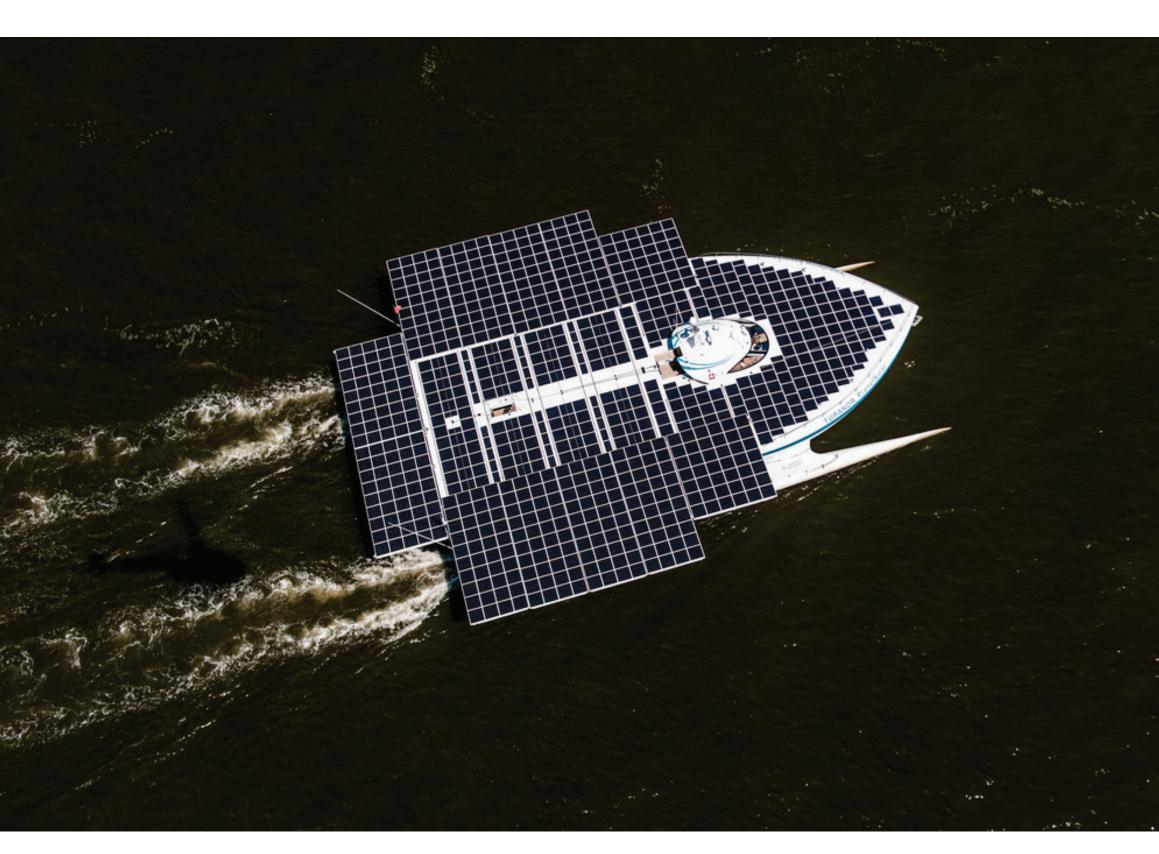
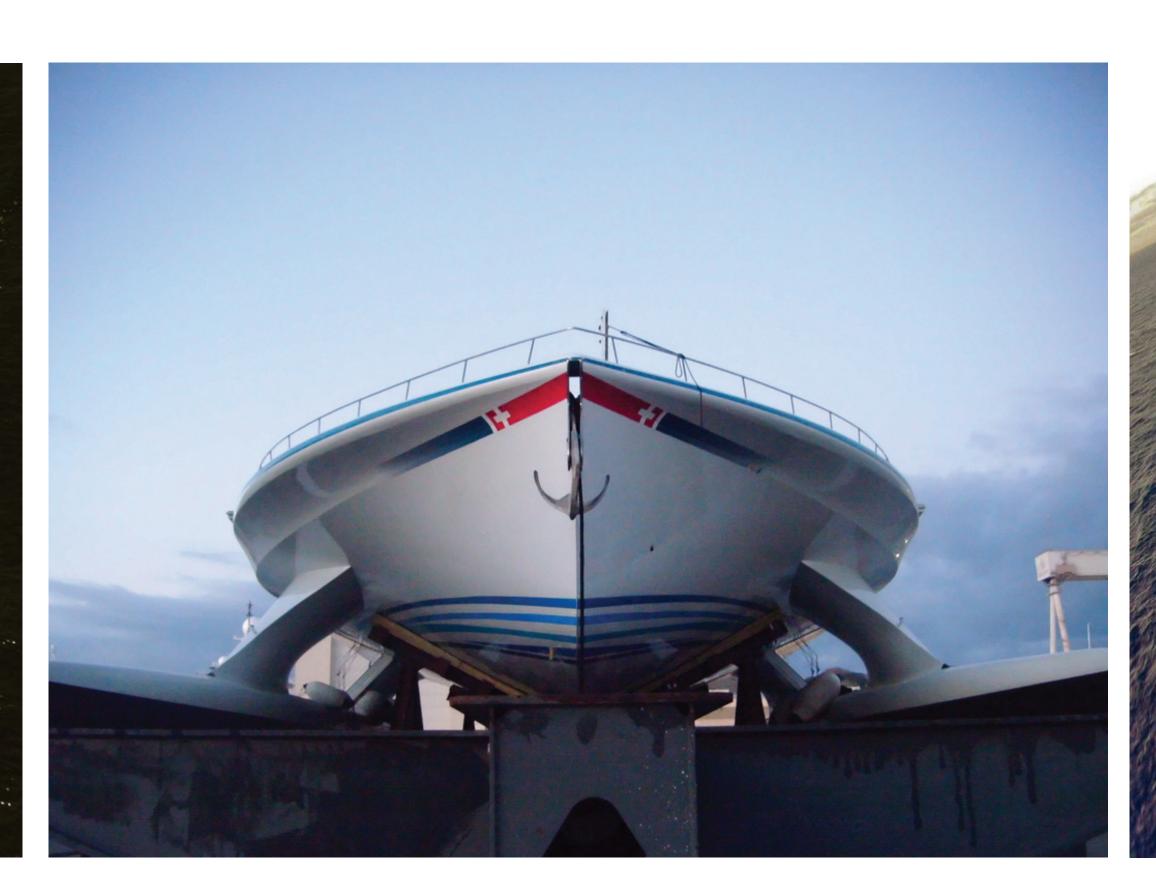
## Electric Boats & Submarines













