CIGRE WG A3.22 / A3.28

A3.22: Technical Requirements for Substation Equipment exceeding 800 kV

A3.28: Switching phenomena and testing requirements for UHV & EHV equipment

Scope:

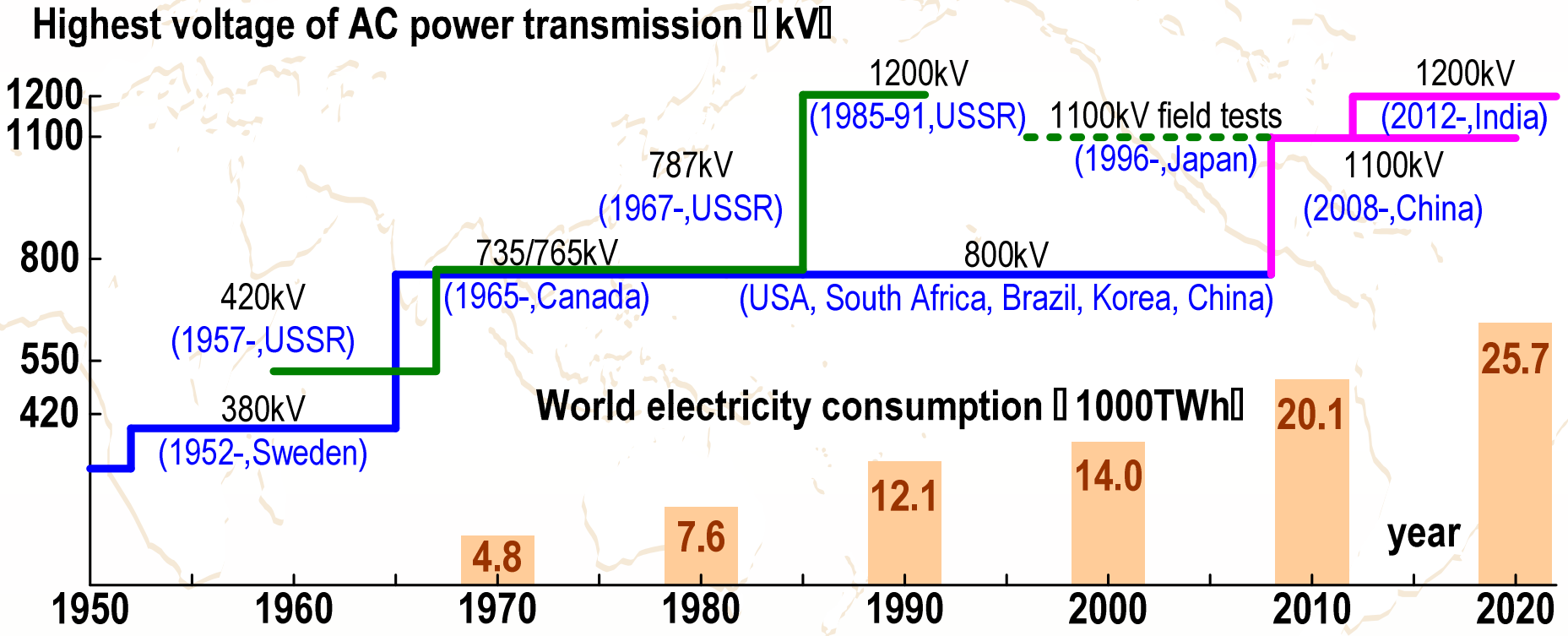
- Review the state-of-the-art of technical specifications for substation equipment at rated voltages exceeding 800 kV (UHV)
- Provide technical background for the specification of UHV equipment to IEC TC17
- Investigate specific aspects of switching phenomena and testing requirements for EHV & UHV equipment

44 members from 17 countries, including liaisons with other CIGRÉ Study Committees

Hiroki Ito, Japan, former Convenor
Denis Dufournet, France, present Convenor
Anton Janssen, the Netherlands, Secretary

IEEE/CIGRE tutorial in San Diego, October 4th, 2012

Highest voltage of AC power transmission



UHV projects

USA 1200 kV R&D projects, 1974-77

BPA built a prototype 1200 kV transmission line (1.2 km) and evaluated its performance.

Russia (Soviet) 1200 kV transmission project, 1985-91

2000 km transmission lines with 1200 km transmitted the maximum power of 5.5 GW.

Italy 1000 kV field demonstration, 1994-95

Field tests with an 1050 kV GIS, cable and OH line were performed.

