

USSynthetic®

Power in the Current

Local, Sustainable, Clean Energy



Village of Ringmo, Nepal



The Himalayan Mountains

tower over some of the most rugged terrain and harshest climate conditions on the planet. Melting snows from Mount Everest, K2, and hundreds of other snow-capped peaks carve out more than 6,000 rivers in Nepal, China, Bhutan, India and Pakistan. The vast majority of the people living along these remote rivers and valleys survive in under-developed living conditions in geographically isolated and difficult-to-access areas. In more ways than one, the rural people of the Himalayas exist off the grid.

The homes and schools in these tiny villages do not have consistent electricity. And, only a few homes have small solar panels that provide hardly enough power for one or two lights. Like most developing countries, basic services—like heat and electricity—are scarce and inconsistent. Small stoves, burning animal dung or scarce wood resources, provide all of the heat and cooking for villagers. Unfortunately, connecting these small communities to existing power grids and centralized power is cost prohibitive.

**“Life isn’t easy
in a tiny Himalayan
community that doesn’t
have reliable power.”**

— Lynn Tessier, engineering advisor, Advantage Products, Inc.

“Small rural schools, for example, are limited in their ability to educate students because of the lack of consistent electricity. The schools in these remote villages typically only provide

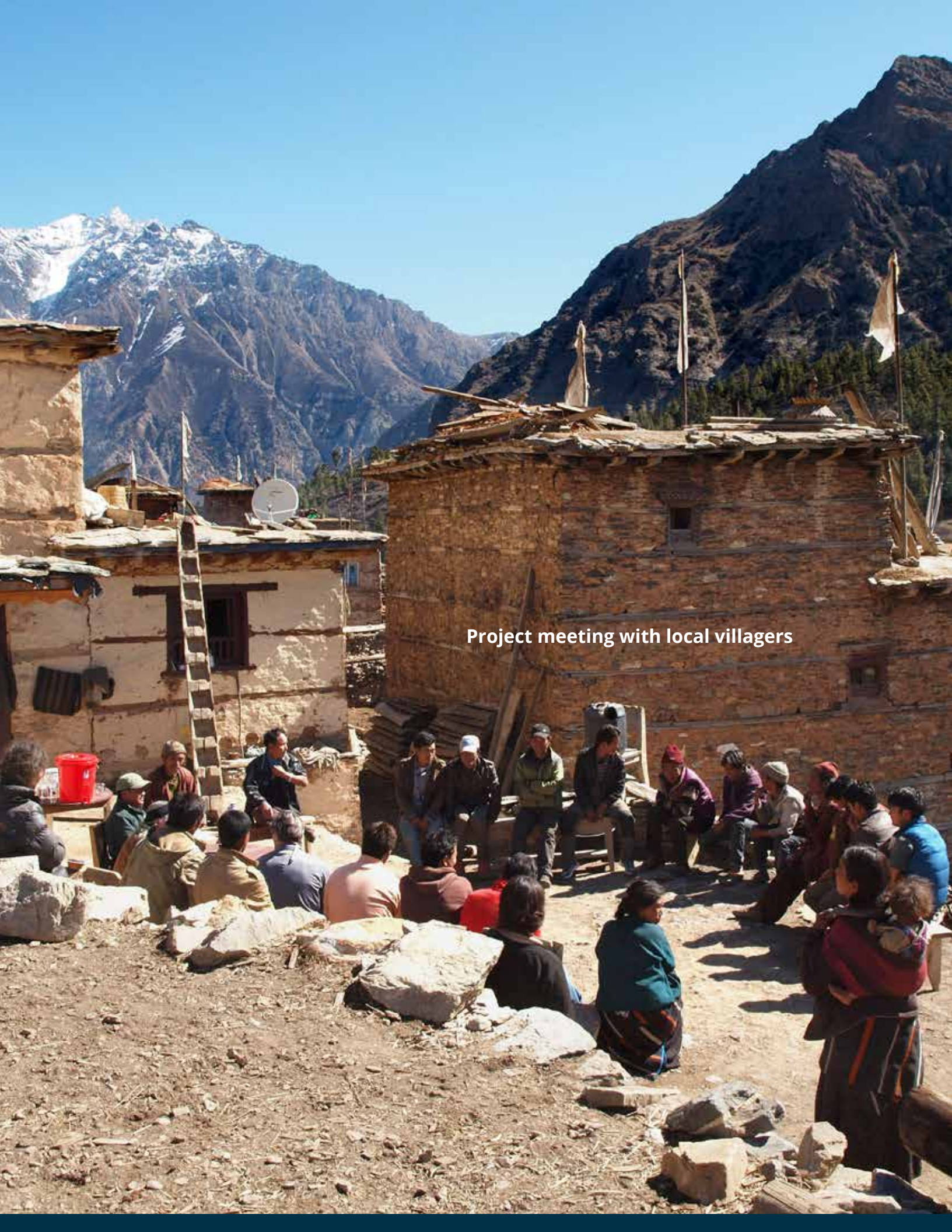
education up to Grade 7 and beyond that the children must go to a bigger city, like Katmandu, for additional schooling. And, as is often the case, once the children experience the world at these bigger schools, they don’t return to the village to help improve living conditions or educate the next generation,” says Tessier.

