



STRATEGIC BUSINESS PLAN – ISO/TC 339

Executive summary

Main Field

ISO/TC 339 develops standardization in the field of site selection planning, design, construction and management for small hydropower plants development up to 30MW.

The committee's major activity is in relation to professional technical terms and definitions, basic requirements and methodology relating to site selection planning, design principles and basic technical requirements, technical guidelines for construction (including civil works, hydro mechanical structures and installation of electromechanical equipment), technical guidelines for management (including project acceptance, renovation, operation and maintenance, etc.) of small hydropower plants. The major activity will not include the standardization of electromechanical equipment for small hydropower plants covered by IEC/TC 4, IEC/TC 14, IEC/TC 17, IEC/TC 22 and IEC/TC 57, etc. as well as standardization of marine energy conversion systems covered by IEC/TC114, and the liaison relationships with them will be established.

Potential Benefit from standardization

- Acceleration of decarbonization, green energy, and sustainable advantage.
- Promote cooperation between nations based on globally accepted practices and norms. Developing countries will be able to use the standards to make small hydropower plants for use in places where the end energy supply is difficult to access. A high-level standard would help ensure standardization of terminology and means and methods, that can be used to level the playing field internationally, particularly in developing countries in which consultants fit studies such as 'feasibility', etc. to lower budgets than developed counterparts. This would enable more competition and better quality for developing countries. In addition, public health and safety relevant to small hydropower will be improved through standardization.
- From the perspective of Sustainable development (social, economic, environmental), small hydropower has proven to be a globally acceptable solution to advancing renewable energy when it has been appropriately sited and sustainably planned and constructed, particularly in developing countries. The challenge is often balancing the incremental cost of a green field small hydropower installation vs. other options that may be less costly, with a much shorter lead time.
- The standardization of small hydropower can remove barriers to trade, improve international market access, support public procurement, and improve business efficiency.

Main Objectives and Priorities

The small hydro industry is growing rapidly as a result of privatization of this sector. Many new companies are entering in this sector as owner-operators, designers, manufacturers, builders and other service providers. Many are unfamiliar with the technologies and engineering practices that are particular to the small hydro industry. There is a series of standards, guidelines and manuals available on electrical, electro-mechanical aspect of moving machines and hydro power related issues by ISO, IEC, IEEE, ASCE, ASME and others. But most of these are developed keeping in view the large water resources/hydropower projects. Small scale hydropower plants are to be developed in a cost effective manner with quality, environmental friendly, economically and

reliability and therefore a need to develop the standards/ guidelines specifically for small scale projects was felt.

The terminology standard is the basic standard, and it is the foundation of the whole standards system so it will be appropriate to start the TC339 standard's development with terminology.

1 Introduction

1.1 ISO technical committees and business planning

The extension of formal business planning to ISO Technical Committees (ISO/TCs) is an important measure which forms part of a major review of business. The aim is to align the ISO work programme with expressed business environment needs and trends and to allow ISO/TCs to prioritize among different projects, to identify the benefits expected from the availability of International Standards, and to ensure adequate resources for projects throughout their development.

1.2 International standardization and the role of ISO

The foremost aim of international standardization is to facilitate the exchange of goods and services through the elimination of technical barriers to trade.

Three bodies are responsible for the planning, development and adoption of International Standards: [ISO](#) (International Organization for Standardization) is responsible for all sectors excluding Electrotechnical, which is the responsibility of [IEC](#) (International Electrotechnical Committee), and most of the Telecommunications Technologies, which are largely the responsibility of [ITU](#) (International Telecommunication Union).

ISO is a legal association, the members of which are the National Standards Bodies (NSBs) of some 164 countries (organizations representing social and economic interests at the international level), supported by a Central Secretariat based in Geneva, Switzerland.

The principal deliverable of ISO is the [International Standard](#).

An International Standard embodies the essential principles of global openness and transparency, consensus and technical coherence. These are safeguarded through its development in an ISO Technical Committee (ISO/TC), representative of all interested parties, supported by a public comment phase (the ISO Technical Enquiry). ISO and its [Technical Committees](#) are also able to offer the ISO Technical Specification (ISO/TS), the ISO Public Available Specification (ISO/PAS) and the ISO Technical Report (ISO/TR) as solutions to market needs. These ISO products represent lower levels of consensus and have therefore not the same status as an International Standard.

