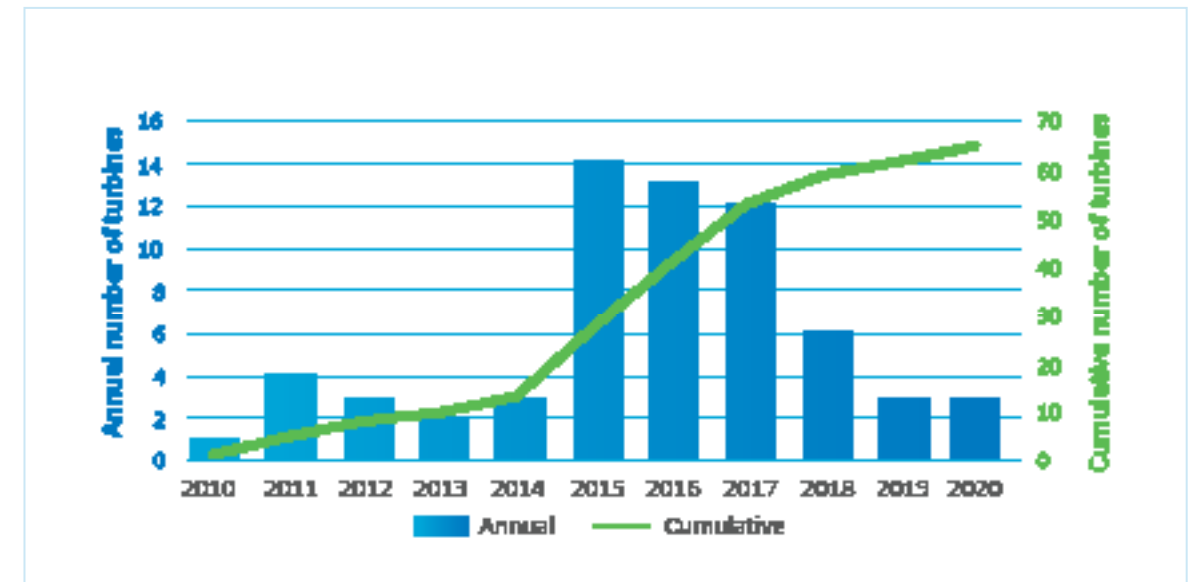


Figure 2: Annual and cumulative tidal turbine installations in Europe

Source: Ocean Energy Europe



Installations linked to new PPA and pilot farm expansion

The Faroe Islands now hosts one of the first commercial tidal stream projects, with Minesto installing a tidal kite in October under a new Power Purchase Agreement (PPA). An ambitious 100% RES by 2030 objective and abundant tidal resource encouraged the local utility to diversify its portfolio and invest in tidal stream.

Installations in the United Kingdom were mainly driven by European funding programmes. Out of the three devices deployed in Europe, two of them were installed in Scotland. Building on its historical leadership and advanced infrastructure, the nation remains an attractive location for testing and demonstration.

Country	Map ref.	Location	Device developer	Device name	Type	Capacity device (kW)	Number of turbines
FAROE ISLANDS	1	Vestmannaasund	Minesto	DG100	Kite	100	1
UK (SCOTLAND)	2	Orkney	Design Pro	DPR60	Vertical Axis	60	1
UK (SCOTLAND)	3	Shetlands	Nova Innovation	M100	Horizontal Axis	100	1



Figure 3: European tidal stream deployments in 2020

Source: Ocean Energy Europe

Tidal energy hits 60 GWh power production milestone in 2020

Electricity production from tidal farms and demonstration projects remained steady in 2020, bringing the cumulative production total to 60 GWh. Led by the main European pilot farms – Meygen, EnFAIT and Oosterschelde- the European tidal stream sector produced close to 12 GWh last year.

The continuous increase in electricity generation by tidal energy demonstrates the reliability and productivity of those projects currently online. Despite a year in which access to workshops and offshore devices was more challenging than usual, tidal turbines proved their robustness even with reduced maintenance schedules.

