



## Third Laureate Research & Development

- ◆ **Project Title:** Generating Low Cost Thermal Energy
- ◆ **Researchers:** Ahmad Nourbakhsh (Ph.D.), Shahram Derakhsham (M.Sc.)

### Abstract:

Using energy of water for generating heat and electrical energy is very attractive for almost all countries in the world. In our country many large hydroelectric power plants have been already installed for production of electricity from water energy. Unfortunately due to high cost installed capacity per kW, difficulty of construction of hydraulic turbines in our country and operating problems, the small hydropower stations have not yet been developed and a large capacity of water energy are not used. The purpose of this research study is to substitute the complex turbines by simple and inexpensive machines such as reversible centrifugal pumps. They are simple from construction point of view, and are easy to install and to operate. To evaluate the feasibility of their applications, a complete laboratory model of small hydropower station was built, and several reversible centrifugal pumps working as turbines have been tested. Based on our experimental results a centrifugal pump could operate properly as a turbine. Using experimental data, some relations were derived to predict the hydraulic performances of pumps working as turbines. Since the overall efficiency of these machines is lower than the overall efficiency of conventional turbines, a new program based on optimization algorithm coupled by 3D Navier-Stokes flow solver have been developed for improving the efficiency. Several new impeller pumps for operating as turbines by using this above program have been designed, constructed and tested. The experimental results confirmed that the efficiency of these new impellers have been improved. Based on this research study four small hydropower stations have been already installed respectively in "Tehran-Dareke", "Ghazvin-Alamot", "Mazandaran-2000" and "Mazandaran-3000". In Summary, the innovation of this research study is to design an impeller operating in both purpose, pump or turbine, with acceptable efficiency up to 1 MW.