

Rugged Renewables Ltd

- Rugged Renewables - formed in 2005 to develop robust and appropriate renewable energy devices.
- The aim is to take concepts to the product demonstration stage and then license them for manufacture by others.
- The company is supported by EMAT Ltd, an engineering test and investigation company who have been trading in the region since 1989. It also has close working relationships with Durham and Northumbria Universities.

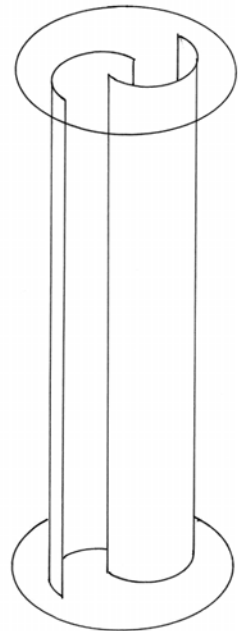


The Team

- Hilary England, Project Manager, 16 years experience in power and mechanical engineering industries.
- Ken England, Technical Manager, 27 years experience in research and design in aerospace and power engineering industries. Since 1989, a working director in EMAT Ltd.
- Niels Girvan, Managing Director of EMAT Ltd, providing technical support to Rugged Renewables.



Savonius Turbine

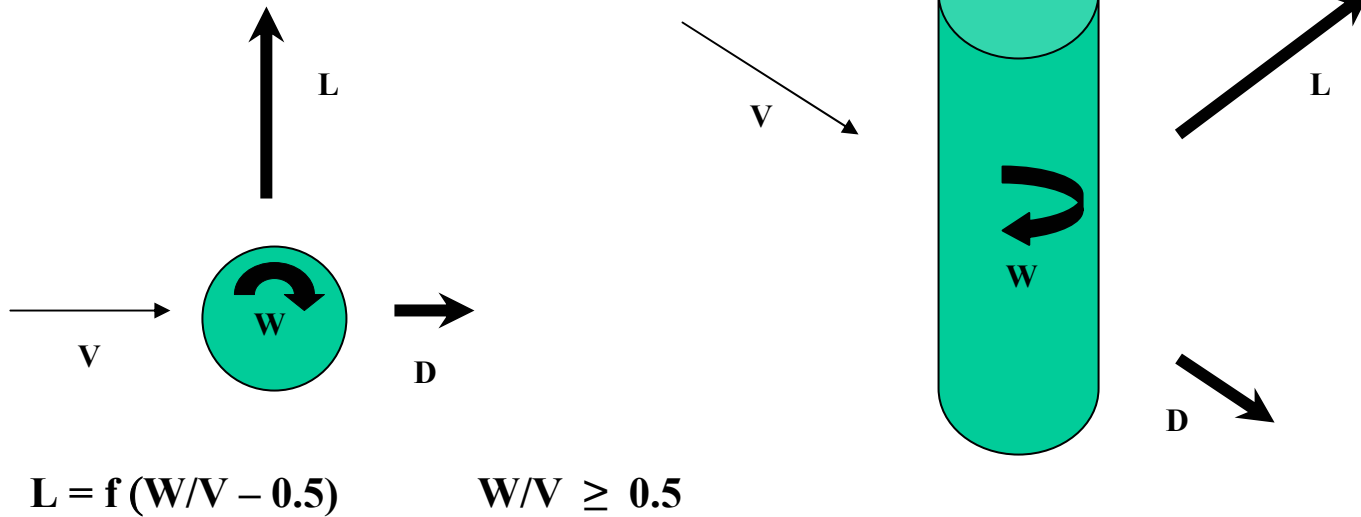


History

- Inspired by the work of Flettner, Savonius invented his turbine in 1924 as a Magnus effect sail.
- He developed it as a power generating machine and although his claims were overoptimistic he identified the Magnus effect flow around it and the importance of end plates.
- This turbine has never really caught on, mainly because it has been misapplied. Rugged Renewables aims to correct this.



Magnus Effect



Limitations

- The Savonius wind turbine is generally considered to have three disadvantages in comparison with a conventional propeller turbine.
- Its efficiency is lower (in an undisturbed flow).
- The blades are large in relation to its swept area.
- Its rotational speed is low.
- These make it unsuitable for some applications.

But.....

