Tidal power is a major growth area, with a global potential of up to 100 GW installed capacity. Being fully predictable renewable energy source, tidal power has the potential to contribute significantly to the future energy mix of many countries wanting to benefit from renewable, low-carbon forms of electricity generation.

Alstom is at the forefront in the design, development and manufacture of tidal stream turbines. With over 10 years of accumulated knowledge and experience, we bring customer-oriented, proven, reliable and efficient technologies, with particular attention to Operation and Maintenance.

Today, Alstom is paving the way in the development of tidal power solutions by offering a unique platform concept Oceade™, as well as an electrical subsea hub solution to help our customers optimise tidal farm economics.
Harnessing tidal energy
to fuel a sustainable future

Tidal stream technology draws on the power of fast currents generated where local geography constrains movement of ocean masses. As water is 800 times denser than air, there is tremendous potential for power extraction.

Alstom has developed leading tidal power technologies to tap into this reliable and predictable energy source.

**An experienced partner**

With its integrated team, totalling over 10 years of combined experience in the field of tidal energy, Alstom is developing a tidal turbine technology and associated O&M solution based on proven concepts and industry-leading knowledge. Following the successful testing of a 500kW turbine, Alstom tested a 1 MW tidal turbine in different operational conditions since 2013. The turbine successfully injected over 1.2 GWh of electricity to the grid. This test programme has enabled Alstom to validate the performance and power curve, design tools and installation and retrieval processes as well as demonstrating autonomous running.

**Innovative tidal technologies**

Building on this extensive experience, Alstom offers you an efficient, cost-effective and easy to maintain tidal technology: the Oceade™ 18 – 1.4 MW. With its innovative buoyant and modular design, the reliable turbine allows offers optimised industrialisation, rapid installation and maintenance industrialisation, installation and maintainability, whilst maximising energy extraction.

Pioneering the way in the development of complete tidal power solutions, Alstom has extended this offering to a unique Oceade™ tidal platform concept which helps you maximise the use of tidal stream resources according to local conditions.

Dedicated to provide you with a complete solution, Alstom teams are as well developing a cutting-edge low cost retrievable subsea hub, to connect tidal turbines to the grid in a reliable and cost effective manner.
How Alstom is helping you to meet the challenges of energy sustainability.

**Clean Power, Clear Solutions™**

**Reducing Cost of Electricity**

- Efficiency improvements
- CAPEX reduction / scaling up
- Capacity Factor increase
- Lead time reduction
- Competitive O&M

**Lowering Environmental Footprint**

Clean generation is on the way of demonstrating environmental responsibility. Another is lowering resource usage, visual impact and noise pollution. In both cases, we can help you meet or exceed regulations and environmental standards. That is why Alstom innovates in the following areas:

- Renewable portfolio
- Natural resource optimisation
- CO₂ emission reduction
- Land use, visual impact and noise
- Water intensity reduction & recyclability

**Increasing Flexibility & Reliability**

Intermittent power generation is a growing challenge of energy security as is maintaining an aging installed base and adapting it to changing market conditions. We help you tackle both issues so that you can enjoy dependable operation with:

- Maintainability and outage time reduction
- Operational and fuel flexibility
- Designs and service for improved availability and reliability
- Climate packages
Clear Solutions
meet the challenges of energy sustainability

Tidal power is an inexhaustible CO₂-free resource

Our promise to our customers

**Reducing Cost of Electricity**

÷10

the vessel day rate for installation thanks to use of low-cost workboat instead of large oil & gas heavy-lift DP vessel

**Lowering Environmental Footprint**

0

CO₂ emissions, non-surface piercing, no visual impact during operation

**Increasing Flexibility & Reliability**

<30 minutes

required to retrieve or re-install turbine for maintenance, increasing availability
As part of our commitment to clean power, Alstom is poised to become a world leader in the promising field of tidal energy.
Innovative Oceade™ 18 – 1.4 MW solution

Built on over 10 years combined knowledge and experience in the English and French tidal teams, the Oceade™ 18 – 1.4 MW, first variant of the Oceade™ platform, offers you high efficiency and eased maintainability while ensuring optimised cost of electricity.

Efficient
- With a rotor diameter of 18 metres, the Oceade™ tidal stream turbine has rated power of 1.4 MW.
- It is equipped with three variable pitching blades benefiting from an optimum hydrodynamic design which ensures maximum energy extraction. This offers the ability to counteract power and speed fluctuations caused by waves and turbulences, whilst controlling maximum power, limiting maximum thrust load and achieving safe shutdown under extreme conditions.
- The nacelle features a yawing system, based on proven and patented technology, to face the oncoming tide and maximise energy extraction while minimising structural loads and wake effects.
- To finish, the nacelle incorporates power conversion equipment for grid compliant power at nacelle output, easing turbine control, improving power quality, reducing losses, and avoiding the need of additional subsea power conversion equipment.

