The Use of the Helical Turbine in River Currents

A brief overview prepared

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The Tide-Energy Project
Near the Mouth of the Amazon

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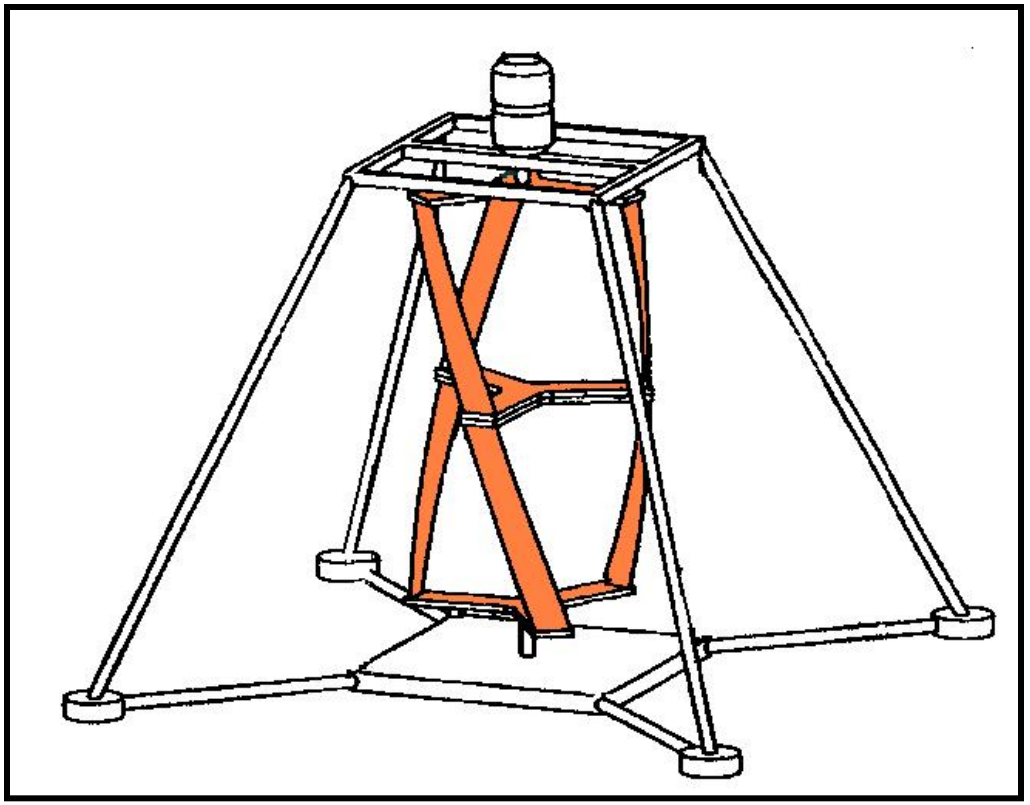
The use of the helical turbine in river currents

Topics:

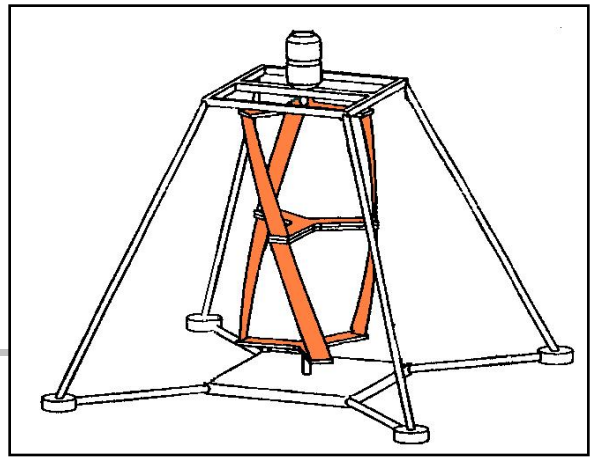
1. Characteristics of the helical turbine
2. Our experience with tide energy in Brazil
3. Use at medium and large scales to provide power for a grid
4. An inexpensive way to measure river currents
5. For more information and assistance