Photos courtesy of PlanetSolar.org

## Boats

The boating industry has been using renewable energy since 4000 BC. The Phoenicians and Egyptians were the first to use sailboats. For many thousands of years sails and paddles where the only mechanisms for powering a boat. In the mid 19th century the internal combustion engine (ICE), the electric motor and the steam engine were becoming viable and practical technologies. Much like automobiles there were steam powered, ICE, and electric boats being developed. In 1839, a Russian by the name of Moritz von Jacobi, created the first electric boat.

Electric boats were rather popular for about 30 years. For a time, steam and electric were the only forms of power for automated boat travel. The river Thames in England at one point had several charging stations along its shores to charge various electric boats. The advantages of the electric boat were recognized throughout history and the pursuit of this technology has never been abandoned. Electric motors are quiet and don't require oxygen to function. Throughout the years the technology has continues to be pursued and developed. A large contributing factor to the continued development of electric propulsion for aquatic vehicles is the submarine, a device that was reliant on electric power to be possible for many years.

Boats offer a great platform for electric power. They can be large and therefore house large batteries. Their size also lends them well to solar technology, as they have a large surface to place many panels on. There are some amazing advantages to solar powered boats. Namely, they can outlast any gas-powered boat, as they merely need the sun to charge. If a gas-powered boat runs out of gas in the middle of the ocean, there is no way to refuel.

In 2012 Raphael Domjan circumnavigated the globe in a boat propelled only by solar power. The trip took 585 days and was achieved by the "Tûranor", the world's largest solar powered boat. It cost \$15 million to build. The boat just recently crossed the Atlantic and has been touring major cities along the east coast of the United States. The potential of watercraft powered by solar energy is limitless.

A popular form of electric boats today is hot tub boats. They are exactly what they sound like; a small boat containing a hot tub. Their performance is impressive allowing for 10 hour cruises. A silent, emission free electric motor is the perfect form of propulsion for these boats as they are clearly meant for relaxation. A loud, sputtering gas motor would be less than ideal.

## Submarines

Since the late 16th century submarines were conceived of and imagined. There were several attempts to develop them. In 1900 the US Navy bought their first submarine. John Philip Holland developed it. He developed a system that could switch between a diesel-powered engine for surface travel and an electric engine when submerged.

Such hybrid submarines still exist today and, like when they were first developed, they must surface or use a snorkel to provide oxygen to the diesel engines. The diesel engines can run the ship's propellers for surface travel or they can run generators that recharge a large supply of batteries. Because of it's inherent lack of emissions and because it does not require oxygen to function, electric power for underwater travel is what first made the submarine possible. The introduction of this technology changed naval warfare forever.

The US Navy today uses nuclear reactors to power their submarines. The reactor generates heat to power a steam turbine. The turbine directly fuels the propellers and the electrical generators. An emergency battery can maintain life support systems and propel the submerged ship should the nuclear reactor fail.

Civilian submarines, for obvious security reasons, are not powered by a nuclear reactor. Non-military submarines are known as Deep Submergence Vehicles (DSV). Various naval forces throughout the world have a similar class of submarine known as Deep Submergence Rescue Vehicles (DSRV). In both cases these submarines are usually propelled entirely by electric battery-power and rely on a support vessel to carry them to and from the areas in which they will be diving. The uses of DSVs include scientific exploration, archeology, tourism and facility maintenance.

The military also uses midget submarines similar to DSVs for delivering small teams of soldiers stealthily into enemy territory. They are similar in that that are powered solely by an electric motor. Such submarines can also be used for harbor penetration in large-scale naval warfare. The electric motors on such submarines makes them incredibly quiet and the technology is being developed further to potentially make sonar ineffective at locating them. Similar submarines have been utilized for drug smuggling.

