

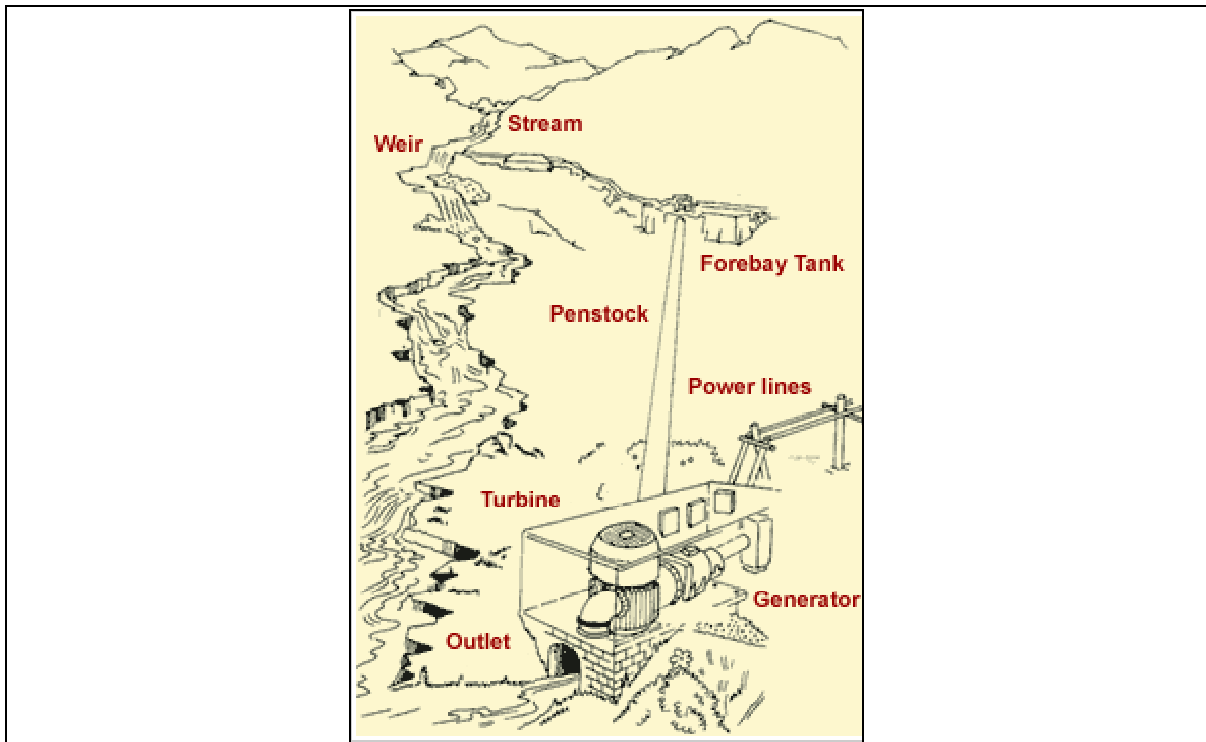
## Renewable Energy for Rural Economic Development Project

### VILLAGE HYDRO SCHEMES

#### KEY FACTS

##### What is a Village Hydro Scheme?

A village hydro (VH) scheme is a micro hydropower system built, owned and operated by a village society to provide electricity to its members. These are small run-off-the-river schemes operated in off-grid areas that do not disturb the environment or the people in the neighborhood. As the following diagram shows, a typical VH will have a weir, headrace channel, forebay tank, penstock, powerhouse and a tailrace that returns the water back to the river.



##### **Principles:**

Water diverted at the weir runs along a channel to the forebay tank. Trash racks either at the intake or in the channel remove debris such as leaves and twigs, stones, and any mud is removed in the sedimentation tank or in the forebay tank. Water from the forebay tank flows through a pipe called a penstock under high pressure to a turbine in the powerhouse. The turbine drives a generator to produce 230V electricity, which is then distributed to homes in the vicinity. Water is then released back into the stream. The amount of power generated depends on the vertical height of the penstock (head) and the quantity of water that flows through the turbine (flow rate). While the former is based on the topography of the terrain, the latter will depend on the catchment area, rainfall pattern and run-off in that locality.

##### **Benefits:**

For example, a typical VH of 10kW capacity can provide electricity to about 40 households within a 2km radius, each being allocated about 250W of power. This is usually sufficient

to light up an average home with a few fluorescent lamps or CFLs and operate appliances such as a TV set, radio etc. Heavier loads such as refrigerators or electric irons will require some advance planning when the project is designed. While domestic application is the primary purpose of a VH scheme, additional benefits could accrue through productive use of electricity by small businesses, particularly by day when the household demand is low.

