

A Holistic Approach to Community I

by Alex Zahnd

More than 99% of the world's 2 billion people now without access to electricity live in developing countries, and four out of five live in rural areas. Today, 100 years after Edison's seemingly forward-looking statement – "We will make electricity so cheap that only the rich will burn candles" – the promise of cheap, abundant electricity seems to hold true only for industrialized countries. Who anticipated that today, more people have no light in their homes than the entire world's population in Edison's time?

There is a clear relationship between poverty and access to electricity. The more remote the community, the greater its poverty level, and the higher the costs for electrification and other development projects. Approximately 85% of Nepal's 26.5 million people live in the rural areas, and about half of these live in such remote areas that neither a road nor the national electricity grid will reach them for decades to come.

Families in the remote areas use precious trees for firewood for cooking, room heating and light. These activities, especially the indoor cooking on open fireplaces, have a direct chronic impact on people's health and are a major factor in the extremely low life expectancy for women and the high death rate of children under five. In some places, families do not even name children under five, since child mortality is so high. Deforestation is alarming in these regions. The once picturesque, biodiverse forests and valleys are being stripped of their resources in unsustainable ways. Drinking water is taken from dirty streams, as there are no latrines. Nepal has no fossil fuel resources, but plenty of renewable energy resources such as water, sun and wind.

Over the past eight years of working with remote villages in Nepal's high country, four issues have again and again been identified by the local people as their most urgent needs for their holistic and sustainable development: light, smokeless stoves, clean drinking

Bringing Water, Sanitation, Heat and Light to Rural Villages in Nepal

This Nepali woman has lived her whole life without indoor lighting – until now.

water, and latrines. Our research has found that this "family of four" increases each other's benefits when developed together.

In remote and poverty-stricken mountain villages in Humla in northwestern Nepal, a program designed and led by Kathmandu University, and sponsored by the ISIS Foundation, is trying out new ways to utilize local renewable energy resources in more affordable, sustainable and appropriate ways. In project villages, three 1-watt white LED lights are installed in each household, powered by a commonly owned, centrally located, self-tracking solar PV system with underground wiring. The LED lights and the self-tracking frame for the four solar modules have been developed and manufactured in Nepal, as part of the University's research program. Further, an efficient smokeless metal cooking and heating stove has been designed and developed with these villagers' needs in mind. The stoves consume half the firewood of an open fire, and offer a smoke free, safe way to cook and heat the home. In keeping with the desire to address the community's needs in a holistic way, a pit latrine for each family and a commonly owned village drinking water system are also implemented in close partnership with the community. Project planning, installation, and local training for operation and maintenance are all part of the excitement.

It is crucial to understand that the local community is at the center of any holistic development project and that the technologies applied are to serve and support their struggle for a better life. Therefore, any project has to be based on a thorough understanding of the local context and culture, and must include an understanding of the "invisible" causes of poverty, and the impact



on the community of decades of deprivation. This approach demands time, compassion and dedication. These more "human" aspects of a development project are crucial factors that need to go alongside the technical aspects. In this way the people are recognized from the beginning as equal partners and not as receivers of imposed ideas. This time-intensive, often frustrating process is central to a holistic development project.

The Situation in Nepal

Every home in the remote, high-altitude villages in Humla uses wood in indoor open fireplaces for cooking, heating and light. Women and children are most likely to suffer from the enormous health effects of this indoor air pollution. The deforestation results in a scarcity of local firewood, and forces villagers (mainly the women and children) to spend up to seven hours every other day gathering fuel wood. Thus it is understandable that women place a high value on improved energy services, because they are not only the primary users of the household energy, but are also exposed to the greatest health risks and work loads.

Lack of electricity and heavy reliance on traditional biomass are hallmarks of poverty in developing countries. This is generally

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true for Nepal, and in particular for the mountain communities in Humla. No light and no stove in the home also lead to generally poor hygienic conditions for families. It is also common to have no latrine and no access to clean drinking water. But through ongoing awareness-training with educational tools such as simple brochures, colorful posters designed according to the peoples' context, and songs in the local language, people understand quickly that light in their homes, a smokeless metal stove, pit latrines and clean drinking water are not just desirable, but necessary for the healthy development of their families and community.