ISO offers also the International Workshop Agreement (IWA) as a deliverable which aims to bridge the gap between the activities of consortia and the formal process of standardization represented by ISO and its national members. An important distinction is that the IWA is developed by ISO workshops and fora, comprising only participants with direct interest, and so it is not accorded the status of an International Standard.

2 Business Environment of the ISO/TC

2.1 Description of the Business Environment

The following political, economic, technical, regulatory, legal and social dynamics describe the business environment of the industry sector, products, materials, disciplines or practices related to the scope of this ISO/TC, and they may significantly influence how the relevant standards development processes are conducted and the content of the resulting standards:

2.1.1 State of the Art of the Domain

Energy remains one of the most important economic, environmental and development issues facing the world today, with approximately 9.5% of the world's population, over 700 million people, still without access to electricity in 2020¹. The United Nations considers clean energy and electricity to be key factors for development and has therefore included energy access as the seventh Sustainable Development Goal (SDG). And clean energy goes hand in hand with other SDGs, including poverty alleviation, education, improving the environment, and combating climate change

Small hydropower is recognized as an important renewable energy source and plays an important role in addressing the demand for electricity in remote rural areas. According to the *World Small Hydropower Development Report 2022* published by the United Nations Industrial Development Organization², the global potential for small hydropower under 10 MW is 221.7 GW, with approximately 79GW installed. While most countries in Europe, the Americas, China and India have high levels of installed small hydropower, the potential resources for small hydropower in many developing countries remain untapped and are constrained by a number of factors, including the lack of best practices or standards for developing small hydropower.

Small hydropower, like any hydropower projects, can have a negative impact on the environment if the project is not properly planned, designed, and managed. Changes in upstream water management during the lifetime of a small hydropower plant can also change the water conditions in the runoff basin, especially as ecological flow discharges are particularly important for maintaining river ecology.

2.1.2 Recent or Expected Changes and Major Innovations

Compared to larger and medium-sized hydropower stations, small hydropower plants are simpler in design, quicker in construction, and suitable for diverse ranges of conditions and materials. In order to improve its competitiveness, small hydropower adopted a series of measures to significantly reduce the construction cost through technological innovation. Cost-effective structures such as rubber dams, prestressed concrete penstocks and precast concrete poles are widely used to reduce its civil works cost. As of the creating the water head for small hydropower are usually with a small dam (or weir), combining with tunnel or canal and penstock, which is obviously different from the large and medium-sized hydropower station with the large dam and large reservoir. Therefore, on the basis of sharing the successful experience and best practices of small hydropower construction in different countries, developing a set of systematic and complete small hydropower standards, as well as strengthening the dissemination of training through digital and networked means, can help countries with limited institutional and technical

¹ World Bank (2020). *Access to electricity (% of population)*. Available at <https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS>. Accessed on 16 August 2022.

² <https://www.unido.org/sites/default/files/files/2023-05/ENGLISH%20SUMMARY-2022.pdf>

capacity to enhance the basic knowledge of developing small hydropower plants. This attracts investment, promotes the development of preferential policies, and assists economic development at the national level.

As the social economy continues to develop, environmental issues are becoming increasingly noteworthy. In recent years, many countries have actively carried out research on environmental protection policies and new technologies, as well as corresponding technical standards and specifications. Examples of such include the low-impact hydropower in the United States and green hydropower certification in Switzerland as well as green small hydropower evaluation in China, as measures to eliminate the negative impacts of small hydropower are worth noting and sharing globally. Based on this progress, we can form small hydropower standards through experience summaries, thus promoting the technical progress of small hydropower, strengthening the standardized management, and ensuring green and healthy development.

To promote the coordinated development of renewable energies, multi-energy complementary technologies have developed rapidly, which puts forward new requirements for the design of small hydropower plants. Thus, the standards need to be updated constantly, for example by developing guidance for further adoption of emerging technologies for efficient operation of small hydropower plants, including electricity storage.

