# Switzerland

The Wetterhorn mountain rises above the lake called the Bachsee in the Bernese Alps near Grindelwald, Switzerland.

**Hydropower is the leading source of renewable energy, supplying the world with about one-fifth of its electricity. It is clean, leaves behind no waste and neither emits pollutants nor significant amounts of harmful greenhouse gases. The Andritz Hydro Power Business Area has provided hydropower plants with modern equipment and extensive services for more than 160 years.**

# “ANDRITZ VA TECH HYDRO MET ALL THE CHALLENGING TARGETS WE SET FOR THEM.”

**Karl Heiz,** President of Rätia Energie, Switzerland


**In the spring of 2006, the Küblis hydropower station, Switzerland, resumed operation after a one-year rebuild period. Andritz VA TECH HYDRO's supply included two machine groups with Pelton turbines and generators as well as the control system and auxiliary equipment.**
**(Photo: The new 22.8 MW vertical double-jet Pelton machine groups are seen on both sides of the glass control cubicle.)**

# CLEAN POWER FROM WATER

## Interview with Karl Heiz

President of Rätia Energie, Switzerland

**Rätia Energie (RE) is a major Swiss electricity company founded in 1904. It has been building up a strong position in the renewable energy segment for several years. RE operates several hydroelectric power plants, holds shares or long-term drawing rights at other facilities, and is building new production capacity in Italy. Karl Heiz, President of the company, talks about renewable energy and Andritz's role as a key supplier.**

**Personal background**

I graduated from the Swiss Federal Institute of Technology with a degree in physics and I also hold an MBA. I joined Rätia Energie in 1987 as its Chief Executive Officer after a successful international career with Nestlé. I am a member of the executive committee of the federation of Swiss electricity enterprises (VSE).

**Balanced and integrated approach**

RE has a balanced and integrated approach to the energy value chain. We started as a power generation company and soon built transmission lines, which gave us access to the Swiss and the international transmission grids. Distribution came later through acquisitions in Switzerland and Italy. While distribution is a relatively low-risk and low-growth business (at least in Switzerland where market liberalization is less advanced than in the EU), international trading offers us good growth opportunities. Key success factors for both distribution and trade are a secure proportion of generation capacity and access to the transmission and distribution grids. Environmental compatibility is always an important aspect of our projects. Several of our plants are ecologically certified as a result of different measures we have taken.

**Current trends**

Energy consumption will continuously increase. Energy generation will be predominantly dependent on fossil fuels; however, renewable energy will become more and more important. Efforts to reduce $CO_2$ emissions will be intensified.

With market liberalization making progress all over Europe, price became the main issue for all customers and security of supply was taken for granted. Today, consumers consider security of supply and sustainability as the main challenges. We also have observed an increased demand for ecologically certified power. Both of these factors speak in favor of hydropower.

**Hydroelectric power development**

Hydro is, by far, the most important source of renewable power, both in terms of quantity and ecological value. Despite the fact that investment costs of a new hydropower plant are extremely high, we believe that the long-term economic prospects remain good. Pumped-storage plants, in particular, are uniquely suited for generating power when demand for electricity is high and for supplying reserve capacity to renewable, fossil-fueled and nuclear plants. The production of renewable energy should be encouraged and expanded. Existing plants should be maintained and refurbished.

**Renovating the Küblis station**

The Küblis station is located in the Graubünden canton in eastern Switzerland. It started operation in 1922 with three 8-MW three-phase groups, one 2.9-MW single-phase group, and two 8.5-MW single-phase groups. The facility was granted an 80-year license when it went into operation.

After lengthy negotiations, we were able to secure a new 80-year license in 2005. We set about to replace the outdated machinery. Our technical goals were to produce 175 GWh of electricity each year with two machine groups. We wanted fully automatic and autonomous operation of each machine group with high availability.

We also were constrained by architectural goals. The power station, and particularly the machinery hall, at Küblis are considered to be of historical value. When the renovation began, it was a big challenge to ensure that technical and safety requirements were met while preserving the historical building.

**Andritz VA TECH HYDRO**

Through its predecessor companies, Andritz VA TECH HYDRO has supplied machinery to Rätia Energie since the 1930's. This business relationship has lasted for several generations.