- The large blade area gives low blade loadings, easing mechanical design.
- The low speed in relation to flow speed ensures minimal environmental disturbance and electrical generators can now be designed to suit.
- The output characteristic is very peaked with a maximum free running speed at a tip speed ratio of about 1.5. Hence a “runaway” Savonius freewheeling in a fast flow is quite tame and over speed protection is not required.

And.....

- Since it rotates in the same direction whatever the angle of flow perpendicular to its axis, it does not require an alignment system.
- The blades are not aerofoils operating in lift hence the angle of attack of the flow is not significant and they do not stall.
- Thus the turbine is capable of extracting energy from flow which is fluctuating rapidly in speed and direction.

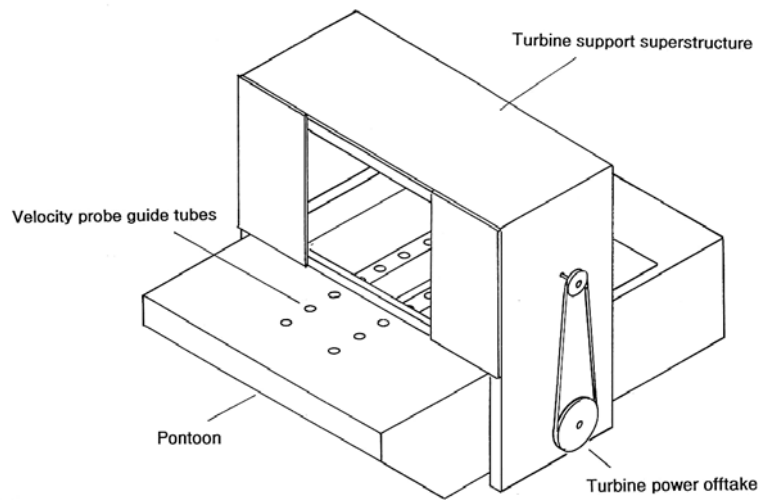
Finally

- The swept area is rectangular in shape, fitting it for applications unsuitable for propeller turbines.
- **MATCHING THE ABOVE CHARACTERISTICS TO APPROPRIATE APPLICATIONS IS THE AIM OF RUGGED RENEWABLES.**

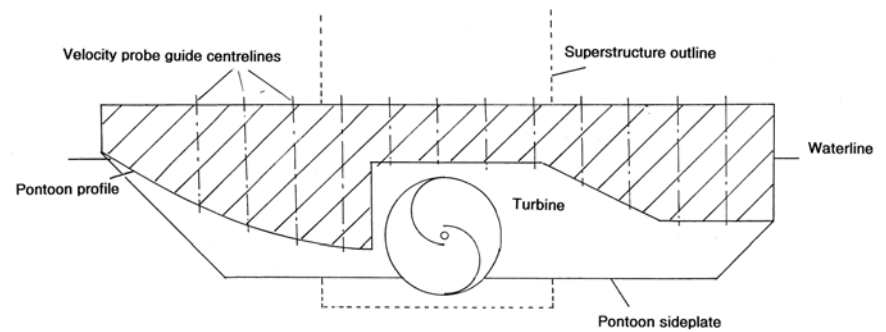
Under Water 1 – Run of Stream

- There are many small fast flowing streams and rivers that could provide energy but are impractical for conventional dam and turbine arrangements.
- These streams are generally shallow in relation to their width making them unsuitable for propeller type turbines.
- A moored pontoon with a horizontal axis Savonius turbine spanning its profiled underside could exploit this energy source.

