Annex 1

Justification off additional output according to the baseline study

1, Supplementary power installed in three units	58.50	MW
2, Working time period for using up the supplementary power (sufficient flow)	3,500	hours/year
3. Maximum supplementary energy	204,750	MWh/year
4, Energy non-generated in Thermo as a result of supplementary electricity produced by project	122,850	MWh/year
5,Increase of Secondary Control Band from 80 to 110 MW/unit	90	MW
6,Utilization time, additional to lower half-band	8,760	hours/year
7.Hydro power generated additionally for secondary control	394,200	MWh/year
8,TOTAL EXCESS HYDROPOWER	517,050	MWh/year
9,Energy generated in thermopower plants in Romania for obtaining a 90MW band with Pmin 65% out of Pn		
-Pn= 90*100/35	257	MW
-Band	90	MW
-Pmin tech	167	MW
Minimal energy supposed to be generated in thermo-pp=Pmin tech.*Tu(see 6 above)	1,464,171	MWh/year

Remarks

In order to justify capacity non-generated in thermo, the amount of 1464.171GWh/year was not considered; instead the excess 517,050 GWh/year generated hydropower was taken into account with a correction by risk factor Kr=0,81

10 Equivalent energy = Kr*En hydro (see 8 above)	418,811	MWh/year

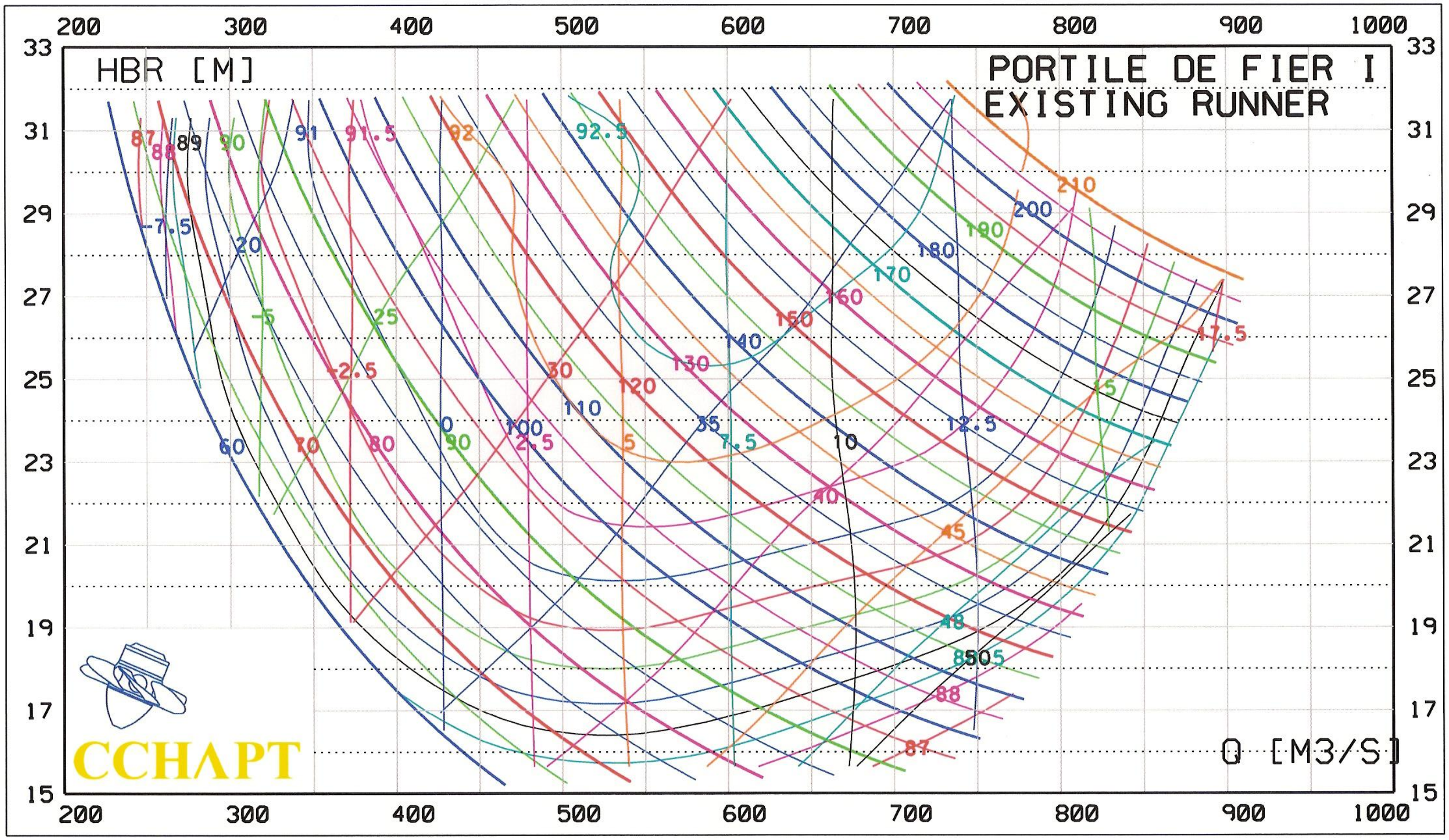