2.1.3 Other Relevant International, Regional, or National Standards or Voluntary Initiatives

Parts of IEC TCs standards are listed here as references:

- IEC 60308, International code for testing of speed governing systems for hydraulic turbines
- IEC 60545, Guide for Commissioning, Operation and Maintenance of Hydraulic Turbines.
- IEC 61362: 2012 Guide to specification of hydro-turbine control systems
- IEC 61116 (1992-10) Electromechanical equipment guide for small hydroelectric installations
- IEC-62006-2010 Hydraulic Machines - Acceptance Tests of Small Hydroelectric Installations
- IEC 62256-2017 Hydraulic turbines, storage pumps and pump-turbines – Rehabilitation and performance improvement
- IEC: 60076 (Part1 to 5) (2011) Specifications for Power Transformer
- IEC 62271-2012-Part 102 High voltage switch gear and controls
- IEC/IEEE 63197 Terms and Definitions for Hydro Turbine Governing Systems
- IEC/IEEE 63198 Technical Guide for Smart Hydroelectric Power Plants
- IEC 61850 Communication networks and systems for power utility automation

Parts of some standards relevant to the working scope of ISO/TC339 are listed here as references:

- IEEE: 1010-2006 Guide for Control of Hydro Power Plants
- IEEE; 492-1999 IEEE Guide for operation and maintenance of hydro generators
- IEEE:1147-2005 Guide for rehabilitation of Hydro Electric Power Plants
- ASME-1996 Guide to Hydropower Mechanical Design
- ASCE-2007: Civil works for Hydroelectric Facility – Guidelines for life extension and upgrade
- ASCE (1989) – Civil engineering guideline for planning and designing of hydroelectric development, Volume IV – Small Hydro
- DIN 4048-2 Water engineering; terms; Part 2: Waterpower plants
- DIN 19752 Hydropower plants - Planning, execution and operation
- VDI 4620 Hydroelectric installations - Technology and design
- V ESHA, 2004 Guide on How to Develop a Small Hydropower Plant
- UNIDO: Small Hydropower Technical Guidelines

Parts of national standards of India provided by BIS are listed here as references:

- CWC 2010 Guidelines for preparation of detailed project report of irrigation and multipurpose projects, Central Water Commission, Govt. of India, Delhi
- IS 4247 : Part 1 to Part 3 Structural design of surface hydroelectric power stations
- IS 4880 : Part 1 to Part 7 Code of practice for design of tunnels conveying water
- IS 7207-1992 Criteria for design of generator foundation for hydroelectric power stations
- IS 7326 : Part 1 to Part 3 Penstock and turbine inlet butterfly valves for hydropower stations and systems
- IS 7332 : Part 1 to Part 3 Spherical valves for hydropower stations and systems
- IS 7357-1974 Code of practice for structural design of surge tanks
- IS 7396 : Part 1 to Part 3 Criteria for hydraulic design of surge tanks
- IS 7418 : 1991 Criteria for design of spiral casing (Concrete And Steel) (First Revision)
- IS 9761-1995 Hydropower intakes - criteria for hydraulic design
- IS 10060: 1981 Code of practice for subsurface investigation for power house sites
- IS 11388-2005 Recommendations for design of trash racks for intakes
- IS 11625 : 1986 Criteria for Hydraulic Design of Penstocks
- IS 11639 : Part 1 to Part 3 Criteria for structural design of penstocks
- IS 12800 : Part 1 to Part 3 Guidelines for selection of turbines, preliminary dimensioning and layout of surface hydro –Electric powerhouses
- IS 12837 : 1989 Hydraulic turbines for medium and large power houses - Guidelines for selection
- AHEC IIT Roorkee Standards/Manuals/Guidelines for Small Hydro Development

Parts of national standards of Indonesia provided by BSN are listed here as references:

- SNI 8636:2018, Technical specifications for Pelton turbines for Micro Hydro Power Plants
- SNI 8499:2018, Technical specifications of Francis turbine for Micro Hydro Power Plant
- SNI 7932:2019, Specifications of crossflow turbine Micro Hydro Power Plant class A
- SNI 8500:2018, Technical specifications for propeller turbines for Micro Hydro Power Plants

Parts of national standards of China are listed here as references:

- GB/T50071-2014 Design code for small hydropower station
- GB/T50700-2022 Technical renovation code for small hydropower station
- GB/T50964-2014 Code for operation and maintenance of small hydropower stations
- SL77-2013 Hydropower calculation code for small hydropower stations
- SL/T16-2019 Economic evaluation code for small hydropower projects

ISO/TC 339 will continue to assemble more relevant international, regional, and national standards as references in future standardization works.

2.1.4 Categories of Relevant Stakeholders

The stakeholders engaged in this area include project investors, plant owners, design and consulting agencies, construction corporations, equipment manufacturers, supervising agencies, Non-governmental organizations, related government and regulatory agencies.

2.2 Quantitative Indicators of the Business Environment

The following list of quantitative indicators describes the business environment in order to provide adequate information to support actions of the ISO/TC 339.

