

COMPANY

Smart Hydro Power GmbH
smart-hydro.de

LOCATION

Feldafing, Germany

SOFTWARE

Autodesk® Product Design Suite Ultimate
Autodesk® Simulation CFD

Running electricity for developing countries

With the help of Autodesk software, Smart Hydro Power has developed micro-hydro power plants for remote regions

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—Karl Kolmsee
CEO of Smart Hydro Power



The turbine just before its installation in Marisol. © Smart Hydro Power

Currently, about 1.2 billion people in the world live without electricity – and this despite the fact that a huge potential source of energy is located somewhere in the neighborhood; like the Amazon and the Ganges rivers, for example. This was what brought Karl Reinhard Kolmsee on a visit to Peru a few years ago, and consequently gave him the idea for his start-up company. He realized that there was a need for the rapid development of cheaper and more practical products – which was non-existent in the marketplace at the time – that could bring clean electricity to remote parts of the world as effortlessly as possible. The birth of an innovation: Smart Hydro Power develops micro-hydro power plants, which uses the kinetic energy from water to produce electrical energy. The plants are constructed in such a way that they don't require any maintenance and can be operated by laymen. Kolmsee's idea may seem a bit daring or even risky, because ultimately, he's found a way for the educated farmer to venture onto three types of uncharted territories all at the same time: a new business, a new product and a new market. The last few years, however, have shown that his concept of decentralized energy supply, is entirely on the right track. After the first system was installed in Peru in 2011, Smart Hydro Power turbines are also found in

other sites in South America, for example, in Salvajina in the Cauca River in Peru, in Indonesia and now also in German waters. And another turbine is planned to be installed in October 2014, in Verdun (Brazil), in the Amazon.

Clean electricity for remote areas

The micro-hydro power plant developed by Karl Kolmsee and his team, is particularly attractive to those regions that are located far from populated centers and extended power networks. To avoid the costly development of these networks, so-called stand-alone systems can be built for the power supply in remote areas. Nowadays, diesel generators are often used for this purpose, but apart from the acquisition costs, additional expenses for diesel fuel, are incurred. Not to mention the fact that these generators are not at all environmentally friendly: they use fossil fuels, they produce climate-damaging carbon dioxide and are primarily intended for temporary use. Smart Hydro Power, on the other hand, offers both an economical and ecological alternative, thanks to its gearless turbine. The micro-hydro power plant uses the power derived from the natural flow of water to produce electricity. This means that no hydroelectric dams or slopes are

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necessary. The flow of the water is therefore not affected and there are no further investments needed for the development of infrastructures. In addition, the environment is not polluted with carbon dioxide emissions.

Within the micro-hydro power plant of Smart Hydro Power, is a cube measuring 1,80 x 1,80 x 1,80m. The turbine weighs a total of 360 kg and can be carried by eight people. Which is exactly how the first Smart Hydro Power plant got transported to the Huayabamba river in Peru, so that the remote village of Marisol (consisting of 28 families) could be provided with clean electricity. The turbine consists of a three-bladed rotor, a five-kilowatt generator as well as a float and a three-part diffuser. For this reason, robust yet affordable materials, such as high density polyethylene (HDPE), aluminum and stainless steel, were used to build the turbine.

A speedy introduction onto the market

Thanks to skilled engineers and the support of necessary software, Autodesk Clean Tech Partner, Smart Hydro Power, was able to develop and present their first prototype within only one and a half years. This is where Autodesk's 3D design software, Inventor, played an invaluable role. By having access to it, this start-up company was able to shorten the time it took for the micro-hydro power plant to be production-ready, immensely. Autodesk® Inventor® provides user-friendly tools for 3D mechanical design, product simulation and documentation. The creation of so-called digital prototypes is a huge help when it comes to the design and validation of the products before the manufacturing process starts. Due to the possibility of viewing a realistic model of the plant's properties and the interaction of various components, one is able to optimize and verify all the details, before construction of the actual plant commences. As a result, design flaws can be avoided, which would have otherwise only been seen after actual construction was completed. "For us, as a small start-up company, it has been incredibly beneficial to have access to such state-of-the-art software," explains Karl Kolmsee. "In fact,

it would have been impossible to enter into the market in such a short period of time, without it. With the use of CAD designs we were, for example, able to test and determine the force ratios between different materials, so that the various joints could be correctly implemented."

A wealth of experience

After a short development phase it was time for Smart Hydro Power to test its turbine under real conditions. For this purpose, this start-up company, based at Lake Starnberg in the past, chose to take the difficult route: After completion of the first plant in 2011, Kolmsee's team tested the turbine in the unknown waters of a Peruvian river. And so the designers tried and tested, among other things, how the pressure on the anchor would change, when the water level rises by several meters. As a result they came to the conclusion that in such a case, the chains would have to be twice as strong, otherwise the turbine would be washed away. "During our test phase, we had countless experiences – unfortunately several negative ones too – in many rivers of the world, that we, as well as the people of Marisol, unfortunately, have had to be pay dearly for," said Kolmsee. "However, I am convinced that these practical experiences are crucial so that one can get to know your product and all its intricacies properly. We had to see with our own eyes and tangibly experience what pressures our turbine would be able to handle. And now – along with a bigger team – we're ready to take the next step, and with state-of-the-art software we're able to avoid making the same mistakes in the future."

Saving time, money and nerves

Kolmsee's team of eight, is about to be joined by another 'member' for additional support. Based on practical experience, this member will come in the form of Autodesk® Simulation® CFD software. The software provides tools for fast, accurate and flexible fluid flow and forces analysis, showing how the product will behave under real conditions. Consequently, before completion, the product's performance can be predicted, structures can be optimized and product behavior can be examined, so that the costs for expensive physical prototypes can be saved. With the use of Autodesk Simulation CFD, Karl Kolmsee's team is able to run a flow analysis and examine –among other things – how the water masses move in and around the turbine and how it interacts with certain materials. "With the help of Autodesk Simulation CFD, we can create in-house high-quality visualizations, which speeds up both the approval process as well as the planning of the installation," commented a very pleased Kolmsee. The unsuccessful installation of a turbine in a developing country, costs at least 25,000 Euros. If Smart Hydro Power can discover and correct errors – using the Autodesk software

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– before installation, these costs can be avoided. "With regards to simulations, we are aspiring to reach a standard, which enables us to complete installations quicker and more efficiently, so that we do not only save time and money, but our nerves too. This is something that the families in Marisol will benefit from too, seeing as we can then optimize our turbine to work in their remote location." The current plant in that location is inactive and needs to be reinstalled.

The benefits that the Autodesk solutions carry for Kolmsee and his plans, are incredible. And ultimately, after the first turbines have been installed successfully, this start-up wants to conquer the German market too. In fact, Smart Hydro Power has already found its first German customer. An owner of a castle, for example, has chosen a Smart Hydro Power turbine, in order to be able to generate his own clean electricity. The effort that will be required from the owner, will be very low, seeing as the turbine will be secured in the neighboring river, and the electronic system of the micro-hydro power plant will be installed in the owner's basement and will function intuitively, similar to a photovoltaic system. Additionally, the system offers its users an interesting usage model, seeing as the amount of electricity that exceeds the individual's usage, is fed into the public grid. According to the "Granting Priority to Renewable Energy Act" German network providers are obliged to purchase electricity from renewable energy sources. As a result, the user not only saves the cost of electricity for their own consumption, but also receives compensation for the delivery of clean electricity.

For more information

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Oblique view of turbine. © Smart Hydro Power