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"DUAL"- AERATORS

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INTRODUCTION

Aquaculture is a promising source of protein for billions of population. To ensure a food secure future for all, the fisheries and aquaculture sector is the key. The world's appetite for fish products shows no signs of slowing. Reports demonstrate the significant and growing role of fisheries and aquaculture in providing food, nutrition and employment. Global aquaculture has grown dramatically over the past 50 years. World aquaculture production attained another all-time record high of 114.5 million tonnes in live weight in 2018.

For the better production and better fish health, aeration plays a great role. Different types of aerators have been developed in an effort to improve the energy efficiency of the oxygen mass transfer process.

These aerators work mainly on two principles :

1) Aeration by splashing water into the air, i.e paddle wheel aerator, vertical pump, pump sprayer, gravity aerators etc.
2) Aerators that are in vogue are either generally operated with the help of electricity or diesel.

But due to this there are disadvantage like electricity charges are becoming a burden to aqua-farmers Besides the accidental death, they have high maintenance cost too. So by linking this concept I have developed a new eco-friendly zero electricity aerator called "DUAL" aerators.

EXISTING SOLUTION

In fact, there are so many aerators existing in the market with high investment cost and operational cost. Among them, gravity aerators convert potential energy to kinetic energy. Here the water is allowed to rise up and then freely falls. Wheel model, gravity-driven paddle wheel model or perforated tray model are some among them. But they need additional space and for operation, it needs either diesel or electricity.

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The second type is surface aerators which will agitate the water by mechanical means and increases the aeration only to the surface levels. Nozzle aerators, vertical pump aerators, common paddlewheel aerators and spray aerators are common in use with electricity or diesel as the primary fuel to run on.

Thirdly, Turbine aerators or propeller diffuser aerators with a submerged propeller is also working mechanically by using the energy from the motor-driven force by either fuel or electricity. Propeller aspirator and diffused aerator among them contain motor, Impeller, diffuser and air blower respectively. In fact, all of them need periodic maintenance and high investment and operational cost.

LIMITATIONS OF EXISTING SOLUTION

Some aerators operate exclusively in the surface water and hence oxygen not distributed through the whole water body. For low-cost aerators, the efficiency is very poor and hence not able to properly manage the disease occurrence in the pond.

Also they need to be equipped with good infrastructural setup which results in high capital cost. Due to the activity of some aerators in the pond, fish may also get injured. While for some advanced aerators, there aeration capacity may be very high but they need much more energy for creating high water pressure. All of them need either electric power or diesel or petrol as a fuel to run on which will suck the money of aqua farmer's. For their periodic maintenance, it needs additional investment too.

PROBLEMS BEING SOLVED

In an economical aspect, it reduces the electricity consumption and by the way the amount to be spent as electricity charge by the farmers. Compared to other types of existing aerators, this aerator need only very little maintenance and periodic repairing cost. For an aqua farmer, it can serve him as one-time investment to nourish water.

Regarding the biological status of the pond, it can add oxygen and enables the circulation of water thereby reducing the accumulation of ammonia. The level of algae and harmful bacteria in the pond water can be reduced to a minimal level. Moreover, it can create uniform water temperature throughout the water and prevent water freezing during winter months

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efficiently. Fishes also get exercised due to the effective movement of water. So all these will eventually results in improvement in fish health as well as maintenance of a sustainable aquatic habitat by an eco friendly manner.

HOW THE IDEA TACKLE THE EXISING SOLUTION

My idea is about operating of aerators with the help of wind power instead of electricity or diesel. India's climatic conditions are very good for this system to work effectively. Throughout India average wind speed ranges between a minimum of 6-13 miles per hour. With a little as 3-5 miles per hour winds, the windmill captures air and forces the system to work. The windmill system can be raised inside the pond over a concrete platform. The tower can be fitted depending on the site elevation and topography, generally at heights levels of 12 feet, 16 feet, 20 feet and 24 feet, 30 feet respectively. The tower can be made with wood, metal like aluminium, iron rod etc. wood is cheaper and easily available. One windmill system can aerate up to 2 to 3 acres of the pond.

This aerator is working one two ways.

1) First with the help of a belt, two pulleys and small wind turbine.

At the back of the wind turbine, we will be attaching a pulley and the bottom another pulley is placed and these two pulleys are connected with a belt. When the turbine rotates due to the wind-driven force, the first pulley on the top get rotated and in turn due to the movement through the belt the second pulley at the bottom is also getting rotated. We will be connecting the second pulley to a floating paddlewheel that in turn will splash the water and thereby aerating the water efficiently and eco-friendly with zero cost of fuel and electricity. Here the user according to his/her wants and needs he/she can operate the paddle wheel by the connecting rod linked with the second pulley. By disconnecting the connection with the second pulley and paddle wheel, user can manually stop the paddlewheel aeration from working if the aeration in the pond is already under saturation level.