Nepal has plenty of renewable energy resources, in particular water and sun energy. As of 2003, only 533 MW have been developed nationwide (nearly all hydropower), which represents less than 2% of the technically and economically feasible potential. The sun's plentiful and free energy provides an excellent local renewable energy resource, with an average solar insolation of 5.5 - 6 kWh/m² per day.

Lighting is often the first use of electricity in a developing country, and people are often willing to invest in home or village electrification once they understand the potential health improvements, the possibility for improved educational opportunities for their children, and the possible financial savings for their families. Solar PV technology is increasingly viewed as an important option, especially by governments in developing countries with a limited and poor national grid network. The technology has proven to be robust in developed countries under field conditions and is considered mature. Installation and maintenance are simple for solar home systems, if installations are done professionally, the systems used according to their design, and maintenance is done faithfully.

In order to design a solar village PV system that will provide the expected energy service in reliable ways, over a typical life span of 20 years, one needs not only technical information about the solar insolation and irradiation for the location, but also detailed information on where and how the system will be installed and maintained. The

participation of all stakeholders in all project steps is crucial for ownership. Culturally appropriate training, hand-over and operation periods have to be incorporated into the process as well.

In order to design projects with these considerations in mind, Kathmandu University and the ISIS Foundation – in partnership with the local communities in the high-altitude mountain areas of Humla – have built a high altitude research station. Here, all the technologies that will be used in the villages are thoroughly tested as part of research projects for students and faculty. The smokeless metal stove, solar cookers, a University-designed solar water heater for high altitudes, a pit latrine, and solar PV modules with self-tracking frames have been tested over an extended period of time at the research station.

Taking it to Villages

In June 2003, Kathmandu University launched a program to help bring holistic development to poor villages in Nepal. The two poorest villages in the area near the university's high-altitude research station were chosen to become pilot projects for holistic village development. In each home a smokeless metal stove, a pit latrine and lights are installed. Each home will have access to pure drinking water through a village water system that taps into a natural spring. One of the two villages, Chauganphaya, now has a centrally located 300-watt solar PV system for its lighting system for 63 homes, and clean water and a pit latrine (previously there was none for the 365 residents, which contributed to a variety of diseases). In the second village, Kholasi, a 1-kilowatt pico hydropower plant powers lighting for its 60 homes. Water and sanitation will be installed once political tensions ease off. As Kholasi's 180 LED lights are only consuming a maximum of 250 watts, it also has a warm water heating system. Both villages have efficient metal stoves in all homes.

Since the mid-1990s the Nepal government – financially supported by various international nongovernmental organizations and donor agencies – has run subsidized solar programs. This caused a mush-

rooming of new solar PV companies in Kathmandu. Today, the appropriateness and effectiveness of solar PV electrification is questioned in many rural places, as solar home systems in Nepal have often not performed as expected or delivered what was promised. The price for a system is so high that subsidy programs will have to run for decades to come if the poor communities are intended recipients. Further, there has not been enough consideration to sustainability, maintenance and availability of spare parts.

With the Chauganphaya solar PV system, we are trying new ways to address these issues. Centrally located solar PV systems use four 75-watt solar modules, mounted on a self-tracking frame to increase the daily energy output by up to 40%. Underground cables connect each home from the centrally located powerhouse. This armored cable is able to cope with a 300% power transmission growth in the years to come, and wires are not exposed to the high UV radiation. Each home has 3 white LED lights (consuming 1 watt each), just enough to read and socialize,



The High Altitude Research Station enables local testing of technologies.

and deeming obsolete the smoky resin-soaked pine-stick lighting.

The lights used in this system have an expected life of 100,000 hours (or 45 years if used for six hours a day), making it close to unnecessary to ever need a spare bulb. The PV system's battery bank means that even after five days of no sunshine there is still plenty of power, and the life expectancy is 8-10 years. The program trains three local people per village, who participated after their initial training in the actual installation work (and thus earned credibility from fellow villagers). They are also responsible for the solar PV system's maintenance and monthly fee collection in order to maintain the whole system.

