Day time (approx 40% load)

Increased milling capacity, oil expelling, rice hulling, spice-hulling, processing of dairy and food products, workshop machines : wood working, metal working, textiles carding, commercial cooking etc.

Evening time (approx 20% load)

Electricity generation : lighting, cooking

Night time (approx 40% load)

Electricity generation : lighting, battery charging.
Heating for : drying, house heating, horticultural glass houses, hot water for washing, for laundry, cooking water, fish farming, chick rearing.
Cold storage for : crops for sale, produce from traders.
Pumping water : irrigation, drinking.

Governing mechanism

For mechanical output no governing mechanism is needed. The speed of the turbine can be controlled by controlling flow through turbine with the help of control valve. But for electricity generation governor is required. Governor is a extremely costly component which does not suit to micro hydro plants of this capacity. Only some alternative may be suggested to run the turbine for electricity generation. Running turbine at back of power may be one of the alternatives.

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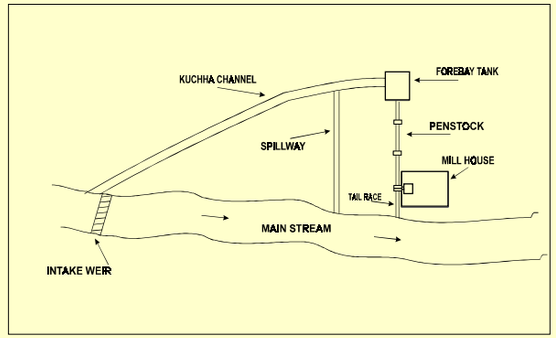
Ministry of Non-Conventional Energy Sources (MNES) under its project UNDP-GEF Hilly Hydro Projects has provided financial support and inputs from international experts for the development of water mills is acknowledged with appreciation and thanks.

SPECIFICATIONS OF MPPU FOR A TYPICAL SITE

Site Details:

Head: 7.0-15.0 m
Discharge: 70-150 lps
Power developed: upto 10.0 kW



LAYOUT OF A TYPICAL MPPU SITE

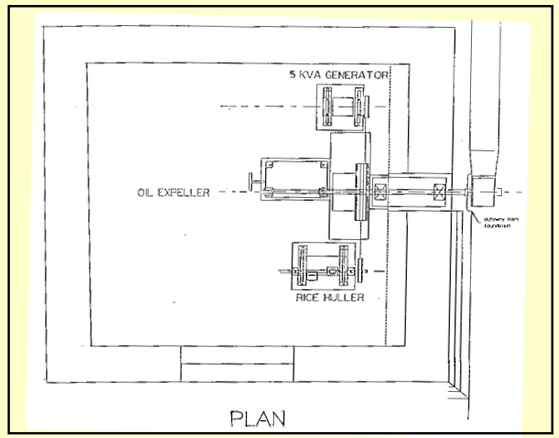
Details of Machine :

Turbine

Type of turbine: Open Cross Flow
Runner dia: 300 mm
Width of runner: 200 mm
Number of blade: 24 Nos.
Shaft dia: 50 mm

End-Use Machines :

Alternator
Oil expeller, Rice huler etc.



Plan of a Typical Mill House

ABOUT AHEC

Alternate Hydro Energy Centre (AHEC) was set up at Indian Institute of Technology Roorkee (formerly University of Roorkee) by the Ministry of Non-Conventional Energy Sources (MNES), Govt. of India, in the year 1982 to promote power generation through the development of small hydro in hilly as well as in plain areas. AHEC offers a variety of services in the field of small hydro power development and other interdisciplinary areas.

Small Hydro Power

* Refurbishment, renovation and modernisation of SHP stations.
* Detailed project reports, engineering designs and construction drawings.
* Technical specifications.
* Pre-feasibility reports.
* Planning, designs and execution.
* Techno-economic appraisal.
* Monitoring of projects.
* Remote sensing and GIS based applications.

Other Fields

* Power system planning and operation.
* Energy Auditing.
* Drainage/irrigation related projects.
* Environment impact assessment and Ecorestoration.
* R&D in the field of other renewable energy sources (Solar, Biomass, Wind etc.)

Human Resources Development

* Training to the field engineers and technologists.
* Offers a three semesters M. Tech Course in AHES.
* Information dissemination, exhibitions, workshops/ seminars.

Head
Alternate Hydro Energy Centre
Indian Institute of Technology Roorkee
(formerly University of Roorkee)
Roorkee-247 667 (Uttaranchal), India
Phone(office) : 0091-1332 74254, 85213, 85841
(Residence) : 0091-1332-73270
FAX : +91 1332-73517 or 73560
Gram : ENERGYCENTRE, ROORKEE
E-Mail : ahec@iitr.ernet.in, ahec@vsnl.com
Web Site : www.ahec.org.in
www.hydrohelp.com

jain printing press, rke ph. : 72722

WATER MILL

MULTIPURPOSE POWER UNIT (MPPU)

**Alternate Hydro Energy Centre,
Indian Institute of Technology,
Roorkee – 247 667**

BACKGROUND

In the hills water mills, commonly known as ‘gharats’ have significant role in utilisation of mechanical power from water streams, mainly for grinding purpose. The design of traditional gharat is quite old and very little modification has been done over the years in the gharat designs. Throughout the Himalayan ranges from Kashmir to Arunachal Pradesh, thousands of water mills are being used for grinding cereals. By the input of technical enrichment the efficiency of traditional water mill can be increased upto 3 times. Alternate Hydro Energy Centre (AHEC), Indian Institute of Technology Roorkee (IITR), Roorkee has been involved in development of water mills.