2) Second way, it can also serve to pump the water from the bottom of fish pond to surface which can be either use for discharging the pond water or to pump the water again to the pond to facilitate agitation and aeration again.

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Here the sail structure is mounted on the wheel arms. The wheel hub is connected to a shaft that extends to the gearbox. The shaft which is connected to the wheel hub has two gears attached to it in the gearbox. As the gears rotate along the shaft, the bigger gears that are meshed to them will rotate in the opposite direction. The bigger gears are connected to the guide wheel by pitman's arm. The guide wheel is mounted on a pitman guide that allows to slide up and down with the rotational motion of the connected gears.

The guide wheel is connected to a pump rod which is extended to the ground. The pump rod goes through a cylindrical drop pipe inside the ground. This pump rod is connected to a plunger that act like a piston and has leather cups to keep the plunger in direct contact with the cylindrical valve and allows water to pass only through the valve when the plunger is making a down stroke. There is a similar check valve is at the bottom of the cylinder that is fitted to a strainer below the water level in the ground.

On a down stroke, water is held in cylinder by check valve and the plunger distend to the bottom while the water passes to the plunger valve. With each up stroke of the pump, the plunger forces cylinder full of water in to drop pipe and out to discharge pipe hence pumping the water out. These pumped water from the bottom of the pond can be pumped again to the water surface for better aeration. For the better aeration to wider area, branching pipes can be fitted to the main discharge line. This allows the water to be maintained at uniform levels of temperature and helps to increase the circulation as well as aeration. With this, the biggest problem in a fish pond, i.e the ammonia and hydrogen sulphide levels can be minimized to a great extend without the cost of fuel like disel, petrol to run aerators or electricity and also from the need of making use of chemicals. Also this can be used for draining the fish pond for harvesting without any lost.

Wind pumps are usually comprised of 6-8 blades. The blades are slightly bent to an exact curvature. To efficiently capture the wind, a metal rib is attached snuggly to the blade and also has a tap that locks in to the hole in the sail centre. Allowing the two sides to interlock. Then the metallic bands are fit through the ribs to assemble the two sails together. The wheel arms are screwed in to the metallic hub to hold the sails of the windmill.

The gear box is mounted on a mast pipe and is also connected to a tailbone on which the vane is bolted. The entire mill can revolve on mast pipe and vane changes the direction of the wind

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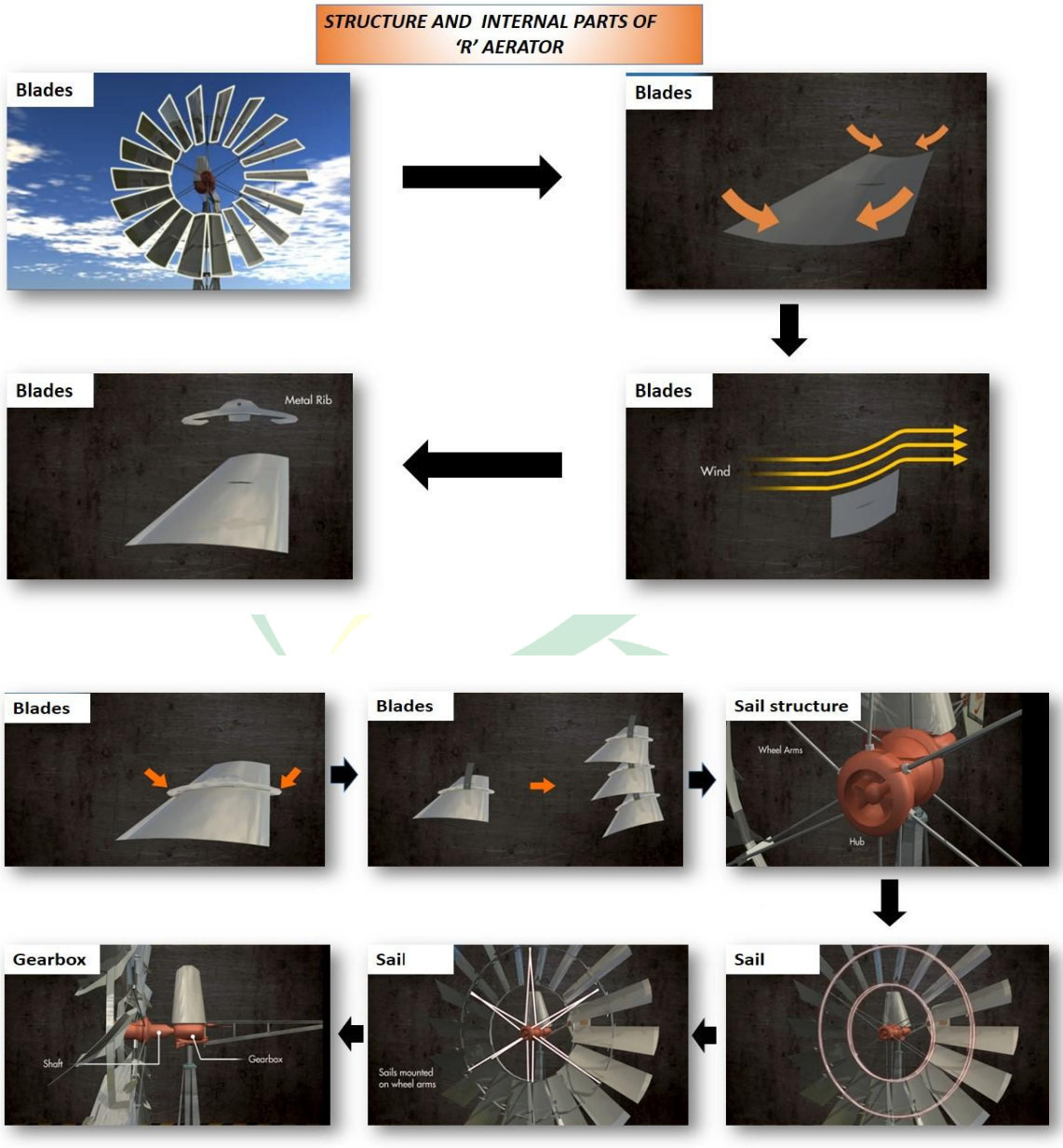
according to the wind direction. While fitting the parts, we will ensure that the shaft and tailbone are offset to the mast pipe in opposite direction. The gear box has a vane spring which is attached to the tailbone. In high wind condition, the wind force furls the mill counter clockwise wise pivoting the mill on the mast pipe whereas the tailbone is parallel to the wind direction. The tension on the vane is increased as the mill is furled and holds the mill into the wind for higher wind velocity. The increased tension on the spring causes the wheel to return in to the wind when the wind velocity decreases.



