

Rope pumps Frequently Asked Questions Version 2-09-09

Who invented the Rope pump?

The principle of the rope pump is over 2000 years old and was used in ancient China. In the Middle east it was known as the Noria Pump. In the 70s, this effective pump principle was “rediscovered” by Mr R. van Tijen of the Dutch Demotech organisation, who started to use PVC pipes and car tires for the wheel. It was introduced in Africa as ‘Rope and washer pump’, among others by ITDG, as a low lift pump for irrigation and family wells in the 70ties. It never really took off, probably for reasons as its low lift capacity, its “Stone Age” image, and the lack of involvement of the local private sector.

This changed in Nicaragua where the rope pump was introduced in 1986. The Dutch organisation SNV worked on technical improvements and first dissemination, after which the company Bombas de mecate SA made it a commercial success through sales to the private sector, and later on to NGOs and government. Now the rope pump provides over 35% of the rural water supply in Nicaragua (ref. 1) and is produced by some 20 workshops. Many rope pump producers around the world still make “improvements” and feel themselves “the inventor”. The local adaptability is the strong, and sometimes weak, point of this modern Appropriate Technology.

How many Rope pumps are in use and where

An estimated 100.000 rope pumps are used by 4 million people. Numbers may be higher since not all rope pump producers and NGOs report their production. Most rope pumps are used in Nicaragua (70.000) and neighbouring countries (15.000) but the rope pump is now also used in Asia (2.500 in Cambodia and India) and Africa (15.000 of which some 5.000 in Zimbabwe and Malawi, The Elephant Pump) 2000 in Ghana, Victoria pump, 2.000 in Ethiopia and 3.000 in Zambia, Tanzania, Mozambique, Madagascar (ref. 2).

Is the Rope pump fit for communal water supply?

There are different opinions on this since the rope pump is a semi-open pump and requires frequent maintenance. In many countries the rope pump are used for communal water supply. In Nicaragua the rope pump is the national standard for hand pumps used by organisations such as UNICEF, CARE, etc. However, if a rope pump is **first introduced in a new area or country it is advised to start with the rope pump as a family pump or as a pump for productive use (irrigation) for larger groups of farmers**. If it works well, useage can be expanded to communal pumps, in cooperation with local or national governments. In all cases it is strongly recommended to use updated manuals combined with training by professional organisations.

For how many people can one rope pump supply water?

The recommended maximum number of people for one rope pump is 100 (about 20 families). But there are also examples that one Rope pump is used by many more users, up to 400 people for 5 years or more.

Why are some Governments and NGOs reluctant to use the rope pump?

Some mayor reasons seem to be:

- It is a semi-open pump, so the perception is that it can contaminate the water.
- In some cases wrong examples were introduced, with lack of follow-up and user involment leading to lack of ownership, and technical mistakes in construction and installation leading to many unnecessary breakdowns.
- Lack of awareness on new developments, and technical and social improvements.

When pumps break down, this does not necessarily lead to a problem as long as the community has the capacity to organise maintenance and repairs themselves. That is why it is not necessarily a bad thing if pumps require regular maintenance, as in that way, the capacity to do so remains in the community. (Of course, there are limits to the acceptable number of breakdowns and required maintenance). If a pump breaks down once every 3 years, local maintenance capacity may have disappeared.

Following the maxim 'Simple is not Easy', even a simple technology as a rope pump requires quality standards for production, installation and maintenance. Evaluations of IRC and others indicate that, if this is done right, over 90% of the rope pumps stay working even many years after installation. That is because the pumps are maintained and repaired by the users themselves. In general it can be said that if rope pumps do not work well, it is not because of the technology, which has proven itself in many places and on a large scale, but because of errors in construction, installation and / or lack of user involvement for ownership and maintenance. In cases where the introduction was wrong, it has produced a negative image of the rope pump, especially to governments.