Project Background

To combat the scarcity of reliable power, US Synthetic, Advantage Products, Inc., New Energy Corporation, World Wildlife Fund (WWF), and Himalaya Currents, Inc. have teamed up to develop a local, sustainable, clean energy system that can provide Himalayan villages with continuous power. The clean energy project relies on an in-stream hydrokinetic power generation system that is submerged in a flume in a nearby river. The 5 kW EnCurrent power generation system converts kinetic energy in the river’s water current into electrical power. The pollution-free electricity is then transmitted to the village.

As a humanitarian project, Advantage Products, Inc. is donating the EnCurrent power generation system developed by New Energy Corp. New Energy Corp. is providing project support and flume and weir design. US Synthetic is donating an environmentally friendly, grease-free Polycrystalline Diamond (PCD) bearing.

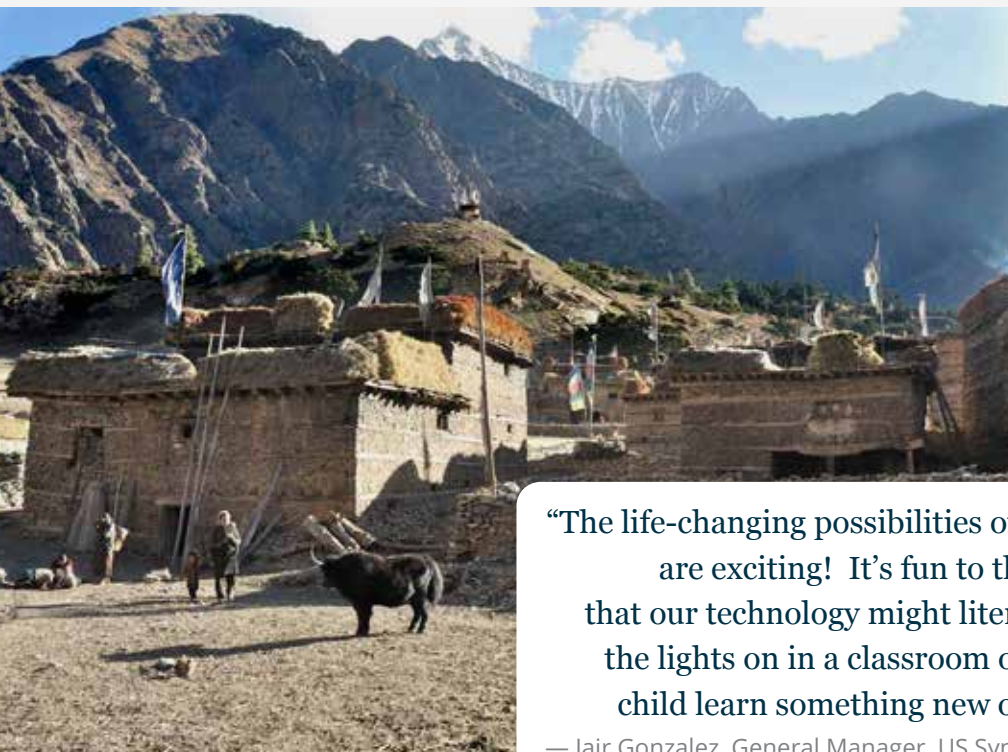




Project meeting with local villagers

Himalaya Currents, Inc. is providing funding to transport and install the equipment. WWF is providing project coordination with local government and communities, permit applications for the project, and travel coordination for the project team. Local community members from the village are also helping out with the project—gathering rock and constructing wire mesh gabions to form the flume and weir in the river and installing the EnCurrent generator.

As snow melts year round in the high Himalayas and flows down into the expansive river system, villagers have access to a significant, consistent potential energy. Hydroelectric power generation is more reliable and, in many locations, more easily accessed than other renewable energy sources like wind or solar. The rivers in the Himalayas offer one of the largest, untapped green energy power sources in the world. The EnCurrent generator is ideally suited to capture potential energy in these remote areas.



“The life-changing possibilities of this project are exciting! It’s fun to think that our technology might literally keep the lights on in a classroom or help a child learn something new online.”

— Jair Gonzalez, General Manager, US Synthetic Bearings

Geographically, most remote villages in the region are built in deep mountain valleys that experience limited sunlight. The shadows, made by these towering mountains, limit the efficiency and effectiveness of solar power (especially when panels are installed within or near the village). Also, installing solar panels on mountaintops or ridgelines where sunlight is more abundant, presents new problems in construction, system maintenance, and energy transmission.

