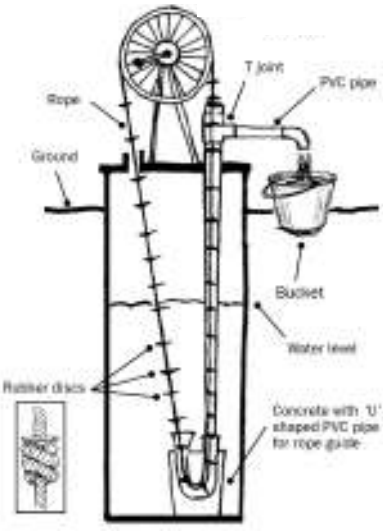


Rope Pump

Experience in Chad

An alternative solution for potable water

Source: Hesperian, 2005, Water for Life

Overview

The rope pump consists of a rope in a closed loop that circles through a tube whose lower end is submerged in water at the bottom of the well. Pistons, with the same diameter as the tube, are placed on the rope at regular intervals. When the wheel (above ground) is turned, the cord moves through the tube and the pressure reduction created by the pistons "pulls" the water upward. These pumps can work up to depths of 40 meters, but function optimally up to a depth of 20 meters since lifting water from greater depths becomes heavy to extract. Rope pumps can provide a water flow rate of 10 to 40 litres per minute depending on the depth. The greater the depth that the water is extracted from, the smaller the diameter of the tube needs to be, to reduce the weight to be lifted. Therefore the flow rate is reduced for deeper wells. Rope pumps are generally installed on traditional wells, but they can also be put on boreholes. They are adapted to small communities (about a dozen families).

Arguments For/Against the Use of Rope Pumps in Eastern Chad

Opportunities

- Construction materials available locally.
- Can be adapted to already existing hand-dug wells (or boreholes).

Threats

- Depth of the well or borehole is limited to 40 m.
- Number of users is limited (on the order of 10 families, or about 50 users).

Strengths

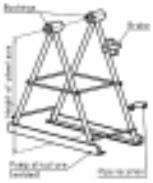
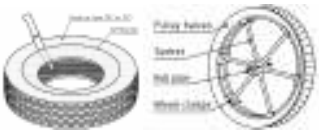
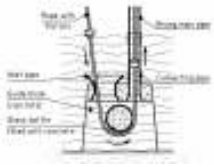
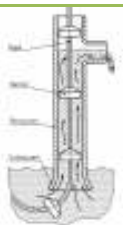
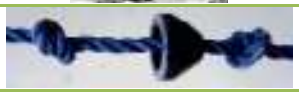
- Low-cost (initial investment and maintenance), easy to build with locally available materials or even salvaged objects.
- Possible to have the pump built, used and maintained by non-technical experts.
- Can be made in local workshops.
- Fairly simple to train users in pump maintenance.
- Promotes user autonomy.
- Light (~15 kg).
- Only dependant on mechanical energy (from the upper body) to get water (no need for fuel, wind, sun, etc.)
- Very little environmental impact.
- Possibility to use an alternative energy source

Weaknesses

- Flow rate limited (10 to 40 l/min depending on the depth.
- Technique is easy to copy, with the risk of "bad copies" leading to early abandonment.
- A braking system on the wheel is required. After pumping, the handle could hit the users (in particular children) if the wheel turns backwards.
- Risk of water contamination because the pump is not completed closed and pollutants could get into the well.
- Pumping time is relatively long for deep wells, taking a long time before water is

such as a lower body manual force (legs that power a bicycle), animal traction, wind (turbine) or gasoline/diesel (motor). • Water can be used for drinking, irrigation or income generating activities.	finally brought to the surface. • Requires regular maintenance. • Risk of users getting wet from water splashing.

