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INTERNATIONAL ELECTROTECHNICAL COMMISSION
TECHNICAL COMMITTEE N°4 - HYDRAULIC TURBINES

History, Mission and Current Activities

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RÉSUMÉ

Ce texte de conférence présente un bref historique de la Commission Électrotechnique Internationale et son Comité d'étude N°4 - Turbines hydrauliques. L'Organisation de la Commission et du CE 4 est décrite avec une brève explication sur le développement des normes et des rapports techniques. Est également décrite, la situation courante du CE 4 comprenant les détails de son programme actuel et les prévisions pour l'avenir.

ABSTRACT

This Paper presents a brief history of the International Electrotechnical Commission and its Technical Committee 4 - Hydraulic Turbines. It describes briefly the steps in production of Standards and Technical Reports, describes the current situation in regard to TC 4 Hydraulic Turbines along with its current programme and future prospects.

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1.0 HISTORY

The International Electrotechnical Commission (IEC) came in to being at a constitutive meeting held in London in 1906 following two years of work on a proposal developed at a meeting held in St.Louis in 1904. Technical Committee 4 was established by the Committee of Action in 1911 and as such, was one of the first to deal with the challenges presented by the hydroelectric field. Technical Committee N°4 (TC 4) Hydraulic Turbines became very active after the second world war particularly during the 1950's and made its first major postwar publication in 1963 with a second edition of Publication 41 «International Code for Field Acceptance Tests of Hydraulic Turbines».

Today, there are twelve Technical Committees which deal with subjects directly related to the production of electrical energy by hydroelectric means. They are :

- TC 2 - Rotating Machinery
- TC 4 - Hydraulic Turbines
- TC 7 - Overhead Electrical Conductors
- TC 11 - Recommendations for Overheads Lines
- TC 14 - Power Transformers
- TC 15 - Insulating Materials
- TC 17 - Switchgear and Control Gear
- TC 20 - Electric Cables
- TC 22 - Power Electronics
- TC 36 - Insulators
- TC 38 - Instrument Transformers
- TC 94 - All-or-Nothing Electric Relays

2.0 MISSION AND PARTICIPATION

The mission of the International Electrotechnical Commission is to promote international cooperation and understanding on all questions of standardization and related matters such as the verification of conformity to standards in the fields of electricity, electronics and associated technologies. As can be seen from this statement, we in the business of hydraulic machinery are, for IEC, an «associated technology». The IEC mission is achieved principally by issuing publications including a coherent and timely set of internationally agreed electrotechnical standards for voluntary worldwide use.

The commission consists of the National Committees of forty-seven participating countries at the present time, each having equal voting rights. Figure 1 lists the current membership and shows their current status in relation to IEC-TC 4. On becoming a member of IEC, each National Committee agrees to open access and balanced representation from all private and public electrotechnical interests in its country.

Where desirable in the interests of efficiency, IEC prepares, publishes and updates standards in cooperation with other international organizations notably with ISO and ITU on, respectively, information technology and telecommunications.

Close relationships are maintained with regional standards bodies in the interests of harmonization underpinned by globally agreed IEC standards.

The commission's objective is to promote worldwide use of its products and services by providing a forum for standards development and a framework for consensus and formal acceptance by IEC members to meet, as far as possible, both commercial and regulatory needs. This includes providing services in the growing field of assessing conformity to IEC standards and the associated development of quality assurance procedures.

3.0 ORGANIZATION OF IEC

Figure 2 shows the Organization Chart for the International Electrotechnical Commission. The procedures are established and the activities are governed by a Council made-up of the Presidents of twelve of the National Committees elected to these posts, along with the President of the Council, the Past-President or President elected, a maximum of three Vice-Presidents, a Treasurer and the General Secretary. The Council delegates the management of technical work to the Committee of Action. The Committee of Action in its turn, has the authority to recommend to Council the formation of a Technical Committee and also to confirm the disbanding of such committee when its task is completed. The formation of a Technical Committee may come as a result of recommendations from a number of sources including the Committee of Action itself, other Technical Committees and member National Committees. Such a recommendation requires two-thirds majority support of the National Committees and requires an indication that at least five National Committees will actively support the work of any new Technical Committee.