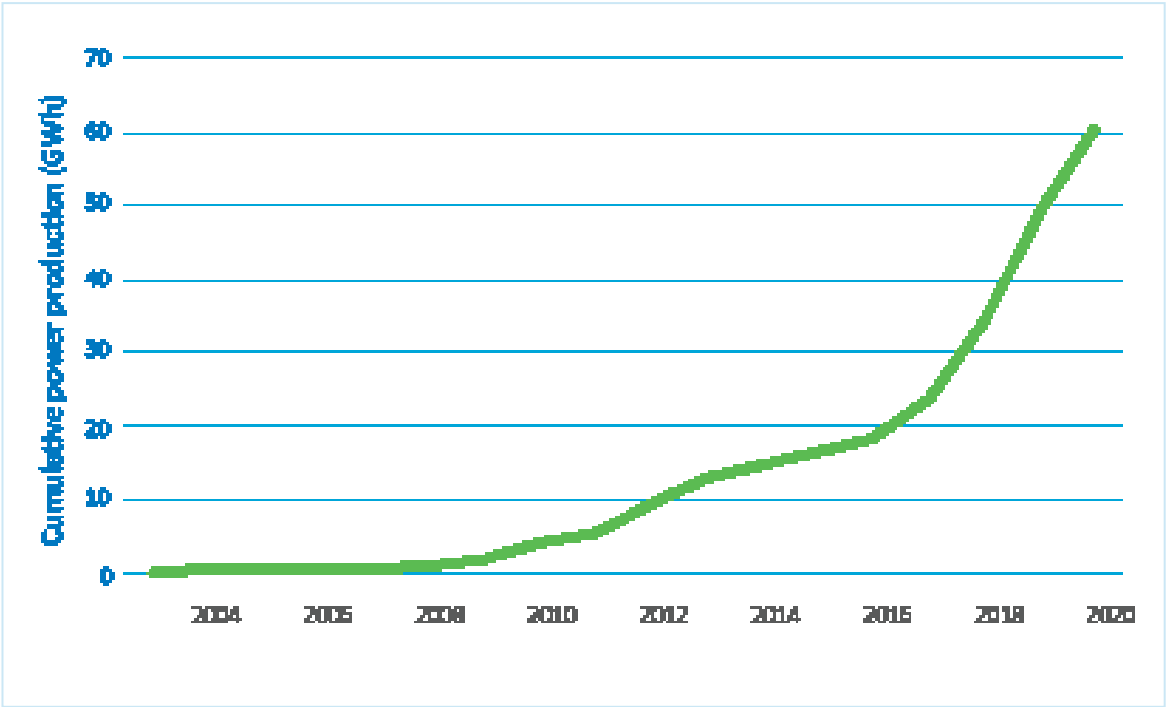


Figure 4: Cumulative power produced by tidal stream in Europe

Source: Ofgem Renewables and CHP Register, public releases from developers, information supplied to OEE by developers

WAVE ENERGY: Deployments postponed but not cancelled

Covid-19 delays majority of capacity additions

Annual installations – 200 kW of wave energy was installed in Europe in 2020. The Covid-19 pandemic severely impacted manufacturing and deployment windows. However, as with the tidal sector, no projects were cancelled, and the wave energy devices originally expected in 2020 will come online in 2021.