2.2.1 Resource potentials

According to the *World Small Hydropower Development Report 2022* published by the United Nations Industrial Development Organization, the global potential for small hydropower under 10 MW is 221.7 GW. The largest known undeveloped SHP potentials are concentrated in Central Asia, Eastern Asia and South-Eastern Asia (Figure 1 and Figure 2).

Share of Global Small Hydropower Potential of ≤ 10 MW by Continent (%)

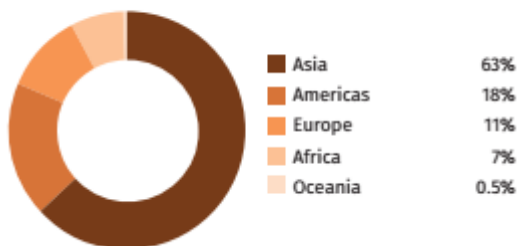


Figure 1: Share of global small hydropower potential up to 10 MW by continent (%)

Developed and Remaining Small Hydropower Potential of ≤10 MW by Region (MW)

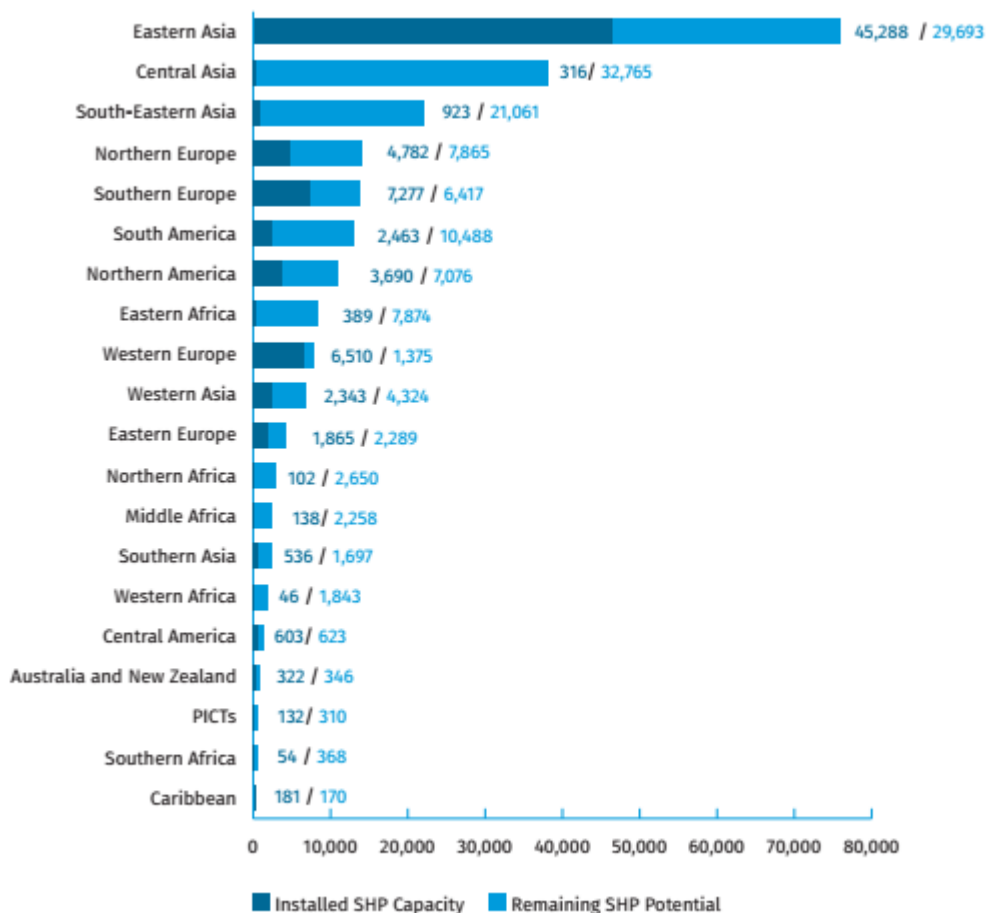


Figure 2: Developed and remaining small hydropower potential up to 10 MW by region (MW)

2.2.2 Status of Development

According to the WSHPDR 2022, the total installed capacity of global small hydropower under 10 MW was about 79 GW. Asia has the largest installed capacity and potential for SHP of ≤ 10 MW, accounting 64 per cent and 63 per cent of the global total, respectively (Figures 3). Europe has the highest percentage of SHP development (52 per cent for SHP ≤ 10 MW), with Western Europe having 83 per cent of its known potential already developed. The top five countries in the world for small hydro development, namely China, the United States, Italy, Japan and Norway, together constitute 71% of the total installed global small hydro capacity.