1. Characteristics of the helical turbine



Schematic view of a standard, 3-blade Gorlov helical turbine mounted in a frame with a generator

The helical turbine



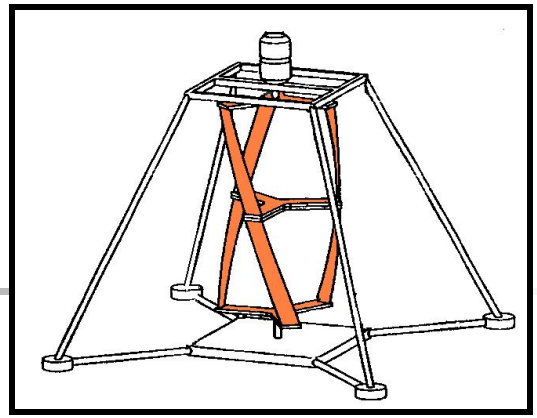
Operation:

- designed for hydroelectric applications in free-flowing water
- operates in river, tidal, and ocean currents

- does not require expensive dams that can also harm the environment
- may need protection from debris in the water

- the faster the current,
  the more energy that can be captured

The helical turbine

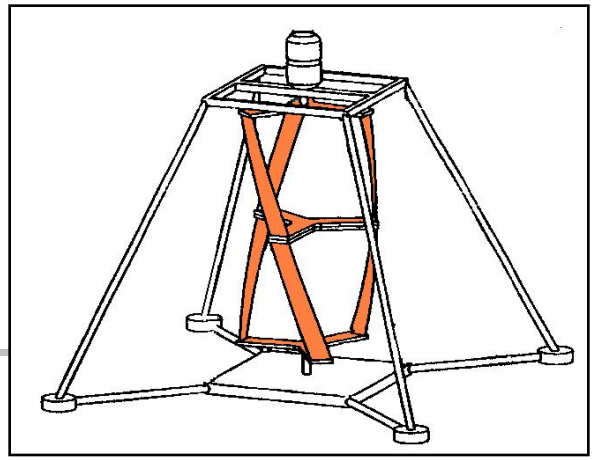


Requirements: River Current Speed

In order to generate electricity effectively with the helical turbine, the flow of water in the river at a site must be at least:

