

# SMALL IS PRACTICAL

## How to be hydropowerful

Nepal tries to harness its hydropower potential, and shows that there are big benefits in scaling down.

**By Kumar Pandey**

**W**hen a country is in economic difficulties, policymakers have a strong temptation to do one of two

things: look for panaceas or find scapegoats. In Nepal's case, as the land-locked kingdom slides down a slippery slope of poverty, unemployment,



*Arun 3 project site — medium scale plants got a chance when the Arun was cancelled.*

PANOS/Kunda Dixit



*Water mill to micro hydro.*

ICIMOD

environmental degradation and a widening trade deficit, all eyes are on one potion that everyone seems to think will cure everything—hydropower.

In the five decades since Nepal opened up to the outside world, successive governments and generations have groped for the right path to development using hydropower. Desperate to find that magic wand, they

have been mesmerised by the potential of hydropower to lift Nepalis out of poverty.

Until recently Nepali politicians have been unable to articulate how they would like to exploit this potentially vast resource, estimated to be as much as 83,000 megawatts. They are still unsure about whether the priority is to export power to India, or take

care of domestic consumption first.

Lately, the small-vs-big debate has dominated the discourse on hydropower, polarising academics, activists and politicians. Nepal has a love-hate relationship with India, and there is a historical perception that India has cheated Nepal on past joint river projects. It is not difficult to see why water is such a political hot potato.

Hydropower development Nepal today is at the crossroads. Those who glibly assert: "Nepal is rich in hydropower" haven't looked at the formidable problems that have to be overcome before falling water can be converted into energy. Political sensitivities, donor-dependent financing, inefficient state owned power supply and distribution monopoly, undefined linkages with local economy, little contribution to local employment, and bottlenecks in mobilisation of local and international financing have all stymied hydropower development.

The fact that progress has been made in private sector involvement in power generation despite these hurdles is an indication of just how lucrative the investment is. As new projects come on line, Nepal's grid capacity will double in the next three years. Nepal has been the first South Asian country to allow private sector involvement in hydropower development, and foreign investors have shown a keen interest in developing small run-of-the-river as well as large scale storage type hydro projects - some even with an eye on exporting power to India.

Local communities are involved in developing and managing hydropower schemes of varying sizes. Local financial institutions and Nepali entrepreneurs have begun to take interest and there have been some creative new initiatives. The response is cautious and slow, but reflects some concurrence to meet aspirations for affordable and reliable energy generated in a pluralistic polity.

Nearly half of Nepal's population lives below the absolute poverty level. Access to safe drinking water, proper sanitation, basic health care, education, and adequate nutrition is still limited to a small percentage of the population. Electricity accounts for less than one percent of total energy usage and only 15 percent of the population, mostly in the urban centers, have access to power from the grid. Of Nepal's total installed capacity of 300 MW, 250 MW is from hydropower.

Hydropower technology is not new to Nepal. Traditionally, water wheels have been important for milling and husking. There are an estimated 30,000 mills all over the country, and some 1,200 have recently been upgraded to generate electricity. With water mills, Himalayan villagers found a solution to a specific problem: in this case motive power for grinding and milling. The lesson for us today is that technology will be mastered and replicated if the people can find a utility for it.

The proliferation of these converted water mills is one of Nepal's little known success stories. Private entrepreneurs and communities have installed micro hydro plants mainly for





**Capacity building - Locally manufactured turbine.** ICIMOD

rural domestic electrification since grid extension is expensive for Nepal's remote and scattered Himalayan villages. There are other strong economic considerations: the people's inability to pay for electricity, inability to generate revenue for maintenance, lack of capital, technical and managerial skills to establish and operate large enterprises, etc. Micro hydro schemes are therefore the appropriate option, especially since they use small indig-

enously manufactured water turbines and generators.

The government in Nepal supports micro hydro installations with subsidies of up to 50 percent, and manufacturers of turbines and generators get tax exemptions on the import of raw material. Donor agencies have also been encouraged to disburse funds through non-governmental organisations to help develop micro hydro. United Mission to Nepal (UMN), In-

intermediate Technology Development Group (IT), International Centre for Integrated Mountain Development (ICIMOD), Rural Energy Development Programme (REDP), and Rural Area Development Committees (RADC) have provided finance as well as technical, managerial and research and development support. Banks have also responded positively to the rapid rise in micro hydro installations throughout Nepal.

### **Beyond micro hydro**

As impressive as the development in the micro hydro has been, and as bright as its potentials are, it cannot be an alternative to a strategic plan to develop larger hydropower schemes. Nepal is now ready to build on its success with micro hydro and expand the scope of its energy projects. For Nepal's 22 million people, hydropower will be meaningful only if energy can be made available to the masses at affordable prices. The bottlenecks lie in the lack of capital, technical know-how, and managerial capability.