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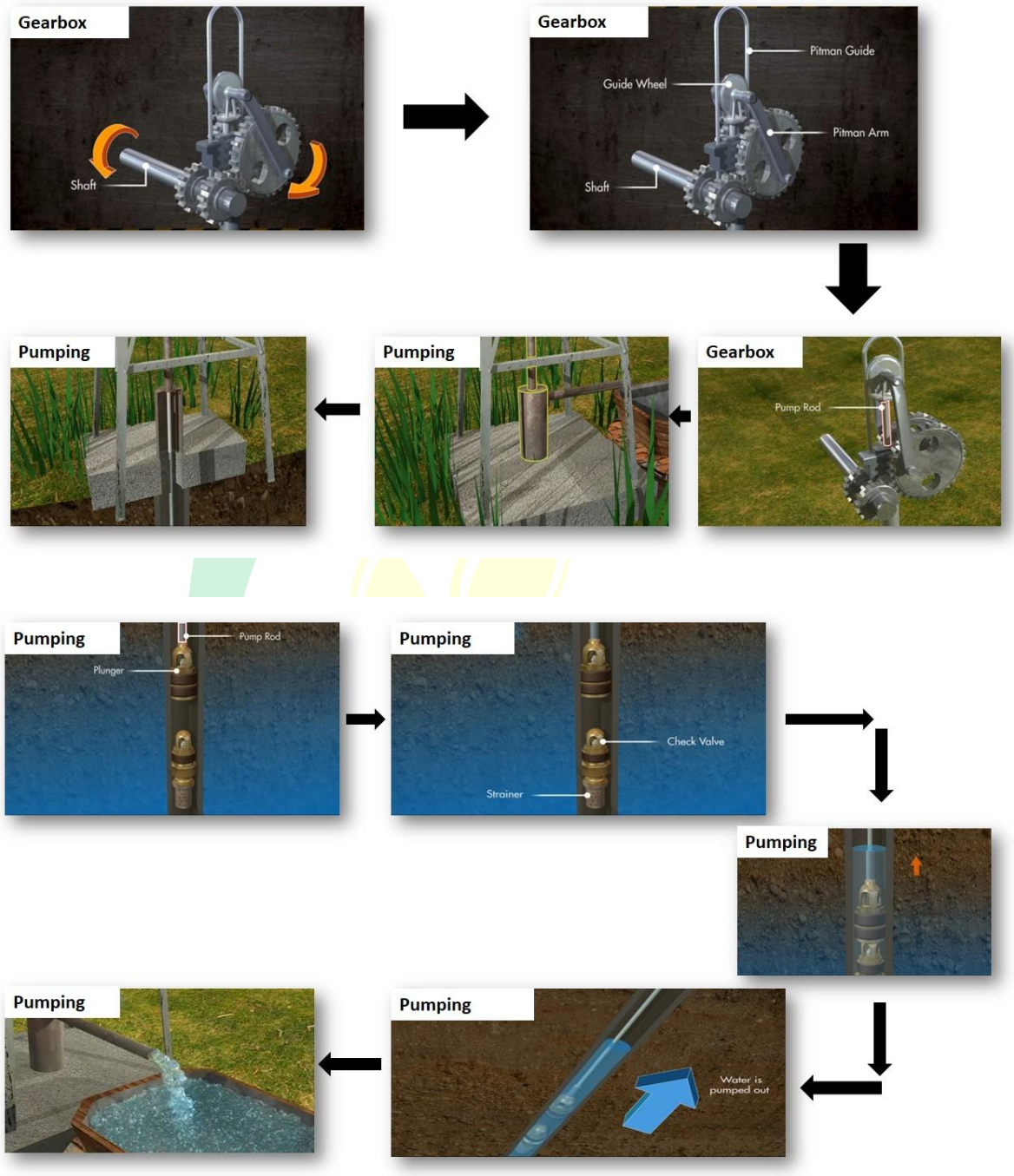