The functional levels within IEC and the relationship to comparable functional levels in ISO are shown in Figure 3.

4.0 ORGANIZATION OF IEC-TC 4

Figure 4 presents the IEC-TC 4 Organization Chart. The Committee is currently chaired by Donald M. Coulson, Vice-President of Rousseau Sauvé Warren Inc., Hydroelectric Consultants with Head Offices in Montréal, Canada.

The Secretary of TC 4 Hydraulic Turbines is Mr. Robert Arseneault, Senior Standards Engineer for GE Hydro, also of Montréal, Canada. IEC-TC 4 has eight current Working Groups whose activities are described hereinbelow and is actively considering the formation of two new working groups on subjects also outlined in the Programme in Chapter 7. Each Working Group has a Project Leader or Working Group Convenor who is responsible for the preparation of the documents at the various stages and for

evaluating and incorporating in these documents, the comments of the National Committees at the appropriate stages.

All official consultation of the National Committees by IEC-TC 4 goes through the IEC Central Office. The comments of National Committees on a Working Group document, be it a Committee Document for comments, a Committee Document for Vote or a Draft International Standard are collated by the Secretary, commented upon by the Secretary and Chairman and returned to the Working Group Convenor for action. Where possible and appropriate, the comments of National Committees, particularly if they are contradictory, are the subject of a Plenary Session organized by the Technical Committee. The Plenary Sessions take place at approximately two year intervals.

5.0 PRODUCTION OF STANDARDS AND TECHNICAL REPORTS

Figure 5 shows the sequence of project stages through which technical work is developed and gives the name of the document associated with each project stage.

Proposals for new work can come from many sources including National Sub-Committees and National Committees, the Technical Committee itself or a Technical Committee in a related field. The Committee of Action and Central Office may also suggest a new work item.

Any proposition for a new work item (proposal) must obtain the approval of a majority of the Participating Countries and commitment of at least five of the Participating Countries to actively take part in the work before it will proceed. With such approval, a Working Group is usually formed and is normally headed by a representative of the National Committee which presented the idea.

The Technical Committee or a Sub-Committee must establish for each project, a programme with target dates for the following :

- Completion of the first working draft;
- Circulation of the first committee draft;
- Circulation of the enquiry draft (voting);
- Circulation of the Final Draft International Standard (voting) with agreement of the CEO;
- Publication of the International Standard (with agreement of office of the CEO).

Figure 6 shows four possibilities or options for production of standards through the six active stages. The seventh stage shown in Figure 5 is a preliminary stage prior to commitment by the Technical Committee to proceed to production of a Standard. The four possibilities are identified «Normal Procedure», «Draft Submitted with Proposal»,

«Fast Track Procedure» and «Technical Report Type 2». The first three options result in the ultimate publication of an International Standard while the latter results in publication of a Technical Report which may in future be considered as the subject of an International Standard or of a modification to an existing Standard.

The current work of IEC-TC 4 in both categories is detailed in Chapter 7 hereinbelow.

6.0 CURRENT ENVIRONMENT

Like most sectors of the world economy, the hydraulic machinery sector is in a state of flux caused by the economic recession which is still making its effects felt throughout most of the world. Economic growth, and with it, the increase in demand for electricity, has varied in the past year among member countries from almost zero in many countries to a high of about 12% in the People's Republic of China. The slow growth, particularly in North and South America and in Europe, has resulted in down-sizing of many firms, producers, consulting engineers and suppliers alike. Such reductions of staff have been achieved, in many cases, by early retirement policies which have removed, in a very short period, thousands of person-years of experience from the worldwide hydraulic machinery market. Such events will create, for one to several decades, a perceptible shortage of top level expertise. This makes it mandatory in our view to provide, through IEC and other similar bodies, the best possible Standards and Technical Reports to ensure the smoothest possible transfer of technology to the "new guard".

Another feature of today's market is a strong increase in major overhaul work. This requires, in many cases, turbine runner or pump impeller replacement with the owner seeking improved performance from the unit without spending large sums on replacement or major modifications to the adjacent water passage components. This situation represents a particular challenge to the hydraulic machine designers who must conduct model and prototype testing programmes which are sometimes more difficult than in the case of a completely new machine.

