

Renaissance of ship mills

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A look back to the past is sometimes worthwhile for energy sources of the future. In medieval times there were hundreds of ship mills on the banks of our rivers which utilised the power of flowing water. This is a potential that lies almost completely idle today, although with modern turbines or paddle wheels a high degree of efficiency can be achieved and although the water wheels are no longer suitable for milling cereals, they could be suitable for an environmentally-friendly generation of electricity. Scientists from the Fraunhofer Institute for Factory Operation and Automation (IFF) in Magdeburg, together with a broad network of enterprises, now want to examine which materials, operating conditions and concepts are most suitable for small stream power stations.

A blue-painted catamaran has moored at the Magdeburg Science Port. A bottle of sparkling wine is sacrificed, and now the "VECTOR Experimental Vehicle" can officially start its work. A small steel frame is constructed over a recess that is several metres wide where the first test turbine hangs in the middle section of the vessel. "In the next few weeks we will collect statistical data series with the turbine, which is powered by an ultra-light propeller with a diameter of about two metres", reports Prof. Gerhard Müller, IFF deputy director. It not only involves performance data which primarily depend on fluid velocity or the propeller's surface design. "We also need experiences pertaining to how the propeller, which is made of extremely lightly foamed aluminium that is protected by a shell of glass fibre reinforced plastic, behaves in practical operation", reports Prof. Müller. Because the new material guarantees favourable performance values and low wear on bearings due to its low weight, yet there is not enough experience with regard to the robustness, such as when flotsam knocks against the propeller.

The research vehicle is anchored by means of anchor and rope on the Elbe River in a section with relatively high flow velocity, but nevertheless sufficient water depth. Afterwards, presumably as of the beginning of summer, the VECTOR will then be modified to a folding paddle wheel. At first glance the "Energy Floater" almost looks like the roller wheels on the stern of historic Mississippi steamers – but is also a product of the most modern materials science and fluid mechanics. For instance, particularly highly stressed components made of carbon composites shall be used here. The respective lightweight blades on top fold up when turning in order to reduce the wheel's diameter by four metres during operation. Another turbine system will follow a few months later at the VECTOR test site.

A total of 19 companies from Saxony-Anhalt, but also from other federal states as well as three research institutes are involved in the network entitled "Fluss-Strom-Forschung 2012", for which the Ministry of Science and Economic Affairs in Magdeburg has granted a subsidy of about one million euros. The return to ship mill technology is by no means at the very beginning, because in the meantime several of the firms involved in the network have built prototypes which are already being utilised. For instance, the "River Rider" from the firm Bänecke Industrieservice & Wasserkraft in Königshütte is already providing electricity in the outlet area of the Wendefurth Dam in the Harz region; a segmented ring waterwheel from the firm Hesseland Manufaktur (Bad Bibra) has even been in operation for six years in the Bode River in the eastern Harz region – but as a stationary plant.

"The river flow force is only usable in very small sections, but in return the outputs are available nearly all year round and completely emission-free", says Prof. Müller. Even if 20 or 40 kilowatts of power are much less than the hydroelectric power stations common today provide on smaller rivers, there are lower investment costs, and above all there is the environmentally-friendly renunciation of river flood barriers on the plus side. "In principle, all bodies of water which have a flow velocity of more than 1.5 metres per second can be utilised, whereby the output exponentially increases the faster the water flows", explains the scientist.

Moreover, the network's objective is not only to make the stream power stations as cost-effective flexibly applicable as possible through the development of standardised components and module capability, but the approval barriers shall also remain low. At the same time, the utilisation of modern era ship mills does not have to remain limited to local rivers. The potential would be practically inexhaustible as a result.

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