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tion by Electricite du Lao for many years, most villages affected by the project are still without electricity.

Livestock Program

To compensate for losses in dietary protein, THPC has worked with villages to improve livestock management through penning of animals, vaccinations, training of volunteers and other interventions. While the strategy for improved livestock management was considered "generally sound," the review panel reported that the benefits will take "some time, likely many years, to reach the majority of households." The review panel reported that present efforts to vaccinate livestock are not reaching most animals, and owners are "enduring economic losses" from annual livestock mortality and disease. Villagers frequently requested greater efforts to provide regular veterinary care for livestock.

Riverbank Erosion

One of the most visible impacts of the Theun-Hinboun Hydropower Project is the severe erosion and collapse of riverbanks along the Nam Hai River. THPC has invested considerable resources to understand the erosion problem and examine its impacts on water quality and downstream fish popula-

tions. It is estimated that two meters of riverbank have eroded each year since the project was completed.

The review panel speculated that mitigation of riverbank erosion "may not be possible" and recommended against implementation of vegetative erosion control techniques and fencing along banks since these would bring only marginal benefits. The panel did suggest small improvements to THPC's monitoring program to inform decision-making on appropriate mitigation strategies. The impacts of past and continuing erosion on water quality are mainly elevating suspended solids and turbidity levels in the dry season, thus curtailing light penetration, which impacts the entire food chain, including the fish, mollusks, shrimps and aquatic weeds which formerly provided subsistence diets and income for villagers. Beyond this, bed-load sediments from bank slumping and other sources are infilling pools, which were formerly important dry season fish refuges. Many of these are now reported by villagers to be half as deep as a decade ago.

Conclusion

The findings of the Theun-Hinboun Mitigation and Compensation Program Review panel underscore the serious difficulties

inherent in trying to replace former natural resources and river-based livelihoods with agricultural-based livelihoods in a limited time frame. This is a longterm and tricky task even for conventional development projects, but is made all the more difficult where the aquatic resource base has been severely depleted by massive environmental changes wrought by a trans-basin diversion of water between river basins with different base characteristics. Even with the high level of commitment shown by EMD staff and significant financial resources made available to the program, there were still signs of exclusion of many of the poorest and most vulnerable community members from core program activities designed to mitigate and compensate for their loss of livelihood. At the same time, it was noted that a participatory living aquatic resources co-management program that might provide more long term benefits for the poorest sectors, had been slow in coming, after a series of conflicting fishery studies over the years. There are strong implications arising from our findings for the future success and sustainability of other hydropower projects planned or under construction in the region, in particular, the World Bank-supported Nam Theun 2 Dam. ■

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Photo: Alex Zahnd

A family enjoys a smokeless stove.

Expected Impact

To have light inside the home means that inevitable changes are occurring, such as:

- Decrease in health problems: fewer respiratory diseases, asthma, eye infections;
- General increase in hygienic conditions;
- Less wood consumption for lighting; and therefore a decrease in longterm deforestation;

- Increase in the literacy rate and children's education level;
- Increase in social gatherings after dark, leading to improved relationships;
- Increased willingness and demand for non-formal education during the evening hours, and
- Increased awareness of community development possibilities.

The program is looking at changes in the villages through a series of surveys. The first was carried out before any community development work had taken place, and a second

survey will take place about 12-18 months after initial installation.

The initial success and strong participation of the local communities, along with the continued support from ISIS, has enabled Kathmandu University to extend the programs in Humla. While the "family

of four" – light, stove, latrine, drinking water – remains fundamental, this year we will also include a non-formal education program for mothers and out-of school children (especially girls), a greenhouse for growing vegetables out of season, separate bathing centers for women and men using high altitude solar water heaters, and a water filter project. All these projects will be implemented in 2005-06 in one neighboring village. Additionally, we will be following up with previous project villages by revisiting families to discuss the ongoing changes and impacts of the projects. The goal is to determine whether or not the villagers' needs have been met, and if overall living conditions have improved as hoped, or if changes in the project approach is needed. ■

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