When selecting potential suppliers, we look at the company (R&D, experience, locations, size, etc.) and we evaluate the quality assurance systems. We look to see how the supplier has improved its products over the years, as well as the competence of its people. In addition, a solid financial base is absolutely necessary for larger projects.

Andritz VA TECH HYDRO scores very well in all these areas. We chose them for the Küblis project. Their scope included the supply, erection, and start-up of the turbines, governors, and turbine shut-off devices, as well as the synchronous generators and their excitation equipment.

**Performance**

When the contract was signed with Andritz VA TECH HYDRO in March 2004, we agreed to shut down the Küblis station on March 29, 2005, dismantle the old machines, lay new foundations, and install the equipment so that trial operations for Group 1 could begin on December 24, 2005 and for Group 2 on February 13, 2006. Andritz VA TECH HYDRO met the start and finish dates exactly on schedule.

The machines have been in operation for almost one year now and meet the challenging targets and requirements with regards to efficiency, reliability, availability, and maintenance to our full satisfaction.

New legislation stipulates that we maintain a minimum water flow for water catchments, which means that the total quantity of water that can be utilized for power generation has been reduced. Thanks to the higher efficiency of the new Andritz VA TECH HYDRO machines, we can partly compensate for this loss of available water volume.

I am very impressed with the willingness of Andritz VA TECH HYDRO to meet future challenges using research, development, and innovation. Their forward-thinking provides us with solutions which meet the needs of our markets. ■

# "CLEAN, CLEVER, AND COMPETITIVE"

## Interview with Richard Taylor

Executive Director of the International Hydropower Association (IHA)

**The International Hydropower Association (IHA) has members in more than 80 countries and is a non-profit organization advancing hydropower's role in meeting the world's water and energy needs. Richard Taylor has over 20 years experience in water resource management and has been Executive Director of the Association since 2001. He shares with us his views about hydropower as a source of renewable energy.**

**Personal background**

My professional career started in 1985. I specialized in hydropower project assessment, focusing on design and environmental performance. Between 1986 and 2001, I edited international journals on hydropower and dam construction. Since 2001, I have been the Executive Director of IHA. I am also a Fellow of the Energy Institute in the UK and have been engaged in various United Nations initiatives. I am IHA's observer to the UN Framework Convention on Climate Change.

**Supply and demand**

Global energy use has risen by 70% since 1971 and continues to increase at the rate of about 2% per year. There are many scenarios for future demand and the energy mix that will be needed to meet this.

In 2005, renewable energy represented one-fifth of total power generation. Hydropower is the most advanced and flexible of the renewables and represents 87% of this production. During 2005 alone, 18 GW of new hydro capacity was commissioned. IHA estimates that only one-third of the realistic potential has been developed.

Five countries make up more than half of the world's hydropower production: China, Canada, Brazil, USA, and Russia. Taking Europe as a benchmark (proportion of production in relation to realistic feasibility), we expect to see a ten-fold increase of hydro in Africa, a three-fold increase in Asia, a doubling in South America, and an increase of about 10% in North America. Future development in countries such as Chile, Colombia, Ethiopia, Nepal, Romania, Turkey, and Zambia will rely on finding appropriate long-term funding mechanisms and partnerships.

There are many recent cases of incremental hydropower, both adding to existing capacity and retrofitting large dams to increase hydropower production. There are 45,000 large dams in the world and the majority does not have hydro facilities. While this is not always an economic option, there is a significant market niche in this area.

An even bigger market is plant modernization. Equipment with improved performance can be installed, often to accommodate market demands for more flexible, peaking modes of operation. Most of the 807 GW of hydro equipment in operation today will need to be modernized by 2030.

**Drivers**

Beyond basic energy demand, there is a long-term economic advantage of hydro development. With annual operating costs in the order of 1% of capital costs, hydro's autonomy from fuel price is a distinct advantage. The flexibility of storage hydro (hydro with reservoirs) also makes it a compelling partner to ensure security in mixed power systems. Another driver is the increasing need for water management. Multi-purpose hydro reservoirs bring security of water supply as well as power.

**Technologies**

Most of the early hydropower projects were built to provide a primary "baseload" to the power system. As other technologies were introduced, hydro has tended to evolve into a supporting role – responding to gaps between supply and peak demand.

Consumers today subscribe to the need for a transition from "dirty, insecure, and expensive" to an energy future which is "clean, clever, and competitive." However, there is certainly no technology panacea on the horizon.

