Article, Published Version

International Association for Hydro-Environment Engineering and Research (IAHR) (Hg.)

10 questions to Dr. Eduard Egusquiza

Hydrolink

10 QUESTIONS TO... Dr. Eduard Egusquiza

Interviewed by Michele Mossa, Editor of Hydrolink and Chair of the Committee on Education and Professional Development (EPD)

1 The IAHR-Committee on Hydraulic Machinery and Systems deals with the advancement of technology associated with the understanding of steady and unsteady flow characteristics in hydraulic machinery and conduit systems connected to machinery. What innovations are there in the field?

With the constant trend to increase power concentration and to extend operation at off-design conditions, dynamic problems are becoming more important. Flow analysis when machines are operating at extreme off-design condition, system response to large hydraulic excitation forces, cavitation, are a few of the hot topics in our field. Advanced sensors and instrumentation for sophisticated experiments as well as complex numerical methods to simulate the fluid-structure interaction are being investigated.

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2 It is well known that physical model tests carried out in laboratories must be scaled down from the prototypes, studies of size and pressure scale effects are also a central research field. In your opinion are physical models still useful in Hydraulic machinery research, and how could they be combined with numerical models?

Physical models are and will be necessary in hydraulic machinery research. What is true is that numerical models are becoming more important every day. They are substituting physical models in design and performance calculation tasks. Today, the number of experimental tests necessary to determine machinery performance has been drastically reduced. However, in complex situations like off-design performance, dynamic behavior and cavitation they are still absolutely necessary.

Both run more or less in parallel: any complex phenomena discovered by experiment can be later simulated with numerical models. A better simulation allows an increase of machine performance which leads to new problems that have to be investigated experimentally and so on. Sometimes, before carrying out an experiment, a previous simulation is very informative for optimizing the tests.

3 Hydropower is both cost-effective and environmentally responsible. The increasing atmospheric content of carbon dioxide related to pollution from thermal power plants, is one of the most significant threats to our global ecology. What can you tell us about the latest developments in hydraulic machinery which could also help to solve environmental problems?

Hydropower is a clean, efficient renewable energy source that is poised to play a larger role in future. Machines with 1000MW capacity, with larger head per stage as well being more efficient and reliable are under development. Fish-friendly turbines as well as innovative marine turbines can help to solve environmental problems. Another contribution of hydraulic machinery is that they can enhance the use of other renewable energies. Using Pumped-storage plants the surplus energy generated by wind mills can be stored and used later at peak hours when energy is needed.

4 One of the biggest problems is the increase of global temperatures and changes in climate which may also result in flooding in some parts of the world. What is your opinion on this point?

I think that the increase in global temperatures is a real fact. Taking into account the world levels of development and increase in population it seems that there is no way back at least in a near future.

Although hydropower has some disadvantages it can offer storage capacity for flood control. Today the challenge is how to harness the large amount of energy generated by phenomena related to this increase in temperatures.

5 Do you think that hydraulic machinery could have had an important impact on the increase of global temperature?

The storage of large amounts of water in dams to be used later by hydraulic machinery could have had an impact. Anyway it is probably much less than the effects of other non renewable energies.

Dr. Eduard Egusquiza is Professor of Mechanical Engineering at the Universitat Politècnica de Catalunya (UPC) in Barcelona since 1988. His research interests are in the dynamic/vibratory behavior of large hydraulic machinery, with application to condition monitoring and diagnosis. At present he is Director of the Center for Industrial Diagnostics and Fluid Dynamics and Vice-chairman of the IAHR-Committee on Hydraulic Machinery and Systems.

6 **The earthquake in Japan has also posed many questions concerning the security of nuclear power stations. In your opinion how safe are nuclear power stations around the world and what is your opinion on the latest generation of power stations?**

I do not have information and expertise enough to talk about this topic. Anyway what has happened in an advanced country like Japan has opened concerns about security and has to be reconsidered.

7 **Should nuclear power still be considered as a viable source of energy or, since the risk is so great, should we extend funding for research and funds on alternative energy sources?**

What is clear is that much more funds have to be invested in alternative energy sources to increase little by little its share in electricity generation. However, unless we reduce energy consumption nuclear power could be still necessary.

8 **How do you think the Hydraulic Machinery Committee of IAHR could help the development of new systems which could produce alternative energy, such as wave, sea current or wind energy?**

One of the most important characteristics of our Committee is that it is well balanced between academia and industry. This fact cannot be found in many other organizations which generally are for academics or for end-users. The interaction between academics and company engineers has generated a large body of knowledge and a strong partnership. This can be used to tackle large projects with complementary groups to develop new machine and systems. Moreover some of the companies participating in the committee have divisions in ocean energy. IAHR has recently established a Working Group in Marine Renewable Energy chaired by Martin Wosnik which is specifically addressing these issues.

9 **What is your opinion on the new machinery for wave, sea current or wind energy? And how valid are they from an economic point of view? Are we now in the position to completely change our energy sources or are new energy sources to still be considered as simply supplementary sources of energy? If so, when do you think the industry might be ready to completely change all energy sources and consequently the machines used for their production?**

"In Spain in March this year for the first time, the principal production of electrical energy was wind energy."

Machinery for wave and marine energy although still in its infancy is showing a large potential. These machines have to be deployed and monitored for some time before definitive conclusions could be extracted.

When talking about economics we must not be short-sighted. The long-term benefits of these renewable energies to reduce carbon emissions and boosting energy security are so large that have to be taken into account.

I do not think we can completely change our energy sources. Anyway, taking into account the available resources if there is the political will and the necessary investment renewable energies could have a predominant role in a near future. For example, in Spain in March for the first time, the dominant source of production of electrical energy was wind energy..

10 **As usual, the last question is not exactly a question. You are free to direct to our readers to send them a message of yours on a topic that is dear to your heart.**

I would like to send a message to young engineers and professionals about the importance and interest of hydraulic machinery. This is a multidisciplinary field in which Computational Fluid Dynamics (CFD), Finite Element Analysis (FEA) and experiments are used. From fluid flow analysis to residual life analysis several interesting areas are covered. Careers with good perspectives and dealing with real world problems can be developed in this field.