Technical Description of Key Rope Pump Components

Component	Description	Image
Pump structure	The pump structure supports the pump above the well. It is usually made of metal (welded steel rods or pipes), which facilitates the addition of a brake, but it needs to be protected against corrosion (such as painting) if the water is corrosive. It can also be made of wooden planks, which requires more frequent maintenance and replacements.	
Bushings	The bushings support the axel that the wheel turns around and can be made of many different materials. The most important factor is that they can be replaced easily (locally) when they are worn.	
Brake	After pumping water, the weight of the water column in the main pipe will start to pull the rope and pistons downward, causing the handle to turn backwards. For user safety a brake needs to be added to the structure.	
Pulley wheel	Two halves of a used car tire attached together make up the pulley wheel. The inner part of each tire half is cut out, and then inversed to form the "V" where the cord is placed. The two halves are secured together with clamps, and further attached to the hub at the center of the wheel with spokes.	
Axel and handle	Normally the axel will extend to form the handle as well. A handle length of 23 cm is recommended so that children can use both hands.	
Handle sleeve	To allow for easier turning of the handle, a sleeve can be added.	
Guide	The guide is placed at the bottom of the well, and directs the rope into the rising main. It should be resistant to abrasion, due to the constant rubbing, so a glass bottle filled with concrete is recommended. For the structure itself, concrete, PVC or metal boxes can be used.	
Rising main	The diameter of this pipe controls the amount of water that can be lifted, with larger diameters meaning more water, that is heavier to lift. Therefore, for very deep wells, smaller diameter pipes need to be used to prevent the lifting from being too strenuous.	
Upper pipe and spout	The upper pipe and spout pipes should have a larger diameter than the rising main pipe. This will slow down the water and allow it to flow out of the spout without overflowing the upper pipe.	
Rope and pistons	The rope is one of the most important components of the pump, and generally wears out the fastest. The best ropes are	

	fiber based. The rope and piston diameters will vary with the size of the rising main. To secure the pistons a knot can be placed before and after each piston.	
Well cover	The well cover serves to protect the well from contaminated water or debris.	
Pump cover	The pump should be covered to extend its lifetime. This protects the rope from sunlight which would otherwise damage it.	

Source: adapted from "The Rope Pump Concept," RWSN, Erpf, 2005. (Image sources: Practica, 2006 and RWSN, Erpf, 2005)

Experience Description

Who and Where

A Chadian company created in 1999, VILTEC TCHAD, is specialized in rope pumps. The company headquarters are located in N'Djamena but they work all over the country. It was created following a rope pump training given in Chad by the company VILTEC INTERNATIONAL, based in Switzerland. The two companies are in close contact and continue to exchange experiences and innovative techniques. Several examples of pumps installed by VILTEC TCHAD are still functioning, for example:

- Market gardens in the Gaga refugee camps, run by the NGO AFRICARE. The rope pump has been installed for one year.
- N'Djamena, Sabangali neighborhood, Rue de la Corniche, near the mosque. The pump was installed in April 2009 on an existing well about 15 meters deep. It was a gift of VILTEC TCHAD. It is used by about 50 families in the neighborhood. Before this pump, the residents bought water from the STEE (Chadian Water and Electricity Society) and suffered from network shortages. The water comes out clear, but its bacteriological quality had not yet been analyzed. The users appreciate the practical and security aspects offered by the pump compared to an open well. They participated in constructing the pump and received training about its maintenance. They have already made a minor repair completely autonomously.

Operation

Hardware

- The Sahel model rope pump is sold for 290,000 FCFA (440€). This cost includes training and maintenance.
- Local materials are used.
- The company also offers treadle pumps (more adapted for irrigation), and electrical submersible pumps. It is trying to develop a solar pump branch (pumps that function with solar energy) in partnership with the Asian company SUNLABOB - www.sunlabob.com - specialized in solar energy.

Software

- VILTEC TCHAD provides training to beneficiary communities (or clients) of their pump who also participate in its construction. It is extremely important to the company that the technique is accepted by the community, and that users are autonomous in terms of maintenance.

