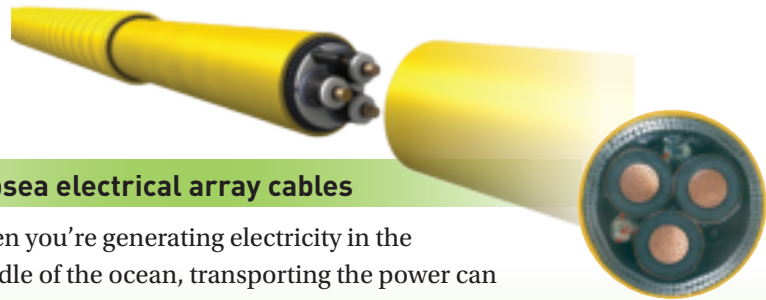




ENGINEERING YOUR SUCCESS.

Water energy is the power generated by flowing or falling water. Capturing it has traditionally taken the form of hydro dams, pumped storage reservoir installations, or river water wheels which have proven to be efficient and cost-effective ways to produce electricity. Today, work is also being done to harness the mechanical power held in the movement of the ocean with innovative and often unusual wave and tidal turbines.

Whatever the generation method, Parker is there with a wide range of motion and control systems and components. From cylinders that move the wicket gates in hydro dam installations and the array cables that export the electricity from ocean wave turbines to the transformer stations ... to the gearbox lubrication systems on tidal turbine generators and advanced, cooled electrical power conversion systems ... Parker has the experience, products, and technical competence needed to further the science of water energy. As well as the global presence necessary to supply and support its capture.



Subsea electrical array cables

When you're generating electricity in the middle of the ocean, transporting the power can be a problem, but Parker Scanrope in Norway has a solution. The division manufactures mooring lines that both attach an ocean wave power generation device to the seabed and export its electricity to offshore transformer stations through subsea electrical array cables.

Parker Scanrope has years of experience producing and servicing products for the offshore industry. With its own quay to enable direct loading of the mooring lines and cables to the cable-laying vessels, Parker Scanrope combines expertise with flexibility to best serve its customers.

INNOVATION
IN ACTION

Micro-hydro: Harnessing the power of small rivers

One of the most traditional methods to harness the power of water is with a water wheel. By transferring the power of flowing water from small rivers into rotational movement and spinning a generator, electricity in the range of 100 KW to 1 MW is produced.

Varying river flows result in inconsistent generator speeds, which prevent the generation of electricity at a constant frequency. Rather than regulating water flow to control the generator speed, a more cost-effective approach is to pass the signal through Parker's power conversion system and produce regulated output at grid frequency.

The core of the power conversion system, Parker's AC890PX inverter provides quality power by incorporating an advanced pulse-width-modulated switching technology, automatically synchronizing to the AC power grid. The insulated gate bipolar transistor-based active bridge bi-directional inverter within the system is actually even capable of delivering full power in either direction within 10 milliseconds, making it ideal for demanding applications like grid frequency stabilization. The efficiency of the inverter exceeds 98%.



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Water Energy MK 6/13



Parker Hannifin Corporation
6035 Parkland Boulevard
Cleveland, Ohio 44124 U.S.A.
phone 1 800 272 7537
<http://renewableenergy.parker.com>



ENGINEERING YOUR SUCCESS.



RENEWABLE ENERGY

Energizing innovation in water – worldwide

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding

Power Source: WATER

Harnessing power from rivers, waves, currents, and tides.

Look to Parker for:

Hydro Solutions

- 1 Hydraulic controls for turbines and generators
- 2 Fluid conveyance
- 3 Bearing lube oil system
- 4 Gate actuation

Wave/Tidal Solutions

- 5 “Wave attenuator” energy converters
- 6 Point absorber
- 7 Paddle style wave harvesters
- 8 Mooring lines and subsea electric cables
- 9 Tidal turbines

Hydro expertise

Hydropower is the oldest form of renewable energy. From “micro-hydro” to “mega-dams,” Parker engineers design systems ranging from sophisticated hydraulic systems to state-of-the-art controls. Parker systems optimize turbine upgrades and enable OEMs with critical technologies ranging from hydraulics, pneumatics, and electromechanical systems to sealing solutions used inside the turbine. By working with Parker, you’ll benefit from collaborative engineering at the beginning of the project and field support through the entire construction cycle.