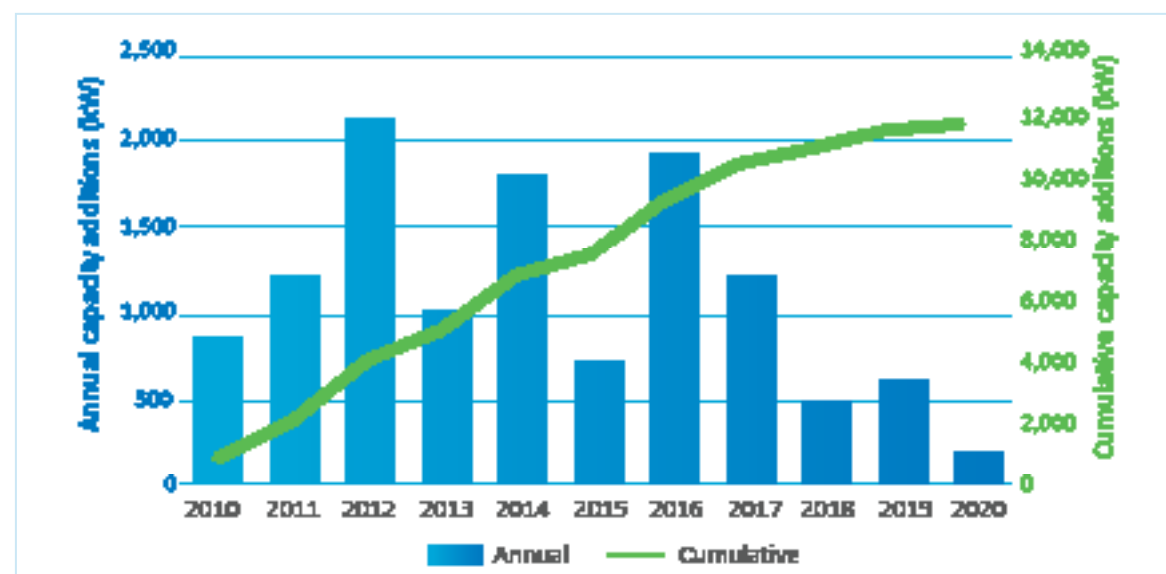


Figure 5: Annual wave energy capacity in Europe

Source: Ocean Energy Europe

Cumulative installations – 12 MW of wave energy has been installed in Europe since 2010. 1.1 MW is currently in the water and 10.9 MW has been decommissioned following the successful completion of testing programmes.

The slowdown in cumulative wave energy installations of the past few years stems from the fact that the next set of projects is currently onshore in the manufacturing phase, and also from operational limitations experienced worldwide during the 2020 pandemic. Developers are now preparing for the deployment of new full-scale devices and the first wave energy pilot farms.

Focus on full-scale devices and new markets

Wave developers are progressing along the TRL¹ scale as a new generation of full-scale devices is being tested. The devices deployed in 2019 performed well in 2020 and they will be joined by new competitors in the coming months.

One wave energy converter – engineered by Danish developer Wavepiston – was deployed in Europe last year. This dual-purpose device reflects a trend among some wave developers, who are now focusing on both electricity and freshwater production in response to increased demand from islands. In addition to mainstream power production, dual applications such as this represent an important market opportunity for the wave energy sector.

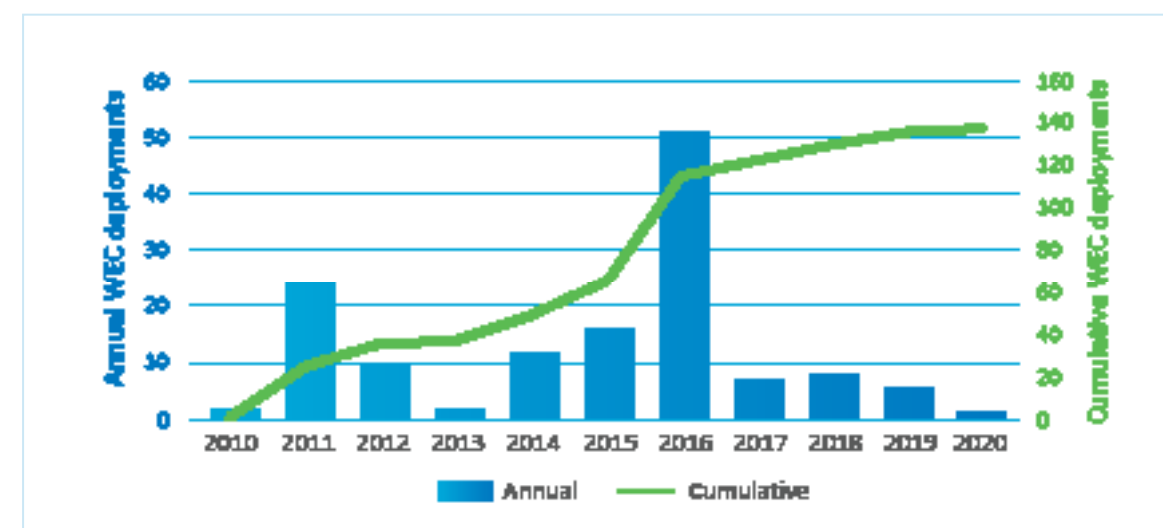


Figure 6: Annual and cumulative wave energy converter deployments in Europe

Source: Ocean Energy Europe

¹Technology Readiness Level

The start of a new era in Southern Europe

The installation of this wave device in Spain signals the beginning of a series of deployments planned in the region over the coming years. Several major projects have been announced in Portugal, Spain, Italy and Greece, as these countries show increasing support for wave energy.

