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RuTAG IIT Roorkee

Rural Technology Action Group (RuTAG)
-A Mechanism to develop and disseminate technologies for rural areas by the Office of the Principal Scientific Adviser to the Government of India

Modification in Pump used as Turbine for Pico Hydro
Modification in Pump used as Turbine for Pico hydro

Details/Cost/Novelty
The problems associated with micro hydro power exploitation are primarily economical. In general, each proposed site requires turbine with specific design parameters to suit head and discharge conditions unique to the site. The cost of turbine therefore escalates since only one or two such turbines are to be designed and fabricated. High cost of turbine and accessories increase the overall cost of hydropower scheme.

Among various options, commercially available water pumps can be highly economical substitute for expensive turbines. Centrifugal pumps are efficient when used for small power generation and specific discharge conditions. However, these pumps are not fitted with mechanism to regulate quantity of water discharge. It adversely affects efficiency in part flow conditions. It therefore limits application of specific pump as efficient turbine for wide range of head and discharge.

RuTAG, IIT Roorkee has designed modified yet low cost centrifugal pumps fitted with flow control mechanism to regulate flow of water while maintaining high efficiency. These modified pumps will be useful in efficient generation of power throughout the year even when discharge in the stream varies significantly. These pumps will also be adapted to wider site parameters rather than just restricted to a specific site. The part load efficiency is improved by providing flow control mechanism. The estimated cost of a pump is about 0.5-0.6 lakh for 5kW of power generation whereas the cost of complete hydro power generating unit is nearly Rs.1.25 lakh/kW.

Salient features / Impact of the Technology
The following are the main features of modified pump-as-turbine:
- The availability of pumps and their spare parts are far better than that of the turbines, especially in developing countries.
- Standard pumps are simple and sturdy and do not require highly qualified mechanic for maintenance.
- Purposes built turbines are more expensive than standard pumps.
- The investment cost of PAT is less than of a comparable turbine (less than 50kW). This might be an important issue for project with limited budget and loan possibilities.
- Absence of flow control mechanism felt as a drawback, is at the same time an advantage since the pump construction is simple.
- Pumps are available for wide range of head and flows
- Due to the wide application, standard pumps are readily available in the market and no special skill is required for installation.

Status of the Technology
The pump used as turbine has been tested in laboratory. On the basis of further testing of pump as turbine, three different sizes of pumps have been fabricated after modifications. These pumps are to be installed at different sites in the field.

Specification of different pumps

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Pump model: 80-50-200</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Head: 10 M, Discharge: 25 m^3/hr</td>
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</tr>
<tr>
<td>2.</td>
<td>Head: 8-10 M, Discharge: 45 m^3/hr</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Head: 10-15 M, Discharge: 15 m^3/hr</td>
<td></td>
</tr>
</tbody>
</table>

Suitability for states
Uttarakhand and Himachal Pradesh, and other states such as J&K, North Eastern states and Western Ghats where pico-hydro potential is available.

Prototype disseminated so far and aspects like entrepreneur, Government support etc. explored.
After field test of modified pump-as-turbine, the standard design of modified pumps for turbine application shall be developed. These designs shall be handed over to the local manufactures for technology transfer through state industry development. We have already initiated the process of dissemination of the technology developed by RuTAG in association with NABARD and Uttarakhand state industry department. Local manufactures shall be given training for these modifications in pump as turbines, so as the modified pumps will be available locally.

Country and Present Status
Presently pump as turbines are not being used in India because of their specific as well as fixed discharge requirements and limited testing facilities. The pumps are also not available with part flow mechanism. However, there are a large number of manufacturers of centrifugal pumps who would require training for manufacturing of modified pumps.

Specific inputs requested
Support is required from RuTAG for developing standard designs of modified pumps for wider applications in turbine mode.

Contact for Availability of technology
Technical support can be provided by RuTAG IIT Roorkee
For further information, please contact/write to:

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