FIG. 1.4 DIAGRAMA DE EXPLOATARE HBR=F(Q) A HIDROAGREGATULUI EXISTENT DE LA CHE PORTILE DE FIER I

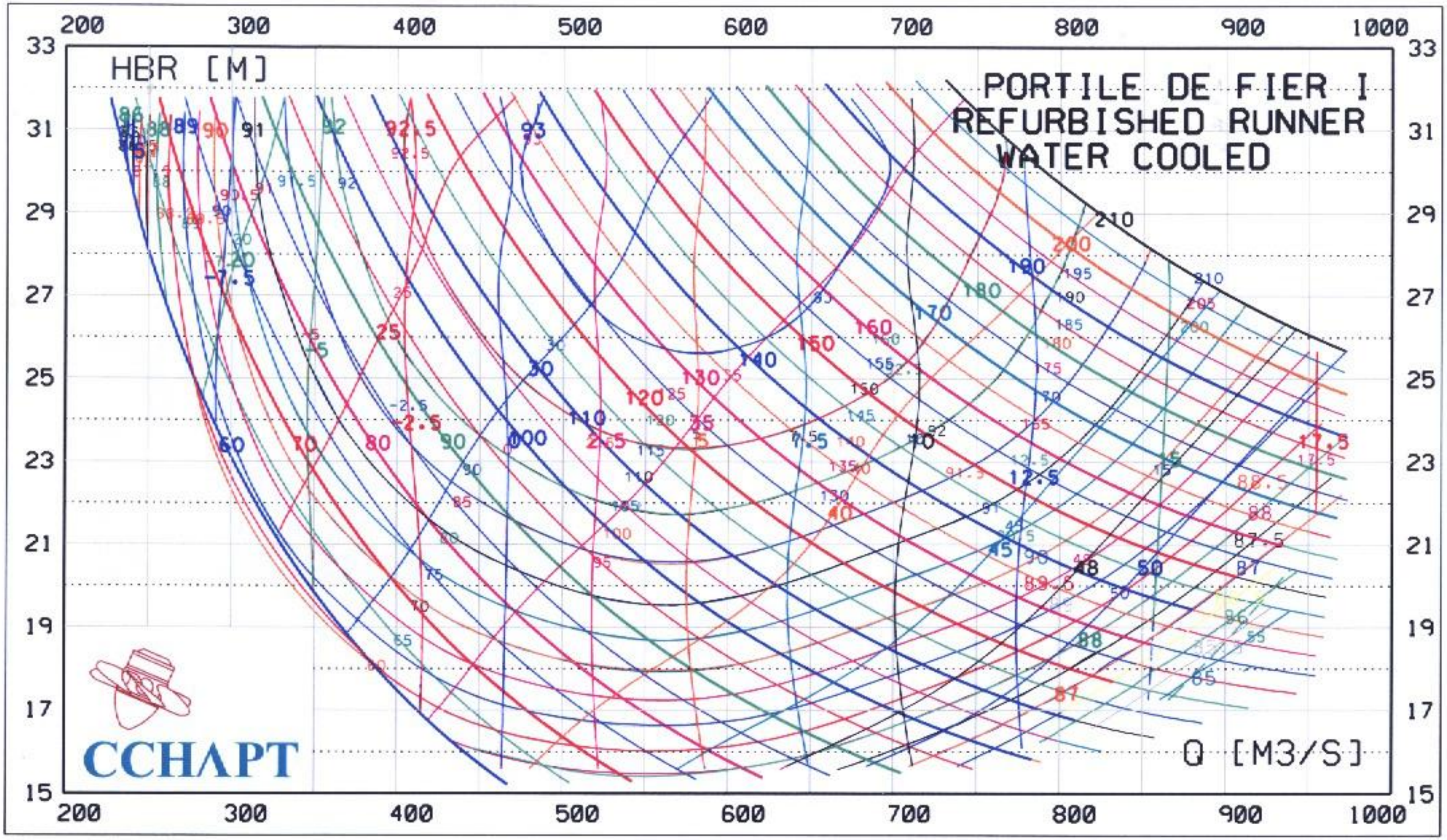

FIG. 1.6 DIAGRAMA DE EXPLOATARE HBR-F(Q) A HIDROAGREGATULUI RETEHNOLOGIZAT DE LA CH PORTILE DE FIER I

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Annex 5 to Monitoring Plan

Quality Assurance and Quality Control Procedure for the process included in the Monitoring Plan

A. General

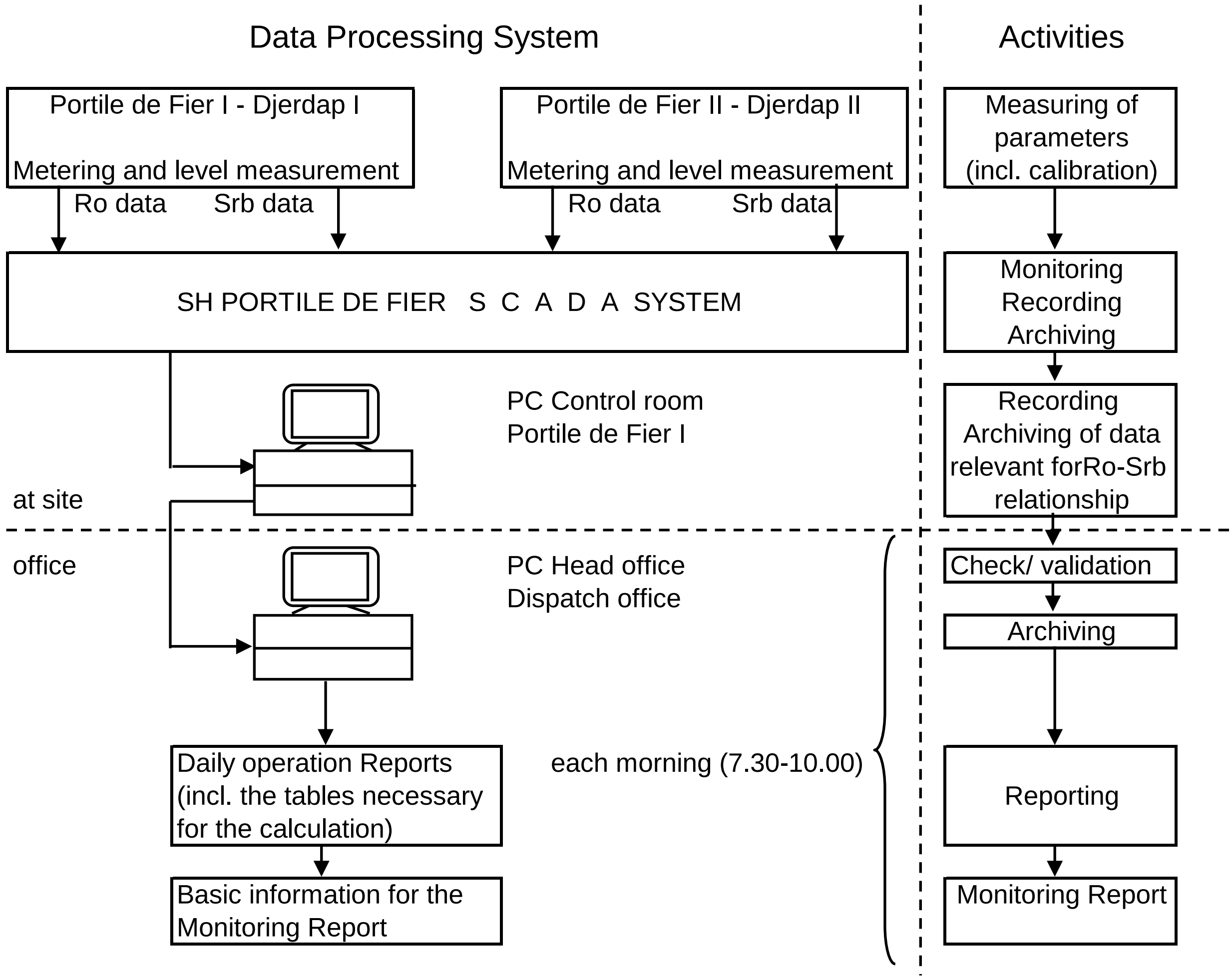
This procedure describes the process, activities and valid quality procedures implemented within SH Portile de Fier for the monitoring of the necessary parameters within the Monitoring Plan