With hydropower technology, the challenge is to improve by continuously pushing the envelope in terms of environmental performance, materials, efficiency, operating range, and costs. The least-cost alternative for producers desiring additional capacity is almost always to modernize existing plants, when this is an option.

**"Water and energy are the world's key challenges – and hydropower has a vital role to play in both."**
**Richard Taylor**

Also, looking at new technologies, I think the hydro industry could take more of a lead in the marine energy sector. More broadly, I think all renewable technologies could benefit from closer collaboration.

**Small versus large**

This is an old debate. From the smallest to the largest, all developments have a footprint, especially when you look at the cumulative effect of a lot of small schemes. Smaller-scale hydro plays an important role in remote areas and in maximizing the value of multi-purpose sites. Large schemes will continue to be the most environmentally benign to the power industry and urban centers.

**Pumped storage**

Storing hydro at times of low demand and releasing it when demands are high can be a very good business. Pumped storage can solve a plethora of system challenges. It can follow load fluctuations so that fossil plants can continue to operate at their best efficiency. In many countries, pumped storage units ensure total system security and maintain the quality of supply.

**Synergies**

There are good synergies between renewable energies. For hydropower, the most developed relationships are with wind and geothermal power generation. Wind produces a variable and intermittent supply and hydro can provide the firming capacity to ensure both security and quality in the system. Geothermal plant characteristics lend the technology to baseload operation. Hydro's flexibility can support this by meeting peaks in demand. Similar synergies between hydro and solar, biomass and the marine technologies will develop as these technologies move into larger scale deployment.

**Issues**

With regard to climate change, hydropower tends to have a very low greenhouse gas (GHG) footprint. As water carries carbon in the natural cycle, scientists have investigated the extent to which a new reservoir might accelerate carbon emissions. In some very shallow tropical reservoirs, this may be the case, and account would need to be taken into consideration in the life cycle analysis of such schemes. In contrast, several hundred reservoirs around the world have been monitored to test their emissions, confirming that hydropower is one of the cleanest methods of power generation. Taking into account an international average for hydropower emissions, fossil fuel power plants tend to emit 10 to 35 times more greenhouse gas per unit of electricity.

Population growth in emerging markets is both a driver and a constraint. The demand for land and water resources increases with population growth. Water management is key to sustainable development. Many of the projects in the future will be multi-purpose: urban water supply, flood control, in addition to power generation.

Finding the right balance is fundamental. Sustainability criteria demand that economic decisions incorporate environmental stewardship and social justice. To give guidance, IHA has developed Sustainability Guidelines. Supplementing this is an Assessment Protocol which sets out a system by which sustainability can be measured. I believe that the Protocol will become the primary tool for certifying the sustainability of hydropower development.

Following this, certification could be a win-win for all parties. That is, the best performers will get the best returns, and customers can buy with confidence.

**Regulatory matters**

Europe and North America tend to have the most advanced regulatory frameworks. While comprehensive project assessment is a given, much unnecessary bureaucracy is created in the development of new projects and the periodic re-licensing of existing installations. The high administration costs are a significant burden, especially for smaller companies. In Europe, the Water Framework and Emissions Trading Directives are in need of clarification regarding hydropower. For the "transition" countries and developing world, regulations relating to the Kyoto mechanisms need to be better understood. In addition, financial institutions must standardize their policies to avoid unnecessary duplication and inefficiency.

**Financing**

Many economically feasible hydropower projects are financially challenged. High up-front costs are a deterrent for investment. Also, hydro tends to have lengthy lead times for planning, permitting, and construction. When you examine life cycle costs, however, hydro often has the best performance, with operating costs being a fraction of the capital investment.

The main challenges relate to creating investor confidence in hydropower. Green markets and trading in emissions reductions will undoubtedly give incentives in some areas. In developing markets, such as Africa, interconnection between countries and the formation of power pools will build investor confidence. Feasibility and impact assessments carried out by the public sector, prior to developer tendering, will ensure greater private sector interest in future projects.

However, I think most investment will only come when the need becomes urgent – when the lights go out. Unless policymakers are better informed, much of the investment will be targeted at quick-fix solutions. It is IHA's priority to increase awareness of the role that hydropower can play in the clean, clever, and competitive markets of tomorrow. ■