

VERY LOW HEAD TURBINE:
NEWS LETTER N°2

2ND NEWS LETTER

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Dear Friends and Partners

Our new concept of Low Head hydro generator project is advancing very well. Since April, we have started to develop new components of the turbo-generator, and even if we are progressing slower than we wish to, we are still able to keep up with our main objectives.

After the preliminary studies that aimed at optimising the hydraulic profile as well as the characteristics of the turbine were performed by Pf Kueny of the INPG, we were able to proceed with the detailed designing of the model test prototype and its manufacturing in Canada.

The testing of the small scale model has begun. The test channel was built by the technical department of the Laval University of Quebec.

Therefore we expect to receive the first results before end of the year, and we plan to receive the full results and reports by the end of February .

So as to take into account the results of the tests on the model, the hydraulic shaped parts will be designed at the end after the results are issued.

Otherwise, the search and selection of partners was achieved in order to complete the technical team, with a special mention for electronic components and generator stator manufacturers. We will introduce them briefly in the present issue, and we add more details in the next one.

Finally, application for water use authorisation for our demonstration site in Millau in the south of France was awarded mid January. Our main objective of putting in operation the first industrial group during autumn 2006 is at hand.

Our next News Letter will provide you with the results of the model tests and will unveil the first technical details of the Millau prototype.

We wish you a prosperous and happy new year.

Marc Leclerc
General Manager

SIGNATURE OF MILLAU LEASE

On 5th of September the long term lease agreement for the site of the first prototype was signed at the Millau town hall by the Mayor of the city Mr Godefrais and Mr Fonkenell, the FMF Manager. This firm will own and operate the power station. This document will enable the VLH to settle on the site of the old pump-

ing station site of Troussy. The site is owned by the city of Millau in the centre south of France.



Mrs Fonkenell & Godefrais signing the lease agreement

COMMAND & CONTROL AND INTEGRATION OF ELECTRIC

More than 40 years of experience in Command & Control equipment for hydropower plants.

Taking into account the wide range of equipment providers involved in the project, we chose to give the task of integration and assembling of all components to a very experienced firm.

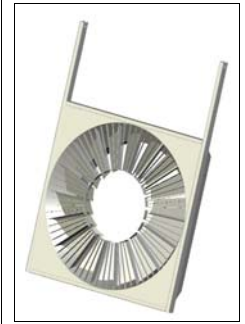
We will have to combine power electronic components acting as a speed variator with their own computerised command and control systems made by two different providers.

Furthermore, we will have to integrate the turbine control PLC together with complementary equipment control such as the

trash rake cleaner, air pressure generator, oleo pressure unit etc..

Finally, it will be necessary to manufacture a conventional electric equipment cubicle for power distribution in low voltage, automatic coupling to the medium voltage grid, and metering.

For all these tasks we chose the firm Dynelec, who has more than 40 years of experience and has fitted more than 500 small hydro power plants fitted with their equipment since its creation.



Distributor of the Millau VLH Group

POWER ELECTRONIC EQUIPMENT

A Franco - Canadian partnership under preparation

Based on an exhaustive selection of skilled and experienced partners in the field of power electronic equipment designing and manufacturing, we have chosen two firms, a French one and a Canadian one. Their association will provide us with both skill and experience.

Their experience in wind generation with variable speed generators is wide. A partnership agreement is about to be signed.

We will tell you more in our next issue.

PERMANENT MAGNET VARIABLE SPEED GENERATOR

A French firm will build the first stator.

A partnership agreement for the industrialisation and supply of the very special stators of the VLH was signed with the French firm Bernard & Bonnefond.

Design studies were finished at the end of October with reasonable hopes to obtain a greater electric efficiency than expected in our initial calculations.

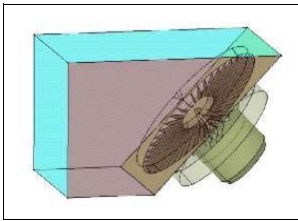
We made great progress on this front too, and we are in perfect accordance with our initial schedule.

The delivery of the generator of the Millau group will take place in September 2006.

« An international and multi-specialist team for an innovative project »

RESULTS OF CFD OPTIMISATION

A first step enabled us to evaluate the water stream behaviour up stream of the distributor by modelling a channel and a simplified distributor.