HYDRO SOLUTIONS



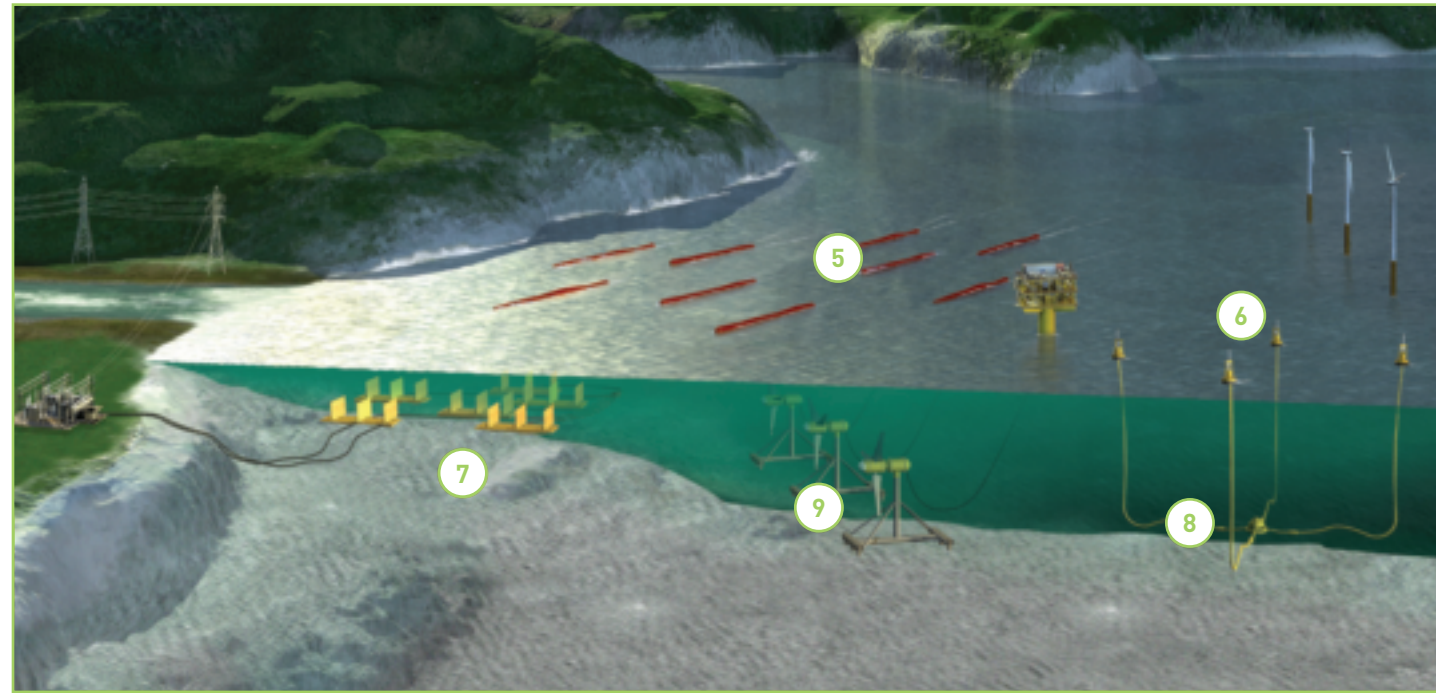
- 1 **Hydraulic controls for turbines and generators**
Modern turbine governing systems rely extensively on hydraulic systems for high power density and precise position control. Parker’s custom cylinder capabilities and high performance DF Plus proportional valves provide superior control along with robust operation.

- 3 **Bearing lube oil system**
Bearings used in hydroelectric turbines require clean fluid for trouble-free operation. Parker can provide in-line filtration solutions or complete kidney loops for continuous off-line filtration. We also recommend using Parker reservoir vent filters or isolation systems to prevent the ingress of harmful particles into the lube oil system.

- 2 **Fluid conveyance**
Parker’s F37 family of non-welded piping solutions reduces potential failure points from traditional welded pipe systems. Parker stainless E02 fittings provide leak-free connections for standard tubes. Parker is also the global leader for medium- and high-pressure hydraulic hoses, available with stainless steel connections.

- 4 **Gate actuation**
Hydraulics are used to control intake, outlet, flood, and Tainter gates. Parker manufactures highly engineered, custom cylinders to operate gates. We can provide all required plumbing for gate systems with our F37 piping solutions. Parker also has global capabilities to design and build custom hydraulic power units.

WAVE/TIDAL SOLUTIONS



- 5 **“Wave attenuator” energy converters**
“Wave attenuator” energy converters ride along the top of ocean waves and harness this motion by allowing hinged sections to pivot around a common axis. This “flapping” motion causes cylinders to extend and retract, creating hydraulic pressure which is then used to drive electrical generators. Parker’s experience and ability to produce highly specialized hydraulic cylinders have proven that Parker is the right provider of motion and control solutions in these state-of-the-art devices.

