

Study Committee B4 HVDC and Power Electronic Equipment

Progress Report 2005

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Highlights

New HVDC Projects, employing ultra-high voltage levels as 800 kV are being planned in India and in China. This will provide a solid market basis for the development of the Power Electronic Technology.

In fact, there is a scenario for China, of one new bipole per year, from 2010 to 2020.

For the first schemes, specifications and tendering processes are expected to be triggered in 2006, at both India and China. Other potential movements towards new projects are being considered in the Southern part of Africa and in Brazil.

The Committee work shall reflect the needs in the Electric Power Industry to solve technical problems and analyze future developments; therefore, the world market in the Power Electronic field has a direct impact on the current and future work of the Committee.

In this direction, new WGs are being proposed to the Technical Committee of CIGRÉ to develop activities to promote and to help these market needs.

As one important highlight from 2005 activities, the issue of promoting Tutorials has shown a remarkable result, in terms of promoting CIGRÉ technical activities throughout the electrical community.

Study Committee 2005 Meeting

It was held in Bangalore – India, during the week of September 19-25. Sponsors were Central Board of Irrigation and Power, CIGRÉ India and Power Grid.

Besides the SC meeting itself, the activities in Bangalore were organized to offer Tutorials, WG/AG meeting facilities, and a two days Colloquium.

The SC meeting took place on Thursday, September 22, with 49 attendees. From the 24 RMs, 21 were present.

The minutes of the meeting are available at the SC web site.

Highlights from the meeting discussions are as follows:

- Need to assign the web site tasks to a webmaster secretary: Manitoba Hydro - Canada, through Mr. Narinder Dhaliwal, accepted the duty of acting as webmaster secretary, starting in 2005;
- Various WGs have reported that although having a long list of members, only few are truly responding and working; it was agreed that those members that do not respond can be taken out from the WG;
- A communication strategy was discussed as part of AG 01 – Strategic Plan and Actions. The SC wants to have a regional focus around the world, and needs to expand B4’s influence especially where technology can be implemented effectively (e.g., Indonesia, the Middle East). It was also stressed the need to issue periodic progress reports from WG Conveners on the SC web site, perhaps resulting in an ELECTRA article on partial progress. Tutorials are very useful, one suggestion is to have PowerPoint presentations available for chapters of WG reports.
- An action item is for AG 02 – WG Conception, to help WGs be more effective including items such as member motivation. One plan is to develop a skill set matrix for RMs and experts – useful for example in determining what talent is available for new WGs.
- Tutorials: Six tutorials were held prior to the WG meetings. These were attended by a large number of students and engineers, the response was beyond the organizers’ imagination. They were: Planning Aspects of HVDC Systems/Brett Davies; Terminal Equipment/Victor Lescale; New Developments in HVDC and Power Electronics/Dietmar Retzmann; Harmonics/Jiang Lin (70 attending!); VSC Transmission/Bjarne Andersen; HVDC Controls/Georg Wild (52 attending). Based on this positive response it is hoped to see this activity carried forward to other places.
- 2006 Paris Meeting: There were 27 papers accepted out of 36 offered. Seven are on new technologies and projects; 10 are on issues concerning projects; 9 are on the role of HVDC and FACTS to assist system performance. The 2006 Special Reporters are Mohamed Zavahir and Kent Soebrink. The B4 Technical Session will be on Thursday Aug 31. New and experimental for 2006, Wednesday Aug 30 will be a poster session for all SC papers, and the authors are to be present to discuss their reports with contributors.

Study Committee Working Group activities

The WGs activities reported in Bangalore were:

B4-38: Simulation of HVDC and FACTS

Huang

Hartmut Huang reported on behalf of Dietmar Retzmann, Report Part 1 will deal with Simulation tools and Application Examples; Report Part 2: will provide Guidance for HVDC Studies. The WG now includes 23 members. The target date for the final reports is early 2006.

B4-39: Integration of Large Scale Wind Power with HVDC and Power Electronics
Andersen

This WG was initiated in 2002, and restarted at the Paris 2004 meeting, There have been two subsequent meetings, and three future meetings are scheduled. The WG met 3 days in Bangalore. The membership is 28, of whom 10 are major contributors, 6 are occasional contributors, and 2 contribute minimally or not at all. The non-contributors are gradually being removed. The final report will include case studies, a benchmark model for studies (nearly ready), and sample studies. The target completion date is the end of 2006. Coordination with SC C6 (Distribution Systems and Dispersed Generation) was also pointed out.

B4-40: Static Series Synchronous Compensator (SSSC) **Edris**
 No report.

B4-41: Systems with Multiple HVDC Infeed **Davies**

The Multiple Infeed Interaction Factor (MIIF) is a new matrix calculation indicating how a small voltage change at one bus results in a voltage change at another bus. The Danish systems show strong interaction potential whereas the Nelson River inverters indicate a much weaker interaction potential. Commutation failure studies have developed a methodology whereby critical contour lines for same percent voltage drop result in commutation failures. A multi-infeed CIGRE benchmark model is nearly finished. The WG progress has been slowed as they are studying new ideas, not reporting on existing work.