The ingenuity of new hydraulic machine builders will also be challenged over the next twenty years since the market is ripe for a resurgence. Asia will most likely lead the increased activity since in India and China alone, the installation of more than 100 000 MW of hydro power facilities is planned before the year 2020.

In the above context, we see the immediate priorities being :

- issuance of a corrigenda to Publication 41 (1991) to correct some serious typographical errors in the prototype Acceptance Test Document;

- issuance of Technical Reports on Guidelines for Preparation of Tender Documents for Turbines, Pump-turbines and Storage Pumps and on Nomenclature for Hydraulic Machinery;

- issuance of the new version of Publication 193 and 497 covering Model Acceptance Tests, starting with Part 1 covering usual performance tests.

7.0 CURRENT WORK PROGRAMME

The following is a summary of the work before TC 4 at this time :

Publications	Responsibilities	Description
41 (1991)	WG-9, TC, C.O.	Complete review of new publication and issue corrigenda (target completion - Year end of 1995);
193, 193 A	WG-23, TC, C.O.	- Revise Part I (Sections 1, 2 and 3) Committee Documents for Vote in accordance with P.M. Paris - 1995, issue DIS of Part I, Publication 193 (1996) (Targeted publication - August 1996); - Review comments of National Committees on CD of Part II, (Section 4). Other Performance Guarantees, following review at the Paris, 1995 P.M. and issue to National Committees for Vote (CDV) (targeted publication Part II, 193 - September 1997).
995	WG-18, TC, C.O.	Issue a questionnaire in early 1996 and identify the priorities and procedures to study other factors than Reynolds number affecting scale effect.
1362	WG-14, TC, C.O.	Guide for Specification of Speed Regulating Systems (CDV vote 93-05-31 approved - issuance of DIS approved Paris, 1995 P.M.);
609 4/113/CDV	WG-22, TC, C.O.	Cavitation Pitting Damage. Paris 1995 P.M. approved issue of DIS Supplement for Pelton turbines to IEC 609. (Anticipated publication date, July 1996);

Publications	Responsibilities	Description
994	WG-5, TC, C.O.	Technical Report - Vibrations in Hydraulic Machines. Revisions to 994 aimed at providing limits on vibration and treatment of noise (Preliminary Technical Report - December 1996);
1366 4/110/CDV	WG-19, TC, C.O.	Technical Report - Preparation of Tendering Documents (Issue T.R. - June 1996);
1364 4/112/CDV	WG-19, TC, C.O.	Technical Report - Nomenclature of Hydraulic Machines, (Issue T.R. - April 1996);
609	New WG-22, TC	Paris 1995 P.M. (15 countries) approved systematic review of existing Standard, Cavitation Pitting (CDV to be issued by October 1996);
308	WG-14, TC	P-countries an Paris 1995 P.M. approved systematic review of existing Standard, Testing of Governing Systems for Hydraulic Turbines (Review and issue CDV by October 1996);
41	WG-24	Obtain test results and prepare TR on Discharge Measurements (Preliminary Report - December 1996). This is a long term project with the ultimate goal of contributing to the next revision of IEC 41.
NP	TC, C.O. France NC, P-countries	Prepare and distribute an NP concerning testing of Model and Prototype Machines for Small Hydro-Electric Installations based on the 1995 French Standards;
NP	TC, C.O. Canada and Russia N.C., P-countries	Prepare and distribute a New Work item Proposal on Rehabilitation and Residual Life Assessment of Hydroelectric Machinery;

8.0 LONG TERM PROSPECTS

One of the important statistics discussed at the Plenary Meeting in Tokyo in May of 1993 concerns the degree of development of the world's hydroelectric resources. The delegates were reminded that fully eighty (80) percent of the world's hydroelectric potential remains to be developed and much of that in third world or developing countries. The true cost of developing and producing alternate forms of energy, coal, oil and nuclear mainly, including the peripheral costs related to environmental damage, will dictate the rate at which untapped hydraulic resources will be developed. Environmental studies and mitigation measures will draw ever-increasing interest and will demand a larger and larger proportion of the hydroelectric development fund as a more educated public demonstrates a willingness to invest in their children's and grand-children's futures. Very large economic projects may well give way to a larger number of more modest, more environmentally acceptable projects. This image had not materially changed at the time of the Paris 1995 Plenary Meeting. However, the emphasis on development of new hydroelectric resources in Asia will lead TC 4 to seek a stronger technical participation from China, already a "P" country, and will see efforts to convert India from "O" to "P" status.

