

Water Filtration and Purification Equipment

Abstract:

The H₂O-Energies group has designed, built, operated and tested a water filtration and purification system.

The purpose of this project was to develop a sound solution to produce clean, drinkable and affordable water where the need for safe, disease free water was not properly fulfilled.

The project included the following requirements:

- Easy to build
- Easy to assemble
- Easy to operate
- Scientifically sound approach
- Technically simple design

1. Who is the H₂O-Energies group?

The H₂O Energies group is a team of highly skilled professionals dedicated to contribute in a practical way to solve the problems related to the decreasing availability of clean sources of water.

Members of the group are engineers, professors and technicians, who are giving their time and expertise to carry out projects and fulfil missions for development institutions. Several of them have important responsibilities in the water production and distribution for the state of Geneva, Switzerland.

Most of the members of the group worked for REDI (Renewable Energies Development Institute). This organization offers to concerned institutions like the ICRC, UNHCR, its experience to help solve critical energy problems in developing and distressed regions

From their former activities or their involvement with REDI, members of the group have acquired the capability to install equipment and to train local people in many remote parts of the world.

The H₂O-Energies group is located in Geneva, Switzerland.

2. Motivation and activities of the group

The UN says that at least 1,4 billion people lack access to safe drinking water. The WHO (World Health Organization) has found that over 3 million people die every year from water-related diseases.

Based on these reports the group decided to apply their in-depth knowledge and experience in water technology to contribute in a practical way to the solution of specific needs.

For the last two years, they have developed a unit to filter and purify water. This unit has been installed and tested with water from the Arve River near Geneva. This water is considered as "difficult" due to the heavy turbidity from sand, mud and other organic particles and to the high content of bacteriological and industrial pollution from the populations living upstream.

With the help of sponsors and the support of the "Services Industriels de Genève" (SIG), the utility company serving the population of Geneva, they were able to purchase the necessary components and to have access to workshops, testing ground and official laboratories to measure the characteristics of the incoming water and the quality of the outgoing drinkable water.

The result of this effort is a unit that is easy to build and to operate for the production of safe water which is well within the official health and food administration standards.

Members of the team are available for assembling the unit on site, for training and for transferring the operation of the unit to a responsible organization.

3. Description of the equipment

The developed unit, fully tested and ready to be installed has the following characteristics:

- 1) Production capacity: 100 to 1'000 litre / hour
- 2) Origin of the water
The equipment can process any type of fresh water coming from rivers, lakes, canals, ducts, wells, rain collected reservoirs, etc.
- 3) Energy consumption:
 - UV purification 30 W
 - Pumping unit 300 W(The pumping unit is not necessary if the water is gravity fed)
- 4) Turbidity:
The production capacity can be maintained with a turbidity up to 130 UTF. A higher turbidity will require an additional decantation device and will limit the production capacity. If the turbidity is lower than 50 UTF no decantation device is necessary.

of calibrated sand and gravel. Clean water then flows through the purification device ② where it will be sterilized by UV

The sterilized process is done by “ultraviolet” (UV). It is the safest method available; it will take care not only of bacteria but also of viruses and does not leave any taste in the water. It is much more appropriate and better accepted by the consumers of the drinkable water. A back up chlorination unit ⑤ is nevertheless built in for use if the UV lamp burns out and no replacement is readily available. The chlorination unit is also used once some time, to disinfect the filtering material during one of the reverse flow cleanings.

One part of the drinking water is stored in a container ③ for automatic rinsing by reverse flow. The over-flowing water from this container is available for consumption ④.

Sooner or later impurities from the untreated water clog the layers of sand and gravel ① and stop the filtering. A simple operation (handling two valves) permits stored water ③ to enter the filter from below in a counter-current way and rinses all the filtering layers. The dirty water is evacuated outside of the filter by a siphon-system and the filter starts operating again after handling again the two valves.

Tests of the unit have been conducted in a particularly difficult situation with water coming from a river containing large amounts of sand, mud, organic particles and bacterial or industrial pollution.

The diagram represents the unit capable of handling high turbidity water coming from a lower positioned source. Depending on the topological situation and the characteristics of the incoming water, the equipment can be simplified; the UV unit being compulsory in all cases.

5. Conditions for success

5.1. Knowledge of the situation

A clear description should be available before the shipment and the installation of the equipment.

The description should include:

- Availability and characteristics of the water to be processed
- Topological situation of the source and the processing unit
- Location and need of the consumers

5.2. Responsibility

It is strongly recommended that a “key person” (or a key team) should be appointed for the safe operation of producing drinkable water.

This person should have some technical background and a good sense of responsibility.

This key person will receive training to:

- Understand the filtering and purification process
- Acquire a good knowledge of each component
- Master the operation and the monitoring of the process
- Perform some simple maintenance tasks
- Remain in touch with an H₂O-Energies group member

The key person could also be instrumental in helping other organizations to manufacture, install and operate new units.

6. H2O-energies group

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