B4-43: Increased System Efficiency by Use of New Generations of Power Semiconductors
Westermann

The WG charge is to determine the impact of the rapid development of power semiconductor technology on power systems. Silicon carbide semiconductors are considered as they would provide a significant reduction in losses. A big question is will there be modules replacing individual power semiconductors? The WG is also investigating trends toward new applications. Target date for completion is mid-2006.

JWG B2.17/B4/C1: Impacts of HVDC Lines on Economics of HVDC Projects
Graham (liaison Member)

This joint WG was formed in 2004, and has been slow to get started. The impact of IGBT converters is of interest. There are three task forces, economics of DC lines (creating a matrix of power/length/kV; economics of converter stations (matching the above matrix); and one to integrate the previous two into a more concise report. (It was commented that environmental concerns are important, e.g. meteorological issues.)

WG B4-44: Planning Guidelines Dealing with HVDC Environmental Issues

Rashwan

Mohamed reported on behalf of Kirsten Faugstad, this was the first WG meeting. A key discussion point is how are utilities handling environmental concerns and what are the issues. The WG will distribute a questionnaire asking utilities what environmental issues they face. A second questionnaire will focus on planned systems – what has been their experience re environmental concerns when addressing licensing issues? The WG requests membership from China and India, where major new systems are being considered (positive response from both RMs).

JWG A2/B4-28, HVDC Converter Transformer Test Procedures

Fu (liaison Member)

This was the third meeting of this Joint WG. They have reviewed IEC draft standard 61378. They have sent out a reliability questionnaire, and have received to date 11 of 22 responses. The data show a significant increase in the annual failure rate. The rate not as high as for conventional ac transformers but the impact is high. There was a detailed report on India failures including dielectric, thermal, and component failures. A task force will address specifications for HVDC transformers accounting for interactions with converter stations. All work/final report is expected to be finished for the Paris 2008 meeting.

New WG proposed to the TC

- A new WG on 800 kV HVDC Technology was proposed and accepted by the TC. The first meeting was held in Delhi - India, in January 2006.

Publication Plan

In 2006, the following Electra publications are planned to be issued:

- WG B4 38: HVDC Simulation (planned to be ready by June)
- WG B4-43: Increased System Efficiency by Use of New Generations of Power Semiconductors (planned to be ready by August)

Future Study Committee Meetings

The 2007 Meeting: The SC accepted the Japanese NC invitation to meet in Osaka, probably in November, in conjunction with SCs B1, C1 and C5.

Working Bodies Update

Below is the updated table of SC B4 WGs.

SC B4: HVDC and Power Electronic Equipment

Type ¹	Number	Title	Name of Convener	Created	Disbanded
AG	B4.01	Strategic Planning Monitoring	M. Zavahir (NZ)	2003	
AG	B4.01-TF01	Action Plan Monitoring	M. Rashwan (CN)	2003	
AG	B4.01-TF02	Customer Survey and Communication	J. Paserba (US)	2003	
AG	B4.02	WG Conception and Guidelines	K. Soebrink (DK)	2003	
AG	B4.02-TF01	WG Gap Analysis	TBA	2003	
AG	B4.02-TF02	WG Guidelines	B. Andersen (GB)	2003	
AG	B4.03	Environmental Issues	K. Faugstad (NO)	2003	
AG	B4.04	HVDC Performance	I. Vancers (US)	1970	
WG	B4.38	Simulation of HVDC and FACTS	D. Retzmann (DE)	2000	2006
WG	B4.39	Integration of Large Scale Wind Power with HVDC and Power Electronics	B. Andersen (GB)	2001	2007
WG	B4.40	Static Synchronous Series Compensators (SSSC)	A. Edris (US)	2001	2006
WG	B4.41	Systems with Multiple HVDC Infeed	B. Davies (CN)	2002	2007
WG	B4.43	Increased system	D.	2003	2006

¹ Type : Working Group (WG), Task Force (TF), Advisory Group (AG), Co-operation Group (CG), Joint Working Group (JWG), Joint Task Force (JTF), ...

		efficiency by use of new generations of power semiconductors	Westermann (CH)		
WG	B4.44	Planning Guidelines vs HVDC Environmental. issues	K.Faugstad (NO)	2005	2007
JTF	B2.17/C1/B4	Impacts of HVDC Lines on Economics of HVDC Projects	J. Nolasco (BR), from B2; B4 liaison J. Graham (BR)	2004	2007
JWG	A2/B4-28	HVDC Converter Transformer Test Procedures, Aging Analysis and Operational Performance	M. Saravolac (FR), from A2; B4 liaison Y. Fu (NL)	2004	2007
WG	B4.45	Technological Assessment of 800 kV HVDC Applications	R.N. NAYAK (IN)	2005	2008

Relations with other organizations

IEC SC22F has participated in the SC B4 meeting. Communication between CIGRÉ SC B4 and IEC SC22F has improved.

SC B4 Website

The new SC web site, in the standard format has been made available at the end of 2005. The webmaster secretary is Mr. Narinder Dhaliwal, which receives the support from his company Manitoba Hydro – Canada.

SC participation in Regional Meetings and Symposia

Tutorials in Norway and in Russia are being planned for 2006.

Summary

In 2005, highlights are the very successful experience with Tutorials and the new market for 800 kV DC applications, starting in China and India.