IEC-TC 4 recognizes these trends and intends to ensure that its present publications are kept current with the state-of-the-art and that new Publications and Reports are issued to accommodate changes in the hydraulic machinery industry.

9.0 CANADIAN SUPPORT FOR IEC-TC 4

As shown in Figure 7, Canada with its modest population of less than thirty million people, is still the world's largest producer of electricity by hydroelectric means. In the last year for which full statistics are available (1993) Canada produced almost 320 TWh from hydroelectric facilities. This status will undoubtedly change in the early decades of the coming century, as indicated in Chapter 6.0 above, however, the significance of this sector of the economy for Canada justifies its continued active participation in the activities of IEC-TC 4.

The funding of the activities for a Technical Committee Secretariat is becoming a more and more onerous burden. It was for this reason in the summer of 1992, when Canada accepted to host the Secretariat of IEC-TC 4 that the funding was organized through the Jacques Desbaillets Foundation whose members are all members of the Canadian Electrical Association and include large utilities, smaller private utilities, manufacturers and consulting engineers.

It became clear when the Canadian National Committee and the Canadian Sub-Committee for TC 4 were considering accepting the Secretariat, that no one company or utility could easily handle a task whose annual budget exceeds 100 000 $ CAN.

The joint effort by all concerned must be encouraged well into the future. Sustaining the effort is in keeping with the attitude and contribution over more than one quarter of a

century of the now deceased Canadian engineer, Jacques Desbaillets, whose name the foundation bears.

Enquiries concerning the activities of IEC-TC 4 may be directed to the Chairman or the Secretary at the addresses given below :

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10.0 ACKNOWLEDGMENTS

The author greatfully acknowledges that the Figures, except Figures 4 and 7, and much of the text of this paper are drawn from recent administrative publications issued by the IEC Central Office in Geneva, Switzerland and from the minutes of the 1995 Paris Plenary Meeting of IEC-TC 4.

FIGURE 1

IEC NATIONAL COMMITTEES - 1996

Country	TC-4 Status	Country	TC-4 Status
Australia	O	Malaysia	-
Austria	P	Mexico	-
Belarus	-	Netherlands	P
Belgium	O	New Zealand	O
Bulgaria	-	Norway	P
Canada	P	Pakistan	-
China	P	Poland	O
Croatia	-	Portugal	-
Czech Republic	P	Romania	O
Denmark	O	Russian Federation	P
Egypt	-	Singapore	O
Finland	O	Slovakia	O
France	P	Slovenia	-
Germany	P	South Africa	-
Greece	O	Spain	P
Hungary	O	Sweden	P
India	O	Switzerland	P
Indonesia	P	Thailand	-
Ireland	O	Turkey	-
Israel	-	Ukraine	O
Italy	P	United Kingdom	P
Japan	P	United States of	
Korea, Republic of	O	America	P
Luxembourg	-	Yugoslavia	P