Policymakers, who are by nature risk-averse, will often opt for known technology options such as the Afridev, Indian Mark 2, etc. As rope pumps are produced by local workshops and don't need to be imported in large quantities, it may also be a less interesting product from a political point of view. NGOs such as Water Aid, Care and Unicef are using Rope pumps in their programmes.

Is the water from a rope pump safe for drinking?

A pump does not change the quality of the water but just pumps it up. In general, water from protected wells and deeper water layers is safe to drink. In case of doubt it is recommended to treat the water at the Point Of Use, with a disinfecting agent and / or waterfilter. Besides boiling there now are new and promising low cost treatment options such as TwinOxide, Silverdyne, Water guard, Aquatabs, SODIS, Biosand filters, Pot filters, Candle filters and Siphon Filters.

What are the advantages of rope pumps compared to Piston pumps?

- **REPARABILITY** — There is no "black box", so people understand how it works. The rope pump is not better than a piston pump but much simpler in design so after training, users can do maintenance. Spares as pistons and rope can be obtained from the local producer and/or shop. The local blacksmith can do repairs such as welding.
- **OWNERSHIP** — In general rope pump users are proud they can manage their pump so users have ownership.
- **EMPLOYMENT** — In all countries the rope pump can be adapted to the materials available in the local hardware store and after training be produced by blacksmiths or metal workshops. Local production creates employment and business development.
- **LOW COST** — At the same depths, rope pumps are 5 to 10 times cheaper than piston pumps especially for wells deeper than 6 meter (Between 1 and 6 meter low cost suction pumps can also be used). Because of the low cost, rope pumps are more affordable at family level than piston pumps. A credit used to buy a rope pump can usually be paid back within 1 year. Other low cost family pumps are EMAS Pumps and Baptist pumps. See www.akvopedia.org.
- **INCOME GENERATION** — Because of the low cost and high pump volume the rope pump is increasingly popular for productive use such as irrigation, fish production, car washing etc. Investigations indicate that a family with a dug well and a rope pump earn 220 US\$ more than families with a dug well with a rope and bucket. (ref. 3).

What are the disadvantages of rope pumps compared to Piston pumps

- The rope pump is a semi-open pump, so the water in the well can be contaminated by hands touching the rope. Some evaluations on this aspect indicate some difference in water from piston pumps and rope pumps. Others indicate no difference (of course on condition that well cover, apron and seal are OK).
- A rope pump cannot pump higher than 20 cm below the height of the wheel. If the water outlet needs to be higher, an additional wheel is needed on a post. See www.ropepumps.org for examples.

Can the rope pump be installed on small boreholes?

- Rope pumps can be installed on boreholes as small as 2" (56 mm inside). In this case ½" pump pipe is needed and a adapted guide box. Most rope pumps are installed on hand dug wells with diameters of 0.8 to 3 meters.

What is the cost of a rope pump?

- 30 to 200 US\$ depending on the model, cost of materials, cost of labour and production efficiency. In projects, the the cost of a rope pump is often higher since it includes cost of installation, training of users, time to form water committees, monitoring etc. The cost of a dug well or a borehole is separate.

What are the maintenance cost per year?

- 5 to 30 US\$/year.

Cost consist mainly of replacing the rope and pistons, for which the frequency depends on use and rope quality. Rope can lasts anywhere between 6 months and 5 years. Pistons in general last two times longer than the rope. Pump pipes or guide boxes hardly wear out. The PVC parts exposed to the sun should be of thick quality and protected by paint.

What is the pump capacity per minute of a rope pump?

- 70 Litres from 5 m deep, pump pipe 1 ¼" (ca 40 mm)
- 35 litres from 10 m deep, pump pipe 1 " (32 mm)
- 17 Litres from 20 m deep, pump pipe ¾" (26 mm)
- 8 Litres from 35 m deep pump pipe ½" (19 mm)
- 8 litres from 60 m deep pump pipe ½" (19 mm, 2 handles needed)

The pump capacity depends mainly on the depth of the well and is based on the input of 50 to 70 watt, (50 watts is the energy of women and children.) The deeper the well, the smaller the diameter of the pump pipe needs to be, in order for the load to remain similar. Capacities are averages and based on 100 RPM and a clearance between pistons and pump pipe of 0.5 to 0.8 mm.