For more than 40 years Nepal has tried to come up with a sustainable strategy for hydropower development. The strategy involved:

- Small-scale projects to directly benefit the rural masses and provide them with new opportunities for self-reliance
- Medium-size projects to meet domestic demand for energy and water
- Large joint multi-purpose projects for irrigation and energy exports

The policy was all-inclusive but the resources and the commitment to support any coherent development was missing.

Nepal's first hydropower plant was installed in 1911. Since then, the country has developed less than 300 MW of hydropower - a shockingly small amount considering the total theoretical potential of 83,000 megawatts. Successive Nepali governments have been entangled in a visionless mission leading to a state of confusion. Power plants were built without a clear national policy, only because it served the interests of a few individuals and donors. Not surprisingly, Nepal's power projects turned out to be some of the most expensive in the world—as much as USD 3,500 per kilowatt installed capacity.

The answer to Nepal's chronic energy shortage in the early nineties was the scaled down 201 megawatt project on the Arun River, a World Bank favourite. The Arun-3 hydroelectric project was backed by a consortium of donors who hoped this one project would provide the required power for the country into the next decade. But the project soon ran into trouble. A group of Nepali engineers, economists and journalists banded together to form a pressure group called Alliance for Energy to lobby with the government as well as international donors against Arun-3. The Alliance maintained that the country was not ready for the project, and building it would be a costly blunder since it would put the country's biggest and most expensive power plant on a river vulnerable

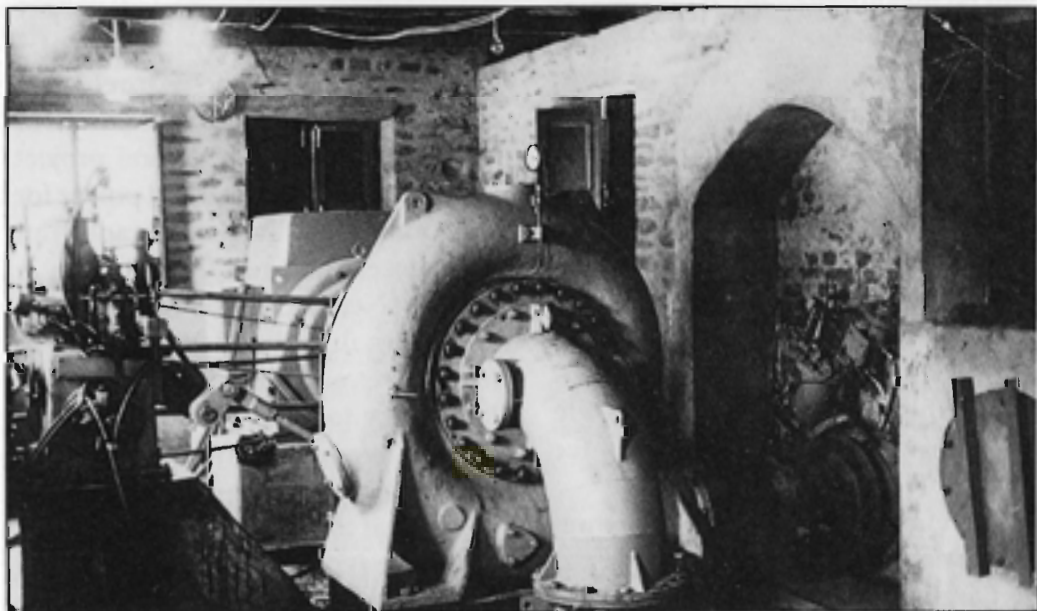
to glacial floods and other risks.

Smarting from intensive international lobbying, the World Bank decided to pull out of Arun-3 in 1995. The country went into a frenzy over the decision. Rival political parties blamed each other and vowed to bring back the project. Today, the cancellation of Arun-3 has turned out to be a blessing in disguise.

Just look at the figures: Arun-3 would have cost over a billion US dollars, taken more than 10 years to build and would have generated 1600 million units (GWH – gigawatt hours) of electricity annually. But in the aftermath of the Arun-3 cancellation, seven medium scale plants are under construction. Together these will produce 1700 million units for a little over half the cost and in half the time. Moreover, the seven projects are spread all over the country and are being built

as private sector joint ventures with foreign companies.

The cancellation of Arun-3 opened the way for private sector involvement and provided the much-needed space for a flexible and pragmatic approach. Since 1995, the Nepali private sector has moved in to build Khimti I (60 MW) and Bhote Kosi (36 MW) with Norwegian and American companies respectively. The Nepal Electricity Authority is implementing the Puwa Khola (6 MW) and Modi (14 MW) with its own resources. It has also initiated the Chilime Project with financial resources generated from among its own staff and a local financing agency. With bilateral and multilateral donors the government is now halfway through the construction of the Kali Gandaki A (144MW). A private Nepali company is teaming up with the Australia's Snowy Mountain Energy Corpo-



*Micro hydro to mini hydro.*

HIMAL/Andreas Bachmann



ration to build a 750 MW reservoir-type project on the West Seti for energy export to India.