Share of Global Installed Small Hydropower Capacity of ≤ 10 MW by Continent (%)

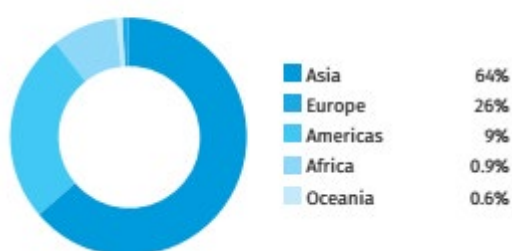


Figure 3: Share of Global Installed small hydropower capacity up to 10 MW by continent (%)

2.2.3 Industry Trend

Despite the many attractions and benefits of small hydropower solutions, much of the world's small hydropower potential remains untapped (66%), with Africa, for example, having developed only about 6% to date.

Countries and regions with relatively low rates of small hydropower development, such as most African countries, have barriers to development from a number of sources, such as lack of hydrological information and awareness of small hydropower. Another obstacle is the lack of investment from foreign and private companies, especially the reluctance of banks to lend for project start-up capital. In addition, human resource capacity, especially the mastery of technology, needs to be further improved.

In countries and regions with relatively high rates of small hydropower development, such as Europe, Asia, and some countries in North America, the main obstacles to small hydropower development are the ecological and fish problems they face. Unregulated small hydropower development can cause significant ecological impacts, including river water loss, changes in river ecology, reduced river connectivity, and impacts on migratory fish and other aquatic species. To maintain the ecological security of the industry, the future development of small hydropower should be in the form of green small hydropower, supported by regulations, standards and incentives.

Small hydropower is a proven, versatile technology that can effectively increase access to clean, sustainable electricity in both developing and developed countries, especially in rural areas. Through the development of small hydropower, many countries have taken or are ready to take steps to reduce poverty and provide universal access to electricity. Small hydropower can also help developed countries achieve their goals of developing renewable energy sources and reducing greenhouse gas emissions.

3 Benefits expected from the work of the ISO/TC

ISO/TC 339's current areas of priority interest will provide the following outcomes:

- (1) Standard common terms and definitions help to unlock more global interactions and trade possibilities due to the common language relating to small hydropower;
- (2) Provide basic technical requirements, methodologies and procedures for the planning and design of small hydropower plants, and provide specifications within an appropriate range as an aid to designers;
- (3) Provide guidance for construction and management of small hydropower plants.

All the standards developed by ISO/TC 339 follow the principle of allowing technological development, and needs to be future proof so that it does not exclude or hamper tech innovations.

4 Representation and participation in the ISO/TC

4.1 Membership

<https://www.iso.org/committee/9065608.html?view=participation>

4.2 Analysis of the participation

There are currently 11 P members and 17 O members.

All the member countries have their unique experiences and technological capabilities in developing small hydropower. ISO/TC 339 will take full advantage to utilize these valuable assets.

ISO/TC 339 will continue to work and seek additional support from a number of international and regional organizations that have already provided strong support in the development of the ISO/IWA 33 Technical Guidelines for Small Hydropower. These international and regional organizations include the United Nations Industrial Development Organization (UNIDO), the International Network on Small Hydro Power (INSHP), the Common Market for Eastern and Southern Africa (COMESA), the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), the Caribbean Center for Renewable Energy and Energy Efficiency (CCREEE), the EAC Center for Renewable Energy and Energy Efficiency (EACREEE), the International Energy Agency (IEA), the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE), etc.

5 Objectives of the ISO/TC and strategies for their achievement

5.1 Defined objectives of the ISO/TC

The objective of ISO/TC 339 is to develop five categories of standards:

- (1) Terms and definitions;
- (2) Technical requirements, methodology, and procedure relating to site selection planning of small hydropower plants;
- (3) Technical requirements for the design of small hydropower plants, mainly including hydrology, geology, energy calculations, project layout, hydraulics, electromechanical equipment selection, construction planning, project cost estimates, economic appraisal, social and environmental assessments;

(4) Construction of small hydropower plants mainly including civil works, hydro-mechanical structures, and installation of electromechanical equipment;

(5) Guidance for management mainly includes project acceptance, renovation, operation, and maintenance as well as guidance for further adoption of emerging technologies for efficient operation of small hydropower plants.

