

TURBINE DE TRÈS BASSES CHUTES,
 VERY LOW HEAD TURBINE: NEWS
 LETTER N° 6

THE 1ST VLH HAS BEEN COMMISSIONED

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www.vlh-turbine.com

Dear Friends and Partners,

On March 19th, the first Very Low Head Turbine has delivered its first kW to the public network on our Millau demonstration site (South of France).

This date stone marks the end of the first R&D stage of the project and the starting point of the industrialisation of the VLH concept.

During the first quarter of 2006, the detailed design that followed the small scale model tests (see NL n°4) has been the first step towards the manufacturing of the first Turbo Generator.

The manufacturing process itself has taken more than 10 months due to the wide extent of innovation that the VLH incorporates.

By the end of February, beginning of March, the first elements of the turbine and generator were delivered on site.

They have been assembled on site before the machine could be craned in its working location.

Once in its location, the VLH has been connected to the electric equipment and the auxiliaries and commissioning tests have started.

Since then, full output has been reached, over speed and runaway speed have been successfully tested, the control equipment and the frequency converter have been tested and commissioned.

The VLH has been working in industrial mode for more than 2 months now. It is smooth and silent, no vibration can be felt.

From the 19th until the 24th of April, the first fish-friendliness tests have been performed with encouraging results.

During the last 6 weeks, almost

100 people, have visited our demonstration site.

Meanwhile, the international sales network has been expanding. Sales representatives have been appointed in Germany, Spain and Italy.

We already have secured orders for 3 VLH to be delivered in 2008, and we will probably close more contracts before the end of the year.



The Millau VLH in working position

New features will be developed and the return on experience of the first VLH will be integrated in the detailed design of the next machines to be built.

We are now entering the industrialisation phase. We are facing new challenges, cost level, reliability, integration in big rivers, withdrawing capacity are among our next targets.

The MJ2 team and owners wishes to congratulate our partners, suppliers and all the public entities from France and Canada who have supported us during 3 years and who have made this project come to life.

Marc Leclerc
 General Manager

DELIVERY AND ASSEMBLY OF THE VLH

The VLH is prefabricated in a workshop. Delivery on site is done in separated sub elements, 2 distributor halves, the complete generator, and the turbine runner delivered without its blades because of its 4,5-m diameter.



Site delivery of half distributor and generator

A flat and clean assembly zone has been prepared closed to the turbine location. The runner wheel is first positioned on pre-fabricated concrete blocs. Then, the runner blades are fitted on the runner wheel.



Runner craned on assembly area



Runner complete with its 8 blades

Afterwards, the two half distributors are bolted on top of the runner.

The generator is finally slipped inside the distributor on top of the turbine shaft and then bolted to the VLH structure.



Assembly of the generator inside the distributor on top of the runner

Connection of cables, sensors and hydraulic ducts can take place.

« Fast local assembly of sub elements

And easy craning in and out of its working position»

CRANING OF THE VLH IN ITS LOCATION



Horizontal rotation towards the VLH location

Once assembled, the complete VLH set, (weight 26 T) is craned in a single operation inside its final location.

It smoothly rotates on its 2 bearings from the horizontal position to the 15° incline position.



Final VLH location

FISH FRIENDLINESS TESTS: ENCOURAGING PRELIMINARY RESULTS

From the 19th to the 25th of April, we have undertaken the first test of downstream turbine crossing with living fishes.

For this task a scientific test procedure has been established in collaboration with the "Conseil Supérieur de la Pêche" (CSP). Two firms specialised in hydrobiology have taken part in the tests: ECOGEA (Toulouse) and GENIVAR (Québec). Their experts Mrs Thierry Lagarrigue and Jean Therrien were present and have performed the tests. Mr Larinier, expert from the ONEMA, has joined them on the 24th in order to eye witness the last test with smolts.

During these tests we have used Atlantic Salmon smolts. These young salmon go through a biological transformation in spring that will prepare them for life in salted water. They will start a downstream



Location of the recovery net upstream frame

migration in order to reach the ocean where they will spend the rest of their lives. Females will come back upstream of their native rivers in order to lay their eggs.