**Cost:**

The typical cost of a VH scheme of 10kW capacity is about Rs2,000,000 to Rs3,500,000 excluding the cost of project preparation consultancy assistance. The actual cost will depend on the terrain (which affects the cost of civil works) and the distance of the houses from the powerhouse (which affects distribution costs).

**Financing:**

VH schemes are financed through a combination of bank loans, equity from beneficiaries (householders) and some grant support. Equity from the beneficiaries or villagers comprises of some cash contribution and 'shramadana' or sweat equity (a cash equivalent of labour for the construction of the civil works and the laying of the distribution network). Loan financing, grant support and technical assistance are available under the Renewable Energy for Rural Economic Development (RERED) Project, which is explained below. In addition, Sabaragamuwa, Southern, Central and Uva Provincial Councils have provided financial assistance to VH schemes

**Management:**

The VH scheme is managed by the beneficiaries themselves, through a co-operative or Electricity Consumer Society (ECS). Once the scheme is operational, the ECS is responsible for day-to-day operation and maintenance of the scheme and collection of tariff from the beneficiaries to pay back the loan with interest plus meet operating and maintenance costs.

**The RERED Project**

The Renewable Energy for Rural Economic Development (RERED) Project is a World Bank and Global Environment Facility (GEF) assisted project of the Government of Sri Lanka. One of the Project goals is to foster the use of electricity generated through renewable resources to improve the quality of life in rural areas. An off-grid village hydro scheme is one such option supported by the RERED Project.

**Credit Arrangements:**

There are at present six Participating Credit Institutions (PCIs) under the RERED Project that are eligible to borrow from the World Bank credit line and on-lend to ECSs to set up VH schemes. While the full list of PCIs and their contact details are given in Annex 1, institutions such as Hatton National Bank, DFCC Bank and SEEDS have provided the most number of loans for VH schemes. The ECS, with the assistance of the Project Preparation Consultant (discussed below), negotiate their loan with PCIs and agree on aspects such as the interest rate, loan amount, loan period, grace period and security. In addition, there are other institutions such as Regional Development Banks (which are not PCIs under the RERED Project) that provide loans for VH schemes at competitive rates.

The amount of loan provided will depend on the cost of the project and the repayment capacity of the members that constitute the ECS. The lending institution will therefore

study aspects such as the income levels of households, their cohesiveness, the managerial capability of ECS, calibre of the office bearers and technical competency of the ECS to maintain the scheme in good working order. Usually the loan will fund items such as plant and equipment for the power station, PVC pipes for the penstock and poles and cables for the distribution line.

All VH schemes are required to obtain approval from the relevant government authority and the Central Environmental Authority (CEA) and satisfy defined technical and environmental standards before a loan is approved. These are verified by Chartered Engineers and Environmental Specialists, and are intended to safeguard the interests of the ECS. The costs of these services are borne by the RERED Project.

***Grant Support:***

The RERED Project provides each successfully completed VH scheme a grant of US\$600 per kW of electricity generating capacity. A Chartered Engineer from a panel of consultants visits the site to verify that the VH scheme complies with RERED technical specifications and to certify the generating capacity of the plant. This process is known as Installation Verification and the cost of this service is borne by the RERED Project.

***Project Preparation Assistance:***

Independent consultants or 'developers' provide assistance to communities in setting up VH schemes. The community should select their developer carefully, based on competence, integrity and past experience; and it may be wise to check the credentials of the developer with the Provincial Council at an early stage. The services provided by the developer range from site selection, community mobilisation, ECS formation, preparation of feasibility studies, bank loan negotiations, assistance in obtaining statutory approvals, provision of technical specifications and drawings, obtaining independent quotations and advising the ECS on the selection of suppliers, project implementation assistance, training of ECS members in operation, maintenance and record keeping and assistance in commissioning the VH scheme.

The cost of this project preparation work by developers is borne by the RERED Project. A total of up to US\$8,000 is paid for such services based on the actual work done, and payment is released in three stages: 40% upon successful Design Verification, 30% upon successful Installation Verification and the final 30% six months after the date of Installation Verification by the Chartered Engineer. The developer is also provided an incentive payment of up to US\$1,000 by the RERED Project to design and develop economic activities in the village using the electricity generated in a productive manner. Payment is made on achieving agreed targets.