The presented procedures are not created specifically for the JI Project for Portile de Fier I and Portile de Fier II being implemented since the beginning of the operation of both Portile de Fier I and Portile de Fier II Systems and is used for the split of the energy between the two parties.

The same data exchanged with the serbian side for the split of energy will be used as basic information for the Monitoring Report

B. Description

The following schema describes the data processing system and the step by step activities witnin the Monitoring Plan for both Portile de Fier I and Portile de Fier II JI Projects



C. Valid Quality Procedures and Regulations used in the process

The basic document used for the operation of both Portile de Fier I and Portile de Fier II in the relationship between romanian and serbian side is the "Regulation for the organization and operation of the common dispacht service for energetics of Portile de Fier and Djardap" appoved by the Common comitee for Portile de Fier which is in force at the level of the two governments.

On the basis of the provisions of this Regulation, Quality procedures and Working instructions were defined (see Attachment) and are used in the Process

Explanation of the factor that diminishes the maximum output of the non refurbished units due to real operation conditions

The additional energy generated by the refurbished units E_A is formed by:
- Ea = the difference between hourly generated power and the maximum power given by the original supplier at the head at which the refurbished unit operates during the respective time/hour;
- Eb the difference between the efficiency of the refurbished unit and the old unit in the same conditions of head and power achieved at the respective hour.

For the calculation of the additional energy Ea, an achieved (real) value of the refurbished unit is compared to a maximum value given by the original supplier (P_{175}) which is a theoretical one from the operational hill-chart determined on the basis of model tests. For a clear understanding of the issue the site operational conditions of the units are slightly different to the conditions during the model tests. The model tests are done without to model the trash racks upstream the unit (at the unit intake). The net head and brutto head in the hill-charts are determined on the basis of the calculation of the head loss on **clean** trash racks. In the real operation the trash racks are slightly clogged (due to the materials and trashes that flows with the water) and this gives a small additional head loss on the trash racks that diminishes the output of the units. When the clogging gets to a certain values the unit is stopped and the trash racks are cleaned.

In order to compare values that reflects the reality in a more clear way, an analysis, made for the entire period before the refurbishment process started (respectively 1978-1999) the output value bandwith (dP) of the hourly energy of all units, in each day where the flow exceeded the capacity of the Units in operation (all Units were supposed to operate at maximum power given by the supplier), was carried out.

For all these days, for each hour (i), based on all 6 values the maximum power of the Romanian Units was established ($Pmax_i$), the minimum power ($Pmin_i$), as well as the difference between them dP respectively dP% (in percentage)

$dP_i = Pmax_i – Pmin_i$ where i is the hour and

$dP\%_i = dP_i*100/Pmax_i$

In the attached table one can find the annual average values dP and dP%, as well as the number of the analyzed hours during the respective year (N).