Country	Map ref.	Location	Device developer	Device name	Type	Capacity device (kW)	Number of turbines	Scale
SPAIN	1	Gran Canaria	Wavepiston	Wavepiston WEC	Piston	200	1	1



Figure 7: European wave energy deployments in 2020

Source: Ocean Energy Europe



Global perspective

Worldwide, a total of 36.3 MW of tidal stream and 23.3 MW of wave energy has been deployed cumulatively since 2010. While the main share of deployed capacity remains in Europe, rollout is now accelerating in other parts of the world.



TIDAL STREAM: China leads capacity additions

Canada, China and the US remain the hottest markets beyond Europe

Canada is currently the most attractive foreign market for European companies, with three developers announcing plans to develop a pilot farm in Nova Scotia. A feed-in tariff of around €350/MWh and grants from the government have created the right conditions for these projects to take off. A fourth project site was allocated to the Canadian tidal company Big Moon Power this year.

Meanwhile, homegrown American and Chinese competitors are still progressing, boosted by increasing public investment. In the US, Verdant Power installed the first American tidal pilot farm in the East River, New York. The China Three Gorges Corporation made headlines by manufacturing and installing a 500 kW tidal turbine - designed by European developer SIMEC Atlantis Energy - despite the pandemic.



Photo: Sustainable Marine Energy

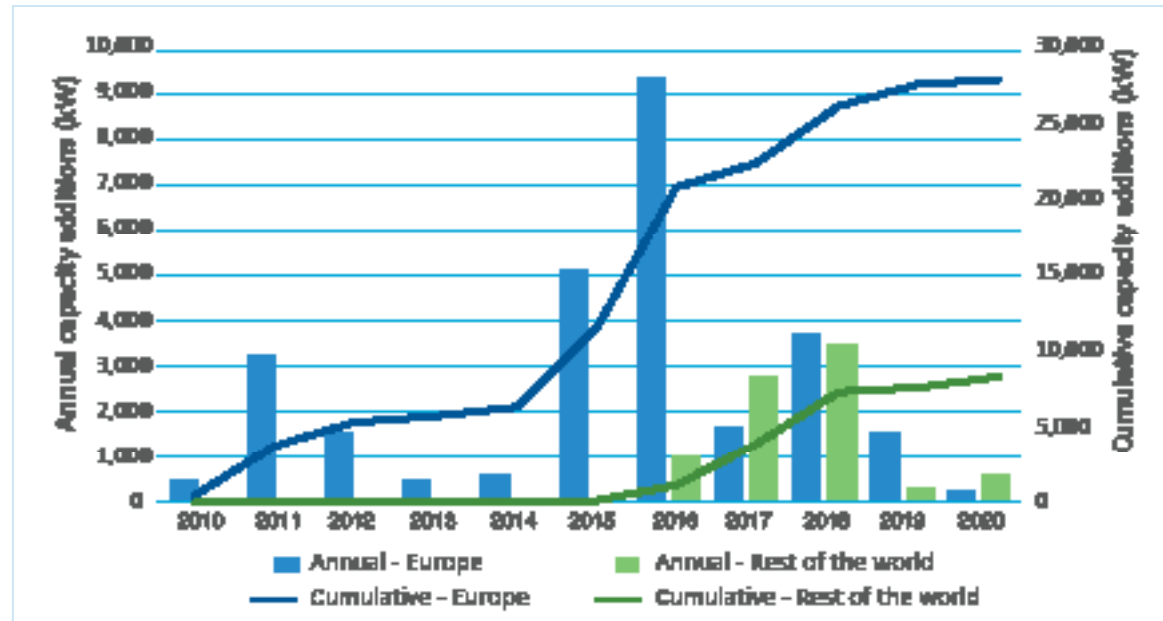


Figure 8: Installed global tidal stream energy capacity

Source: Ocean Energy Europe

Country	Device developer	Device name	Type	Capacity device (kW)	Number of turbines
USA	Verdant Power	TriFrame	Horizontal axis	105	3
CHINA	SIMEC Atlantis	SG500	Horizontal axis	500	1

Figure 9: Tidal stream installations outside Europe in 2020

Source: Ocean Energy Europe



Photo: Verdant Power



WAVE ENERGY: China adds full-scale device

Increasing competition in the wave energy sector

The Covid-19 pandemic delayed most wave energy projects outside of Europe, as manufacturing came to a halt and deployments were postponed by repeated lockdowns.

