

Rope pumps Frequently Asked Questions

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Who invented the Rope pump?

The principle of the Rope pump was used hundreds of years ago in the Middle east and known as the Noria Pump. In the 70s this effective pumping system was “rediscovered” by Reinder van Tijen of the Dutch Demotech organisation, who started to use PVC pipes for pumping and used car tires for the wheel. As Rope and washer pump it was introduced in Africa, among others by ITDG, as a low lift pump for irrigation and family wells. It never really took off probably for reasons as its low lift and “Stone Age” image. Also it was not a product that was interesting for the local private sector. This changed in Nicaragua where the Rope pump was introduced in 1986. The Dutch organisation SNV and others made technical improvements and started to train local private companies. The company Bombas de mecate SA made it a commercial success via sales to cattle farmers and later on to NGOs and Government. In 2000 the Rope pump provided some 40% of the rural water supply in Nicaragua (Ref. 1) and was produced by some 10 workshops. Since 2000 this technology started to spread out to Africa and Asia. Rope pump producers world wide make “improvements” and feel themselves the inventor! This is exactly the strong (and sometimes weak) point of this innovative and Affordable Technology.

How many Rope pumps are in use and where ?

There now are an estimated 130.000 Rope pumps worldwide used by an estimated 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 (20.000) but the Rope pump is now also used in Cambodia (6.000) and Nepal. In Africa it is known in Zimbabwe and Malawi as the Elephant Pump (10.000). In Malawi the Rope pump model 3 (with 2 wood poles) is used for irrigation (3000). In Ghana the most successful model is the Victoria pump (3000) and in Ethiopia and Madagascar there is the Practica model (20.000). In Tanzania, Malawi, Mozambique and Zambia there is the SHIPO model (11.000). (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. Some numbers. In Nicaragua of the total number an estimated 20.000 Rope pumps are used in communities and schools in 2000 and many pumps of over 15 years old are still functioning. Similar experiences are in Africa. For instance Rope pumps installed 11 years ago in schools in Njombe (Southern Tanzania) are still functioning. In all these cases the key is .. “repairability”. The Rope pump is not a better pump than other pumps but since it is produced locally it can be repaired locally. Spare parts are available and affordable and users often. Small repairs like changing the rope can be done by users. Larger repairs like welding the pump structure can be done by the pump producers. In general each pump has the telephone number of the pump producer. Depending on the number of users the cost of maintenance and repairs ranges between 10 and 40US\$ per year. If the pump is used for communities it is advised not have more than 150 users to avoid to frequent repairs. In Nicaragua the Rope pump is a national standard for hand pumps used for both communal and family wells by organisations as UNICEF, CARE and others. However to **start in a new area or country it is advised to start with the Rope pump for small communities or as a Family pump for domestic use and productive use (irrigation)**. If it works well, expand to larger communities in cooperation with local or national governments. In all cases it is strongly recommended to use updated models combined with training by professional organisations and focus on quality.

For how many people can one Rope pump supply water?

The recommended maximum number of people for one Rope pump is 150 (20- 30 families),

but there are examples that well produced and installed Rope pumps are used by 400 people for 10 years or more. In all cases training of the users in maintenance (oiling the bushings etc.) and training of the local producers in repairs, of pump pipes, rope etc. is essential.

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

Reasons include;

- It is a semi open pump so the perception is that the rope can contaminate the water in the well.
- Wrong examples because of outdated models, errors in production and installation and lack of organising the maintenance and repairs.
- Lack of awareness at implementing level on both technical and non technical aspects.
- Limited awareness that frequent repairs and need for maintenance may be an advantage. If pumps needs maintenance or repairs every year it creates local capacity (and business). An example is Indian mark 2 pump in India. Many millions are installed there and installation and repairs is a business for a local repair men. If a pump only breaks down once in 3 to 5 years, maintenance capacity may be gone. It is not a problem if a pump breaks down as long as the community can organise the repairs. (Of course frequency of breakdowns has limits).

If the Rope pump is so simple and low cost why is it not yet widely used?

Experiences with this and other technology is; **SIMPLE is NOT EASY**. Even a simple technology like a Rope pump requires high quality in the details of 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 after many years of installation. If Rope pumps do not work well, it is because of errors in construction, installation and / or lack of maintenance. The last is often the case if communities do not raise funds for maintenance or repairs. There are many examples (Ghana, Mozambique, Ethiopia,..) where the first introduction of the Rope pump was a failure. The bad quality in production or installation in these countries has given a bad image to the Rope pump. It requires many good examples to repair a bad image. Another reason maybe that policymakers and implementers do not like to take risks so rather use known technologies as Afridev, Indian Mark 2, etc. Also with Rope pumps there are less possibilities for "commission" since they are not imported but produced decentralised by local workshops. Despite all this NGOs like UNICEF, Winrock, Water Aid, Care, Cordaid, World Vision and others are increasingly using Rope pumps in their programmes.

Is the water from an Rope pump safe to drink?

A pump does not change quality of the water but just pumps it up. If water in the well is contaminated the water from the pump is contaminated also. Investigations in Tanzania (ref 3) and other countries indicate that, if installed well, water from Rope pumps has more or less the same quality as pistons pumps. (ACCRA Tanzania 2012. www.ropepumps.org)

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 disinfection options or household filters. Besides boiling and chlorine there are new low cost treatment options like Agua prove, Aguatabs, Pot filters, Table top filters and Siphon Filters.

What are advantages of Rope pumps compared to Piston pumps?