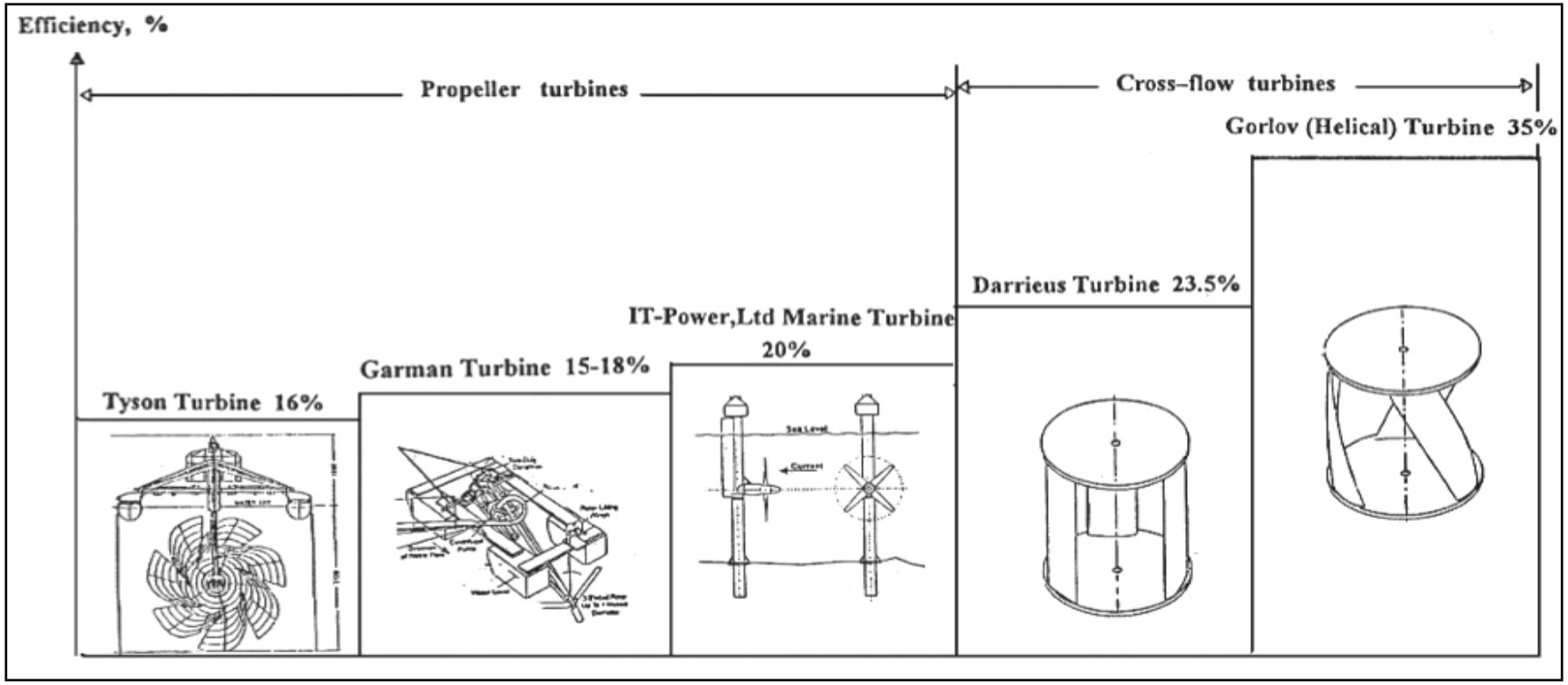
1.5 meters per second

How well does the helical turbine work compared to other turbines?



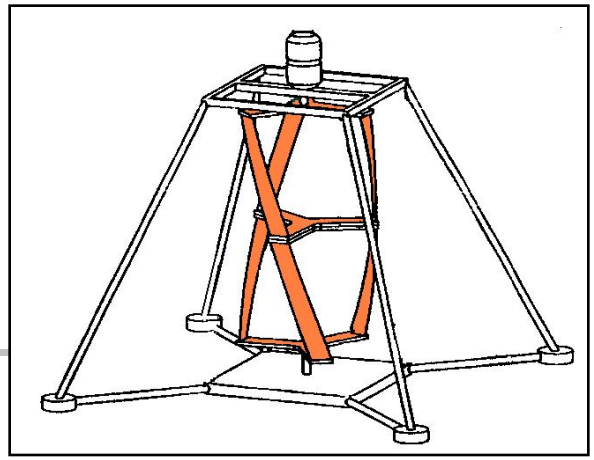
- High efficiency: 35%

In testing at the University of Michigan Hydrodynamic Laboratory



Source: Prof. Alexander Gorlov (inventor of the helical turbine)

How much does a helical turbine cost?



Small helical turbine blades are not currently available on the market for purchase.

Their availability and price are now under discussion with the manufacturer GCK/Lucid.

Disclaimer: the preparer of this overview has no financial interest whatsoever in that company or in the sale of these blades.

"If I can find a better technology, I will use it."

2. Our experience with tide energy in Brazil

Easy to build

The skilled carpenter and mechanic (above) and a welder built all of the equipment necessary to mount the blades and generate electricity.

