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Subject	**Input on expected effective electricity generation**

Honorable Members of the CDM Executive Board,

Due to various factors, the *expected* effective electricity *generation* of a hydropower plant will always be lower than the *theoretical* electricity generation *potential*. Recognising this, the application of effective electricity generation has been included in Chinese legislation since 1994[1] to ensure that feasibility studies for Chinese hydropower projects accurately reflect the amount of electricity that a hydropower plant will generate.; in accordance with legislation, the *expected* effective electricity *generation* is included in feasibility studies for Chinese hydropower projects and used to financially assess the projects.

Theoretical electricity generation potential vs. Expected effective electricity generation

The quantity of electricity that a hydropower plant is expected to generate is calculated in two steps in feasibility studies for Chinese hydropower projects. First, the *theoretical* electricity generation *potential* is calculated based on historical hydrological data without taking into account that not all of the available water resources may be used to generate electricity or that the plant may close for maintenance. Second, the *expected* effective electricity *generation*[2], which represents what the power plant is expected to actually generate, is derived from the theoretical electricity generation potential by factoring in:

1. the estimated absorptive capacity of the power grid
2. the regulating/storage capacity of the power plant
3. the estimated plant maintenance and emergency shut down

1. Estimated absorptive capacity of the power grid

The absorptive capacity of the grid is determined by the demand of power users, which differs from season to season in a year and even hour to hour in a day. All power generating plants connected to the

[1] The application of the coefficient factor is included in the Code of Hydroenergy Design for Small Hydro Power Projects (Document No. SL76-94), from 1994, and the Economic Evaluation Code for Small Hydropower Projects (Document No. SL16-95), from 1995.
[2] For small scale projects, the *theoretical* electricity generation *potential* is multiplied by a coefficient ranging from 0.6 to 0.95, in accordance with SL16-95.

grid are typically required to be in close to full operation during the peak load period. However, during low demand periods, hydropower plants are often required by the grid operator to decrease their outputs first, before thermal power generating plants, since thermal power generating plants need much more time to respond to rapid variation of power demand load. During the wet season this can mean that some of the water flow will be discharged without use, thus reducing the water use rate of the hydropower plant. Depending on the hydropower plant and the schedule of operation dictated by the grid operator[3], the water use rate can be quite low during the wet season, when there is a large amount of available water resources, and during the night, when there is less demand from consumers.

2. Regulating/storage capacity of the power plant

The power generation of a hydropower plant is subject to water resources, such as annual rainfall within a drainage basin, mean annual runoff, water head, etc. Clearly, the water flow in wet season will be much greater than the one in dry season. In wet season, the water flow will exceed the amount of water resources that can be used by the hydropower plant for full capacity generation and flow will be discharged without use if the regulating capacity of the hydropower plant is restricted (i.e. when the plant cannot store the water resources for later use, e.g. when there is no reservoir or when the storage capacity of the reservoir is low – daily, weekly). Conversely in dry season there will be quite limited water flow for power generation, especially when the plant cannot store water accumulated during the wet season. This means that sometimes water resources will be wasted (i.e. in wet season) and sometimes there will be insufficient water resources to meet demand (i.e. in dry season).

3. Estimated plant maintenance and emergency shut down

In addition to the grid operation effect on the power plant, hydropower plants are usually stopped a certain number of days each year for maintenance or due to emergency shutdown.

Expected electricity supply[4]

Once the *expected* effective electricity *generation* has been calculated, in order to determine the *expected* electricity *supply* of the power plant, the expected internal power use and transmission losses then have to be deducted from the *expected* effective electricity *generation*.

Conclusion

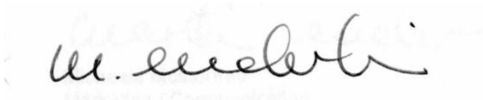
In accordance with regulations applicable to hydropower projects, in order to calculate the *expected* effective electricity *generation*, the Design Institutes developing the feasibility studies factors in: the characteristics of the grid to which the proposed hydropower plant is connected, the average values for annual maintenance and shut down for hydropower plants and the regulating/storage capacity of the power plant. This is necessary as the *theoretical* electricity generation *potential* unrealistically assumes that all available water resources are used. Finally, to calculate the expected amount of electricity generation to be supplied to the grid, internal power use and transmission losses are subtracted from the *expected* effective electricity *generation*. Please refer to Annex 1 for a diagram for further clarification. The appropriateness of calculating the *expected* electricity *supply*, based on the *expected* effective electricity *generation*, and using this figure in the financial assessment of hydropower projects is confirmed through available data on the CER issuance rate of Chinese CDM hydropower projects. The actual amount of CERs issued by Chinese CDM hydropower projects is 84% of what was expected in the PDD[5], this demonstrates that it is conservative to use the *expected* electricity *supply* (which is

[3] The coefficient factors determined by SL16-95 take into account the rate a hydropower plant will use water resources.
[4] This will be the actual amount of electricity that is possible to be inputted to the grid from the power plant
[5] UNEP Risoe CDM/JI Pipeline Analysis, 1 June 2009.

calculated in feasibility studies based on the *expected* effective electricity *generation*) in PDDs because it is typically lower than the actual amount of electricity supplied to the grid based on monitoring data[6].