- **REPAIRABILITY**. The Rope pump has no "black box" so people understand how it works and therefore can repair it. The Rope pump is not better than other pumps but in general simpler and cheaper to produce and repair. After training, users can do the weekly maintenance and simple repairs. Spares like pistons and rope can be obtained from the local producer and/or shop. The local pump producer can do the larger repairs such as welding the pump structure or prolonging the pump pipe.
- **REPLICABILITY**. The Rope pump can be produced in any country with materials that are available in the local market.

- **OWNERSHIP** In general Rope pump users are proud they can manage their pump so users have ownership, especially if it is used for Self-supply.
- **EMPLOYMENT.** Rope pump can be adapted to the materials available in the local hardware store and after training be produced by metal workshops. Local production creates employment and business development.
- **LOW COST.** At same depths Rope pumps are 5 to 10 times cheaper than Piston pumps especially for wells between 6 and 35 m deep (Till 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 and is an option for irrigation. Other low cost family pumps are EMAS Pumps and BAPTIST pumps . See www.AKVO.org
- **INCOME GENERATING.** Because of the low cost and high pump volume, the Rope pump is popular for Self-supply were it can be used for production like livestock, irrigation, fish production, car washing etc. Investigations indicate that a family with a well and a Rope pump earns 220 US\$ more than families with a dug well with a rope and bucket. (Ref. 4). Micro credits for Rope pumps can be paid within 1 year in general.

What are disadvantages of Rope pumps compared to Piston pumps?

- Semi open pump so the water in the well can be contaminated by touching the rope by hands. 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.)
- Cannot pump higher than the height of the wheel. If water outlet needs to be higher, an additional wheel is needed on a post. See www.ropepumps.org

Can the Rope pump be installed on boreholes?

- Rope pump can be installed on boreholes as small as 2" (56 mm inside). In this case a 1/2" pump pipe is needed and a small guide box. Most Rope pumps are installed on casings of 3 to 4 inch and even more on hand dug wells with diameters of 0.8 to 3 meters

What is the cost of a Rope pump?

- Prices vary from 30 to 200 US\$ and depend on model, cost of materials, cost of labour and production efficiency. In projects the cost of a Rope pump often is higher since it includes cost of installation, training of users, time to create water committees, monitoring etc. The prices mentioned do not include cost of the well.

What are the maintenance cost per year?

- Cost varies from 10 to 40 US\$/year. Cost consist mainly of oiling bushings every week and replacing the rope and pistons. The frequency of rope replacements depends on use and rope quality. Bushings can last up to 20 years as proven in Nicaragua. Ropes last 6 months to 6 years depending on quality and pump use. Pistons in general last 2 times longer than the rope. Pump pipes or guide boxes are hardly wearing. The PVC parts exposed to the sun should be of thick quality and protected by paint.

What is the pump capacity / minute of a Rope Pump?

- 70 Litres from 5 m deep, pump pipe 1 1/4" (ca 40 mm)
- 35 litres from 10 m deep, pump pipe 1 " (32 mm)
- 17 Litres from 20 m deep, pump pipe 3/4" (26 mm)
- 8 Litres from 35 m deep pump pipe 1/2" (19 mm)
- 8 litres from 60 m deep pump pipe 1/2" (19 mm, 2 handles needed)

Pump capacity depends mainly on depths 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. Capacities are averages and based on 100 RPM and 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 20 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 that is the strong point of the Rope pump. In Tanzania, Vietnam and Cambodia there now are family models with production cost of some 35 US\$ completely made of GI pipes. The SMART Centres in Tanzania, Malawi, Zambia and Mozambique now promote 4 Rope pump models. All models work if 10 basic design rules are respected.

What are basic design rules of the Rope pump?

- The rubber parts of the wheel should have a good, sharp V shape
- The eccentricity of the handle should be the wheel radius plus 1 inch
- Length of the bushings > 60mm and clearance 0.5 -0.8 mm.
- A correct diameter of pump pipe, see above
- The length of the outlet pipe above the T piece should be 20 cm or more
- Clearance of pistons in the pump pipe 0.5 to 0.8 mm
- Distance between pistons 1 meter
- The rope should be just loose; never tight!
- Handle at height of the belly button. If higher, a platform is needed
- If corrosion is a problem use of galvanised pipes and material.

Can a Rope pump be powered by an engine?

There are many ways to power a Rope pump including Pedals, Animal, Wind, Solar, Gasoline or diesel engine, Electric motor. See www.ropepumps.org

Are PE pistons better than Rubber pistons?

Pistons can be made out of many different materials and most common are rubber from car tires 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 diameter 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, and is 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 has a more hi tech image so attractive for commercial workshops because other workshops can not 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 used in hand dug wells.

Especially if hand dug wells are deeper than 10 meter the 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 frequent problems in Rope pumps?

- Wearing of the bushings because of misalignment. clearance to big, 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, often because of wrong alignment or errors in the guide block
- Braking of handle or other part. Main reason is construction errors in welding.
- Rope gets stuck or rope starts slipping on the wheel. See Manual
- Pump handle is high so loss of energy with pumping. Pump handle should be on the height of the belly button of the average person pumping`. If it is higher, then a platform is needed! Information see manuals on www.ropepumps.org

How much area can a Rope pump irrigate?

- 100 to 1000 m² depending on crop, depth of well, and hours of pumping

In Zimbabwe 1 Rope pump of 10 meter deep 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 a Rope pump be used for drip irrigation?

Yes, depending on type of laterals. In general laterals with prepunched holes (for instance from KB drip) give good results and are 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 “Paddy pump” for rice irrigation.

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