

# TECHNOLOGY INFORMATION SHEET

## Venturi-Enhanced Turbine Technology and its Benefits

VETT technology harnesses the potential of low-head hydropower through VerdErg's innovative, low cost, fish and environmentally-friendly design and improved reliability.

### TECHNOLOGY PURPOSE

Hydropower represents the largest share of renewables worldwide and is increasingly recognised as the ideal, predictable partner for variable wind and solar power. Considerable installation potential remains undeveloped however, with low-head run-of-river installations using conventional technologies often regarded as uneconomical or environmentally harmful. Decentralised, low carbon electricity potential has therefore gone unharnessed.

*VerdErg Renewable Energy's VETT technology was designed to take advantage of low-head hydroelectric power in an economical, fish and environmentally-friendly way.*

### REDUCING COST BY AMPLIFYING WATER HEAD

VETT's low-cost design centres on its innovative use of the Venturi effect. The Venturi effect acts like a pressure amplifier to increase the pressure differential across a turbine.

Instead of providing the turbine with a large volume of water at small pressure, the VETT system provides the turbine with a lower water volume but at a higher pressure by passing the majority of the flow through a Venturi pipe. The large Venturi pipe does not contain moving parts and is fish friendly.

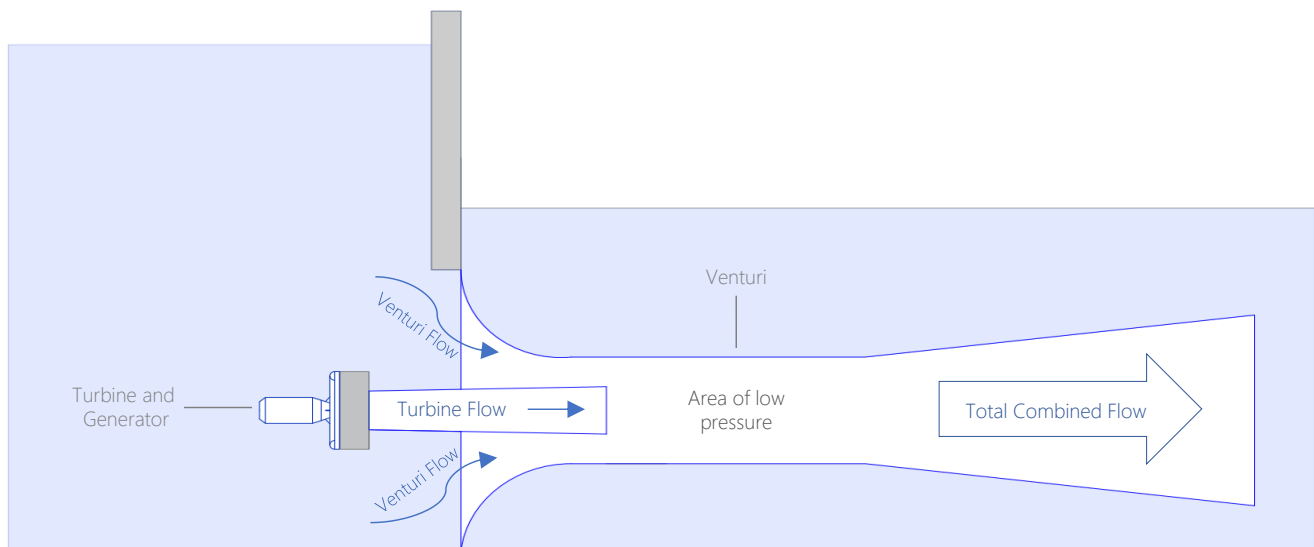


Figure 1: VETT operating principle. The turbine discharges into a very low-pressure region created by the Venturi flow. The pressure differential across the turbine therefore increases as the turbine not only experiences the site head pressure but also the considerably lower Venturi pressure downstream of the turbine.

## SIMPLE, ROBUST TURBINE

The VETT turbine is 3-5x smaller and 4-15x faster than conventional turbines with no gearbox required, helping to reduce maintenance burden.

The simple, robust turbine has fixed blades with static guide vanes. Variable speed allows for optimum power output

## ZERO NOISE AND ZERO VISUAL POLLUTION

Silent operation causes no sound impact on local eco-systems. All civil infrastructure is concealed below the waterline and no turbine house is required. The only component positioned above the waterline is the control system in a compact electrical kiosk. This can be camouflaged into the surroundings with a location adaptable to suit the site.

This means the VETT is suitable for installation by historic or listed sites, in watercourses in areas of outstanding natural beauty or where fish safety is paramount.

## VERIFIED FISH-FRIENDLY DESIGN APPROVED BY THE ENVIRONMENT AGENCY

The UK's Environment Agency concluded VETT to be 'Low-Risk' and independent third-party environmental testing classified the technology as 'Outstanding' and verified 'zero fish mortality'.

International testing at VisAdvies B.V. (NL) and by Fishtek Consulting at HR Wallingford (both UK) was carried out during the development of the VETT technology.

Multiple full scale test programmes took place covering a range of physostomic and physoclist fish. Testing included juvenile and mature fish, such as: Atlantic salmon, rainbow trout, round goby, bream, lamprey, perch and European eel. The VETT system therefore provides a safe downstream migration route.

VerdErg worked together with the Environment Agency to develop an environmental acceptance criterion for installations.

Only a small part (typically 20-35%) of the total flow passes through the turbine, reducing the size of required fish screens by 5-9x compared to conventional propeller turbines. The vast majority of water (65-80%) flows through the Venturi pipe and encounters no moving parts, making it the safest fish-friendly design on the market.

## HIGHER RELIABILITY, LESS MAINTENANCE

Moving parts are kept to a minimum for increased reliability, also helped by smaller and lighter mechanical and electrical equipment. Design flexibility and the possibility to use any horizontal propeller turbine in combination with VETT allows the supply chain to be flexible.



Figure 2: A VETT turbine during installation at Eaton Socon, Cambridgeshire in the UK.



Figure 3: A VETT turbine during installation at Eaton Socon, Cambridgeshire in the UK.