Cost-Effective
- The Oceade™ 18 – 1.4 MW has a fully modular design which ensures an optimised, cost-effective, industrialisation.
- The nacelle of the turbine is buoyant, making it easy to tow to and from the operating site. Installation and maintenance costs are therefore lower because there is no need for specialist vessels.
- The turbine features a patented system to winch the nacelle down to its seabed support structure allowing diver-less operation.
- Simple and cost effective installation tooling is used for offshore operations which can be shared for a whole farm, reducing operating costs.

Easy To Maintain
- The Oceade™ 18 – 1.4 MW is equipped with line-replaceable plug-and-play units and allows module interchange ensuring rapid turn-around times.
- Maintainability is enhanced thanks to the presence of a rear door and a man-hatch (providing quick access for many maintenance tasks), which enable faster assembly and maintenance.
- The buoyant nacelle permits a spare turbine strategy on commercial farms to maximise availability and offering higher production time. With this innovative design, Alstom offers you the lowest risk and most flexible O&M solution.
The Oceade™ - A proven turbine concept

Alstom has proven the Oceade™ concept operating a full scale 1 MW prototype and exporting over 1.2 GWh on the Scottish grid. Alstom’s 1 MW tidal turbine, deployed in 2013 as part of the ReDAPT consortium project (Reliable Data Acquisition Platform for Tidal, implemented and co-funded by the Energy Technologies Institute), at EMEC’s tidal test site, had demonstrated its endurance, autonomous running and performance, generating at its full nominal power since July 2013. Previously, the 500 kW tidal stream turbine had already generated electricity into the grid after its connection in September 2010 at the Fall of Warness test site. Alstom has taken advantage of this significant experience to improve the design of its tidal turbine and now offers the Oceade™ 18 - 1.4 MW, first variant of this tidal turbine platform.

Raz Blanchard tidal pilot farm equipment

Alstom has been chosen in December 2014 to supply equipment for a tidal energy pilot farm at Raz Blanchard, west of the Cotentin peninsula (Manche) in France. Four Oceade™ 18 - 1.4 MW tidal turbines, as well as an Alstom electrical subsea hub will be installed at this high-potential tidal site.

This project will allow Alstom to test its 18 metres rotor diameter Oceade™ tidal turbine, with a 1.4 MW output, under installation and operational conditions similar to those in commercial plants.

The installation of the Oceade™ 18 - 1.4 MW turbine at the raz Blanchard pilot farm for our customer ENGIE represents a decisive step towards setting up commercial operations in tidal energy.
Alstom
Efficient, cost-effective

PITCHING
COMPOSITE BLADES
Proven blade design with efficient hydrodynamic profile and individual pitch control to respond to local flow conditions, optimise yield and minimise structural loads.

BUOYANT DESIGN
Structure towed to site, deployed or retrieved with a low cost work-class vessel and ROV in one slack water period. Fully submerged when installed with no visual impact.

CLAMP AND STAB SYSTEM
Patented technology permitting secure connection to the support structure during generation and yawing at slack water whilst maintaining power connection to the shore.

CABLE
Interface to the power export cable running either to a subsea power collection hub or direct to shore.

Alstom has taken advantage of its experience to develop a fully modular tidal stream turbine – the Oceade™ 18 – 1.4MW – allowing optimised, cost-effective and reliable installation, operation and maintenance. Alstom’s Oceade™ platform permits optimisation of the drivetrain to help maximise the use of tidal stream resources according to site conditions and therefore reduce the levelised cost of electricity.
Alstom has taken advantage of its experience to develop a fully modular tidal stream turbine – the Oceade™ 18 – 1.4MW – allowing optimised, cost-effective and reliable installation, operation and maintenance. Alstom’s Oceade™ platform permits optimisation of the drivetrain to help maximise the use of tidal stream resources according to site conditions and therefore reduce the levelised cost of electricity.
A unique tidal turbine platform

Alstom innovates to help you optimise tidal farms economics, by offering a unique tidal turbines platform concept: the Oceade™ platform. Expanding upon the Oceade™ 18 – 1.4 MW technology, the rotor diameter of the turbine can be extended up to 23m+, allowing you to select the best variants to fit the specifics of your site. Alstom takes advantage of its extensive testing of two prototypes in real conditions to include lessons learnt in the design of the Oceade™ platform: each of its variants offer the efficient, cost-effective and easy to maintain features of the Oceade™ 18 – 1.4 MW, to help you optimise the output of your tidal farm.
The best turbine to fit each site’s conditions

Alstom Oceade™ platform is designed to fit the variations in your tidal site conditions. It will allow you to choose the best turbine according to your site’s depth and current conditions to ensure optimum use of the tidal resource. Alstom teams are able to advise you on best variant selection and turbine locations to fit your specific tidal site requirements.

