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Technical guidelines for the development of small hydropower plants —

Part 1: **Vocabulary**

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Foreword

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Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

A list of all parts in the IWA 33 series can be found on the ISO website.

Introduction

Small hydropower (SHP) is increasingly recognized as an important renewable energy solution to the challenge of electrifying remote rural areas. However, while most countries in Europe, in North and South America and in China have high degrees of installed capacity, the potential of SHP in many developing countries remains untapped and is hindered by a number of factors including the lack of globally agreed good practices or standards for SHP development.

The technical guidelines for the development of small hydropower plants contained in this document address the current limitations of the regulations applied to technical guidelines for SHP plants by applying the expertise and best practices that exist across the globe. It is intended for countries to utilize this document to support their current policy, technology and ecosystems. Countries that have limited institutional and technical capacities will be able to enhance their knowledge base in developing SHP plants, thereby attracting more investment in SHP projects, encouraging favourable policies and subsequently assisting in economic development at a national level. This document will be valuable for all countries, but especially allow for the sharing of experience and best practices between countries that have limited technical know-how.

This document is the result of a collaborative effort between the United Nations Industrial Development Organization (UNIDO) and the International Network on Small Hydro Power (INSHP). About 80 international experts and 40 international agencies were involved in this document's preparation and peer review. This document can be used as the principles and basis for the planning, design, construction and management of SHP plants up to 30 MW.

Technical guidelines for the development of small hydropower plants —

Part 1: Vocabulary

1 Scope

This document defines the professional technical terms and definitions commonly used for small hydropower (SHP) plants.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Terms related to hydrology

4.1 Hydrological observation

4.1.1
precipitation
liquid or solid products of the condensation or sublimation of water vapour falling from clouds or deposited from air on to the ground

Note 1 to entry: It is the amount of precipitation on a unit of horizontal surface per unit time.

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 1114]

4.1.2
precipitation days
number of days with daily precipitation more than 0,1 mm within a specified period of time

4.1.3
precipitation duration
period of time during which continuous precipitation occurs at a specific point or within a specific area

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 1115]

4.1.4
precipitation intensity
rainfall intensity
rate at which precipitation occurs, expressed in units of depth per unit of time

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 1157]

4.1.5
effective rainfall
<surface hydrology> part of the rainfall which contributes to runoff

Note 1 to entry: In groundwater, it is the part of the rainfall which contributes to groundwater recharge.

Note 2 to entry: In agriculture, it is that part of the rainfall which remains in the soil and contributes to the growth of crops.

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 458]

4.1.6
probable maximum precipitation
PMP
maximum rainfall that can occur under modern climate conditions within a given period of time in a certain river basin area

4.1.7
evaporation
water volume of extracting moisture by converting liquid into vapour through heat conduction within a certain period of time

Note 1 to entry: It is often expressed in terms of the depth of water layer evaporated.

4.1.8
infiltration
percolation
seepage
flow of water through the soil surface into a porous medium

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 795]

4.1.9
infiltration intensity
speed at which water will enter a given soil at any given time

4.1.10
stage
water level
elevation of the free water surface of a water body relative to a specified datum

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 1621]

4.1.11
maximum stage
maximum instantaneous stage at a certain observation point within the specified duration

4.1.12
minimum stage
minimum instantaneous stage at a certain observation point within the specified duration

4.1.13
discharge
rate of flow
volume of water flowing through a river (or channel) cross section per unit time

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 391]

4.1.14
maximum discharge
maximum instantaneous fluid volume which passes through a certain cross section within a specified duration

4.1.15
minimum discharge
minimum instantaneous fluid volume which passes through a certain cross section within a specified duration

4.1.16
mean discharge
averaged flow which passes through a certain cross section within a specified duration

EXAMPLE Daily, monthly or yearly mean flow.