These should be technologically neutral so that the standards do not hinder technological development of small hydropower.

ISO/TC 339 will start working on Item 1 to Item 3 based on IWA 33 Technical Guidelines for The Development of Small Hydropower Plants-Part 1: Vocabulary (IWA 33-1), Part 2: Site selection planning (IWA 33-2), Part 3: Design principles and requirements (IWA 33-3), which were proposed by SAC and ASI and published in 2019 and 2021. The remaining Items will be started within three to five years after the establishment of new TC.

5.2 Identified strategies to achieve the ISO/TC's defined objectives

The strategies that ISO/TC339 will be adopted to achieve the objectives are to:

(1) Encourage active participation of the government and the industry. Encourage nations to become P members and actively engage in work solutions.

(2) Other standards or regulatory references. Many countries with matured technical capabilities for small hydropower, such as the United States, Germany, India, etc. have announced related standards and laws. What's more, some international organizations have also published relevant technical guidelines which would be helpful for the technical committee to reference in the future.

(3) Liaison with other committees. In order to understand the demands of users and to avoid duplication or contradiction with other work, ISO/TC 339 needs to strengthen its links with other international organizations. For example, ISO/TC 339 would like to liaise with IEC/TC 4 Hydraulic turbines, IEC/TC 14 Power transformers, IEC/TC 17 High-voltage switchgear and control gear, IEC/TC 22 Power electronic systems and equipment, and IEC/TC 57 Power systems management and associated information exchange.

(4) Discussions and communications will be enhanced through multi approaches including organizing virtual meetings to promote the formulation of standards.

6 Factors affecting completion and implementation of the ISO/TC work programme

Factors affecting completion and implementation of the ISO/TC339 work programme may include:

- A common understanding of the priorities for the standards must be realized by all members. New work items may also challenge the member bodies in providing appropriate resources.
- The discussion on a virtual meeting may have the possibility of causing insufficient communication or less efficient than face-to-face meetings.
- Participants who have the necessary expertise are commonly busy in their normal work, and thus the time available to work on the development of standards may be limited.
- Participants may have difficulty in sustaining the necessary technical expertise and funding.

7 Structure, current projects and publications of the ISO/TC

At the beginning of this new committee, it is important to establish several standards, as the first step, that are essential and urgent to meet the needs of construction of small hydropower

internationally. According to ISO/IEC directives, Part 1 (2.4.3), when a new project is accepted, the secretariat may propose to the technical committee or subcommittee, either at a meeting or by correspondence, to create a working group the convenor of which will normally be the project leader. So, the WGs would be established in order to facilitate the completion of the developing standards. Once all the projects are finished, the WG should be disbanded, but if P members and experts consider it is important to keep the working organization to develop similar type of standards, subcommittee is expected to be created, as the second step. The structure of ISO/TC 339 can be updated from time to time based on the needs and demands of the technical committee and standards that are being developed.

The proposed structure of ISO/TC339 is planned to consist of the following working groups. The TC is considering creating several working groups, but are not limited to, such as:

WG1: Terms and definitions

WG2: Site selection planning

- Including technical requirements, methodology and procedure relating to site selection planning of small hydropower plants;

WG3: Design

- Technical requirements for the design of small hydropower plants, mainly including hydrology, geology, energy calculations, project layout, hydraulics, electromechanical equipment selection, construction planning, project cost estimates, economic appraisal, social and environmental assessments;

WG4: Construction

- Mainly including civil works, hydro mechanical structures and installation of electromechanical equipment of small hydropower plants;

WG5: Management

- Mainly including project acceptance, renovation, operation and maintenance of small hydropower plants.

WGX: Additional working groups will be created according to the approved new projects.

Proposed standards and the creation of each working group is to be completed through a Committee Internal Ballot (CIB).

Also, according to ISO/IEC Directives, the establishment of WG is depending on whether there are relevant projects approved, so that WGs wouldn't be created if there are no relevant standards to develop. The strategic business plan is a dynamic and living document.

Information on ISO online

<https://www.iso.org/committee/9065608.html>

This link provides access to the TC page on ISO website. The following information can be accessed through this link:

- Details of the Secretariat, Chair, ISO Technical Programme Manager
- Scope of the TC
- Published standards and standards under development
- Structure: Subcommittees and Working Groups
- Liaisons

Reference information

[Glossary of terms and abbreviations used in ISO/TC Business Plans](#)

[General information on the principles of ISO's technical work](#)