Nonetheless, China deployed a full-scale wave energy converter. Chinese technology developer GIEC successfully installed a 500 kW structure combining wave energy conversion and aquaculture. China and the US are positioning themselves as Europe's main competitors in the wave energy market.

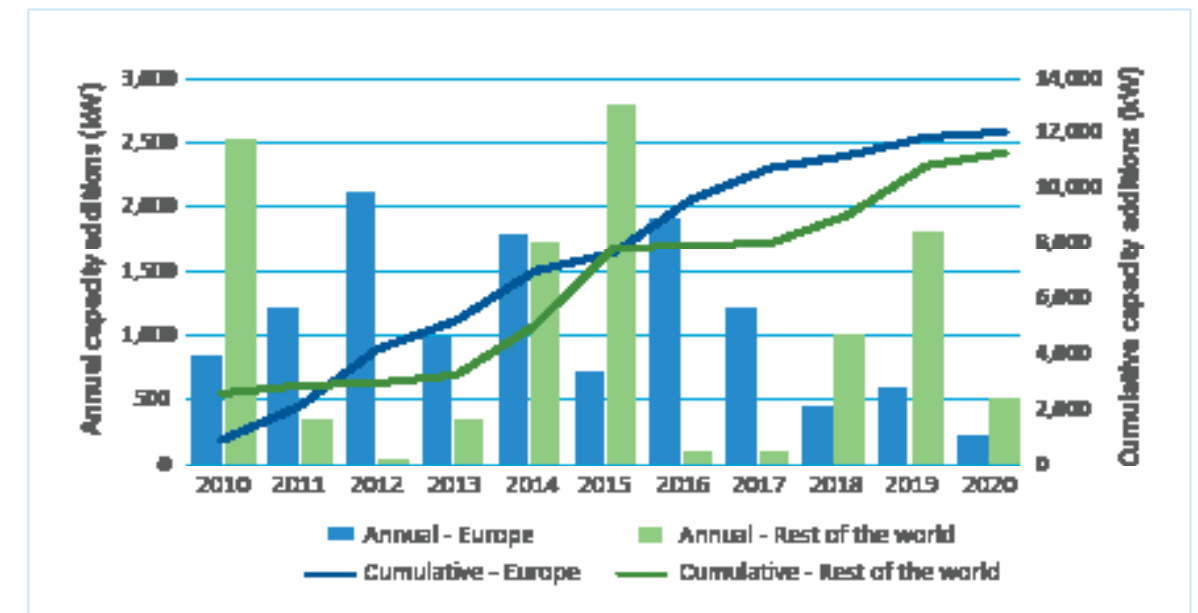


Figure 10: Installed global wave energy capacity

Source: Ocean Energy Europe

Country	Device Developer	Device name	Type	Capacity (kW)	Number of devices
CHINA	GIEC	Sharp Eagle	Point absorber	500	1

Figure 11: Wave energy installations outside Europe in 2020

Source: Ocean Energy Europe

Project spotlight

NOVA INNOVATION

Expanding the first tidal pilot farm

Scottish tidal technology developer Nova Innovation expanded the Shetland Tidal Array last year. “Eunice” is the first of three additional 100 kW direct-drive turbines to be installed, which will double the size of the tidal array under the EnFAIT project.

The first half of the five-year project has been focused on learning from the existing turbines and proving the reliability of the technology. The next stage of the project is focused on installing new direct-drive turbines to demonstrate the rapidly falling cost of tidal energy.



MINESTO

Developing their first commercial tidal project

Following a successful test of their large-scale device in Wales in 2019, Minesto signed a Power Purchase Agreement (PPA) with the Faroe Islands’ energy utility SEV. A significant milestone was achieved in 2020 with the deployment of the first demonstration tidal kite for this project: the DG100.

Minesto’s marine energy technology, Deep Green, consists of a subsea kite carrying a turbine. The kite flies across the underwater current, significantly enhancing the water flow speed through the turbine.



