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To cdm-info@unfccc.int
From martin.enderlin@pd-forum.net
Date 29 June 2009
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Subject **Input on expected effective electricity generation**

CHAIRMAN

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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 1994¹ 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.

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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 operator³, 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 supply⁴

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 PDD⁵, 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

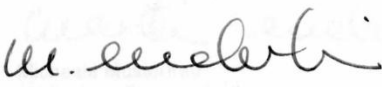
⁵ UNEP Risoe CDM/JI Pipeline Analysis, 1 June 2009.

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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 data⁶.

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 letters⁷ to the Executive Board on this topic.

Kind regards,



Martin Enderlin

Martin Enderlin
Chair of the PD Forum

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.

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Annex 1

