



HYDI: Hydropower Data Initiative – Database

METHODOLOGICAL NOTES

How to fill the HYDROPOWER QUESTIONNAIRE





PART I: ENERGY DATA

1. CURRENT

Number of plants, Installed Gross Capacity And Generation

Annual electricity gross generation (GWh): the quantity of electricity generated in reporting year (Y-1) by all hydropower plants of the MS measured in GWh, excluding production from pumped storage units using water that has previously been pumped uphill.

Installed gross capacity (MW): the total gross installed generating capacity of all hydropower plants of the MS at the end of the reporting year (Y-1), measured in MW.

Annual Electricity Consumed for pumping (GWh): the quantity of electricity consumed in reporting year (Y-1) for pumping water in pumped storage units, measured in GWh.

Normalised electricity generation from hydropower (excluding pumped storage plants): The effects of climatic variation should be smoothed through the use of a normalisation rule as set out in Annex II of Directive 2009/28/EC.

$$Q_{N(norm)} = C_N \times \left[\sum_{i=N-14}^N \frac{Q_i}{C_i} \right] / 15$$

where:

- N = reference year;
- $Q_{N(norm)}$ = normalised electricity generated by all hydropower plants of the Member State in year N , for accounting purposes;
- Q_i = the quantity of electricity actually generated in year i by all hydropower plants of the Member State measured in GWh, excluding production from pumped storage units using water that has previously been pumped uphill;
- C_i = the total installed capacity, net of pumped storage, of all hydropower plants of the Member State at the end of year i , measured in MW.

e.g.: In order to calculate the normalized electricity generation for the year 2005 the previous annual output back to 1991 is needed (i.e, annual electricity production and installed capacity data for the period 1991-2005 or 15 years period).



Run-of-river: Plants who have no or relatively small water storage capability. These installations normally operate on base load and use the cumulative flow continuously. $D \leq 2$ hours. This criterion is based on the reservoir filling period "D" calculated using the annual characteristic mean flow. (source: UNIPEDE).

Storage: Hydro-electric installations with substantial capability of water storage in (elevated) reservoirs in order to produce electricity in time of higher demand. According to the filling period of a reservoir it can be defined as follows:

- Pounding: $2 \text{ hours} < D < 400 \text{ hours}$
- Reservoir: $D \geq 400 \text{ hours}$

(source: UNIPEDE)

Pumped storage: Storage installations where water is pumped from a lower elevation reservoir to a higher elevation reservoir. It's a method for accumulate and store water's potential energy.

Pure pumped storage plant: A plant with reversible turbines that usually generates electricity by using exclusively water previously pumped into an elevated storage reservoir with insignificant catchment area to generate natural inflow (5% below the average volume of water feeding the turbines in a year). There is no renewable electricity production.

Mixed pumped storage plant: A hydro power plant with reversible turbines, when the natural inflow which supplies a higher elevation reservoir is 5% above the average volume of water feeding the turbines in a year. Normally the upper reservoir has significant catchment area to generate natural inflow. There is a part of renewable electricity production resulting from natural inflow = green electricity production.

2. FORECASTS

Plants under construction: Plants that have already obtained all permits and concessions and are under construction during the reporting period (Y-1).

- **of which new hydropower plants**
- **of which upgrading:** plants that have incorporated some refurbishing or repowering intervention (such as change in energy conversion efficiency, change in installed power, change in civil works leading to the change of head, decrease of energy consumption for own needs, increase of power availability index, improvement of environmental conditions)



Planned plants (with concession): New Plants that have already obtained concession for water use but need to ask other permits like the permit to build and run the plant or the EIA during the reporting year (Y-1).

Planned plants (2020): gross estimation of the whole number, installed capacity and generation of all hydropower plants that will be in operation in 2020. They are cumulative values, coming from the sum of existing hydropower plants plus the new ones that will be realized from now to 2020.

3. POTENTIALS

Gross Theoretical Potential:

The annual energy potentially available in the country if all natural flows were turbinized down to sea level or to the water level of the border of the country (if the water course extends into another country) with 100% efficiency. These data should if possible be estimated on the basis of atmospheric precipitation and water runoff.

