

## IEEE EPEC 2010 Hydropower Panel Session Programme

Application of innovation and technical expertise to the life extension of critically ageing hydropower plants

---



**Session Chair's bio:** Tihomir Maricic graduated in Mechanical Engineering from University of Nis, Yugoslavia, in 1981. After his graduation, he joined the team that worked on the development and building of the Hydroelectric Plant "Iron Gates 2", joint venture project between Yugoslavia and Romania. For more than 10 years and through the variety of positions, he gained substantial and wide experience in the design, manufacturing, and installation of hydro equipment. After moving to Canada, he has used this experience in international and domestic projects as a consultant, as well as a project and design engineer for operation and rehabilitation of hydroelectric plants. In 2006, Mr. Maricic joined Ontario Power Generation as a Senior Plant Engineer with the Asset Management Department of Niagara Plant Group.

Mr. Maricic is a licensed Professional Engineer in the Province of Ontario.

---

**1**

**Title: Ageing hydropower fleet longevity and its life extension**

**Speaker: Don Haber, P. Eng., Manager**

**Engineering Programming & Oversight Hydro Engineering Division, Ontario Power Generation Inc.**

**Abstract:** The Sayano-Shushenskaya disaster that occurred in Russia in August 2009 claimed lives of 75 hydropower plant employees. In addition to the human tragedy, the plant went into an operational mode that resulted in 9 out of 10 hydro units being seriously damaged or destroyed. The powerhouse was also extensively damaged, and there was a major release of oil to the environment. The units were at the end of their calculated life expectancy. That condition, combined with irregular operational modes, lack of effective maintenance, design flaws, and malfunctioning of some pieces of equipment, contributed to the catastrophe.

This failure of unprecedented magnitude prompted OPG to conduct an exercise to determine the possibility of a similar event in its own fleet. A subsequent OPG Disaster Aversion Workshop discussed in detail the known information regarding the Sayano-Shushenskaya failure and compared those factors with conditions and practice within the OPG Hydro business. The workshop included reviews of analyses conducted by CEATI and the US Army Corps of Engineers. OPG developed a preliminary risk assessment, which considered a number of risk factors that contributed to the failure of the Sayano-Shushenskaya turbine. Areas of higher risk were identified and recommendations of specific actions to reduce these risks to an acceptable level have been implemented.



**Speaker's bio:** Don Haber is currently Manager, Engineering Programming & Oversight, in the OPG Hydro Engineering Division. He is responsible for engineering oversight and programming activities across OPG's Hydro Business. He has held various operating, maintenance and technical roles in the organization. He has over 30 years of experience with Ontario Power Generation and its predecessor company, Ontario Hydro. Mr. Haber is a licensed Professional

Engineer in the Province of Ontario.

---

---

---

**2**

**Title: Innovation and technical expertise for hydro plants**

**Speaker: Pierre Seguin, ing., Head of Business Development  
Voith Hydro Canada**

**Abstract:** Catastrophic failures of ageing hydro units happened in Canada as well. When a major failure occurred in the Unit 3 at G.M. Shrum, one of the largest hydro plants in Canada, BC Hydro's objective was to get the machine back on line as quickly as possible. Through the use of innovative repair methods, the unit was rebuilt and got back on line in 14 months. The repair at this 2,730-MW plant is an example of the innovation and technical expertise abounding in the North American hydro market regardless of the unit size.



**Speaker's bio:** Pierre Séguin has over 25 years of hydro experience in maintenance, manufacturing, project management and sales and marketing. He is currently Head of Business Development of Voith Hydro Canada. Mr. Séguin is a member of L'Ordre des Ingénieurs du Québec.

---

---

**3**

**Title: Hydro turbine governor and why it is important to understand it**

**Speaker: John Codrington, P. Eng., Senior Mechanical Engineer  
Hatch Inc., Niagara Falls, Ontario**

**Abstract:** Governor was first treated analytically by Clark Maxwell in the 19th century. Governor action was correctly seen as something very important in the days when hydro plants were installed as the sole or the principal contributor to a small power system. As large interconnected systems developed, the large number of loads and generators obscured the action of the governor. Less interest was taken in how the governor should be specified and adjusted for use in a large interconnected system. However, mysterious power flows began to be seen in generation areas where the generation was predominantly hydro. This led to governor setting policies, which are valid today. Now, we have the ability to build very large computer models and to demonstrate the significance of the governor. In addition, it has been demonstrated that the computer models may indicate that a system is robust, while real life experience shows that the system has collapsed. This anomaly has been explained by inadequate representation of the hydro turbine and its governor. It is now a requirement of the System Operator that hydro power plant owners submit data that will allow realistic models to be developed for inclusion in system models.