WAVEPISTON

Moving south to go full scale

Building on a successful scale test in Denmark, Wavepiston moved to PLOCAN in the Spanish Canary Islands, to test two full-scale devices. The stronger wave climate offers the perfect conditions for Wavepiston’s full-scale wave energy converter.

The initial phase of the 200 kW project was deployed in December 2020. A second device, which will also produce freshwater, will be deployed during 2021.



VERDANT POWER

Blue energy at the foot of the UN

American tidal developer, Verdant Power, installed an array of three tidal power turbines simultaneously at its Roosevelt Island Tidal Energy (RITE) Project site in New York's East River. The deployment is the first licensed tidal power project in the US.

The 105 kW RITE Project is a technology demonstration of Verdant Power’s fifth-generation tidal power system and its novel TriFrame mounting system. This project will demonstrate the integrated system’s performance, and optimise the economics of installation and maintenance over the system’s 20-year lifespan.



2020 ocean energy highlights



JANUARY
Design Pro installs 60 kW tidal turbine in Scotland
ENI launches marine energy research laboratory with Politecnico di Torino



FEBRUARY
Tidal developer **Minesto** signs PPA with Faroe Islands utility
Basque wave plant **Mutriku** reaches 2 GWh of electricity production



MARCH
Tidal stream in Europe hits **50 GWh** power generation milestone



APRIL
SIMEC Atlantis Energy deploys 500 kW tidal project in China



MAY
Hydroquest's tidal device celebrates 1 year in the water + power curve certified
UK Government study confirms **strong public support** for ocean energy



JUNE
SIMEC Atlantis Energy secures lease for 12 MW tidal project in Raz Blanchard, France



JULY
CorPower Ocean secures €9m equity funding + announces wave energy factory in Portugal



SEPTEMBER
Minesto opens tidal kite factory in Wales
Big Moon Power granted licence and PPA for 4 MW tidal project in Canada
Canadian Government invests C\$4 million in **Nova Innovation's** tidal energy project
US commits to investing **US\$600m** in ocean energy by 2025



OCTOBER
Verdant Power installs 3 tidal turbines (105 kW) in New York City's East River
Nova Innovation installs 100 kW tidal turbine in Scotland
Minesto installs 100 kW tidal kite in Faroe Islands
GIEC installs 500 kW Sharp Eagle wave device in China
Tocardo restarts power production at Dutch 1.25 MW Oosterschelde tidal project



NOVEMBER
EU Offshore Renewables Strategy published with ocean energy target of **100 MW by 2025**
Welsh Government invests €1.3m in **Nova Innovation's** Ynys Enlli tidal energy project
Canada invests record C\$28.5m in **SME's** 9 MW tidal stream pilot farm
CorPower awarded 10-year marine license for wave project in Portugal



DECEMBER
Wavepiston deploys wave device in Spain's Canary Islands
SIMEC Atlantis Energy lands €13m private investment deal, tidal turbine arrives in Japan
Sabella unveils new, 30% cheaper, tidal turbine blade

Hitting industry and investment milestones in 2020

Ramping up industrial capacity

MINESTO

Swedish tidal energy developer Minesto has completed the construction of its assembly hall in Wales, which will serve as the hub for its engineering and operational activities. The construction was managed by Stena Line and the building is equipped with a loadout quay and an external storage area. The facility will support Minesto's tidal projects at Holyhead Deep and in the Faroe Islands.

CORPOWER

CorPower Ocean is establishing an R&D, Manufacturing & Service Centre for Wave Energy Converters in Portugal's Viana do Castelo – investing €16m in the project. The location has been chosen to enable CorPower's demonstration project HiWave-5, and for the long-term development of supply and service capacity for commercial wave energy farms in the region.

ENI

Politecnico di Torino and ENI have opened a joint research laboratory, the Marine Offshore Renewable Energy Lab (MORE). The lab will bring together researchers to maximise expertise on marine energy and accelerate industrial deployment of offshore renewable technologies. This initiative establishes Italy as a new hub in ocean energy development and will support ENI's plans to deploy the first wave energy farm in the Mediterranean.

Developers land significant investment deals

Ocean energy attracted public and private investors alike in 2020. Several European tidal and wave energy companies secured exciting new investments for their projects.