What is the maximum pumping depth of a rope pump?

- 35 meters with one handle
- 60 meters with 2 handles (2 persons)
- 100 meters with engine or electric driven models (Strong rope and different piston mountings needed. See also www.ropepumps.org).

What is the best rope pump model?

There is no one best model. There are over 30 rope pump models since in every country models are adapted to the local situation and local flavour. There are rope pumps of wood that have worked for 15 years, Pumps with wheels of 22 Inch and 12 inch, pumps completely covered with a brick construction or sheet steel. Every rope pump producer invents improvements and local adaptations, which is one of the strong points of the rope pump. In Tanzania, Vietnam and Cambodia there now are family models with production cost of some

40 US\$, which are completely made of GI pipes. All models work if basic design rules are respected.

What are basic design rules of the rope pump?

- Diameter of pump pipe, see above
- Rope speed between 1.5 and 2.5 m / sec.
- Right clearance in bushings, pump structure, wheel structure with V belt principle.
- Good quality guide box, rope not too tight
- If corrosion is a problem use of galvanised pipes for the structure.

Can a rope pump be powered by an engine?

There are many ways to power a rope pump including pedals, animal power, wind, gasoline or diesel engine, electric motor. See www.practicafoundation.org and www.ropepumps.org.

Are PE pistons better than rubber pistons?

Pistons can be made out of many different materials and the most effective seems rubber from car tire and HDPE (High Density Poly Ethylene). Rubber pistons can be made with a simple punch or even scissors. The advantage of rubber pistons is that car tires are available everywhere. The piston size can easily be adapted to the often varying inside diameters of the local PVC pipes. Rubber pistons have less friction in water with sand particles, which makes it also very useful to clean and develop a recently drilled borehole.

PE pistons can be made with a mechanical press or a small manual operated injection press. The advantage of PE pistons is that it has a standardised size and a more hi-tech image, making it more attractive for commercial workshops because other workshops can not so easily copy it.

When to use a cement guide box and when a steel guide box?

In general cement guide boxes are bigger in size and are used in hand dug wells. Especially if wells are deeper than 10 meter a heavier guide box functions to keep the pump pipe straight. In boreholes smaller than 4 inch the guide box has to be small so a metal version is suitable. Guide boxes completely of PVC are being tested in Tanzania and Cambodia.

What are most the frequent problems with rope pumps?

- Wearing of the bushings because of misalignment. Clearance too big, a lack of oiling or use of grease (new oil is needed, not grease). Bushings should be clean, not black. If well produced and oiled, metal bushings last for 15 years or more.
- Breaking of the rope. The rope should be replaced before breaking.
- Braking of the handle or other parts. Main reason is construction errors, wrong welding etc.
- Rope gets stuck or rope starts slipping on the wheel. See Manual.
- Pump handle is too high so ergonomic loss of energy with pumping. Pump handle should be on the height of the navel of the average person pumping. If it is higher, then a platform is needed. For more Information see manuals on www.connectinternational.nl.

How much area can a Rope pump irrigate?

- 100 to 1000 m², depending on crop, depth of well, and hours of pumping.
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An example from Zimbabwe has 1 rope pump of 10 meter deep which is operated by 8 women, irrigating 1000 m², producing food for 100 people and providing 10 families of water for domestic use. In Zambia a farmer family irrigates 500 m² of tomatoes from a borehole of 12 m deep.

Can I use a Rope pump for drip irrigation?

Yes, depending on type of laterals. In general, laterals with prepunched holes (for instance from the Indian brand KB Drip) give the best results and are most cost effective. This system can be directly coupled to the outlet of the pump. No elevated storage tank is needed. In Vietnam there are experiments with a low-lift "Paddy pump" for rice irrigation.

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