**Speaker's bio:** John Codrington received his B.Sc. (Honours) in Mechanical Engineering from University of Manchester, England. He has been with Acres, and now Hatch Energy, contributing to many different projects, most recently in hydroelectric engineering, much of this being in Latin America and Iran. He has been responsible for the design review of mechanical equipment including turbines, governors, gates in the high head arch dam, and other equipment in the powerhouse. He participated in the shop testing of the governor, where a feedforward algorithm requested in the specifications was coded in and successfully tested in the course of the shop testing. Mr. Codrington has a strong background in analysis of transients in pumping installations and hydro plants. He developed a computer model to investigate the dynamic behaviour of the interconnected electrical systems, with a focus on prime mover control and the system and tie lines response to demand/load changes. Mr. Codrington is a registered Professional Engineer in the province of Ontario, and a Life Member of the American Society of Mechanical Engineers (ASME).

---

---

**4**

**Title: Governor types and longevity**

**Speaker: Ronald J. Hahn, Customer Service Manager  
Alstom Power Inc., Canada**

**Abstract:** Governors are a matter of concern to the majority of hydro fleet owners. Problems with governors are related to ageing, diminishing spare parts availability for obsolete products, as well as limited availability of know-how and expertise related to pre-existing governors. Specialty knowledge is required for governor upgrades, retrofits and replacement. Special considerations are necessary when integrating older governors with modern hydro power plant monitoring and control systems that utilize state-of-the-art products. Types of governors available nowadays with comparison of PLC based governors versus proprietary governor products will be discussed. Beginning with a brief overview of pre-existing governor types, today's digital governor systems that utilize PLC-based technology versus proprietary governor products will be discussed.



**Speaker's bio:** Ronald Hahn received his B.S. degree (Summa Cum Laude) in Business Management from the Upper Iowa University. He has been in the hydroelectric field since 1990 focusing his career on both technical and business operations. His background extends to the areas of mechanical vibration analysis, application engineering, control system design and implementation, project management, PLC programming, field installation and startup services, R&D activities for the development of PLC-based digital governor technologies, solid-state circuit design and governor system hydraulic designs. He has successfully maintained past career positions as a Mechanical Analyst, Controls Designer, R&D team member, Project Manager, Sr. Application Engineer, Application Engineering Manager, Sales & Marketing Manager and Vice President of Business Development. Ron has direct field experience that is demonstrated through start-up and commissioning activities for both domestic and international hydroelectric projects. Ron actively performs assessments for governors, controls, and electrical balance of plant system within hydroelectric facilities. In his current position he is responsible for the overall application engineering, sales and tendering activities for the Governors and Controls business unit for Alstom Power, Inc.

---

---

**5**

**Title: Major overhaul, upgrade and up-rate of ageing hydropower units**

**Speaker: Charles Prévost, ing., System Engineer  
Large Hydro, Andritz Canada**

**Abstract:** Electrical and mechanical equipment of the existing hydropower plants need to be revitalized, rejuvenated, and brought up to the current technical level of development. The latest and most successful technological approaches to major rehabilitation projects will be discussed. A real life example of a complex overhaul work will be shown.

In July 2009, Andritz Hydro was awarded, along with the supply of a new generator, the refurbishment of the turbine components, all but the runner and shaft, of the Sir Adam Beck 1 (SAB) Generating Station. A refurbishment strategy and rigorous process were developed and agreed to with Ontario Power Generation (OPG) early into the project, the objective of which were to force rigor around assessing refurbished part conditions and addressing issues to ensure present and future personnel and equipment safety, reliability, performance, and maintainability.

This presentation will include a comprehensive methodology overview and specific examples (based on the SAB project as well as others) of machine improvements, and how this methodology can be improved in the future.

Hydraulic design parameters are left out on purpose, in order to concentrate on the refurbishment of other turbine components, more frequently left out. Ad-hoc processes or lack of processes should be avoided as turbine refurbishment projects require rigour in order to ensure public and personnel safety, machine reliability, and high performance.



Speaker's bio: Charles Prévost has worked for the last seven years in the Hydro Electric field. He now works for Andritz Hydro (formerly General Electric Hydro) as a system engineer on both the generator and turbine product lines. He also held various other positions in tooling design, Kaplan turbine design, vendor supervision, manufacturing technology development, quality assurance and continuous improvement. Charles has coauthored a patent on turbine blade manufacturing technology, with GE, and a paper on the use of fiber optic Bragg Grating interferometer for strain measurement, with the National Research Council's Institute for Aerospace Research. Mr. Prévost is a member of L'Ordre des Ingénieurs du Québec.