- 7 **Paddle style wave harvesters**
Paddle style wave harvesters are mounted to the ocean floor in shallow water. Ocean waves create rotary motion, which is then converted to stored hydraulic energy used for rotating an electric generator. Parker provides custom hydraulic cylinders, accumulators, hydrostatic drives, and a full line of stainless steel fluid connections to enable these novel devices.

- 6 **“Point absorber” wave energy converters**
“Point absorber” wave energy converters transfer the energy from ocean waves by utilizing vertical oscillations near the ocean’s surface. Linear motion is converted into rotary motion, which in turn drives a generator to produce electrical power. The core of the power conversion system may be either hydraulic or electromechanical and can be designed and built using a vast range of products available from Parker.

- 8 **Mooring lines and subsea electric cables**
Maintaining the position of wave devices at sea and exporting the electricity generated from the devices to the shore are significant technical challenges. Parker Scanrope’s mooring lines are tried and tested in harsh offshore environments and are known for their high tensile strength and capability to deploy extremely long lengths. Scanrope also excels in the production of low/medium voltage subsea export cables.

- 9 **Tidal turbines**
Lubrication oil filtration systems (LOFS) are vital for problem-free operation of the gearboxes in many undersea tidal turbines. Parker’s LOFS offer a complete solution for the health management of the gearbox. They not only include the necessary pumps and filters, but also incorporate condition monitoring capabilities to detect changes in the oil quality, allowing ample warning of deterioration to prevent catastrophic failures.

WATER ENGINEERED SOLUTIONS



>> Specially designed cylinders

Situation:
Hydraulic cylinders are critical components of many hydro installations and ocean devices. They must deliver reliable performance under tough conditions.

Solution:
Parker designs and builds special cylinders with longer strokes and larger bores for hydro projects. Whether they use oil or other fluids, or are on land or at sea, Parker cylinders are designed to withstand harsh environmental conditions.

Customer Advantage:
You can count on Parker cylinders to deliver the required performance long term. And because the cylinders are designed and built in-house, Parker can supply any needed spare parts for maintenance.



>> Grid tie power conversion systems

Situation:
Wave and tidal generators reside in an environment that makes it difficult to carry out maintenance work for on-board electronic and electrical systems. Additionally, the space on board the devices is often limited.

Solution:
Installing Parker’s ruggedized grid tie inverter provides a reliable and efficient way to return power to the grid. The self-contained, two-phase liquid cooled loop protects power components from ambient conditions and the modular design provides a scalable solution.

Customer Advantage:
The closed-loop cooling system keeps power electronics free from contaminants. Mobile hardened design ensures that vibration and physical shock will not affect the longevity of the inverter’s life.



>> Hydraulic systems

Situation:
In an environment where leveled cost of energy is the overall greatest influencing factor in the success or failure of a project, reliability becomes a critical element. A reliable hydraulic system is a must.

Solution:
Using hydraulic systems and power units designed and built by Parker that utilize Parker’s own proven, high quality components assure longest system uptime.

Customer Advantage:
Field life is increased, maintenance can be planned, spare part sourcing is easy, and system running costs are kept low.



>> Fluid connectors

Situation:
The majority of fluid system failures resulting in expensive and unplanned repairs originate from leaking connectors or failed hoses.

Solution:
Parker offers the world’s largest selection of approved and tested hose, fittings and couplings. With pressure ratings up to 58,000 psi (4,000 bar) and bore sizes up to 6" (152 mm), Parker has the right fluid connector product for your application.

Customer Advantage:
Reliable, leak-free connections are essential to minimize service and protect the environment.



>> Accumulators

Situation:
When hydraulic system stability or reserve power for peak requirements or emergency shutdowns are required, hydraulic accumulators are essential.

Solution:
Parker offers a complete range of CE-approved piston, bladder, and diaphragm accumulators that allow high pressure dynamic control of the system.

Customer Advantage:
Using Parker accumulators results in reduced system costs through greater system efficiency, longer system life, less noise, and the need for smaller pumps.



>> DF Plus proportional valves

Situation:
Traditional torque motor style servovalves are commonly used to position governor controls in hydropower turbine speed regulation. Servovalves are especially sensitive to contamination and can experience uncontrolled failure modes.

Solution:
Parker DF Plus high dynamic proportional valves are ideally suited for governor controls. Matching high performance with robust operation and controlled failsafe conditions make the DF Plus the best choice for controls. These valves are also available in high flow configurations with an optional external pressure supply port.

Customer Advantage:
Provides precise control of wicket gates to optimize turbine speed control using a high performance proportional valve that is both dirt tolerant and has a defined failsafe mode upon loss of power.