Secured new investment in 2020:

CORPOWER OCEAN	SIMEC ATLANTIS ENERGY	NOVA INNOVATION	SUSTAINABLE MARINE ENERGY
€9M	£13M	C\$4M	C\$28.5M

Beyond public investments and funding rounds, crowdfunding has become a very popular way to raise equity for ocean energy developers. More than 15 successful campaigns were launched in the past 3 years:

- Orbital Marine Power more than doubled its target, raising £2.5m.
- Nova Innovation raised £700,000 in two weeks, smashing its initial target of £500,000.
- Oscilla Wave Power raised more than \$300,000.



Photo: Corpower Ocean



European developers secure new export projects

SIMEC ATLANTIS ENERGY

Scottish tidal developer, SIMEC Atlantis Energy, designed a tidal turbine for the Chinese Company China Three Gorges. Built in Wuhan, the 500 kW turbine entered into service in April last year.

The developer also signed a contract with Kyuden Mirai to test a 500 kW turbine in Japan. The turbine arrived in Nagasaki in December.

SUSTAINABLE MARINE ENERGY

Sustainable Marine Energy's Canadian tidal power pilot farm is advancing and the first device – a 420 kW floating platform – will hit the water in 2021.

NOVA INNOVATION

Nova Innovation announced its first export project – a 1.5 MW tidal energy farm in Nova Scotia. The attractive feed-in tariff and subsidies from the Canadian government opened the way for the Scottish company to design the 15-turbine farm.



Policy support picks up in 2020

Beyond industrial achievements, major pieces of legislation supporting the development of ocean energy were adopted around the world.

At national level

Spain, Portugal and Ireland have adopted deployment targets for wave energy – respectively 50 MW by 2030, 70 MW by 2030 and 110 MW by 2035.

At European level

The European Commission adopted a new strategy on offshore renewables containing key provisions on ocean energy, namely:

- For the first time, the EU has set deployment objectives for wave and tidal energy: 100 MW by 2025, 3 GW by 2030 and 40 GW by 2050.
- A forum gathering national governments, EU authorities and the industry will be created to plan grid deployments and ensure quick access to the sea.

Rest of the world

- The USA's House of Representatives passed a bill authorising the administration to invest \$600m in the development of ocean energy between 2021 and 2025.
- Canada continues to show strong support to the tidal energy sector, allocating grants and feed-in-tariffs for the installation of pilot farms in Nova Scotia.
- India has recognised ocean energy technologies as renewable energy sources. Tidal, wave energy and OTEC are thus now eligible for meeting the non-solar Renewable Purchase Obligation – a national support system.
- Finally, the International Renewable Energy Agency (IRENA) launched two reports on ocean energy and offshore renewables, as well as a collaborative platform to accelerate the deployment of these technologies.



2021 outlook: A strong project pipeline in the year ahead



TIDAL STREAM: A new generation of devices in the Atlantic

Europe

Deployments are set to pick up again in 2021, with at least 2.9 MW of capacity slated for installation. Following the trend of deployments in 2020, the majority of devices to be installed will find a home in the waters off Scotland and the Faroe Islands.

International

Outside of Europe, installations in 2021 could increase the world's tidal energy capacity by 1.2 MW. Canada will lead deployments with the development of Nova Scotia's pilot farms; China is set to install at least one device.



WAVE ENERGY: A big year for Europe

Europe

Up to 3.1 MW of wave energy is lined up for deployment in 2021, the bulk of which will come from full-scale, high-capacity devices. The majority of these deployments will occur in the UK and Spain, with funding from the EU's BlueGift and Ocean DEMO projects. Three new full-scale devices should hit European waters – made by Bombora, Wello and Wavepiston.

International

Outside Europe, installations could add 850 kW of wave energy capacity to the global total. Several devices are expected to be deployed: Enel Green Power's OPT project in Chile, Columbia Power Technologies in the US, and Wave Swell Energy in Australia.