The average value of the entire analyzed period are for Portile de Fier I:

dP		dP%
6,487 Mw	respectively	4,20%

Due to the fact that the maximum power given by the original supplier is variable with the head it is not recommended the diminution with a fix value (dP) (expressed in Mw), but a percentage diminution. The most probably value is the half of the difference between the maximum and minimum values of the outputs recorded every hour during the overflow period between 1978 – 1999, this being: **2.10%.**

Monitoring parameters

1. Head = difference between upstream water level and downstream water level (see ID 111.1)
This parameter is calculated parameters as the difference between 2 measured values (upstream and downstream levels)

Parameter	Measuring unit	Measuring device	Accuracy	Checking	Calibration	Spare
Upstream level	m	TLN	0,15%	Permanent checking with the Serbian value	Once per year by geodesic checking	Serbian device same accuracy
Downstream level	m	TLN	0,15%	Permanent checking with the Serbian value	Once per year by geodesic checking	Serbian device same accuracy

TLN = Telelimnimeter (device that measures the water level and transmit the value at distance)

2. Power = hourly measured power of each unit (the produced energy each hour) see ID 111.2
This parameter is a measured one

Parameter	Measuring unit	Measuring device	Accuracy	Checking	Calibration	Spare
Power (hourly produced energy)	MWh	Energy counter	0,2%	Permanent checking with the OMEPA counters same accuracy	Every 5 years according metrological laws	OMEPA counters for delivered energy same accuracy

3. Increased efficiency = difference between the efficiency of the new and old turbine (see ID 111.4)

The other parameters like **Increased Power** (see ID 111.3) and **Increased Energy** (see ID 111.5) are derived from above mentioned item Power (see ID 111.2)

"Modernization of 3 hydro units in Portile de Fier I hydro station".

Contract ERU 01/01

Monitoring Plan

Table of content :

I. Context

The project consists in the modernization of 3 hydro units (U 1, U 2 and U 3) and is based on an expert experience over years and on the solution successfully applied in modernising other 3 units of the station (U 6, U 5, U 4) by VA TECH HYDRO Ltd company.

The modernization works apart from a non-polluted energy gain resulted by the increase of the unitary active power by 19,5 MW/unit, will lead to an enhanced units efficiency, most preferably operated as secondary regulation and tertiary frequency-power regulation, spinning reserve and reactive power (voltage) regulation.

The modernization includes such main works as:

- turbine and associated installation;
- generators, auxiliary installations and excitation system;
- automation and electric protection system.

The amount of emission reduction units, contracted according to the ERU01/01 contract, was established based on the baseline study (Annex 1).

II. Justification of the proposed methodology

According to the baseline methodology developed for this project the amount of emission reduction units results from the production of additional energy caused by the modernization, starting from the assumption that this will replace the electricity produced in fuel fire power plants. The amount of GHG, which should have been produced in the fuel fire power plants for generation of similar output, will be considered as ERU of this project.

The assumed for calculation of emissions reduction units related to the current project is described in the selected baseline.

The monitoring methodology, described in the next chapter, accounts for all data relevant for determination of ERU achieved by the project, respectivly the most conservative scenario.

All the collected and used data are verified and validated by neutral entities:

- The hourly energy values are measured by the counters installed at the terminals of each generator. The energy is also measured at the outgoings at the 220 kV network by OMEPA, a neutral entity abilitated for measuring and deduction of the electric energy between the producer and consumer. This system is considered the back-up system in case that one of the counters fails. At the same time we mention that the output split between Romania and Serbia is based on these values.

- The efficiency values for the old and the refurbished hydrounits were measured by a neutral laboratory "ASTRO" from Graz, Austria and are used for the calculation of the additional output in the split between Romania and Serbia-Montenegro (annexes 2 and 4).