Like solar power, wind power would present logistical problems—requiring mountaintop or ridgeline construction that would decentralize power generation from power consumption. In both cases, providing 24-hour power requires a much larger system and an equally large

battery storage bank. Batteries also present a significant environmental hazard, are expensive, offer limited life, and present significant transportation challenges in remote areas. This first system will be installed at the remote

mountain village of Ringmo. Ringmo is located on the shores of Lake Phoksundo in the Shey Phoksundo National Park, high in the Dolpa region in Nepal. A suitable location along the river was chosen in April 2013. Ringmo was very enthusiastic about the possibility of having electricity for their village.

Harnessing the Constant Flow of Energy

The clean energy project utilizes the flow of the river to keep the hydrokinetic turbine rotors constantly spinning—supplying power 24-hours a day, 7 days a week. The generator’s simple design provides clean and continuous power with an extremely small environmental footprint. The industry’s first above water direct drive generator coupled with the water-lubricated, long-lasting PCD bearings used in the underwater turbine rotor eliminates environmental contaminants like grease or oil.



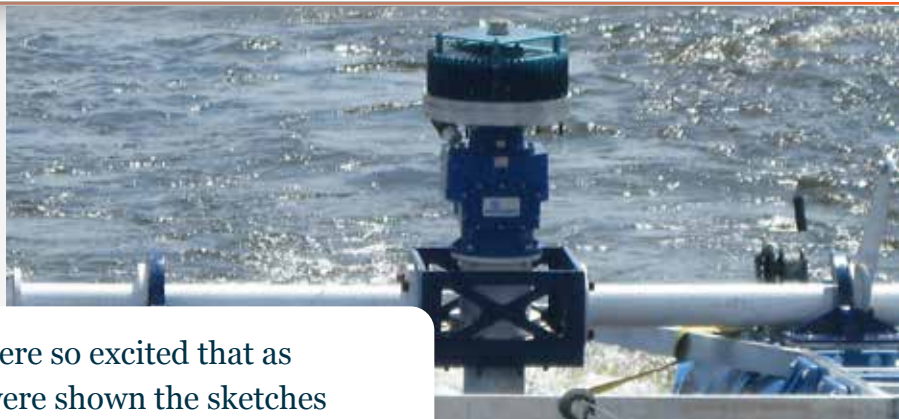
Selecting a suitable project location



Overcoming Challenging Conditions

"A significant problem with this project is the remoteness of the location. The first location for installation is a three-day walk from the nearest airstrip and a six-day walk from the nearest road. Getting equipment in and out is difficult. And, doing it by helicopter is incredibly expensive," explains Clayton Bear, president, New Energy Corporation. "Because we will have to haul the equipment in by porter or pony caravans, we quickly recognized the need to make our system as simple and light weight as possible. So, we scrapped the gearbox and focused on a simple above water direct drive hydrokinetic generator using a submerged water lubricated PCD bearing for the turbine rotor. This design breaks the system down into small enough components that can be carried by porters and assembled on site with hand tools."

The biggest challenge facing the hydrokinetic system is the underwater abrasion and wear on the turbine's rotor. As water moves downstream in Himalayan rivers, it picks up more and more debris and sediment—turning the water brown from all of the mud, gravel and sand churning up from the river bottom. The melting ice from Himalayan glaciers is laden with abrasive sediment. These abrasive particles can quickly destroy standard sealed bearings and wear components on traditional turbine rotors; however, New Energy designed the project's underwater turbine rotor to work with PCD bearings from US Synthetic. PCD



"Villagers were so excited that as soon as they were shown the sketches of the gabion and weir design, they wanted to go down to the river and begin construction immediately,"

— Lynn Tessier, engineering advisor, Advantage Products, Inc.

bearings are ideally suited for operation in harsh process fluid environments where abrasive particles can cause accelerated wear. US Synthetic diamond bearings

are the perfect match for the harshest, most demanding conditions and environments.

Once completed, the project will generate 24-hour power, easily handling fluctuating energy loads without losing a lot of energy in the transmission process. PCD bearings will make the generator virtually maintenance free. And, the small, environmentally friendly hydrokinetic system will provide power for needed light and satellite connection to the outside world to an isolated, ecologically sensitive area of the world. This first installation builds on the concept of localized power and eliminates environmentally destructive

energy replacements. It utilizes clean energy technology and resources without contaminating the environment in the process.

Similar to Nepal, there are tens of thousands of locations around the globe that do not have access to continuous, reliable, clean energy that could benefit immediately from this type of innovative system.



"In our initial testing, we threw sand and gravel into the PCD bearing to see how it would perform.

It seemed to like it—just ground up the particles with no problem. In some ways, it actually worked better."

— Clayton Bear, president, New Energy Corp.