Japan 1100 kV field demonstration, 1996-

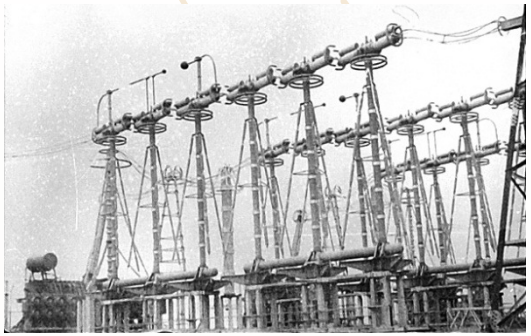
Three-phase transformer, 1100 kV GIS, MOSA and HSGS have been verified since 1996; 450 km OHL

China 1100 kV transmission projects, 2008-

Single circuit OH-line (650 km) with 3 substations is successfully in operation since 2009. Double circuit with 4 substations under construction; uprating of single circuit pilot

India 1200 kV transmission projects, 2012-

high-capacity 1200 kV AC system along with a 800 kV HVDC system is being planned.



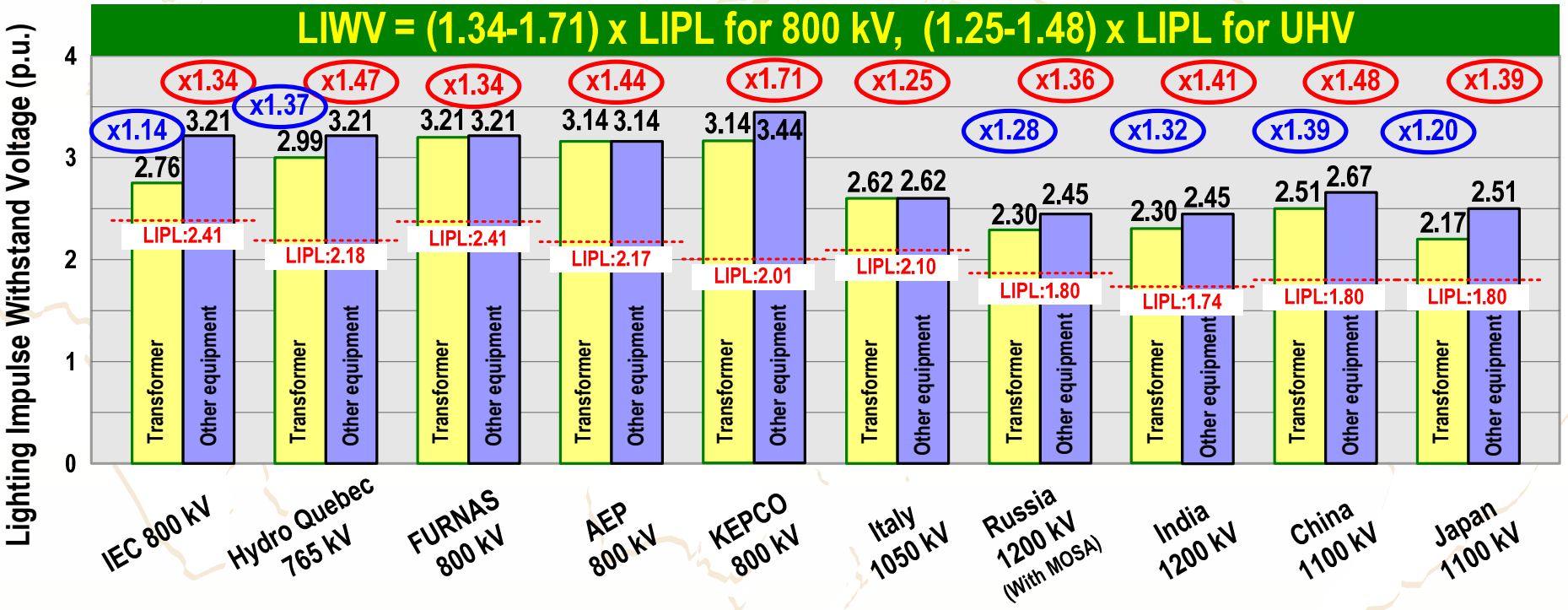
Russia 1200kV GCB

Suvereto testing field

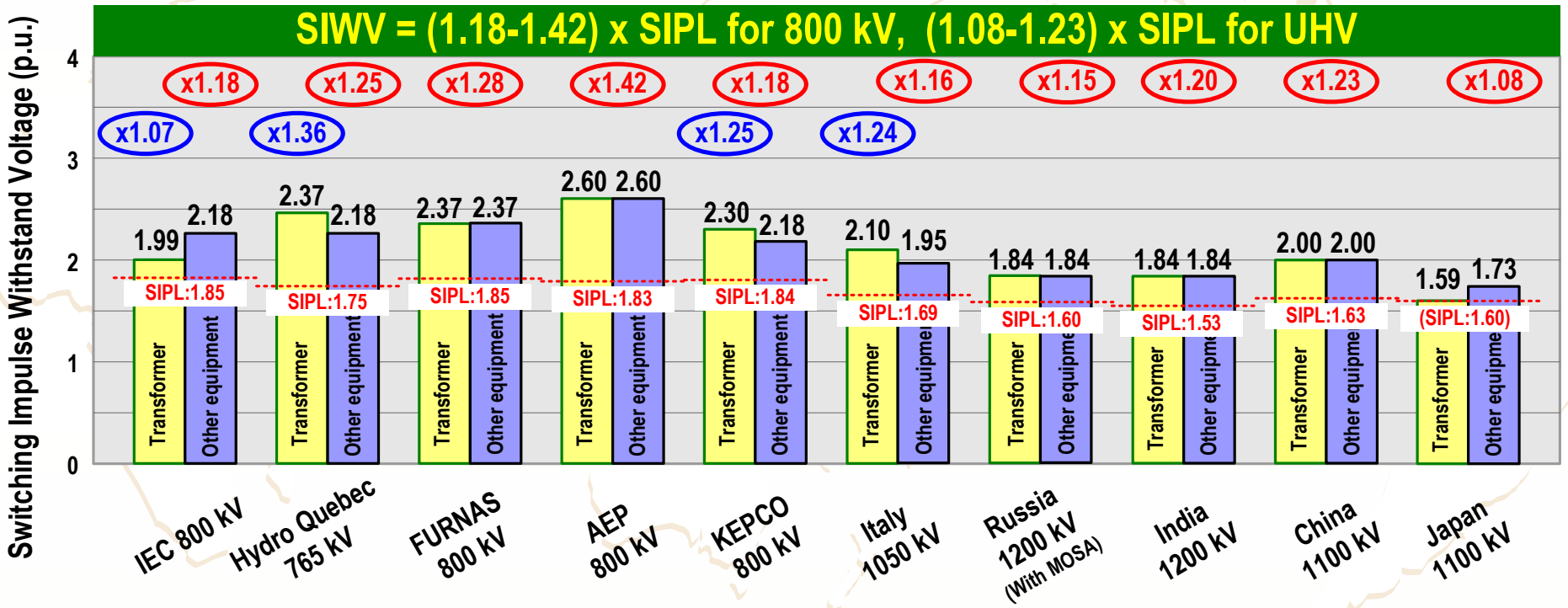
TEPCO testing field

China 1100kV projects

Insulation level: LIWV and LIPL



Insulation level: SIWV and SIPL



System and Compensation parameters

Country	Utility	Voltage	Line Length	Circuit	Transposition	Shunt Reactor	Series Cap.	4-legged SR	Re-closing
RSA	ESKOM	800 kV	440 km	Single	Applicable	Applicable	N/A	Applicable	SPAR
Canada	Hydro Quebec	765 kV	400 km	Single	Applicable	Applicable	Applicable	N/A	TPAR
S. Korea	KEPCO	800 kV	160 km	Double	N/A	N/A	N/A	HSGS	MPAR
USA	AEP	800 kV	300 km	Single	N/A	Applicable	N/A	Special	SPAR
Brazil	FURNAS	800 kV	330 km	Single	Applicable	Applicable	Applicable	N/A	TPAR
Russia	EES Rossii	787 kV	500 km	Single	Applicable	Applicable	N/A	Applicable	SPAR
