

Solar Boats

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“Thomic R., Roland R. and Herbert J. traveled more than 660 km along the river Elbe from Dresden to Hamburg in August 2003 with an 8-seat solar boat.”

“Heinz H. has already traveled along the Nile in a solar boat from Alexandria to Aswan twice.”

These examples show that solar boats are on their way. In Germany you can even rent solar boats in Berlin-Köpenick (www.solarwaterwold.de). Solar boats are electrically powered boats equipped with photovoltaic cells on their roofs. When the sun shines these boats are powered completely by photovoltaic current. Photovoltaic energy can be stored in an onboard storage battery, so that the boats can return safely even in bad weather or at night.

Water eco-tourism without ecological damages

Conventional boats equipped with a combustion engine cause air pollution and water pollution. They distribute exhaust emissions as well as fuel and lubricant residues. In addition, there is considerable noise exposure. Unlike conventional boats, solar boats are zero-emission boats that don't pollute our lakes and rivers. Furthermore neither people nor animals are bothered by noise since electric motors are intrinsically quiet. For these reasons, solar boats are particularly suitable for water tourism, recreational activities and for use in nature reserves.

Examples: Selected solar boats



Small boat (catamaran), length 7,5 m, up to 8 passengers, up to 12 km/h, power of electric drive between 1 and 2 kW, 24 Volt, storage capacity approx. 360 Ah, range without sun approx. 60 to 80 km, unlimited range in solar mode at approx. 5 to 6 km/h.



Saloon ship „Chassali Solar“, length 9,5 m, 23 passengers, approx. 12 km/h, power of electric drive between 3 and 5 kW, 750 W solar power on the roof of the cabin, 108 Volt, storage capacity 180 Ah, range without sun approx. 60 to 80 km, unlimited range in solar mode at approx. 4 to 5 km/h.



Passenger ships, carry up to 125 passengers, 10 km/h, operation time 10 h, power of electric drive 10-40 kW, range without sun approx. 60 to 100 km. unlimited range in solar mode at approx. 5 km/h.

The picture shows a 66-passenger ship operated on the Maschsee, Hannover, Germany.

Technology of solar boats

Electric drive systems: Electric drives are extremely efficient as well as being completely reliable. Electric drives were used for shipbuilding even before combustion engines had been developed. At the Königsee, in Germany, electric ships have been reliably used for commercial tours for over 100 years. Electric drives are perfectly suitable for boats as they can cope with the typical battery weights of between 300 and 600 kg much better than road vehicles. Moreover, boats move at low speed so the drive power does not need to be very high. For example, a drive power of 3 to 5 kW is sufficient for a boat with a length of 10m. With an optimized hull construction and water propeller it can reach a top speed of between 12 and 15 km/h. With better boats and stronger motors even higher top speeds are obtainable.

Solar energy supply: An on-board solar power plant charges the storage battery or is used for direct energy supply of the motor when the sun is shining. For small solar boats with a length between 4 and 6 m an installed solar power between 200 and 500 Watt is sufficient. Solar catamarans with a length of 7.5 m for 8 persons, e.g. the catamarans at solar boat rental www.solarwaterworld.de in Berlin-Köpenick, are equipped with 600 Watt photovoltaic cells. Bigger ships for 60 to 120 passengers do not require more than 3 to 10 kW of solar power. Generally, the photovoltaic cells can be placed on the roof of the boat so that they protect the passengers from the sun at the same time. If additional power is needed, the on-board storage battery can be charged by a solar power plant located at the berth of the boat.

Energy efficiency: The energy efficiency of solar boats is very high for three reasons. First, the efficiency factor of **electric drives** is 80 to 90 %, which is much higher than the efficiency factor of combustion engines. Furthermore, the **on-board solar generator** provides a high level of transparency in energy supply, which counters a potential energy waste. Moreover, an **optimized hull** reduces train resistance and energy consumption.

Cost effectiveness of solar boats

A comparison of solar boats with conventional boats shows that solar boats do not require any costs for fuel and lubricants. Moreover, maintenance costs for the electric drive and the storage battery are low. There are, however, additional costs for the solar power system and the storage battery. In general, high quality three phase drives are more expensive than diesel engines. However, three phase drives are also very durable. Electric drives hardly ever have to be maintained. Only the storage batteries have to be changed after 5 to 10 years or after 500 to 1000 charges (typical data for high quality lead-gel batteries).

Building new boats: If a completely new boat is built, the electric drive is hardly more expensive than a diesel engine, but there are additional costs for the photovoltaic cells. However, fuel savings must be subtracted. In sunny countries there can be considerable cost advantages for solar boats. These advantages are even more obvious if fuel supply is difficult and expensive, such as when the diesel price is above 0.60 US-\$/Liter.

Renovating existing boats: In the majority of cases it makes sense to refit a boat with an electric drive, especially if the old combustion engine has to be replaced. If there are budget restrictions, it is possible to install the electric drive first without the solar power system. The boat can be upgraded later by the installation of photovoltaic cells. It is also possible to initially install a few photovoltaic cells and to extend the solar power capabilities later.

In future there will be distinct cost advantages for solar boats since the costs of photovoltaic cells will further decline and diesel prices will increase considerably.

Builders and dealers of solar boats

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