CIGRE Study Committee A1

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP (1)

WG N° A1.36	**Name of Convenor : Jouni Ahtiainen (Finland)** **E-mail address**: jouni.ahtiainen@fortum.com
Technical Issues # (2): xxxxxxx	**Strategic Directions # (3):** 2
Title of the Group: **Vibration and Stability Problems Met In New, Old and Refurbished Hydro Generators, Root Causes and Consequences**	

Scope, deliverables and proposed time schedule of the Group :

Background: Mechanical problems in hydro generators (units) can cause increased vibrations and/or forces in construction during operation. Dynamic and/or static forces cause increased stresses and possibly fatigue loading in the generator mechanical construction which later can lead to damages, unplanned outage of machinery and the need for repair or larger refurbishment. It is desirable to avoid unnecessary repairs and refurbishments where possible.

Deviations like: Air gap deviations around the circumference; Deviations of mean air gap from design air gap; Stator roundness as a percentage of design air gap; Eccentricity as a percentage of design air gap; Rotor roundness as a percentage of design air gap; specific deformation forms (ellipticity, tri-angularity, quad-angularity...) influence the operation of the generator and whole machinery.

In addition when the generator is operated in different operation modes, reactive and active power loadings, cold and warm generator has influence on the behaviour of the machinery. The generator construction also has influence on machine behaviour: stator and rotor stator winding configuration and construction that includes stator slot number /slot pitch; type and connection in stator winding (diamond/wave, number of parallel branches); damper winding (number of damper bars and slot pitch); form of rotor pole shoe; skewed slots and/or damper bars and also rotor poles with non centered damper bar.

There are also other sources of vibration like oscillations induced by the control systems (voltage and turbine governor) and hydraulic phenomena on the intake and draft tubes.

Scope: The aim of the work is to study and make a survey of the vibration and stability problems in different generator construction type. Review the vibration limits given in different standards. Review what are reasonable requirements for different design parameters and acceptance criteria for vibrations according to point of view of power plant owners and manufacturers. Study dynamic stability and vibration problems that can possibly be encountered, conduct root cause analysis and report on them as far as possible. Deviations in different parameters (vibration, essential design parameters, operation conditions, stator/rotor roundness etc.). In the study also vibrations caused by control system and caused by hydraulic phenomena on the intake and draft tubes shall be considered. New as well as old and refurbished machines will be considered.

Deliverables: Information obtained with the questionnaire shall be presented in structured way in a report; the report will include proposed recommendations and limitations for different parameters based on study and identify maximum limits where operation can still be possible for different types of machines with certain deviations based on information received. Report to be published in Electra or Technical Brochure with summary in Electra

Time Schedule :

- TOR submitted for approval April 2012
- Forming the team April/May 2012
- First draft questionnaire May/June 2012
- Issue First Draft Questionnaire for comments: June/July 2012
- Discussion of First Draft Questionnaire at CIGRE session in Paris August 2012
- Additional comments to the First draft Questionnaire: October 2012
- Second draft questionnaire December 2012
- Comments on Second draft Questionnaire: February 2013
- Final questionnaire March 2013
- Answers to the Final Questionnaire: June 2013
- Discussion at Romania Meeting: August/September 2013
- Draft report 1 – December 2013
- Comments to Draft report 1: February 2014
- Draft report 2 – May 2014
- Comments to Draft report 2: July 2014
- Presentation and approval of the Draft report 2: SC-A1 meeting at Biennial Session in August, 2014
- Final Report: November 2014
- Comments to the Final Report: December 2014
- Technical Brochure or report ready for publication: March 2015

Comments from Chairmen of SCs concerned :

Approval by Technical Committee Chairman : Klaus Fröhlich **Date** :06/05/2012

(1) Joint Working Group (JWG) - (2) See attached table 1 – (3) See attached table 2

Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

1	Active Distribution Networks resulting in bidirectional flows within distribution level and to the upstream network.
2	The application of advanced metering and resulting massive need for exchange of information.
3	The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation.
4	The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation.
5	New concepts for system operation and control to take account of active customer interactions and different generation types.
6	New concepts for protection to respond to the developing grid and different characteristics of generation.
7	New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics.
9	Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network.
10	An increasing need for keeping Stakeholders aware of the technical and

	commercial consequences and keeping them engaged during the development of the network of the future.

Table 2: Strategic directions of the TC (cf. Electra 249 April 2010)

1	The electrical power system of the future
2	Making the best use of the existing system
3	Focus on the environment and sustainability
4	Interactive communication with the public and with political decision maker