

## The Pico Hydro Market in Vietnam

**Oliver Paish, Dr John Green**

IT Power, The Manor House, Chineham Court, Lutyens Close  
Chineham, Hampshire RG24 8AG, UK  
Tel: +44 (0)1256 392700 Fax: +44 (0)1256 392701

### ***Background***

The term 'Pico' hydro covers hydropower systems normally less than 2kW and certainly less than 5kW. The most common size range is 200-1000 Watts for domestic lighting and/or battery-charging. The units are small and cheap enough to be owned, installed and utilised by a single family, hence are also known as 'family hydro' units.

Pico-hydro covers a range of turbine technologies, applicable to different heads. For example:

- Tiny pelton wheels ('Peltric' sets) are being promoted in Nepal for sites with 20-50m head – only a hose-pipe is required for a penstock.
- In the Philippines, tiny crossflow turbines ('Fireflies') are being trialled (5-20m head).
- In the USA, Canada and Australia, a few companies offer a variation on the Turgo-turbine for medium and high head sites, principally to serve remote off-grid dwellings.
- China and Vietnam have had the greatest success with low-head propeller turbines, suitable for only 1-2m head, and tiny turgo turbines for 5-20m head.

Low-head sites (<5m) are by far the most widespread, available on irrigation canals as well as streams, and both in hilly and plain areas. These sites often avoid the political difficulties of crossing land outside the ownership of the family seeking to develop a scheme.

Vietnam (>100,000 units) and China (>30,000 units **per year**) are the only countries to date where 'family hydro' technology has become widely available at affordable cost. This has been with a mixture of low-head and medium-head units and has occurred despite the existing technology being fairly inefficient and short-lived.

Other countries who are known to have workshops involved in pico-hydro manufacture include:

Bolivia, Colombia, Peru, India, Nepal, Sri Lanka, Laos, Philippines. There have been no significant developments in Africa to date.

There is believed to be massive unexploited potential throughout South-East Asia, South America and the Indian sub-continent for pico-hydro units serving single families, or small groups, either for battery-charging or continuous operation. In some cases, the systems could also drive machinery for agro-processing, workshop tools, etc. in order to generate income.

### ***Market characteristics***

In Vietnam, about fifty percent of ten million rural households lack access to electricity and have little hope of a grid connection in the foreseeable future. As a result, a large number of households have chosen off-grid solutions to provide electricity. In particular, Vietnam has a very high usage of pico-hydro systems.

In Vietnam, pico-hydro systems are sold for cash in the markets in Hanoi and other cities in the northern provinces. They are sold by shops that sell electrical equipment, pumps, generators, or agro-machinery. Although some subsidies have reportedly been available in certain provinces, the market is basically 'cash and carry'. In general the government of Vietnam is not promoting pico-hydro and all the promotion has been done by word of mouth.

Rural people install these systems on their own land (irrigation fields or channels) or even on public land (a river or creek). Usually concentrations are found where several families have built a small dam in the river to create a head difference and installed a number of systems.

Wires to the houses (usually without insulation) are supported by bamboo and cover distances up to 200 - 300m. The load is normally fixed: a few lights and a TV running continuously.

There are no sluice gates to stop the machines. When not in use, the units are removed from the dam and left by the river side or taken home (theft of units has been a problem).

### ***Available equipment***

#### **CHINESE IMPORTS**

The systems in Vietnam are mostly illegally imported from China where they are manufactured in a factory near Nanning City. The most common units come in sizes of 100W and 500W. These power ratings are approximate actual output - the nameplate outputs are respectively 200W (sometimes 300W) and 1000W.

No guarantees are given on any part of the system, the only instructions are in Chinese, and there is no after sales service. However since there are already so many installed, buyers can refer to those that are already in operation. The installation is done by customers themselves with the help of friends or local technicians.

Prices in the market-place vary, but are in the range \$20-30 for the 100W unit and \$300 for the 500W unit. This price does not include the draft tube for the turbine or the transmission cable, and excludes any civil works costs. These balance-of-system elements can cost in the range \$40-60 and hence are the more significant cost element for the 100W unit.

The Chinese 100W units dominate the market with over 90% coverage, achieved through its very low unit price (illegally avoiding tax and import duty) and a well-established distribution network of importers and retailers in the provinces and district towns.

However the technical quality of the system is low. Total repair and maintenance cost for the 100W unit over one year is estimated to be about the same as the purchase price of the product (~\$25). The lower bearing is the most frequent cause of failure, and generator windings and seals also fail on a regular basis. However, owners seem to be able to fix their units with the help of a local repair shop. In general most systems become unusable after 2-3 years and have to be replaced.

**100W Chinese propeller turbine**



**100W Chinese turgo turbine**



#### **VIETNAMESE DESIGN**

There is a more efficient and reliable Vietnamese design available from the Renewable Energy Research Centre (RERC) which attempts to overcome most of the shortcomings of the Chinese units. This design has a higher output and a longer lifespan (typically 5 years). However the system costs \$55 for a 200W output and therefore has not yet gained a significant market share among rural households short of cash. RERC also supplies a 1000W unit.

More recently, a Canadian company Asian Phoenix Resources Ltd, identified the market potential for improved quality pico-hydro units in Vietnam and nearby countries, and developed the 'Powerpal' 200W propeller turbine unit for manufacture in Hanoi. The unit sells for \$90 in Vietnam but the sales volumes achieved to date are unknown.

**Powerpal  
200W**



### ***Market size***

All reference sources on this topic refer to between 100,000 and 120,000 of these systems sold in Vietnam over the last 10-15 years. Since the units have a short lifetime, it is doubtful whether there are more than 30,000 of these machines actually in operation.

The Hydropower Department of the Institute of Energy has quoted the total market size at about 100,000 units. Hence the potential pico-hydro market in Vietnam is estimated to be in the order of 20,000 to 25,000 units annually.

Grid electricity prices were subsidised until 1995, at only \$0.04/kWh. They have increased since then up to \$0.07/kWh in 1999. This has caused many more rural people to consider alternative options for electricity supply and boosted the sales of pico and micro-hydro equipment.

### ***Conclusions***

- Vietnam has a well-established market for pico-hydro units, mostly of <200W capacity, which are bought for cash from numerous retail outlets and installed by the buyer himself.
- The success of the market has been based on the very low up-front cost of the Chinese imported equipment, attractive to low-income rural households, although system cost is still well beyond the reach of the majority of rural families.
- The Chinese equipment is of poor quality and the balance-of-system and repair & maintenance costs make up a much larger proportion of the life-cycle cost than the equipment cost.
- Better quality alternatives are now available but have yet to make a major impact on the market.

### ***References***

- Personal communication, Prof Nguyen Duc Loc, Hanoi University of Technology, Nov 2001
- Pico Hydro Systems in Vietnam, Winfried Rijsenbeek, RR Energy Consulting, 2000
- Mini and micro hydropower in Vietnam, Dang Dinh Thong, SHP News Winter 1999.
- Family Hydro in Vietnam, Dr J.P.Green, Hydronet, Issue 2, 1993.
- [www.powerpal.com](http://www.powerpal.com)