RRRP 1



GENERAL ARRANGEMENT

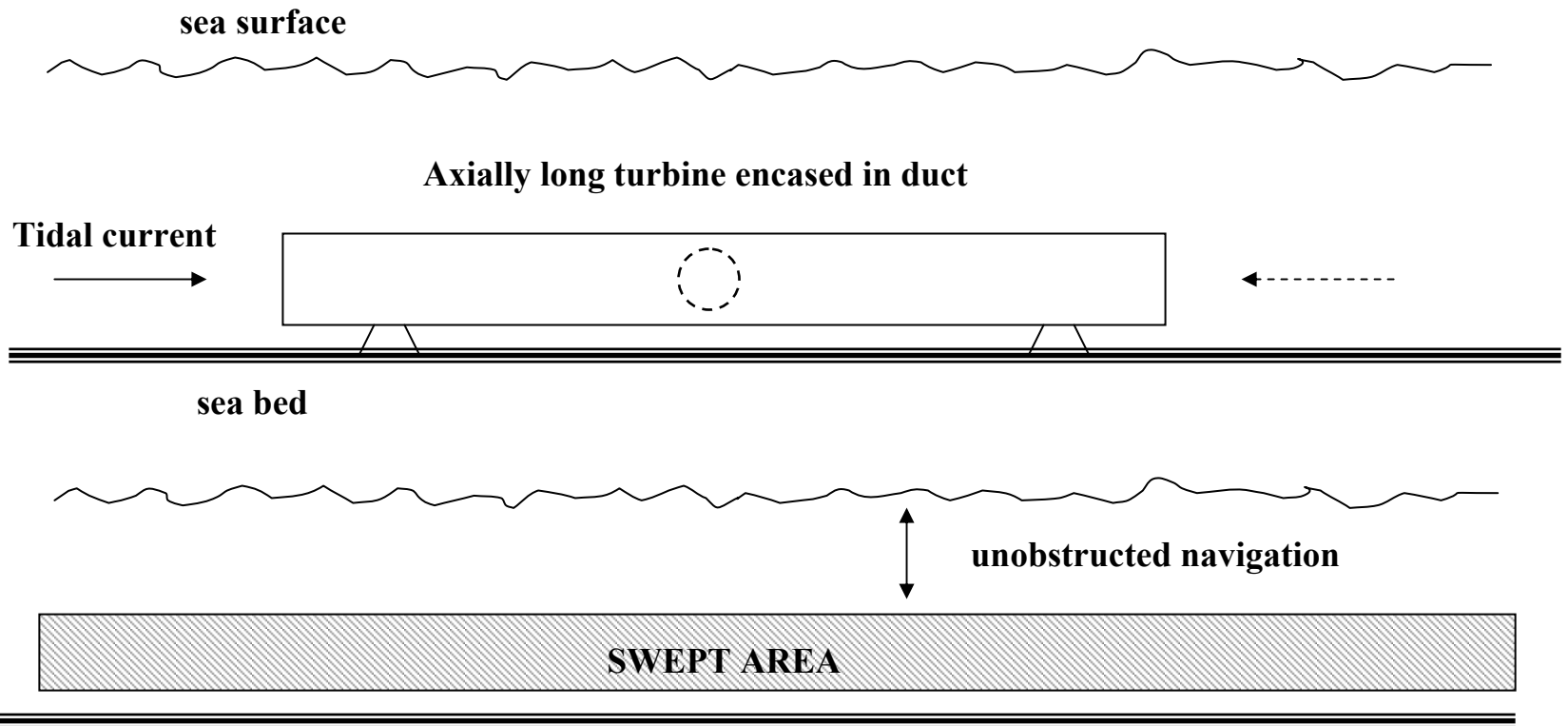


SECTION OF TEST PONTOON

Under Water 2 – Tidal Current

- It is reported that tidal stream turbulence is a major problem in exploiting this energy source.
- The Savonius turbine is thus well suited to this application.
- With its axis horizontal, the rectangular swept area again matches flow stream shape.
- A ducted form of turbine has been devised which will enhance performance and protect the rotating parts.

Tidal Arrangement



Tidal continued

- The arrangements shown would be eminently suitable for tidal rivers and inlets.
- This would ease electricity transmission problems.
- The turbines low tip speed ratio presents little hazard to marine life.

Other Applications

- Small wind turbines for turbulent locations.
- An alternative to the Wells turbine in oscillating air column wave power systems.
- Turbines integrated into structures.
- An auxiliary sail system for merchant ships.

State of Play

- Our first project is a small wind turbine. Development work on the prototype has confirmed its turbulence tolerance. Pre production machines have been built and batch production is planned.
- NaREC and Durham University have been very supportive of this project.
- With the encouragement of NaREC, the run of stream research pontoon has been built and will be tested.

Conclusion

- We have plenty of ideas but limited resources and are trying to pull ourselves up by the bootstraps.
- To progress some of these ideas we will require partners with the resources we lack.