Our experience with tide energy in Brazil

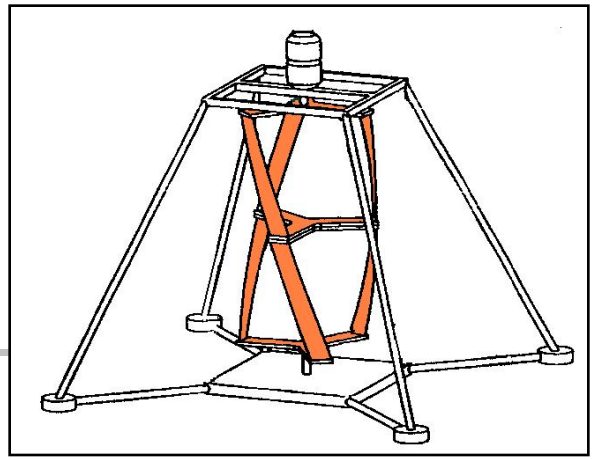
A complete helical turbine generating system

(b) drive shaft, pulley, and belt

(c) automotive alternator to charge batteries

(a) special 6-blade helical turbine

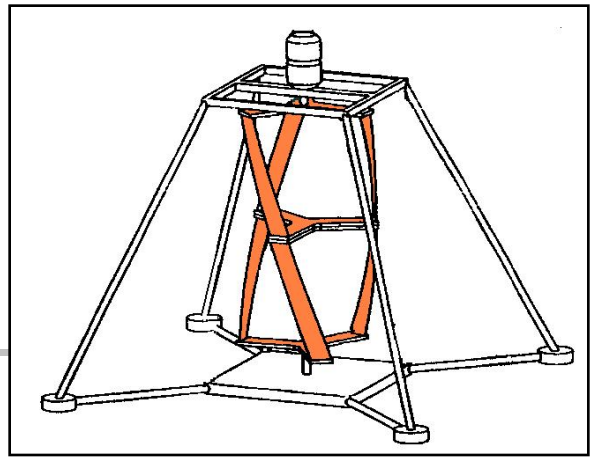
Our experience with tide energy in Brazil



Local inputs:

- About 80-90% of a tide-energy station can be built using locally available labor, materials, and equipment.
- The technically refined helical turbine blades are the only outside components.
- The total cost of a generating system would depend on both of these items.

Our experience with tide energy in Brazil



Benefits in river applications
(extrapolating from our experience):

- Energy production: at least 240 Ampere-hours/day with 24 hour operation for the purpose of charging 12 V automotive batteries.
- Sufficient to meet basic needs of 20 households at World Bank standards for solar, rural electrification projects.

3. Use at medium and large scales to provide power for a grid

Helical turbines can also be used at medium and large scales to provide power for a grid.

This is done by mounting two or more turbines vertically on a drive shaft, depending on the depth of the river, and/or on several drive shafts, depending on the width of the river.

Vertical arrangement of two turbines to provide power for a grid – medium scale

Photograph of the Uldolmok Channel pilot project in Korea

Vertical and horizontal arrangement of turbines to provide power for a grid – large scale

Artist's conception of the final Uldolmok Channel project in Korea

4. An inexpensive way to measure river currents

How to measure river current velocity?

One way is to use expensive measuring and recording devices, requiring trained technicians to operate,

or

with local labor and materials, you can use very simple equipment.

An inexpensive way to measure river currents

Necessary equipment:

(1) bottle weighted so only the neck is visible floating above the water;

(2) a line to attach securely to the bottle;

(3) a tape to measure the length of the line; and

(4) an inexpensive digital watch with a stopwatch feature.

An inexpensive way to measure river currents

How to measure and calculate the speed of the current?

From a fixed position in the river, where you could locate a helical turbine, put the bottle in the current and count the number of seconds until the bottle reaches the end of the line.

Then calculate the speed of the current:

$$\frac{\text{Length of the line in meters}}{\text{Number of seconds}} = \text{meters per second}$$

An inexpensive way to measure river currents

How many measurements need to be made?

1) You may wish to make a number of measurements in a river to determine where the current is fastest to help decide the best place to locate the turbine.

2) You probably will need to make measurements at different times of the year as the level of the river, and thus the current speed, changes.

5. For more information and assistance

Insofar as my time allows, I would be pleased to assist (via e-mail) anyone interested in making initial site evaluations and plans for installing a helical turbine.

There would be no charge for this. Good Luck.

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