Up Stream Channel 3D Model

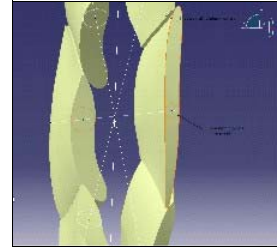
The design of the fixed distributor was performed afterwards in order to feed the turbine runner efficiently while maintaining the technical

design as simple as possible and respecting exterior constraints such as fish migrations and a good anti clogging behaviour.

A 3D parametric model was designed, based on the industrial concept. Thanks to a systematic scanning of all potential geometries, we were able to measure the corresponding flows and to find a geometry that can match best the set of design criteria while achieving an optimal energy efficiency.

This innovative design approach of the hydraulic shapes of the VLH allowed us to integrate in the design process the severe constraints imposed by us on the designer, obtaining nonetheless efficiencies comparable to those of a modern simple regulation Kaplan turbine.

This theoretical approach shall be confirmed by the small scale model tests to be performed at the Laval University



Closed Blades

The ongoing study of automation of the complete optimisation process, will allow us to shorten the design time of a new configuration of this kind of turbine and therefore, to fit a specific hydraulic profile for each site.

MANUFACTURING OF THE SCALE MODEL

The small scale model is being assembled



Manufacturing of a runner blade

and manufactured by the Canadian firm Ateliers Onmec Ltd



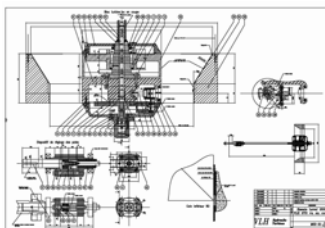
Finished runner blade

"The International partnership for the development of the project was signed"

COLLABORATION WITH CANADA

November 2005

The agreements allowing public funding by NRcan of the model test were signed by our Canadian Licensee the firm ONMEC and the Federal Government of Canada on one side and the Laval University of Quebec on the other side.



Complete design of the scale model

MODEL TEST IN THE LABORATORY OF THE LAVAL UNIVERSITY OF QUEBEC

In the frame of the development of the VLH turbine, a complete test of the model will be launched within a few days in order to demonstrate the efficiency of the concept and the characteristics of fish friendliness of this new turbine which had previously been designed with a numerical model. This model test will be performed by the "Laboratoire de Machines Hydrauliques (LAMH)" of the Laval University of Quebec.

In order to match the peculiarities of the VLH, the LAMH had to build an open channel test rig with a nominal flow of $1 \text{ m}^3/\text{s}$. This channel has a volume of $5 \text{ m}^3/\text{s}$ and it will feed a model of 670 mm diameter.

The model will work under a 1 m head during the tests. The maximum expected error on efficiency for this test will be $\pm 0.3\%$.

In addition to the efficiency hill charts of the VLH, the fish friendliness characteristics of the turbine will also be checked during these tests. This will be done by controlling that the biological criteria established by the Engineering firm are met.

Furthermore, the behaviour of the VLH under different configurations will be evaluated. Among other points, the effect of overflow over the VLH will be tested in order to simulate the VLH behaviour during floods as well as its sensitivity to variation of downstream level.

Taking into account the very special design of the runner blades which allow them to close completely, the closing torque will also be measured at runner blades shaft level.

The **LAMH** is a laboratory of fluid mechanic and model testing for turbo machines located within the Department of Mechanic of the Laval University of Quebec

The laboratory is fitted with a test rig that is able to work in either closed or open circuit. The test rig can receive different configurations of reaction hydro turbines. It is equipped with high precision

measurement instruments according to the international standards of the IEC (International Electric Commission).

The laboratory is devoted to the development of hydraulic machines and to the research in this field, mainly in Northern America. It fulfils its missions by offering

various types of measurement thus allowing a better understanding of the way machines operates and helping manufacturers to provide more efficient machines on both a technical and an environmental point of view.

During the last 5 years the LAMH has been working with well known big hydro manufacturers as well as with manufacturers in the field of micro turbines for projects ranking from 100 kW up to 45 MW per unit.

You will find more information in our web site:

<http://www.gmc.ulaval.ca/Labos/LAMH/>.



Downstream Channel



Turbine location in the test channel



View of the complete test channel

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