Village Hydro Developers working under the patronage of the RERED Project are also members of the ***Micro Hydro Developers Association of Sri Lanka***. Some are also informally registered with the Provincial Council. More information may be obtained from:

**Micro Hydro Developers Association, Sri Lanka**

C/O REDCo (Pvt) Ltd  
110, D3, New Kandy Road  
Kothalawela  
Kaduwela

Tel/Fax: 011 253 7671  
Email: [redcohyd@sltnet.lk](mailto:redcohyd@sltnet.lk)

***Provincial Councils:***

The Uva, Central, Sabaragamuwa and Southern Provincial Councils have taken a considerable interest in the development of the VH sector. They conduct periodic meetings with developers and ECSs to discuss problems and seek solutions. In addition, Provincial Councils also provide supplementary grant assistance to VH schemes in many instances.

***Suppliers:***

The main items of procurement in a VH scheme include the turbine, generator, load controller, control panel, PVC pipes for the penstock and electricity cables and poles for power distribution. Cement and other building materials are required for the weir, channels, forebay tank and powerhouse. While pipes and cables are manufactured by large companies to established specifications, the powerhouse plant and equipment are usually designed and manufactured by small to medium size enterprises. The ECS, with the assistance of the developer, should select their suppliers carefully to ensure that they purchase equipment of acceptable quality at a reasonable price.

The RERED Project has recommended that suppliers follow standard practices, including:

- Provide a minimum warranty of 2 years on the turbine and 1 year for the generator, controller and control panel
- Respond to a customer complaint within one week
- Repair or replace the defective equipment within two weeks of the visit.

***Electricity Consumer Society:***

VH schemes are usually built, owned and operated by the rural community through Electricity Consumer Societies (ECSs) that are set up for the purpose. The ECS is responsible for the operation, maintenance and management of the scheme. It decides on the tariff to be charged to users of electricity and ensures that members understand their individual responsibilities. This includes collection of monthly payments from members that go towards settlement of loan instalments and interest, meeting routine operation and maintenance expenses and setting up a small pool of funds for sudden repairs and emergencies. The ECS has to ensure that there is no overloading of the system and that member use only the agreed amount of electricity. It will have to attend to disconnections of defaulters and provide new connections if applicable. The Treasurer of the ECS has to maintain proper accounts, collect member dues and bank them on time. The office bearers are also required to present the annual budget at the Annual General Meeting and get it approved by the membership.

For a VH scheme to be successful it is important that the ECS is united, efficient and disciplined. All activities must be done in a fair and transparent manner. Regular meetings have to be held and an Annual General Meeting held to elect office bearers and adopt the accounts. It is also essential that records of meetings and important decisions taken at meetings are retained carefully. For easy identification and diagnosis of major faults in the system, the ECS should keep records of all operation and maintenance activities as well as all repairs carried out on the power system in the Log Book maintained for the purpose.

The developer who assists the ECS with project preparation is required to train the ECS members on all the forgoing aspects.

***Federation of Electricity Consumer Societies:***

The Federation of Electricity Consumer Societies (FECS), formed with the assistance of the Energy Forum, is an umbrella body that provides the users a common focal point. Currently there are about ... member societies in the Federation. Joining FECS will give the ECS an opportunity share and discuss experiences and problems with other ECSs, present a unified voice to other stakeholders, and give it an opportunity to obtain benefits like capacity building from the RERED Project. The address of FECS is:

**Federation of Electricity Consumer Societies**

441/6, High Level Road  
Gangodawila  
Nugegoda

Tel: 011-552 4613  
Fax: 011 553 2188  
Email : [fecs@efsl.lk](mailto:fecs@efsl.lk)

***Administrative Unit:***

The day to day management of the RERED Project is handled by an Administrative Unit (AU) set up within DFCC Bank. The AU functions independently of the banking arm of DFCC Bank. It is primarily responsible for the administration of the credit and grant funds and for project support. The latter includes market development activities, provision of technical assistance and consumer protection. The AU works closely with FECS, Micro Hydro Developers' Association, Sri Lanka and the Village Hydro Working Group for this purpose. It also conducts a quarterly stakeholders meeting covering all participants in the RERED Project.

Problems faced by an ECS should first be resolved internally and where applicable with assistance from the project developer. If this fails, the matter should be brought to the notice of the lending institution that provided the loan to the ECS. If the PCI is also unable to resolve the issue, the AU could be contacted at the following address:

**Project Director**

Administrative Unit – RERED Project  
DFCC Bank  
73/5, Galle Road  
Colombo 3

Tel: 011 244 2442  
Fax: 011 247 2022  
Email : [info@dfccbank.com](mailto:info@dfccbank.com)  
Web : [www.energyservices.lk](http://www.energyservices.lk)