At water mill sites where sufficient head and water flow be available to develop 3 kW-10 kW power, a multipurpose power unit is considered to be appropriate. Based on the turbine technology a new design with low cost fabrication technology has been developed by AHEC under UNDP-GEF Hilly Hydro Projects of Ministry of Non-Conventional Energy Sources (MNES), Govt. of India. The developed system is capable of producing upto 10 kW of mechanical power for driving agro processing machines directly and for generating electricity if connected with an alternator. The system is a Horizontal Shaft ‘Open Cross Flow Turbine’.

MULTIPURPOSE POWER UNIT

In order to develop a Multipurpose Power Units (MPPUs) at existing water mill sites, following are the components need to be modified by adopting cost effective approach.

Civil Works

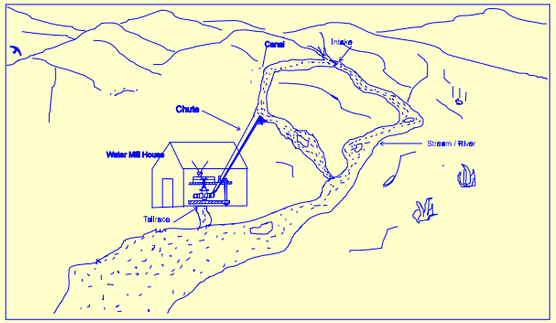
- Diversion
- Power channel
- Forebay
- Penstock pipe

Turbine

- Improved water mill unit

End use machines

- Grain grinding and other crop processing machines
- Workshop machines Alternator



Layout of a typical water mills site

Diversion

This must be of temporary in nature to avoid any investment. This can be constructed of boulders and stones to divert the water.

Power channel

Power channel may be a kuchcha channel without any lining work. However, this should be widened to increase the capacity as per the requirement.

Forebay

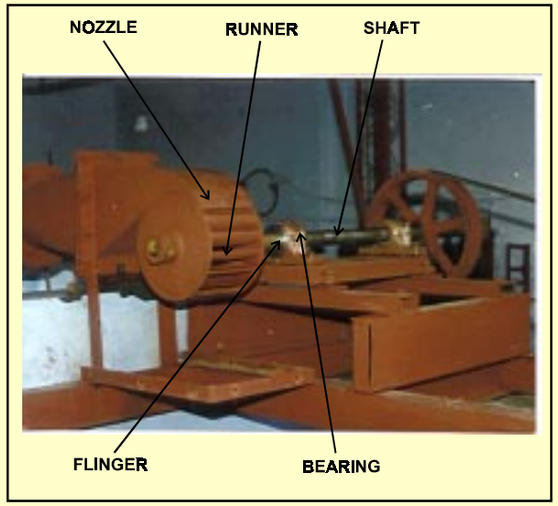
A forebay has to be constructed to connect the penstock with the power channel. Design of forebay need not be of conventional type and size. Local materials can be used to construct it.

Penstock pipe

As compared to steel pipe, PVC pipe will be cheaper and easy to transport and install. It needs not have complicated and sophisticated valves. A simple locally made butterfly valve is recommended.

Turbine

A simple ‘Over Hung’ open cross flow turbine has been designed and fabricated. Open cross flow turbine with horizontal shaft has been considered as a suitable turbine for these sites. Advantage of using open cross flow runner is that it saves the cost in construction as compared to closed one. The main features of the turbine is the ‘Over hung’ layout which allows the wet components to be kept outside the mill building with the bearing inside. The newly designed water mill consist of the following components.



Runner

The runner radius is 150 mm and the width 200 mm. The single piece casting of a cross flow runner is a very tricky task but it has been successfully done to evolve ‘single piece’ of the runner which is a unique achievement. The runner has a total of 24 blades and no casing has been provided over the runner to reduce the cost of the turbine.

Nozzle

The nozzle is fabricated from the metal sheet. A simple ‘pushed flap’ valve has been designed and fitted in the nozzle.

Shaft

The shaft is machined from 50 mm stock leaving the length between the bearings at the full diameter. The bearings are a ‘push fit’ onto a step. The runner is fixed to one end of the shaft using only one boss on one side of the runner.

Bearings

A bed-plate with two plummer blocks containing double-row self aligning bearings are provided.

Flinger

Two flingers are provided and it is proposed to provide a enclosure made of thin M.S. sheet for catching the water, which may sprayed around the machinery.

End use machines

In order to increase the load factor of these plants, it has been suggested to divide the possible end-uses into day-time, evening, and night-time as given below and accordingly type of end use machines can be installed.