Technically Feasible Potential:

The portion of the Gross Theoretical Potential that could be exploited within the limits of current technology (should include output from currently installed capacity)

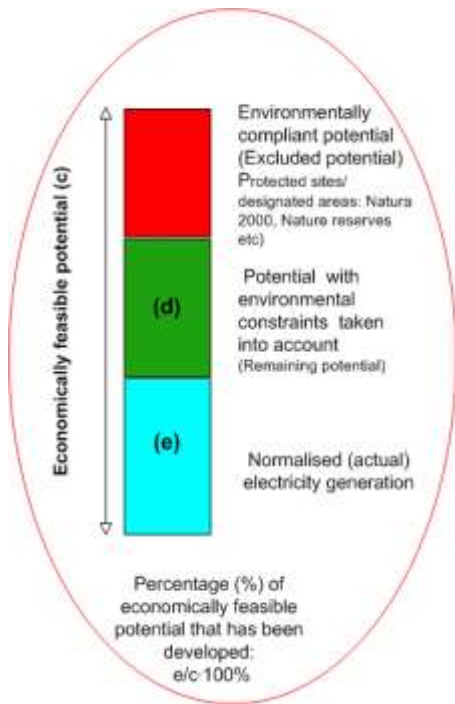
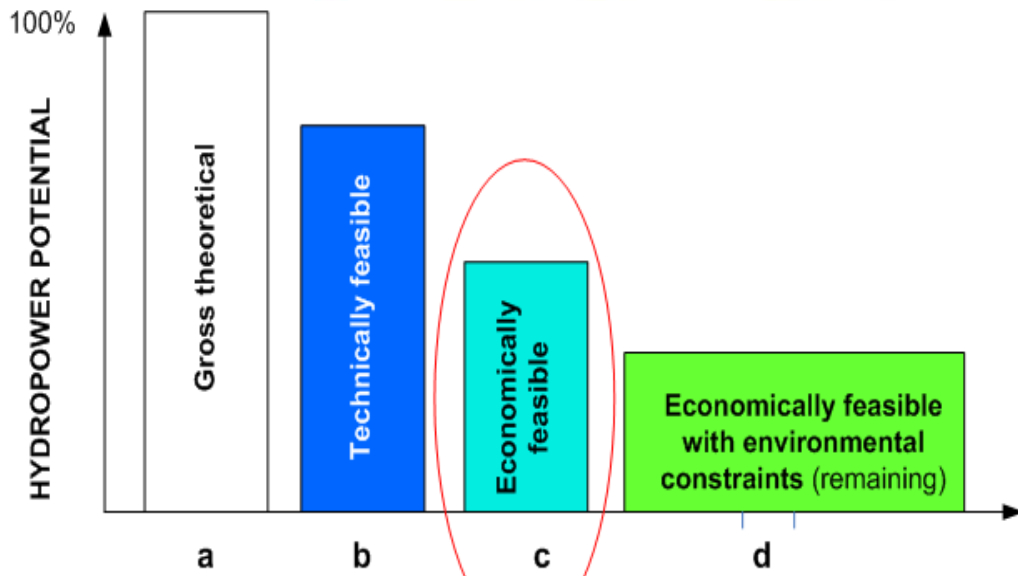
Economically Feasible Potential:

The portion of the Gross Theoretical Potential that could be exploited within the limits of current technology and under present and expected local economic conditions (should include output from currently installed capacity)

Economically feasible potential with environmental constraints taken into account:

The portion of the Gross Theoretical Potential that could be exploited within the limits of current technology and under present and expected local economic and environmental protection conditions (should include output from currently installed capacity).

Percentage (%) of economically feasible potential that has been developed in 2009. This is calculated as normalized generation in 2009 divided by economically feasible potential.





Data not available/not applicable:

Where data are not available, please write **"Not Available"**; where the question is not applicable, write **"Not Applicable"**; where the answer is zero, put "0"; Please do not leave any answer boxes empty.