P - Participating Country; O - Observer Country

FIGURE 2

IEC ORGANIZATION CHART

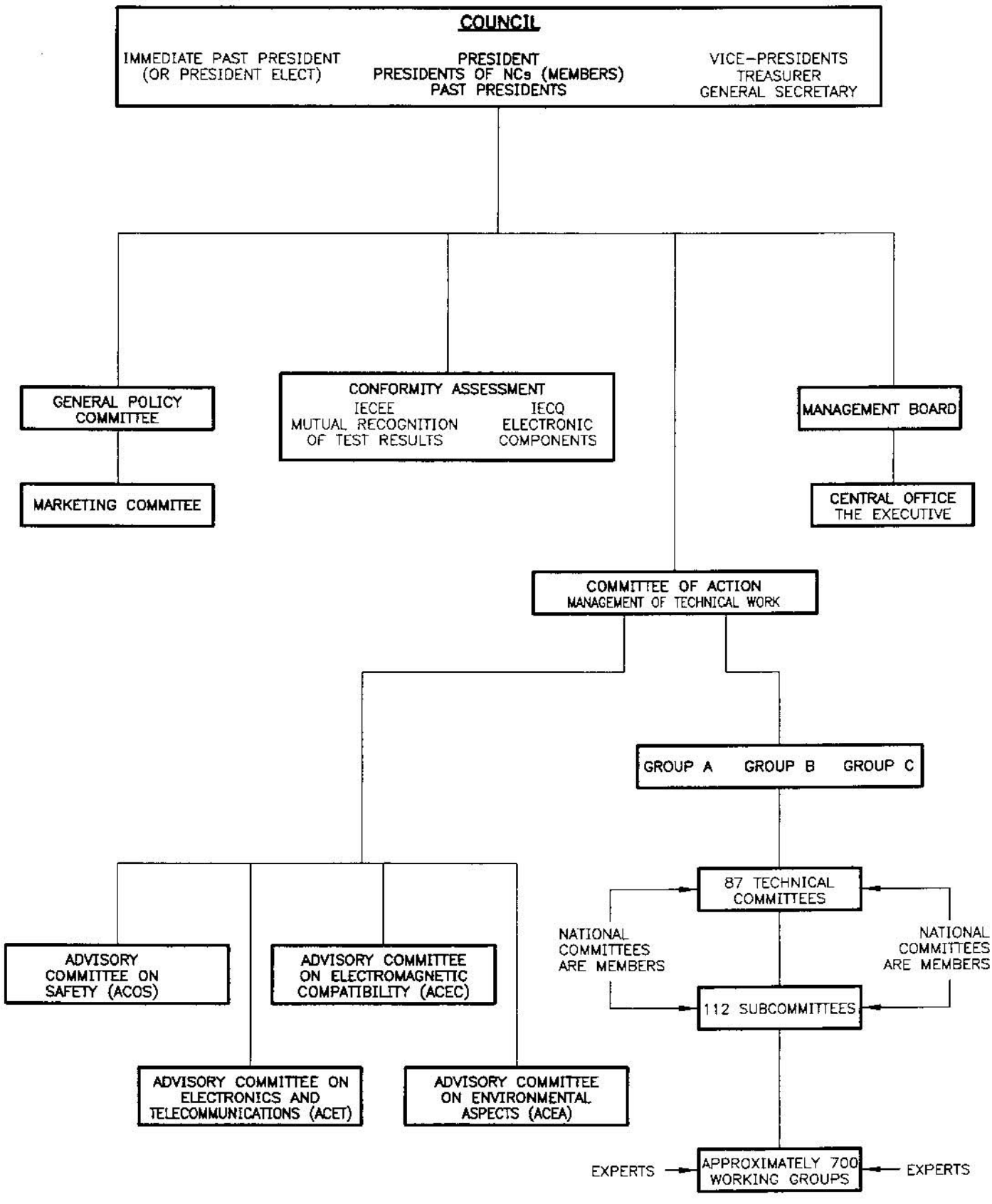

FIGURE 3

FUNCTIONAL LEVELS

Term	ISO	IEC
national body :	member body	National Committee
Technical Management Board:	Technical Management Board	Committee of Action
Chief Executive Officer (CEO)	Secretary-General	General Secretary
office of the CEO	Central Secretariat	Central Office
policy level committee	General Assembly Committee	Council Committee
enquiry draft	Draft International Standard (DIS)	Committee Draft for Vote (CDV)