4.2 Hydrologic data processing

4.2.1
isohyetal map
map showing the rainfall distribution by a contour connecting the points of equal rainfall

4.2.2
runoff isopleth map
map showing the runoff distribution depth by a contour connecting the points of equal runoff depth

4.2.3
hydrograph
graph showing the variation in time of data such as stage, discharge, velocity

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 733]

4.2.4
stage-discharge relation
rating curve
curve showing the relation between stage and discharge of a stream at a hydrometric station

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 1172]

4.2.5
storm -runoff relation curve
curve showing the relation between the storm and the corresponding runoff produced by it

4.2.6
flow-duration curve
curve showing the percentage of time during which the flow of a stream is equal to or greater than given amounts, regardless of chronological order

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 570]

4.3 Hydrological computation

4.3.1
bench-mark station
observation station that records the hydrometric data which helps in hydrologic computation

4.3.2
typical year
representative year
year that has hydrologic characteristic values close to the design value, along with its spatial and temporal distribution, which is used as the design basis

4.3.3
hydrologic series
series composed of hydrologic characteristic values in chronological order

4.3.4
series representativeness
extent of closeness of statistical property of the selected sample to the overall statistical property

4.3.5
design hydrograph
hydrograph of discharge, etc., at a certain frequency, for design of hydropower plants

4.3.6
reservoir back water
rise in water level upstream of the reservoir along the channel stream, after the reservoir is filled with water

4.3.7
frequency analysis
process of ascertaining the statistical parameters and design values of hydrologic variables from the existing hydrologic data according to the statistical characteristics of a certain hydrological phenomenon

4.3.8
return period
recurrence interval
long-term average time interval between a hydrological event of a specific magnitude and an event with equal or greater magnitude

[SOURCE: UNESCO/WMO, WMO-No. 385, Section 2 No. 1234]

4.3.9
design frequency
frequency of a certain hydrologic feature used for planning and designing any structure

4.3.10
design annual runoff
annual runoff corresponding to the design standard and its annual distribution

4.3.11
naturalized computation of runoff
analysis and computation of runoff data for that volume of river flow which is influenced by the human activities in the catchment

4.3.12
naturalized water volume
volume of water to be considered while computing runoff as the river flow decreases or increases due to the influence of human activities

4.3.13
annual distribution of runoff
distribution process of annual runoff by month, ten-day period, or daily

4.3.14
mean annual runoff
long-term average value of annual runoff

4.3.15
design flood
flood adopted for design purposes

Note 1 to entry: It can be the probable maximum flood, the total amount of flood or a flood corresponding to some adopted frequency of occurrence (e.g. 50, 100, 200 or 500 years), depending on the standard of safety to be provided.

4.3.16
probable maximum flood
PMF
flood that can occur under probable maximum precipitation

4.3.17
design flood for construction period
flow value that meets the temporary flood control design parameter during the construction period

5 Terms related to engineering geology

5.1
topography
study of all kinds of natural features and forms on the earth surface

5.2
geomorphology
study of all kinds of relief form on the earth surface

5.3
geologic structure
forms of deformation or displacement of rock stratum that make up the earth crust, under the action of the earth's internal forces

5.4
lithology
composition, colour, physicochemical properties and structure of the rocks that make up the rock formation

5.5
hydrogeology
study of phenomena of change and movement of groundwater in nature, including groundwater distribution and formation rules, physical properties and chemical composition of groundwater, groundwater resources and their rational utilization, adverse effects of groundwater on engineering construction and mining, and their mitigation

5.6
physical geology
ecological processes and phenomena which are produced by the external and internal forces of the earth and adversely affect engineering construction

EXAMPLE Faults; landslide; collapse; karst; suffosion; earthquake; debris flows; weathering; frost heave; thaw collapse; surface erosion.

5.7
weathering of a rock mass
process and phenomenon relating to the change in organizational structure, mineral chemical composition and physical behaviour of a rock mass under the combined action of solar radiation, temperature variations, wind, water (ice), gas and biological factors

5.8
landslide
phenomenon of rock mass, earth mass or debris moving down a slope under gravity

5.9
rockfall
phenomenon of rock falling abruptly down a steep slope

5.10
unloading deformation
deformation of surface rock and earth mass due to the adjustment of internal stresses caused by unloading, which occurs either due to natural geologic processes or engineering activity

5.11
creep
phenomenon of surface rock and earth mass moving slowly down a slope

5.12
debris flow
mudflow
sudden flood carrying a lot of solid matter like sediment and rocks, which takes place in a mountainous area, in most cases due to a rainstorm or intense melting of ice and snow