India	PowerGrid	800 kV	400 km	Double	Applicable	Applicable	N/A	Applicable	SPAR
Japan	TEPCO	1100 kV	210 km	Double	N/A	N/A	N/A	HSGS	MPAR
China	SGCC pilot	1100 kV	358 km	Single	Applicable	Applicable	Applicable	Applicable	SPAR
China	SGCC	1100 kV	327 km	Double	Applicable	Applicable	Applicable	Applicable	SPAR
Russia	EES Rossii	1200 kV	700 km	Single	Applicable	Applicable	N/A	Applicable	SPAR
India	PowerGrid	1200 kV	400 km	Single	N/A	Applicable	N/A	Applicable	SPAR

SPAR: Single phase Rapid Auto-Re-closing
TPAR: Three phase Rapid Auto-Re-closing
MPAR: Multi-phase Rapid Auto-Re-closing

Publications of CIGRE WG A3.22

Technical Brochures: 2, Technical papers: 6

Technical Brochure TB362 (December 2008)

"Technical requirements for substation equipement exceeding 800 kV"

Technical Brochure TB 456 (April 2011)

"Background of technical specifications of substation equipment exceeding 800 kV"

WG A3.28 plans to publish its Technical Brochure in 2013

Tutorial at IEEE Fall 2012 Switchgear Committee meeting:

1) Transient phenomena by travelling waves (Anton Janssen)
2) TRV phenomena related to Transformer limited fault (Denis Dufournet)
3) Disconnectors, Earthing Switches and HSES requirements (Masa Kosakada)
4) Very Fast Transient Overvoltages (VFTO) (Uwe Riechert)