FIGURE 4

IEC–TC4 – HYDRAULIC TURBINES
ORGANIZATION CHART–1996

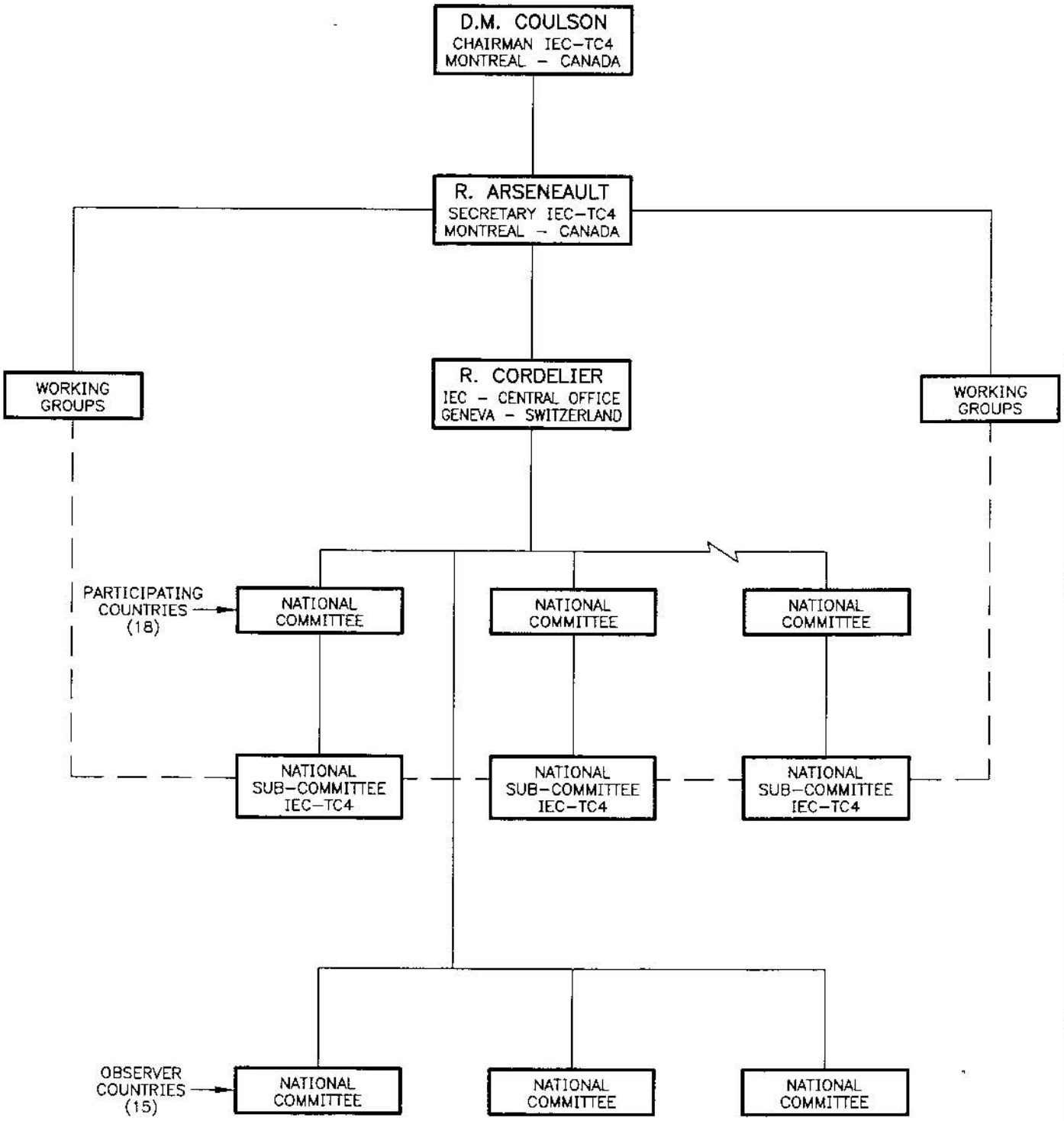

FIGURE 5

PROJECT STAGES AND ASSOCIATED DOCUMENTS

Project Stage	Associated document	
	Name	Abbreviation
0 Preliminary stage	Preliminary work item	PWI
1 Proposal stage	New work item proposal	NP
2 Preparatory stage	Working draft(s)	WD
3 Committee stage	Committee draft(s)	CD
4 Enquiry stage	Enquiry draft, i.e.	
	Draft International Standard (ISO)	DIS
	Committee Draft for Vote (IEC)	CDV
5 Approval stage	Final Draft International Standard	FDIS
6 Publication stage	International Standard	ISO, IEC or ISO/IEC