5.13
reservoir leakage
phenomenon of water loss from a reservoir through the rocks and earth mass of the reservoir basin, which can result in a loss of water volume and can also affect the stability of the dam

5.14
reservoir bank immersion
phenomenon of groundwater level rise in the area surrounding a reservoir zone due to water storage in the reservoir, and resulting in secondary geological hazards like swampiness, salinization and deterioration of the foundations of structures

5.15
reservoir bank caving
reservoir bank collapse
phenomenon in which caving of a bank slope occurs due to changes in the stability of the bank slope under the effects of water level changes and wave action in the reservoir, after or during the process of water filling

5.16
upward extension of reservoir deposition
phenomenon where back water is gradually elevated due to the continuous deposition of reservoir sediment, which causes the reservoir tail silt to develop upstream

5.17
limit state of sediment deposition in a reservoir
state of reservoir siltation having ceased as it reaches the equilibrium of sediment transport

5.18
geophysical prospecting
method for determining the geological structure as part of engineering investigation by observing, analysing and studying the differences in the physical properties of different geological bodies, and in combination with the relevant geological data

5.19
exploratory drilling
application of the mechanical engineering technology of deep drilling to determine the profile of the formation and retrieve strata samples to obtain the relevant geological parameters

6 Terms related to hydraulic engineering and energy

6.1
daily regulated hydropower plant
regulation of the supply of uniform inflow from the utilizable reservoir capacity, over a day, to handle the daily power demand of a hydropower plant

6.2
annual regulated hydropower plant
hydropower station with reservoir capacity sufficient to regulate the river water volume over a year

6.3
multiyear regulation of hydropower station
hydropower station with sufficient reservoir capacity to store the surplus water over the years in the reservoir and distribute the water stored in high-flow years over several low-flow years

6.4
non-regulated hydropower plant
hydropower station which operates without a regulating reservoir

6.5
regulated reservoir capacity
usable reservoir volume from the normal reservoir water level to the dead water level

6.6
installed capacity
nominal rated generating capacity of all turbine generator units in a hydropower plant

6.7
firm power
firm output
output of a hydropower plant in the hydrological period within the design dependability

6.8
average annual energy output
arithmetic mean value of the hydropower plant's annual energy output

6.9
load factor
ratio of average power demand to peak power demand for the period being considered

Note 1 to entry: Load factor can be computed on a daily, weekly, monthly or annual basis.

6.10
plant load factor
ratio of power generated to the maximum possible generation from a hydropower plant

6.11
load forecast
process of predicting the load data over a specific period of time in the future, on the premise of satisfying requirements according to the operational characteristics of the system, decisions on capacity increases, natural conditions and social influences

6.12
electric power and energy balance
balance of supply and demand of electric power and energy in an electric power system

6.13
normal water level
water level required for meeting the designated use under normal reservoir conditions

6.14
limited level during flood season
upper limit of water level allowed for impounding for utilization during the flood season

Note 1 to entry: It is also the prime level of regulation when the reservoir is operated for flood control during the flood season.

6.15
dead water level
minimum allowed water level to be reached under normal reservoir conditions

6.16
gross head
elevation difference between the water surfaces at the intake and tailrace of a hydroelectric system

6.17
net head
head available for power generation at the turbine, incorporating all head losses in the water conveyance system, from intake to turbine inlet

6.18
maximum head
maximum head available for the operation of a unit

6.19
minimum head
minimum head available for the operation of a unit

6.20
design head
minimum head available for the rated output of a unit

6.21
arithmetic average head
arithmetic mean of the heads calculated over various time intervals (e.g. a day, ten days, a month) within a specified period

6.22
weighted average head
average head calculated for a relatively long operational period with the output power as the weight

7 Terms related to hydraulic structure

7.1 Structure type

7.1.1
permanent structure
structure used during the operational period of a project

7.1.2
temporary structure
structure used during engineering construction and maintenance periods

7.1.3
main structure
structure serving a major role in the project, which, in the case of an accident, can result in a severe disaster or seriously influence the benefit of a project

7.1.4
secondary structure
structure with a relatively minor role in the project which has little impact in the case of an incident

7.1.5
water retaining structure
hydraulic structure built to store water and/or raise the water level