Group URD's Observations

If the rope pump installation is relatively simple and a wide number of construction manuals are available, **local expertise remains highly important**. This is as much for technical aspects (knowledge of materials and parts easily available locally) as it is for aspects concerning local capacity building in the communities obtaining the pump.

Different pump models have been introduced in Africa, but the success has been rather mixed. Evaluations show that about 80% of pumps are no longer working just one year after their

installation. However, **when the chosen model and training are adapted to the local context, more than 90% of the pumps are still working**. *(Source: Akvopedia)* One of the principal conditions for their success lies in the level of adaptation to and responsibility of the community.

Rope pump, Sabangali quater, N'Djamena

Company advertisement- sign installed on the pump

Upper part of a pump installed by Viltec

Car tire, view from above

For More Information:

- RWSN, Erpf, 2005, The Rope Pump Concept: http://www.rwsn.ch/documentation/skatdocumentation.2005-10-28.4721047420
- Practica Foundation, 2006, Rope Pump Manual Ethiopia: http://www.practicafoundation.nl/services/publications/manuals/
- Akvopedia (Open online resource about water and sanitation) http://www.akvo.org/wiki/index.php/Rope_pump
- www.ropepumps.org
- www.ropepump.com

Organizations :

- www.pumpaid.org
- http://www.ideorg.org/OurTechnologies/RopePump.aspx

Opportunities to Explore

- Fitting of existing open wells with rope pumps, in particular in villages and cities (such as Abéché).

Contacts

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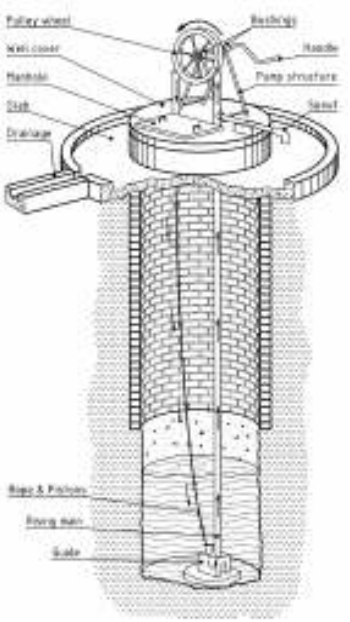
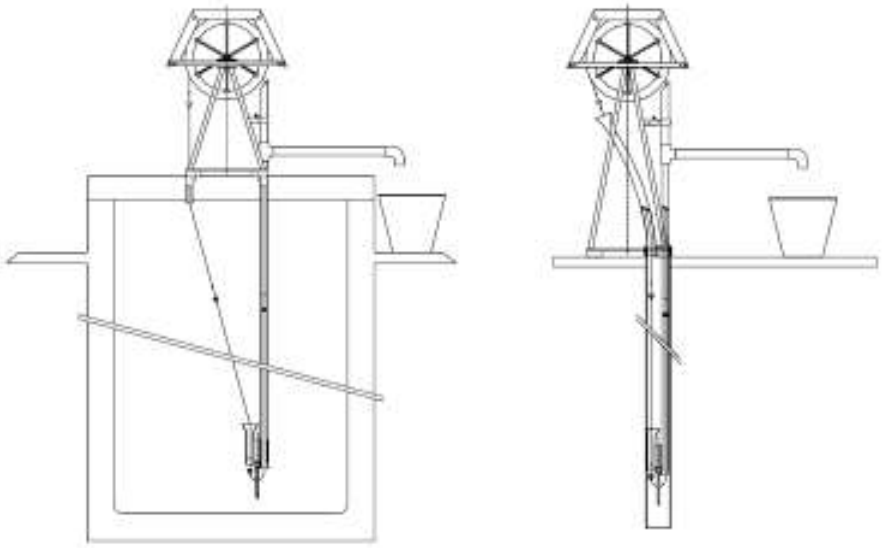


Principal components of the rope pump (Source: RWSN, Erpf, 2005)



Left: Rope pump over a hand-dug well; Right: Rope pump over a borehole (Source: Practica, 2006)