We hope that the above explanation clarifies why the *expected* effective electricity *generation* should be applied in assessing hydropower project activities. Furthermore, we would like to express our support to other unsolicited letters[7] to the Executive Board on this topic.

Kind regards,



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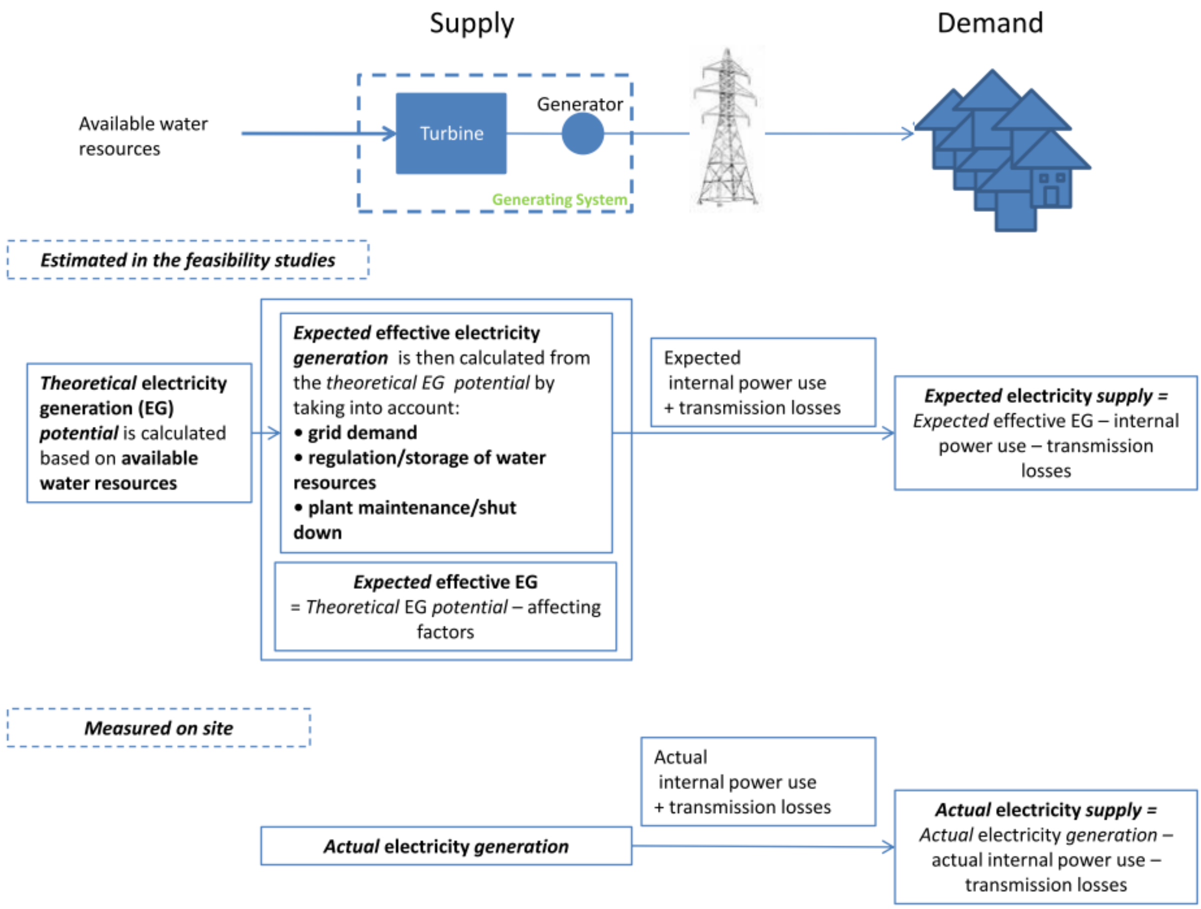
[6] For hydropower projects, the amount of CERs is proportional to the amount of electricity supplied to the grid: CERs = amount of electricity supplied to the grid x grid emission factor
[7] Other letters have been written by: Caspervandertak Consulting BV; Ministry of Water Resources, P.R. China.

Annex 1


Supply
Demand
Available water resources
Turbine
Generator
Generating System
Estimated in the feasibility studies
Theoretical electricity generation (EG) potential is calculated based on available water resources
Expected effective electricity generation is then calculated from the theoretical EG potential by taking into account:
• grid demand
• regulation/storage of water resources
• plant maintenance/shut down
Expected effective EG = Theoretical EG potential – affecting factors
Expected internal power use + transmission losses
Expected electricity supply = Expected effective EG – internal power use – transmission losses
Measured on site
Actual internal power use + transmission losses
Actual electricity generation
Actual electricity supply = Actual electricity generation – actual internal power use – transmission losses