PART II: MARKET DATA

1. INDUSTRIAL DATA

→ **Number of companies (any company producing something for or working with hydropower) in hydro sector**

→ **Employment:** Direct and Indirect people employed (full time equivalent & percentage of SHP) in the sector for the different branches and works during the reporting period (Y-1). The following branches should be considered and specified when possible.

a. Equipment suppliers: it includes Manufactures (Turbines, Generators, Gearboxes, Valves and gates, Trash-rack cleaners, Penstocks, Cranes, Electric panels, Automation facilities, Transformers) and Companies for Electromechanical equipment erection.

b. Engineering activities: it includes Companies for technical assistance, plant and structures design, on site supervision, hydrology, geological and geotechnical survey, topographic survey, biologic survey and training.

c. Maintenance services: it includes plant managing companies, postselling services companies.

d. Others: Legal assistance, economical and environmental consultants, producers, promoters, administrators, researchers etc.

e. Civil works (estimation): it includes Civil works companies, Special foundation works companies and Penstock erection.

2. ECONOMICS

All the figures reported in this sections are an average value of the last five year time from the reporting year (Y-1).



Average Investment cost: The investment cost is the capital costs in terms of design cost, electromechanical equipment, civil works, grid connection and land purchase or rent and administration for investment cost.

Average Cost per kWh produced: The total cost per kWh produced (specific cost) is calculated by discounting and leveling investment and O&M costs over the lifetime of the power plant, and then dividing them by the annual electricity production.

Average Operation and maintenance (O&M) costs: O&M costs are related to water right costs, labor cost, insurance, maintenance, repair, spare parts, leases, rents, administration for O&M costs etc measured as a percentage of the total cost.

Average Lifetime of the mechanical equipment: The technical lifetime of the mechanical equipment represent the period during which it operates in technical sense without replacement of its major parts of investing more than 50% in refurbishing the equipment measured as an average.

Cost of civil works: Average cost of all civil works including foundation works, construction of powerhouse, intake, tunnel, penstock entrenchment, conduit channel, etc measured as a percentage of the total cost.

Energy Payback ratio: The energy payback ratio is the ratio of net energy production during plant life and the cumulative energy used for construction, operation and operating supply items

IRR: The internal rate of return (IRR) is a rate of return used in capital budgeting to measure and compare the profitability of investments. It is also called the discounted cash flow rate of return (DCFROR) or simply the rate of return (ROR).

Low head and High head: The distinction between different heads can be measured as follows.

- **High head:** 100 m and above
- **Medium head:** 20 - 100 m
- **Low head:** up to 20 - 30 m



PART III: POLICY DATA¹

1. SUPPORT

Current support mechanism: This includes, but is not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and premium. All that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased.

Type Support and measurement : This includes two categories

a) Regulatory price-driven strategies: producers of RES-E receive financial support in terms of:

- a subsidy per kW of capacity installed: financial support is given by investment subsidies, soft loans or tax credits usually per unit of generating capacity;
- a payment per kWh produced and sold: financial support is a fixed regulated feed-in tariff (FIT) or a fixed premium (in addition to the electricity price) that a governmental institution, utility or supplier is legally obligated to pay for renewable electricity from eligible generators.

b) Regulatory quantity-driven strategies: The desired level of RES generation or market penetration – a quota or a Renewable Portfolio Standard – is defined by governments by tradable certificate systems: Green Certificate (GC) systems. In such systems, the generators (producers), wholesalers, distribution companies or retailers (depending on who is involved in the electricity supply chain) are obliged to supply or purchase a certain percentage of electricity from RES. At the date of settlement, they have to submit the required number of certificates to demonstrate compliance.

¹ Use national divisions between small and large hydro in this section



2. CONCESSIONS

Concession: Regulation on the national law which regulates concession (= all needed permits and authorizations completed) of water use for new plants and the re-licensing of old ones and other permits needed.

- a. Type of permits needed & average time:** List of the main type of permits needed to use the water and produce hydropower energy and average time needed to obtain all the permits.
- b. Number of plants granted during the reporting year (Y-1):** Number of licenses granted during the previous year.

New permits: Number of licenses for new plants

Refurbishment + relicensing: Number of plants who got a renewal of the old license or a license for a refurbishment.

3. LEGISLATION

This includes all kind of regulation/law at local, national and European level which is implemented and valid during the reporting year and its application affects the development of hydropower. Some examples include the Water Framework Directive, all national laws which are concerned with the environment field, such as EIA, designated areas, fish protection law, eels, flood protection, Natura 2000 and other legislation coming from energy, development, economic and other areas.