As a result, Nepal's hydropower generation today is being decentralised. District and village-level bodies are now getting involved in local hydropower generation. The Rural Area Development Committee and Rural Energy Development Program have broken ground among beneficiaries at the grassroots level. Villages now contribute in cash and in kind for micro hydro establishment as well as for rural electrification.

The Ghandruk and Thame experience has gone one step forward. These schemes have been able to mobilise external financing for hydro schemes and rural electrification in their communities. Ownership of the project is in the hands of the local users who operate and maintain the plant and plan future expansions.

Another initiative in Lamjung District in central Nepal takes the energy vision still further. Individuals and locally elected bodies of Lamjung district have invested in a company which aims to chart out an integrated energy plan for the district. This involves all forms of renewable energy including community forestry, biogas schemes, solar photovoltaics and small hydro schemes. Actual selection of the kind of energy alternative appropriate for each community will be considered in the second phase of the program.

Despite all these initiatives, the country will continue to suffer from power cuts until the first of the post-Arun-3 schemes comes on line next

year. And even when power is available, its cost is one of the highest in the world. Apart from past blunders in selection of projects, part of the problem has to do with the seasonality of demand and supply which do not coincide. The demand for electricity is highest when Nepal's snow-fed rivers are at their minimum in winter. The demand is much lower during the monsoon months, when there is abundant water. It is uneconomical to develop hydropower plants to meet the daily or seasonal peaks alone, but large storage reservoirs in the Himalaya have their own problems.

The trick is not just to increase consumption of electricity, but rather to ensure that the end use of electricity can contribute to the productivity of the nation. New industrial end-users that can consume electricity from the grid throughout the day and night must be encouraged to improve the performance of the national grid. Increase in demand for electricity will make it viable for other players to enter the energy supply scene.

Nepal's planners are convinced that the country needs to export hydroelectricity to take care of its trade deficit, especially with India. Nepal's two neighbours, India and China, are potential buyers. However, both markets pose challenges. The Chinese have made it quite clear that they are not interested in buying energy from other countries, while there are still issues that need to be tackled to facilitate agreements for large-volume energy sales to India. There is also the complexity of evaluating the downstream

benefits that India would receive in the form of clean water and flood control.

For the moment, Nepal needs to develop its own capacity to produce hydroelectricity at competitive prices in these markets. Therefore reliance on the industrial and agricultural as well as the domestic sector in the country may be a better alternative.

Like any other industry, hydropower also relies on a market. The market demands that a supplier be able to produce and supply a quality product at competitive prices. Producing cheap and reliable power so that industry can use this energy to generate employment and wealth for the nation is a challenge. There are encouraging signs that the Nepali hydropower industry is moving in this direction.

### **Financing small hydro**

Ideally one would like to see the hydropower industry in Nepal be self-sufficient in building schemes through local expertise and capital. The production industry would include the manufacturing of turbines and associated hydro-mechanical equipment. Just as important would be the human resources required to construct hydropower plants and industries that provide backward linkages.

Nepali manufacturers are already competing with international manufacturers to fabricate penstocks, gates and other hydro-mechanical equipment. Some manufacturers are working in joint ventures with parties from Europe and the United States. Nepali

contracting companies, in co-operation with foreign construction firms, are building large power plants of up to 60 MW capacity.

Historically the government has relied on foreign funding to develop hydropower plants or extend transmission and distribution networks. These funds originally came in as grants but have now started coming into the country as soft loans with long pay back periods. Lately, however, funds for the energy sector have begun to dwindle. The private sector is being asked to come in and close the gap.

One way to overcome this crisis in local funding is to select and promote power plants that are within the capacity of the Nepali banking and lending institutions to support and bear the associated risks. These may include power plants that are relatively small, with relatively easy access and close to the transmission network. The Central Bank has issued a directive to other banks to invest at least 12% of their total investments in this priority sector. This may free up some much-needed funds for hydropower.

The latest development is the announcement of buy back rates by the Nepal Electricity Authority, and the assurance that the government will buy all the energy produced by small establishments of up to 5 MW capacity. Nepal will now need to make some further policy decisions to ensure that power plants in this capacity range benefit from the local capital market. This will require adequate guarantees



from the government, reforms in taxation and financial policies, and also reforms in banking and lending policies. It appears that there is sufficient liquidity in the local money market to

support several small projects. The government needs to come up with some legislative and policy level reforms that will encourage the small private sector to move in.



*Small hydro projects, the solution for countries in the Himalaya and Hindu Kush.*

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