Alstom Oceade™ platform also provides project developers with greater flexibility for optimised tidal resource use within an array. The possibility of combining variants of the Oceade™ family allows our customers to address the variability of tidal conditions within a single site and optimise the layout to achieve the best overall yield.

The Oceade™ platform therefore improves annual energy production of the tidal farm, with capacity factors increased by up to 20% compared to using a single variant.

Optimised commercialisation, operation and maintenance

The Oceade™ platform variants share a maximum number of common parts to decrease the cost of electricity through standardisation, reduced leadtime and increased supply chain volume. This concept also eases serial production of the main nacelle components, thanks to the use of plug-and-play modules, decreasing the overall cost of energy.

Alstom Oceade™ modular platform concept also ensures rapid maintenance onshore helping our customers maximise the time spent generating power. The interchangeability of the Oceade™ turbine modules or line replaceable units means reduced maintenance costs and rapid turn-around times. In addition, the modular approach allows thorough tests prior to system assembly, increasing the reliability of your tidal farm.
Optimising the overall tidal farm

Alstom electrical subsea hub concept

Exporting the electricity generated by tidal turbines subsea to the onshore substation represents a significant portion of capital investment in a tidal farm, and a major technological challenge. It calls for the development of underwater electric power transformation and interconnection systems, in order to lower installation and maintenance costs, especially in comparison to existing systems.

Alstom has designed a low cost retrievable subsea hub solution that avoids the need to run multiple cables to shore. This allows lowered environmental footprint, as well as reduced cable costs, and thus enables the development of commercial tidal farms.

Alstom’s subsea hub concept is buoyant, using Alstom’s proven design, which ensures rapid installation using small vessels. It is configurable to fit your equipment: Alstom can provide you with 4 to 16 turbines connections and plans for export voltages up to 33kV. In addition, thanks to the individual autonomous stab connections, and with the reduction of the ROV involvement during its deployment, we help you reduce installation costs and complexity.

This concept will be installed at the raz Blanchard, France as part of the equipment that Alstom will supply for the ENGIE pilot farm. The Alstom subsea hub is developed in the frame of the PRISMER Research and Development project awarded by Ademe to Alstom within the Brique technologique Call for Expression of Interest (CEI).

A partnership for performance

When you choose Alstom as your Original Equipment Manufacturer, engineering, procurement and construction partner or operation and maintenance (O&M) provider, you are buying into a wealth of energy know-how and experience. The long-term performance potential of a tidal array is only partially determined at the manufacturing and construction stages. The best design and construction will be of little benefit if O&M is not fully optimised.

That is why Alstom operates a global network of local service centres and offers a full range of O&M contracts, packages and services including:

- Preventive & Corrective maintenance
- Parts delivery and upgrade pack
- Integrated control and remote monitoring services
- Field service and O&M contracts

From generation to transmission

Thanks to 120 years of expertise and continuous R&D, Alstom is a major player in the evolving power transmission industry. Our expertise encompasses all aspects of a tidal array’s electrical system – from network consulting, design, project management, products and systems to installation and service. Alstom brings its industry-leading offshore wind transmission experience to the emerging tidal industry.
Alstom

Alstom is a global leader in the world of power generation, power transmission and rail infrastructure and sets the benchmark for innovative and environmentally friendly technologies.

Alstom builds the fastest train and the highest capacity automated metro in the world, provides turnkey integrated power plant solutions and associated services for a wide variety of energy sources, including hydro, nuclear, gas, coal, wind, solar thermal, geothermal and ocean energies. Alstom offers a wide range of solutions for power transmission, with a focus on smart grids.

Power generation

Alstom Power offers solutions which allow their customers to generate reliable, competitive and eco-friendly power.

Alstom has the industry’s most comprehensive portfolio of thermal technologies – coal, gas, oil and nuclear – and holds leading positions in turnkey power plants, power generation services and air quality control systems. It is also a pioneer in carbon capture technologies.

Alstom offers the most comprehensive range of renewable power generation solutions today: hydro power, wind power, geothermal, biomass and solar. With ocean energies, we are developing solutions for tomorrow. Alstom is one of the world leaders in hydro power, the largest source of renewable energy on the planet.