Therefore, these smolts have a natural



Recovery device located at the end of the net

need to migrate downstream, which is the reason why we have selected them.

Preliminary results: Smolts were too weak

At first, tests were scheduled to take place



Immersion of the recovery device

at end of March, during the period when the fishes are naturally smoltified and ready to migrate downstream. Tests could only start on the 19th of April due to a longer commissioning test of the VLH than expected. Furthermore, April has been very hot, the grade of smoltification was too high, making the fishes extremely weak. Before the first release, 500 of the original 800 smolts had died. During the tests, the dying rate of the reference lots was too high (smolts that are not launched inside the turbine) and did not allow for final conclusions on the tests.



Complete recovery net and device in the river stream

First results of the tests

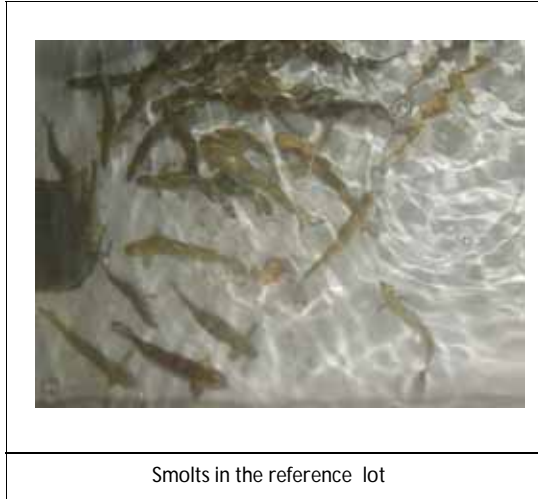
Despite the impossibility to reach scientific and statistic results for the above reason, we could come to partial conclusions of

FISH FRIENDLINESS TESTS: ENCOURAGING PRELIMINARY RESULTS

these first tests:



Smolts injection upstream of the VLH (Tests are performed at night)



Smolts in the reference lot

- o We could see that the fishes having died after crossing the VLH had a very low percentage of exterior wounds



One hour later the smolts are recovered from the net downstream of the turbine



The test Team: Ph Lautier, J.M Alléguède, T Lagarrigue C Brengues, J Fonkenell, J Therrien

- (2%) or internal haemorrhage (1%) that could result from shocks with the turbine.
- o The device that collects the fishes after their crossing showed a good efficiency (95 % average)
- o This device can be improved for the next tests with eels scheduled for September-October and for the new tests with smolts in the spring of 2008.

Next tests in autumn.

COMMISSIONING TESTS RESULTS OF THE FIRST VLH OF MILLAU (FRANCE)

Once connected to the grid the first VLH went through exhaustive commissioning tests. It is a DN 4500 type (runner diameter 4,5 m).

The results have been in complete similitude with small scale model tests.



The VLH in withdrawn maintenance position

Runaway speed at full opening (75 rpm) and maximum runaway speed (90 rpm) have been exactly as expected.

The nominal full output of 438 kW was



Filling up the upstream channel

precisely reached at the expected nominal rotation speed of 37 rpm under the nominal net head of 2,5 m and nominal flow of 22,5 m³/s.

Nevertheless, for administrative reasons, the power plant will operate at a maximum 410-kW output delivered to the public network.

All along the test period and since then, the VLH has shown a very smooth and vibration-less operation.



The VLH in operation connected to the grid

One has to touch the VLH frame to know whether it is working or not.

Since its commissioning, more than 100 hundred people have visited the site.

Experts, consultants and power plant owners have gathered in Millau to see the new VLH in operation.

3 machines have been ordered and among them c o m p a n y SHEMA (EDF branch for small hydro)

has ordered a VLH DN 3550 of 158-kW output to be installed next year on its La Roche site on the French river Mayenne in the western part of France.

The R&D team is now working on improving the VLH concept based on the return on experience of the Millau demonstration site.

New features are also under R&D process in order to cope with special applications of the VLH concept. Multi groups for big rivers, navigation locks, water level regulation during floods, reinforced protection and withdrawing structure, Canadian weather conditions etc..



VLH in working position during the visit of 50 powerplant owners on the 3rd of May

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