STATUS OF WIND SPEED AND DIRECTION IN INDIA

The wind experienced at any given location is highly dependent on the local topography and other factors. But in general India's wind nature is highly supportive for our windmill to work

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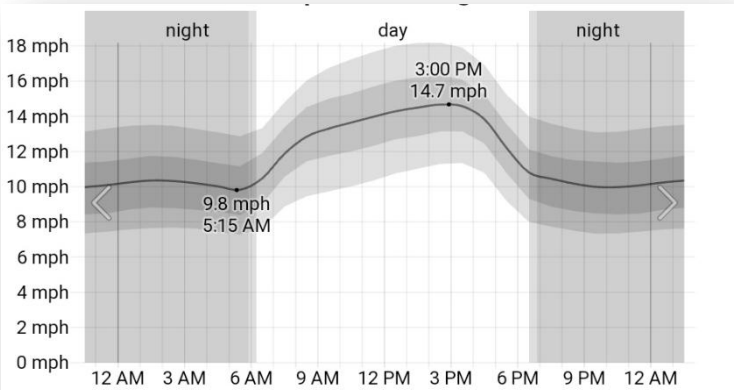
efficiently. On an average, India had a minimum average wind speed in the range 6 to 13 miles.

Here we have given the graph showing hourly average wind speed at 10 meters above the ground. Hilly or mountain areas and coastal areas experience more wind speed at lower heights..



The average of mean hourly wind speeds (dark gray line), with 25th to 75th and 10th to 90th percentile bands. Civil twilight and night are indicated by shaded overlays.

Every state has this same figures and configurations. Also the wind direction in India change with time. But generally India experience more westerly wind than from other directions. Anyways our windmill system is flexible to change the direction of spinning according to the wind direction

MOTIVATION FOR SOLVING THE PROBLEM

While analysing the facts and limitations of traditional aerators, it is understood that the need for effective cost free aeration system is necessary. By linking with this we find a new eco-friendly method where farmer can find a solution to high operational cost of electric or fuel driven aerators in an eco-friendly sustainable manner. Farmers are spending minimum of 5000-8000 rupees monthly for running the traditional aerators in an intensive to semi intensive system. By this project they can free from that huge burdenburden and can use this money for nourishing the pond and fish health.

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OUTCOME OF THE SOLUTION

1. ZERO ELECTRICITY
2. ECO FRIENDLY
3. WATER TEMPERATURE REGULATION
4. ONE TIME INVESTMENT
5. USE OF MONEY FOR OTHER THINGS
6. INCREASE IN CONFIDENCE
7. LESSER CHANCE OF DISEASE

Quality of fish production is only a secondary factor among Indian farmers. In order to reduce the cost input, they have to opt for low quality seed and feed. The "DUAL"-AERATORS involves a onetime investment and very low maintenance cost. It serve as a multipurpose apparatus which helps in aeration, pond drainage, algal bloom elimination and water temperature regulation. So overall production cost can be decreased. In such healthy condition, probability for disease occurrence will be very minimal and eventually farmers were able to achieve better production. Zero electricity consumption makes it a sustainable eco-friendly management practice and in a way can create an advanced level of farming in near future.

TIME FRAME FOR THE PROJECT

Literature study	1 months
Field study	1 months
Designing support	1 months
Mechanical support	2 months
Installation	2 weeks
Total	6 months

ESTIMATE OF THE PROJECT

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Component	Estimated cost (approx.)
Tower	15,000
Sails	20,000
Wheel and frame	10,000
Belt	5,000
Pipes	5,000
Paddle wheel	5,000
Additional costs	15,000
Total cost	75,000