



STRATEGIC BUSINESS PLAN (SBP)

IEC/TC or SC 4	Secretariat Canada	Date January 2013
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Title of TC
Hydraulic Turbines

A Background

- TC 4 is responsible for the preparation, periodic review and updating of standards and technical reports covering the design, manufacturing and rehabilitation, commissioning, installation, testing, operation and maintenance of hydraulic machines including turbines, storage pumps and pump turbines of all types as well as related equipment.
- TC 4 is responsible for sixteen (16) main Standards and Guides (some additionally available in several languages), either published or being developed. Eight different Working Groups are currently active in the development of new standards and maintenance of existing standards.
- TC4 maintains liaisons with other TC's, ISO, ASME and IEEE regarding Vibrations, Large Flow Measurement and Monitoring and Control.
- Fourteen (14) of the eighteen (19) "P" countries confirmed planned participation for the Tokyo Plenary Meeting held October 15-17, 2012, mobilizing the efforts of some 65 active technical expert members present from around the world. Please note that an additional sixteen (16) Observer countries are formally registered for TC 4 activities.

B Business Environment

B.1 General

- Hydropower is currently the most common form of renewable energy and plays an important part in global power generation. In 2010, hydroelectricity accounted for 16% of the total electrical energy consumption and is regaining its status of green energy after more than one decade of disparagement and disinformation. The World Bank recently declared "hydropower now is viewed as an integral factor in addressing energy security, climate change, water security, and regional cooperation".
- Regarding Greenhouse Gas generation, reservoirs in temperate and boreal regions are not responsible for more equivalent carbon emission per kWh of generation than wind or nuclear power. Greenhouse Gas emission per kWh is limited to few per cent of emissions from fossil fuel generating stations. In rain forest regions, it remains well below any of the fossil fuel emissions (less than natural gas and 1/3 to 1/5 of most existing technologies), the smaller the reservoir being the better.
- Greater implementation of intermittent types of energies, mainly wind and solar, necessitating greater requirements for grid stability. Benefiting from both Large and Small hydropower, energy storage and pump turbines enable the electricity grid to cope with random disturbances induced by all other renewable energies, existing and emerging.
- Hydraulic turbines have the particularity of not being individually designed in large quantities; they are always unique designs for specific given hydraulic sites. Exceptionally for low head applications and large flows, we have been able to have some twenty identical units.

B.2 Market demand

- International hydroelectric production is in constant growth, 2.8% in 2008, 22% within the last 10 years, two thirds of this growth pertaining to the People Republic of China.
- Decommissioning of old polluting thermal plants and of aging nuclear power plants as well as the world difficulty in reducing its energy consumption should put a logical pressure on the increased demand for very valuable hydroelectric projects, the world potential being estimated between one and two million MW.
- With greater globalization of Manufacturing facilities including new locations requires better integration to globally recognized and internationally approved standards.
- Extending equipment availability, increased performance and reliability as expected from long running hydro production units, necessitate increasing rehabilitation expertise and efforts to further extend the life of their valuable energy contributions, contributing to increased grid stability and revenue generation capabilities.

- Loss of expertise from retiring technical experts and with lower numbers of younger colleagues integrating this area of specialized technology, can be partly compensated by technical experience documented in these technical Standards.

B.3 Trends in technology

- The development of computational tools during the last fifteen years has brought hydraulic turbines to a level of quality and reliability which might seem difficult to improve, most new units being able to extract 95% of the hydraulic energy they receive in their most frequent operating zones.
- Evolution of materials and fabrication tools, including increased used of industrial robots. .
- Fatigue computations and sophisticated commissioning tests aim to space out major overhauls. Planned and unplanned outages are expected to remain in the region of one per cent, in spite of daily starts and stops made necessary to accommodate the growing fluctuations of the grids.
- Surprisingly, both these extreme performances and reliability can always be improved by tenths of a percent, precisely because of the exceptional longevity of hydropower installations, high specific energy and the excellent return on investment they authorize. Research and development is needed even more for the megaprojects being now developed or planned.

B.4 Market trends

- Either for new projects or rehabilitation and upgrades, the market is active and will support the existing hydroelectric industry for many decades.
- Industry concentration can be considered completed and the world financial crisis should not compromise the trends for a better cleaner world. Electrification of domestic and public transportation is part of this trend and will require flexible and predictable sources of energy.

B.5 Ecological environment

- Large hydropower remains the best legacy to future generations with a return on investment in terms of produced and invested energy ratio over a life cycle of 200 to 300 as compared to an optimistic 30 for windpower; 15 for nuclear; and 3 to 5 for plantation biomass, solar photovoltaic and combined cycle natural gas; and even less for most fossil fuels.
- Carefully planned, safely engineered, developed by socially responsible communities, Hydroelectricity is recovering the aura it had before the public developed an exaggerated infatuation for new renewable sources of energy whose performances and real costs now appear less attractive.
- Electricity is strongly linked to development and communities who have access to hydraulic energy must be able to take advantage of it, so reducing wood burning, erosion and floods, and getting access to irrigation, local food supply, drinking water and more attractive socially healthy communities.
- Increasing demand for fish friendly turbines in certain parts of the world.

C System approach aspects

- The hydroelectric science is already supported by a century of research, publications and tests. The future will combine this valuable know-how with new technologies.
- Industries are moving towards the major markets, mainly the Asia-Pacific area, and the tradition of excellence and reliability of the hydroelectric industry has to survive such reorganizations.
- International standards, based on the best practices, are the answer to this necessity of preserving and improving the traditional reliability of equipment, some of which are still in as-new condition in spite of being nearly a century old.

D Objectives and strategies (3 to 5 years)

Maintenance and elaboration of standards for optimal performances and improved reliability:

- Hydraulic machines rehabilitation and performance improvement
- Model step-up and homology to incorporate available manufacturing technologies and the influence of roughness

- Modernization of discharge measurement methods at site
- Prediction of erosion resistance
- Up to date power plant automation and testing
- Development of internationally recognized installation rules
- Establishment of unit vibration assessment criteria

All in synergy with ISO & IEEE related standards

E Action plan

The involvement of China in most working groups of the IEC-TC4 is now a fact and the expertise gained through the large Chinese Hydroelectric Projects is particularly important. Efforts are being made to involve major South-American countries as Participating Countries, bearing in mind the activity in, and considerable potential of these zones.

The USA is a recent example of increased governmental encouragement of hydro production wishing to vastly increase additional hydroelectric activities in that country. They quoting that their industry could add 70,000 MW of capacity by installing more efficient turbines at existing dams, increasing the use of pumped-storage projects, and encouraging the use of run-of -the-river turbines. The great energy potential is noted, with only some 3% of that country's 82,000 dams presently used for electricity generation.

Ongoing discussions on the use of hydroelectric generating equipment for stabilization of power networks in the mix with all other renewable energies, existing and emerging, and of hydro's unique storage capabilities for power generation.

Guides that would enhance the reliability of hydraulic turbo-machinery, should be made available rapidly to respond simultaneously to recent technological challenges and moves in the industrial structure.

Finally, erection tolerances need to be standardized, preferably in conjunction with TC2, since the Industry has now largely integrated hydraulic and electrical machinery supplies and installation.

F Useful links to IEC web site

[TC 4 dashboard](#) giving access to Membership, TC/SC Officers, Scope, Liaisons, WG/MT/PT structure, Publications issued and Work and Maintenance Programmes and similar information for SCs, if any.

Name or signature of the secretary

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