Figure 6

Simplified diagram of options in production of standards

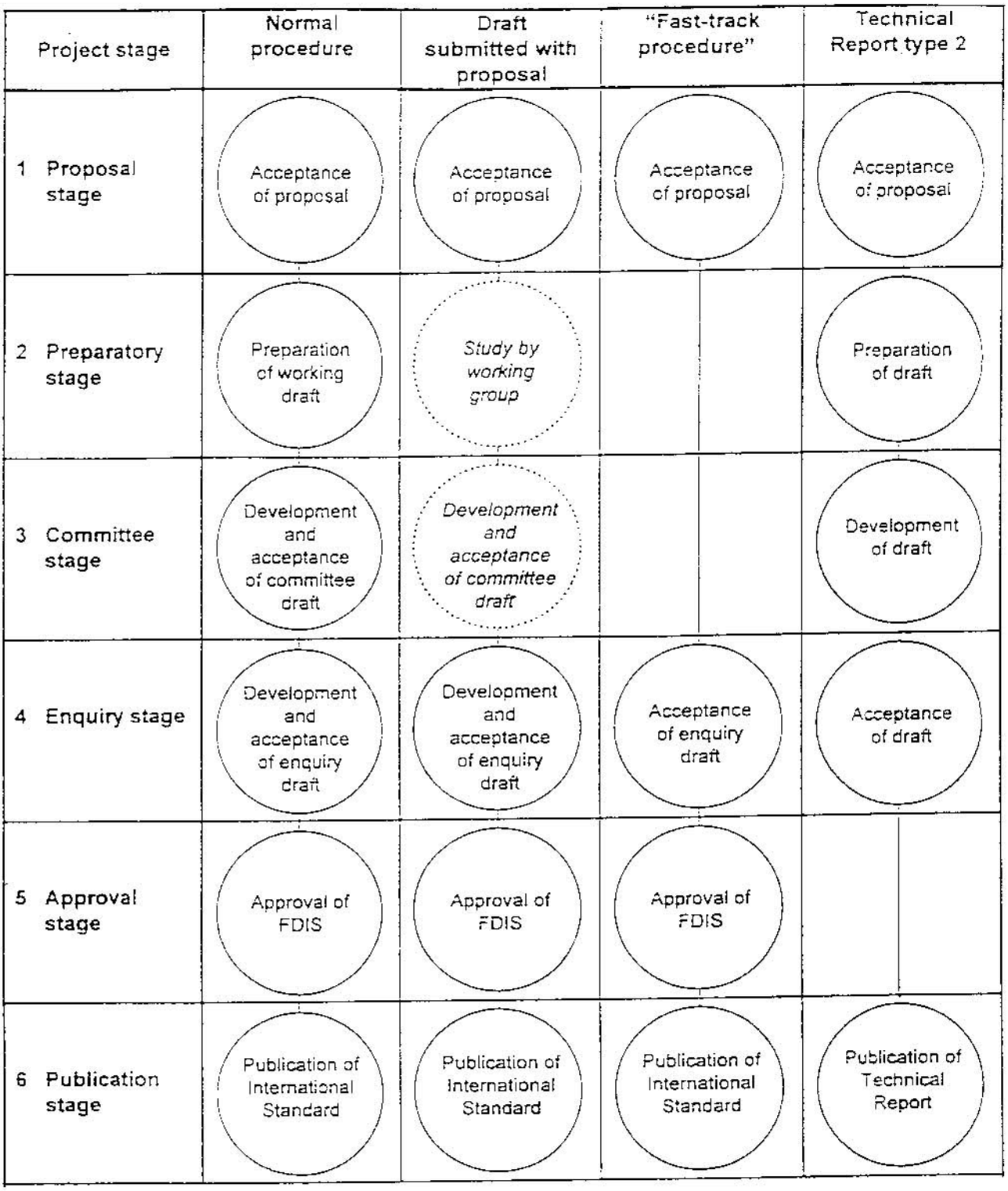

Figure 7

Global producers of hydroelectricity

Source: WEC Survey of Energy Resources - 1993