III. Calculation methodology for the additional output

The additional output (E_A) is calculated based on the hourly measurements for each hydrounit according to the following equation and is a result of the increased installed capacity and higher efficiency :

$$E_A = E_a + E_b = \sum_{1}^{8760}((P - P_{175}) + \Delta\eta * P) \quad [\text{Mwh}]$$

where :

P = hourly measured energy by the counters (hourly medium power) [Mw]
P_{175} = maximal hourly medium power (depending on the head) of the old hydro units [Mw], where
head = difference between the upstream and downstream levels measured [m]
$\Delta\eta$= increased efficieny represented by the difference between the efficiency of the refurbished unit and the old hydro unit

This energy includes two components, respectively:

a. *Additional generated energy through increase of capacity (higher installed flow through the turbines)*
b. *Additional generated energy as a result of higher efficiency*

a. *Additional generated energy through increase of install capacity*

The calculation for the additional generated energy is based on the difference between the hourly generated power for each refurbished hydro unit and the power that could have been generated by the old hydro unit under the same operational conditions (P_{175}).

The hourly output for each hydro unit (P) is measured at the terminals of each unit by class 0.2% ABB meters installed both in the Romanian and in the Serbian power plants. Based on these measurements a split between the two generated energy amounts (Romanian and Serbian) is done.

The output which could have been generated by the old hydro units (P_{175}) will be determined from the "power-head" characteristic of the old hydro units (from the producer) which has 3 areas:

I. For heads above 27.76 m – the maximal power is 175 MW
II. For a head of 22.20 m – the maximal power is 138MW
III. For a head of 18.10 – the maximal power is 96 MW

Between the mentioned heads the variation of the power is linear.

Due to the fact that during the real operation the units don't archive the maximum output given by the original supplier in the calculation this output must be diminished by a factor of 2.10% representing the most probably value being the half of the difference between the maximum and minimum values of the outputs recorded every hour during overflow period between 1978 – 1999 (for explanations see Annex 6)
The hourly value of the heads are measured in the process and represents also an element of the energy split process between de Romanian and Serbian parts.

b. Additional generated energy as a result of higher efficiency
The efficiency depends on power and head specified above. Due to the need to separate the Danube total potential while different efficiency hydro units are operated, the two parties (Romanian and Serbian) applied to a neutral laboratory, ASTRO from Gratz - Austria, to measure and validate the efficiency for each operated hydro unit. The validated values are confirmed by both parties and are used in calculating the hydropower potential as additionally used due to the efficiency differential of the units.

IV. Assessment of AAU's and ERU's

ERU will be calculated using the following formula:

$$URE = E * CEF$$

where :
- CEF – carbon emission factor as in the baseline study, scenario S6;
- E – additional output caused by the modernization

For each reporting year, the AAU's/ERU's will be calculated using the same spreadsheet as presented in baseline report.
The imput data for this consists of :
- E values , calculated as presented in chapter III of this monitoring plan;
- CEF, as calculated for the selected baseline scenario.

The table bellow might be used for a centralized reporting:

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
E (GWh)										
CEF (tCO2/GWh)	943	923	902	882	861	840	820	800	779	758
ERU (tCO2)										

V. Data quality control and quality assurance

Hidroelectrica has implemented and certified an integrated management system according to the international standards:
ISO 9001:2000 for Quality Management System;
ISO 14001:2004 for Environmental Management System;
OHSAS 18001:2004 for Health and Occupational Safety Management System.

The management system provides for the control of the quality of the measurement and monitoring data. The certification of SC HIDROELECTRICA SA for the management system is proved by the certifications shown in the Annex 4.

The Quality Assurance and Quality Control Procedure for the process included in the Monitoring Plan is presented in Annex 5

VI. ANNEXES

1. Annex 1 - Justification of the additional output according to the baseline study
2. Running chart of the old hydro unit depending on the bruto head.
3. Running chart of the refurbished hydro unit depending on the bruto head.
4. IQNet certification for the managment system.
5. QA/QC procedures for the monitoring of the parameters included in the Monitoring plan
6. Explanation of the factor that diminishes the maximum output of the non refurbished units due to real operation conditions.
7. Monitoring parameters

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