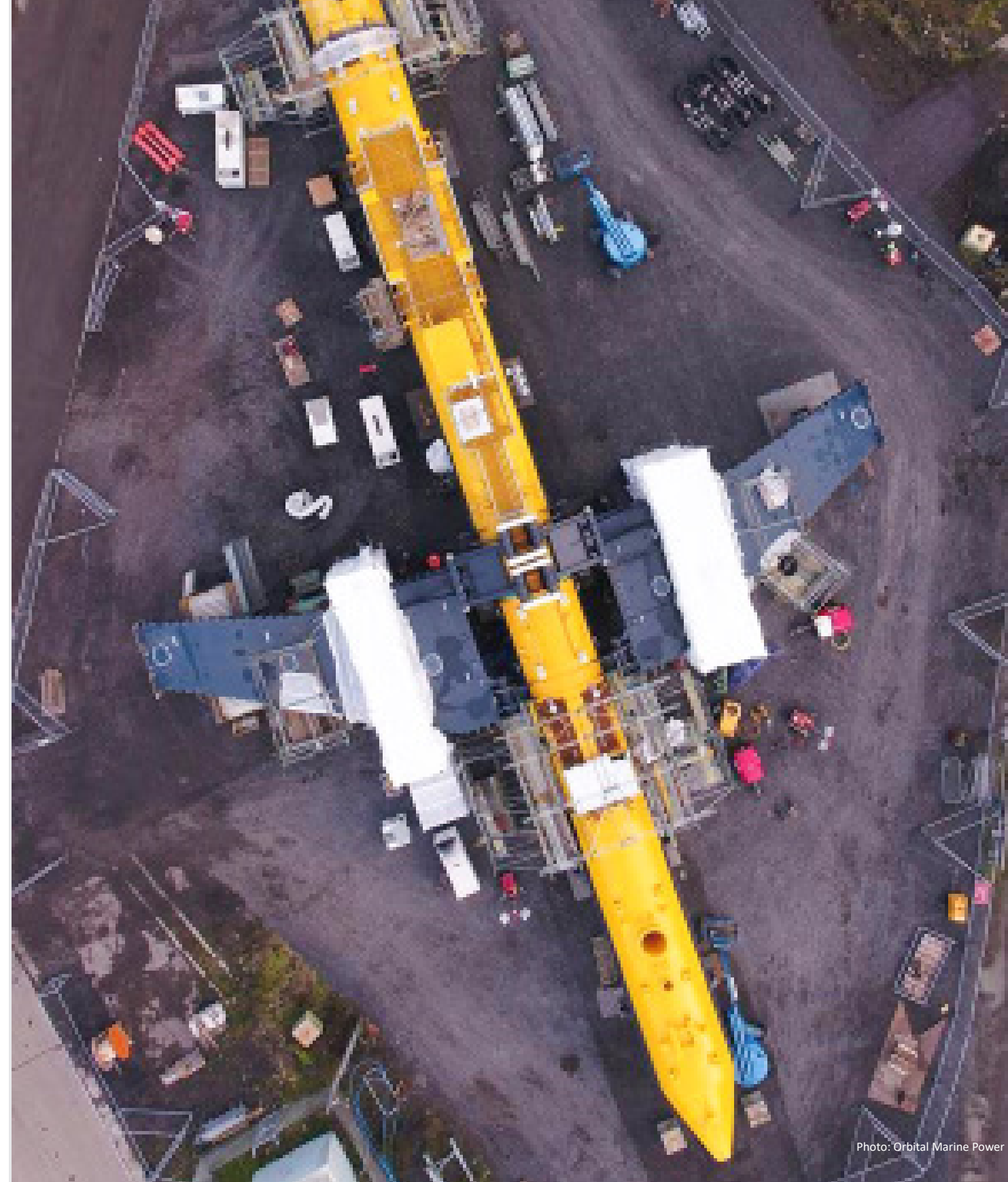


Photo: Orbital Marine Power



Want to go into more detail?

Did you know that Ocean Energy Europe members can request information from our 'Kit-in-the-Water' database about projects deployed around the world?

Contact us now to find out more about this and the many other benefits of OEE membership!

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Ocean Energy Europe (OEE) is the largest network of ocean energy professionals in the world. Our mission is to create a strong environment for the development of ocean energy, improve access to funding, and enhance business opportunities for our members.

Over 120 organisations, including Europe's leading utilities, industrialists and research institutes, trust OEE to represent the interests of Europe's ocean energy sector. If you're active in the ocean energy sector, we can help your business grow.

As a not-for-profit organisation, every euro invested in OEE is used to promote the European ocean energy industry.

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